VOSpec: A Tool to Handle Virtual Observatory Spectra Through SSAP

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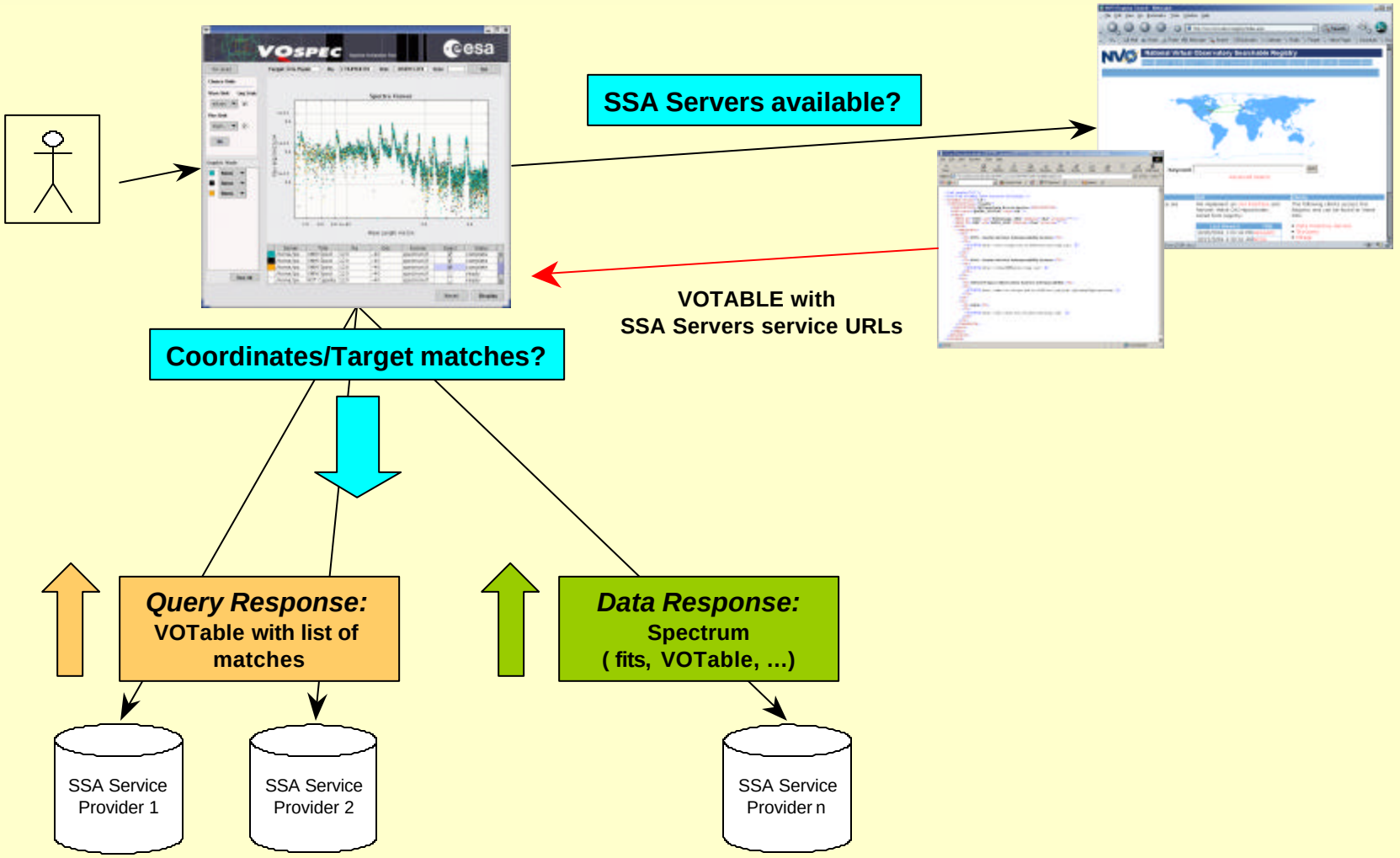
Spectrum handling in the Virtual Observatory through SSAP



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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 dimensional analysis parameters into SSA to allow for automatic unit conversion

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

- A typical query would be like:

http://pma.iso.vilspa.esa.es:8080/aio/jsp/siap.jsp?POS=10,41&SIZE=1&imageType=Spectrum

- SSAP query Response with pointers to FITS (and other formats) spectra

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SSAP dimensional parameters extension

