



ELIGO 35W PSL Report



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G0900223 LVC Meeting Mar 2009

Overview

- Laser performance and shutdowns
- Output power drop
- Pump diode power drop
- Relaxation Oscillation Monitor installed and working
- Humidity effect on beam alignment – polarizers replaced Mar 4th 09
- Diode Room and Water System performance



Shut Downs

- Running continuously since Mar 08 except for some brief shutdowns
- 18 total
- 5 during installation
- 5 due to access system
- 4 due to line power issues
- 2 unknown (not elogged)
- 2 due to water system work



PSL Shut Downs

Date and Time	Reason	On Purpose?
03/28/2008 01:14 UTC	Install	?
03/28/2008 21:02 UTC	Install	?
03/31/2008 14:45 UTC	Install	?
03/31/2008 18:19 UTC	Install	?
04/29/2008 04:49 UTC	Interlock Trip	No
05/02/2008 23:19 UTC	?	?
05/13/2008 15:16 UTC	Filter change	Yes
05/22/2008 20:19 UTC	?	?
05/28/2008 17:09 UTC 17:17 UTC 17:49 UTC	Blown fuse replacement	No
07/15/2008 21:50 UTC	Test of flow sensors?	Yes
08/04/2008 07:55 UTC	Site Voltage Drop	No
08/08/2008 06:26 UTC	Site Voltage Drop	No
08/26/2008 20:51 UTC 21:00 UTC	Safety System Checks	No
09/15/2008 16:52 UTC	Safety System Check	Yes
09/24/2008 14:57 UTC	Power Outage	Yes
03/04/2009 18:11 UTC	Lid Interlock Trip	No
03/06/2009 20:19 UTC	Enabling Lid Interlock	Yes

Power Monitoring

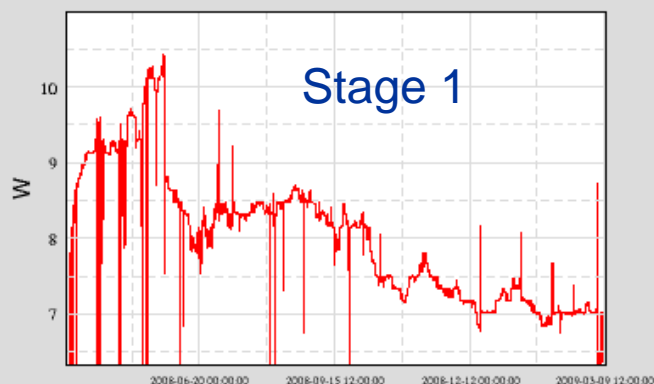
- We installed our own PD for laser output
- Pickoffs drifted out of calibration immediately
- Table Power measurements:
 - 35.5 W Mar 08
 - 34.8 W Jul 08
 - 33.0 W Dec 08
 - 31.7 W Mar 09
- Output power 10% down
- New water-cooled power meter

MEAN

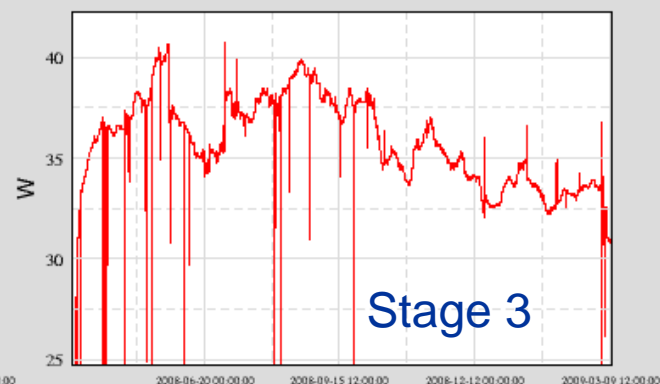
Trend from 08-03-25-21-28-47 to 09-03-10-21-27-47

