SimDAL

Implementation feedback

Carlos Rodrigo Blanco[1,2]

[1]CAB,INTA-CSIC
[2]Spanish Virtual Observatory

IVOA interoperability meeting
Cape Town, May 2016

Overview

Introduction: SimDAL

The Simulation Data Access Protocol (SimDAL) is a proposed VO protocol to discover simulations and numerical models and to access data extracted from these simulations in a standardized way.

- IVOA Working Draft 07 September 2015.
- Main authors: David Languignon, Franck Le Petit.
- Time for implementing and feedback.

Introduction: SimDAL

Three components (types of services)

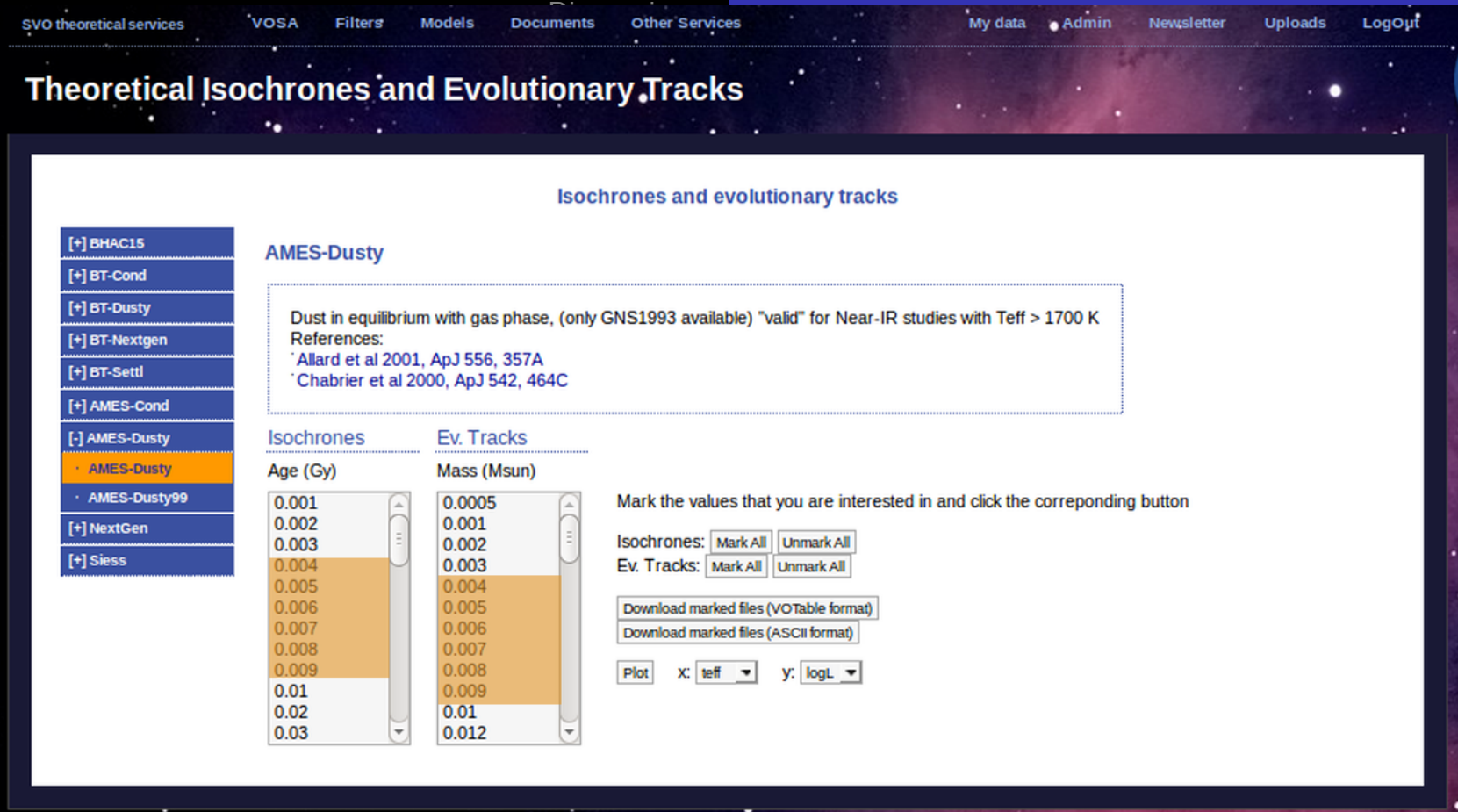
- SimDAL Repository: Discover simulations projects dealing with one's research interest, get related info, and find the associated services.
- SimDAL Search: Dig into one project results, using the relevant parameters for this project, and specifying the desired range of values for these parameters, to find particular datasets.
- SimDAL Data Access: Access the simulation raw dataset(s) or subset of it (cutout) for the results identified in the search.

