3C273 BeppoSAX-ASCA intercalibration

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Contents

1 Introduction

We report the results of an intercalibration study based on quasi-simultaneous observations of the quasar 3C273 performed by the BeppoSAX and ASCA satellites. 3C273 was observed twice: the first pointing occurred on 1996 July 18-21, during the Science Verification Phase (SVP) of BeppoSAX; the second one about two years later on 1998 June 24-25. These observations have been used both to inter-calibrate the 4 different Narrow Field Instruments (NFI) of BeppoSAX (LECS, MECS, HP, PDS) and to inter-calibrate the LECS and the MECS with the ASCA (SIS0, SIS1,GIS2 and GIS3) detectors. As the 1996 data have been partially discussed in two previous papers (Grandi et al. 1997, Orr et al. 1998), we essentially focus on the 1998 results and report only the comparative study between the MECS and SIS/GIS data collected in the first observation. This study refers to the September 1997 BeppoSAX calibration release.

2 Observations and Data Analysis

The count rates and the effective exposure times for each instrument aboard of BeppoSAX and ASCA are listed in Tab. **??** and **??** for the 1996 and 1998 observations, respectively. The data reduction of the BeppoSAX NFI instruments followed the standard SAXDAS

Table 1: First 3C273 Observation

BEPPOSAX
Start Time 18-7-96 2:3:25 - End Time 21-7-96 8:35:00

Instrument	Energy Range	count/sec	time (ksec)
LECS	0.1-9 keV	0.518±0.07	12
MECS	1.5-10 keV	1.175±0.003	130
HP	7.0-34 keV	1.23±0.08	32
PDS (RTF)*	13-200 keV	1.15±0.03	61

ASCA
Start Time 16-7-96 19:52:32 - End Time 19-7-96 12:28:14

Instrument	Energy Range	count/sec	time (ksec)
SIS0	0.6-10 keV	2.280±0.008	42
SIS1	0.6-10 keV	1.818±0.007	42
GIS2	1.0-10 keV	1.181±0005	42
GIS3	1.0-10 keV	1.431±0.006	42

* – RTF indicates Fixed Rise Time background rejection method

procedures as described by Fiore et al. (1999). The most recent version of the Saxpipe

Table 2: Second 3C273 Observation

BEPPOSAX

Start Time 24-6-98 5:59:0.7 - End Time 26-6-98 4:19:07

Instrument	Energy Range	count/sec	time (ksec)
LECS	0.1-9 keV	0.968±0.006	27
MECS	1.5-10 keV	1.294±0.004	72
HP	7.0-34 keV	1.71±0.05	33
PDS (RTF)*	13-200 keV	2.30±0.04	34
PDS (RTV)	13-200 keV	2.13±0.03	34

ASCA

Start Time 24-6-98 6:42:42 - End Time 26-6-98 10:00:43

Instrument	Energy Range	count/sec	time (ksec)
SIS0	0.6-10 keV	3.448±0.007	73
SIS1	0.6-10 keV	2.767±0.006	73
GIS2	1.0-10 keV	1.798±0.005	72
GIS3	1.0-10 keV	2.248±0.006	72

* – RFT and RFV refer to the Rise Time background rejection method based on fixed (RTF) or variable (RTV) thresholds, respectively.

