

TCS installation & results at LLO

Update: Systems Telecon

8th Jan 2014

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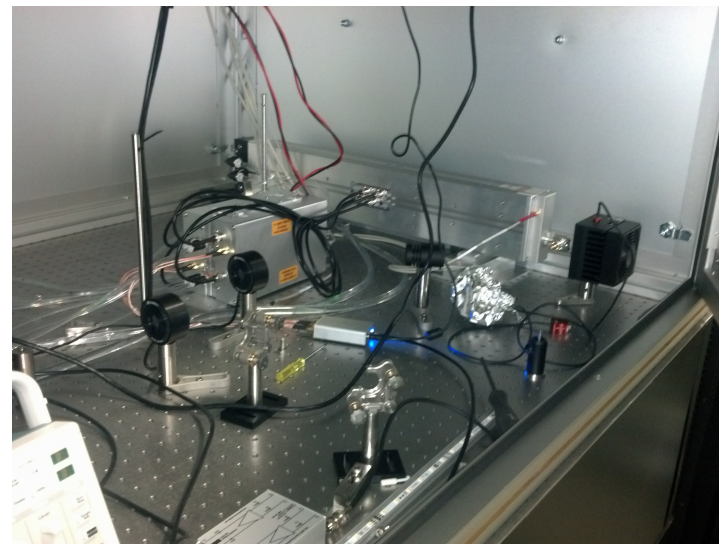
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CO2 Laser Status

- Enclosures installed
- Lasers plumbed
- Phase I (central heating) optics to be installed in January

