



*International
Virtual
Observatory
Alliance*

DAL query Response with Extensions: Use cases and implementation rules. Ex- ample of SIAP

Version 1.00

IVOA Note 2005-01-31

This version:

<http://www.ivoa.net/...>

Latest version:

<http://www.ivoa.net/...>

Previous versions:

Editor(s):

F.Bonnarel

Authors:

T.Boch, F.Bonnarel, M.Louys, P.Fernique, P.Osuna, J.Salgado

Contents

1	Description of Use cases	2
1.1	Detailed descriptions of an Observation:	2
1.2	Related Observations and Internal Structured Observations . .	3
2	Description of a general extension mechanism to SIAP	3
3	Annex	6

Introduction

It was agreed at the Boston and Pune Interoperability meetings that there is a need to extensions in the SIA protocol (see Doug Tody's conclusions). This was in peculiar lessons learnt from the AVO demos and AVO prototype development and was expressed by several science archives operators such as ST ECF, CADC and ESAC XMM Science Archive. Beyond the simple case of SIA, the mechanism proposed here can be applied to any kind of query response for a specific DAL protocol. The general scheme is one of a query response organized as a VOTable containing a main table giving a raw level of characterization and a single to several Extensions, containing tables or other kind of xml elements giving additional Observation metadata as various datamodels serializations.

1 Description of Use cases

1.1 Detailed descriptions of an Observation:

From SIA1.0 raw "characterization" to full IVOA Characterization: In the main section of SIAP defined by SIA 1.1 we should more or less find what is intended as "Characterization" DM in the IVOA Data Model Working group. The "Observation" DataModel IVOA note explains that there are several level of characterization. Probably everything in "Location" and "Bounds" are in the right place in the main resource of SIA. In SIA 1.0 we already have Spatial, Temporal and Spectral Locations. We only have "Bounds" for Spectral but not for Temporal and Spatial axis. It could be useful to add a start/stop time and explicitly a spatial bounding box. As said in the discussion the Spectral bounds could be replaced in the main section by a bandpassID , with details in the extension. (By the way, if we do that it would be usefull to add the spectral range of the bandpass in the input parameters) Resolution and Sampling should be present at the raw number level. Presently we already have the old VOX:Image_scale field (instr.scale in UCD1+) for SamplingPrecision. We lack the integrated resolution.

But "Support" and "Sensibility" should be reserved to the details in the so called SIA extensions we are proposing here. So should be the other detailed descriptions such as full WCS astrometric reduction or everything which is in Provenance.

1.2 Related Observations and Internal Structured Observations

When we are facing really different observations but with obvious generation links between them, the actual connection between these Observations cannot be modeled by a simple reference from one to the others. We would like to see the Observations themselves in the first section of SIA and all the Observation Process / Image Processing stuff necessary to understand the links from one Observation to the others in secondary sections. In some use cases, we would like to have the internal and sometimes complex structure of the observations too.

Examples are:

- Whole field Observations and specific detector observations in CCD mosaics Observations or similar multidetector observations
- HST associations reprocessing together (coaddition et al) families of previous "member" associations
- XMM images in full band (0.2 - 12 keV) and their 5 sub-bands, as it was already stated at the AVO demo, using a modified IDHA tree. In this science case, the interest was in trying to elucidate if a YSO was of type I or II. (Some of us commented on this structure of "Observation - Exposure - Source -Energy Band" on the document at: <http://www.ivoa.net/Documents/latest/PossibleSIAPExtension.html>)

2 Description of a general extension mechanism to SIAP

A SIAP VOTable document contains a main Resource the name of which is "results". In the following we do not rely on the exact content of this first section which may be consistent with version 1.0 of SIAP, or can also be upgraded to 1.1. Extensions will consist of one to several additional resources whose names, ids, types are free. To create links between records in the main table and additional information contained in the additional resources, it is allowed to add one to several FIELDS to the main table with references to elements situated in the additional sections (free names and ids, utype ='a data model xpath for this field' - the utype will have an xpath syntax, and can help a client software to extract the matching information). It is also allowed to refer to elements in the additional section from a standard SIAP field. It is possible to refer to the following elements:

