

# QPD #1

**Measurement Date:**

**Sept. 27, 2011**

Impedance measured at  $V_R = 15V$

**Shunt Resistance ( $R_{SH}$ ):**

Elem1: 15.850 MOhm  
 Elem2: 16.342 MOhm  
 Elem3: 17.016 MOhm  
 Elem4: 16.326 MOhm

**Series Resistance ( $R_s$ ):**

Elem1: 1372.6 Ohm  
 Elem2: 1209.0 Ohm  
 Elem3: 249.0 Ohm  
 Elem4: 1320.5 Ohm

**Junction Capacitance: ( $C_{pd}$ ):**

Elem1: 9.0 pF  
 Elem2: 9.8 pF  
 Elem3: 6.4 pF  
 Elem4: 8.6 pF

**Dark Current [nA]:**

Elem1: 5.41 nA  
 Elem2: 5.97 nA  
 Elem3: 5.39 nA  
 Elem4: 6.19 nA

**Dark Noise:**

**1~10Hz avg**

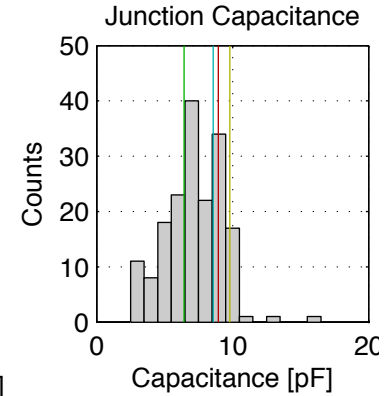
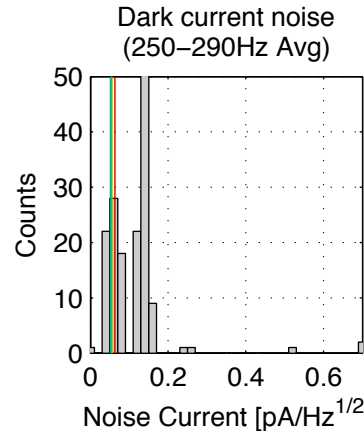
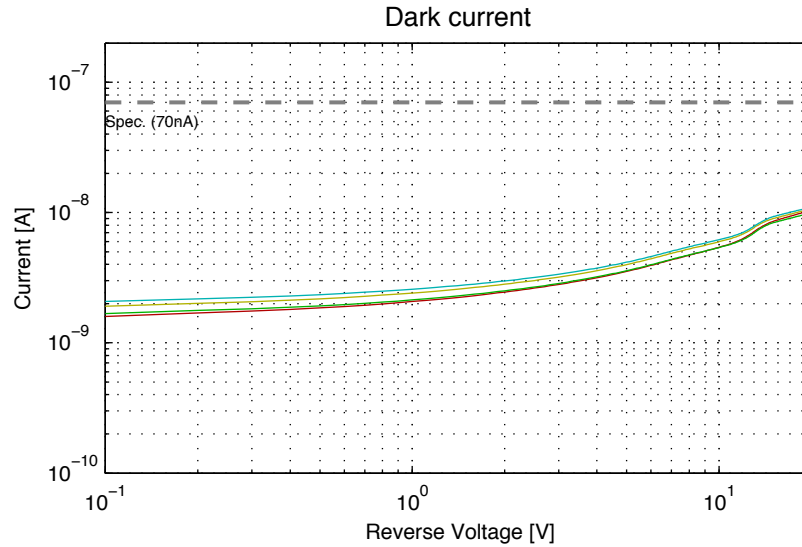
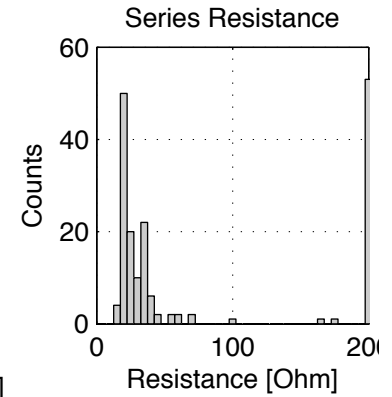
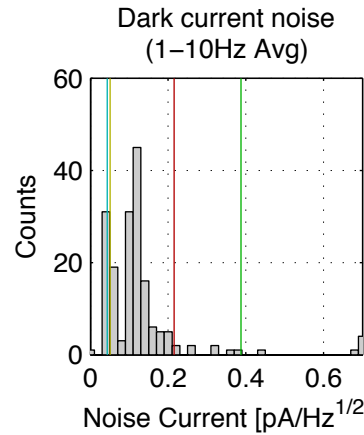
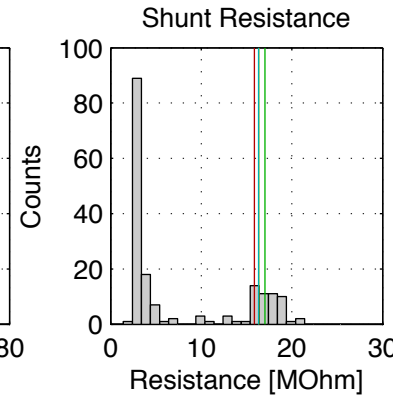
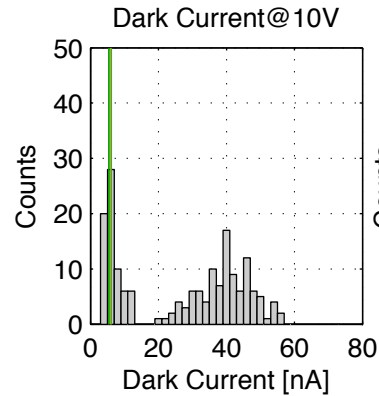
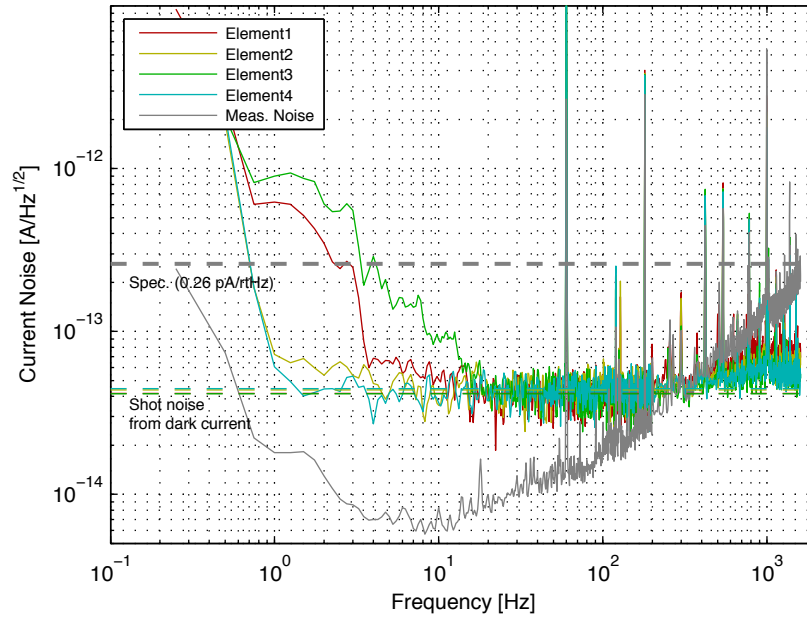
Elem1: 0.215 pA/rtHz  
 Elem2: 0.050 pA/rtHz  
 Elem3: 0.388 pA/rtHz  
 Elem4: 0.043 pA/rtHz

**250~290Hz avg**

Elem1: 0.063 pA/rtHz  
 Elem2: 0.056 pA/rtHz  
 Elem3: 0.052 pA/rtHz  
 Elem4: 0.053 pA/rtHz

Total Penalty: -200

Dark noise:  $V_R = 10V$



Errors / Warnings

Elem1:  $i_{noise} (LF) > 180fA/rtHz$  (100nA shot)  
 Elem3:  $i_{noise} (LF) > 180fA/rtHz$  (100nA shot)

# QPD #8

**Measurement Date:**

**Sept. 27, 2011**

Impedance measured at  $V_R = 15V$

**Shunt Resistance ( $R_{SH}$ ):**

Elem1: 18.424 MOhm  
 Elem2: 16.930 MOhm  
 Elem3: 16.037 MOhm  
 Elem4: 15.608 MOhm

**Series Resistance ( $R_s$ ):**

Elem1: 1441.0 Ohm  
 Elem2: 1881.7 Ohm  
 Elem3: 2359.7 Ohm  
 Elem4: 174.9 Ohm

**Junction Capacitance ( $C_{pd}$ ):**

Elem1: 9.2 pF  
 Elem2: 10.0 pF  
 Elem3: 7.1 pF  
 Elem4: 8.1 pF

**Dark Current [nA]:**

Elem1: 4.86 nA  
 Elem2: 6.21 nA  
 Elem3: 23.85 nA  
 Elem4: 7.12 nA

**Dark Noise:**

**1~10Hz avg**

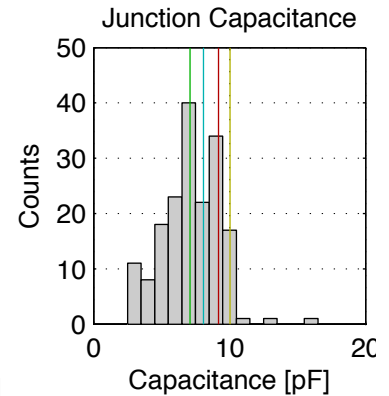
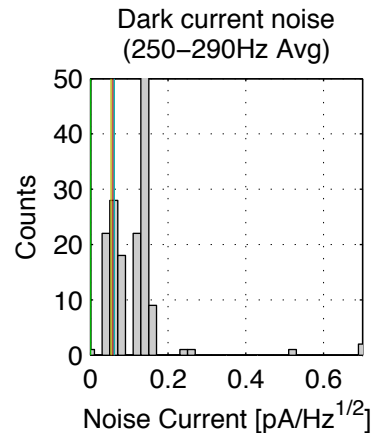
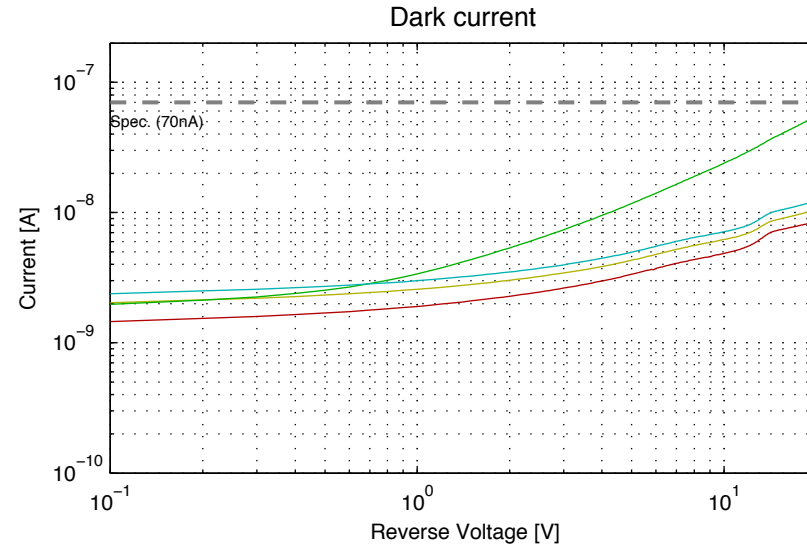
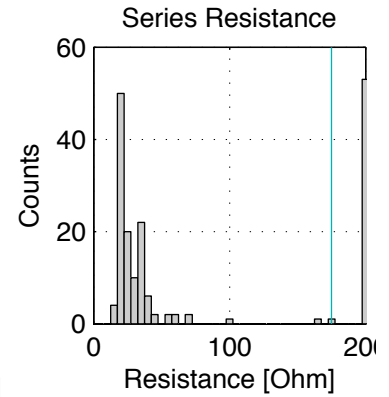
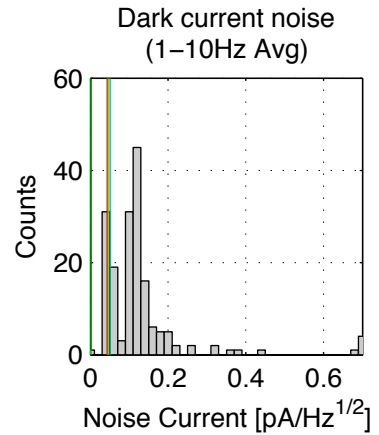
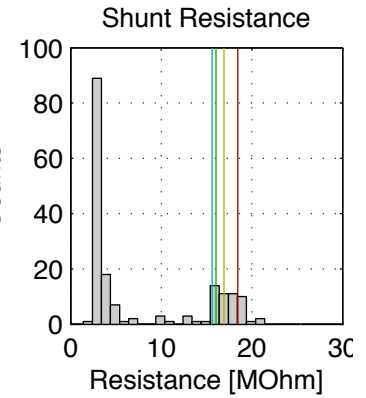
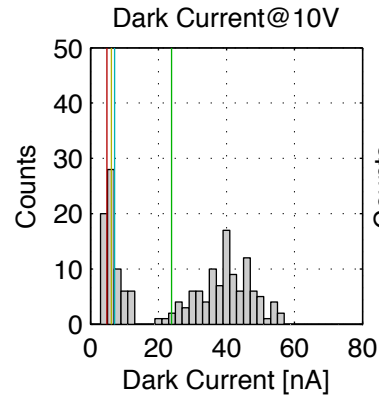
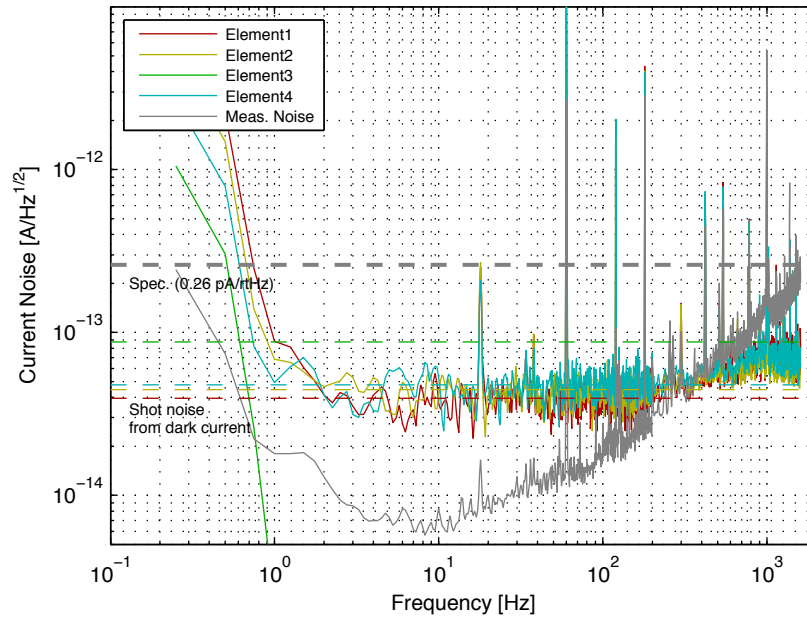
Elem1: 0.043 pA/rtHz  
 Elem2: 0.046 pA/rtHz  
 Elem3: 0.001 pA/rtHz  
 Elem4: 0.051 pA/rtHz

**250~290Hz avg**

Elem1: 0.058 pA/rtHz  
 Elem2: 0.053 pA/rtHz  
 Elem3: 0.001 pA/rtHz  
 Elem4: 0.061 pA/rtHz

Total Penalty: -215

Dark noise:  $V_R = 10V$



Errors / Warnings

Elem3:  $R_s > 2k\Omega$   
 Elem2:  $C_{pd} > 10pF$   
 Elem3:  $i_{pd} > 15nA$   
 Elem3:  $i_{dark(LF)}$ : too high dark current?  
 Elem3:  $i_{noise(HF)}$ : too high dark current?

# QPD #9

**Measurement Date:**

Sept. 27, 2011

Impedance measured at  $V_R = 15V$

**Shunt Resistance ( $R_{SH}$ ):**

Elem1: 20.814 MOhm  
 Elem2: 19.148 MOhm  
 Elem3: 18.581 MOhm  
 Elem4: 17.502 MOhm

**Series Resistance ( $R_s$ ):**

Elem1: 1013.7 Ohm  
 Elem2: 97.8 Ohm  
 Elem3: 1722.2 Ohm  
 Elem4: 1136.5 Ohm

**Junction Capacitance ( $C_{pd}$ ):**

Elem1: 9.6 pF  
 Elem2: 9.4 pF  
 Elem3: 7.4 pF  
 Elem4: 7.3 pF

**Dark Current [nA]:**

Elem1: 4.15 nA  
 Elem2: 5.19 nA  
 Elem3: 5.02 nA  
 Elem4: 5.86 nA

**Dark Noise:**

**1~10Hz avg**

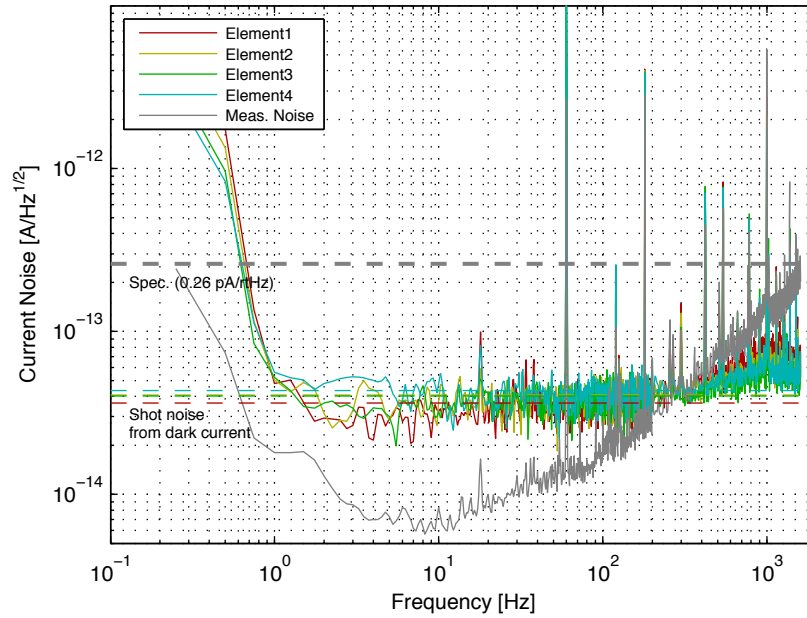
Elem1: 0.032 pA/rtHz  
 Elem2: 0.037 pA/rtHz  
 Elem3: 0.035 pA/rtHz  
 Elem4: 0.047 pA/rtHz

**250~290Hz avg**

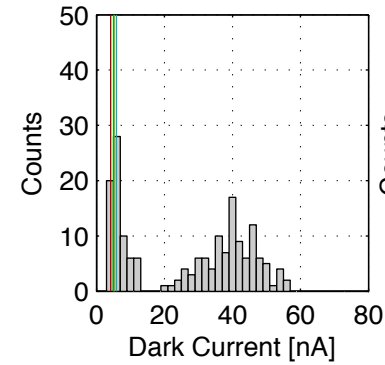
Elem1: 0.052 pA/rtHz  
 Elem2: 0.049 pA/rtHz  
 Elem3: 0.047 pA/rtHz  
 Elem4: 0.050 pA/rtHz

Total Penalty: 0

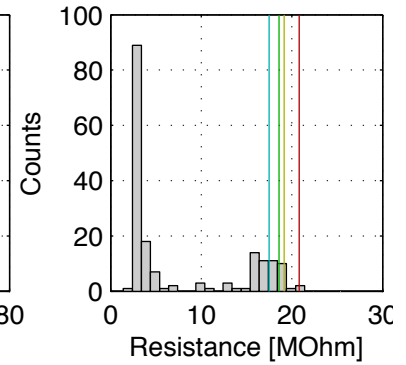
Dark noise:  $V_R = 10V$



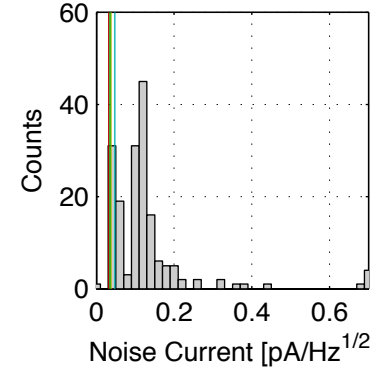
Dark Current@10V



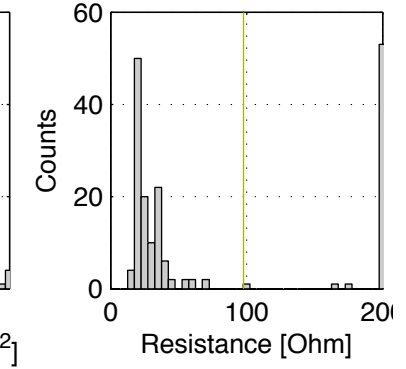
Shunt Resistance



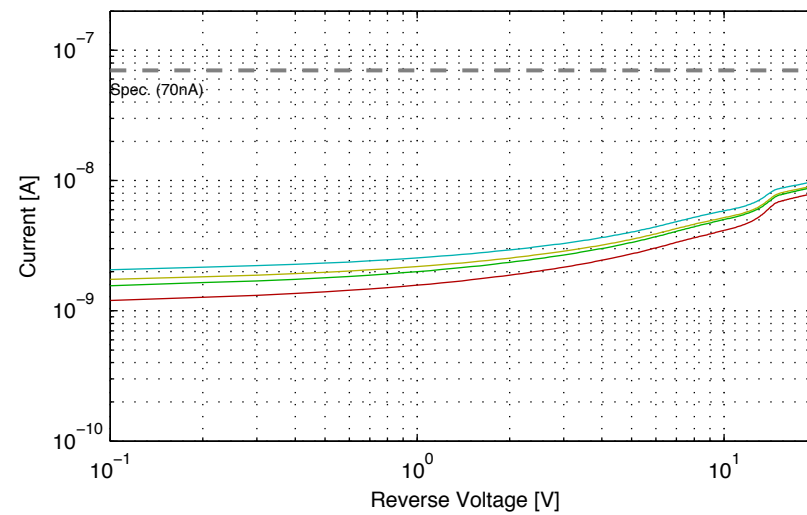
Dark current noise (1-10Hz Avg)



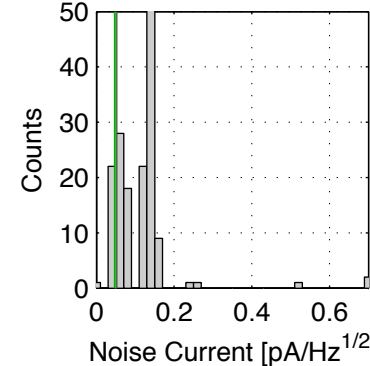
Series Resistance



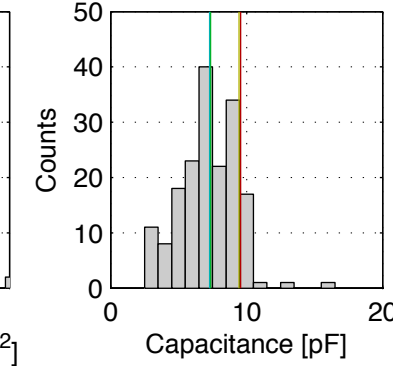
Dark current



Dark current noise (250-290Hz Avg)



Junction Capacitance



Errors / Warnings



# QPD #10

**Measurement Date:**

Sept. 27, 2011

Impedance measured at  $V_R = 15V$

**Shunt Resistance ( $R_{SH}$ ):**

- Elem1: 16.822 MOhm
- Elem2: 15.969 MOhm
- Elem3: 15.550 MOhm
- Elem4: 14.740 MOhm

**Series Resistance ( $R_s$ ):**

- Elem1: 1385.9 Ohm
- Elem2: 629.2 Ohm
- Elem3: 2680.7 Ohm
- Elem4: 1156.5 Ohm

**Junction Capacitance ( $C_{pd}$ ):**

- Elem1: 8.8 pF
- Elem2: 16.0 pF
- Elem3: 6.8 pF
- Elem4: 8.9 pF

**Dark Current [nA]:**

- Elem1: 5.34 nA
- Elem2: 6.36 nA
- Elem3: 6.12 nA
- Elem4: 7.15 nA

**Dark Noise:**

**1~10Hz avg**

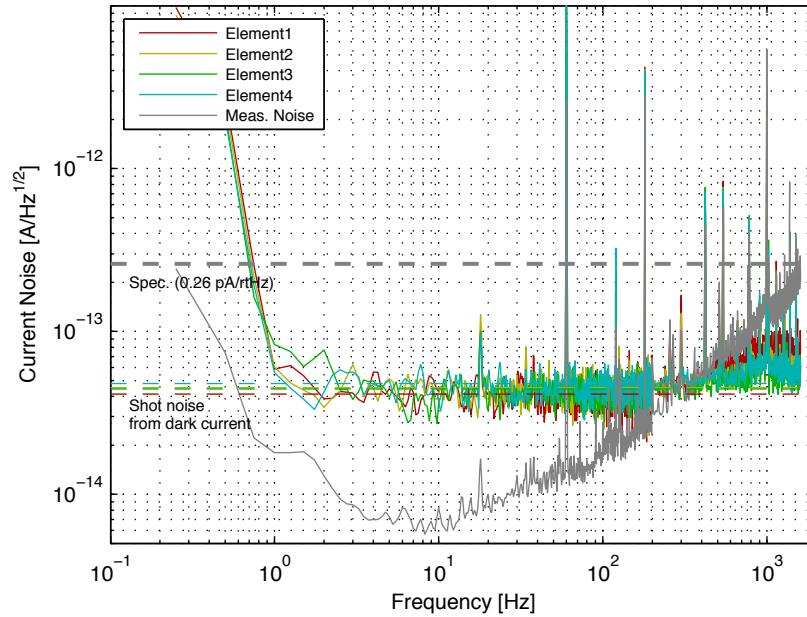
- Elem1: 0.044 pA/rtHz
- Elem2: 0.046 pA/rtHz
- Elem3: 0.047 pA/rtHz
- Elem4: 0.047 pA/rtHz

**250~290Hz avg**

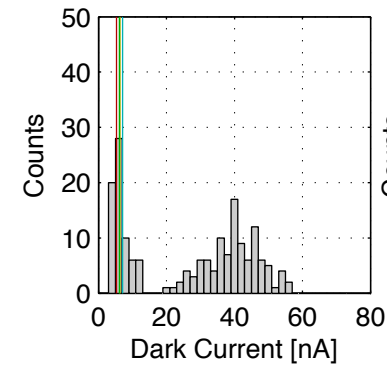
- Elem1: 0.059 pA/rtHz
- Elem2: 0.053 pA/rtHz
- Elem3: 0.050 pA/rtHz
- Elem4: 0.054 pA/rtHz

Total Penalty: -105

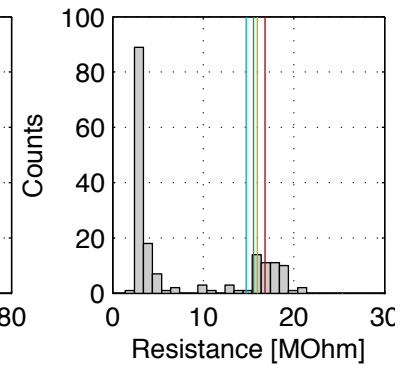
Dark noise:  $V_R = 10V$



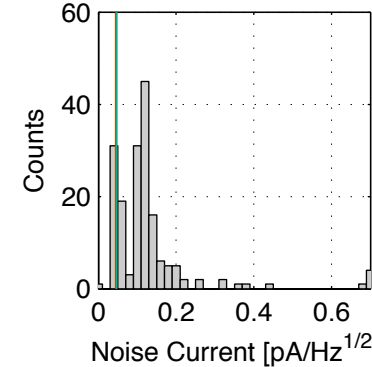
Dark Current@10V



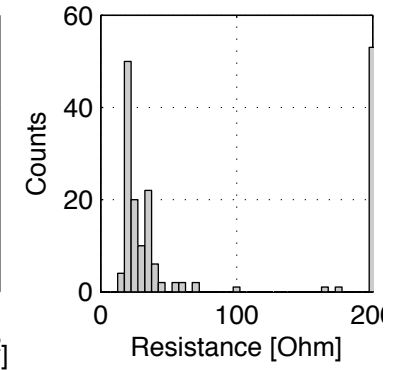
Shunt Resistance



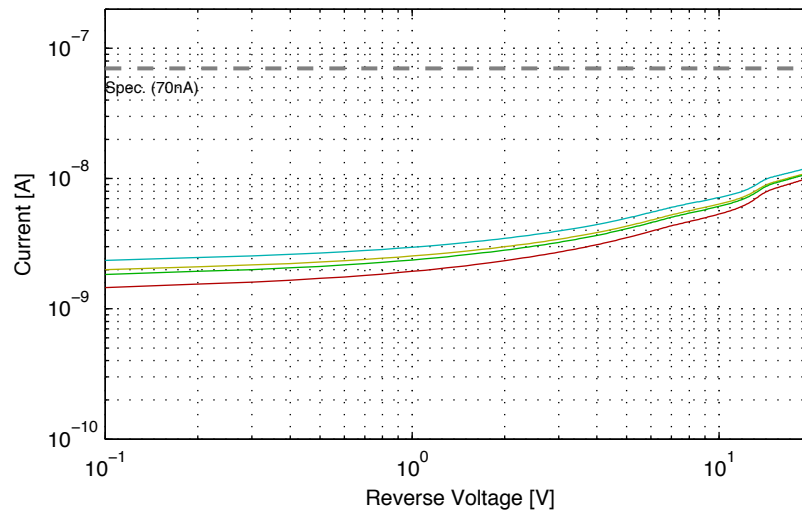
Dark current noise (1-10Hz Avg)



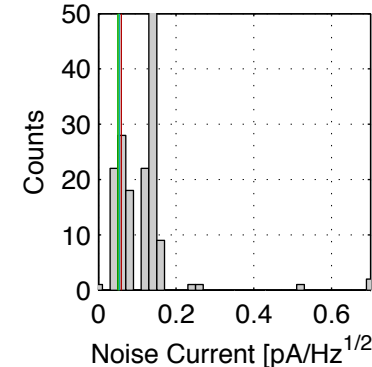
Series Resistance



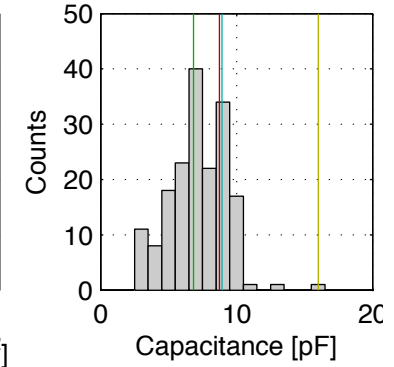
Dark current



Dark current noise (250-290Hz Avg)



Junction Capacitance



Errors / Warnings

Elem3:  $R_s > 2kOhm$   
 Elem2:  $C_{pd} > 12pF$  (spec.)

# QPD #11

**Measurement Date:**

**Sept. 27, 2011**

Impedance measured at  $V_R = 15V$

**Shunt Resistance ( $R_{SH}$ ):**

Elem1: 19.361 MOhm  
 Elem2: 17.776 MOhm  
 Elem3: 16.541 MOhm  
 Elem4: 15.994 MOhm

**Series Resistance ( $R_s$ ):**

Elem1: 1284.0 Ohm  
 Elem2: 166.1 Ohm  
 Elem3: 1059.4 Ohm  
 Elem4: 1316.7 Ohm

**Junction Capacitance ( $C_{pd}$ ):**

Elem1: 9.4 pF  
 Elem2: 9.5 pF  
 Elem3: 6.6 pF  
 Elem4: 9.3 pF

**Dark Current [nA]:**

Elem1: 4.36 nA  
 Elem2: 5.63 nA  
 Elem3: 5.51 nA  
 Elem4: 6.42 nA

**Dark Noise:**

**1~10Hz avg**

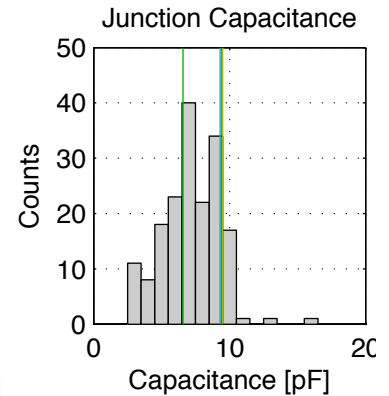
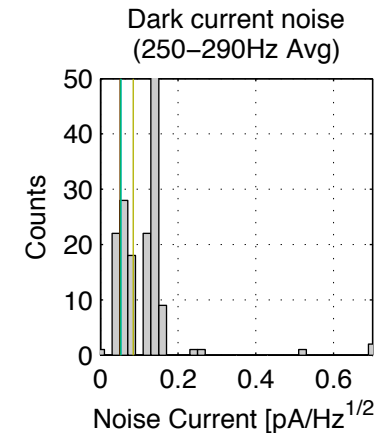
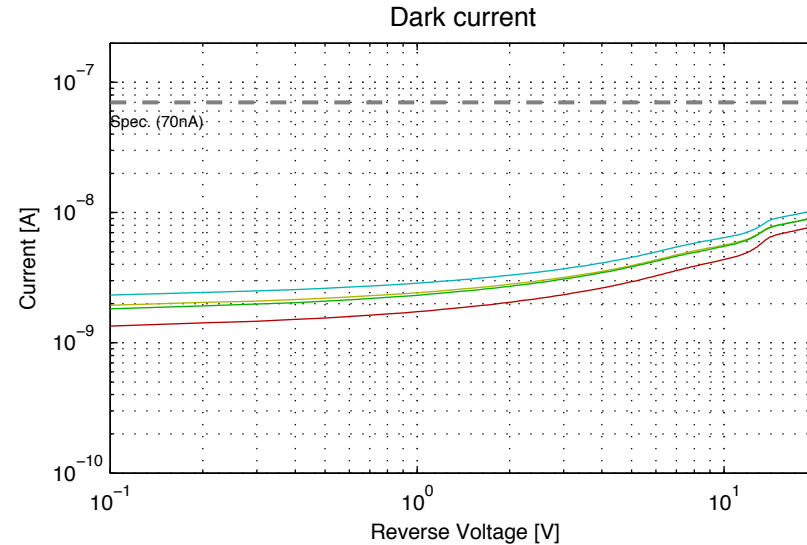
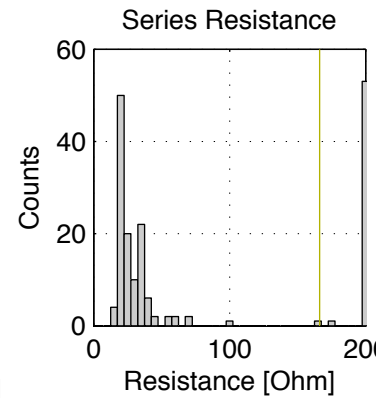
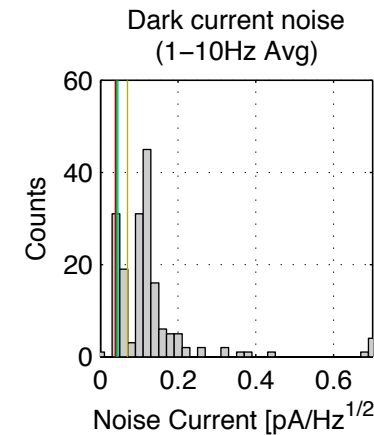
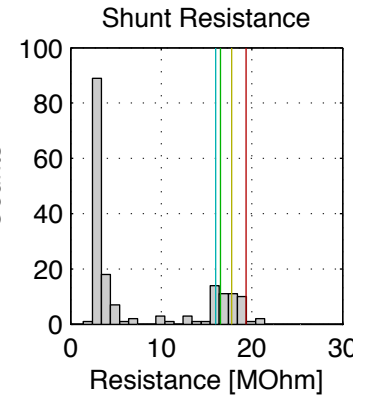
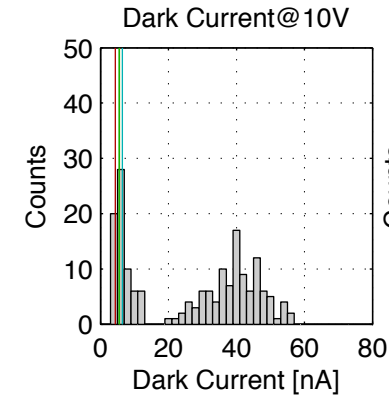
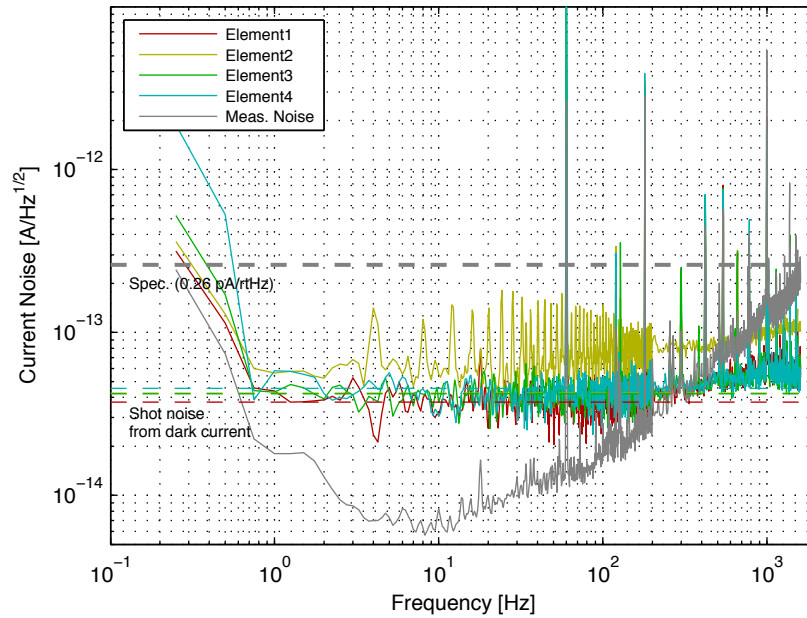
Elem1: 0.038 pA/rtHz  
 Elem2: 0.070 pA/rtHz  
 Elem3: 0.042 pA/rtHz  
 Elem4: 0.045 pA/rtHz

**250~290Hz avg**

Elem1: 0.051 pA/rtHz  
 Elem2: 0.084 pA/rtHz  
 Elem3: 0.051 pA/rtHz  
 Elem4: 0.053 pA/rtHz

Total Penalty: -5

Dark noise:  $V_R = 10V$



Errors / Warnings

Elem2:  $i_{noise} (LF) > 56fA/rtHz$  (10nA shot)

# QPD #12

**Measurement Date:**

**Sept. 27, 2011**

Impedance measured at  $V_R = 15V$

**Shunt Resistance ( $R_{SH}$ ):**

Elem1: 19.056 MOhm  
 Elem2: 18.337 MOhm  
 Elem3: 18.976 MOhm  
 Elem4: 18.412 MOhm

**Series Resistance ( $R_s$ ):**

Elem1: 1262.3 Ohm  
 Elem2: 1250.3 Ohm  
 Elem3: 1203.3 Ohm  
 Elem4: 1877.0 Ohm

**Junction Capacitance: ( $C_{pd}$ ):**

Elem1: 9.6 pF  
 Elem2: 10.5 pF  
 Elem3: 6.7 pF  
 Elem4: 9.2 pF

**Dark Current [nA]:**

Elem1: 4.40 nA  
 Elem2: 4.71 nA  
 Elem3: 4.58 nA  
 Elem4: 4.81 nA

**Dark Noise:**

**1~10Hz avg**

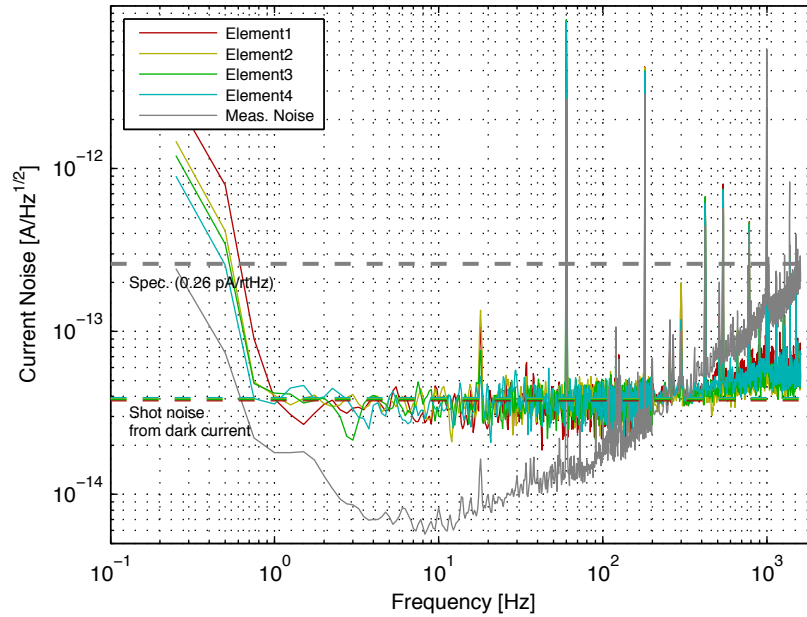
Elem1: 0.035 pA/rtHz  
 Elem2: 0.037 pA/rtHz  
 Elem3: 0.036 pA/rtHz  
 Elem4: 0.035 pA/rtHz

**250~290Hz avg**

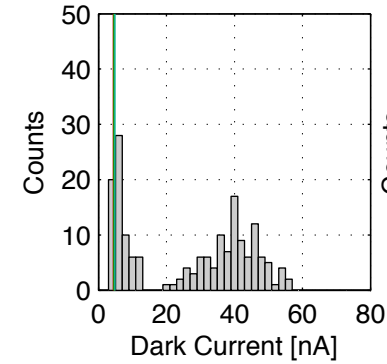
Elem1: 0.050 pA/rtHz  
 Elem2: 0.043 pA/rtHz  
 Elem3: 0.046 pA/rtHz  
 Elem4: 0.049 pA/rtHz

Total Penalty: -5

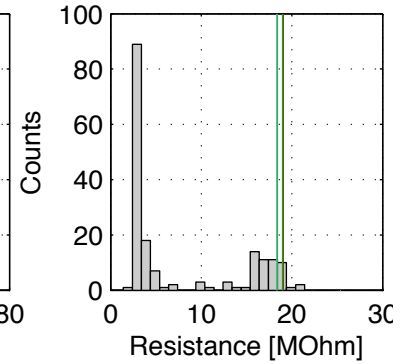
Dark noise:  $V_R = 10V$



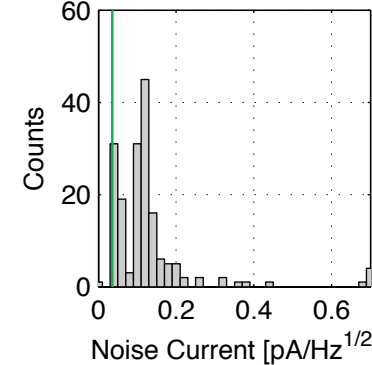
Dark Current@10V



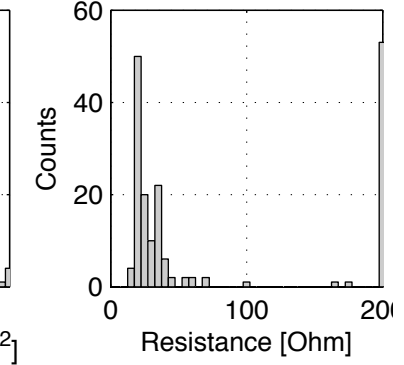
Shunt Resistance



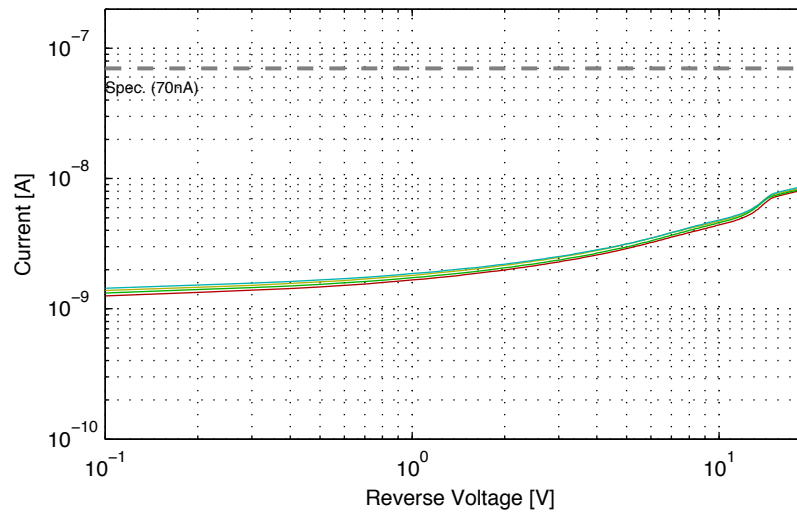
Dark current noise (1~10Hz Avg)



