SVO - ESAVO Use case: Comparison of evolutionary synthesis models

Enrique Solano (LAEFF/SVO)

SVO
- Carlos Rodrigo
- Miguel Cerviño

ESAVO
- Pedro Osuna
- Isa Barbarisi
- Jesús Salgado

Interop., ESAC, Oct 2005

Theory in the VO

- Goal: Definition of science use cases to extract requirements for the various IVOA working groups.
  - Theory spectra: SVO & ESAVO

- Structure of X-Ray Clusters
- Virtual telescope configuration
- Synthesis Models in VO (SVO-ESAVO)
- Multiwavelength Analysis of Interstellar Clouds
- Determination of Physical conditions in interstellar clouds
- Theory SkyNode
- Tools for cosmological simulations: Simulated S-Z maps
- Intermediate scale : Nbody/Stellar Evolution in Globular Clusters / MHD Simulations of Astrophysical Jets

Dirección http://svo.laeff.esa.es/theory/tsap.php?teff_min=3750&teff_max=3750

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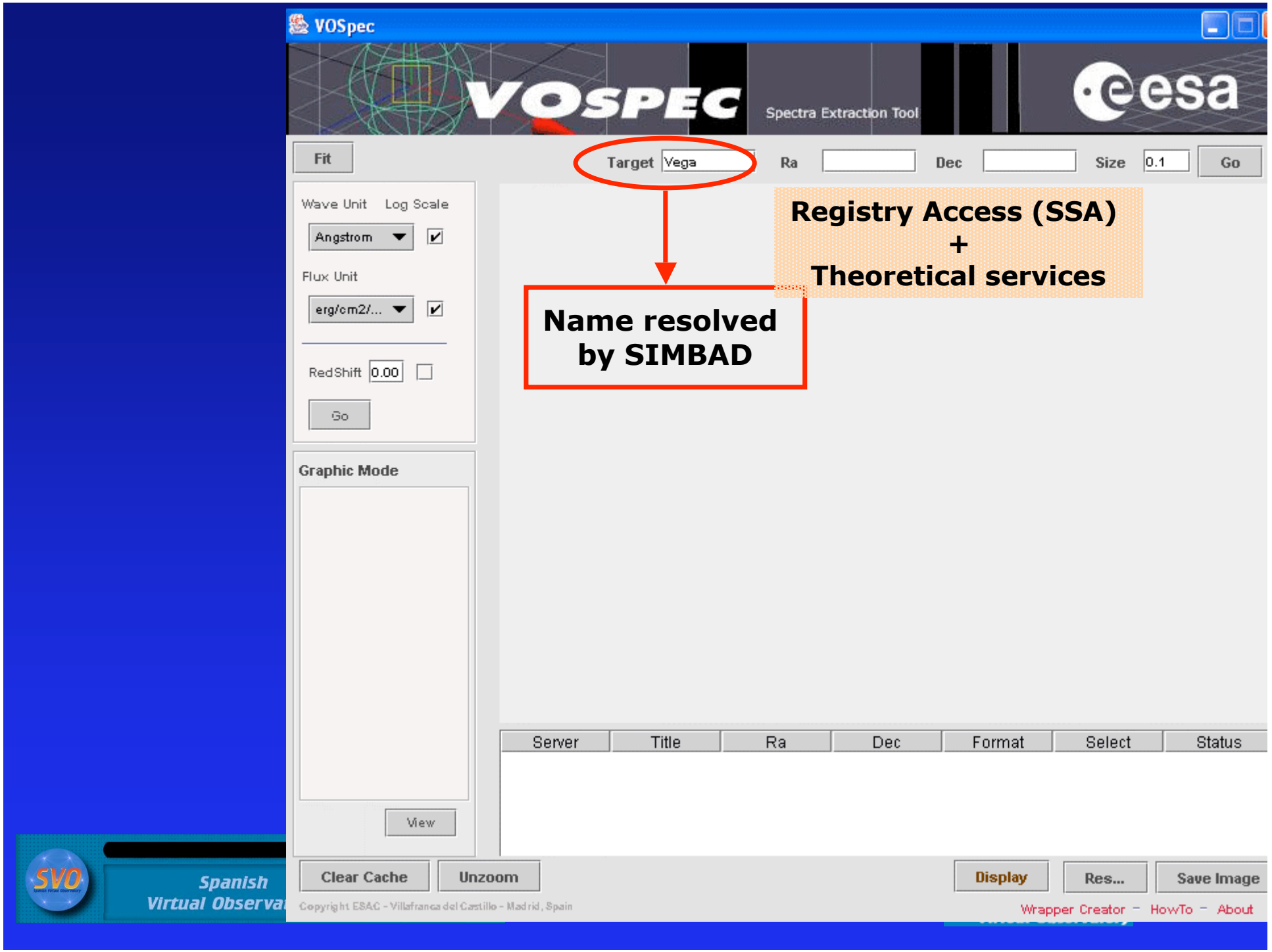
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Wrapper Creator - HowTo - About
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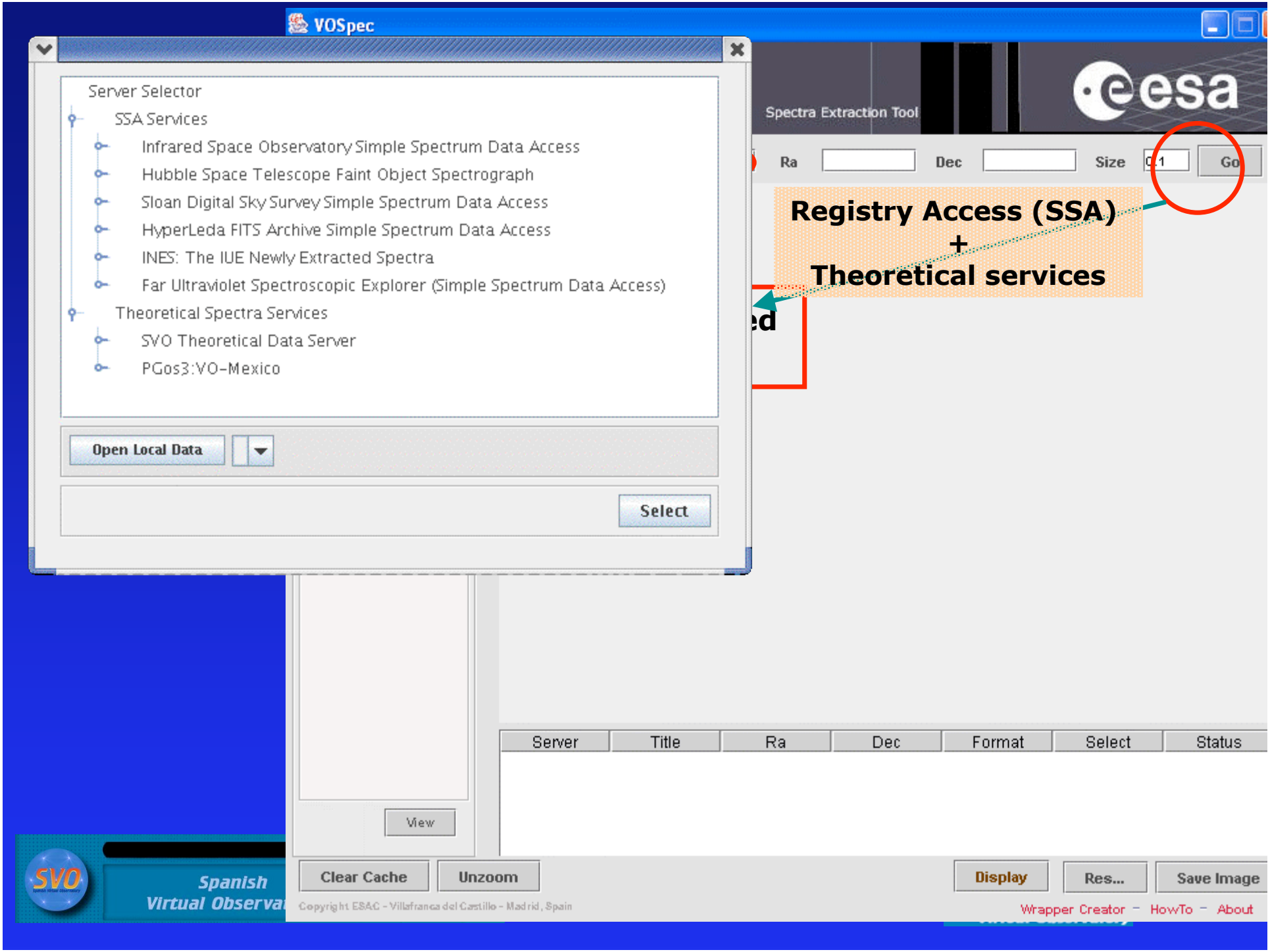
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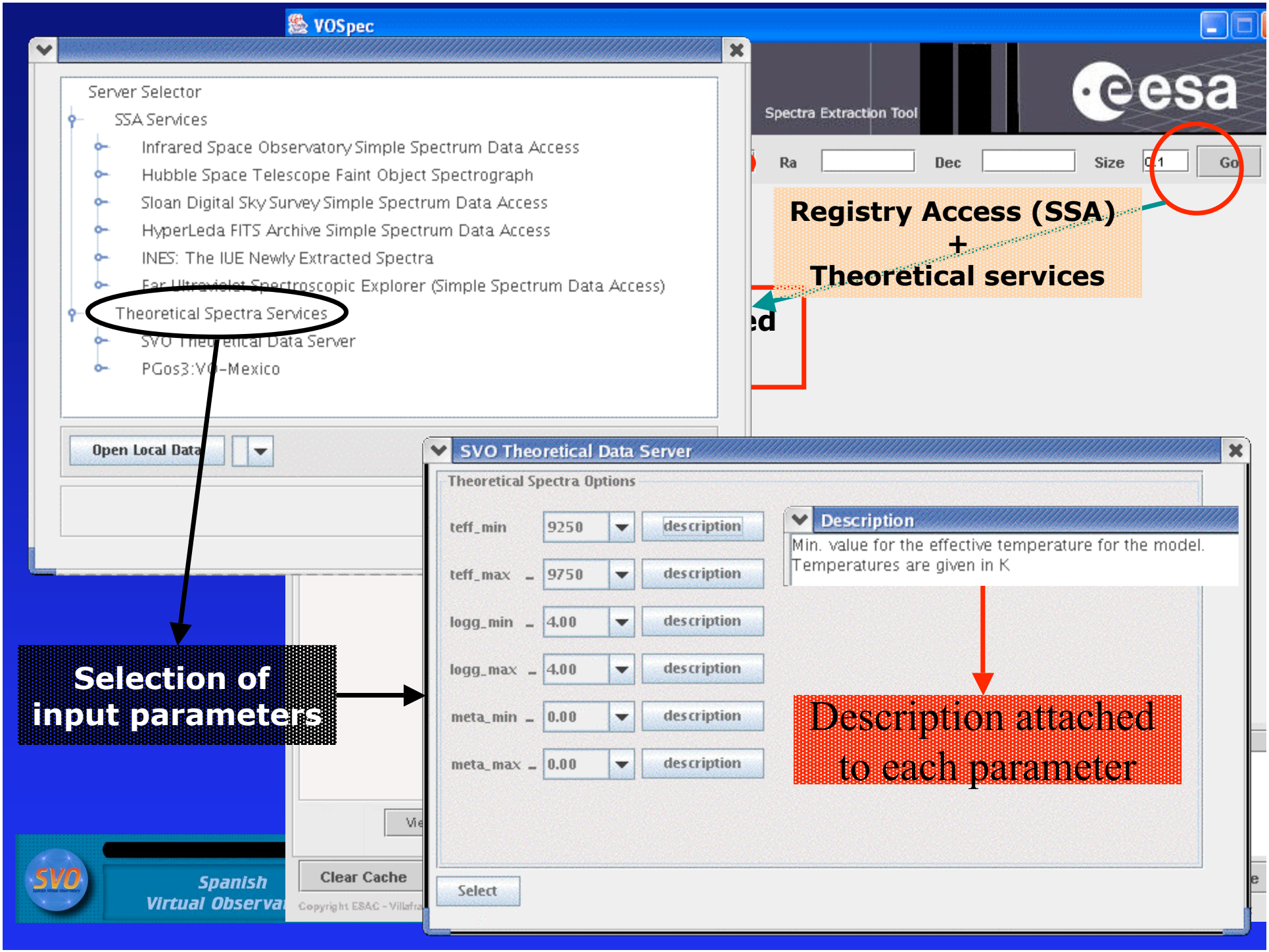
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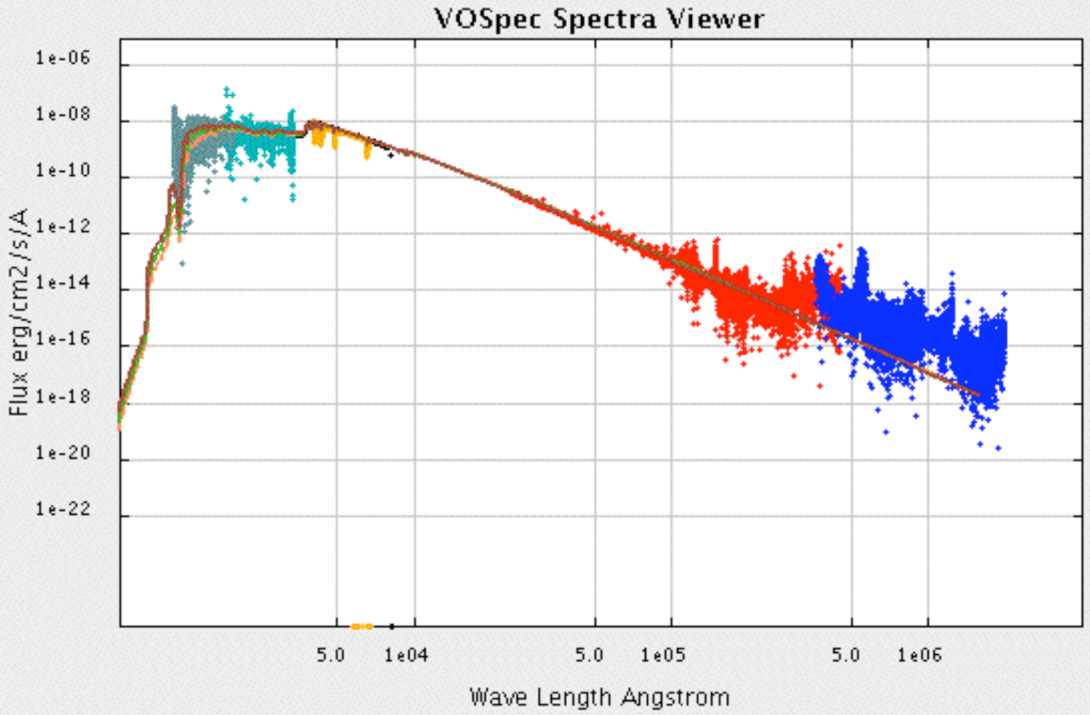

