XMM-Newton/ Chandra Cross Calibration with Clusters of Galaxies

L. David & J. Nevalainen

CXC Calibration Review
September 21 2009
Comparison of XMM-Newton and Chandra derived Cluster Temperatures

Default HRMA effective area prior to Jan. 21, 2009
Internal comparison of ACIS derived temperatures

CALDB 3.4

ACIS 2.0–7.0 (keV) vs. ACIS 0.5–7.0 (keV)

ACIS 2.0–6.0 (keV) vs. ACIS Fe–Line (keV)
Cluster Temperature vs. Fe-line Ratio
Comparison between ACIS and MOS derived temperatures in the 2-7 keV band.

Comparison between ACIS and MOS derived temperatures in the 0.5-7 keV band.
Chandra/XMM-Newton Cluster Cross-Calibration using SASS v8.1 and CALDB 4.1.1

<table>
<thead>
<tr>
<th>Cluster</th>
<th>kT (keV)</th>
</tr>
</thead>
<tbody>
<tr>
<td>N5044</td>
<td>1.3</td>
</tr>
<tr>
<td>A262</td>
<td>2.3</td>
</tr>
<tr>
<td>A2052</td>
<td>3.2</td>
</tr>
<tr>
<td>Hydra A</td>
<td>3.5</td>
</tr>
<tr>
<td>MKW3S</td>
<td>3.9</td>
</tr>
<tr>
<td>A2199</td>
<td>4.3</td>
</tr>
<tr>
<td>A3112</td>
<td>5.0</td>
</tr>
<tr>
<td>A85</td>
<td>5.6</td>
</tr>
<tr>
<td>A1795</td>
<td>5.7</td>
</tr>
<tr>
<td>A3571</td>
<td>7.2</td>
</tr>
<tr>
<td>A2029</td>
<td>7.9</td>
</tr>
<tr>
<td>Coma</td>
<td>8.3</td>
</tr>
</tbody>
</table>

A2029

R (arcsec) vs kT (keV) graph
XMM-Newton Internal Cross-Calibration
Comparison between MOS and PN derived temperatures from the Fe-line ratio.
Comparison between ACIS and PN derived temperatures from the Fe-line ratio.
XMM-Newton Internal Comparison (Soft vs. Hard Band Temperatures)
E0102 Cross-Calibration

Similar trend as derived from Cluster temperatures in the 0.5-2.0 keV energy band
Chandra/XMM broad energy band comparison
Summary

Hard energy band (2.0-7.0 keV)

- MOS1 temperatures are approximately 5% greater than MOS2 temperatures
- MOS1 and PN temperatures are essentially consistent
- ACIS, MOS1 and PN temperatures are essentially consistent

Soft (0.5-2.0 keV) vs. Hard energy bands

- ACIS - soft band temperatures are 10% less than hard band temperatures
- MOS1 and MOS2 - soft band temperatures are 20% less than hard band temperatures
- PN - soft band temperatures are 30% less than hard band temperatures

Broad energy band

- ACIS temperatures are 5% greater than MOS temperatures
- MOS temperatures are 5% greater then PN temperatures