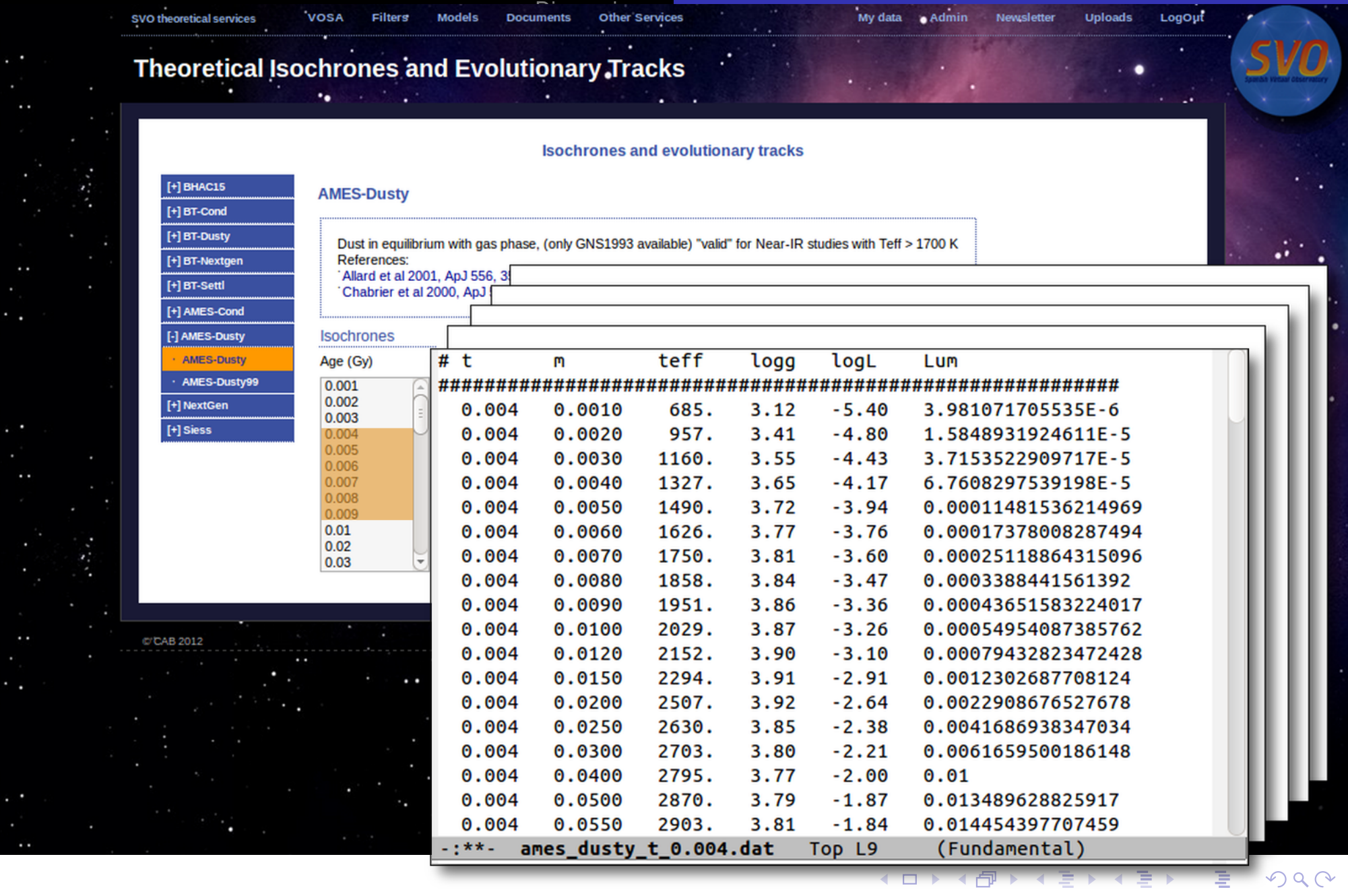
Our use case: grids of theoretical data

- There are many simulations of astrophysical interest that are available as “grids” of data.
- Each point of the “grid” is defined by different values of several parameters. And one data file corresponds to each point of the grid.
  - (T_{eff},logg,metallicity...) for theoretical spectra.
  - (age) from isochrones
  - (mass) for evolutionary tracks
  - etc
- Each data file can be seen as a table with several columns:
  - (λ, flux) for theoretical spectra.
  - (mass, teff, logg, ...) from isochrones
  - (age, teff, logg, ...) for evolutionary tracks
  - etc.

Isochrones and Evol. Tracks implementation

- We implement all the 3 simDAL services (repository, search, and data access) for theoretical isochrones and evolutionary tracks.
  - 48 data collections.
  - Different codes, groups, etc.
  - 1 SimDAL repository
  - 48 SimDAL Search services.
  - 96 SimDAL DataAccess services.
  - Isochrones: identified by age (t parameter).
  - Tracks: identified by mass (m parameter).
