S3: Simple Self-described Service

A simple access protocol for microphysics simulations

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Outline

Requirements: Simplicity.

- A microphysics model is often developed by
  - **a small team.**
  - **focused on science, not computing.**
- They want to make their model available in the VO, but probably
  - not to study long and complex protocol definitions.
  - not to invest much time (or people) in developing a complex service.

Requirements: Simplicity.

$\Rightarrow$ Simplicity.

- The simpler the development of the service is, the more people will be willing to implement it $\Rightarrow$ more theoretical models in the VO.

Requirements: Self-described data

- **A theoretical model:**
  - Is not related with a real object or with spatial coordinates.
  - Is defined by a set of parameters and the allowed values for each of them.
  - Those parameters and values are not the same for different models.
  - Even models describing similar physics are often characterized using different types of parameters.
- We need **Flexibility**.

Flexibility: Self-described data.

Self-described data.

- The server offering the model must describe itself as clearly as possible.
  - What kind of model is being offered.
  - What parameters characterize the model (what kind of queries can be done).
  - What is the physical meaning of those parameters.
  - What kind of results can be retrieved.
- The protocol must explain how a application/user can:
  - obtain that self-description in a standardized way.
  - build viable queries to the server.

S3 protocol

- Dialog between the application and the model server.
- The server must be able to answer three questions:
  - Which parameters define this model, and what values are allowed for each of them?
  - Which files are available for a given range of those parameters?
  - Give me a particular file.
- Each answer is just a VOTable document (XML)

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S3 protocol

The query

http://www.../.../s3p.php?format=metadata

- Dialog between the application and the model server.
- The se
  - W
    all
    - W
      pa
    - Gi
- Each a

The answer

```
<VOTABLE version="1.1">
  <RESOURCE type="meta">
    <DESCRIPTION>
      Theoretical Isochrones for the MyModel model.
    </DESCRIPTION>

    <PARAM name="INPUT:age" ucd="phys.age" unit="Gyr">
      <DESCRIPTION>
        Age of the star in Gyr.
      </DESCRIPTION>
    </PARAM>

    <PARAM name="INPUT:metallicity" ucd="..." unit=>
      <DESCRIPTION>
        Metallicity of the star defined as Fe/H
      </DESCRIPTION>
    </PARAM>

  </RESOURCE>
</VOTABLE>
```

S3 protocol

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S3 protocol

The query

http://www.../.../s3p.php?age=0/10&metallicity=0,1

- Dialog between the application and the model server.
- The se
  - W
    all
  - W
    pa
  - Gi
- Each a

The answer

```
<VOTABLE version="1.1">
  <INFO name="QUERY_STATUS" value="OK"/>
  <RESOURCE type="results">
    ...
    <TABLE>
      <FIELD NAME="age"/>
      <FIELD NAME="metallicity"/>
      <FIELD NAME="link"/>
      <TABLEDATA>
        <TR>
          <TD>1</TD>
          <TD>0</TD>
          <TD><![CDATA[http://myservice.com/s3.php?id=12]]></TD>
        </TR>
        <TR>
          <TD>3</TD>
          <TD>0.5</TD>
          <TD><![CDATA[http://myservice.com/s3.php?id=23]]></TD>
        </TR>
        ...
      </TABLEDATA>
    </TABLE>
  </RESOURCE>
</VOTABLE>
```

S3 protocol

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S3 protocol

The query

http://www.../.../s3p.php?id=12

- Dialog between the application and the model server.
- The se
  - W
    all
  - W
    pa
  - Gi
- Each a

The answer

```
<VOTABLE version="1.1">
  <INFO name="QUERY_STATUS" value="OK"/>
  <RESOURCE type="results">
    <DESCRIPTION>
      Theoretical Isochrone for the MyModel model.
    </DESCRIPTION>
    <PARAM name="age" ucd="phys.age" unit="Gyr" value="1" />
    <PARAM name="metallicity" ucd="..." unit="" value="0" />
    <TABLE>
      <FIELD name="t" ucd="time.age" unit="Gyr" datatype="float" />
      <FIELD name="M" ucd="phys.mass" unit="" datatype="float" />
      <FIELD name="teff" ucd="phys.temperature.effective" unit="K" datatype="int" />
      <FIELD name="Logg" ucd="phys.gravity" unit="" datatype="float" />
      <FIELD name="Lum" ucd="phys.luminosity" unit="" datatype="float" />
      <TABLEDATA>
        <TR>
          <TD>0.001</TD>
          <TD>0.0005</TD>
          <TD>628</TD>
          <TD>2.645</TD>
          <TD>4.2658e-06</TD>
        </TR>
        <TR>
          <TD>0.001</TD>
          <TD>0.0010</TD>
          <TD>942</TD>
          <TD>2.996</TD>
          <TD>1.92752e-05</TD>
        </TR>
        ....
```

S3 protocol

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IVOA Note

International Virtual Observatory Alliance

IVOA Documents

S3: Proposal for a simple protocol to handle theoretical data (microsimulations)
Version 1.00