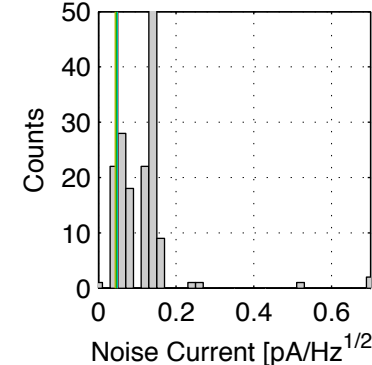
Series Resistance



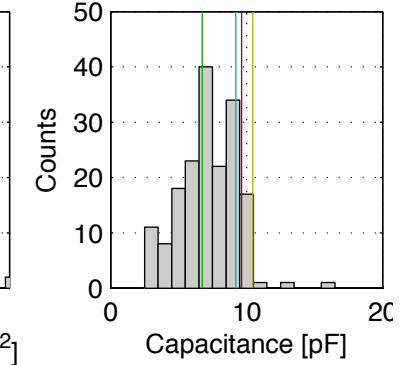
Dark current



Dark current noise (250~290Hz Avg)



Junction Capacitance



Errors / Warnings

Elem2:  $C_{pd} > 10pF$

# QPD #13

**Measurement Date:**

**Sept. 27, 2011**

Impedance measured at  $V_R = 15V$

**Shunt Resistance ( $R_{SH}$ ):**

Elem1: 15.913 MOhm  
 Elem2: 18.564 MOhm  
 Elem3: 18.323 MOhm  
 Elem4: 18.274 MOhm

**Series Resistance ( $R_s$ ):**

Elem1: 1330.7 Ohm  
 Elem2: 1572.1 Ohm  
 Elem3: 279.4 Ohm  
 Elem4: 699.5 Ohm

**Junction Capacitance ( $C_{pd}$ ):**

Elem1: 9.3 pF  
 Elem2: 10.7 pF  
 Elem3: 6.6 pF  
 Elem4: 9.2 pF

**Dark Current [nA]:**

Elem1: 4.17 nA  
 Elem2: 4.72 nA  
 Elem3: 4.61 nA  
 Elem4: 4.95 nA

**Dark Noise:**

**1~10Hz avg**

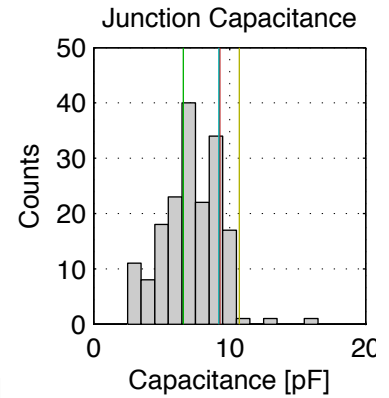
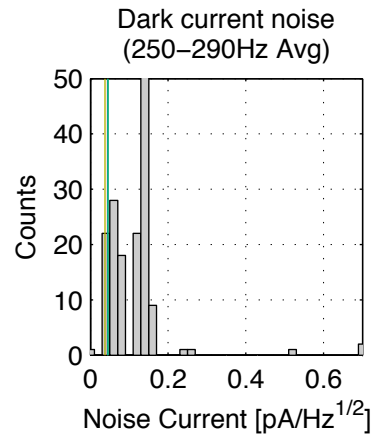
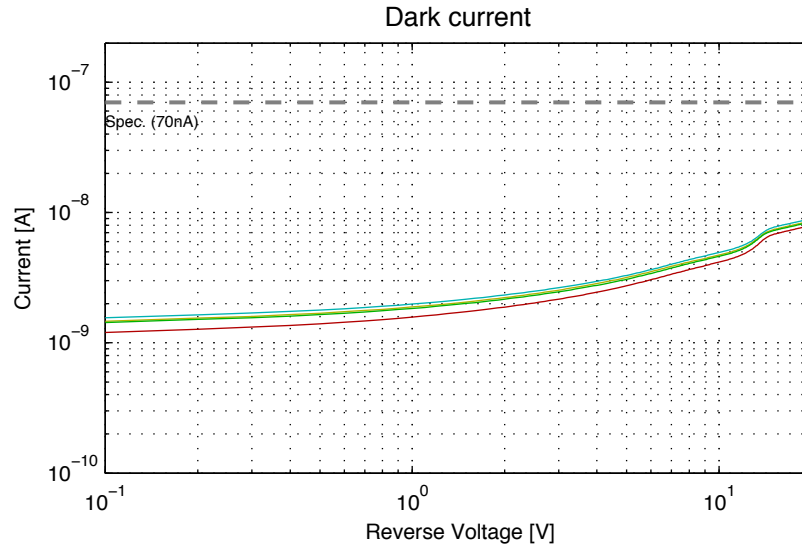
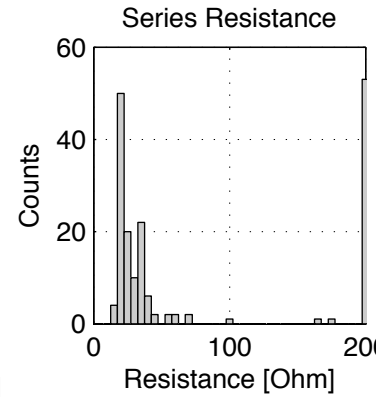
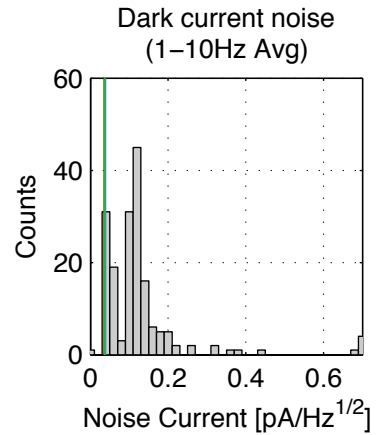
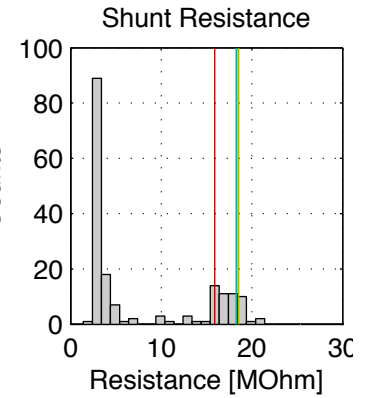
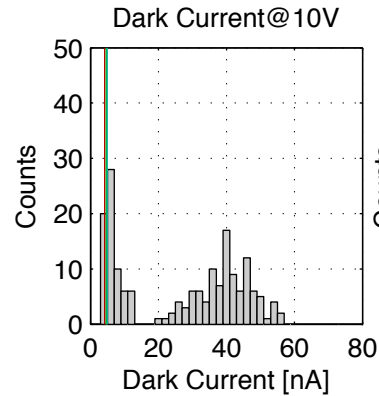
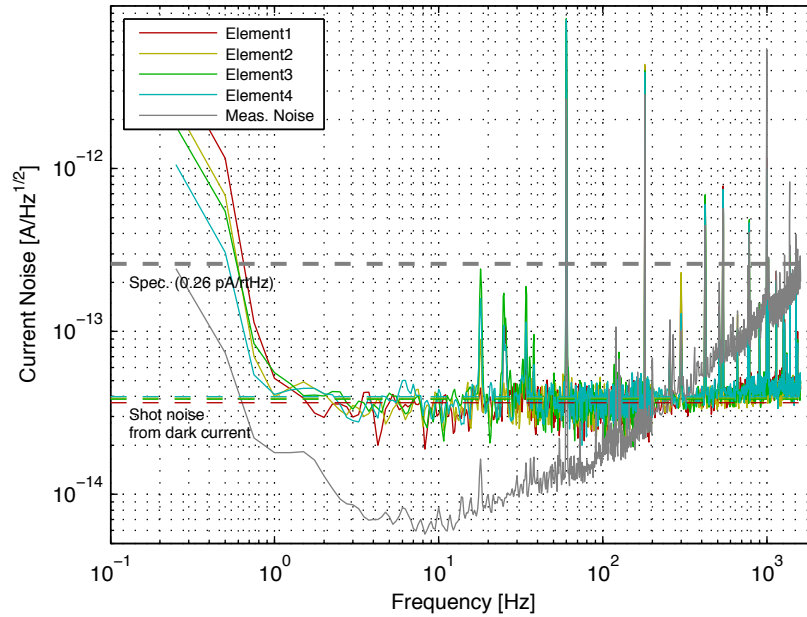
Elem1: 0.035 pA/rtHz  
 Elem2: 0.036 pA/rtHz  
 Elem3: 0.037 pA/rtHz  
 Elem4: 0.039 pA/rtHz

**250~290Hz avg**

Elem1: 0.044 pA/rtHz  
 Elem2: 0.038 pA/rtHz  
 Elem3: 0.045 pA/rtHz  
 Elem4: 0.045 pA/rtHz

Total Penalty: -5

Dark noise:  $V_R = 10V$



Errors / Warnings

Elem2:  $C_{pd} > 10pF$

# QPD #14

**Measurement Date:**

**Sept. 27, 2011**

Impedance measured at  $V_R = 15V$

**Shunt Resistance ( $R_{SH}$ ):**

Elem1: 16.150 MOhm  
 Elem2: 16.142 MOhm  
 Elem3: 16.117 MOhm  
 Elem4: 15.746 MOhm

**Series Resistance ( $R_s$ ):**

Elem1: 1617.6 Ohm  
 Elem2: 1295.7 Ohm  
 Elem3: 1910.2 Ohm  
 Elem4: 869.1 Ohm

**Junction Capacitance ( $C_{pd}$ ):**

Elem1: 9.2 pF  
 Elem2: 10.0 pF  
 Elem3: 7.1 pF  
 Elem4: 8.2 pF

**Dark Current [nA]:**

Elem1: 5.68 nA  
 Elem2: 6.30 nA  
 Elem3: 6.17 nA  
 Elem4: 6.80 nA

**Dark Noise:**

**1~10Hz avg**

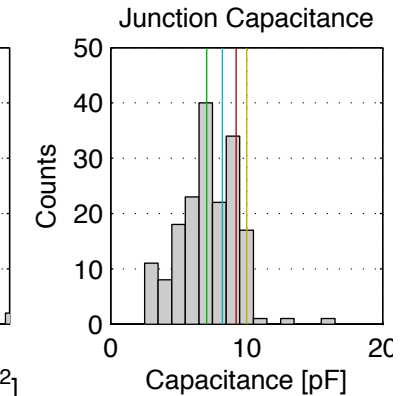
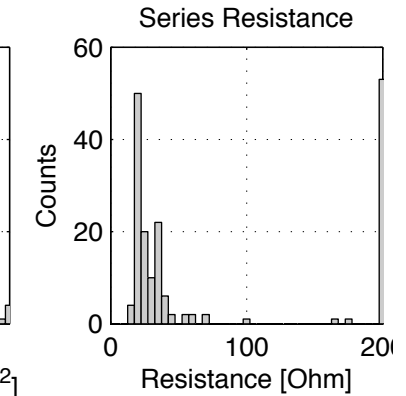
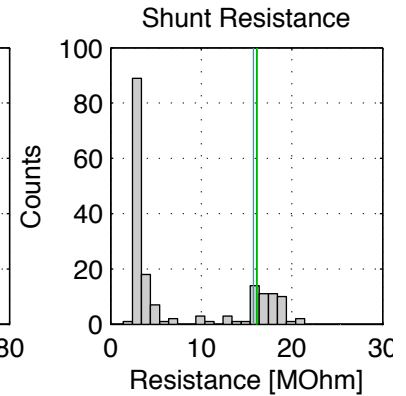
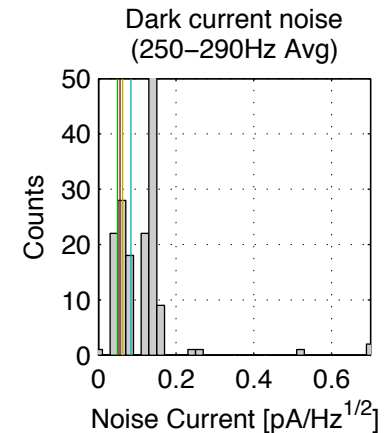
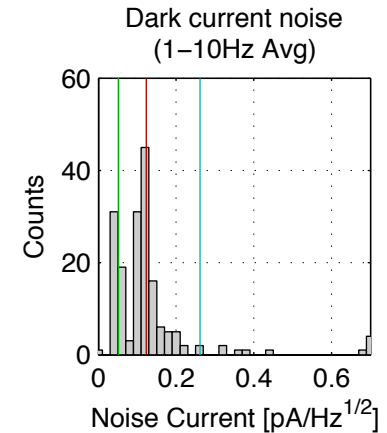
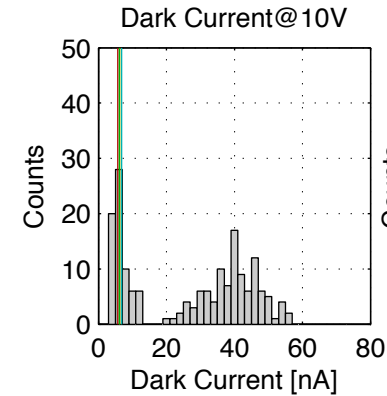
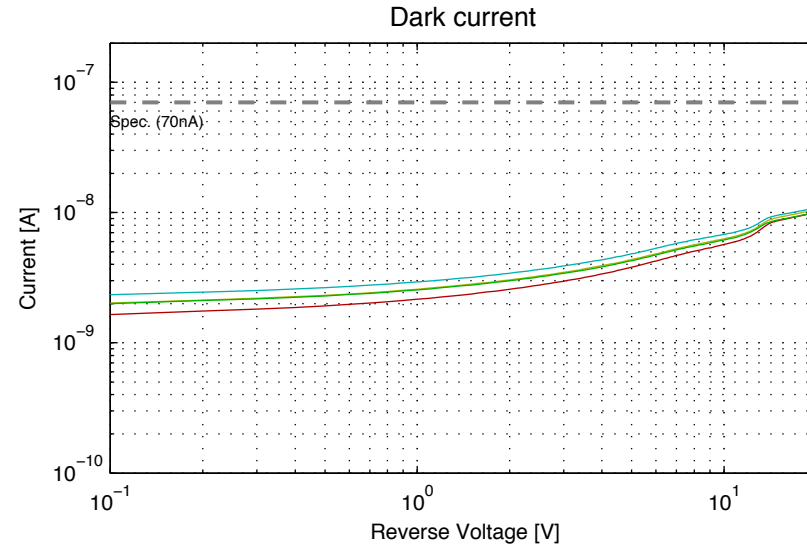
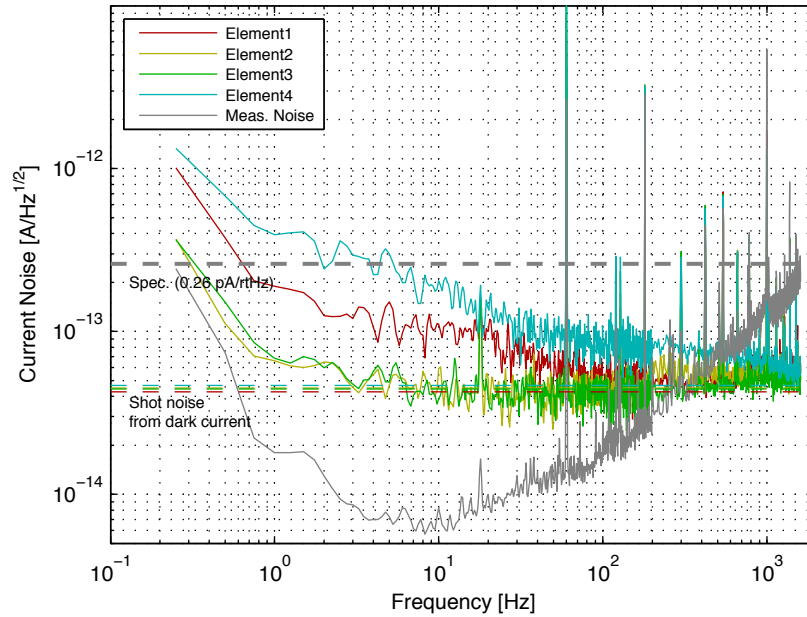
Elem1: 0.123 pA/rtHz  
 Elem2: 0.051 pA/rtHz  
 Elem3: 0.051 pA/rtHz  
 Elem4: 0.261 pA/rtHz

**250~290Hz avg**

Elem1: 0.056 pA/rtHz  
 Elem2: 0.062 pA/rtHz  
 Elem3: 0.049 pA/rtHz  
 Elem4: 0.084 pA/rtHz

Total Penalty: -110

Dark noise:  $V_R = 10V$



Errors / Warnings

Elem2:  $C_{pd} > 10pF$   
 Elem1:  $i_{noise} (LF) > 56fA/rtHz$  (10nA shot)  
 Elem4:  $i_{noise} (LF) > 180fA/rtHz$  (100nA shot)



# QPD #15

**Measurement Date:**

**Sept. 27, 2011**

Impedance measured at  $V_R = 15V$

**Shunt Resistance ( $R_{SH}$ ):**

Elem1: 18.923 MOhm  
 Elem2: 17.590 MOhm  
 Elem3: 17.306 MOhm  
 Elem4: 15.965 MOhm

**Series Resistance ( $R_s$ ):**

Elem1: 1378.1 Ohm  
 Elem2: 1103.2 Ohm  
 Elem3: 1533.9 Ohm  
 Elem4: 964.7 Ohm

**Junction Capacitance ( $C_{pd}$ ):**

Elem1: 9.7 pF  
 Elem2: 10.5 pF  
 Elem3: 7.5 pF  
 Elem4: 9.1 pF

**Dark Current [nA]:**

Elem1: 4.63 nA  
 Elem2: 5.72 nA  
 Elem3: 5.27 nA  
 Elem4: 6.21 nA

**Dark Noise:**

**1~10Hz avg**

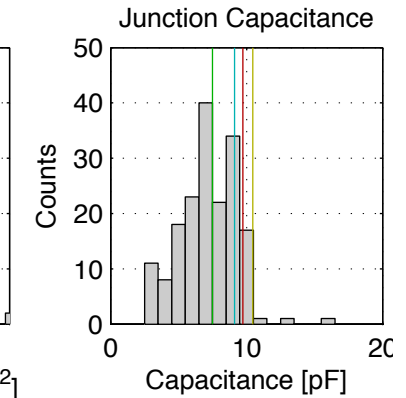
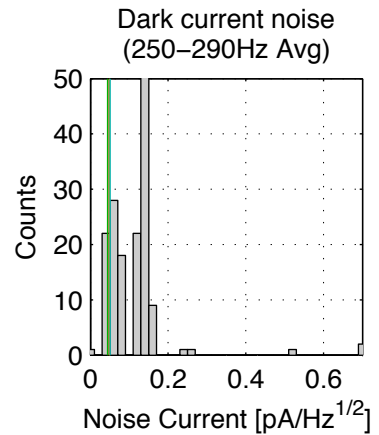
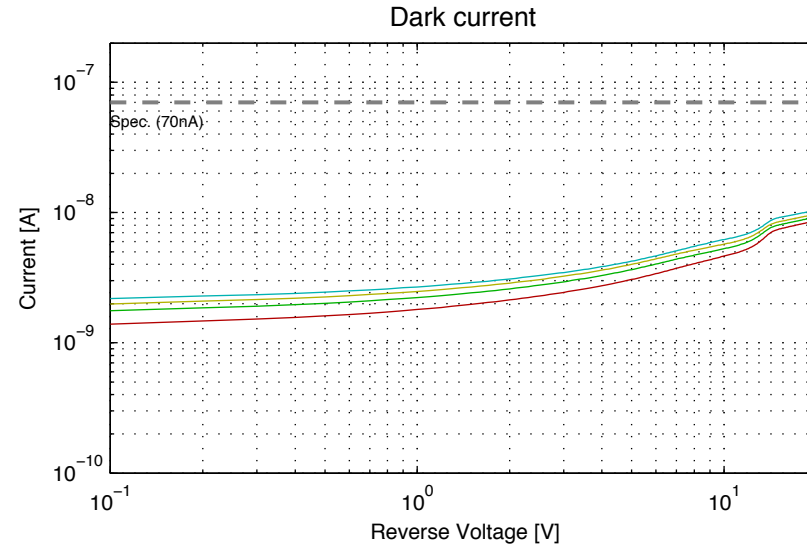
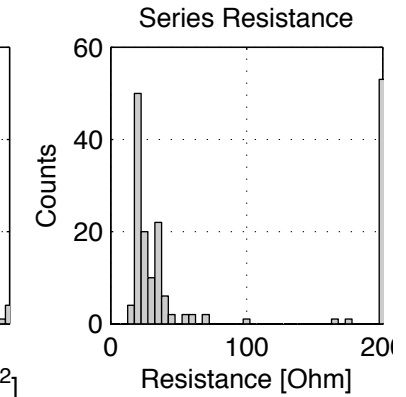
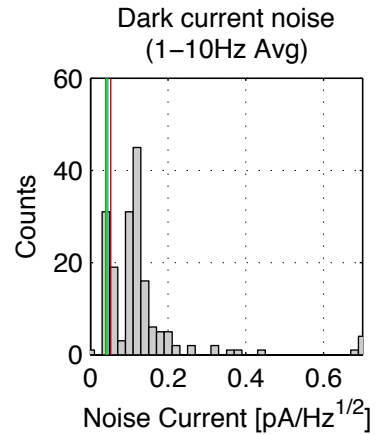
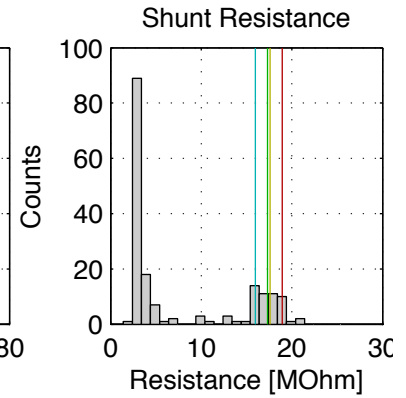
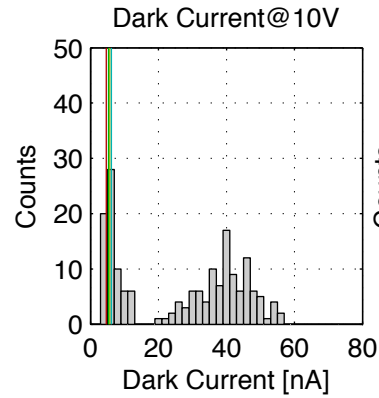
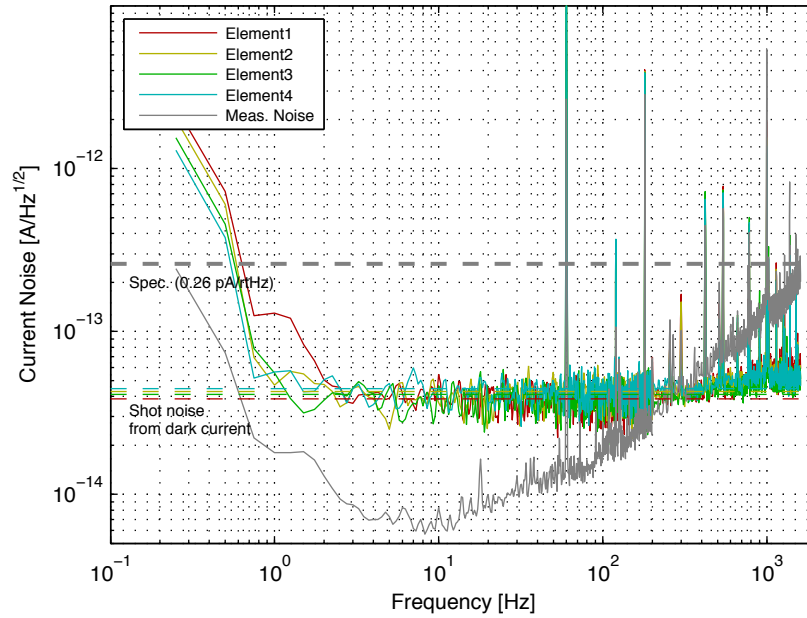
Elem1: 0.052 pA/rtHz  
 Elem2: 0.041 pA/rtHz  
 Elem3: 0.039 pA/rtHz  
 Elem4: 0.045 pA/rtHz

**250~290Hz avg**

Elem1: 0.048 pA/rtHz  
 Elem2: 0.049 pA/rtHz  
 Elem3: 0.044 pA/rtHz  
 Elem4: 0.051 pA/rtHz

Total Penalty: -5

Dark noise:  $V_R = 10V$



Errors / Warnings

Elem2:  $C_{pd} > 10pF$

# QPD #16

## Measurement Date:

Sept. 27, 2011

Impedance measured at  $V_R = 15V$

## Shunt Resistance ( $R_{SH}$ ):

Elem1: 19.918 MOhm  
 Elem2: 18.289 MOhm  
 Elem3: 18.156 MOhm  
 Elem4: 16.501 MOhm

## Series Resistance ( $R_s$ ):

Elem1: 1966.5 Ohm  
 Elem2: 895.6 Ohm  
 Elem3: 2507.9 Ohm  
 Elem4: 1814.8 Ohm

## Junction Capacitance: ( $C_{pd}$ ):

Elem1: 9.3 pF  
 Elem2: 8.9 pF  
 Elem3: 7.6 pF  
 Elem4: 9.3 pF

## Dark Current [nA]:

Elem1: 4.53 nA  
 Elem2: 5.46 nA  
 Elem3: 5.37 nA  
 Elem4: 11.14 nA

## Dark Noise:

### 1~10Hz avg

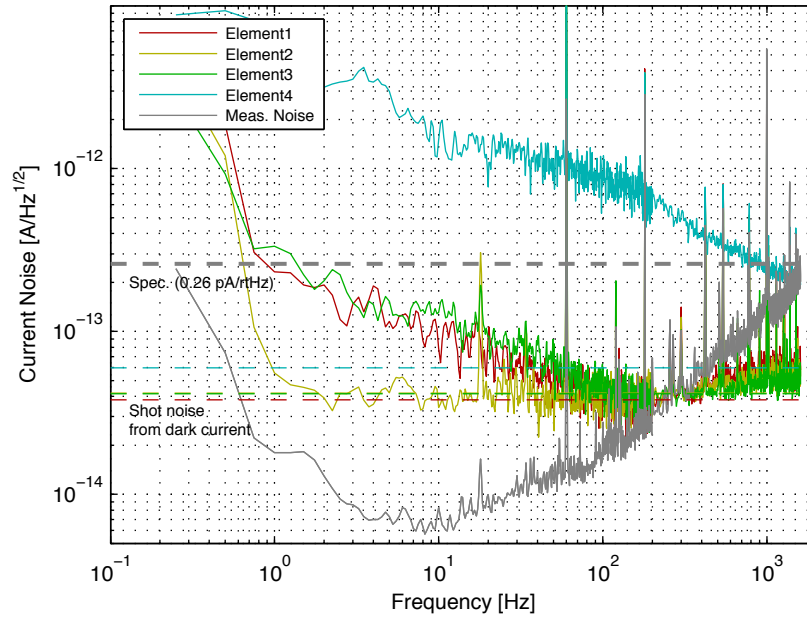
Elem1: 0.139 pA/rtHz  
 Elem2: 0.043 pA/rtHz  
 Elem3: 0.165 pA/rtHz  
 Elem4: 2.928 pA/rtHz

### 250~290Hz avg

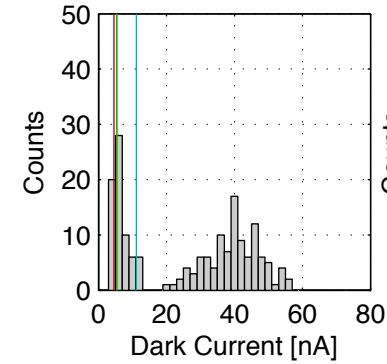
Elem1: 0.050 pA/rtHz  
 Elem2: 0.050 pA/rtHz  
 Elem3: 0.045 pA/rtHz  
 Elem4: 0.522 pA/rtHz

Total Penalty: -215

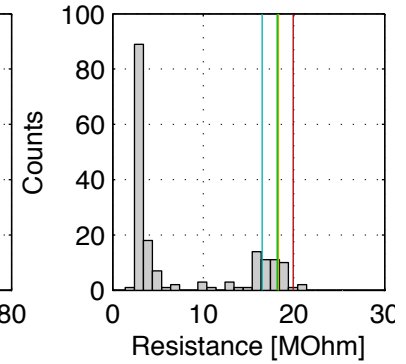
Dark noise:  $V_R = 10V$



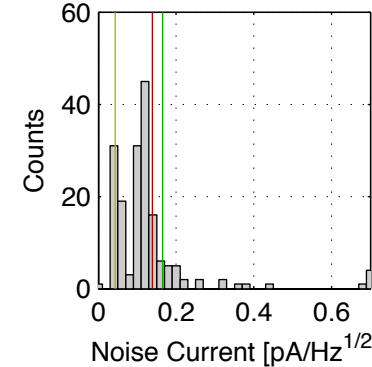
Dark Current@10V



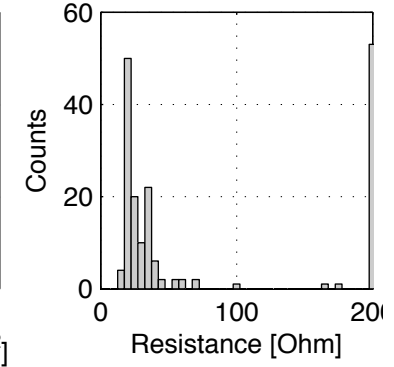
Shunt Resistance



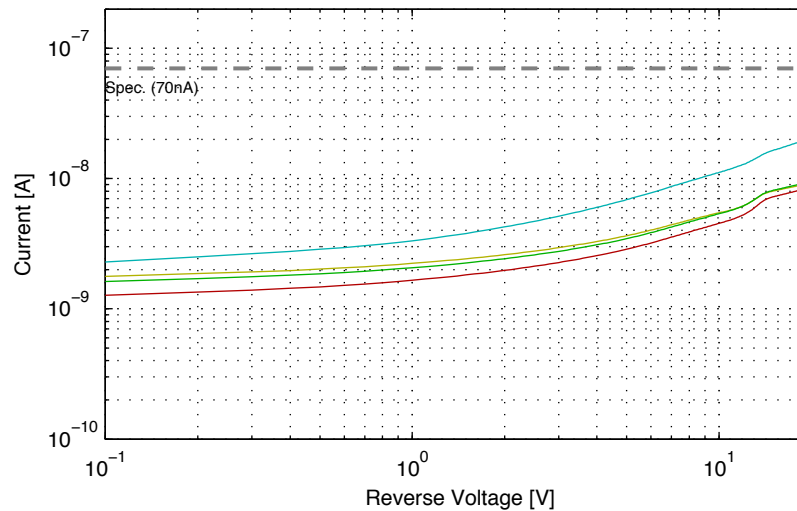
Dark current noise (1-10Hz Avg)



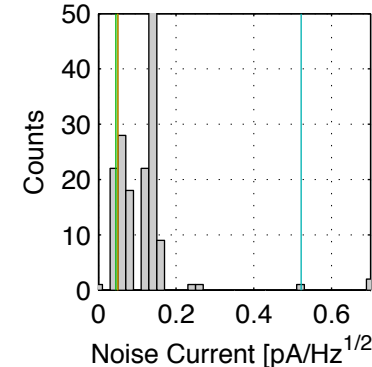
Series Resistance



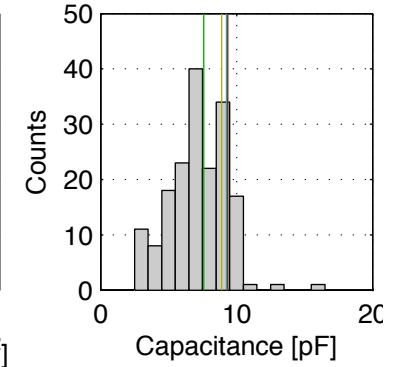
Dark current



Dark current noise (250-290Hz Avg)



Junction Capacitance



Errors / Warnings

Elem3:  $R_s > 2k\Omega$   
 Elem1:  $i_{noise}^{(LF)} > 56fA/rtHz$  (10nA shot)  
 Elem3:  $i_{noise}^{(LF)} > 56fA/rtHz$  (10nA shot)  
 Elem4:  $i_{noise}^{(LF)} > 180fA/rtHz$  (100nA shot)  
 Elem4:  $i_{noise}^{(HF)} > 180pA/rtHz$  (100nA shot)

# QPD #17

**Measurement Date:**

**Sept. 27, 2011**

Impedance measured at  $V_R = 15V$

**Shunt Resistance ( $R_{SH}$ ):**

Elem1: 7.335 MOhm  
 Elem2: 4.339 MOhm  
 Elem3: 5.336 MOhm  
 Elem4: 5.908 MOhm

**Series Resistance ( $R_s$ ):**

Elem1: 1339.6 Ohm  
 Elem2: 918.5 Ohm  
 Elem3: 1589.8 Ohm  
 Elem4: 1328.0 Ohm

**Junction Capacitance: ( $C_{pd}$ ):**

Elem1: 9.5 pF  
 Elem2: 10.0 pF  
 Elem3: 7.4 pF  
 Elem4: 9.3 pF

**Dark Current [nA]:**

Elem1: 7.86 nA  
 Elem2: 9.28 nA  
 Elem3: 8.67 nA  
 Elem4: 9.21 nA

**Dark Noise:**

**1~10Hz avg**

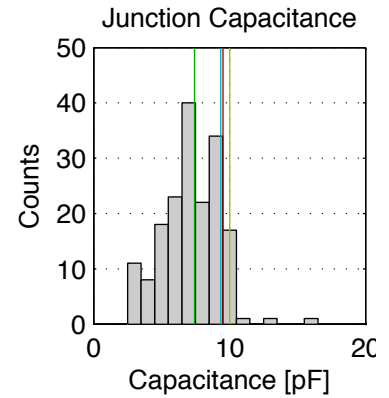
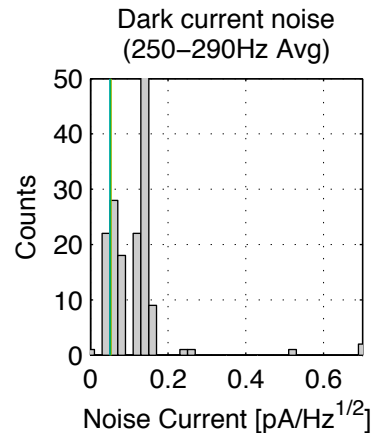
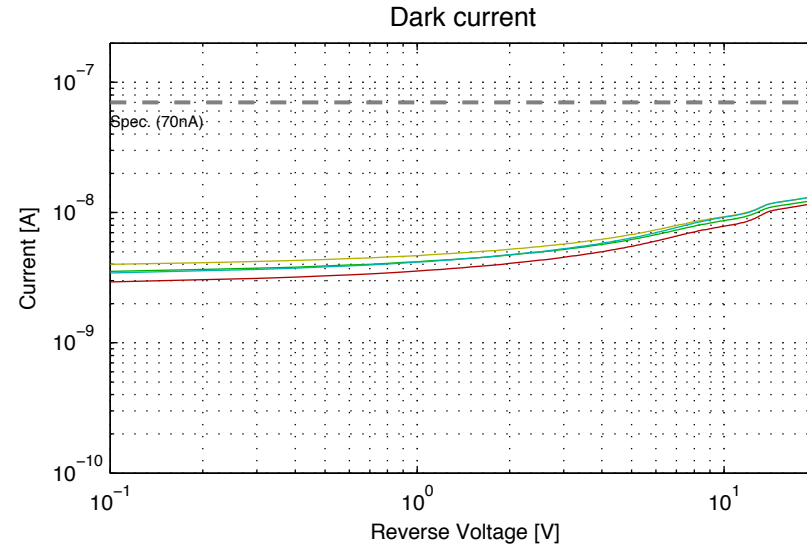
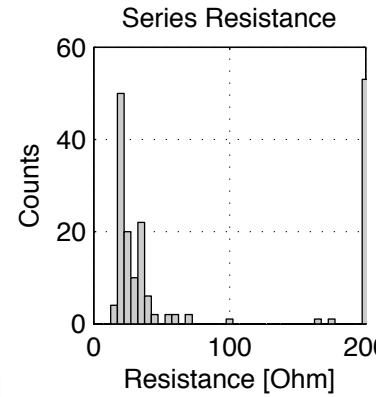
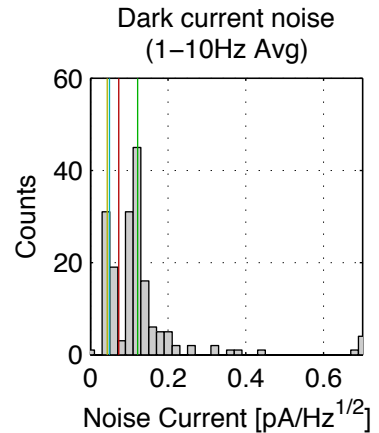
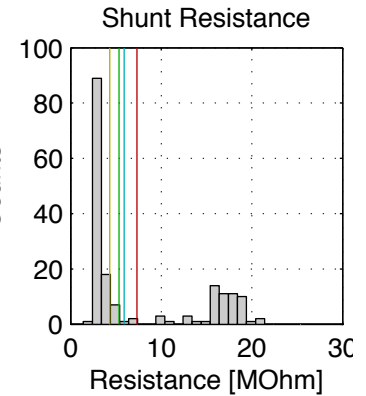
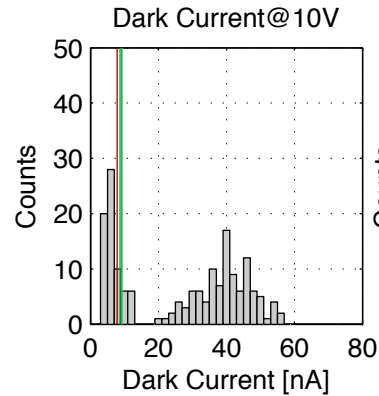
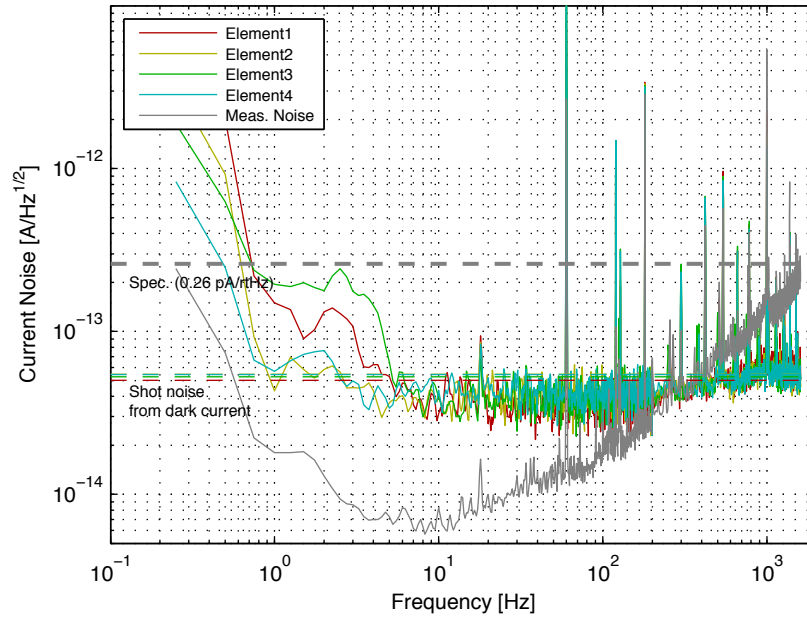
Elem1: 0.073 pA/rtHz  
 Elem2: 0.043 pA/rtHz  
 Elem3: 0.121 pA/rtHz  
 Elem4: 0.049 pA/rtHz

**250~290Hz avg**

Elem1: 0.052 pA/rtHz  
 Elem2: 0.053 pA/rtHz  
 Elem3: 0.051 pA/rtHz  
 Elem4: 0.050 pA/rtHz

Total Penalty: -15

Dark noise:  $V_R = 10V$



Errors / Warnings

Elem2:  $C_{pd} > 10pF$   
 Elem1:  $i_{noise} (LF) > 56fA/rtHz$  (10nA shot)  
 Elem3:  $i_{noise} (LF) > 56fA/rtHz$  (10nA shot)

# QPD #18

## Measurement Date:

Sept. 27, 2011

Impedance measured at  $V_R = 15V$

## Shunt Resistance ( $R_{SH}$ ):

Elem1: 13.382 MOhm  
 Elem2: 18.799 MOhm  
 Elem3: 17.190 MOhm  
 Elem4: 17.937 MOhm

## Series Resistance ( $R_s$ ):

Elem1: 1219.3 Ohm  
 Elem2: 797.6 Ohm  
 Elem3: 1087.8 Ohm  
 Elem4: 1716.5 Ohm

## Junction Capacitance: ( $C_{pd}$ ):

Elem1: 9.7 pF  
 Elem2: 10.1 pF  
 Elem3: 7.5 pF  
 Elem4: 9.4 pF

## Dark Current [nA]:

Elem1: 4.33 nA  
 Elem2: 11.87 nA  
 Elem3: 55.84 nA  
 Elem4: 6.21 nA

## Dark Noise:

### 1~10Hz avg

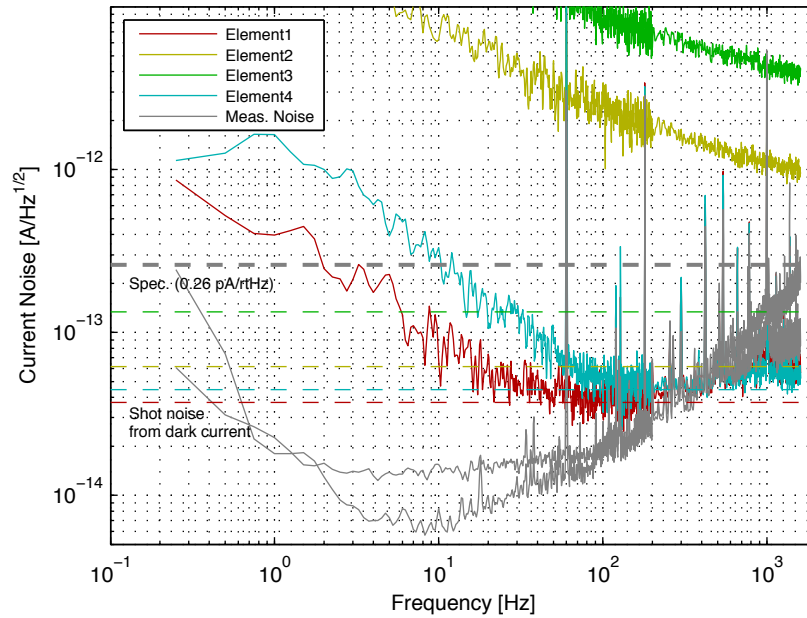
Elem1: 0.205 pA/rHz  
 Elem2: 15.250 pA/rHz  
 Elem3: 43.061 pA/rHz  
 Elem4: 0.683 pA/rHz

### 250~290Hz avg

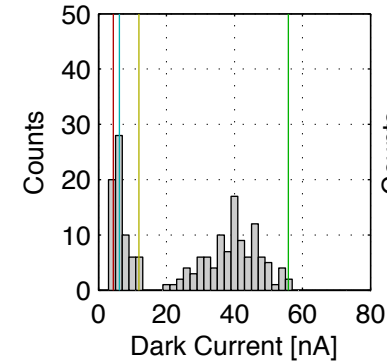
Elem1: 0.053 pA/rHz  
 Elem2: 1.723 pA/rHz  
 Elem3: 6.427 pA/rHz  
 Elem4: 0.053 pA/rHz

