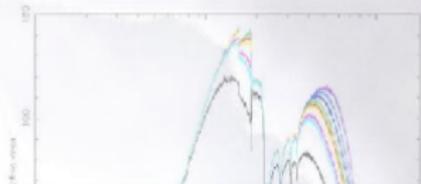


Swift-XRT Update

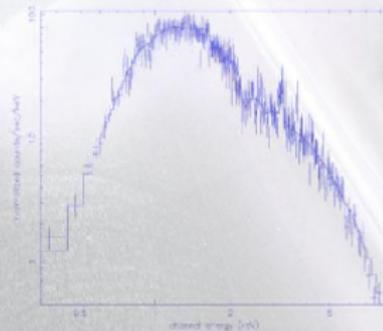
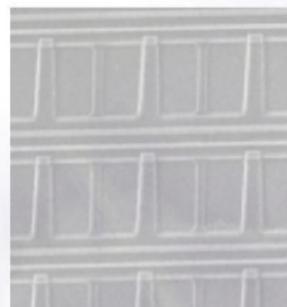
Andy Beardmore

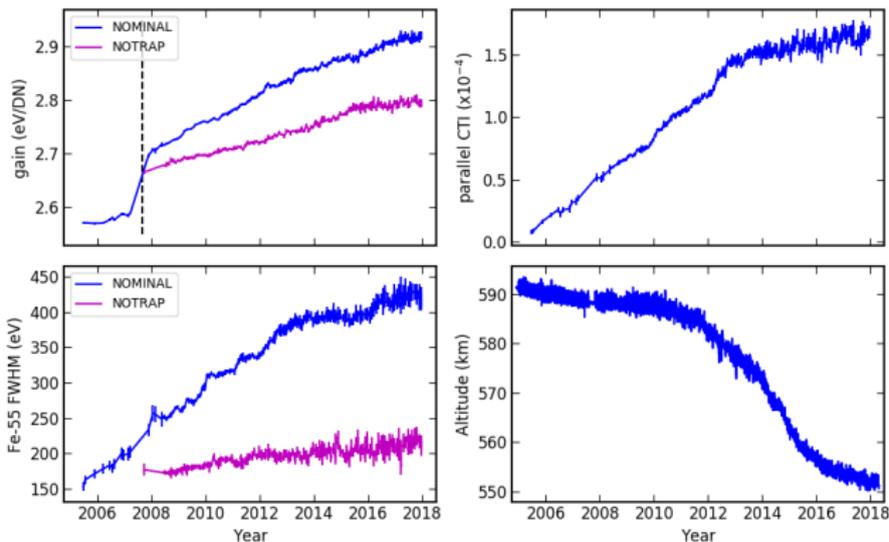
University of Leicester

IACHEC14, 2019-05-20



example (4)



