VOSpec: A Tool to Handle VO Spectra Through SSAP

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Simple Spectrum Access Protocol

- [...]*To define a uniform interface to spectral data.*[...]
    - Problem: handle units; no "uniform" solution yet.
    - Proposal from Osuna/Salgado at IVOA meeting @ Strasbourg, October 2003, to add parameters into SSA to allow for automatic unit conversion

- [...]*The term "Simple" in Simple Spectrum Access Protocol refers to the design goal of simplicity in both implementing spectral data services and in retrieving spectroscopic data from distributed data collections*[...]
    - Try to make the retrieving simple and comparable

- [...]*Required query parameters: POS, SIZE, FORMAT*[...]

- [...]*Required response columns: FORMAT, ACREF, SED Object, Dataset Object, Coverage Object*[...]

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Simple Spectrum Access Protocol

❑ ESAC proposal: Add the following three extra response columns in the SSA Protocol:

```
FIELD ID="AXES"   ucd=VOX:Spectrum_axes   […]
FIELD ID="DIMEQ"  ucd=VOX:Spectrum_dimeq  […]
FIELD ID="SCALEQ" ucd=VOX:Spectrum_scaleq […]
```

❑Allows unit conversion, spectra superimposition and multiwavelength analysis

❑Information on the Units in the metadata.

❑Dimensional equation only has to be calculated once (and forever) per project.

SSA Query Response VOTABLE Sample

\<TD\>**40001501**\</TD\> -

\<TD\>-\<![CDATA[http://[…]swaa]]\>\</TD\>

\<TD\>**ISO SWS01 Spectrum Target: M31_BULGE**\</TD\>

\<TD\>**20-Dec-1996 21:09:09**\</TD\>

\<TD\>**20-Dec-1996 21:28:09**\</TD\>

\<TD\>**10.691809995**\</TD\>

\<TD\>**41.27003**\</TD\>

\<TD\>**SWAAWAVE SWAAFLUX**\</TD\>

\<TD\>**um Jy**\</TD\>

\<TD\>**L MT-2**\</TD\>

\<TD\>**10.E-6 10.E-26**\</TD\>

\<TD\>**spectrum/fits**\</TD\>

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VOSpec fact sheet

❑ Using VO Standards:

- Ready to access the Registry to get SSA servers information
- Use SIMBAD Web Service (easily integrated with rest of the tool)
- Display VOTable information from SSA
- Already working with available SSAP services: ISO (ESAC/ADT) and IUE (INES archive) plus SSA-modified local data for HST, XMM, etc.

❑ Handling spectra

- Get spectra from SSA servers
- Display and superimpose spectra
- Automatic unit conversion through dimensional analysis
- Multi-wavelength analysis
- Polynomial/Black body/Gaussian fitting and other utilities on the way

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VOSpec: Interoperable Tool

SIMBAD Web Service

Registry Access

(Currently directly from VOTable)

VOTable standard

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Superimposition and Multiwavelength analysis

```
FIELD ID="AXES"   ucd=VOX:Spectrum_axes   […]
FIELD ID="UNITS"  ucd=VOX:Spectrum_units  […]
FIELD ID="DIMEQ"  ucd=VOX:Spectrum_dimeq  […]
FIELD ID="SCALEQ" ucd=VOX:Spectrum_scaleq […]
```

```
<TD>40001501</TD> -
<TD>- <![CDATA[ http://[…]swaa]]></TD>
<TD>ISO SWS01 Spectrum Target:
M31_BULGE</TD>
<TD>20-Dec-1996 21:09:09</TD>
<TD>20-Dec-1996 21:28:09</TD>
<TD>10.691809995</TD>
<TD>41.27003</TD>
<TD>SWAAWAVE SWAAFLUX</TD>
<TD>um Jy</TD>
<TD>L MT-2</TD>
<TD>10.E-6 10.E-26</TD>
<TD>spectrum/fits</TD>
```

```
<TD>58001701</TD> -
<TD>- <![CDATA[ http://[…]lsan]]></TD>
<TD>ISO LWS02 Spectrum Target:
M31_BULGE</TD>
<TD>18-Jun-1997 10:19:19</TD>
<TD>18-Jun-1997 11:10:09</TD>
<TD> 10.691809995 </TD>
<TD> 41.27003 </TD>
<TD>LSANWAV LSANFLX</TD>
<TD>microns watts/cm^2/micron</TD>
<TD>L ML-1T-3</TD>
<TD>10.E-6 10.E+10</TD>
<TD>spectrum/fits</TD>
```