Total Penalty: -610

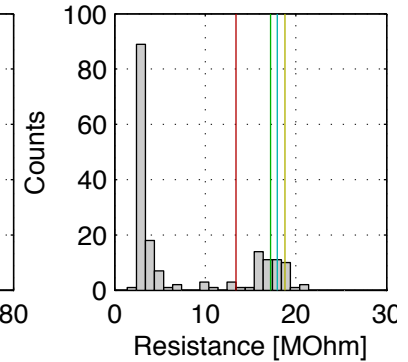
Dark noise:  $V_R = 10V$



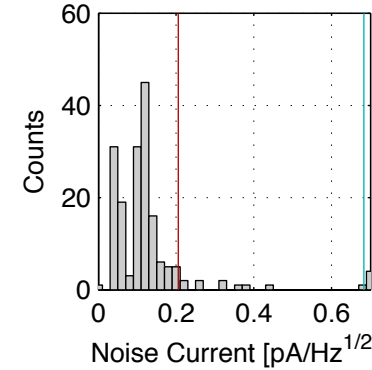
Dark Current@10V



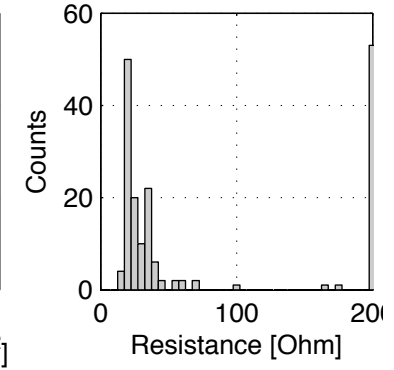
Shunt Resistance



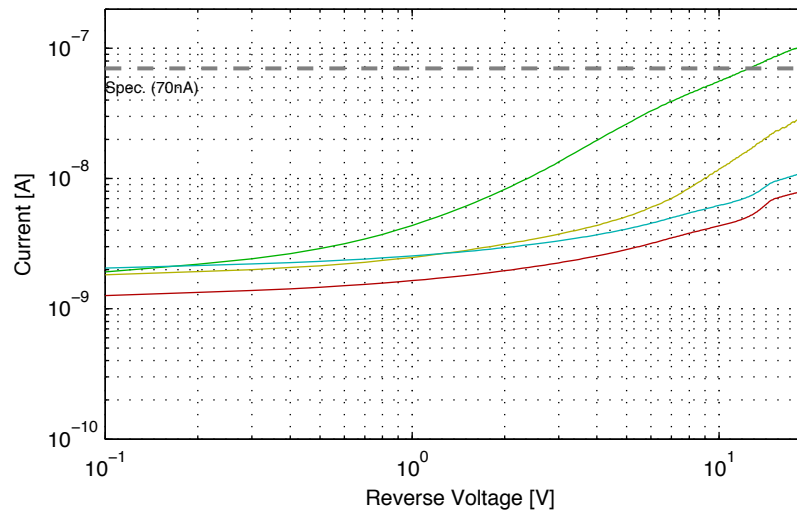
Dark current noise (1-10Hz Avg)



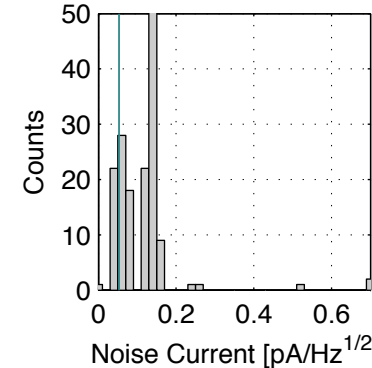
Series Resistance



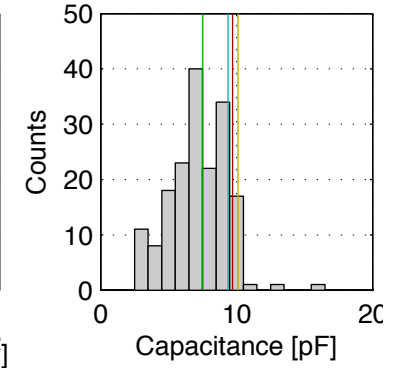
Dark current



Dark current noise (250-290Hz Avg)



Junction Capacitance



Errors / Warnings

Elem2:  $C_{pd} > 10pF$   
 Elem3:  $i_{pd} > 15nA$   
 Elem1:  $i_{noise}^{dark} (LF) > 180fA/rHz$  (100nA shot)  
 Elem2:  $i_{noise} (LF) > 180fA/rHz$  (100nA shot)  
 Elem3:  $i_{noise} (LF) > 180fA/rHz$  (100nA shot)  
 Elem4:  $i_{noise} (LF) > 180fA/rHz$  (100nA shot)  
 Elem2:  $i_{noise} (HF) > 180pA/rHz$  (100nA shot)  
 Elem3:  $i_{noise} (HF) > 180pA/rHz$  (100nA shot)

# QPD #19

**Measurement Date:**

Sept. 27, 2011

Impedance measured at  $V_R = 15V$

**Shunt Resistance ( $R_{SH}$ ):**

Elem1: 12.536 MOhm  
 Elem2: 18.012 MOhm  
 Elem3: 17.273 MOhm  
 Elem4: 17.152 MOhm

**Series Resistance ( $R_s$ ):**

Elem1: 1533.0 Ohm  
 Elem2: 659.6 Ohm  
 Elem3: 2020.9 Ohm  
 Elem4: 886.1 Ohm

**Junction Capacitance ( $C_{pd}$ ):**

Elem1: 9.3 pF  
 Elem2: 8.5 pF  
 Elem3: 7.7 pF  
 Elem4: 6.1 pF

**Dark Current [nA]:**

Elem1: 4.44 nA  
 Elem2: 5.45 nA  
 Elem3: 5.15 nA  
 Elem4: 6.08 nA

**Dark Noise:**

**1~10Hz avg**

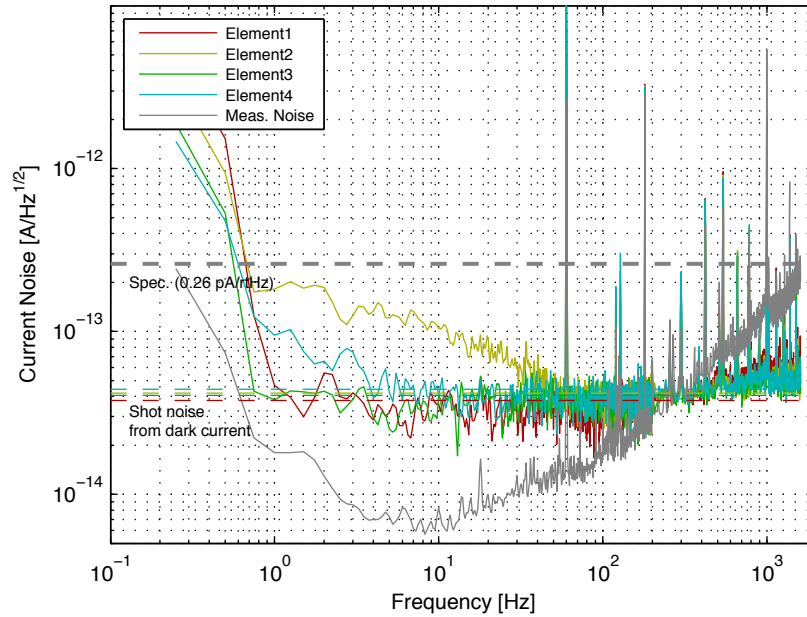
Elem1: 0.036 pA/rtHz  
 Elem2: 0.134 pA/rtHz  
 Elem3: 0.035 pA/rtHz  
 Elem4: 0.056 pA/rtHz

**250~290Hz avg**

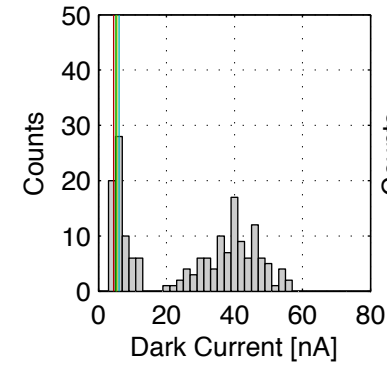
Elem1: 0.047 pA/rtHz  
 Elem2: 0.047 pA/rtHz  
 Elem3: 0.044 pA/rtHz  
 Elem4: 0.047 pA/rtHz

Total Penalty: -10

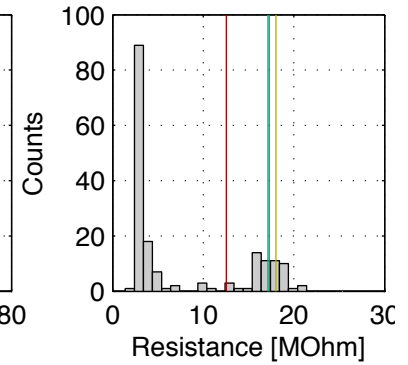
Dark noise:  $V_R = 10V$



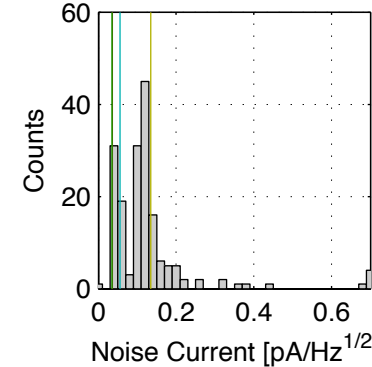
Dark Current@10V



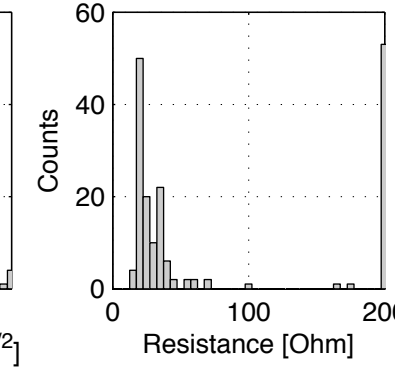
Shunt Resistance



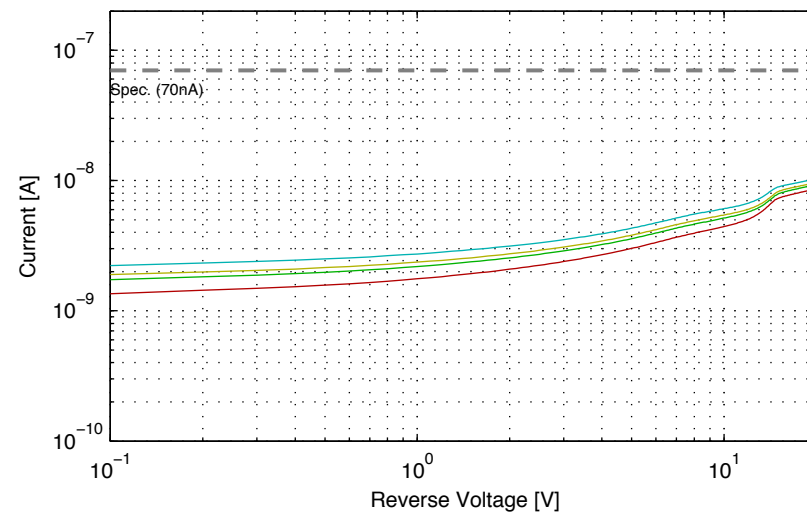
Dark current noise (1-10Hz Avg)



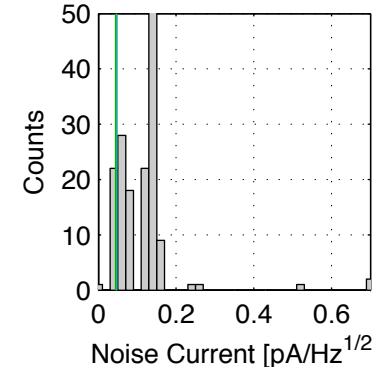
Series Resistance



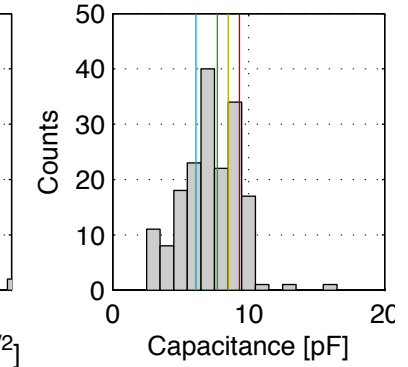
Dark current



Dark current noise (250-290Hz Avg)



Junction Capacitance



Errors / Warnings

Elem3:  $R_s > 2kOhm$   
 Elem2:  $i_{noise}^{(LF)} > 56fA/rtHz$  (10nA shot)

# QPD #20

**Measurement Date:**

**Sept. 27, 2011**

Impedance measured at  $V_R = 15V$

**Shunt Resistance ( $R_{SH}$ ):**

Elem1: 17.187 MOhm  
 Elem2: 7.096 MOhm  
 Elem3: 16.675 MOhm  
 Elem4: 5.231 MOhm

**Series Resistance ( $R_s$ ):**

Elem1: 1162.4 Ohm  
 Elem2: 1002.4 Ohm  
 Elem3: 1612.3 Ohm  
 Elem4: 1791.3 Ohm

**Junction Capacitance ( $C_{pd}$ ):**

Elem1: 9.4 pF  
 Elem2: 10.3 pF  
 Elem3: 7.2 pF  
 Elem4: 8.9 pF

**Dark Current [nA]:**

Elem1: 4.86 nA  
 Elem2: 7.70 nA  
 Elem3: 6.11 nA  
 Elem4: 8.72 nA

**Dark Noise:**

**1~10Hz avg**

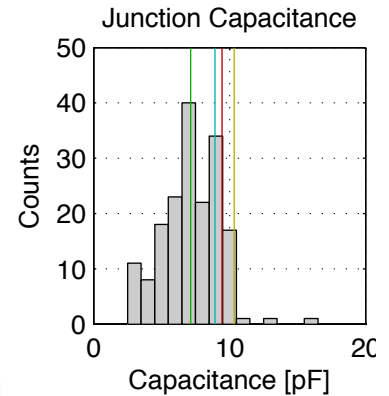
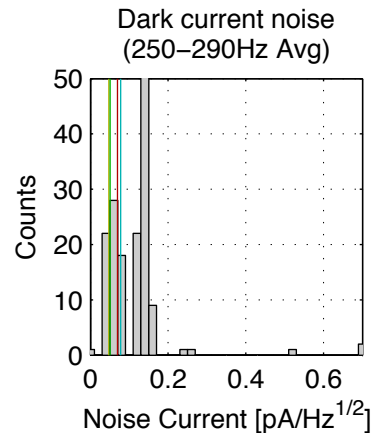
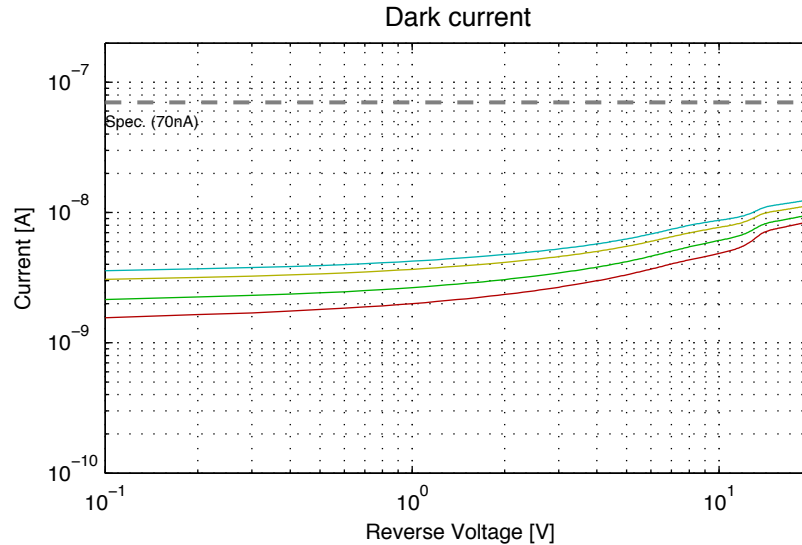
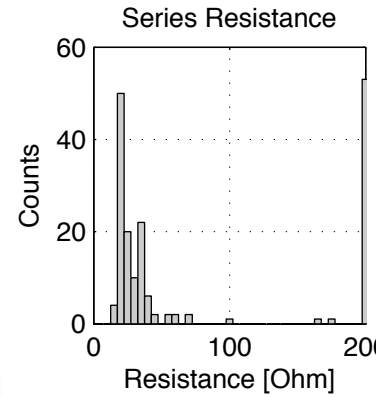
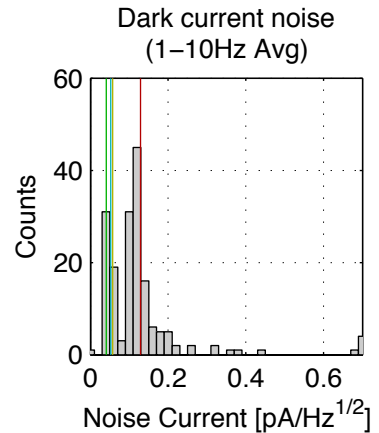
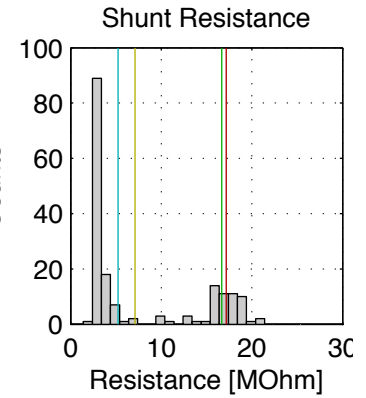
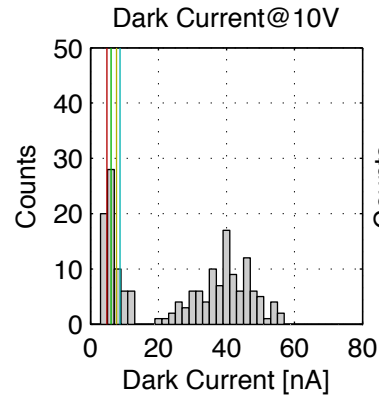
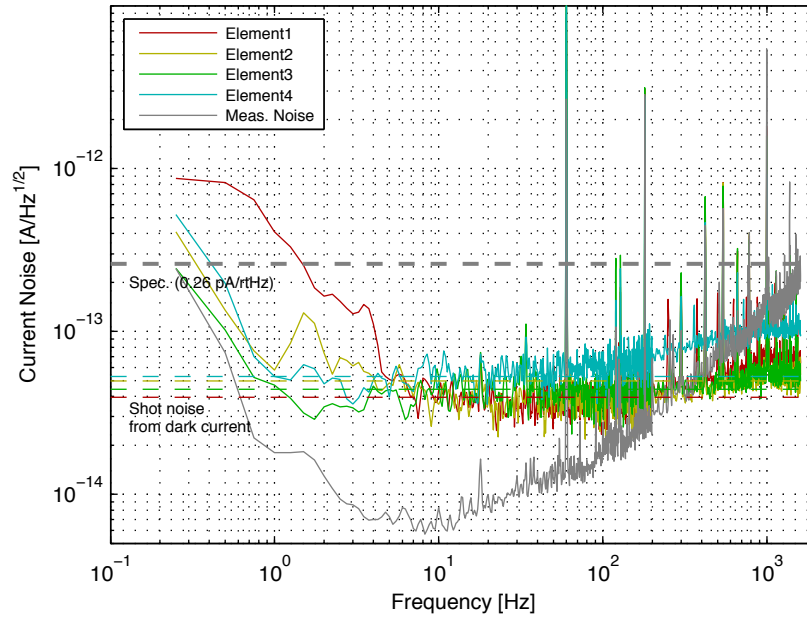
Elem1: 0.129 pA/rtHz  
 Elem2: 0.057 pA/rtHz  
 Elem3: 0.041 pA/rtHz  
 Elem4: 0.053 pA/rtHz

**250~290Hz avg**

Elem1: 0.070 pA/rtHz  
 Elem2: 0.047 pA/rtHz  
 Elem3: 0.050 pA/rtHz  
 Elem4: 0.078 pA/rtHz

Total Penalty: -15

Dark noise:  $V_R = 10V$



Errors / Warnings

Elem2:  $C_{pd} > 10pF$   
 Elem1:  $i_{noise}^{(LF)} > 56fA/rtHz$  (10nA shot)  
 Elem2:  $i_{noise}^{(LF)} > 56fA/rtHz$  (10nA shot)

# QPD #21

## Measurement Date:

Mar. 15, 2013

Impedance measured at  $V_R = 15V$

## Shunt Resistance ( $R_{SH}$ ):

Elem1: 2.868 MOhm  
 Elem2: 3.081 MOhm  
 Elem3: 3.252 MOhm  
 Elem4: 2.942 MOhm

## Series Resistance ( $R_s$ ):

Elem1: 20.5 Ohm  
 Elem2: 25.0 Ohm  
 Elem3: 57.6 Ohm  
 Elem4: 27.7 Ohm

## Junction Capacitance ( $C_{pd}$ ):

Elem1: 3.7 pF  
 Elem2: 6.5 pF  
 Elem3: 4.9 pF  
 Elem4: 5.3 pF

## Dark Current [nA]:

Elem1: 36.75 nA  
 Elem2: 40.40 nA  
 Elem3: 35.91 nA  
 Elem4: 42.21 nA

## Dark Noise:

### 1~10Hz avg

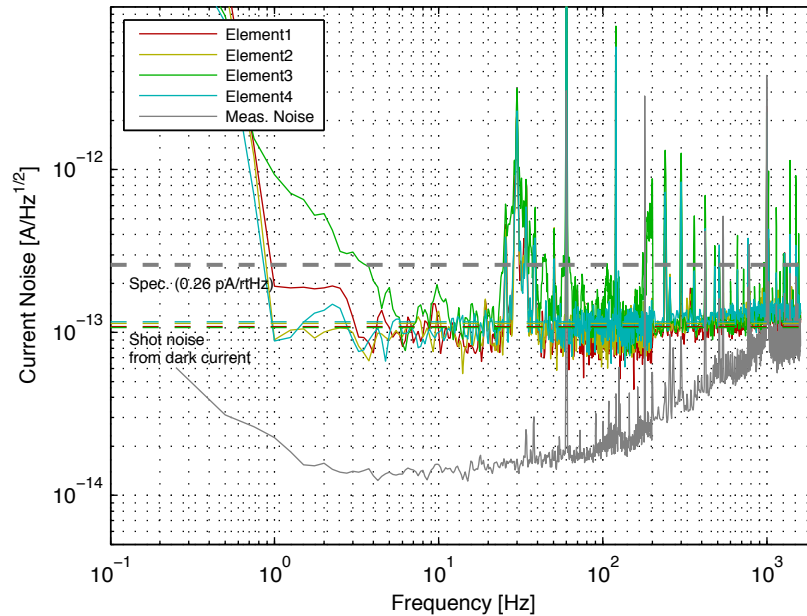
Elem1: 0.129 pA/rtHz  
 Elem2: 0.101 pA/rtHz  
 Elem3: 0.311 pA/rtHz  
 Elem4: 0.103 pA/rtHz

### 250~290Hz avg

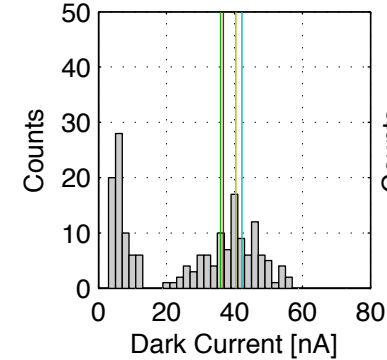
Elem1: 0.118 pA/rtHz  
 Elem2: 0.125 pA/rtHz  
 Elem3: 0.124 pA/rtHz  
 Elem4: 0.135 pA/rtHz

Total Penalty: -155

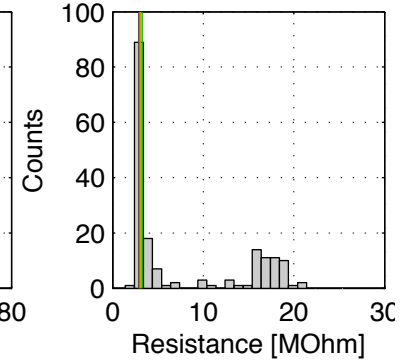
Dark noise:  $V_R = 10V$



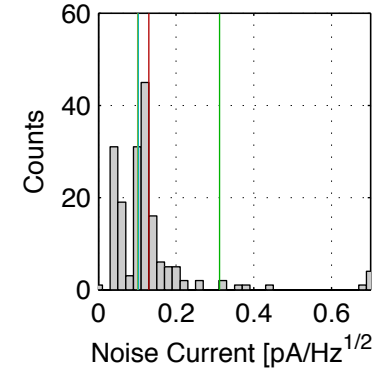
Dark Current@10V



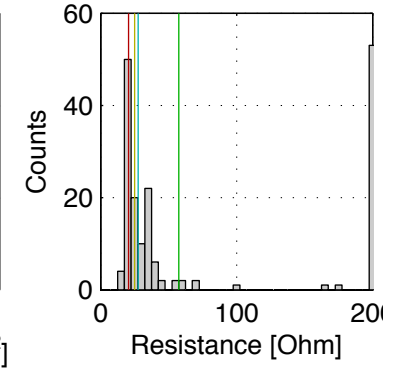
Shunt Resistance



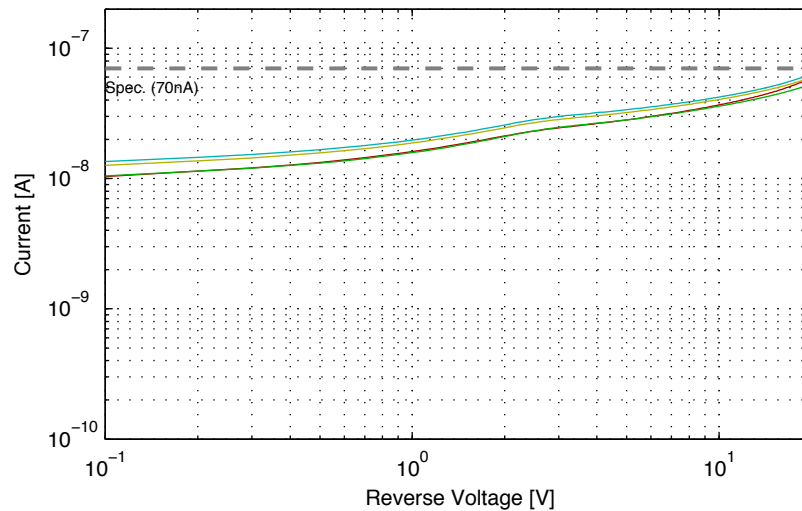
Dark current noise (1-10Hz Avg)



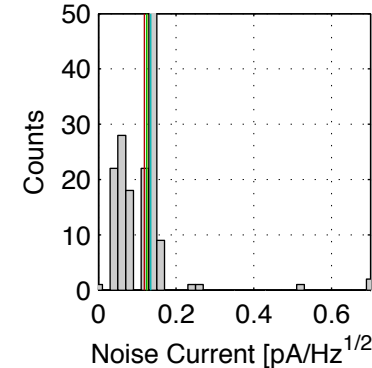
Series Resistance



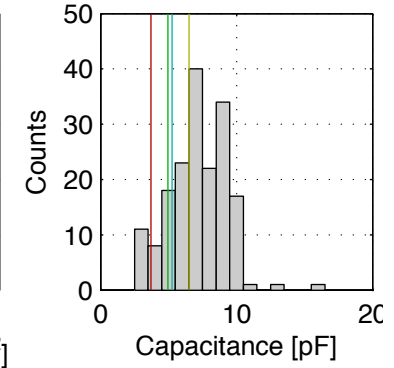
Dark current



Dark current noise (250-290Hz Avg)



Junction Capacitance



Errors / Warnings

Elem1: $i_{dark} > 15nA$	Elem3: $i_{noise} (LF) > 180fA/rtHz$ (100nA shot)
Elem2: $i_{dark} > 15nA$	Elem4: $i_{noise} (LF) > 56fA/rtHz$ (10nA shot)
Elem3: $i_{dark} > 15nA$	Elem1: $i_{noise} (HF) > 100fA/rtHz$ (30nA shot)
Elem4: $i_{dark} > 15nA$	Elem2: $i_{noise} (HF) > 100fA/rtHz$ (30nA shot)
Elem1: $i_{dark} (LF) > 56fA/rtHz$ (10nA shot)	Elem3: $i_{noise} (HF) > 100fA/rtHz$ (30nA shot)
Elem2: $i_{dark} (LF) > 56fA/rtHz$ (10nA shot)	Elem4: $i_{noise} (HF) > 100fA/rtHz$ (30nA shot)

# QPD #22

## Measurement Date:

Mar. 15, 2013

Impedance measured at  $V_R = 15V$

## Shunt Resistance ( $R_{SH}$ ):

Elem1: 3.367 MOhm  
 Elem2: 3.241 MOhm  
 Elem3: 3.044 MOhm  
 Elem4: 2.971 MOhm

## Series Resistance ( $R_s$ ):

Elem1: 17.5 Ohm  
 Elem2: 20.7 Ohm  
 Elem3: 27.9 Ohm  
 Elem4: 24.7 Ohm

## Junction Capacitance ( $C_{pd}$ ):

Elem1: 3.8 pF  
 Elem2: 6.4 pF  
 Elem3: 4.6 pF  
 Elem4: 7.1 pF

## Dark Current [nA]:

Elem1: 30.19 nA  
 Elem2: 37.11 nA  
 Elem3: 36.80 nA  
 Elem4: 43.68 nA

## Dark Noise:

### 1~10Hz avg

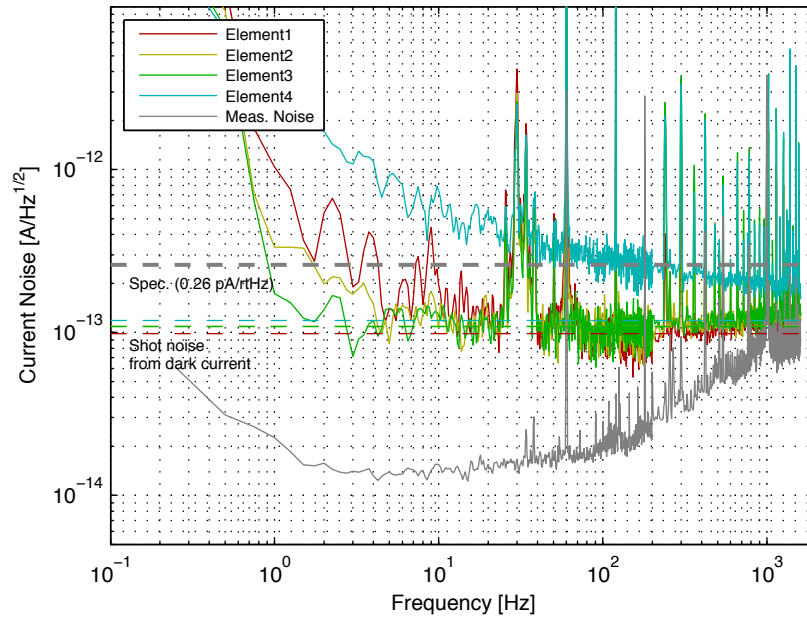
Elem1: 0.359 pA/rtHz  
 Elem2: 0.176 pA/rtHz  
 Elem3: 0.128 pA/rtHz  
 Elem4: 1.122 pA/rtHz

### 250~290Hz avg

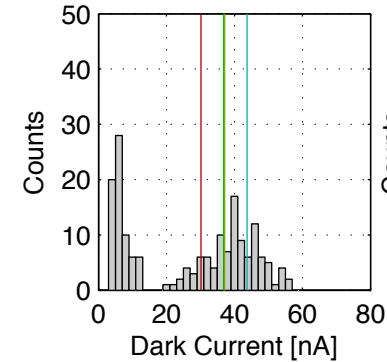
Elem1: 0.119 pA/rtHz  
 Elem2: 0.133 pA/rtHz  
 Elem3: 0.131 pA/rtHz  
 Elem4: 0.254 pA/rtHz

Total Penalty: -345

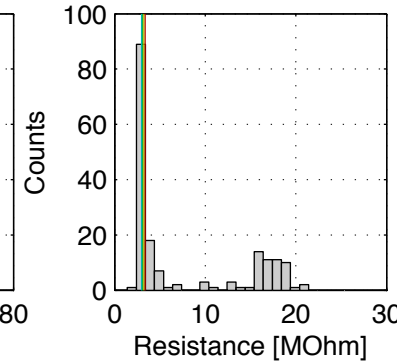
Dark noise:  $V_R = 10V$



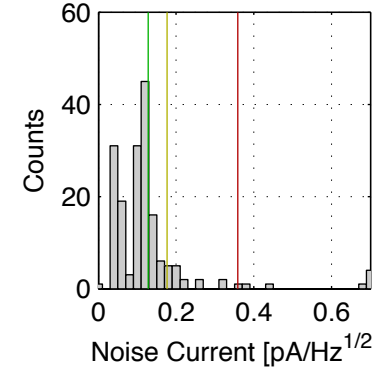
Dark Current@10V



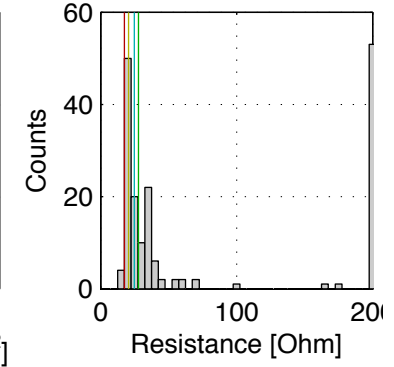
Shunt Resistance



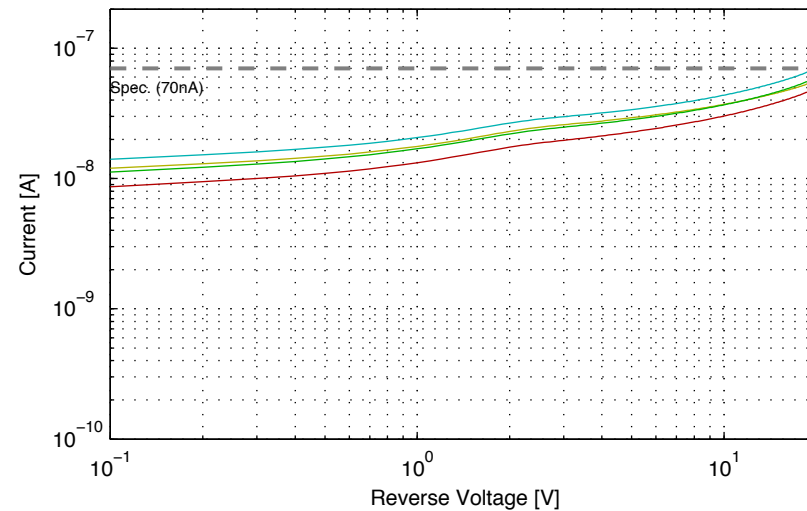
Dark current noise (1~10Hz Avg)



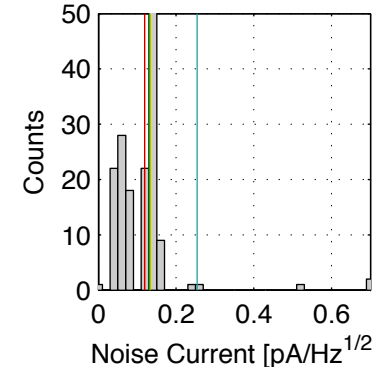
Series Resistance



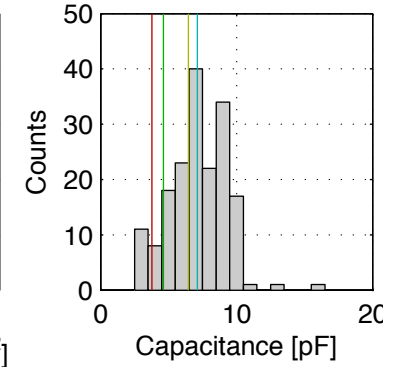
Dark current



Dark current noise (250~290Hz Avg)



Junction Capacitance



Errors / Warnings

Elem1: $i_{dark} > 15nA$	Elem3: $i_{noise} (LF) > 56fA/rtHz$ (10nA shot)
Elem2: $i_{dark} > 15nA$	Elem4: $i_{noise} (LF) > 180fA/rtHz$ (100nA shot)
Elem3: $i_{dark} > 15nA$	Elem1: $i_{noise} (HF) > 100fA/rtHz$ (30nA shot)
Elem4: $i_{dark} > 15nA$	Elem2: $i_{noise} (HF) > 100fA/rtHz$ (30nA shot)
Elem1: $i_{noise} (LF) > 180fA/rtHz$ (100nA shot)	Elem3: $i_{noise} (HF) > 100fA/rtHz$ (30nA shot)
Elem2: $i_{noise} (LF) > 56fA/rtHz$ (10nA shot)	Elem4: $i_{noise} (HF) > 180pA/rtHz$ (100nA shot)



# QPD #23

## Measurement Date:

Mar. 15, 2013

Impedance measured at  $V_R = 15V$

## Shunt Resistance ( $R_{SH}$ ):

Elem1: 3.031 MOhm  
 Elem2: 2.846 MOhm  
 Elem3: 2.660 MOhm  
 Elem4: 2.635 MOhm

## Series Resistance ( $R_s$ ):

Elem1: 21.6 Ohm  
 Elem2: 18.4 Ohm  
 Elem3: 35.8 Ohm  
 Elem4: 22.4 Ohm

## Junction Capacitance ( $C_{pd}$ ):

Elem1: 6.3 pF  
 Elem2: 7.1 pF  
 Elem3: 4.5 pF  
 Elem4: 7.4 pF

## Dark Current [nA]:

Elem1: 35.70 nA  
 Elem2: 43.78 nA  
 Elem3: 43.62 nA  
 Elem4: 49.93 nA

## Dark Noise:

### 1~10Hz avg

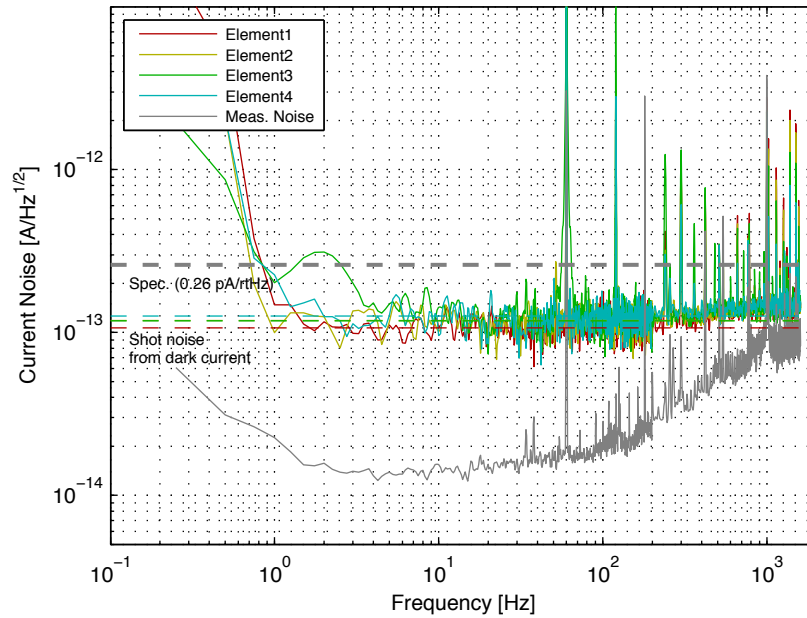
Elem1: 0.109 pA/rtHz  
 Elem2: 0.120 pA/rtHz  
 Elem3: 0.183 pA/rtHz  
 Elem4: 0.130 pA/rtHz

### 250~290Hz avg

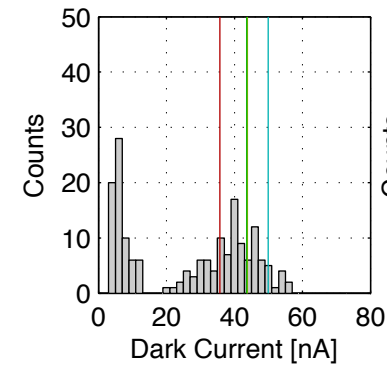
Elem1: 0.141 pA/rtHz  
 Elem2: 0.139 pA/rtHz  
 Elem3: 0.146 pA/rtHz  
 Elem4: 0.142 pA/rtHz

Total Penalty: -155

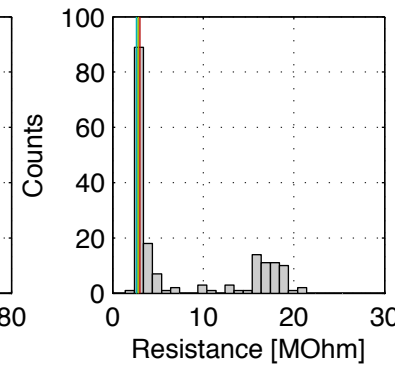
Dark noise:  $V_R = 10V$



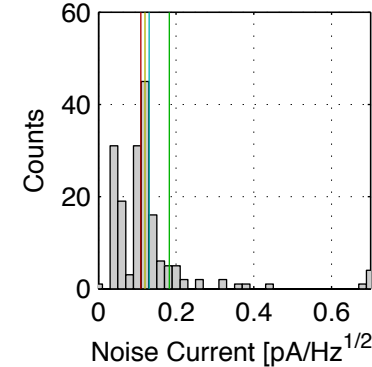
Dark Current@10V



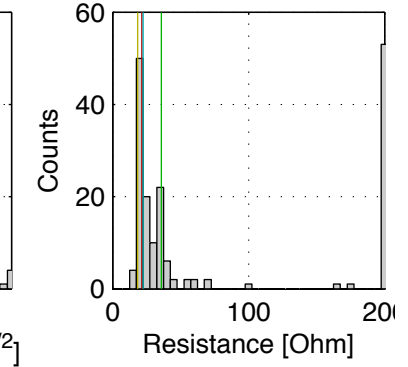
Shunt Resistance



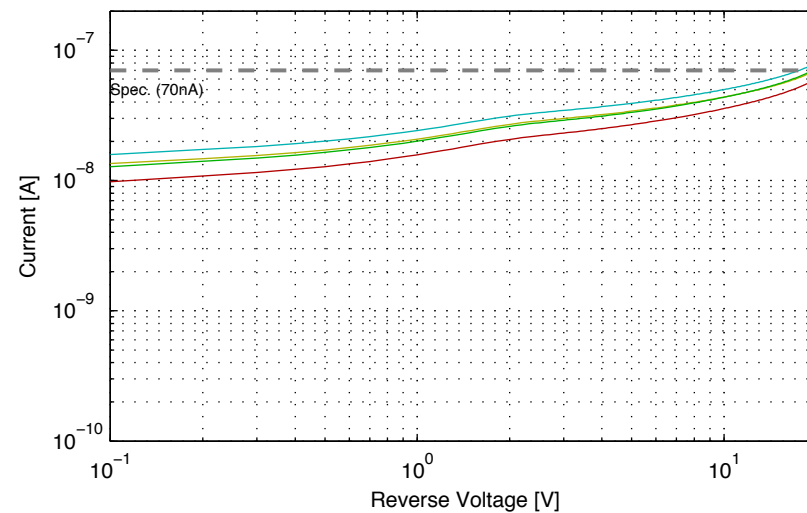
Dark current noise (1~10Hz Avg)



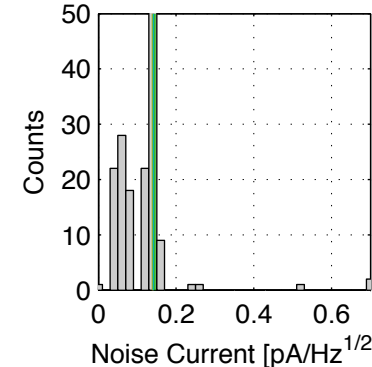
Series Resistance



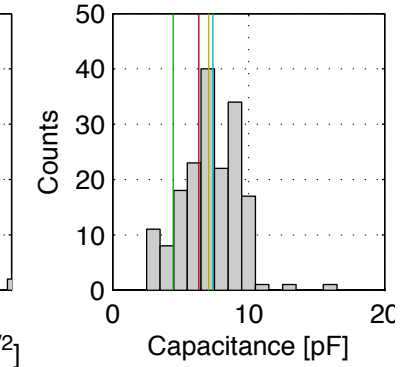
Dark current



Dark current noise (250~290Hz Avg)



Junction Capacitance



Errors / Warnings

Elem1: $i_{dark} > 15nA$	Elem3: $i_{noise} (LF) > 180fA/rtHz (100nA shot)$
Elem2: $i_{dark} > 15nA$	Elem4: $i_{noise} (LF) > 56fA/rtHz (10nA shot)$
Elem3: $i_{dark} > 15nA$	Elem1: $i_{noise} (HF) > 100fA/rtHz (30nA shot)$
Elem4: $i_{dark} > 15nA$	Elem2: $i_{noise} (HF) > 100fA/rtHz (30nA shot)$
Elem1: $i_{dark} (LF) > 56fA/rtHz (10nA shot)$	Elem3: $i_{noise} (HF) > 100fA/rtHz (30nA shot)$
Elem2: $i_{dark} (LF) > 56fA/rtHz (10nA shot)$	Elem4: $i_{noise} (HF) > 100fA/rtHz (30nA shot)$

