INES Interoperability

The SIAP Protocol

1.- Purpose of the document:

The purpose of this document is to describe the use of the SIAP protocol in the context of the INES Archive.

2.- Introduction:

Already in its origins, well before the advent of the Virtual Observatory, the INES system was designed to easily inter-operate with other archives. The information exchange between INES and the NASA Abstract Data System represents one of the first fruitful examples of interoperability between astronomical archives (figure 1).
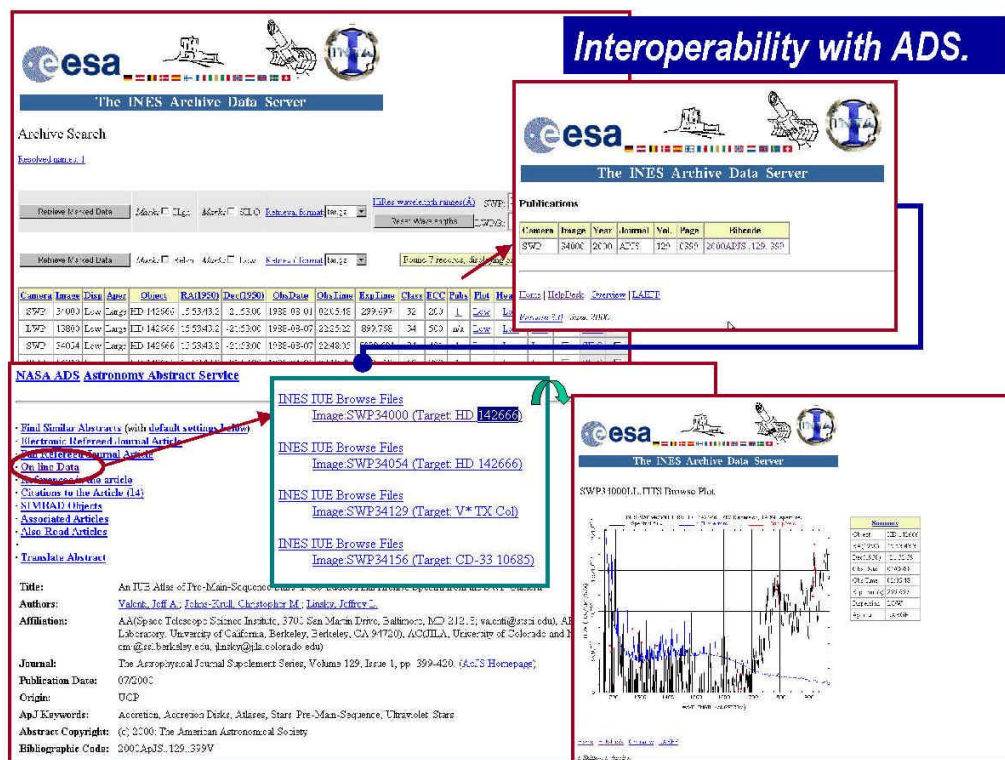

Fig1.- INES-ADS interoperability.

3.- The SIAP protocol in INES

SIAP (Simple Image Access Prototype) is the standard protocol defined by the Virtual Observatory for retrieving data from a repository of astronomical images through a uniform interface. Through this web method, a client searches for available images that match certain client-specified criteria using a HTTP GET request . The response is a table (in VOTable format) describing the available data including metadata and access references (implemented as URLs) for retrieving them. More details about SIAP and VOTable can be found at http://us-vo.org/news/simspec.html and http://www.ivoa.net/twiki/bin/view/IVOA/IvoaVOTable respectively.

In VOTable format, the RESOURCE element identified with the tag *type="results"* contains an INFO with *name=QUERY_STATUS"*. Its value attribute is set to "*OK*" if the query is executed successfully, regardless of whether any matching images were found. Otherwise, the value attribute is set to "*ERROR*".

