Including CTI Time Dependence in the PSU CTI Corrector

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- changes in CTI with time were measured and quantified by C. Grant
- these were incorporated (for each CCD) into the PSU CTI corrector in May 2002 OUTLINE:

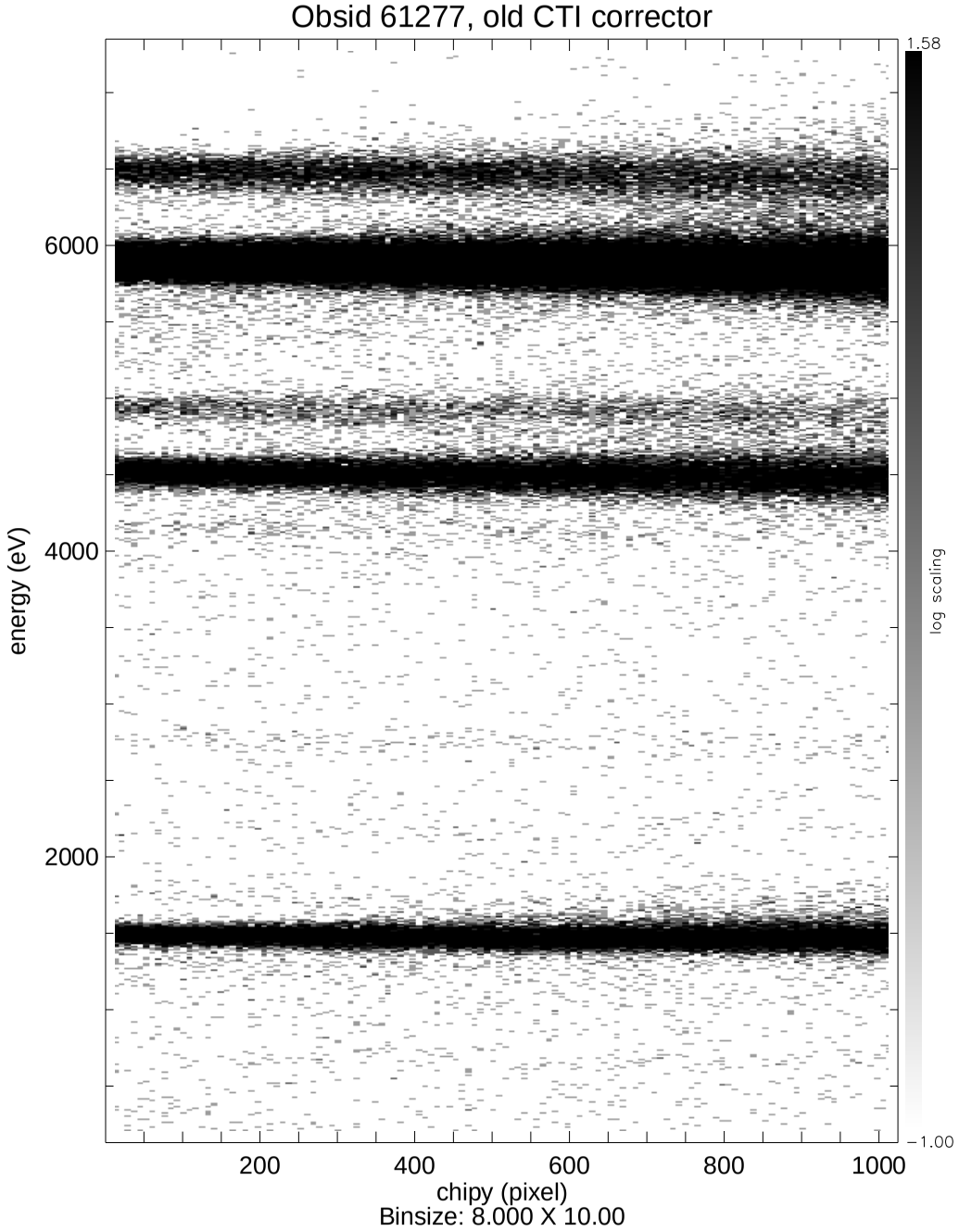
- ACIS External Cal Source data (March 2002) without time-dependent corrector (FI and BI)
- model for time dependence
- same cal data with time-dependent corrector
- suggestions for improving CTI corrector using time dependence

