Intel MET Status and Plans for 2009

IEUVI Optics Contamination TWG
San Jose, 2/26/2009

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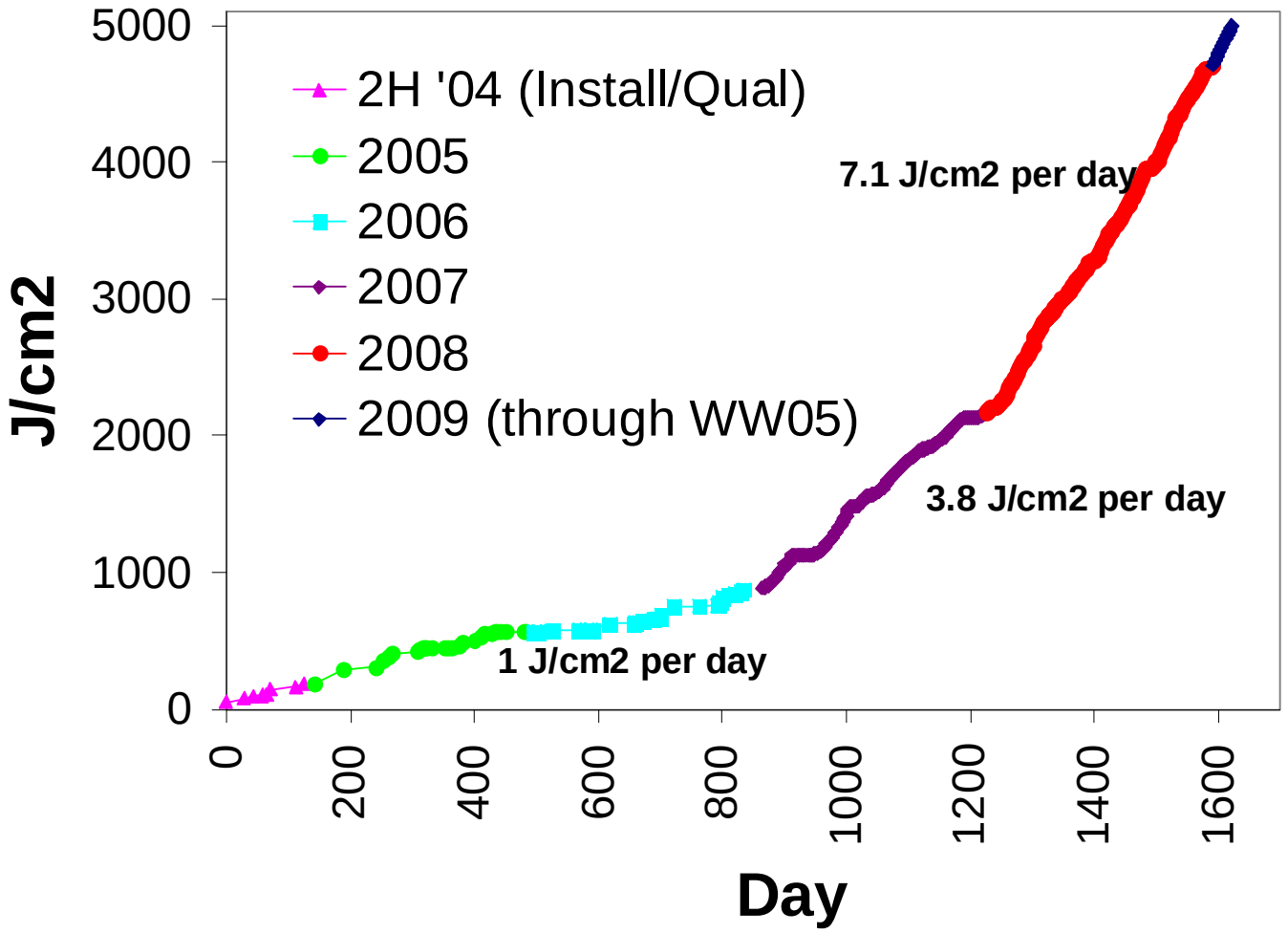
Outline

- MET Statistics and Current Status
- Dose calibration trend and relation to optics contamination
- Optics replacement plans for 2009
- Other possible MET contamination experiments
- A word about likely contamination sources on the MET
- Questions and Discussion

MET has demonstrated steady increase in productivity as measured by dose delivered to wafer plane