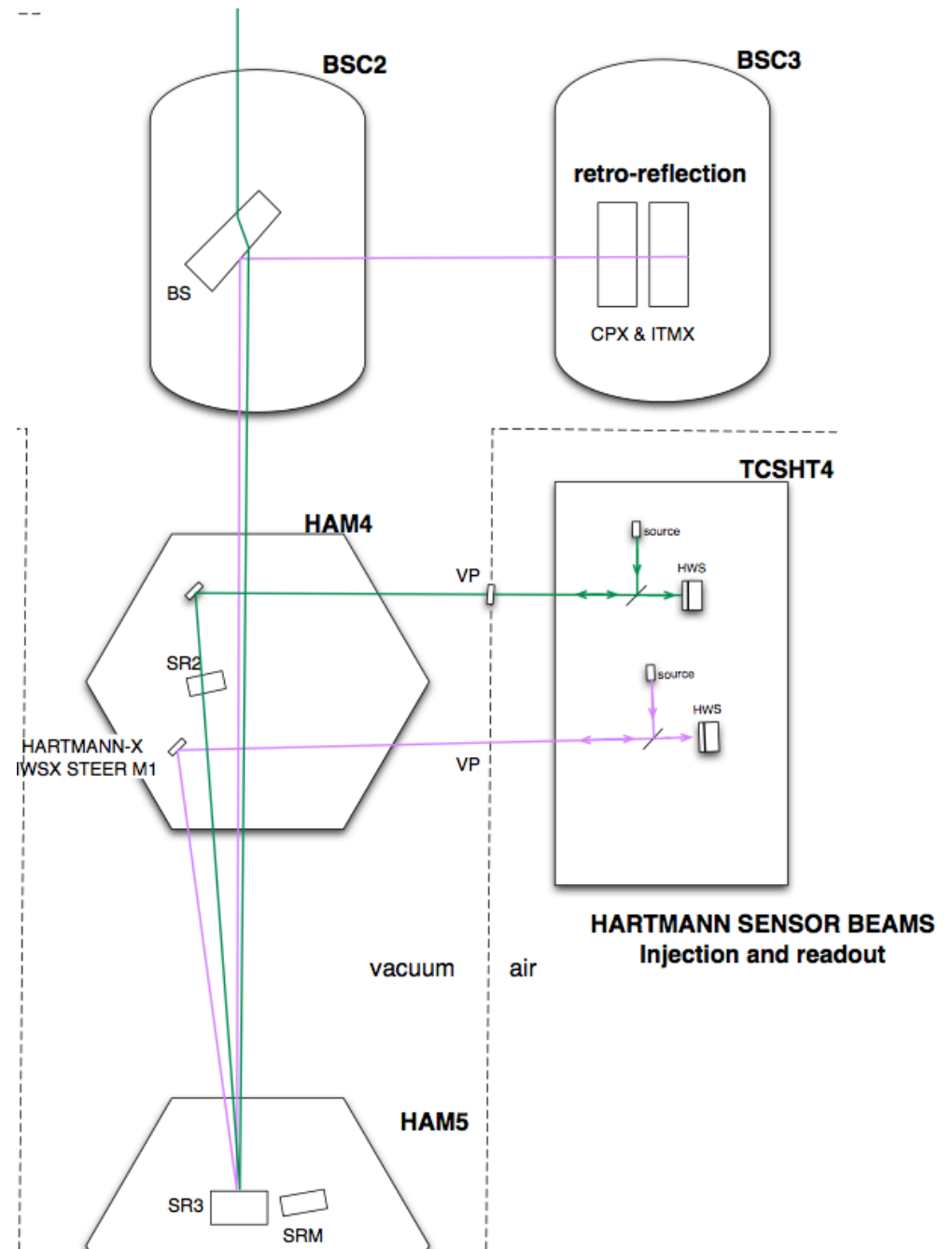


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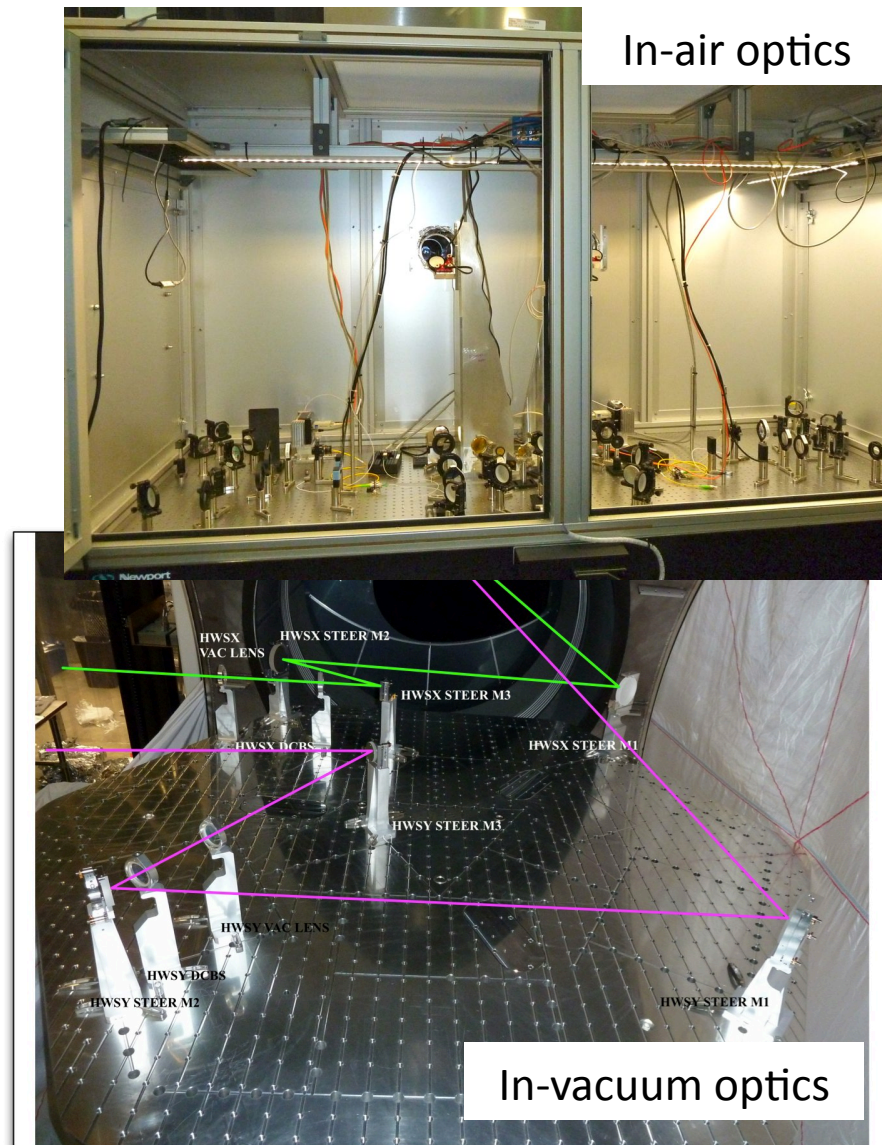
HWS cartoon layout

- Hartmann in-air table
 - Next to HAM4
- Probe beams injected
 - Into main optical axis
 - Retro-reflected from ITMX and ITMY
 - Accumulated wavefront distortion is readout by HWS on return beam
- In-vacuum optics in HAM4
- Must match in-vacuum and in-air optical axes