350 days

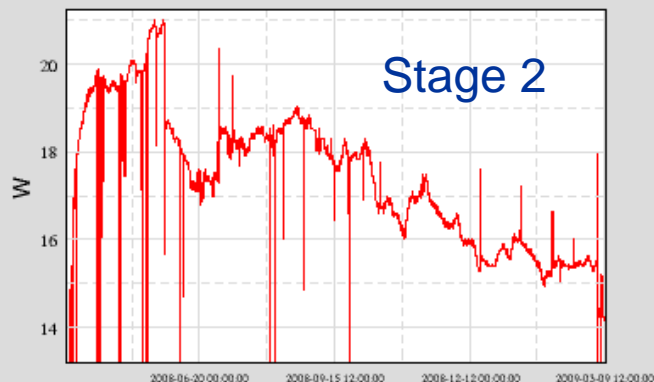
Ch 3: H1:PSL-AMP_PWR1



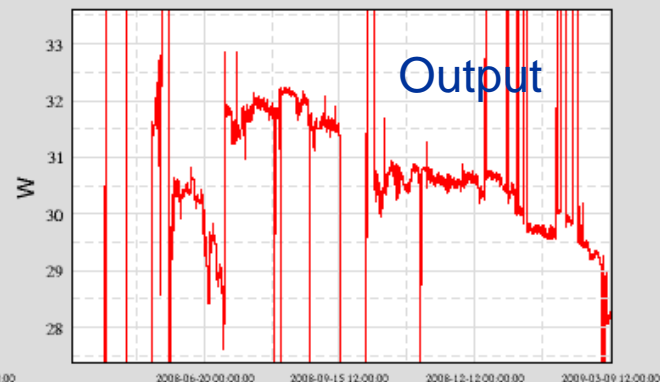
Ch 6: H1:PSL-AMP_PWR3



Ch 2: H1:PSL-AMP_PWR2



Ch 5: H1:PSL-PMC_PWRIN



Pump Diodes

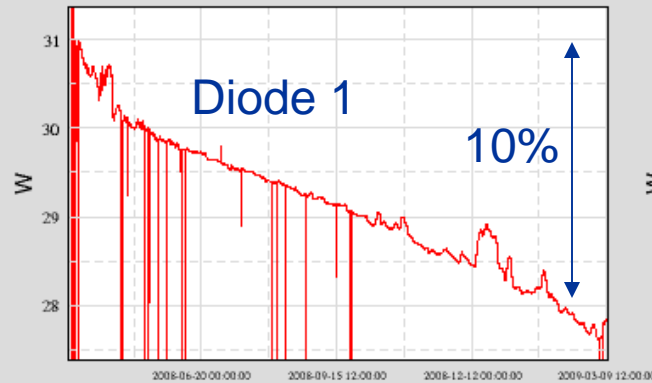
- The pump diode powers have trended down ~10%
- No change in diode currents (47 amps)

MEAN

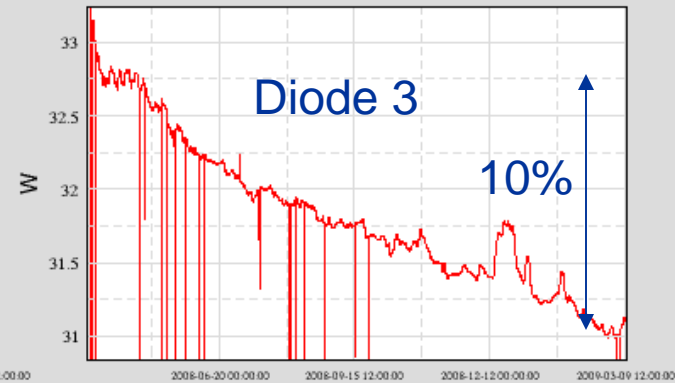
Trend from 08-03-27-20-02-47 to 09-03-10-21-27-47

350 days

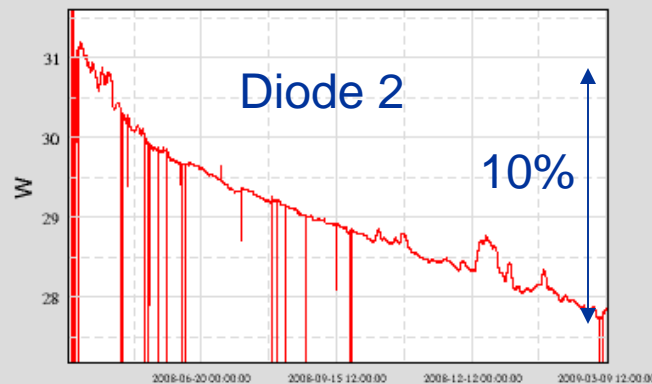
Ch 10: H1:PSL-AMP_D1PWR



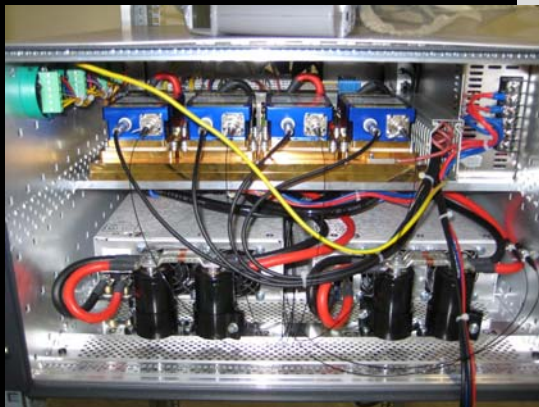
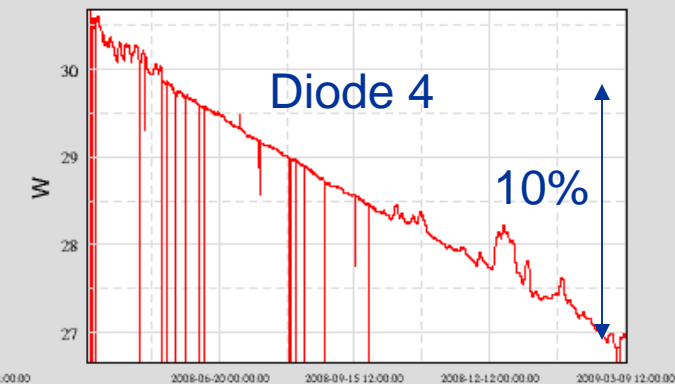
Ch 14: H1:PSL-AMP_D3PWR



