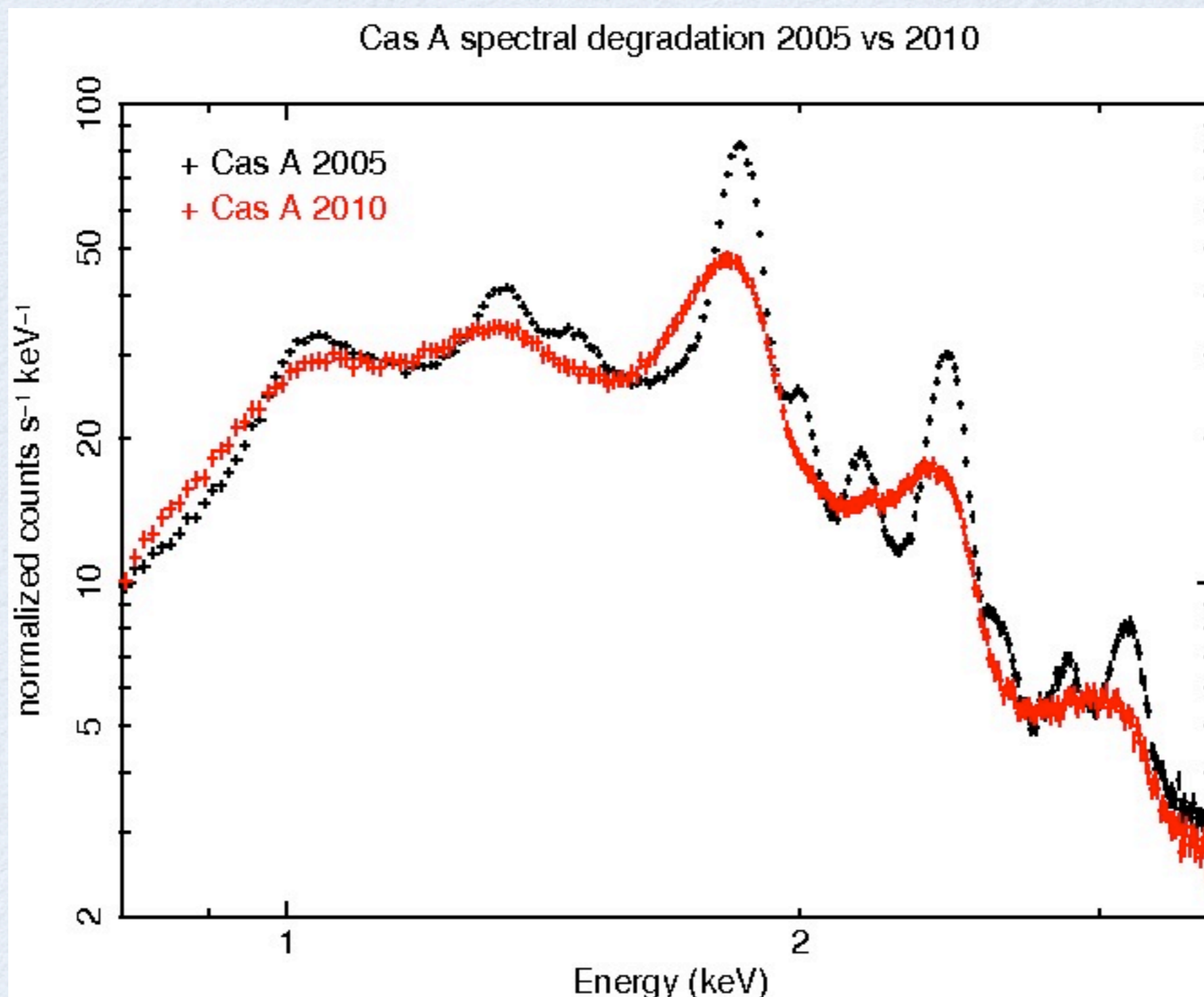


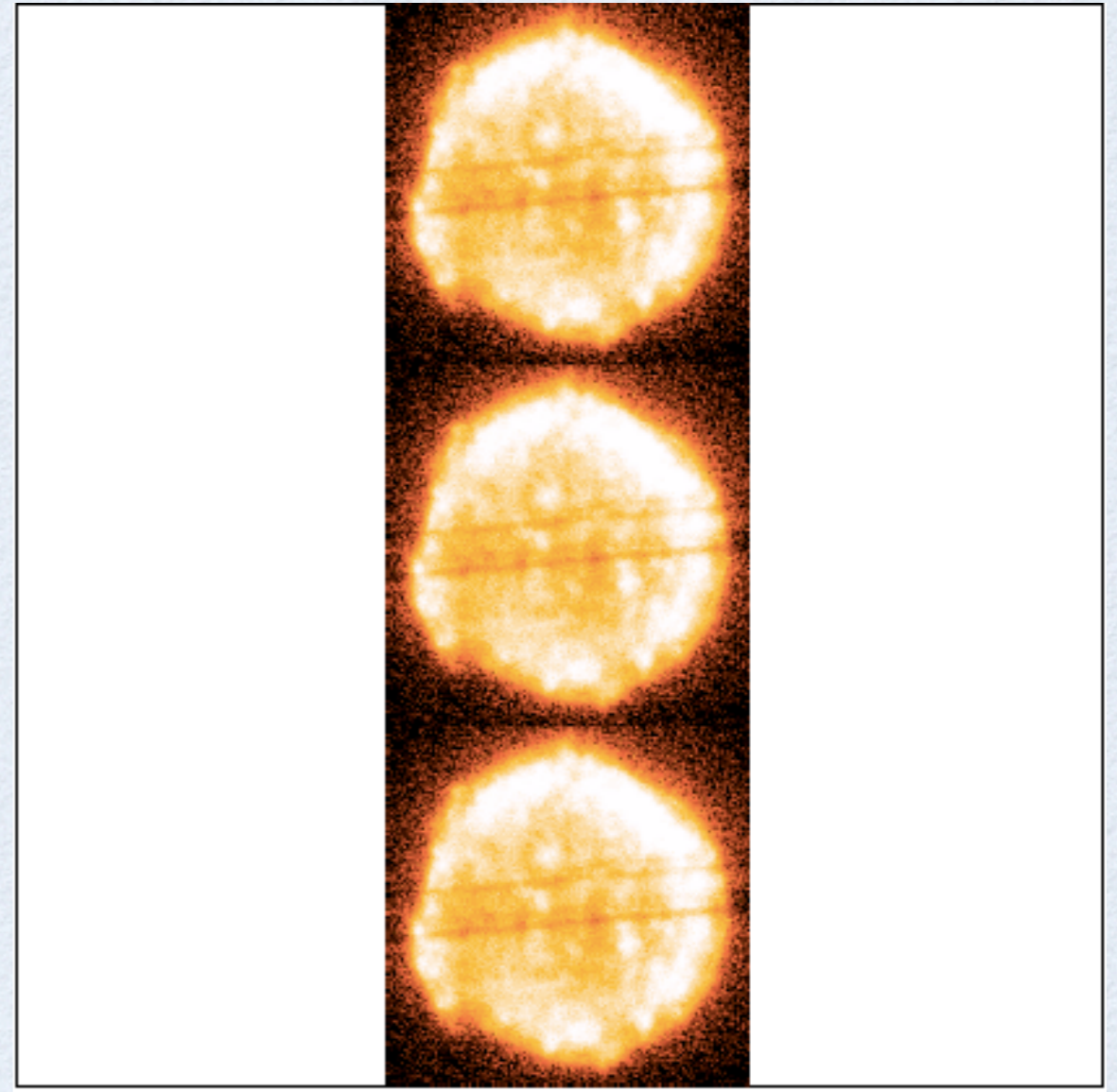
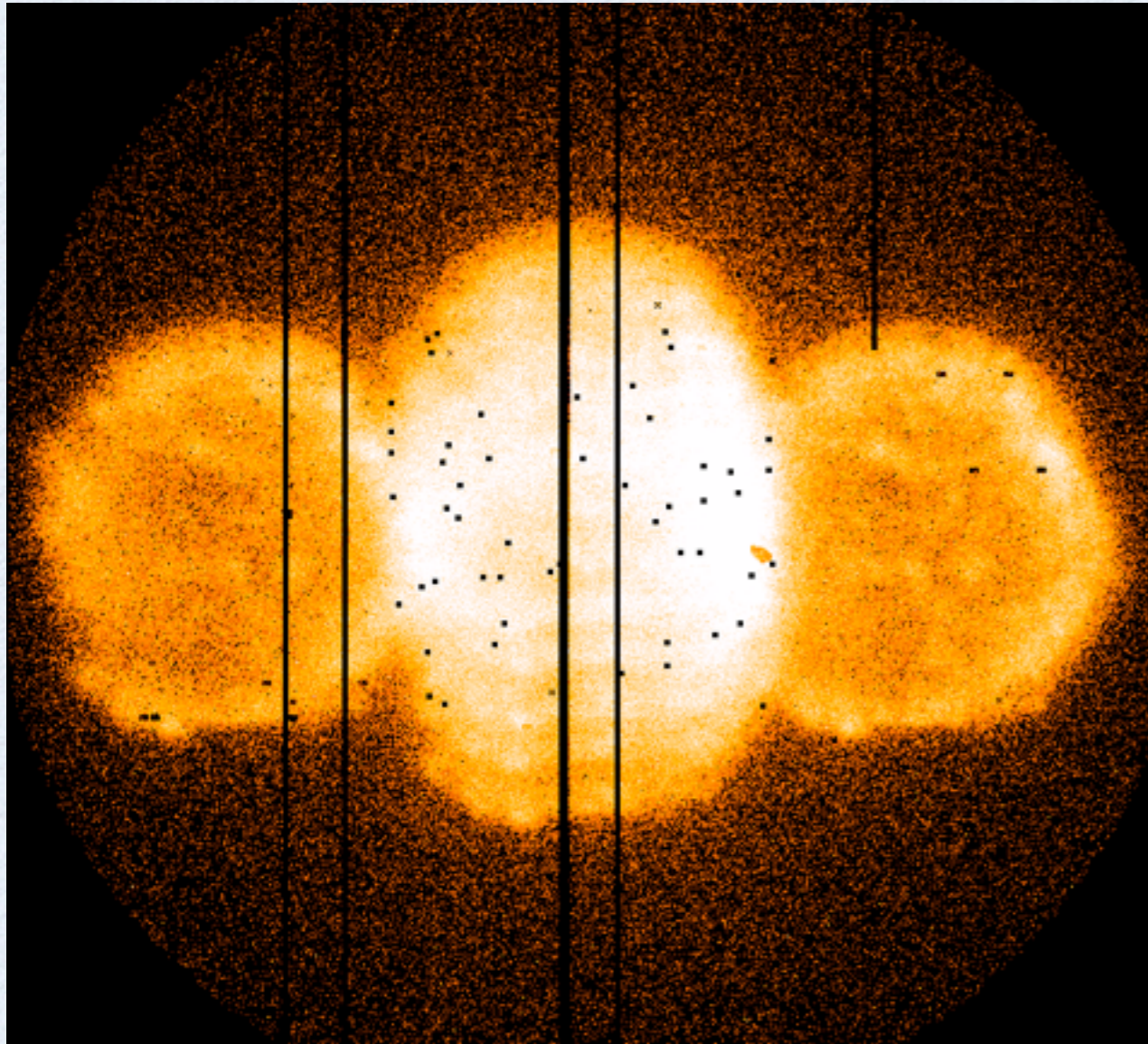
Swift-XRT charge traps