To know the input parameters supported by the system as well as the columns it will return, the following query has to be done:

→ http://sdc.laeff.esa.es/ines/jsp/siap.jsp?FORMAT=metadata

The result of this query will show like this:

```xml
<?xml version="1.0" ?>
<!DOCTYPE VOTABLE SYSTEM "http://us-vo.org/xml/VOTable.dtd">
<VOTABLE version="1.0">
        <RESOURCE type="results">
                <DESCRIPTION>
                        INES Simple Image Access Protocol (SIAP) Service
                </DESCRIPTION>
                <INFO name="QUERY_STATUS" value="OK" />
                <PARAM name="INPUT:POS">
                <DESCRIPTION>Search Position in the form "ra,dec" where ra and dec are given in decimal degrees in the ICRS coordinate
                system.</DESCRIPTION>
                </PARAM>
                <PARAM name="INPUT:SIZE">
                 <DESCRIPTION>Size of search region in the RA and Dec. directions in the form "ra_size,dec_size" given in decimal degrees. If
                only one value is provided, this value will be used for both sizes.</DESCRIPTION>
                </PARAM>
                <PARAM name="INPUT:OBJECT">
                 <DESCRIPTION>Object name to search for. The Object Name can refer to any of the names of the object given by the SIMBAD
                database, or by the IAU for Solar System objects.
                 </DESCRIPTION>
                 <LINK href="http://sdc:80/ines/Resolver.html" />
                </PARAM>
                <PARAM name="INPUT:DATE">
                <DESCRIPTION>Date of the observation in the form "date_init,date_end" (observations made between date_init and date_end),
                "date_init" (observations made after date_init or ",date_end" (observations made until date_end). date_init and date_end must be in
                the format "YYYY-MM-DD".
                  </DESCRIPTION>
                </PARAM>
                <PARAM name="INPUT:CAMERA">
                <DESCRIPTION>Camera used to perform the observation (LWP=Long Wavelength Prime (1850-3350 Å); LWR=Long Wavelength
                Redundant (1850-3350 Å); SWP=Short Wavelength Prime (1150-1980 Å) ). Several values can be specified separated by ",".
                  </DESCRIPTION>
                </PARAM>
                <PARAM name="INPUT:IMAGE">
```

```
<DESCRIPTION>Sequential image number. LWP:501-32696; LWR:501-18765; SWP:502-58388.  Several values can be specified
separated by ",".
 </DESCRIPTION>
</PARAM>
<PARAM name="INPUT:DISPERSION">
<DESCRIPTION>Dispersion is specified for the IUE spectrograph dispersion modes (LOW:low resolution spectrograph, ~6A;
High:high resolution spectrograph, ~0.2A; NA:not applicable (e.g. NULL and flat field images)).  Several values can be specified
separated by ",".
 </DESCRIPTION>
</PARAM>
<PARAM name="INPUT:APERTURE">
 <DESCRIPTION>The values for the aperture used in exposures (Large:large aperture, 10x20 arcsec oval; Small:small aperture, 3
arcsec diameter circle; N/A:not applicable (e.g. NULL and flat field images)).  Several values can be specified separated by ",".
 </DESCRIPTION>
</PARAM>
<PARAM name="INPUT:IUECLASS">
 <DESCRIPTION>The IUE Object Classification code for the target.
 </DESCRIPTION>
 <LINK href="http://sdc:80/ines/OutForm.html#class" />
</PARAM>
<PARAM name="INPUT:FORMAT" value="text/xml">
 <DESCRIPTION>Requested output format of the results.</DESCRIPTION>
 <VALUES>
   <OPTION>METADATA</OPTION>
 </VALUES>
</PARAM>
<TABLE>
        <FIELD ID="Camera"      ucd="INST_ID"           datatype="char" arraysize="*">
         <DESCRIPTION>IUE Camera name (LWP=Long Wavelength Prime (1850-3350 A); LWR=Long Wavelength
         Redundant (1850-3350 A); SWP=Short Wavelength Prime (1150-1980 A) ).</DESCRIPTION>
        </FIELD>
        <FIELD ID="Image"      ucd="ID_NUMBER"          datatype="char" arraysize="*">
         <DESCRIPTION> The sequential image number which, combined with the camera name, gives the image
         identification. LWP:501-32696; LWR:501-18765; SWP:502-58388.</DESCRIPTION>
        </FIELD>
        <FIELD ID="Dispersion" ucd="INST_DISPERSION"       datatype="char" arraysize="*">
        <DESCRIPTION>The dispersion mode of the observation: Low=low resolution (6A); High= high resolution (0.2A);
        N/A=not applicable (e.g. NULL and flat field images)</DESCRIPTION>
        </FIELD>
        <FIELD ID="Aperture"   ucd="INST_APERT"           datatype="char" arraysize="*">
        <DESCRIPTION>The aperture used for the exposure: Large=10x20 arcsec oval; Small=3 arcsec diameter circle;
        N/A=not applicable (e.g. NULL and flat field images)</DESCRIPTION>
        </FIELD>