# QPD #24

## Measurement Date:

Mar. 15, 2013

Impedance measured at  $V_R = 15V$

## Shunt Resistance ( $R_{SH}$ ):

Elem1: 3.463 MOhm  
 Elem2: 3.066 MOhm  
 Elem3: 2.901 MOhm  
 Elem4: 2.773 MOhm

## Series Resistance ( $R_s$ ):

Elem1: 36.3 Ohm  
 Elem2: 39.6 Ohm  
 Elem3: 68.8 Ohm  
 Elem4: 47.0 Ohm

## Junction Capacitance ( $C_{pd}$ ):

Elem1: 7.1 pF  
 Elem2: 7.7 pF  
 Elem3: 5.3 pF  
 Elem4: 6.9 pF

## Dark Current [nA]:

Elem1: 30.37 nA  
 Elem2: 39.75 nA  
 Elem3: 41.10 nA  
 Elem4: 46.60 nA

## Dark Noise:

### 1~10Hz avg

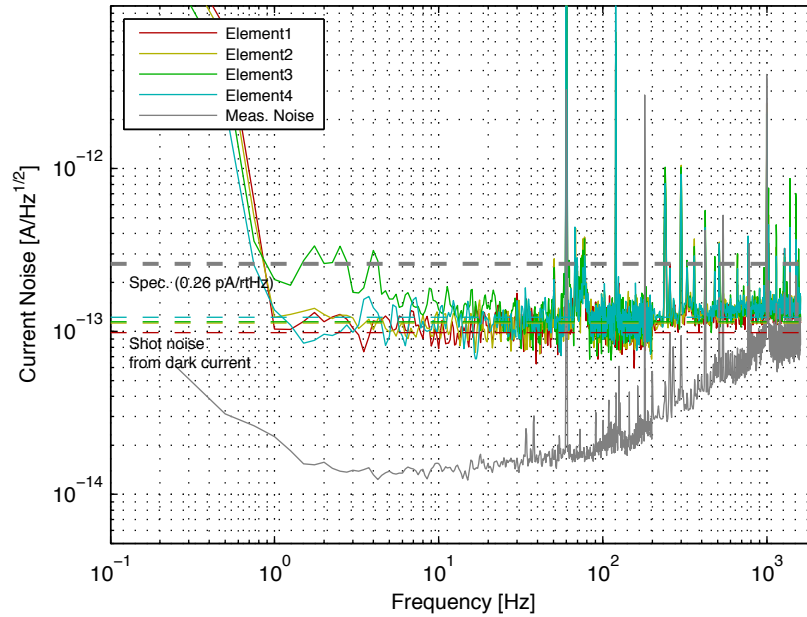
Elem1: 0.109 pA/rtHz  
 Elem2: 0.112 pA/rtHz  
 Elem3: 0.199 pA/rtHz  
 Elem4: 0.117 pA/rtHz

### 250~290Hz avg

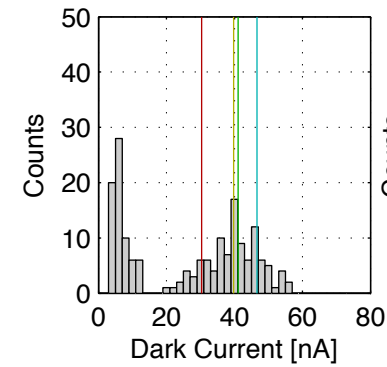
Elem1: 0.136 pA/rtHz  
 Elem2: 0.135 pA/rtHz  
 Elem3: 0.138 pA/rtHz  
 Elem4: 0.141 pA/rtHz

Total Penalty: -155

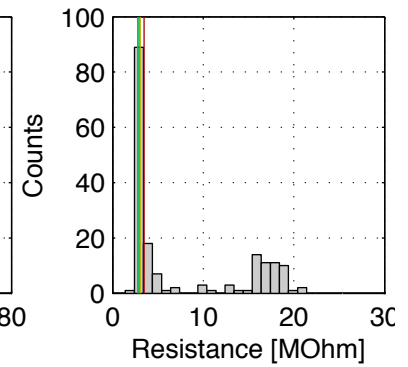
Dark noise:  $V_R = 10V$



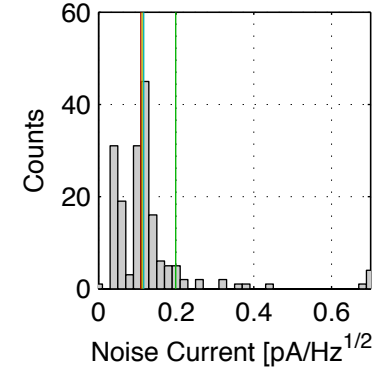
Dark Current@10V



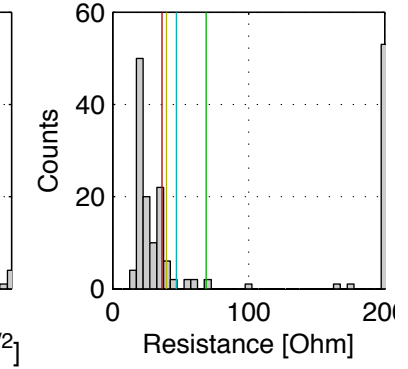
Shunt Resistance



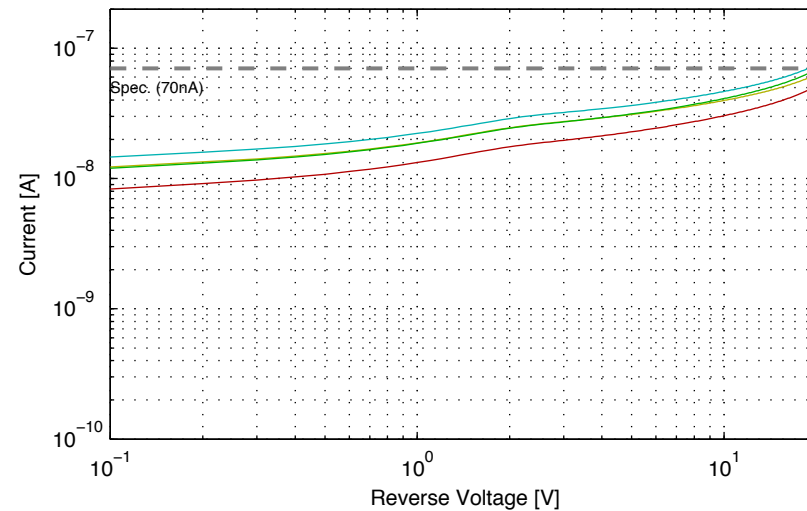
Dark current noise (1-10Hz Avg)



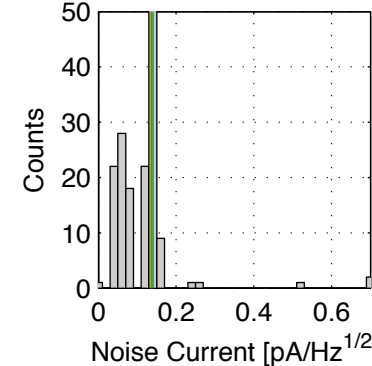
Series Resistance



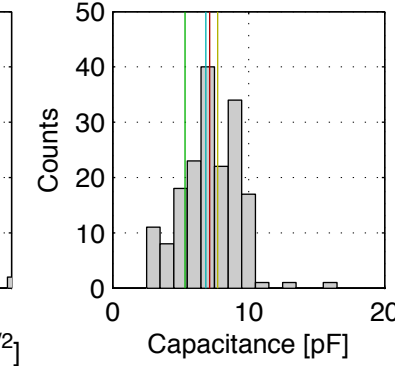
Dark current



Dark current noise (250-290Hz Avg)



Junction Capacitance



Errors / Warnings

Elem1: $i_{dark} > 15nA$	Elem3: $i_{noise} (LF) > 180fA/rtHz$ (100nA shot)
Elem2: $i_{dark} > 15nA$	Elem4: $i_{noise} (LF) > 56fA/rtHz$ (10nA shot)
Elem3: $i_{dark} > 15nA$	Elem1: $i_{noise} (HF) > 100fA/rtHz$ (30nA shot)
Elem4: $i_{dark} > 15nA$	Elem2: $i_{noise} (HF) > 100fA/rtHz$ (30nA shot)
Elem1: $i_{noise} (LF) > 56fA/rtHz$ (10nA shot)	Elem3: $i_{noise} (HF) > 100fA/rtHz$ (30nA shot)
Elem2: $i_{noise} (LF) > 56fA/rtHz$ (10nA shot)	Elem4: $i_{noise} (HF) > 100fA/rtHz$ (30nA shot)

# QPD #25

## Measurement Date:

Mar. 15, 2013

Impedance measured at  $V_R = 15V$

## Shunt Resistance ( $R_{SH}$ ):

Elem1: 2.768 MOhm  
 Elem2: 2.631 MOhm  
 Elem3: 2.580 MOhm  
 Elem4: 2.546 MOhm

## Series Resistance ( $R_s$ ):

Elem1: 23.3 Ohm  
 Elem2: 18.0 Ohm  
 Elem3: 35.0 Ohm  
 Elem4: 22.7 Ohm

## Junction Capacitance ( $C_{pd}$ ):

Elem1: 7.8 pF  
 Elem2: 8.5 pF  
 Elem3: 3.0 pF  
 Elem4: 6.1 pF

## Dark Current [nA]:

Elem1: 39.98 nA  
 Elem2: 46.64 nA  
 Elem3: 45.35 nA  
 Elem4: 50.51 nA

## Dark Noise:

### 1~10Hz avg

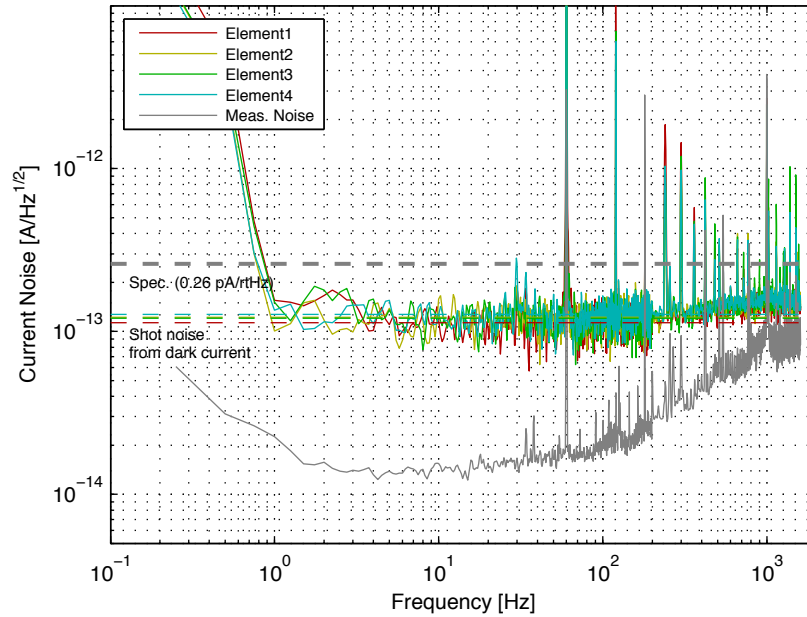
Elem1: 0.129 pA/rtHz  
 Elem2: 0.115 pA/rtHz  
 Elem3: 0.134 pA/rtHz  
 Elem4: 0.126 pA/rtHz

### 250~290Hz avg

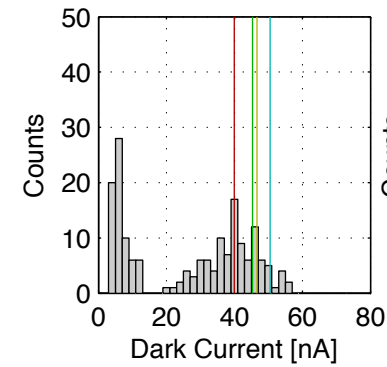
Elem1: 0.141 pA/rtHz  
 Elem2: 0.144 pA/rtHz  
 Elem3: 0.139 pA/rtHz  
 Elem4: 0.150 pA/rtHz

Total Penalty: -60

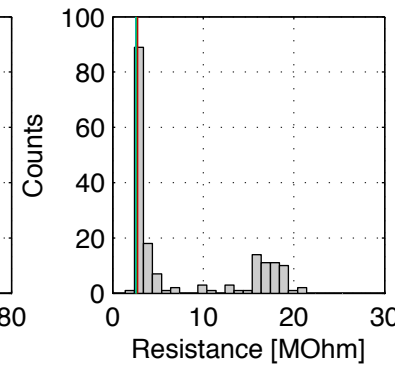
Dark noise:  $V_R = 10V$



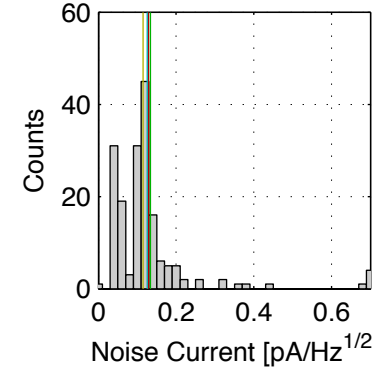
Dark Current@10V



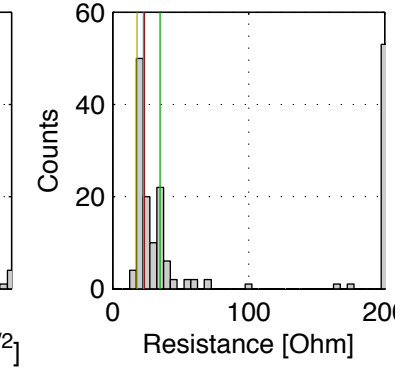
Shunt Resistance



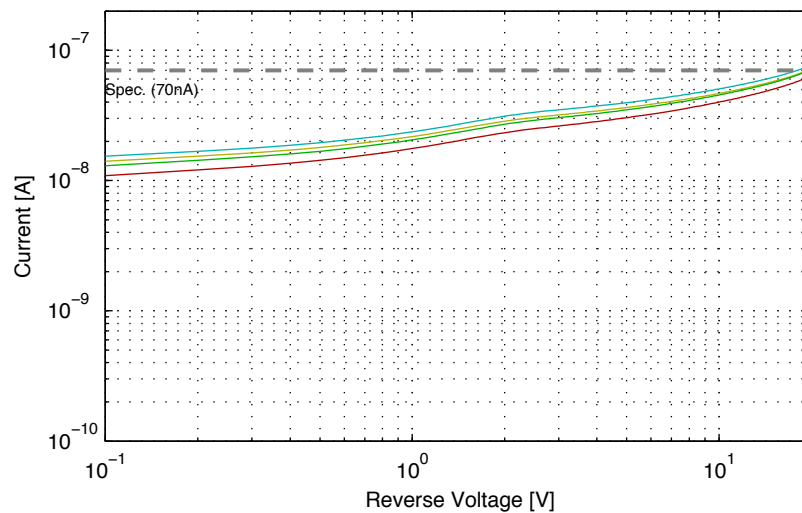
Dark current noise (1-10Hz Avg)



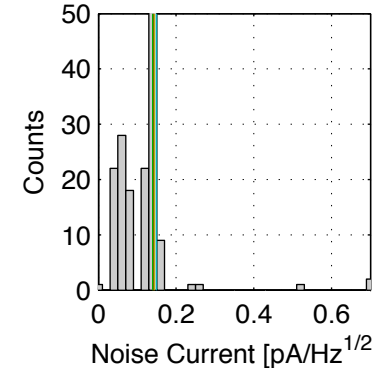
Series Resistance



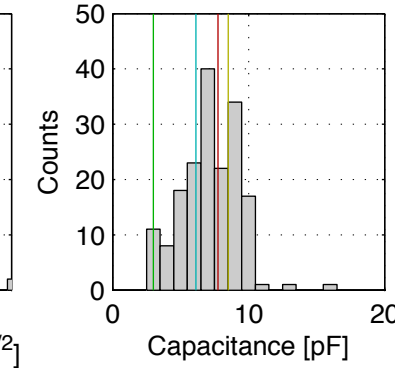
Dark current



Dark current noise (250-290Hz Avg)



Junction Capacitance



Errors / Warnings

Elem1: $i_{dark} > 15nA$	Elem3: $i_{noise} (LF) > 56fA/rtHz$ (10nA shot)
Elem2: $i_{dark} > 15nA$	Elem4: $i_{noise} (LF) > 56fA/rtHz$ (10nA shot)
Elem3: $i_{dark} > 15nA$	Elem1: $i_{noise} (HF) > 100fA/rtHz$ (30nA shot)
Elem4: $i_{dark} > 15nA$	Elem2: $i_{noise} (HF) > 100fA/rtHz$ (30nA shot)
Elem1: $i_{dark} (LF) > 56fA/rtHz$ (10nA shot)	Elem3: $i_{noise} (HF) > 100fA/rtHz$ (30nA shot)
Elem2: $i_{noise} (LF) > 56fA/rtHz$ (10nA shot)	Elem4: $i_{noise} (HF) > 100fA/rtHz$ (30nA shot)

# QPD #26

## Measurement Date:

Mar. 15, 2013

Impedance measured at  $V_R = 15V$

## Shunt Resistance ( $R_{SH}$ ):

Elem1: 3.412 MOhm  
 Elem2: 2.767 MOhm  
 Elem3: 2.538 MOhm  
 Elem4: 2.472 MOhm

## Series Resistance ( $R_s$ ):

Elem1: 16.4 Ohm  
 Elem2: 17.6 Ohm  
 Elem3: 31.6 Ohm  
 Elem4: 21.2 Ohm

## Junction Capacitance ( $C_{pd}$ ):

Elem1: 7.8 pF  
 Elem2: 6.8 pF  
 Elem3: 5.4 pF  
 Elem4: 7.3 pF

## Dark Current [nA]:

Elem1: 32.12 nA  
 Elem2: 44.91 nA  
 Elem3: 47.21 nA  
 Elem4: 53.74 nA

## Dark Noise:

### 1~10Hz avg

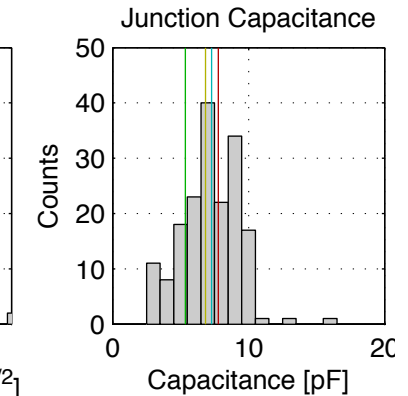
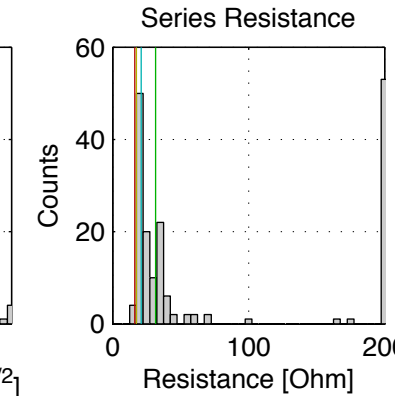
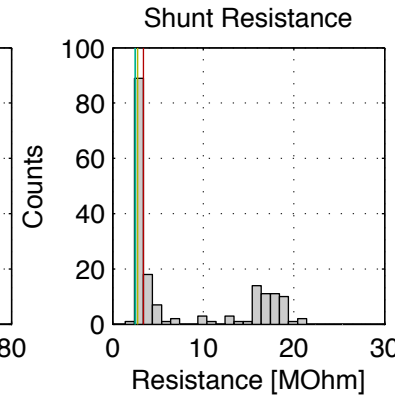
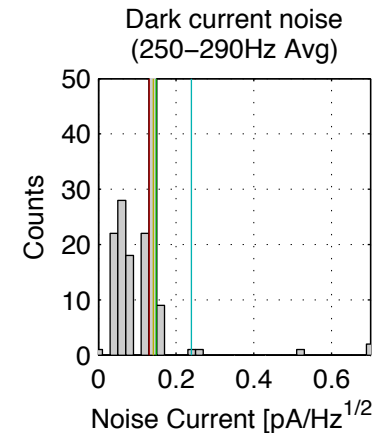
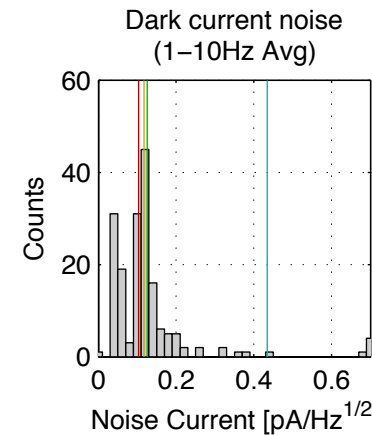
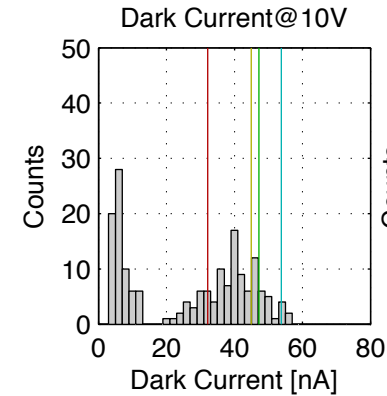
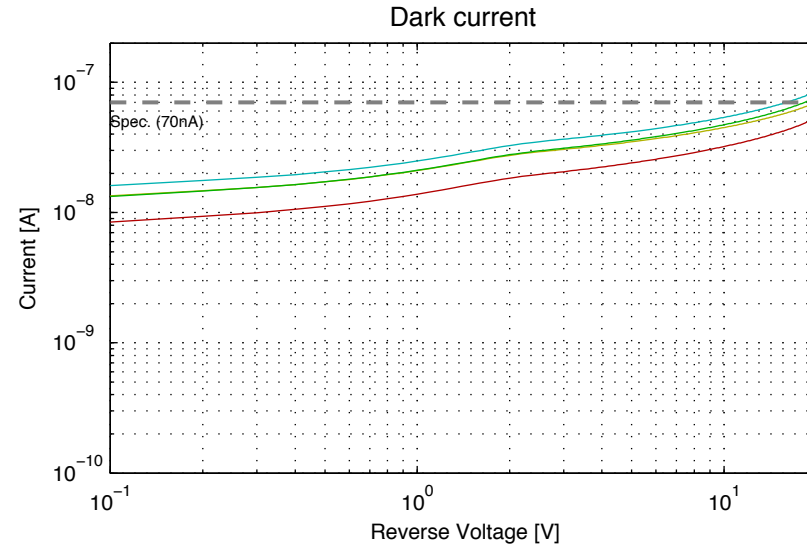
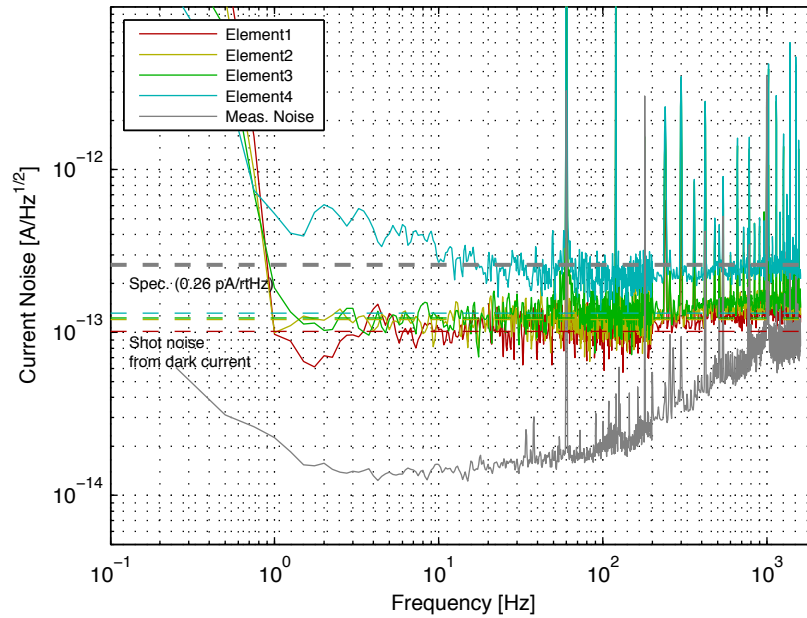
Elem1: 0.104 pA/rtHz  
 Elem2: 0.118 pA/rtHz  
 Elem3: 0.126 pA/rtHz  
 Elem4: 0.435 pA/rtHz

### 250~290Hz avg

Elem1: 0.130 pA/rtHz  
 Elem2: 0.141 pA/rtHz  
 Elem3: 0.149 pA/rtHz  
 Elem4: 0.239 pA/rtHz

Total Penalty: -250

Dark noise:  $V_R = 10V$



## Errors / Warnings

Elem1: $i_{dark} > 15nA$	Elem3: $i_{noise} (LF) > 56fA/rtHz$ (10nA shot)
Elem2: $i_{dark} > 15nA$	Elem4: $i_{noise} (LF) > 180fA/rtHz$ (100nA shot)
Elem3: $i_{dark} > 15nA$	Elem1: $i_{noise} (HF) > 100fA/rtHz$ (30nA shot)
Elem4: $i_{dark} > 15nA$	Elem2: $i_{noise} (HF) > 100fA/rtHz$ (30nA shot)
Elem1: $i_{noise} (LF) > 56fA/rtHz$ (10nA shot)	Elem3: $i_{noise} (HF) > 100fA/rtHz$ (30nA shot)
Elem2: $i_{noise} (LF) > 56fA/rtHz$ (10nA shot)	Elem4: $i_{noise} (HF) > 180pA/rtHz$ (100nA shot)

# QPD #27

## Measurement Date:

Mar. 15, 2013

Impedance measured at  $V_R = 15V$

## Shunt Resistance ( $R_{SH}$ ):

Elem1: 3.882 MOhm  
 Elem2: 3.084 MOhm  
 Elem3: 2.633 MOhm  
 Elem4: 2.452 MOhm

## Series Resistance ( $R_s$ ):

Elem1: 19.1 Ohm  
 Elem2: 20.1 Ohm  
 Elem3: 38.3 Ohm  
 Elem4: 26.3 Ohm

## Junction Capacitance ( $C_{pd}$ ):

Elem1: 9.6 pF  
 Elem2: 7.0 pF  
 Elem3: 8.4 pF  
 Elem4: 7.1 pF

## Dark Current [nA]:

Elem1: 27.77 nA  
 Elem2: 40.70 nA  
 Elem3: 44.51 nA  
 Elem4: 52.29 nA

## Dark Noise:

### 1~10Hz avg

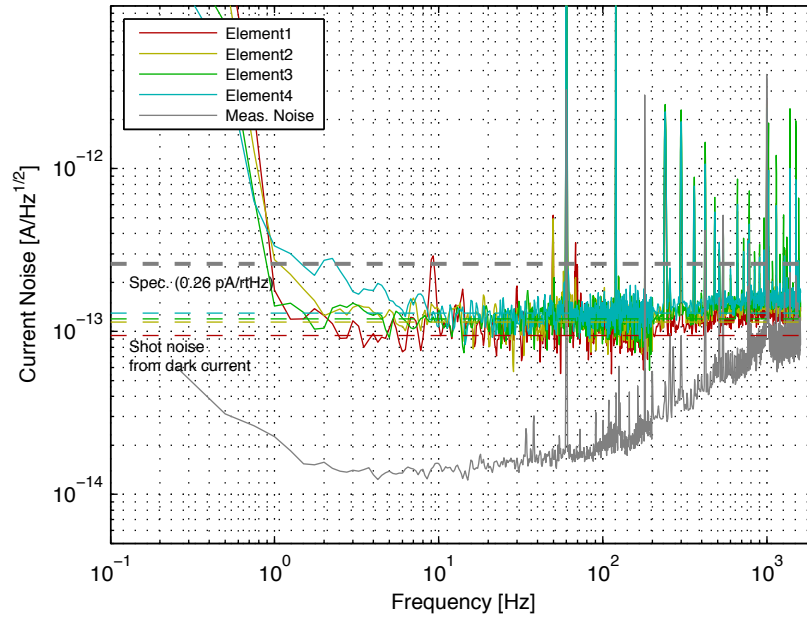
Elem1: 0.131 pA/rtHz  
 Elem2: 0.142 pA/rtHz  
 Elem3: 0.124 pA/rtHz  
 Elem4: 0.184 pA/rtHz

### 250~290Hz avg

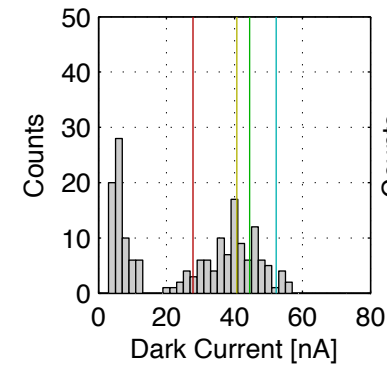
Elem1: 0.125 pA/rtHz  
 Elem2: 0.143 pA/rtHz  
 Elem3: 0.145 pA/rtHz  
 Elem4: 0.156 pA/rtHz

Total Penalty: -155

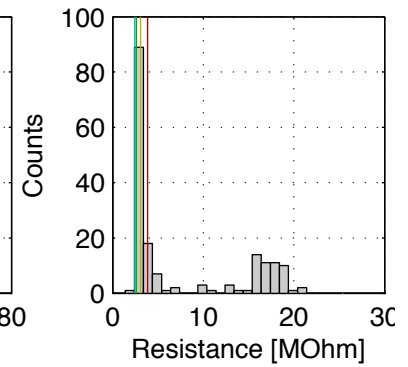
Dark noise:  $V_R = 10V$



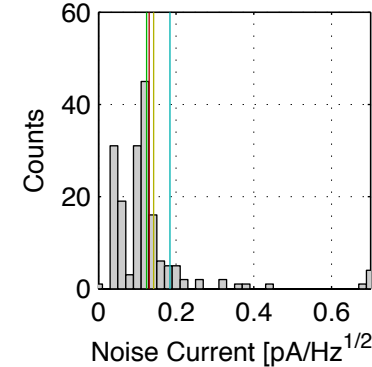
Dark Current@10V



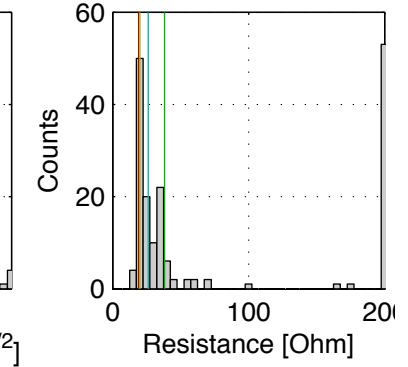
Shunt Resistance



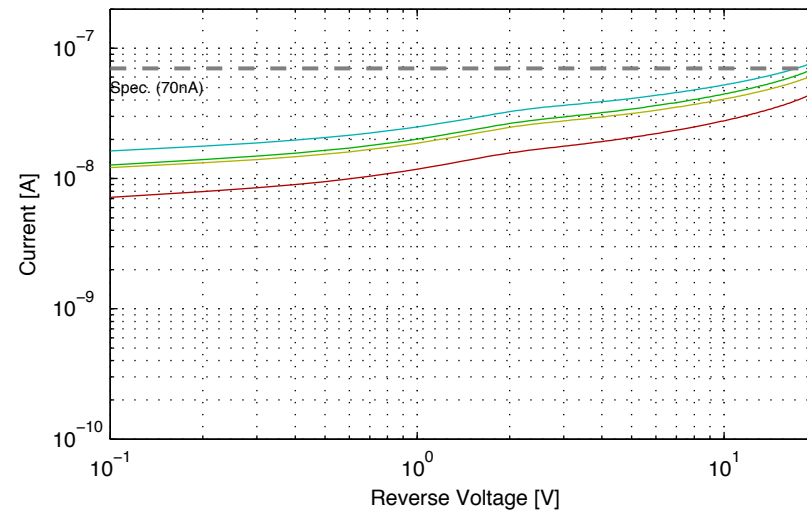
Dark current noise (1-10Hz Avg)



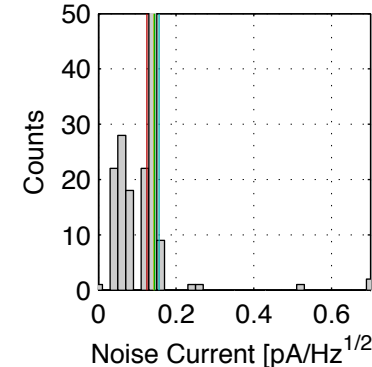
Series Resistance



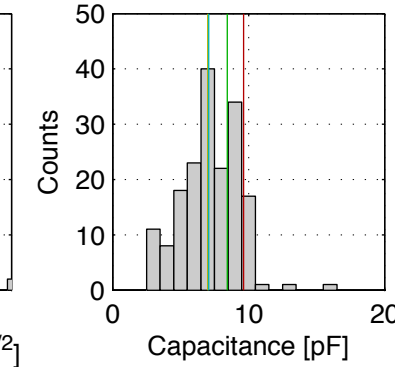
Dark current



Dark current noise (250-290Hz Avg)



Junction Capacitance



Errors / Warnings

Elem1: $i_{dark} > 15nA$	Elem3: $i_{noise} (LF) > 56fA/rtHz$ (10nA shot)
Elem2: $i_{dark} > 15nA$	Elem4: $i_{noise} (LF) > 180fA/rtHz$ (100nA shot)
Elem3: $i_{dark} > 15nA$	Elem1: $i_{noise} (HF) > 100fA/rtHz$ (30nA shot)
Elem4: $i_{dark} > 15nA$	Elem2: $i_{noise} (HF) > 100fA/rtHz$ (30nA shot)
Elem1: $i_{noise} (LF) > 56fA/rtHz$ (10nA shot)	Elem3: $i_{noise} (HF) > 100fA/rtHz$ (30nA shot)
Elem2: $i_{noise} (LF) > 56fA/rtHz$ (10nA shot)	Elem4: $i_{noise} (HF) > 100fA/rtHz$ (30nA shot)

# QPD #28

## Measurement Date:

Mar. 15, 2013

Impedance measured at  $V_R = 15V$

## Shunt Resistance ( $R_{SH}$ ):

Elem1: 3.721 MOhm  
 Elem2: 3.064 MOhm  
 Elem3: 2.782 MOhm  
 Elem4: 2.695 MOhm

## Series Resistance ( $R_s$ ):

Elem1: 24.4 Ohm  
 Elem2: 19.5 Ohm  
 Elem3: 33.6 Ohm  
 Elem4: 22.9 Ohm

## Junction Capacitance ( $C_{pd}$ ):

Elem1: 5.9 pF  
 Elem2: 8.7 pF  
 Elem3: 5.8 pF  
 Elem4: 7.4 pF

## Dark Current [nA]:

Elem1: 27.10 nA  
 Elem2: 38.21 nA  
 Elem3: 39.98 nA  
 Elem4: 47.13 nA

## Dark Noise:

### 1~10Hz avg

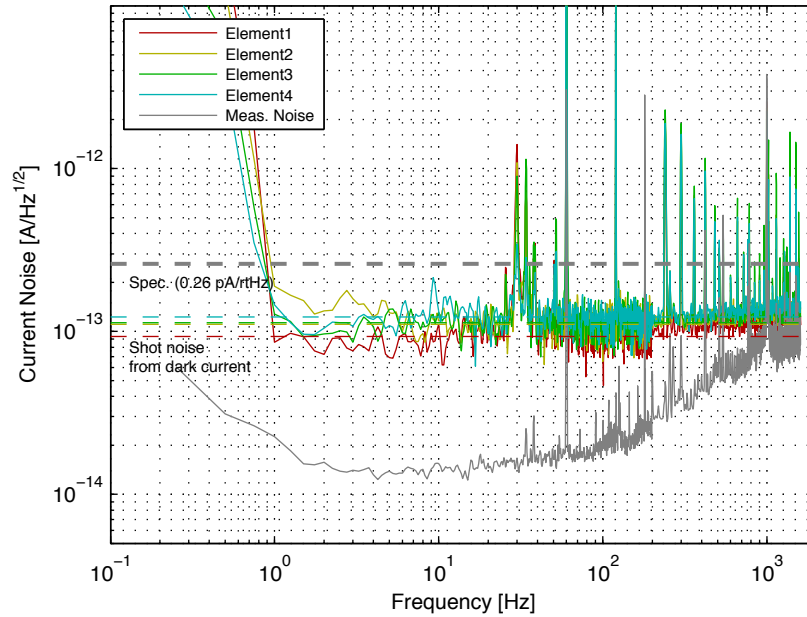
Elem1: 0.087 pA/rtHz  
 Elem2: 0.130 pA/rtHz  
 Elem3: 0.113 pA/rtHz  
 Elem4: 0.128 pA/rtHz

### 250~290Hz avg

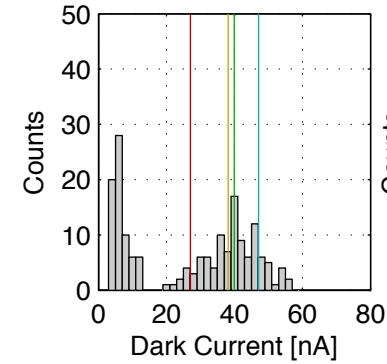
Elem1: 0.123 pA/rtHz  
 Elem2: 0.136 pA/rtHz  
 Elem3: 0.138 pA/rtHz  
 Elem4: 0.139 pA/rtHz

Total Penalty: -60

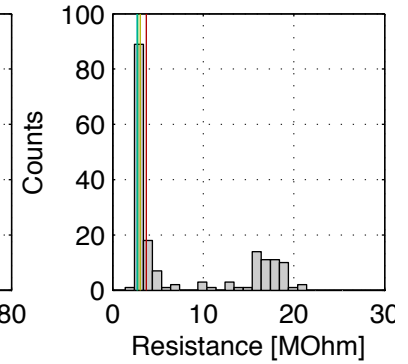
Dark noise:  $V_R = 10V$



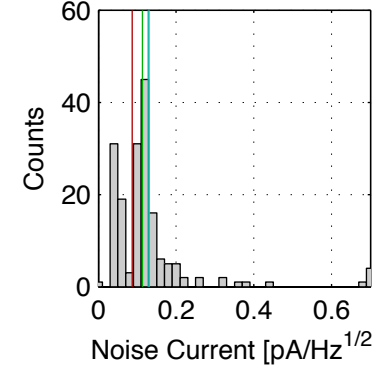
Dark Current@10V



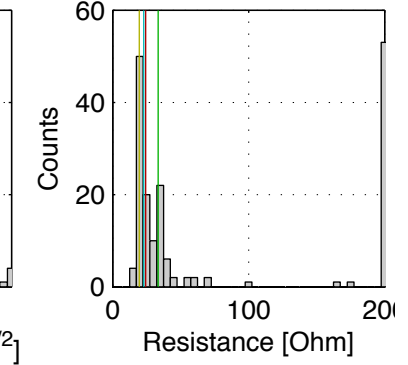
Shunt Resistance



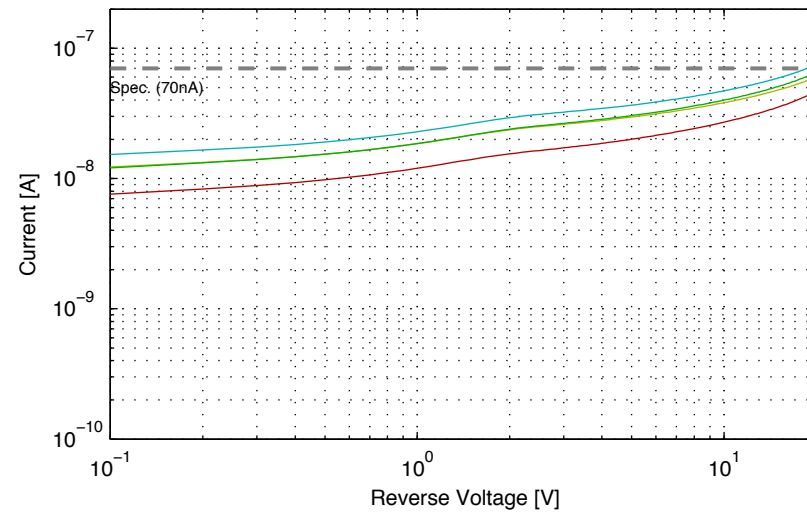
Dark current noise (1-10Hz Avg)



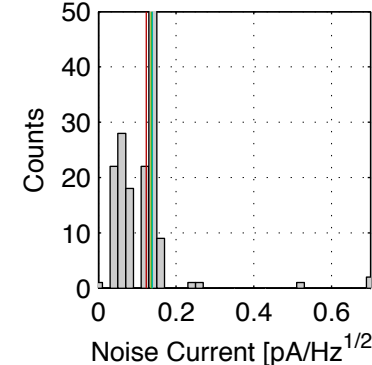
Series Resistance



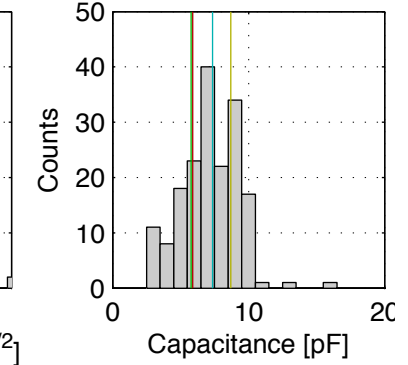
Dark current



Dark current noise (250-290Hz Avg)



Junction Capacitance



Errors / Warnings

Elem1: $i_{dark} > 15nA$	Elem3: $i_{noise} (LF) > 56fA/rtHz$ (10nA shot)
Elem2: $i_{dark} > 15nA$	Elem4: $i_{noise} (LF) > 56fA/rtHz$ (10nA shot)
Elem3: $i_{dark} > 15nA$	Elem1: $i_{noise} (HF) > 100fA/rtHz$ (30nA shot)
Elem4: $i_{dark} > 15nA$	Elem2: $i_{noise} (HF) > 100fA/rtHz$ (30nA shot)
Elem1: $i_{dark} (LF) > 56fA/rtHz$ (10nA shot)	Elem3: $i_{noise} (HF) > 100fA/rtHz$ (30nA shot)
Elem2: $i_{noise} (LF) > 56fA/rtHz$ (10nA shot)	Elem4: $i_{noise} (HF) > 100fA/rtHz$ (30nA shot)

# QPD #29

## Measurement Date:

Mar. 15, 2013

Impedance measured at  $V_R = 15V$

## Shunt Resistance ( $R_{SH}$ ):

Elem1: 2.616 MOhm  
 Elem2: 2.440 MOhm  
 Elem3: 2.435 MOhm  
 Elem4: 2.408 MOhm

## Series Resistance ( $R_s$ ):

Elem1: 25.7 Ohm  
 Elem2: 19.3 Ohm  
 Elem3: 35.0 Ohm  
 Elem4: 25.2 Ohm

## Junction Capacitance ( $C_{pd}$ ):

Elem1: 7.1 pF  
 Elem2: 6.9 pF  
 Elem3: 5.9 pF  
 Elem4: 8.0 pF

## Dark Current [nA]:

Elem1: 42.69 nA  
 Elem2: 50.74 nA  
 Elem3: 49.22 nA  
 Elem4: 54.71 nA

## Dark Noise:

### 1~10Hz avg

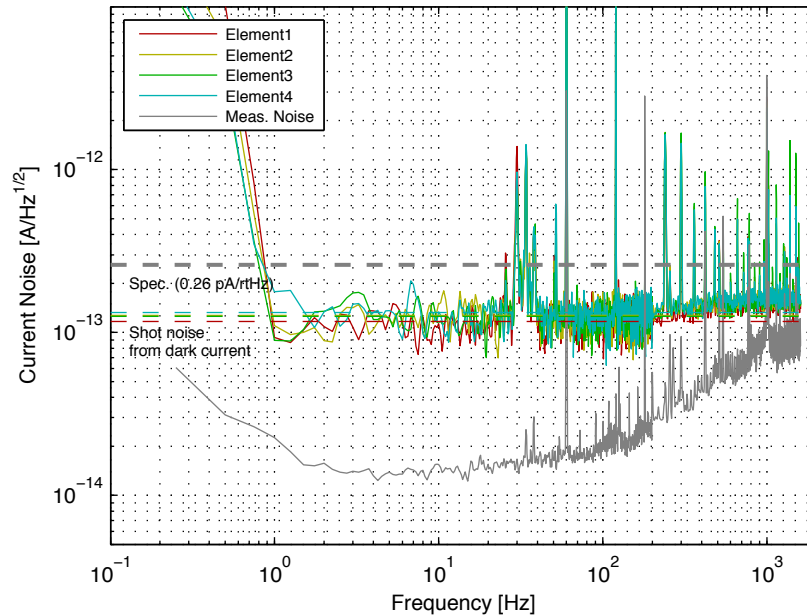
Elem1: 0.113 pA/rtHz  
 Elem2: 0.122 pA/rtHz  
 Elem3: 0.131 pA/rtHz  
 Elem4: 0.138 pA/rtHz

### 250~290Hz avg

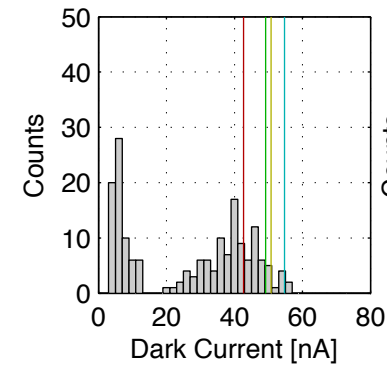
Elem1: 0.147 pA/rtHz  
 Elem2: 0.154 pA/rtHz  
 Elem3: 0.150 pA/rtHz  
 Elem4: 0.155 pA/rtHz