Ch 9: H1:PSL-AMP_D2PWR



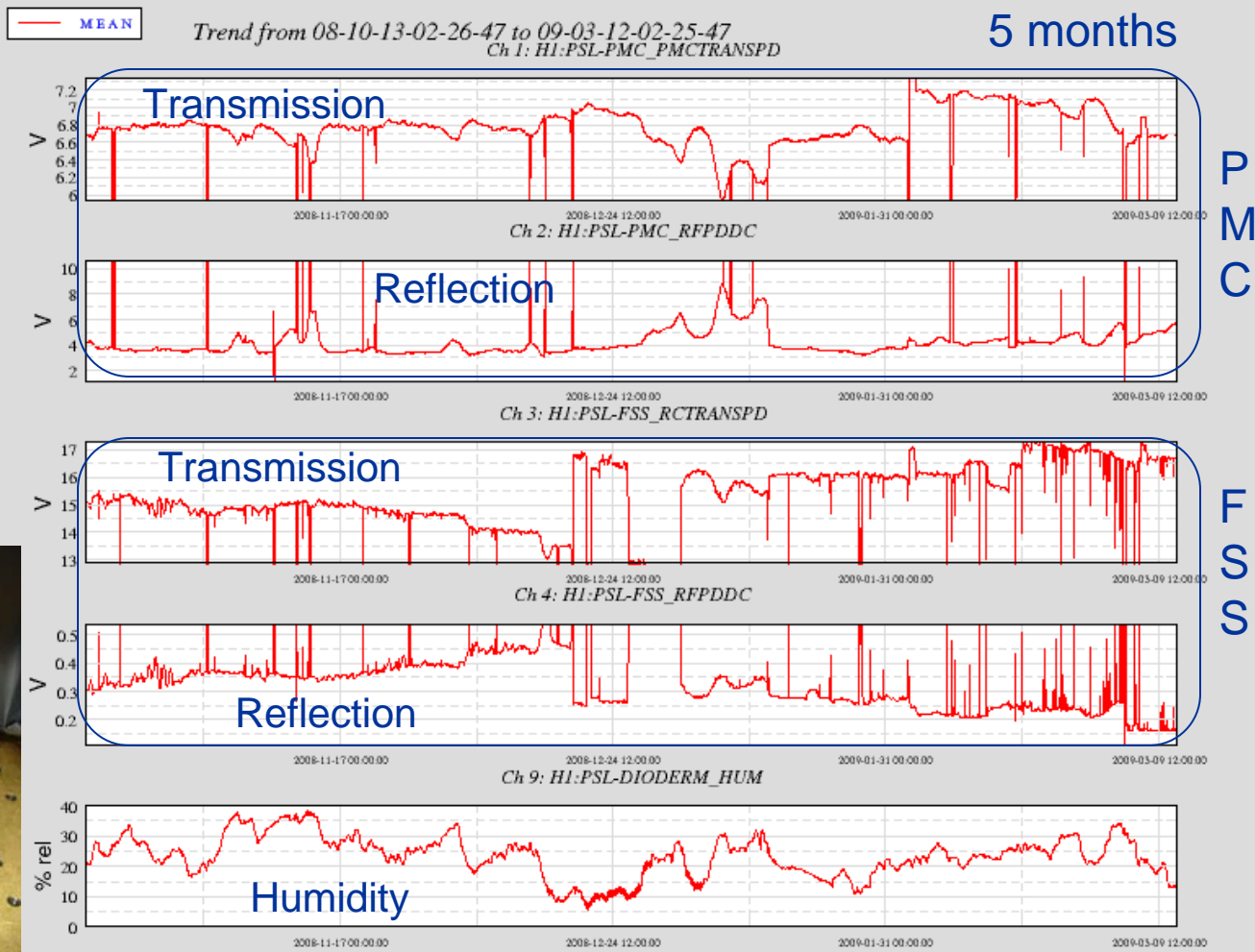
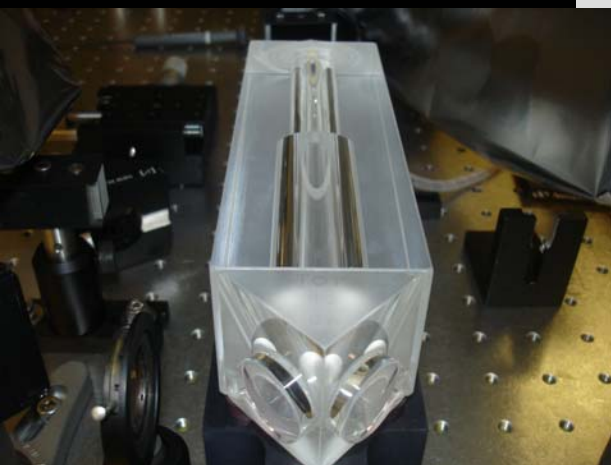
Ch 13: H1:PSL-AMP_D4PWR