  - Data files provide t,m,teff,logg,logL,Lum data (for constant age or mass).


SVO theoretical services
VOSA
Filters
Models
Documents
Other Services
My data
Admin
Newsletter
Uploads
LogOut
Theoretical Isochrones and Evolutionary Tracks
Isochrones and evolutionary tracks
[+] BHAC15
[+] BT-Cond
[+] BT-Dusty
[+] BT-Nextgen
[+] BT-Settl
[+] AMES-Cond
[-] AMES-Dusty
AMES-Dusty
AMES-Dusty99
[+] NextGen
[+] Siess
AMES-Dusty
Dust in equilibrium with gas phase, (only GNS1993 available) "valid" for Near-IR studies with Teff > 1700 K
References:
Allard et al 2001, ApJ 556, 357A
Chabrier et al 2000, ApJ 542, 464C
Isochrones
Age (Gy)
0.001
0.002
0.003
0.004
0.005
0.006
0.007
0.008
0.009
0.01
0.02
0.03
Ev. Tracks
Mass (Msun)
0.0005
0.001
0.002
0.003
0.004
0.005
0.006
0.007
0.008
0.009
0.01
0.012
Mark the values that you are interested in and click the correponding button
Isochrones: Mark All Unmark All
Ev. Tracks: Mark All Unmark All
Download marked files (VOTable format)
Download marked files (ASCII format)
Plot
x: teff
y: logL
©CAB 2012


