

XMM-Newton CCF Release Note

XMM-CCF-REL-289

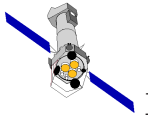
Recent evolution of RGS gain and CTI

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1 CCF components

Name of CCF	VALDATE	List of Blocks changed	XSCS flag
RGS1_ADUCONV_0022	2007-08-01T02:00:00	ADUCOEFF	NO
RGS1_ADUCONV_0023	2010-01-01T00:00:00	ADUCOEFF	NO
RGS1_ADUCONV_0024	2011-01-01T00:00:00	ADUCOEFF	NO
RGS2_ADUCONV_0025	2007-08-01T02:00:00	ADUCOEFF	NO
RGS2_ADUCONV_0026	2010-01-01T00:00:00	ADUCOEFF	NO
RGS2_ADUCONV_0027	2011-01-01T00:00:00	ADUCOEFF	NO
RGS1_CTI_0010	2007-08-01T06:00:00	CTI CTI_EXTENDED XCTI CTIY1-9	NO
RGS1_CTI_0011	2010-01-01T00:00:00	CTI CTI_EXTENDED XCTI CTIY1-9	NO
RGS1_CTI_0012	2011-01-01T00:00:00	CTI CTI_EXTENDED XCTI CTIY1-9	NO
RGS2_CTI_0011	2007-08-17T02:00:00	CTI CTI_EXTENDED XCTI CTIY1-9	NO
RGS2_CTI_0012	2010-01-01T00:00:00	CTI CTI_EXTENDED XCTI CTIY1-9	NO
RGS2_CTI_0013	2011-01-01T00:00:00	CTI CTI_EXTENDED XCTI CTIY1-9	NO



2 Changes

Overlapping spectral orders in RGS are separated through the energies assigned to detected events encoded in the PI values. As in all CCD detectors, PI values depend on the CCD gain and CTI which are subject to change with time. It is therefore necessary periodically to recalibrate the gain and CTI individually for each of the CCDs, although evolution is slow enough for this to be done about every one or two years. The new values here supplied cover three epochs: consolidation following the switch to RGS2 single-node operations in 2007; beyond 2010-01-01; and beyond 2011-01-01.

3 Test procedures & results

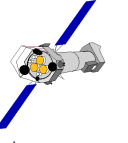
Two bright smooth continuum sources, the blazars Mkn421 and PKS2155-304, and two bright line-rich coronal sources, Capella and AB Dor, have been processed with the current and new ADU CONV and CTI CCFs and comparative statistics accumulated. Only event PI values are affected, causing different numbers of events to fall in the selection regions for the RGS spectral orders. Tables 1 and 3 compare the numbers of events selected in 1st and 2nd order spectra; and Tables 2 and 4 compare the outcome of spectral analysis. The numbers of selected events changed by a fraction of a percent. The changes in best-fit model parameters, while small, were sometimes larger than the statistical error. The statistical quality of the models, as judged by the C-Statistic have usually improved, although this is not always the case.

4 Estimated Scientific Quality

It is well known that the statistical errors calculated for model parameters are accompanied by systematic errors that are hard to quantify. The analysis reported here suggests that systematic errors due to imperfect calibration can be comparable to the statistical errors of bright sources.

5 Expected Updates

ADU CONV and CTI CCFs should be revised every one or two years.



