Kristin Kruse Madsen
For IACHEC 2019

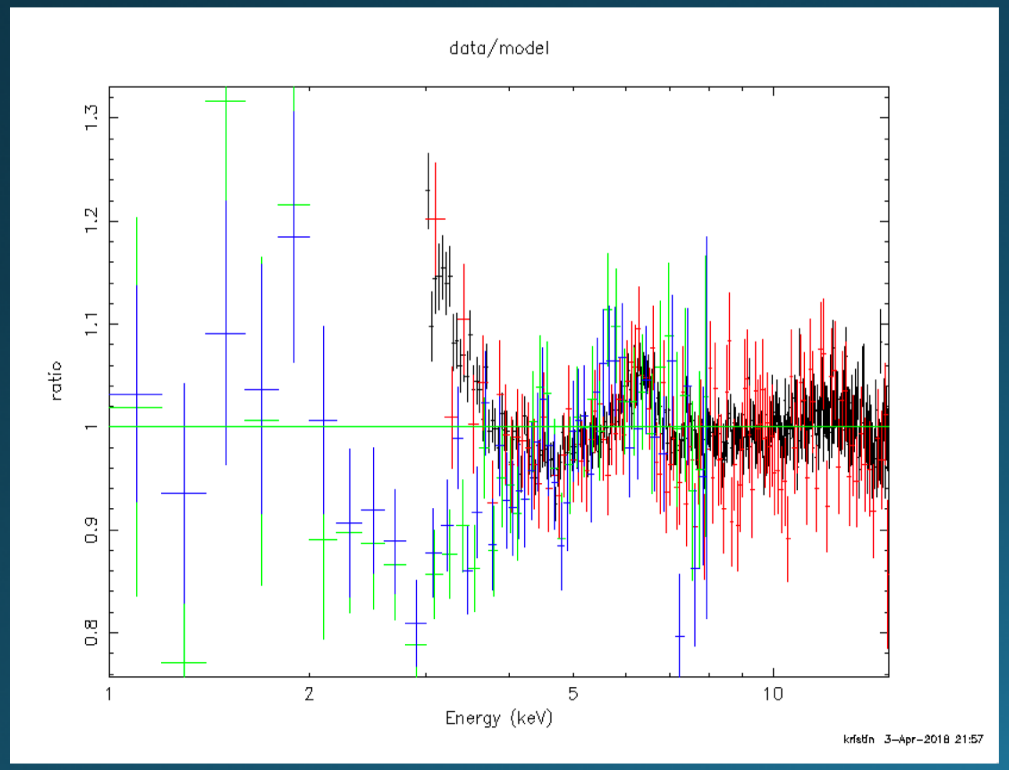
Coordinated observations report

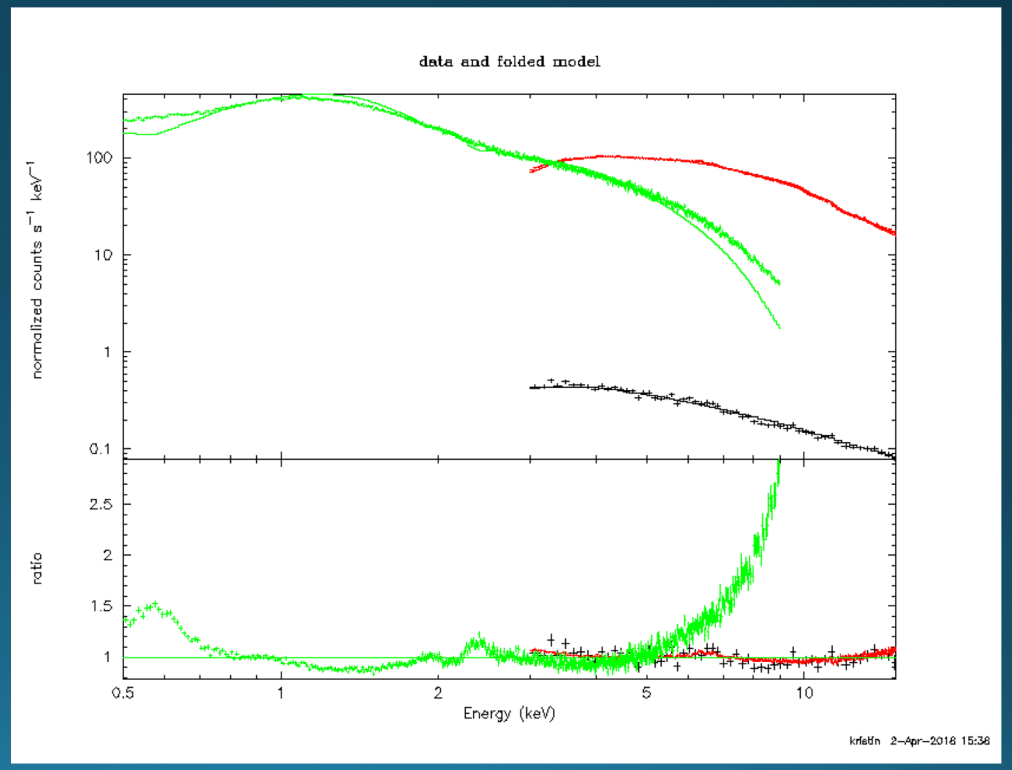
Introduction

- The Problem
- Bright NuSTAR-XRT observations
- Conclusions/Discussion

The Problem

- Increasing reports from NuSTAR and XRT users about mismatches between XRT-WT and NuSTAR in bright sources.

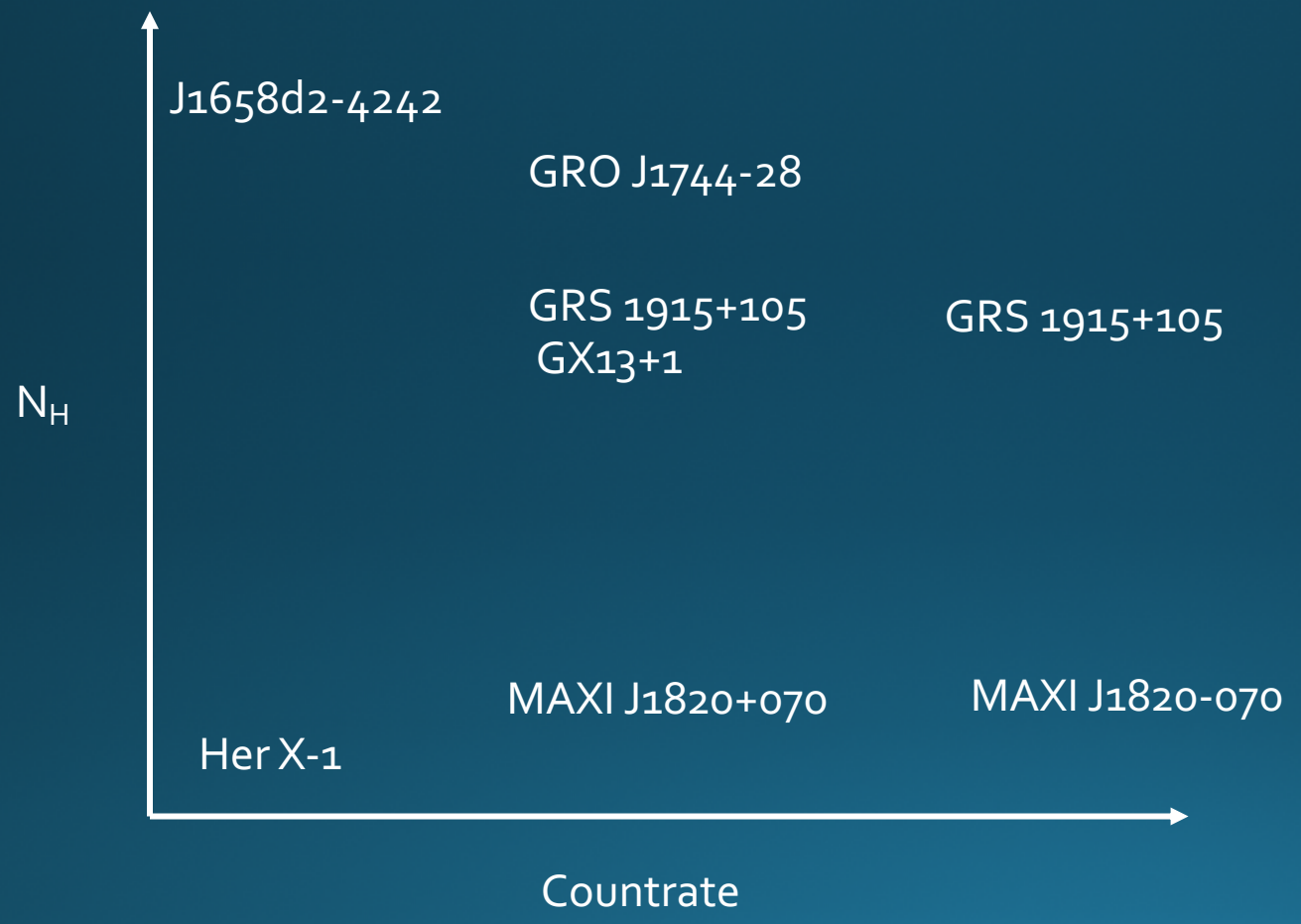




Comparing NuSTAR to Swift

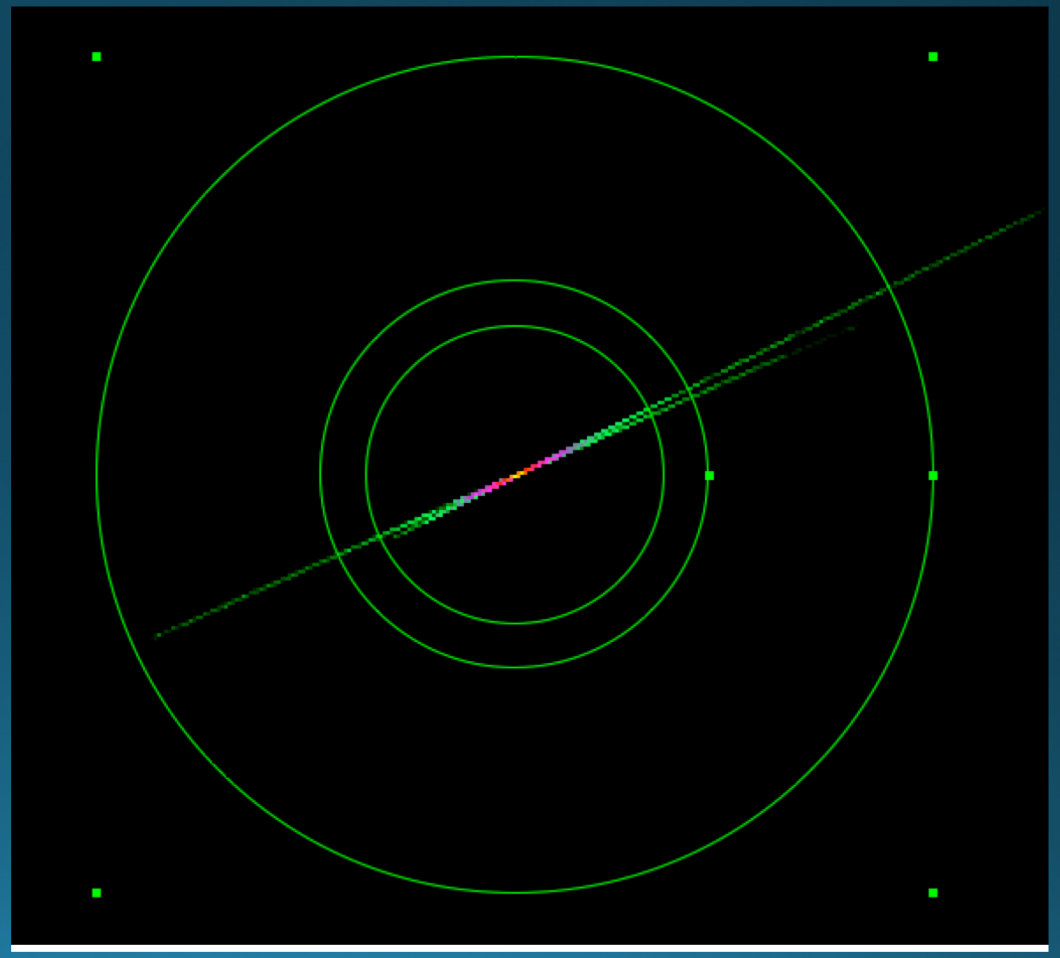
Object Name	N_H (10^{22})	NuSTAR Obsid	Swift Obsid	Swift countrate (counts/s)	NuSTAR countrate (count/s)
Her X-1	1.7e-2	10202002002	00081452005	30	75
MAXI J1820+070	~0.2	90401309006			~940
		90401311004 SL	00010627010	~910	~35
		90401309002	00010627003	~170	~220
			00010627001	~170	
GX13+1	~3	30301003001	0088018001	~110	~200
GRS 1915+105	~4	30202033004	00081904002	~120	~250
GRS 1915+105	~4	30202033002	00081904001	~270	~930
GRO J1744-28	~8	80002017004	00030898021	~60	~330
J1658d2-4242	~15	90401307002	00810300002	~ 10	~40

Phase space

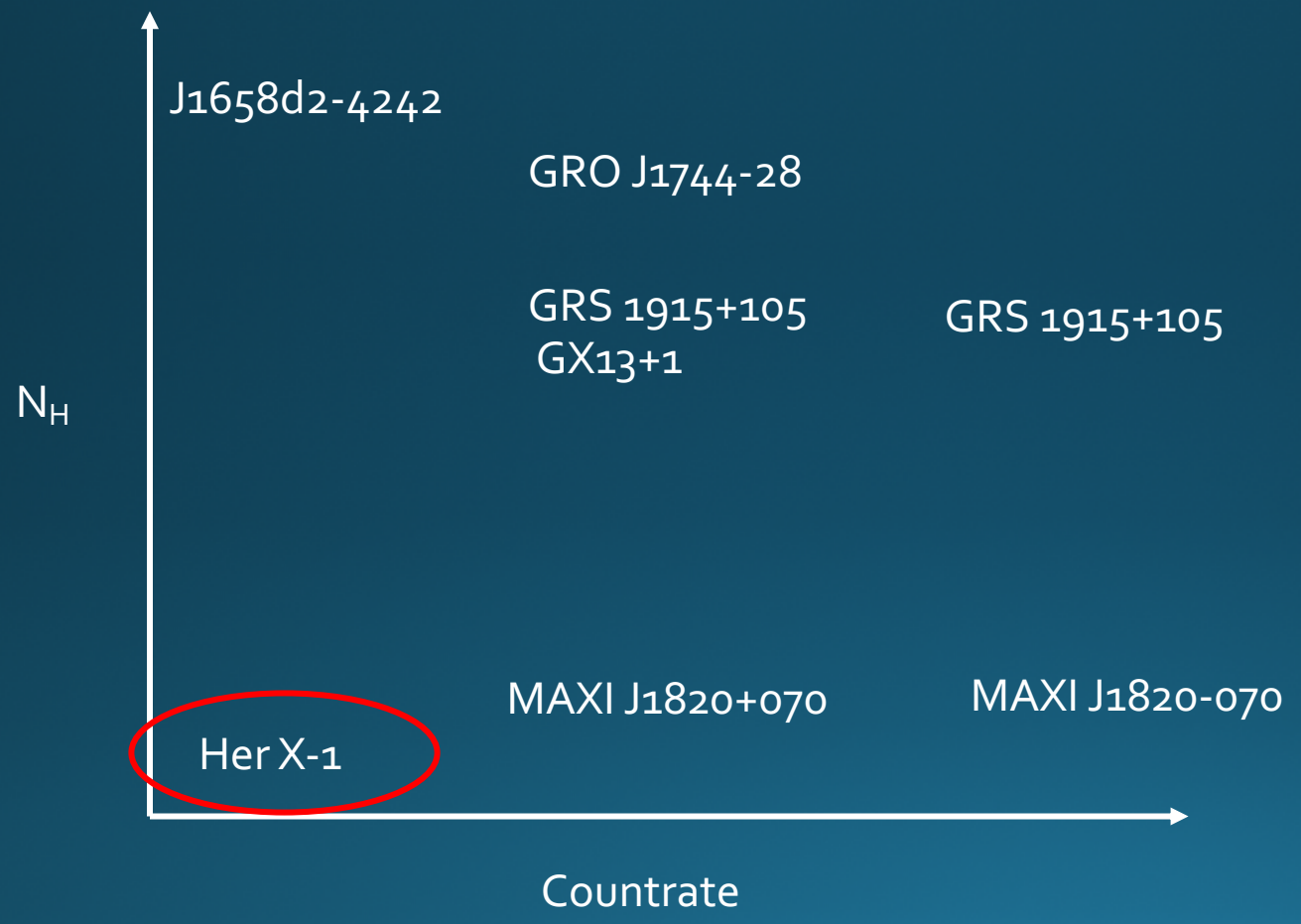

J1658d2-4242
GRO J1744-28
GRS 1915+105
GX13+1
GRS 1915+105
N_H
MAXI J1820+070
MAXI J1820-070
Her X-1
Countrate

Reductions: Swift-XRT WT

- xrtpipeline, xselect, xrtmkarf
- Grade 0 v. grade 0-2
- Extraction region
  - Circle: size
  - Annulus: inner radius