- group

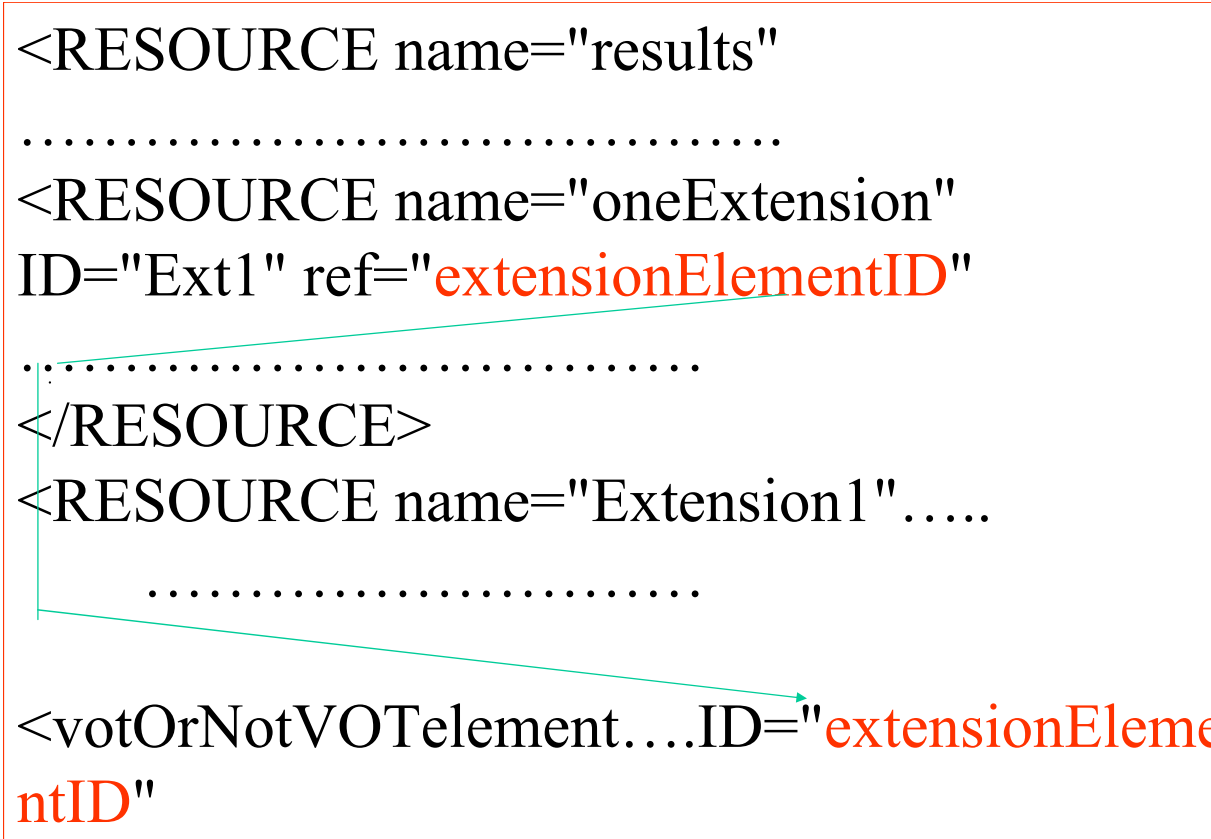


Figure 1: Reference from main section to another element

- table
- resource
- "external namespace" xml element

This implies that all these elements get an explicit ID, used as a value of the ref attribute of the extension(s) FIELD (fig 1).

The ref mechanism is not sufficient to create the links between records in the main table and additional information, because each record in the main table will generally need a specific extension different from those of the other records. That's why we need an indexing mechanism. The values taken by the extension(s) field(s) for specific records are used as keys for this index-

```

<RESOURCE type="results">
  .....
  <FIELD ID="ObservationName" datatype="char" arraysize="*" ref="Provenance"
  utype="ivoa:observation/name" ucd=... />
  ....
  <FIELD ucd="DATA_LINK" .....>
  <TABLEDATA>
    .....
    <TR>...<TD>Cl Trumpler 16</TD><TD><![CDATA[.....</TD>.....</TR>
  </TABLEDATA></TABLE></RESOURCE>

  <RESOURCE name="Extensions">
    <TABLE ID="Provenance">
      .....
      <FIELD ref="ObservationName"/>
      <FIELD ID="ProcessingMode"...../>
      <FIELD ID="RelatedImages" ...../>
      .....
      <TABLEDATA>
        .....
        <TR><TD>Cl Trumpler 16</TD><TD>Coaddition</TD><TD>Cl-Trumpler-16</TD></TR>
      </TABLEDATA></TABLE>
    </RESOURCE>