        <FIELD ID="Object"     ucd="ID_TARGET"           datatype="char" arraysize="*">
          <DESCRIPTION>The Homogeneous Object Identifier (HOI) for the target.</DESCRIPTION>
          <LINK href="http://sdc:80/ines/Resolver.html" />
        </FIELD>
        <FIELD ID="RA"         ucd="POS_EQ_RA_MAIN"       datatype="char" arraysize="*" unit="deg">
          <DESCRIPTION>The Homogeneous Right Ascension of the object in J2000.</DESCRIPTION>
          <LINK href="http://sdc:80/ines/Resolver.html#HOI_coord" />
        </FIELD>
        <FIELD ID="DEC"        ucd="POS_EQ_DEC_MAIN"      datatype="char" arraysize="*" unit="deg">
          <DESCRIPTION>The Homogeneous Declination of the object in J2000.</DESCRIPTION>
          <LINK href="http://sdc:80/ines/Resolver.html#HOI_coord" />
        </FIELD>
        <FIELD ID="PosAngle"   ucd="POS_POS_ANG"          datatype="char" arraysize="*" unit="deg">
         <DESCRIPTION>The position angle of the long axis of the large aperture during the observation (North to
        East).</DESCRIPTION>
        </FIELD>
        <FIELD ID="ObsDateTime" ucd="VOX:OBS_START_TIME"      datatype="char" arraysize="*">
          <DESCRIPTION>The U.T. date and time of the start of the exposure.</DESCRIPTION>
        </FIELD>
        <FIELD ID="ExpTime"    ucd="TIME_EXPTIME"         datatype="char" arraysize="*" unit="s">
         <DESCRIPTION>The effective exposure time in seconds, i.e. the commanded exposure time corrected for camera rise
        time and exposure quantization, and for aperture length and trail rate quantization for trailed
        exposures.</DESCRIPTION>
        </FIELD>
        <FIELD ID="HJDMid"     ucd="TIME"               datatype="char" arraysize="*" unit="d">
          <DESCRIPTION>The heliocentric Julian date of mid-exposure.</DESCRIPTION>
        </FIELD>
        <FIELD ID="IUEClass"   ucd="CLASS_CODE"          datatype="char" arraysize="*">
```

```
                        <DESCRIPTION>The IUE Object Classification code for the target.</DESCRIPTION>
                        <LINK href="http://sdc:80/ines/OutForm.html#class" />
                    </FIELD>
                    <FIELD ID="ECC"         ucd="CODE_QUALITY"        datatype="char" arraysize="*">
                    <DESCRIPTION>The exposure classification code for continuum, emission lines and background, derived from the raw
                    image immediately after read-down, and ranging from 0 (weakest) to 9 (heavily saturated) for each category. Before
                    mid-1979 the ECC referred only to continuum and emission lines.</DESCRIPTION>
                        <LINK href="http://sdc:80/ines/OutForm.html#ecc" />
                    </FIELD>
                    <FIELD ID="Publications" ucd="REFER_BIBCODE"        datatype="char" arraysize="*">
                    <DESCRIPTION>The bibcodes of the publications which have used the corresponding observation.</DESCRIPTION>
                    </FIELD>
                    <FIELD ID="AXES"        ucd="VOX:Spectrum_axes"       datatype="char" arraysize="*">
                    <DESCRIPTION>Axes names (corresponding to the keyword names in the fits file) that ought to be used to do a
                    display.</DESCRIPTION>
                    </FIELD>
                    <FIELD ID="UNITS"      ucd="VOX:Spectrum_units"       datatype="char" arraysize="*">
                      <DESCRIPTION>Units in which each of the axes is represented.</DESCRIPTION>
                    </FIELD>
                    <FIELD ID="DIMEQ"      ucd="VOX:Spectrum_dimeq"        datatype="char" arraysize="*">
                      <DESCRIPTION>Dimensional equation of the units in each of the axes.</DESCRIPTION>
                    </FIELD>
                    <FIELD ID="SCALEQ"      ucd="VOX:Spectrum_scaleq"       datatype="char" arraysize="*">
                    <DESCRIPTION>Scaling factor needed to transform the dimensional equation to the International System of
                    Units.</DESCRIPTION>
                    </FIELD>
                    <FIELD ID="FORMAT"      ucd="VOX:Spectrum_format"       datatype="char" arraysize="*">
                      <DESCRIPTION>Mime format for spectrum products in fits format.</DESCRIPTION>
                    </FIELD>
                    <FIELD ID="Spectrum"    ucd="DATA_LINK"            datatype="char" arraysize="*">
                      <DESCRIPTION>Link to the spectrum file.</DESCRIPTION>
                    </FIELD>
                    <DATA>
                            <TABLEDATA>
                            </TABLEDATA>
                    </DATA>
                </TABLE>
            </RESOURCE>
</VOTABLE>
```