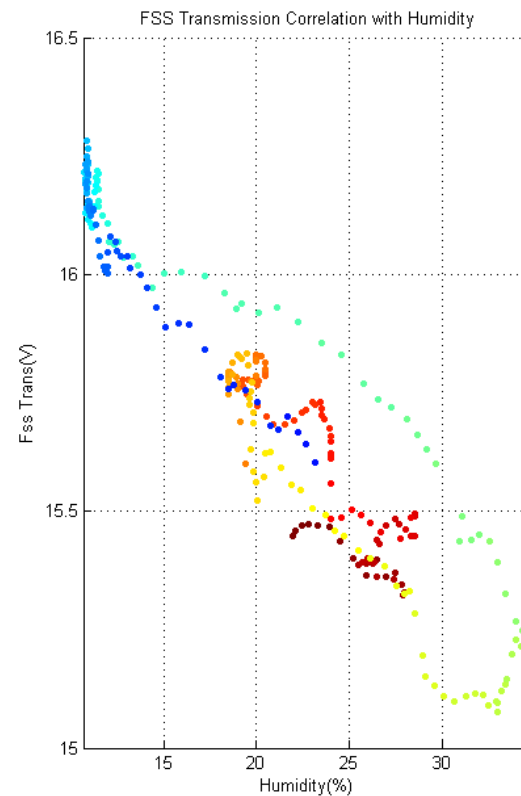
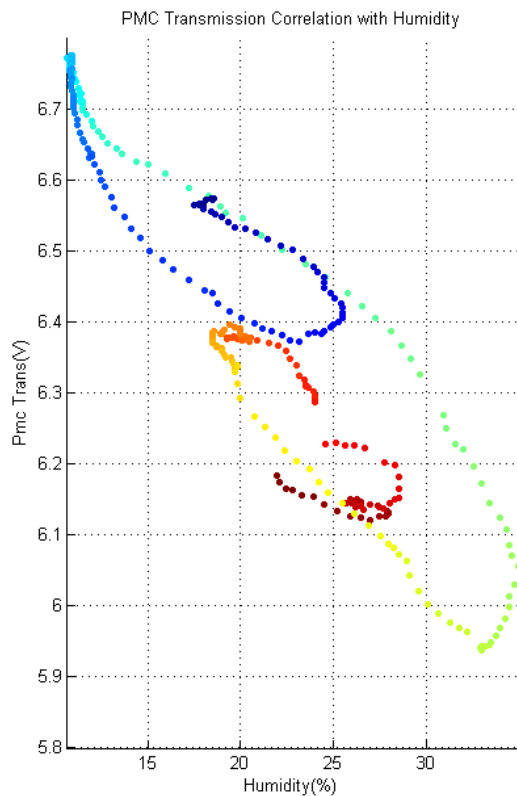
Humidity Correlation

- PMC output power varies by up to 10% over ~week periods – correlated with relative humidity



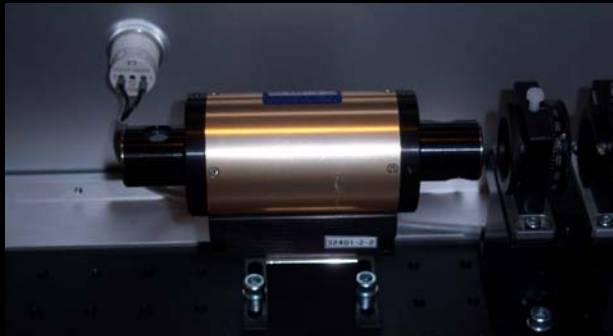
Humidity Correlation

- Scatter plot of PMC trans and FSS trans versus humidity before polarizer replacement



Polarizer Replacement Mar 09

- LZH identified glue in polarizers in the Faraday isolator as source of pointing variations