software (version 1.5) was adopted. Extraction regions of 8 and 4 arc-minutes were used for the LECS and MECS spectra, respectively. The MECS spectrum was produced by merging the single units (MECS1, MECS2 and MECS3 on July 96, MECS2 and MECS3 on June 98). The current SAXPIPE version allows to obtain the PDS spectrum using two different strategies to reject the background (Fiore et al. 1999): the Fixed Rise Time (RTF) threshold and the variable Rise Time (RTV) threshold. We considered both the spectra produced with the two different methods. The September 1997 release of the BeppoSAX calibration was adopted:

```
LECS: lecs_sep97.rmf, lecs_130_128_6_feb98.arf
MECS: mecs1_sep97.rmf, mecs23_4_sep97.arf
HPGSPC: hpgspc_sep97.rmf, hpgspc_sep97.arf
PDS: pds_256_aug97_fixjan98.rmf
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The reduced ASCA data have been kindly provided from Tahir Yaqoob. They have been obtained using the current public software.

3 Intercalibration ASCA BeppoSAX: June 1998

3.1 BeppoSAX NFI Instruments

We first fitted the data of each instrument separately on the energy band reported in Tab. **??** using a single power law absorbed with a Galactic column density ($N_H = 1.68 \times 10^{20}$ cm^{-2};

Table 3: **1998 June**– Best-fit parameters of the **continuum** when a power-law model with Galactic absorption is applied to the ASCA and BeppoSAX data

BEPPOSAX		**June 1998**	
INSTRUMENT	Γ	A^a	χ^2 (d.of.)
LECS (0.5-3 keV)	$1.60^{+0.04}_{-0.03}$	$1.70^{+0.03}_{-0.02}$	43(37)
MECS (1.5-4,8-10 keV)	$1.63^{+0.01}_{-0.02}$	2.32 ± 0.04	44(52)
HPGSPC (7-34 keV)	$1.59^{+0.10}_{-0.09}$	$2.8^{+0.8}_{-0.6}$	40(25)
PDS$^{(RTF)}$ (15-200 keV)	1.76 ± 0.05	$4.1^{+0.8}_{-0.7}$	11 (16)
PDS$^{(RTV)}$ (15-200 keV)	1.78 ± 0.04	$4.16^{+0.7}_{-0.6}$	12 (14)
ASCA		**June 1998**	
INSTRUMENT	Γ	A^a	χ^2 (d.o.f.)
SIS0 (1.5-4,8-10 keV)	$1.66^{+0.02}_{-0.02}$	$2.39^{+0.05}_{-0.03}$	153(112)
SIS1 (1.5-4,8-10 keV)	$1.65^{+0.02}_{-0.03}$	$2.34^{+0.04}_{-0.04}$	108(106)
GIS2 (1.5-4,8-10 keV)	$1.66^{+0.02}_{-0.02}$	2.40 ± 0.04	263(270)
GIS3 (1.5-4,8-10 keV)	$1.66^{+0.01}_{-0.02}$	2.55 ± 0.04	281(291)
SIS+GIS(1.5-4,8-10 keV)	1.66 ± 0.01	2.38 ± 0.02^b	805(780)

^{a} normalization at 1 keV $\times10^{-2}$ photons cm^{-2} sec^{-1} keV^{-1}.
^{b} Normalization at 1 keV of the SIS0.
A^{SIS1}/A^{SIS0}=0.988$\pm$0.008,
$A^{GIS2}/A^{SIS0} = 1.071 \pm 0.009$,
$A^{GIS3}/A^{SIS0} = 1.009 \pm 0.008$

Savage et al. 1993). The residuals to the model for each instrument are shown in Fig. **??**.

We note that:

1) the LECS data strongly deviate from a power law below 0.5 keV and above 3 keV. While the soft excess below 0.5 keV is true and probably produced by the accretion disk, the hard tail above 3 keV is spurious. The hardening of the LECS at high energies is a well known instrumental problem. It is probably due to a combination of penetration in the drift-less gas cell and obscuration by a window support structure rib. In the SVP phase the LECS data deviations started at slightly higher energies, at $\sim$ 4 keV (Orr et al. 1998).

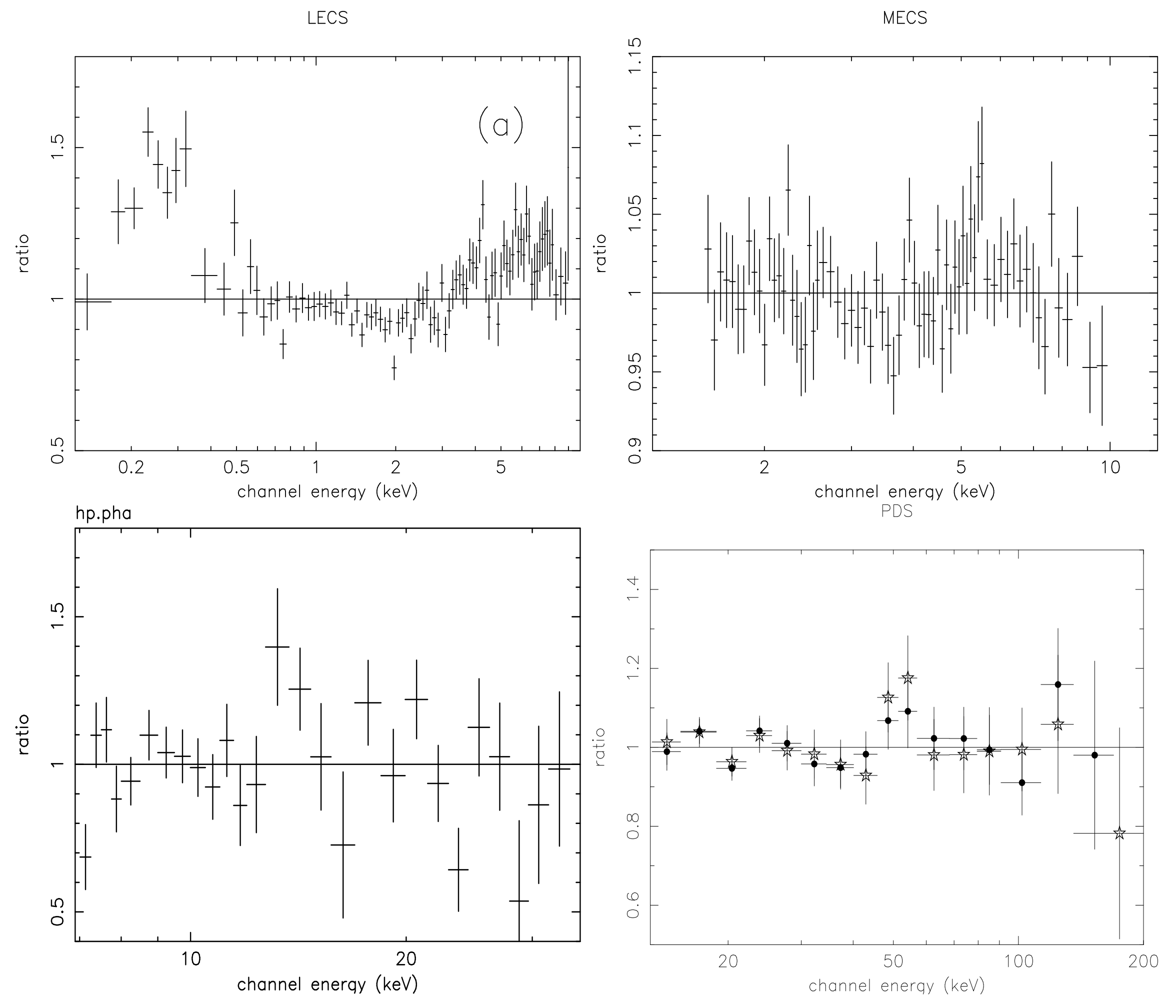

Figure 1: Ratio between the data and the model when a power law is used to separately fit the LECS, MECS, HP and PDS data

