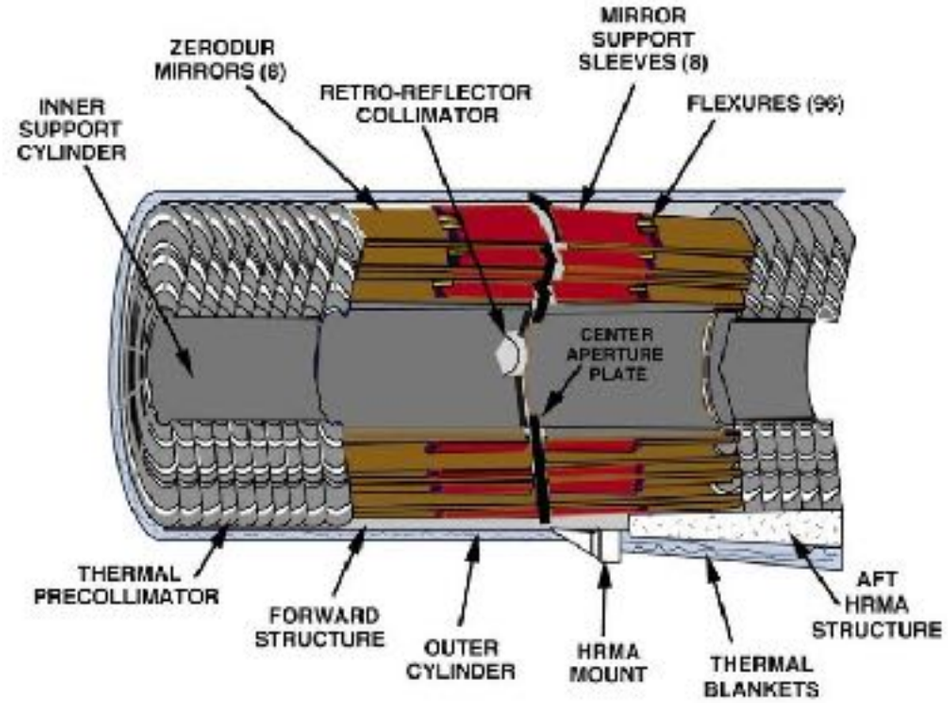
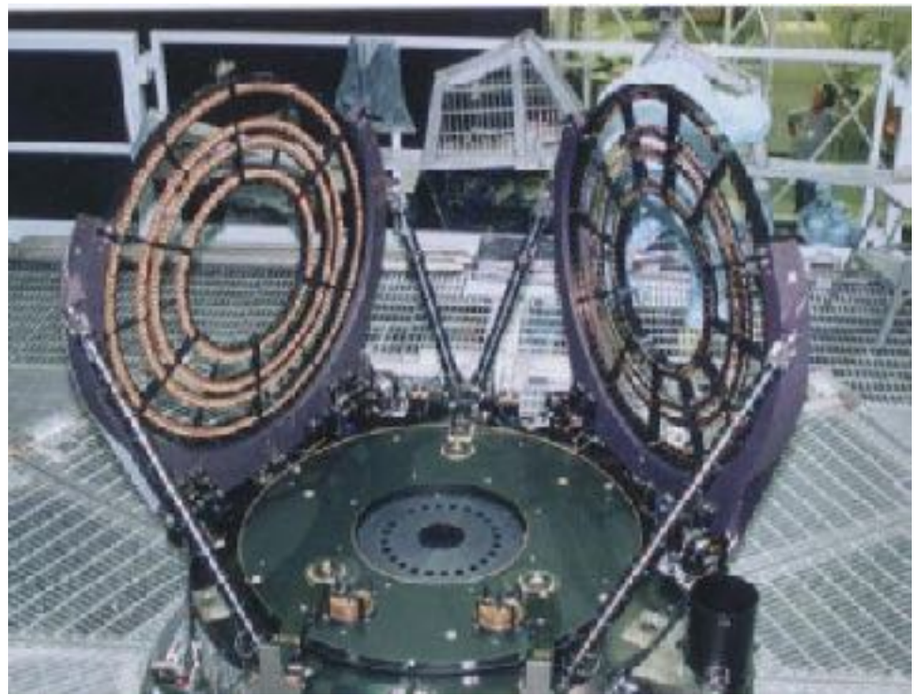
JEREMY J. DRAKE AND THE CXC CALIBRATION GROUP

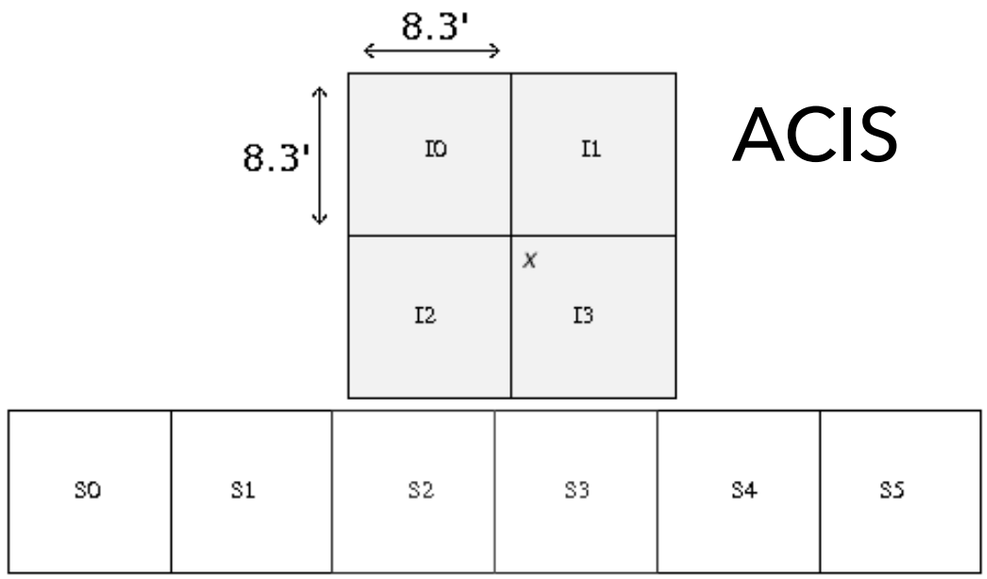
CHANDRA CALIBRATION STATUS


iachec 2018

CHANDRA HARDWARE COMPONENTS

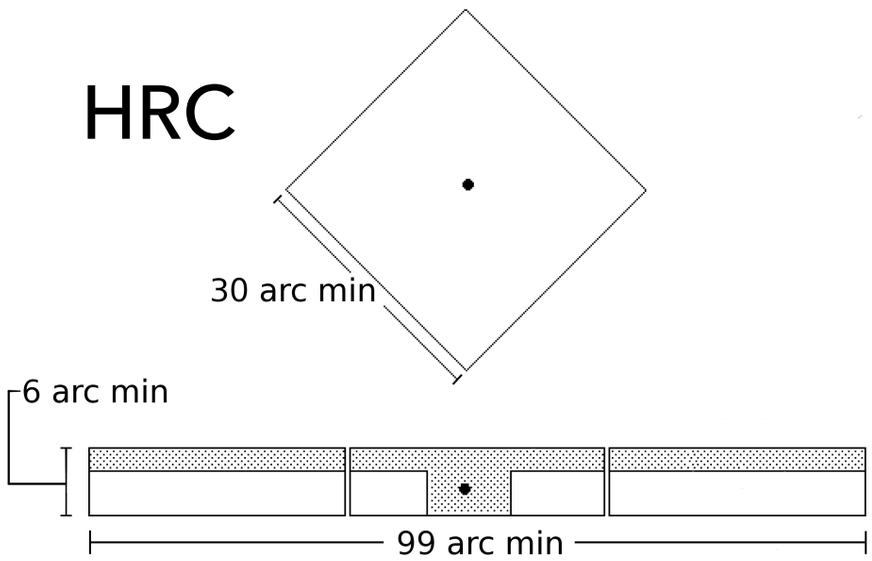






ACIS

HRC



OUTLINE

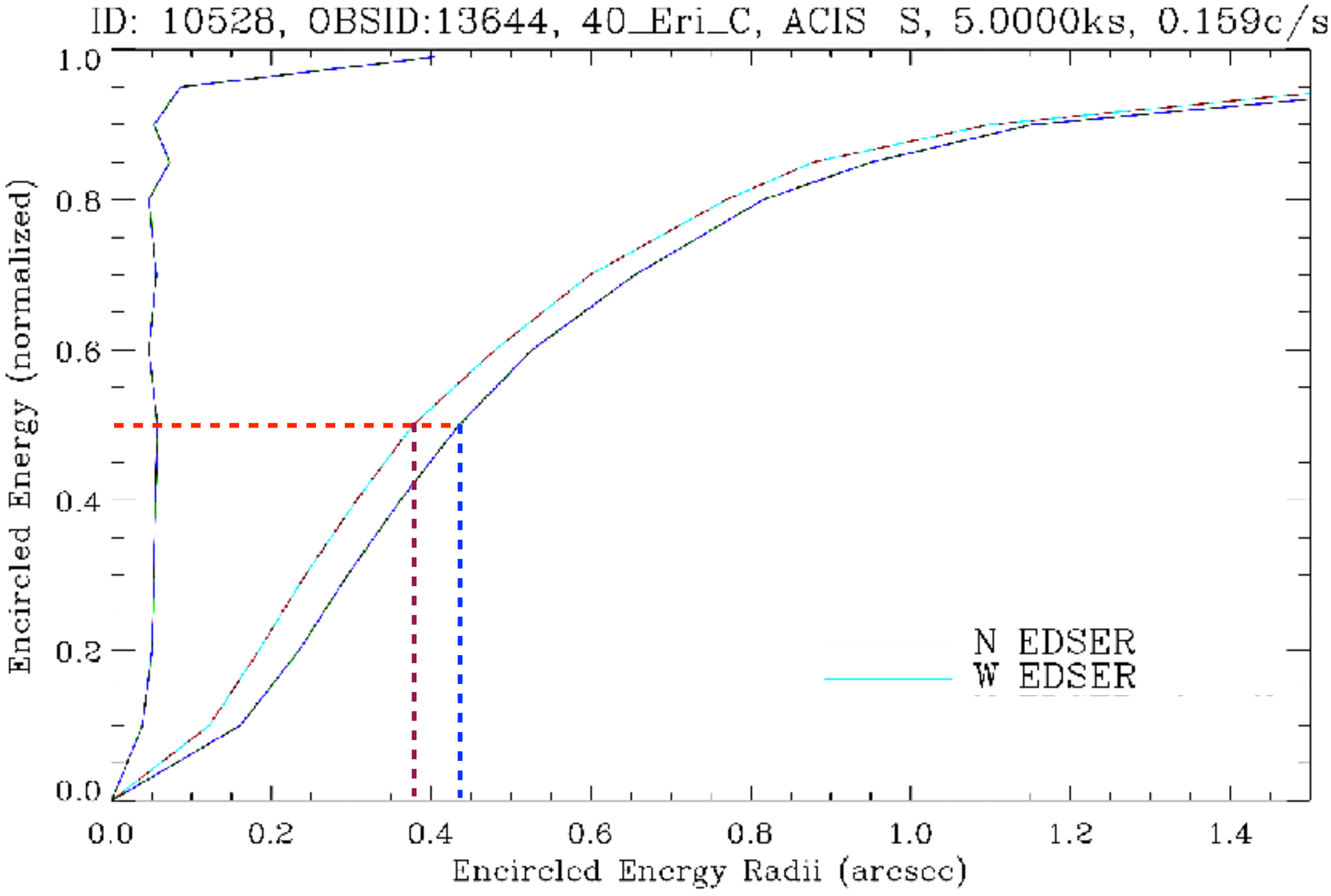
- Point Spread Function
  - calibrating EDSER; empirical PSFs
- ACIS
  - mid-chip gain droop; QEU; contamination
- HRC-S,I
  - QE decline; gain decline

POINT SPREAD FUNCTION

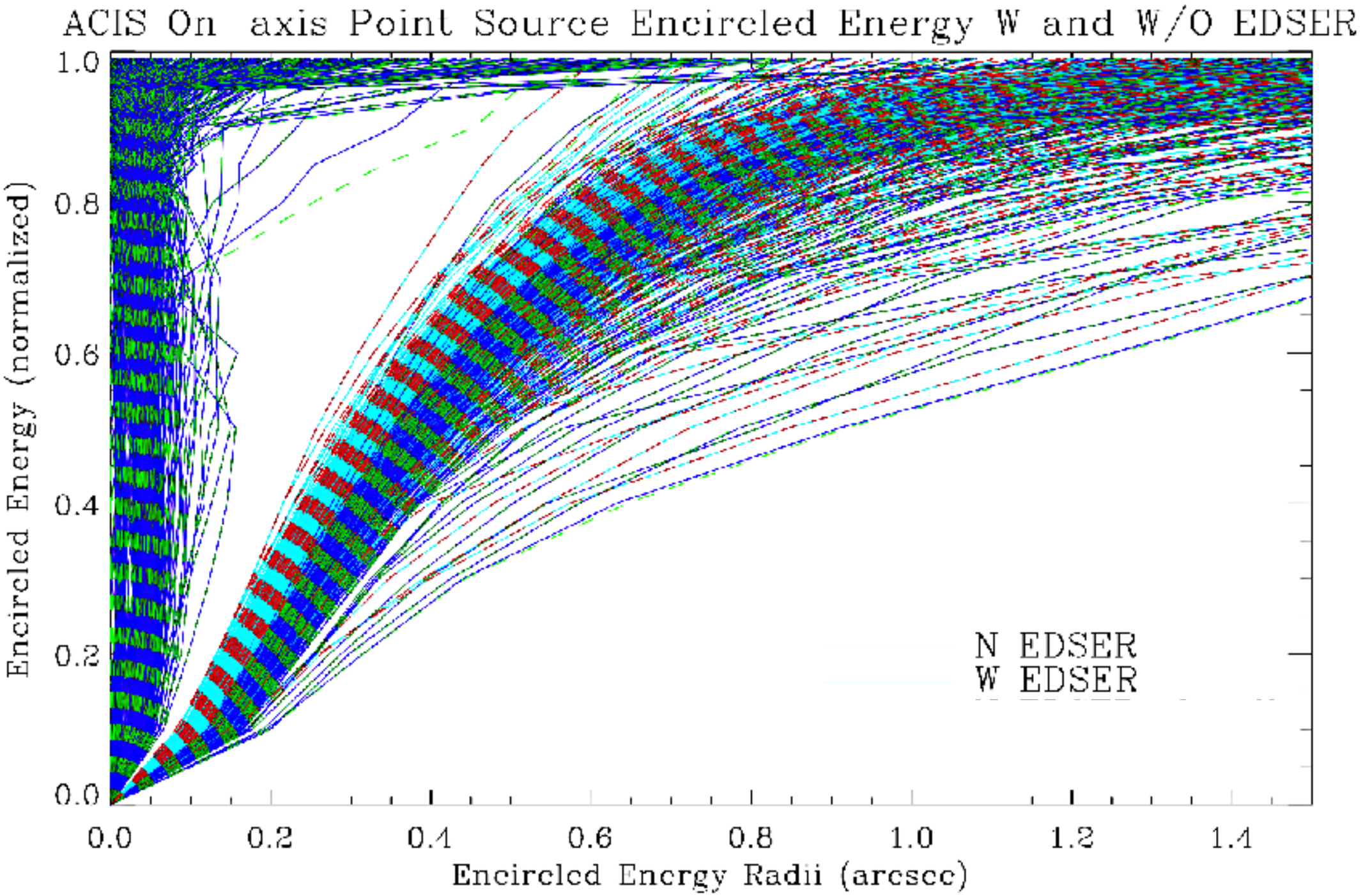
ACIS PSF WITH EDSER (V. KASHYAP, P. ZHAO, D. JERIUS)

