

REMOTE INTERFACE SAS ANALYSIS (RISA) AND XSA TEST REPORT

Prepared by	Aitor Ibarra
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Table of contents:

1	INTRODUCTION.....	4
2	RISA PROCESSING SERVICE	4
3	RISA DATA ANALYSIS SERVICE	6
4	RISA EPIC SOURCE REPROCESSING SERVICE.....	9
5	RISA SERVICES VALIDATION TESTS.....	11
5.1	RISA processing validation test.....	11
5.1.1	EPIC PN event lists.....	11
5.1.2	EPIC MOS1 event lists.....	12
5.1.3	EPIC MOS2 event lists	12
5.1.4	RGS fluxed spectra	12
5.1.5	OM source products	12
5.2	RISA data analysis validation test	12
5.2.1	Filtered event list.....	12
5.2.2	Filtered image.....	13
5.2.3	Light curve.....	13
5.2.4	Spectra	13
5.3	RISA EPIC source reprocessing validation test.....	14
5.3.1	EPIC PN observation 0112570601 source number 19	14

1 INTRODUCTION

The Remote Interface to SAS Analysis (RISA) (Ref. Carlos ADASS) is a client/server application able to create SAS workflow and executed it in a GRID infrastructure.

RISA Client is a SAS workflow builder able to construct and concatenate a set of XMM-Newton SAS tasks in a XML file. In Fig. 1, we show a typical RISA XML file with a set of SAS tasks and their corresponding parameters.

```

-<VOTABLE>
-<DESCRIPTION>
  XMM-Newton SOC. European Space Astronomy Centre ESAC/ESA (http://www.esac.esa.int)In case of problems, please contact: aibar
</DESCRIPTION>
+<RESOURCE></RESOURCE>
-<RESOURCE name="0555471201" ID="2_1_0" type="PPS" utype="PN">
-<DESCRIPTION>WR140</DESCRIPTION>
-<TABLE ID="BasicWorkflow" name="ciibuild" ref="Observation">
  <PARAM name="withobservationdate" value="true"/>
  <PARAM name="observationdate" value="now"/>
  <DATA>
  <TABLEDATA/>
  </DATA>
</TABLE>
-<TABLE ID="PNWorkflow" name="evselect" ref="S003">
  <PARAM name="table" value="P0555471201PNS003PIEVL10000.FTZ"/>
  <PARAM name="timebinsize" value="100"/>
  <PARAM name="rateset" value="rateEPIC.fits"/>
  <PARAM name="makereccolumn" value="true"/>
  <PARAM name="maketimecolumn" value="true"/>
  <PARAM name="timecolumn" value="TIME"/>
  <PARAM name="withrateset" value="true"/>
  <PARAM name="expression" value="#XMMEA_EP && (PI in [10000:12000]) && (PATTERN==0)"/>
  <DATA>
  <TABLEDATA/>
  </DATA>
</TABLE>
-<TABLE ID="PNWorkflow" name="tabngen" ref="S003">
  <PARAM name="table" value="rateEPIC.fits"/>
  <PARAM name="gtsset" value="EPICgiti.fits"/>
  <PARAM name="expression" value="RATE <= 0.4"/>
  <DATA>
  <TABLEDATA/>
  </DATA>
</TABLE>
-<TABLE ID="PNWorkflow" name="evselect" ref="S003">
  <PARAM name="table" value="P0555471201PNS003PIEVL10000.FTZ"/>
  <PARAM name="keepfilteroutput" value="yes"/>
  <PARAM name="expression" value="(FLAG == 0) && (PATTERN <= 4) && (PI in [200:9000]) && gti(EPICgiti.TIME)"/>
  <DATA>
  <TABLEDATA/>
  </DATA>
</TABLE>
.....
-<TABLE ID="PNWorkflow" name="evselect" ref="S003">
  <PARAM name="table" value="P0555471201PNS003PIEVL10000.FTZ"/>
  <PARAM name="withimageset" value="true"/>
  <PARAM name="xcolumn" value="X"/>
  <PARAM name="ycolumn" value="Y"/>
  <PARAM name="imageset" value="image.ds"/>
  <DATA>
  <TABLEDATA/>
  </DATA>
</TABLE>
-<TABLE ID="PNWorkflow" name="eregionanalyse" ref="S003">
  <PARAM name="imageset" value="image.ds"/>
  <PARAM name="srcexp" value="((X,Y) IN circle(24875.182,24161.974,505.34607))"/>
  <PARAM name="backexp" value="((X,Y) IN circle(23200.941,29309.48,1422.0269))"/>
  <PARAM name="withoutputfile" value="yes"/>
  <PARAM name="output" value="eregion.txt"/>
  <DATA>
  <TABLEDATA/>
  </DATA>
</TABLE>
-<TABLE ID="PNWorkflow" name="especper" ref="S003">
  <PARAM name="backexp" value="((X,Y) IN circle(23200.941,29309.48,1422.0269))"/>
  <PARAM name="rmfset" value="true"/>
  <PARAM name="extendedsource" value="false"/>
  <PARAM name="witharfset" value="true"/>
  <PARAM name="useodfset" value="false"/>
  <PARAM name="table" value="P0555471201PNS003PIEVL10000.FTZ"/>
  <PARAM name="filestem" value="myfiles"/>
  <PARAM name="withbadpixcorr" value="true"/>
  <PARAM name="srcrmfset" value="R0555471201PNS003SRCRMF0001.FIT"/>
  <PARAM name="bckspecset" value="R0555471201PNS003BGSPCC0001.FIT"/>
  <PARAM name="detybins" value="5"/>
  <PARAM name="srcarfset" value="R0555471201PNS003SRCARF0001.FIT"/>
  <PARAM name="withfilesicu" value="false"/>
  <PARAM name="witharfset" value="false"/>
  <PARAM name="srcexp" value="((X,Y) IN circle(24875.182,24161.974,505.34607))"/>
  <PARAM name="detybins" value="5"/>
  <PARAM name="srspeset" value="R0555471201PNS003SRSPCC0001.FIT"/>
  <DATA>
  <TABLEDATA/>
  </DATA>
</TABLE>
</RESOURCE>
</VOTABLE>