2) There is an excess of emission ($\sim 7-8\%$) between 5-6 keV in the MECS data. A similar feature was also observed in the SVP data and interpreted as fluorescence iron line. On the contrary, the count deficit ($\sim 5-10\%$) above 9 keV is probably of instrumental origin.
3) A spurious excess of emission ($\sim 5-10\%$) between 50-60 keV is present in both the PDS spectra. This effect is more marked when the Fixed Rise Time threshold is used.

3.1.1 *Continuum of Emission*

The goodness of our calibration is strongly dependent on the intrinsic spectral shape of 3C273 that, as suggested by the fits of the single instruments, is not represented by unique power law in the entire 0.1-200 keV band. There are at least two complications: 1) a soft excess below 0.5 keV; 2) the iron line in the MECS data.

As we were first interested in the study the continuum, we restricted the LECS energy band to the 0.5-3 keV and the MECS one to the 1.5-4 keV and 8.0-10 keV. The iron line at

$\sim 5-6$ keV is weak in the MECS data but, as shown in sections 3.2 and 4.2, prominent in the ASCA data. As we are working with spectral slope uncertainties of the order of a few percent, we prefer to exclude the feature in emission from our analysis of the continuum.

The results are in Tab. **??**. The fit parameters refer to the observer frame. The statistical uncertainties are 90% confidence level for one interesting parameter.

The χ^2_ν is acceptable for each instrument but the HPGSPC, that, as shown in Fig. **??**, is characterized by a particularly noisy spectrum. There is a good agreement among the spectral slopes of LECS, MECS and HPGSPC, while the PDS appear steeper, independently of the background subtraction used. We think that this effect is real and due to a bending of the 3C273 spectrum at high energies. (Similar results were found by Haardt et al. 1998 using AO1 observations of 3C273).

There is a substantial agreement between the spectral slopes obtained using the fixed rise time PDS spectrum (RTF) and the variable time spectrum (RTV; Fig. **??**). The RTF and RTV nominal power-law best fit parameters differ less than 2% (note that the statistic error is $\sim 4-5\%$).

3.1.2 *Soft Excess*

Fixed the shape of the hard continuum, we investigated the soft excess emission below 0.5 keV in the LECS data. We tested two different models: i) two power laws and ii) a broken power law. We fixed the hard power law spectral index to the value reported in Tab. **??** ($\Gamma = 1.6$) and also the absorption to the Galactic value. In both the cases, the fits is unacceptable ($\chi^2_\nu \geq 1.5$; see Tab. **??**). As shown in Fig. **??**, deviations of 20-30% are still

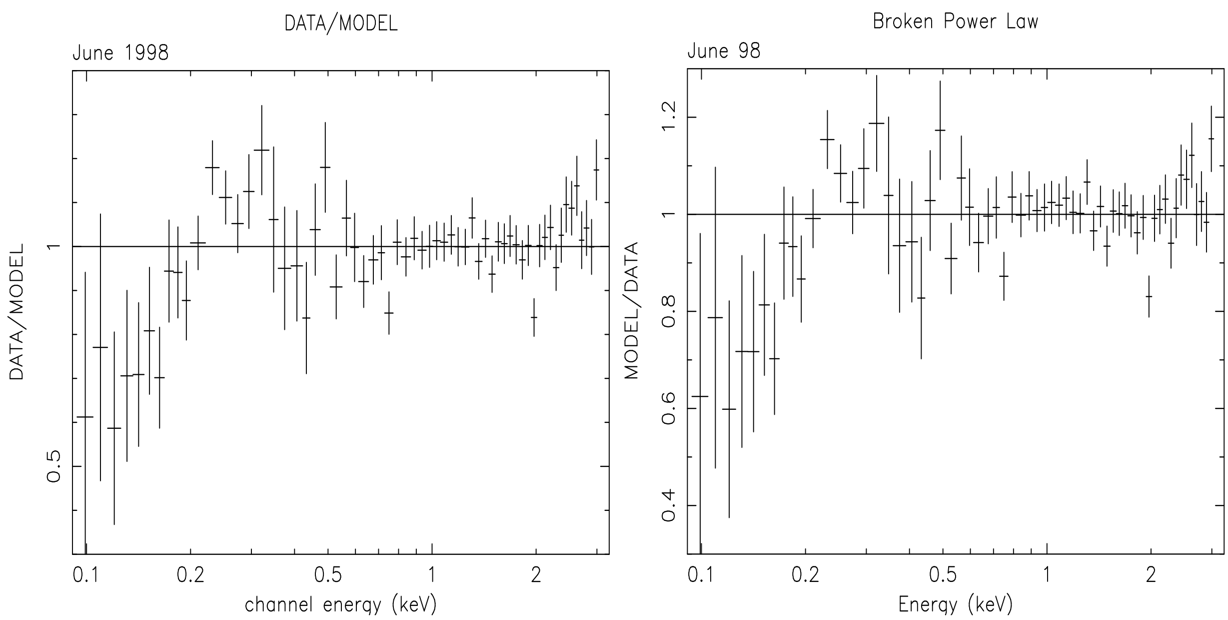

Figure 2: LECS residuals to two power laws (*left panel*) model and a broken power law model. The column density is fixed to the Galactic value

Table 4: **1998 June**– Best fit parameters of the **soft excess** as measured by the BeppoSAX/LECS. The energy range is 0.1-3 keV. The slope of the hard power law Γ^{hard}=1.6 is fixed

Model	$N_H^{additional}$ (10^{20} cm^{-2})	Γ^{soft}	E_{break} (keV)	χ^2 (d.of.)
PL+PL	0.0 (fixed)	$3.1^{+0.6}_{-0.4}$		100(59)
	$2.6^{+0.5}_{-0.9}$	4.9±0.04		64(58)