DIMEQ= **MT-2**

DIMEQ= **ML-1T-3**

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❑Already done for:

Project	Unit	DIMEQ	SCALEQ
ISO	Jy	MT-2	10E-26
XMM	Counts/cm2/s/Å	ML-1T-2 (in c/lambda units)	6.626E-20
IUE	erg/cm2/s/Å	ML-1T-3	1E+7
HST	erg/cm2/s/Å	ML-1T-3	1E+7

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A Working example: The HST case

❑ HST spectrum units (taken from http://archive.stsci.edu/hst/search.php)

▪ Erg/s/cm^2/A

▪ Reference Unit (can be any): Jy

❑ Metadata for HST spectrum:

▪ DIMEQ = ML-1T-3

▪ SCALEQ = 10^7

```
<TD>HST M82</TD> -
<TD><![CDATA[file:/home/posuna/IVOA/HS
T/o5f501010_sx1.fits]></TD>
<TD>M82 Spectrum</TD>
<TD>10-Feb-1997 10:11:51</TD>
<TD>10-Feb-1997 11:00:09</TD>
<TD>148.9</TD>
<TD>69.67</TD>
<TD>WAVELENGTH FLUX</TD>
<TD>A erg/S/cm^2/A</TD>
<TD>L ML-1T-3</TD>
<TD>1.E-10 1E+7</TD>
<TD>spectrum/fits</TD>
```

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$$[Jy] = MT^{-2} \text{ Scaling factor} :10^{-26} \qquad [HST] = ML^{-1}T^{-3} \text{ Scaling factor} :10^{7}$$

$$\frac{[Jy]}{[HST]} = \frac{MT^{-2}}{ML^{-1}T^{-3}}L^{1}T^{1} \qquad [l]^{n}[c]^{m} = L^{n}L^{m}T^{-m} = L^{1}T^{1};$$

$$\left.\begin{array}{l} n=m=1 \\ -m=1 \end{array}\right\} \Rightarrow \left\{\begin{array}{l} m=-1 \\ n=2 \end{array}\right. \qquad \Rightarrow \qquad [Jy] = [HST]\frac{?^{2}}{c}\frac{10^{7}}{10^{-26}}$$