```

RISA Server back-end contains all the logic needed to process the RISA client request and convert the request in to a perl script able to process XMM-Newton data.

In this document, we present a set of new RISA rest-full services, client independent, able to execute predefined SAS tasks that create one of the following SAS products:

Although the RISA services could be accessible from any client, for this first public release, we have restricted the access only to the XSA client.

In the next chapters, we will briefly describe the RISA services provided through the XSA and the SAS tasks used to create the products.

2 RISA PROCESSING SERVICE

This service is in charge of the execution of the standard SAS instrument procs (epproc, emproc, rgsproc, omichain, omfchain and omgchain) through the execution of the *xmmextractor* SAS task.

The RISA service is called using the following url and with the following parameters:

http://xxxxxx.xxx.xxx:8080/axis/RISA_reprocessing?

obsid=0135720601&
PN=yes&
MOS1=yes&
MOS2=yes&
RGS1=yes&
RGS2=yes&
OM=yes&
ra=15.958335&
dec=-72.031294&
target=ODF&
username=aibarra&
mail=aibarra@sciops.esa.int

NOTE: The RISA server is not public, therefore we do not include the real name of the service. The service is only accessible through the XSA interface.

Where:

obsid is the XMM-Newton observation ID.

PN is a boolean parameter to create or not EPIC PN event lists

MOS1 is a boolean parameter to create or not EPIC MOS1 event lists

MOS2 is a boolean parameter to create or not EPIC MOS2 event lists

RGS1 is a boolean parameter to create or not RGS1 event lists, source and background spectra, response matrix, fluxed spectra and light curve.