BK	0.0 (fixed)	1.87±0.08	$0.70^{+0.15}_{-0.14}$	89(59)
	1.2±0.5	$2.5^{+0.4}_{-0.3}$	0.63±0.08	68 (58)

present below the carbon edge energy.

When an additional column density was added to the baseline model, the χ^2 significantly improved (Tab. **??**). The results do not significantly change when a slightly higher value of the Galactic column density is assumed, as measured by of Stark et al. (1992). Assuming $N_H^{Gal} = 1.84 \times 10^{20}$ cm^{-2}, a extra absorber $N^{additional} = 1.03 \pm 0.55 \times 10^{20}$ cm^{-2} was required by the broken power law model.

The LECS SVP data of 3C273 did not allow to reveal this effect because of the poor statistics. The time observation of the LECS on 1996 July was only 12 ksec and in addition the source was fainter (compare Tab. **??** and Tab. **??**).

We can not really say if the addition N_H required by the LECS data is intrinsic to the source or reflects calibration problems below the carbon edge. To be more conclusive on this point, a systematic analysis of a large sample of sources with significant emission below 0.5 is necessary.

3.1.3 *Iron Line*

The deviation of MECS data from a power law model is about 7-8% between 5-6 keV. We modeled a such feature in emission with both a narrow ($\sigma = 0$ eV) and a broad Gaussian profile. The results are shown in Tab. **??**. Here we also list the $\chi^2(dof)$ obtained fitting in the 1.5-10 keV a power law and the improvement in $\Delta\chi^2$ upon the addition of a Gaussian profile (last column). The iron line is statistically required by the data. However it is not possible to distinguish between a narrow and broad profile with the MECS data only.

3.2 Comparison between LECS/MECS and SIS/GIS in the 1.5-10 keV band

The continuous divergence towards lower energies of the SIS and GIS spectra makes the comparison between BeppoSAX and ASCA more difficult than in the past. As reported on the ASCA team on the web page

`(http://heasarc.gsfc.nasa.gov/docs/asca/watchout.html)`

Table 5: **1998 June** – Best-fit parameters of the **iron line** when a Gaussian profile is applied to the ASCA and BeppoSAX data

INSTRUMENT	Γ	E_{Fe} (keV)	σ (eV)	EW (eV)	χ^2_{PL} (d.of.)	$\Delta\chi^2$
MECS	1.61±0.01	5.5±0.2	0(f)	36^{+16}_{-17}	91(94)	12
	$1.62^{+0.02}_{-0.01}$	$5.7^{+0.6}_{-0.4}$	$0.8^{+5.5}_{-0.8}$	90^{+180}_{-30}		13
SIS+GIS	1.65±0.01	5.6±0.1	0 (f)	25^{+6}_{-14}	1779(1710)	15
	1.66±0.01	$5.7^{+0.2}_{-0.1}$	0.6±0.2	70±30		27

this effect started to become evident since approximately late 1995/early 1996. It is probably due to SIS deterioration as the GIS response is not thought to be time-dependent. In Fig. **??**, the residuals are shown, when a power-law model with Galactic absorption is applied to the ASCA spectra of the 3C273 collected during the last coordinated observation with BeppoSAX. SIS and GIS are strongly discrepant for E $\leq$ 1.5 keV.

In the light of that, we separately considered the cross-calibration of the ASCA detectors with the MECS in the 1.5–10 keV energy band and with the LECS below 3 keV. Since the total ASCA and BeppoSAX observations were not perfectly simultaneous (see Tab. **??**), we filtered the ASCA data in XSELECT with the Good Time Interval file of the MECS, in order to accumulate exactly simultaneous spectra.