VOSpec IVOA Poona Sep 2004

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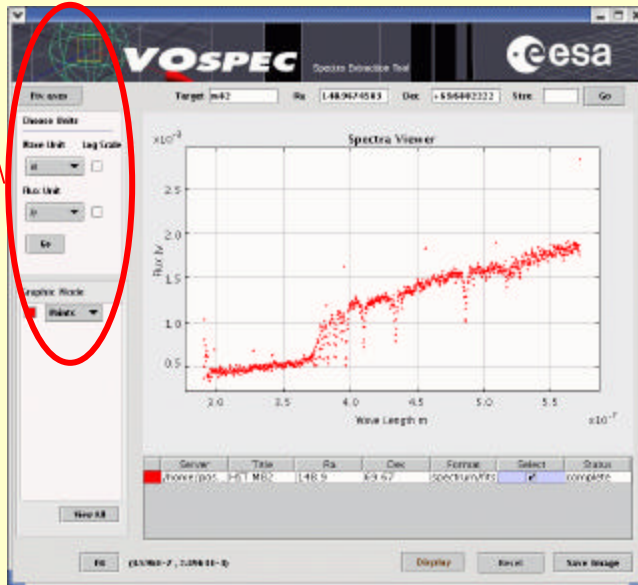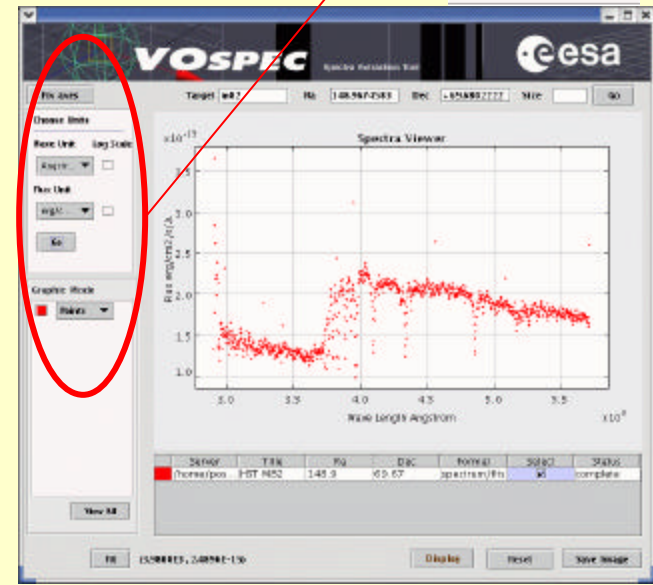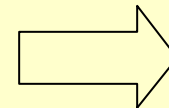