IVOA Note 15 October 2008

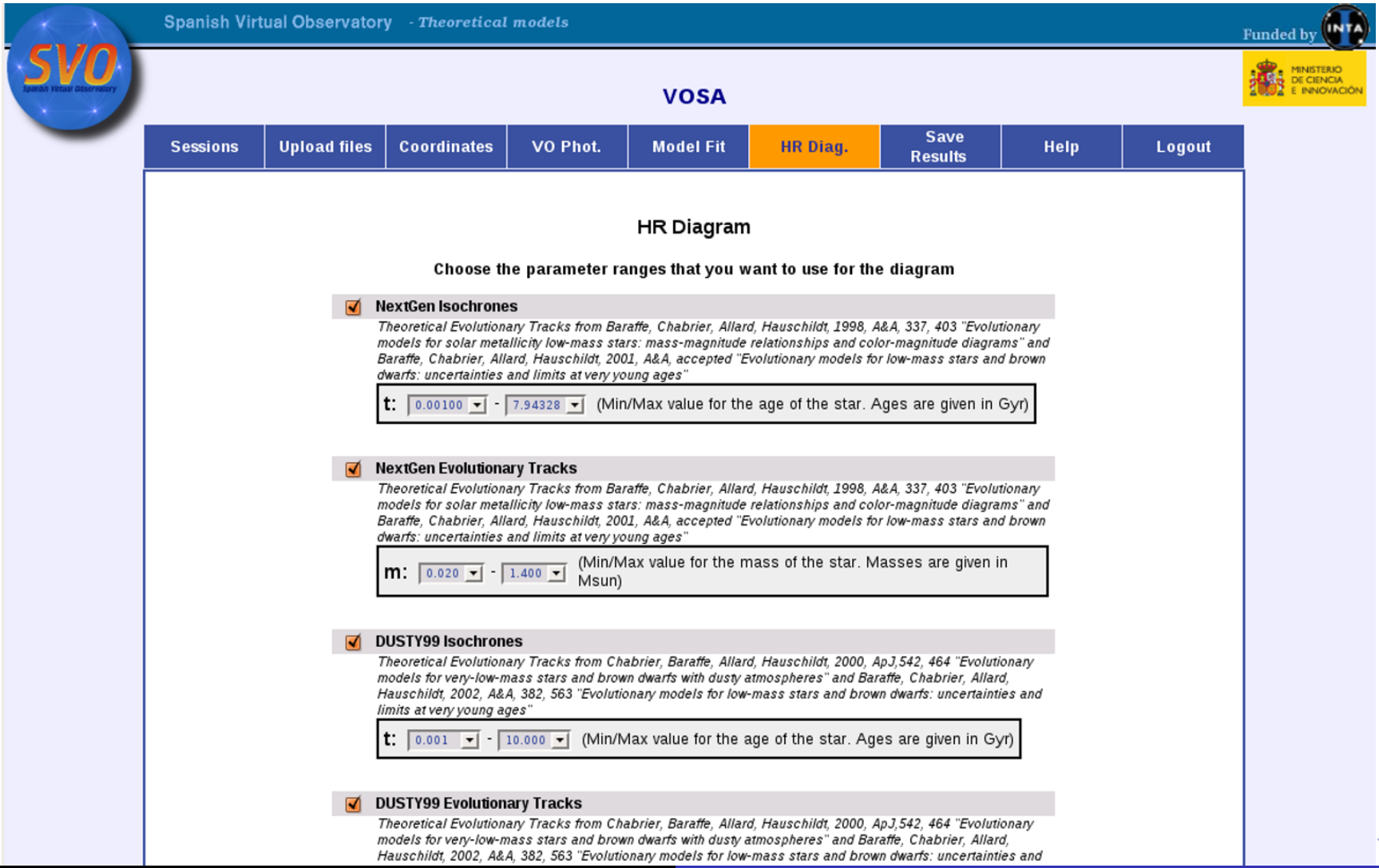
Interest/Working Group:
Theory Interest Group
Author(s):
Carlos Rodrigo, Miguel Cerviño, Enrique Solano, Patrizia Manzato
Editor(s):
Carlos Rodrigo, Enrique Solano

Abstract

A working approach

- Isochrones/evolutionary tracks servers.
  - Spanish VO: NextGen, COND, DUSTY, Siess.
  - Italian VO: BATSI.
  - An application using some services to compare with user data (*iDraw*)
- A service offering synthetic photometry corresponding to 4 collections of models and more than 50 different filters.
  - An application using the service to infer physical parameters from observed data (*VOSA*).
  - Useful for science (*Bayo et al, A&A 2008, in press*).
- TSAP: a similar approach for the case of theoretical spectra.
  - Included as a use case in the SSAP standard.