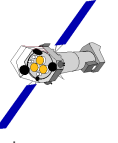
target	rev	ObsID	ADU CTI		R1o1		R1o2		ADU CTI		R2o1		R2o2	
					nT	nB	nT	nB			nT	nB	nT	nB
PKS2155-304	1543	0411780301	0021	0009	234478	9090	48046	2991	0024	0010	242547	8289	41591	2502
			0022	0010	232217	9133	45119	2921	0025	0011	239168	8343	39316	2469
Mkn421	1640	0560980101	0021	0009	854199	28212	198595	10399	0024	0010	880754	28080	170938	8179
			0022	0010	843585	28378	186560	9953	0025	0011	867473	27991	161688	8058
Mkn421	1732	0560983301	0021	0009	668344	20248	147804	6919	0024	0010	680295	21008	126844	5848
			0022	0010	660749	20324	138261	6699	0025	0011	670185	20939	119424	5705
PKS2155-304	1734	0411780401	0021	0009	177472	9483	33692	3121	0024	0010	180463	8729	28888	2755
			0022	0010	175673	9545	31717	3065	0025	0011	178033	8816	27435	2731
Mkn421	1820	0411083201	0021	0009	994072	28109	261923	11281	0024	0010	1034704	31214	224731	9243
			0022	0010	978578	28128	244470	10885	0025	0011	1016980	30948	210891	9016
PKS2155-304	1902	0411780501	0021	0009	95446	8401	18583	2754	0024	0010	98896	6934	16322	2560
			0022	0010	95522	8383	18639	2771	0025	0011	99038	6901	16415	2643
Mkn421	1904	0656380101	0021	0009	668057	21827	170990	8698	0024	0010	685587	23093	145523	7184
			0023	0011	668510	21772	171772	8643	0026	0012	686066	23623	146418	7170
Mkn421	2001	0656380801	0021	0009	461022	14243	114672	5442	0024	0010	481104	15985	99150	4669
			0023	0011	461579	14249	115304	5427	0026	0012	481371	15886	99966	4717
Mkn421	2002	0656381301	0021	0009	346494	12903	78996	4727	0024	0010	354253	13490	66837	3960
			0023	0011	346989	12882	79414	4696	0026	0012	354814	13407	67377	3983
PKS2155-304	2084	0411780601	0021	0009	125739	6623	27107	2158	0024	0010	131884	5682	23559	1907
			0022	0010	125896	6603	27257	2179	0025	0011	131975	5694	23704	1948
Mkn421	2094	0658800101	0021	0009	222528	13427	48912	4674	0024	0010	228652	13758	42491	4626
			0023	0011	222714	13194	49152	4682	0026	0012	228880	13707	42481	4665
Mkn421	2192	0658800801	0021	0009	96664	6531	19723	2275	0024	0010	96999	6251	17231	2254
			0024	0012	96862	6507	19907	2303	0027	0013	97159	6213	17492	2274

Table 1: Number of events selected for 1st and 2nd order RGS1 and RGS2 spectra of bright blazars for current and new ADU CONV and CTI CCFs. The table's three sections correspond to the three most recent calibration epochs. The ADU and CTI columns indicate the ADU CONV and CTI CCF version numbers; nT and nB are the numbers of selected events in the total and background spectra.