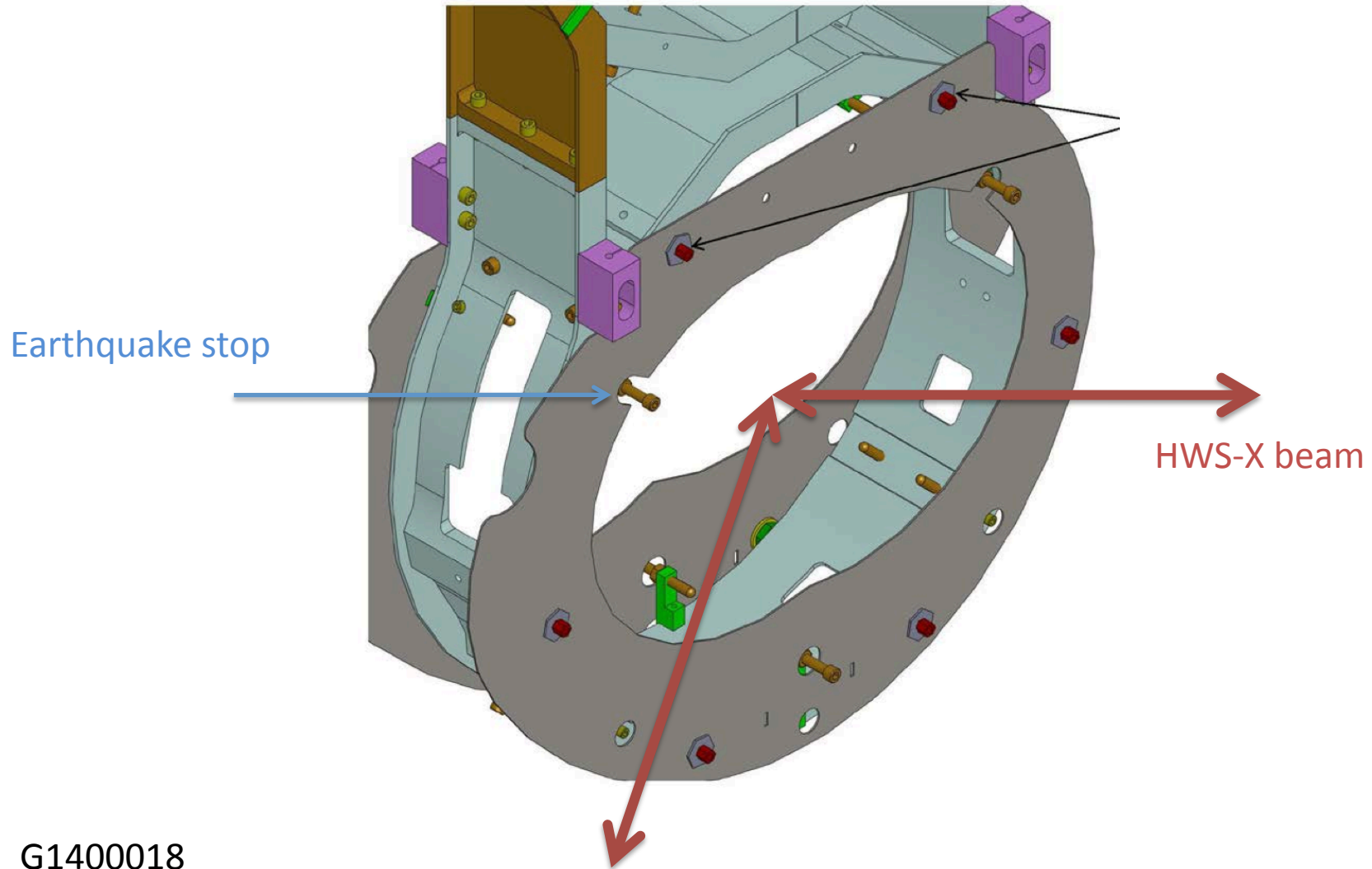
HWS installation

- All optics installed
- In-air and in-vacuum optics aligned separately
- In-air and in-vacuum axes mated
 - Took some effort
 - Currently out of alignment following December vent
- Calibrated
 - HWS lever arm
 - Magnification