VOSA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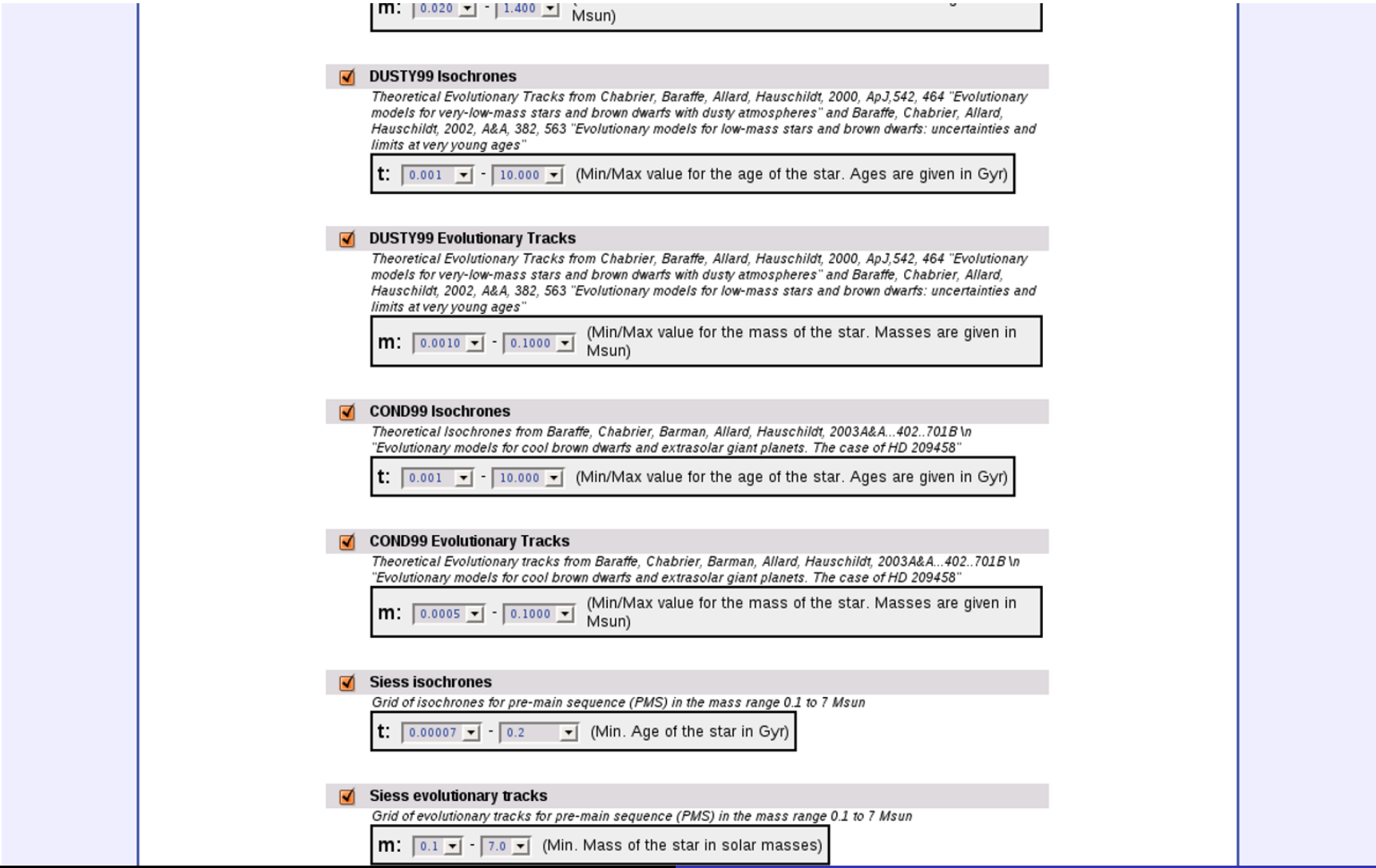
VOSA
Sessions
Upload files
Coordinates
VO Phot.
Model Fit
HR Diag.
Save Results
Help
Logout
HR Diagram
Choose the parameter ranges that you want to use for the diagram
NextGen Isochrones
Theoretical Evolutionary Tracks from Baraffe, Chabrier, Allard, Hauschildt, 1998, A&A, 337, 403 "Evolutionary models for solar metallicity low-mass stars: mass-magnitude relationships and color-magnitude diagrams" and Baraffe, Chabrier, Allard, Hauschildt, 2001, A&A, accepted "Evolutionary models for low-mass stars and brown dwarfs: uncertainties and limits at very young ages"
t: 0.00100 - 7.94328 (Min/Max value for the age of the star. Ages are given in Gyr)
NextGen Evolutionary Tracks
Theoretical Evolutionary Tracks from Baraffe, Chabrier, Allard, Hauschildt, 1998, A&A, 337, 403 "Evolutionary models for solar metallicity low-mass stars: mass-magnitude relationships and color-magnitude diagrams" and Baraffe, Chabrier, Allard, Hauschildt, 2001, A&A, accepted "Evolutionary models for low-mass stars and brown dwarfs: uncertainties and limits at very young ages"
m: 0.020 - 1.400 (Min/Max value for the mass of the star. Masses are given in Msun)
DUSTY99 Isochrones
Theoretical Evolutionary Tracks from Chabrier, Baraffe, Allard, Hauschildt, 2000, ApJ,542, 464 "Evolutionary models for very-low-mass stars and brown dwarfs with dusty atmospheres" and Baraffe, Chabrier, Allard, Hauschildt, 2002, A&A, 382, 563 "Evolutionary models for low-mass stars and brown dwarfs: uncertainties and limits at very young ages"
t: 0.001 - 10.000 (Min/Max value for the age of the star. Ages are given in Gyr)
DUSTY99 Evolutionary Tracks
Theoretical Evolutionary Tracks from Chabrier, Baraffe, Allard, Hauschildt, 2000, ApJ,542, 464 "Evolutionary models for very-low-mass stars and brown dwarfs with dusty atmospheres" and Baraffe, Chabrier, Allard, Hauschildt, 2002, A&A, 382, 563 "Evolutionary models for low-mass stars and brown dwarfs: uncertainties and

