

LSC RF photodetector test

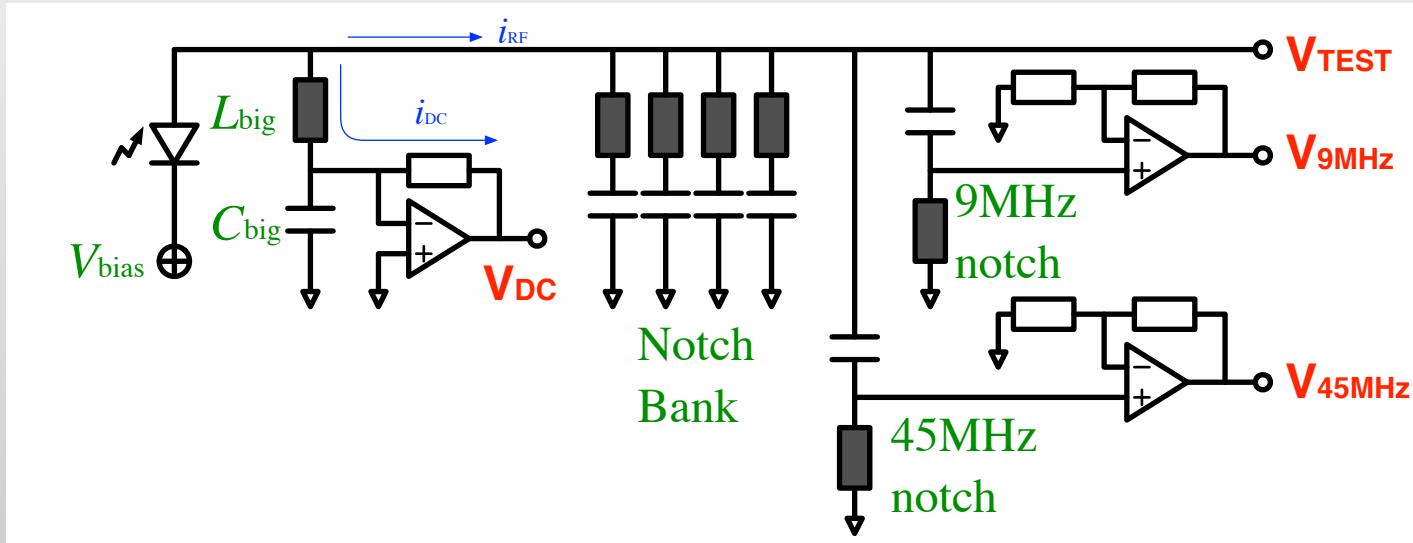
Koji Arai LIGO-G1101199

- aLIGO RF photodetector

LIGO-T1100402: [ISC RF Photodetector Design: LSC & WFS](#) (Design / Requirements)

LIGO-D1101124: [aLIGO LSC RF Photodetector PCB](#) (Schematic / PCB)