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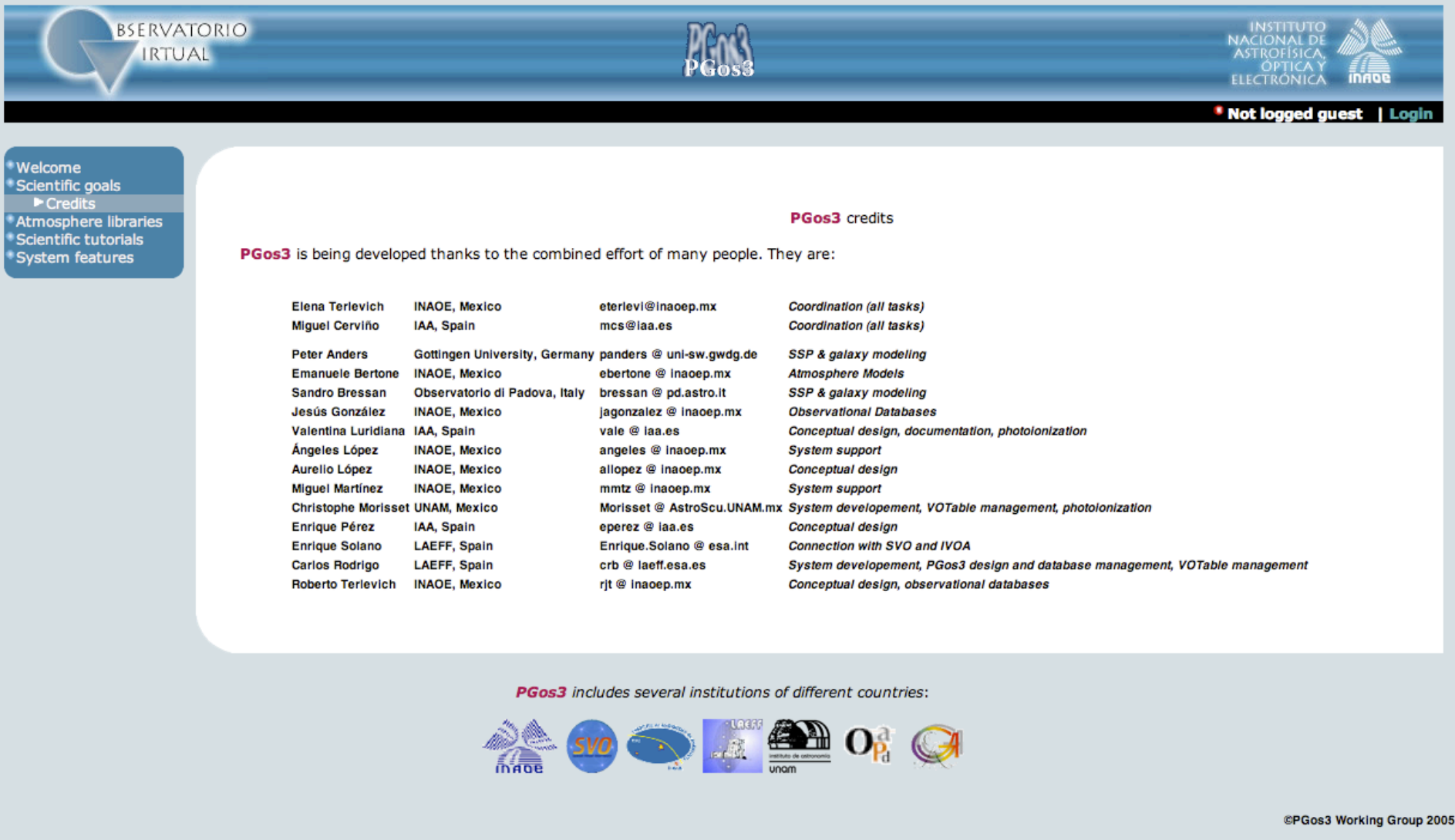
Application II: PGos3

VSF Legacy Tool

PGos3

- Federative project that plans to include public codes related to the modelling of stellar populations in galaxies.
- Beta version. The development and implementation phase began in July 2004 during the Guillermo Haro Workshop: "Violent Star Formation and the Legacy Tool" held at INAOE, Mexico.

Application II: PGos3 (http://ov.inaoep.mx)



PGos3 in the VO framework

➲ PGos3 is a very valuable tool in the VO context:

➢ 'Star Formation Histories in Galaxies' was the extragalactic Science Case chosen for the AVO-Demo 2005. This involves retrieving multiwavelength datasets that are then compared against stellar spectral evolution codes, to enable information to be derived on galaxy star formation histories.

➲ The Spanish Virtual Observatory is adapting PGos3 to the VO standards and requirements.

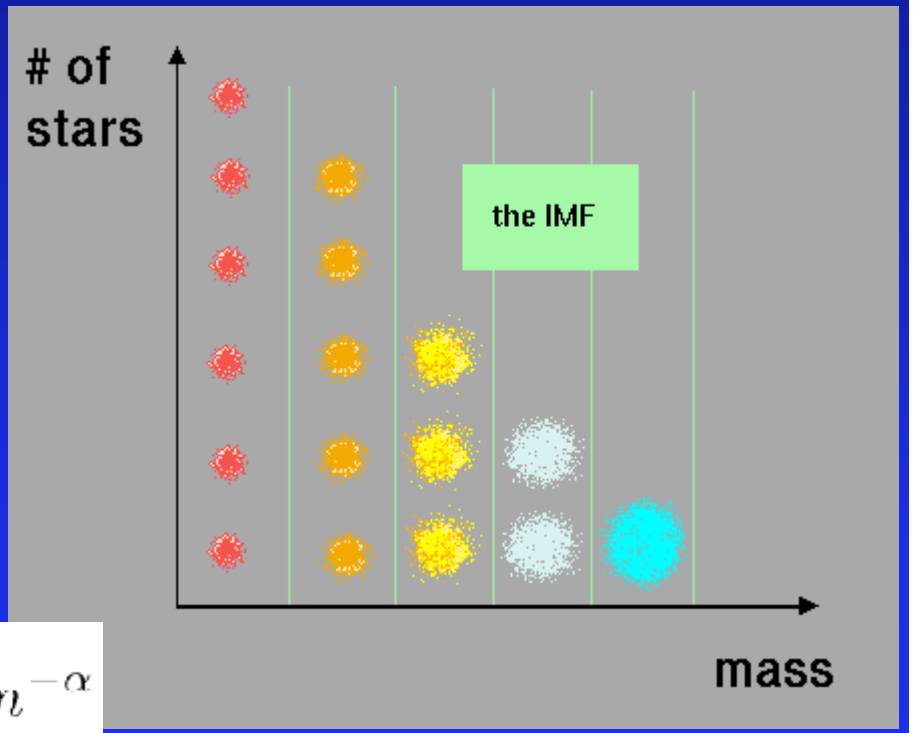
The evolutionary synthesis models

- Definition: a model of the expected emission of a stellar population defined as the sum of the emission of the individual stars.