VOSA


m: 0.020 - 1.400 Msun)
DUSTY99 Isochrones
Theoretical Evolutionary Tracks from Chabrier, Baraffe, Allard, Hauschildt, 2000, ApJ,542, 464 "Evolutionary models for very-low-mass stars and brown dwarfs with dusty atmospheres" and Baraffe, Chabrier, Allard, Hauschildt, 2002, A&A, 382, 563 "Evolutionary models for low-mass stars and brown dwarfs: uncertainties and limits at very young ages"
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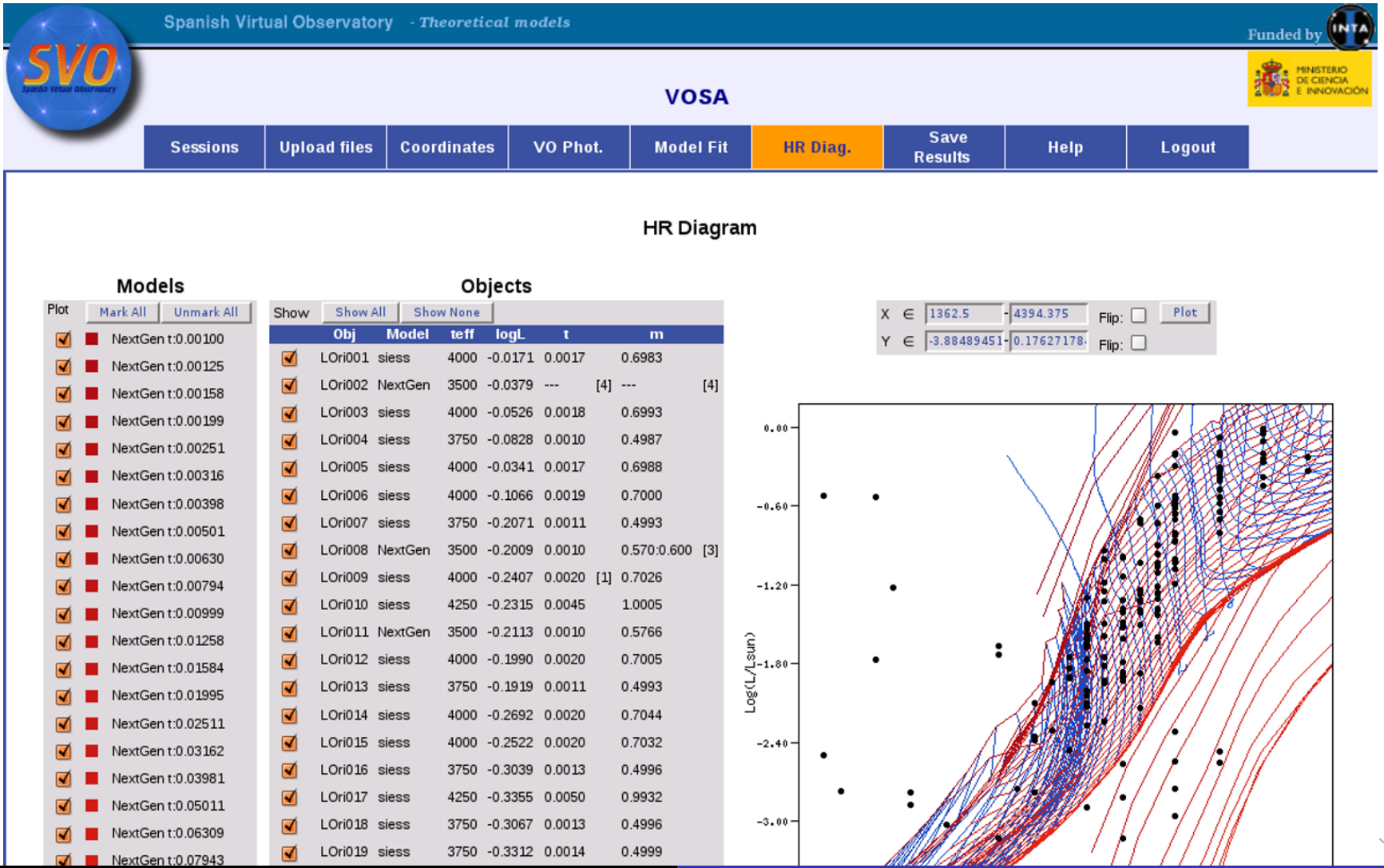
m: 0.0010 - 0.1000 (Min/Max value for the mass of the star. Masses are given in Msun)
COND99 Isochrones
Theoretical Isochrones from Baraffe, Chabrier, Barman, Allard, Hauschildt, 2003A&A...402..701B \n "Evolutionary models for cool brown dwarfs and extrasolar giant planets. The case of HD 209458"
t: 0.001 - 10.000 (Min/Max value for the age of the star. Ages are given in Gyr)
COND99 Evolutionary Tracks
Theoretical Evolutionary tracks from Baraffe, Chabrier, Barman, Allard, Hauschildt, 2003A&A...402..701B \n "Evolutionary models for cool brown dwarfs and extrasolar giant planets. The case of HD 209458"
m: 0.0005 - 0.1000 (Min/Max value for the mass of the star. Masses are given in Msun)
Siess isochrones
Grid of isochrones for pre-main sequence (PMS) in the mass range 0.1 to 7 Msun
t: 0.00007 - 0.2 (Min. Age of the star in Gyr)
Siess evolutionary tracks
Grid of evolutionary tracks for pre-main sequence (PMS) in the mass range 0.1 to 7 Msun
m: 0.1 - 7.0 (Min. Mass of the star in solar masses)