Analogously to the method followed for the BeppoSAX data we first studied the continuum of emission of each instrument between 1.5-4.0 and 8.0-10 keV (Tab. **??**) and then added a Gaussian profile (Tab. **??**). Positive residuals around E $\simeq$ 5.5 keV were present in the both the SIS (15%) and marginally in the GIS (4%). Since the spectral slope of all the ASCA instruments were consistent (see Tab. **??**) each other, the iron line was studied combined the SIS and GIS together.

Tab. **??** shows that **the LECS/MECS spectral slopes are consistent with those slopes measured by the single instruments of ASCA. The MECS 2-10 keV flux is also consistent whit both the SIS and the GIS2 and it is only** $\sim$ 10% **lower than the GIS3 one**. However when we force the SIS and GIS data to be modeled with a unique power law, the ASCA slope error is reduced ($\Gamma^{SIS+GIS} = 1.66 \pm 0.01$) and SIS+GIS and MECS are not consistent within the errors anymore. The difference in slope between the two satellites is however **very small** (Γ^{ASCA}-$\Gamma^{MECS} = 0.03 \pm 0.01$).

The ASCA data, when all the instruments are fitted together in the 1.5-10 keV band, prefer a broad iron profile rather than a narrow one (Tab. **??**). The χ^2 significantly increases when the intrinsic width of the Gaussian is left free to vary (σ = 0.6 $\pm$ 0.2). In addition, the energy centroid is slightly blue-shifted although consistent (at 90%) with a cold iron line ($E_{z=0.158} = 6.4/1.158 = 5.5$).

The centroid of the line (and the intrinsic width in the case of broad profile) as well as the equivalent width (EW) measured by ASCA and BeppoSAX are completely consistent.

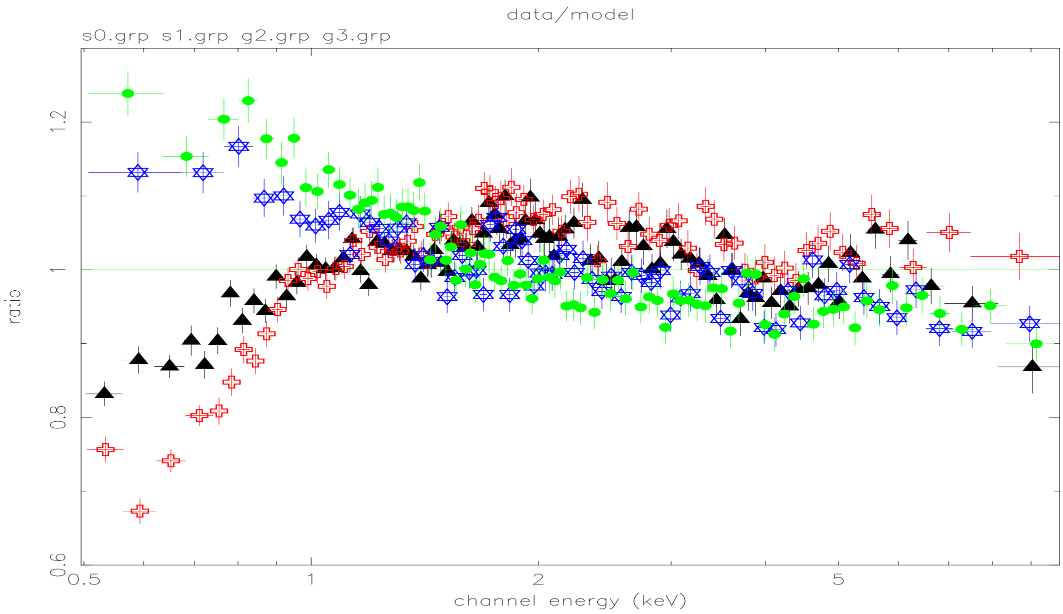

Figure 3: Residuals in data/model ratio, when a power-law model with Galactic photoelectric absorption is simultaneously applied to the spectra of the four ASCA detectors (SIS0: red cross; SIS1: black triangle; GIS2: blue star; GIS3: green circle)
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3.3 LECS/SIS cross-calibration

Although it has been customary to cross-calibrate ASCA and BeppoSAX also in the soft X-rays (down to below the Carbon edge) with 3C273, the task is admittedly difficult, since no clear clue of the phenomenological model that should be used exists. Grandi et al. (1997) employed a double power-law, absorbed by a Galactic N_H, and were compelled to include in the fit an absorption edge of not trivial physical interpretation. Further complexity were unveiled by Cappi et al. (1998) and Haardt et al. (1998), who demonstrated that the soft X-ray emission of 3C273 is variable on timescales greater than the typical time span of an X-ray observation, and in some cases no soft excess above the extrapolation of the hard X-ray power-law is required. The absorption feature is variable as well (Haardt et al. 1998). In the following, we will assume the best-fit model of Grandi et al. (1997; baseline model hereinafter) and try to interpret the comparison between the LECS and the ASCA spectra in the light of it. It is worthwhile to stress that the deductions below are somewhat model-dependent. In this section, the