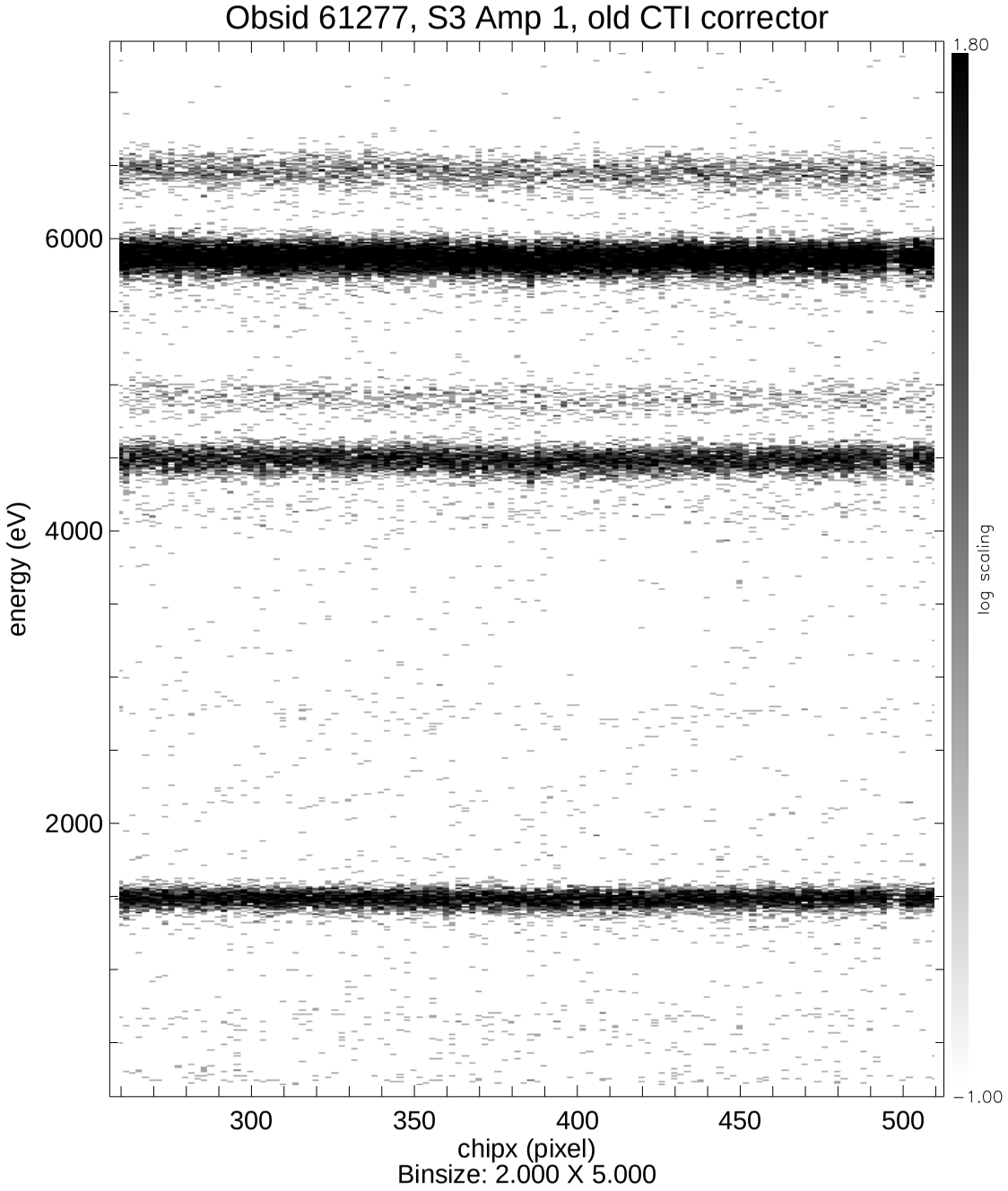
This plot shows the External Calibration Source lines displayed as a function of row number (chipy) for the FI device I0 (all amps combined). Linear fits to these lines yield the line energy before CTI losses (the intercept, in eV) and the charge loss per pixel transfer (the slope, in eV per pixel transfer). These data have been CTI-corrected with the original, time-independent corrector. Residual slopes represent the inadequacy of the corrector for removing gain variations across the CCD in March 2002. Errors are not shown because formal errors are very small and systematics are hard to estimate.

```
Intercept (eV) Slope (eV per pixel transfer)
-------------------------------------------
1488 -0.027
4513 -0.041
5894 -0.052
```

Same plot as above, for the BI device S3, Amp 1.

Intercept (eV)	Slope (eV per pixel transfer)
1483	+0.001
4494	-0.027
5875	-0.029


Obsid 61277, old CTI corrector
energy (eV)
6000
4000
2000
200
400
600
800
1000
chipy (pixel)
Binsize: 8.000 X 10.00
1.58
log scaling
1.00


Obsid 61277, S3 Amp 1, old CTI corrector
energy (eV)
6000
4000
2000
300
350
400
450
500
chipx (pixel)
Binsize: 2.000 X 5.000
1.80
log scaling
−1.00

Implementing Catherine's Measurements

- Catherine provided linear change in CTI per year for each CCD (-120C data)