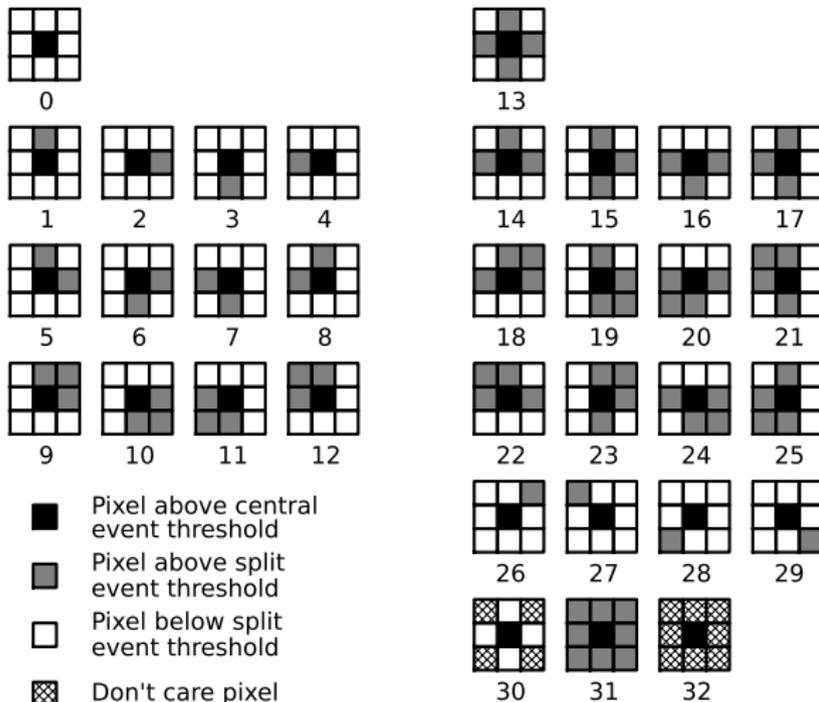


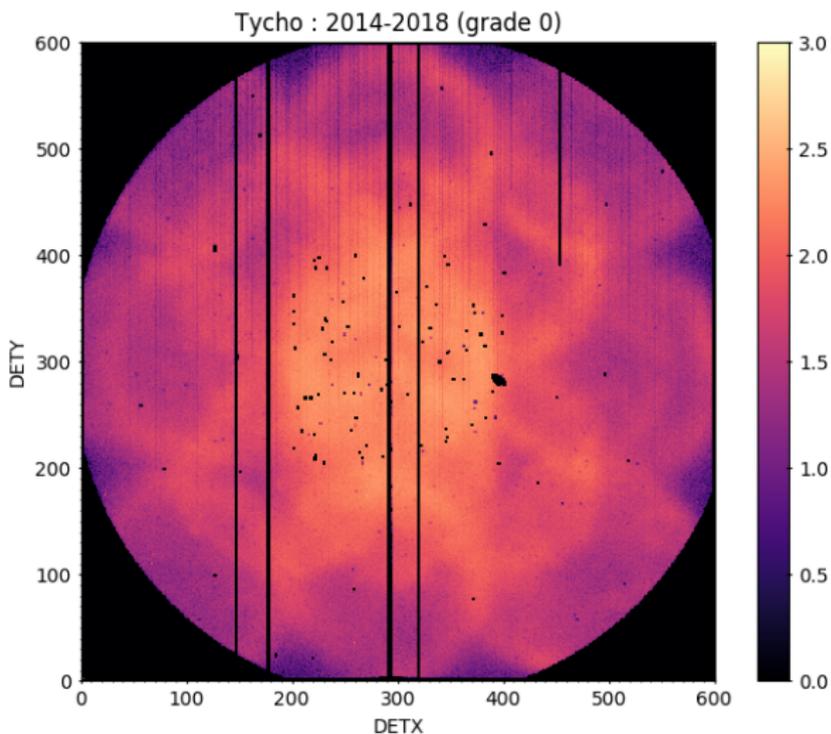
- XRT gain (top left) and parallel CTI (top right), estimated from four Fe-55 ‘corner’ sources
 - Parallel CTI increased steadily until 2012, then slowed down
- Fe-55 FWHM (bottom left) for corner source closest to readout (blue: whole source; magenta: trap-free columns)
- Decline in *Swift*’s altitude (bottom right) correlated with CTI
 - reduction in radiation damage at slightly lower altitudes ($\lesssim 580\text{km}$)