- much-simplified schematic



- Tested items

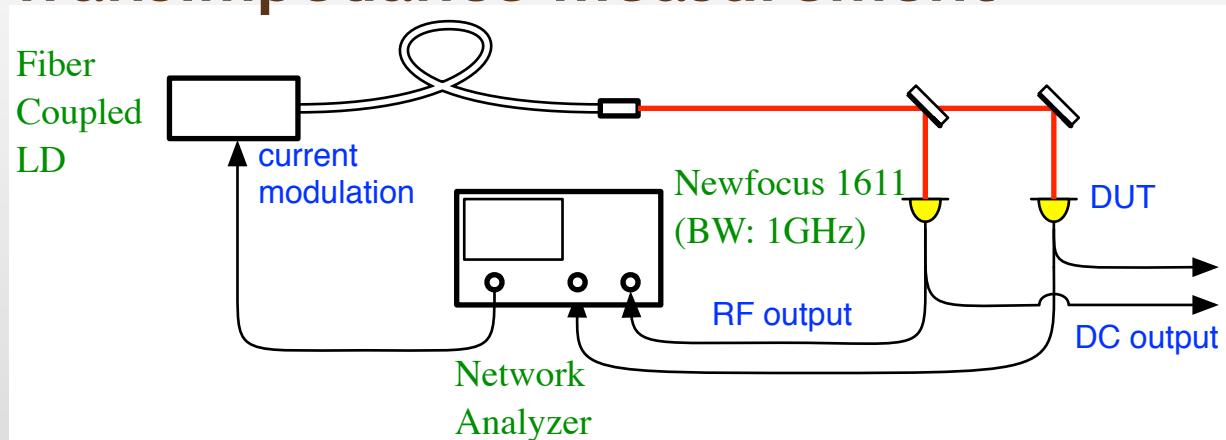
Transimpedance (V/A) measurement

Shotnoise intercept current (A) with white light illumination

Current noise spectrum (A/rtHz)

LSC RF photodetector test

- Transimpedance measurement



Use Newfocus 1611
as a reference

- Shotnoise intercept current with white light illumination

Output voltage noise (V_n) as a function of the DC current (i_{DC})

$$V_n(i_{DC}) = g_{det} \sqrt{2 e (i_{DC} + i_{det})}$$

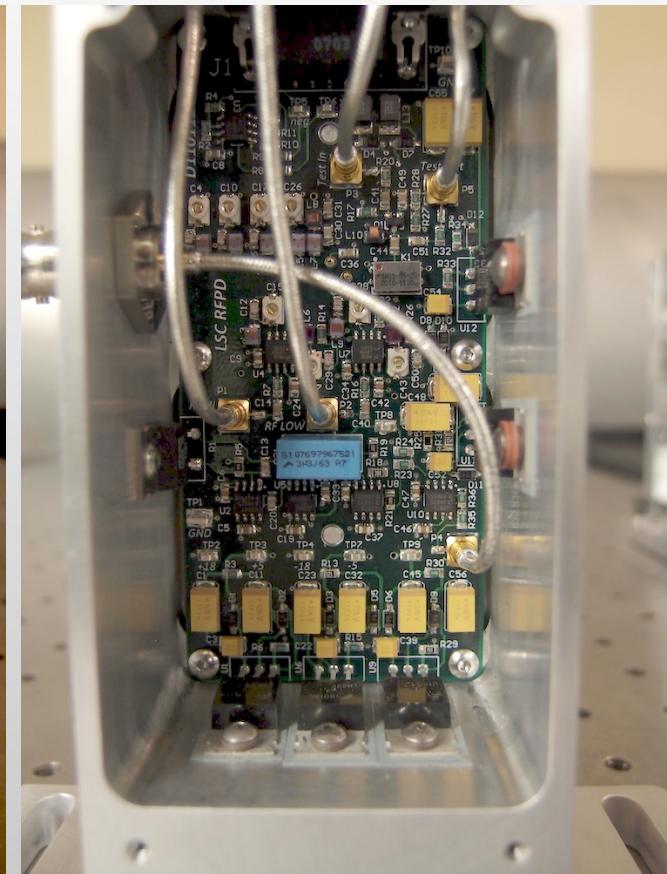
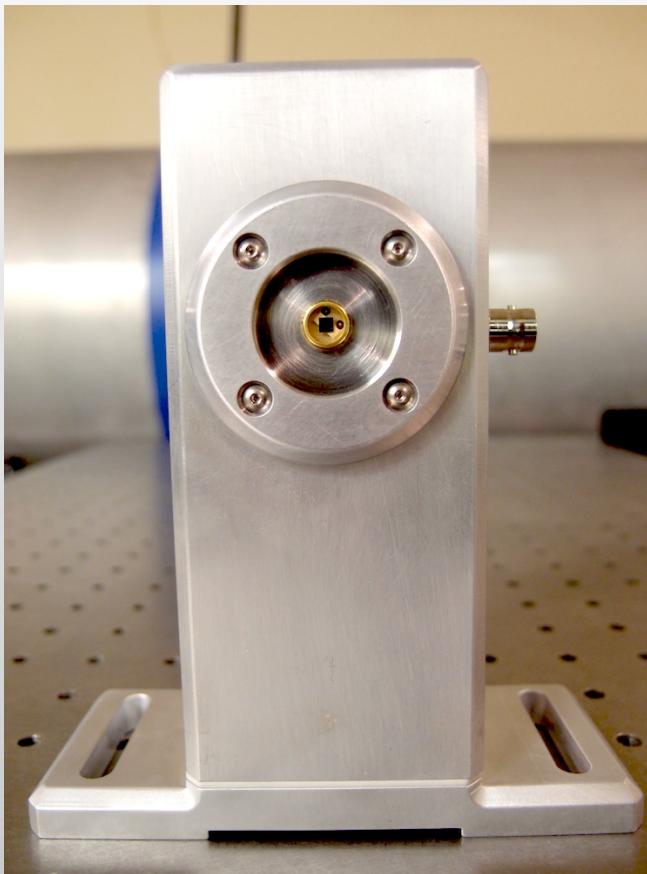
i_{det} : shotnoise intercept current [A]