IACHEC 2013

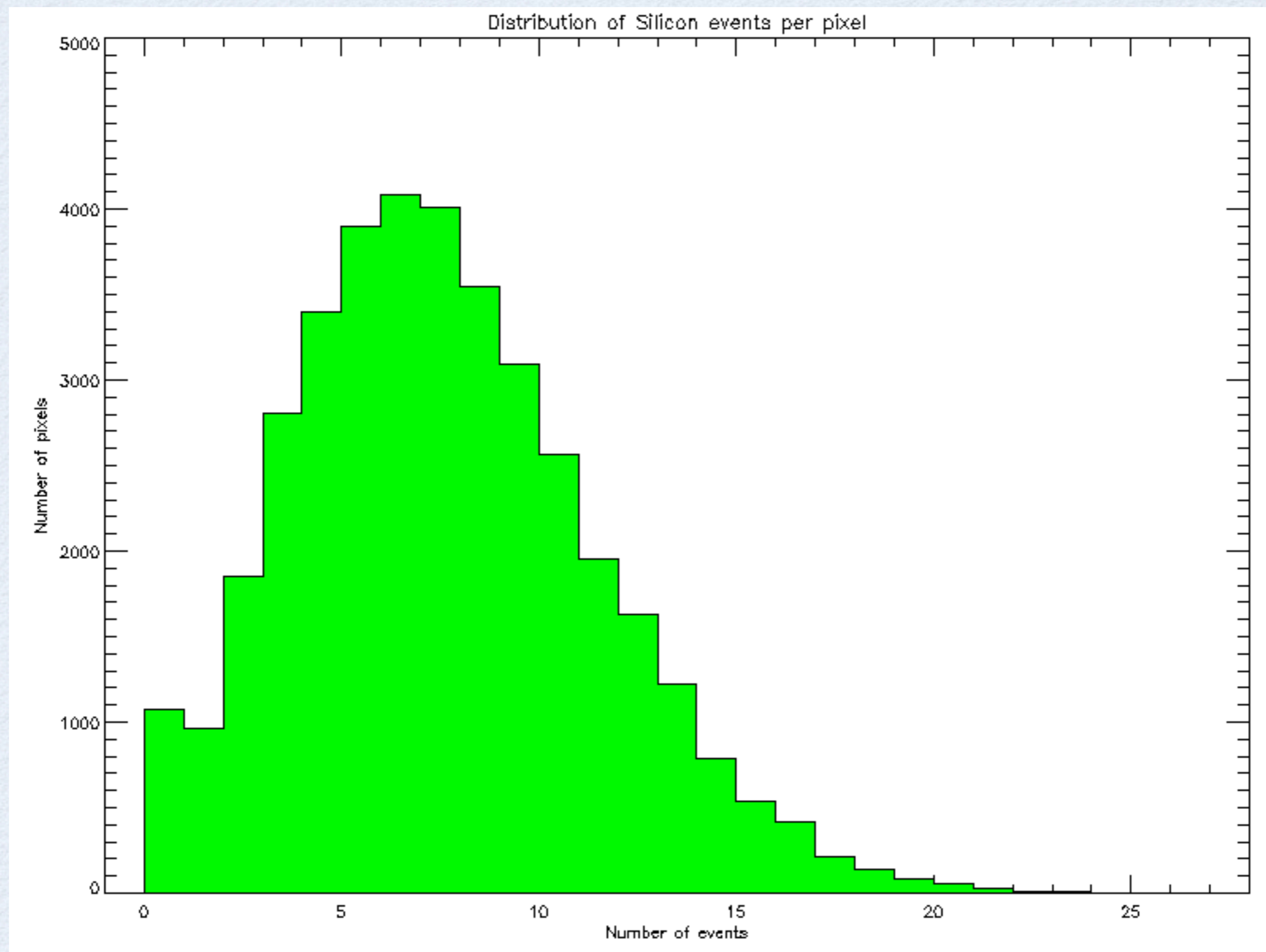
XRT SPECTRAL DEGRADATION



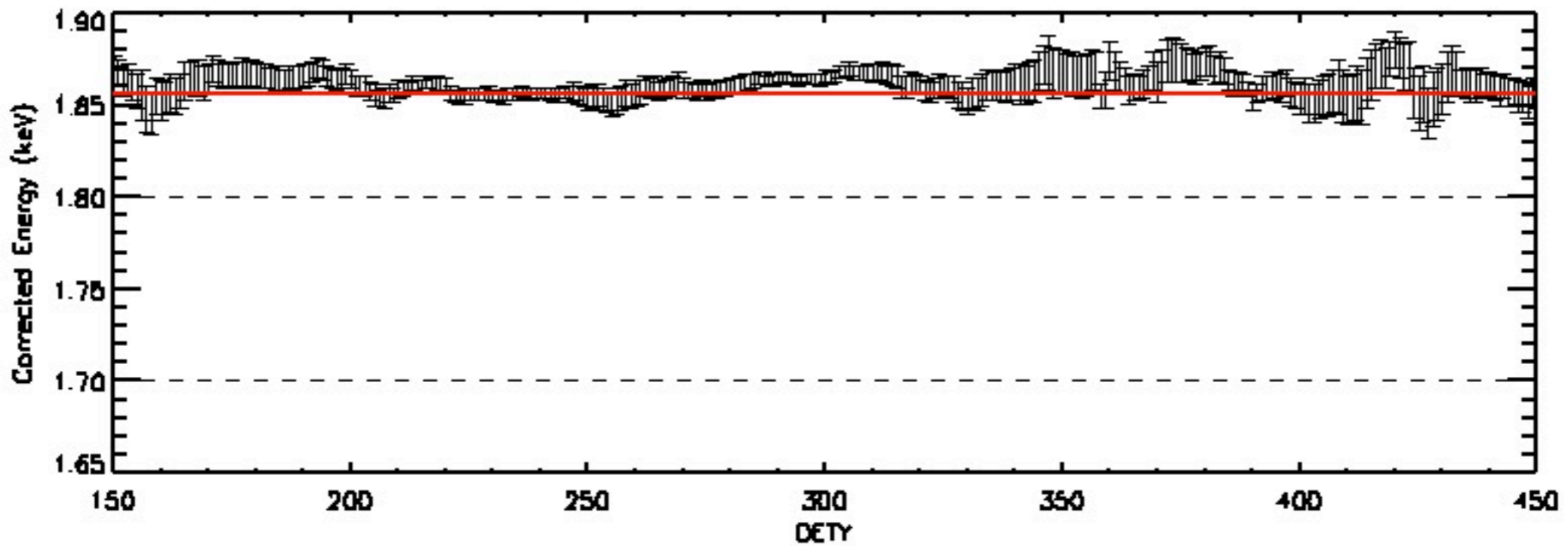
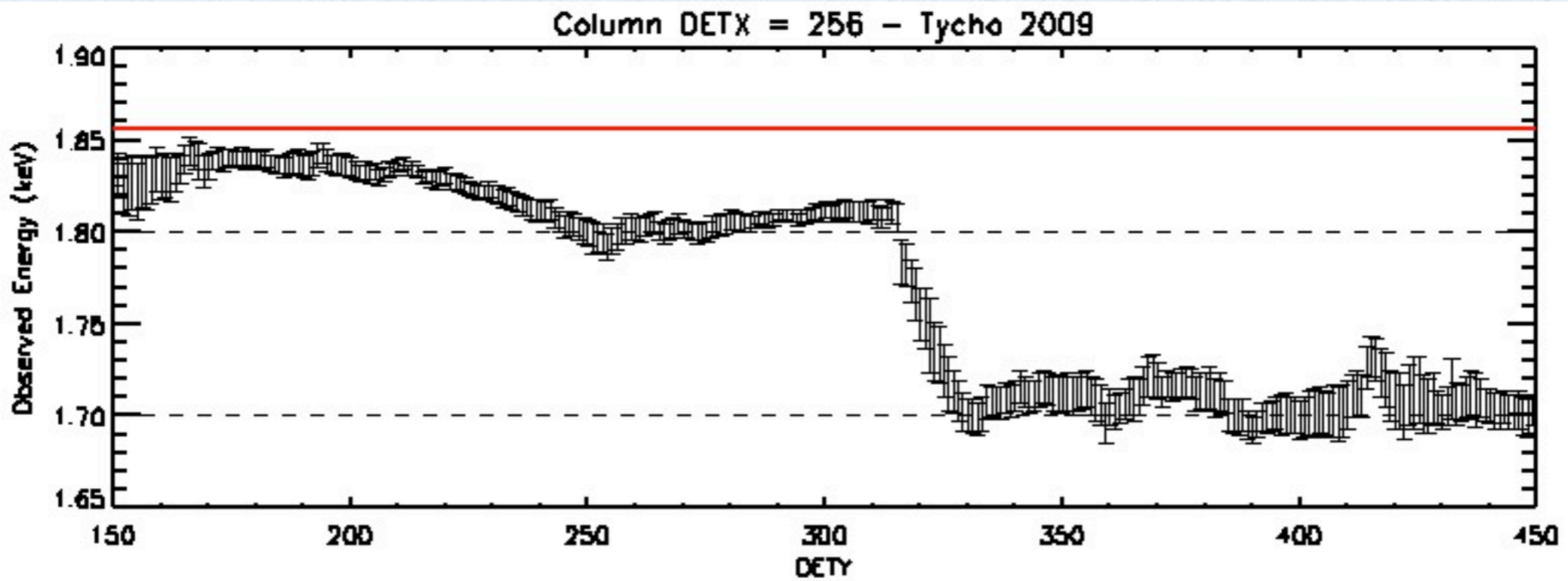
XRT SPECTRAL DEGRADATION