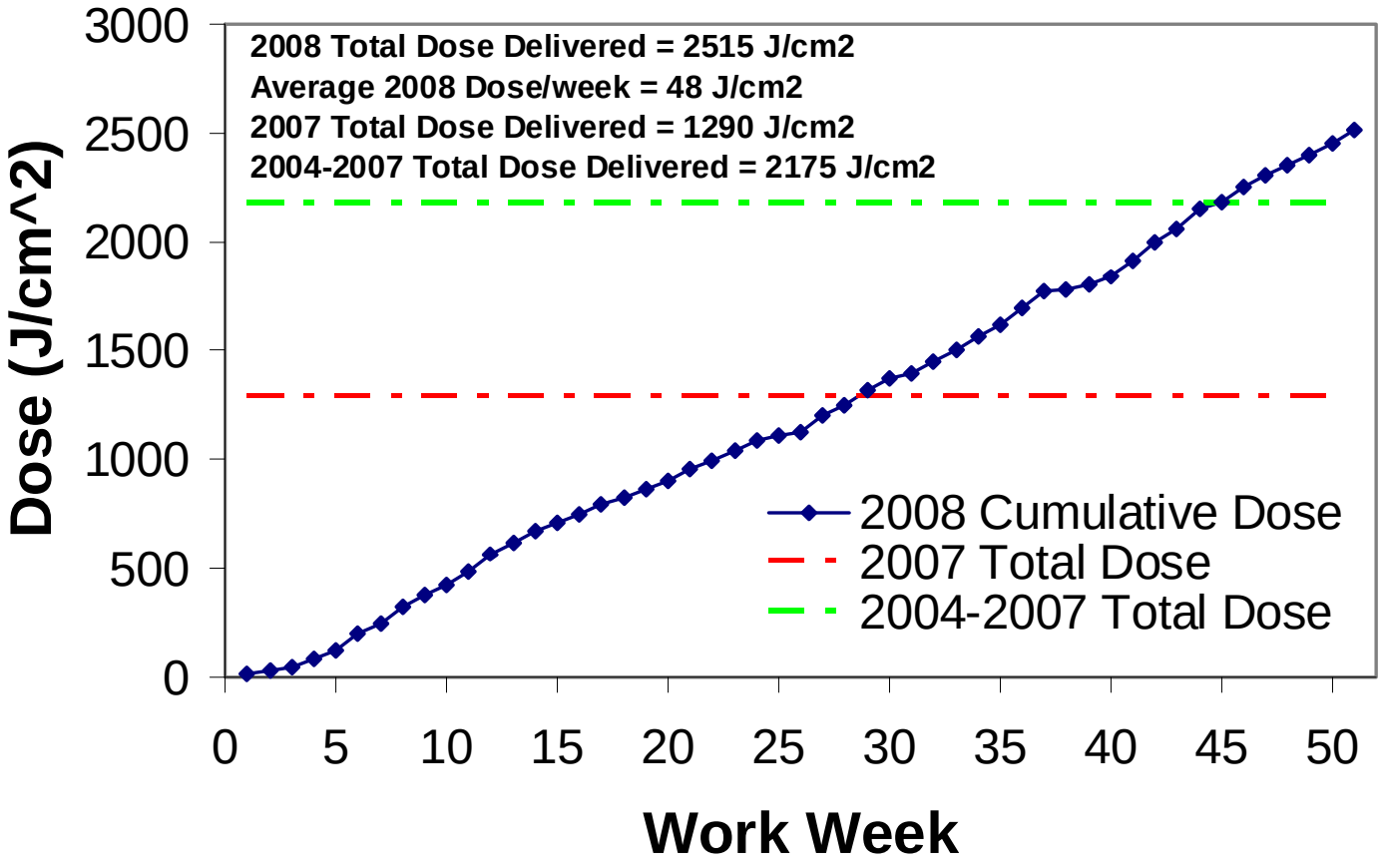
MET Cumulative Dose (J/cm2)



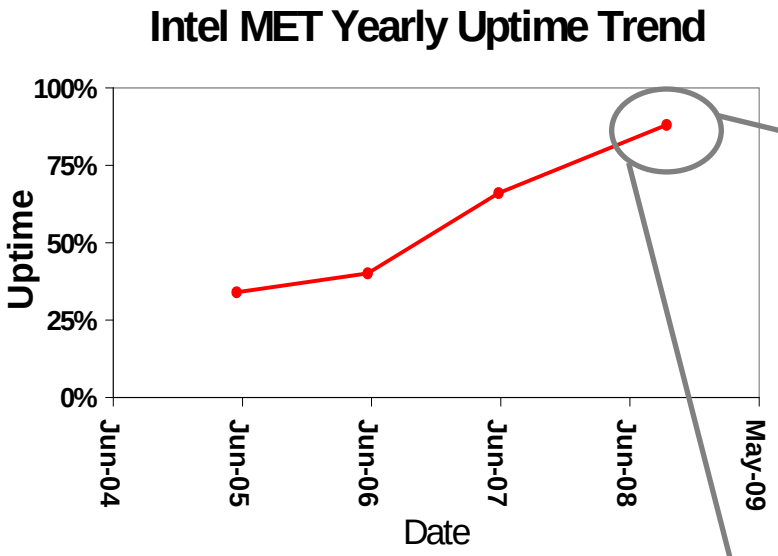
Note: Dose calculated using updated dose calibration (based on NIST calibrated photodiode)

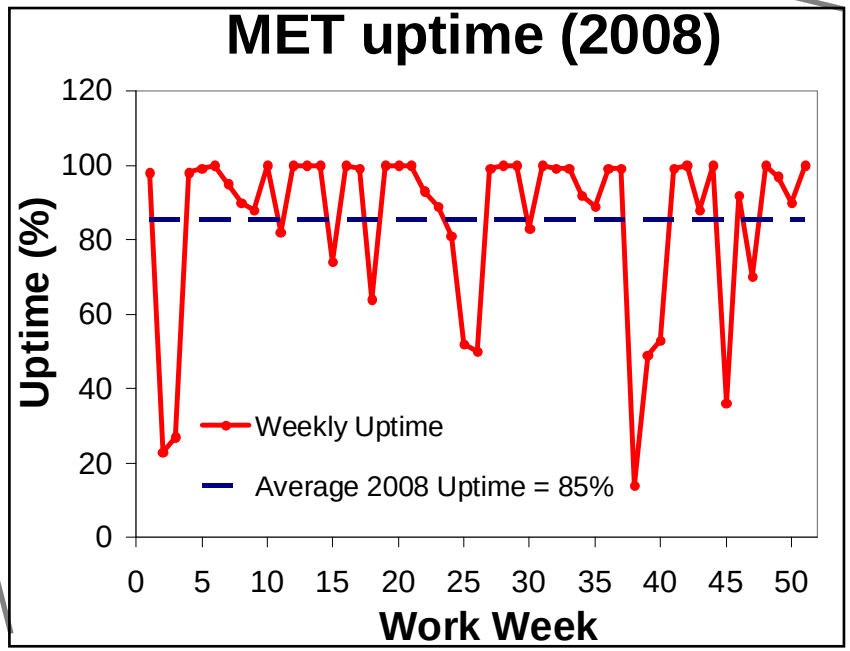
By WW46 of 2008, MET delivered more dose than had previously been delivered for entire history of MET (2004-2007)