- 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
- Dimensional equation only has to be calculated once (and forever) per project.
- Proposed at IVOA meeting in Pune 2004. Data Access Layer (DAL) group showed interest.
- As an example of its usefulness, both ISO data and IUE data (from two different archive providers) implement our proposed extension (see next slides)

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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
  - Accept spectra in FITs and VOTable formats
  - Automatic unit conversion through dimensional analysis
  - Multi-wavelength analysis
  - Polynomial/Black body/Gaussian fitting and other utilities on the way

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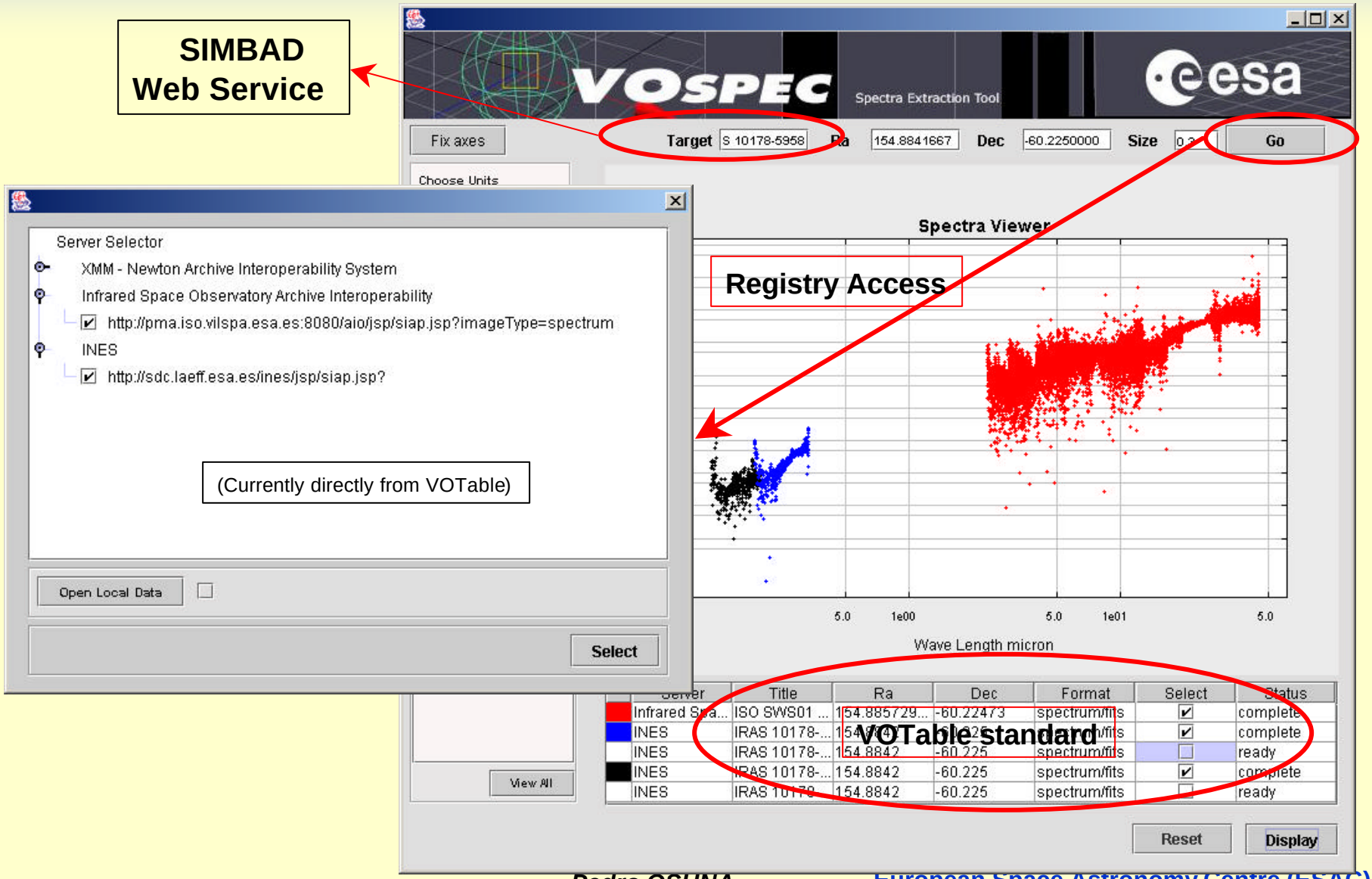
VOSpec: Interoperable Tool