- Energy Dependent Subpixel Event Repositioning (EDSER) - ACIS images can be sharpened significantly at sub-pixel resolutions
- Applies corrections to event locations based on photon energy and grade (Li et al. 2004, ApJ 610, 1204)
- BUT: EDSER'd PSFs have not yet been calibrated

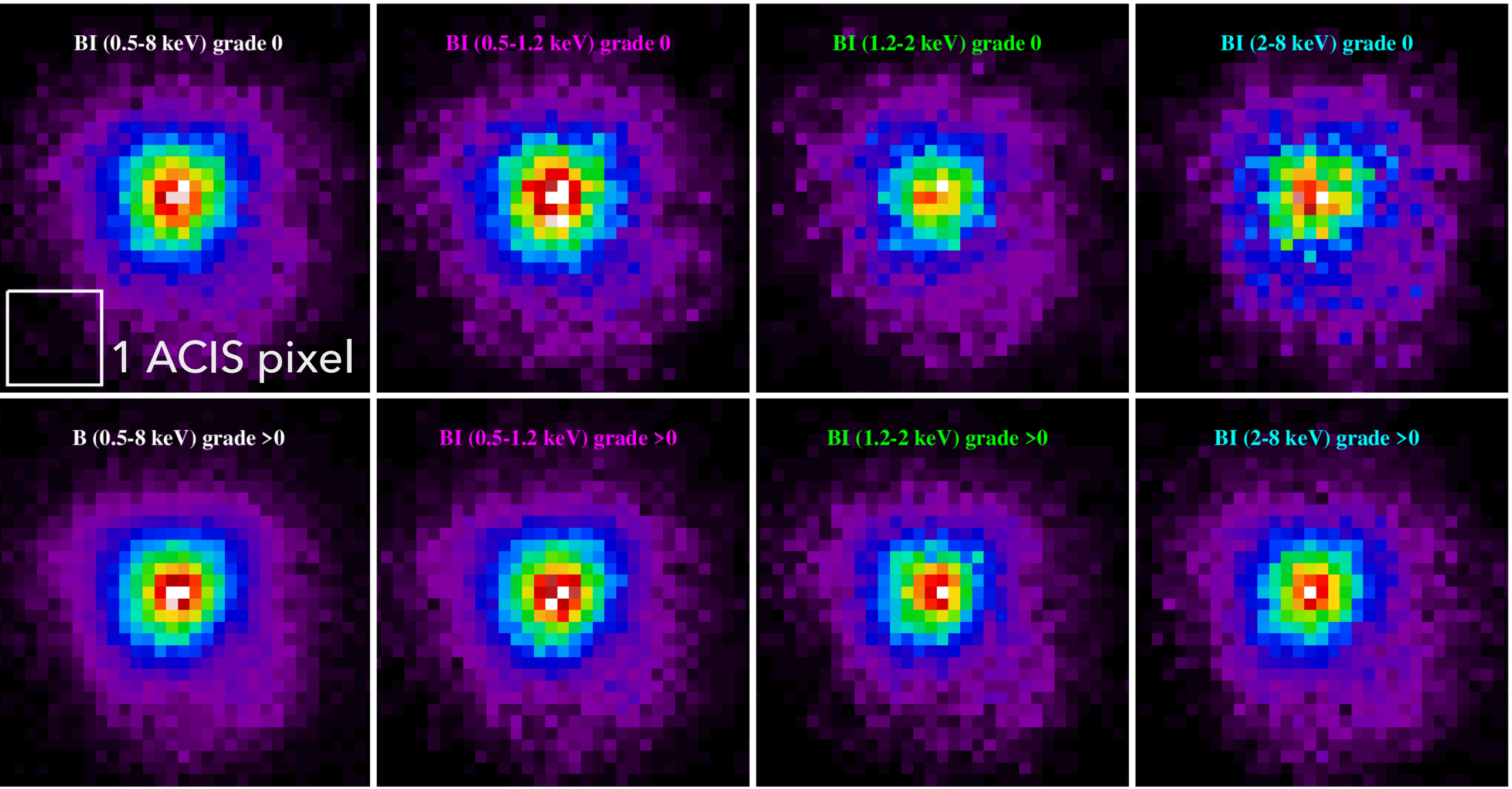
QUANTIFYING EDSER (V. KASHYAP, P. ZHAO, D. JERIUS)



QUANTIFYING EDSER (V. KASHYAP, P. ZHAO, D. JERIUS)



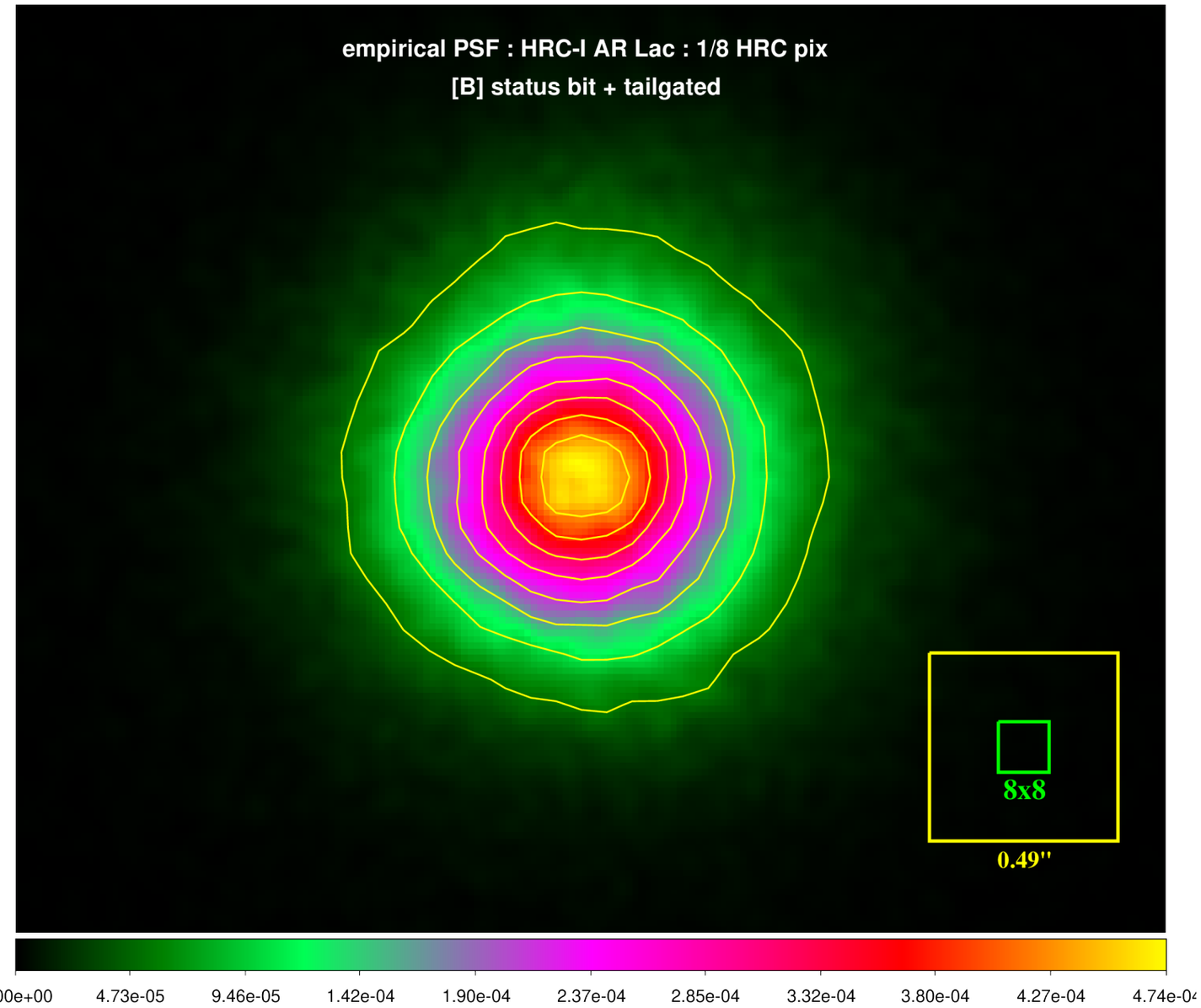
EMPIRICAL PSF WITH EDSER (V. KASHYAP, P. ZHAO, D. JERIUS)



Preliminary ACIS-BI empirical stacked and derolled PSF in different bands

Vinay Kashyap

HRC-I EMPIRICAL PSF (V. KASHYAP)

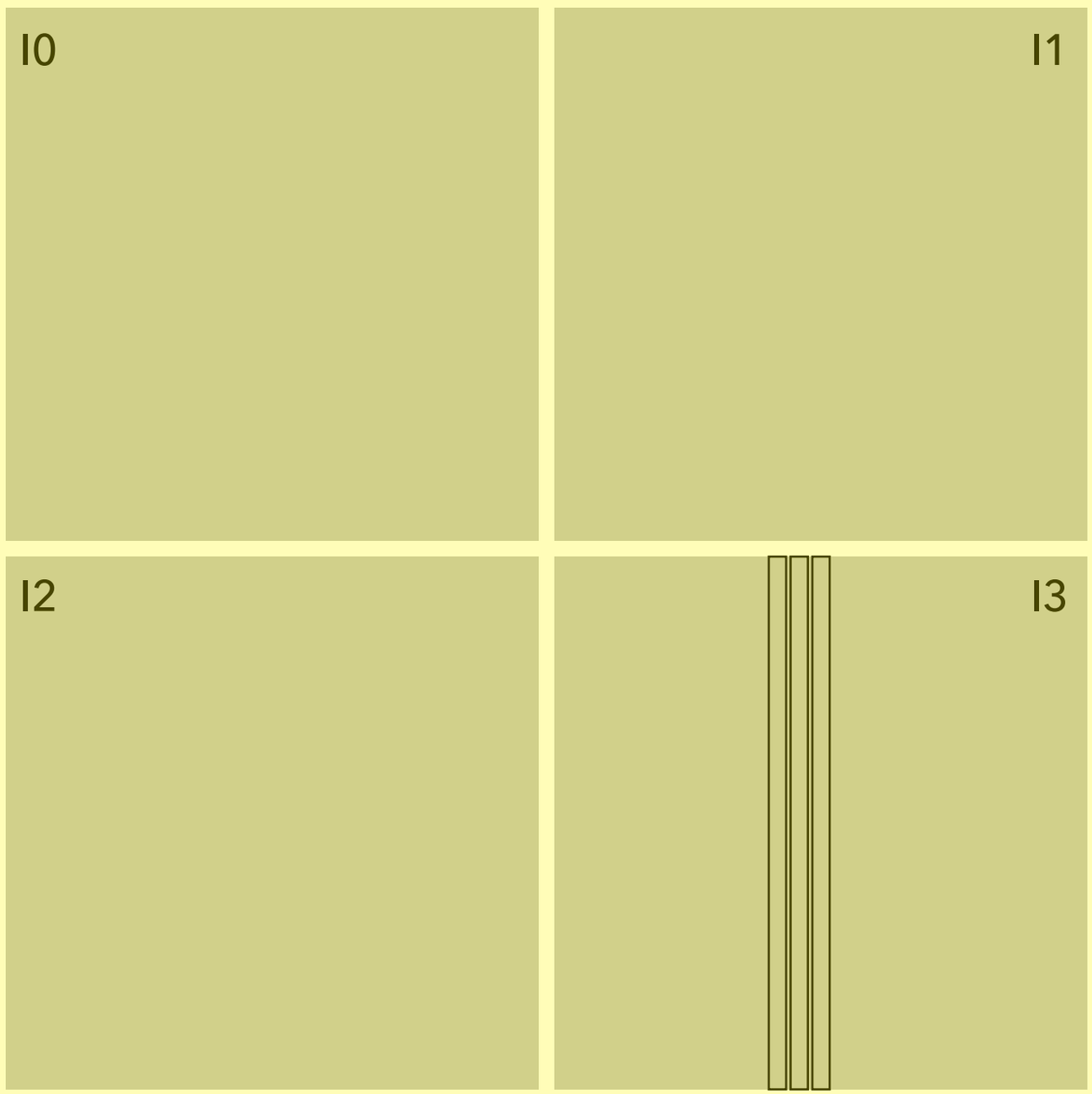


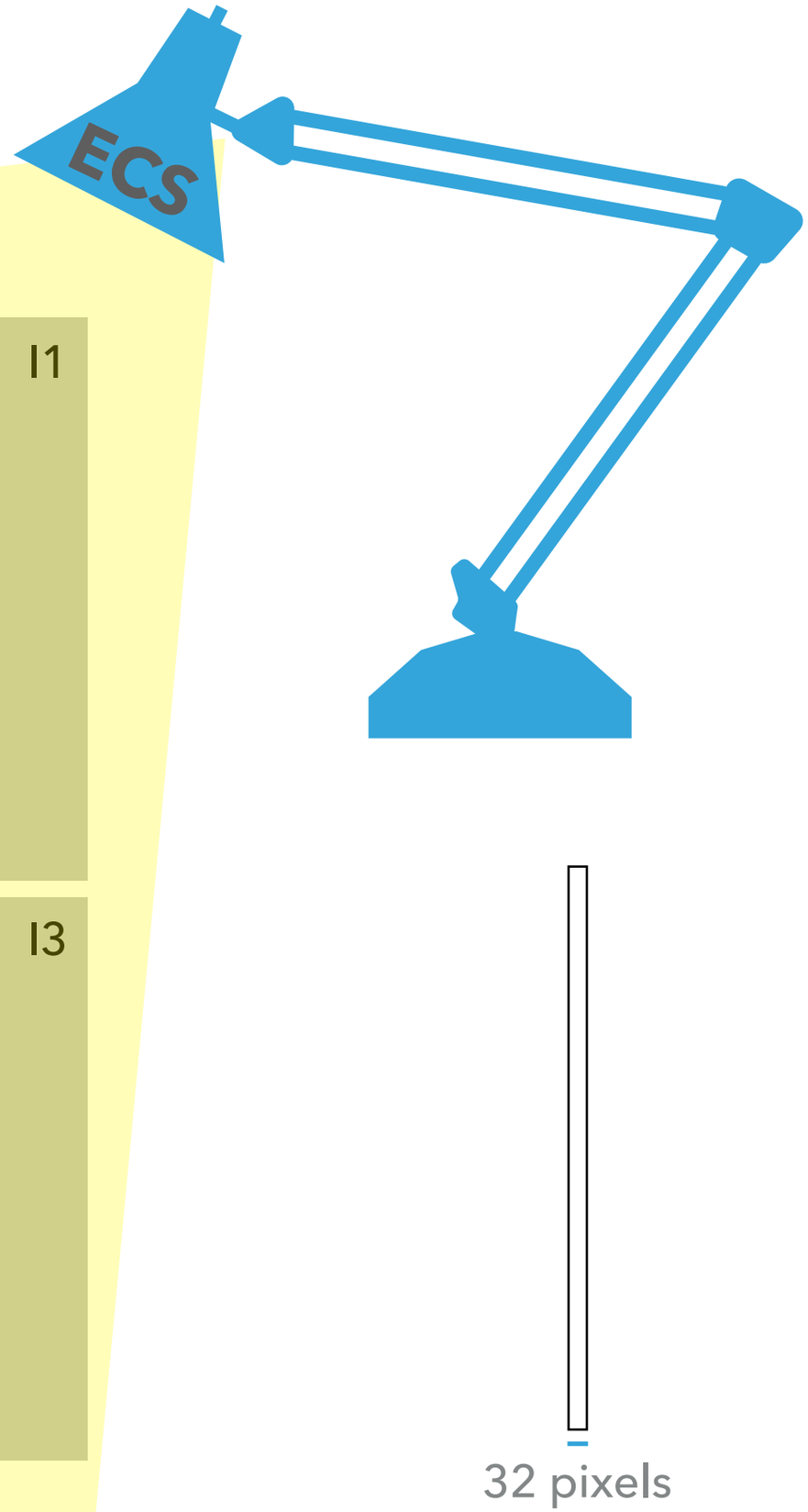
On-axis HRC-I AR Lac data, filtered on status-bits and tailgated events, derolled, and stacked (contours at 10% intervals from peak)