RGS2 is a boolean parameter to create or not RGS2 event lists, source and background spectra, response matrix, fluxed spectra and light curve.

OM is a boolean parameter to create or not OM source specific products.

ra is the target Right Ascension coordinate. This parameter is used to run *rgsproc* with the source RA.

dec is the target Declination coordinate. This parameter is used to run *rgsproc* with the source Dec.

target is the XSA target name. This parameter is used to label SAS products.

username is the XSA user name.

mail is the user's email address used to notify the user when the executions has finished.

This service provides the following products:

1. Product file with the following nomenclature:

risa_reqID_ObsID_ODF.tar.gz

Where:

reqID is the unique identifier provided by RISA server

ObsID is the XMM-Newton observation ID

ODF is an identifier for RISA processing service

2. Standard output log file with the following nomenclature:

out_reqID_ObsID_ODF

Where:

reqID is the unique identifier provided by RISA server

ObsID is the XMM-Newton observation ID

ODF is an identifier for RISA processing service

3. Standard error log file with the following nomenclature:

err_reqID_ObsID_ODF

Where:

reqID is the unique identifier provided by RISA server

ObsID is the XMM-Newton observation ID

ODF is an identifier for RISA processing service

Once the processing has finished, the system notifies the user via email.

3 RISA DATA ANALYSIS SERVICE

This service is available for EPIC PN and MOS instruments in imaging mode.

This service provides the following products:

1. Create a filtered event list
2. Create a filtered image
3. Create a light curve
4. Create a EPIC spectra

For each of the products, RISA server creates a scripts that execute the following SAS tasks:

- Filtered event list:

evselect → to create the light curve to filter for high background particles

tabgtigen → to create the Good Time Intervals corresponding to the time periods clean of high background particles.

evselect → to create the filtered event list.

- Filtered Image:

evselect → to create the light curve to filter for high background particles

tabgtigen → to create the Good Time Intervals corresponding to the time periods clean of high background particles.

evselect → to create the filtered image.

- Light curve:

evselect → to create the light curve to filter for high background particles

tabgtigen → to create the Good Time Intervals corresponding to the time periods clean of high background particles.

evselect → to create the filtered image.

evselect → to create the source light curve.

evselect → to create the background light curve.

epiclccorr → to create the final light curve

- Spectra:

evselect → to create the light curve to filter for high background particles

tabgtigen → to create the Good Time Intervals corresponding to the time periods clean of high background particles.

evselect → to create image.

eregionanalyse → to centroid and optimize source region.

especget → to create the source spectra, background spectra, ancilliary respnse file and response matrix file.

The RISA data analysis service is called using the following url and with the following parameters:

http://xxxxxx.xxx.xxx:8080/axis/RISA_sl?

product=spectra&
obsid=0651300301&
inst=EMOS2&
exp=S003&
target=WR140&
srcreg=((X,Y) IN circle(24385.14,24706.642,592.29775))&
bkgreg=((X,Y) IN circle(23969.759,34756.796,1519.4881))&
optsrcregion=no&
pimin=200&
pimax=8000&
pattern=<=4&
flag=0&
highbkgflaringcountrate=<=0.35 &
timebinsize=100&
username=aibarra&
mail=aibarra@sciops.esac.esa.int

NOTE: The RISA server is not public, therefore we do not include the real name of the service. The service is only accessible through the XSA interface.