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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>

DIMEQ= **MT-2**

<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= **ML-1T-3**

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DIMEQ: Easy to calculate

- **Already done for:**

Project	Unit	DIMEQ	SCALEQ
ISO	Jy	MT-2	10E-26
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

<TD>**HST M82**</TD> -
<TD><![CDATA[file:/home/posuna/IVOA/HST/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>

- Metadata for HST spectrum:
  - DIMEQ = ML-1T-3
  - SCALEQ = 10^7

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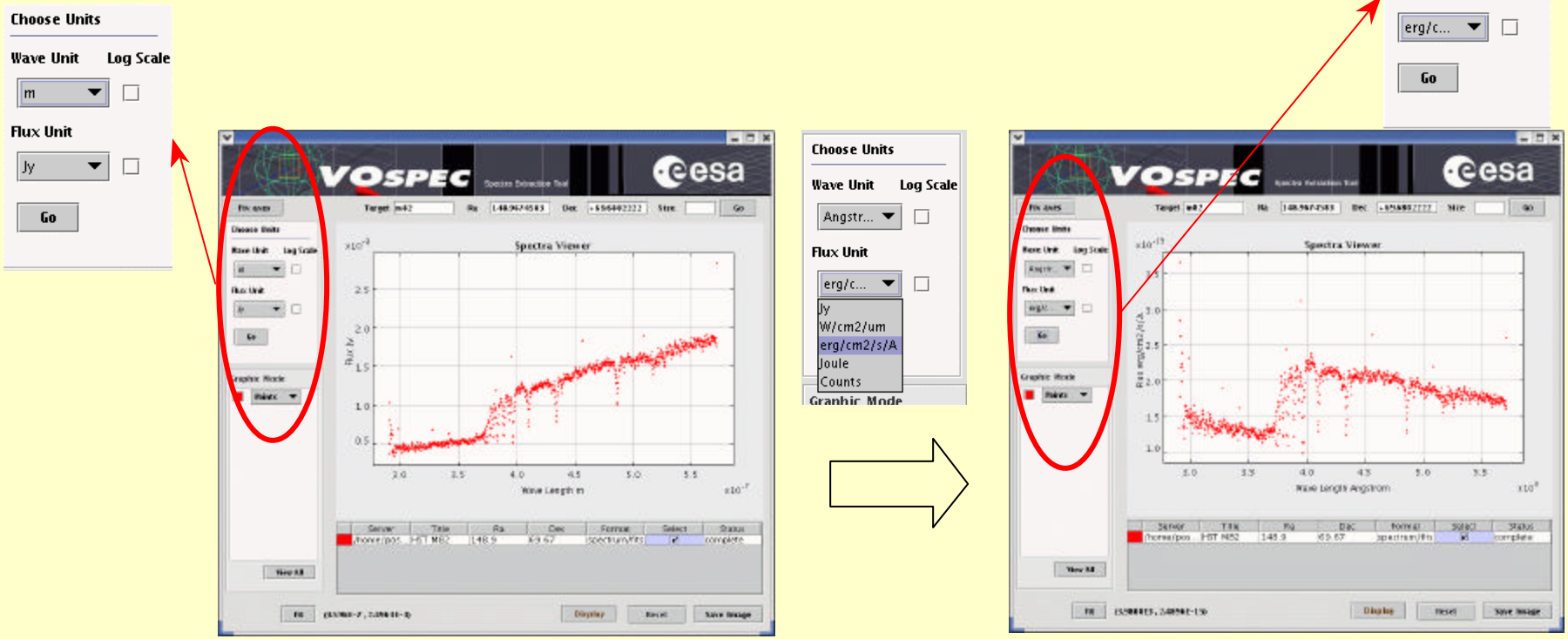
A Working example: The HST case
Unit conversion