SVO theoretical services
VOSA
Filters
Models
Documents
Other Services
My data
Admin
Newsletter
Uploads
LogOut
Theoretical Isochrones and Evolutionary Tracks
Isochrones and evolutionary tracks
[+] BHAC15
[+] BT-Cond
[+] BT-Dusty
[+] BT-Nextgen
[+] BT-Settl
[+] AMES-Cond
[-] AMES-Dusty
AMES-Dusty
AMES-Dusty99
[+] NextGen
[+] Siess
AMES-Dusty
Dust in equilibrium with gas phase, (only GNS1993 available) "valid" for Near-IR studies with Teff > 1700 K
References:
Allard et al 2001, ApJ 556, 3
Chabrier et al 2000, ApJ
Isochrones
Age (Gy)
0.001
0.002
0.003
0.004
0.005
0.006
0.007
0.008
0.009
0.01
0.02
0.03
© CAB 2012
t m teff logg logL Lum
0.004 0.0010 685. 3.12 -5.40 3.981071705535E-6
0.004 0.0020 957. 3.41 -4.80 1.5848931924611E-5
0.004 0.0030 1160. 3.55 -4.43 3.7153522909717E-5
0.004 0.0040 1327. 3.65 -4.17 6.7608297539198E-5
0.004 0.0050 1490. 3.72 -3.94 0.00011481536214969
0.004 0.0060 1626. 3.77 -3.76 0.00017378008287494
0.004 0.0070 1750. 3.81 -3.60 0.00025118864315096
0.004 0.0080 1858. 3.84 -3.47 0.0003388441561392
0.004 0.0090 1951. 3.86 -3.36 0.00043651583224017
0.004 0.0100 2029. 3.87 -3.26 0.00054954087385762
0.004 0.0120 2152. 3.90 -3.10 0.00079432823472428
0.004 0.0150 2294. 3.91 -2.91 0.0012302687708124
0.004 0.0200 2507. 3.92 -2.64 0.0022908676527678
0.004 0.0250 2630. 3.85 -2.38 0.0041686938347034
0.004 0.0300 2703. 3.80 -2.21 0.0061659500186148
0.004 0.0400 2795. 3.77 -2.00 0.01
0.004 0.0500 2870. 3.79 -1.87 0.013489628825917
0.004 0.0550 2903. 3.81 -1.84 0.014454397707459
-:**- ames_dusty_t_0.004.dat Top L9 (Fundamental)

SVO theoretical services | VOSA | Filters | Models | Documents | Other Services | My data | Admin | Newsletter | Uploads | LogOut

Theoretical Isochrones and Evolutionary Tracks

Isochrones and evolutionary tracks

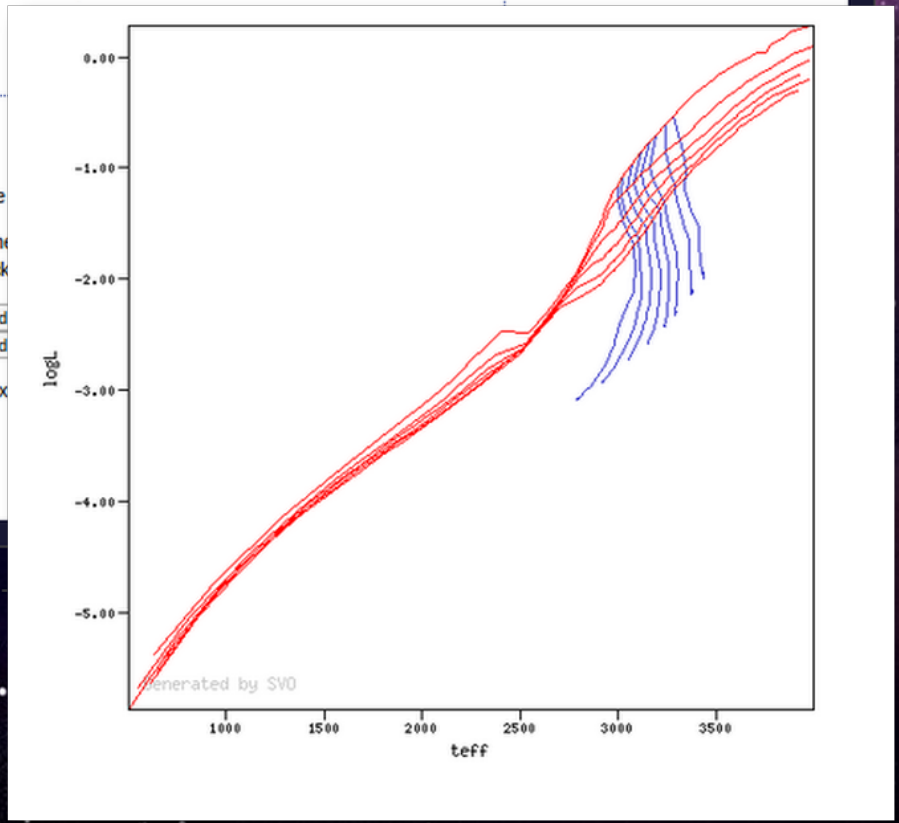
- [+] BHAC15
- [+] BT-Cond
- [+] BT-Dusty
- [+] BT-Nextgen
- [+] BT-Settl
- [+] AMES-Cond
- [-] AMES-Dusty
  - AMES-Dusty
  - AMES-Dusty99
- [+] NextGen
- [+] Siess