```

Figure 2: Illustration of the key mechanism

ing mechanism. This implies that the field from the main table referring to a Pure VOTable Extension (Fig 2,3) element must be itself replicated in this extension element as a reference. Example 2 shows an HST Association Observation of "ObservationName" "Cl Trumpler 16" related to a list of "member" Observations with the generic "RelatedImages" Fieldname set to "Cl-Trumpler-16" through a relationship record contained by the "Provenance" table. Example 3 shows the relationship between XMM Observations contained in the main table and their complex internal structure ("exposures" and "energy bands") described in pure XML As it can be seen in this example, the reference mechanism could point to an 'external namespace' allowing the representation of recursive information inside SIAP. As in

the other examples, old SIAP software clients will only read the "results" resource, but the internal and sometimes complex data structure could be represented and used by new SIAP software clients.

In the example, the normal SIAP "results" resource represents a plain table at observation level, but the internal obs structure (exposures inside observations, energy bands inside exposures,...) is represented in the second resource (linked to the main one through the reference "Xml")

In the external namespace xml element case we will use a xpath matching algorithm, using the utype of the referred field (fig 4). This example shows how we could relate Observations in the main table to their detailed "ivoa/characterization/support/" expressed as an stc:AstroCoordArea xml structure.

In addition it is possible to refer from any extension element to other elements in the document using the same mechanism.

It is allowed to point from Extensions to records located in the main section, except if this generates a circular link.

3 Annex

In this Annex we present two examples implementing the "related observations" use case. The first one is borrowed from the WFPC2 Associations delivered by ST Sci, ST ECF and CADC. Its visualization through a customized version of Aladin can be seen in figure 5. The second example is borrowed from the Xmm ESAC Archive and implements the Integrated, Instrument and specific waveband levels of observations. It is visualized in figure 6. The only "utypes" that are implemented are those which are really used by the visualization algorithm. They are deduced from the UML diagrams presented in the IVOA note "Data Model for Observation". Of course we should complete that, and use all the characterization utypes in the future.

These visualizations are produced the following way (case of figure 5): Aladin software reads the VOTable. In the main table each image is a candidate top node of the tree. The field of utype "observation/identifier" (here ObservationReference) is used as a reference field. The referred TABLE (here "Packaging") is then searched for the occurrence of the same field. The value of this common field is the Key which associates records in the extension to the top nodes. If the field in Packaging table of utype "Observation/name" is empty, the node is considered as a Visualization mode of the Observation (PREVIEW or MOSAIC) If the field in Packaging table of utype "Observation/name" (here ObservationName) is not empty its value is used as a key

```

<RESOURCE type ="results">
.....
  <FIELD ID="ObservationNumber" datatype="char" arraysize="*" ref="Xml"
  utype="esacXmm:observation/@number" />
  <FIELD ucd="DATA_LINK" .....>
    <TABLEDATA>
.....  <TR>....<TD>001565543</TD><TD><![CDATA[.....</TD>.....</TR>
    </TABLEDATA></TABLE></RESOURCE>
  <RESOURCE ID="Xml" >
    <esacXmm:Observation number="001565543">
      <esacXmm:exposure number="001">
        .....
        .....
        <esacXmm:url .....>/>
        <esacXmm:energyband >
          .....
          </esacXmm:energyband>
        </esacXmm:exposure>
        <esacXmm:exposure number=002">
.....
      </esacXmm:Observation>
      <esacXmm:Observation number="00156.....">
        .....
      </esacXmm:Observation>

```

Figure 3: A reference to an xml element for an external model: eg esacXmm Observation

```

<RESOURCE type="results">
  .....
  <FIELD ID="ObservationName" datatype="char" arraysize="*" ref="Provenance"
  utype="ivoa:observation/name" ucd=... />
  ....
  <FIELD ID="Support" .....utype="ivoa:observation/characterization/support/@id" ref="support">
  <TABLEDATA>
    <TR>....<TD>Cl Trumpler 16</TD><TD>support1</TD></TR>
  </TABLEDATA></TABLE></RESOURCE>
  <RESOURCE name="Extensions">
    <RESOURCE ID="support" >
      <stc:AstroCoordArea id="support1">
        <.....
          .....
        </stc:AstroCoordArea>