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

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

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



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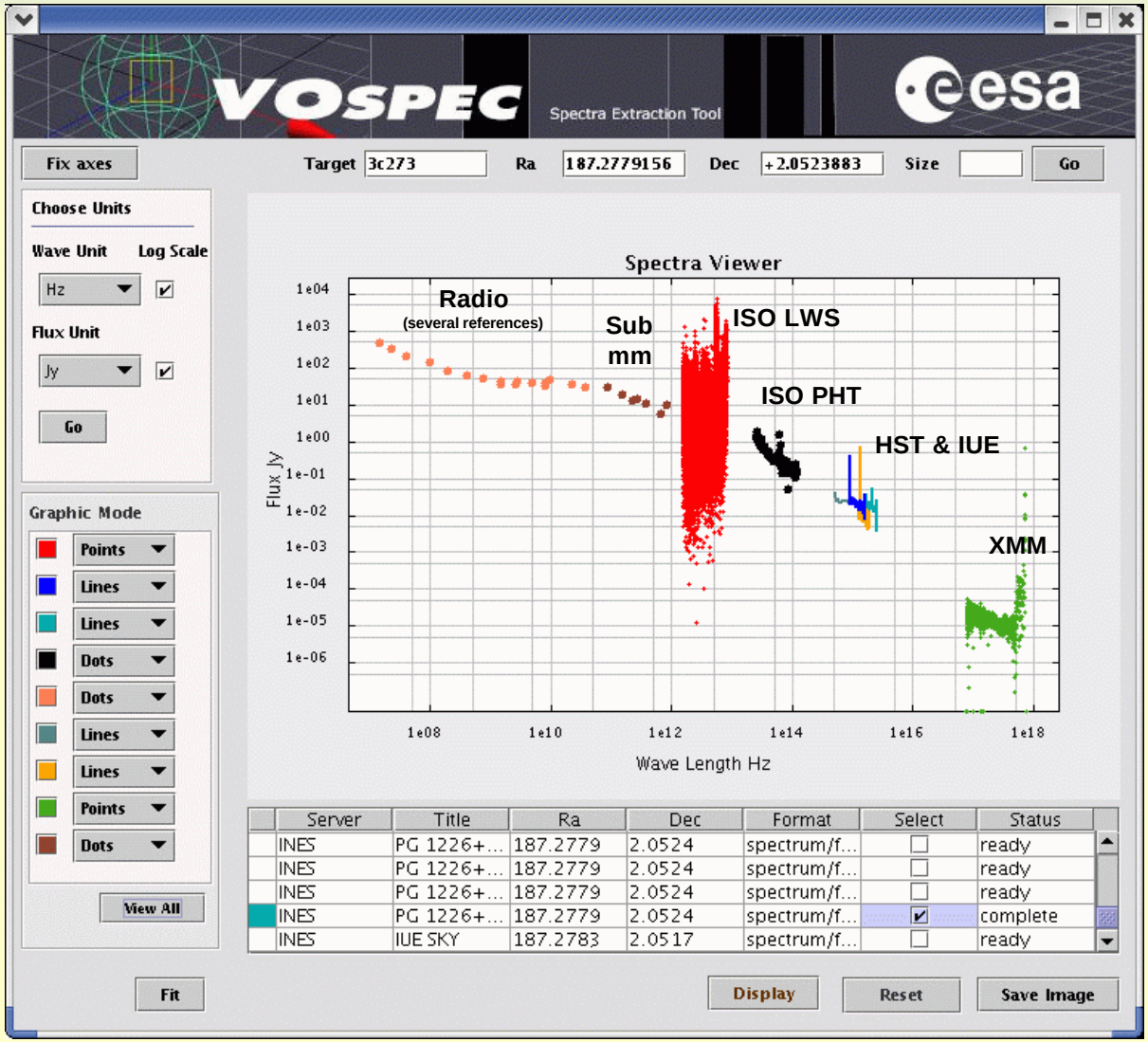
VOSpec: Multi-wavelength Analysis