VOSpec: Multi-wavelength Analysis

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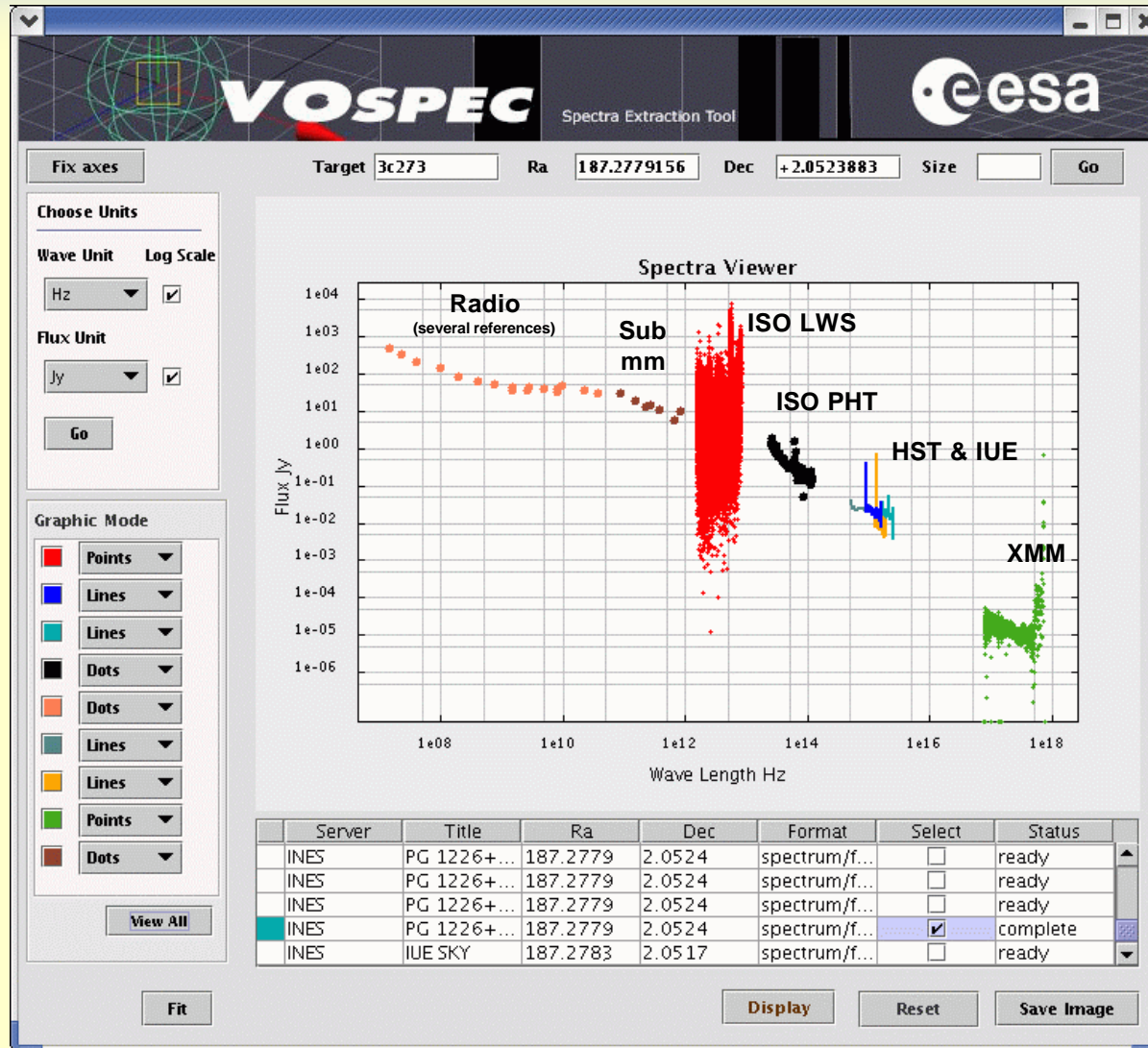
VOSpec: Superimposition