3.1.- The SSA protocol

SSA (Simple Spectral Access) is a protocol to access spectra in a SIAP-like way. Although not yet a VO standard, it is successfully working in the context of the ISO/XMM Archives and has been adopted by INES. Basically, SSA requires the inclusion of five new fields in the VOTable output:

- FIELD_ID="AXES" ucd=VOX:Spectrum_axes datatype="char" arraysize="*" indicating the axes names that ought to be used from the spectrum product to do a display of the spectrum.

- FIELD ID="UNITS" ucd="VOX:Spectrum_units" datatype="double" arraysize="*" indicating the units in which each of the axes is represented.

- FIELD ID="DIMEQ" ucd="VOX:Spectrum_dimeq" datatype="char" arraysize="*"/> representing the dimensional equation of the units in each of the axes.

- FIELD ID="SCALEQ" ucd="VOX:Spectrum_scaleq" datatype="char" arraysize="*"/>

representing the scaling factor needed to transform the dimensional equation (dimensionless by definition) to the International System of Units.

- FIELD ID="FORMAT" ucd="VOX:Spectrum_format" datatype="char" arraysize="*"/>

representing the mime format for spectrum products in FITS format.

4.- Query examples

4.1.- Query by position:

→ *http://sdc.laeff.esa.es/ines/jsp/siap.jsp?POS=...&SIZE=...&FORMAT=*

where

- POS is the position of the region of interest, expressed as the right-ascension and declination of the field centre, in decimal degrees in the ICRS coordinate system. A comma should delimit the two values.

- SIZE is the size of search region in the RA and Dec. directions in the form "ra_size, dec_size" given in decimal degrees. If only one value is provided, this value will be used for both sizes.

- FORMAT indicates the desired format of the output table. Presently, the only supported format is VOTable. If format is not specified, FORMAT=VOTable is assumed.

Example:

→ http://sdc.laeff.esa.es/ines/jsp/siap.jsp?POS=336.5228,-48.43854&SIZE=0.2

In this example, the client requests to list all the INES spectra available in the region centered at RA=336.5228 degrees and DEC= -48.43854 degrees (ICRS) with a radius of 0.2 degrees.