fits are performed on the energy interval within 3 keV and Γ_{hard} is held fixed to the best MECS/ASCA X-ray value (1.64, see above). If the baseline model is applied to the **LECS and SIS spectra**, with all the parameters, except the relative normalization, mutually tied, the fit is very poor ($\chi^2 = 3329/209$ dof). The main difference is due to a clear deviation of the residuals below 1 keV. We untied the parameters of the model one by one to try and phenomenologically reconcile the discrepancy. The best result is obtained allowing the absorbing column density to be different in the LECS and in the SIS.

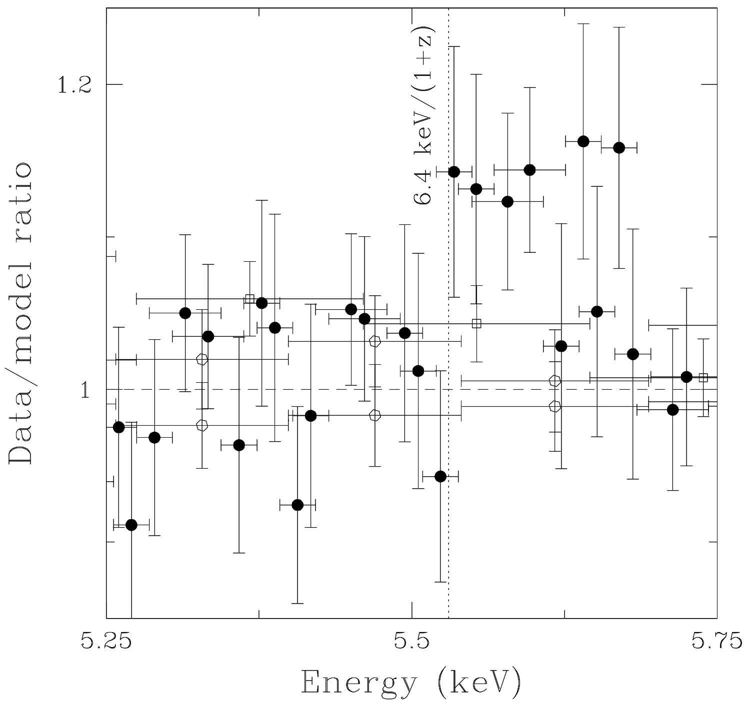

Figure 4: Data/model ratio in the 5.25–5.75 keV energy range, when a power-law model plus Gaussian profile model is applied to the MECS and ASCA spectra and the line normalization is set to zero. The different symbols indicate: MECS (*empty squares*); SIS (*filled circles*); GIS (*empty circles*). The *dotted line* marks the observer's energy of a K_α fluorescent line from neutral iron, emitted at the redshift of 3C273.

The SIS detectors require an excess absorption in comparison to the LECS (which is fixed to the Galactic value), by 6 and 9.1×10^{20} cm^{-2} (SIS0 and SIS1, respectively). Under these conditions, the residuals uncertainties (which still produce a rather high $\chi^2 = 339/207$ dof) are mainly due to the LECS data points below 0.5 keV. Other possibilities (untying the soft spectral indices, or the relative normalizations between hard and soft power-laws) do not produce satisfactory fits.

By contrast, the baseline model with all the parameters mutually tied (again, except the relative normalizations among the different spectra) yields a fairly good fit when applied to the **LECS and GIS spectra** simultaneously ($\chi^2 = 159/99$; again the residuals uncertainties are due to the LECS data points below 0.5 keV). In Tab. **??** we summarize the best-fit parameters.

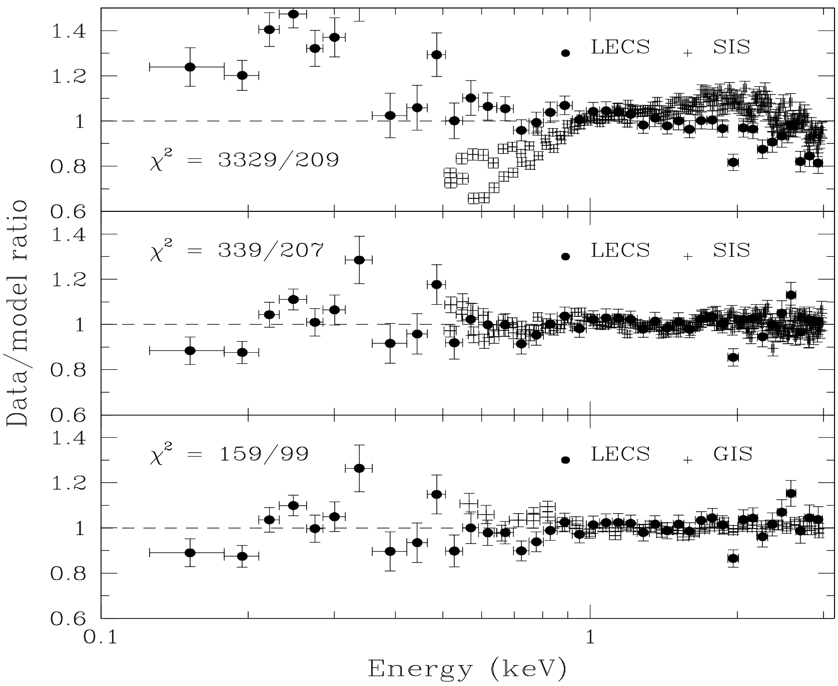

Figure 5: Data/model ratio when the baseline model is applied to the LECS and SIS spectra with absorption held fixed to the Galactic value (*upper*), and absorption left free to vary independently in the fit of each detector spectrum (*central*; the same for the LECS and GIS spectra, with absorption equal to the Galactic value (*lower*)

4 Intercalibration ASCA BEPPOSAX: July 1996

3C273 was quasi-simultaneous observed with both the satellites during the Science Verification Phase of BeppoSAX on 1996 July 19-20 (see Tab. ??). The comparison between LECS and SIS data have been treated in details by Orr et al. 1998. Here we briefly report the MECS-SIS-GIS intercalibration results.

4.1 Comparison between MECS and SIS/GIS

4.1.1 *The Continuum*

The best fit parameters of the continuum of emission of the SVP observation are listed in Tab. ??.

The MECS spectral index reported in this report is slightly steeper than that published ($\Gamma^{MECS} = 1.57 \pm 0.01$) in Grandi et al. (1997). We attribute this discrepancy to the different version of the response matrices used.

The MECS slope and the normalization at 1 keV are completely consistent with the SIS1.