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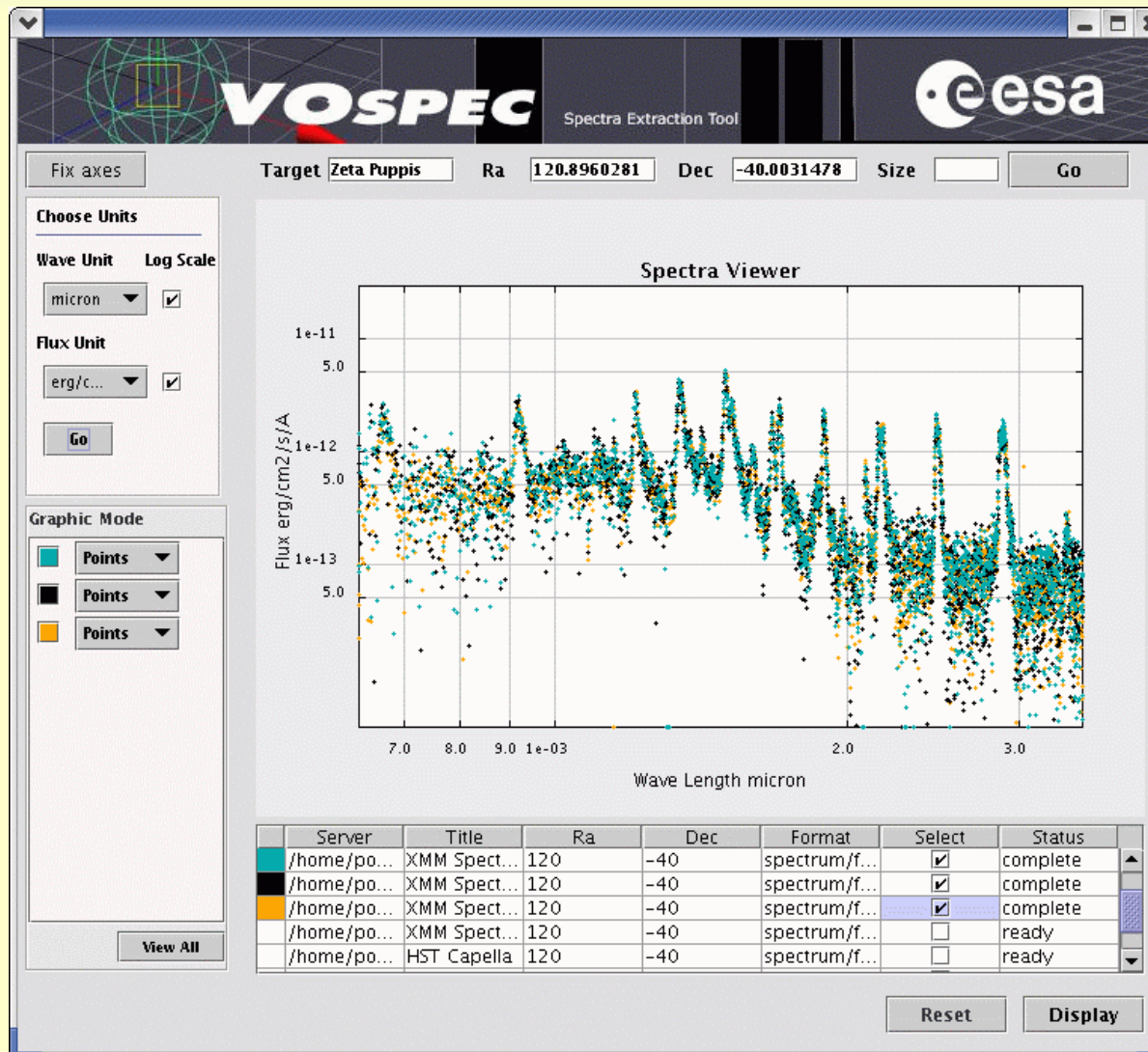
VOSpec: Unit Conversion
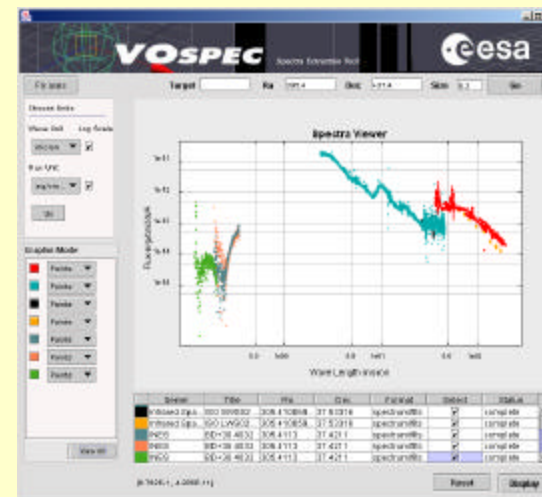