- HRC-I is the best for high spatial resolution analysis
- *pros*: no pixels, no pileup, low(ish) background
- *cons*: colorblind, tailgated events broaden PSF

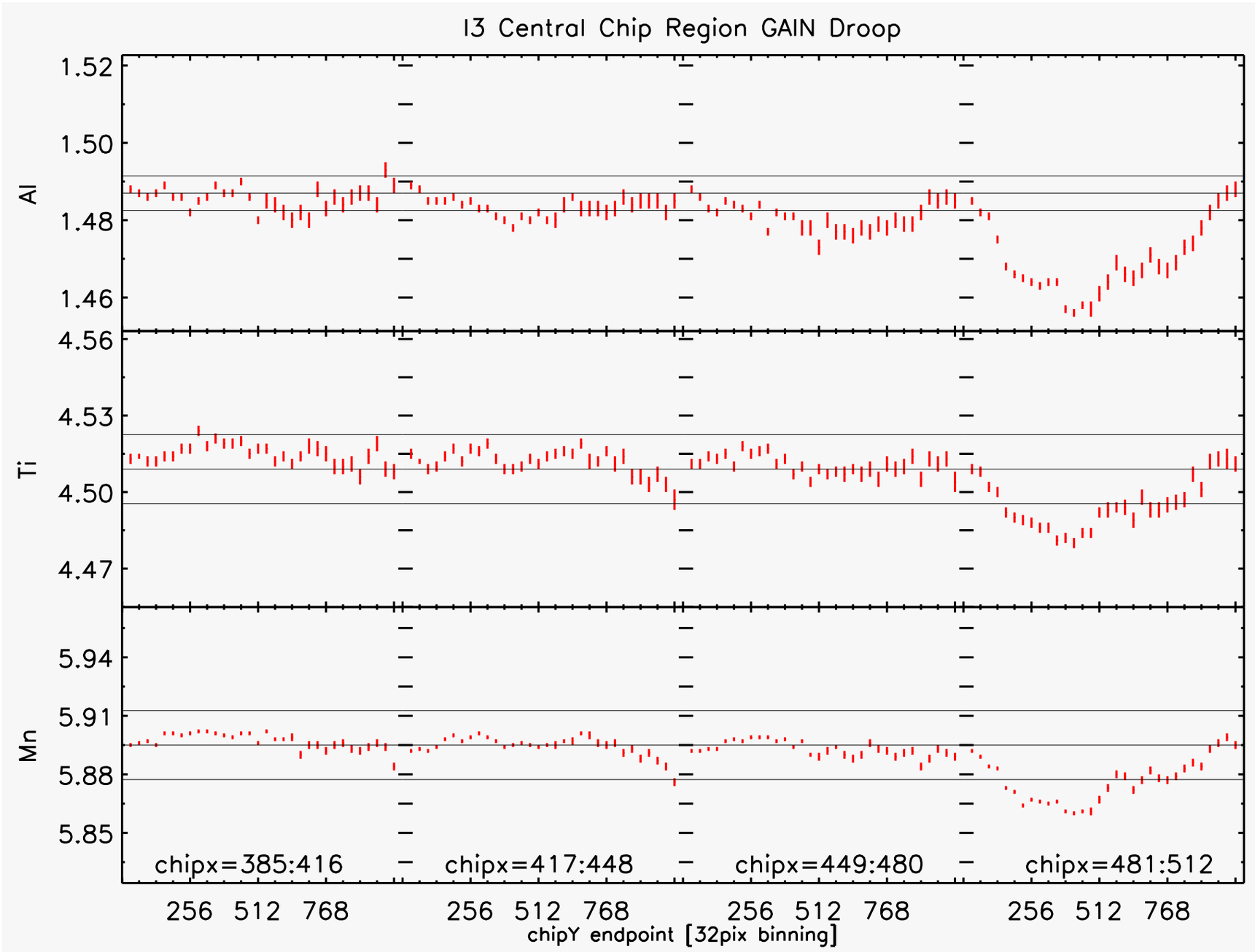
ADVANCED CCD IMAGING SPECTROMETER (ACIS)

MID-CHIP GAIN DROOP (T. GAETZ)

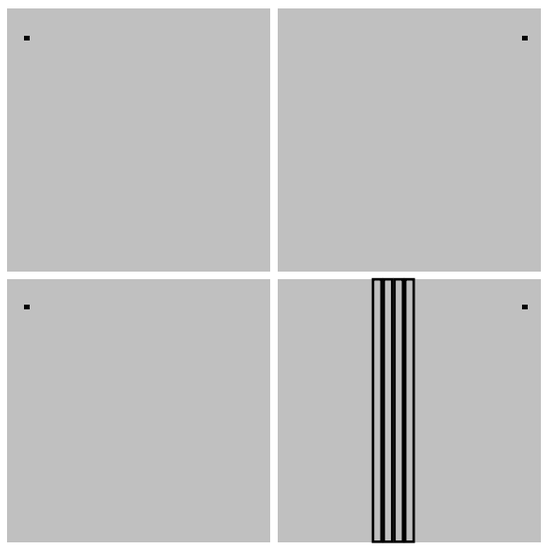




MID-CHIP GAIN DROOP (T. GAETZ)

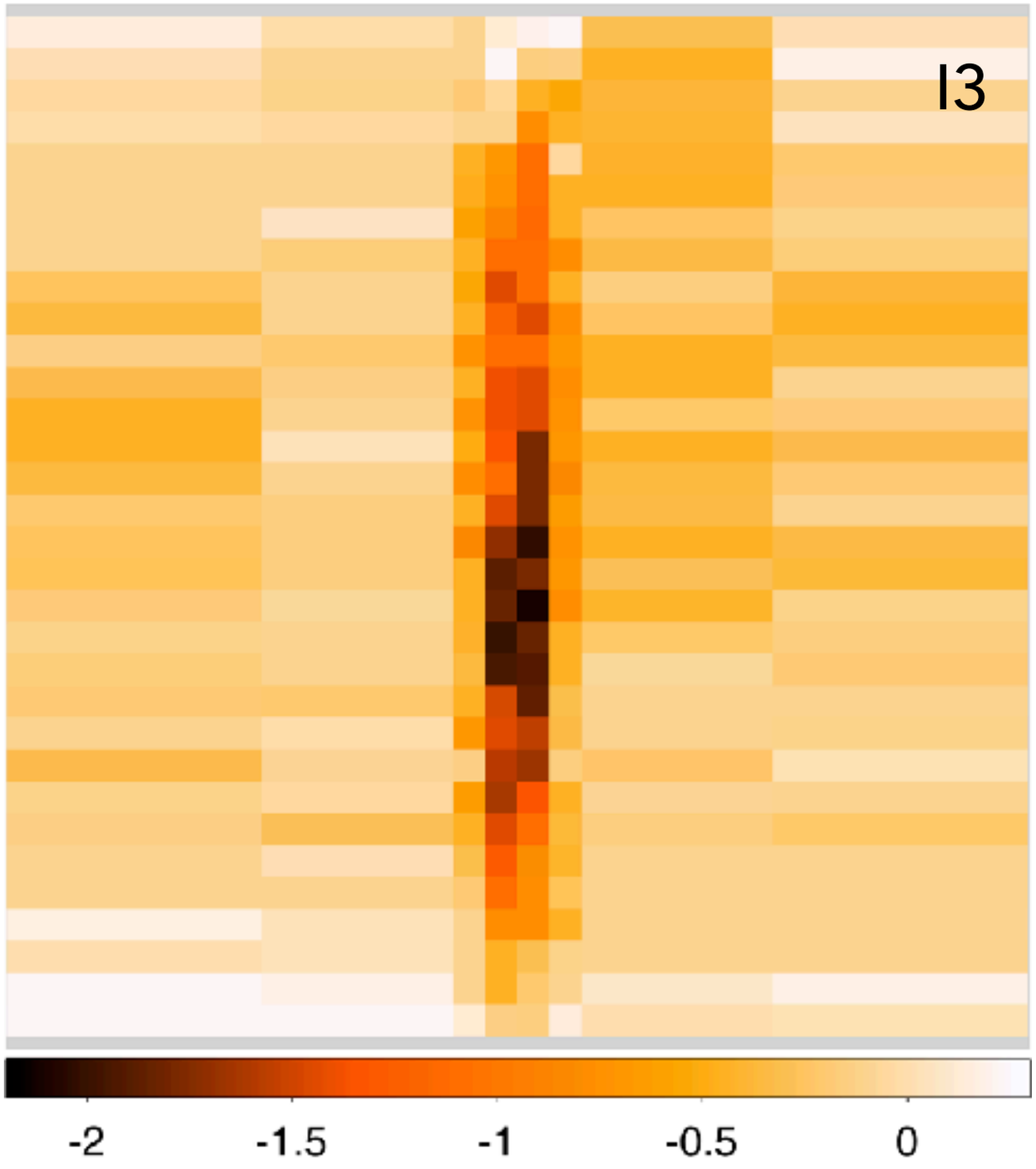


Epoch 1, -120.19 to -119.19 C

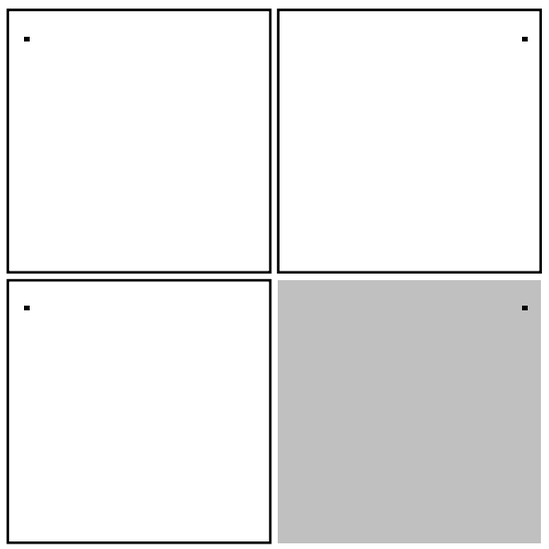


MID-CHIP GAIN DROOP (T. GAETZ)

Al K



Epoch 1, -120.19 to -119.19 C

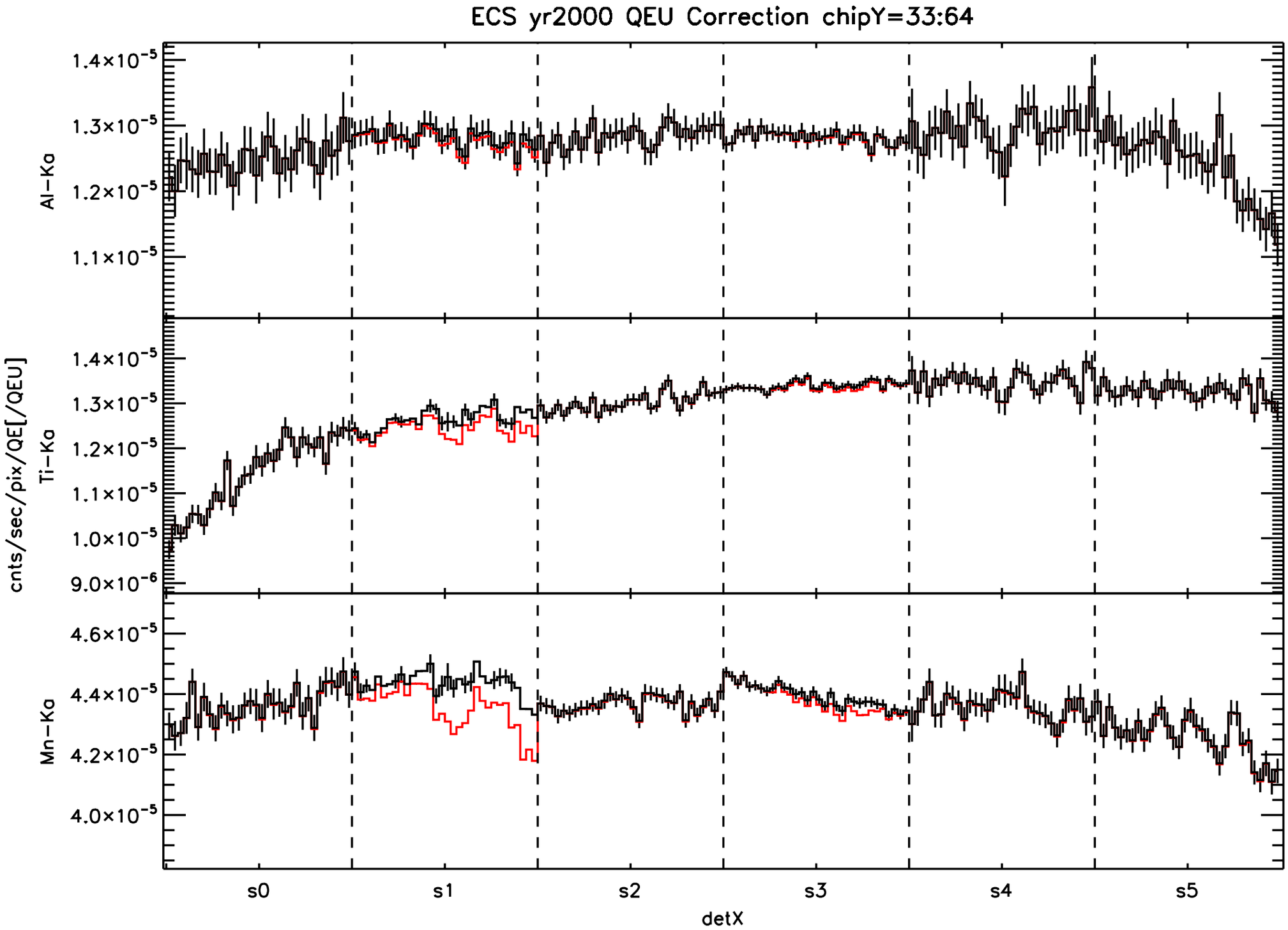


QUANTUM EFFICIENCY UNIFORMITY (R. DURHAM, P. PLUCINSKY)