```

The diagram consists of a green rectangular box with a thin border. Inside the box, there are three lines of XML code. The first line is a table row: `<TR>....<TD>Cl Trumpler 16</TD><TD>support1</TD></TR>`. The second line is `</TABLEDATA></TABLE></RESOURCE>`. The third line is `<RESOURCE ID="support" >`. A green arrow points from the `support1` text in the table cell to the `support` text in the resource ID. Below the box, there is another line of XML code: `<stc:AstroCoordArea id="support1">`. A green arrow points from the `support1` text in this line back to the `support1` text in the table cell.

Figure 4: A reference to the "support" of the Observation seen as an "STC" AstroCoordArea

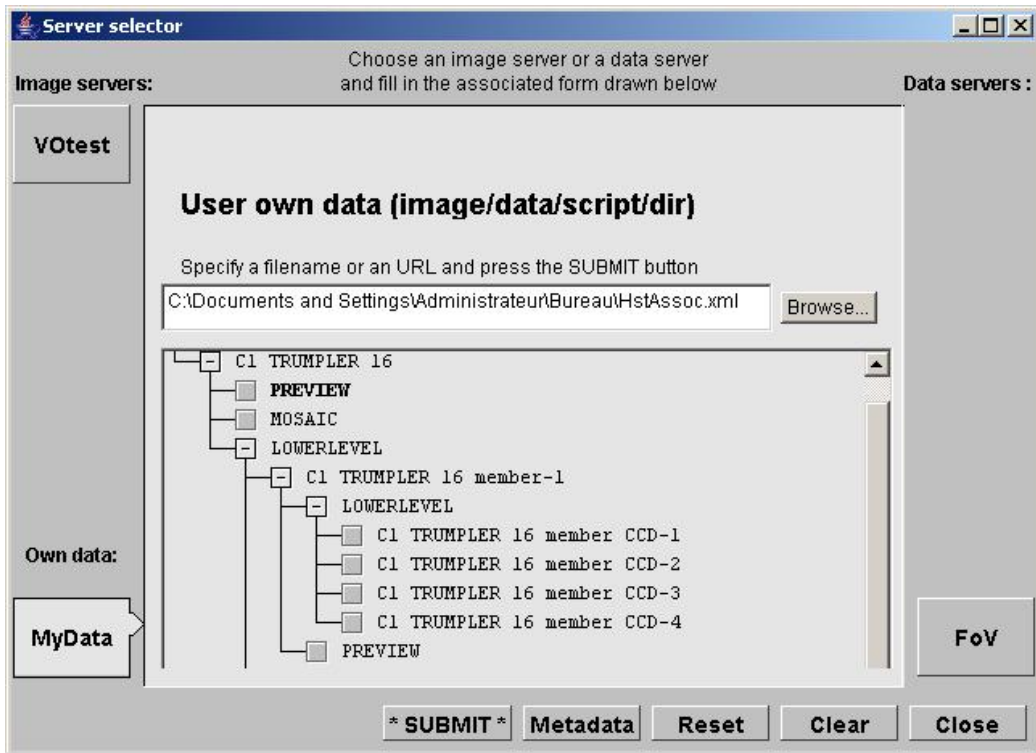


Figure 5: WFPC2 tree.

to associated images in the main table, which will appear lower in the node. These images are then removed from the main table. This process can be iterated.

