Chandra ACIS BI Low-E Gain

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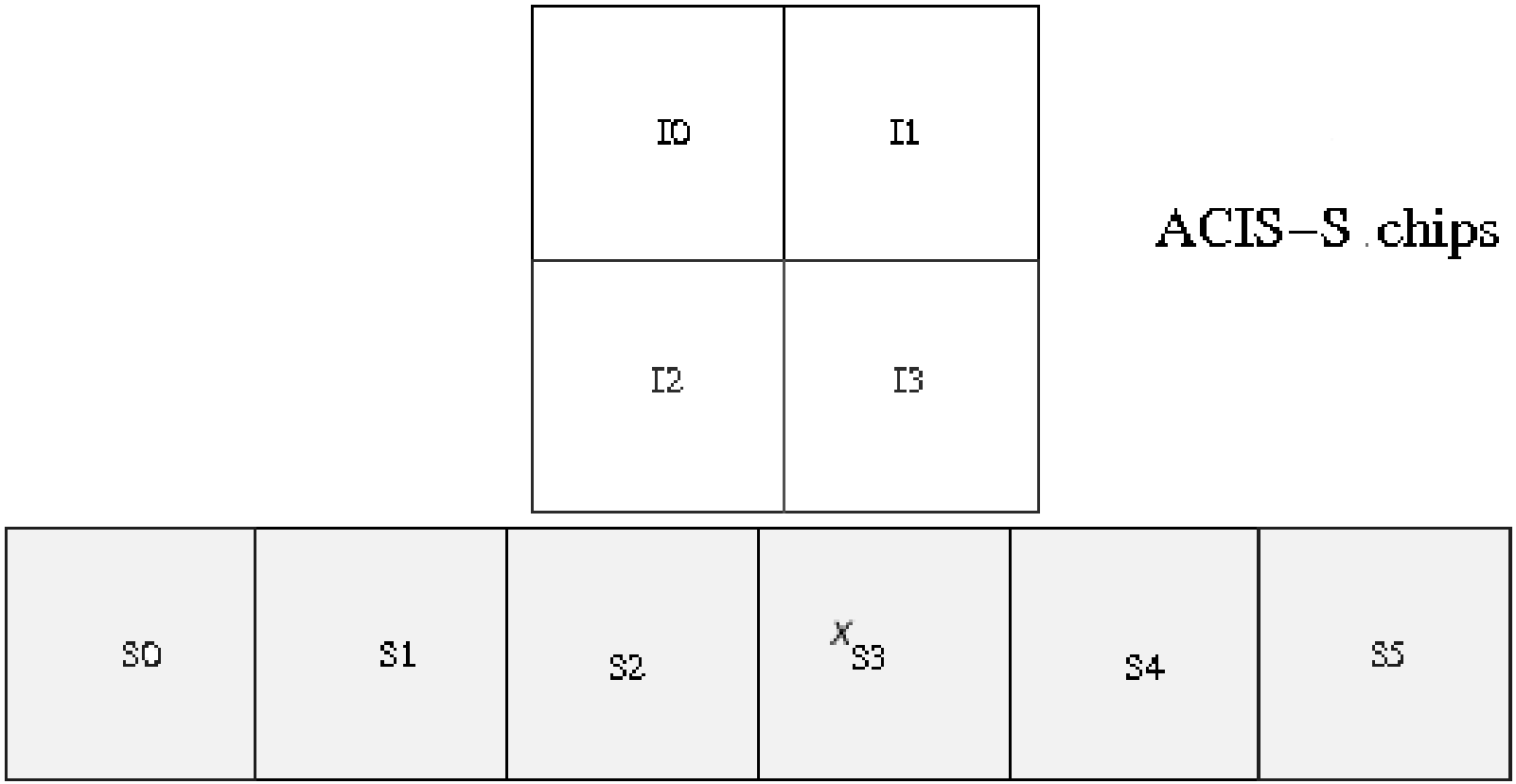
Overview

- ACIS low-E gain: BI chips (S1, S3)
- nominal model $\Rightarrow$ gain errors at low E
- Gain: relation between E_{true} and `pha`; want $E_{\texttt{pha}} = E_{true}$
- Use LETG+ACIS observations
  - narrow range in `CHIPX`: grating $\Rightarrow$ *E independent of PHA!*
  - aimpoint (offset y) shifted to put different energy ranges on S1 & S3
- take $E_{true} = E_{grat}$ (E from grating dispersion)
- $\langle E_{pha} \rangle / \langle E_{grat} \rangle$ provides correction to `PHA`-E_{pha} relation ("tweak")