g_{det} : transimpedance [V/A]

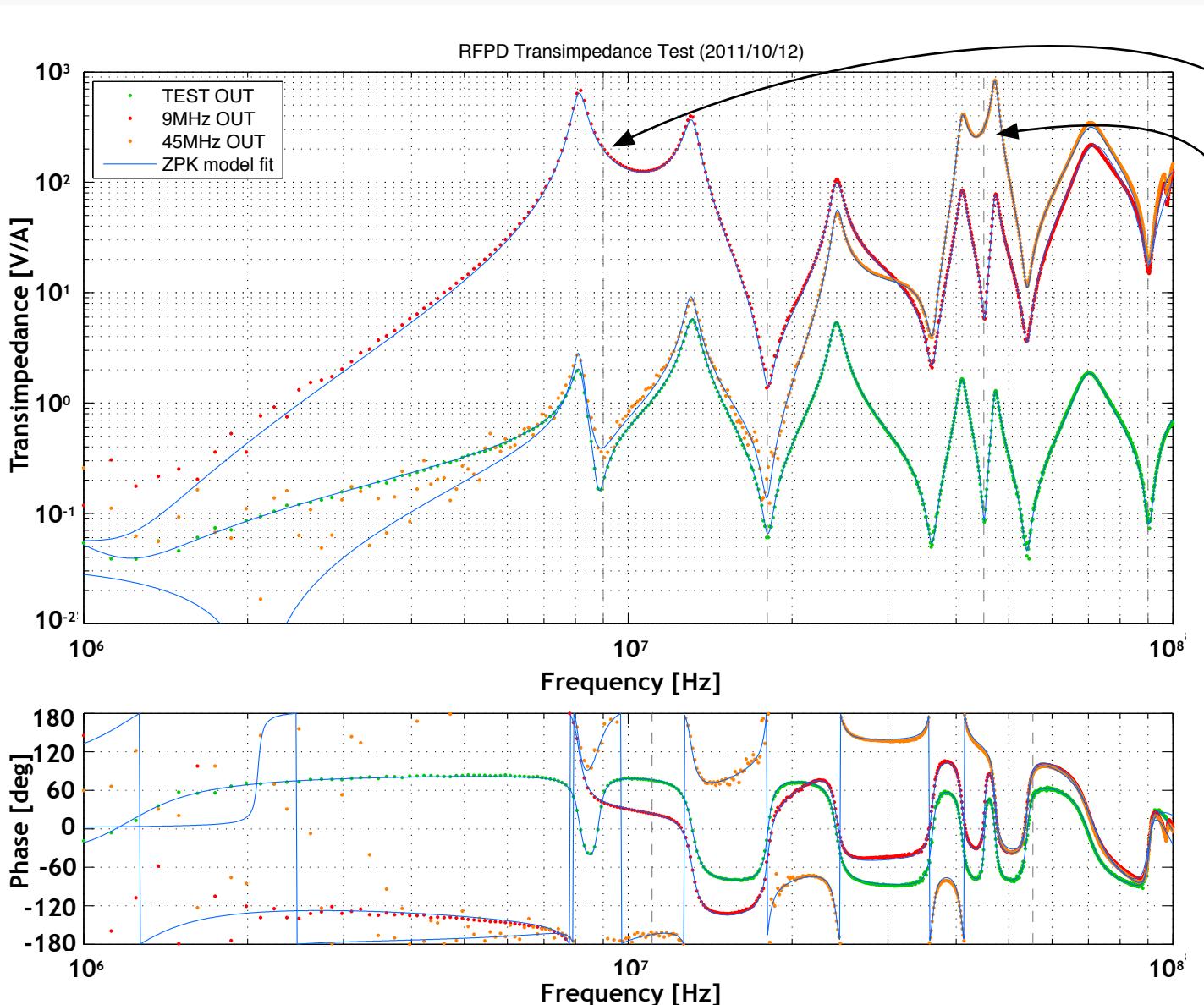
- Current noise spectrum

$$i_n = V_{dark} / g_{det}$$