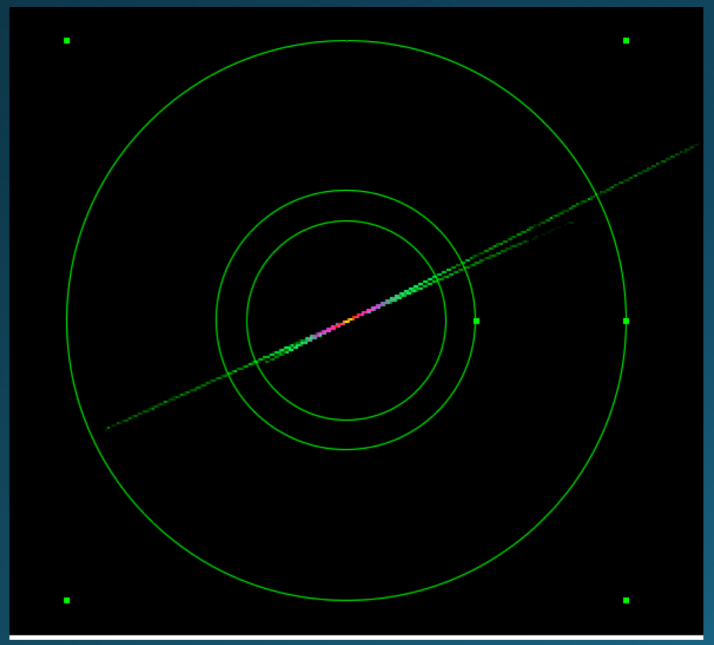


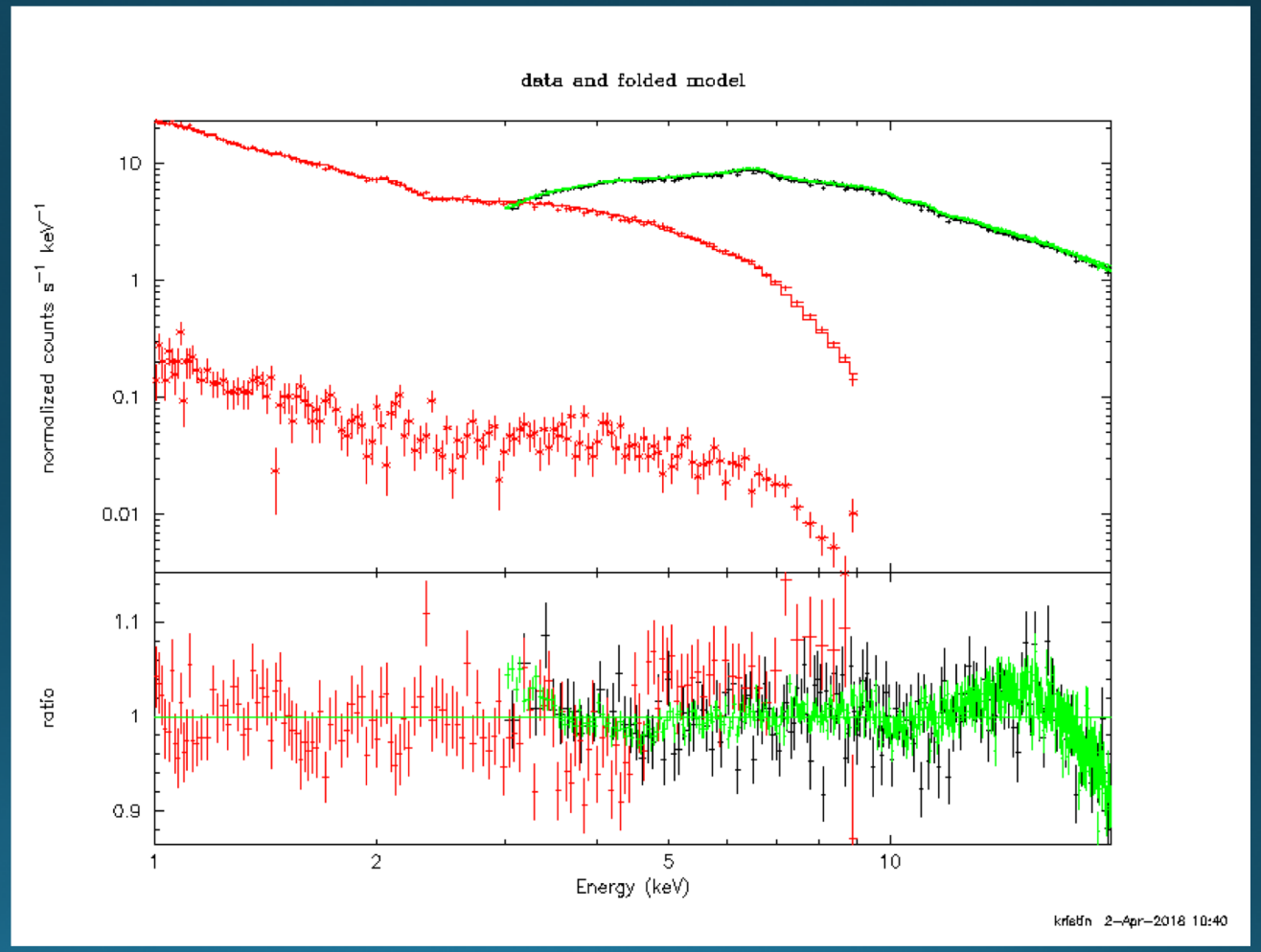
Phase space


J1658d2-4242
GRO J1744-28
GRS 1915+105
GX13+1
GRS 1915+105
N_H
MAXI J1820+070
MAXI J1820-070
Her X-1
Countrate

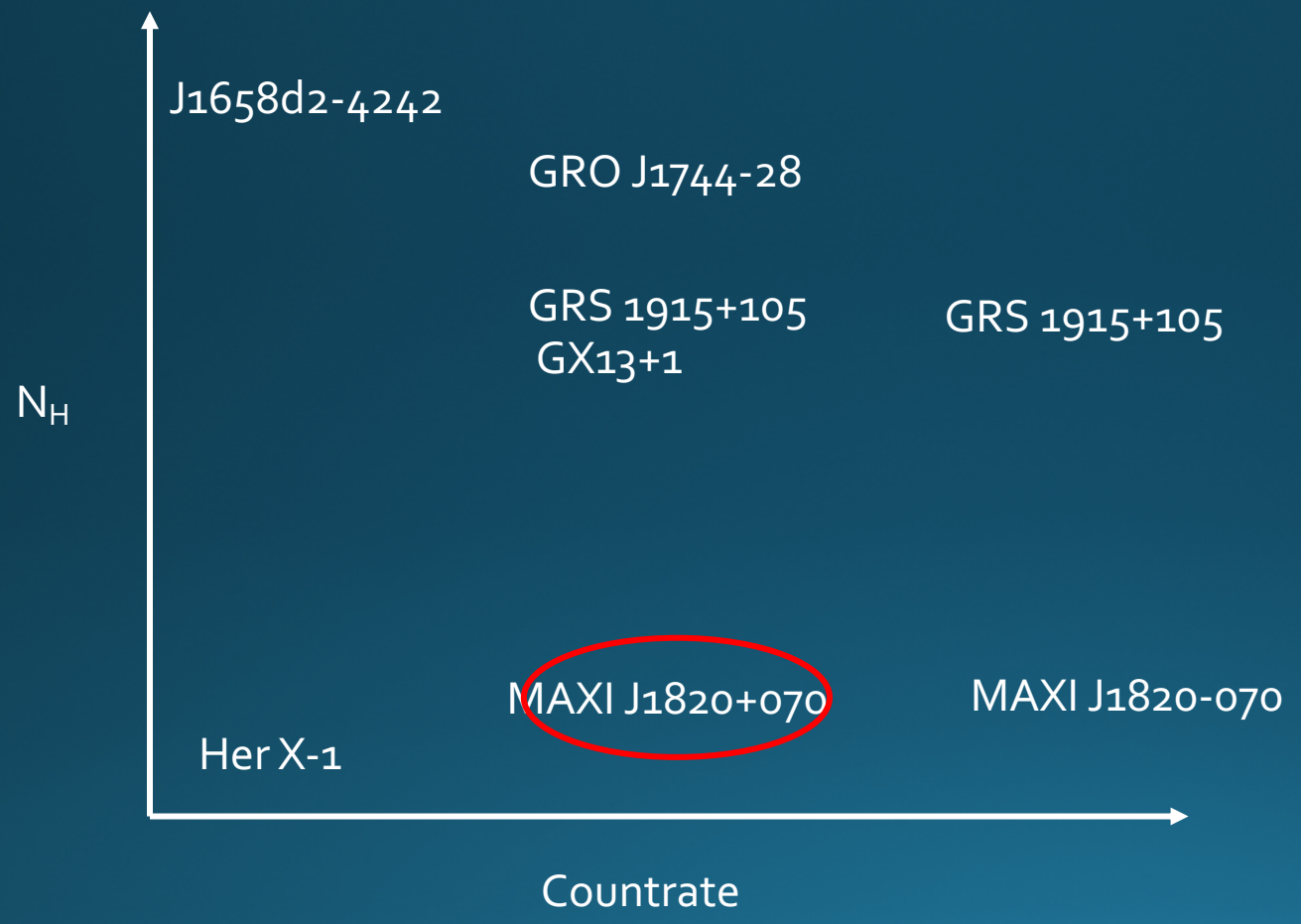
Her X-1: No problems

Black: Simultaneous NuSTAR with Swift.
Red: Swift (cirle:100”)
Green: Full NuSTAR observation





Phase space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MAXI J1820-070
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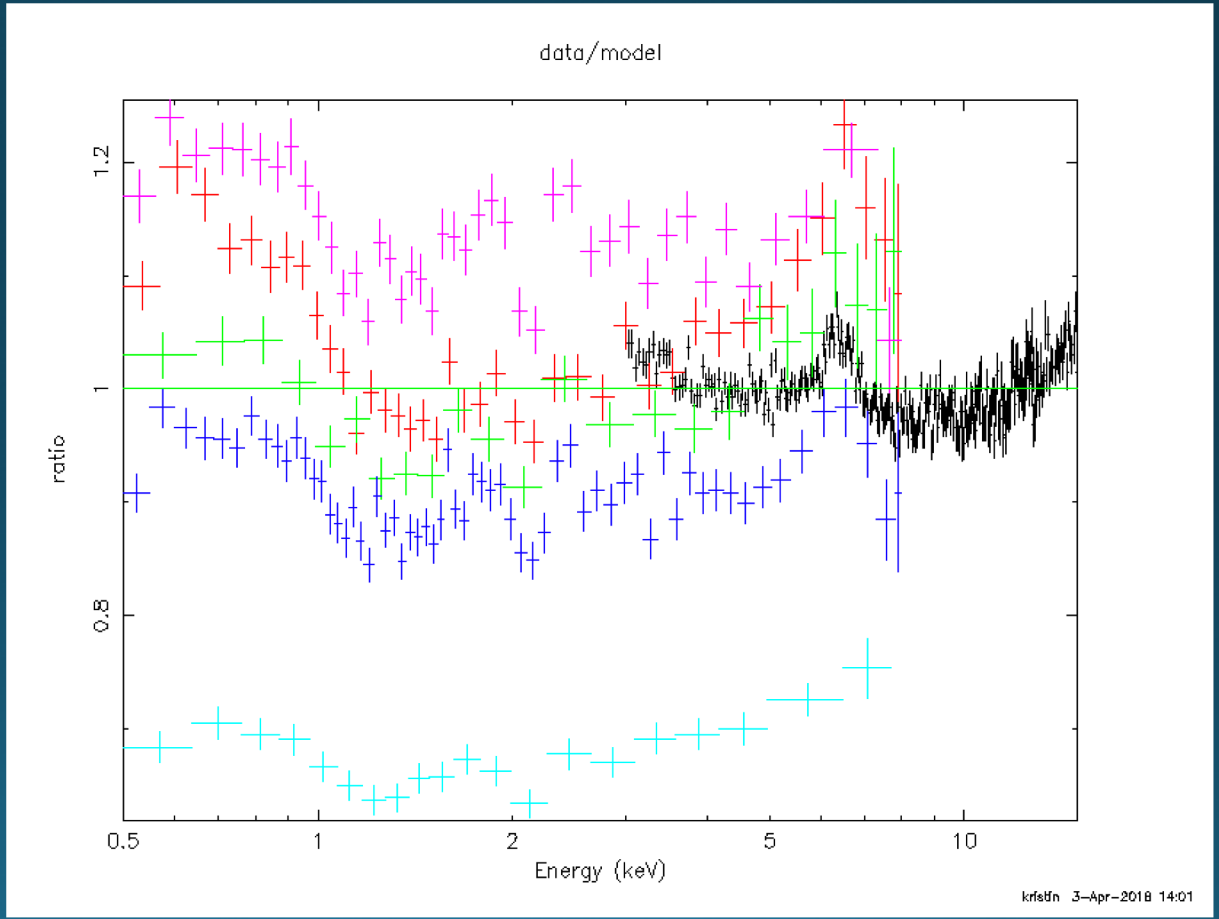
Countrate

MAXI J1820+070 “low”

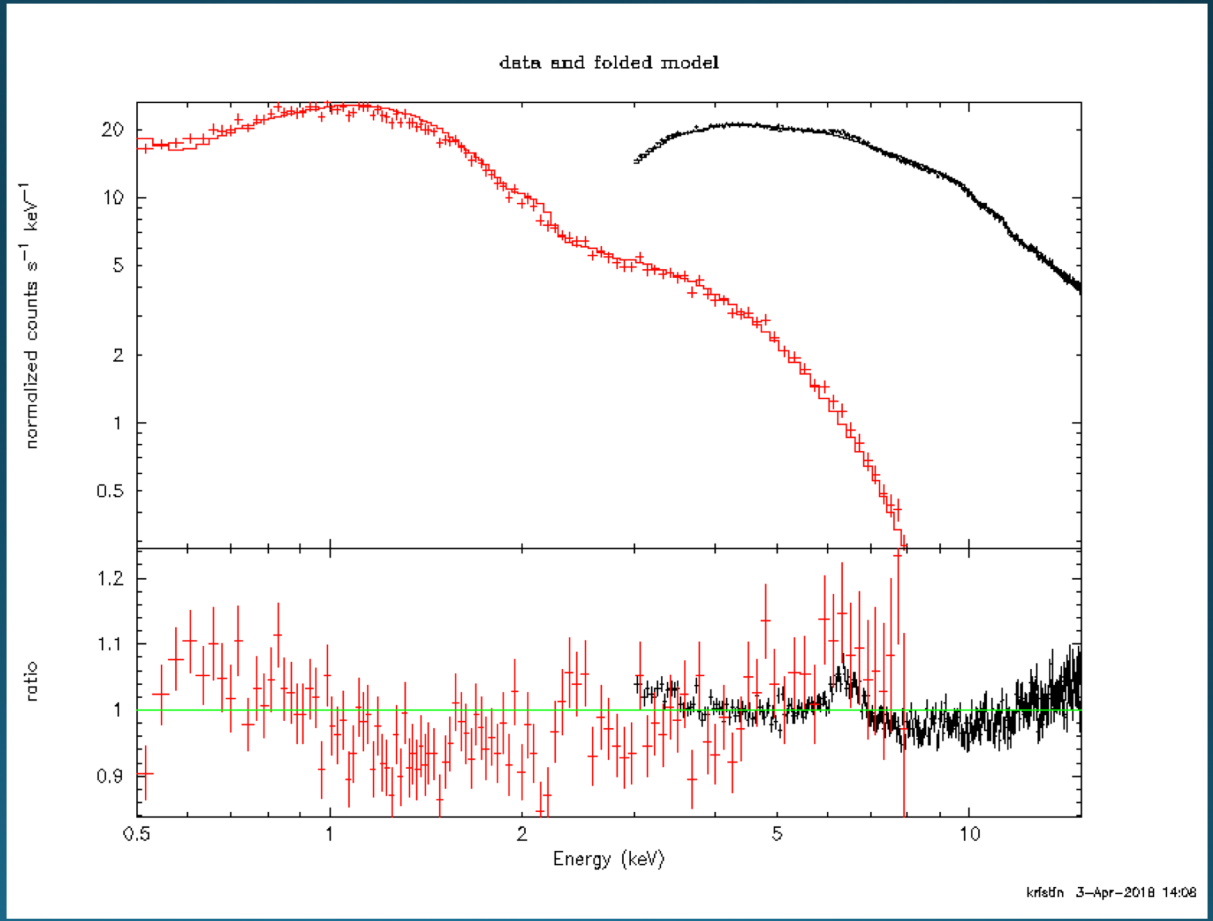
Different extraction from different people!