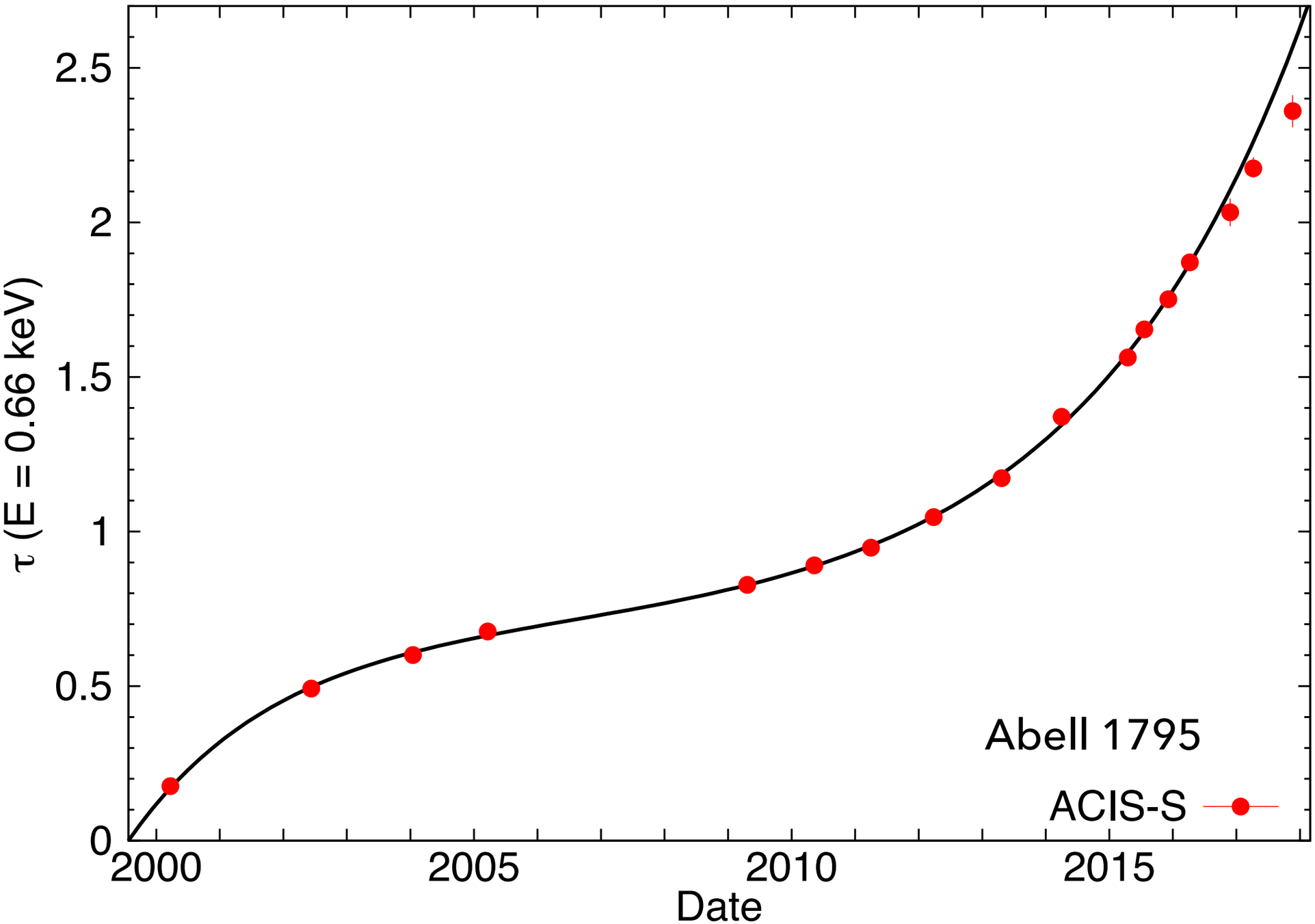
1.5 keV

4.5 keV

5.9 keV



FILTER CONTAMINATION LAYER (A. BOGDAN, H. MARSHALL, P. PLUCINSKY ET AL)



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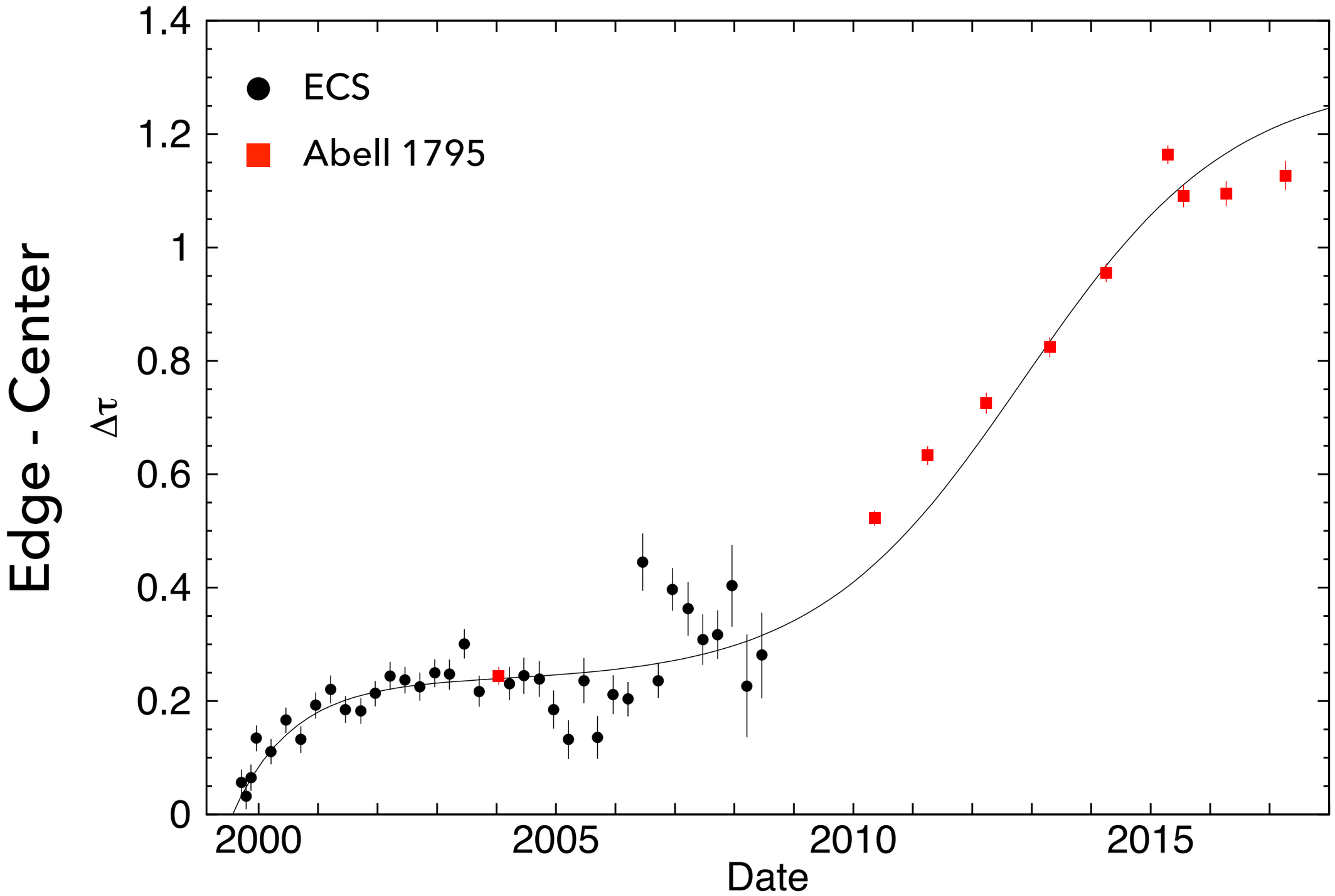
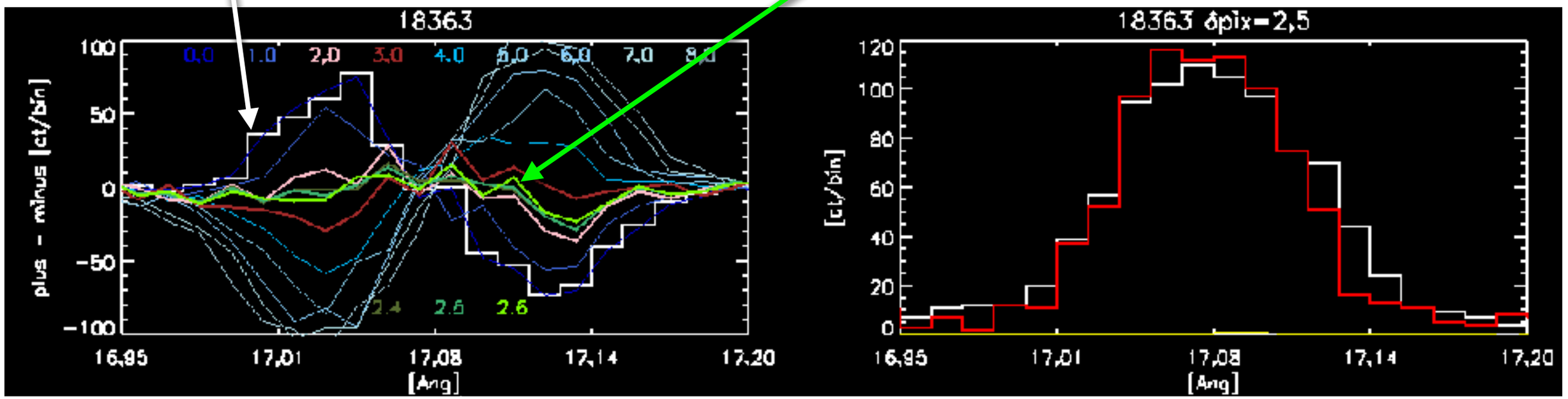


HIGH RESOLUTION CAMERA

HRC-S DEGAP UPDATE (V. KASHYAP)

Old line profile difference

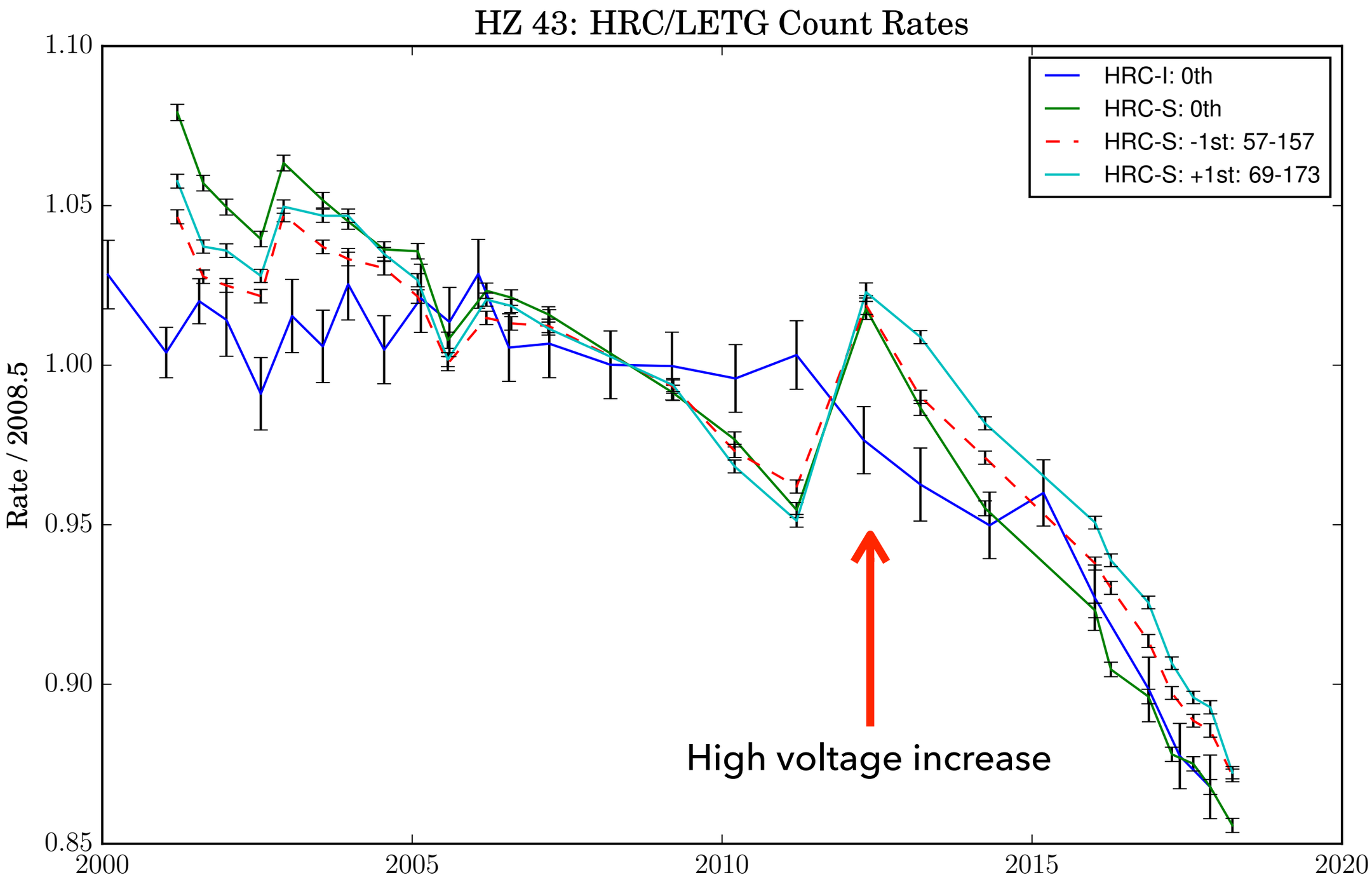
New line profile difference



- HRC-S aim point degap solution improved in 2012 ==> sharper images
- But…! Caused a shift in derived wavelengths relative to 0th order location…

http://cxc.harvard.edu/cal/Hrc/Degap/hrcsdegap_centershift.html

QUANTUM EFFICIENCY DECLINE (B. WARGELIN, P. RATZLAFF, V. KASHYAP, J. DRAKE)