- The building blocks:

  - ***Initial Mass Function*** **(IMF):** the number of stars with different masses to include in the population at t=0.

  - The IMF is often approximated either by a power-law or by a sum of power-laws over different subranges. (e.g. _: 2.35, Salpeter, (1955):

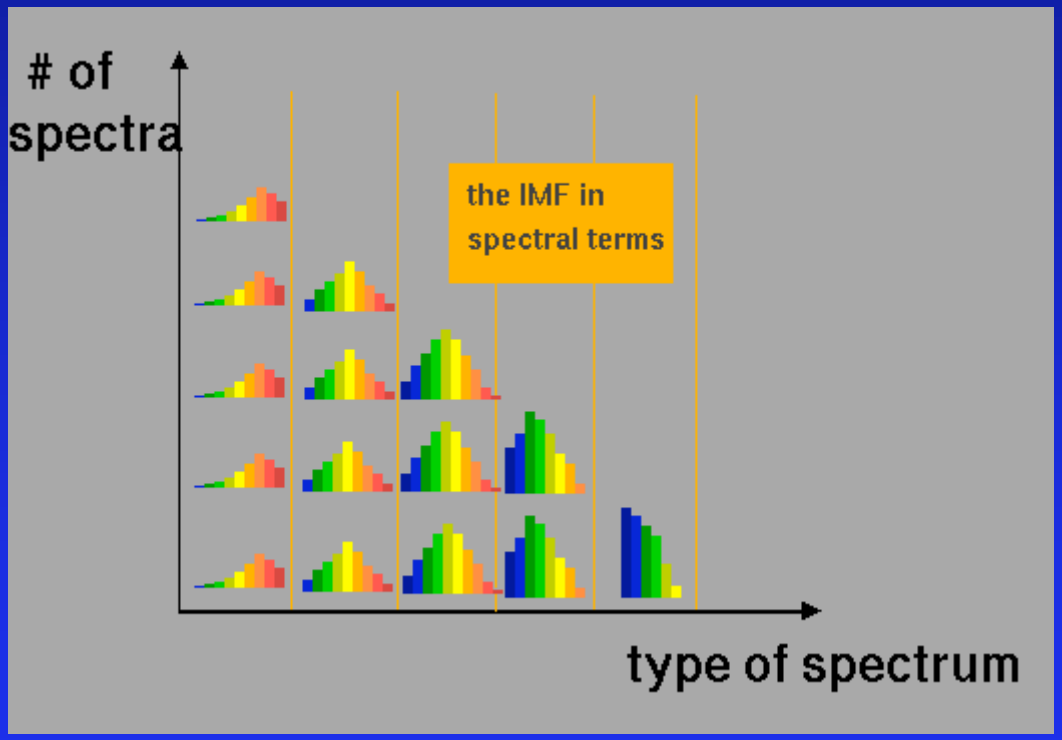


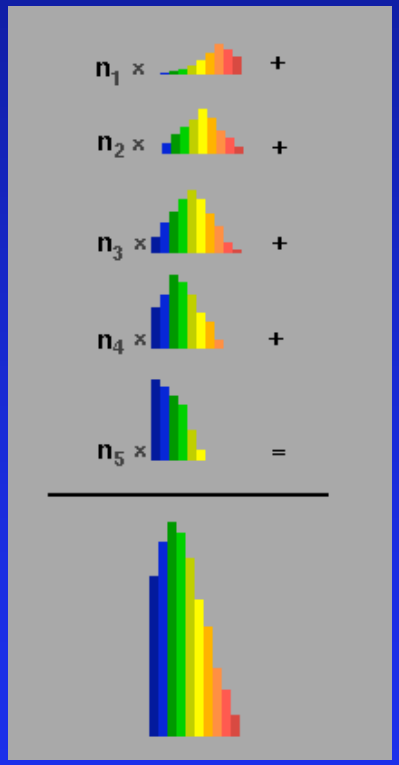
$$\frac{dN}{dm} \propto m^{-\alpha}$$

Evolutionary synthesis models (II)

- The IMF must be translated into spectral information to obtain the population spectrum at t=0.

→ ***Stellar Model Atmospheres***



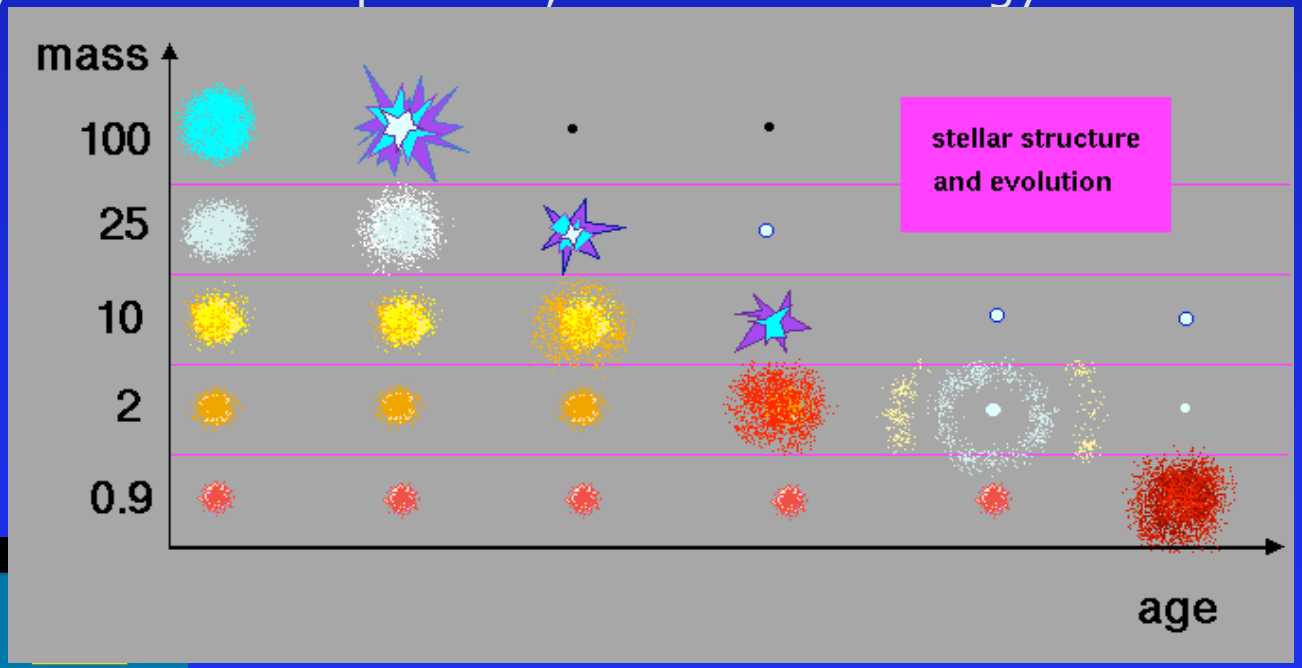


Evolutionary synthesis models (III)

➲ ***Evolutionary tracks:***

➢ To know the total emission at a later time, ageing of the stars must be taken into account.