Pink=red (003)
Green=cyan
Blue=cyan+pink (001)

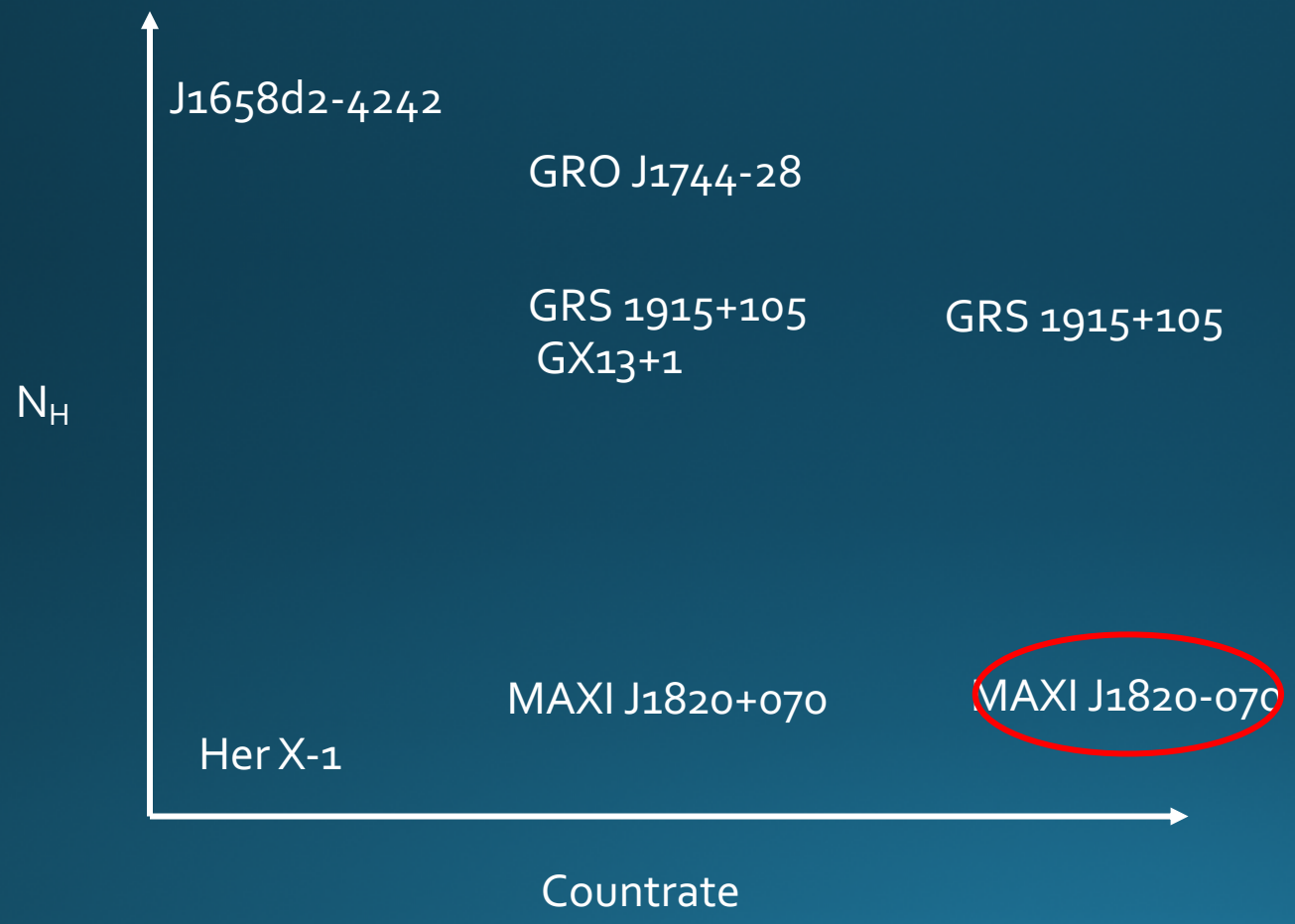


MAXI J1820+070 “low”: OK

Swift: annulus 8-40"

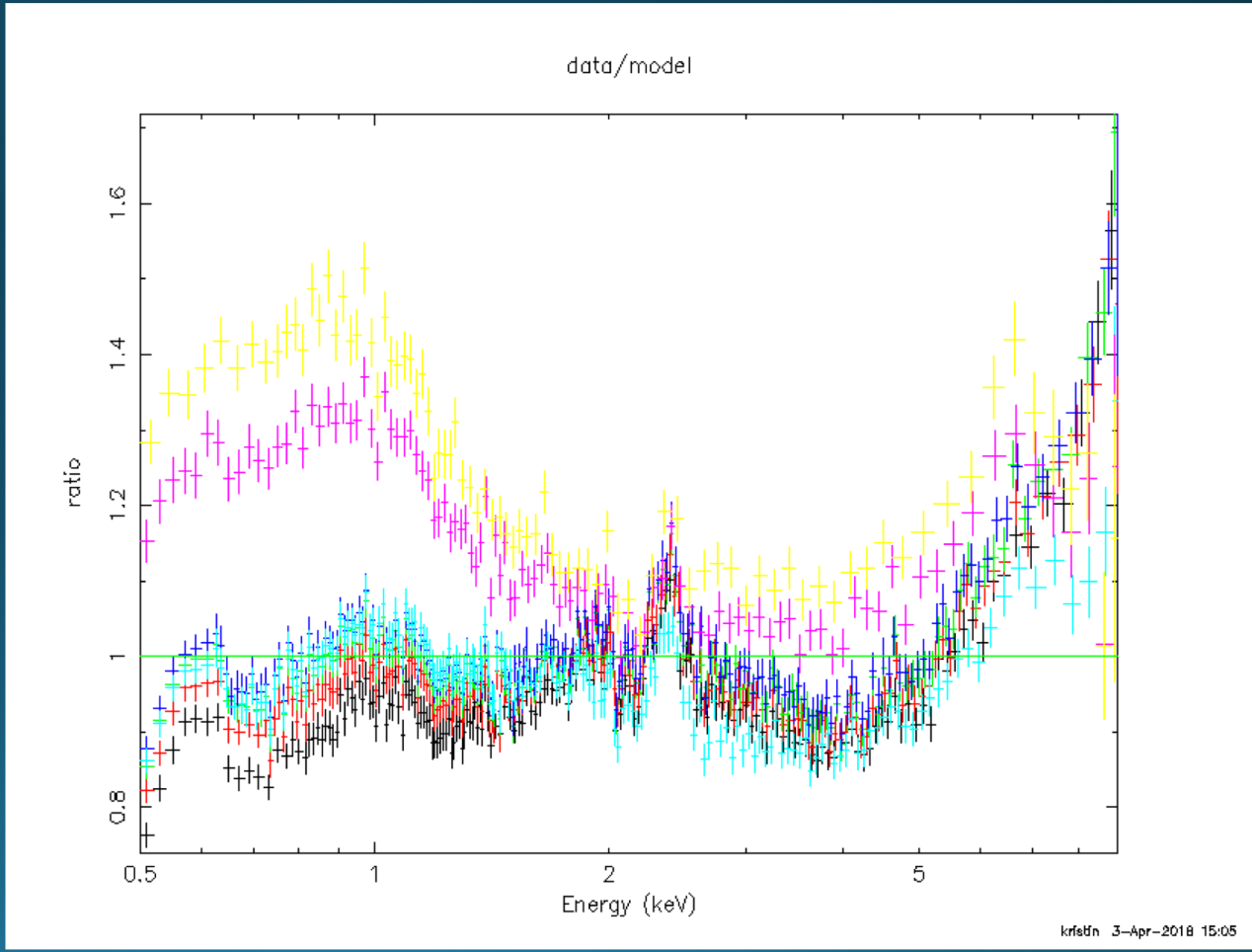


Phase space


J1658d2-4242
GRO J1744-28
GRS 1915+105
GX13+1
GRS 1915+105
N_H
MAXI J1820+070
MAXI J1820-070
Her X-1
Countrate

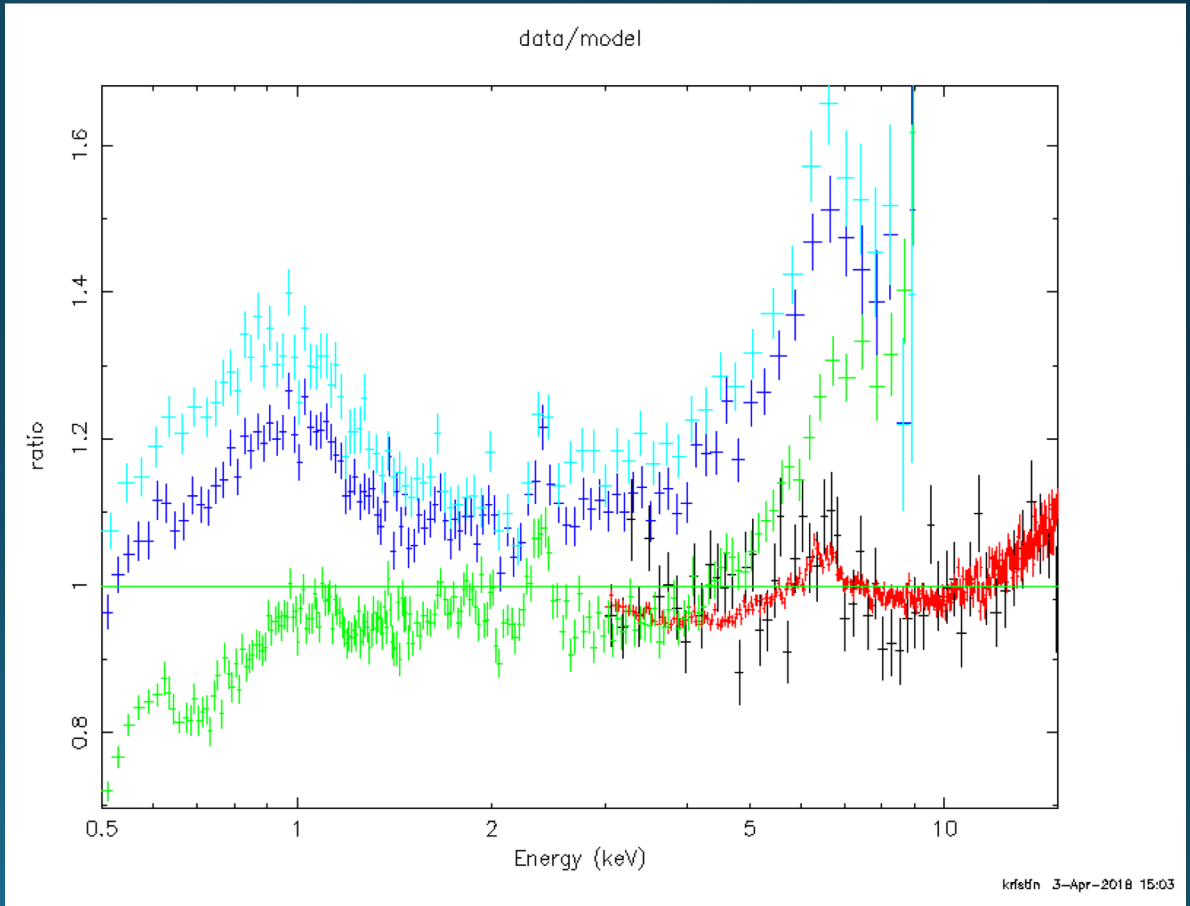
MAXI J1820+070 “high”

Black	annulus 8 - 40”
Red	annulus 8 - 60”
Green	annulus 8 - 80”
Blue	annulus 8 - 100”
Cyan	annulus 8 - 100”, grade 0
Pink:	annulus 15 - 100”, grade 0
Yellow:	annulus 20 - 100”, grade 0

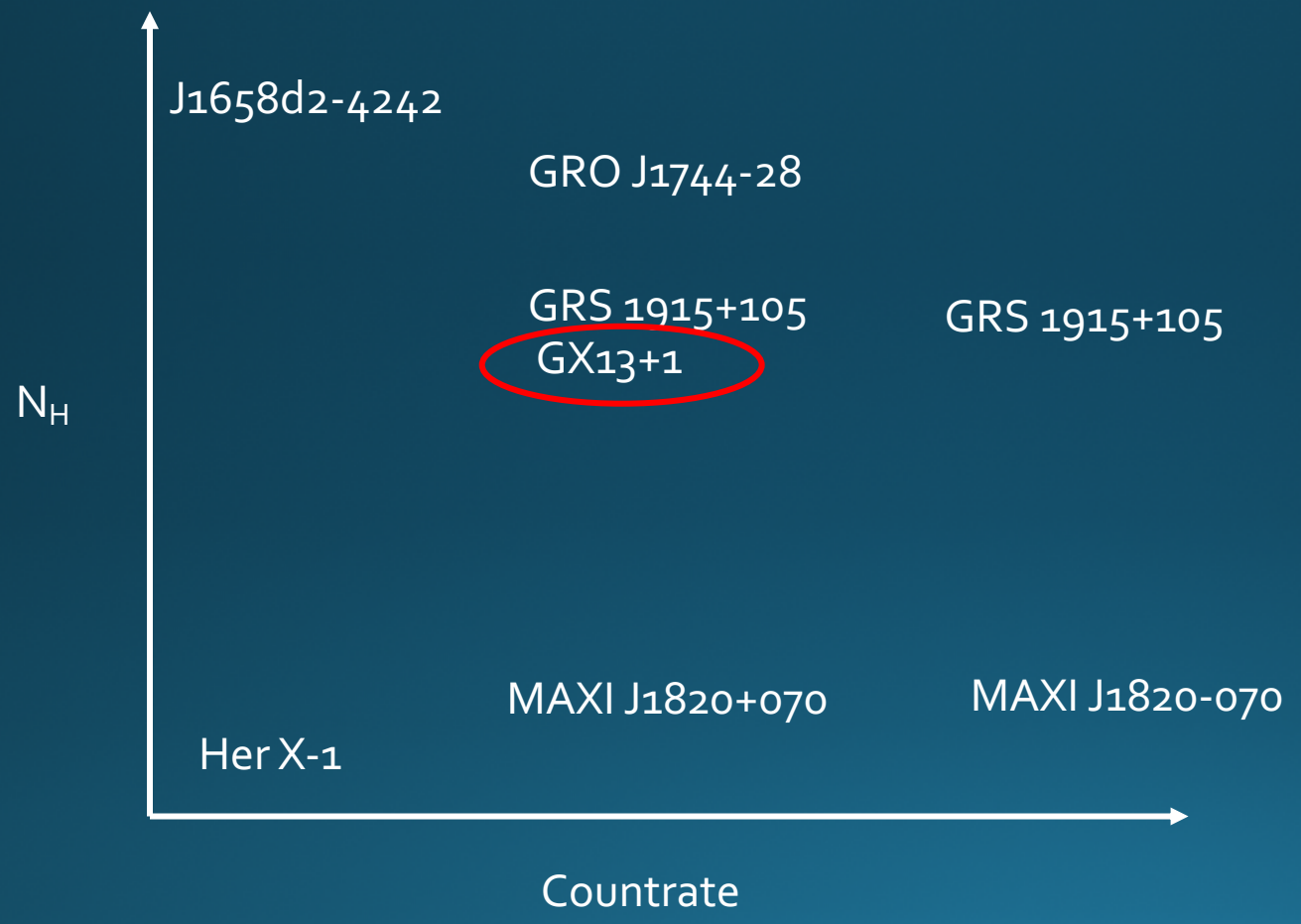


MAXI J1820+070 “high”: Not good’ish

Green : annulus 8 – 100”, grade 0
Blue : annulus 15 – 100”, grade 0
Cyan : annulus 20– 100”, grade 0



Phase space


J1658d2-4242
GRO J1744-28
GRS 1915+105
GX13+1
GRS 1915+105
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MAXI J1820-070
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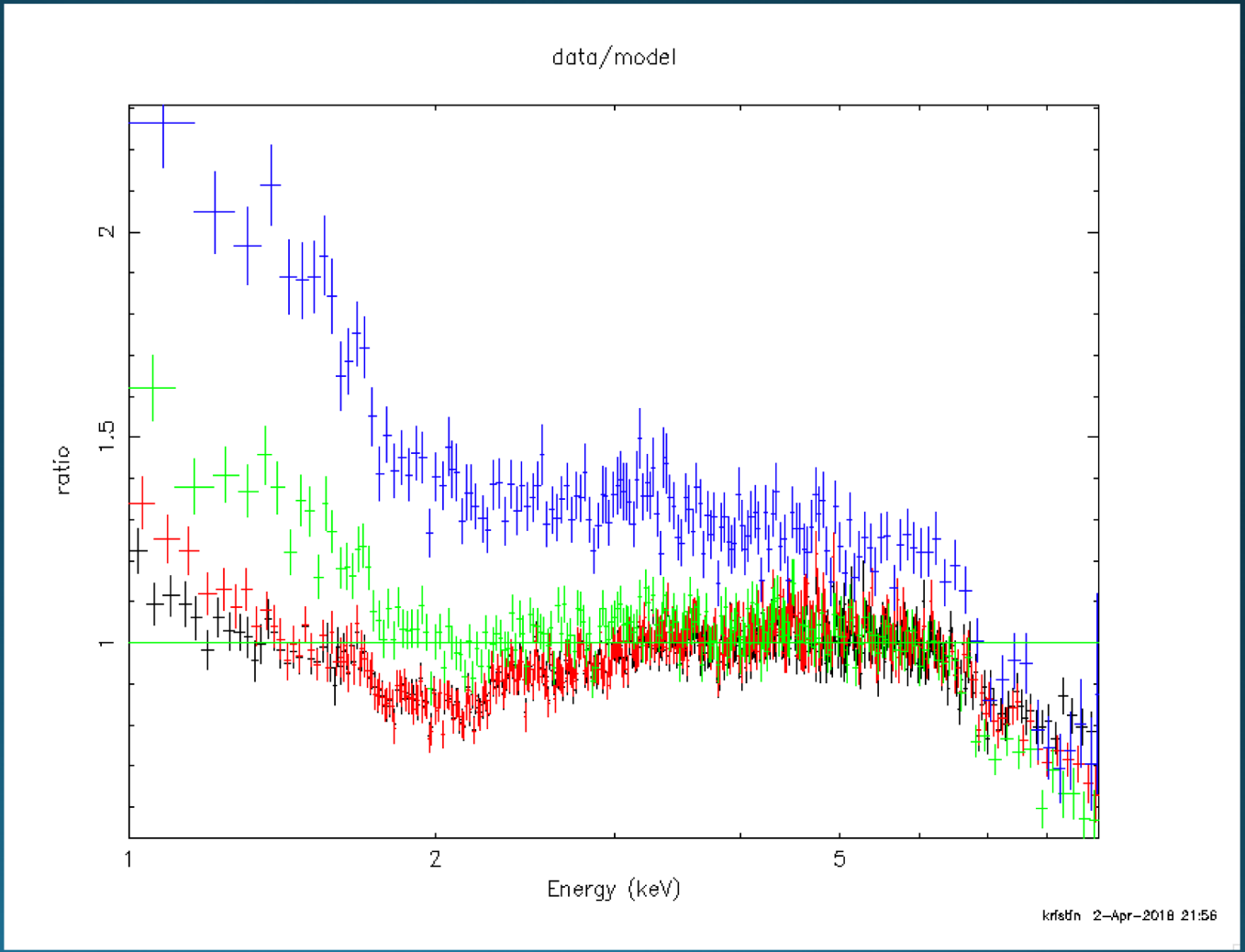
Countrate