The result in VOTable format is as follows:
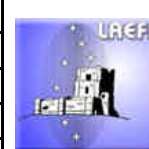
```
<?xml version="1.0" ?>
<!DOCTYPE VOTABLE SYSTEM "http://us-vo.org/xml/VOTable.dtd">
<VOTABLE version="1.0">
        <RESOURCE type="results">
                <DESCRIPTION>
                        INES Simple Image Access Protocol (SIAP) Service
                </DESCRIPTION>
                <INFO name="QUERY_STATUS" value="OK" />
                <PARAM ID="ObstyID"  ucd="OBSTY_ID"        datatype="char" arraysize="*" value="IUE" />
                <PARAM ID="Database" ucd="ID_DATABASE"      datatype="char" arraysize="*" value="INES" />

                <TABLE>
```

```
<FIELD ID="Camera"     ucd="INST_ID"          datatype="char" arraysize="*">
<DESCRIPTION>IUE Camera name (LWP=Long Wavelength Prime (1850-3350 A); LWR=Long Wavelength
Redundant (1850-3350 A); SWP=Short Wavelength Prime (1150-1980 A) ).</DESCRIPTION>
</FIELD>
<FIELD ID="Image"     ucd="ID_NUMBER"          datatype="char" arraysize="*">
<DESCRIPTION> The sequential image number which, combined with the camera name, gives the image
identification. LWP:501-32696; LWR:501-18765; SWP:502-58388.</DESCRIPTION>
</FIELD>
<FIELD ID="Dispersion"  ucd="INST_DISPERSION"       datatype="char" arraysize="*">
 <DESCRIPTION>The dispersion mode of the observation: Low=low resolution (6A); High= high resolution (0.2A);
N/A=not applicable (e.g. NULL and flat field images)</DESCRIPTION>
</FIELD>
<FIELD ID="Aperture"   ucd="INST_APERT"          datatype="char" arraysize="*">
<DESCRIPTION>The aperture used for the exposure: Large=10x20 arcsec oval; Small=3 arcsec diameter circle;
N/A=not applicable (e.g. NULL and flat field images)</DESCRIPTION>
</FIELD>
<FIELD ID="Object"    ucd="ID_TARGET"          datatype="char" arraysize="*">
  <DESCRIPTION>The Homogeneous Object Identifier (HOI) for the target.</DESCRIPTION>
  <LINK href="http://sdc:80/ines/Resolver.html" />
</FIELD>
<FIELD ID="RA"      ucd="POS_EQ_RA_MAIN"       datatype="char" arraysize="*" unit="deg">
  <DESCRIPTION>The Homogeneous Right Ascension of the object in J2000.</DESCRIPTION>
  <LINK href="http://sdc:80/ines/Resolver.html#HOI_coord" />
</FIELD>
<FIELD ID="DEC"      ucd="POS_EQ_DEC_MAIN"      datatype="char" arraysize="*" unit="deg">
  <DESCRIPTION>The Homogeneous Declination of the object in J2000.</DESCRIPTION>
  <LINK href="http://sdc:80/ines/Resolver.html#HOI_coord" />
</FIELD>
<FIELD ID="PosAngle"   ucd="POS_POS_ANG"         datatype="char" arraysize="*" unit="deg">
<DESCRIPTION>The position angle of the long axis of the large aperture during the observation (North to
East).</DESCRIPTION>
</FIELD>
<FIELD ID="ObsDateTime"  ucd="VOX:OBS_START_TIME"    datatype="char" arraysize="*">
  <DESCRIPTION>The U.T. date and time of the start of the exposure.</DESCRIPTION>
</FIELD>
<FIELD ID="ExpTime"   ucd="TIME_EXPTIME"        datatype="char" arraysize="*" unit="s">
<DESCRIPTION>The effective exposure time in seconds, i.e. the commanded exposure time corrected for camera rise
time and exposure quantization, and for aperture length and trail rate quantization for trailed
exposures.</DESCRIPTION>
</FIELD>
<FIELD ID="HJDMid"    ucd="TIME"            datatype="char" arraysize="*" unit="d">
  <DESCRIPTION>The heliocentric Julian date of mid-exposure.</DESCRIPTION>
</FIELD>
<FIELD ID="IUEClass"   ucd="CLASS_CODE"         datatype="char" arraysize="*">
  <DESCRIPTION>The IUE Object Classification code for the target.</DESCRIPTION>
  <LINK href="http://sdc:80/ines/OutForm.html#class" />
</FIELD>
<FIELD ID="ECC"      ucd="CODE_QUALITY"        datatype="char" arraysize="*">
<DESCRIPTION>The exposure classification code for continuum, emission lines and background, derived from the raw
image immediately after read-down, and ranging from 0 (weakest) to 9 (heavily saturated) for each category. Before
mid-1979 the ECC referred only to continuum and emission lines.</DESCRIPTION>
  <LINK href="http://sdc:80/ines/OutForm.html#ecc" />
</FIELD>
<FIELD ID="Publications" ucd="REFER_BIBCODE"        datatype="char" arraysize="*">
<DESCRIPTION>The bibcodes of the publications which have used the corresponding observation.</DESCRIPTION>
</FIELD>
<FIELD ID="AXES"     ucd="VOX:Spectrum_axes"     datatype="char" arraysize="*">
<DESCRIPTION>Axes names (corresponding to the keyword names in the fits file) that ought to be used to do a
display.</DESCRIPTION>
</FIELD>
<FIELD ID="UNITS"     ucd="VOX:Spectrum_units"     datatype="char" arraysize="*">
  <DESCRIPTION>Units in which each of the axes is represented.</DESCRIPTION>
</FIELD>
<FIELD ID="DIMEQ"     ucd="VOX:Spectrum_dimeq"     datatype="char" arraysize="*">
  <DESCRIPTION>Dimensional equation of the units in each of the axes.</DESCRIPTION>
</FIELD>
<FIELD ID="SCALEQ"    ucd="VOX:Spectrum_scaleq"    datatype="char" arraysize="*">
<DESCRIPTION>Scaling factor needed to transform the dimensional equation to the International System of
Units.</DESCRIPTION>
</FIELD>
<FIELD ID="FORMAT"    ucd="VOX:Spectrum_format"    datatype="char" arraysize="*">
```

```
                    <DESCRIPTION>Mime format for spectrum products in fits format.</DESCRIPTION>
                    </FIELD>
                    <FIELD ID="Spectrum"    ucd="DATA_LINK"         datatype="char" arraysize="*">
                      <DESCRIPTION>Link to the spectrum file.</DESCRIPTION>
                    </FIELD>
                    <DATA>
          <TABLEDATA>
                                  <TR>
                                          <TD>SWP</TD>
                                          <TD>45924</TD>
                                          <TD>LOW</TD>
                                          <TD>LARGE</TD>
                                          <TD>HD 212539</TD>
                                          <TD>336.5228</TD>
                                          <TD>-48.4385</TD>
                                          <TD>298.02</TD>
                                          <TD>1992-10-11 11:33:43</TD>
                                          <TD>899.761</TD>
                                          <TD>2448906.98925</TD>
                                          <TD>43</TD>
                                          <TD>00</TD>
                                          <TD></TD>
                                          <TD>WAVELENGTH FLUX SIGMA QUALITY</TD>
                                          <TD>ANGSTROM ERG/CM2/S/A ERG/CM2/S/A n/a</TD>
                                          <TD>L M/L/T3 M/L/T3 n/a</TD>
                                          <TD>10-10 10+7 10+7 n/a</TD>
                                          <TD>spectrum/fits</TD>
                                          <TD>
              <STREAM href="http://sdc:80/cgi-ines/SingleDownload?filename=SWP45924LL.FITS" />
                                          </TD>
                                  </TR>
                          </TABLEDATA>
                    </DATA>
                </TABLE>
          </RESOURCE>
</VOTABLE>
```