Where:

product is one of the following options:

- spectra
- lightcurve
- image
- events

obsid is the XMM-Newton observation ID.

inst is the EPIC instrument name (EPN, EMOS1 or EMOS2).

exp is th EPIC exposure ID.

target is the source target name.

srcreg is the source region. The region shapes allowed are: CIRCLE and ANNULUS for source region and CIRCLE for background region (used only for **spectra** product).

bkgreg is the background region. The region shape allowed is CIRCLE (used only for **spectra** product).

optsrcregion is the boolean flag to execute or not *eregionanalyse* SAS task to centroid and optimize source region (used only for **spectra** product).

pimin is the minimum PI energy in eV to filter the event file.

pimax is the maximum PI energy in eV to filter the event file.

pattern is the EPIC SAS PATTERN FLAG, currently the following pattern values are allowed:

- No pattern

- 0 pattern

- <= 4 for PN or <=12 for MOS

flag is the SAS FLAG variable, currently only (flag == 0) is allowed.

highbkgflaringcountrate is the count rate threshold used to create Good Time Intervals clean of High background particles.

timebinsize is the size of the time bins (used only for **lightcurve** product)

username is the XSA user name.

mail is the user's email address used to notify the user when the execution has finished.

This service provides the following products:

1. Product file with the following nomenclature:

risa_reqID_ObsID_target.tar.gz

Where:

reqID is the unique identifier provided by RISA server

ObsID is the XMM-Newton observation ID

target is the source target name

This file contains respectively:

- For image product
 - RXXXXXXXXXXYYZZZIMAGE0000.FTZ
 - Where:
 - XXXXXXXXXX is the observation ID
 - YY is the EPIC instrument identifier
 - ZZZZ is the exposure identifier
- For event product
 - RXXXXXXXXXXYYZZZZEVL0000.FTZ
 - Where:
 - XXXXXXXXXX is the observation ID
 - YY is the EPIC instrument identifier
 - ZZZZ is the exposure identifier
- For lightcurve product
 - RXXXXXXXXXXYYZZZZSRCTSR0001.FIT
 - Where:
 - XXXXXXXXXX is the observation ID
 - YY is the EPIC instrument identifier
 - ZZZZ is the exposure identifier
- For spectra product
 - RXXXXXXXXXXYYZZZZSRSPEC0001.FIT
 - RXXXXXXXXXXYYZZZZBGSPEC0001.FIT

- RXXXXXXXXXXYYZZZZSRCARF0001.FIT
- RXXXXXXXXXXYYZZZZSRCRMF0001.FIT

Where:

XXXXXXXXXX is the observation ID

YY is the EPIC instrument identifier

ZZZZ is the exposure identifier

SRSPEC is the source spectra

SRSPEC is the background spectra

SRCARF is the ancillary matrix file

SRCRMF is the response matrix file

2. Standard output log file with the following nomenclature:

out_reqID_ObsID_target

Where:

reqID is the unique identifier provided by RISA server

ObsID is the XMM-Newton observation ID

target is the source target name

3. Standard error log file with the following nomenclature:

err_reqID_ObsID_target

Where:

reqID is the unique identifier provided by RISA server

ObsID is the XMM-Newton observation ID

target is the source target name

Once the processing has finished, the system notifies the user via email.

4 RISA EPIC SOURCE REPROCESSING SERVICE

This RISA service is available for EPIC catalogue sources and it re-extracts source products for a selected source, with the latest SAS and calibration files.

This service is in charge of the execution of the following SAS tasks:

- region → to create regions corresponding to all sources detected.
- evselect → to remove all sources from image (clean event file) except the input source and create image.
- ebggreg → to create background region.
- ecoordconv → to convert from sky coordinates to physical (camera) coordinates.
- tabgtigen → to create the Good Time Intervals corresponding to the time periods clean of high background particles.
- eregionanalyse → to centroid and optimize source region.
- especget → to create the source spectra, background spectra, ancillary response file and response matrix file.

The RISA data analysis service is called using the following url and with the following parameters:

http://xxxxxx.xxx.xxx:8080/axis/RISA_singleskyprod?

product=spectra&
obsid=0202230201&
inst=EPN&
ra=10.8504&
dec=41.22551&
optsrcregion=yes&
highbkgflaringcountrate=<=0.4 &
target=SRC1 &
username=aibarra&
mail=aibarra@sciops.esa.int

NOTE: The RISA server is not public, therefore we do not include the real name of the service. The service is only accessible through the XSA interface.