MET dose delivered (2008 vs previous)



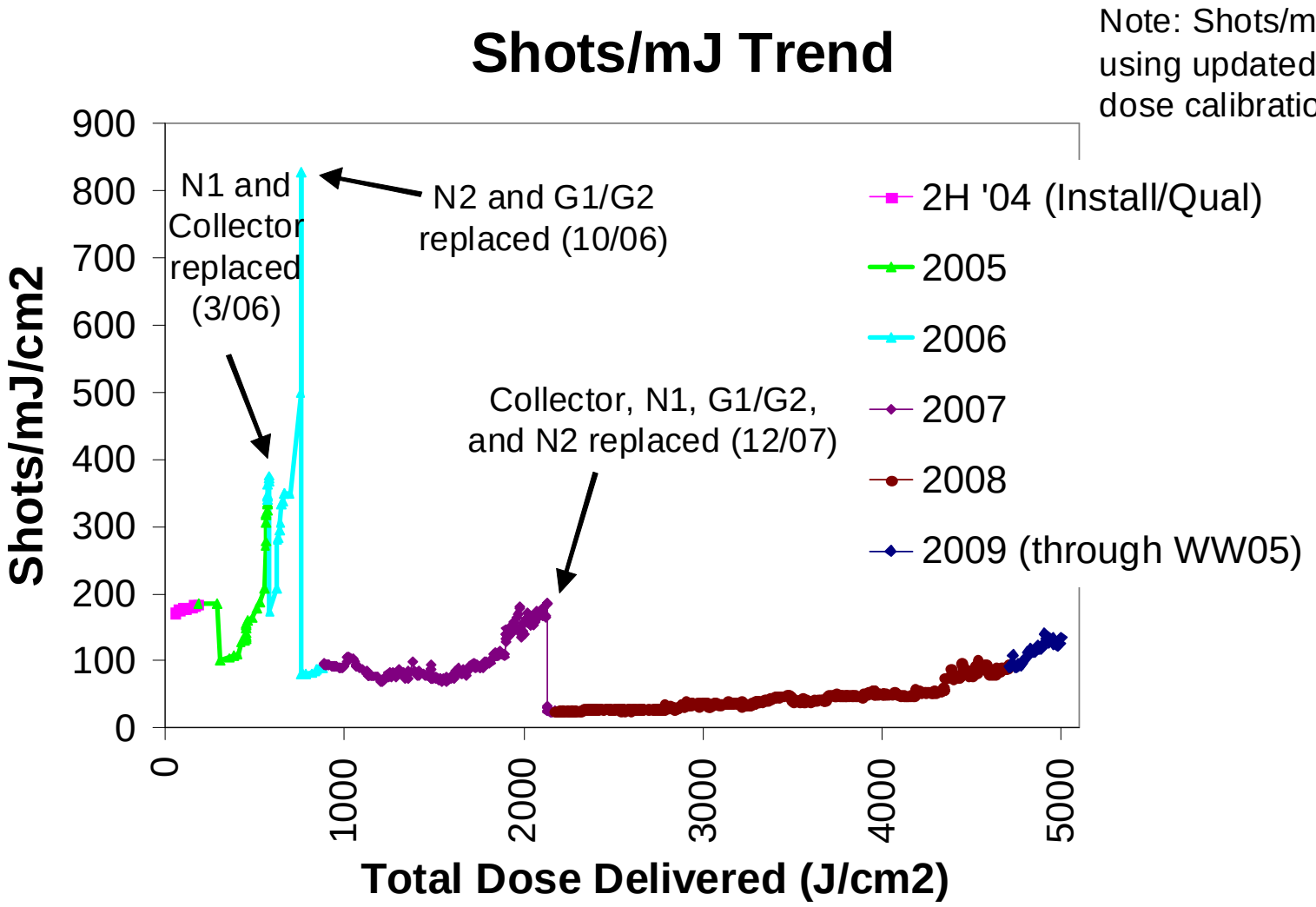
Increased MET productivity was enabled by continuous improvement in uptime in 2008



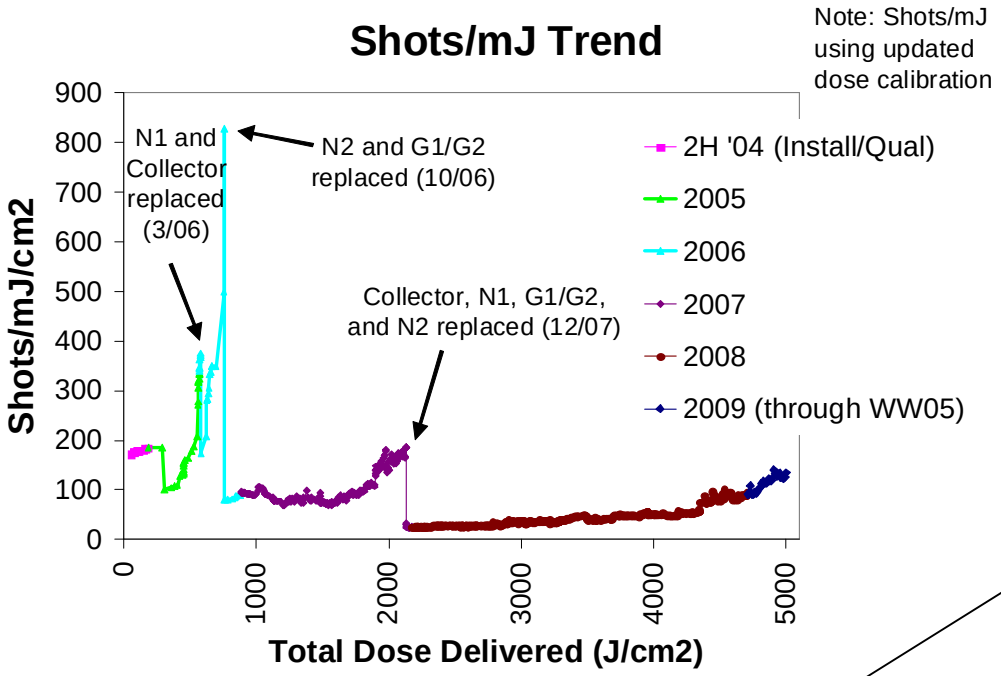


- 2008 Average uptime = 85%
- 2009 (to date)
  Average uptime = 83% (not shown here)