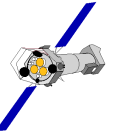
target	rev	ObsID	ADU	CTI	rate	$n_H(10^{20} \text{cm}^{-2})$	α	norm	NPHA	NDOF	C-Statistic
PKS2155-304	1543	0411780301	0021	0009	9.016	0.802 ± 0.067	2.589 ± 0.007	4.374 ± 0.011	9757	9754	12799.85
			0022	0010	8.838	1.107 ± 0.067	2.665 ± 0.008	4.257 ± 0.011	9757	9754	12368.71
Mkn421	1640	0560980101	0021	0009	28.824	1.653 ± 0.036	2.432 ± 0.004	16.114 ± 0.022	9647	9644	15194.35
			0022	0010	28.859	2.025 ± 0.037	2.517 ± 0.004	15.691 ± 0.022	9647	9644	14090.78
Mkn421	1732	0560983301	0021	0009	28.693	1.508 ± 0.040	2.524 ± 0.004	15.506 ± 0.024	9633	9630	13991.27
			0022	0010	28.071	1.881 ± 0.041	2.611 ± 0.004	15.083 ± 0.024	9633	9630	13266.80
PKS2155-304	1734	0411780401	0021	0009	6.246	0.809 ± 0.076	2.785 ± 0.009	2.852 ± 0.008	9698	9695	12227.85
			0022	0010	6.125	1.144 ± 0.077	2.865 ± 0.009	2.772 ± 0.008	9698	9695	12130.89
Mkn421	1820	0411083201	0021	0009	46.543	0.955 ± 0.034	2.110 ± 0.003	27.716 ± 0.036	9615	9612	17943.59
			0022	0010	46.628	1.367 ± 0.035	2.204 ± 0.004	26.943 ± 0.036	9615	9612	16369.73
PKS2155-304	1902	0411780501	0021	0009	3.038	1.050 ± 0.109	2.778 ± 0.013	1.432 ± 0.006	9692	9689	11056.70
			0023	0011	3.043	0.992 ± 0.109	2.767 ± 0.013	1.435 ± 0.006	9692	9689	10909.27
Mkn421	1904	0656380101	0021	0009	39.465	1.233 ± 0.042	2.206 ± 0.004	22.954 ± 0.037	9791	9788	16378.54
			0023	0011	39.534	1.165 ± 0.042	2.196 ± 0.004	22.971 ± 0.037	9791	9788	14372.38
Mkn421	2001	0656380801	0021	0009	27.990	1.333 ± 0.050	2.266 ± 0.005	16.282 ± 0.031	9644	9641	11139.89
			0023	0011	28.047	1.269 ± 0.050	2.256 ± 0.004	16.301 ± 0.031	9644	9641	11399.73
Mkn421	2002	0656381301	0021	0009	23.019	1.651 ± 0.057	2.516 ± 0.006	12.627 ± 0.027	9659	9656	10977.70
			0023	0011	23.075	1.570 ± 0.057	2.503 ± 0.006	12.645 ± 0.027	9659	9656	10884.57
PKS2155-304	2084	0411780601	0021	0009	4.664	0.834 ± 0.094	2.519 ± 0.010	2.374 ± 0.009	9737	9734	11110.52
			0023	0011	4.671	0.752 ± 0.094	2.508 ± 0.010	2.374 ± 0.009	9737	9734	11070.47
Mkn421	2094	0658800101	0021	0009	17.455	1.670 ± 0.073	2.593 ± 0.008	9.151 ± 0.025	9885	9882	11121.68
			0023	0011	17.490	1.635 ± 0.073	2.586 ± 0.008	9.172 ± 0.025	9885	9882	11250.41
Mkn421	2192	0658800801	0021	0009	8.229	1.776 ± 0.109	2.758 ± 0.012	4.138 ± 0.017	9872	9869	10531.18
			0024	0012	8.260	1.671 ± 0.109	2.737 ± 0.012	4.155 ± 0.017	9872	9869	10703.26

Table 2: Results of absorbed power-law models fit simultaneously with XSPEC to 1st and 2nd order RGS1 and RGS2 spectra for current and new ADU CONV and CTI CCFs. The table's three sections correspond to the three calibration epochs. The ADU and CTI columns indicate the ADU CONV and CTI CCF version numbers. The rate column is the summed rate of the four simultaneous RGS spectra. The best-fit values reported are the full set of free parameters for these simple models.



target	rev	ObsID	ADU CTI		R1o1		R1o2		ADU CTI		R2o1		R2o2	
					nT	nB	nT	nB			nT	nB	nT	nB
Capella	1413	0510780101	0021	0009	242794	13008	97540	6506	0024	0010	350716	15118	95941	5702
			0022	0010	240903	13204	93366	6283	0025	0011	345993	15412	91294	5838
AB Dor	1478	0412580301	0021	0009	63003	5095	20928	2033	0024	0010	80159	4722	18299	1823
			0022	0010	62300	5120	19833	1927	0025	0011	78900	4769	17423	1773
Capella	1607	0510780201	0021	0009	182454	12504	71912	5528	0024	0010	250005	13608	68839	5238
			0022	0010	180582	12600	68430	5398	0025	0011	247222	13250	65688	5090
AB Dor	1662	0412580401	0021	0009	46129	5069	15271	2023	0024	0010	57025	4479	13129	1754
			0022	0010	44681	5122	14497	2023	0025	0011	56197	4516	12517	1715
Capella	1796	0510780401	0021	0009	162979	7570	60585	3825	0024	0010	227258	8009	59543	3034
			0022	0010	161045	7705	57661	3689	0025	0011	223596	8326	56113	3061
AB Dor	1825	0602240201	0021	0009	53020	5219	17650	1989	0024	0010	68465	4282	15930	1849
			0022	0010	52450	5257	16734	1971	0025	0011	67326	4353	15054	1802
AB Dor	1848	0412580601	0021	0009	41313	4726	13672	2023	0024	0010	52811	3940	12170	1640
			0022	0010	41333	4756	13694	1796	0025	0011	52883	3882	12226	1683
Capella	1961	0510780501	0021	0009	135715	6700	47929	3177	0024	0010	187331	7122	47738	2606
			0022	0010	135586	6681	47815	3179	0025	0011	187941	6925	48242	2546
Capella	2163	0510780601	0021	0009	162879	7100	57894	3462	0024	0010	226613	7904	56777	2922
			0022	0010	163289	7028	58051	3464	0025	0011	227479	7840	57473	2944