In addition Fields in the main table with utypes like "observation/DataCollection/name" or "observation/provenance/filter/name" are used to create links towards the content of the referred tables (here "Filter" and "ObservingProgram").


```

                <TD><![CDATA[http://archive.stsci.edu/hst/wfpc2/about.html]]></TD>
                <TD>Optical</TD>
            </TR>
        </TABLEDATA></DATA>
    </TABLE>
</RESOURCE>
<RESOURCE name="ObservationDetails">
    <TABLE ID="Packaging">
        <DESCRIPTION>
            <DESCRIPTION>
                <FIELD ref="ObservationReference" />
                <FIELD ID="DataOrganisation" name="Organisation" datatype="char" />
                <FIELD ID="desc" name="OrganisationDescription" datatype="char" />
                <FIELD ID="MaximumSize" name="Maximum size" datatype="int" />
                <FIELD ID="Indexing" name="Indexing" datatype="char" />
                <FIELD ID="LinktoPixels" name="LinktoPixels" datatype="char" ucd="DATA_LINK" />
                <FIELD ID="RelatedObservation" datatype="char" ref="ObservationName" utype="observation/name" />
            <DATA>
                <TABLEDATA>
                    <TR><TD>U3YH0404B</TD><TD>PREVIEW</TD><TD></TD><TD></TD><TD>800</TD><TD>URL</TD>
                    <TD><![CDATA[http://cadwww.hia.nrc.ca/proxies/wfpc2previewproxy?asn_id=U4K2CX07B]]></TD><TD></TD></TD></TR>
                    <TR><TD>U3YH0404B</TD><TD>MOSAIC</TD><TD></TD><TD></TD><TD>1600</TD><TD>URL</TD>
                    <TD><![CDATA[http://cadwww.hia.nrc.ca/cadcbn/hstproxy?file_id=u4k2cx07b.mosaic]]></TD><TD></TD></TD></TR>
                    <TR><TD>U3YH0404B</TD><TD>LOWERLEVEL</TD><TD></TD><TD></TD><TD></TD><TD>Observation</TD><TD></TD>
                    <TD>C1 TRUMPLER 16 member</TD></TR>
                    <TR><TD>U4K2CX06R</TD><TD>PREVIEW</TD><TD></TD><TD></TD><TD>800</TD><TD>URL</TD>
                    <TD><![CDATA[http://archive.eso.org/preview/preview/preview_hst/U4K2CX06R/fits/ascii]]></TD><TD></TD></TD></TR>
                    <TR><TD>U4K2CX07R</TD><TD>LOWERLEVEL</TD><TD></TD><TD></TD><TD></TD><TD>Observation</TD><TD></TD>
                    <TD>C1 TRUMPLER 16 member CCD</TD></TR>
                    <TR><TD>U4K2CX07R</TD><TD>PREVIEW</TD><TD></TD><TD></TD><TD>800</TD><TD>URL</TD>
                    <TD><![CDATA[http://archive.eso.org/preview/preview/preview_hst/U4K2CX07R/fits/ascii]]></TD><TD></TD></TD></TR>
                </TABLEDATA></DATA>
            </TABLE>
        </RESOURCE>
    </VOTABLE>