Historically low shots/mJ throughout 2008 also was key in enabling increased MET productivity in 2008



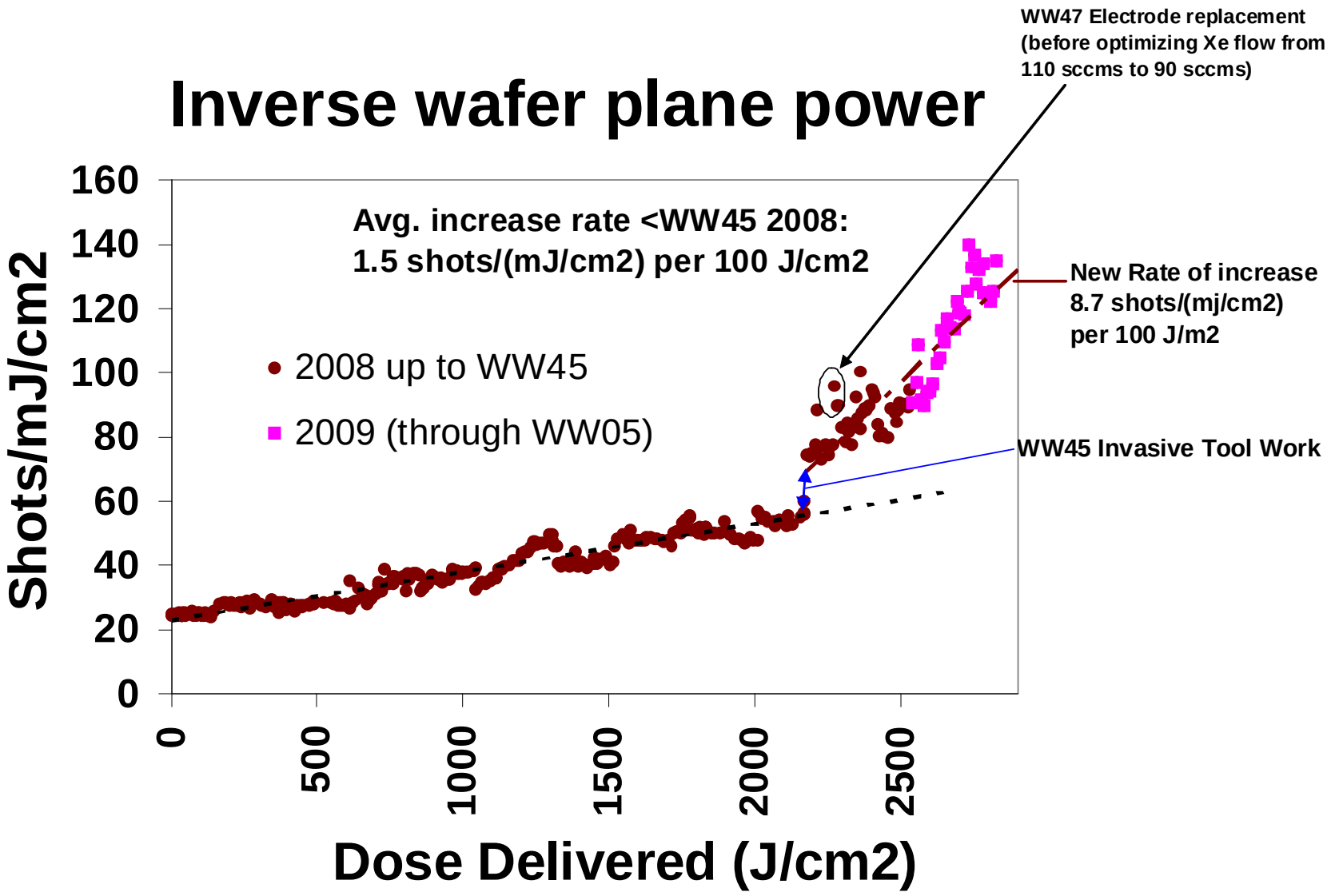
Possible factors enabling low shots/mJ on MET



Less contamination

- Shots/mJ increased at a much slower rate in 2008 than previous years
- Possible explanations:
  - Field stops at more closed position **reducing amount of light** incident on illuminator optics
  - **Cleaner MET** chamber over time

