# REMOTE INTERFACE SAS ANALYSIS (RISA) AND XSA TEST REPORT

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# APPROVAL

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# CHANGE RECORD

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# 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-Mewton 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.



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.

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


[http://xxxxxx.xxx.xxx:8080/axis/RISA_reprocessing](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 osbervation 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 Declinatio 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

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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 osbervation ID.
**inst** is the EPIC instrument name (EPN, EMOS1 or EMOS2).
**exp** is th EPIC exposure ID.
**target** is the source target name.

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**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 backgraound 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:

<p align="center"><em>risa_reqID_ObsID_target.tar.gz</em></p>

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
  - RXXXXXXXXXXYYZZZZIMAGE0000.FTZ
    Where:
    XXXXXXXXXX is the observation ID
    YY is the EPIC instrument identifier
    ZZZZ is the exposure identifier
- For event product
  - RXXXXXXXXXXYYZZZZEVLI0000.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

o RXXXXXXXXXXXYYZZZZSRCARF0001.FIT
o RXXXXXXXXXXXYYZZZZSRCRMF0001.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.
- ebkgreg → 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, ancilliary 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 backgraound 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
  - RXXXXXXXXXXYYZZZZSRSPEC0000.FIT
  - RXXXXXXXXXXYYZZZZBGSPEC0000.FIT
  - RXXXXXXXXXXYYZZZZSRCARF0000.FIT
  - RXXXXXXXXXXYYZZZZSRCRMF0000.FIT
    Where:

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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_RAND_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/P0555470801OMS010SWSRLI1000.FIT
RISA/ODF/0555470801/aibarra/om/P0555470801OMS010SWSRLI1000.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

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### 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
```

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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

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