XRT SPECTRAL DEGRADATION

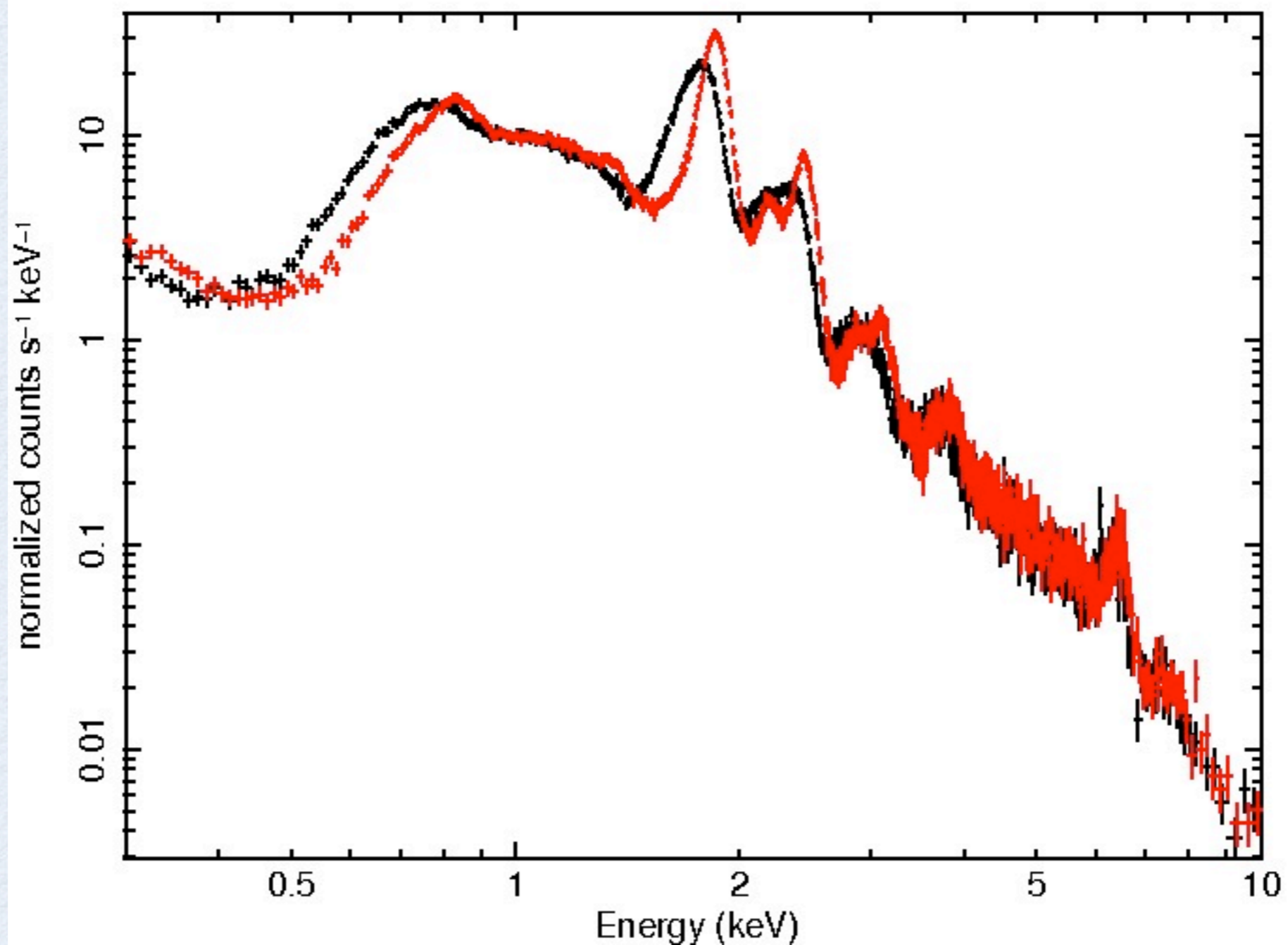


TRAP MAPPING

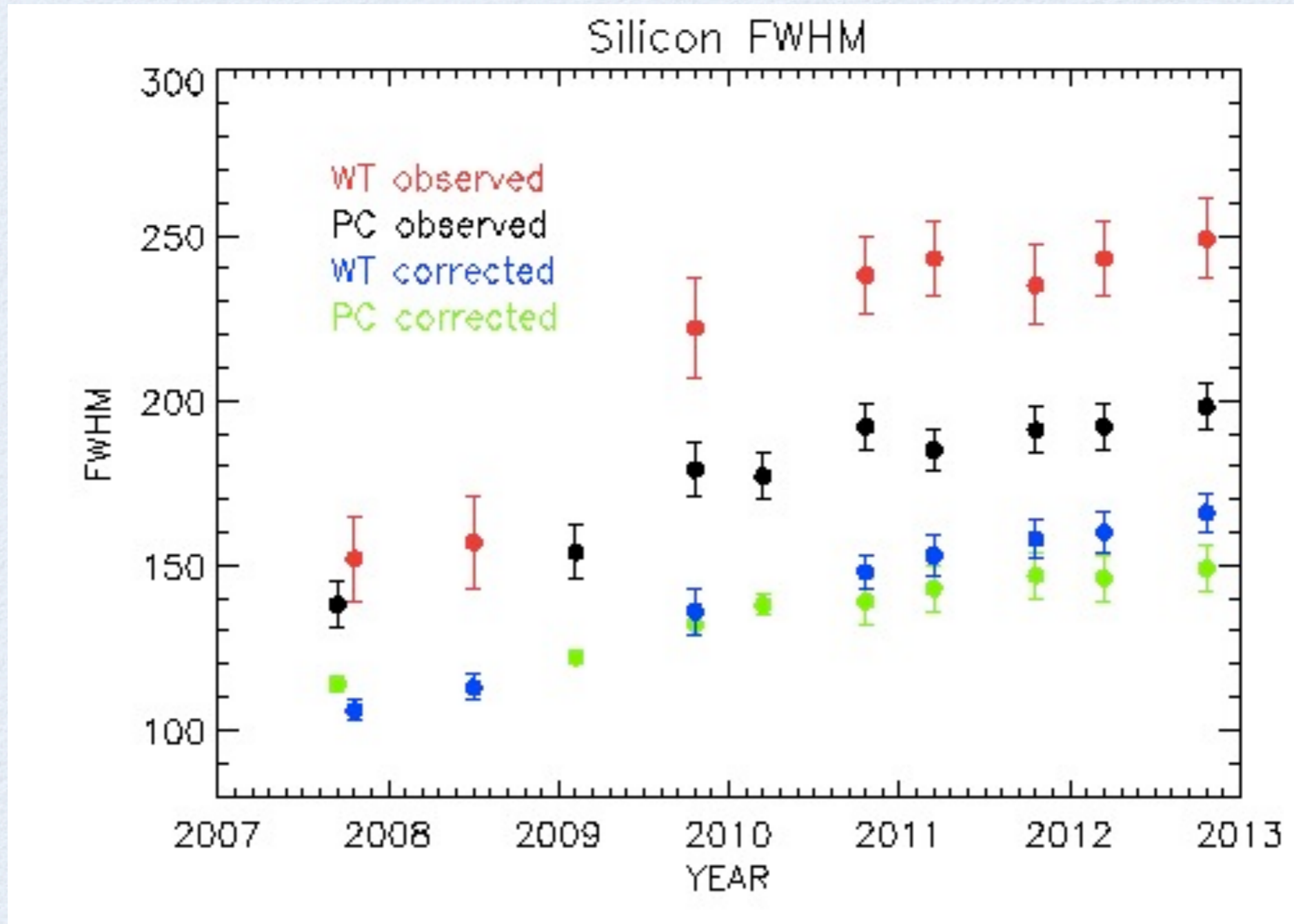


TRAP MAPPING

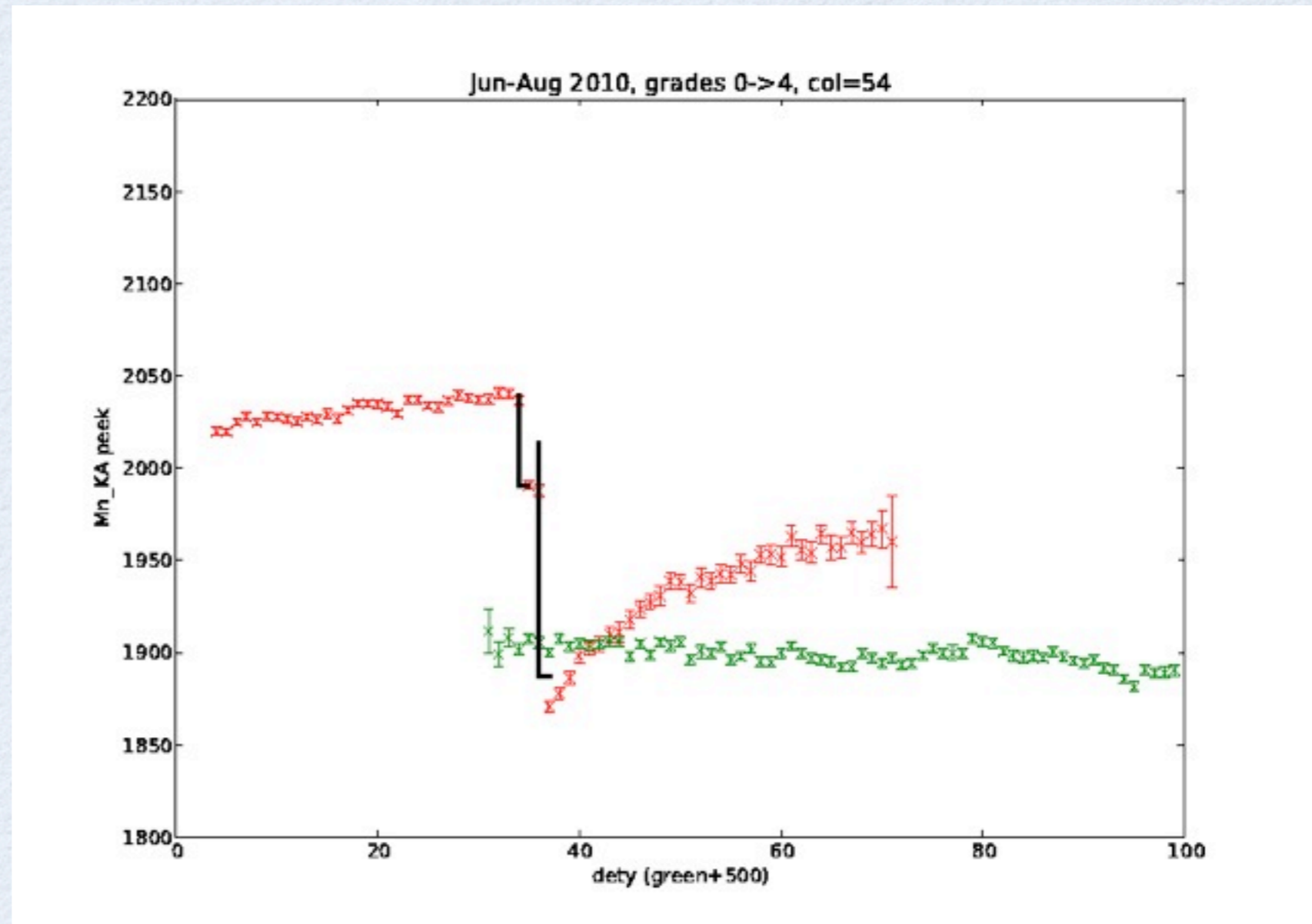
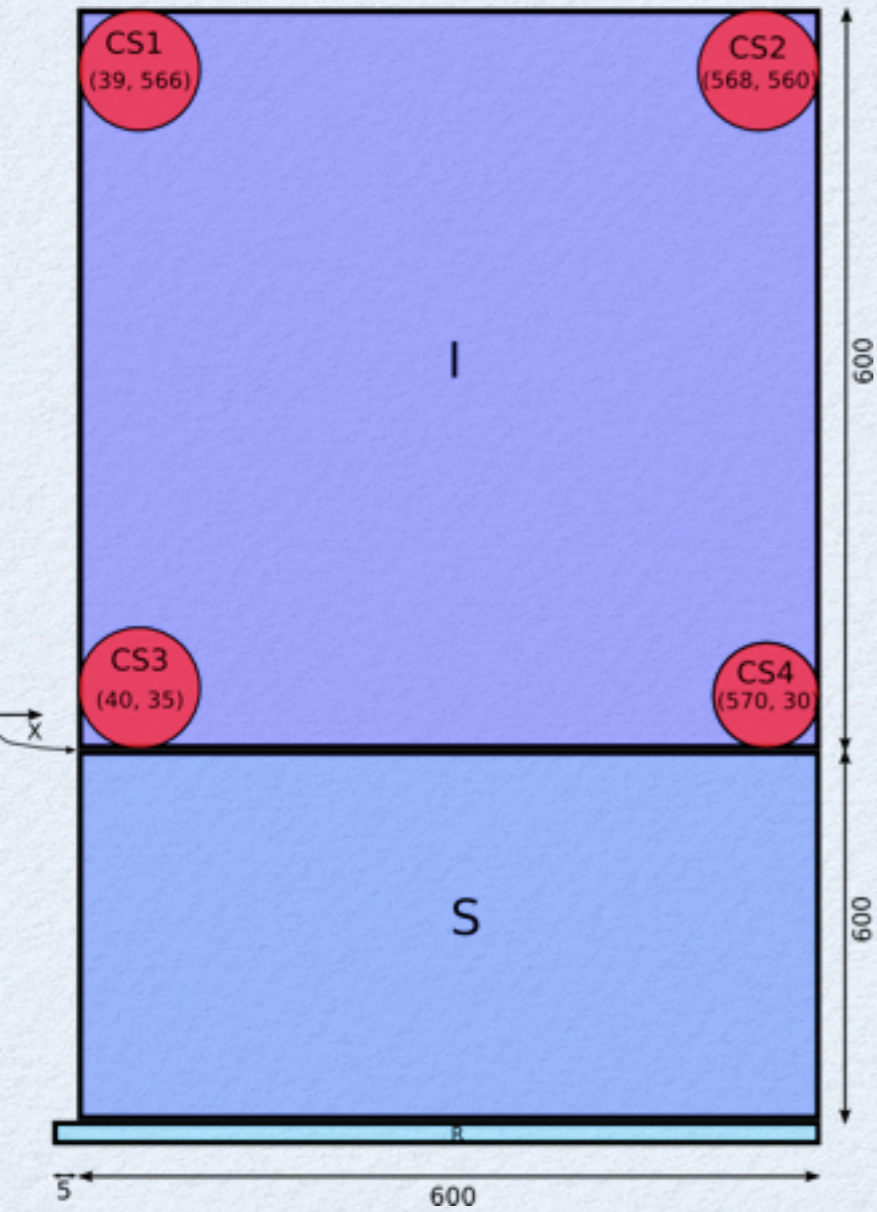
Tycho 2010/10 – WT Original and Corrected spectrum