VOSA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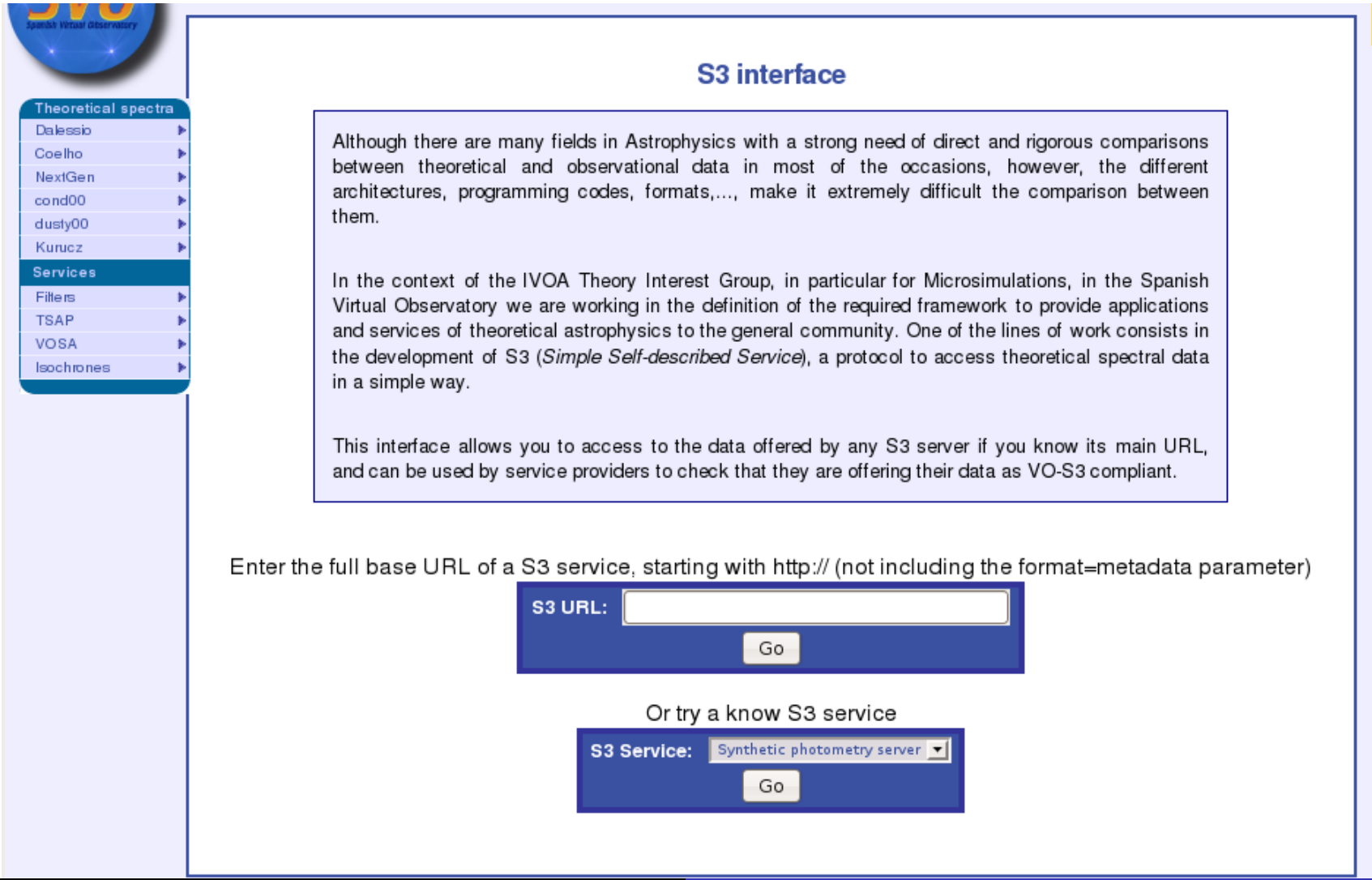
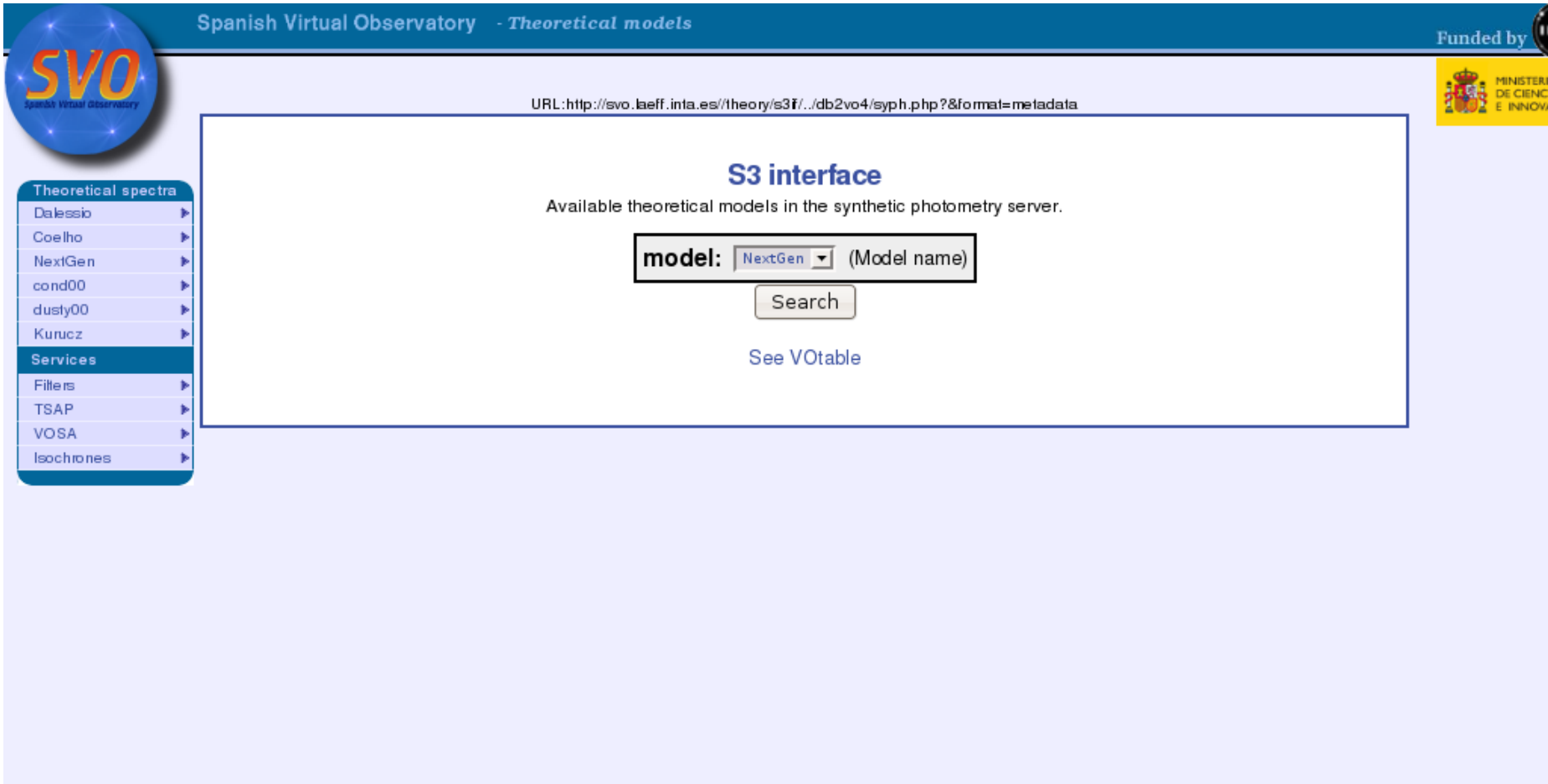
VOSA
Sessions
Upload files
Coordinates
VO Phot.
Model Fit
HR Diag.
Save Results
Help
Logout
HR Diagram
Models
Plot
Mark All
Unmark All
NextGen t:0.00100
NextGen t:0.00125
NextGen t:0.00158
NextGen t:0.00199
NextGen t:0.00251
NextGen t:0.00316
NextGen t:0.00398
NextGen t:0.00501
NextGen t:0.00630
NextGen t:0.00794
NextGen t:0.00999
NextGen t:0.01258
NextGen t:0.01584
NextGen t:0.01995
NextGen t:0.02511
NextGen t:0.03162
NextGen t:0.03981
NextGen t:0.05011
NextGen t:0.06309
NextGen t:0.07943
Objects
Show
Show All
Show None
Obj Model teff logL t m
LOri001 siess 4000 -0.0171 0.0017 0.6983
LOri002 NextGen 3500 -0.0379 --- [4] --- [4]
LOri003 siess 4000 -0.0526 0.0018 0.6993