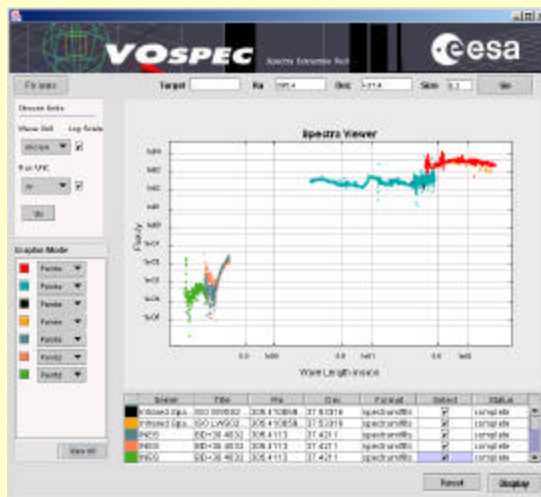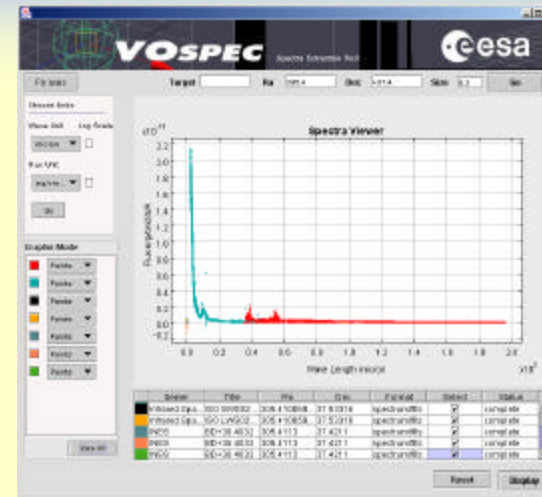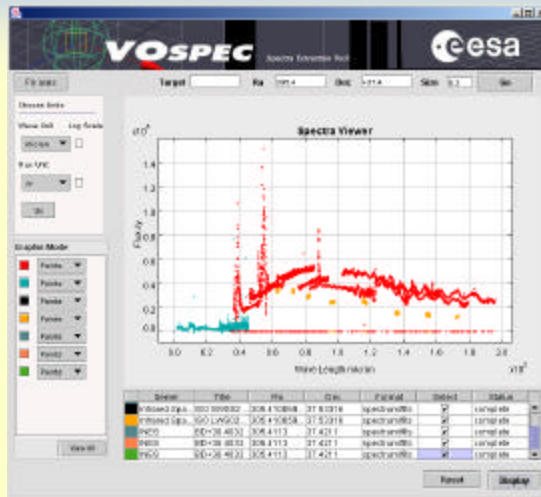
VOSpec working example: Sampling AGBs