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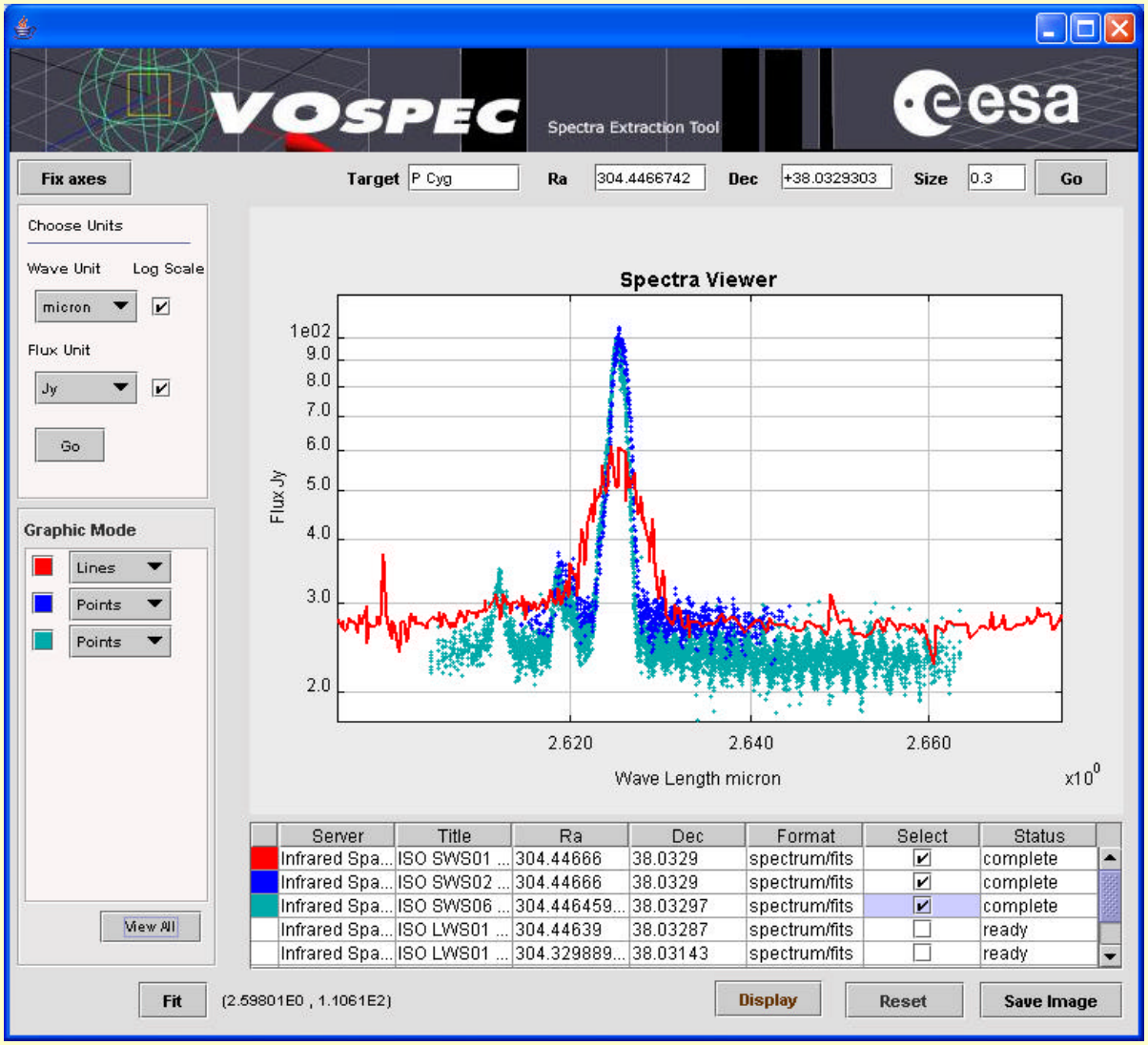
VOSpec: Superimposition