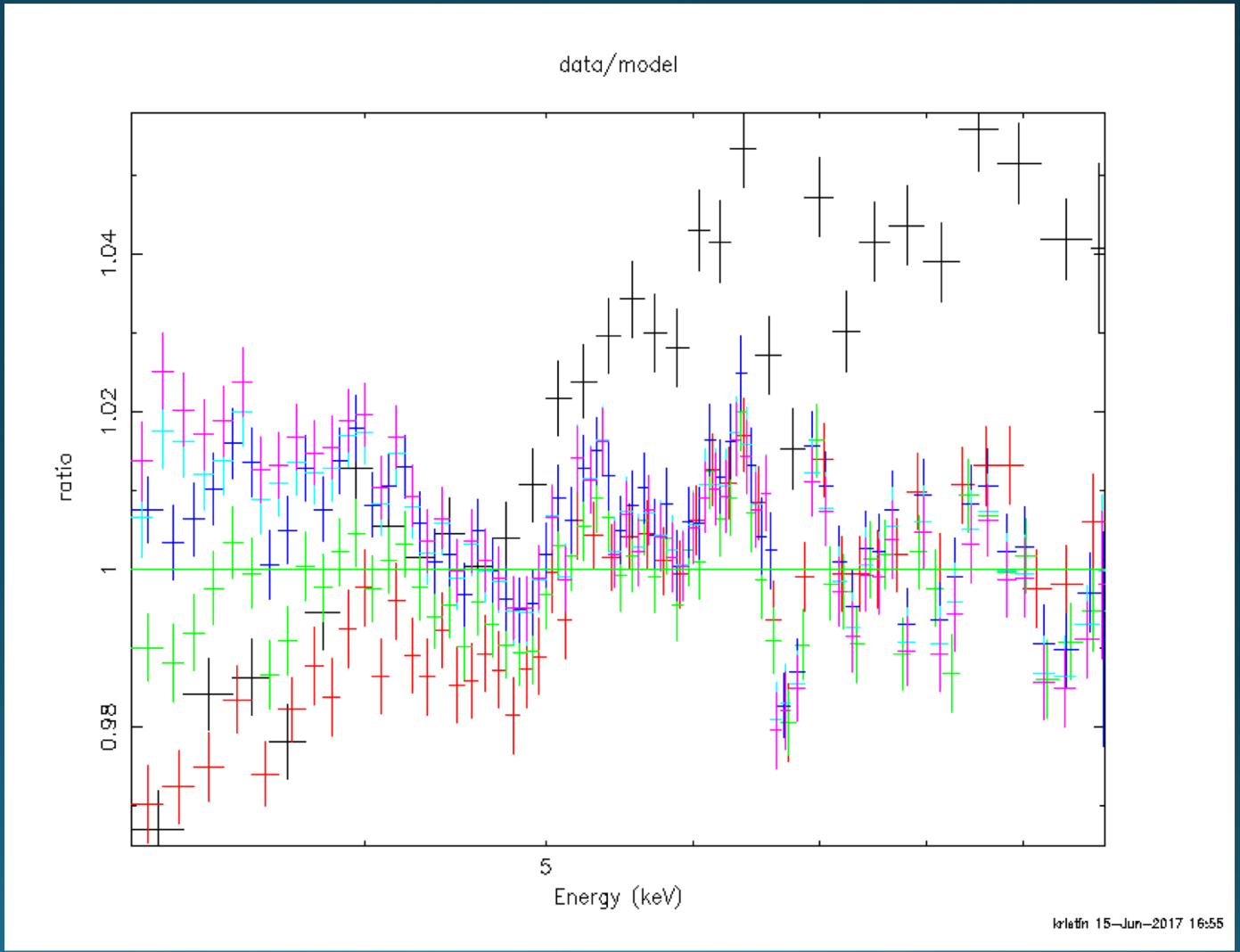
GX 13+1:

Black: Grade 0-2, circle
Red: Grade 0, circle
Green: Grade 0, annulus 8-100”
Blue: Grade 0, annulus 15-100"



GX 13+1:

The NuSTAR extraction shows that the halo is very peaked and it does not make a big difference with extraction region.

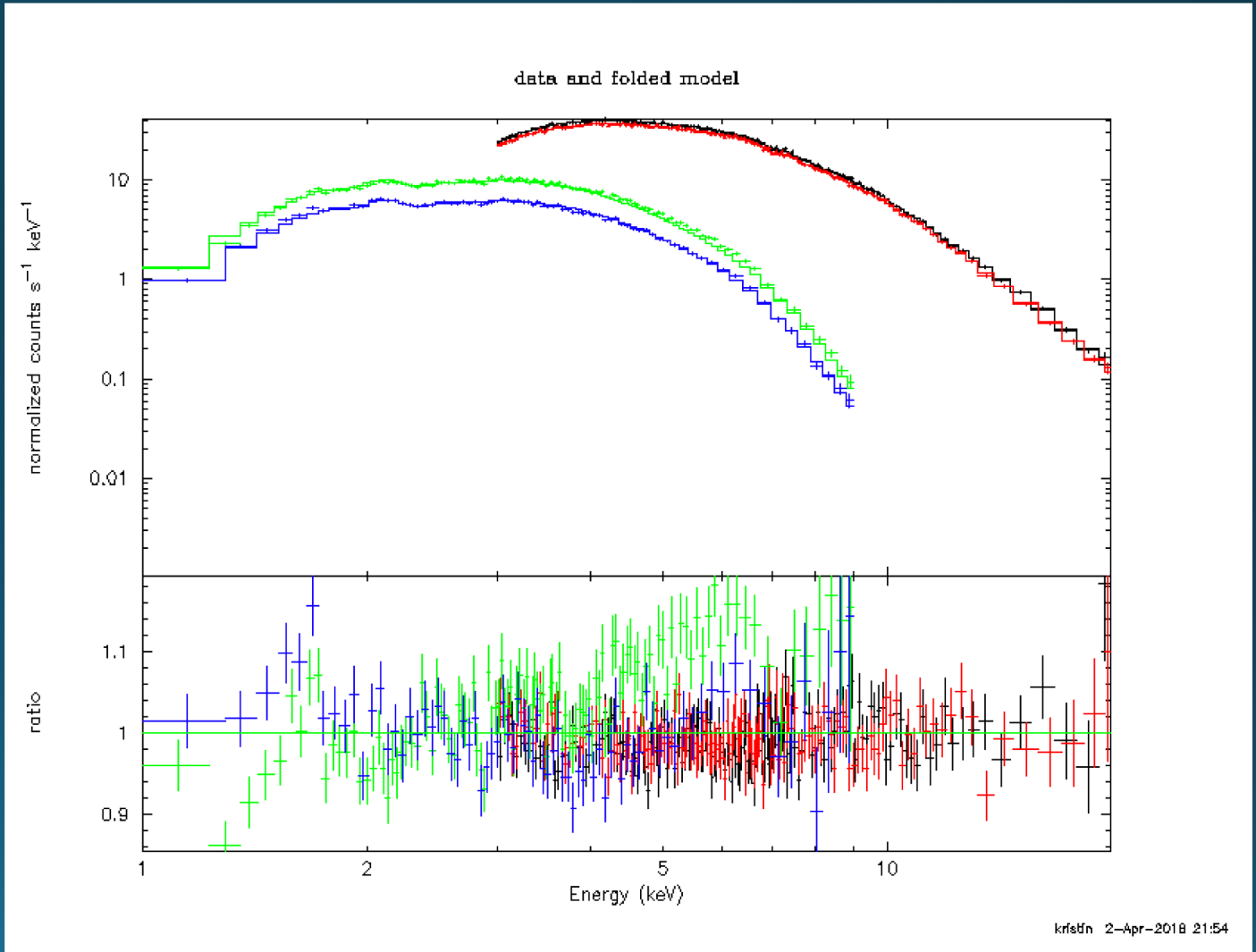


GX 13+1: OK

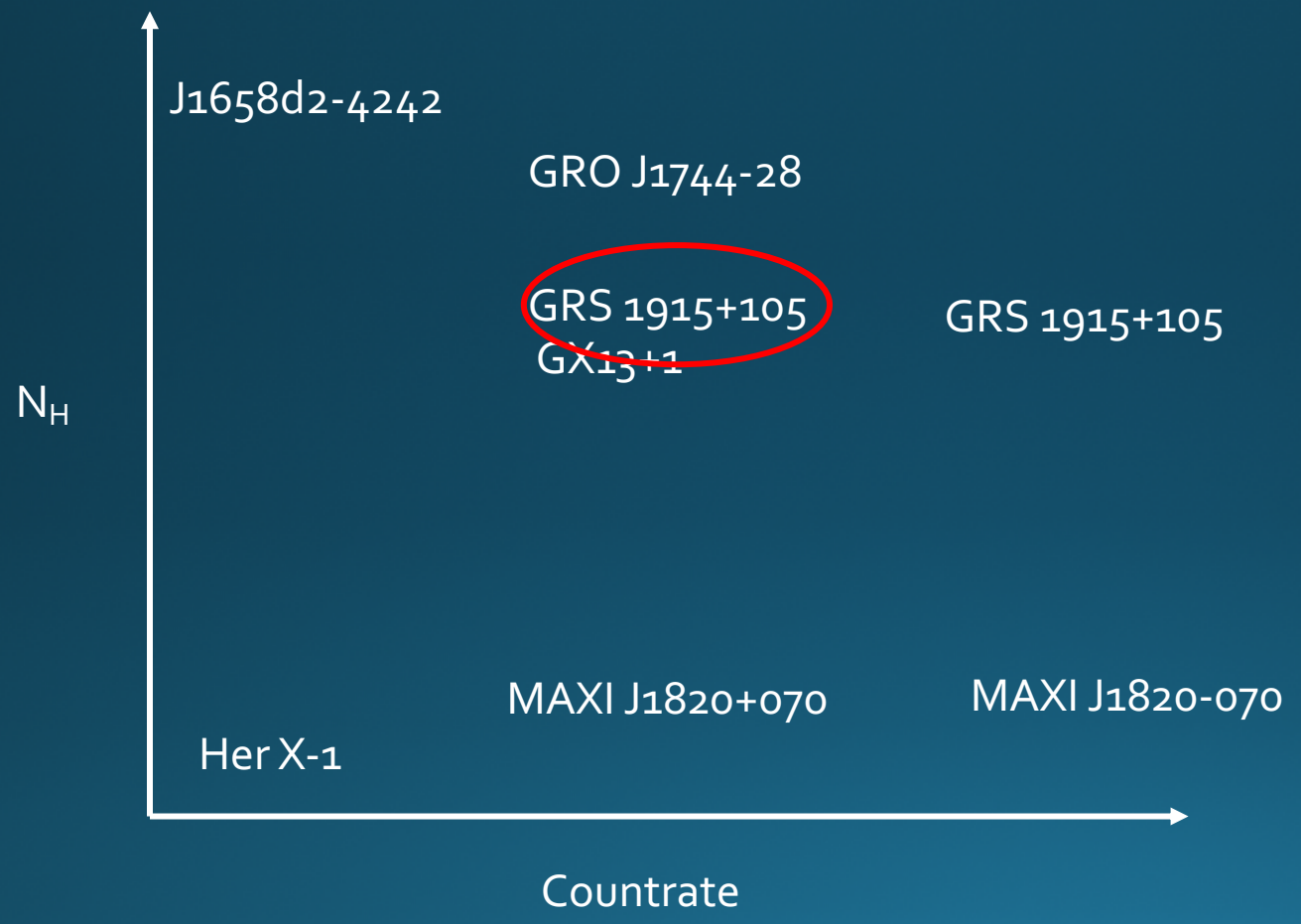
Green: Grade 0, annulus 8-100”
Blue: Grade 0, annulus 15-100”

Conclusion: Probably OK

The source does have a dust scattering halo, and it concerns me that excising any part of the spectrum will make it incorrect to compare directly to NuSTAR, but the NuSTAR data shows there isn’t too much difference between small and large extraction regions.



Phase space


J1658d2-4242
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GRS 1915+105
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MAXI J1820-070
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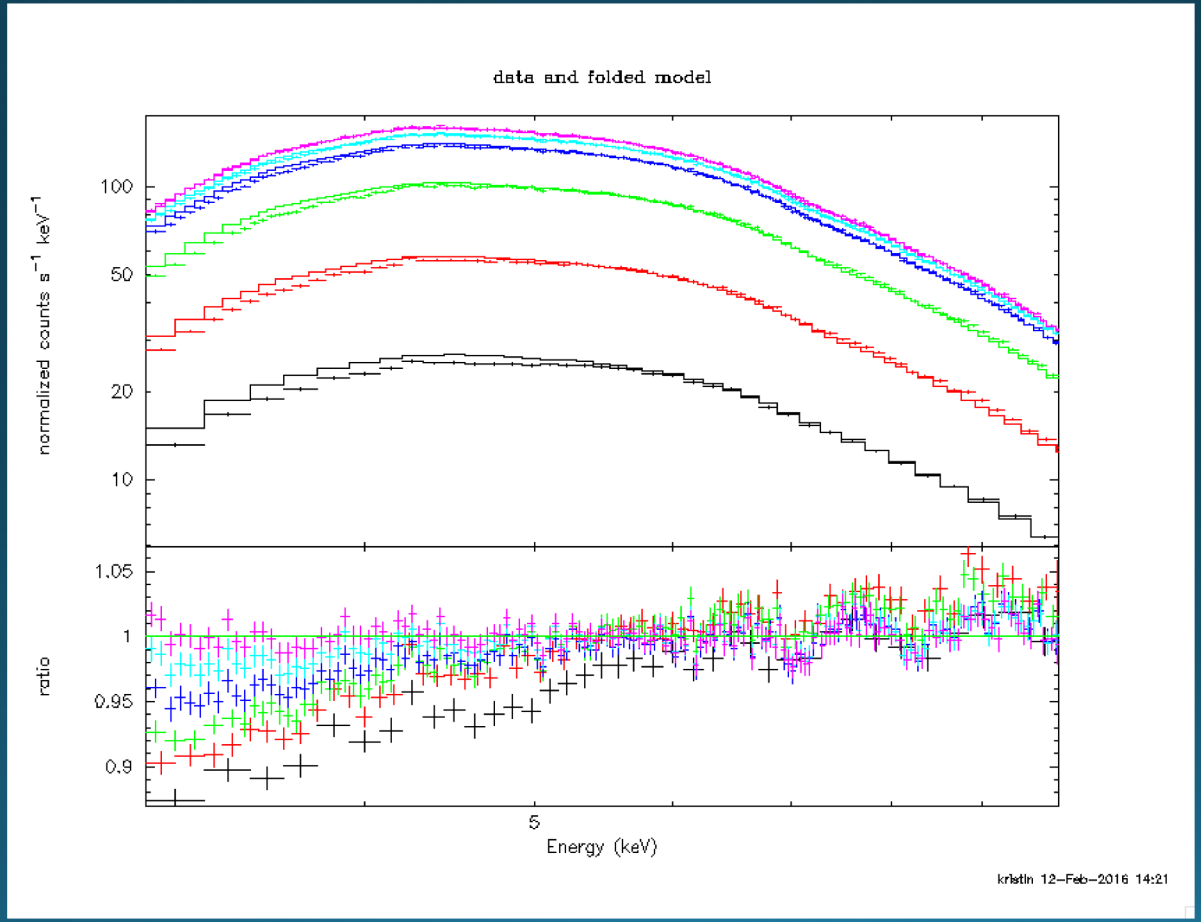
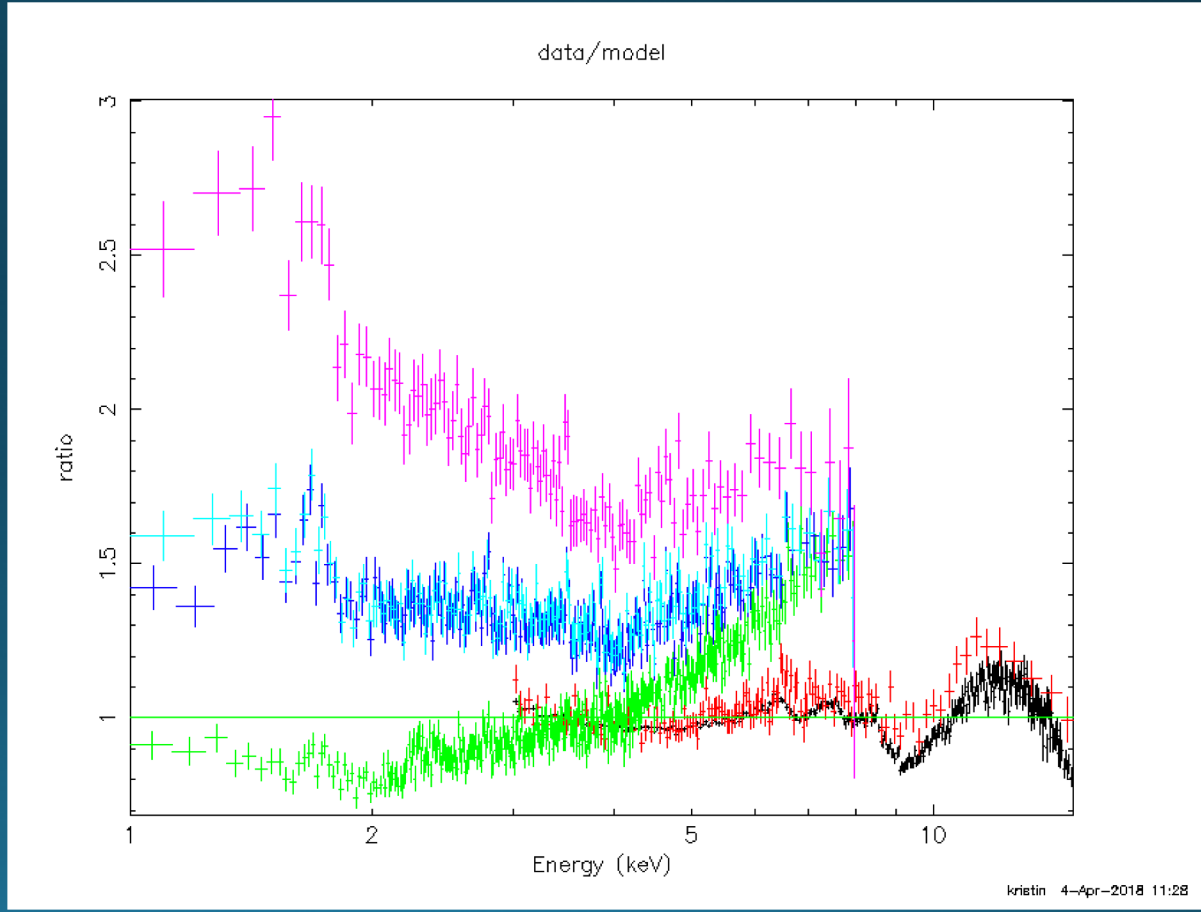
Countrate

GRS 1915+105 “low”



GRS 1915+105 “low”

Black	Nustar
Red	NuSTAR (swift GTI)
Green	Circle 100”, grade 0
Blue	Annulus 8-100”
Cyan	Annulus 8-100”, grade 0
Pink	Annulus 15-100”, grade 0