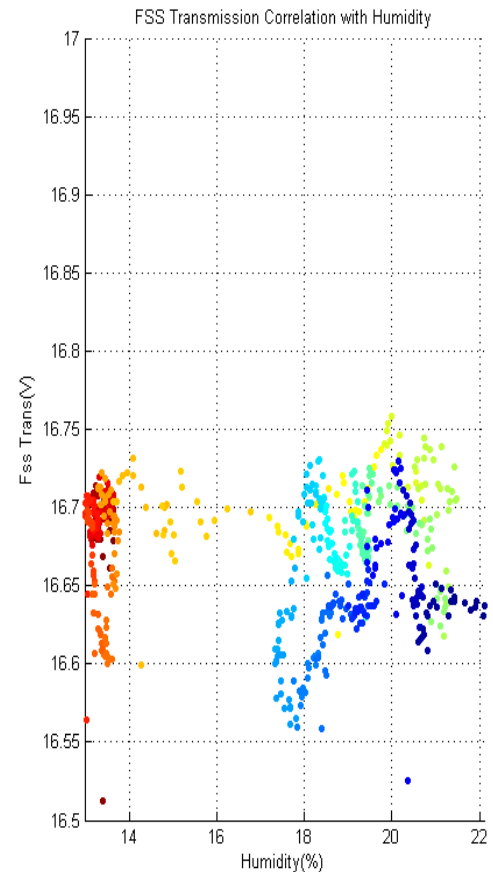
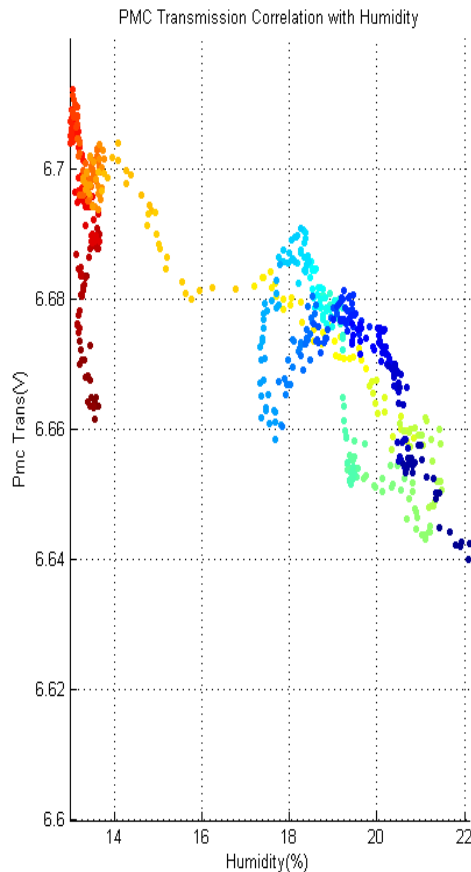
- New polarizers use glue that is less hydroscopic



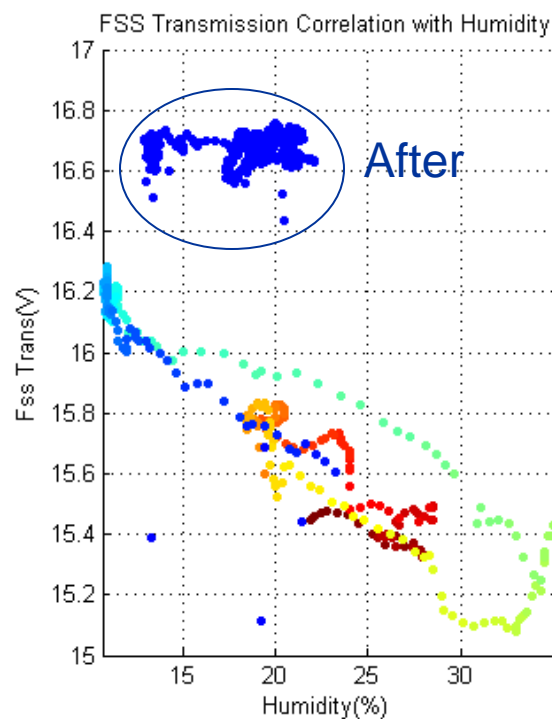
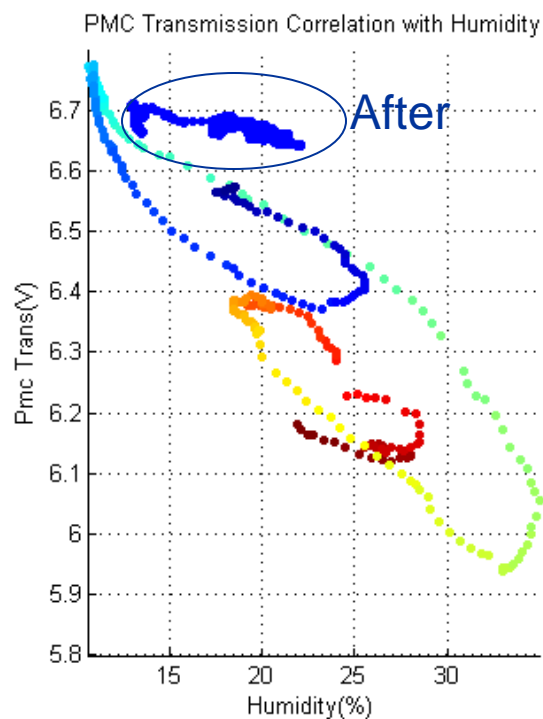