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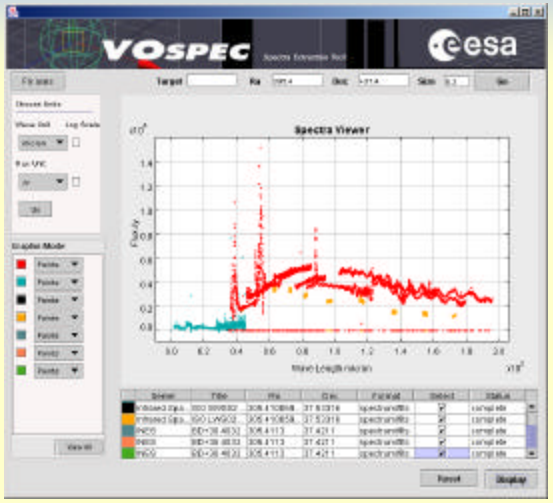
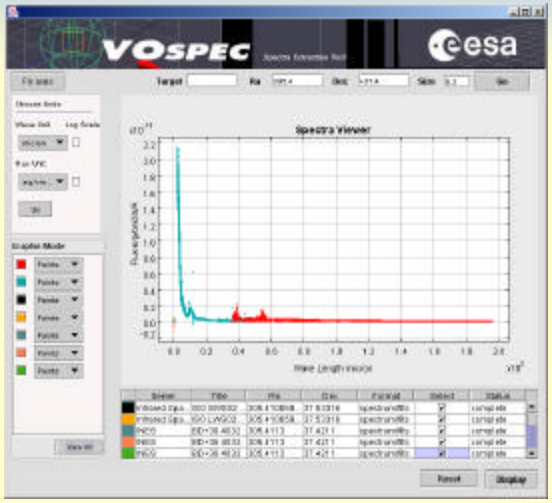
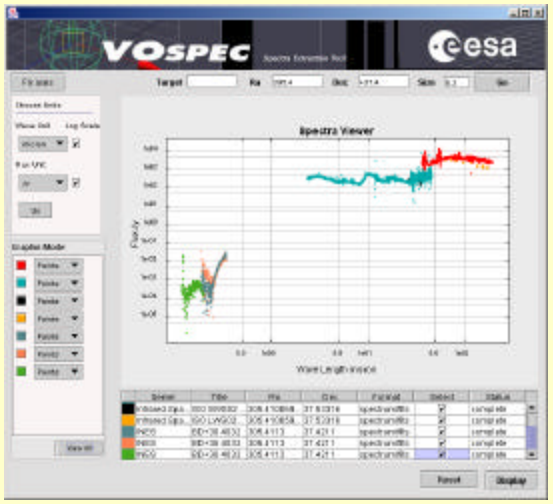
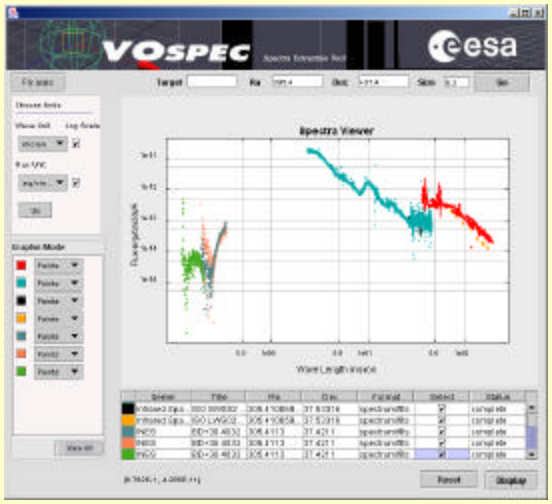
VOSpec: Unit Conversion









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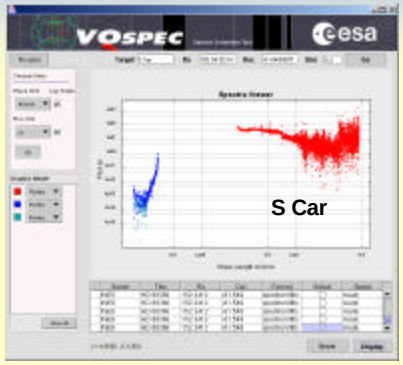
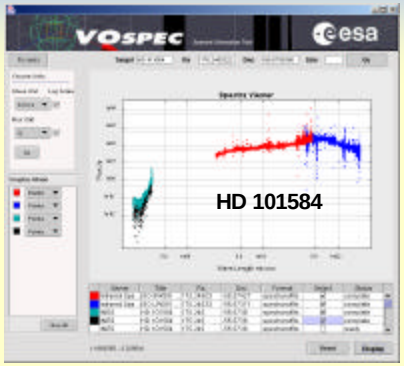
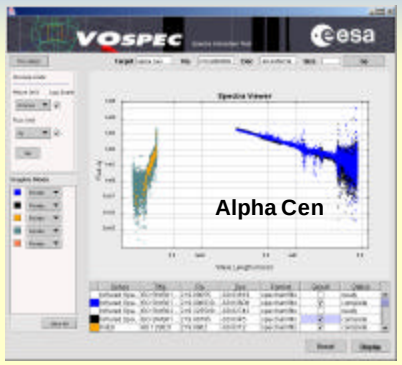
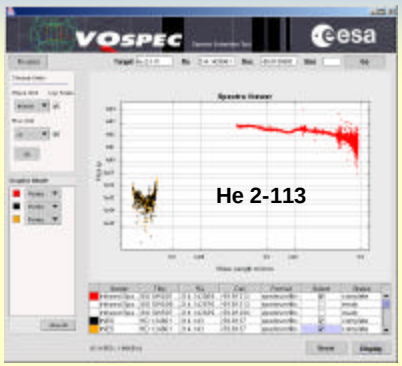
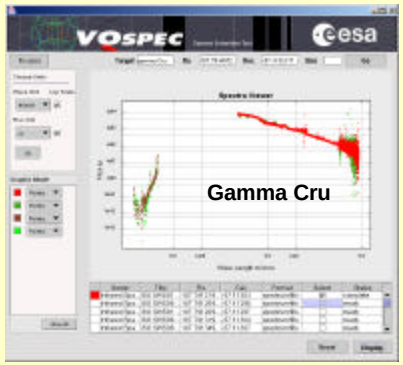
VOSpec working example: Sampling AGBs