```

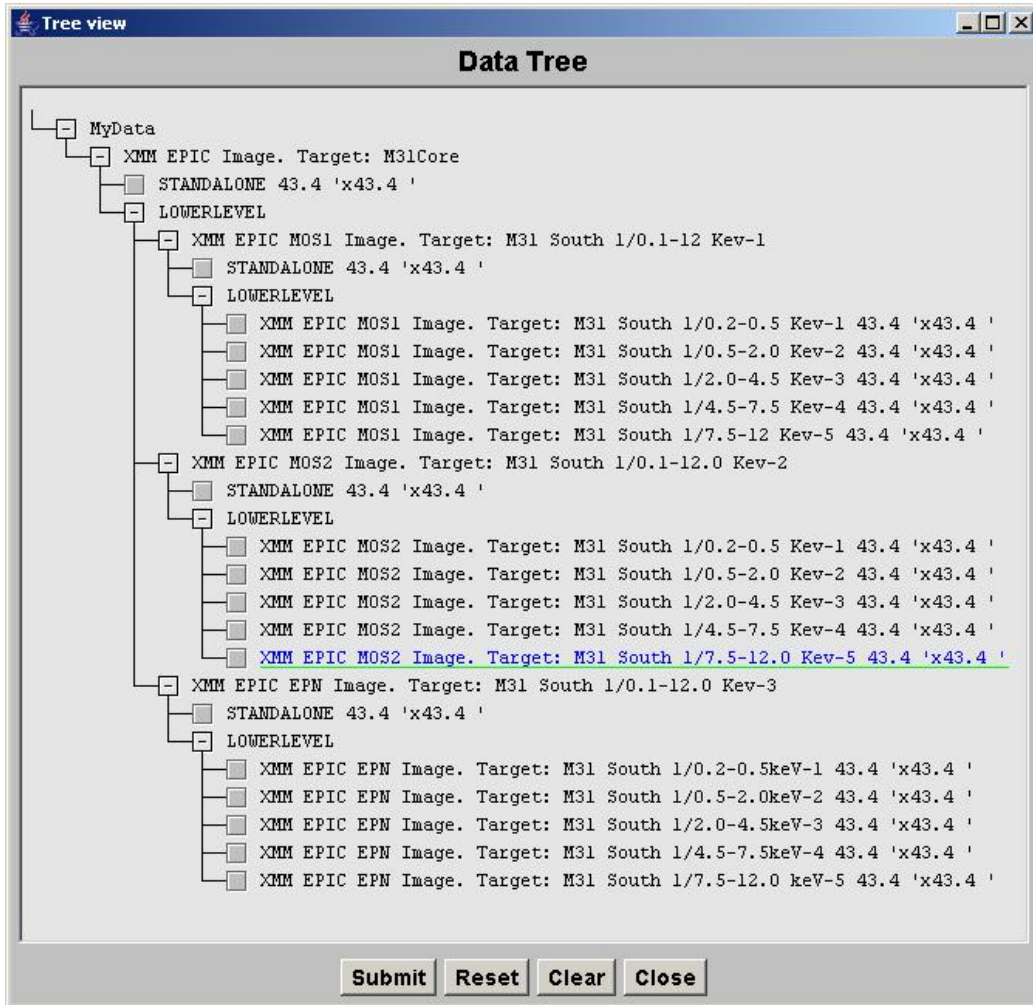


Figure 6: XMM ESAC tree.

```

<?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE VOTABLE SYSTEM "http://us-vo.org/xml/VOTable.dtd">
<VOTABLE ID="v1.0">
  <DESCRIPTION> SIAP output for Aladin server </DESCRIPTION>
  <RESOURCE type="results">
    <INFO name="QUERY_STATUS" value="OK"/>
    <TABLE>
      <FIELD ID="ObsId" ucd="OBS_ID" datatype="char" arraysize="*" ref="Packaging" />
      <FIELD ID="Reference" ucd="DATA_LINK" datatype="char" arraysize="*" />
      <FIELD ID="Target_Name" ucd="VOX:Image_Title" datatype="char" arraysize="*" utype="observation/identifier"/>
      <FIELD ID="Start_Time" ucd="VOX:OBS_START_TIME" datatype="char" arraysize="*" />
      <FIELD ID="End_Time" ucd="VOX:OBS_END_TIME" datatype="char" arraysize="*" />
      <FIELD ID="On_Time" ucd="VOX:OBS_DURATION" datatype="int"/>
      <FIELD ID="RA" ucd="POS_EQ_RA_MAIN" datatype="char" arraysize="*" />
      <FIELD ID="DEC" ucd="POS_EQ_DEC_MAIN" datatype="char" arraysize="*" />
      <FIELD ID="Instrument" ucd="VOX:Instrument_Name" datatype="char" arraysize="*" />
      <FIELD ID="Energy_Band" ucd="VOX:Energy_Band" datatype="char" arraysize="*" />
      <FIELD ID="NAXES" ucd="VOX:Image_Naxes" datatype="int"/>
      <FIELD ID="NAXIS" ucd="VOX:Image_Naxis" datatype="double" arraysize="*" />
      <FIELD ID="SCALE" ucd="VOX:Image_Scale" datatype="double" arraysize="*" />
      <FIELD ID="FORMAT" ucd="VOX:Image_Format" datatype="char" arraysize="*" />
      <FIELD ID="Proprietary Date" ucd="VOX:PROP_DATE" datatype="char" arraysize="*" />
      <FIELD ID="LevelGenericName" datatype="char" arraysize="*" utype="observation/name"/>
    </TABLE>
  </RESOURCE>
</VOTABLE>