Humidity Correlation

- Scatter plot of PMC trans and FSS trans with humidity after polarizer replacement

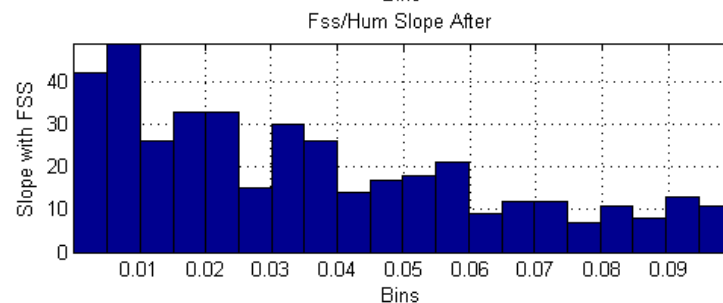
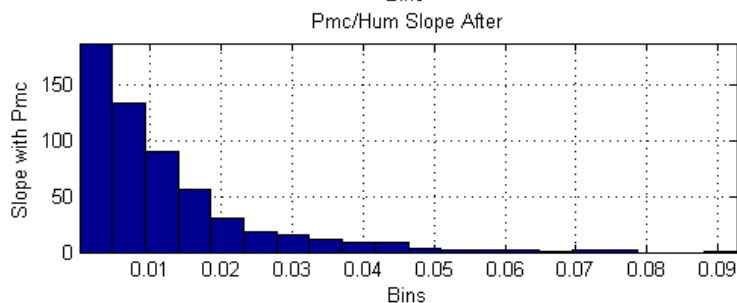
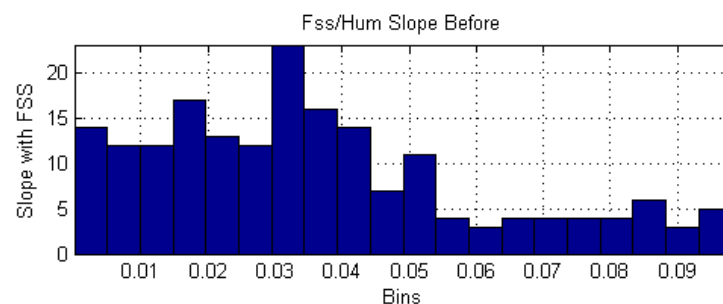
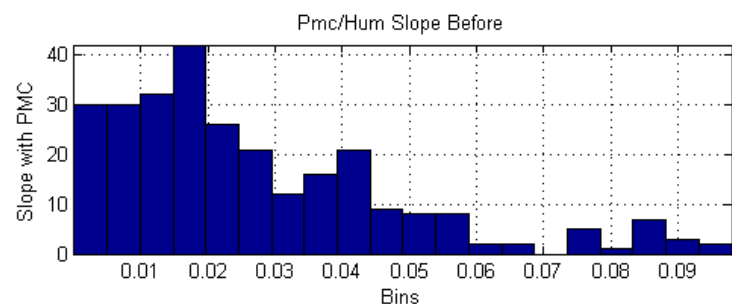


Humidity Correlation



- Before and after on same plot
- Notice decrease in slope
- Not enough data yet for more analysis