LOri004 siess 3750 -0.0828 0.0010 0.4987
LOri005 siess 4000 -0.0341 0.0017 0.6988
LOri006 siess 4000 -0.1066 0.0019 0.7000
LOri007 siess 3750 -0.2071 0.0011 0.4993
LOri008 NextGen 3500 -0.2009 0.0010 0.570:0.600 [3]
LOri009 siess 4000 -0.2407 0.0020 [1] 0.7026
LOri010 siess 4250 -0.2315 0.0045 1.0005
LOri011 NextGen 3500 -0.2113 0.0010 0.5766
LOri012 siess 4000 -0.1990 0.0020 0.7005
LOri013 siess 3750 -0.1919 0.0011 0.4993
LOri014 siess 4000 -0.2692 0.0020 0.7044
LOri015 siess 4000 -0.2522 0.0020 0.7032
LOri016 siess 3750 -0.3039 0.0013 0.4996
LOri017 siess 4250 -0.3355 0.0050 0.9932
LOri018 siess 3750 -0.3067 0.0013 0.4996
LOri019 siess 3750 -0.3312 0.0014 0.4999
X ∈ 1362.5 - 4394.375 Flip: Plot
Y ∈ -3.88489451 - 0.17627178 Flip:
0.00
-0.60
-1.20
-1.80
-2.40
-3.00
Log(L/Lsun)