```



```

<TD> 62830 </TD><TD> 10.3577364 </TD><TD> 40.923332 </TD><TD> MOS2 </TD><TD> 7.5-12.0 </TD><TD> 2 </TD><TD> 650 650 </TD>
<TD> -1.111111111111E-03 1.111111111111E-03 </TD><TD> image/fits </TD><TD> Feb 12 2003 </TD><TD> 0112570201.S002 </TD></TR>
<TR><TD> 0112570201 </TD>
<TD><![CDATA[http://xsa.vilspa.esa.es:8080/aio/jsp/product.jsp?obsno=0112570201&instname=PN&expno=S003&datasubsetno=1&source=000
&name=IMAGE_&level=PPS&extension=FTZ&protocol=HTTP]]></TD>
<TD> XMM EPIC EPN Image. Target: M31 South 1/0.2-0.5keV </TD><TD> 2002-01-12 17:32:07.0 </TD><TD> 2002-01-13 12:12:59.0 </TD>
<TD> 67252 </TD><TD> 10.3577364 </TD><TD> 40.923332 </TD><TD> EPN </TD><TD> 0.2-0.5 </TD><TD> 2 </TD><TD> 650 650 </TD>
<TD> -1.111111111111E-03 1.111111111111E-03 </TD><TD> image/fits </TD><TD> Feb 09 2003 </TD><TD> 0112570201.S003 </TD></TR>
<TR><TD> 0112570201 </TD>
<TD><![CDATA[http://xsa.vilspa.esa.es:8080/aio/jsp/product.jsp?obsno=0112570201&instname=PN&expno=S003&datasubsetno=2&source=000
&name=IMAGE_&level=PPS&extension=FTZ&protocol=HTTP]]></TD>
<TD> XMM EPIC EPN Image. Target: M31 South 1/0.5-2.0keV </TD><TD> 2002-01-12 17:32:07.0 </TD><TD> 2002-01-13 12:12:59.0 </TD>
<TD> 67252 </TD><TD> 10.3577364 </TD><TD> 40.923332 </TD><TD> EPN </TD><TD> 0.5-2.0 </TD><TD> 2 </TD><TD> 650 650 </TD>
<TD> -1.111111111111E-03 1.111111111111E-03 </TD><TD> image/fits </TD><TD> Feb 09 2003 </TD><TD> 0112570201.S003 </TD></TR>
<TR><TD> 0112570201 </TD>
<TD><![CDATA[http://xsa.vilspa.esa.es:8080/aio/jsp/product.jsp?obsno=0112570201&instname=PN&expno=S003&datasubsetno=3&source=000*
&name=IMAGE_&level=PPS&extension=FTZ&protocol=HTTP]]></TD>
<TD> XMM EPIC EPN Image. Target: M31 South 1/2.0-4.5keV </TD><TD> 2002-01-12 17:32:07.0 </TD><TD> 2002-01-13 12:12:59.0 </TD>
<TD> 67252 </TD><TD> 10.3577364 </TD><TD> 40.923332 </TD><TD> EPN </TD><TD> 2.0-4.5 </TD><TD> 2 </TD><TD> 650 650 </TD>
<TD> -1.111111111111E-03 1.111111111111E-03 </TD><TD> image/fits </TD><TD> Feb 09 2003 </TD><TD> 0112570201.S003 </TD></TR>
<TR><TD> 0112570201 </TD>
<TD><![CDATA[http://xsa.vilspa.esa.es:8080/aio/jsp/product.jsp?obsno=0112570201&instname=PN&expno=S003&datasubsetno=4&source=000
&name=IMAGE_&level=PPS&extension=FTZ&protocol=HTTP]]></TD>
<TD> XMM EPIC EPN Image. Target: M31 South 1/4.5-7.5keV </TD><TD> 2002-01-12 17:32:07.0 </TD><TD> 2002-01-13 12:12:59.0 </TD>
<TD> 67252 </TD><TD> 10.3577364 </TD><TD> 40.923332 </TD><TD> EPN </TD><TD> 4.5-7.5 </TD><TD> 2 </TD><TD> 650 650 </TD>
<TD> -1.111111111111E-03 1.111111111111E-03 </TD><TD> image/fits </TD><TD> Feb 09 2003 </TD><TD> 0112570201.S003 </TD></TR>
<TR><TD> 0112570201 </TD>
<TD><![CDATA[http://xsa.vilspa.esa.es:8080/aio/jsp/product.jsp?obsno=0112570201&instname=PN&expno=S003&datasubsetno=5&source=000
&name=IMAGE_&level=PPS&extension=FTZ&protocol=HTTP]]></TD>
<TD> XMM EPIC EPN Image. Target: M31 South 1/7.5-12.0 keV </TD><TD> 2002-01-12 17:32:07.0 </TD><TD> 2002-01-13 12:12:59.0 </TD>
