



# Calibration of the XMM EPIC-pn Camera in the Fast Modes

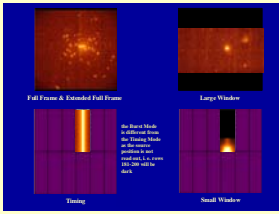


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## Modes



- the pn-CCDs can be read out in different modes
- the fast modes are Timing and Burst Mode

basic numbers of Timing Mode:

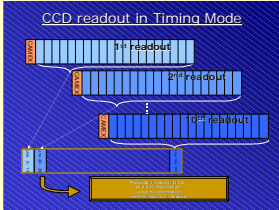
time resolution: **0.03 ms**

Max. count rate (flux) point source [s<sup>-1</sup>] (mCrab): **1500 (160)**

basic numbers of Burst Mode:

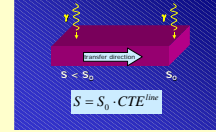
time resolution: **7 μs**

Max. count rate (flux) point source [s<sup>-1</sup>] (mCrab): **60000 (6300)**

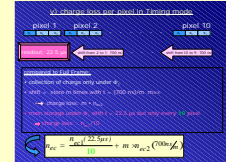
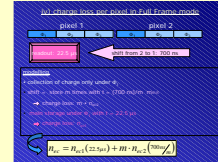
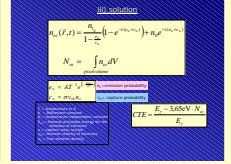
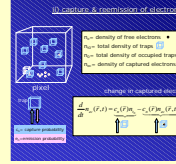
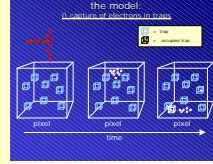


## Timing CTE-Model

### Charge Transfer Efficiency

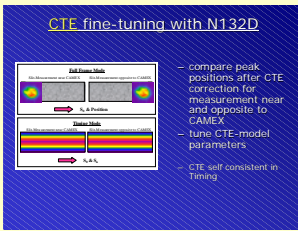


- the different read out in Timing requires a modified CTE-Model

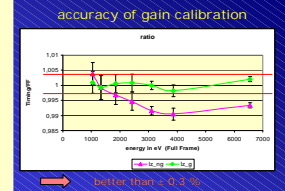
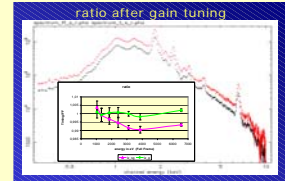
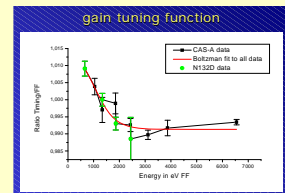
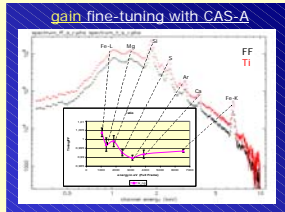
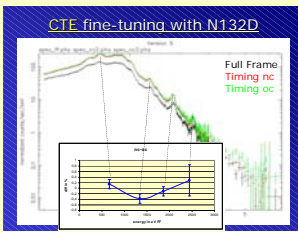
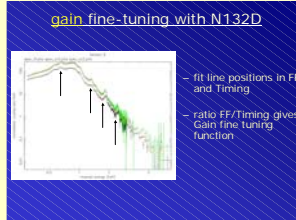


## Calibration of Timing Mode

### 1st step: calibration of CTE



### 2nd step: calibration of Timing gain

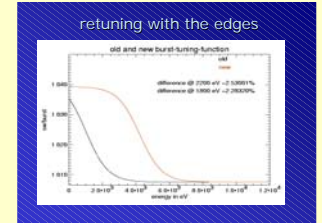
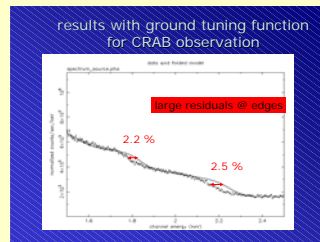
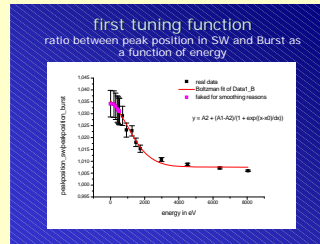


### mainstream of corrections in Timing Mode

- gain correction Full Frame
- additional gain correction for Timing
- CTE correction Timing
- 2<sup>nd</sup> order corrections Full Frame (long term CTE & temperature)

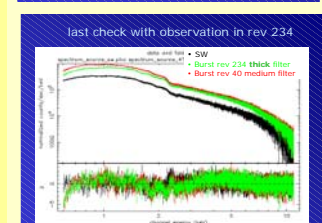
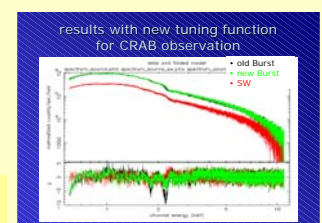
## Calibration of Burst Mode

- first try with correction derived by ground cal-data did not give satisfying results
- tuning function changed, based on the difference between spectra and model at edges of the mirror response function
- with new tuning function the residuals in Burst Mode are similar to those in Small Window Mode



### mainstream of corrections in Burst Mode

- gain correction Full Frame
- additional CTE/gain correction for Burst
- CTE correction Full Frame
- 2<sup>nd</sup> order corrections Full Frame (long term CTE & temperature)



- for more detailed spectral accuracy a new calibration observation of a source with prominent lines would be necessary (i. ex. CAS-A)
- but estimated cal-time would be very long due to only 3% lifetime in Burst Mode

Many thanks to Heinrich Braeuninger and the PANTER crew for ground calibration support and to all the VILSPA crew for in orbit calibration support