Injected HWS-X beam

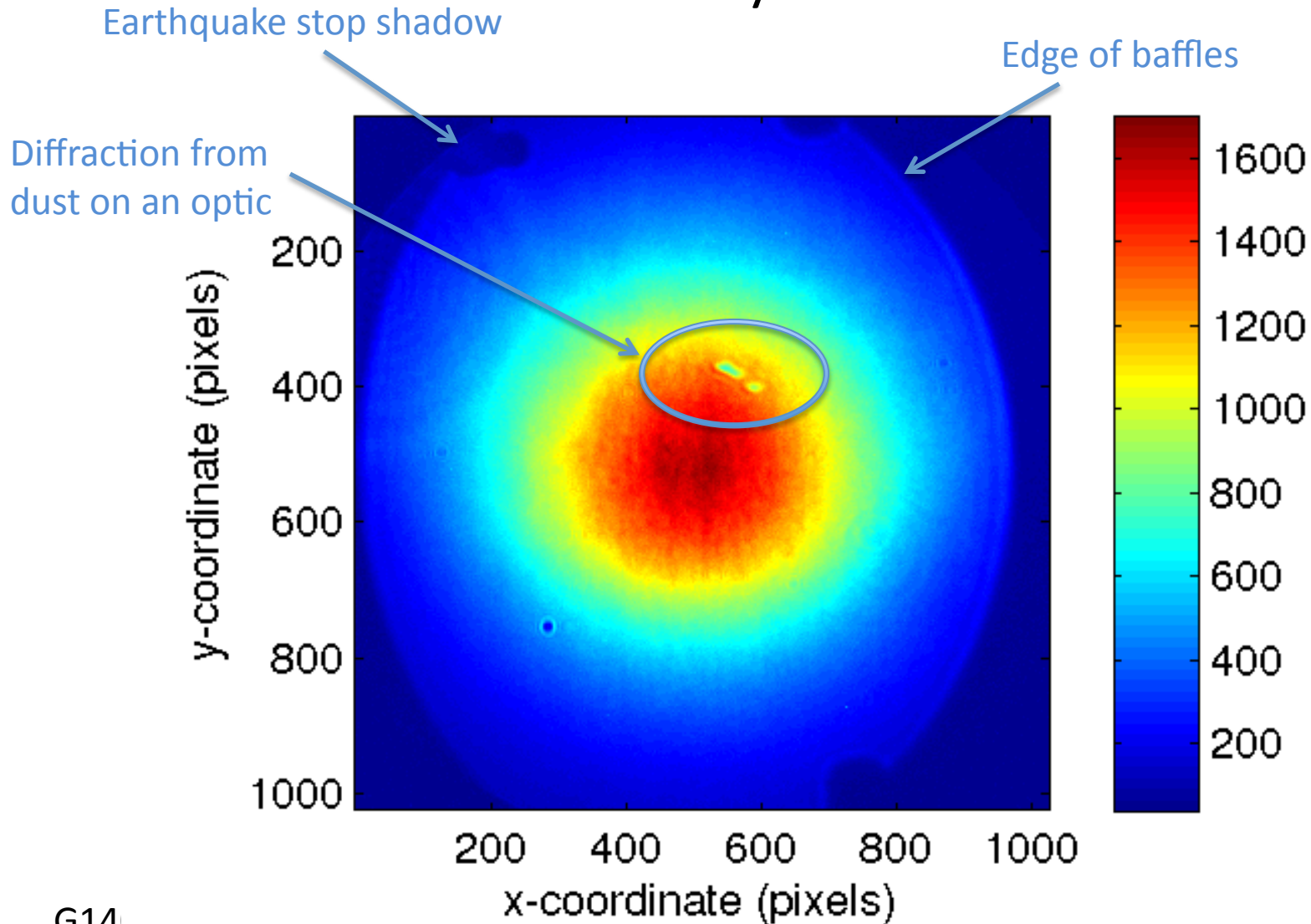
BS baffle is limiting aperture



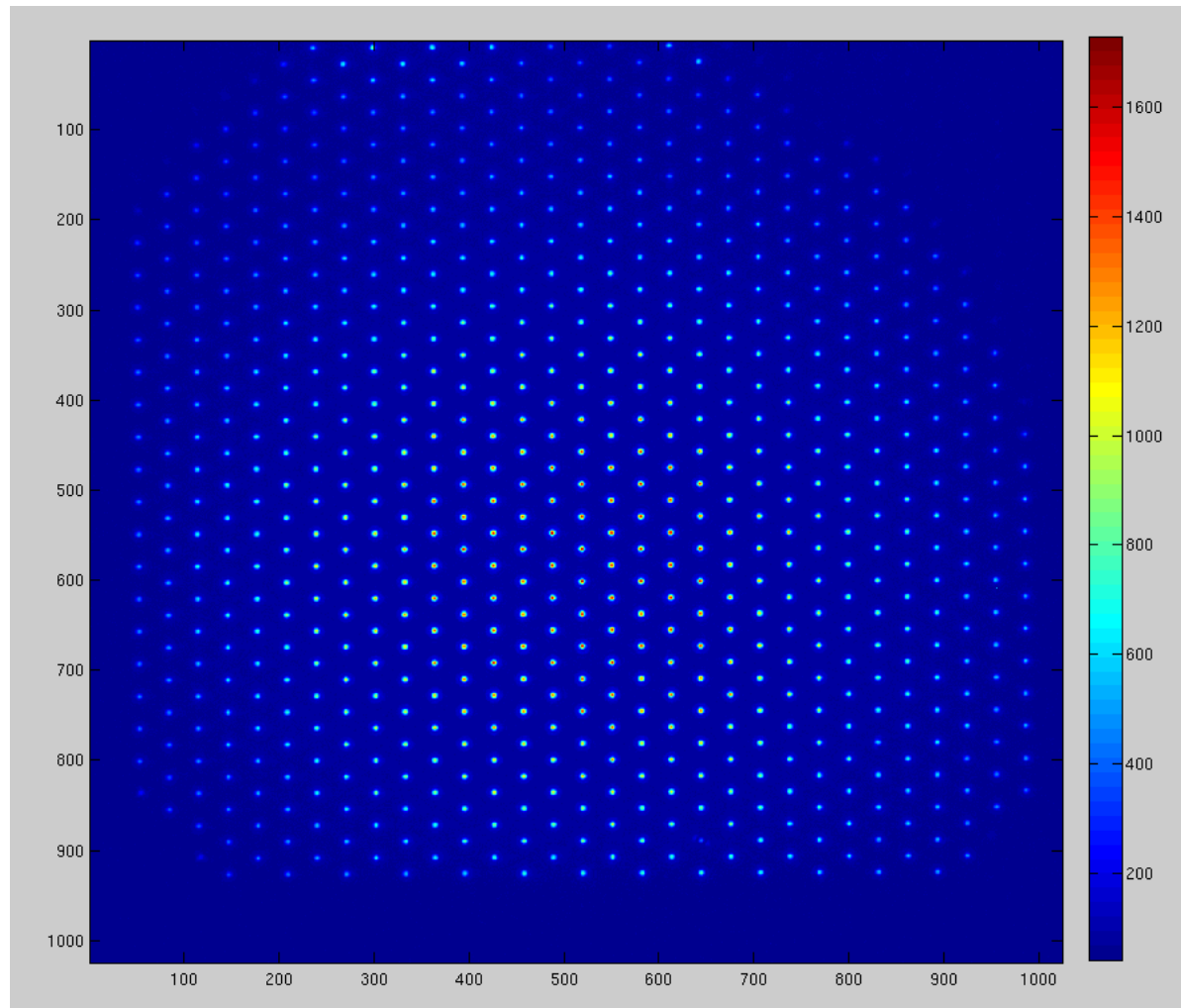
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Transmitted HWS-X beam