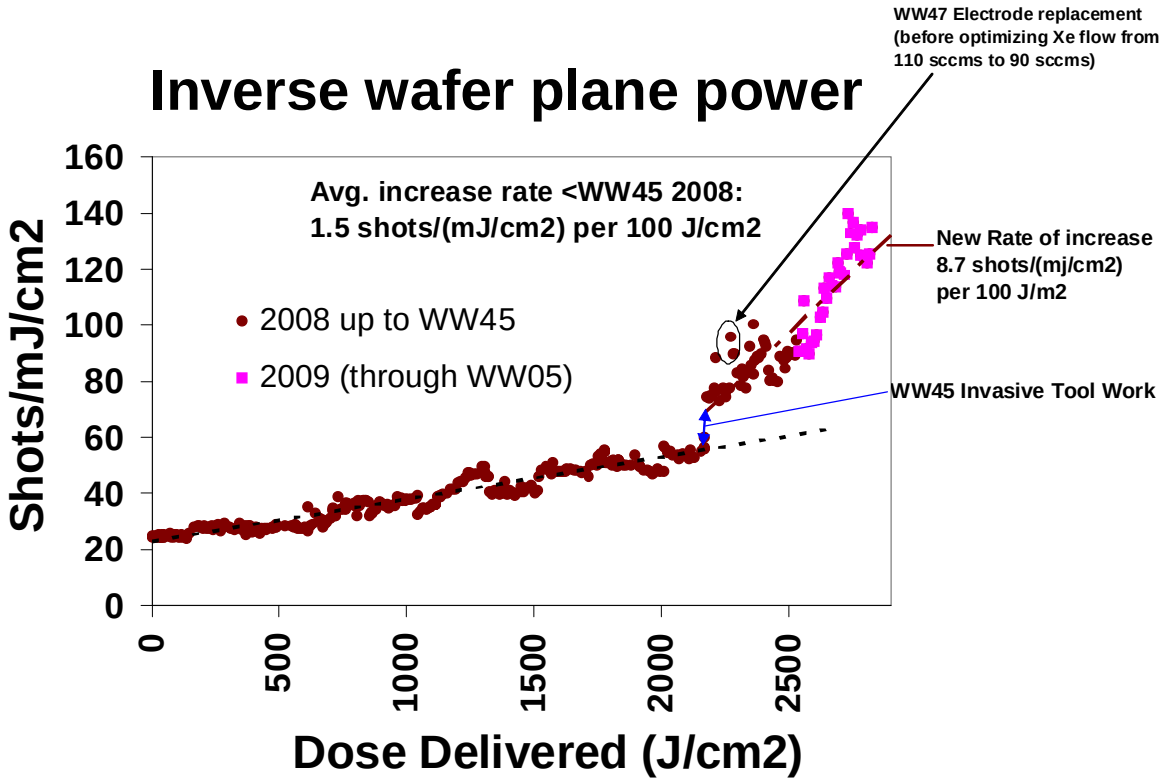
A closer look at 2008/2009 shots/mJ data



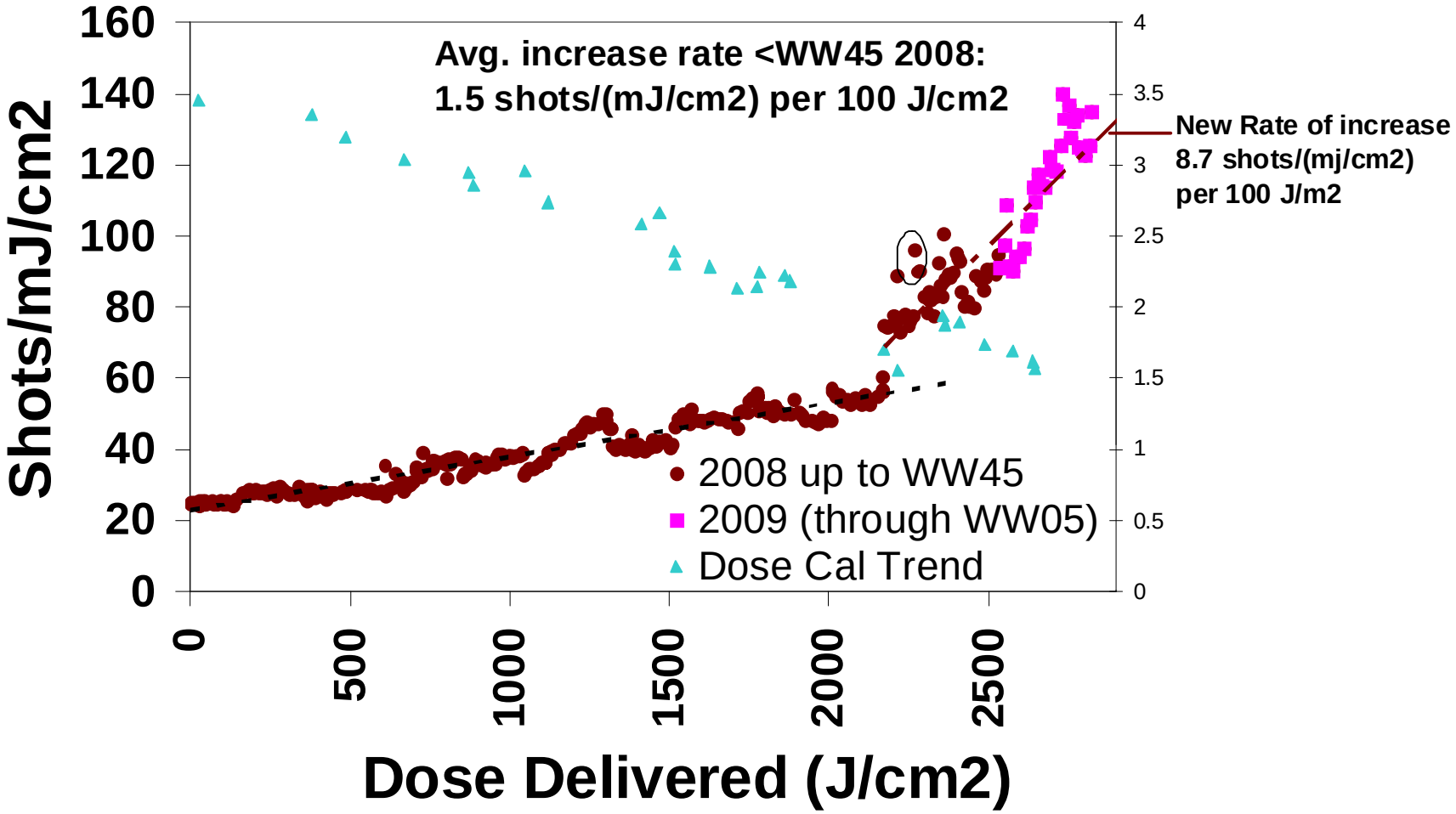
A closer look at 2008/2009 shots/mJ data