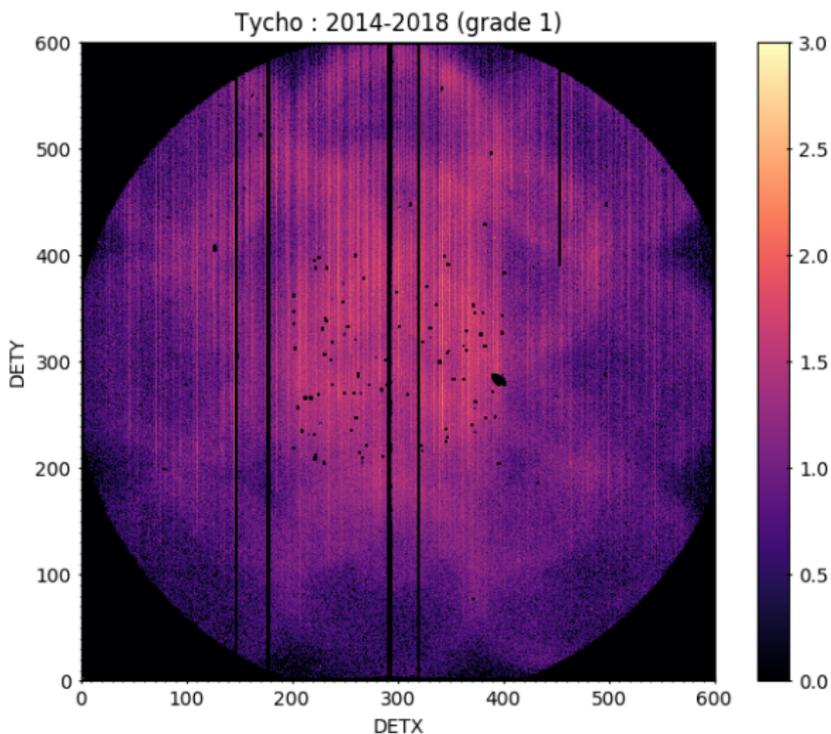


- After ~ 3 years, CTI became more and more dominated by the formation of deep charge traps in individual pixels (in PC mode)
- Since 2009, the location and depth of traps have been mapped \sim yearly using Si-K α line in the Tycho & Cas A SNRs
 - PC mode : 15×20 ks on Tycho
 - WT mode : 6×10 ks on Cas A
- Energy dependent corrections $\propto (E/E_{break})^\alpha$ then applied on top of gain/CTI correction









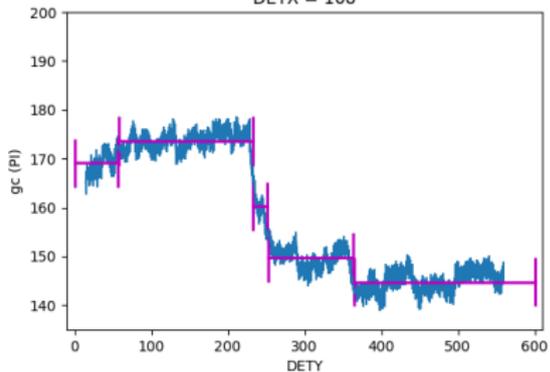
- Ratio of grade n to grade 0 – –12

Date	0	1	2	3	4
2010-02	0.790	0.094	0.018	0.059	0.018
2012-08	0.775	0.113	0.017	0.058	0.017
2014-08	0.772	0.116	0.017	0.058	0.017
2015-08	0.732	0.155	0.017	0.057	0.017
2016-08	0.737	0.149	0.017	0.057	0.017
2017-08	0.730	0.160	0.016	0.056	0.016
2018-08	0.722	0.168	0.016	0.056	0.016

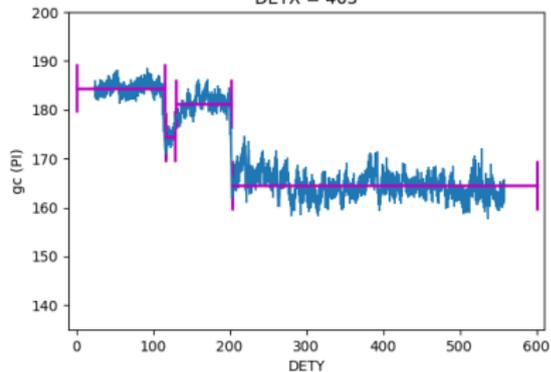
- Grade migration from 0 \rightarrow 1
 - Emission of charge from traps \rightarrow trailing charge effects in PC
- Grades 3, 2 & 4 are relatively well behaved
- Grades 5–12 total less than 3 per cent at Si-K α
- Advice : use grade 0 – 4 or 0 – 12 to counter loss of QE in grade 0 in PC mode