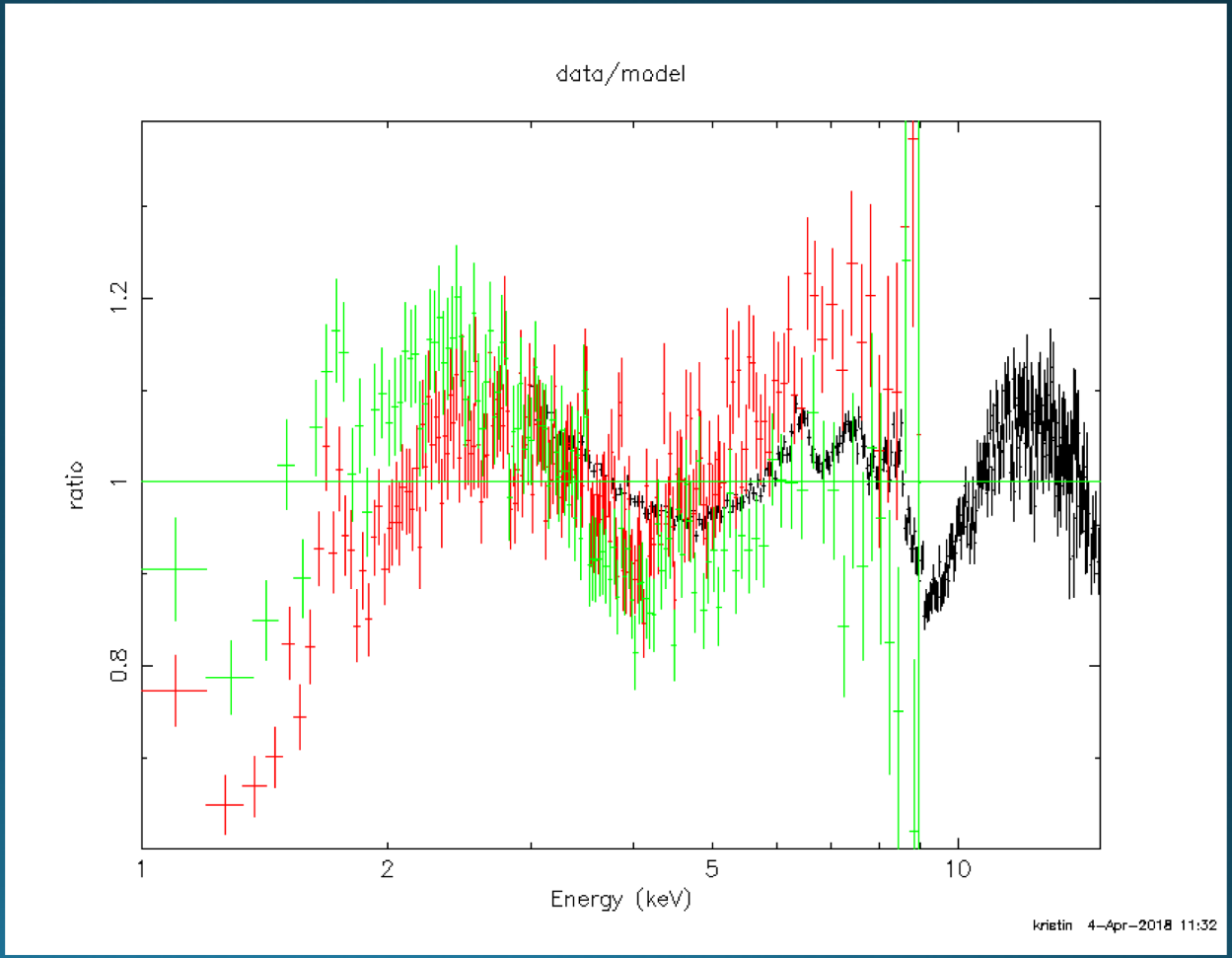


GRS 1915+105 “low”: OK?

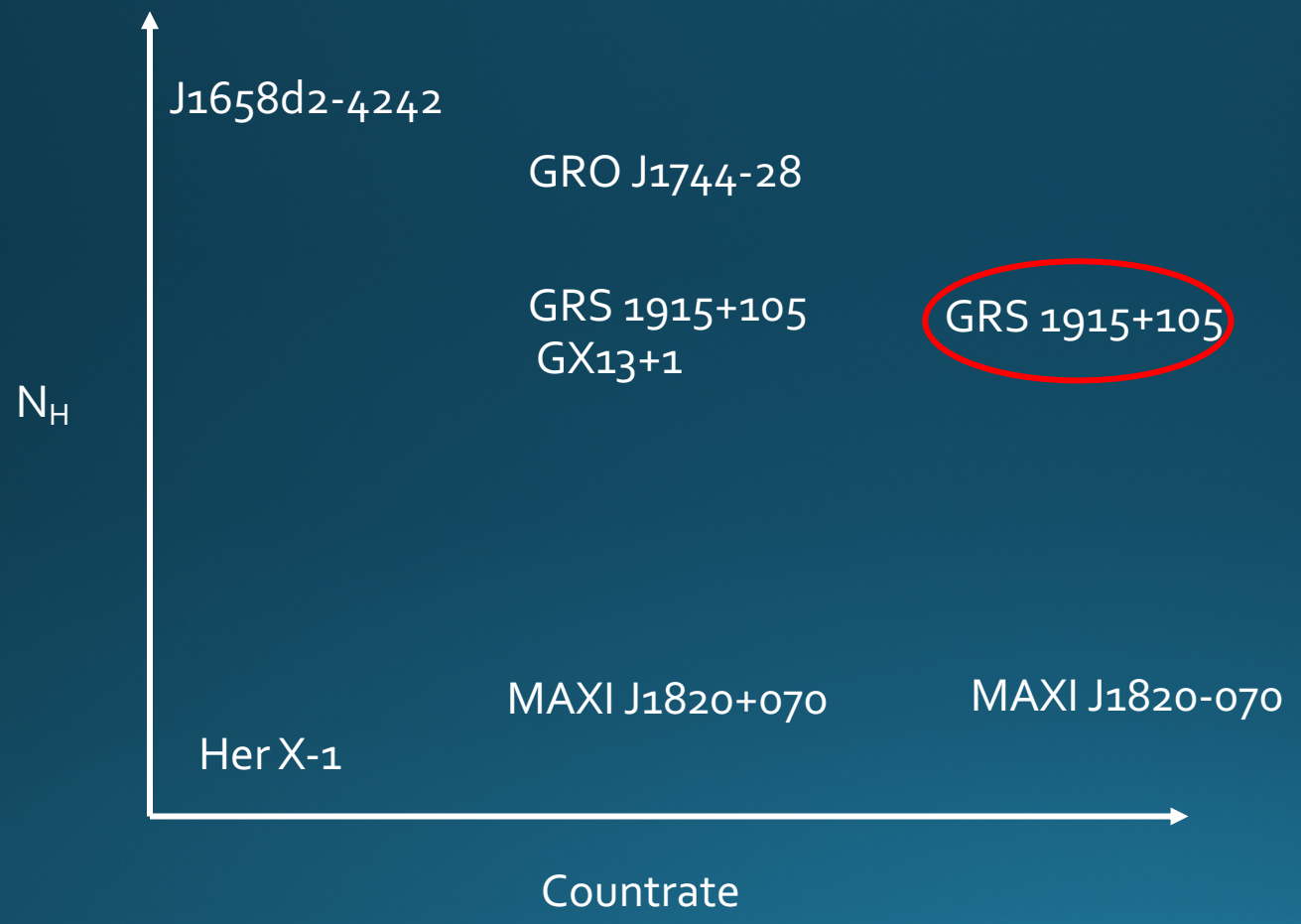
Black	Nustar
Red	Annulus 8-100”, grade 0
Green	Annulus 15-100”, grade 0

Conclusion: OK?

Like GX 13+1, this source definitely has a big dust halo and comparing directly with NuSTAR has to be done under those assumptions. It does appear that you can get a good fit, tails and all, by excising Swift, but how much is that simply due to luck, will have to be investigated a little better.



Phase space


J1658d2-4242
GRO J1744-28
GRS 1915+105
GX13+1
GRS 1915+105
N_H
MAXI J1820+070
MAXI J1820-070
Her X-1
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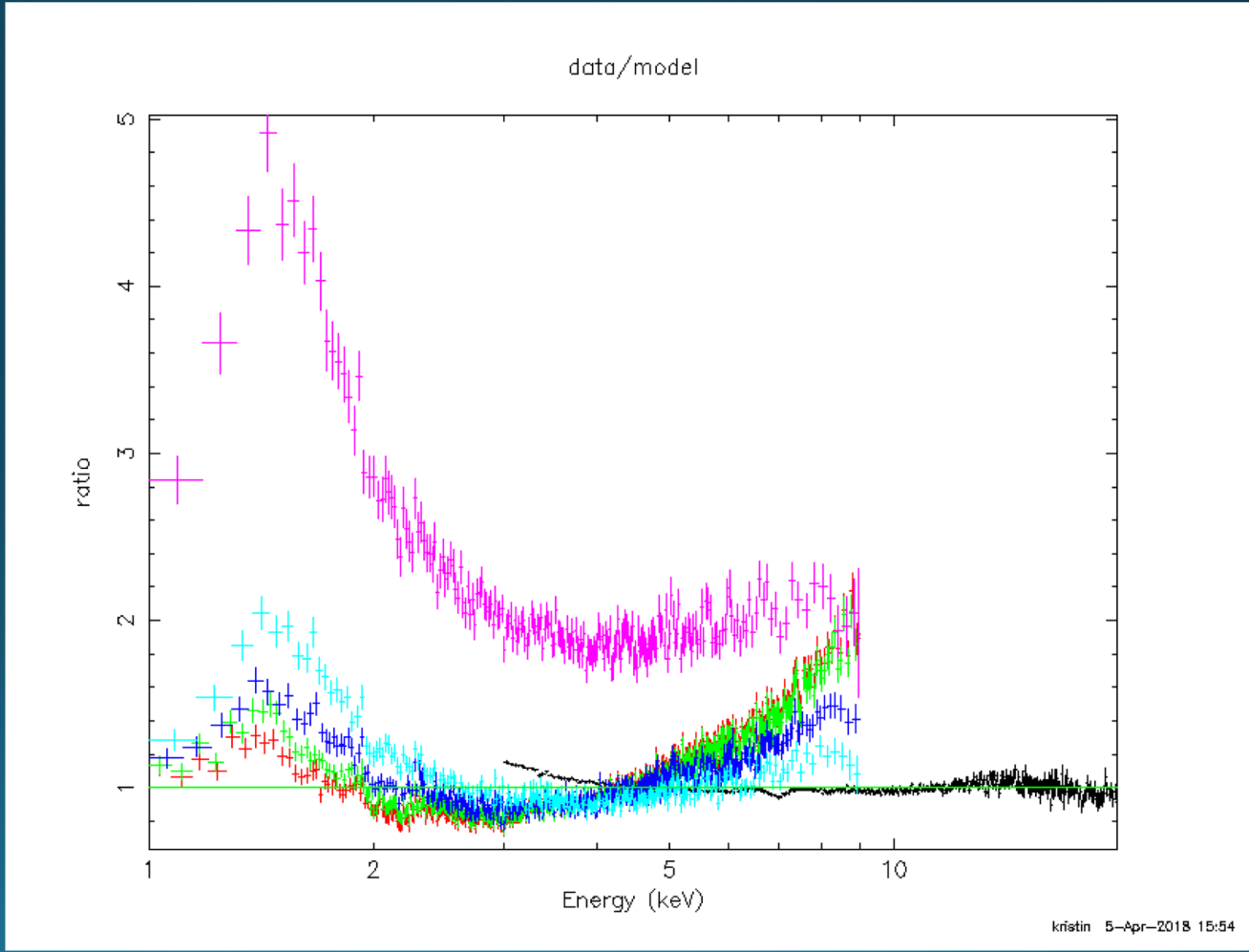
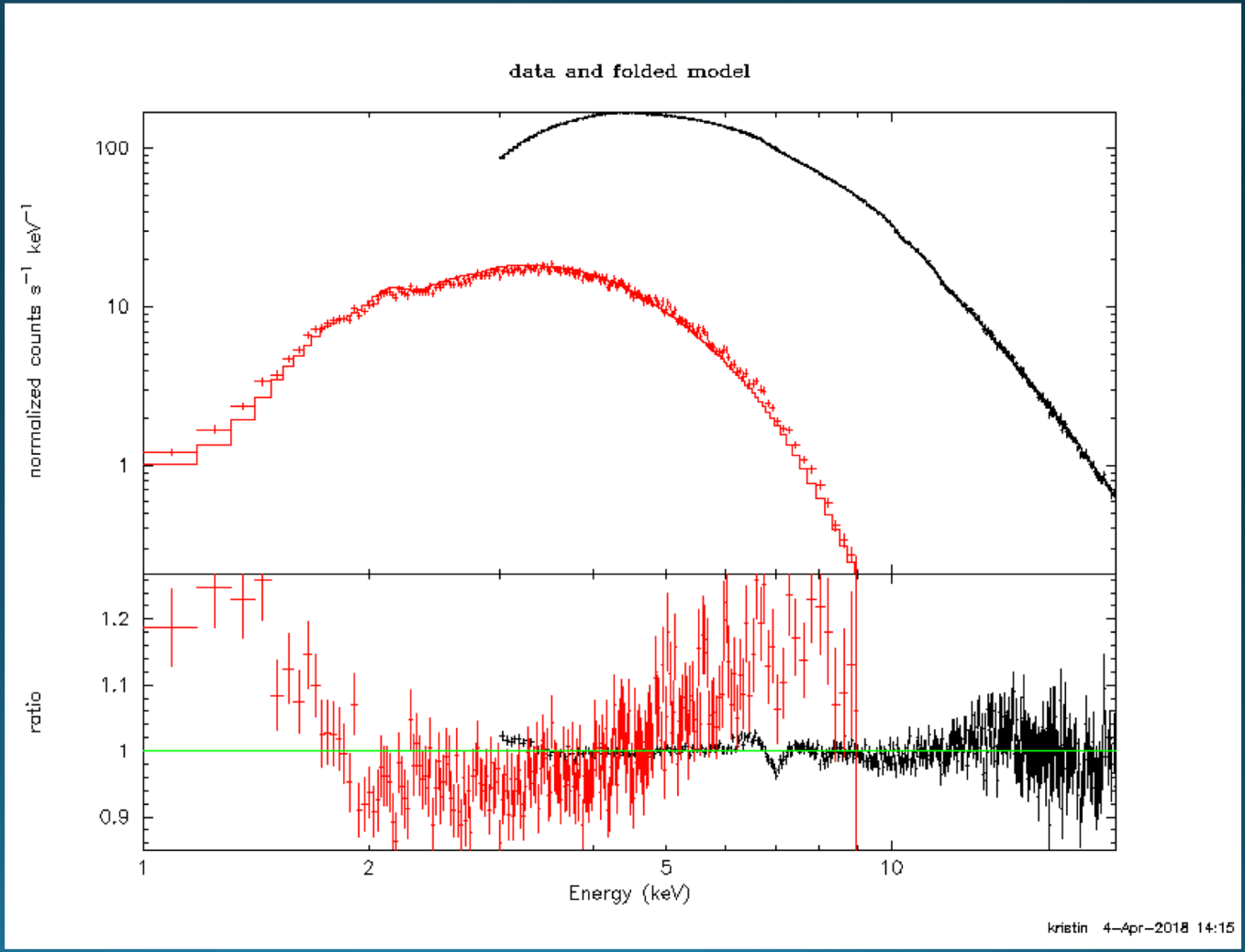
GRS 1915+105 “high”

Red: circle 100”, grade 0
Green: circle 150”, grade 0
Blue: annulus 8 – 100”, grade 0
Cyan: annulus 15 – 100”, grade 0
Pink: annulus 20 – 100”, grade 0

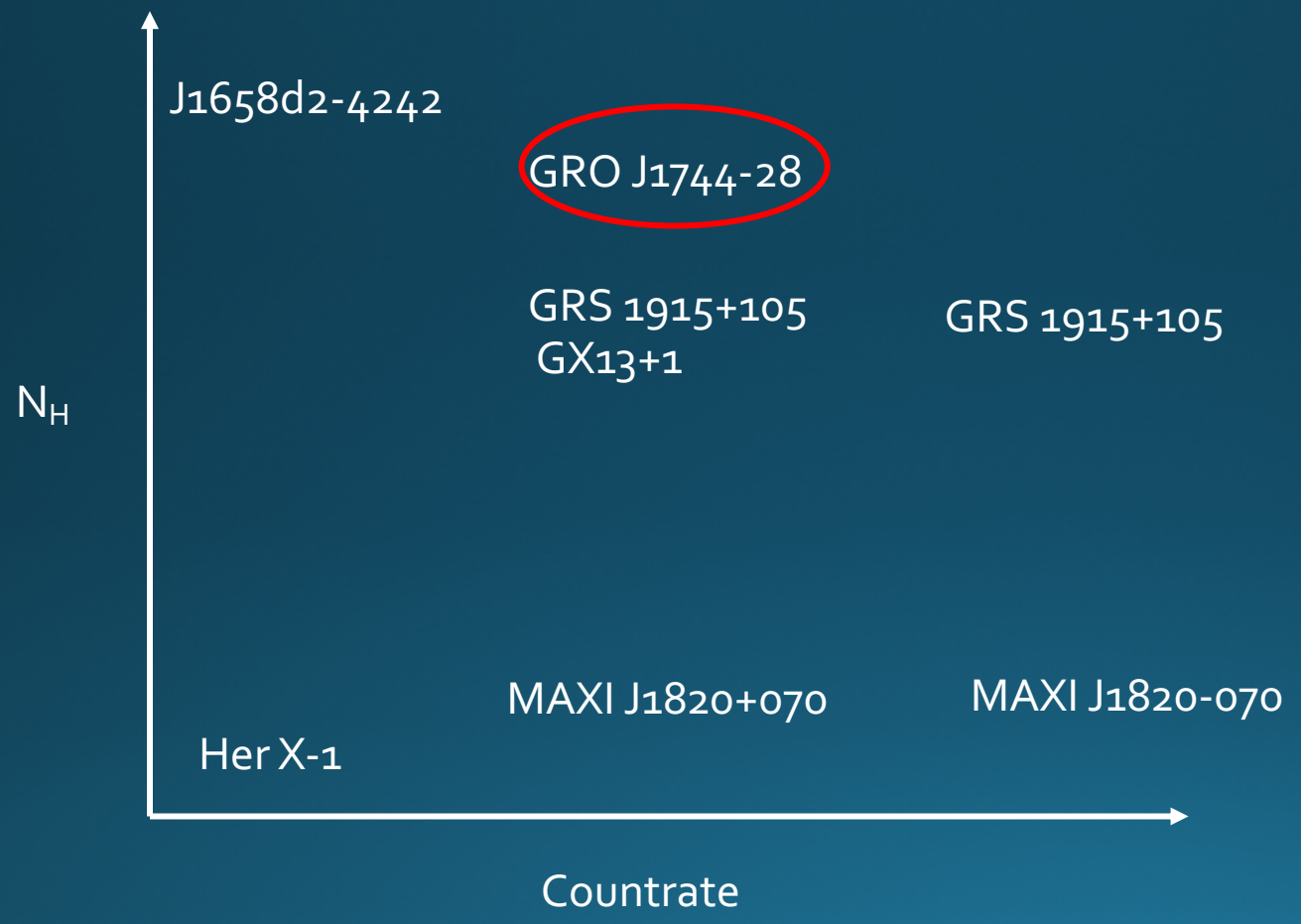


GRS 1915+105 “high”: No good

Best fit with 20-100”