ACIS Focal Plane Layout



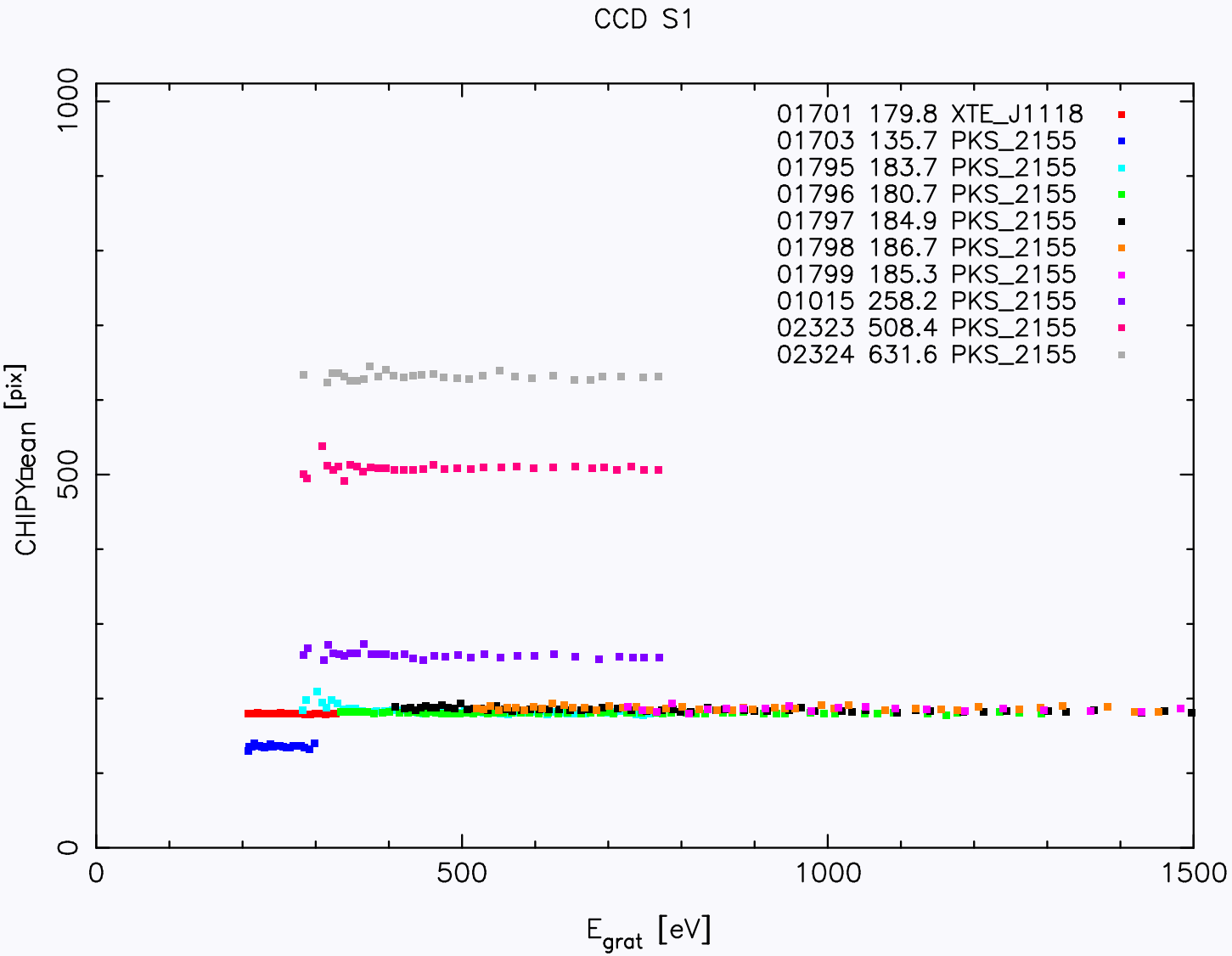
Procedure

- remove any existing low-E tweak; reprocess data
- split into narrow `chipx` intervals (32 to 4 pixels)
- evaluate $\langle E_{grat} \rangle$ and $\langle E_{pha} \rangle$
  - correct for $\langle E_{pha} \rangle$ RMF asymmetry
- compare $\langle E_{pha} \rangle$ and $\langle E_{grat} \rangle \Rightarrow$ gain tweak
- generate new gainfile; reprocess data
- verify $\langle E_{pha} \rangle \approx \langle E_{grat} \rangle$
- test against other data (*e.g.* E0102)
- $\Rightarrow$ CALDB