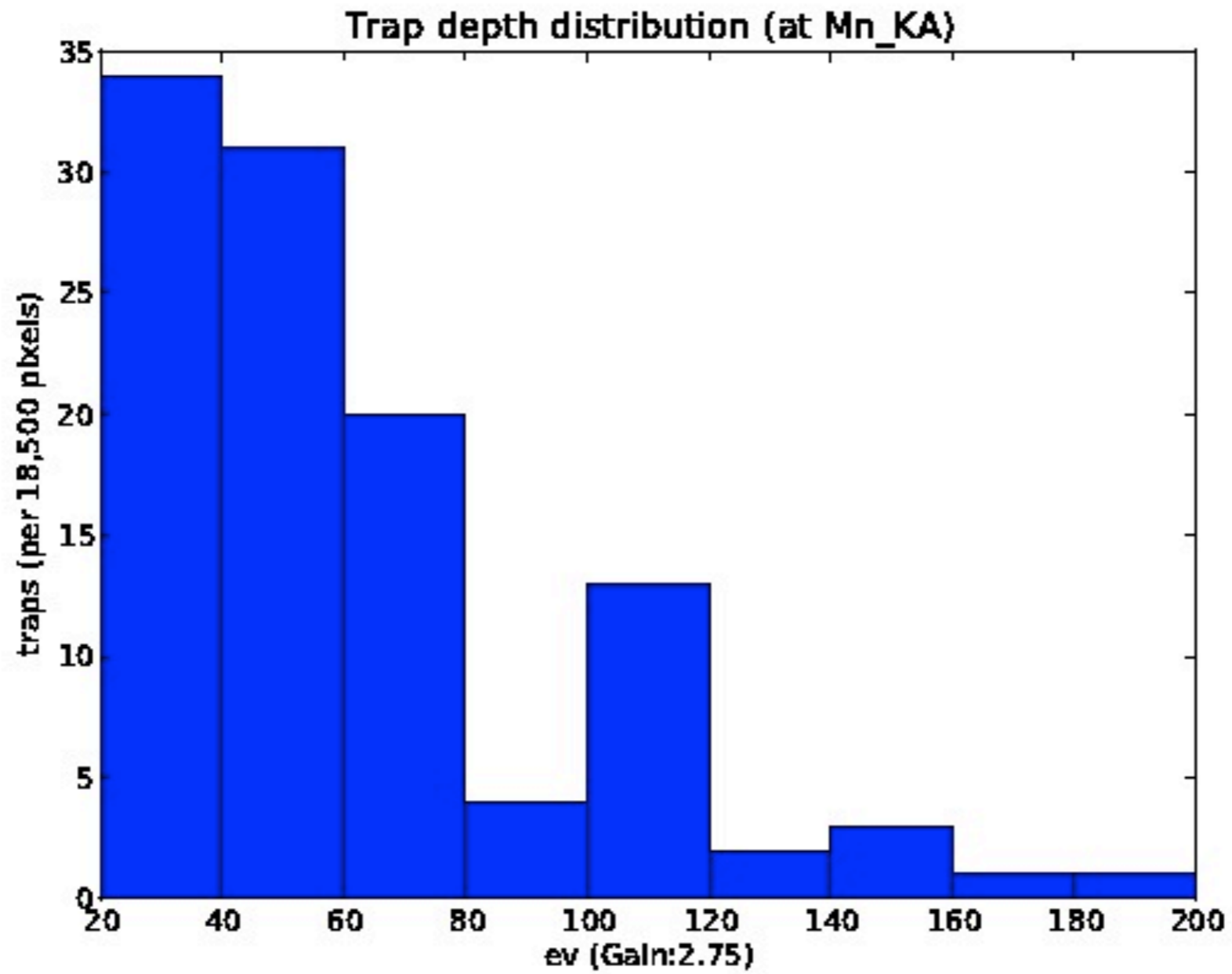
TRAP MAPPING



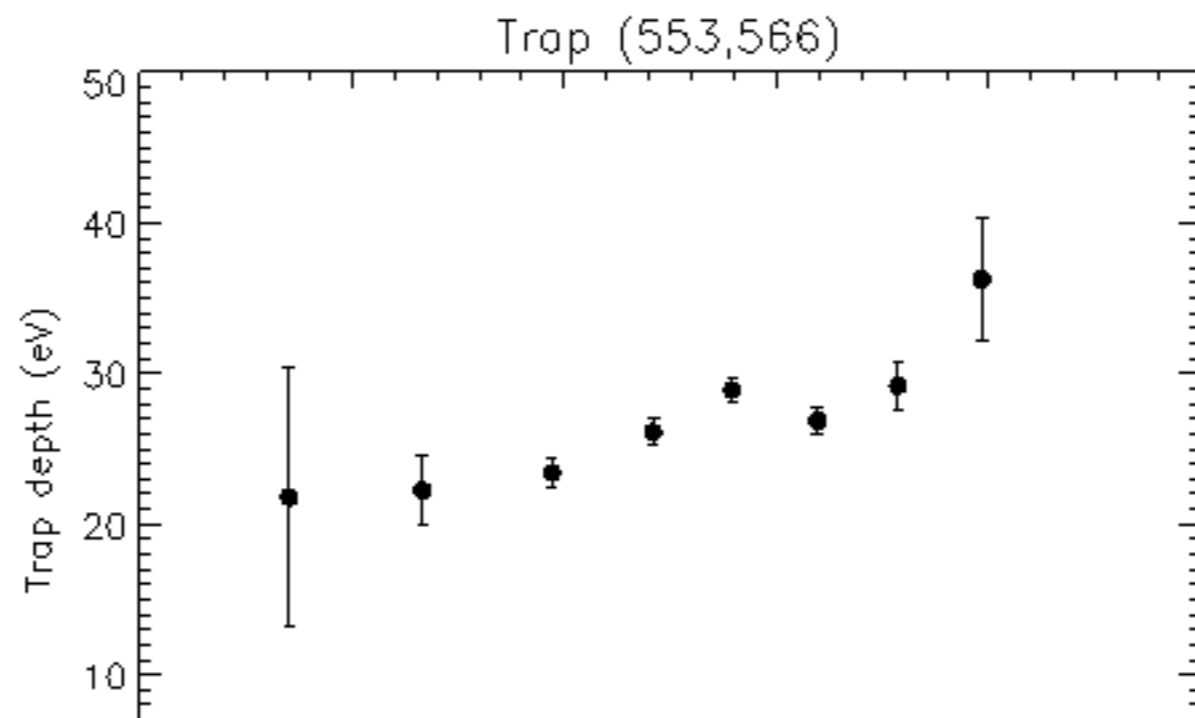
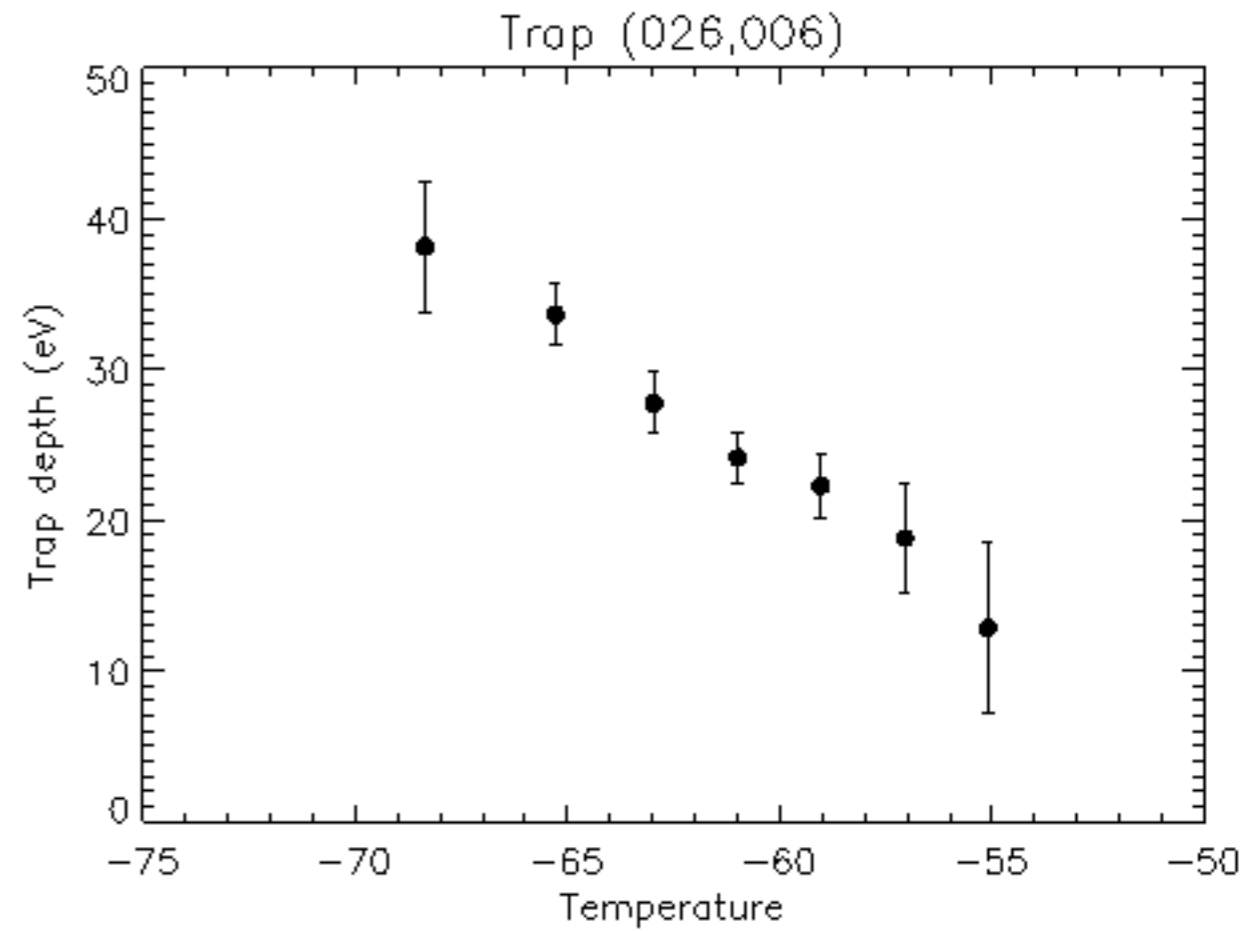
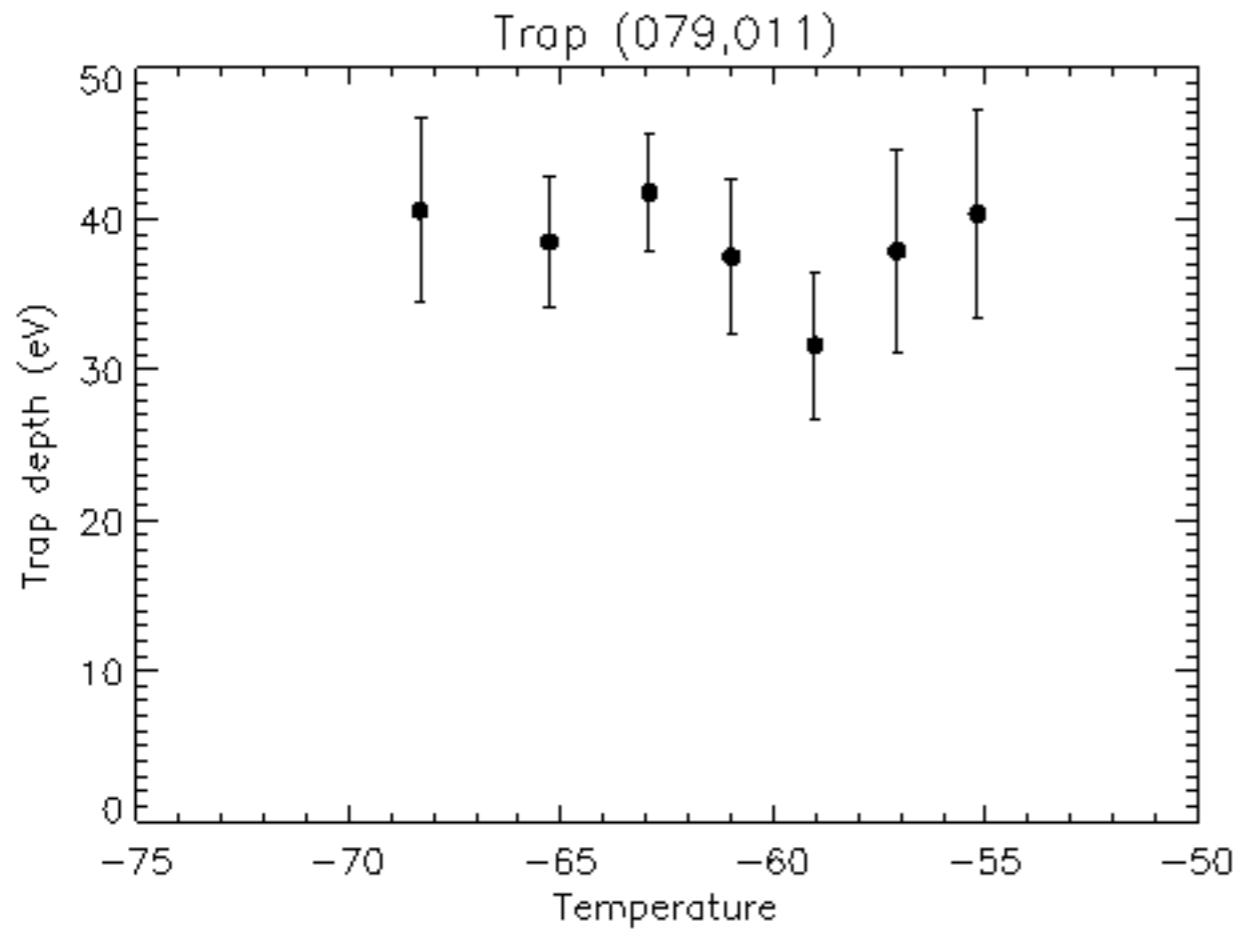
CORNER SOURCES



CORNER SOURCES



CORNER SOURCES - TEMPERATURE DEPENDENCE



WARNING: Trap close to CS lower boundary

detx	26
dety	6
extent	1
depth	$26.480 \pm 33.509 Dn$

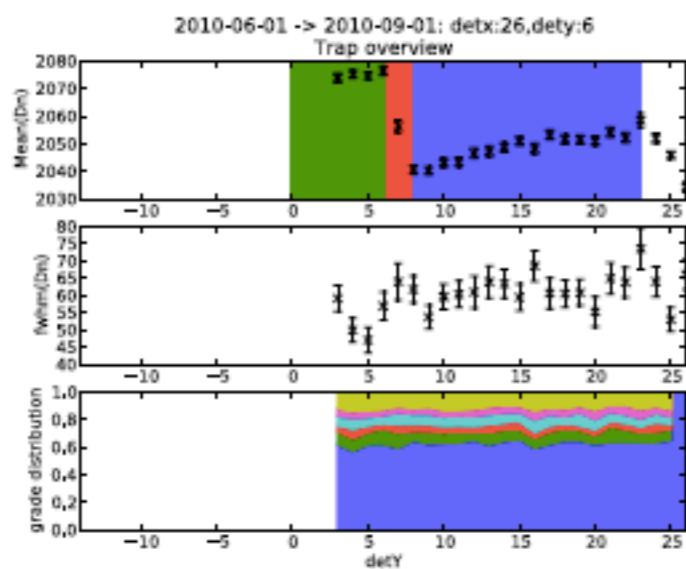


Figure 77: $Mn K\alpha$ **top**: Peak center (green: pre-trap region, red: trap extent, blue- post-trap region), **center**: Peak fwhm, **lower**: grade distribution by pixel (blue:0, green:1, red:2,cyan:3,magenta:4, yellow:5+).

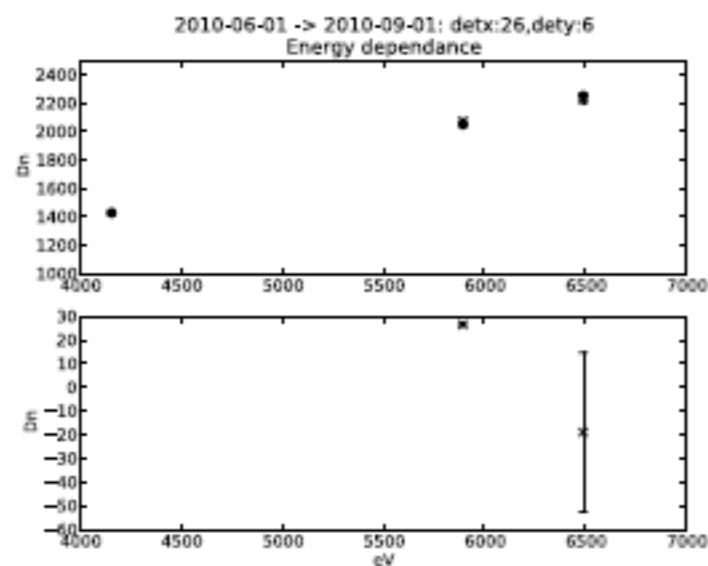


Figure 78: Energy dependance of trap depth, measured at $Mn K\alpha, K\beta'$ and Si escape peak..

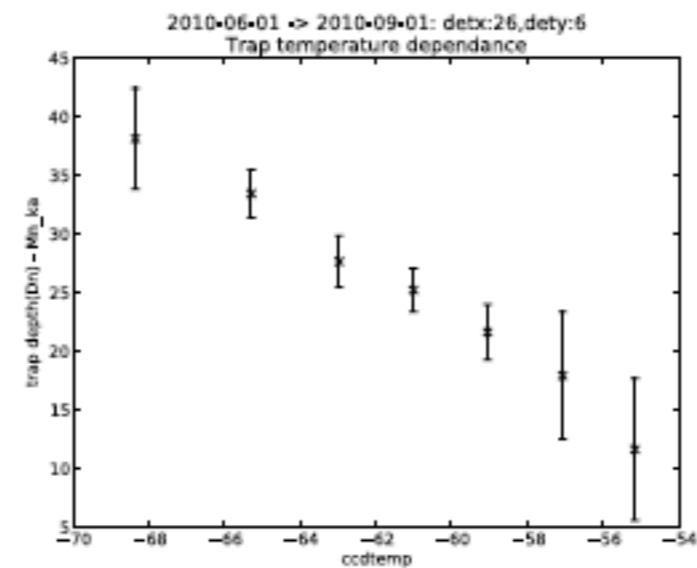
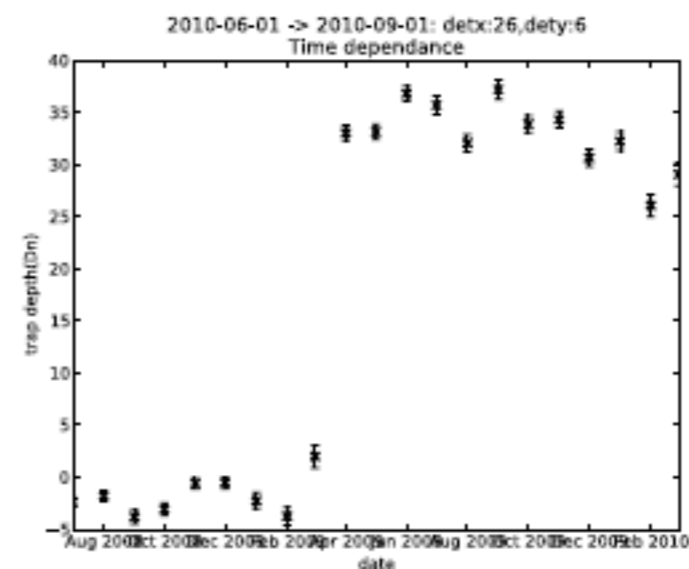


Figure 79: Temperature dependance of trap depth at $Mn K\alpha$.



2.28 031-044

detx	31
dety	44
extent	1
depth	$20.573 \pm 0.572Dn$

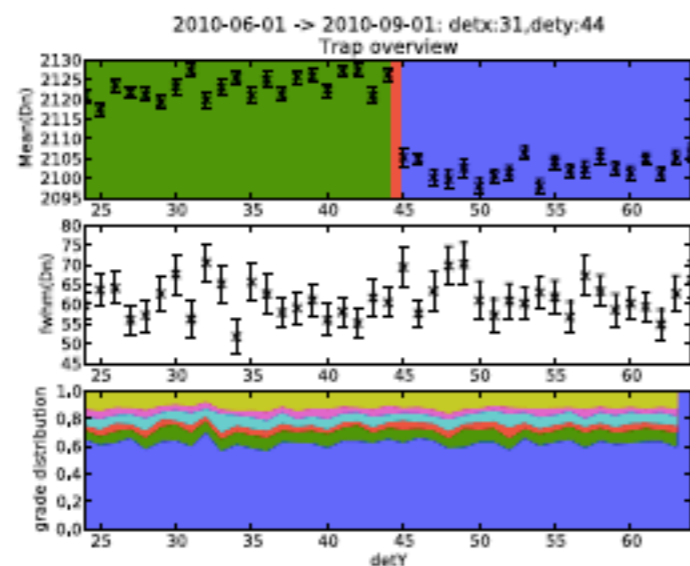


Figure 109: $Mn K\alpha$ **top:** Peak center (green: pre-trap region, red: trap extent, blue- post-trap region), **center:** Peak fwhm, **lower:** grade distribution by pixel (blue:0, green:1, red:2,cyan:3,magenta:4, yellow:5+).

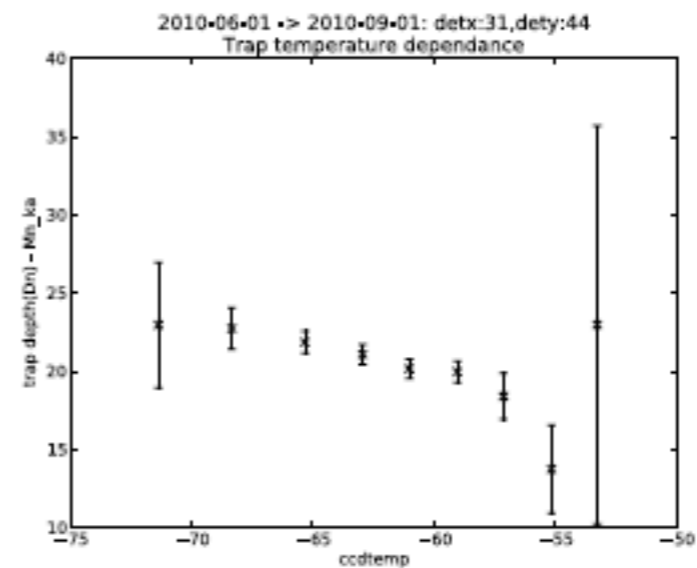


Figure 111: Temperature dependence of trap depth at $Mn K\alpha$.