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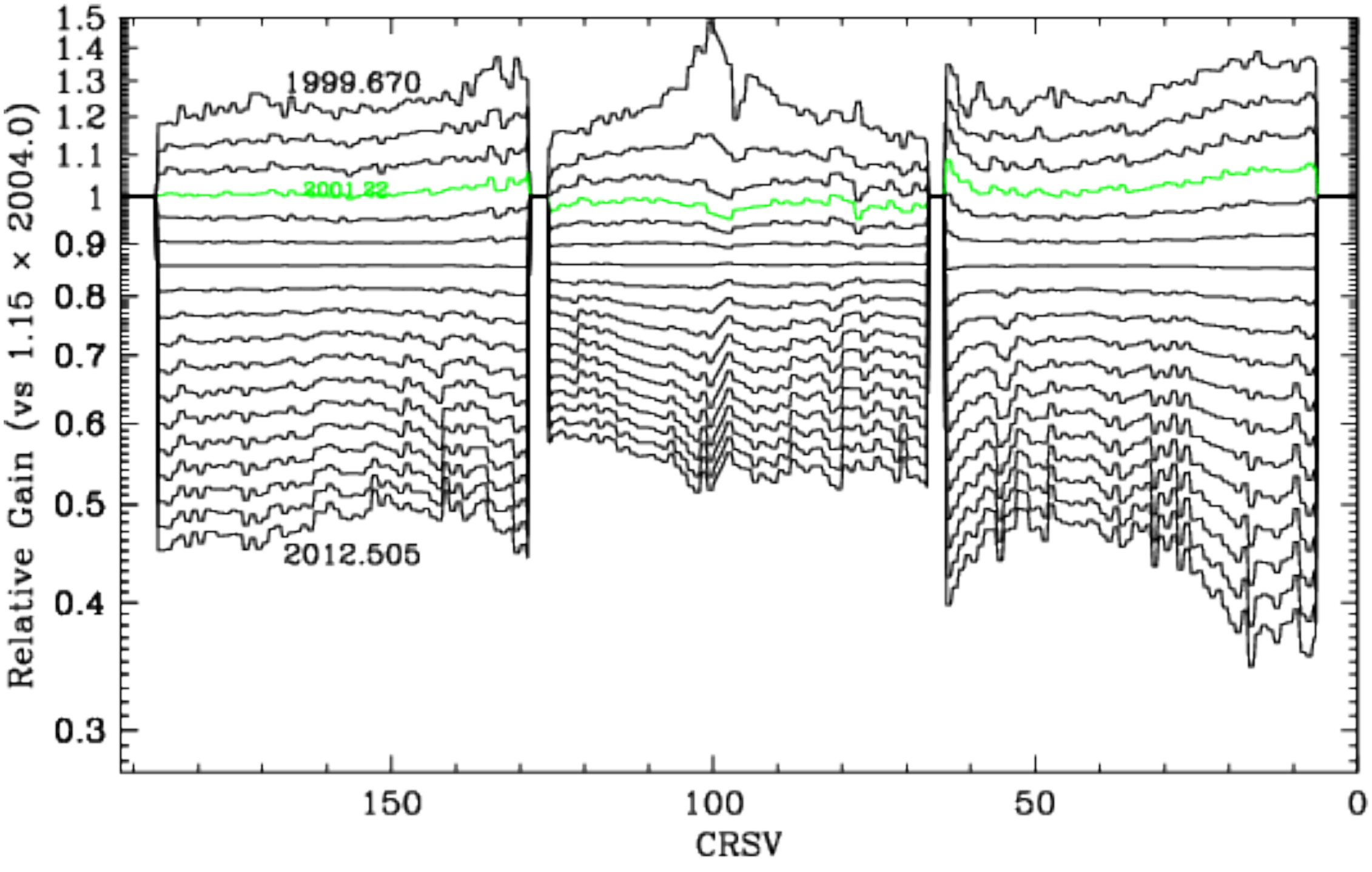
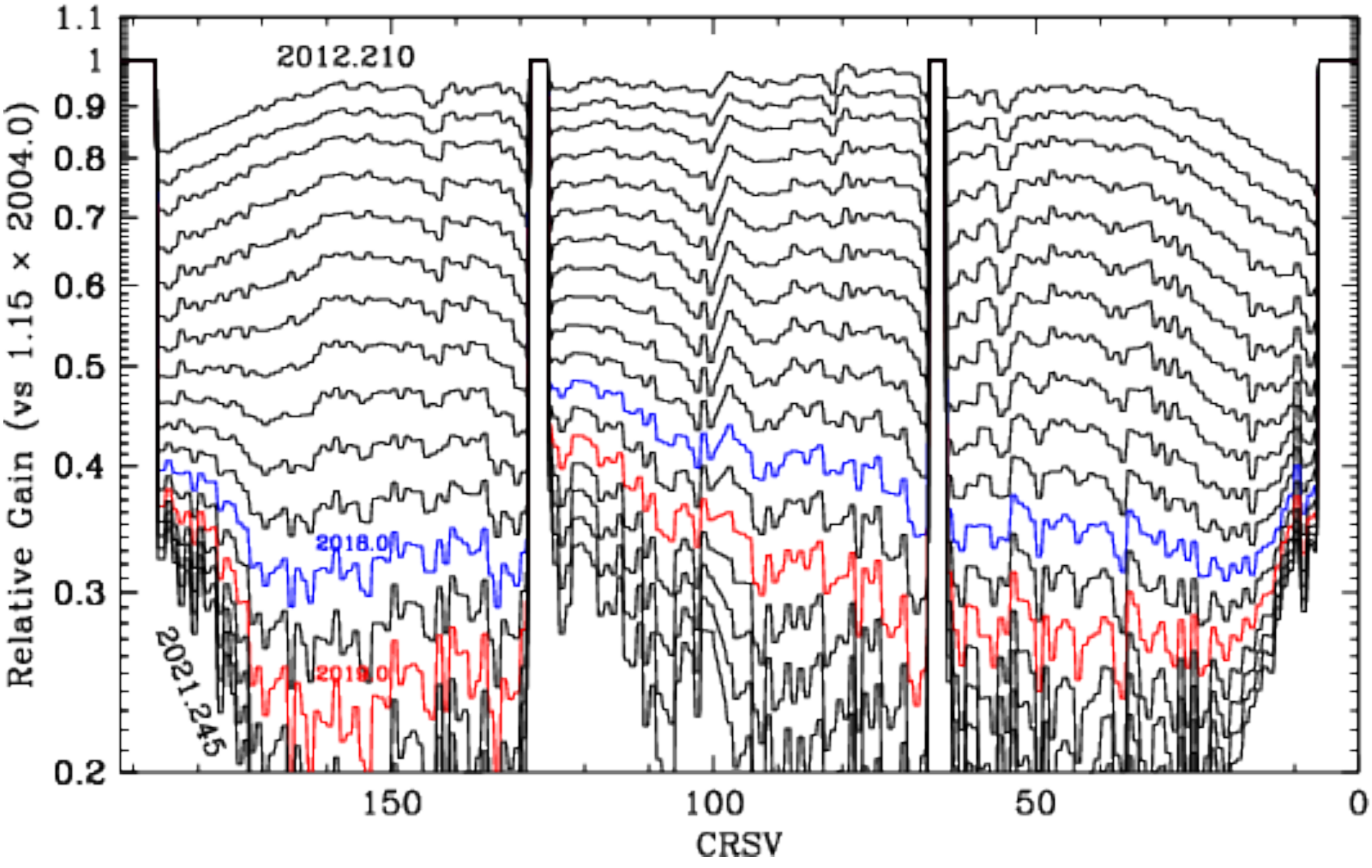
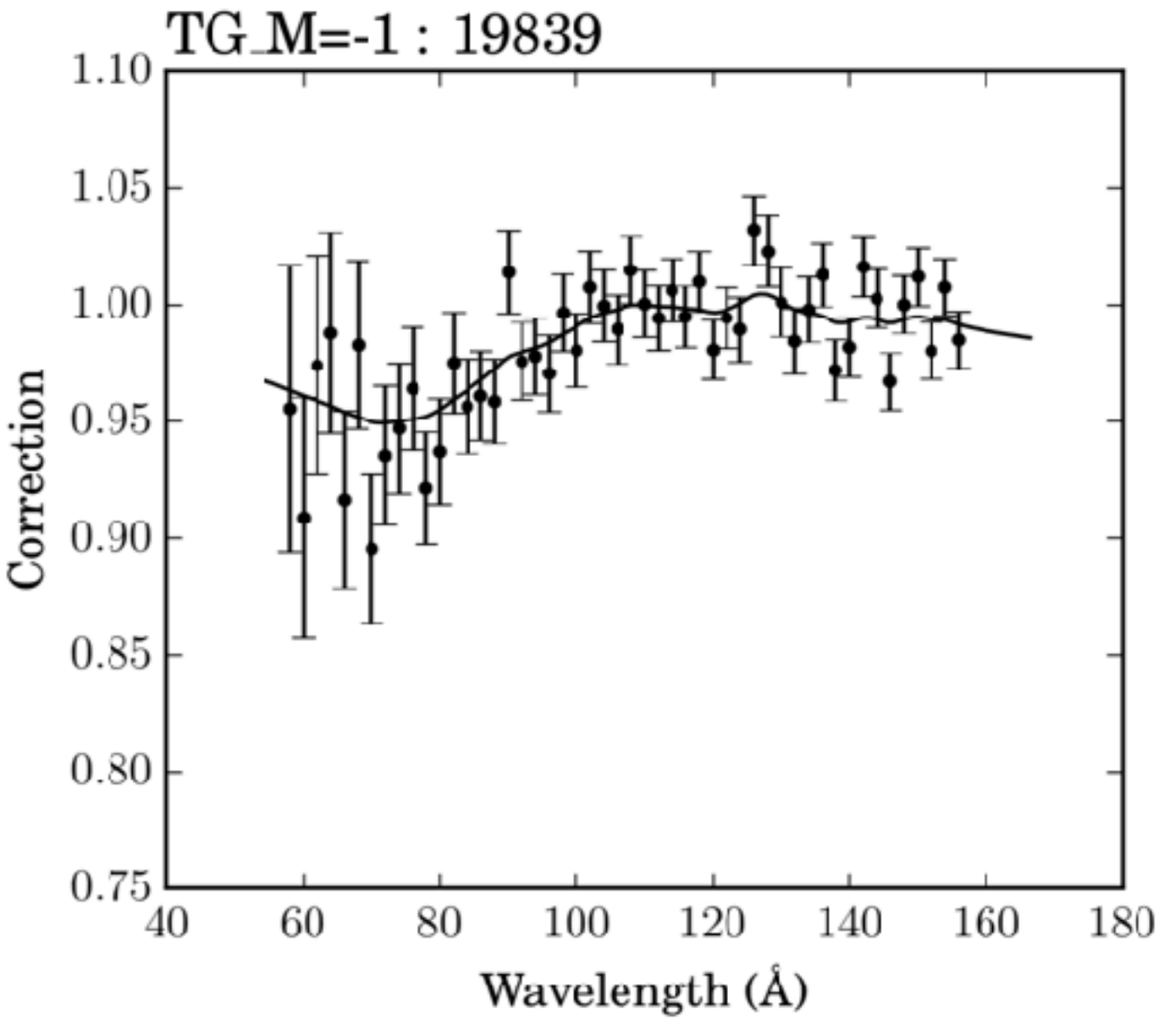


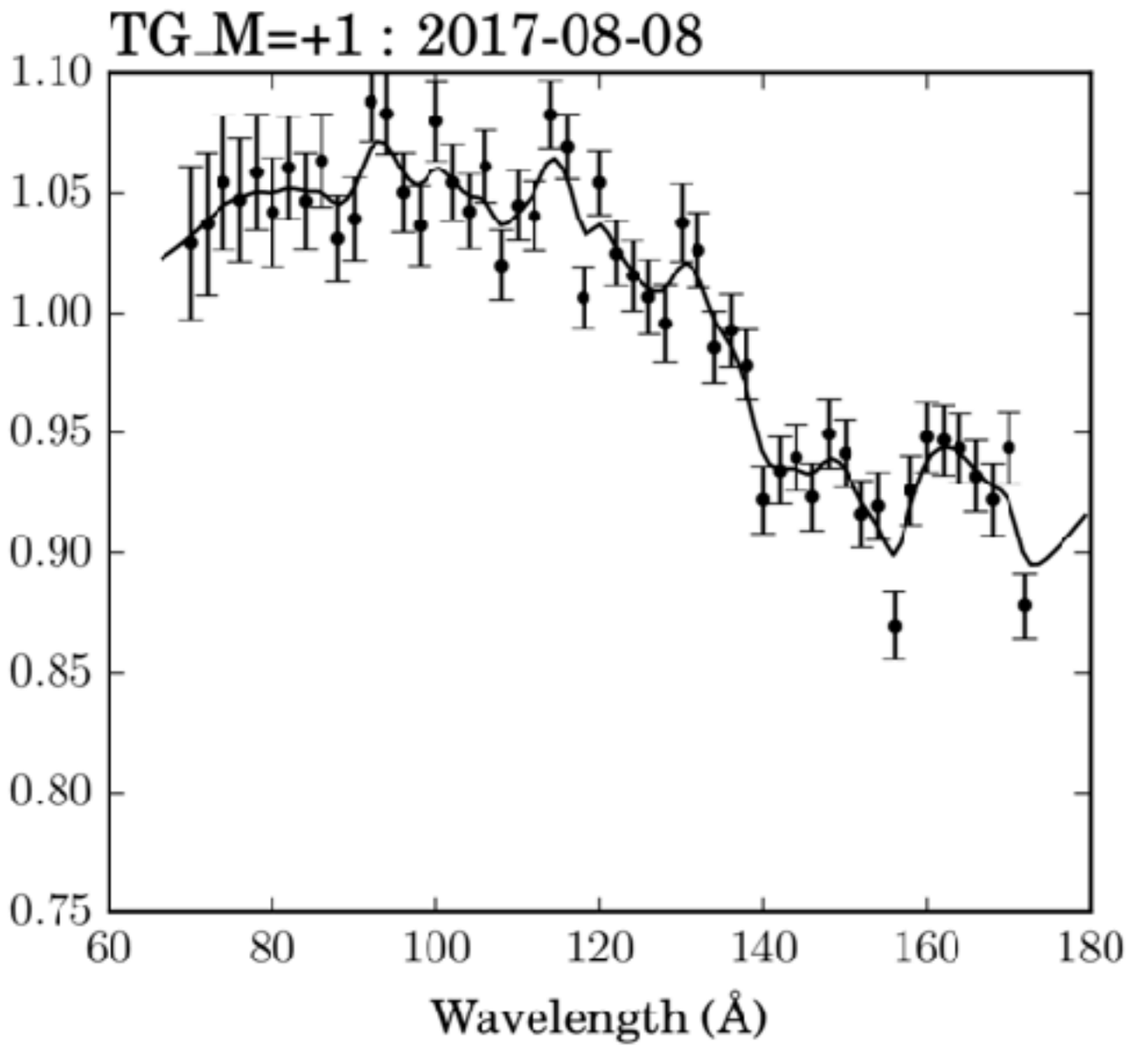
QUANTUM EFFICIENCY DECLINE (B. WARGELIN, P. RATZLAFF, V. KASHYAP, J. DRAKE)



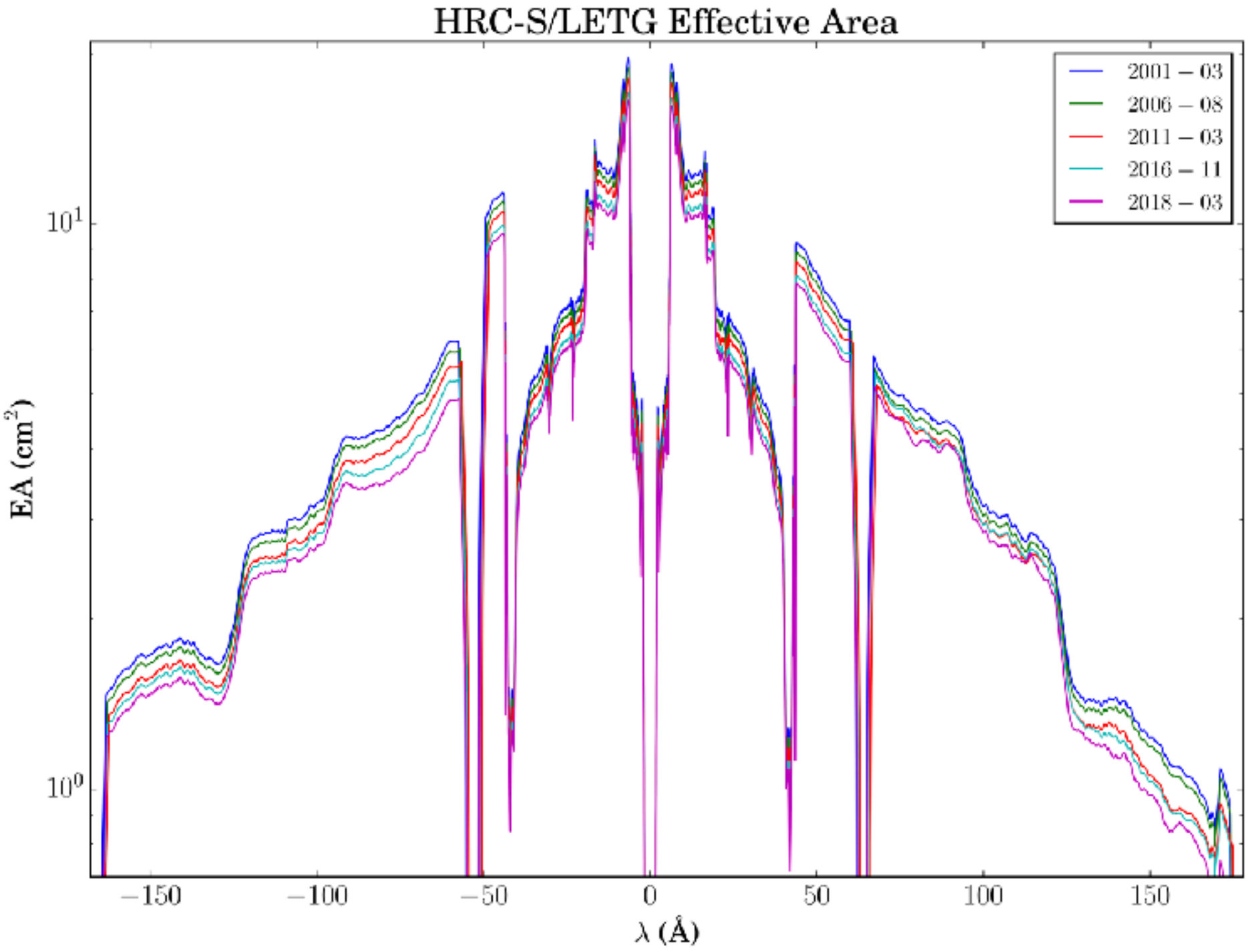
QUANTUM EFFICIENCY DECLINE (B. WARGELIN, P. RATZLAFF, V. KASHYAP, J. DRAKE)