➢ Each timepoint of an evolutionary track gives information on the stellar structure, that is, the dependence on radius of variables such as temperature, density, chemical composition, and nuclear energy production rate, etc.

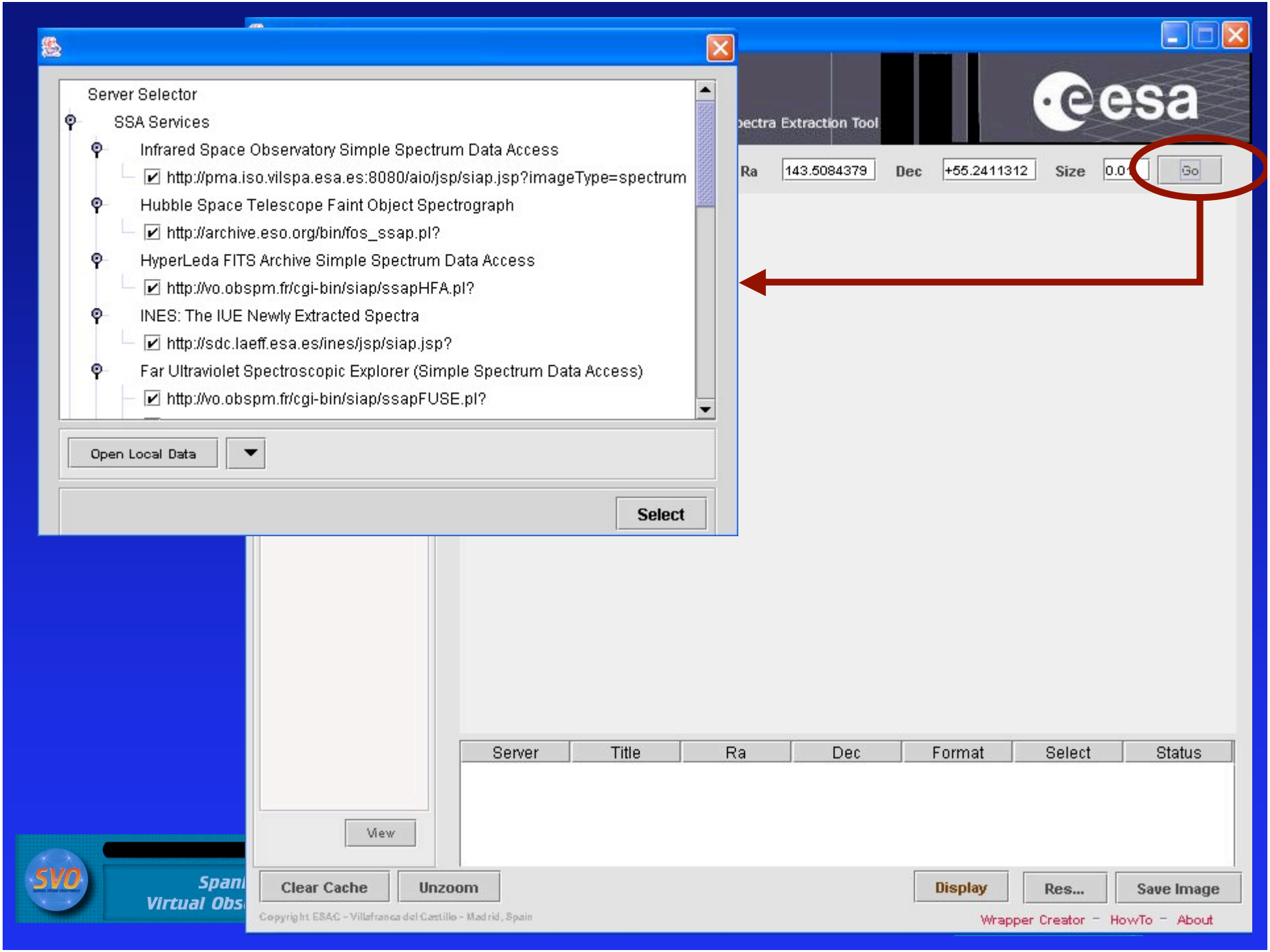


The use case

➲ Comparison between the results given by different grids of evolutionary synthesis models (produced by different developers/groups) with observational data.

➲ The model that best fit for any parameter combination does not exist: (sed@, Starburst99 are optimized for young populations; Bruzual, Pegase for older populations).