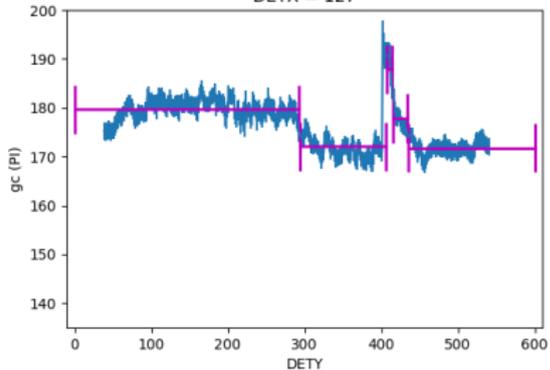
DETX = 168



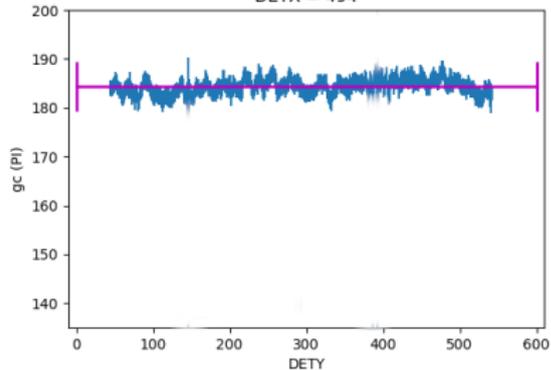
DETX = 463



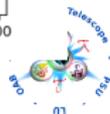
DETX = 127



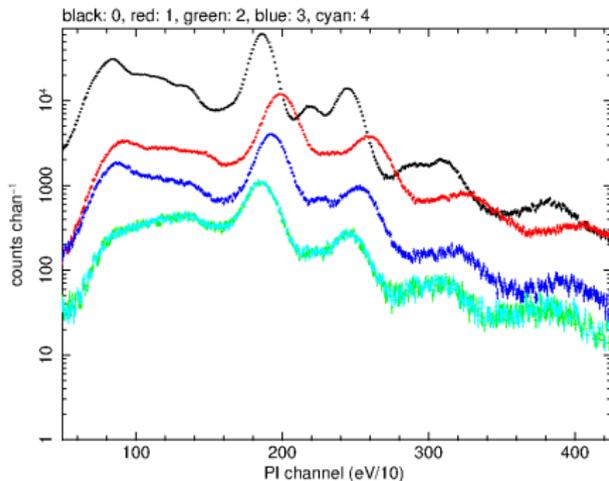
DETX = 494



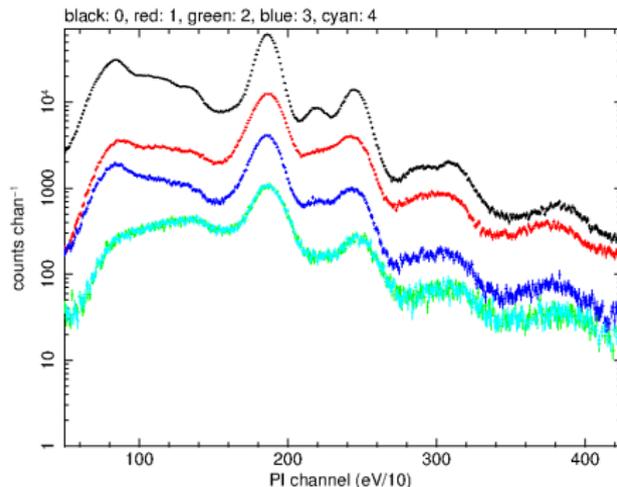
- Trap locations now identified by Bayesian block algorithm