AMES-Dusty

Dust in equilibrium with gas phase, (only GNS1993 available) "valid" for Near-IR studies with Teff > 1700 K
References:
- Allard et al 2001, ApJ 556, 357A
- Chabrier et al 2000, ApJ 542, 464C

Isochrones	Ev. Tracks
Age (Gy)	Mass (Msun)
0.001	0.0005
0.002	0.001
0.003	0.002
0.004	0.003
0.005	0.004
0.006	0.005
0.007	0.006
0.008	0.007
0.009	0.008
0.01	0.009
0.02	0.01
0.03	0.012

Mark the
Isochron
Ev. Track
Download
Download
Plot



The implementation

To see the implementation at work, we have developed a web page that access all the relevant resources on a typical workflow. In each case:

- Shows the URL of the corresponding query.
- Makes the query and downloads the response VOTable.
- Shows the full content of the VOTable
- Analyses that VOTable and shows the relevant info in it.

http://svo2.cab.inta-csic.es/theory/simdal1/

2 object types / 2 datasets in a view?

- There are many cases with two or more kinds of datasets produced by one code.
- Appendix A.2 says that it is not possible to develope SimDAL services that link both datasets (for instance, in the same view).
- This comment is obsolete.
- In fact there is not any technical problem to do that.

2 object types / 2 datasets in a view?

View schema: 1 output dataset/object type

```
-<VOTABLE XMLns="http://www.ivoa.net/XML/VOTable/v1.2">
 -<RESOURCE name="view_schema">
  -<TABLE name="isochrones">
   -<GROUP utype="vo-dml:Instance.root">
      <PARAM name="type" utype="vo-dml:Instance.type" value="simdm:resource/experiment/output_dataset"/>
      <PARAM name="object" utype="simdm:resource/experiment/output_dataset.object_type" value="isochrone"/>
      <FIELDRef ref="t"/>
      <FIELDRef ref="fid"/>
    </GROUP>
   -<FIELD name="t" id="t" datatype="float" unit="Gyr">
      <DESCRIPTION>value for the age of the star in Gyr</DESCRIPTION>
     -<VALUES>
        <MIN value="0.001" inclusive="yes"/>
        <MAX value="12" inclusive="yes"/>
      </VALUES>
      <LINK content-role="type" href="http://purl.org/astronomy/vocab/PhysicalQuantities/Age"/>
    </FIELD>
   -<FIELD name="fid" id="fid" utype="simdm:resource/experiment/OutputDataset.publisherDID" datatype="int">
      <LINK content-role="view/data_access" href="http://[...]/iso3/simdal/vosi/ames_dusty/data/iso/"/>
    </FIELD>
  </TABLE>
 </RESOURCE>
</VOTABLE>
```

2 object types?