- CTI corrector code changed to use TSTART to calculate # of years since a nominal date (1 Aug 2000)
- CTI change rates for each CCD incorporated via existing CTI parameter files
- $\mathrm{CTI}_{\mathrm{today}} = \mathrm{CTI}_{\mathrm{nominal}} + \Delta\mathrm{CTI} \times$ years_since_nominal
- Code design is such that this time-dependence is automatically included in the PSU ACIS CCD simulator as well
- Original CTI-corrected RMFs are still valid

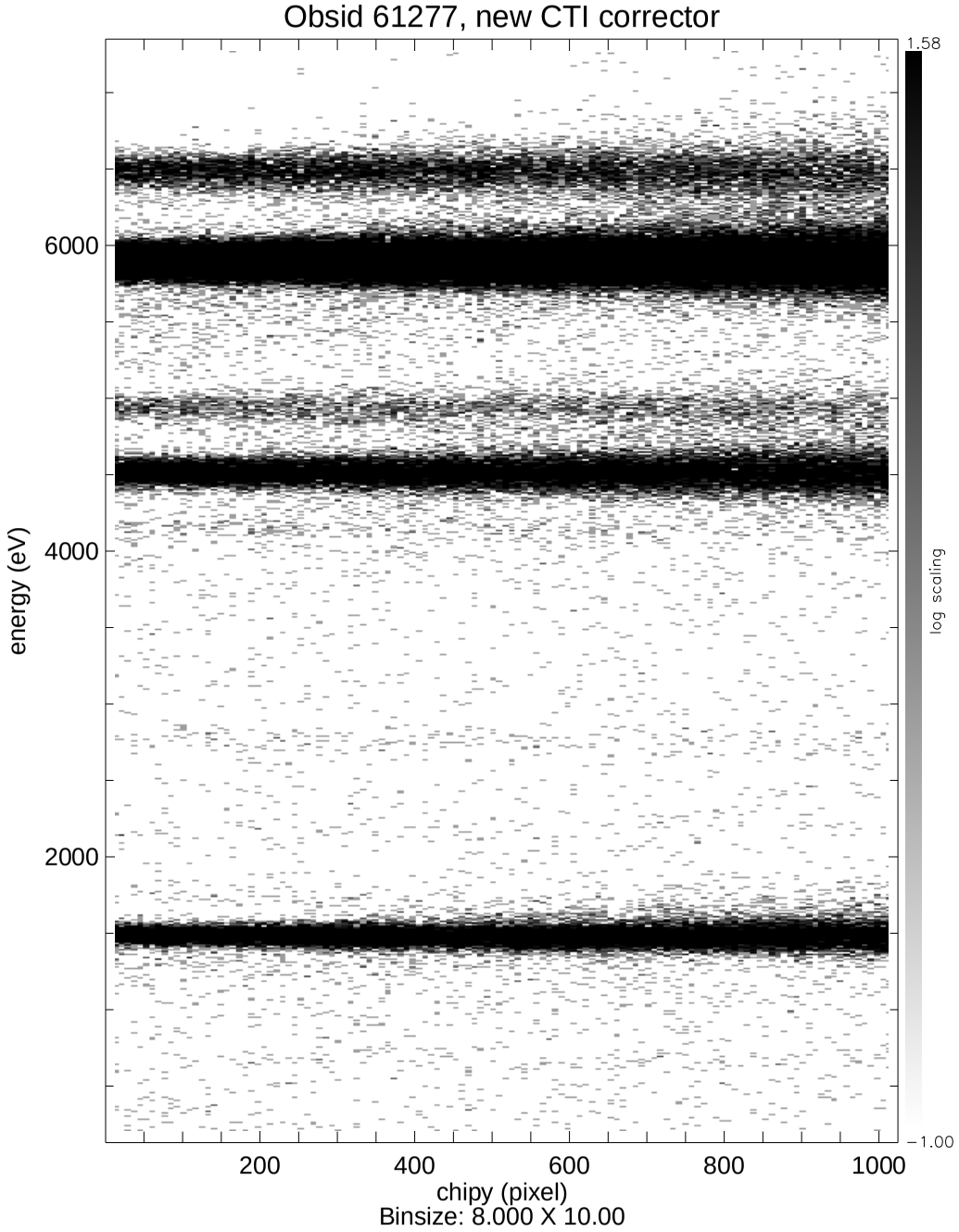
This plot again shows the External Calibration Source lines displayed as a function of row number (chipy) for the FI device I0 (all amps combined).