Phase space


J1658d2-4242
GRO J1744-28
GRS 1915+105
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GRS 1915+105
N_H
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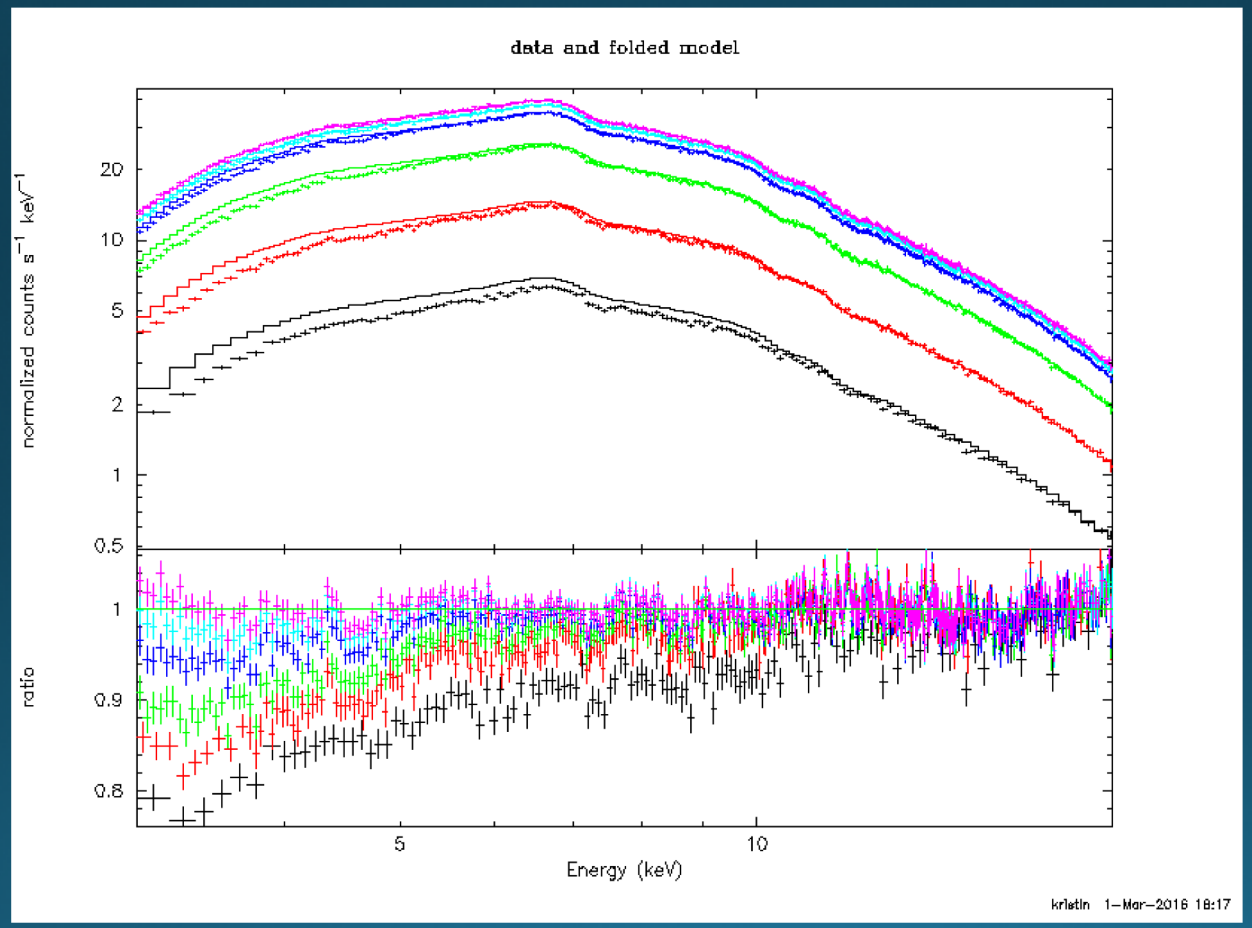
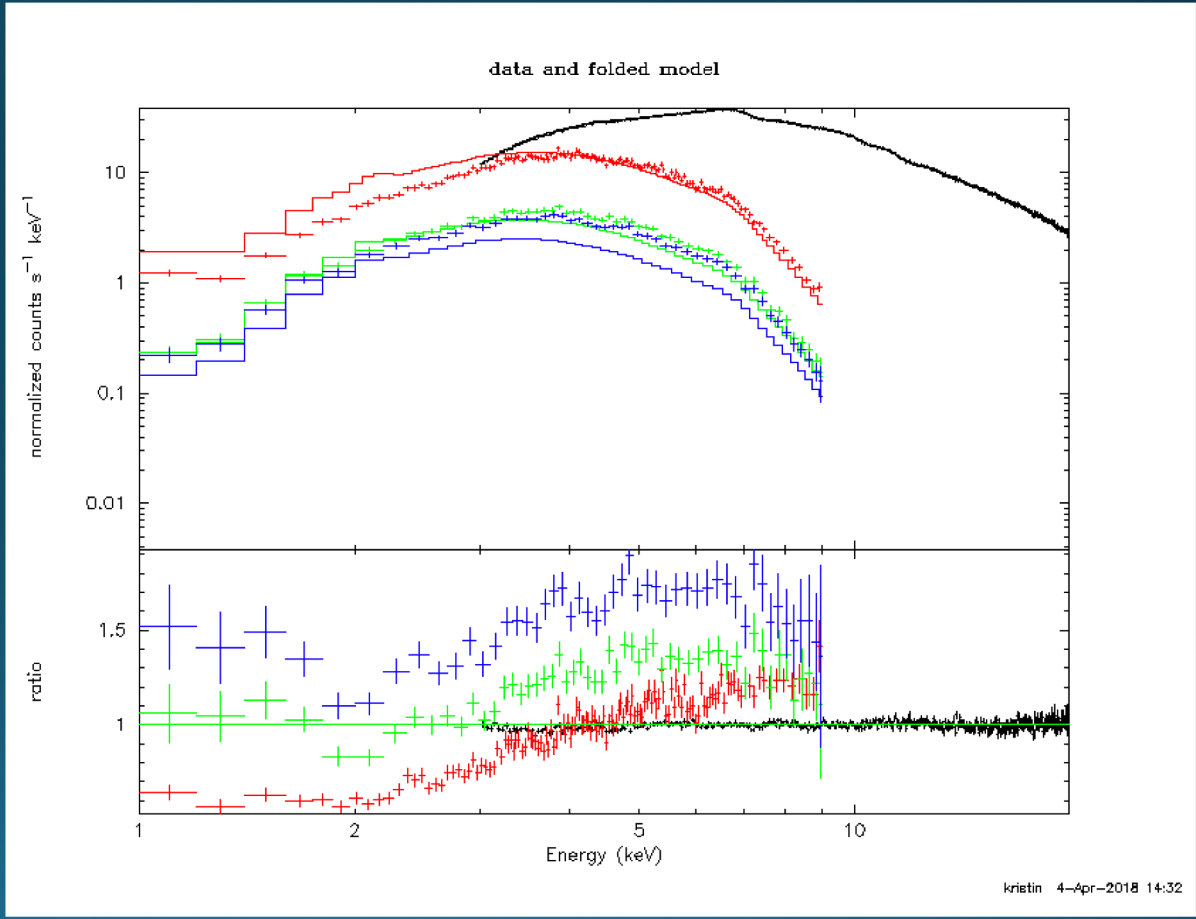
GRO J1744-28


data and folded model
normalized counts s^{-1} keV^{-1}
20
10
5
2
1
0.5
ratio
1
0.9
0.8
5
10
Energy (keV)
kristin 1-Mar-2016 18:17