Table 6: Best-fit parameters when the baseline model (details in text) is applied to the LECS/SIS (*first row*) and LECS/GIS spectra (*second row*) simultaneously

Fit	$N_h{}^{a,b}$	Γ_s	$N_s{}^{a,b}$	$N/N_{LECS}{}^b$	$N_H{}^c$
LECS/SIS	1.68 ± 0.04	3.1 ± 0.3	0.9 ± 0.4	$(0.725\pm^{0.010}_{0.016})^{-1}$ (SIS0)	$7.7\pm^{0.4}_{0.5}$ (SIS0)
				$(0.709 \pm 0.010)^{-1}$ (SIS1)	10.8 ± 0.5 (SIS1)
LECS/GIS	$1.48\pm^{0.06}_{0.07}$	$2.37\pm^{0.15}_{0.17}$	$3.1\pm^{0.9}_{0.6}$	$(0.709 \pm 0.010)^{-1}$ (GIS2)	1.68^d
				$(0.654\pm^{0.009}_{0.013})^{-1}$ (GIS3)	

^{a}normalization of the power-laws ("h", hard; "s", soft) in units of 10^{-2} photons s^{-1} cm^{-2} keV^{-1}
^{b} at 1 keV
^{c}in units of 10^{20} cm^{-2}
^{d}fixed

In the SIS0, a prominent feature at $\sim 1.5-2$ keV causes a further steepening of the photon index.

As in the 1998 observation, the combined ASCA (SIS+GIS) spectra are systematically steeper, the difference in slope being Γ^{ASCA}-$\Gamma^{MECS} = 0.06^{+0.01}_{-0.02}$.

In principle, these results may be slightly affected by flux variability. The ASCA and BEPPOSAX pointings overlapped only partially and, in addition, BeppoSAX revealed a 15% intensity decreasing during the pointing. We did not restrict the analysis to the overlapping time interval (that was very short) but preferred to accumulate the photons collected during the entire pointing.

The spectral slopes of MECS, SIS0 and SIS1 reported in Orr et al (1998) are consistent each other within the statistical uncertainties. In that case, however the SIS data were fitted in the 2-10 keV band with a only power law. If the same experiment is repeated, the 2-10 keV SIS photon indices become harder $\Gamma_{SIS0} = 1.61 \pm 0.02$ and $\Gamma_{SIS1} = 1.60 \pm 0.03$ and also the SIS0 agrees with the MECS. The prominent iron line, if not fitted with a appropriate Gaussian profile, produces a slightly flattening of the spectrum.

4.1.2 *The Iron Line*

In Tab. **??** the iron line parameters for the MECS and SIS+GIS instruments are listed. We included the 4.0-8.0 keV energy range in the fit and used a Gaussian profile to parameterize the feature in emission. There is a good agreement between the BeppoSAX and ASCA fits. In both the cases a broad line is preferred. The centroid of the line and the intrinsic width are completely consistent each other.

5 Conclusion

Coordinate BeppoSAX and ASCA observations of 3C273 were organized on 1996 July 18-21 and on 1998 June 24 26. During the second pointing the source was slightly brighter (by about a factor 1.5).

Several spectral components have been observed in the 3C273: a flat continuum of emission, a soft excess below 0.5 keV, an iron line and, in the first pointing, an absorption feature

Table 7: **1996 July**– Best-fit parameters of the **continuum** when a power-law model with Galactic absorption is applied to the SIS/GIS and MECS data

BEPPOSAX		**July 1996**	
INSTRUMENT	Γ	A^a	χ^2 (d.of.)
MECS (1.5-4,8-10 keV)	$1.61^{+0.01}_{-0.01}$	1.47±0.02	44(52)
ASCA		**July 1996**	
INSTRUMENT	Γ	A^a	χ^2 (d.o.f.)
SIS0 (1.5-4,8-10 keV)	$1.69^{+0.03}_{-0.03}$	$1.59^{+0.04}_{-0.04}$	122(98)
SIS1 (1.5-4,8-10 keV)	$1.63^{+0.03}_{-0.03}$	$1.49^{+0.04}_{-0.04}$	104(95)
GIS2 (1.5-4,8-10 keV)	$1.66^{+0.04}_{-0.03}$	$1.60^{+0.04}_{-0.05}$	303(241)