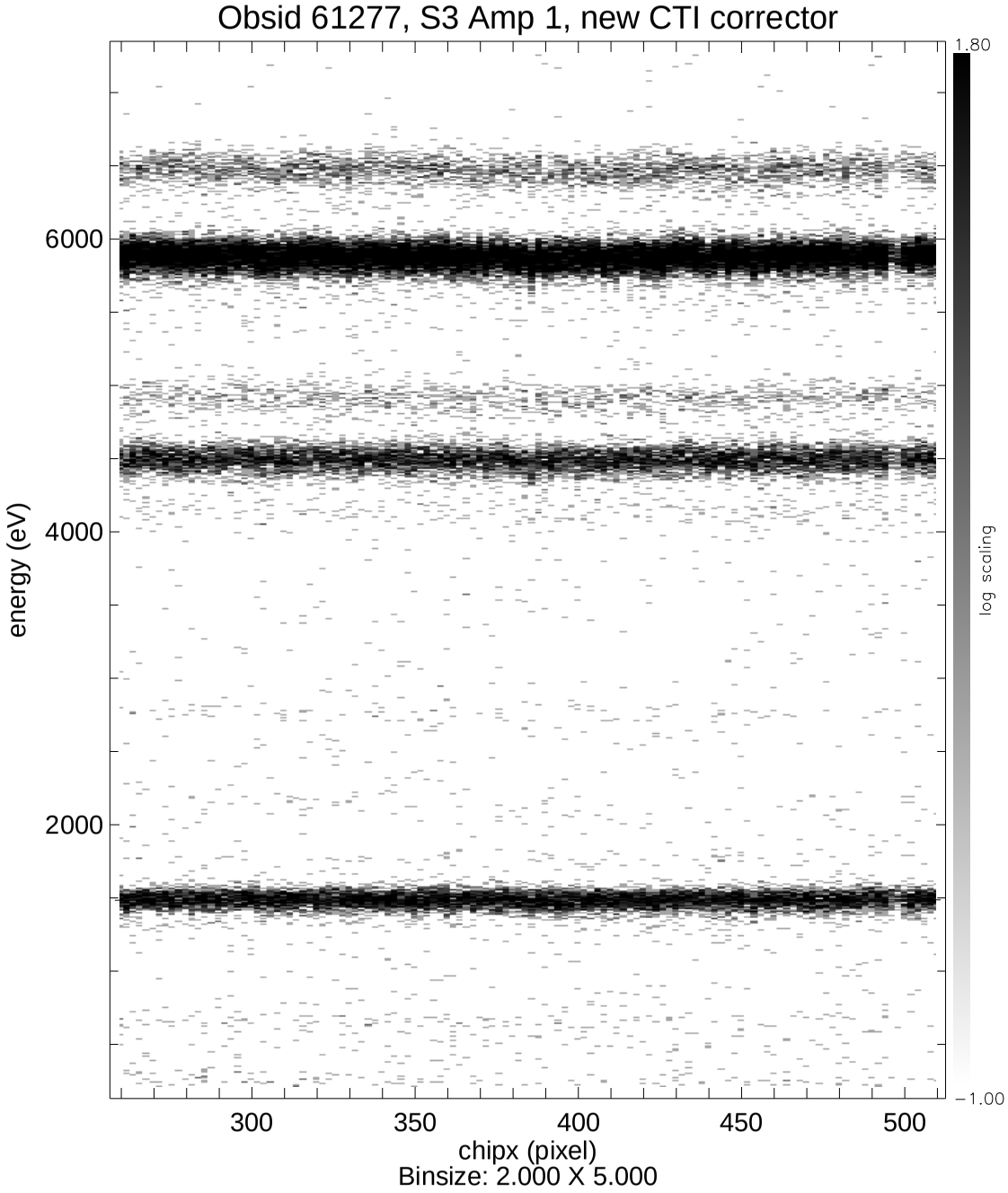
Linear fits to these lines yield the line energy before CTI losses (the intercept, in eV) and the charge loss per pixel transfer (the slope, in eV per pixel transfer). These data have been CTI-corrected with the new, time-dependent corrector.

```
Intercept (eV) Slope (eV per pixel transfer)
--------------------------------------------
1488 -0.016
4513 -0.011
5894 -0.014
```

Same plot as above, for the BI device S3, Amp 1.

```
Intercept (eV) Slope (eV per pixel transfer)
--------------------------------------------
1481 +0.012
4491 -0.002
5872 +0.005
```


Obsid 61277, new CTI corrector
energy (eV)
6000
4000
2000
200
400
600
800
1000
chipy (pixel)
Binsize: 8.000 X 10.00
1.58
log scaling
1.00


Obsid 61277, S3 Amp 1, new CTI corrector
energy (eV)
6000
4000
2000
300
350
400
450
500
chipx (pixel)
Binsize: 2.000 X 5.000
1.80
log scaling
−1.00

Improving the Corrector

- In Spring 2001, corrector tuned with cal data: Jan 2000 - Jan 2001
- "pivot point" 1 Aug 2000 (data over-corrected before this nominal date, under-corrected after)
- using time-dependent corrector, could re-correct these data, include more recent cal data, might derive better deviation map, yield better spectral resolution