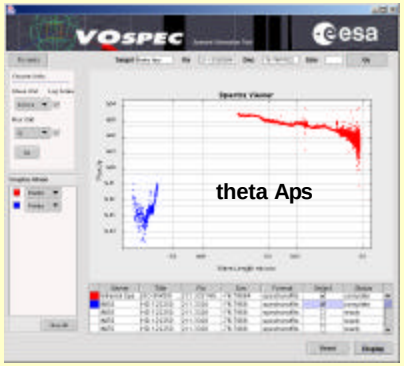


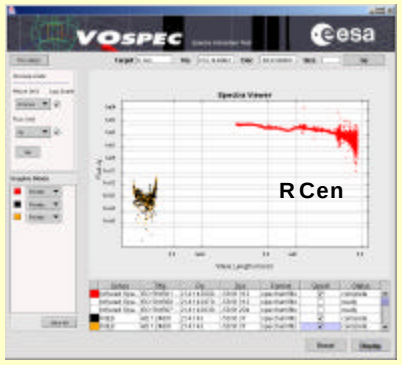


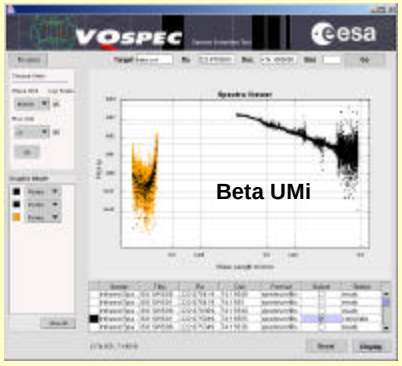


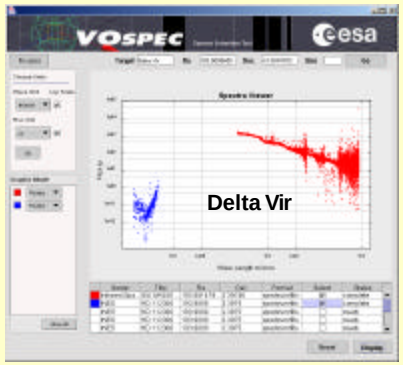


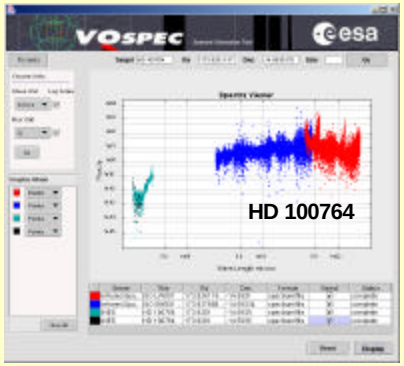


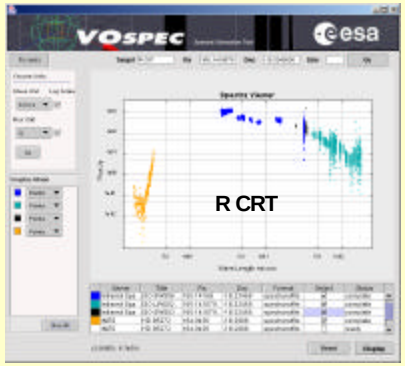


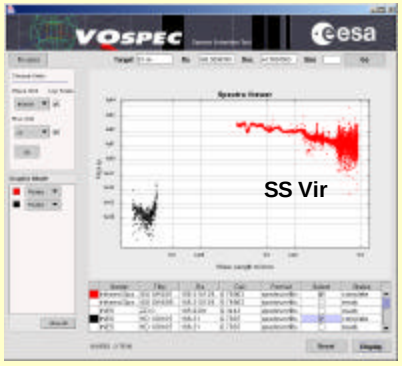












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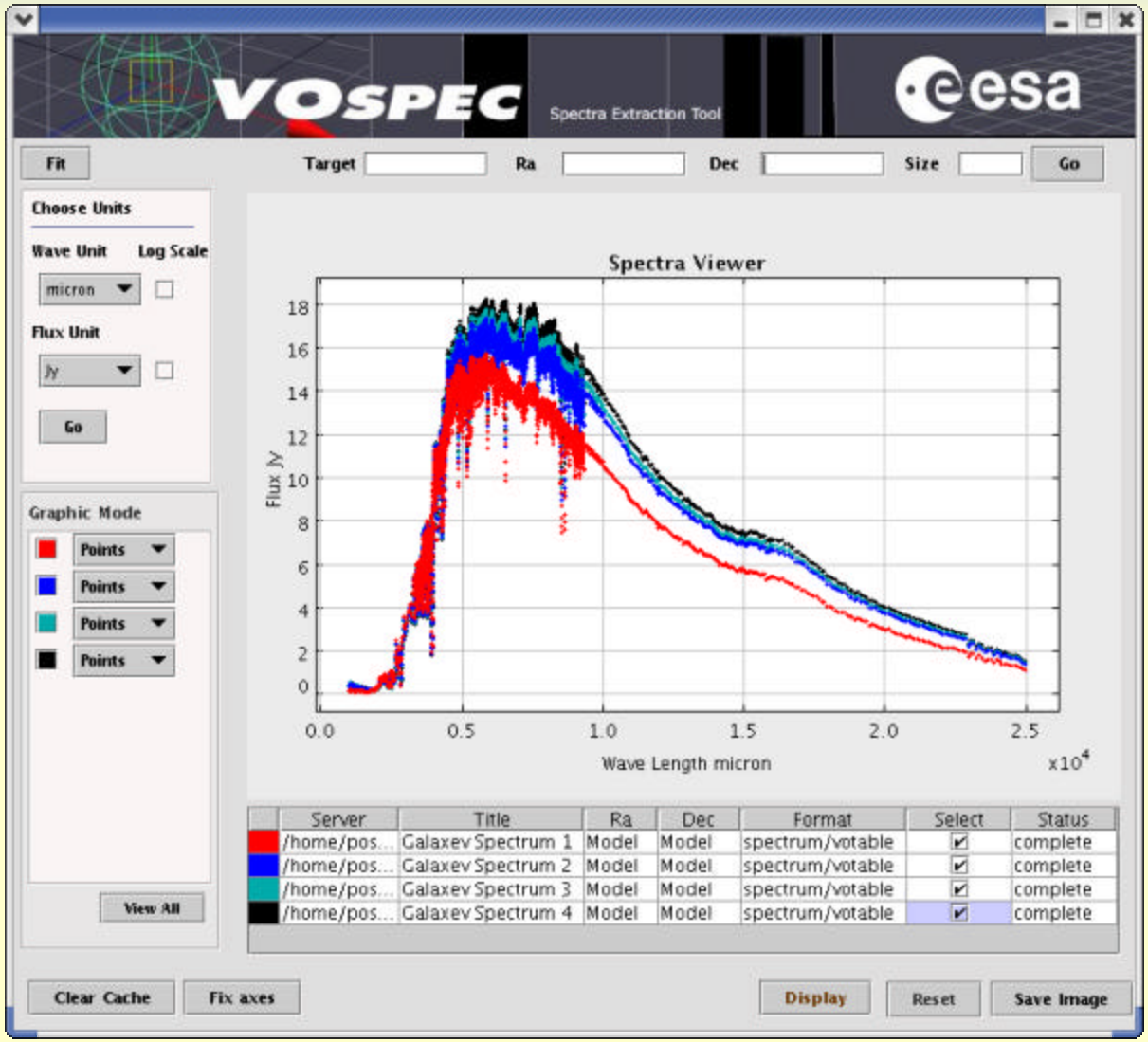
VOSpec working example:
Galactic Evolution from GALAXEV



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URL (temporal) and Contact Point

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

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See us at the MAGNOLIA room in B floor

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