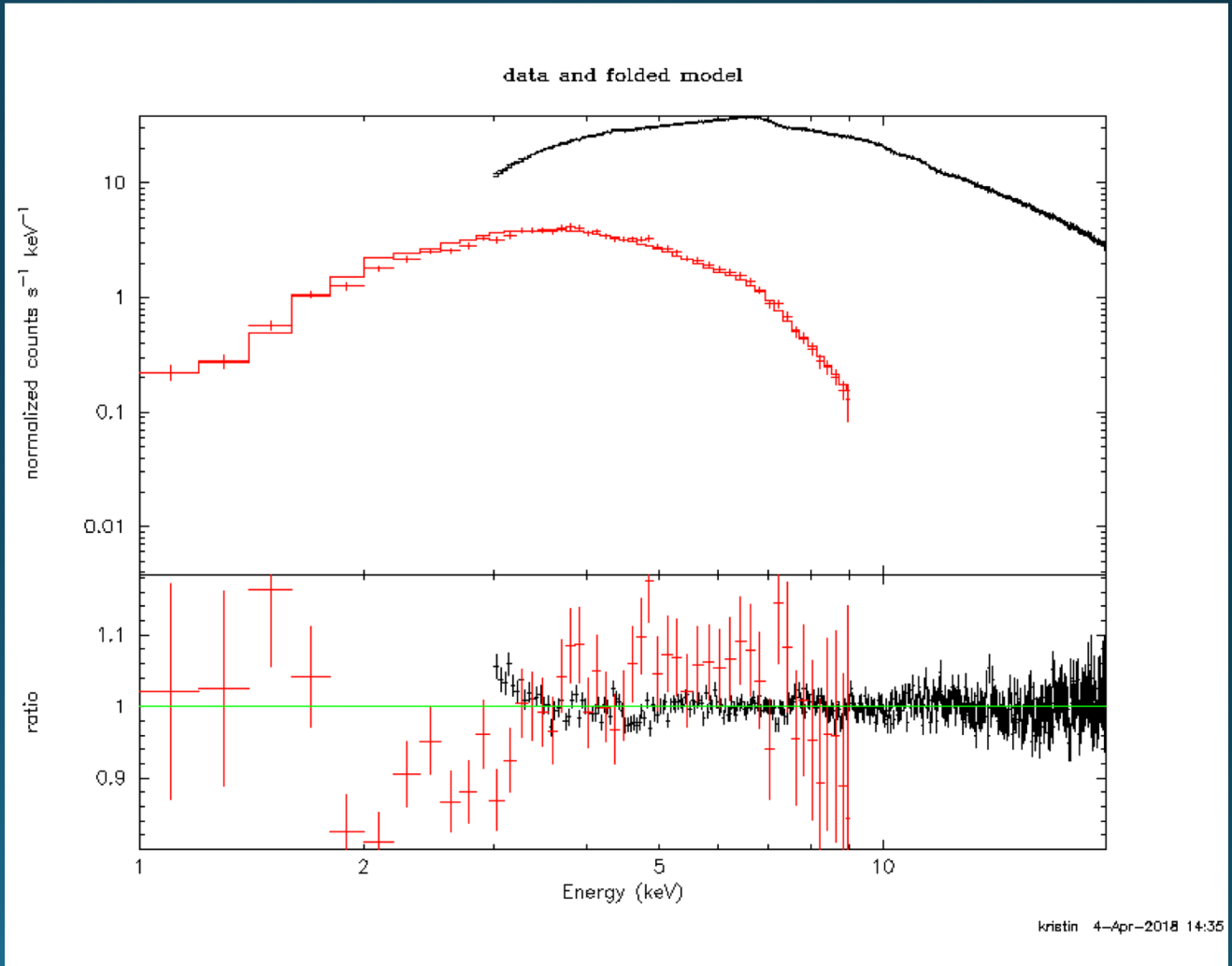
GRO J1744-28

Red: 150" circle
Green: annulus 10-100", grade 0
Blue: 15 - 100", grade 0

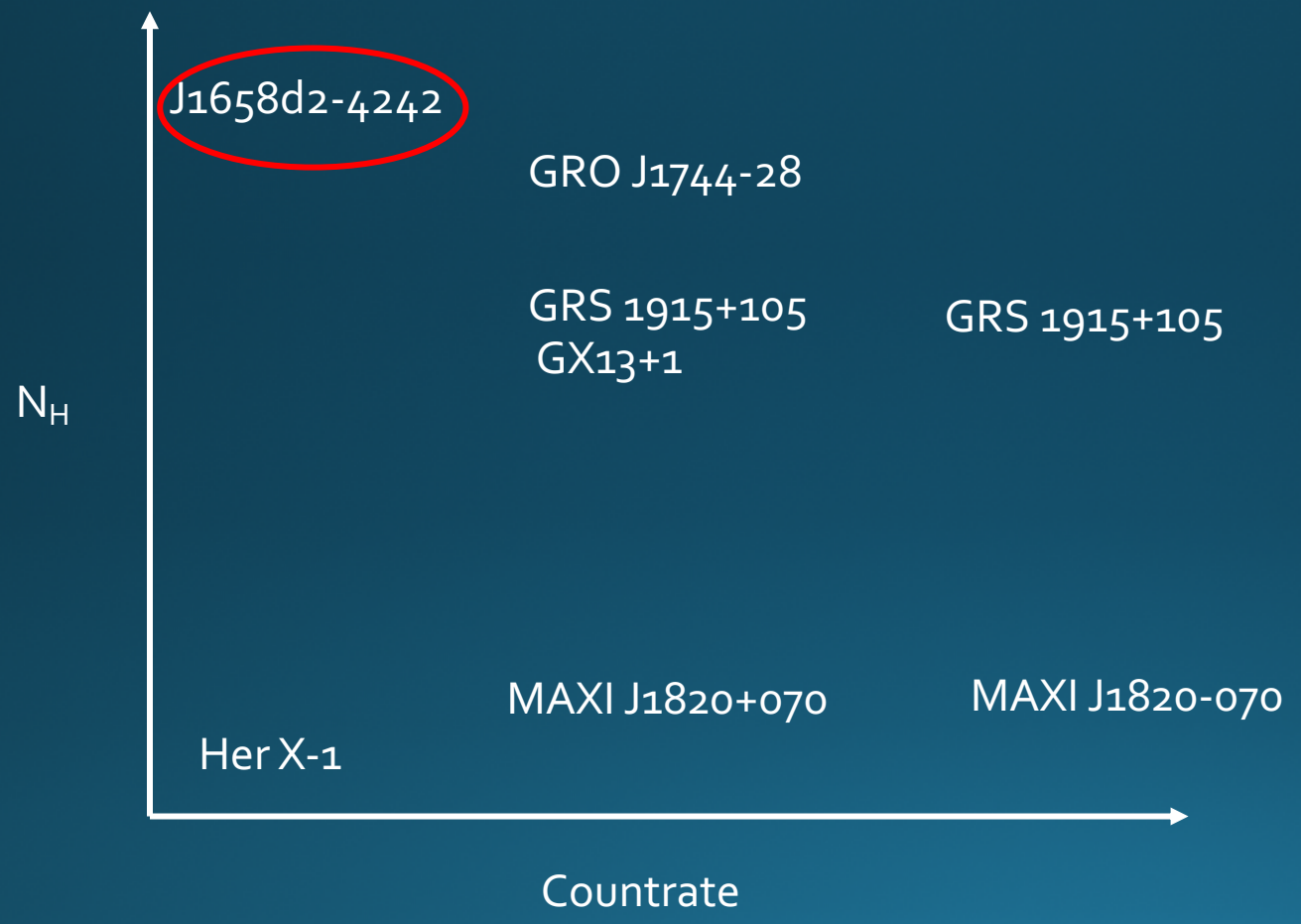


GRO J1744-28: Alright'ish

Best fit: 15 - 100a", grade 0



Phase space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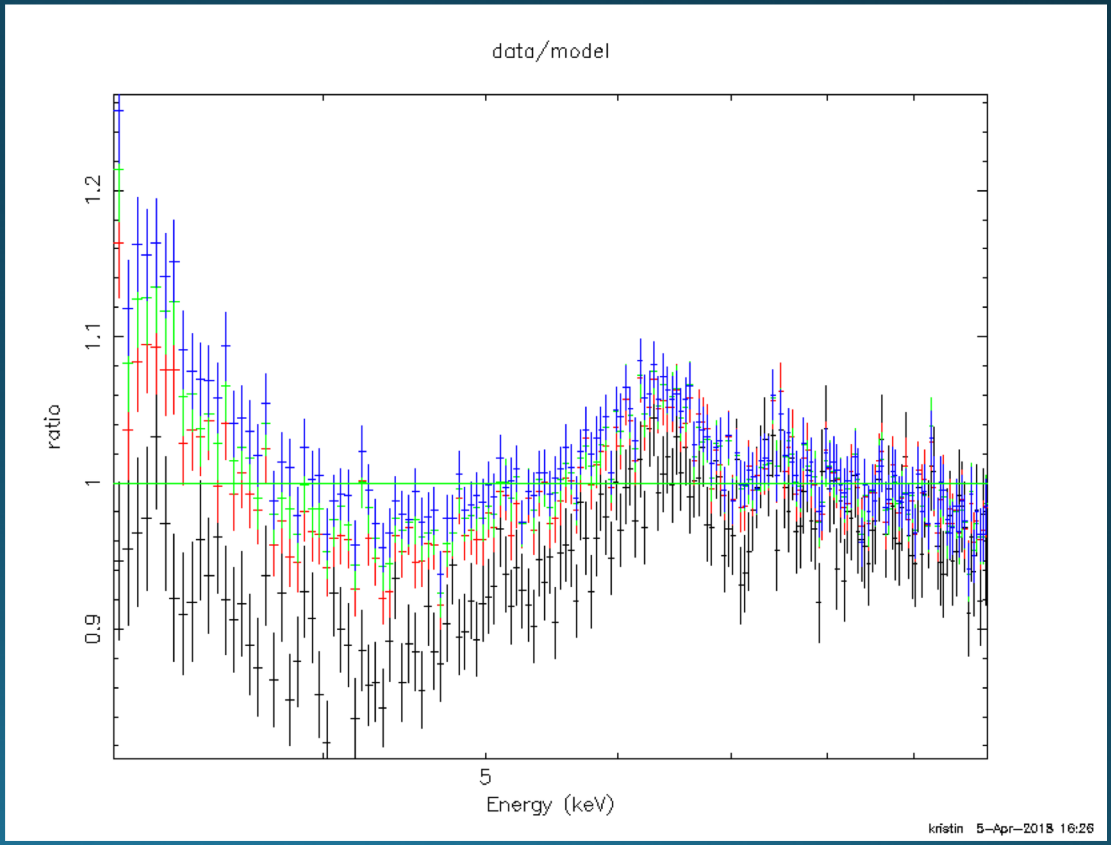
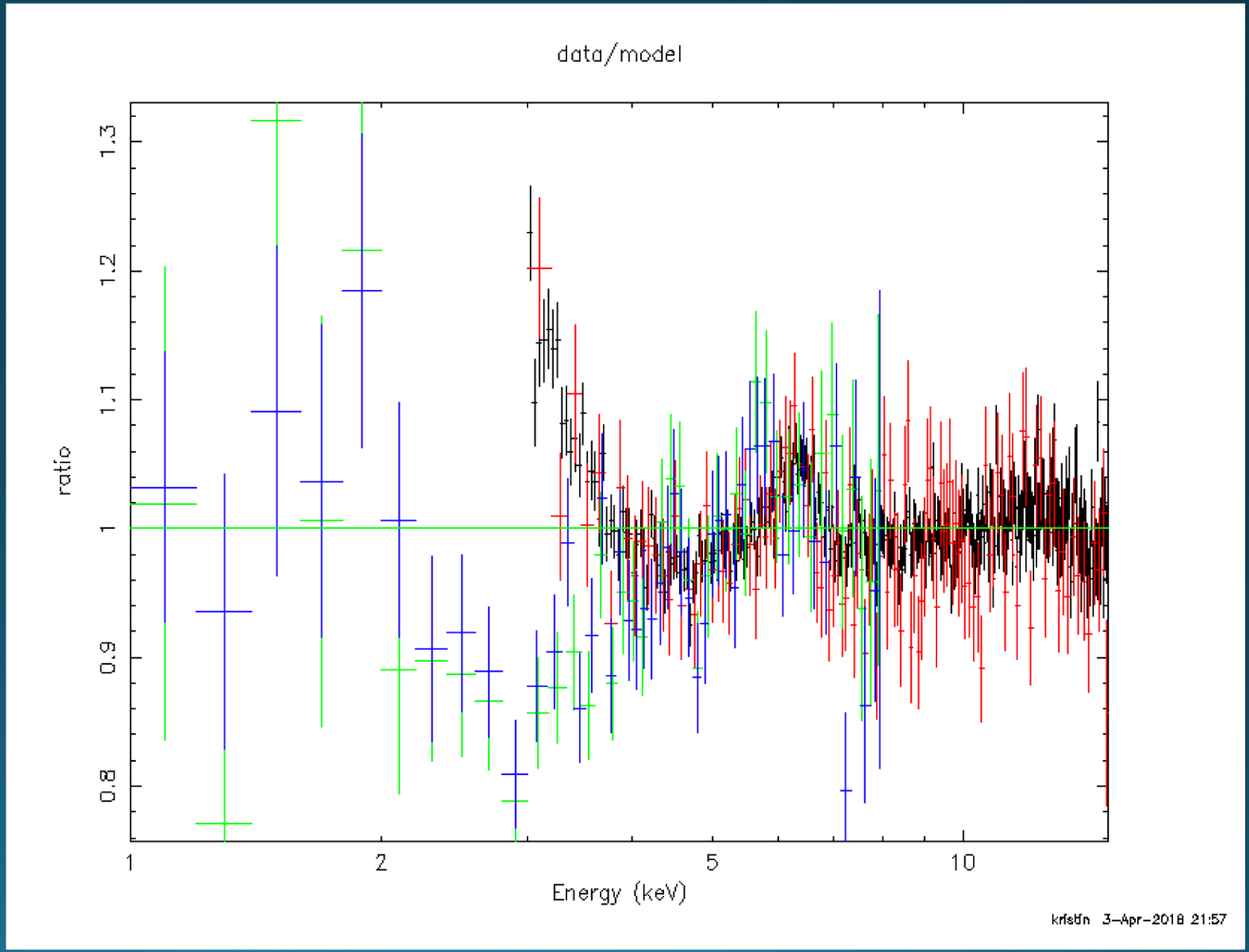
J1658d2-4242

Halo size comparable, if not bigger, than GRO J1744-28

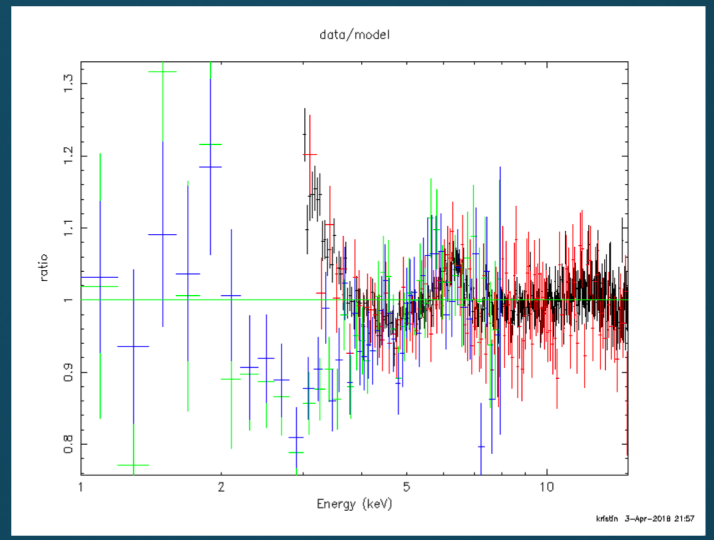


J1658d2-4242: Not good

Green: circle 40″
Blue: circle 40″, grade 0



Phase space



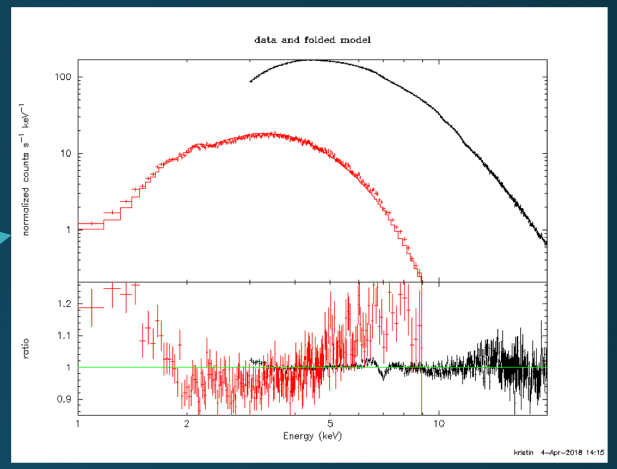
J1658d2-4242

GRO J1744-28

GRS 1915+105

GX13+1

GRS 1915+105

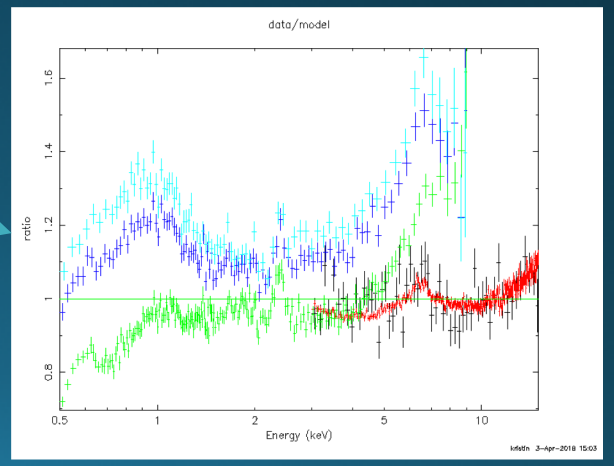


N_H

MAXI J1820+070

MAXI J1820-070

Her X-1



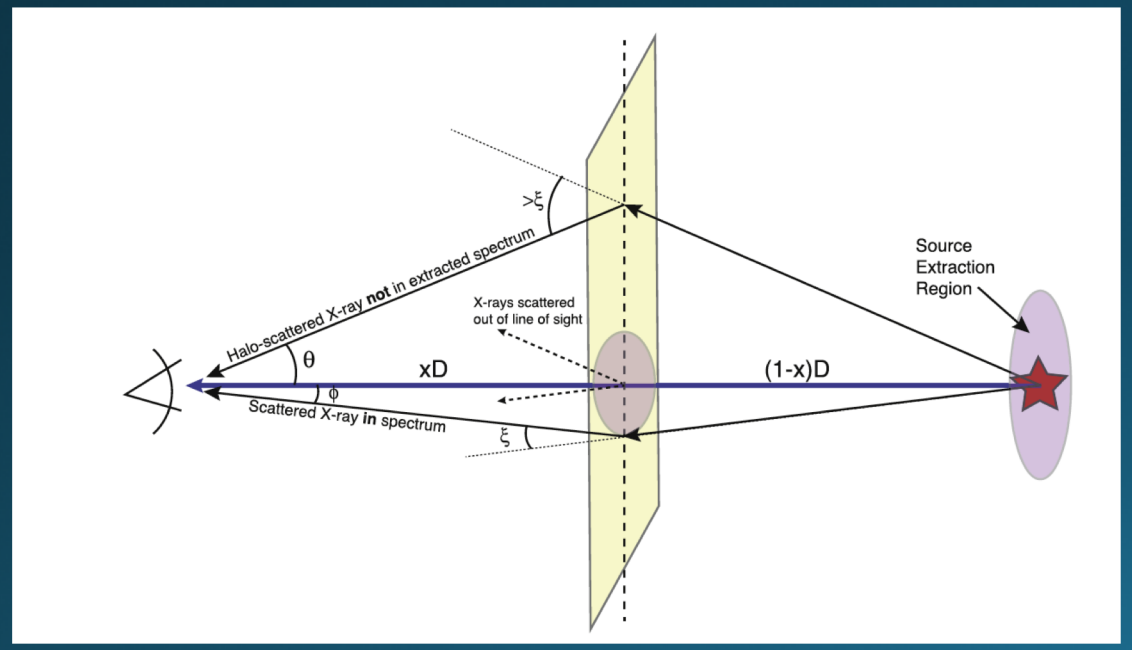
Countrate

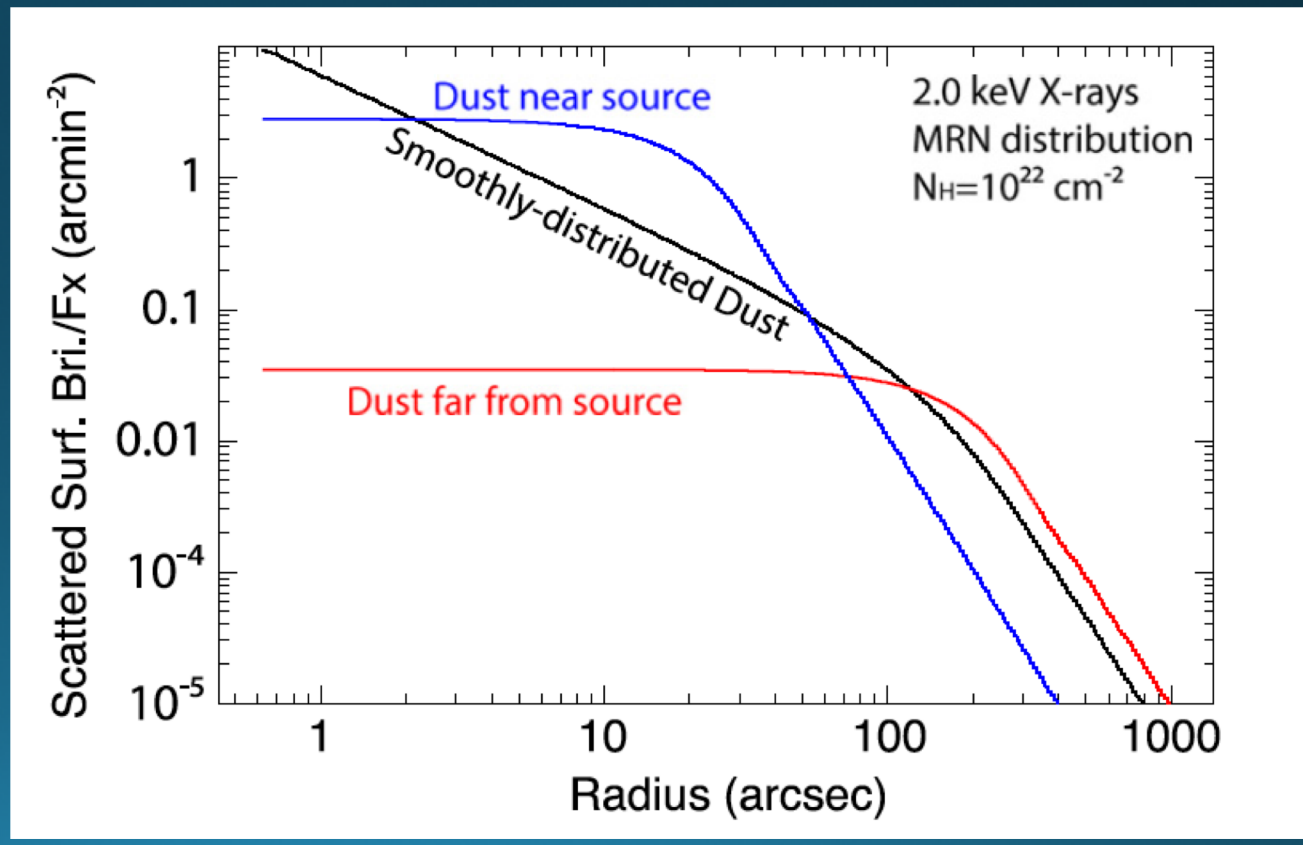
Conclusions

- Grade 0 is a must
- More research on extraction regions
- More research on excision radius
  - Check Her X-1
- Position dependent RMFs?
- More observations of low N_H v. high N_H sources, and bright v. moderate bright
- NuSTAR low energy tails, ~5% can be attributed to calibration errors