Total Penalty: -60

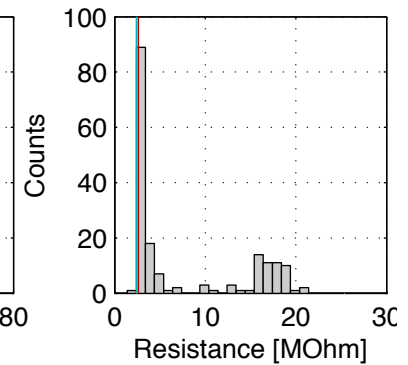
Dark noise:  $V_R = 10V$



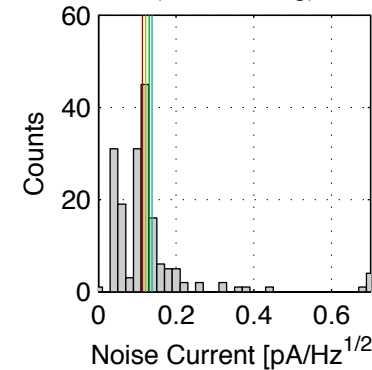
Dark Current@10V



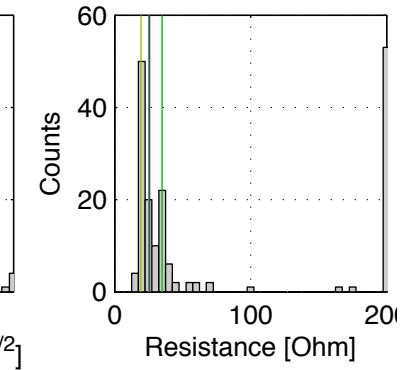
Shunt Resistance



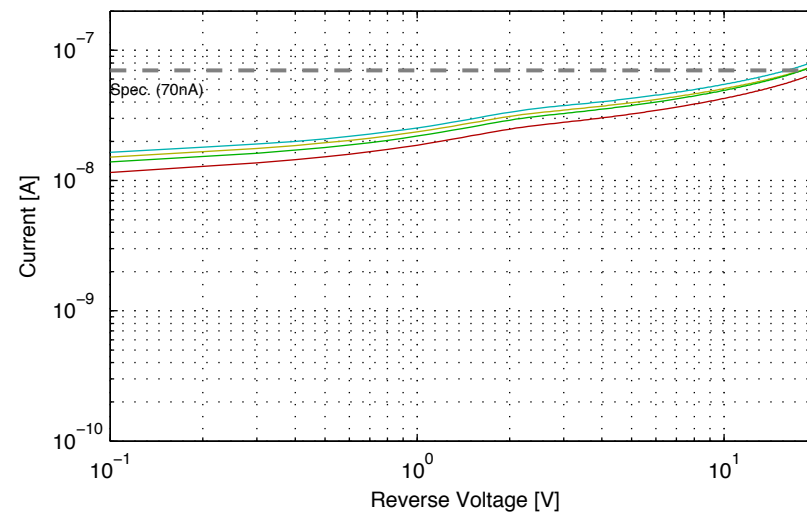
Dark current noise (1-10Hz Avg)



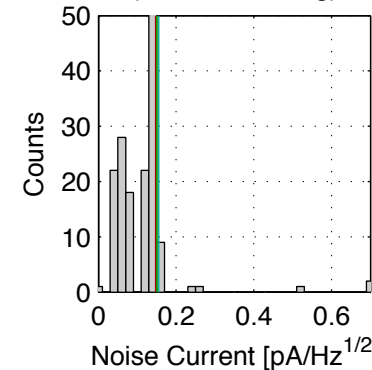
Series Resistance



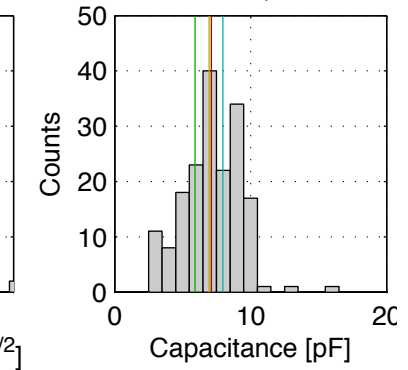
Dark current



Dark current noise (250-290Hz Avg)



Junction Capacitance



Errors / Warnings

Elem1: $i_{dark} > 15nA$	Elem3: $i_{noise} (LF) > 56fA/rtHz$ (10nA shot)
Elem2: $i_{dark} > 15nA$	Elem4: $i_{noise} (LF) > 56fA/rtHz$ (10nA shot)
Elem3: $i_{dark} > 15nA$	Elem1: $i_{noise} (HF) > 100fA/rtHz$ (30nA shot)
Elem4: $i_{dark} > 15nA$	Elem2: $i_{noise} (HF) > 100fA/rtHz$ (30nA shot)
Elem1: $i_{dark} (LF) > 56fA/rtHz$ (10nA shot)	Elem3: $i_{noise} (HF) > 100fA/rtHz$ (30nA shot)
Elem2: $i_{noise} (LF) > 56fA/rtHz$ (10nA shot)	Elem4: $i_{noise} (HF) > 100fA/rtHz$ (30nA shot)

# QPD #30

## Measurement Date:

Mar. 15, 2013

Impedance measured at  $V_R = 15V$

## Shunt Resistance ( $R_{SH}$ ):

Elem1: 3.784 MOhm  
 Elem2: 3.446 MOhm  
 Elem3: 3.277 MOhm  
 Elem4: 2.930 MOhm

## Series Resistance ( $R_s$ ):

Elem1: 24.6 Ohm  
 Elem2: 19.1 Ohm  
 Elem3: 34.9 Ohm  
 Elem4: 22.6 Ohm

## Junction Capacitance ( $C_{pd}$ ):

Elem1: 4.9 pF  
 Elem2: 7.3 pF  
 Elem3: 2.7 pF  
 Elem4: 10.4 pF

## Dark Current [nA]:

Elem1: 25.66 nA  
 Elem2: 33.87 nA  
 Elem3: 32.63 nA  
 Elem4: 40.14 nA

## Dark Noise:

### 1~10Hz avg

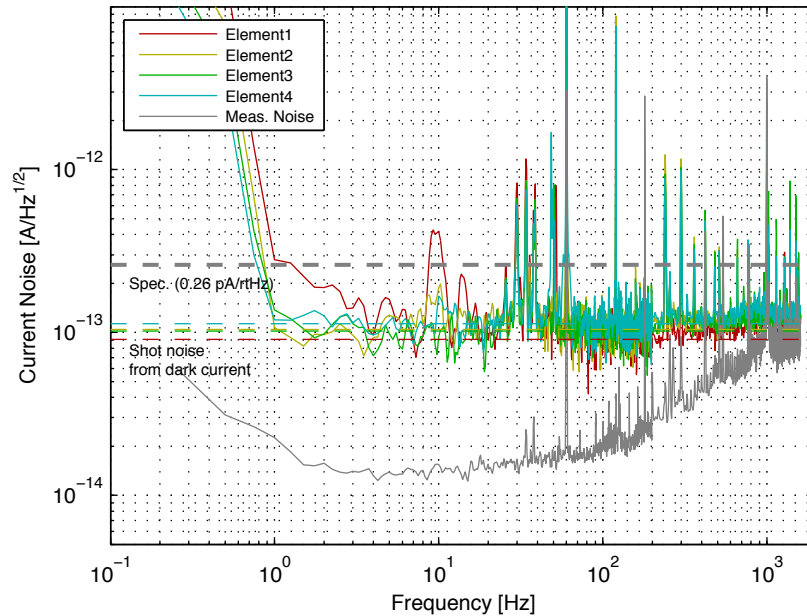
Elem1: 0.211 pA/rtHz  
 Elem2: 0.121 pA/rtHz  
 Elem3: 0.101 pA/rtHz  
 Elem4: 0.115 pA/rtHz

### 250~290Hz avg

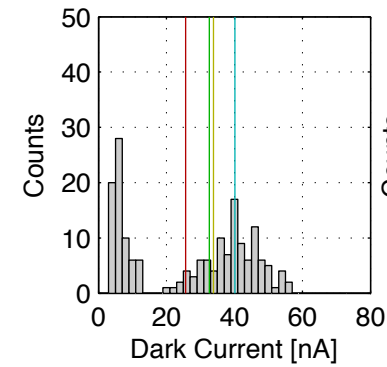
Elem1: 0.119 pA/rtHz  
 Elem2: 0.133 pA/rtHz  
 Elem3: 0.135 pA/rtHz  
 Elem4: 0.141 pA/rtHz

Total Penalty: -160

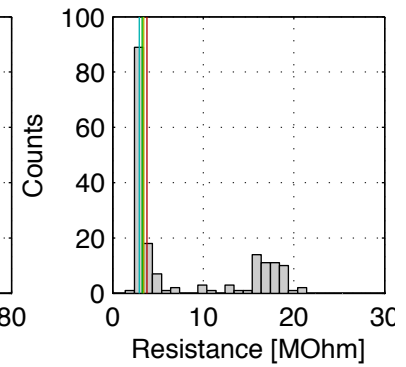
Dark noise:  $V_R = 10V$



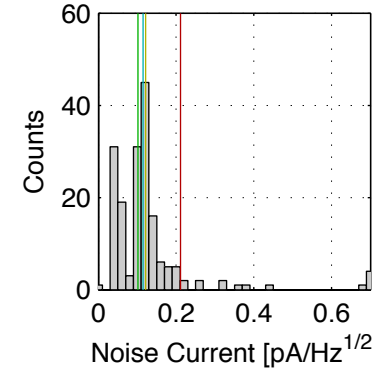
Dark Current@10V



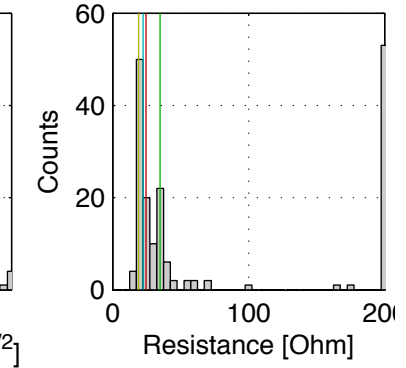
Shunt Resistance



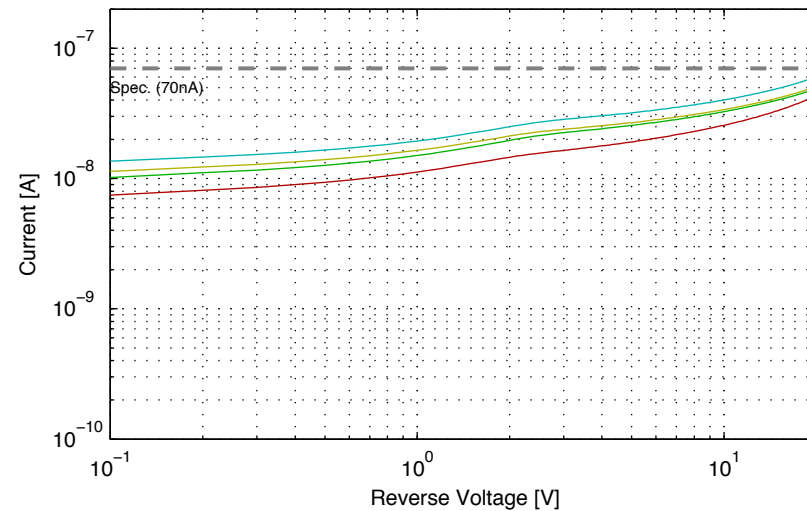
Dark current noise (1-10Hz Avg)



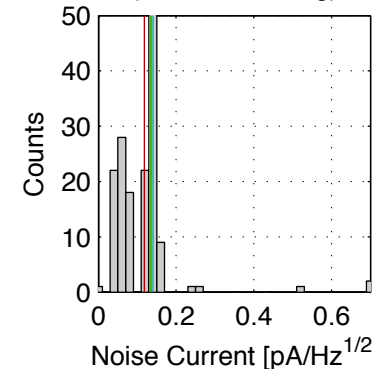
Series Resistance



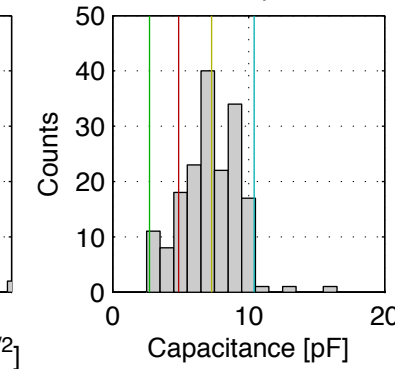
Dark current



Dark current noise (250-290Hz Avg)



Junction Capacitance



## Errors / Warnings

Elem4: $C_{pd} > 10pF$	Elem2: $i_{noise} (LF) > 56fA/rtHz$ (10nA shot)	Elem4: $i_{noise} (HF) > 100fA/rtHz$ (30nA shot)
Elem1: $i_{pd} > 15nA$	Elem3: $i_{noise} (LF) > 56fA/rtHz$ (10nA shot)	
Elem2: $i_{dark} > 15nA$	Elem4: $i_{noise} (LF) > 56fA/rtHz$ (10nA shot)	
Elem3: $i_{dark} > 15nA$	Elem1: $i_{noise} (HF) > 100fA/rtHz$ (30nA shot)	
Elem4: $i_{dark} > 15nA$	Elem2: $i_{noise} (HF) > 100fA/rtHz$ (30nA shot)	
Elem1: $i_{noise} (LF) > 180fA/rtHz$ (100nA shot)	Elem3: $i_{noise} (HF) > 100fA/rtHz$ (30nA shot)	



# QPD #31

## Measurement Date:

Mar. 15, 2013

Impedance measured at  $V_R = 15V$

## Shunt Resistance ( $R_{SH}$ ):

Elem1: 3.264 MOhm  
 Elem2: 2.912 MOhm  
 Elem3: 2.737 MOhm  
 Elem4: 2.672 MOhm

## Series Resistance ( $R_s$ ):

Elem1: 20.3 Ohm  
 Elem2: 18.7 Ohm  
 Elem3: 32.9 Ohm  
 Elem4: 22.4 Ohm

## Junction Capacitance ( $C_{pd}$ ):

Elem1: 3.4 pF  
 Elem2: 7.1 pF  
 Elem3: 3.9 pF  
 Elem4: 5.9 pF

## Dark Current [nA]:

Elem1: 31.21 nA  
 Elem2: 40.09 nA  
 Elem3: 40.77 nA  
 Elem4: 47.43 nA

## Dark Noise:

### 1~10Hz avg

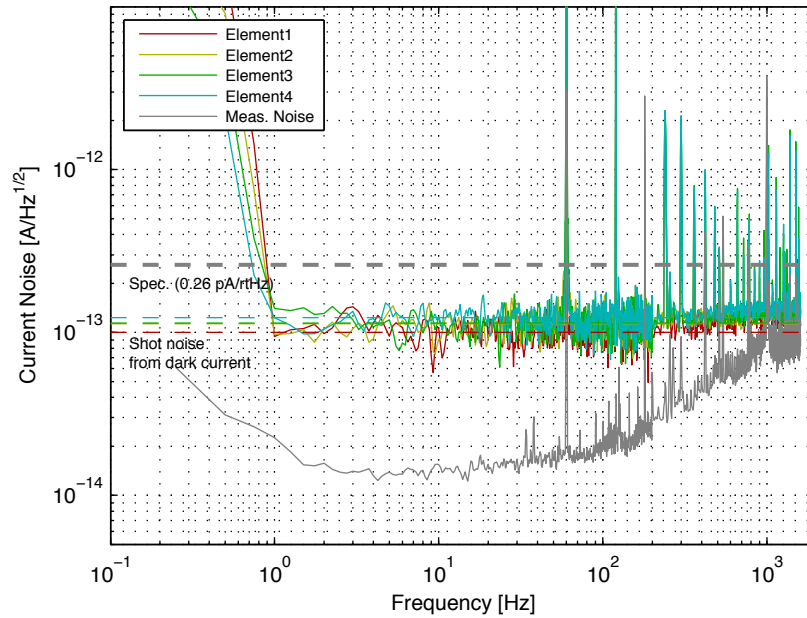
Elem1: 0.107 pA/rtHz  
 Elem2: 0.110 pA/rtHz  
 Elem3: 0.118 pA/rtHz  
 Elem4: 0.121 pA/rtHz

### 250~290Hz avg

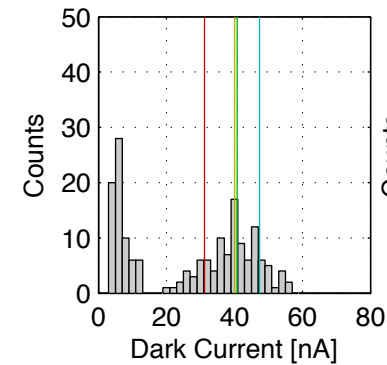
Elem1: 0.125 pA/rtHz  
 Elem2: 0.137 pA/rtHz  
 Elem3: 0.137 pA/rtHz  
 Elem4: 0.145 pA/rtHz

Total Penalty: -60

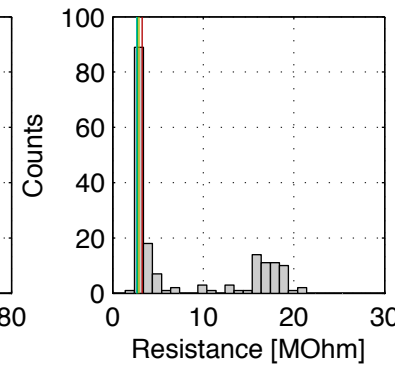
Dark noise:  $V_R = 10V$



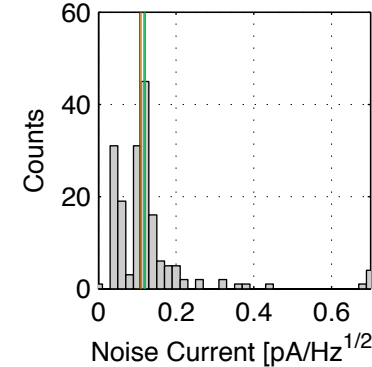
Dark Current@10V



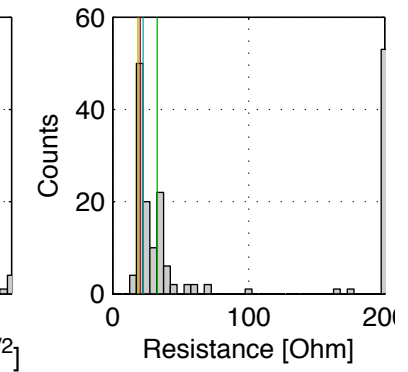
Shunt Resistance



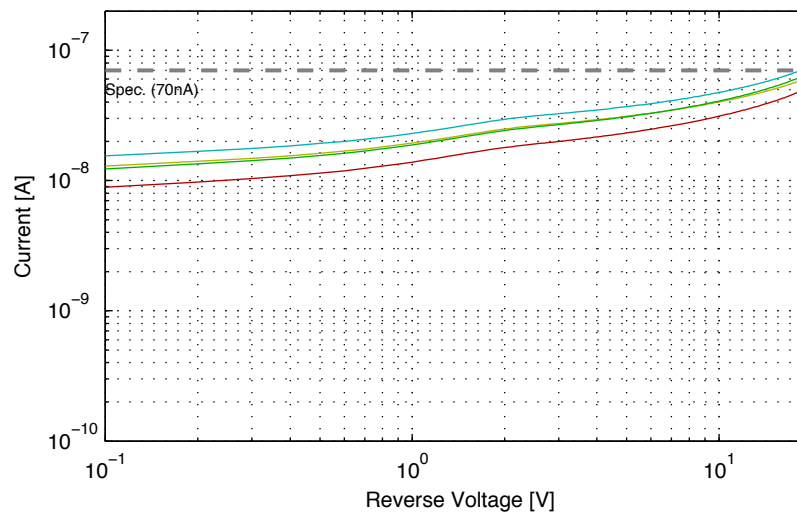
Dark current noise (1-10Hz Avg)



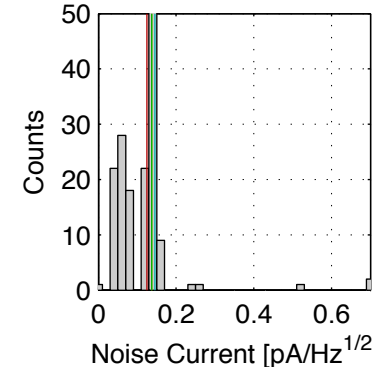
Series Resistance



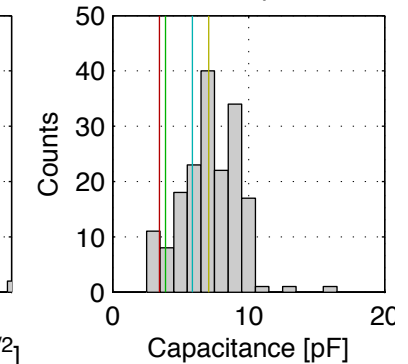
Dark current



Dark current noise (250-290Hz Avg)



Junction Capacitance



Errors / Warnings

Elem1: $i_{dark} > 15nA$	Elem3: $i_{noise} (LF) > 56fA/rtHz$ (10nA shot)
Elem2: $i_{dark} > 15nA$	Elem4: $i_{noise} (LF) > 56fA/rtHz$ (10nA shot)
Elem3: $i_{dark} > 15nA$	Elem1: $i_{noise} (HF) > 100fA/rtHz$ (30nA shot)
Elem4: $i_{dark} > 15nA$	Elem2: $i_{noise} (HF) > 100fA/rtHz$ (30nA shot)
Elem1: $i_{dark} (LF) > 56fA/rtHz$ (10nA shot)	Elem3: $i_{noise} (HF) > 100fA/rtHz$ (30nA shot)
Elem2: $i_{noise} (LF) > 56fA/rtHz$ (10nA shot)	Elem4: $i_{noise} (HF) > 100fA/rtHz$ (30nA shot)

# QPD #32

## Measurement Date:

Mar. 15, 2013

Impedance measured at  $V_R = 15V$

## Shunt Resistance ( $R_{SH}$ ):

Elem1: 3.842 MOhm  
 Elem2: 3.092 MOhm  
 Elem3: 2.805 MOhm  
 Elem4: 2.737 MOhm

## Series Resistance ( $R_s$ ):

Elem1: 21.5 Ohm  
 Elem2: 18.6 Ohm  
 Elem3: 32.3 Ohm  
 Elem4: 21.0 Ohm

## Junction Capacitance: ( $C_{pd}$ ):

Elem1: 3.4 pF  
 Elem2: 8.6 pF  
 Elem3: 5.2 pF  
 Elem4: 13.1 pF

## Dark Current [nA]:

Elem1: 26.43 nA  
 Elem2: 38.11 nA  
 Elem3: 39.90 nA  
 Elem4: 46.56 nA

## Dark Noise:

### 1~10Hz avg

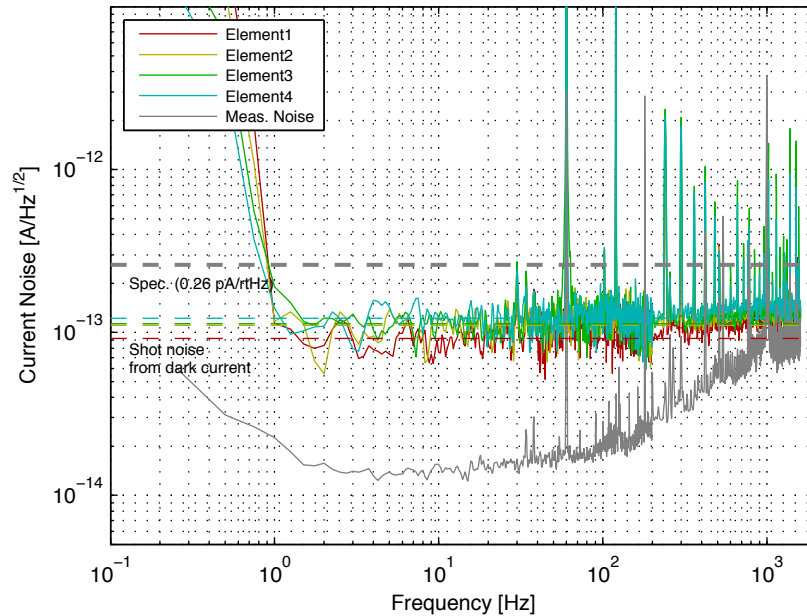
Elem1: 0.090 pA/rtHz  
 Elem2: 0.107 pA/rtHz  
 Elem3: 0.118 pA/rtHz  
 Elem4: 0.126 pA/rtHz

### 250~290Hz avg

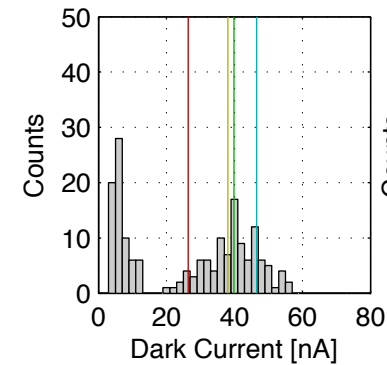
Elem1: 0.124 pA/rtHz  
 Elem2: 0.135 pA/rtHz  
 Elem3: 0.134 pA/rtHz  
 Elem4: 0.143 pA/rtHz

Total Penalty: -160

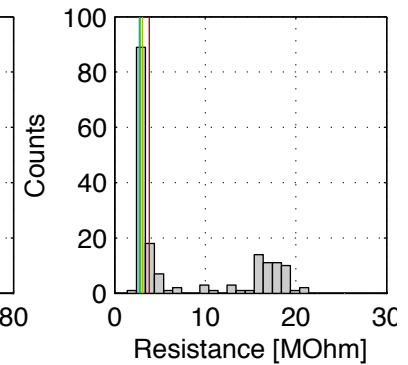
Dark noise:  $V_R = 10V$



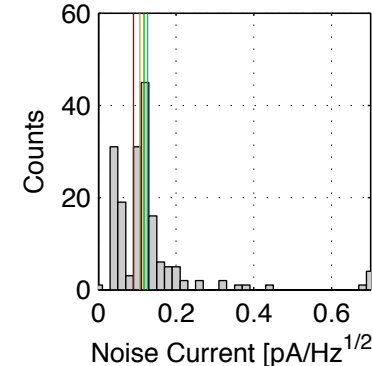
Dark Current@10V



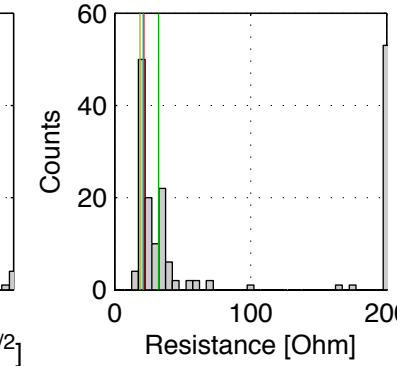
Shunt Resistance



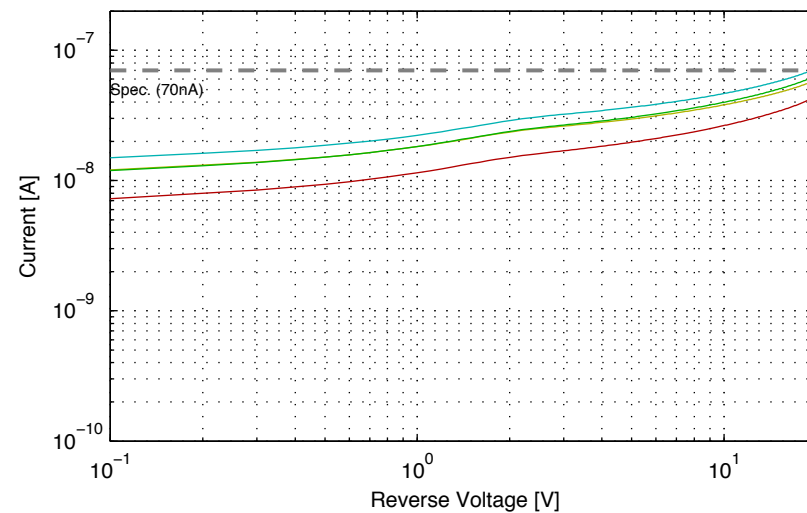
Dark current noise (1-10Hz Avg)



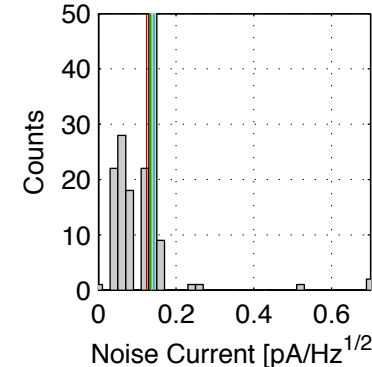
Series Resistance



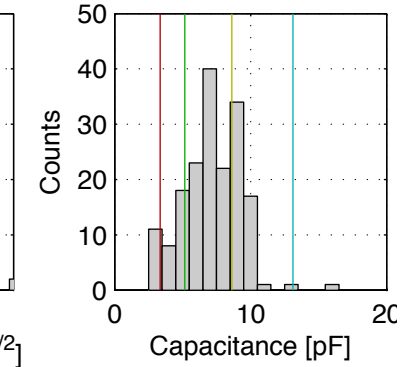
Dark current



Dark current noise (250-290Hz Avg)



Junction Capacitance



Errors / Warnings

Elem4: $C_{pd} > 12pF$ (spec.)	Elem2: $i_{noise} (LF) > 56fA/rtHz$ (10nA shot)	Elem4: $i_{noise} (HF) > 100fA/rtHz$ (30nA shot)
Elem1: $i_{pd} > 15nA$	Elem3: $i_{noise} (LF) > 56fA/rtHz$ (10nA shot)	
Elem2: $i_{dark} > 15nA$	Elem4: $i_{noise} (LF) > 56fA/rtHz$ (10nA shot)	
Elem3: $i_{dark} > 15nA$	Elem1: $i_{noise} (HF) > 100fA/rtHz$ (30nA shot)	
Elem4: $i_{dark} > 15nA$	Elem2: $i_{noise} (HF) > 100fA/rtHz$ (30nA shot)	
Elem1: $i_{noise} (LF) > 56fA/rtHz$ (10nA shot)	Elem3: $i_{noise} (HF) > 100fA/rtHz$ (30nA shot)	

# QPD #33

## Measurement Date:

Mar. 15, 2013

Impedance measured at  $V_R = 15V$

## Shunt Resistance ( $R_{SH}$ ):

Elem1: 3.131 MOhm  
 Elem2: 2.919 MOhm  
 Elem3: 2.769 MOhm  
 Elem4: 2.758 MOhm

## Series Resistance ( $R_s$ ):

Elem1: 20.3 Ohm  
 Elem2: 20.2 Ohm  
 Elem3: 42.9 Ohm  
 Elem4: 23.5 Ohm

## Junction Capacitance: ( $C_{pd}$ ):

Elem1: 7.2 pF  
 Elem2: 8.1 pF  
 Elem3: 5.6 pF  
 Elem4: 8.1 pF

## Dark Current [nA]:

Elem1: 32.85 nA  
 Elem2: 39.87 nA  
 Elem3: 40.18 nA  
 Elem4: 46.36 nA

## Dark Noise:

### 1~10Hz avg

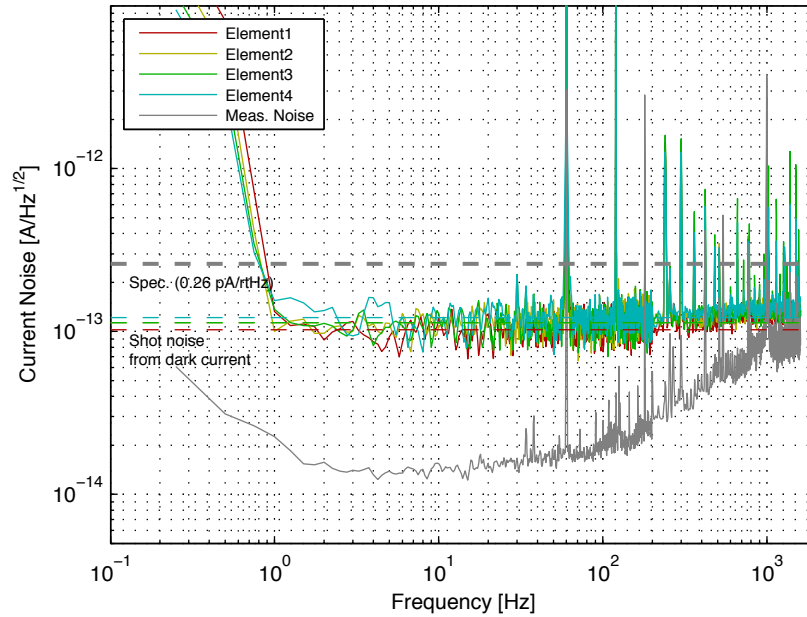
Elem1: 0.102 pA/rtHz  
 Elem2: 0.110 pA/rtHz  
 Elem3: 0.110 pA/rtHz  
 Elem4: 0.124 pA/rtHz

### 250~290Hz avg

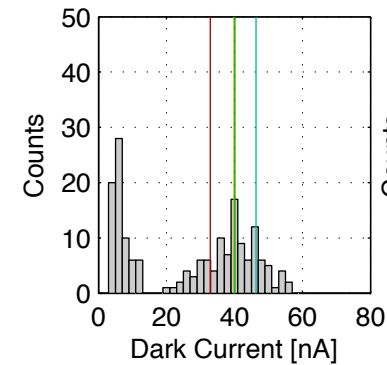
Elem1: 0.137 pA/rtHz  
 Elem2: 0.139 pA/rtHz  
 Elem3: 0.139 pA/rtHz  
 Elem4: 0.144 pA/rtHz

Total Penalty: -60

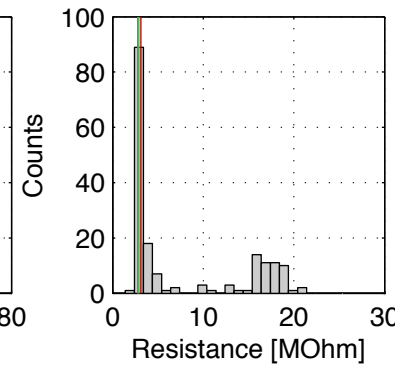
Dark noise:  $V_R = 10V$



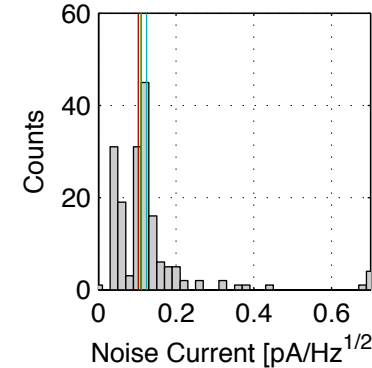
Dark Current@10V



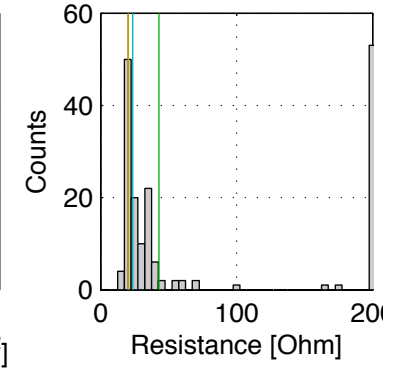
Shunt Resistance



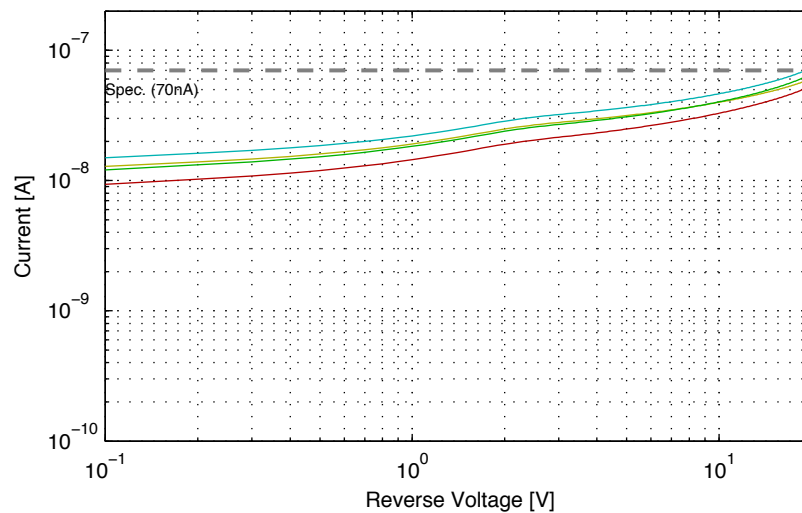
Dark current noise (1-10Hz Avg)



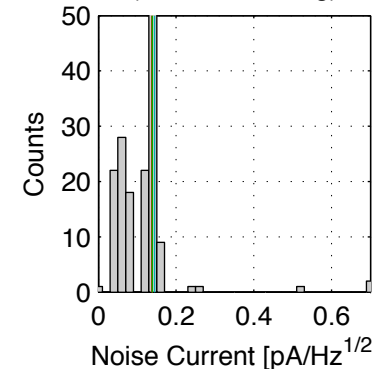
Series Resistance



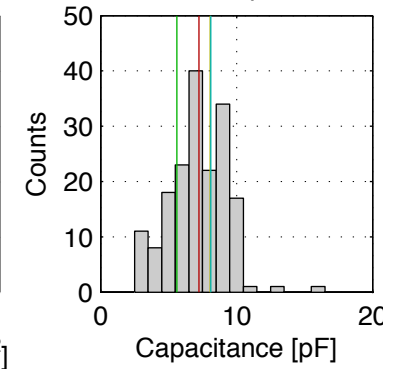
Dark current



Dark current noise (250-290Hz Avg)



Junction Capacitance



Errors / Warnings

Elem1: $i_{dark} > 15nA$	Elem3: $i_{noise} (LF) > 56fA/rtHz$ (10nA shot)
Elem2: $i_{dark} > 15nA$	Elem4: $i_{noise} (LF) > 56fA/rtHz$ (10nA shot)
Elem3: $i_{dark} > 15nA$	Elem1: $i_{noise} (HF) > 100fA/rtHz$ (30nA shot)
Elem4: $i_{dark} > 15nA$	Elem2: $i_{noise} (HF) > 100fA/rtHz$ (30nA shot)
Elem1: $i_{noise} (LF) > 56fA/rtHz$ (10nA shot)	Elem3: $i_{noise} (HF) > 100fA/rtHz$ (30nA shot)
Elem2: $i_{noise} (LF) > 56fA/rtHz$ (10nA shot)	Elem4: $i_{noise} (HF) > 100fA/rtHz$ (30nA shot)

# QPD #34

## Measurement Date:

Mar. 15, 2013

Impedance measured at  $V_R = 15V$

## Shunt Resistance ( $R_{SH}$ ):

Elem1: 2.798 MOhm  
 Elem2: 2.577 MOhm  
 Elem3: 2.507 MOhm  
 Elem4: 2.494 MOhm

## Series Resistance ( $R_s$ ):

Elem1: 23.2 Ohm  
 Elem2: 20.8 Ohm  
 Elem3: 34.4 Ohm  
 Elem4: 24.1 Ohm

## Junction Capacitance ( $C_{pd}$ ):

Elem1: 3.1 pF  
 Elem2: 8.3 pF  
 Elem3: 6.0 pF  
 Elem4: 6.0 pF

## Dark Current [nA]:

Elem1: 38.32 nA  
 Elem2: 46.42 nA  
 Elem3: 45.65 nA  
 Elem4: 50.52 nA

## Dark Noise:

### 1~10Hz avg

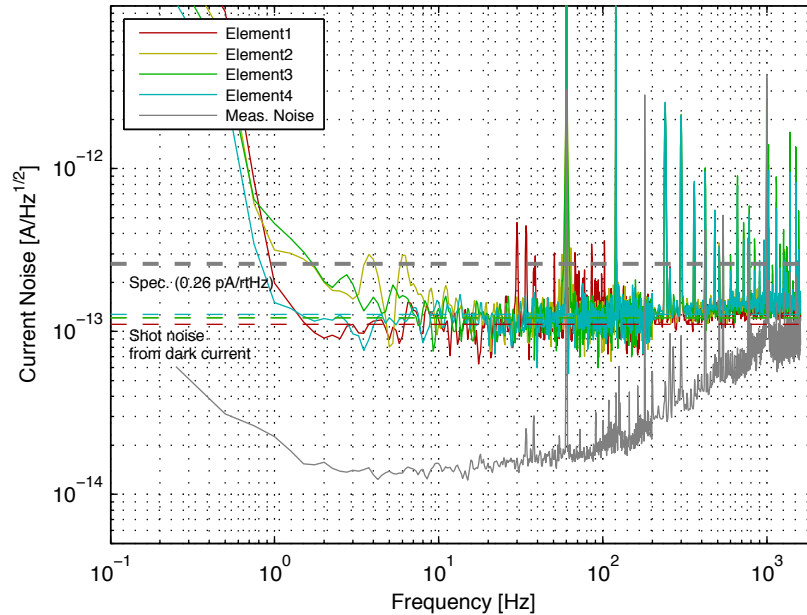
Elem1: 0.119 pA/rtHz  
 Elem2: 0.202 pA/rtHz  
 Elem3: 0.186 pA/rtHz  
 Elem4: 0.120 pA/rtHz

### 250~290Hz avg

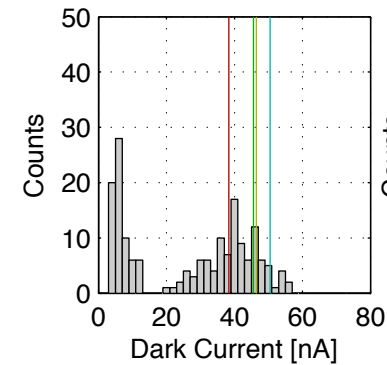
Elem1: 0.138 pA/rtHz  
 Elem2: 0.140 pA/rtHz  
 Elem3: 0.148 pA/rtHz  
 Elem4: 0.151 pA/rtHz

Total Penalty: -250

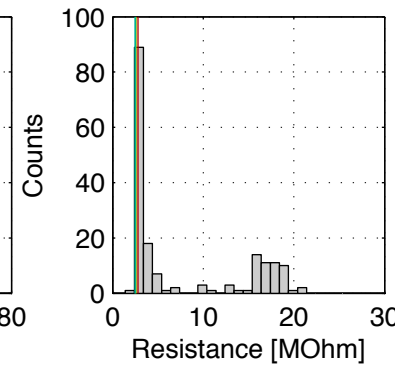
Dark noise:  $V_R = 10V$



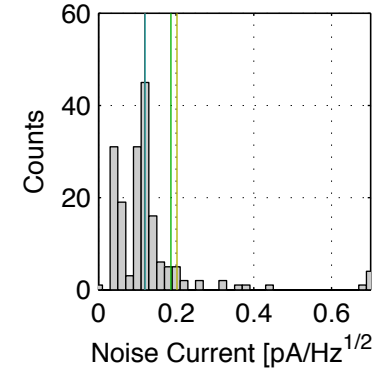
Dark Current@10V



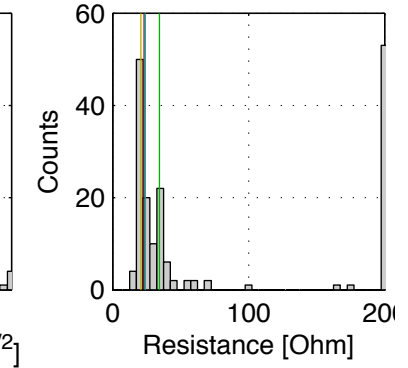
Shunt Resistance



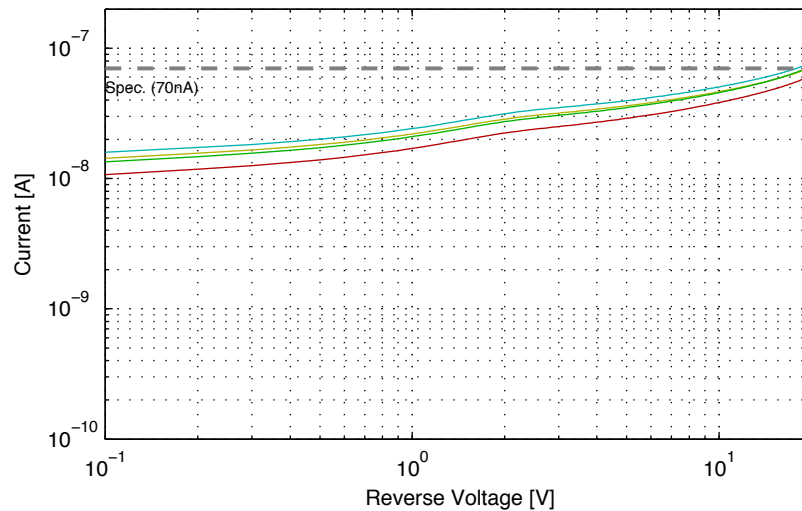
Dark current noise (1-10Hz Avg)