Mostly clean



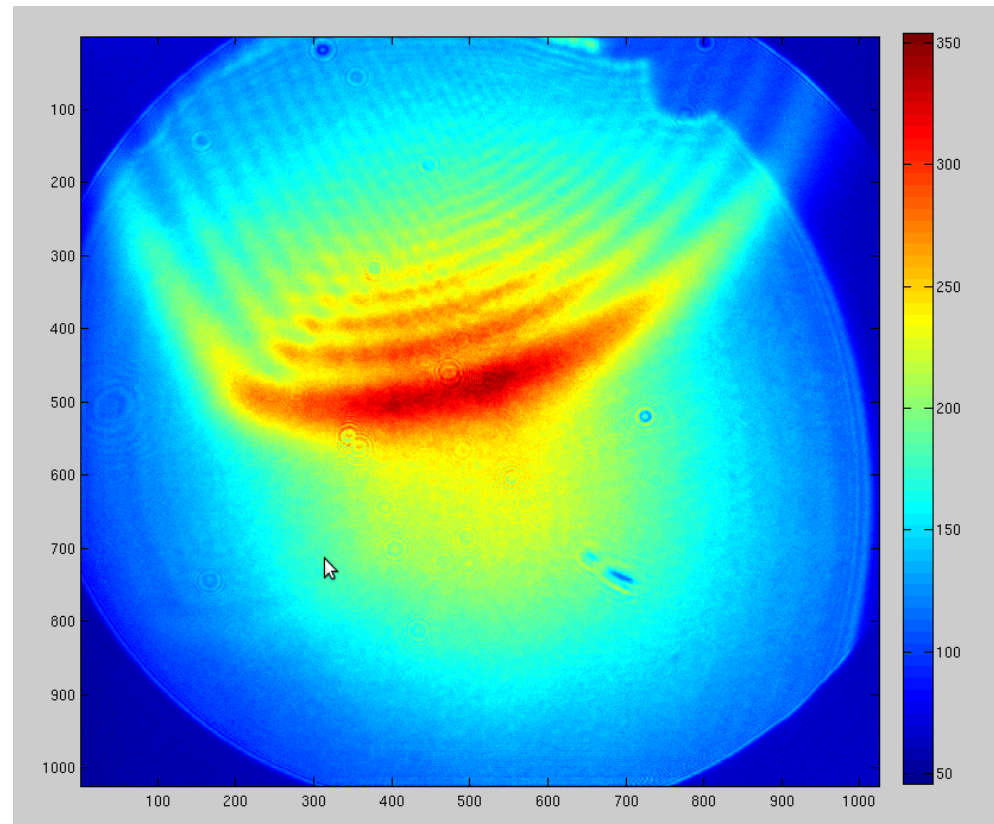
With Hartmann Plate HWS-Y



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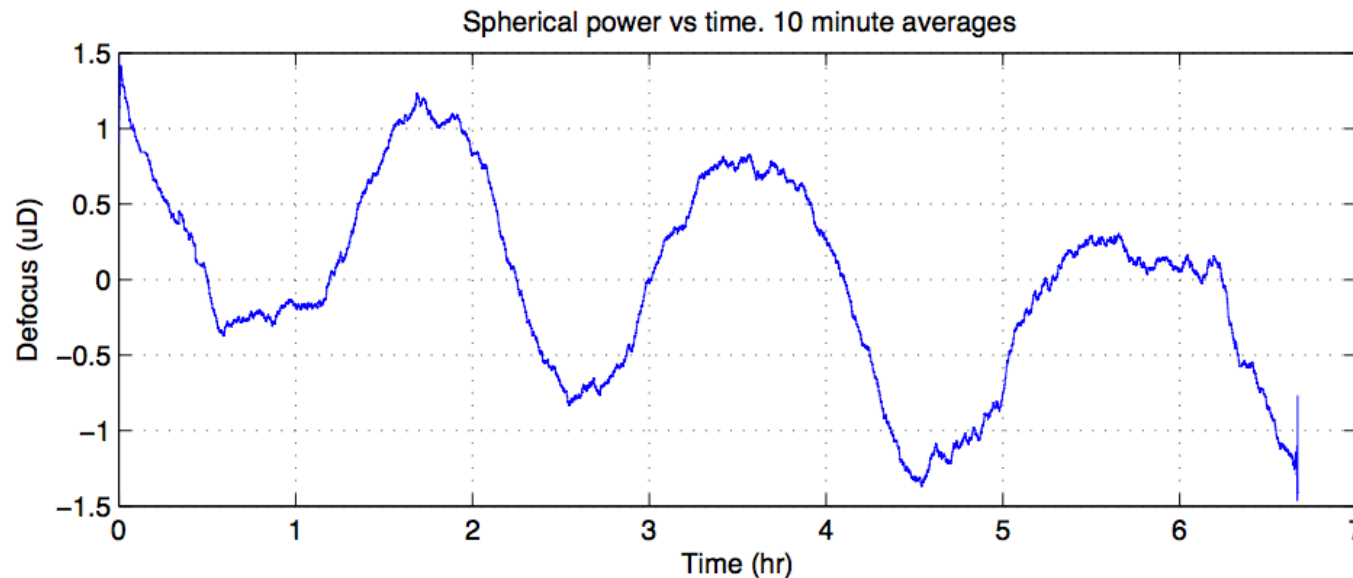
Stray reflections from in-vacuum optics

- We see stray reflections from optics within HAM4
- These can be mostly spatially filtered out.
- Example of **unfiltered** reflection is shown here
- Possibly require tweaking alignment of in-vacuum optics at a later date