HZ43 Empirical QEU Corrections

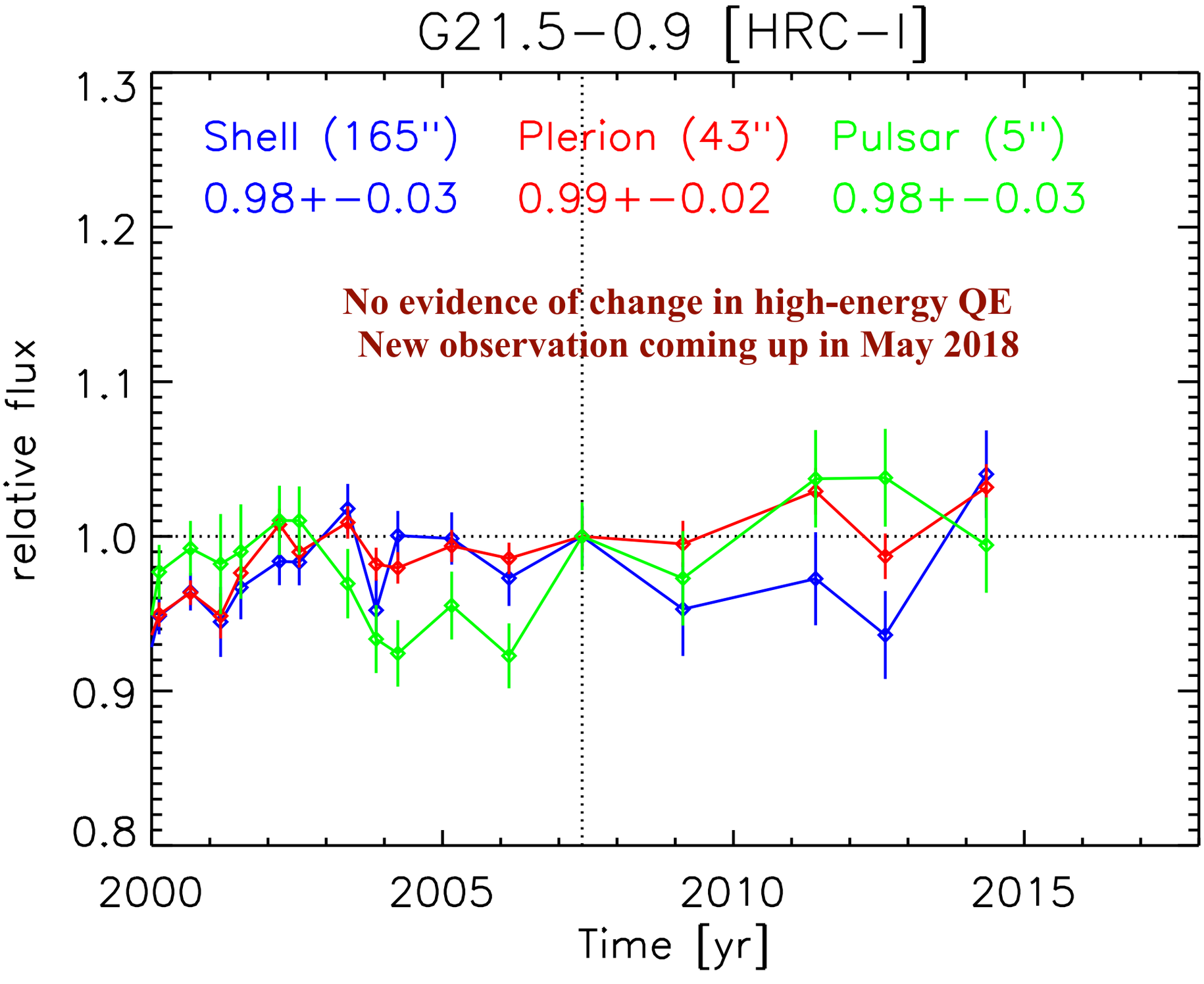




QUANTUM EFFICIENCY DECLINE (B. WARGELIN, P. RATZLAFF, V. KASHYAP, J. DRAKE)



HRC-I HIGH ENERGY QE (V. KASHYAP, P. RATZLAFF)



Vinay Kashyap

SUMMARY

- EDSER PSF calibration well underway; empirical PSFs soon
- ACIS mid-chip gain droop calibration ongoing
- ACIS QEU improvements underway
- ACIS contamination model will be updated: slower rate of increase; uniform rate of increase across detector
- Continuing HRC-S QE secular changes calibrated; HRC-I QE re-calibration underway
- HV increase on HRC-S…. Only a matter of time


So, how is the concordance project coming along?
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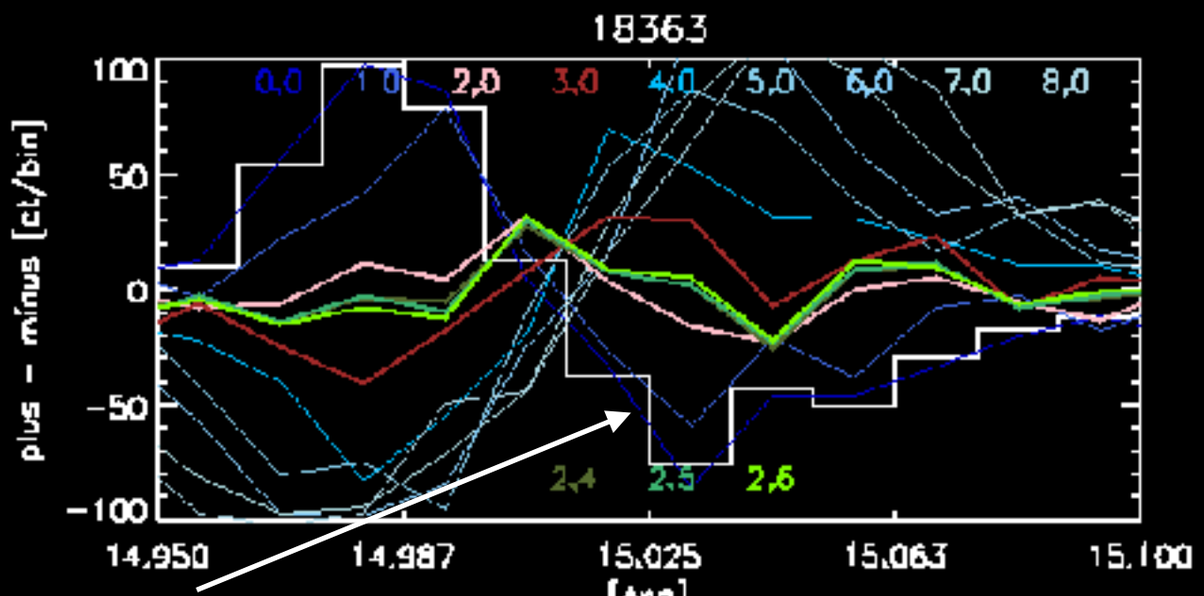
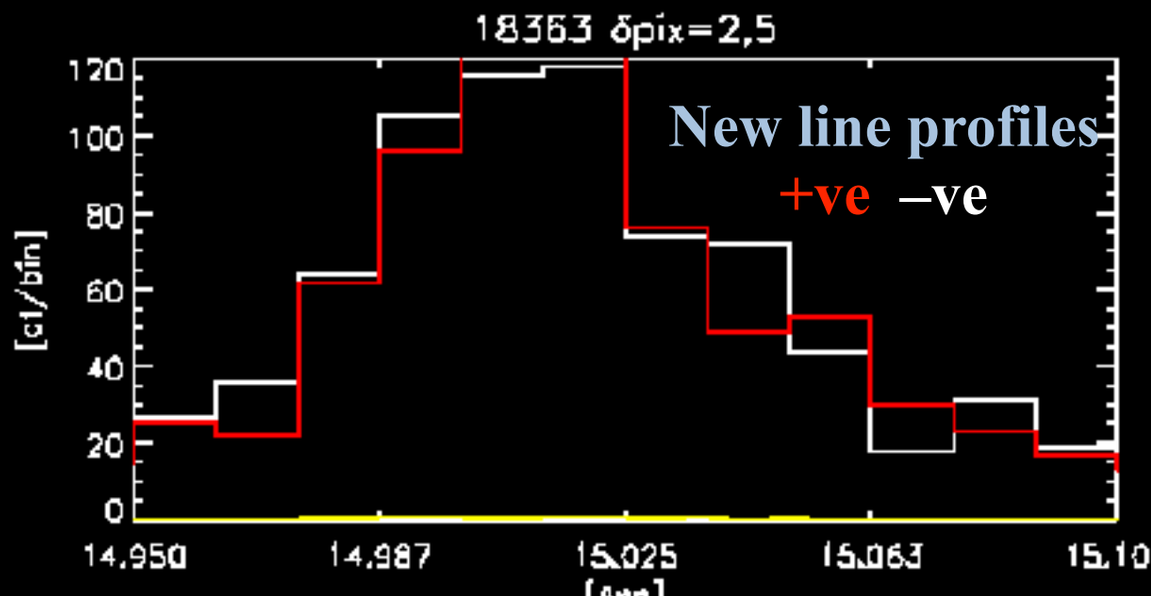
SUPPLEMENTARY MATERIAL