Reductions: NuSTAR

- Standard pipeline
- Different extraction regions to check for dust haloes





Reductions: NuSTAR

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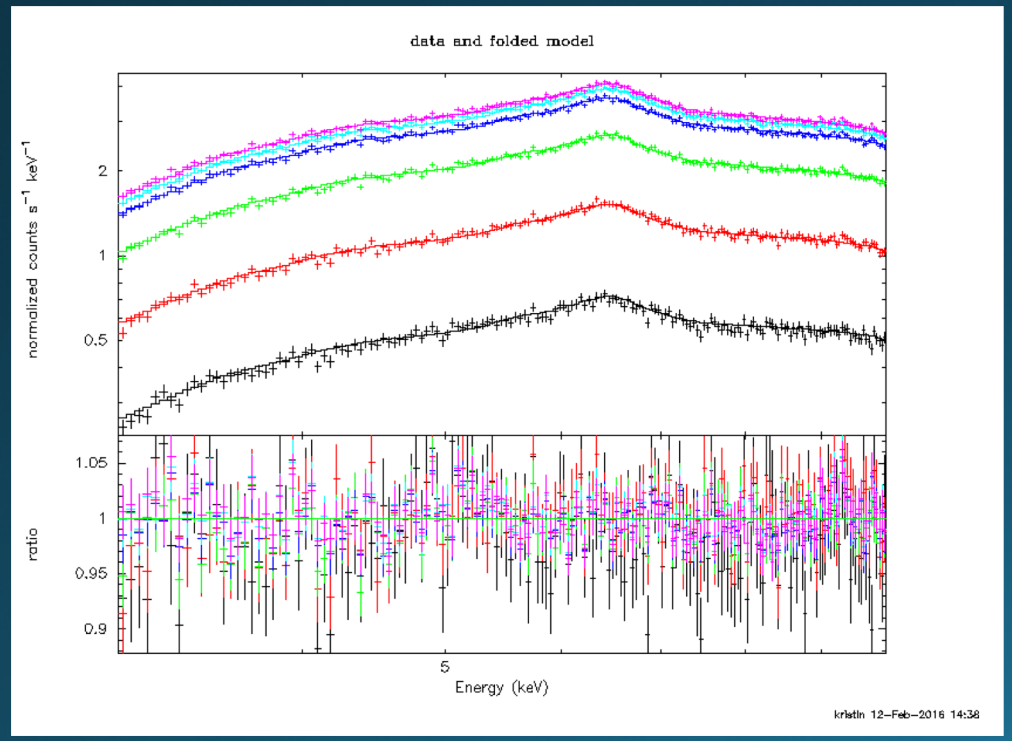
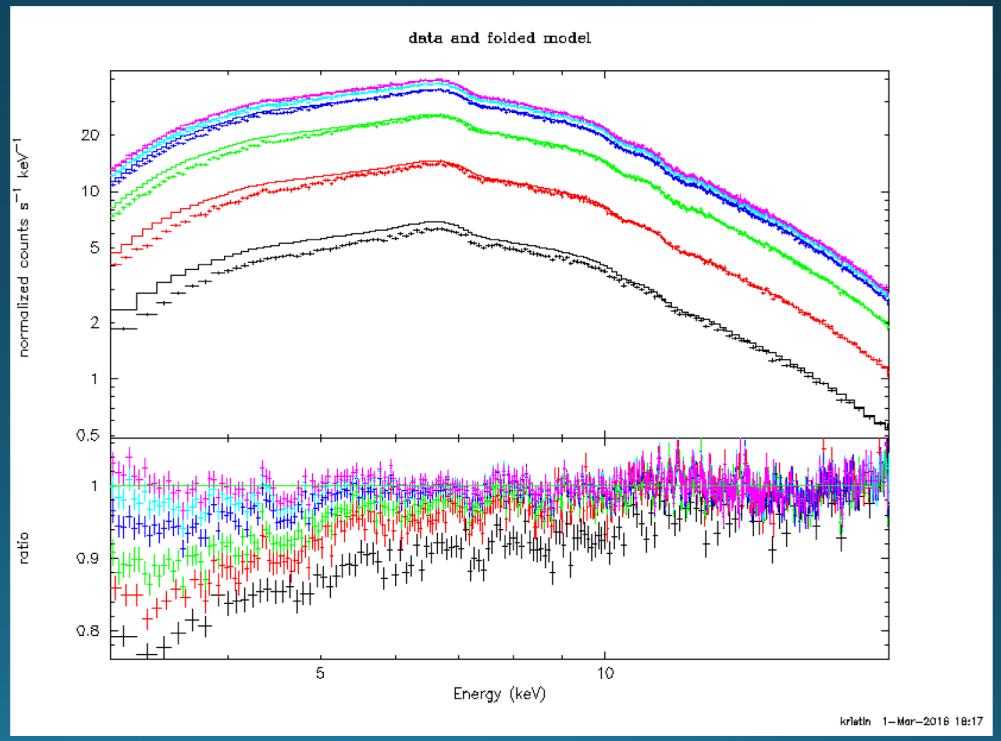
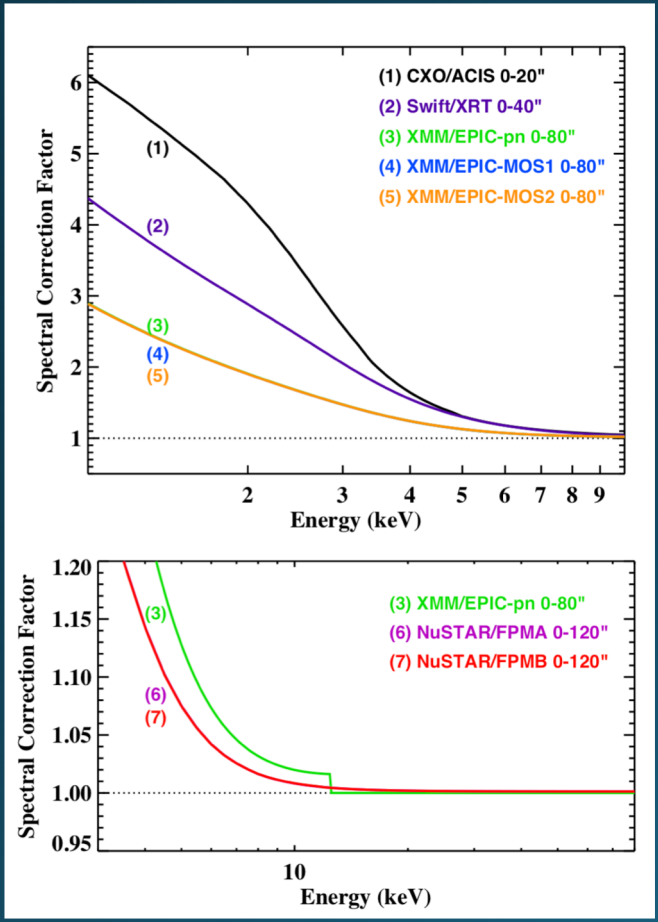


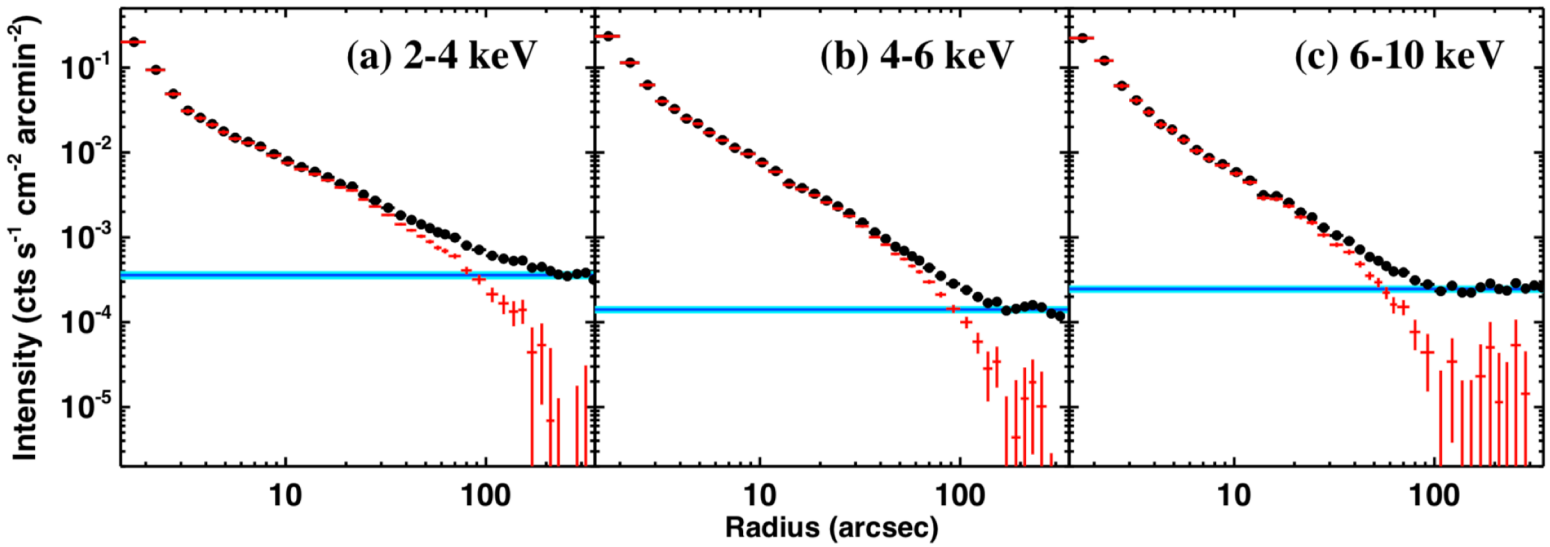


Dust scattering correction



Exploring the Interstellar Medium Using an Asymmetric X-ray Dust Scattering Halo

CHICHUAN JIN,[1] GABRIELE PONTI,[2,3] GUANGXING LI,[4] AND DAVID BOGENSBERGER[3]



Kristin K Madsen

MAXI J1820+070 Integral + NuSTAR

NuSTAR planning (day 73 = March, 14 = MJD 58191) INTEGRAL planning

2018:073:20:15:35 2018:073:20:25:00 90401309001 MAXI
2018:073:20:25:08 2018:074:10:35:00 90401309002 MAXI
day 75:11:07-77:12:52 rev 1931
day 78:05:41-80:05:11 rev 1932
2018:080:00:24:19 2018:080:00:30:00 90401309003 MAXI
2018:080:00:30:16 2018:080:05:15:00 90401309004 MAXI 1932 scw 52-56 (00:19-05:11)

2018:080:05:17:56 2018:080:05:25:00 90401311001 MAXI_SLPA155
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2018:080:06:57:54 2018:080:07:05:00 90401309005 MAXI
2018:080:07:05:14 2018:080:16:30:00 90401309006 MAXI

2018:080:16:32:56 2018:080:16:40:00 90401311003 MAXI_SLPA155
2018:080:16:40:15 2018:080:18:10:00 90401311004 MAXI_SLPA155
day 80:18:18-82:21:13 rev 1933

2018:083:12:21:13 2018:083:12:30:00 90401309007 MAXI
day 83:13:17-85:12:52 rev 1934
2018:083:12:30:06 2018:083:18:35:00 90401309008 MAXI
common part day 83:13:17-18:35 1934 scw 10-15.25

2018:083:18:37:54 2018:083:18:45:00 90401311005 MAXI_SLPA155 1934 scw 15.25-15.42
2018:083:18:45:22 2018:083:20:15:00 90401311006 MAXI_SLPA155 1934 scw 15.42- 16

2018:083:20:17:55 2018:083:20:25:00 90401309009 MAXI 1934 scw 17-17.5
2018:083:20:25:06 2018:084:01:05:00 90401309010 MAXI 1934 scw 17.5-21

day 94:00:12-94:14:31 rev 1938
2018:094:04:20:35 2018:094:04:30:00 90401309011 MAXI 1938 scw 06-06.2
2018:094:04:30:09 2018:095:04:30:00 90401309012 MAXI
common part day 94:04:30-14:31 1938 scw 06.2-15

2018:106:16:05:16 2018:106:16:15:00 90401314001 MAXI_SLPA140
2018:106:16:15:39 2018:106:22:20:00 90401314002 MAXI_SLPA140

2018:106:22:22:52 2018:107:01:40:00 90401309013 MAXI
?? 2018:107:01:42:01 2018:107:06:30:00 90401316001 MAXI_bkgd_PA140 ??

day 107:07:19-107:21:38 rev 1943
2018:107:06:32:00 2018:107:22:20:00 90401309014 MAXI
common part day 107:07:19-21:38 1943 scw 02-15

day 123:05:28-123:12:53 rev 1949
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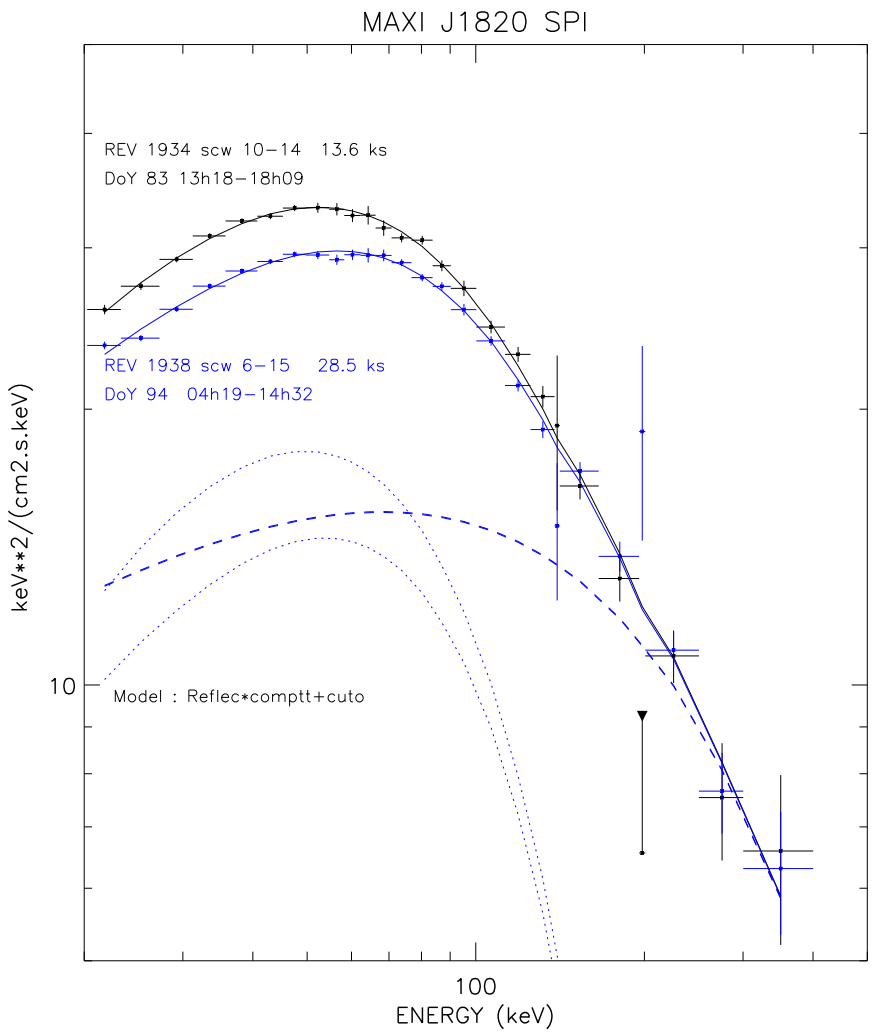
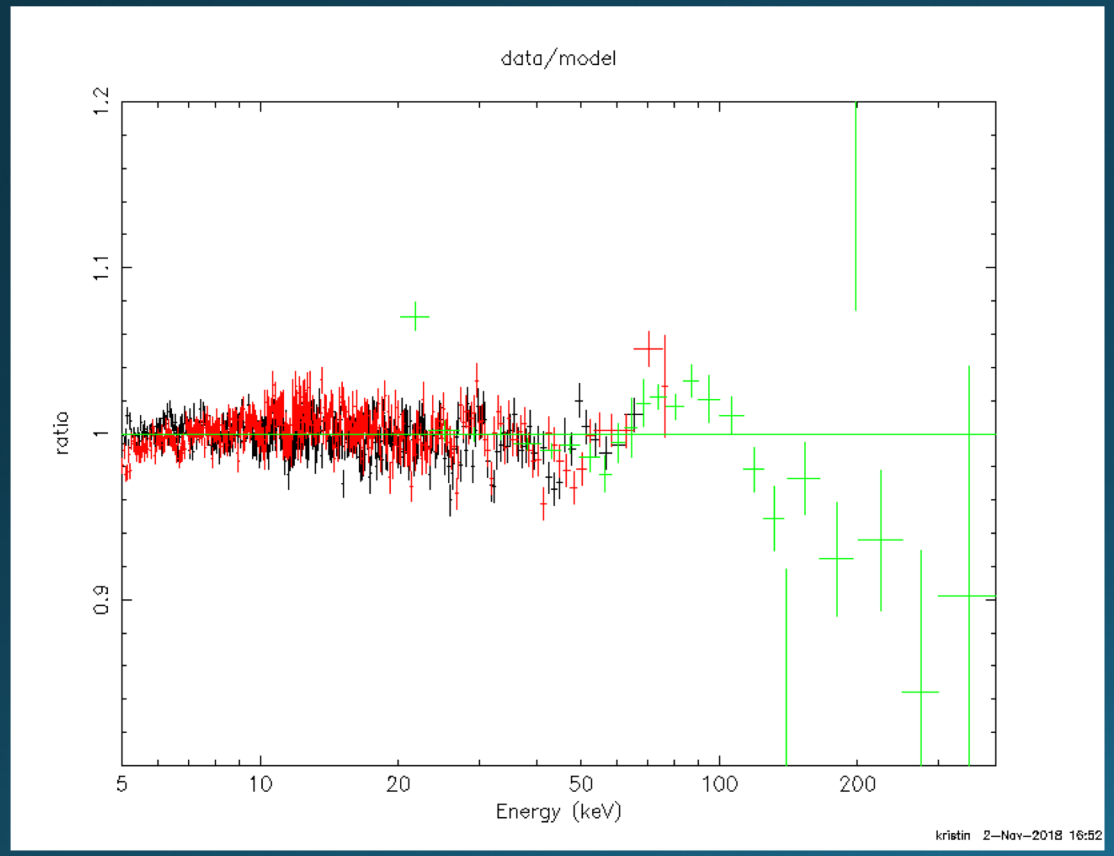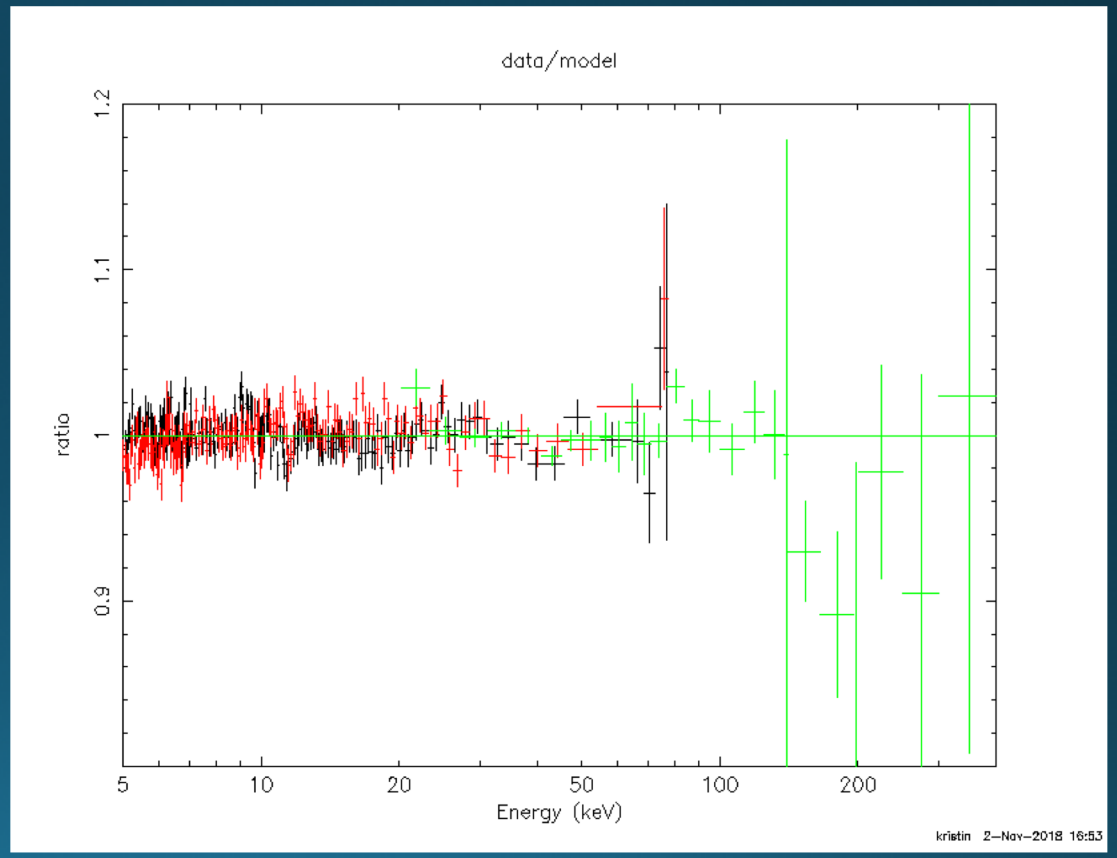
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