 - If determined that these introduce significant noise



HWS-Y background noise measurements

- Shows background defocus over time
 - Equivalent Power Absorbed $\sim 1.2\text{mW}$
 - 0.3% of maximum expected
 - Fluctuation is correlated with temperature variation by HWS
 - Expect to be able to remove some of temperature fluctuations

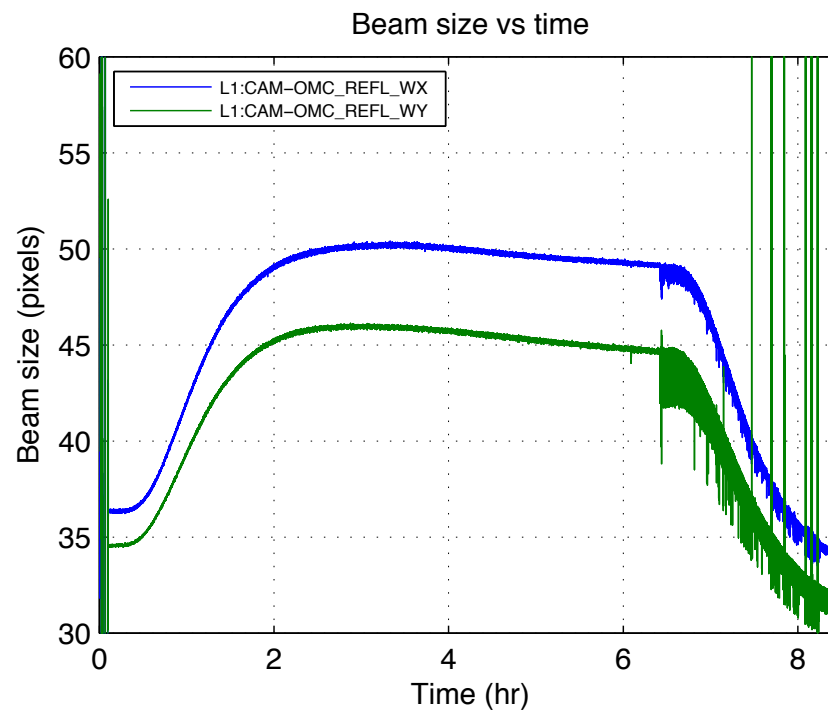
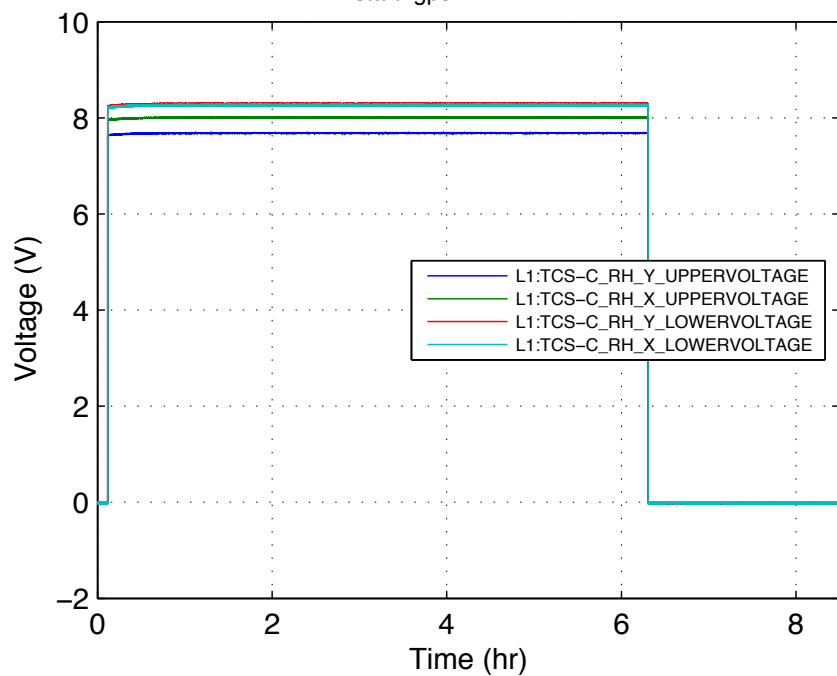