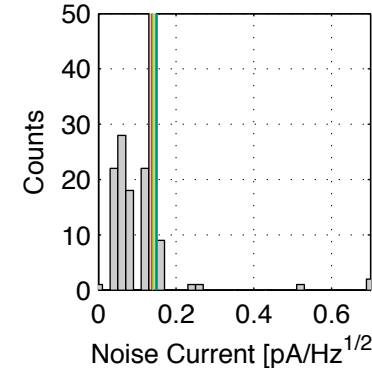
Series Resistance



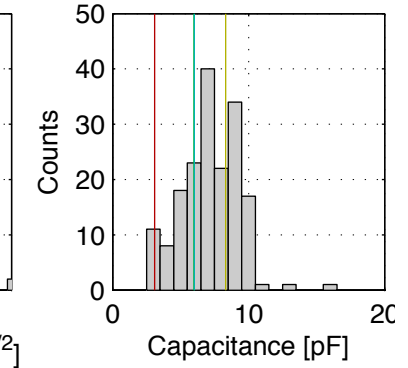
Dark current



Dark current noise (250-290Hz Avg)



Junction Capacitance



## Errors / Warnings

Elem1: $i_{dark} > 15nA$	Elem3: $i_{noise} (LF) > 180fA/rtHz$ (100nA shot)
Elem2: $i_{dark} > 15nA$	Elem4: $i_{noise} (LF) > 56fA/rtHz$ (10nA shot)
Elem3: $i_{dark} > 15nA$	Elem1: $i_{noise} (HF) > 100fA/rtHz$ (30nA shot)
Elem4: $i_{dark} > 15nA$	Elem2: $i_{noise} (HF) > 100fA/rtHz$ (30nA shot)
Elem1: $i_{noise} (LF) > 56fA/rtHz$ (10nA shot)	Elem3: $i_{noise} (HF) > 100fA/rtHz$ (30nA shot)
Elem2: $i_{noise} (LF) > 180fA/rtHz$ (100nA shot)	Elem4: $i_{noise} (HF) > 100fA/rtHz$ (30nA shot)

# QPD #35

## Measurement Date:

Mar. 15, 2013

Impedance measured at  $V_R = 15V$

## Shunt Resistance ( $R_{SH}$ ):

Elem1: 3.837 MOhm  
 Elem2: 3.022 MOhm  
 Elem3: 2.772 MOhm  
 Elem4: 2.645 MOhm

## Series Resistance ( $R_s$ ):

Elem1: 19.4 Ohm  
 Elem2: 18.4 Ohm  
 Elem3: 33.4 Ohm  
 Elem4: 19.6 Ohm

## Junction Capacitance ( $C_{pd}$ ):

Elem1: 2.9 pF  
 Elem2: 8.1 pF  
 Elem3: 3.1 pF  
 Elem4: 8.5 pF

## Dark Current [nA]:

Elem1: 26.98 nA  
 Elem2: 39.45 nA  
 Elem3: 41.24 nA  
 Elem4: 47.59 nA

## Dark Noise:

### 1~10Hz avg

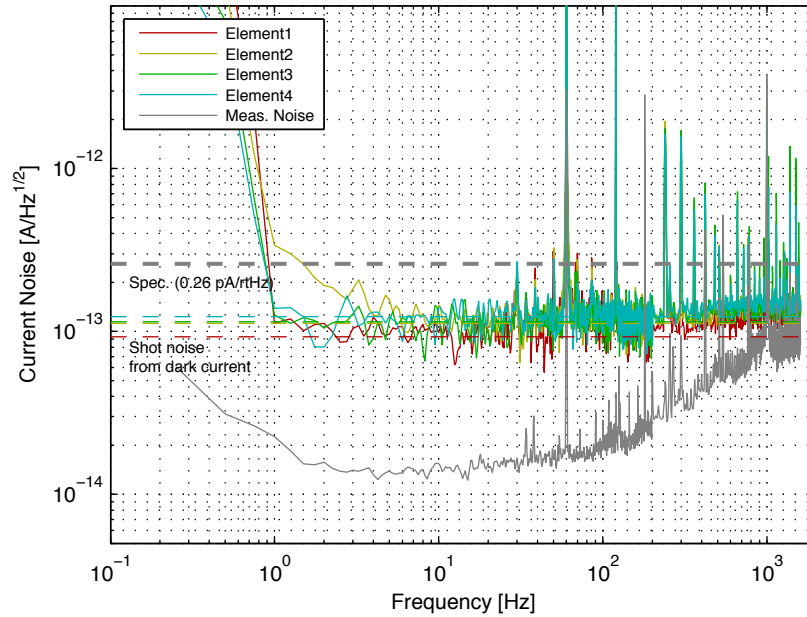
Elem1: 0.103 pA/rtHz  
 Elem2: 0.162 pA/rtHz  
 Elem3: 0.113 pA/rtHz  
 Elem4: 0.119 pA/rtHz

### 250~290Hz avg

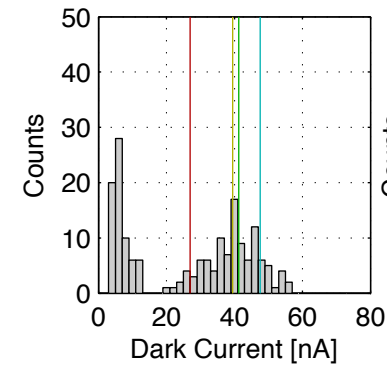
Elem1: 0.128 pA/rtHz  
 Elem2: 0.144 pA/rtHz  
 Elem3: 0.141 pA/rtHz  
 Elem4: 0.145 pA/rtHz

Total Penalty: -60

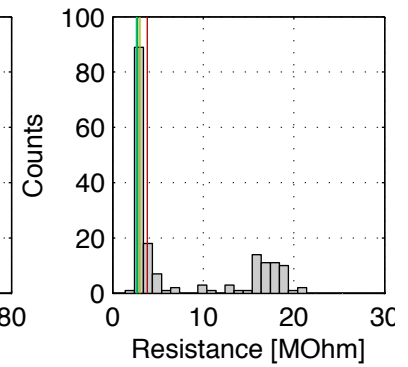
Dark noise:  $V_R = 10V$



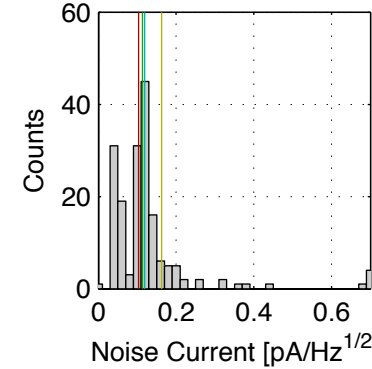
Dark Current@10V



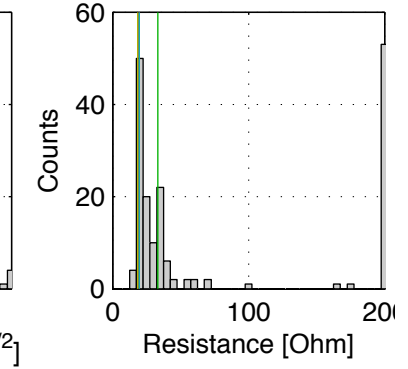
Shunt Resistance



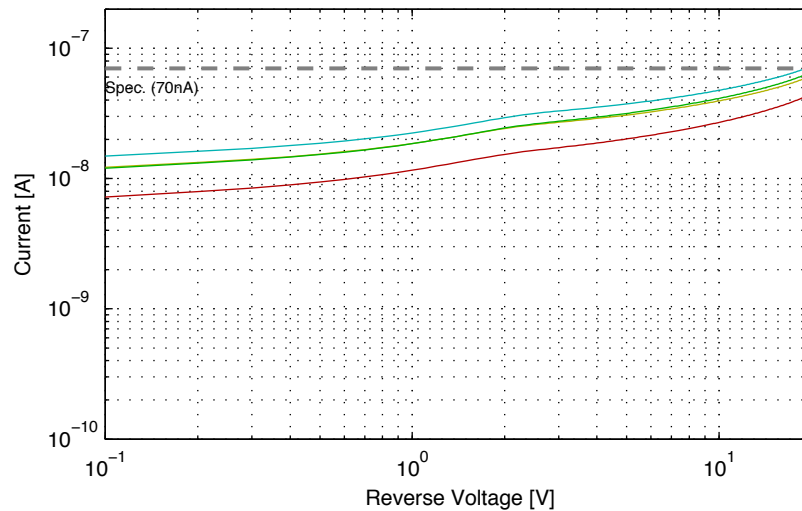
Dark current noise (1-10Hz Avg)



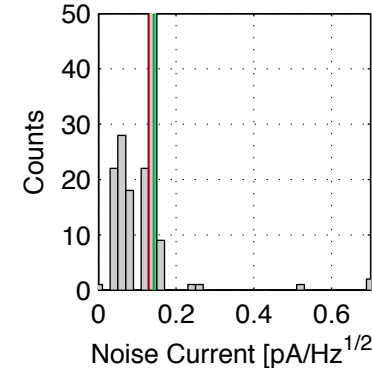
Series Resistance



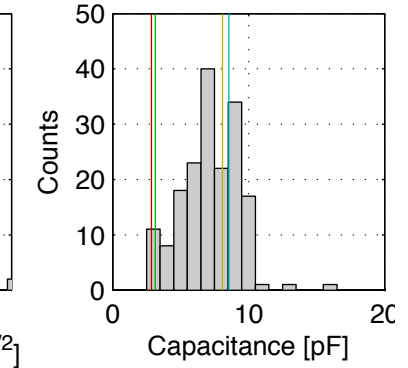
Dark current



Dark current noise (250-290Hz Avg)



Junction Capacitance



Errors / Warnings

Elem1: $i_{dark} > 15nA$	Elem3: $i_{noise} (LF) > 56fA/rtHz$ (10nA shot)
Elem2: $i_{dark} > 15nA$	Elem4: $i_{noise} (LF) > 56fA/rtHz$ (10nA shot)
Elem3: $i_{dark} > 15nA$	Elem1: $i_{noise} (HF) > 100fA/rtHz$ (30nA shot)
Elem4: $i_{dark} > 15nA$	Elem2: $i_{noise} (HF) > 100fA/rtHz$ (30nA shot)
Elem1: $i_{dark} (LF) > 56fA/rtHz$ (10nA shot)	Elem3: $i_{noise} (HF) > 100fA/rtHz$ (30nA shot)
Elem2: $i_{noise} (LF) > 56fA/rtHz$ (10nA shot)	Elem4: $i_{noise} (HF) > 100fA/rtHz$ (30nA shot)

# QPD #36

## Measurement Date:

Mar. 15, 2013

Impedance measured at  $V_R = 15V$

## Shunt Resistance ( $R_{SH}$ ):

Elem1: 4.628 MOhm  
 Elem2: 3.365 MOhm  
 Elem3: 2.849 MOhm  
 Elem4: 2.686 MOhm

## Series Resistance ( $R_s$ ):

Elem1: 21.5 Ohm  
 Elem2: 20.4 Ohm  
 Elem3: 36.5 Ohm  
 Elem4: 20.4 Ohm

## Junction Capacitance ( $C_{pd}$ ):

Elem1: 3.1 pF  
 Elem2: 8.6 pF  
 Elem3: 5.1 pF  
 Elem4: 8.0 pF

## Dark Current [nA]:

Elem1: 22.02 nA  
 Elem2: 35.31 nA  
 Elem3: 39.68 nA  
 Elem4: 46.66 nA

## Dark Noise:

### 1~10Hz avg

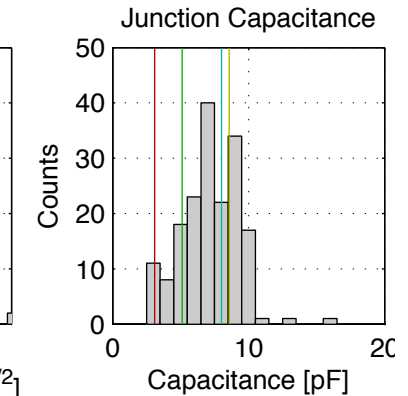
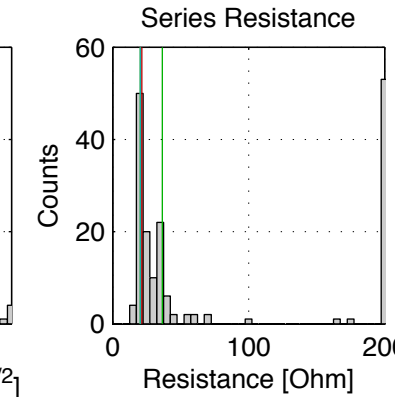
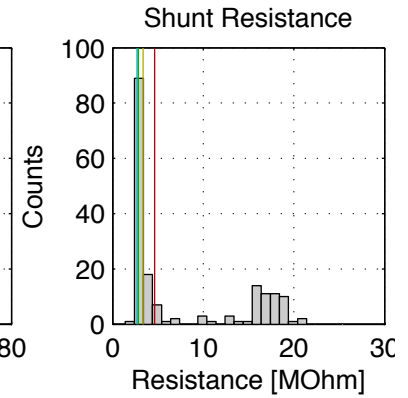
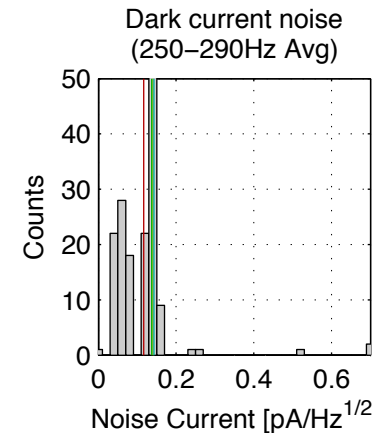
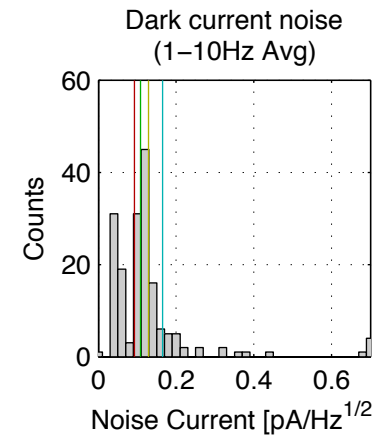
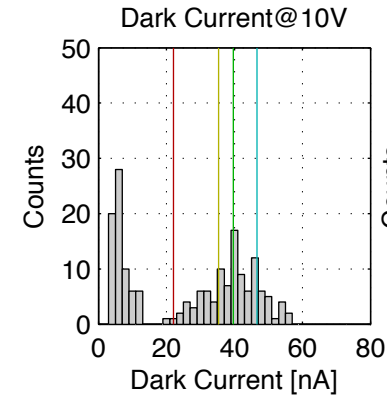
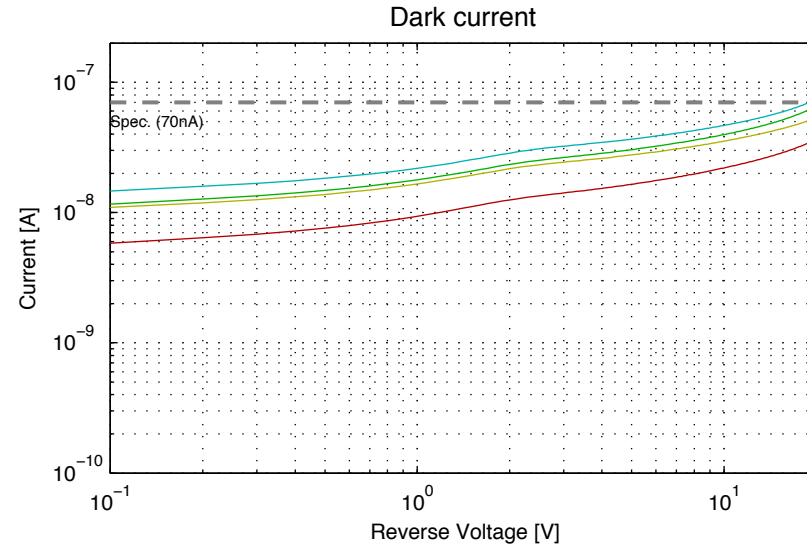
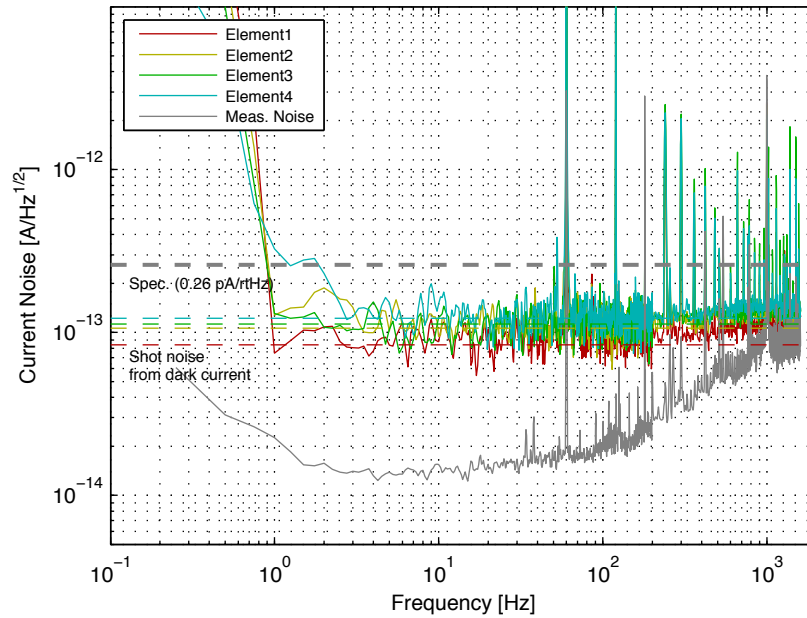
Elem1: 0.093 pA/rtHz  
 Elem2: 0.129 pA/rtHz  
 Elem3: 0.108 pA/rtHz  
 Elem4: 0.165 pA/rtHz

### 250~290Hz avg

Elem1: 0.117 pA/rtHz  
 Elem2: 0.140 pA/rtHz  
 Elem3: 0.138 pA/rtHz  
 Elem4: 0.143 pA/rtHz

Total Penalty: -60

Dark noise:  $V_R = 10V$



## Errors / Warnings

Elem1: $i_{dark} > 15nA$	Elem3: $i_{noise} (LF) > 56fA/rtHz$ (10nA shot)
Elem2: $i_{dark} > 15nA$	Elem4: $i_{noise} (LF) > 56fA/rtHz$ (10nA shot)
Elem3: $i_{dark} > 15nA$	Elem1: $i_{noise} (HF) > 100fA/rtHz$ (30nA shot)
Elem4: $i_{dark} > 15nA$	Elem2: $i_{noise} (HF) > 100fA/rtHz$ (30nA shot)
Elem1: $i_{dark} (LF) > 56fA/rtHz$ (10nA shot)	Elem3: $i_{noise} (HF) > 100fA/rtHz$ (30nA shot)
Elem2: $i_{dark} (LF) > 56fA/rtHz$ (10nA shot)	Elem4: $i_{noise} (HF) > 100fA/rtHz$ (30nA shot)

# QPD #37

## Measurement Date:

Mar. 15, 2013

Impedance measured at  $V_R = 15V$

## Shunt Resistance ( $R_{SH}$ ):

Elem1: 3.843 MOhm  
 Elem2: 2.923 MOhm  
 Elem3: 2.574 MOhm  
 Elem4: 2.404 MOhm

## Series Resistance ( $R_s$ ):

Elem1: 22.3 Ohm  
 Elem2: 19.4 Ohm  
 Elem3: 36.5 Ohm  
 Elem4: 21.8 Ohm

## Junction Capacitance ( $C_{pd}$ ):

Elem1: 7.8 pF  
 Elem2: 7.2 pF  
 Elem3: 6.6 pF  
 Elem4: 6.0 pF

## Dark Current [nA]:

Elem1: 28.14 nA  
 Elem2: 42.19 nA  
 Elem3: 46.04 nA  
 Elem4: 53.43 nA

## Dark Noise:

### 1~10Hz avg

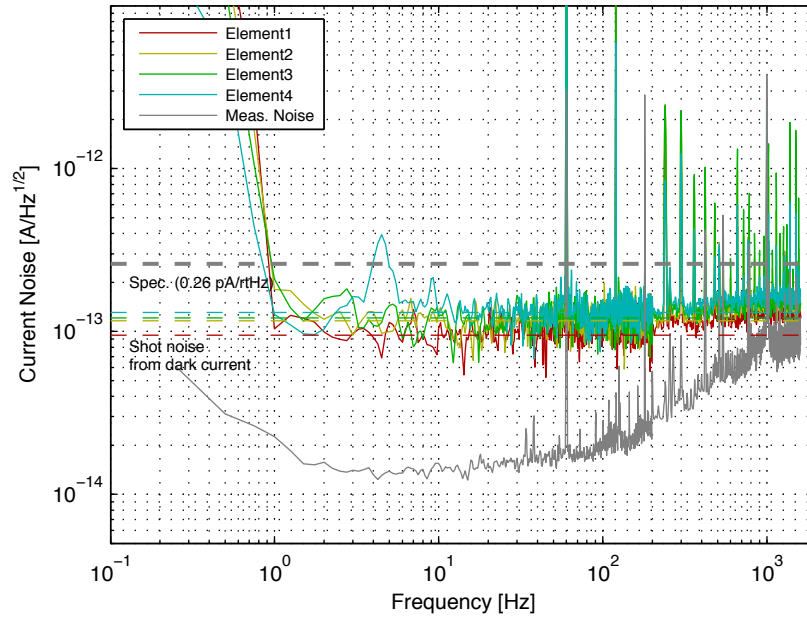
Elem1: 0.099 pA/rtHz  
 Elem2: 0.126 pA/rtHz  
 Elem3: 0.129 pA/rtHz  
 Elem4: 0.188 pA/rtHz

### 250~290Hz avg

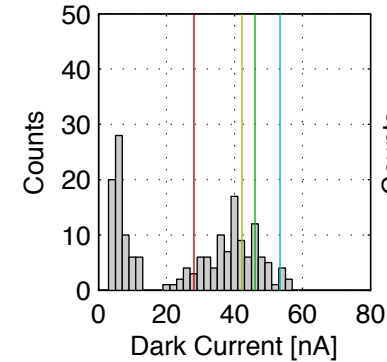
Elem1: 0.133 pA/rtHz  
 Elem2: 0.141 pA/rtHz  
 Elem3: 0.146 pA/rtHz  
 Elem4: 0.162 pA/rtHz

Total Penalty: -155

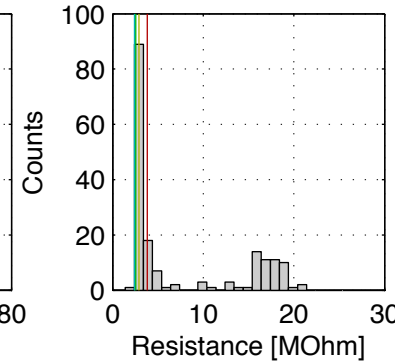
Dark noise:  $V_R = 10V$



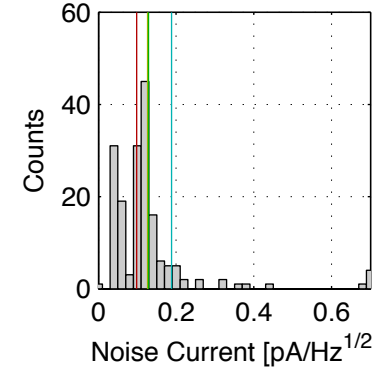
Dark Current@10V



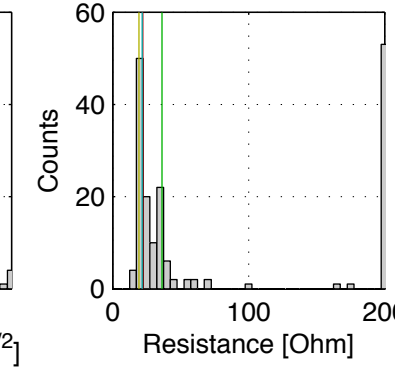
Shunt Resistance



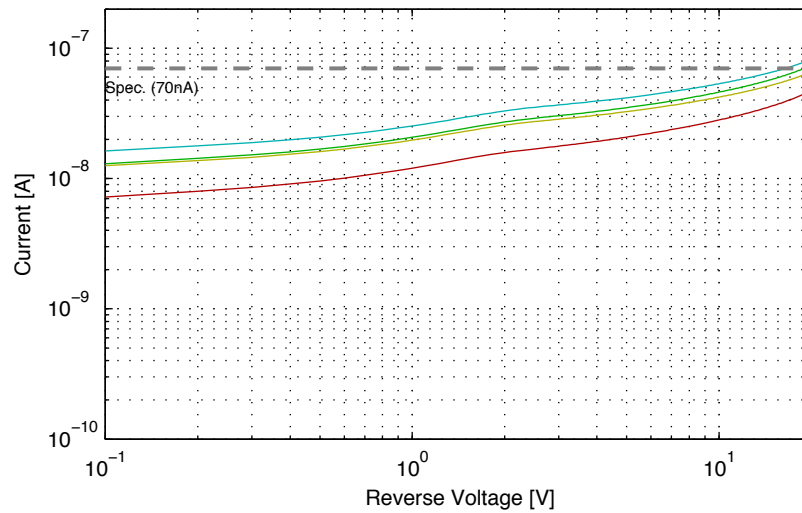
Dark current noise (1~10Hz Avg)



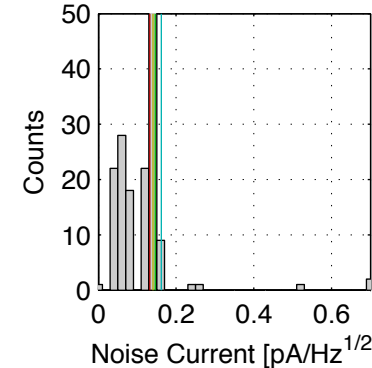
Series Resistance



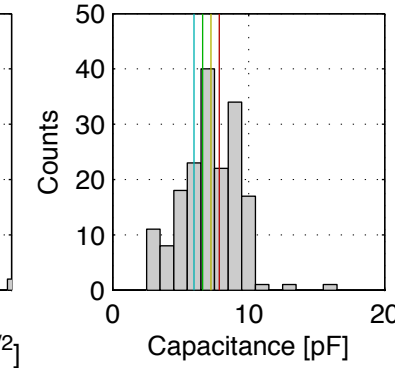
Dark current



Dark current noise (250~290Hz Avg)



Junction Capacitance



Errors / Warnings

Elem1: $i_{dark} > 15nA$	Elem3: $i_{noise} (LF) > 56fA/rtHz$ (10nA shot)
Elem2: $i_{dark} > 15nA$	Elem4: $i_{noise} (LF) > 180fA/rtHz$ (100nA shot)
Elem3: $i_{dark} > 15nA$	Elem1: $i_{noise} (HF) > 100fA/rtHz$ (30nA shot)
Elem4: $i_{dark} > 15nA$	Elem2: $i_{noise} (HF) > 100fA/rtHz$ (30nA shot)
Elem1: $i_{noise} (LF) > 56fA/rtHz$ (10nA shot)	Elem3: $i_{noise} (HF) > 100fA/rtHz$ (30nA shot)
Elem2: $i_{noise} (LF) > 56fA/rtHz$ (10nA shot)	Elem4: $i_{noise} (HF) > 100fA/rtHz$ (30nA shot)

# QPD #38

## Measurement Date:

Mar. 15, 2013

Impedance measured at  $V_R = 15V$

## Shunt Resistance ( $R_{SH}$ ):

Elem1: 3.515 MOhm  
 Elem2: 2.753 MOhm  
 Elem3: 2.466 MOhm  
 Elem4: 2.334 MOhm

## Series Resistance ( $R_s$ ):

Elem1: 22.4 Ohm  
 Elem2: 20.6 Ohm  
 Elem3: 35.1 Ohm  
 Elem4: 22.0 Ohm

## Junction Capacitance: ( $C_{pd}$ ):

Elem1: 7.1 pF  
 Elem2: 9.2 pF  
 Elem3: 3.2 pF  
 Elem4: 10.1 pF

## Dark Current [nA]:

Elem1: 30.90 nA  
 Elem2: 45.06 nA  
 Elem3: 48.17 nA  
 Elem4: 55.35 nA

## Dark Noise:

### 1~10Hz avg

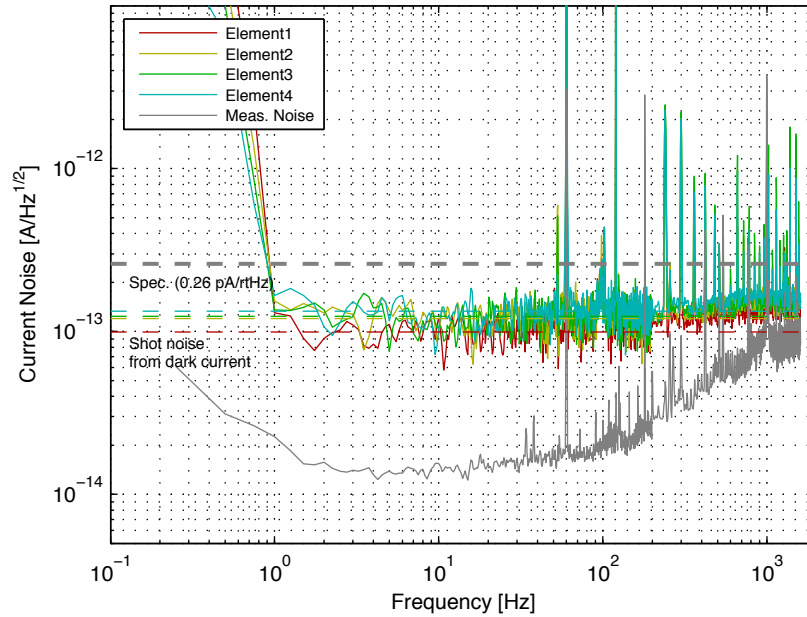
Elem1: 0.103 pA/rtHz  
 Elem2: 0.129 pA/rtHz  
 Elem3: 0.124 pA/rtHz  
 Elem4: 0.131 pA/rtHz

### 250~290Hz avg

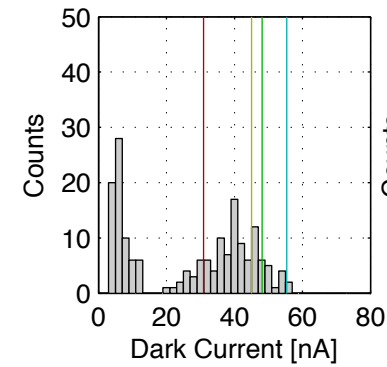
Elem1: 0.135 pA/rtHz  
 Elem2: 0.152 pA/rtHz  
 Elem3: 0.151 pA/rtHz  
 Elem4: 0.160 pA/rtHz

Total Penalty: -65

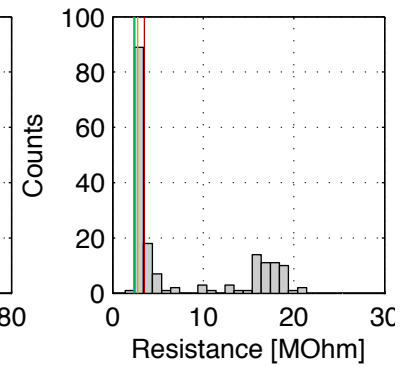
Dark noise:  $V_R = 10V$



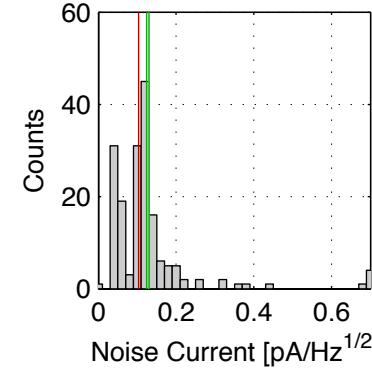
Dark Current@10V



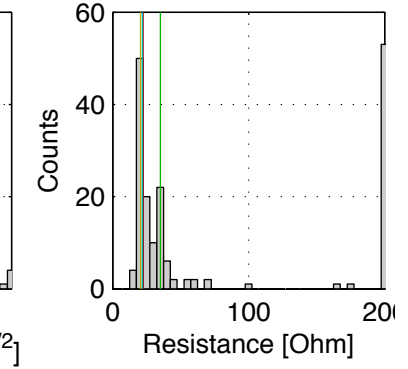
Shunt Resistance



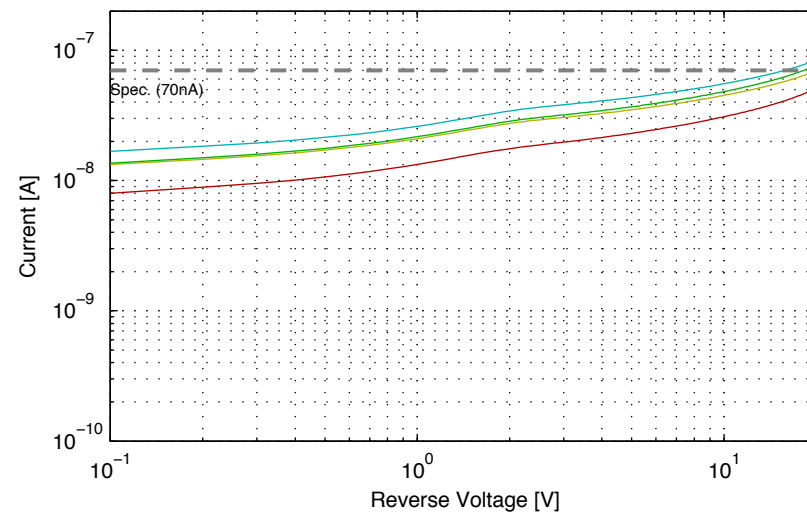
Dark current noise (1-10Hz Avg)



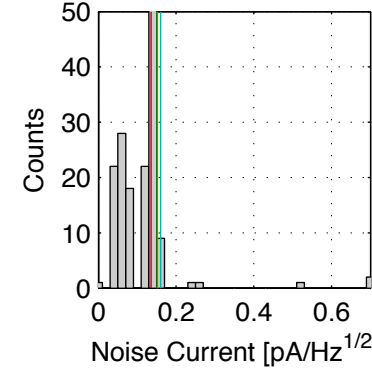
Series Resistance



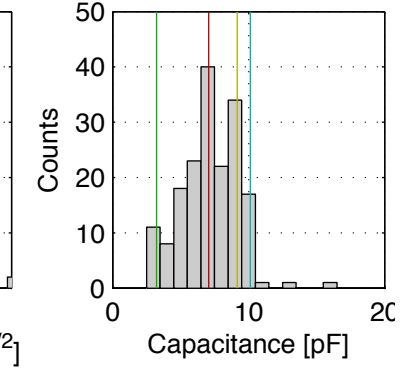
Dark current



Dark current noise (250-290Hz Avg)



Junction Capacitance



Errors / Warnings

Elem4: $C_{pd} > 10pF$	Elem2: $i_{noise} (LF) > 56fA/rtHz$ (10nA shot)	Elem4: $i_{noise} (HF) > 100fA/rtHz$ (30nA shot)
Elem1: $i_{pd} > 15nA$	Elem3: $i_{noise} (LF) > 56fA/rtHz$ (10nA shot)	
Elem2: $i_{dark} > 15nA$	Elem4: $i_{noise} (LF) > 56fA/rtHz$ (10nA shot)	
Elem3: $i_{dark} > 15nA$	Elem1: $i_{noise} (HF) > 100fA/rtHz$ (30nA shot)	
Elem4: $i_{dark} > 15nA$	Elem2: $i_{noise} (HF) > 100fA/rtHz$ (30nA shot)	
Elem1: $i_{noise} (LF) > 56fA/rtHz$ (10nA shot)	Elem3: $i_{noise} (HF) > 100fA/rtHz$ (30nA shot)	



# QPD #39

## Measurement Date:

Mar. 15, 2013

Impedance measured at  $V_R = 15V$

## Shunt Resistance ( $R_{SH}$ ):

Elem1: 3.681 MOhm  
 Elem2: 2.855 MOhm  
 Elem3: 2.559 MOhm  
 Elem4: 2.421 MOhm

## Series Resistance ( $R_s$ ):

Elem1: 20.9 Ohm  
 Elem2: 18.7 Ohm  
 Elem3: 35.6 Ohm  
 Elem4: 20.7 Ohm

## Junction Capacitance ( $C_{pd}$ ):

Elem1: 2.9 pF  
 Elem2: 8.5 pF  
 Elem3: 5.0 pF  
 Elem4: 4.0 pF

## Dark Current [nA]:

Elem1: 29.17 nA  
 Elem2: 43.00 nA  
 Elem3: 46.08 nA  
 Elem4: 53.09 nA

## Dark Noise:

### 1~10Hz avg

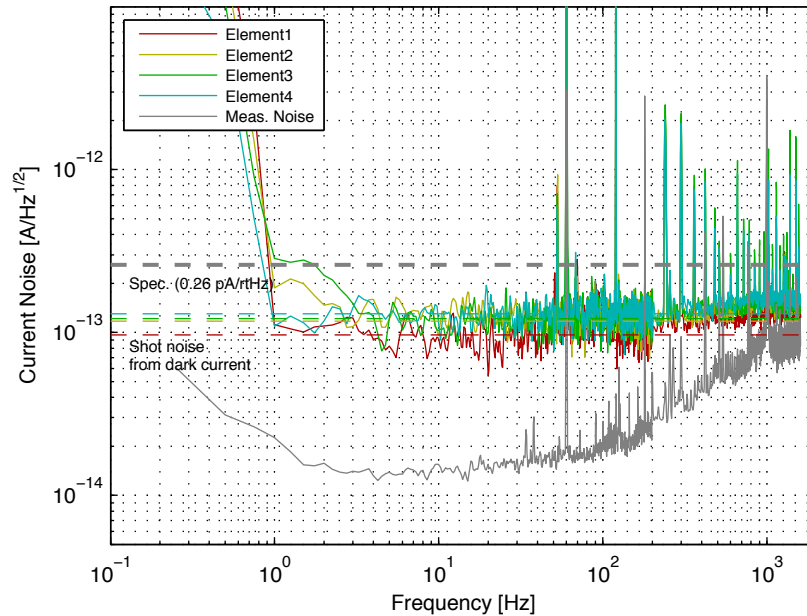
Elem1: 0.100 pA/rtHz  
 Elem2: 0.142 pA/rtHz  
 Elem3: 0.154 pA/rtHz  
 Elem4: 0.131 pA/rtHz

### 250~290Hz avg

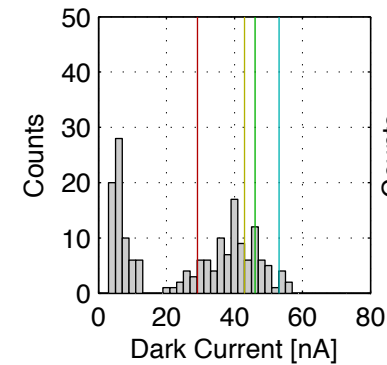
Elem1: 0.129 pA/rtHz  
 Elem2: 0.140 pA/rtHz  
 Elem3: 0.146 pA/rtHz  
 Elem4: 0.151 pA/rtHz

Total Penalty: -60

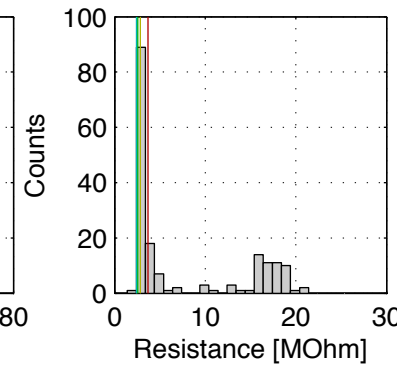
Dark noise:  $V_R = 10V$



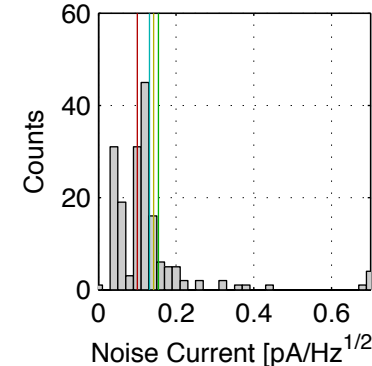
Dark Current@10V



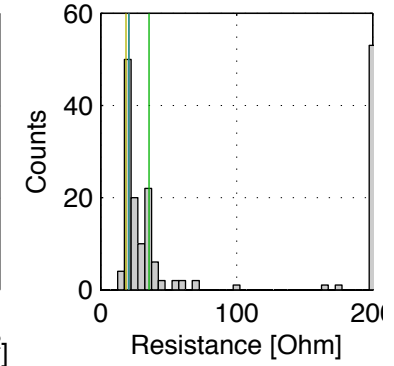
Shunt Resistance



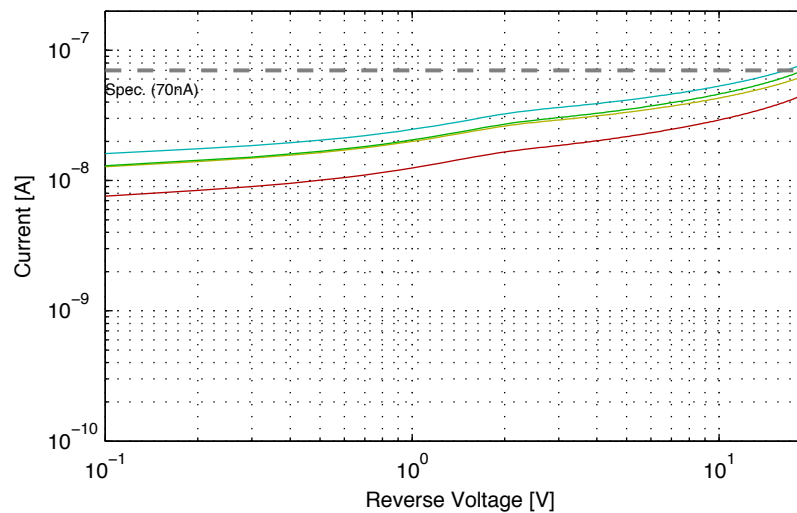
Dark current noise (1-10Hz Avg)



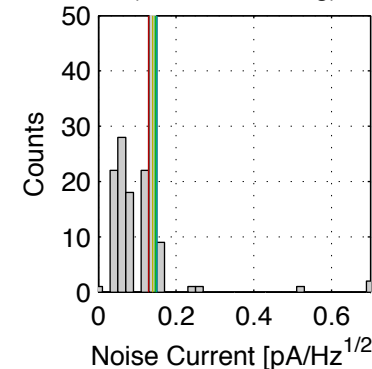
Series Resistance



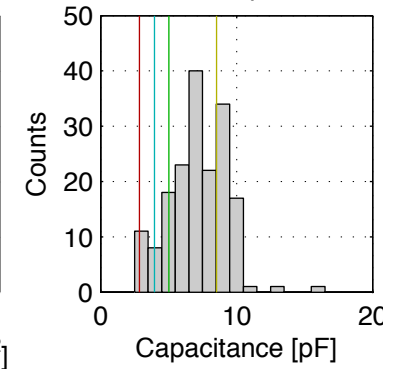
Dark current



Dark current noise (250-290Hz Avg)



Junction Capacitance



Errors / Warnings

Elem1: $i_{dark} > 15nA$	Elem3: $i_{noise} (LF) > 56fA/rtHz$ (10nA shot)
Elem2: $i_{dark} > 15nA$	Elem4: $i_{noise} (LF) > 56fA/rtHz$ (10nA shot)
Elem3: $i_{dark} > 15nA$	Elem1: $i_{noise} (HF) > 100fA/rtHz$ (30nA shot)
Elem4: $i_{dark} > 15nA$	Elem2: $i_{noise} (HF) > 100fA/rtHz$ (30nA shot)
Elem1: $i_{dark} (LF) > 56fA/rtHz$ (10nA shot)	Elem3: $i_{noise} (HF) > 100fA/rtHz$ (30nA shot)
Elem2: $i_{dark} (LF) > 56fA/rtHz$ (10nA shot)	Elem4: $i_{noise} (HF) > 100fA/rtHz$ (30nA shot)