LSC RF photodetector



Transimpedance measurement



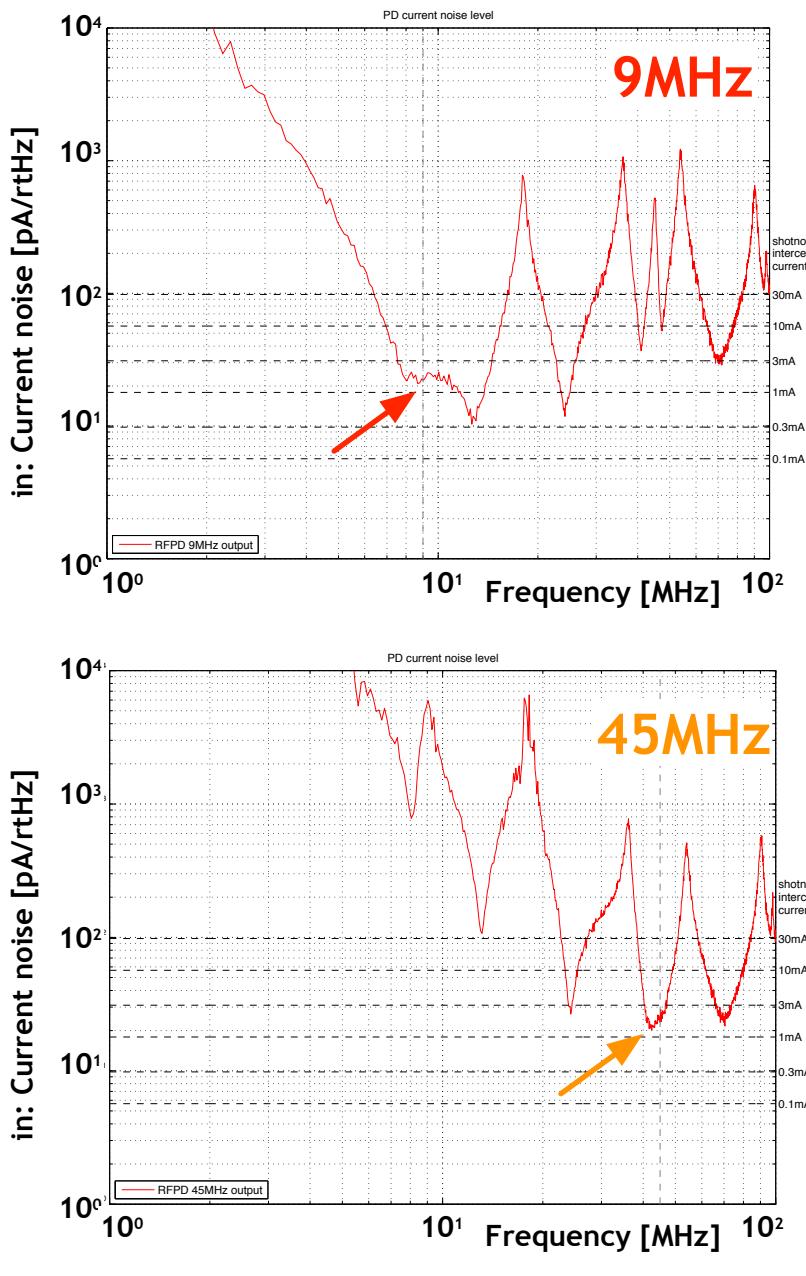
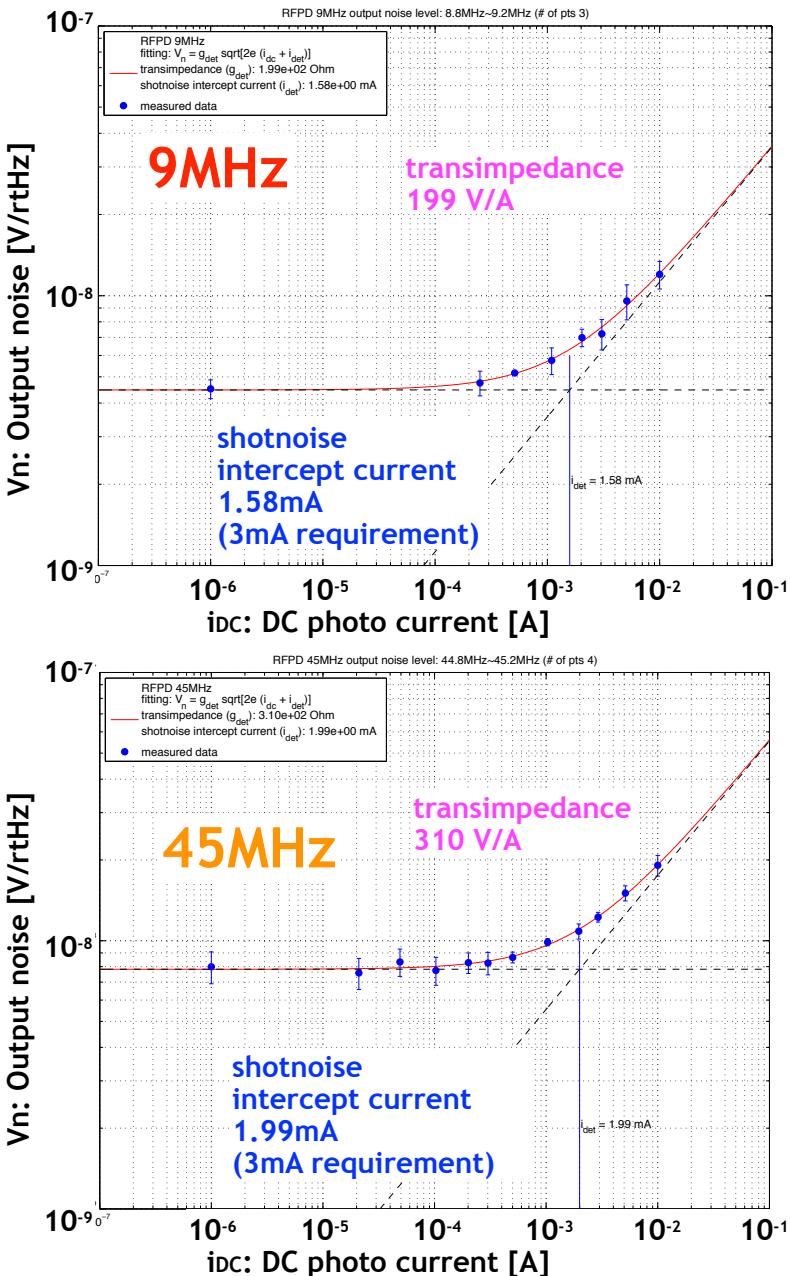
- 9MHz out
~200V/A@9MHz
- 45MHz out
~300V/A@45MHz

The other freq.
successfully
notched out

The results are
as expected.