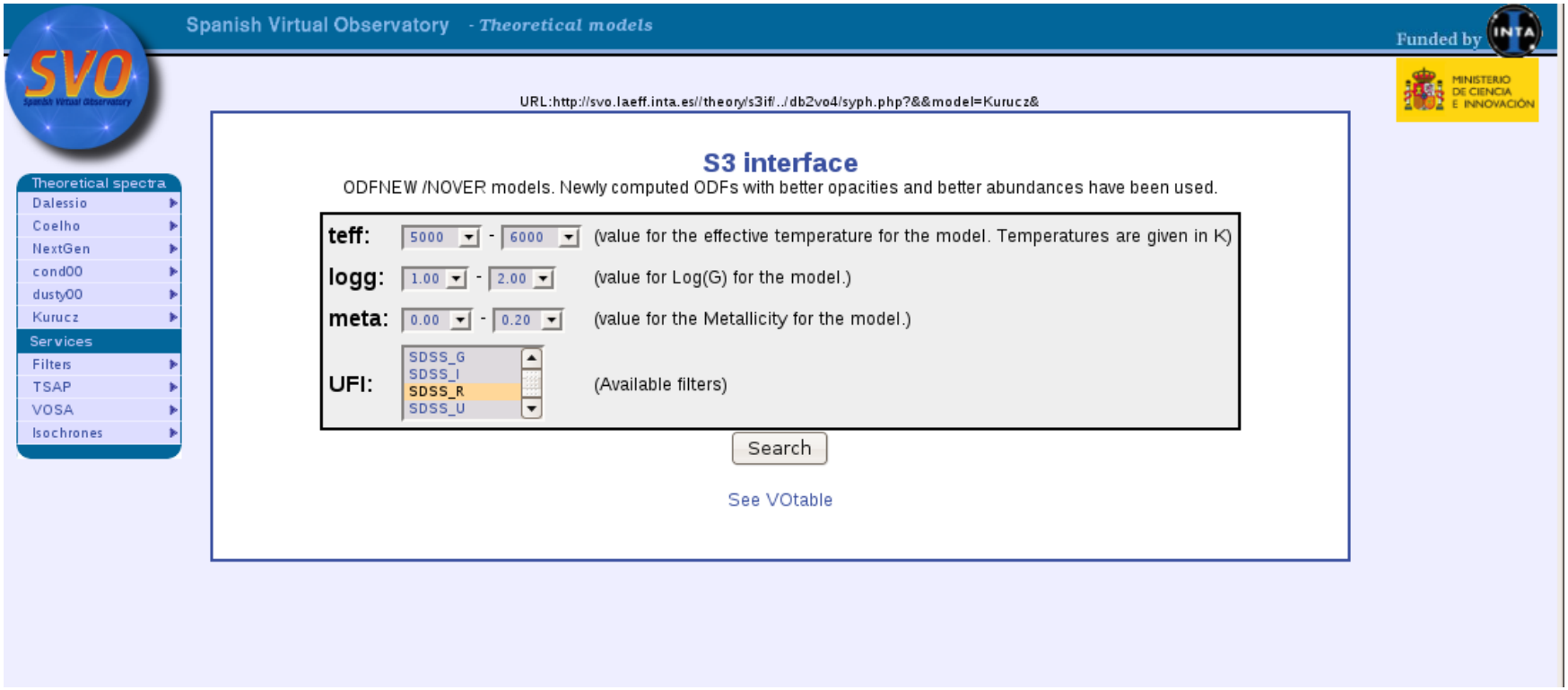
S3 interface



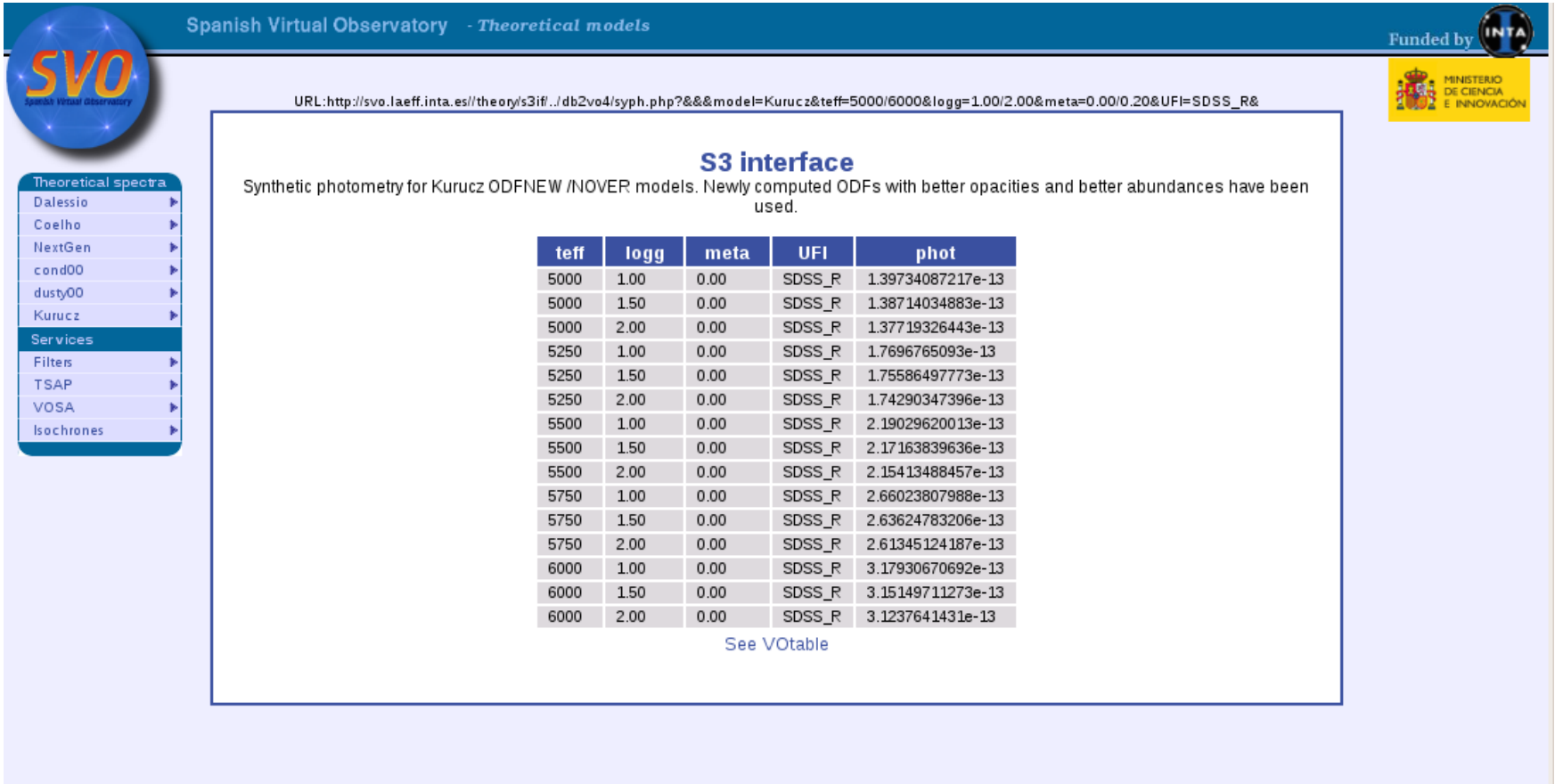
S3 interface



S3 interface



S3 interface



S3wizard

- A wizard that helps to build a VO service for a theoretical model.
- Two inputs are needed
  - A set of ascii files containing the data corresponding to each model.
  - An ascii file with the name of every data file and the values of the parameters that characterize each file.
  - (User inputs about the meaning of parameters, data columns, curation, credits... All by a web interface.)
- The application builds:
  - The database
  - A web page with forms to download files in ascii and votable formats.
  - A VO service able to answer the three types of S3 queries.