Table 3: Number of events selected for 1st and 2nd order spectra of bright coronal sources for current and new ADU CONV and CTI CCFs. The table's three sections correspond to the three most recent calibration epochs. The ADU and CTI columns indicate the ADU CONV and CTI CCF version numbers. nT and nB are the numbers of selected events in the total and background spectra.



target	rev	ObsID	ADU	CTI	rate	flux($10^{-5}\text{cm}^{-2}\text{s}^{-1}$)			NPHA	NDOF	C-Statistic
						OVIII	FeXVII	NeX			
Capella	1413	0510780101	0021	0009	12.638	282.93 ± 2.33	561.89 ± 4.02	182.82 ± 3.12	9675	9521	29350.91
			0022	0010	12.378	279.98 ± 2.32	545.77 ± 3.96	182.24 ± 3.00	9671	9517	29043.64
AB Dor	1478	0412580301	0021	0009	3.549	131.17 ± 1.58	51.09 ± 1.36	80.69 ± 2.14	9707	9562	12247.54
			0022	0010	3.469	130.62 ± 1.58	49.88 ± 1.35	77.46 ± 2.09	9707	9562	12011.50
Capella	1607	0510780201	0021	0009	10.116	257.73 ± 2.09	536.07 ± 4.40	150.89 ± 2.67	9720	9566	23606.28
			0022	0010	9.914	258.26 ± 2.10	521.05 ± 4.35	146.49 ± 2.63	9722	9568	22941.76
AB Dor	1662	0412580401	0021	0009	2.591	115.05 ± 1.48	45.61 ± 1.25	66.74 ± 1.96	9716	9571	11570.45
			0022	0010	2.534	115.08 ± 1.48	43.90 ± 1.23	63.42 ± 1.77	9718	9573	11453.81
Capella	1796	0510780401	0021	0009	8.031	227.27 ± 2.03	480.59 ± 3.44	112.56 ± 2.02	9667	9513	22560.26
			0022	0010	7.835	226.75 ± 2.03	458.39 ± 3.37	107.54 ± 1.98	9668	9514	22134.69
AB Dor	1825	0602240201	0021	0009	2.499	106.95 ± 1.38	44.94 ± 1.13	58.29 ± 1.66	9672	9527	11727.68
			0022	0010	2.439	106.23 ± 1.37	43.74 ± 1.11	55.31 ± 1.62	9672	9527	11668.56
AB Dor	1848	0412580601	0021	0009	2.239	101.56 ± 1.35	40.66 ± 1.17	56.46 ± 1.69	9693	9548	11478.25
			0023	0011	2.243	101.83 ± 1.36	40.81 ± 1.17	56.80 ± 1.69	9693	9548	11463.44
Capella	1961	0510780501	0021	0009	6.793	191.19 ± 1.70	404.38 ± 3.00	92.82 ± 1.95	9699	9545	20059.58
			0023	0011	6.810	191.19 ± 1.69	404.38 ± 2.99	92.82 ± 1.94	9700	9546	20305.29
Capella	2163	0510780601	0021	0009	7.205	203.48 ± 2.01	419.15 ± 2.85	108.26 ± 1.92	9656	9502	18690.84
			0024	0012	7.240	203.48 ± 2.00	419.15 ± 2.84	108.26 ± 1.91	9661	9507	19176.21

Table 4: Results of multiple-line and single-continuum models fit simultaneously with XSPEC to 1st and 2nd order RGS1 and RGS2 spectra of coronal sources for current and new ADU CONV and CTI CCFs. The table's three sections correspond to the three calibration epochs. The ADU and CTI columns indicate the ADU CONV and CTI CCF version numbers. The rate column is the summed rate of the four simultaneous RGS spectra. The best-fit values reported are the fluxes of the three brightest lines, some of which were indeed identical as shown.