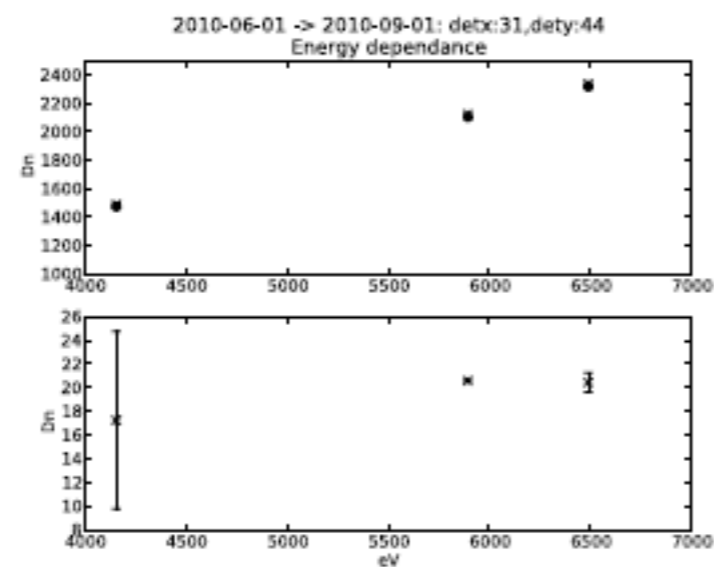
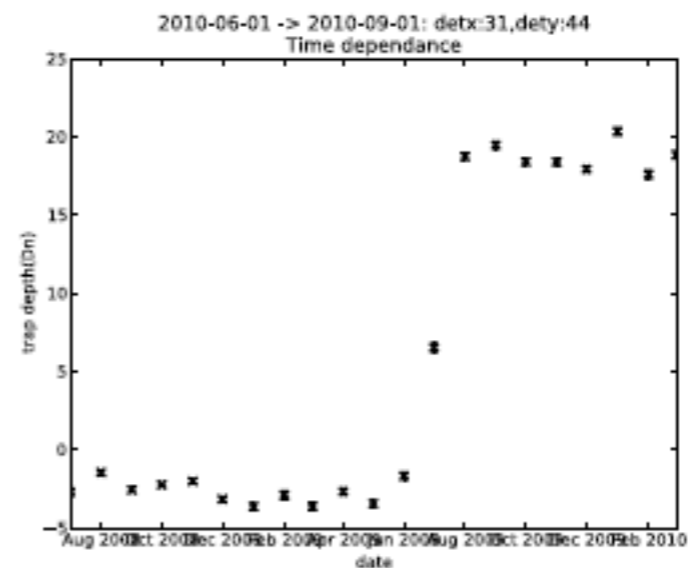


Figure 110: Energy dependance of trap depth, measured at $Mn K\alpha, K\beta'$ and Si escape peak..



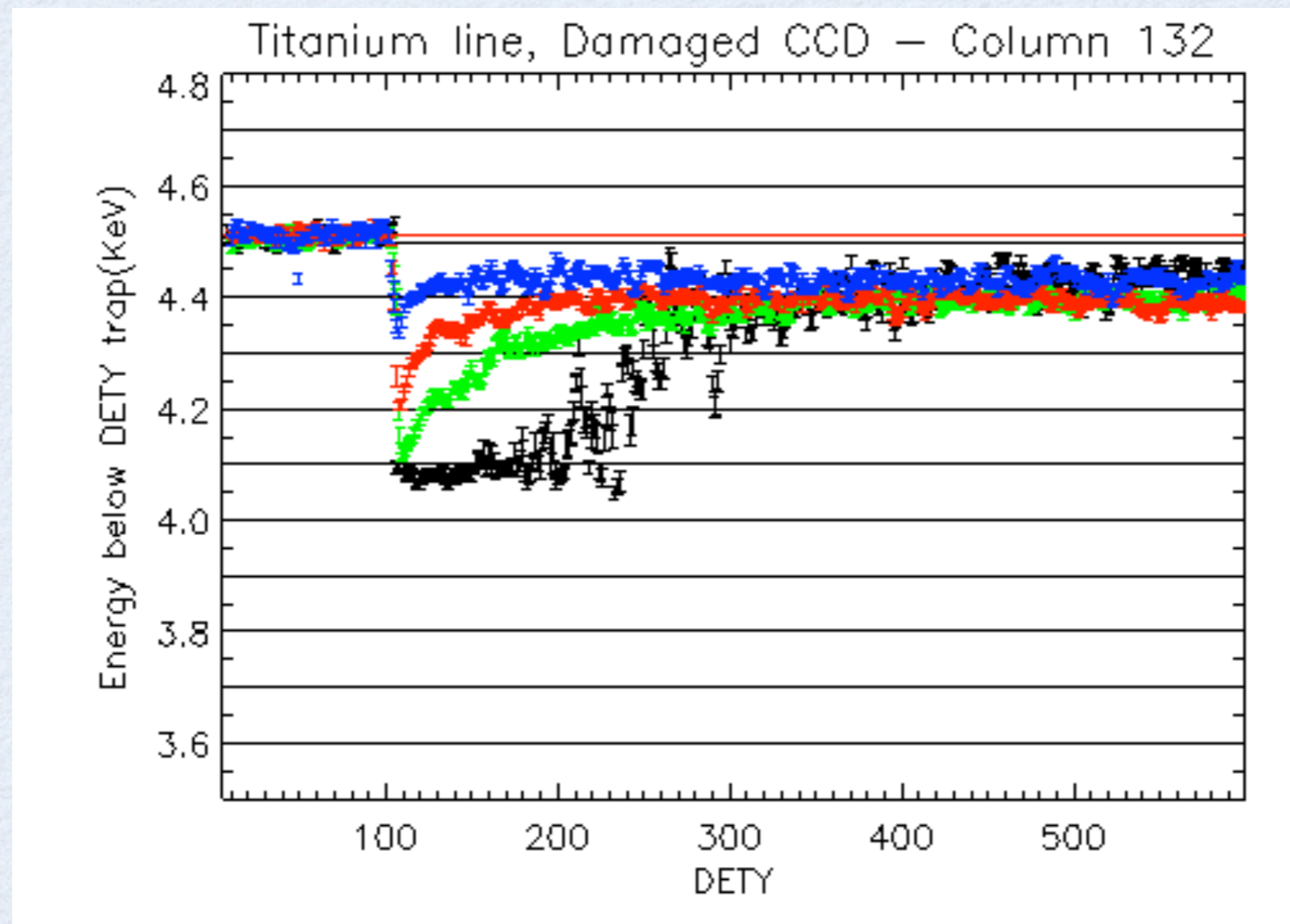
PROTON DAMAGED CCD -TEMPERATURE DEPENDENCE

2 sections:

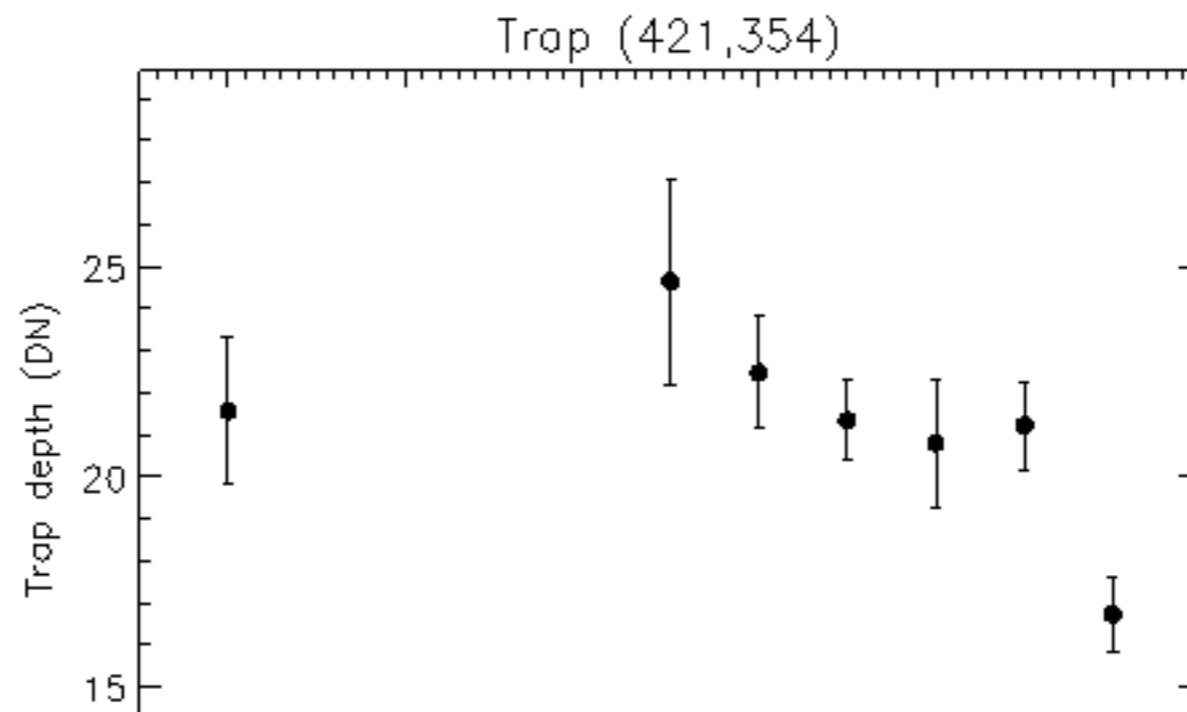
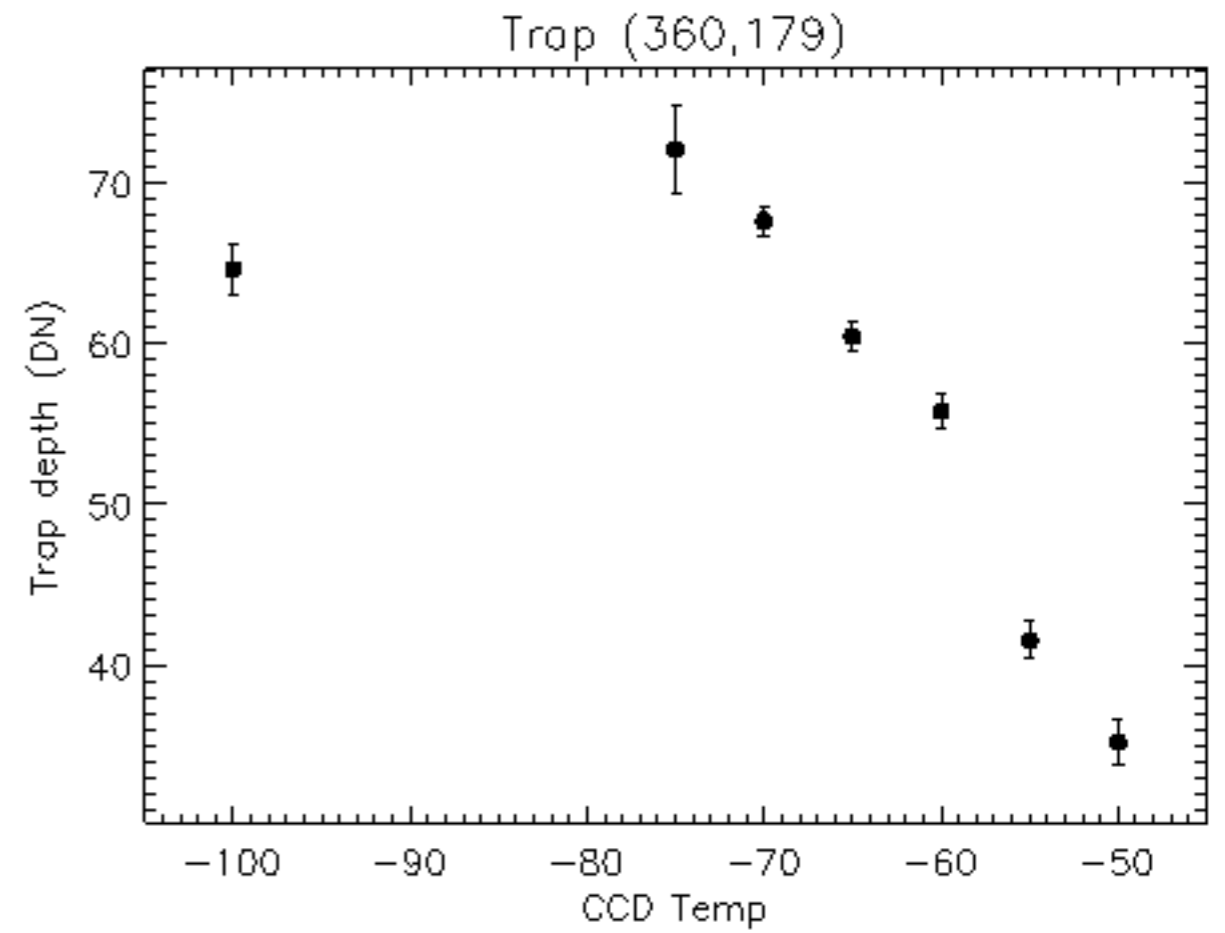
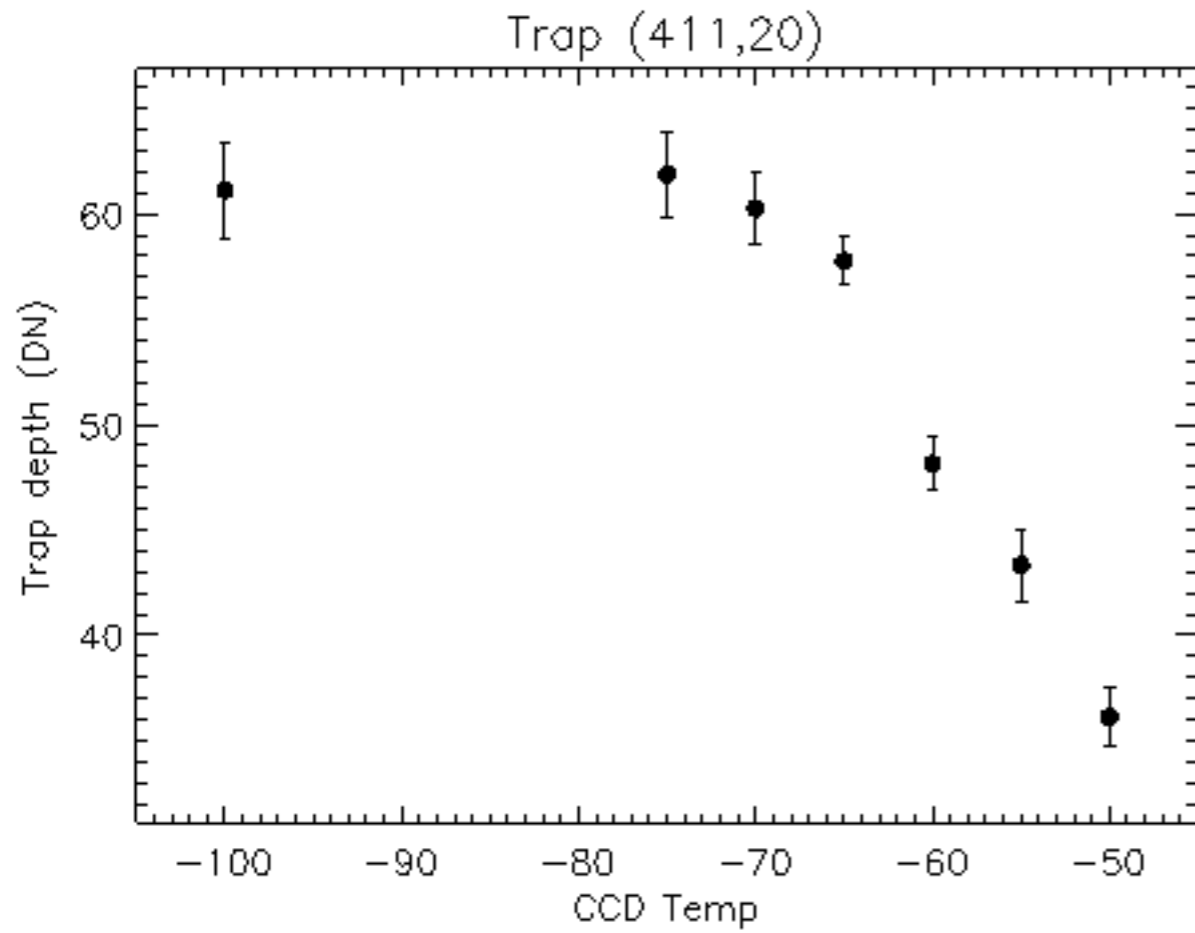
2.5×10^8 10 MeV protons (equivalent proton dose of ~ 1 year of Swift in orbit)