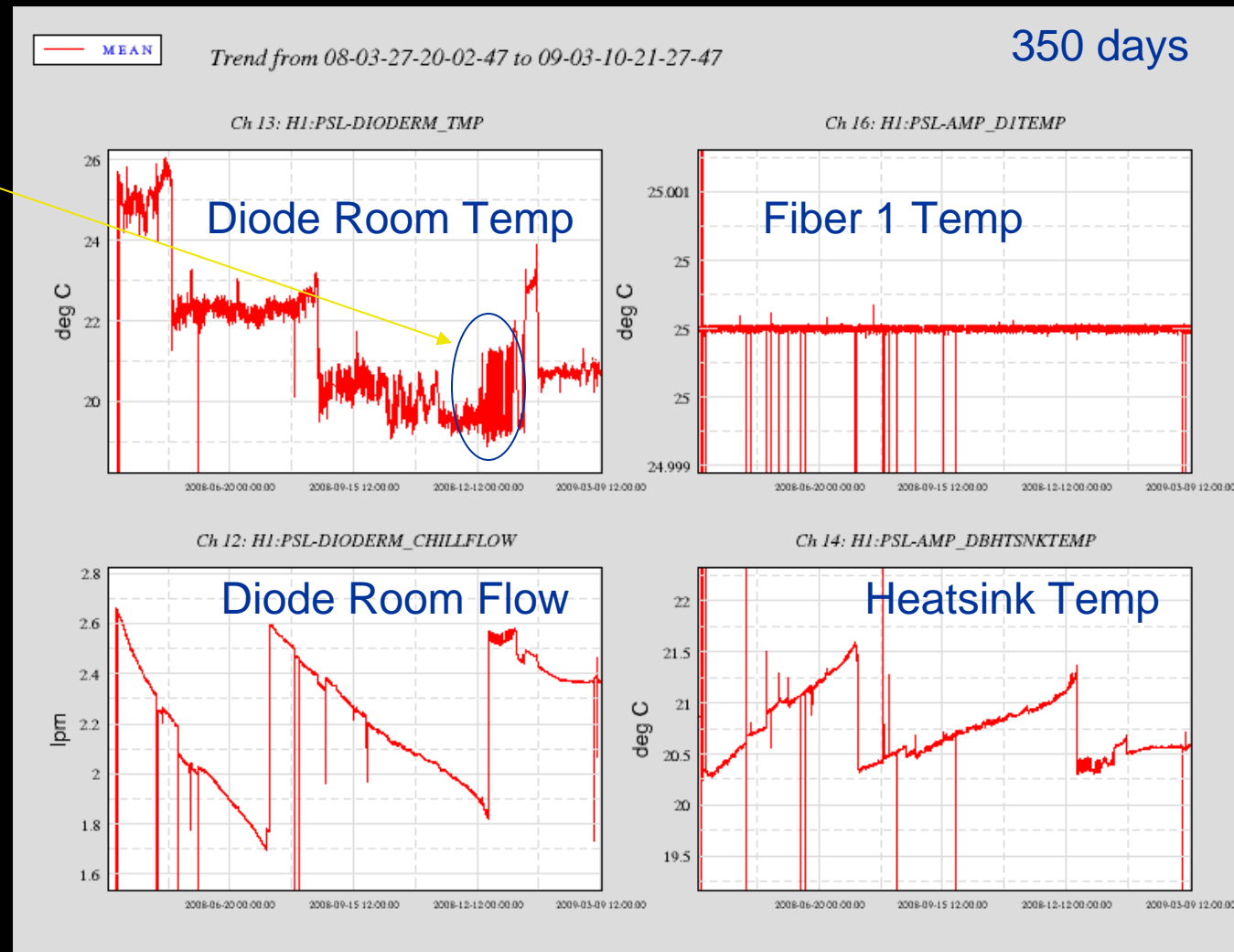
Humidity Correlation



- Try to calculate a slope over 4 points of the data shown
- Bin it to see change before and after
- Not very clear for FSS, but smaller for PMC correlation

Diode Room

- Diode room air temperature fluctuates sometimes possibly due to a low heat load
- Negligible effect on diode temperatures



Water System

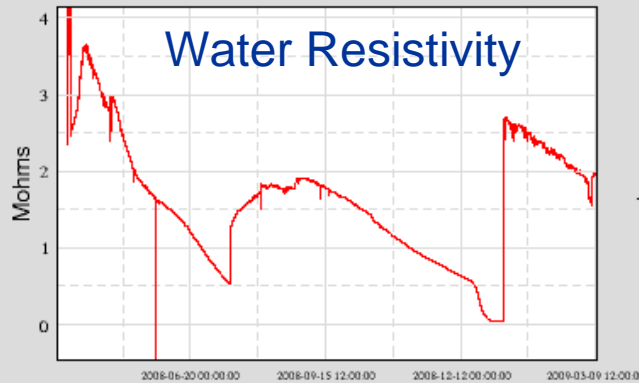
- Water pressure and flows dropping monotonically
- Changed DI filter twice
- Changed water filter twice (carbon shedding in pump?)
- Reset flows to “nominal” values

— MEAN

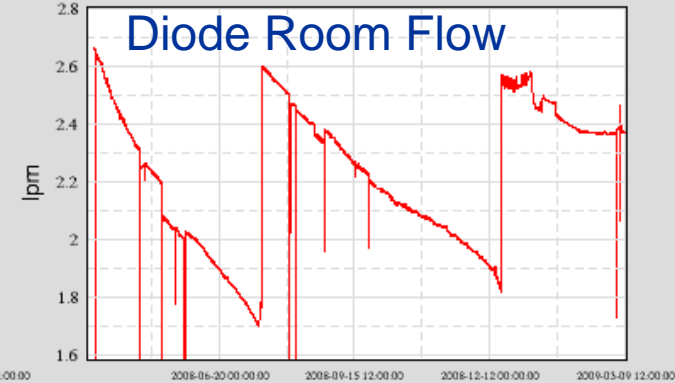
Trend from 08-03-30-17-39-47 to 09-03-10-21-27-47