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S3wizard

S3 Wizard

Siess et al isochrones

Models
* New Model
* siess
* siesst

Config
* Admin User
* DB config
* About
* Logout

Model | Read File | Params | Data | Curation | Credits | Delete

In order to build a VO service with your model data, some more information is necessary to describe the parameters in a useful way.

Please, try to fill in the following form as much as posible

Name [?]	Type [?]	Unit [?]	UCD [?]	Title [?]	Description [?]
t	float	Gyr	phys.age	Age	Age of the star in Gyr

Save Params

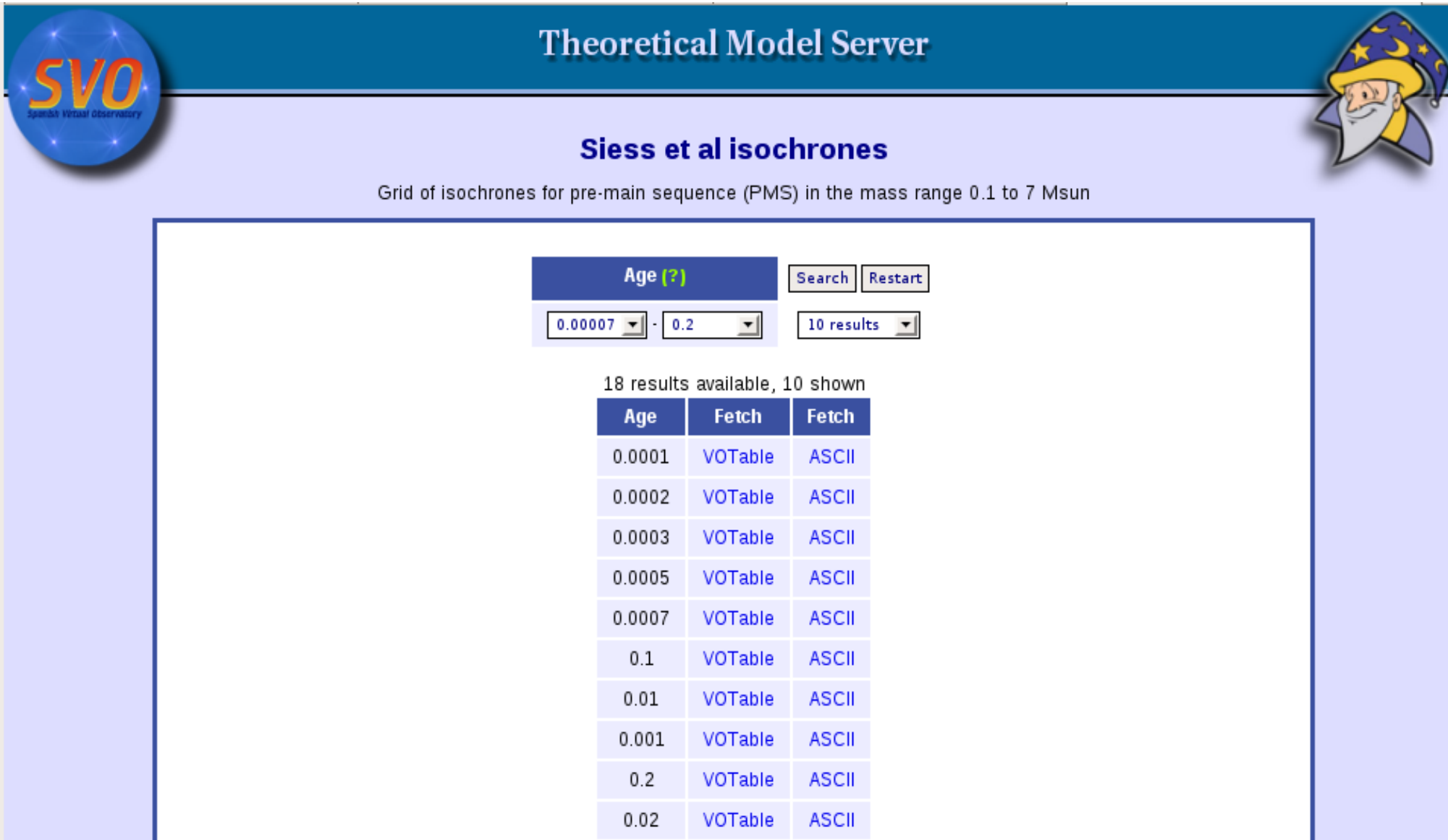
S3wizard

Theoretical Model Server

Available Models

- **Siess et al isochrones**:
  Grid of isochrones for pre-main sequence (PMS) in the mass range 0.1 to 7 Msun
- **Siess et al evolutionary tracks**:
  Grid of evolutionary tracks for pre-main sequence (PMS) in the mass range 0.1 to 7 Msun

S3wizard


Theoretical Model Server
Siess et al isochrones
Grid of isochrones for pre-main sequence (PMS) in the mass range 0.1 to 7 Msun
Age (?)
Search
Restart
0.00007
0.2
10 results
18 results available, 10 shown
Age
Fetch
Fetch
0.0001 VOTable ASCII
0.0002 VOTable ASCII
0.0003 VOTable ASCII
0.0005 VOTable ASCII
0.0007 VOTable ASCII
0.1 VOTable ASCII
0.01 VOTable ASCII
0.001 VOTable ASCII
0.2 VOTable ASCII
0.02 VOTable ASCII

Conclusions

- **Flexible**: self-described data.
- **Simple**: http queries + dialog + votable.
  - not discarding more complex protocols where they are needed.
- **Useful**:
  - Developers can make their models available in the VO.
  - Applications can access those models.
- *Something like what ConeSearch is for catalogues:*
  - an easy, fast and effective way to develope a theoretical service in the VO.

THANK YOU!