5×10^8 10 MeV protons

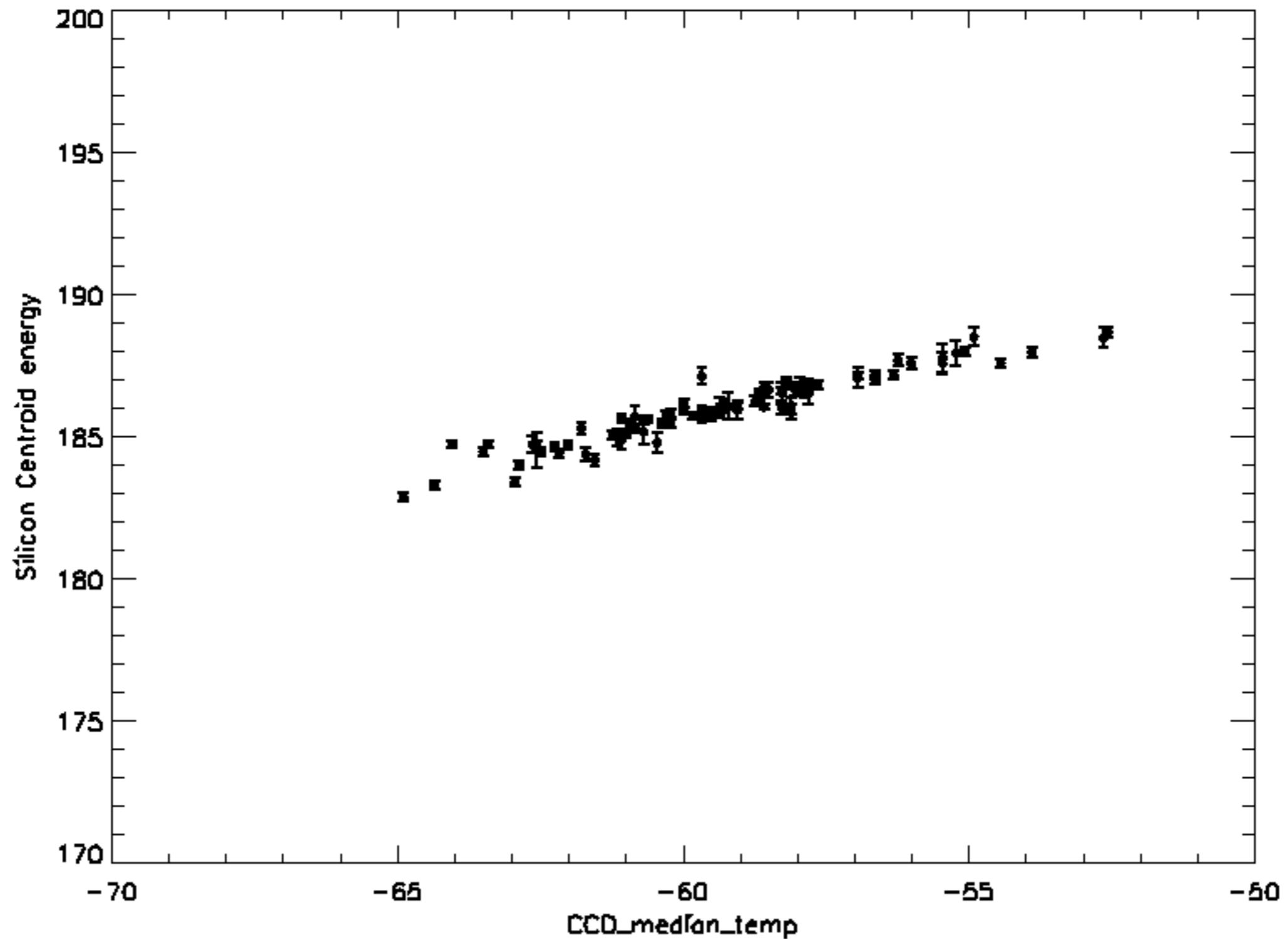
Lab runs to investigate proton-generated traps, temperature, energy and flux dependence



PROTON DAMAGED CCD - TEMPERATURE DEPENDENCE

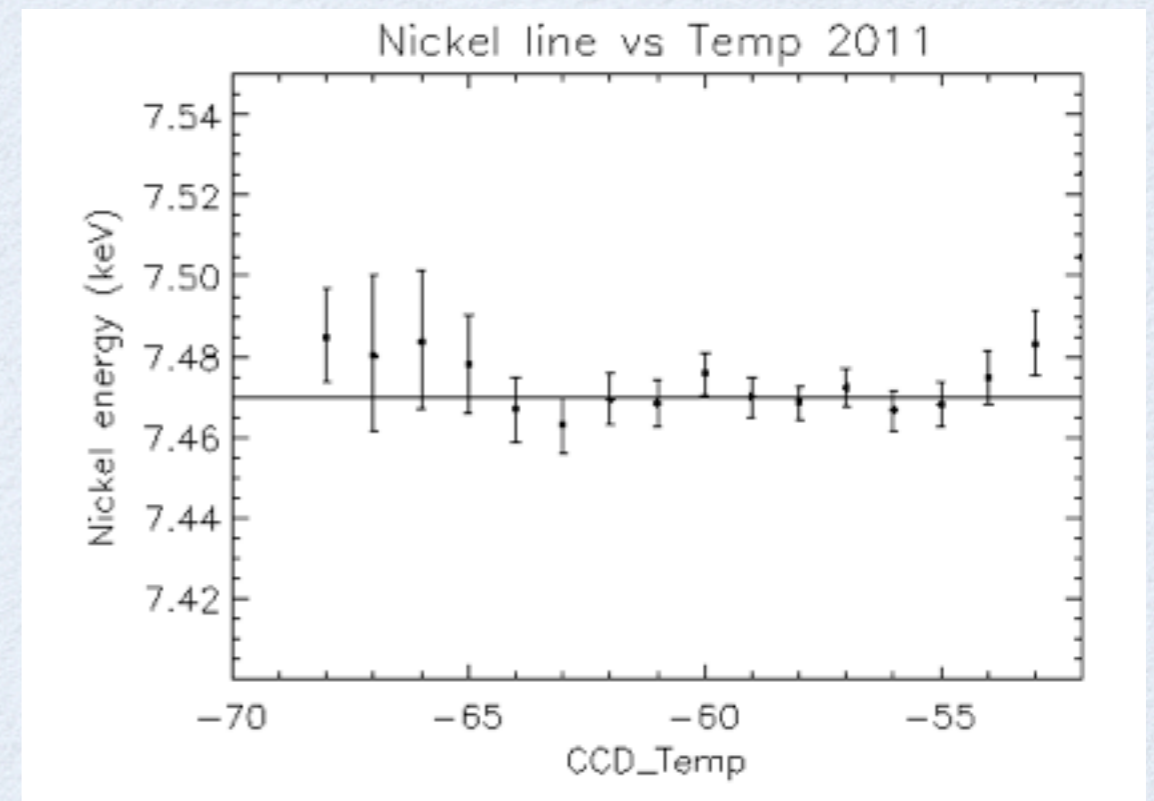
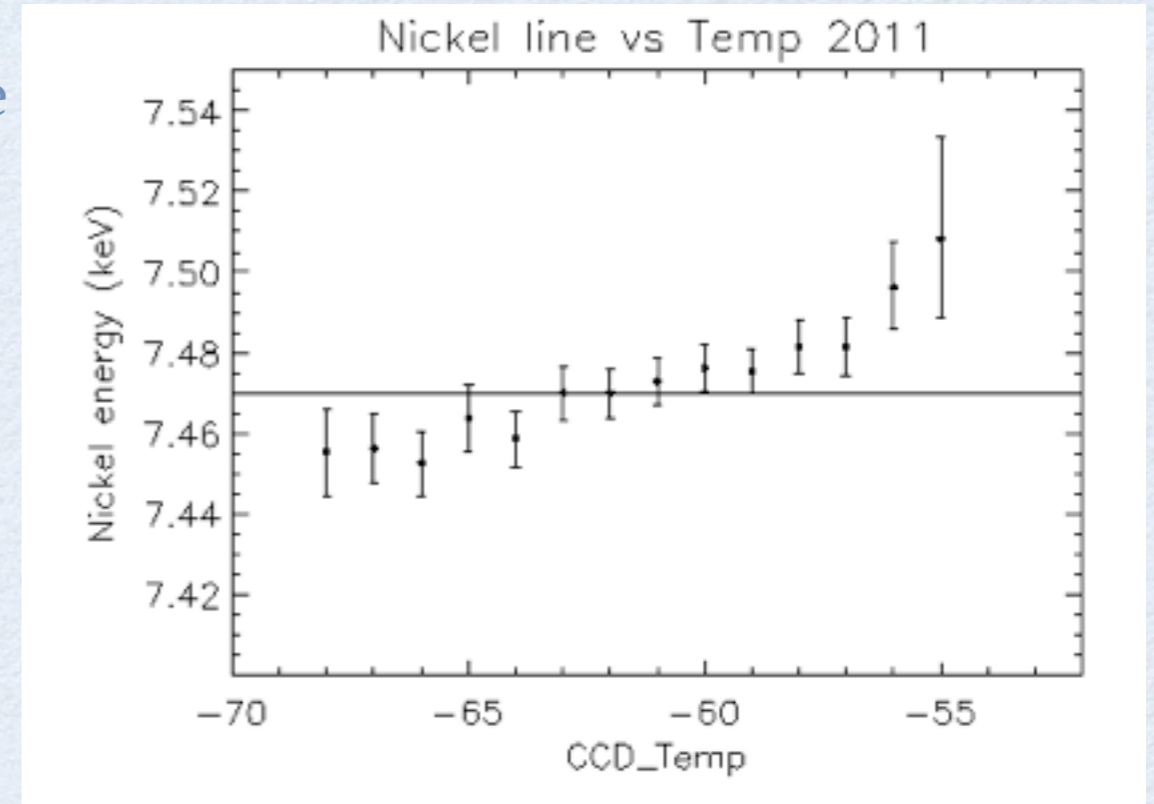
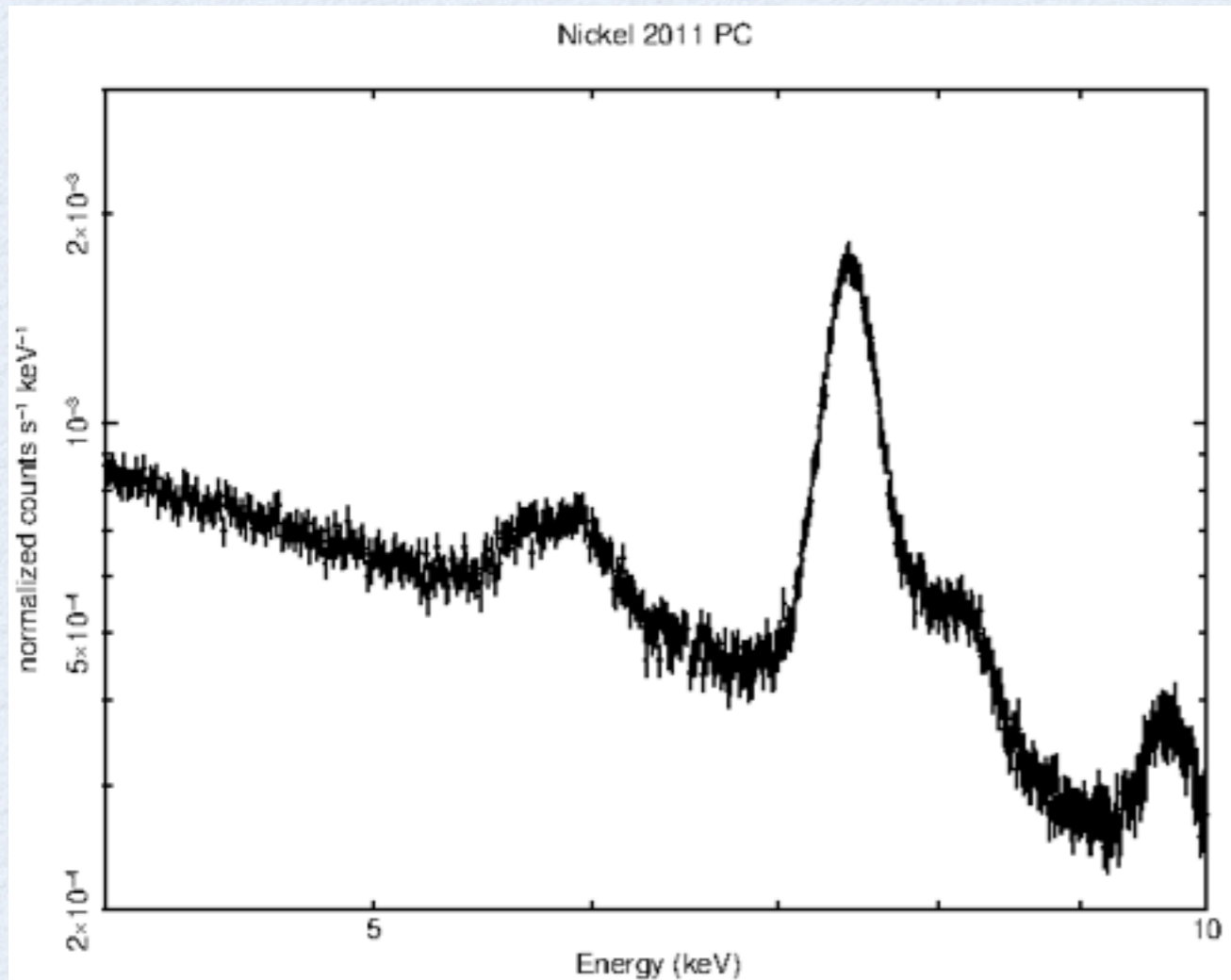