They are
reasonably
expressed by ZPK
models as well as
the physical circuit
models

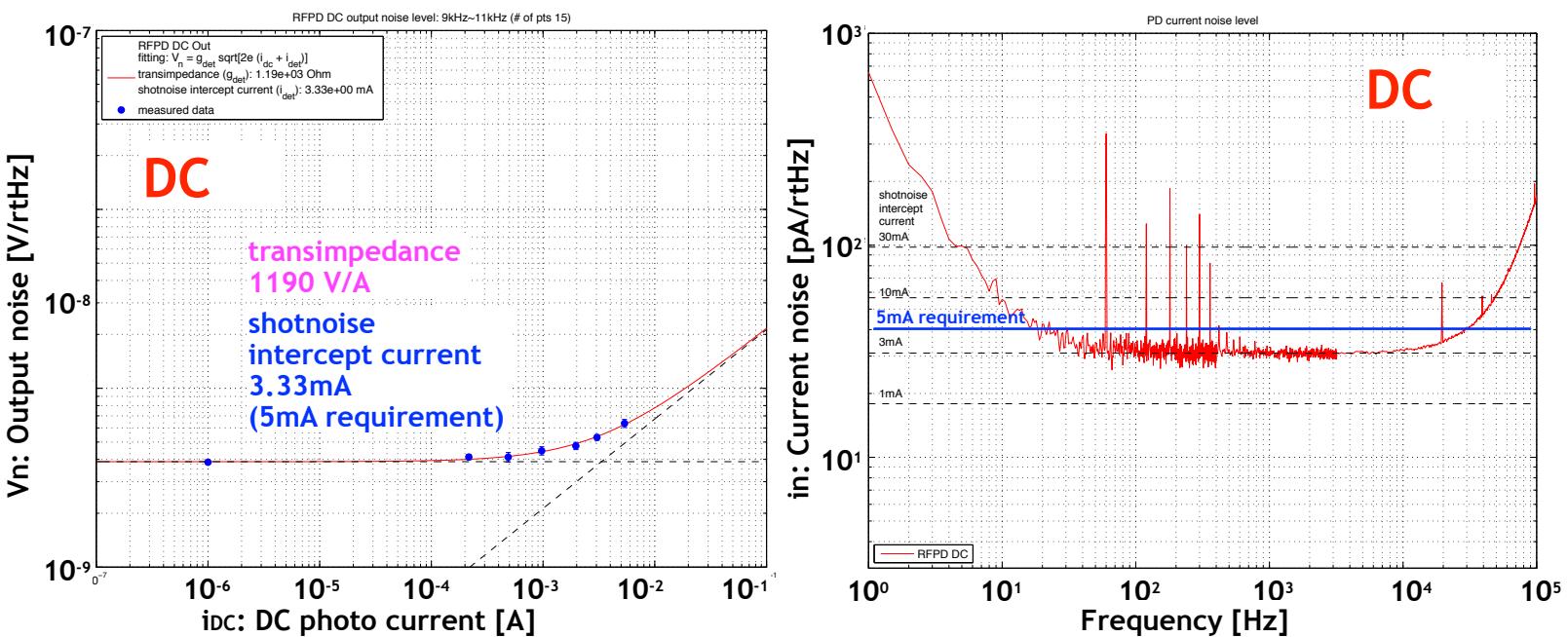
Shotnoise test / current noise



The shotnoise intercept currents were smaller than 3mA (requirement)

The current noise PSDs is fairly insensitive at around the target freqs.

DC output test



The shotnoise intercept current was smaller than 5mA (requirement)

Summary

- The tests show reasonable results

The transimpedances are very close to the design

The noise levels fullfills the requirements

- The item not investigated

The PD have not been tested with a high power beam (~100mA)