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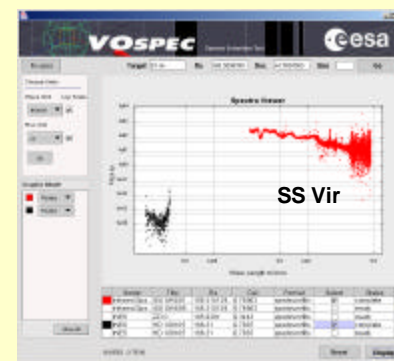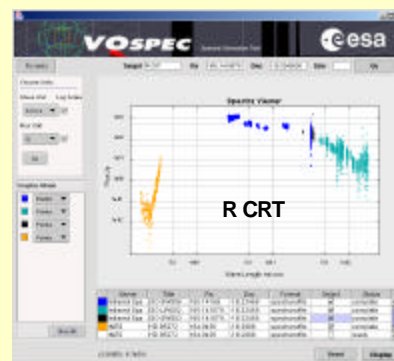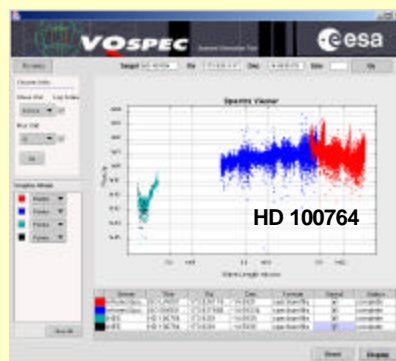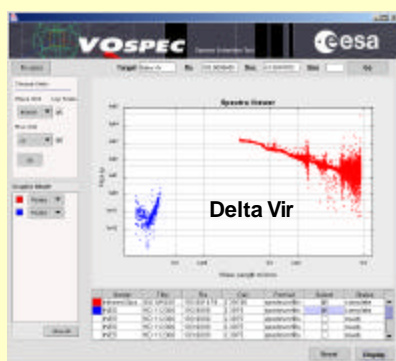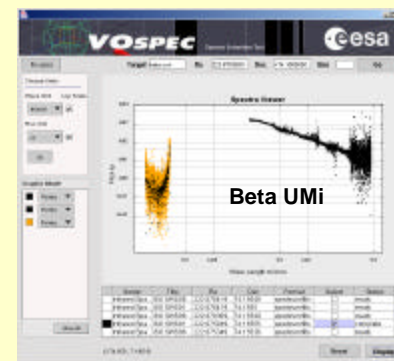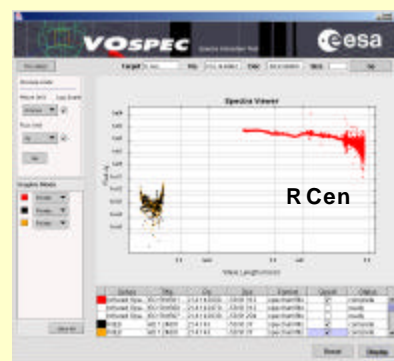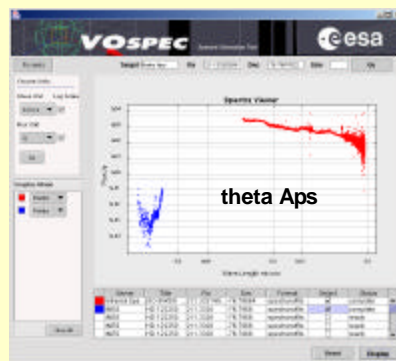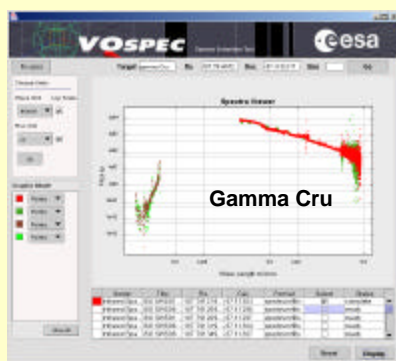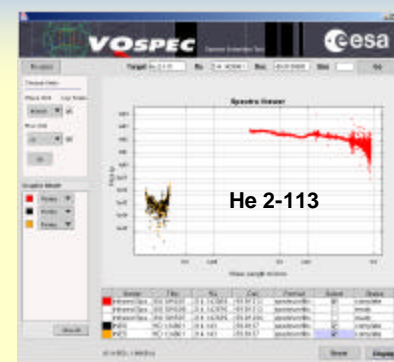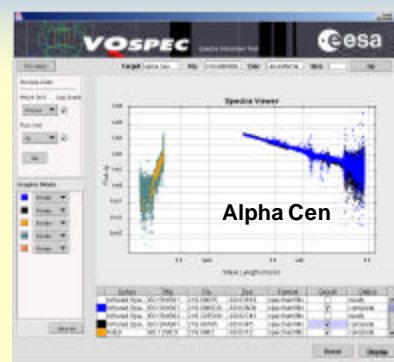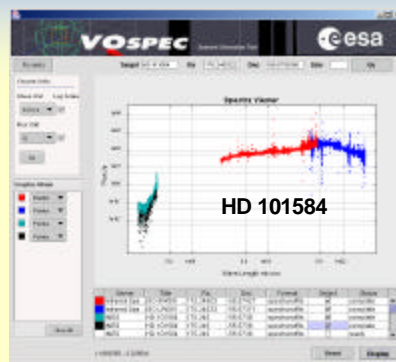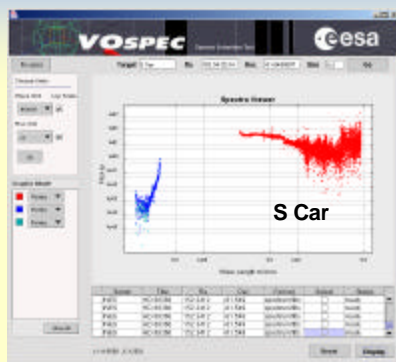
Prototype tool URL

❑ A test version of the tool can be accessed at:

http://pma.standby.vilspa.esa.es:8080/vospec/index.html

❑ Production version will be announced conveniently

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