XRT CCD - TRAPS TEMPERATURE DEPENDENCE

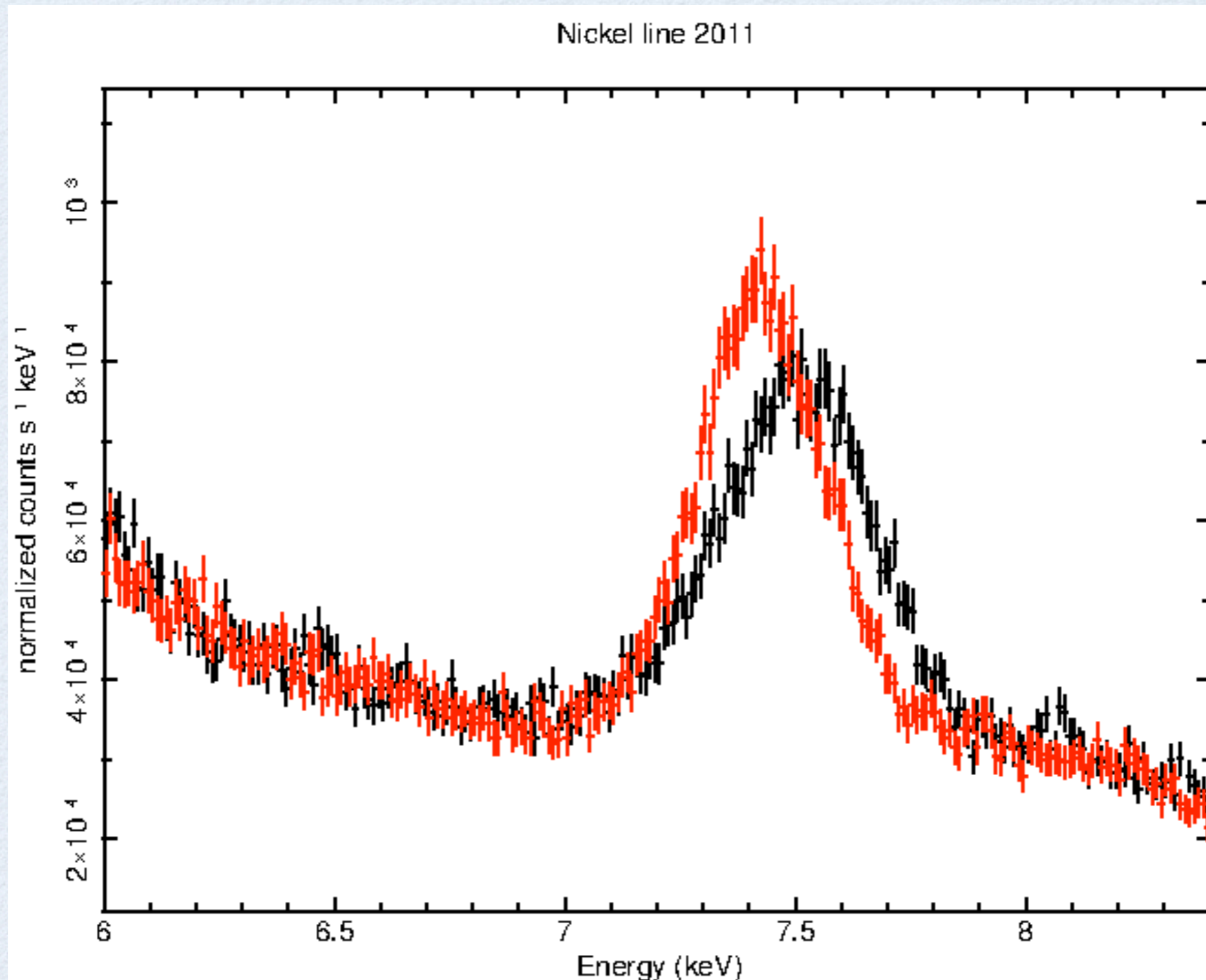


XRT CCD - TRAPS TEMPERATURE DEPENDENCE

Instrumental Nickel line to measure temperature dependence



XRT CCD - NICKEL LINE FOR TRAPS ENERGY DEPENDENCE



TRAPS - ENERGY DEPENDENCE

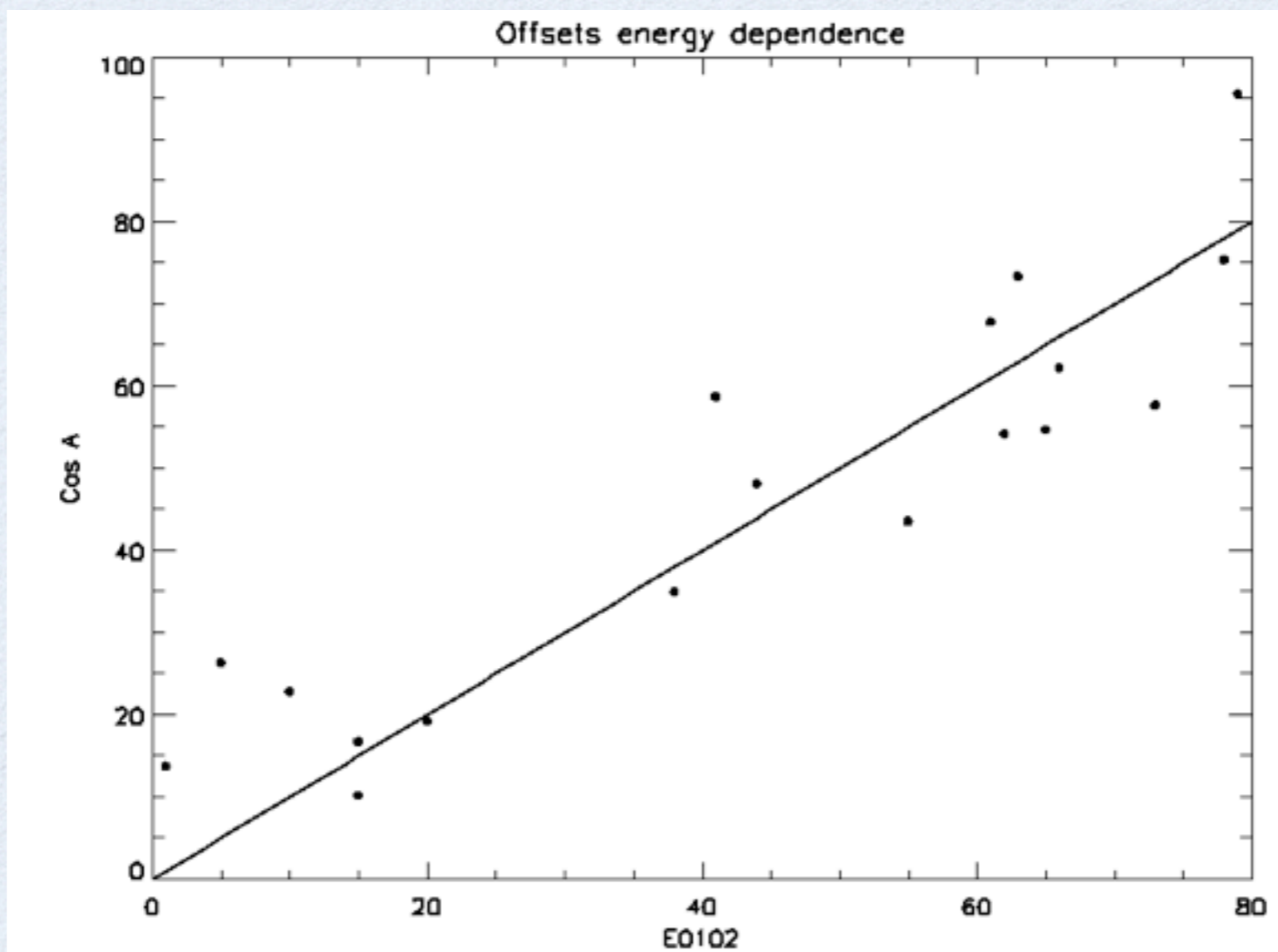
$$Depth(E) = Depth(E_{break}) \left(\frac{E}{E_{break}} \right)^\alpha$$

$$E_{break} = 1.856 \text{ keV}$$

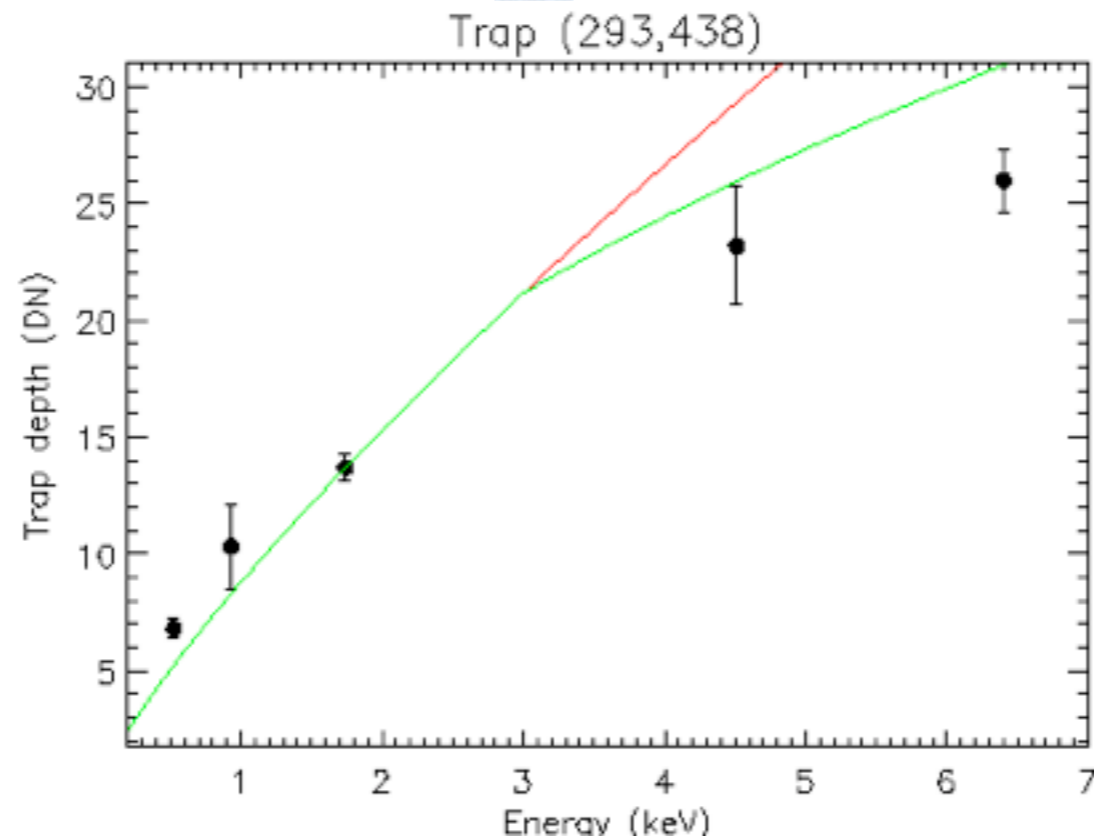
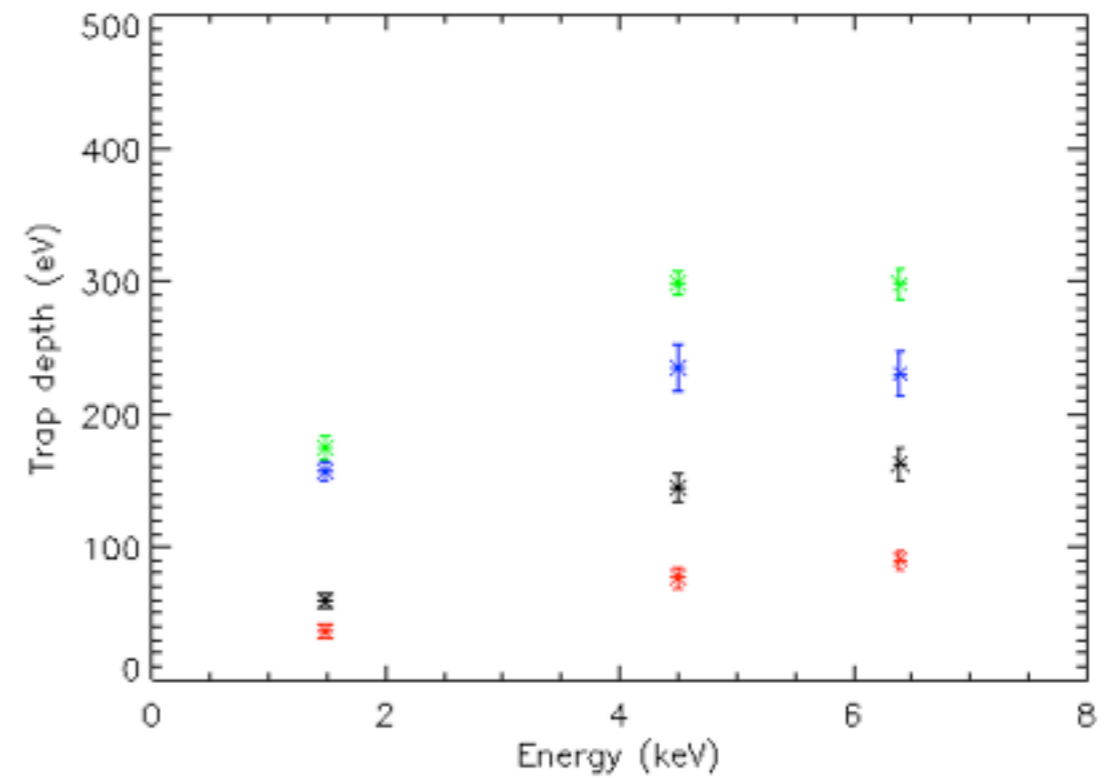
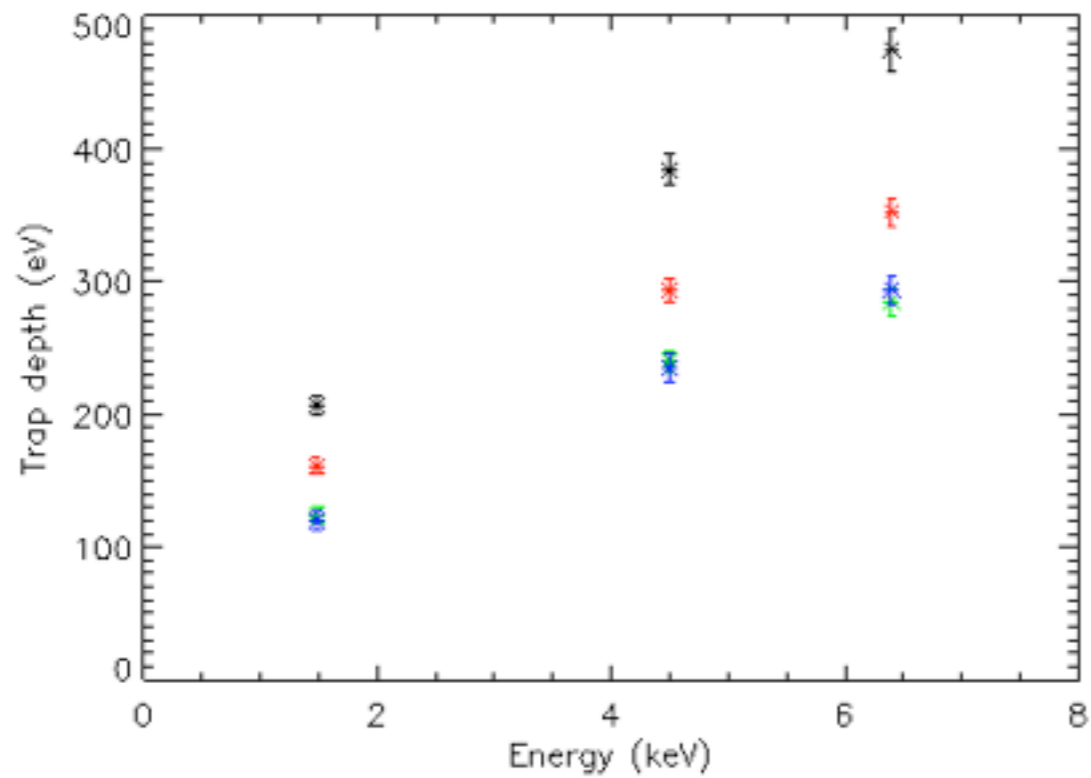
$$\alpha = 0.75, E < E_{break}$$