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Recall: Indirect Ring Heater measurement

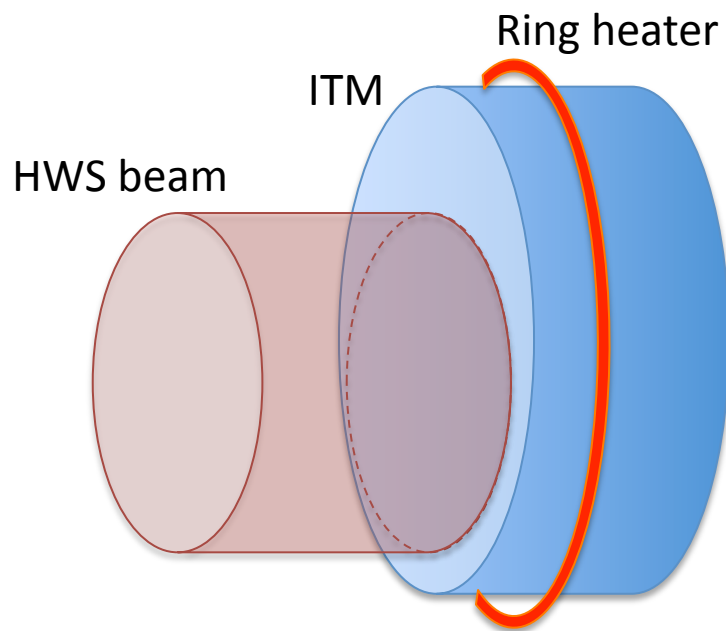
Measured 1064nm beam size

Voltage across RH vs time. $t_{\text{start-gps}} = 1060771664$. RH_x total power =