It is also possible to make queries using any combination of the input parameters displayed when the *FORMAT=metadata* option is used. We are giving here some examples.

4.2.- Query by instrumental configuration

http://sdc.laeff.esa.es/ines/jsp/siap.jsp?CAMERA=...&DISPERSION=...&APERTURE=

where

- CAMERA: the IUE camera name (**LWP**=Long Wavelength Prime (1850-3350 Å); **LWR**=Long Wavelength Redundant (1850-3350 Å); **SWP**=Short Wavelength Prime (1150-1980 Å)).

- DISPERSION: the dispersion mode of the observation: **Low**=low resolution (6Å); **High**= high resolution (0.2Å); **NA**=not applicable (e.g. NULL and flat field images).

- APERTURE: the aperture used for the exposure: **Large**=10x20 arcsec oval; **Small**=3 arcsec diameter circle; **NA**=not applicable (e.g. NULL and flat field images).

Example:

➔http://sdc.laeff.esa.es/ines/jsp/siap.jsp?CAMERA=LWP&DISPERSION=HIGH&APERTURE=LARGE

The result of this query will return all IUE spectra taken with the LWP camera in High dispersion using the Large aperture.

4.3.- Query by object

http://sdc.laeff.esa.es/ines/jsp/siap.jsp?OBJECT=

where

- OBJECT can refer to any of the names of the object given by the SIMBAD database, or by the IAU for Solar System objects. Blank spaces in the object name are permitted.

 # Example:

➔ http://sdc.laeff.esa.es/ines/jsp/siap.jsp?OBJECT=HD142666

The result oft his query will give all IUE observations of HD 142666.

4.4.- Query by date

http://sdc.laeff.esa.es/ines/jsp/siap.jsp?DATE=

where

- DATE is the date of the observation in the form "date_init,date_end" (observations made between date_init and date_end), "date_init" (observations made after date_init or ",date_end" (observations made untill date_end). date_init and date_end must be in the format "YYYY-MM-DD".

 # Example:

➔ http://sdc.laeff.esa.es/ines/jsp/siap.jsp?DATE=1996-09-26,1996-09-27

This will return all the IUE spectra taken on 1996 September 26 and 27.

4.5.- Query by IUE Object Classification Code

http://sdc.laeff.esa.es/ines/jsp/siap.jsp?IUECLASS=

where

- IUECLASS is the IUE Object Classification code. The full list can be found at:
  http://ines.laeff.esa.es/ines/InForm.html#class

 # Example:

 → http://sdc.laeff.esa.es/ines/jsp/siap.jsp?IUECLASS=58
The result of this query will be all IUE observations of T Tauri objects (IUECLASS=58).