➲ Needed to assess the reliability of the scientific conclusions obtained from the models.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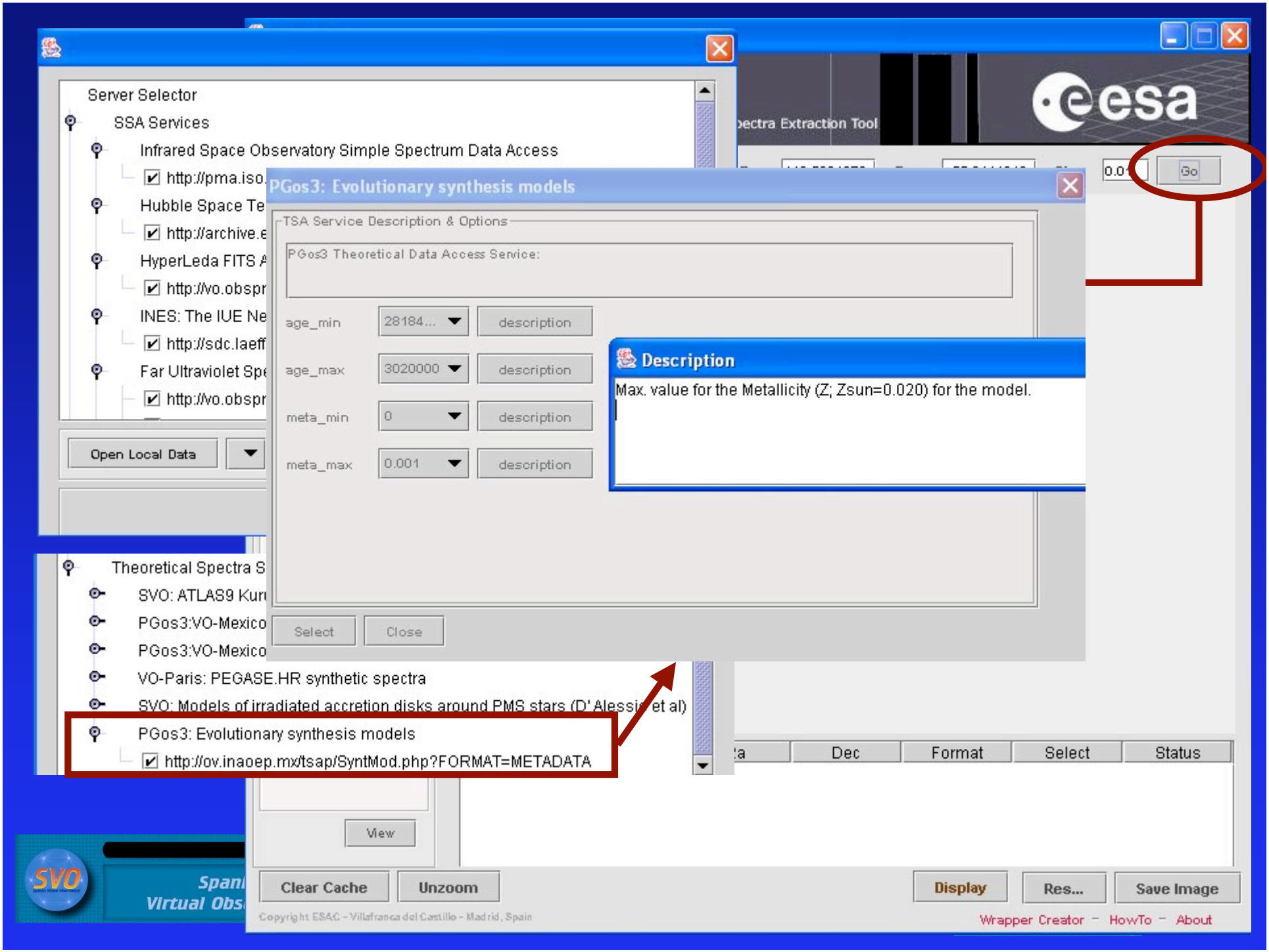
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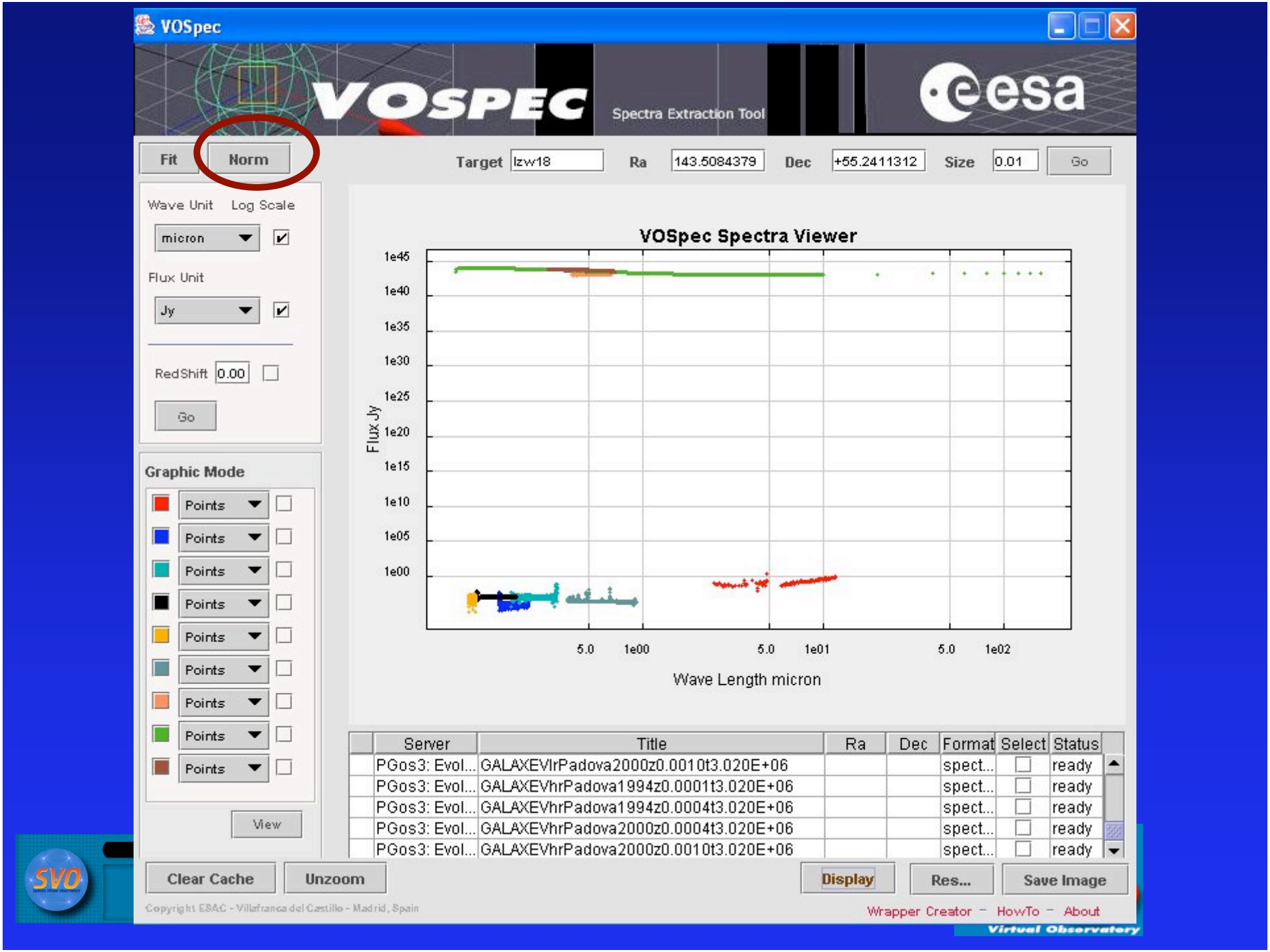
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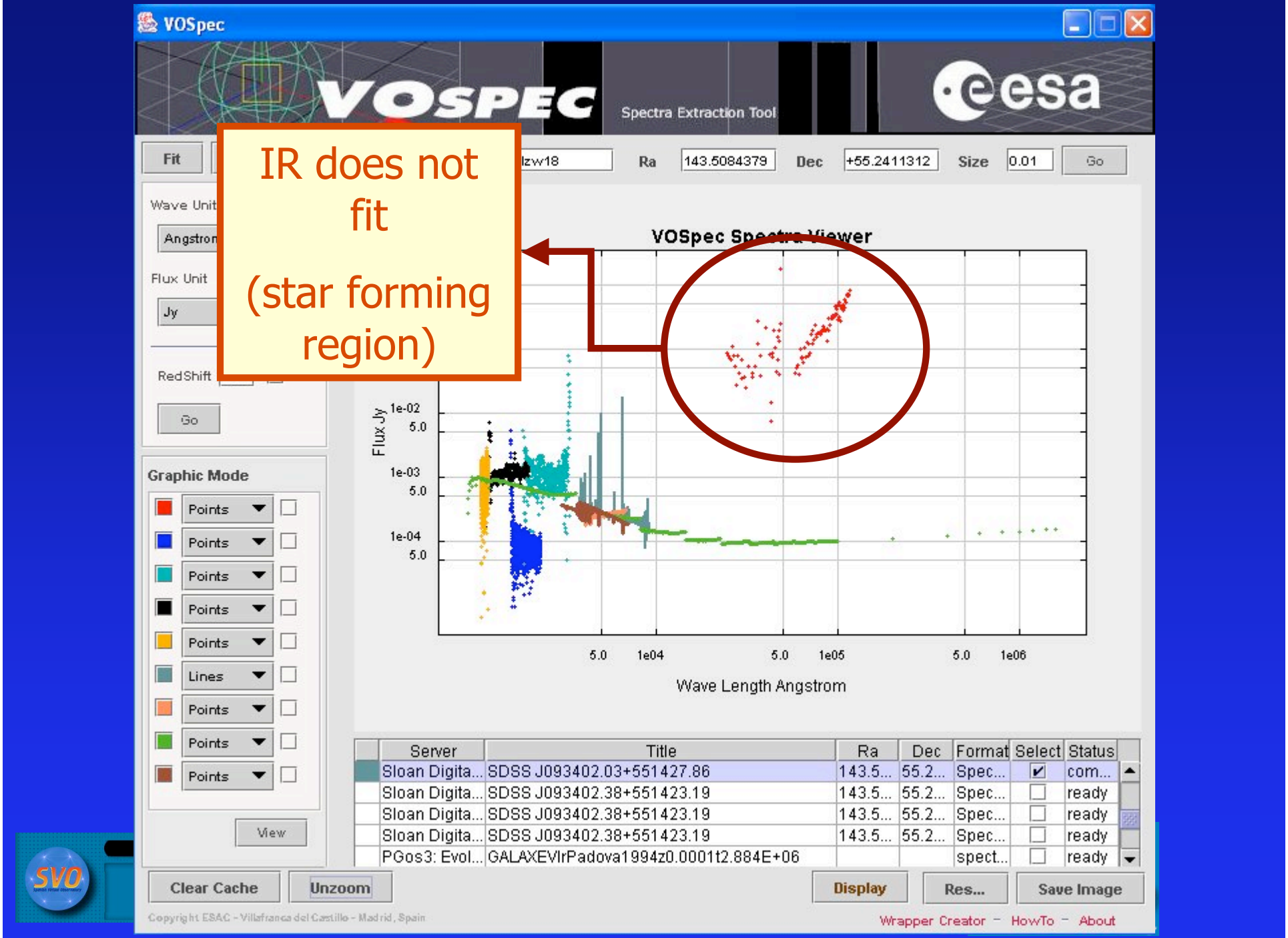
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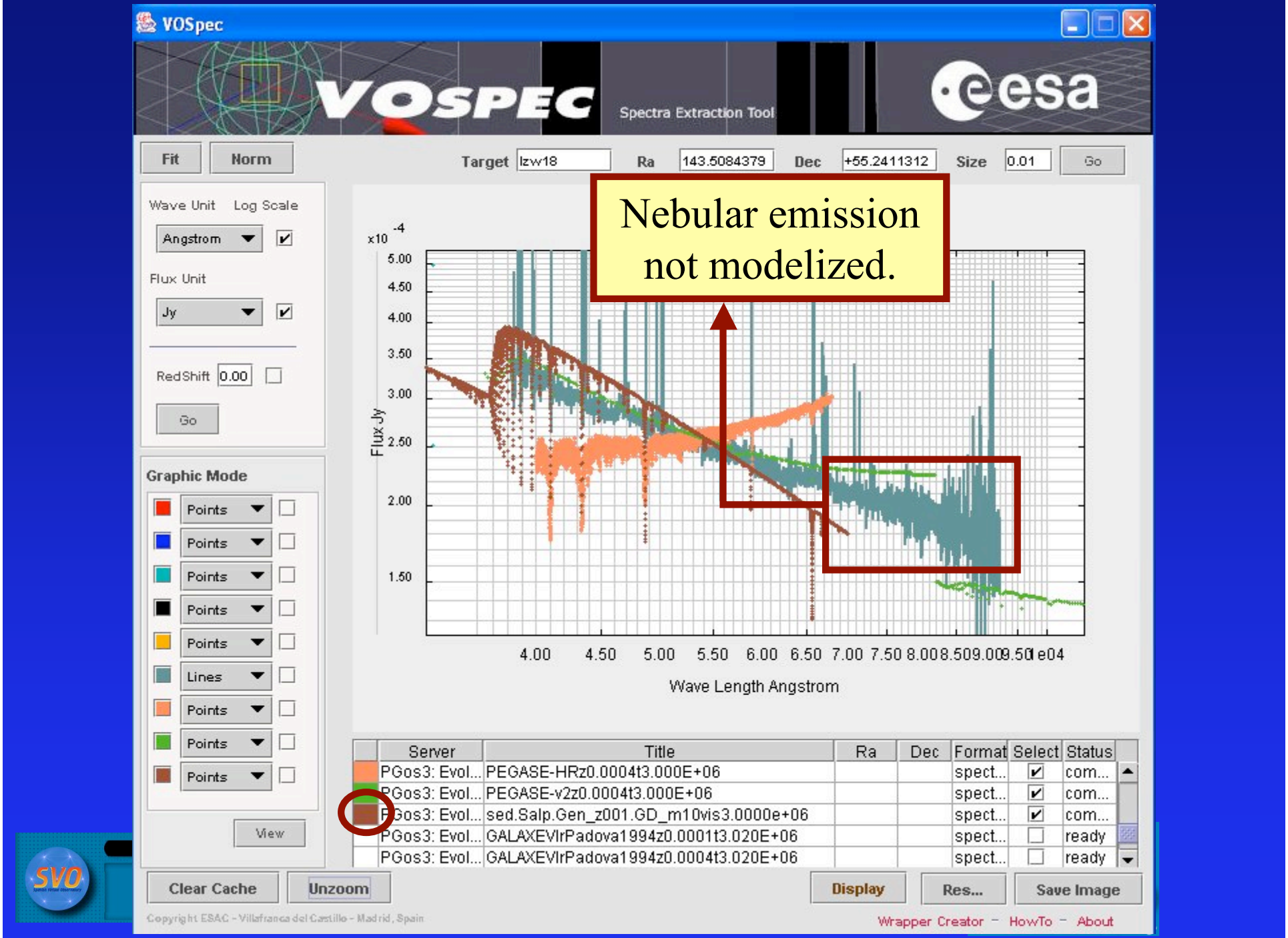
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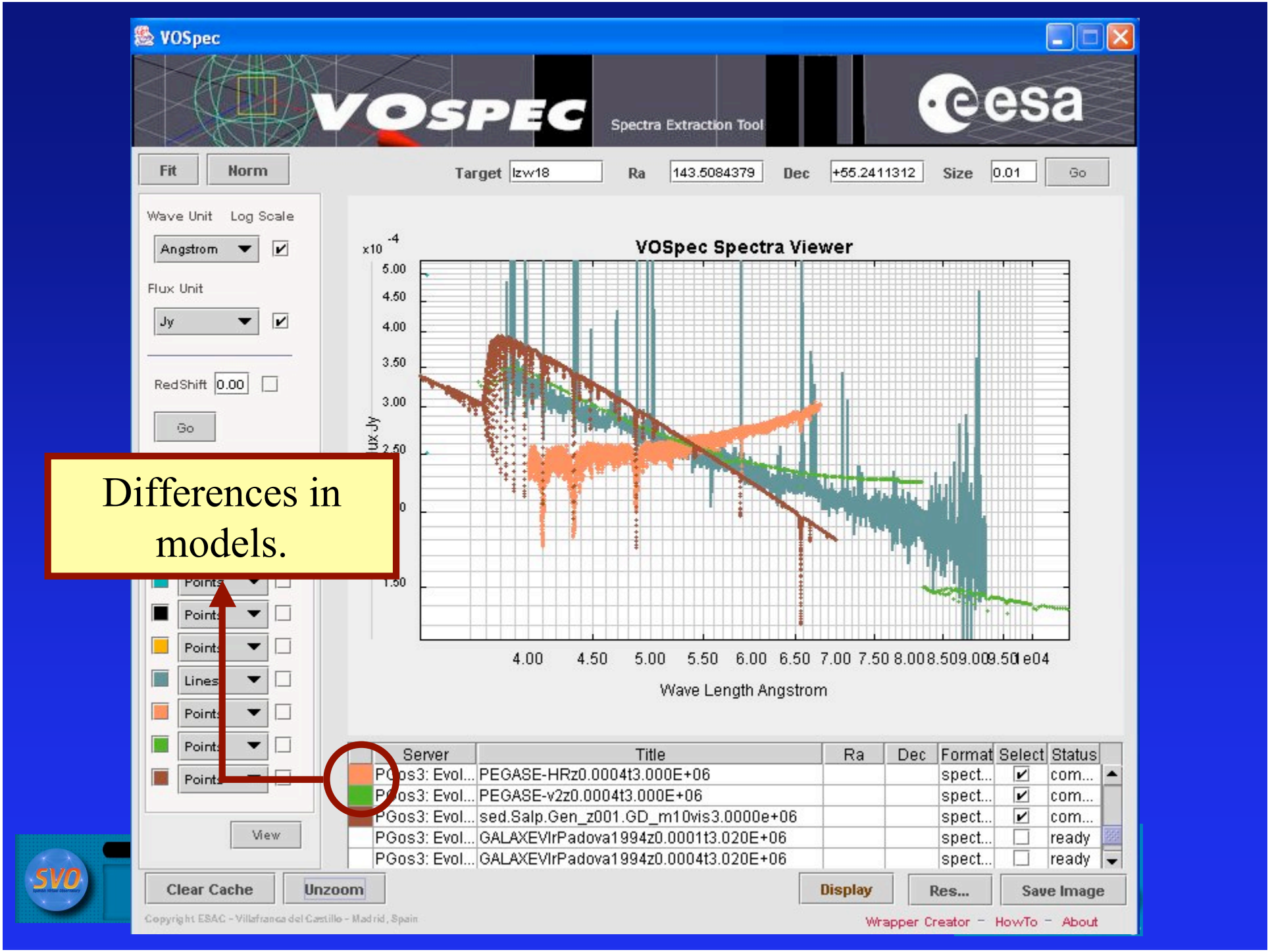