- A delta increase in shots/mJ occurred in WW45 following a tool vent, however can be explained by dose calibration update following vent

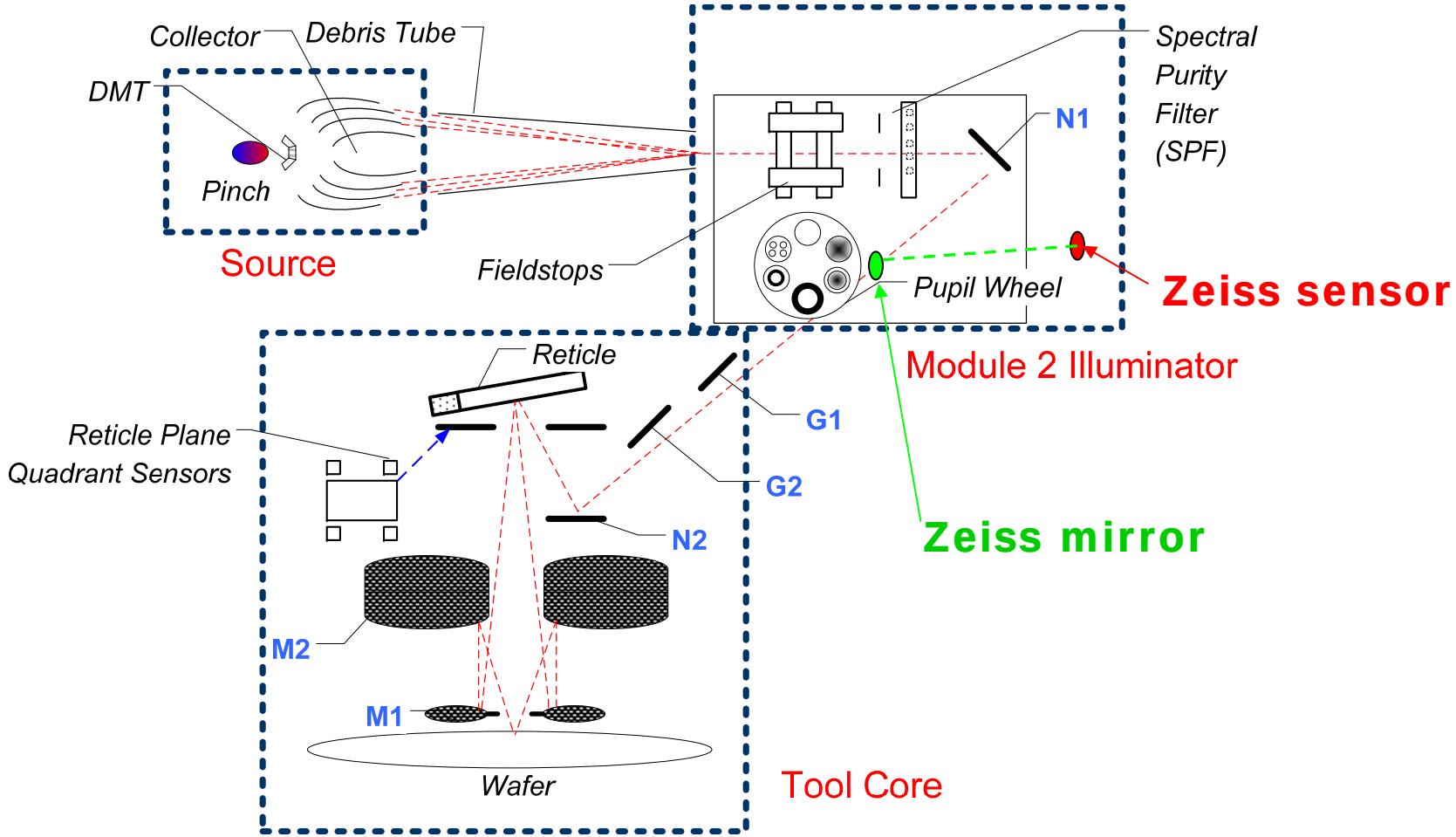
- Shots/mJ are increasing more quickly due to contamination (also seen on Albany MET)