350 days

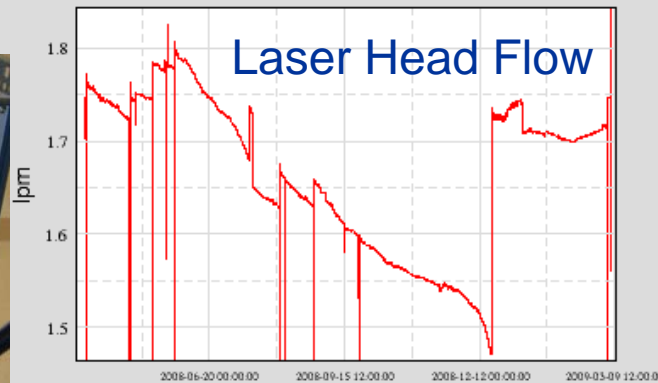
Ch 9: H1:PSL-TABLE_CHILLCND



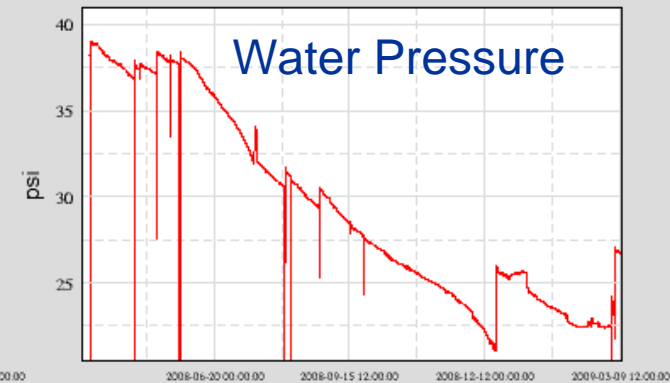
Ch 12: H1:PSL-DIODERM_CHILLFLOW



Ch 7: H1:PSL-TABLE_CHILLFLOW

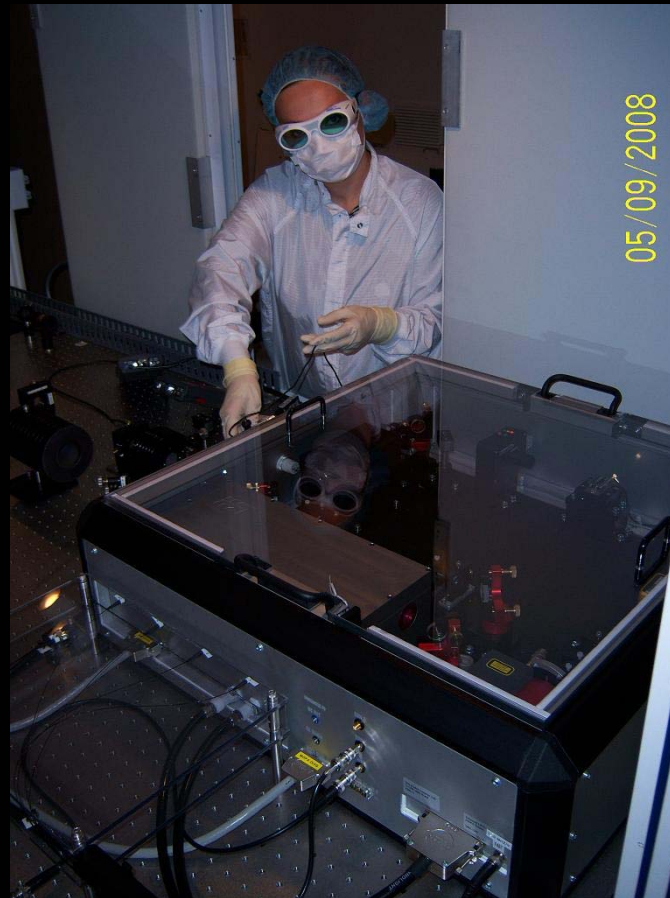


Ch 10: H1:PSL-TABLE_CHILLPR



Summary and Plans

- The laser has been running 24/7 for a full year without major issues
- No attempt at realigning the amplifier
- 10% output power decrease
- Polarizer replacement seems to mitigate humidity effects
- Diode Room/Water system working well



- Chiller interface
- Integrating sphere on PSL table for power monitoring
- Grounding strategy?
- 5 Hz noise investigation
- Noise investigations at eLIGO sensitivity
- Acoustic coupling