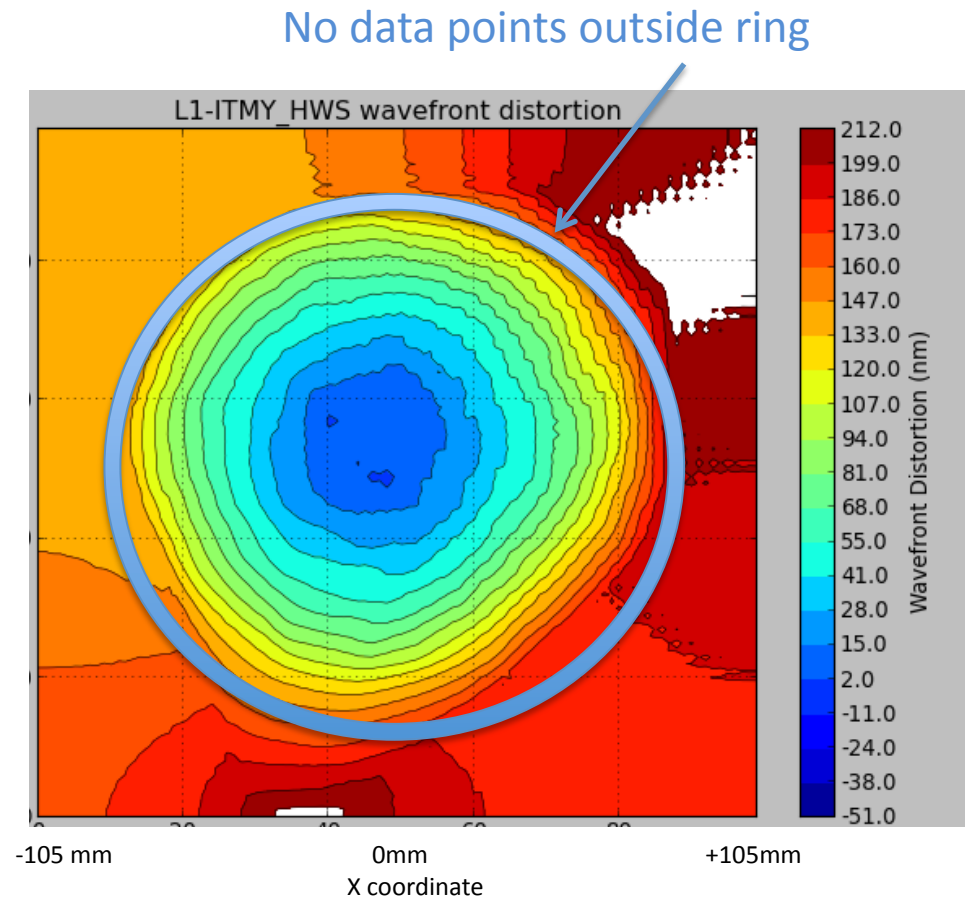


Directly observed RH thermal lens

- Step 1: Apply ring heater
- Step 2: See thermal lens form at glacial speed
- Still need to characterize this lens. Need to measure astigmatism.
- <http://youtu.be/GcoqCn8Ytds>

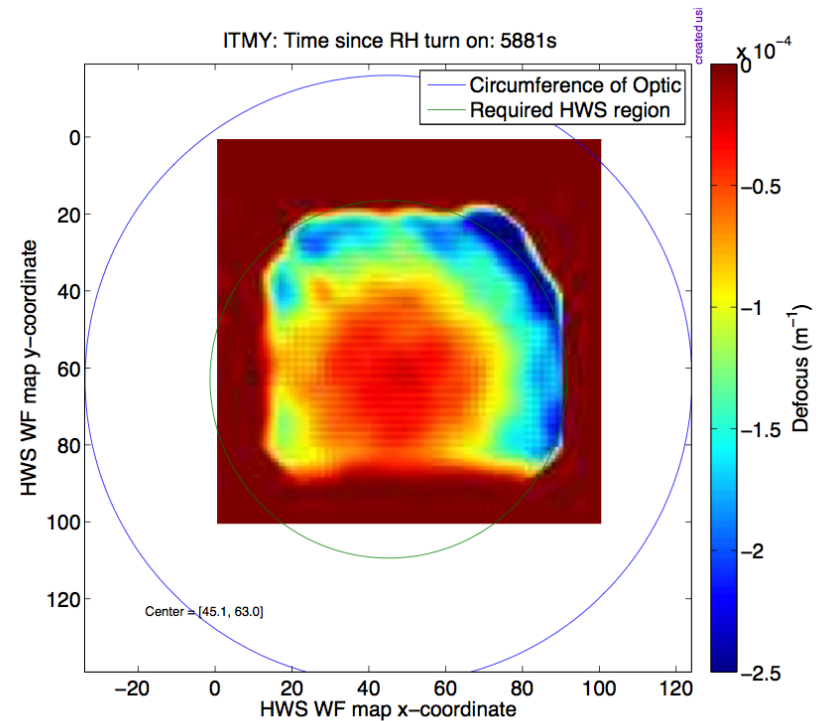
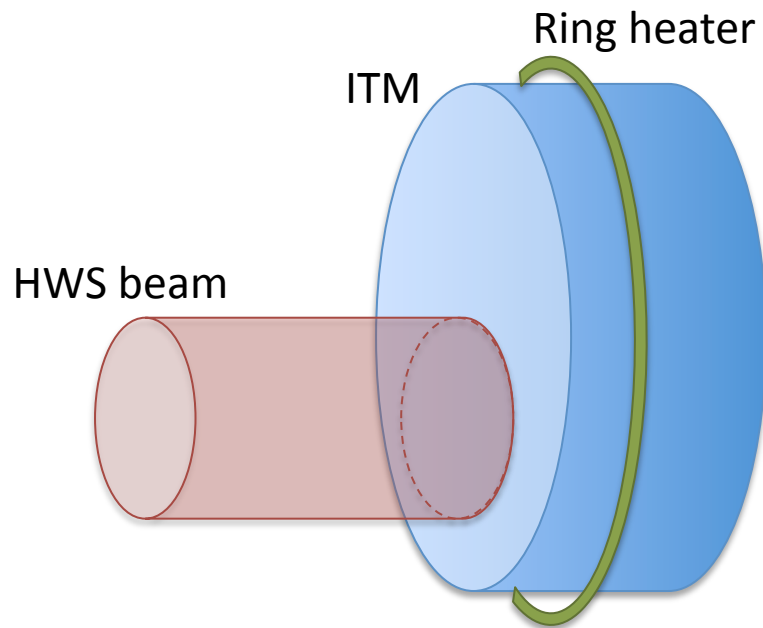


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HWS beam position on test mass

- Located the center of the test mass
 - Relative to the center of the HWS beam
 - Used the ring heater thermal lens



Appendix: HWS alignment

- Located return beams by swinging SR3
- Identified 2 reflections from ITM and 2 from CP
- Once correct beam is identified:
 - Misalign SR3 to return beam to HWS
 - Adjust HWS input periscope until no misalignment is required on SR3