$$\alpha = 0.80, E \geq E_{break}$$

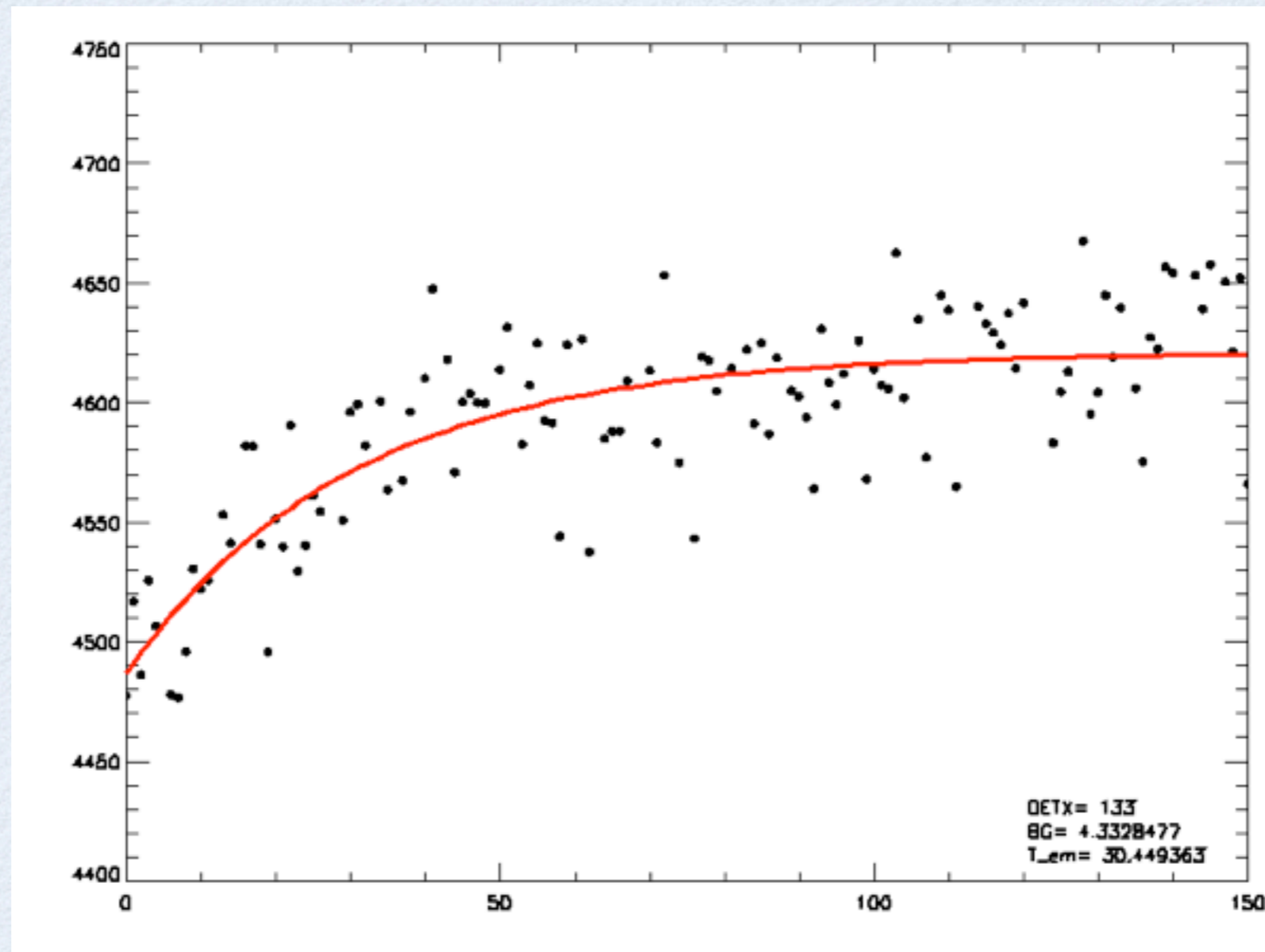
- S, Fe lines in Tycho
- E0102 at low energies



PROTON DAMAGED CCD - ENERGY DEPENDENCE



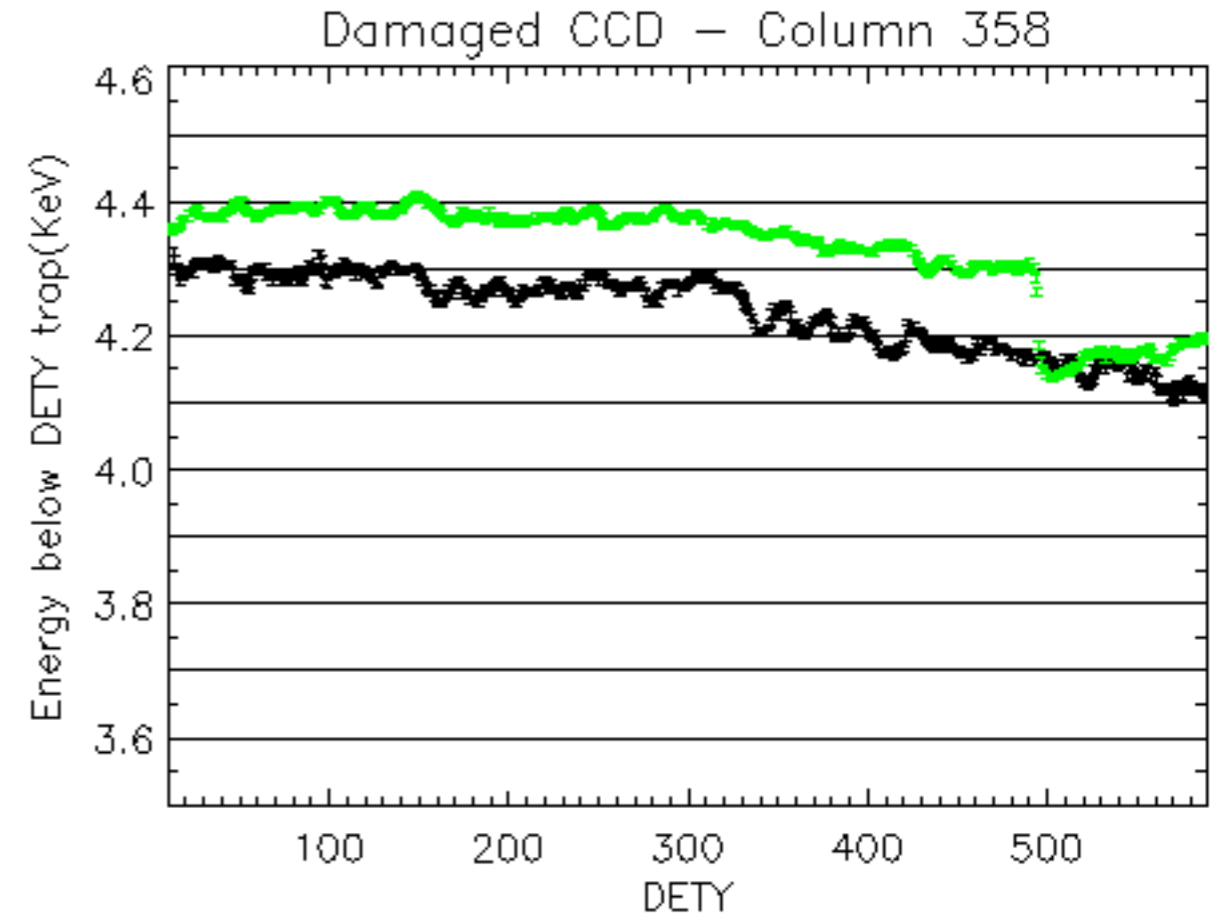
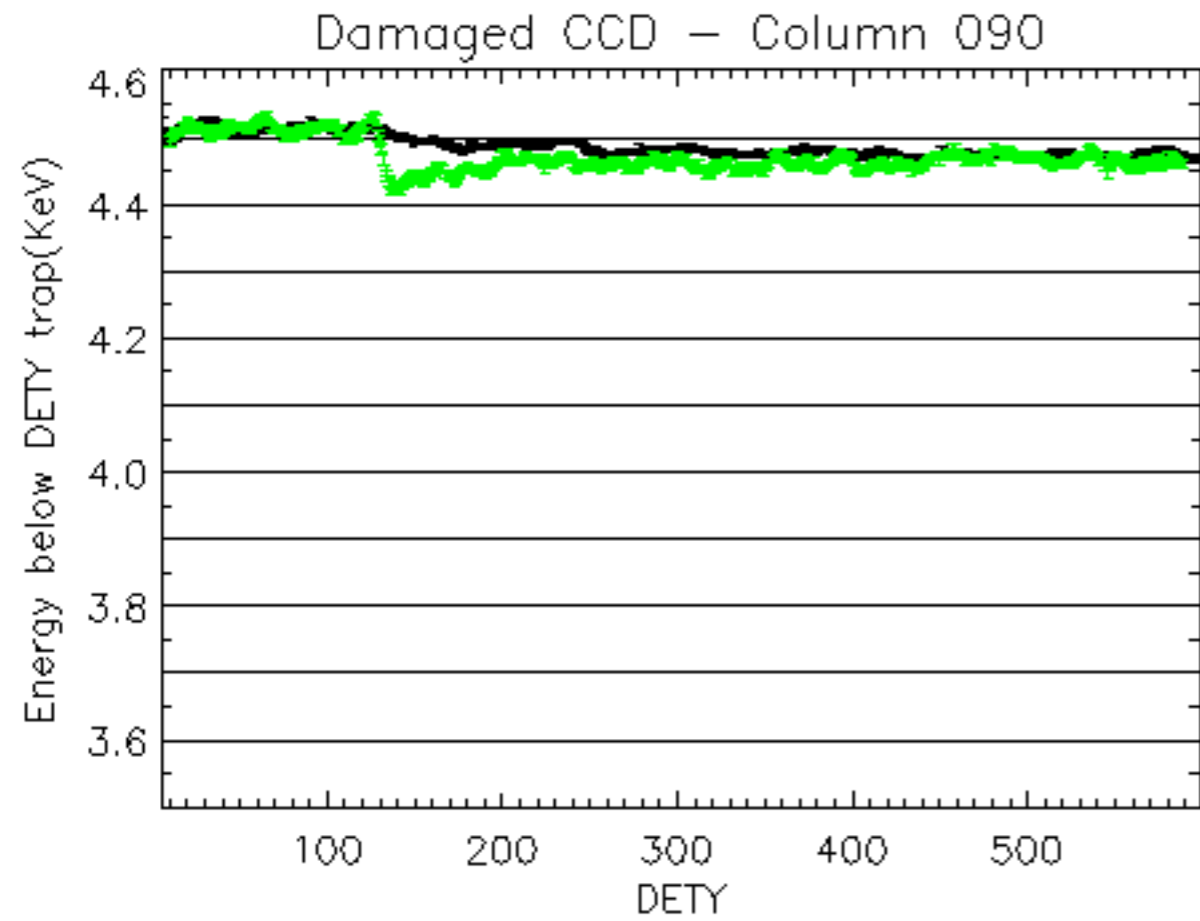
PROTON DAMAGED CCD - TRAP EMISSION TIME



$$\tau_e = \frac{\exp[E_T/(kT)]}{\sigma_n v_{th} N_C}$$

NEUTRON DAMAGED CCD

Neutron generator at Enea-Frascati - Neutron irradiation, dose: 10^8 14 MeV neutrons



NEUTRON DAMAGED CCD