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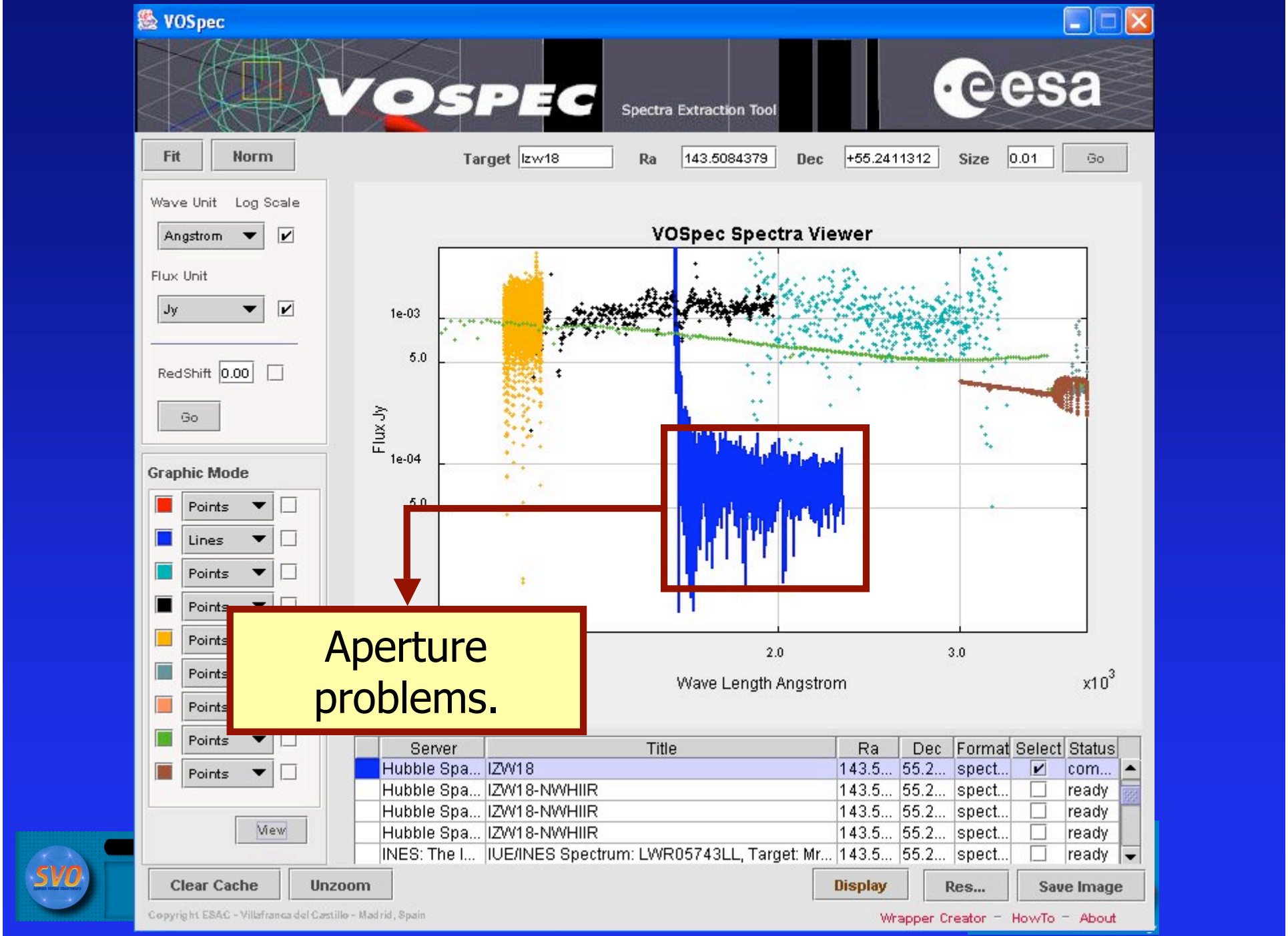
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Conclusions

- Something simple like TSAP allows:

  ✓ Quality control of theoretical models (a general problem).

  ✓ Help to make more efficient science.

Open questions for discussion

- Tool refinement/improvement is necessary for this specific use case:
  - ✓ Extinction in the UV
  - ✓ Vacuum / Air wavelengths
  - ✓ Fitting (VOSpec only rescales at present)

"The service returns a VOTable with the results..." Consider returning this table to a VOStore. This lets the derivation of the table run asynchronously from VOSpec, which may be useful if the model has to be recomputed to produce the result. Note that VOspec and similar applications can get to the storage via the AstroGrid Client Runtime.

-- GuyRixon - 04 Oct 2005

- How to evaluate if the resulting model (final product of a mathematical algorithm) has a physical meaning? Use of cautions, warnings etc...?