# QPD #40

## Measurement Date:

Mar. 15, 2013

Impedance measured at  $V_R = 15V$

## Shunt Resistance ( $R_{SH}$ ):

Elem1: 3.048 MOhm  
 Elem2: 2.700 MOhm  
 Elem3: 2.679 MOhm  
 Elem4: 2.656 MOhm

## Series Resistance ( $R_s$ ):

Elem1: 19.7 Ohm  
 Elem2: 19.5 Ohm  
 Elem3: 31.6 Ohm  
 Elem4: 26.5 Ohm

## Junction Capacitance ( $C_{pd}$ ):

Elem1: 5.7 pF  
 Elem2: 5.5 pF  
 Elem3: 5.7 pF  
 Elem4: 6.9 pF

## Dark Current [nA]:

Elem1: 33.36 nA  
 Elem2: 42.66 nA  
 Elem3: 40.79 nA  
 Elem4: 45.71 nA

## Dark Noise:

### 1~10Hz avg

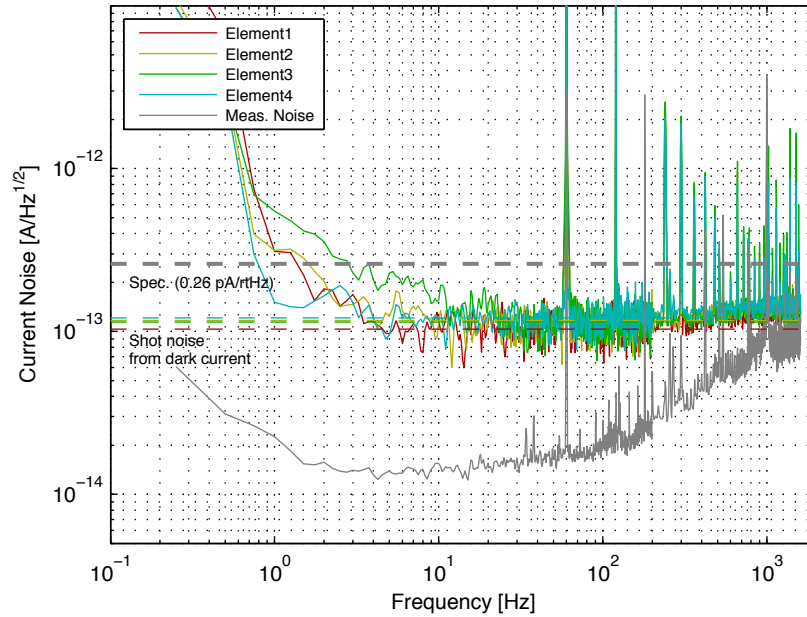
Elem1: 0.140 pA/rtHz  
 Elem2: 0.160 pA/rtHz  
 Elem3: 0.253 pA/rtHz  
 Elem4: 0.131 pA/rtHz

### 250~290Hz avg

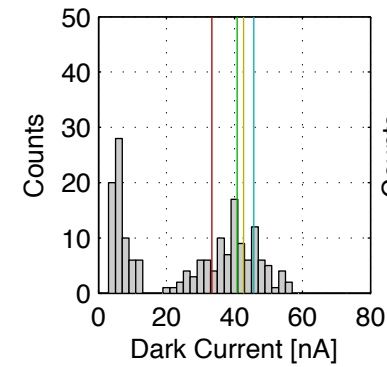
Elem1: 0.133 pA/rtHz  
 Elem2: 0.138 pA/rtHz  
 Elem3: 0.129 pA/rtHz  
 Elem4: 0.145 pA/rtHz

Total Penalty: -155

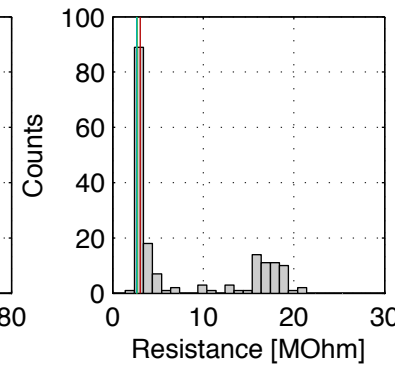
Dark noise:  $V_R = 10V$



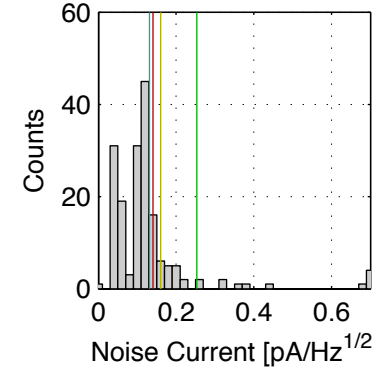
Dark Current@10V



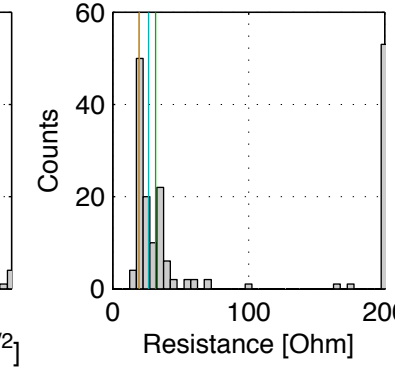
Shunt Resistance



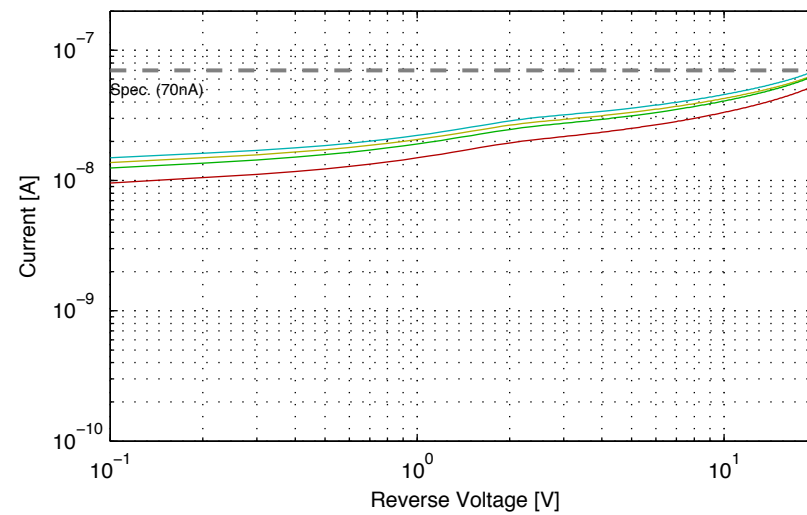
Dark current noise (1-10Hz Avg)



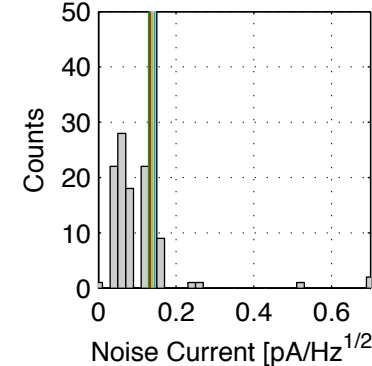
Series Resistance



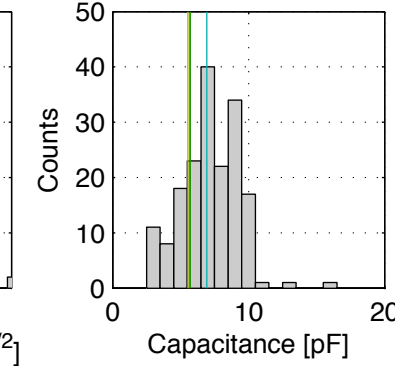
Dark current



Dark current noise (250-290Hz Avg)



Junction Capacitance



Errors / Warnings

Elem1: $i_{dark} > 15nA$	Elem3: $i_{noise} (LF) > 180fA/rtHz$ (100nA shot)
Elem2: $i_{dark} > 15nA$	Elem4: $i_{noise} (LF) > 56fA/rtHz$ (10nA shot)
Elem3: $i_{dark} > 15nA$	Elem1: $i_{noise} (HF) > 100fA/rtHz$ (30nA shot)
Elem4: $i_{dark} > 15nA$	Elem2: $i_{noise} (HF) > 100fA/rtHz$ (30nA shot)
Elem1: $i_{noise} (LF) > 56fA/rtHz$ (10nA shot)	Elem3: $i_{noise} (HF) > 100fA/rtHz$ (30nA shot)
Elem2: $i_{noise} (LF) > 56fA/rtHz$ (10nA shot)	Elem4: $i_{noise} (HF) > 100fA/rtHz$ (30nA shot)

# QPD #41

## Measurement Date:

Mar. 16, 2013

Impedance measured at  $V_R = 15V$

## Shunt Resistance ( $R_{SH}$ ):

Elem1: 3.958 MOhm  
 Elem2: 3.370 MOhm  
 Elem3: 3.116 MOhm  
 Elem4: 3.109 MOhm

## Series Resistance ( $R_s$ ):

Elem1: 26.4 Ohm  
 Elem2: 17.6 Ohm  
 Elem3: 36.9 Ohm  
 Elem4: 26.6 Ohm

## Junction Capacitance ( $C_{pd}$ ):

Elem1: 5.6 pF  
 Elem2: 7.2 pF  
 Elem3: 3.6 pF  
 Elem4: 7.6 pF

## Dark Current [nA]:

Elem1: 26.61 nA  
 Elem2: 36.04 nA  
 Elem3: 36.81 nA  
 Elem4: 42.25 nA

## Dark Noise:

### 1~10Hz avg

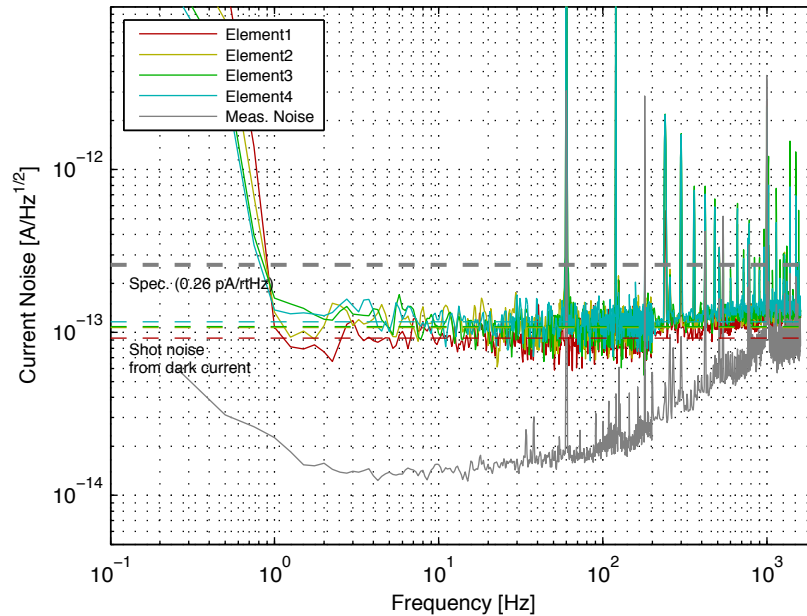
Elem1: 0.096 pA/rtHz  
 Elem2: 0.117 pA/rtHz  
 Elem3: 0.128 pA/rtHz  
 Elem4: 0.129 pA/rtHz

### 250~290Hz avg

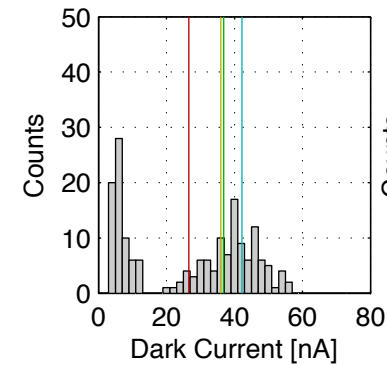
Elem1: 0.126 pA/rtHz  
 Elem2: 0.142 pA/rtHz  
 Elem3: 0.133 pA/rtHz  
 Elem4: 0.135 pA/rtHz

Total Penalty: -60

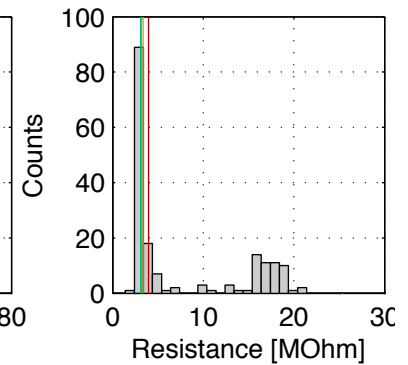
Dark noise:  $V_R = 10V$



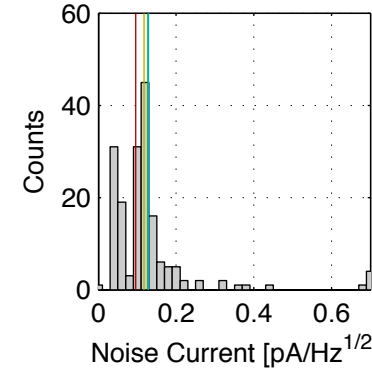
Dark Current@10V



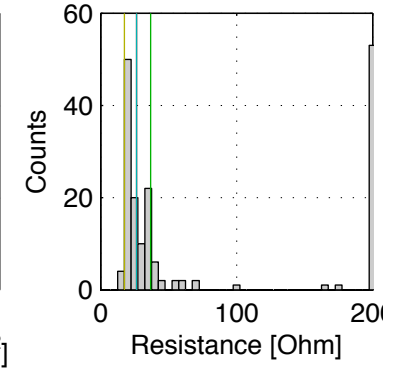
Shunt Resistance



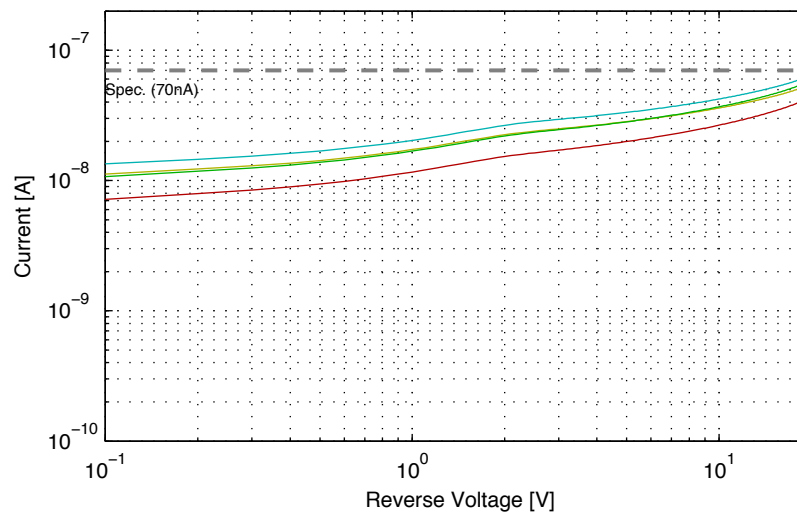
Dark current noise (1-10Hz Avg)



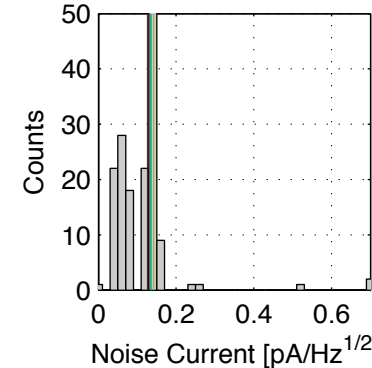
Series Resistance



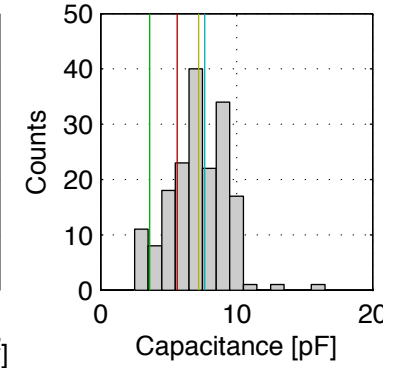
Dark current



Dark current noise (250-290Hz Avg)



Junction Capacitance



Errors / Warnings

Elem1: $i_{dark} > 15nA$	Elem3: $i_{noise(LF)} > 56fA/rtHz$ (10nA shot)
Elem2: $i_{dark} > 15nA$	Elem4: $i_{noise(LF)} > 56fA/rtHz$ (10nA shot)
Elem3: $i_{dark} > 15nA$	Elem1: $i_{noise(HF)} > 100fA/rtHz$ (30nA shot)
Elem4: $i_{dark} > 15nA$	Elem2: $i_{noise(HF)} > 100fA/rtHz$ (30nA shot)
Elem1: $i_{dark(LF)} > 56fA/rtHz$ (10nA shot)	Elem3: $i_{noise(HF)} > 100fA/rtHz$ (30nA shot)
Elem2: $i_{dark(LF)} > 56fA/rtHz$ (10nA shot)	Elem4: $i_{noise(HF)} > 100fA/rtHz$ (30nA shot)

# QPD #42

## Measurement Date:

Mar. 16, 2013

Impedance measured at  $V_R = 15V$

## Shunt Resistance ( $R_{SH}$ ):

Elem1: 3.162 MOhm  
 Elem2: 3.115 MOhm  
 Elem3: 3.142 MOhm  
 Elem4: 3.230 MOhm

## Series Resistance ( $R_s$ ):

Elem1: 20.3 Ohm  
 Elem2: 15.8 Ohm  
 Elem3: 30.4 Ohm  
 Elem4: 21.0 Ohm

## Junction Capacitance ( $C_{pd}$ ):

Elem1: 7.0 pF  
 Elem2: 4.5 pF  
 Elem3: 3.3 pF  
 Elem4: 5.7 pF

## Dark Current [nA]:

Elem1: 33.11 nA  
 Elem2: 37.73 nA  
 Elem3: 35.45 nA  
 Elem4: 39.77 nA

## Dark Noise:

### 1~10Hz avg

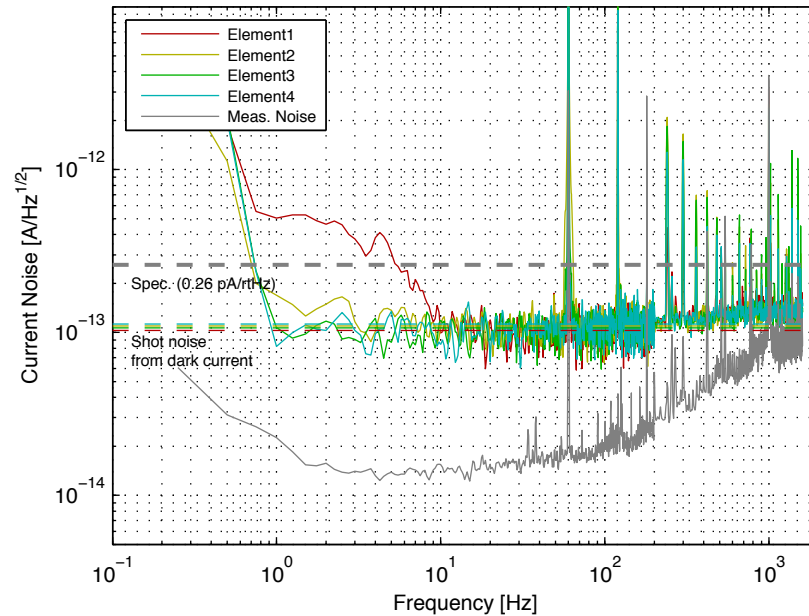
Elem1: 0.315 pA/rtHz  
 Elem2: 0.125 pA/rtHz  
 Elem3: 0.101 pA/rtHz  
 Elem4: 0.105 pA/rtHz

### 250~290Hz avg

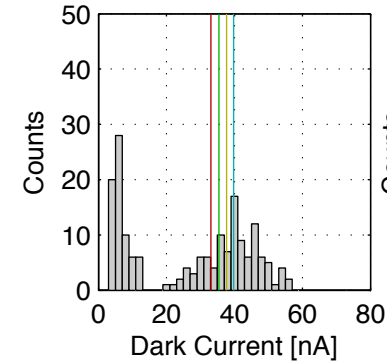
Elem1: 0.141 pA/rtHz  
 Elem2: 0.133 pA/rtHz  
 Elem3: 0.126 pA/rtHz  
 Elem4: 0.132 pA/rtHz

Total Penalty: -155

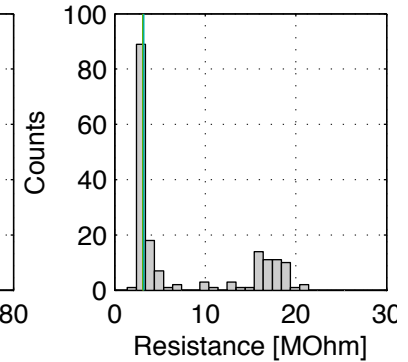
Dark noise:  $V_R = 10V$



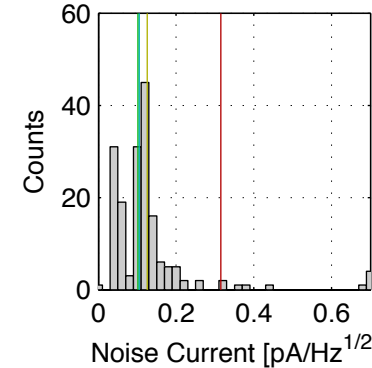
Dark Current@10V



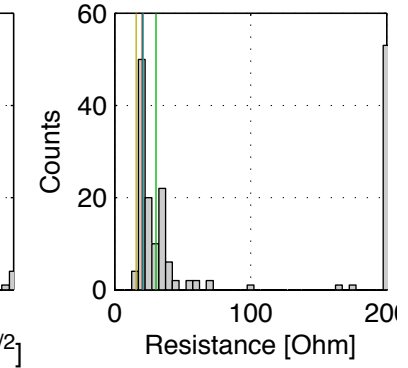
Shunt Resistance



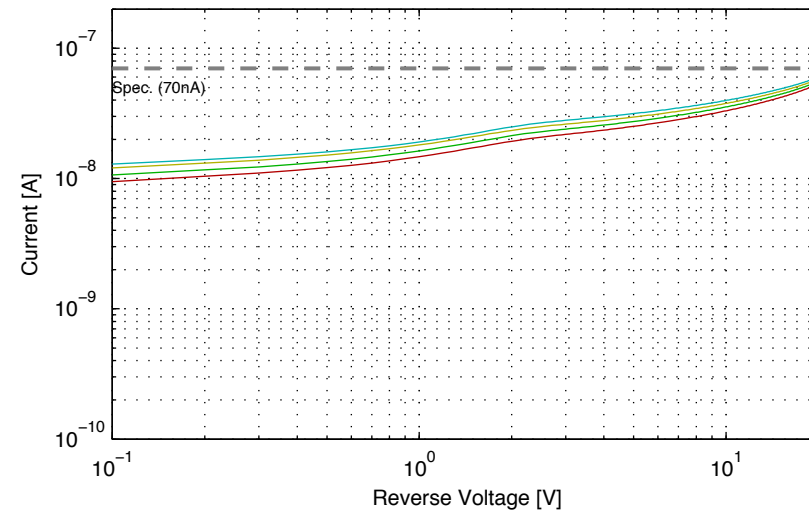
Dark current noise (1-10Hz Avg)



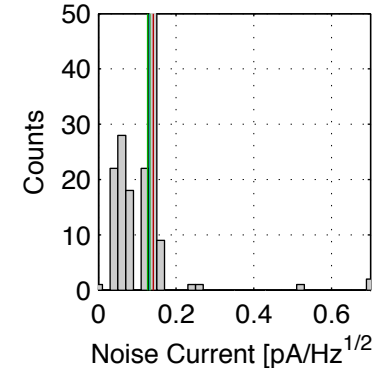
Series Resistance



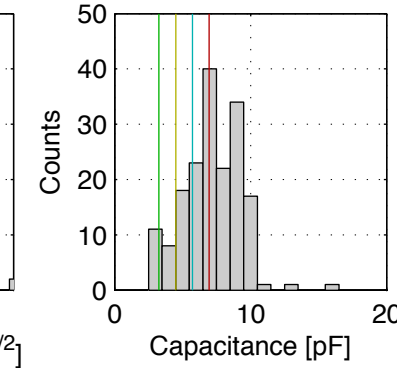
Dark current



Dark current noise (250-290Hz Avg)



Junction Capacitance



Errors / Warnings

Elem1: $i_{dark} > 15nA$	Elem3: $i_{noise} (LF) > 56fA/rtHz$ (10nA shot)
Elem2: $i_{dark} > 15nA$	Elem4: $i_{noise} (LF) > 56fA/rtHz$ (10nA shot)
Elem3: $i_{dark} > 15nA$	Elem1: $i_{noise} (HF) > 100fA/rtHz$ (30nA shot)
Elem4: $i_{dark} > 15nA$	Elem2: $i_{noise} (HF) > 100fA/rtHz$ (30nA shot)
Elem1: $i_{dark} (LF) > 180fA/rtHz$ (100nA shot)	Elem3: $i_{noise} (HF) > 100fA/rtHz$ (30nA shot)
Elem2: $i_{noise} (LF) > 56fA/rtHz$ (10nA shot)	Elem4: $i_{noise} (HF) > 100fA/rtHz$ (30nA shot)

# QPD #43

## Measurement Date:

Mar. 16, 2013

Impedance measured at  $V_R = 15V$

## Shunt Resistance ( $R_{SH}$ ):

Elem1: 3.595 MOhm  
 Elem2: 3.126 MOhm  
 Elem3: 2.866 MOhm  
 Elem4: 2.683 MOhm

## Series Resistance ( $R_s$ ):

Elem1: 22.1 Ohm  
 Elem2: 16.1 Ohm  
 Elem3: 39.3 Ohm  
 Elem4: 23.7 Ohm

## Junction Capacitance ( $C_{pd}$ ):

Elem1: 5.5 pF  
 Elem2: 7.2 pF  
 Elem3: 5.1 pF  
 Elem4: 8.0 pF

## Dark Current [nA]:

Elem1: 29.99 nA  
 Elem2: 39.55 nA  
 Elem3: 40.68 nA  
 Elem4: 48.00 nA

## Dark Noise:

### 1~10Hz avg

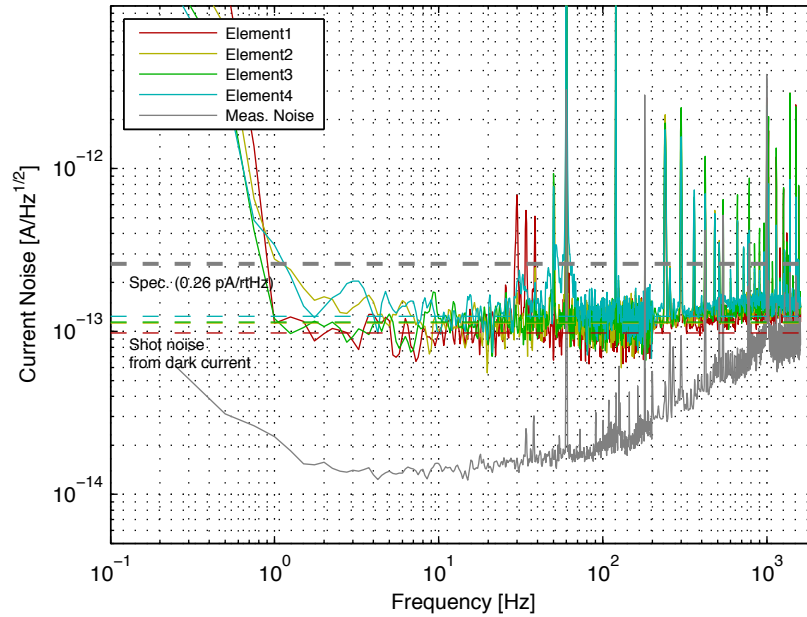
Elem1: 0.098 pA/rtHz  
 Elem2: 0.141 pA/rtHz  
 Elem3: 0.112 pA/rtHz  
 Elem4: 0.159 pA/rtHz

### 250~290Hz avg

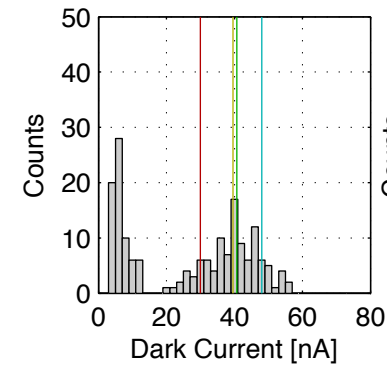
Elem1: 0.133 pA/rtHz  
 Elem2: 0.138 pA/rtHz  
 Elem3: 0.137 pA/rtHz  
 Elem4: 0.150 pA/rtHz

Total Penalty: -60

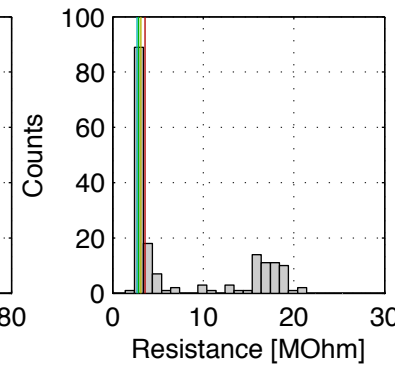
Dark noise:  $V_R = 10V$



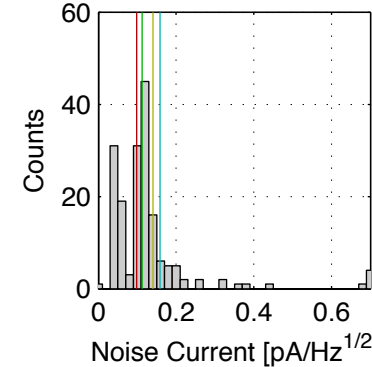
Dark Current@10V



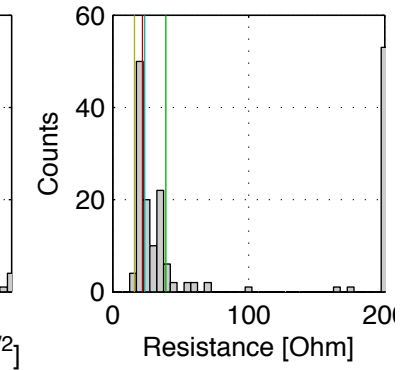
Shunt Resistance



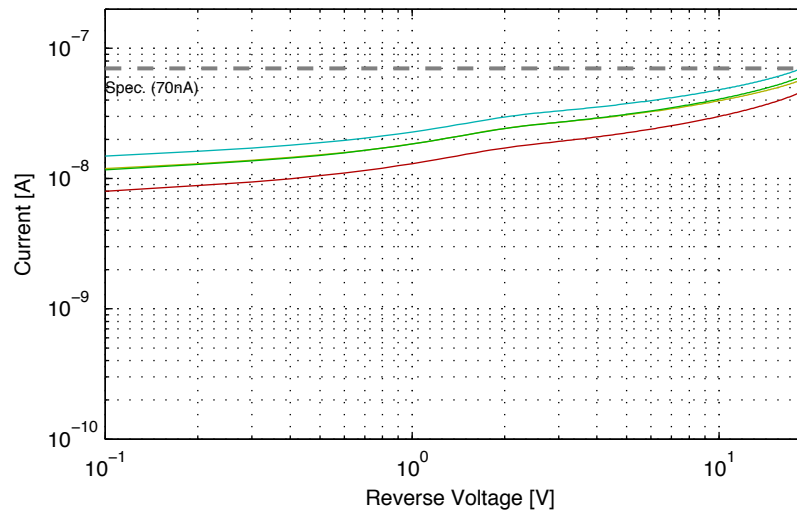
Dark current noise (1-10Hz Avg)



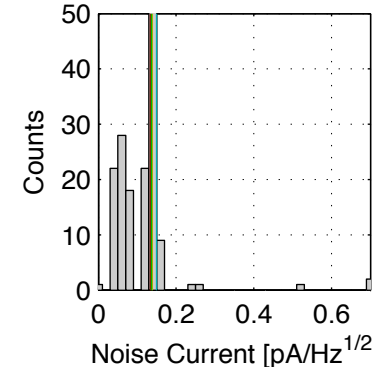
Series Resistance



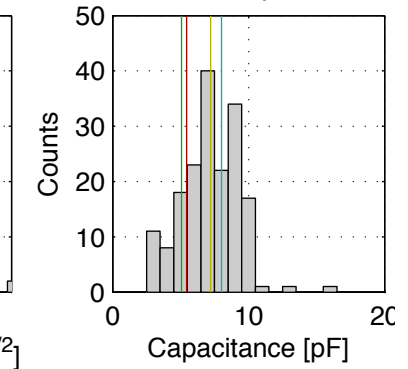
Dark current



Dark current noise (250-290Hz Avg)



Junction Capacitance



## Errors / Warnings

Elem1: $i_{dark} > 15nA$	Elem3: $i_{noise} (LF) > 56fA/rtHz$ (10nA shot)
Elem2: $i_{dark} > 15nA$	Elem4: $i_{noise} (LF) > 56fA/rtHz$ (10nA shot)
Elem3: $i_{dark} > 15nA$	Elem1: $i_{noise} (HF) > 100fA/rtHz$ (30nA shot)
Elem4: $i_{dark} > 15nA$	Elem2: $i_{noise} (HF) > 100fA/rtHz$ (30nA shot)
Elem1: $i_{dark} (LF) > 56fA/rtHz$ (10nA shot)	Elem3: $i_{noise} (HF) > 100fA/rtHz$ (30nA shot)
Elem2: $i_{dark} (LF) > 56fA/rtHz$ (10nA shot)	Elem4: $i_{noise} (HF) > 100fA/rtHz$ (30nA shot)

# QPD #44

## Measurement Date:

Mar. 16, 2013

Impedance measured at  $V_R = 15V$

## Shunt Resistance ( $R_{SH}$ ):

Elem1: 13.335 MOhm  
 Elem2: 4.417 MOhm  
 Elem3: 9.779 MOhm  
 Elem4: 3.350 MOhm

## Series Resistance ( $R_s$ ):

Elem1: 41.7 Ohm  
 Elem2: 32.7 Ohm  
 Elem3: 55.1 Ohm  
 Elem4: 39.4 Ohm

## Junction Capacitance ( $C_{pd}$ ):

Elem1: 7.5 pF  
 Elem2: 9.4 pF  
 Elem3: 7.0 pF  
 Elem4: 7.5 pF

## Dark Current [nA]:

Elem1: 4.82 nA  
 Elem2: 10.15 nA  
 Elem3: 8.12 nA  
 Elem4: 12.69 nA

## Dark Noise:

### 1~10Hz avg

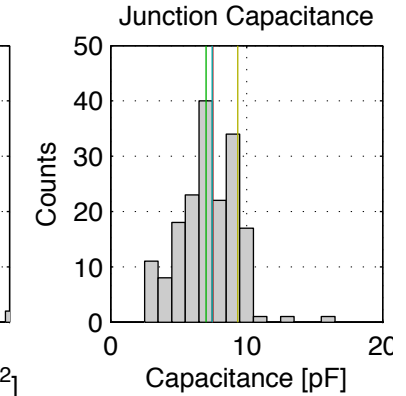
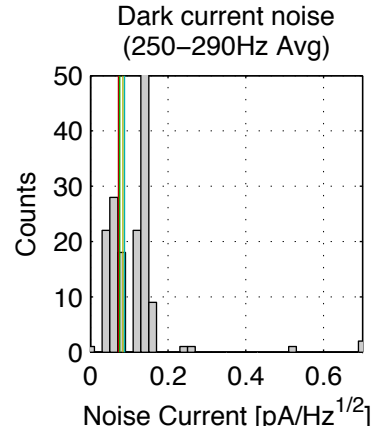
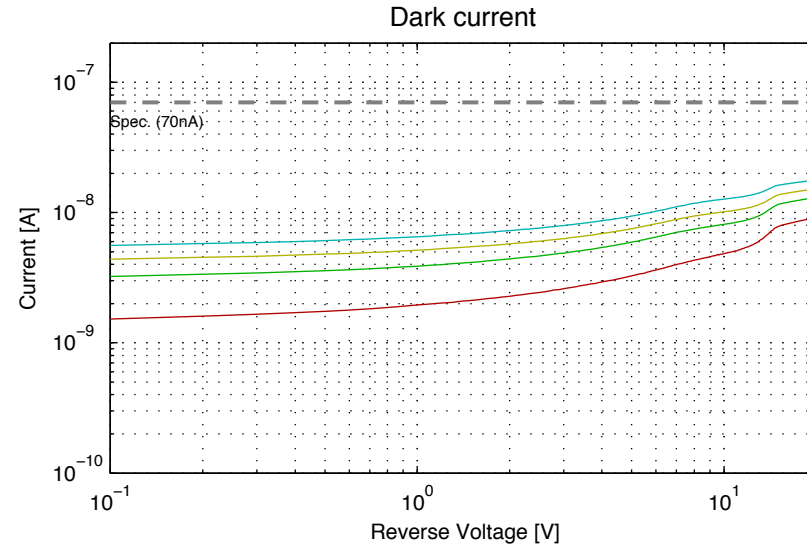
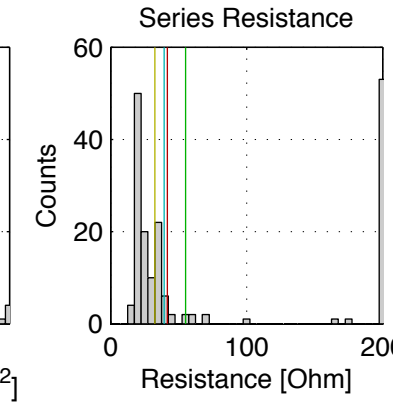
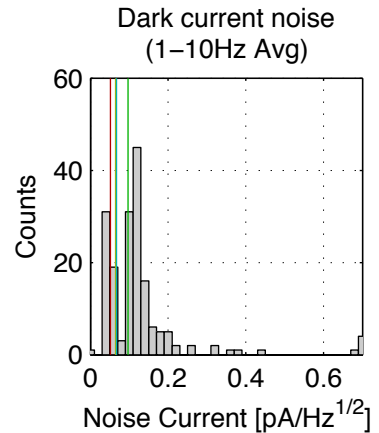
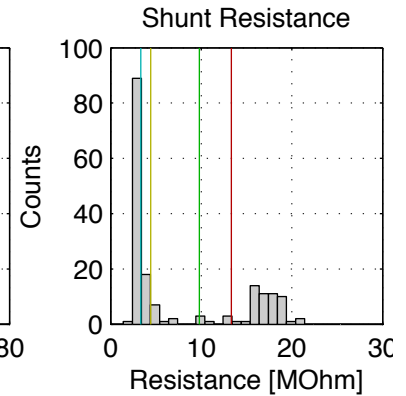
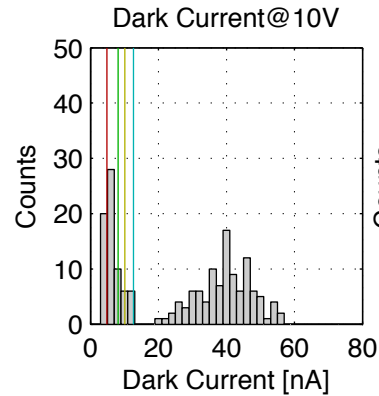
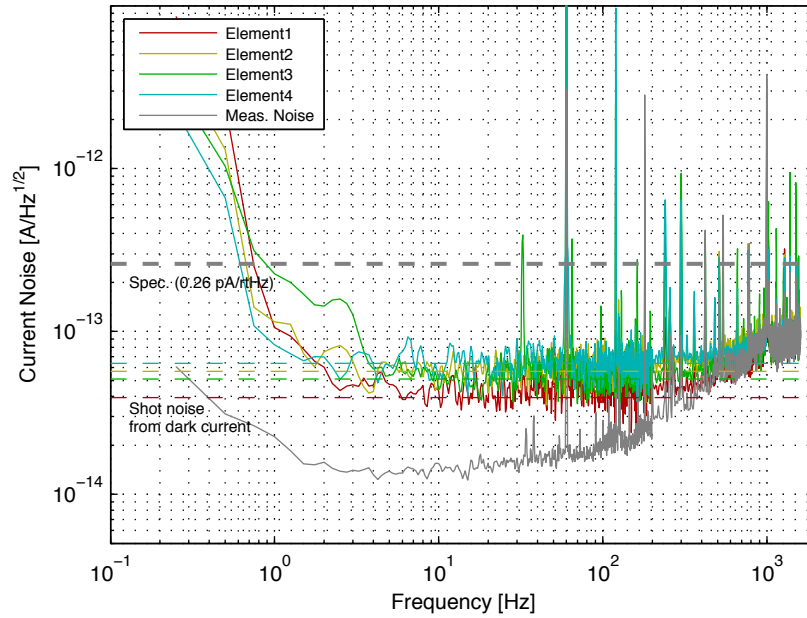
Elem1: 0.052 pA/rtHz  
 Elem2: 0.065 pA/rtHz  
 Elem3: 0.097 pA/rtHz  
 Elem4: 0.067 pA/rtHz

### 250~290Hz avg

Elem1: 0.072 pA/rtHz  
 Elem2: 0.083 pA/rtHz  
 Elem3: 0.075 pA/rtHz  
 Elem4: 0.088 pA/rtHz

Total Penalty: -15

Dark noise:  $V_R = 10V$



Errors / Warnings

Elem2:  $i_{noise} (LF) > 56fA/rtHz$  (10nA shot)  
 Elem3:  $i_{noise} (LF) > 56fA/rtHz$  (10nA shot)  
 Elem4:  $i_{noise} (LF) > 56fA/rtHz$  (10nA shot)

# QPD #45

## Measurement Date:

Mar. 16, 2013

Impedance measured at  $V_R = 15V$

## Shunt Resistance ( $R_{SH}$ ):

Elem1: 17.973 MOhm  
 Elem2: 4.448 MOhm  
 Elem3: 9.897 MOhm  
 Elem4: 3.393 MOhm

## Series Resistance ( $R_s$ ):

Elem1: 34.9 Ohm  
 Elem2: 29.7 Ohm  
 Elem3: 53.8 Ohm  
 Elem4: 36.7 Ohm

## Junction Capacitance ( $C_{pd}$ ):

Elem1: 4.2 pF  
 Elem2: 8.6 pF  
 Elem3: 5.2 pF  
 Elem4: 4.9 pF

## Dark Current [nA]:

Elem1: 4.80 nA  
 Elem2: 9.63 nA  
 Elem3: 7.68 nA  
 Elem4: 12.21 nA

## Dark Noise:

### 1~10Hz avg

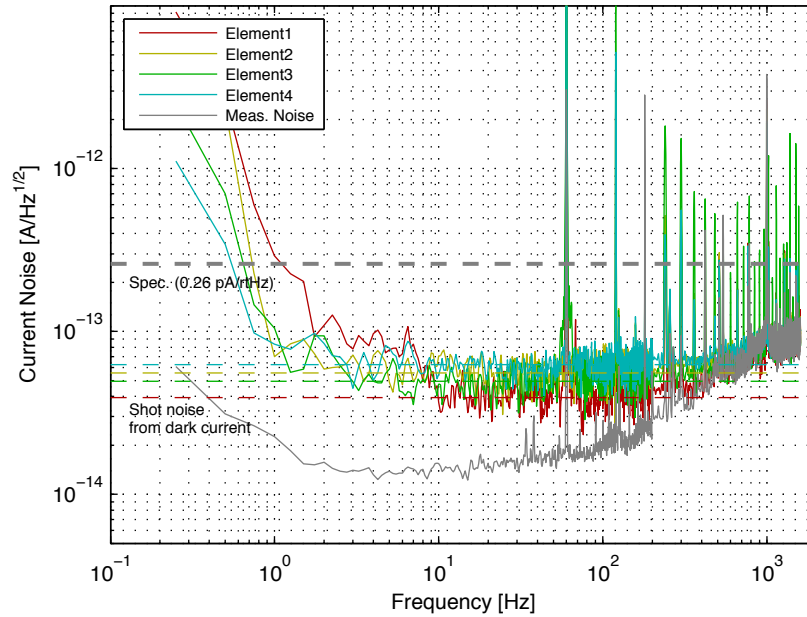
Elem1: 0.103 pA/rtHz  
 Elem2: 0.063 pA/rtHz  
 Elem3: 0.057 pA/rtHz  
 Elem4: 0.069 pA/rtHz

### 250~290Hz avg

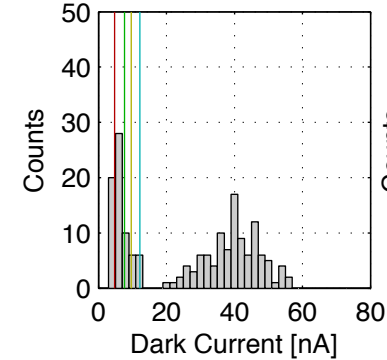
Elem1: 0.072 pA/rtHz  
 Elem2: 0.079 pA/rtHz  
 Elem3: 0.074 pA/rtHz  
 Elem4: 0.086 pA/rtHz