<TD> 67252 </TD><TD> 10.3577364 </TD><TD> 40.923332 </TD><TD> EPN </TD><TD> 7.5-12.0 </TD><TD> 2 </TD><TD> 650 650 </TD>
<TD> -1.111111111111E-03 1.111111111111E-03 </TD><TD> image/fits </TD><TD> Feb 09 2003 </TD><TD> 0112570201.S003 </TD></TR>
</TABLEDATA></DATA>
</TABLE>
</RESOURCE>
<RESOURCE name="GeneralFeatures">
</RESOURCE>
<RESOURCE name="ObservationDetails">
<TABLE ID="Packaging">
<DESCRIPTION>
</DESCRIPTION>
<FIELD ref="Target_Name" />
<FIELD ID="DataOrganisation" name="Organisation" datatype="char" />
<FIELD ID="desc" name="OrganisationDescription" datatype="char" />
<FIELD ID="MaximumSize" name="Maximum size" datatype="int" />
<FIELD ID="Indexing" name="Indexing" datatype="char" />
<FIELD ID="LinktoPixels" name="LinktoPixels" datatype="char" ucd="DATA_LINK" />
<FIELD ID="RelatedObservation" datatype="char" ref="LevelGenericName" utype="observation/name"/>
<DATA>
<TABLEDATA>
<TR><TD>XMM EPIC Image. Target: M31Core</TD><TD>STANDALONE</TD><TD></TD><TD></TD><TD>800</TD><TD>URL</TD>
<TD><![CDATA[http://xsa.vilspa.esa.es:8080/aio/jsp/product.jsp?obsno=0109270101
&name=OIMAGE&level=PPS&extension=FTZ&protocol=HTTP]]></TD><TD></TD></TR>
<TR><TD>XMM EPIC Image. Target: M31Core</TD><TD>LOWERLEVEL</TD><TD></TD><TD></TD><TD>800</TD><TD>Observation</TD>
<TD></TD><TD>0112570201</TD></TR>
<TR><TD>XMM EPIC MOS1 Image. Target: M31 South 1/0.1-12 Kev</TD><TD>STANDALONE</TD><TD></TD><TD></TD><TD>800</TD><TD>URL</TD>
<TD><![CDATA[http://xsa.vilspa.esa.es:8080/aio/jsp/product.jsp?obsno=0112570201&instname=M1&expno=S001&datasubsetno=8&source=000
&name=IMAGE_&level=PPS&extension=FTZ&protocol=HTTP]]></TD><TD></TD></TR>
<TR><TD>XMM EPIC MOS1 Image. Target: M31 South 1/0.1-12 Kev</TD><TD>LOWERLEVEL</TD><TD></TD><TD></TD><TD>800</TD><TD>Observation</TD>
<TD></TD><TD>0112570201.S001</TD></TR>
<TR><TD>XMM EPIC MOS2 Image. Target: M31 South 1/0.1-12.0 Kev</TD><TD>STANDALONE</TD><TD></TD><TD></TD><TD>800</TD><TD>URL</TD>
<TD><![CDATA[http://xsa.vilspa.esa.es:8080/aio/jsp/product.jsp?obsno=0112570201&instname=M2&expno=S002&datasubsetno=8&source=000
&name=IMAGE_&level=PPS&extension=FTZ&protocol=HTTP]]></TD><TD></TD></TR>
<TR><TD>XMM EPIC MOS2 Image. Target: M31 South 1/0.1-12.0 Kev</TD><TD>LOWERLEVEL</TD><TD></TD><TD></TD><TD>800</TD><TD>Observation</TD>
<TD></TD><TD>0112570201.S002</TD></TR>
<TR><TD>XMM EPIC EPN Image. Target: M31 South 1/0.1-12.0 Kev</TD><TD>STANDALONE</TD><TD></TD><TD></TD><TD>800</TD><TD>URL</TD>
<TD><![CDATA[http://xsa.vilspa.esa.es:8080/aio/jsp/product.jsp?obsno=0112570201&instname=PN&expno=S003&datasubsetno=8&source=000
&name=IMAGE_&level=PPS&extension=FTZ&protocol=HTTP]]></TD><TD></TD></TR>
<TR><TD>XMM EPIC EPN Image. Target: M31 South 1/0.1-12.0 Kev</TD><TD>LOWERLEVEL</TD><TD></TD><TD></TD><TD>800</TD><TD>Observation</TD>
<TD></TD><TD>0112570201.S003</TD></TR>
</TABLEDATA></DATA>
</TABLE>
</RESOURCE>
</VOTABLE>

```