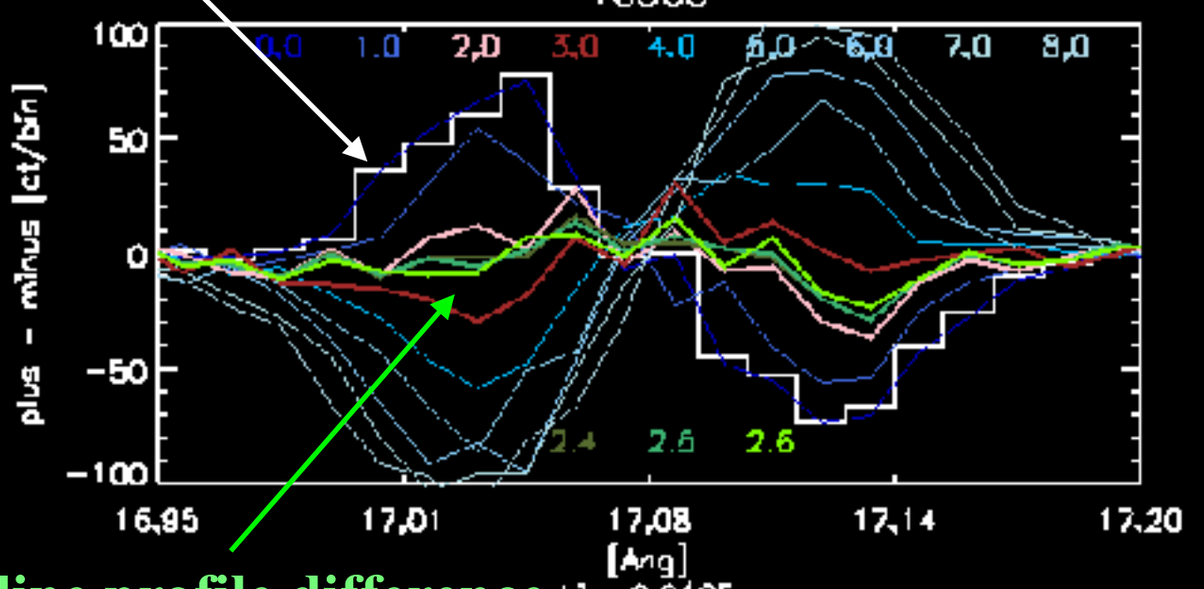
TE

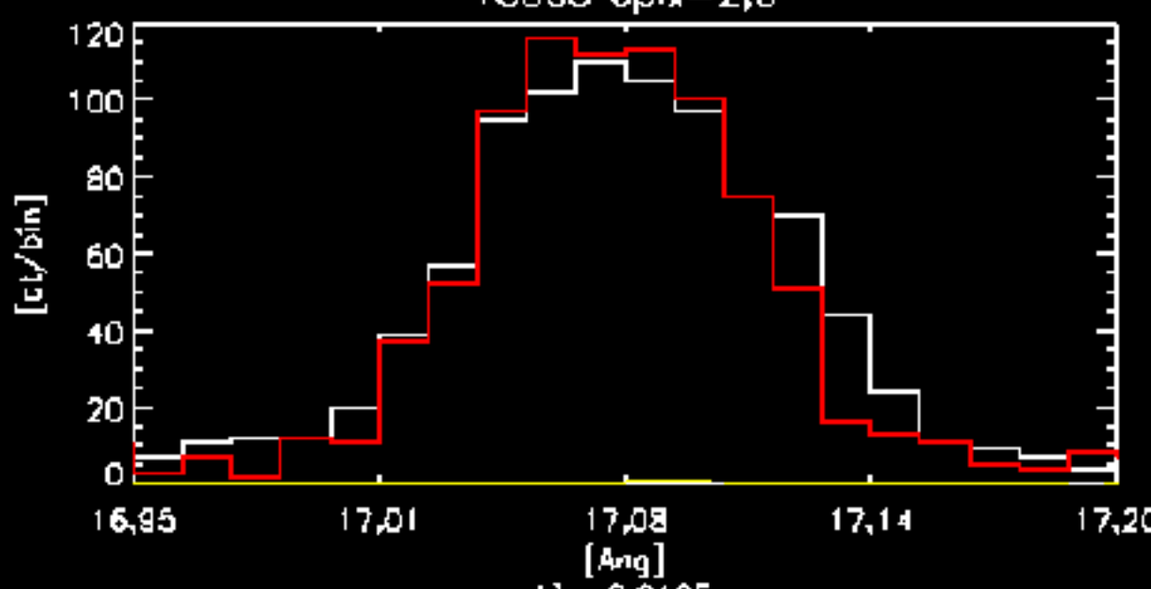
Old line profile difference

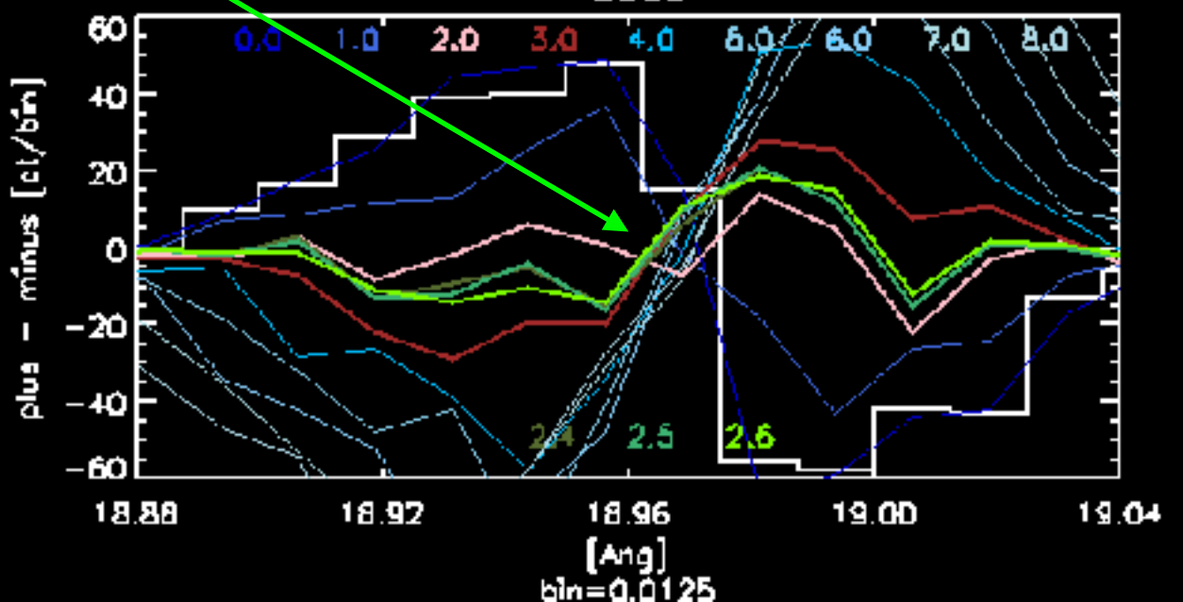
New line profile difference

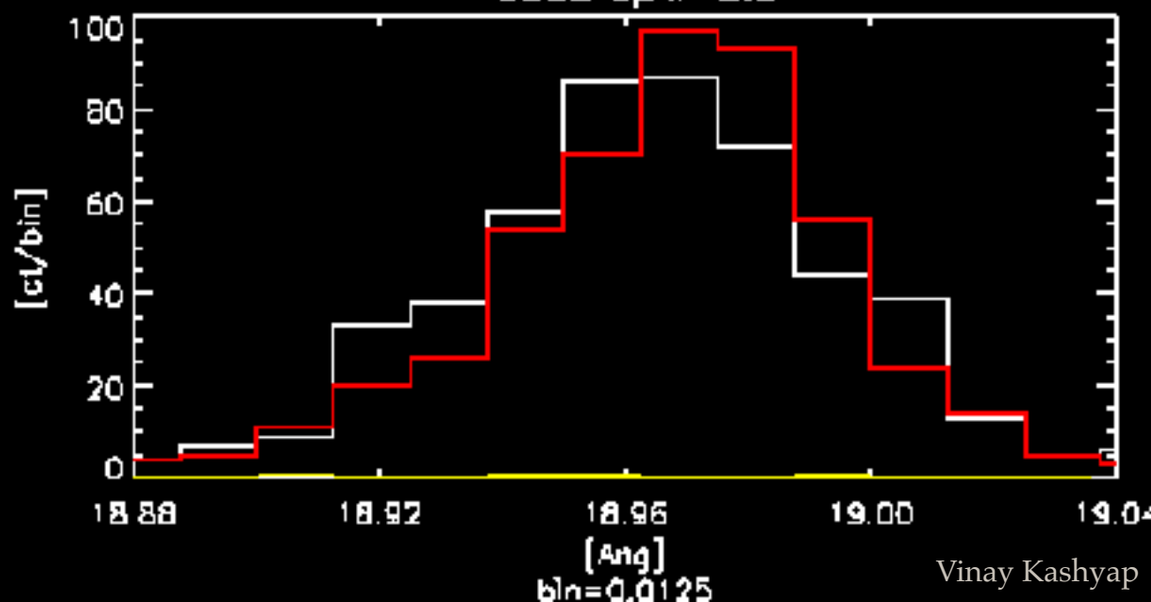












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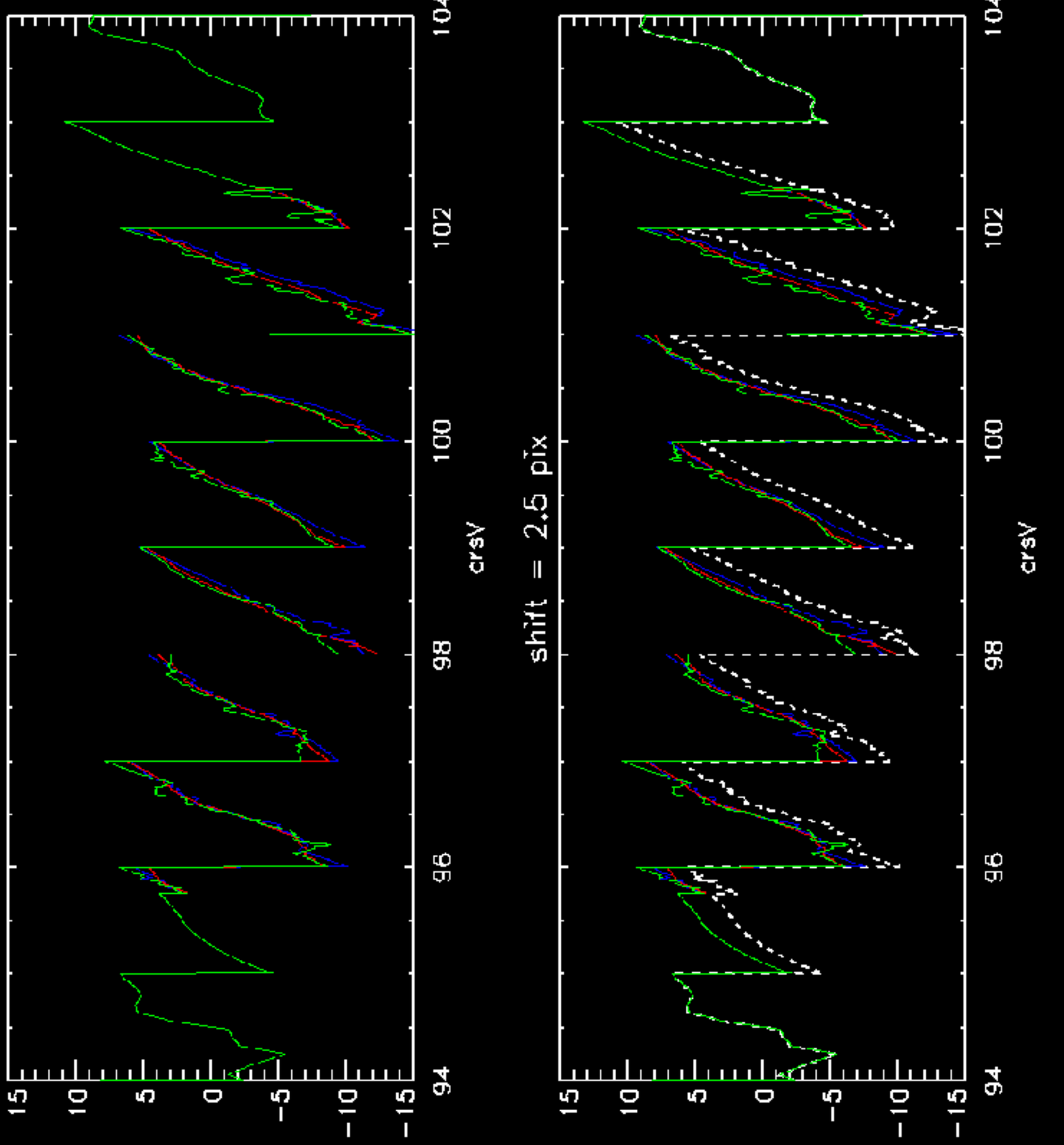
A simple fix: shift the degap for V taps near aim point by +2.5 pix

Top: old (blue/green/red are AMP_SF=1,2,3)

Bottom: new (dashed = old AMP_SF=1)

Vinay Kashyap



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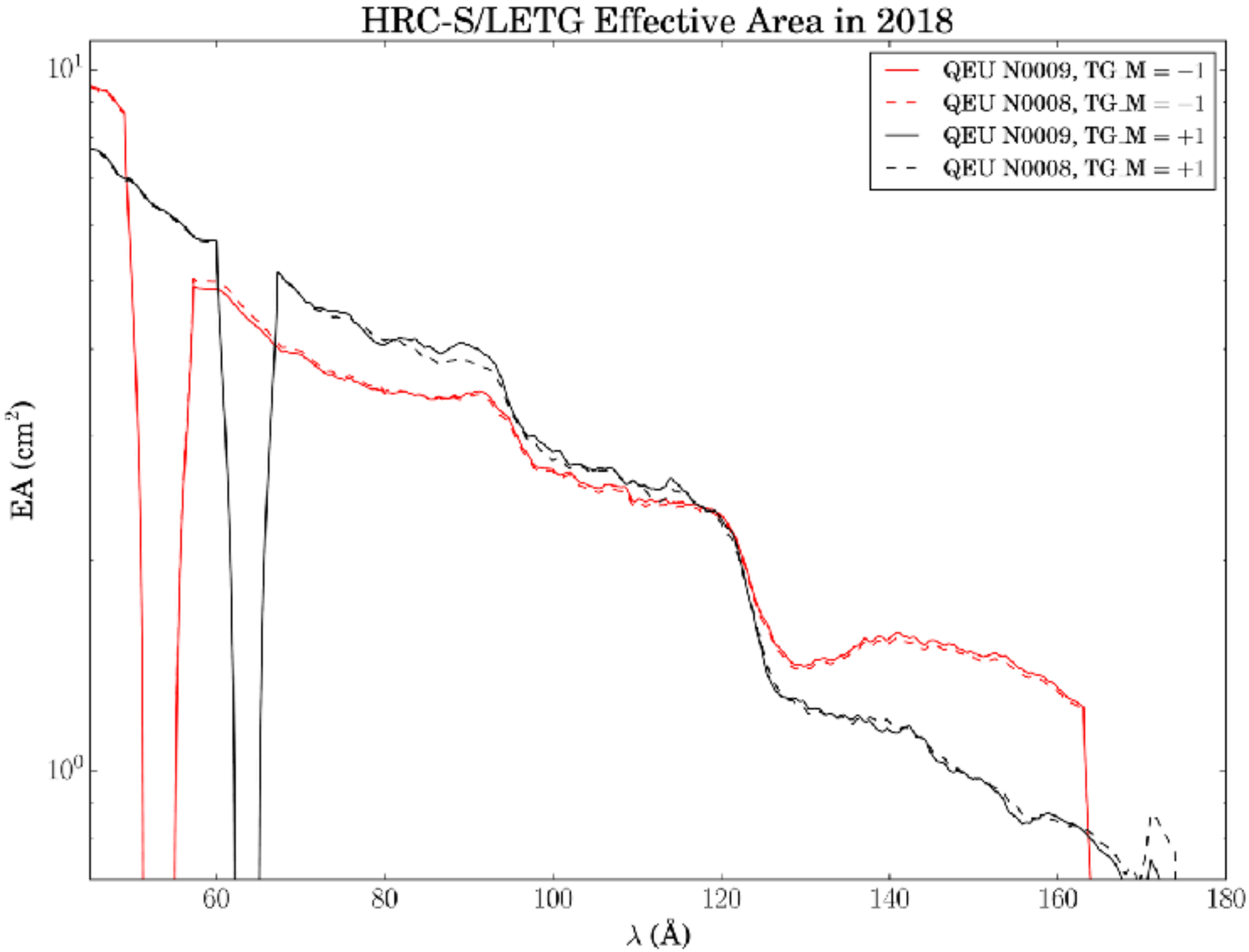
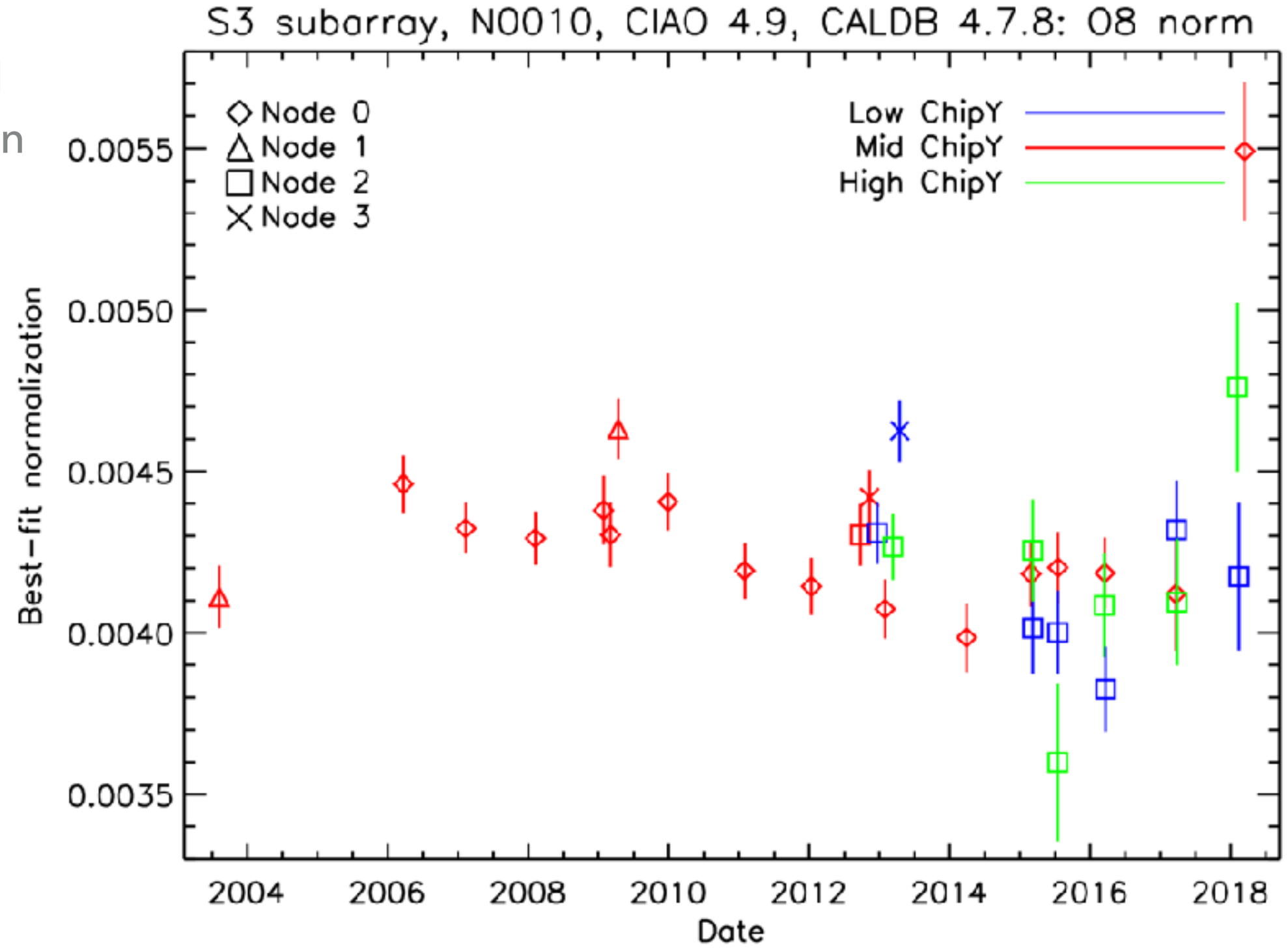
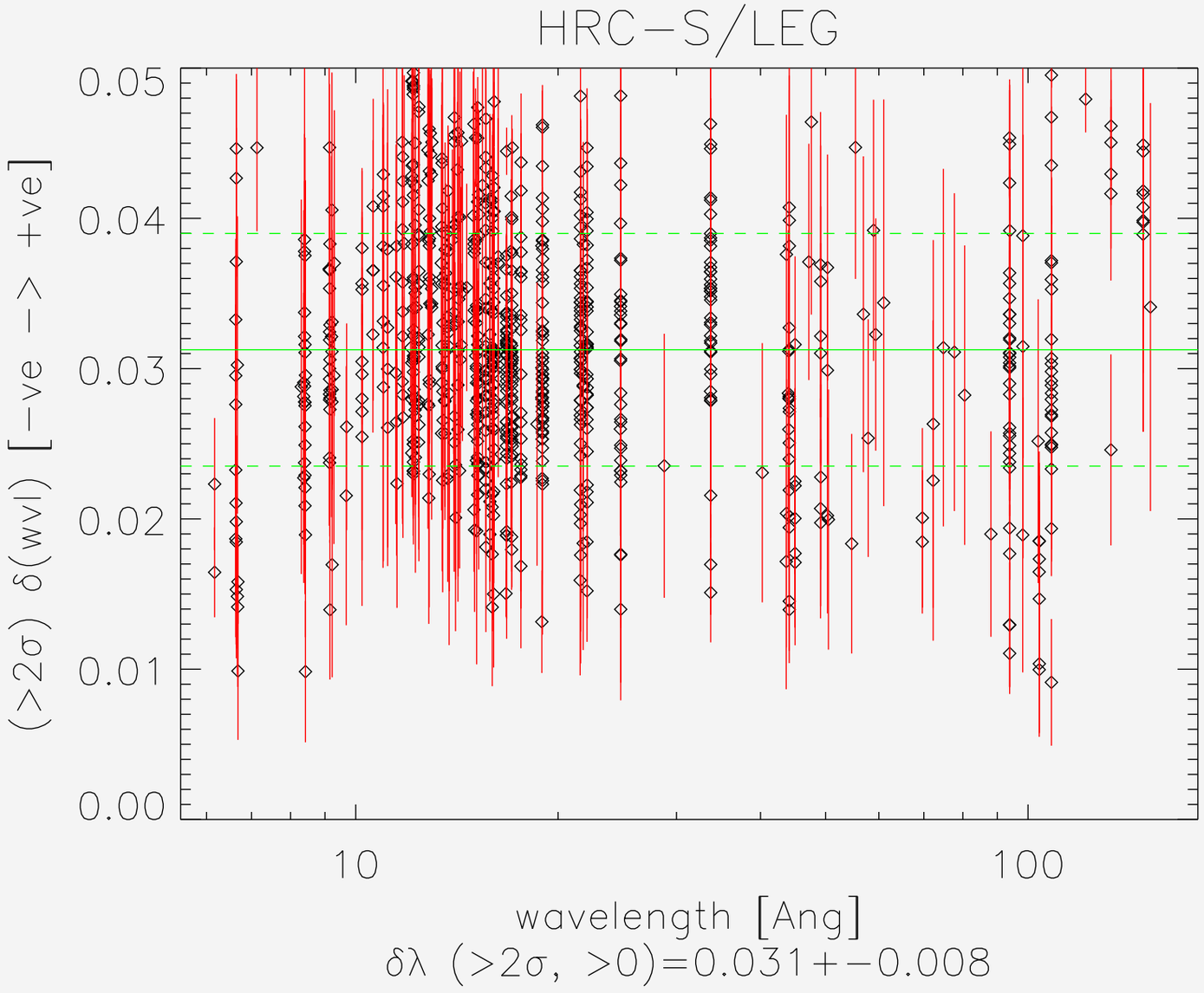