Where:

product is currently fixed to **spectra**.

obsid is the XMM-Newton observation ID.

inst is the EPIC instrument name (EPN, EMOS1 or EMOS2).

ra is the source Right Ascension in decimal degrees.

dec is the source Declination in decimal degrees.

optsrcregion is the boolean flag to execute or not *eregionanalyse* SAS task to centroid and optimize source region.

highbkgflaringcountrate is the count rate threshold used to create Good Time Intervals clean of High background particles.

target is the source target name.

username is the XSA user name.

mail is the user's email address used to notify the user when the executions has finished.

This service provides the following product:

4. Product file with the following nomenclature:

risa_reqID_ObsID_SrcNr.tar.gz

Where:

reqID is the unique identifier provided by RISA server

ObsID is the XMM-Newton observation ID

SrcNr is the source number identifier from XSA

This file contains

- Spectra products
 - RXXXXXXXXXXXXYYZZZSRSPEC0000.FIT
 - RXXXXXXXXXXXXYYZZZBGSPEC0000.FIT
 - RXXXXXXXXXXXXYYZZZSRCARF0000.FIT
 - RXXXXXXXXXXXXYYZZZSRCRMF0000.FIT

Where:

XXXXXXXXXX is the observation ID
YY is the EPIC instrument identifier
ZZZZ is the exposure identifier
SRSPEC is the source spectra
SRSPEC is the background spectra
SRCARF is the ancillary matrix file
SRCRMF is the response matrix file

5. Standard output log file with the following nomenclature:

out_reqID_ObsID_SrcNr

Where:

reqID is the unique identifier provided by RISA server
ObsID is the XMM-Newton observation ID
SrcNr is the source number identifier from XSA

6. Standard error log file with the following nomenclature:

err_reqID_ObsID_SrcNr

Where:

reqID is the unique identifier provided by RISA server
ObsID is the XMM-Newton observation ID
SrcNr is the source number identifier from XSA

Once the processing has finished, the system notifies the user via email.

5 RISA SERVICES VALIDATION TESTS

We have selected the following two XMM-Newton observations (0555470801 and 0555470901) to compare results obtained from the execution of the RISA services and the results obtained from the execution of the SAS tasks. To do this comparison, we have fixed the SAS_RANDOM_SEED SAS variable to avoid differences due to randomization.

For all products we have compared the file products using the HEADAS *fdiff* command. This command gives you a binary comparison of the content of FITS files.

5.1 RISA processing validation test

5.1.1 EPIC PN event lists

We execute the following command:

```
#> fdiff SAS/0555470801/Work/pn/1619_0555470801_EPN_S003_ImagingEvts.ds  
RISA/ODF/0555470801/aibarra/pn/1619_0555470801_EPN_S003_ImagingEvts.ds
```

Result: No differences in all FITS extensions

5.1.2 EPIC MOS1 event lists

We execute the following command:

```
#> fdiff SAS/0555470801/Work/mos/1619_0555470801_EMOS1_S001_ImagingEvts.ds  
RISA/ODF/0555470801/aibarra/mos/1619_0555470801_EMOS1_S001_ImagingEvts.ds
```

Result: No differences in all FITS extensions

5.1.3 EPIC MOS2 event lists

We execute the following command:

```
#> fdiff SAS/0555470801/Work/mos/1619_0555470801_EMOS2_S002_ImagingEvts.ds  
RISA/ODF/0555470801/aibarra/mos/1619_0555470801_EMOS2_S002_ImagingEvts.ds
```

Result: No differences in all FITS extensions

5.1.4 RGS fluxed spectra

We execute the following command:

```
#> fdiff SAS/0555470801/Work/rgs/P0555470801OBX000fluxed1000.FIT  
RISA/ODF/0555470801/aibarra/rgs/P0555470801OBX000fluxed1000.FIT
```