- Same trap offsets all grades



- Grade dependent trap offsets

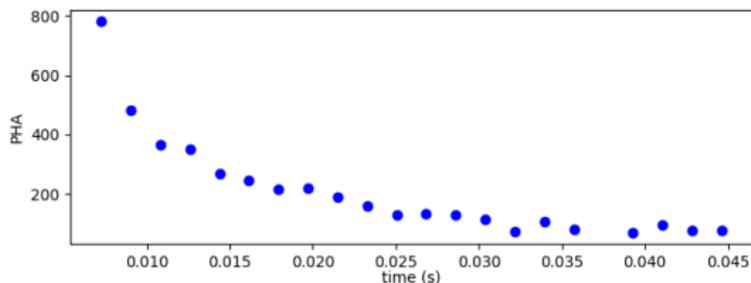


- Grade dependent PC mode trap corrections implemented in next release of XRTCALCPI
 - New CALDB gain file to enable them will be released soon

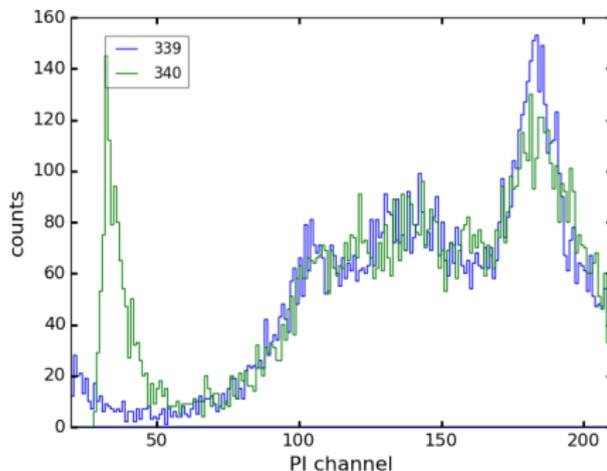


- Trap release timescale comparable to WT readout time

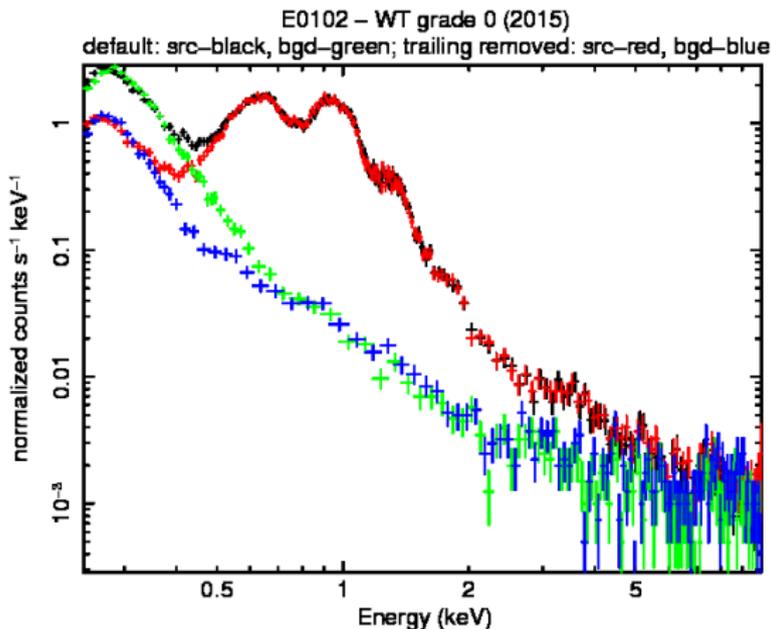
- Causes 'trailing charge' leaked from deepest charge traps into following readout rows (i.e. time bins)