View schema: 2 output datasets/object types

```
-<VOTABLE XMLns="http://www.ivoa.net/XML/VOTable/v1.2">
 -<RESOURCE type="schema">
  -<TABLE name="my view">
   -<GROUP utype="vo-dml:Instance.root">
      <PARAM name="type" utype="vo-dml:Instance.type" value="simdm:resource/experiment"/>
      <PARAM name="protocol" utype="simdm:/resource/experiment.protocol" value="pdr_152_r34"/>
    -<GROUP utype="simdm:resource/experiment.output_data">
      <PARAM name="type" utype="vo-dml:Instance.type" value="simdm:resource/experiment/output_dataset"/>
      <PARAM name="object" utype="simdm:/resource/experiment/output_dataset.object_type" value="structure"/>
      <FIELDRef ref="str_dataset_id" utype="simdm:/resource/experiment/output_dataset.publisherdid"/>
     </GROUP>
    -<GROUP utype="simdm:resource/experiment.output_data">
      <PARAM name="type" utype="vo-dml:Instance.type" value="simdm:resource/experiment/output_dataset"/>
      <PARAM name="object" utype="simdm:/resource/experiment/output_dataset.object_type" value="oscillation"/>
      <FIELDRef ref="osc_dataset_id" utype="simdm:/resource/experiment/output_dataset.publisherdid"/>
      <FIELDRef ref="f0"/>
      <FIELDRef ref="gs"/>
     </GROUP>
   </GROUP>
   -<FIELD name="str_dataset_id" ID="str_dataset_id" utype="simdm:/resource/experiment/output_dataset.publisherdid">
      <LINK content-role="view/data_access" href="http://[...]/asteroseismology/structure/dataaccess/"/>
    </FIELD>
   -<FIELD name="osc_dataset_id" ID="osc_dataset_id" utype="simdm:/resource/experiment/output_dataset.publisherdid">
      <LINK content-role="view/data_access" href="http://[...]/asteroseismology/oscillation/dataaccess/"/>
    </FIELD>
   +<FIELD name="teff" ID="teff" datatype="float" unit="K"></FIELD>
   +<FIELD name="lum" ID="lum" datatype="float" unit="Lsun"></FIELD>
   +<FIELD name="f0" ID="f0" datatype="float" unit="muHz"></FIELD>
   +<FIELD name="gs" ID="gs" datatype="float" unit="muHz"></FIELD>
   </TABLE>
  </RESOURCE>
</VOTABLE>
```

2 object types / 2 datasets in a view?

- There is no reason to force services to offer one view by object type (unless they wish to do so).
- Having two different datasets in a single view is possible (and often, easier).
- Let developers decide what option is better for their case.

2 object types / 2 datasets in a view?

and, by the way:

Recommended
~~Mandatory~~ views To enforce predictability on the content of SimDAL Search services, it is mandatory to have at least one *view* (more precisely one per ObjectType), with fields corresponding to ParameterSettings (i.e the input of a simulation) and fields corresponding to OutputData (datasets produced by a simulation) IDs.

On the fly calculated quantities

Appendix A.2: *In fact, it would be useful to be able to do searches on operations between quantities. For example: search for simulations in which a N II line intensity divided by an O III line intensity has a given value. Queries on " on the fly" computed quantities should be considered in a next version of the access protocol.*

On the fly calculated quantities

- Queries on “on the fly” computed quantities are already possible if the service defines the corresponding parameter, for instance “NII_OIII_fraction”, in a view.
  - This quantity is not previously calculated or storaged in the server, and there are not statistics about it.
  - But the server offers it as parameter because it is able, and prepared, to calculate it, if requested, in order to give an answer.
  - So the service could allow users to make queries on value ranges for that parameter.

- What is not possible is allowing the user to define his own quantities as free operations using the parameters offered by the service view. That’s true (and good ;).

On the fly calculated quantities

- For instance, we have datasets characterized by two fields:
  - $V_{\rm rot}$: star rotation velocity. Values: (1, 300) km/s.
  - R : star radius. Values: (0.5, 10) $R_{\rm sun}$
- But we know that users could like to search using the period:
  - $T \equiv 2\pi R / V_{\rm rot}$.
  - T is not previously calculated or storaged in the server,
  - there are not statistics about it.
  - But we are prepared to answer queries in terms of T.
  - Thus, we can offer it as a search field.
- and a user coud make a query as:
  $V_{\rm rot}$ in (10,20)km/s && R in (1,2)$R_{\rm sun}$ && T in (3,10)days

THANK YOU!