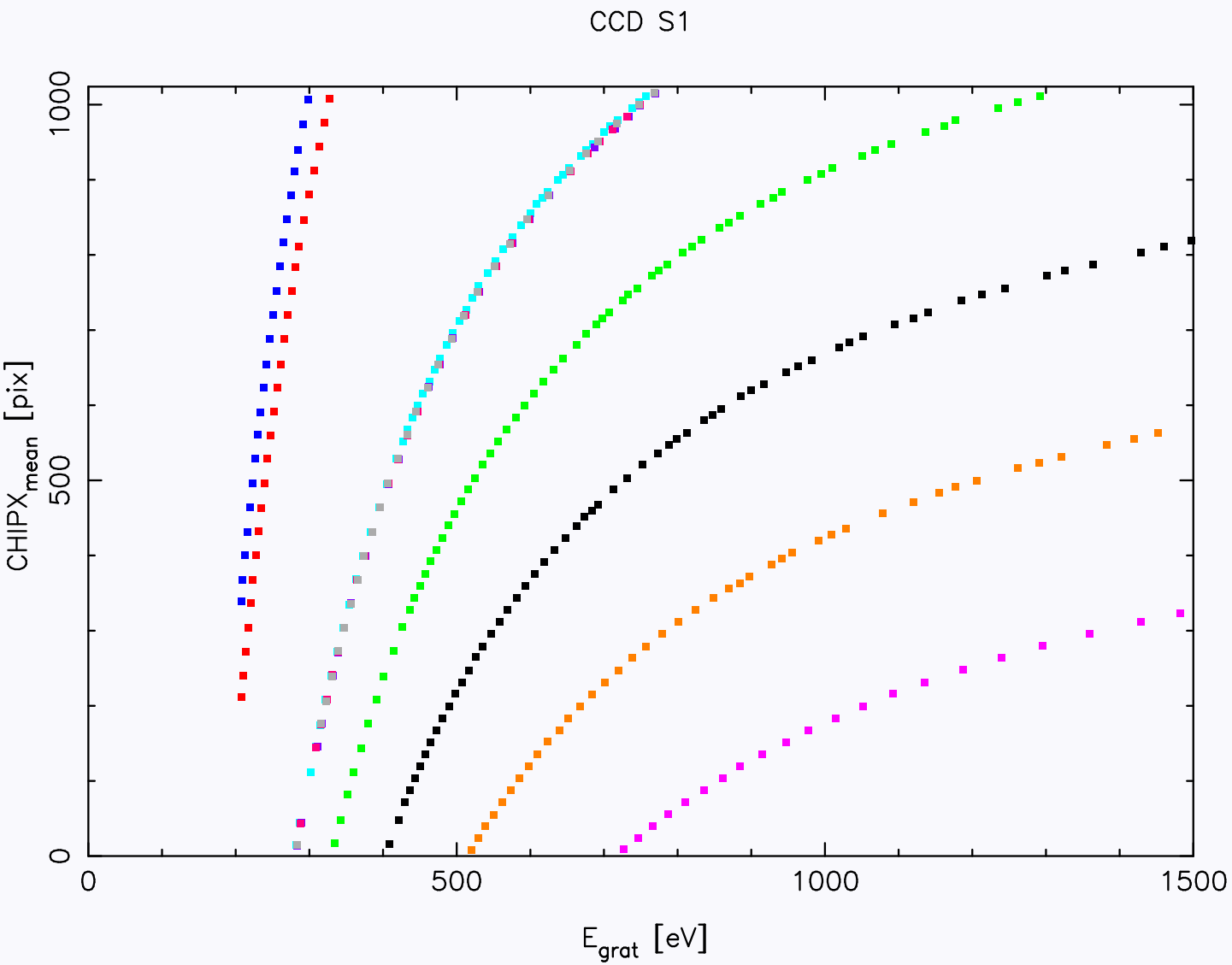
Observations

ObsID	Y offset (arcmin)	⟨CHIPY⟩ (pix)	Ontime (ks)	Date Obs	Target
01701	−0.33	179.8	24.9	2000-04-18	XTE_J1118
01703	−1.5	135.7	26.2	2000-05-31	PKS_2155
01795	6	183.7	20.0	2000-08-07	PKS_2155
01796	8	180.7	19.8	2000-08-08	PKS_2155
01797	10	184.9	19.8	2000-08-08	PKS_2155
01798	12	186.7	19.8	2000-08-08	PKS_2155
01799	14	185.3	20.1	2000-08-10	PKS_2155
01015	6	258.2	9.6	2000-12-06	PKS_2155
02323	6	508.4	9.1	2000-12-07	PKS_2155
02324	6	651.6	8.8	2000-12-07	PKS_2155