- These then appear as additional low E events



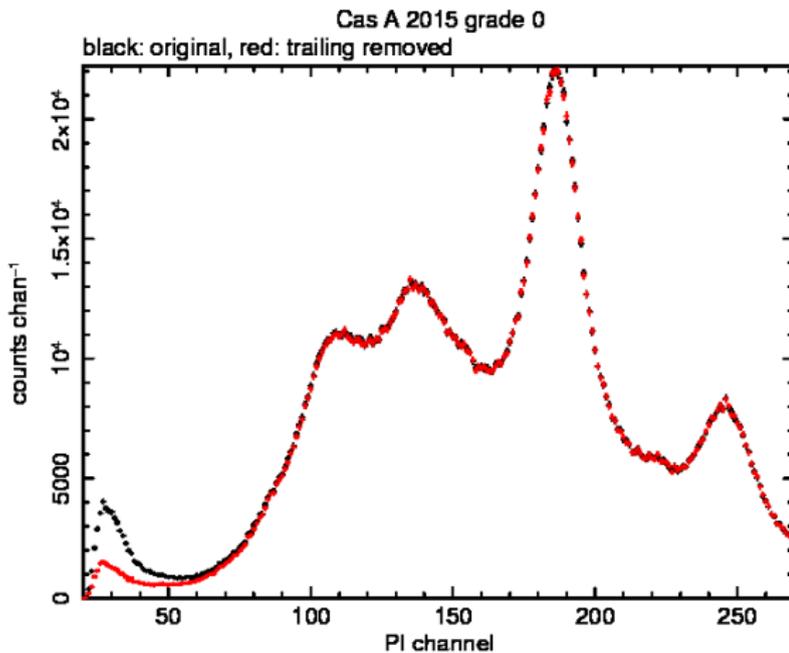
- XRTWTCORR – new subroutine written to identify and remove trailing charge events
- Examples : E0102 (grade 0)



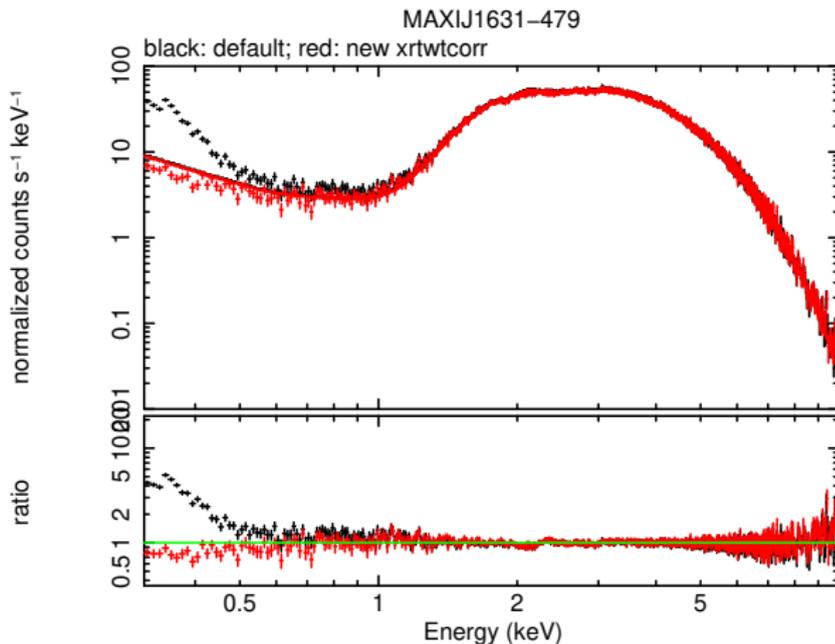
- Factor of 2 decrease in background below 0.5 keV



- Cas A (grade 0)



- MAXIJ1631–479 (grade 0)



apb 17–Jan–2019 16:35



- CTI degradation (as measured from the corner source Fe-55 data) has eased since ~ 2012
 - Might be related to reduction in radiation damage due to decrease in spacecraft altitude after this time
- New charge trap identification approach used for PC mode
- Updated XRTCALCPI to implement grade dependent trap corrections in PC mode
- Updated XRTWTCORR to implement trailing charge removal
 - Future: investigate adding trailing charge back to main event



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- Now where/when are we watching the GoT finale?