Result: No differences in all FITS extensions

5.1.5 OM source products

```
#> fdiff SAS/0555470801/Work/om/P0555470801OMS010WSRLI1000.FIT  
RISA/ODF/0555470801/aibarra/om/P0555470801OMS010WSRLI1000.FIT
```

Result: No differences in all FITS extensions

5.2 RISA data analysis validation test

5.2.1 Filtered event list

We execute the following command:

```
#> fdiff PPS/0555470801/pps/R0555470801PNS003IEVLI0000.FTZ  
RISA/Event/0555470801/aibarra/pn/R0555470801PNS003IEVLI0000.FTZ
```

Result: No differences in all FITS extensions

5.2.2 Filtered image

We execute the following command:

```
#> fdiff PPS/0555470801/pps/R0555470801PNS003IMAGE0000.FTZ  
RISA/Image/0555470801/aibarra/pn/R0555470801PNS003IMAGE0000.FTZ
```

Result: No differences in all FITS extensions

5.2.3 Light curve

We execute the following command:

```
#> fdiff PPS/0555470801/pps/R0555470801PNS003SRCTSR0001.FIT  
RISA/Lighcurve/0555470801/aibarra/pn/R0555470801PNS003SRCTSR0001.FIT
```

Result: No differences in all FITS extensions

5.2.4 Spectra

For the spectra validation test we have to compare independently the following files: source spectra, background spectra, ancilliary file and response matrix file

We execute the following command:

```
#> fdiff PPS/0555470801/pps/R0555470801PNS003SRSPEC0001.FIT  
RISA/Spectra/0555470801/aibarra/pn/R0555470801PNS003SRSPEC0001.FIT
```

Result: No differences in all FITS extensions

We execute the following command:

```
#>fdiff PPS/0555470801/pps/R0555470801PNS003BGSPEC0001.FIT  
RISA/Spectra/0555470801/aibarra/pn/R0555470801PNS003BGSPEC0001.FIT
```

Result: No differences in all FITS extensions

We execute the following command:

```
#>fdiff PPS/0555470801/pps/R0555470801PNS003SRCARF0001.FIT  
RISA/Spectra/0555470801/aibarra/pn/R0555470801PNS003SRCARF0001.FIT
```

Result: No differences in all FITS extensions

We execute the following command:

```
#> fdiff PPS/0555470801/pps/R0555470801PNS003SRCRMF0001.FIT  
RISA/Spectra/0555470801/aibarra/pn/R0555470801PNS003SRCRMF0001.FIT
```

Result: No differences in all FITS extensions

5.3 RISA EPIC source reprocessing validation test

5.3.1 EPIC PN observation 0112570601 source number 19

For the spectra in the source reprocessing validation test, we have to compare independently the following files: source spectra, background spectra, ancilliary file and response matrix file

We execute the following command:

```
#> fdiff PPS/0112570601/pps/R0112570601PNS003SRSPEC0001.FIT  
RISA/SkyProd/0112570601/aibarra/pn/R0112570601PNS003SRSPEC0001.FIT
```

Result: No differences in all FITS extensions

We execute the following command:

```
#> fdiff PPS/0112570601/pps/R0112570601PNS003BGSPEC0001.FIT  
RISA/SkyProd/0112570601/aibarra/pn/R0112570601PNS003BGSPEC0001.FIT
```

Result: No differences in all FITS extensions

We execute the following command:

```
#> fdiff PPS/0112570601/pps/R0112570601PNS003SRCARF0001.FIT  
RISA/SkyProd/0112570601/aibarra/pn/R0112570601PNS003SRCARF0001.FIT
```

Result: No differences in all FITS extensions

We execute the following command:

```
#> fdiff PPS/0112570601/pps/R0112570601PNS003SRCRMF0001.FIT  
RISA/SkyProd/0112570601/aibarra/pn/R0112570601PNS003SRCRMF0001.FIT
```

Result: No differences in all FITS extensions