Chandra ACIS Background Nonuniformity

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IACHEC 2014
Introduction
ACIS Background Rates & Observations

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Chandra

ACIS Background Nonuniformity

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ACIS Focal Plane Layout

8.3'

S0 | S1 | S2 | S3 | S4 | S5

ACIS-I chips

I0 | I1 | X | I2 | I3

8.3'
ACIS Focal Plane Layout

ACIS-S chips

S0  S1  S2  X  S3  S4  S5
Background Spatial Variation (ACIS “stowed”)
FI Chips – example I3

I0+I2+I3 Background Spatial Variation: 0.3-0.7 keV

ACIS—I023: 0.300–0.700 keV: 2002–09 – 2011–11
I0+I2+I3 Background Spatial Variation: 1.0-2.0 keV

Background Spatial Variation (ACIS “stowed”)
FI Chips – example I3

**I0+I2+I3 Background Spatial Variation: 2.0-5.0 keV**

ACIS-I03: 2.000–5.000 keV: 2002–09 – 2011–11

![Graphs showing background spatial variation](image-url)
Background Spatial Variation (ACIS “stowed”)
FI Chips – example I3

I0+I2+I3 Background Spatial Variation: 5.0-8.0 keV

ACIS—I023: 5.000–8.000 keV: 2002–09 – 2011–11
Background Spatial Variation (ACIS “stowed”)
FI Chips – example I3

I0+I2+I3 Background Spatial Variation: 8.0-10.0 keV

ACIS-I023: 8.000–10.000 keV: 2002-09 – 2011-11
Background Spatial Variation (ACIS “stowed”)
FI Chips – example I3

I0+I2+I3 Background Spatial Variation: 10.0-12.0 keV

ACIS-I023: 10.000–12.000 keV: 2002-09 – 2011-11
Background Spatial Variation (ACIS “stowed”)
BI Chip – S3

S3 Background Spatial Variation: 0.3-0.7 keV

ACIS–S3: 0.300–0.700 keV: 2002–09 – 2011–11
Background Spatial Variation (ACIS “stowed”)
BI Chip – S3

S3 Background Spatial Variation: 1.0-2.0 keV

S3 Background Spatial Variation: 2.0-5.0 keV

Background Spatial Variation (ACIS “stowed”)
BI Chip – S3

S3 Background Spatial Variation: 5.0-8.0 keV

ACIS–S3: 5.000–8.000 keV: 2002–09 – 2011–11

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S3 Background Spatial Variation: 8.0-10.0 keV

Background Spatial Variation (ACIS “stowed”)
BI Chip – S3

S3 Background Spatial Variation: 10.0-12.0 keV
Background Spatial Variation (ACIS “stowed”) 
BI Chip – S1

S1 Background Spatial Variation: 0.3-0.7 keV

ACIS–S1: 0.300–0.700 keV: 2002–09 – 2011–11
S1 Background Spatial Variation: 1.0-2.0 keV

ACIS-S1: 1.000–2.000 keV: 2002–09 – 2011–11
S1 Background Spatial Variation: 2.0-5.0 keV
S1 Background Spatial Variation: 5.0-8.0 keV
Background Spatial Variation (ACIS “stowed”) BI Chip – S1

S1 Background Spatial Variation: 8.0-10.0 keV

S1 Background Spatial Variation: 10.0-12.0 keV

ACIS-S1: 10,000–12,000 keV: 2002-09 – 2011-11
Background Spatial/Spectral Variation (ACIS “stowed”)  
FI Chips – I0, I2, I3

ACIS-I023 Background Spectrum: chipy Variation (no VF cleaning)
Background Spatial/Spectral Variation (ACIS “stowed”)
FI Chips – I0, I2, I3

ACIS-I023 Background Spectrum: chipy Variation (with VF cleaning)
Background Spatial/Spectral Variation (ACIS “stowed”)
FI Chips – I0, I2, I3

ACIS-I023: chipx Variation (no VF cleaning)
ACIS-I023: chipx Variation (with VF cleaning)
Bartalucci *et al.* 2014 (arXiv:1404.3587v1)
- analytic model for ACIS-I chips; 0.3-11 keV band
- VFAINT mode only; based on Phase D+E ACIS “stowed” backgrounds
- includes “position independent” and “position dependent” lines
  - “position dependent”: lines with "frame store" counterparts

Additional coverage needed:
- extend to remaining chips: S3, S2, (maybe not S1)
- VFAINT mode only; extend to FAINT mode
- treat 11.6 keV line
- extend to complete data set (add in Phase F)
ACIS-S1: *chipy* Variation (no VF cleaning)
ACIS-S1: *chipy* Variation (with VF cleaning)
Background Spatial/Spectral Variation (ACIS “stowed”)

BI Chips – S1

ACIS-S1: \texttt{chipx} Variation (no VF cleaning)
Background Spatial/Spectral Variation (ACIS “stowed”)
BI Chips – S1

ACIS-S1: chipx Variation (with VF cleaning)

![Graph showing chipx Variation](image-url)
ACIS-S3: chipy Variation (no VF cleaning)
ACIS-S3: chipy Variation (with VF cleaning)
ACIS-S3: chipx Variation (no VF cleaning)
ACIS-S3: chipx Variation (with VF cleaning)