Dose Cal Factor Trend provides additional information on optics degradation

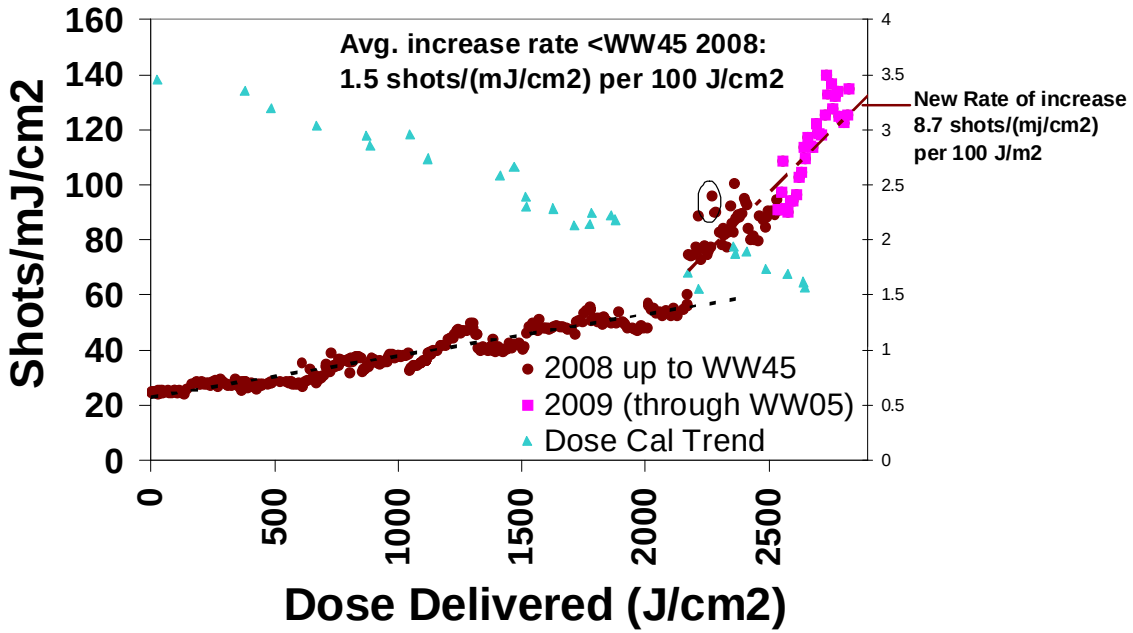


Schematic of MET showing Zeiss sensor position



Dose Cal Factor Trend provides additional information on optics degradation

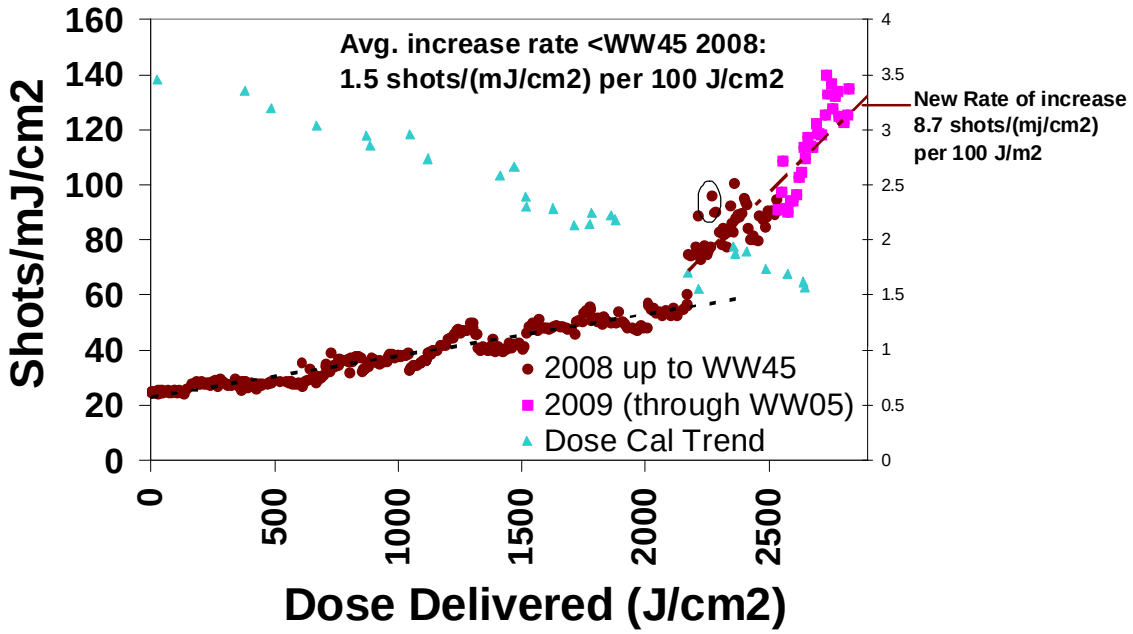
General trend is for MET to drift towards underexposing over time, i.e. less dose being delivered to WP relative to Zeiss sensor at ~pupil wheel plane. Thus trend is to adjust dose cal factor down over time.



**Note: noise in dose cal trend is likely due to collector position drifting away from optimum position with electrode wear

Dose Cal Factor Trend provides additional information on optics degradation

Explanation: Zeiss sensor sees contamination of N1 mirror, Zeiss mirror, and Zeiss sensor whereas wafer sees contamination of N1, G1, G2, N2, reticle, and projection optics (M1 and M2).



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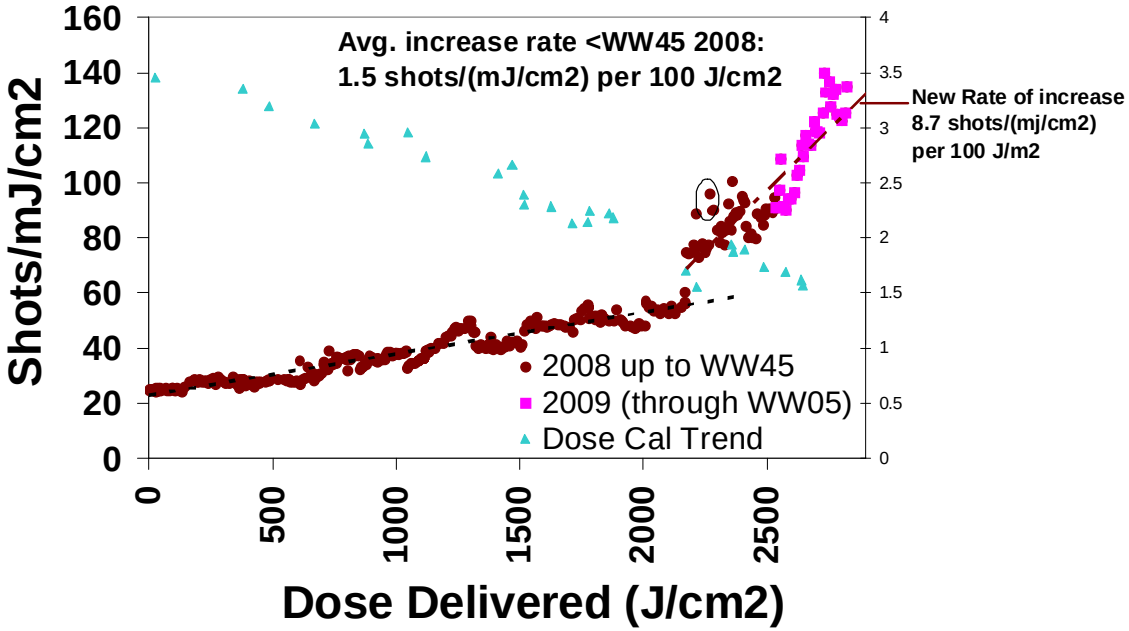
Dose Cal Factor Trend provides additional information on optics degradation