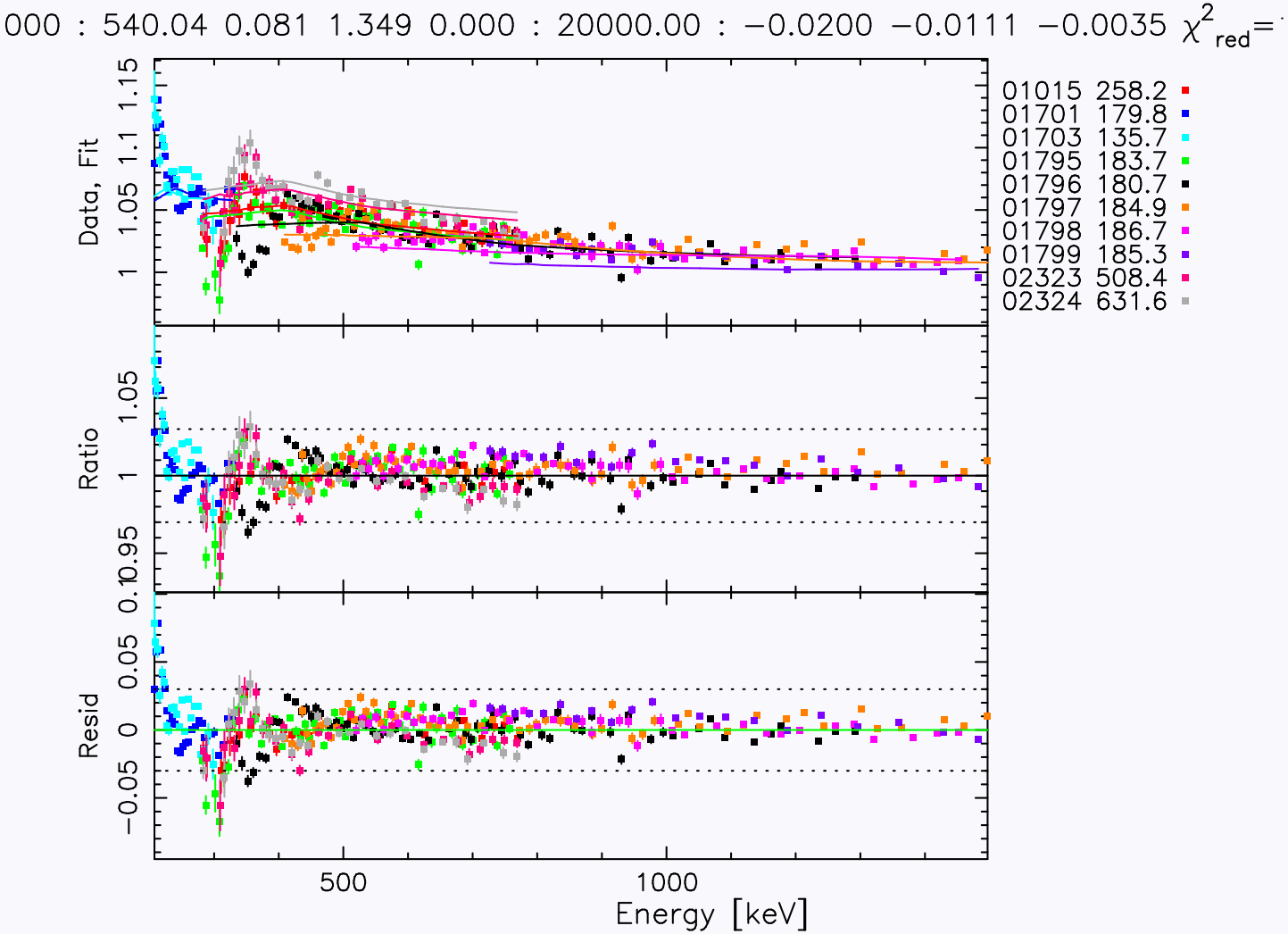
Variation with CHIPY



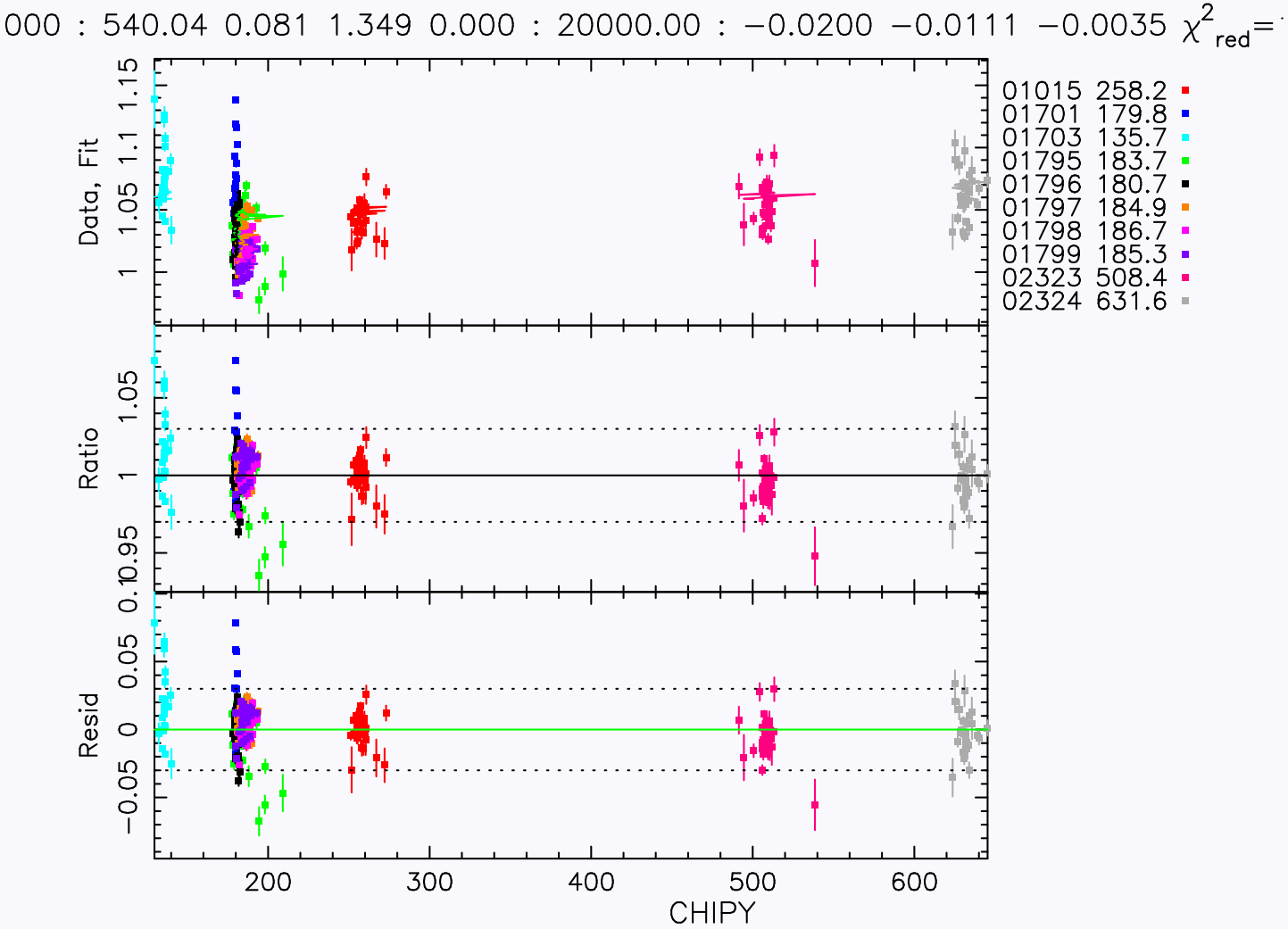
Variation with CHIPX



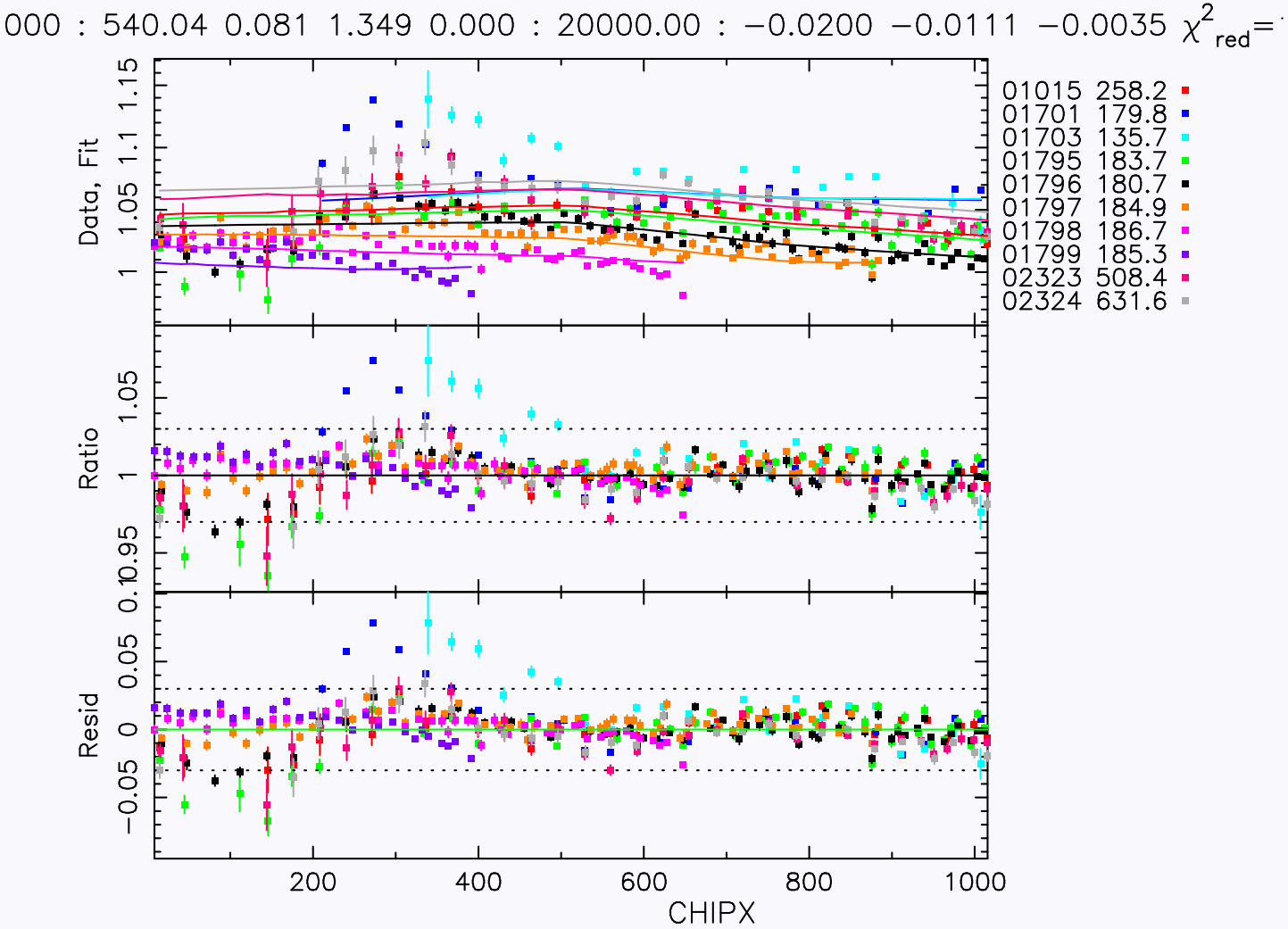
Example “fit” – versus energy



Example “fit” – versus chipy



Example “fit” – versus chipx



Summary

Summary:

- S1: narrowed ratio and residuals ($\sim \pm 2 - 3\%$) down to ~ 400 eV
  - a significant improvement, but gain error still large compared to other ACIS chips
- below ~ 400 eV more complex

Next steps:

- generate tweaks for S3 (much smaller effects...)
- generate and test CALDB-compatible gain and resp files
- test against other datasets (*e.g.*, E0102)
- if ok, include in CALDB release

ACIS Frame Readout