Total Penalty: -20

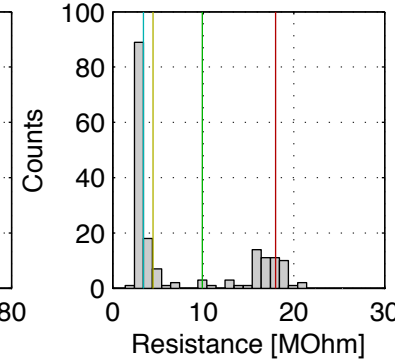
Dark noise:  $V_R = 10V$



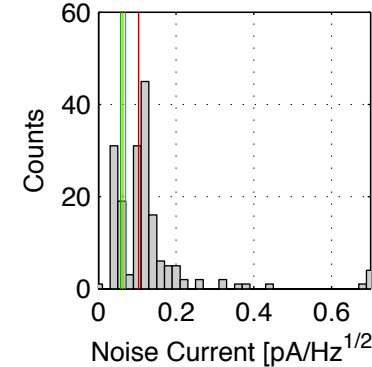
Dark Current@10V



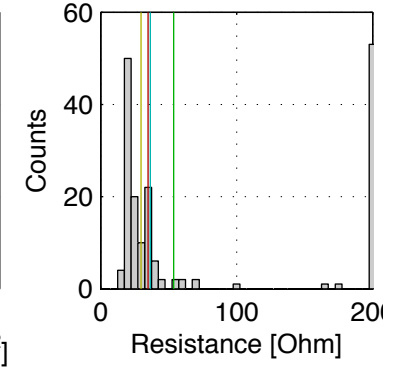
Shunt Resistance



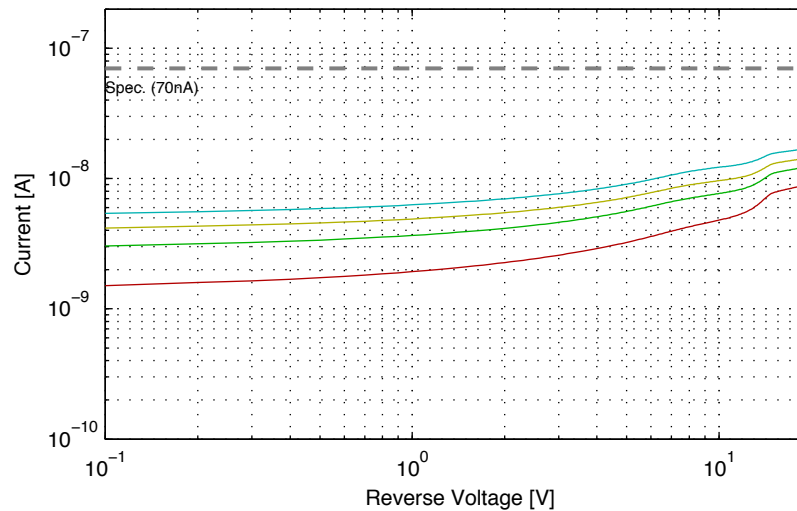
Dark current noise (1-10Hz Avg)



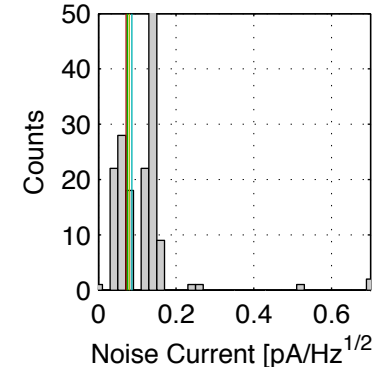
Series Resistance



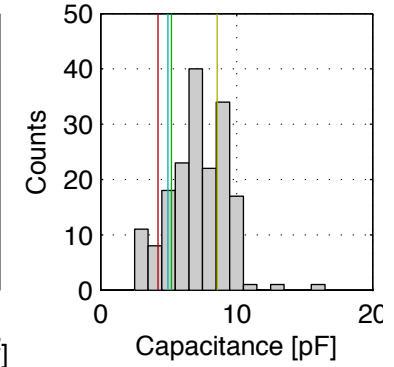
Dark current



Dark current noise (250-290Hz Avg)



Junction Capacitance



Errors / Warnings

Elem1:  $i_{noise}(LF) > 56fA/rtHz$  (10nA shot)  
 Elem2:  $i_{noise}(LF) > 56fA/rtHz$  (10nA shot)  
 Elem3:  $i_{noise}(LF) > 56fA/rtHz$  (10nA shot)  
 Elem4:  $i_{noise}(LF) > 56fA/rtHz$  (10nA shot)

# QPD #46

## Measurement Date:

Mar. 16, 2013

Impedance measured at  $V_R = 15V$

## Shunt Resistance ( $R_{SH}$ ):

Elem1: 3.400 MOhm  
 Elem2: 3.122 MOhm  
 Elem3: 2.943 MOhm  
 Elem4: 2.916 MOhm

## Series Resistance ( $R_s$ ):

Elem1: 21.7 Ohm  
 Elem2: 21.1 Ohm  
 Elem3: 33.7 Ohm  
 Elem4: 21.3 Ohm

## Junction Capacitance ( $C_{pd}$ ):

Elem1: 7.8 pF  
 Elem2: 8.8 pF  
 Elem3: 5.1 pF  
 Elem4: 6.9 pF

## Dark Current [nA]:

Elem1: 30.97 nA  
 Elem2: 38.50 nA  
 Elem3: 38.37 nA  
 Elem4: 43.91 nA

## Dark Noise:

### 1~10Hz avg

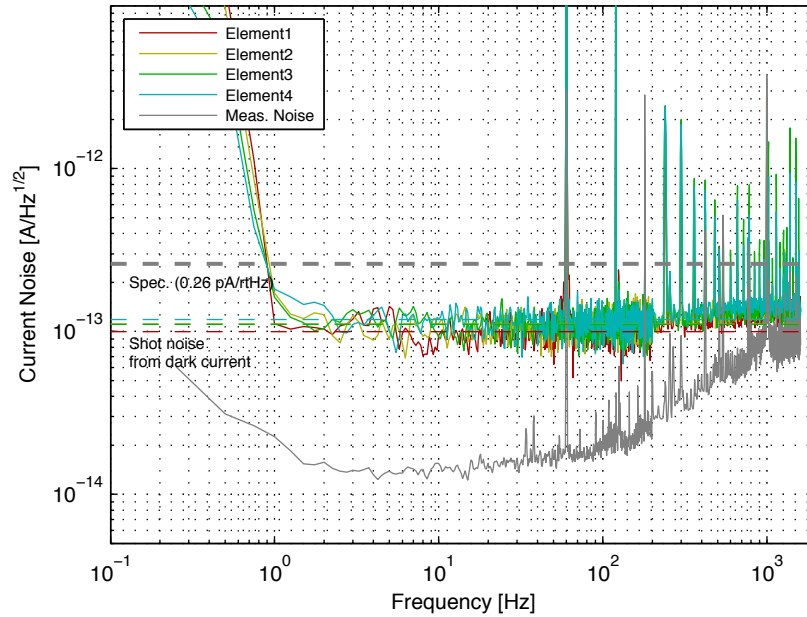
Elem1: 0.103 pA/rtHz  
 Elem2: 0.108 pA/rtHz  
 Elem3: 0.120 pA/rtHz  
 Elem4: 0.121 pA/rtHz

### 250~290Hz avg

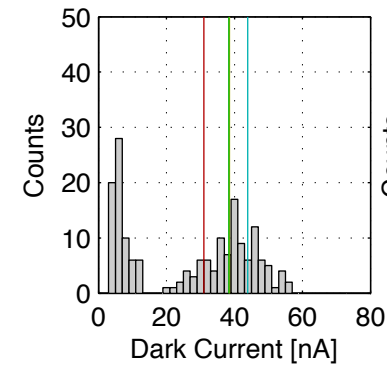
Elem1: 0.129 pA/rtHz  
 Elem2: 0.135 pA/rtHz  
 Elem3: 0.137 pA/rtHz  
 Elem4: 0.139 pA/rtHz

Total Penalty: -60

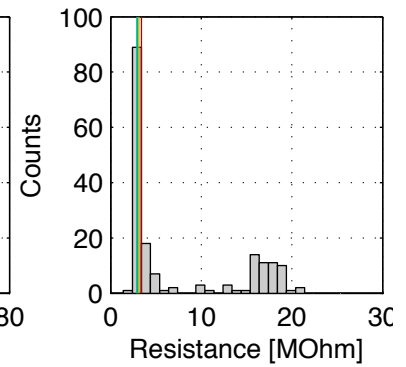
Dark noise:  $V_R = 10V$



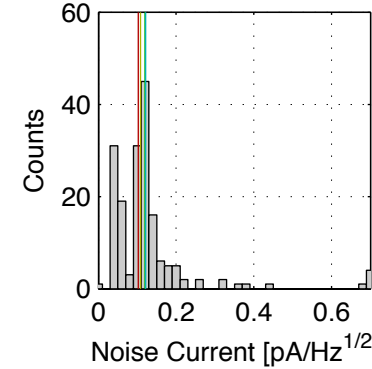
Dark Current@10V



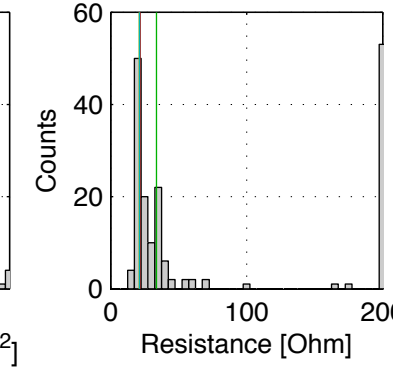
Shunt Resistance



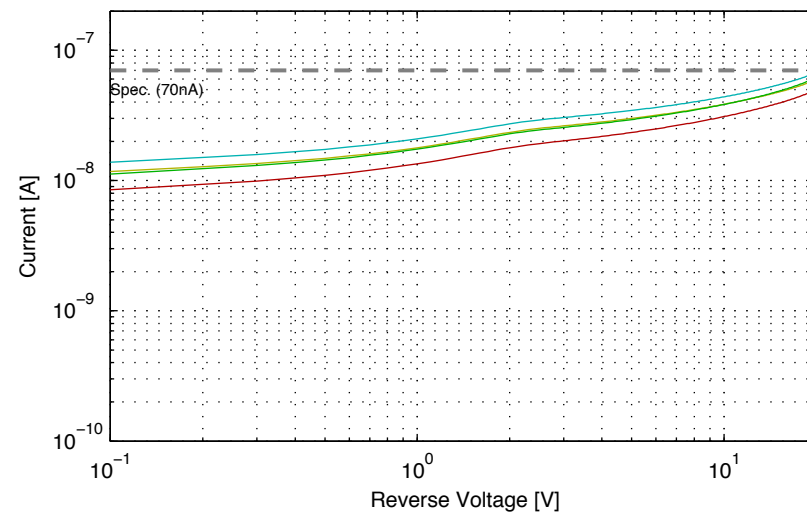
Dark current noise (1-10Hz Avg)



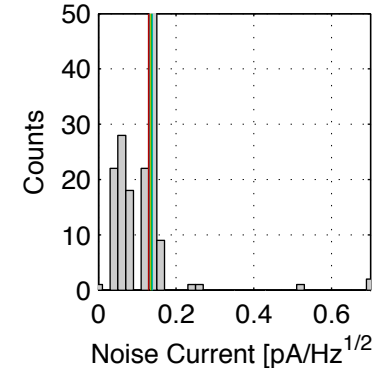
Series Resistance



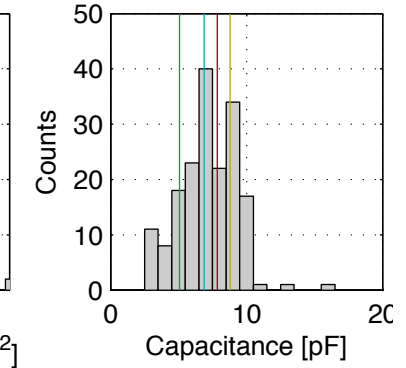
Dark current



Dark current noise (250-290Hz Avg)



Junction Capacitance



Errors / Warnings

Elem1: $i_{dark} > 15nA$	Elem3: $i_{noise} (LF) > 56fA/rtHz$ (10nA shot)
Elem2: $i_{dark} > 15nA$	Elem4: $i_{noise} (LF) > 56fA/rtHz$ (10nA shot)
Elem3: $i_{dark} > 15nA$	Elem1: $i_{noise} (HF) > 100fA/rtHz$ (30nA shot)
Elem4: $i_{dark} > 15nA$	Elem2: $i_{noise} (HF) > 100fA/rtHz$ (30nA shot)
Elem1: $i_{dark} (LF) > 56fA/rtHz$ (10nA shot)	Elem3: $i_{noise} (HF) > 100fA/rtHz$ (30nA shot)
Elem2: $i_{dark} (LF) > 56fA/rtHz$ (10nA shot)	Elem4: $i_{noise} (HF) > 100fA/rtHz$ (30nA shot)



# QPD #47

## Measurement Date:

Mar. 16, 2013

Impedance measured at  $V_R = 15V$

## Shunt Resistance ( $R_{SH}$ ):

Elem1: 4.665 MOhm  
 Elem2: 3.677 MOhm  
 Elem3: 3.361 MOhm  
 Elem4: 3.333 MOhm

## Series Resistance ( $R_s$ ):

Elem1: 22.1 Ohm  
 Elem2: 19.5 Ohm  
 Elem3: 31.2 Ohm  
 Elem4: 20.3 Ohm

## Junction Capacitance ( $C_{pd}$ ):

Elem1: 4.0 pF  
 Elem2: 7.0 pF  
 Elem3: 6.2 pF  
 Elem4: 7.3 pF

## Dark Current [nA]:

Elem1: 20.66 nA  
 Elem2: 31.09 nA  
 Elem3: 31.56 nA  
 Elem4: 36.99 nA

## Dark Noise:

### 1~10Hz avg

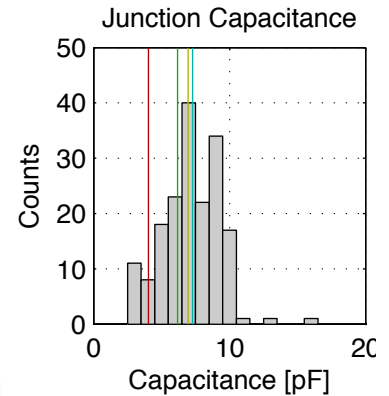
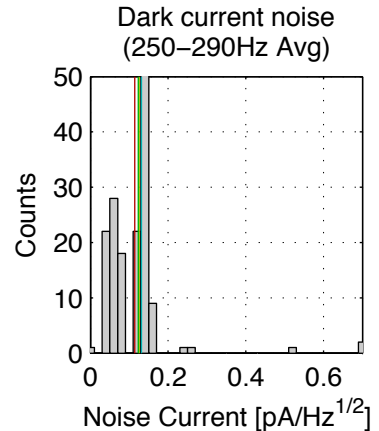
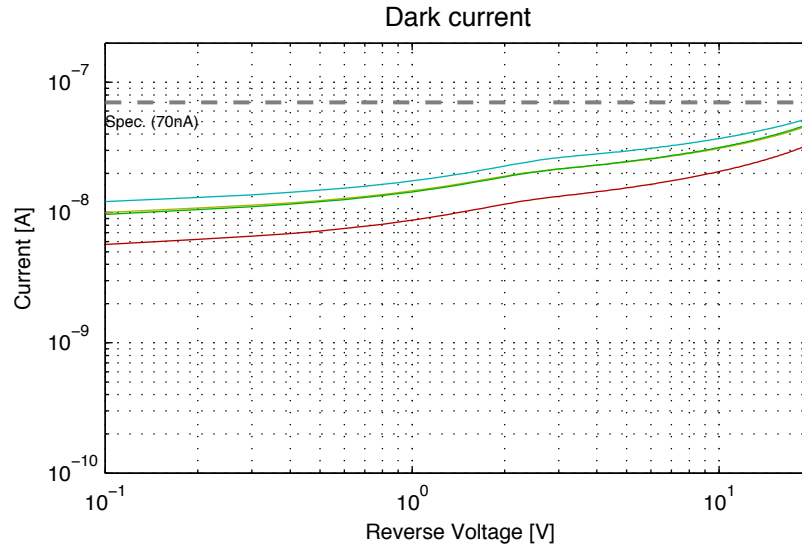
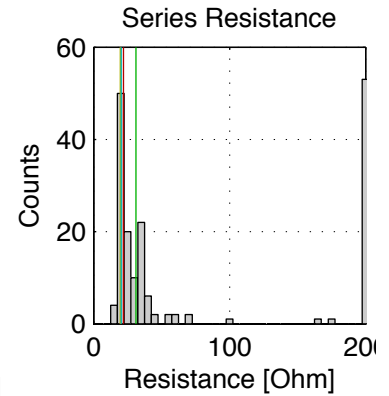
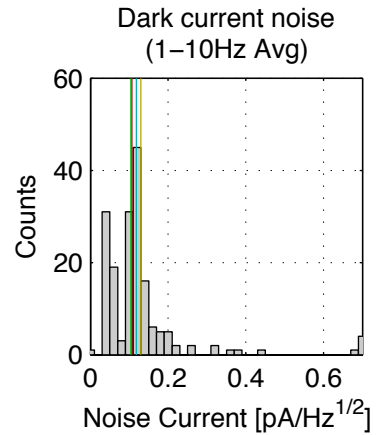
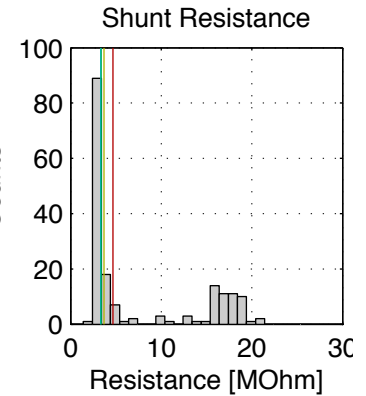
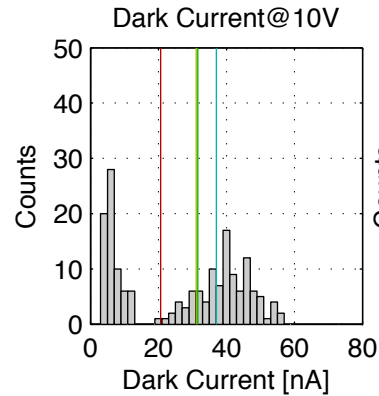
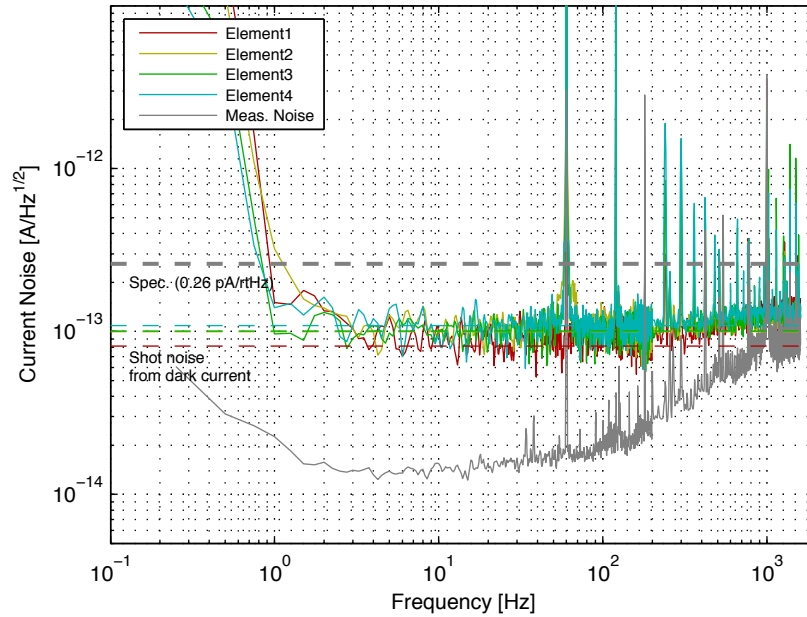
Elem1: 0.107 pA/rtHz  
 Elem2: 0.129 pA/rtHz  
 Elem3: 0.104 pA/rtHz  
 Elem4: 0.118 pA/rtHz

### 250~290Hz avg

Elem1: 0.114 pA/rtHz  
 Elem2: 0.126 pA/rtHz  
 Elem3: 0.123 pA/rtHz  
 Elem4: 0.132 pA/rtHz

Total Penalty: -60

Dark noise:  $V_R = 10V$



## Errors / Warnings

Elem1: $i_{dark} > 15nA$	Elem3: $i_{noise} (LF) > 56fA/rtHz$ (10nA shot)
Elem2: $i_{dark} > 15nA$	Elem4: $i_{noise} (LF) > 56fA/rtHz$ (10nA shot)
Elem3: $i_{dark} > 15nA$	Elem1: $i_{noise} (HF) > 100fA/rtHz$ (30nA shot)
Elem4: $i_{dark} > 15nA$	Elem2: $i_{noise} (HF) > 100fA/rtHz$ (30nA shot)
Elem1: $i_{dark} (LF) > 56fA/rtHz$ (10nA shot)	Elem3: $i_{noise} (HF) > 100fA/rtHz$ (30nA shot)
Elem2: $i_{noise} (LF) > 56fA/rtHz$ (10nA shot)	Elem4: $i_{noise} (HF) > 100fA/rtHz$ (30nA shot)

# QPD #48

## Measurement Date:

Mar. 16, 2013

Impedance measured at  $V_R = 15V$

## Shunt Resistance ( $R_{SH}$ ):

Elem1: 4.152 MOhm  
 Elem2: 3.326 MOhm  
 Elem3: 2.990 MOhm  
 Elem4: 2.926 MOhm

## Series Resistance ( $R_s$ ):

Elem1: 24.0 Ohm  
 Elem2: 20.0 Ohm  
 Elem3: 35.4 Ohm  
 Elem4: 23.8 Ohm

## Junction Capacitance ( $C_{pd}$ ):

Elem1: 5.5 pF  
 Elem2: 9.3 pF  
 Elem3: 5.2 pF  
 Elem4: 7.4 pF

## Dark Current [nA]:

Elem1: 23.42 nA  
 Elem2: 34.28 nA  
 Elem3: 36.05 nA  
 Elem4: 42.16 nA

## Dark Noise:

### 1~10Hz avg

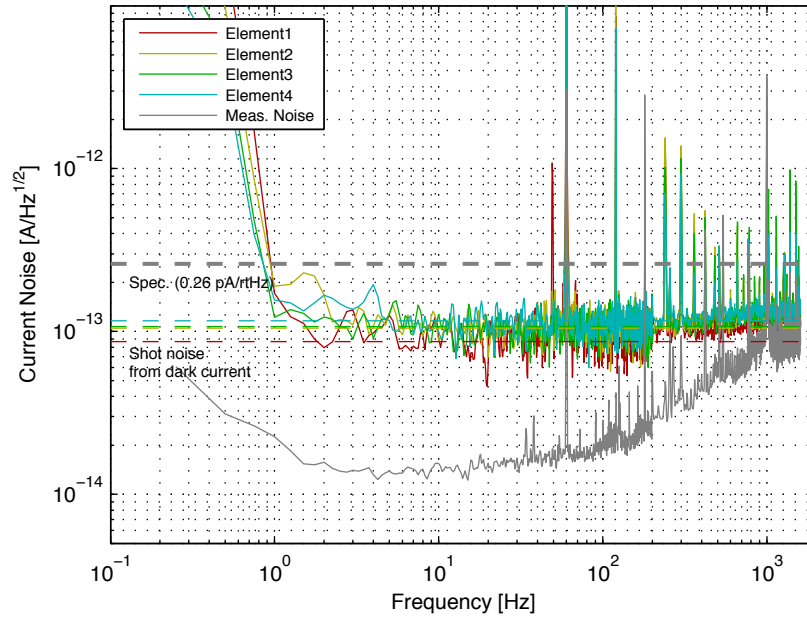
Elem1: 0.103 pA/rtHz  
 Elem2: 0.130 pA/rtHz  
 Elem3: 0.117 pA/rtHz  
 Elem4: 0.129 pA/rtHz

### 250~290Hz avg

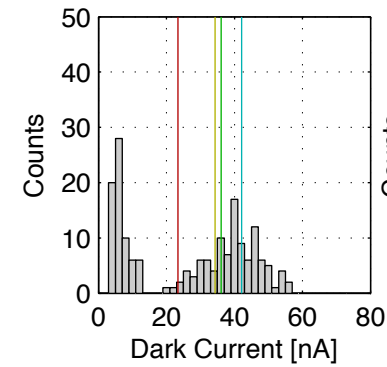
Elem1: 0.116 pA/rtHz  
 Elem2: 0.130 pA/rtHz  
 Elem3: 0.125 pA/rtHz  
 Elem4: 0.139 pA/rtHz

Total Penalty: -60

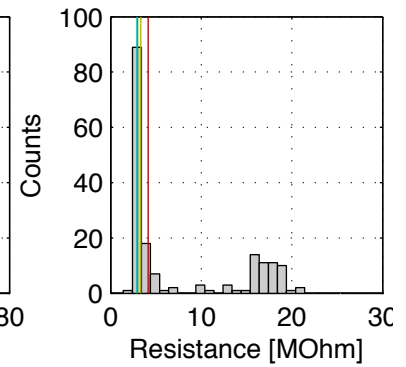
Dark noise:  $V_R = 10V$



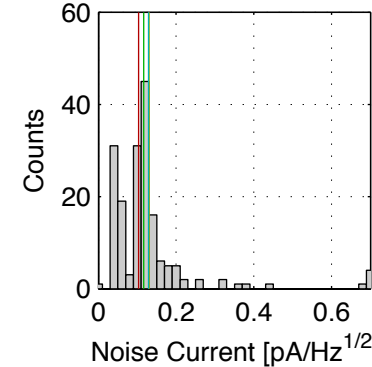
Dark Current@10V



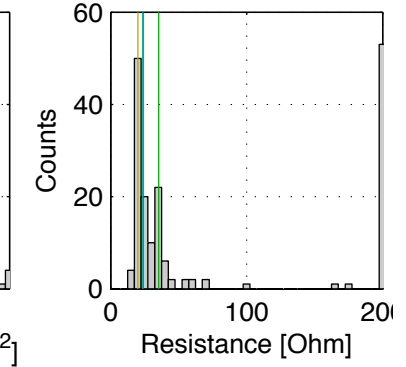
Shunt Resistance



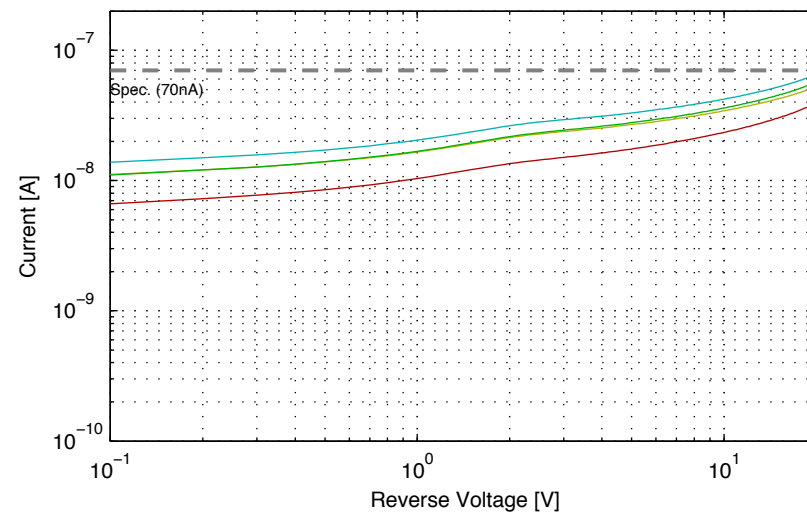
Dark current noise (1-10Hz Avg)



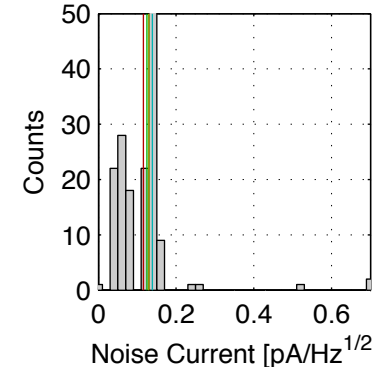
Series Resistance



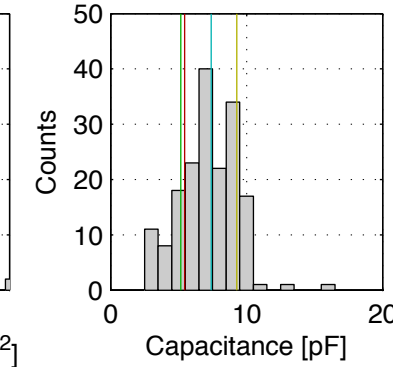
Dark current



Dark current noise (250-290Hz Avg)



Junction Capacitance



## Errors / Warnings

Elem1: $i_{dark} > 15nA$	Elem3: $i_{noise} (LF) > 56fA/rtHz$ (10nA shot)
Elem2: $i_{dark} > 15nA$	Elem4: $i_{noise} (LF) > 56fA/rtHz$ (10nA shot)
Elem3: $i_{dark} > 15nA$	Elem1: $i_{noise} (HF) > 100fA/rtHz$ (30nA shot)
Elem4: $i_{dark} > 15nA$	Elem2: $i_{noise} (HF) > 100fA/rtHz$ (30nA shot)
Elem1: $i_{dark} (LF) > 56fA/rtHz$ (10nA shot)	Elem3: $i_{noise} (HF) > 100fA/rtHz$ (30nA shot)
Elem2: $i_{noise} (LF) > 56fA/rtHz$ (10nA shot)	Elem4: $i_{noise} (HF) > 100fA/rtHz$ (30nA shot)

# QPD #49

## Measurement Date:

Mar. 16, 2013

Impedance measured at  $V_R = 15V$

## Shunt Resistance ( $R_{SH}$ ):

Elem1: 20.469 MOhm  
 Elem2: 4.378 MOhm  
 Elem3: 9.815 MOhm  
 Elem4: 3.397 MOhm

## Series Resistance ( $R_s$ ):

Elem1: 36.6 Ohm  
 Elem2: 31.8 Ohm  
 Elem3: 58.6 Ohm  
 Elem4: 40.3 Ohm

## Junction Capacitance ( $C_{pd}$ ):

Elem1: 5.7 pF  
 Elem2: 7.9 pF  
 Elem3: 7.8 pF  
 Elem4: 6.3 pF

## Dark Current [nA]:

Elem1: 4.25 nA  
 Elem2: 9.39 nA  
 Elem3: 7.60 nA  
 Elem4: 11.91 nA

## Dark Noise:

### 1~10Hz avg

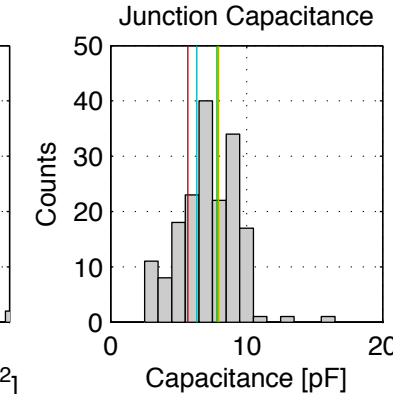
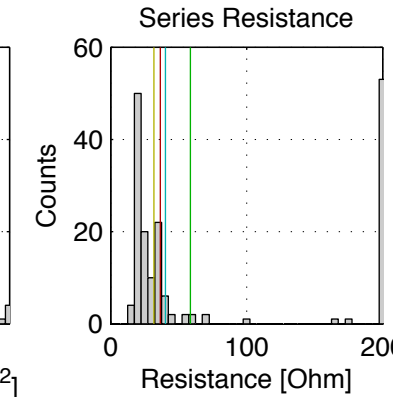
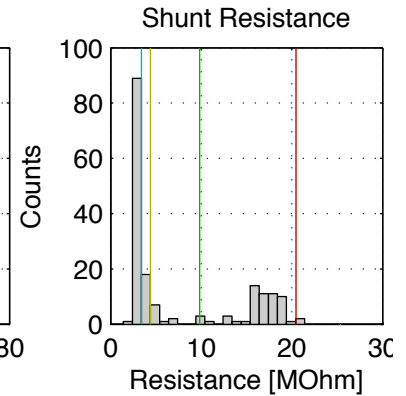
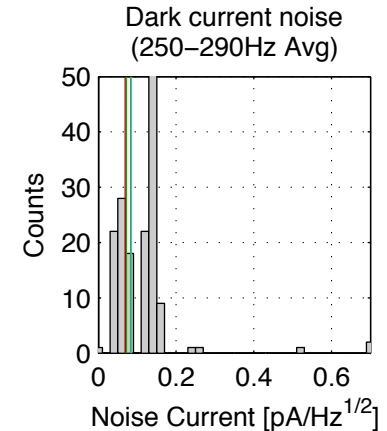
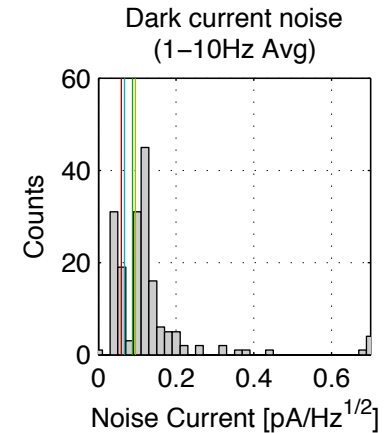
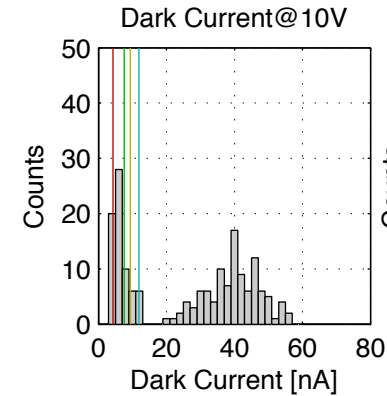
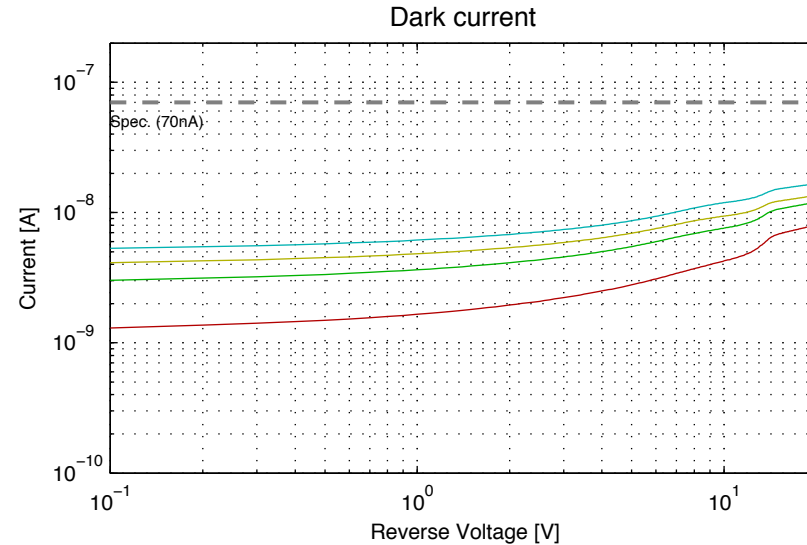
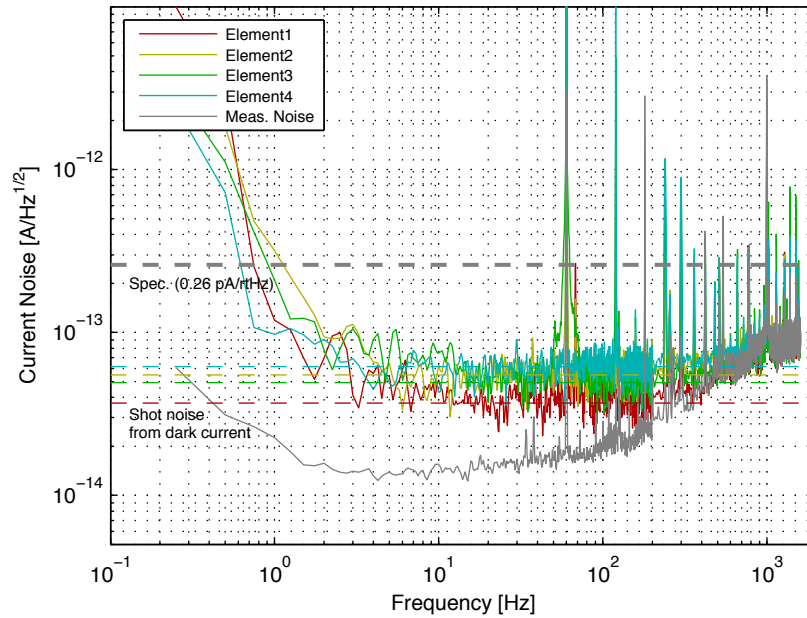
Elem1: 0.059 pA/rtHz  
 Elem2: 0.095 pA/rtHz  
 Elem3: 0.088 pA/rtHz  
 Elem4: 0.067 pA/rtHz

### 250~290Hz avg

Elem1: 0.069 pA/rtHz  
 Elem2: 0.085 pA/rtHz  
 Elem3: 0.072 pA/rtHz  
 Elem4: 0.083 pA/rtHz

Total Penalty: -20

Dark noise:  $V_R = 10V$



Errors / Warnings

Elem1:  $i_{noise}(LF) > 56fA/rtHz$  (10nA shot)  
 Elem2:  $i_{noise}(LF) > 56fA/rtHz$  (10nA shot)  
 Elem3:  $i_{noise}(LF) > 56fA/rtHz$  (10nA shot)  
 Elem4:  $i_{noise}(LF) > 56fA/rtHz$  (10nA shot)

# QPD #50

## Measurement Date:

Mar. 16, 2013

Impedance measured at  $V_R = 15V$

## Shunt Resistance ( $R_{SH}$ ):

Elem1: 14.013 MOhm  
 Elem2: 4.701 MOhm  
 Elem3: 10.571 MOhm  
 Elem4: 3.545 MOhm

## Series Resistance ( $R_s$ ):

Elem1: 33.9 Ohm  
 Elem2: 29.5 Ohm  
 Elem3: 69.5 Ohm  
 Elem4: 35.8 Ohm

## Junction Capacitance ( $C_{pd}$ ):

Elem1: 6.4 pF  
 Elem2: 9.7 pF  
 Elem3: 5.6 pF  
 Elem4: 4.5 pF

## Dark Current [nA]:

Elem1: 4.59 nA  
 Elem2: 9.86 nA  
 Elem3: 8.01 nA  
 Elem4: 12.53 nA

## Dark Noise:

### 1~10Hz avg

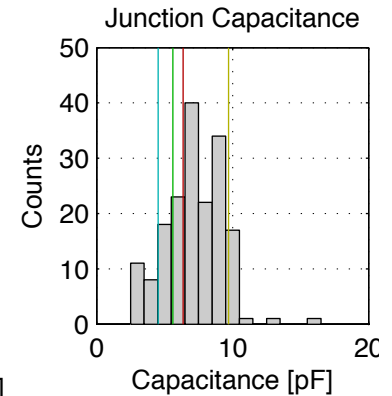
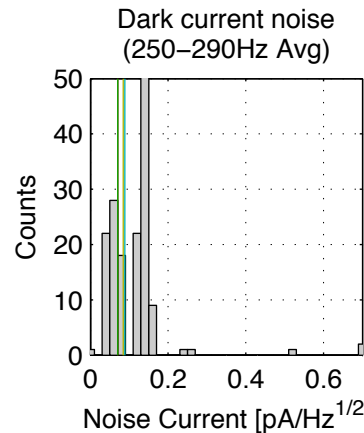
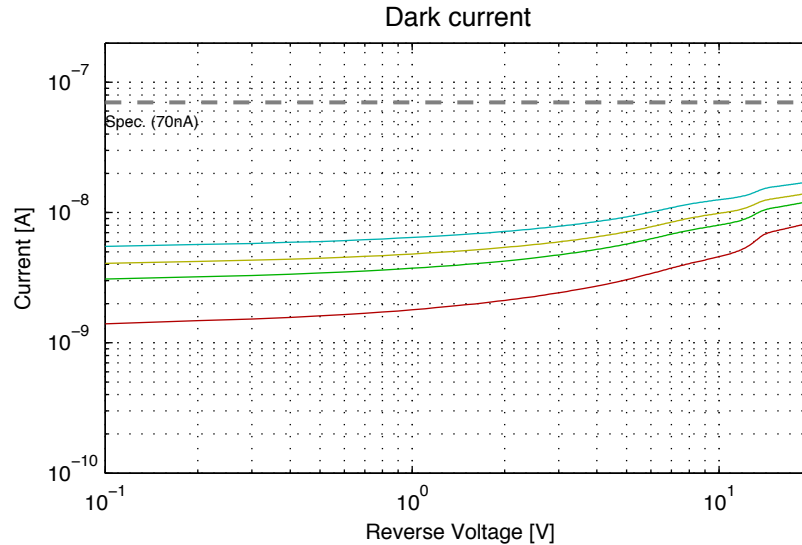
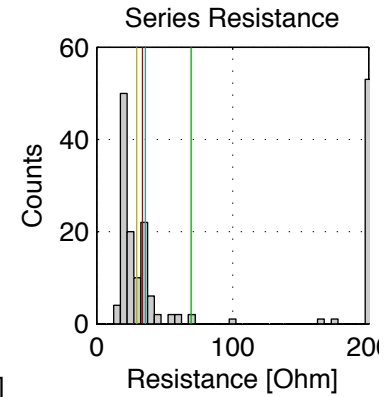
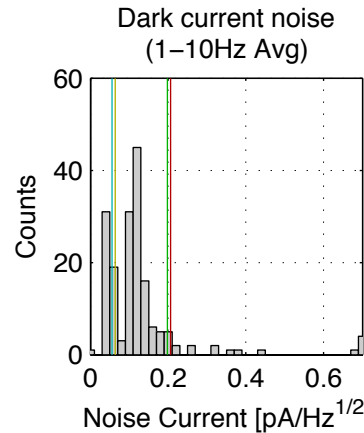
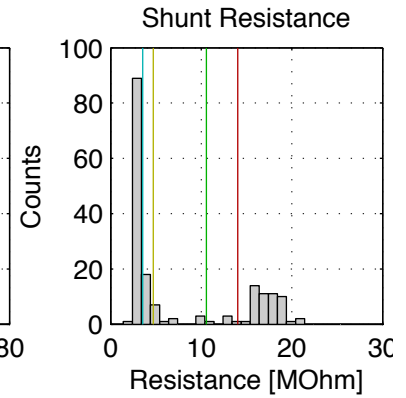
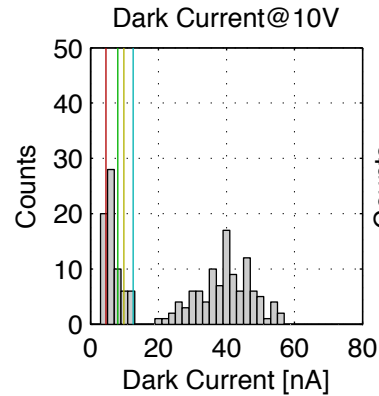
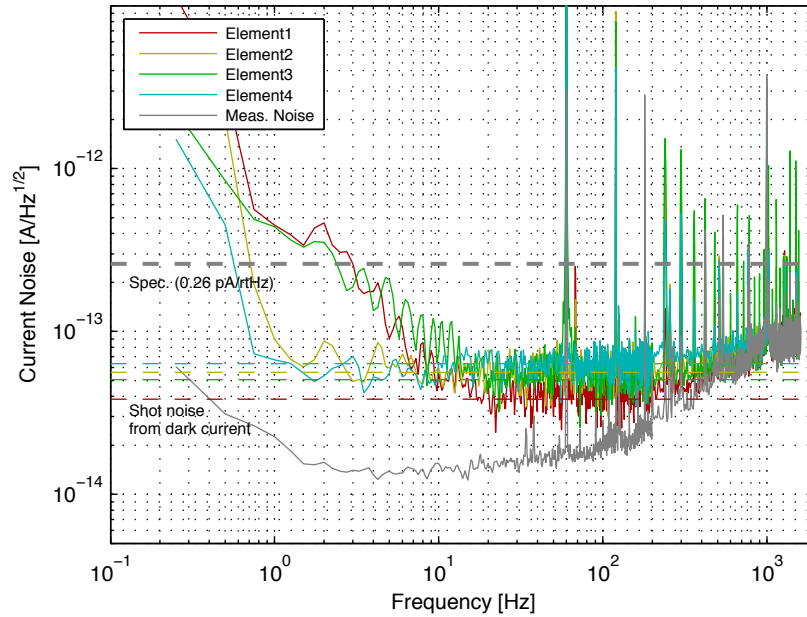
Elem1: 0.207 pA/rtHz  
 Elem2: 0.064 pA/rtHz  
 Elem3: 0.198 pA/rtHz  
 Elem4: 0.056 pA/rtHz

### 250~290Hz avg

Elem1: 0.070 pA/rtHz  
 Elem2: 0.084 pA/rtHz  
 Elem3: 0.070 pA/rtHz  
 Elem4: 0.089 pA/rtHz

Total Penalty: -205

Dark noise:  $V_R = 10V$



Errors / Warnings

Elem1:  $i_{noise} (LF) > 180fA/rtHz$  (100nA shot)  
 Elem2:  $i_{noise} (LF) > 56fA/rtHz$  (10nA shot)  
 Elem3:  $i_{noise} (LF) > 180fA/rtHz$  (100nA shot)