GIS3 (1.5-4,8-10 keV)	$1.68^{+0.02}_{-0.03}$	1.67±0.04	240(257)
SIS+GIS(1.5-4,8-10 keV)^b	$1.67^{+0.01}_{-0.02}$	$1.56^{+0.03}_{-0.02}$	890(853)

^{a}normalization at 1 keV in units of $\times 10^{-2}$ photons cm^{-2} sec^{-1} keV^{-1}
^{b}SIS0 flux at 1 keV.
A^{SIS1}/A^{SIS0}=0.981±0.012,
A^{GIS2}/A^{SIS0}=1.025 ± 0.014,
A^{GIS3}/A^{SIS0}=1.066 ± 0.019

at about 0.5 keV. Given the complexity of 3C273 spectrum, we point out that our conclusions are model-dependent and that intercalibration studies should be extended to a large sample of sources.

This effect is particularly evident in the June 1998 observation. In the previous ASCA-BeppoSAX observations (on July 1996) the LECS data has been used to re-calibrate the SIS (Orr et al. 1998). The re-alignment of the ASCA/CCD's to the LECS detector using the 1998 observation is very complex. The ASCA team is working on it.

The main conclusions of this work can be so summarized:

1) The LECS data show deviations ($20-30\%$) below the carbon edge from the model of Grandi et al. (1997). This discrepancy can be corrected by including an additional column density $N_H < 3 \times 10^{20}$ cm^{-2}. The amount of cold absorber depends on the model used to parameterize the soft excess. We can exclude neither that the absorption is intrinsic to the source nor that it reflects calibration problems.

2) The LECS (0.5-3 keV), MECS (1.5-10 keV) and HP (7.0-34 keV) are in good agreement each other in both the observations. The PDS data is significantly steeper than MECS in 1998 ($\Delta\Gamma = 0.15 \pm 0.04$) It is possible that this steepening at high energies is real and

Table 8: **1996 July**– Best-fit parameters of the **iron line** when a Gaussian profile is applied to the ASCA and BeppoSAX data

INSTRUMENT	Γ	E_{Fe} (keV)	σ (eV)	EW (eV)	χ^2_{PL} (d.of.)	$\Delta\chi^2$
MECS	1.60±0.01	5.4±0.2	0(f)	33^{+9}_{-20}	125(94)	13
	1.61±0.01	5.8±0.4	$0.8^{+0.3}_{-0.5}$	80^{+70}_{-40}		17
SIS+GIS	1.65±0.01	5.4±0.1	0 (f)	35^{+9}_{-20}	1554(1493)	13
	1.67±0.02	5.7±0.3	0.7±0.2	130^{+130}_{-50}		27

represents a spectral evolution of 3C273.

3) THE PDS spectra obtained with the two different background rejection methods produce similar results. The power laws difference is $\Gamma^{RTF} - \Gamma^{RTV} = 0.02 \pm 0.06$.

4) The continuum shape in the 2–10 keV band is well described by a simple power-law plus a broad Gaussian emission line in both the ASCA and BeppoSAX observation (the line is significantly broad only in the SIS spectra). The LECS (within 3 keV) and MECS spectra indices are slightly steeper than those measured by ASCA detectors. The difference between the MECS and the individual ASCA detectors spectra indices in the 1998 observation ranges between 0.02 and 0.03. If all the ASCA detectors are fitted simultaneously. $\Gamma^{\rm ASCA} - \Gamma^{\rm MECS} = 0.03\pm^{0.01}_{0.02}$. This difference is slightly lower than observed in the 1996 observation ($\Gamma^{\rm ASCA} - \Gamma^{\rm MECS} = 0.06\pm^{0.01}_{0.02}$)" An iron line at $\sim 5-6$ keV has been detected in both the observations. The shape and the intensity of the line measured by the two satellites are consistent.

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