Conclusion:
Contamination of G1/G2, N2, M1, M2 reduce power more than contamination of Zeiss mirror and sensor, i.e. cumulative contamination of G1/G2, N2, M1, M2 is worse (makes sense since more surfaces)



**Note: noise in dose cal trend is likely due to collector position drifting away from optimum position with electrode wear

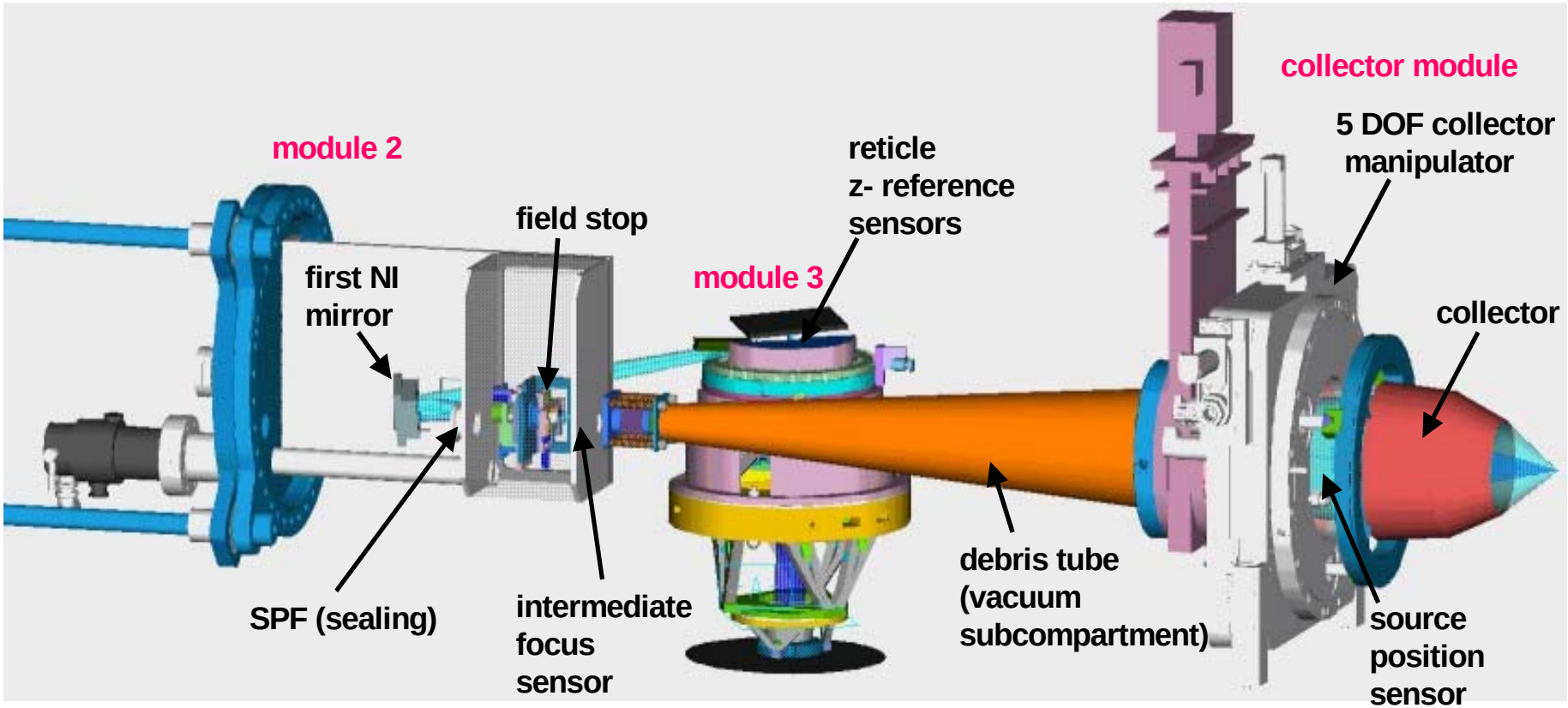
Plan for MET optics replacement WW13:

- Install **New Collector** with added outer shell
  - extending outer sigma to 0.65
- Replace **N1 and G1/G2** mirrors
  - Reflectivity and contamination analysis will be convoluted with effects from O2 mitigation cleaning experiments but may still provide useful data
- Install new **SPF strip with Si/Zr** windows
  - Reduce OOB radiation with Zr and test if new optics contaminate at a reduced rate
- Replace quartz wool cryotrap with **stainless steel cryotrap**
  - Samples can be collected from the MET with the less retentive SS cryotrap for further studies of the MET vacuum under different conditions, i.e. immediately after a vent, while processing wafers, etc.

Other possible optics contamination experiments on the MET

- Installation of a more sensitive RGA with better conductance to the Mod2 chamber where the illuminator optics reside
- OOB radiation testing at the WP
- Other ideas?

Resist outgassing and contamination of N1?



Unlikely in MET that resist outgassing plays major role since

- Large separation between N1 and wafer
- Small field size of MET, i.e. takes ~1 year to expose the equivalent of 1 wafer

Questions?