FILTER CONTAMINATION LAYER (A. BOGDAN, H. MARSHALL, P. PLUCINSKY ET AL)

E0102 O VIII normalisation



HRC-S DEGAP UPDATE (V. KASHYAP)



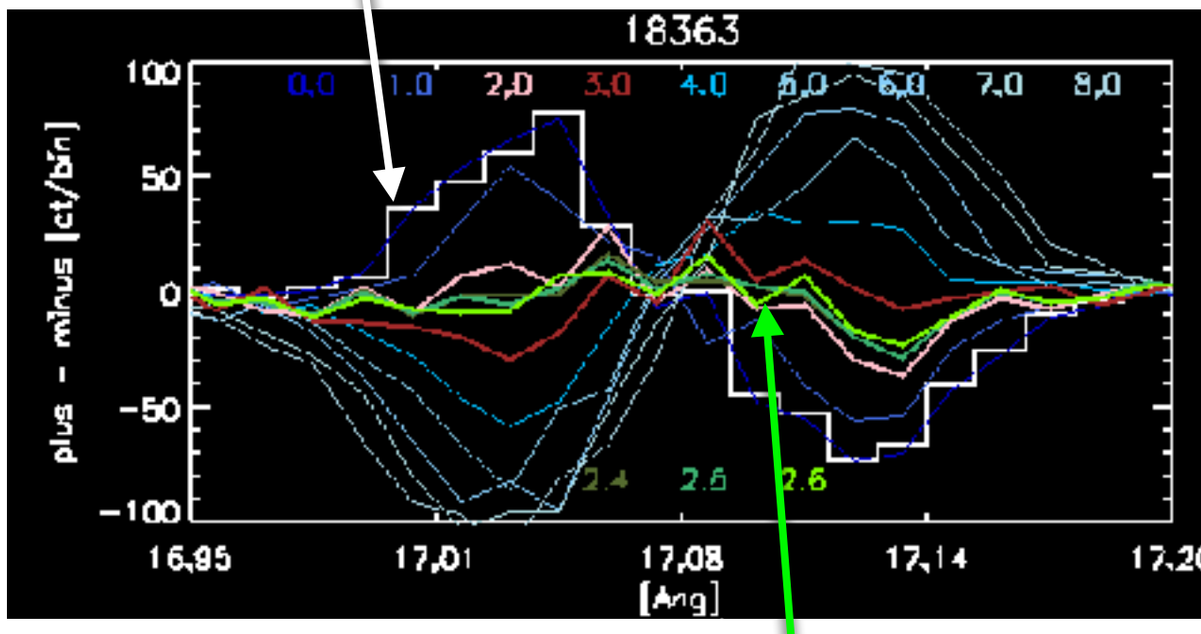
Measured shifts between strong lines seen in coronal sources observed with LETGS+HRC-S

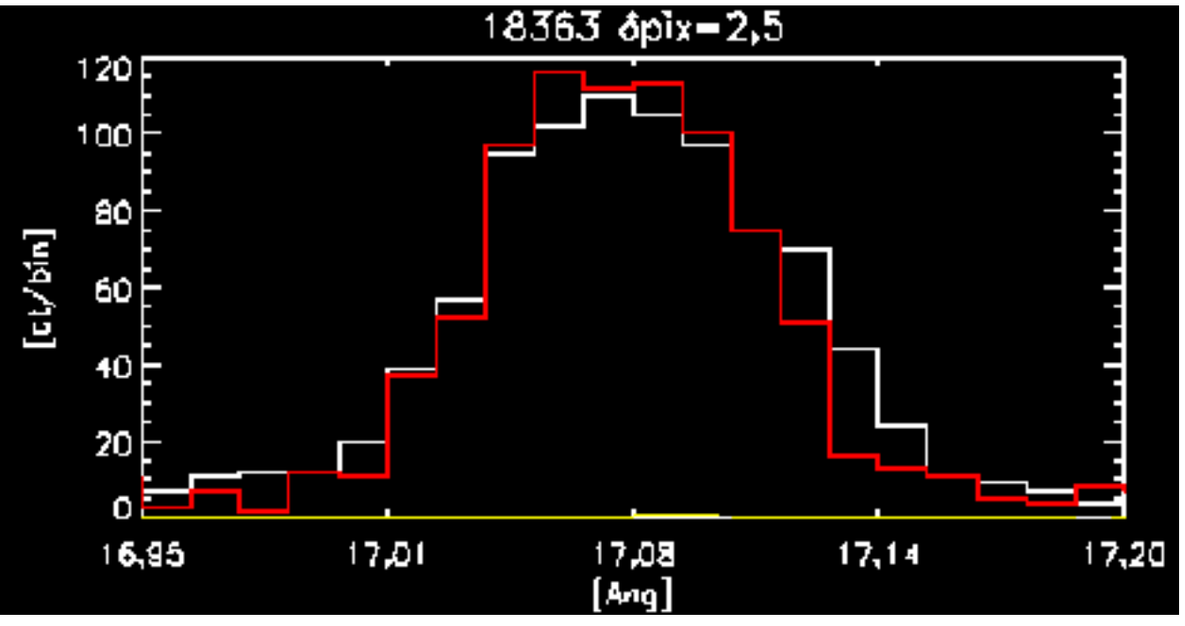
- HRC-S aim point degap solution improved in 2012 ==> sharper images
- But introduced a 2-3 pixel offset in absolute astrometry!
- Caused a shift in derived wavelengths relative to 0th order location

http://cxc.harvard.edu/cal/Hrc/Degap/hrcsdegap_centershift.html

HRC-S DEGAP UPDATE (V. KASHYAP)

Old line profile difference

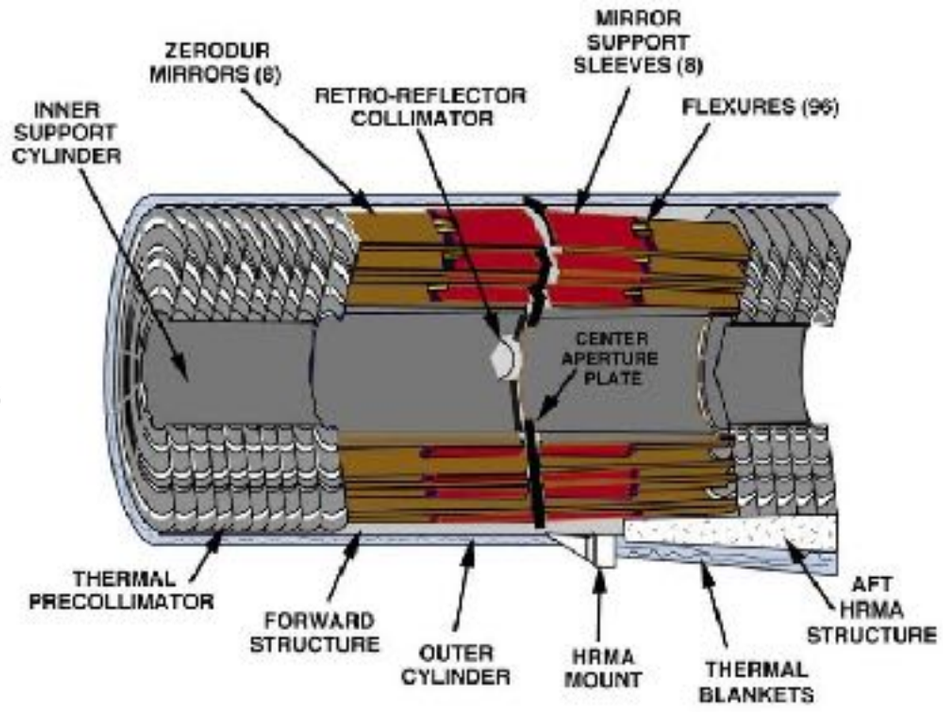




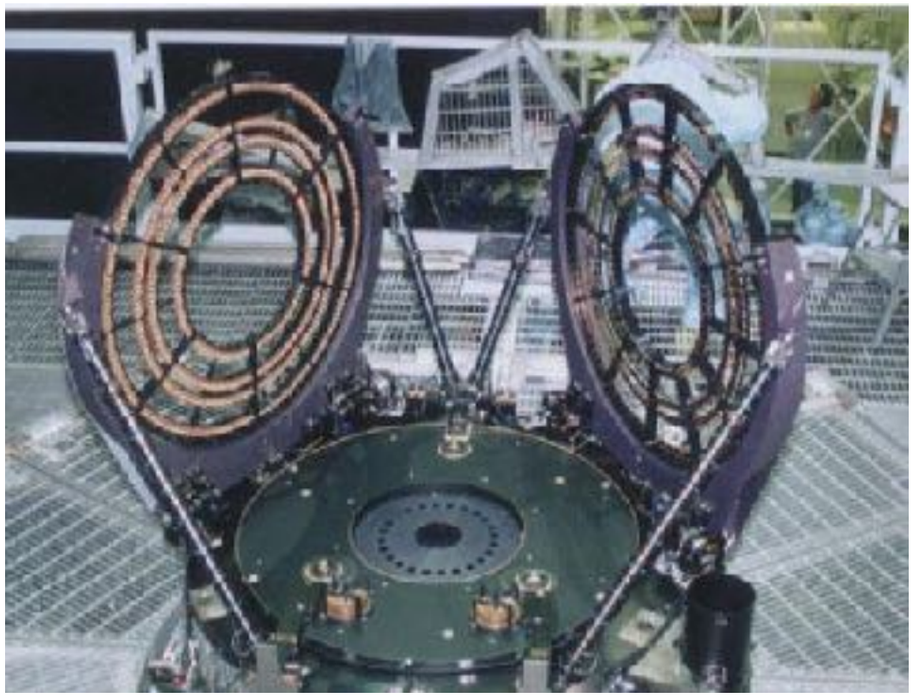
New line profile difference

CHANDRA HARDWARE COMPONENTS

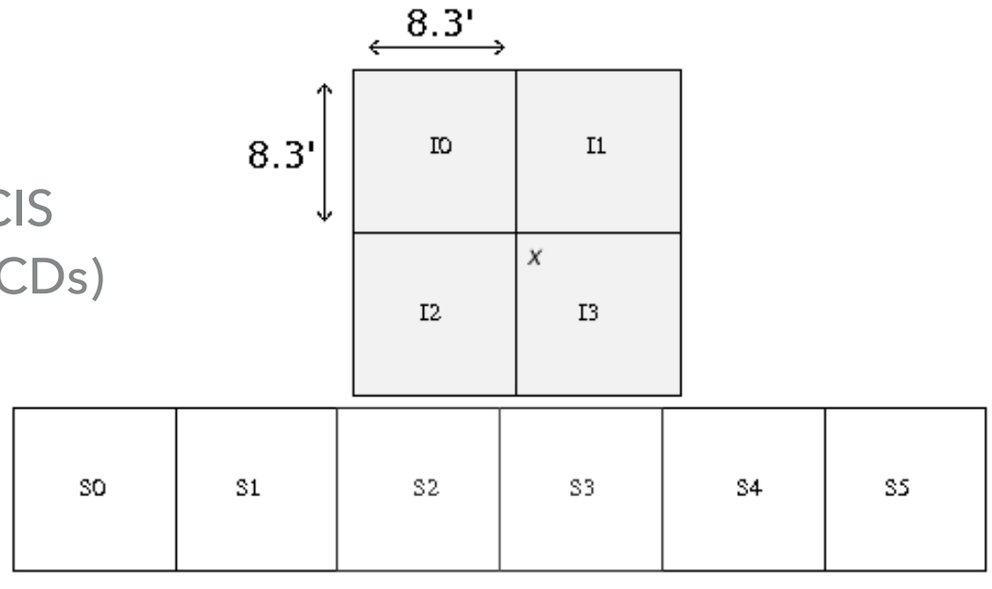
HRMA
Mirrors



LETG, HETG
diffraction gratings



ACIS
(CCDs)



HRC
(Microchannel
plates