



A usecase for stellar spectra within the Virtual Observatory

Goal *Derive a first estimate of the rotation velocity of a star*

Tools :

- database of observed stellar spectra **TBL Legacy**
- database of stellar synthetic spectra **POLLUX**
- database of stellar parameters from the literature **PASTEL/ Simbad**
- service for visualization of stellar spectra **VOSpec**

POLLUX and **TBL Legacy** teams :

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STEP 1

Search for Vega in TBL Legacy using VOSpec

The screenshot displays the 'Server Selector' application window, divided into several functional areas:

- Query by Service:** A list of services with checkboxes. The service 'TBL Narval legacy' is selected and circled in red. Other services include Hubble Space Telescope Spectra, HyperLeda FITS Archive, INES: The IUE Newly Extracted Spectra, International Ultraviolet Explorer, OMC: The INTEGRAL Optical Monitoring Camera, and others.
- Query by params:** A tree view showing query parameters. The parameters 'TARGET.NAME VEGA', 'POS 279.234735,38.78369194', and 'SIZE 1' are highlighted with a red circle.
- Query Outlook:** A section containing a 'Refresh' button, an 'Add SSA/TSA' button, and a 'Select All SSA' checkbox. Below these are three identical URL templates: `http://tblegacy.bagn.obs-mip.fr/cgi-bin/ssap/ssa_tbl?&POS=279.234735,38.78369194&SIZE=1`.
- Insert Param Value:** A section with a text input field and a 'Query' button. A red circle highlights the 'Query' button.

STEP 1

Search for Vega in TBL Legacy using VOSpec

The screenshot displays the VOSpec Spectral Analysis Tool interface. At the top, the title bar reads "VOSpec" and the logo for "cesavo Virtual Observatory" is visible. Below the title bar is a menu bar with "File", "Edit", "View", "Operations", "Plastic", "SAMP", and "Help". A toolbar contains various icons for file operations, editing, and analysis.

The main interface is divided into several sections:

- Target Information:** Target: **VEGA**, Ra: **279.234735**, Dec: **38.78369194**, Size: **1**. A "Query" button is located to the right.
- Wave Unit:** A dropdown menu is set to "Angstrom".
- Flux Unit:** A dropdown menu is set to "Counts".
- RedShift:** A text input field is set to "0.00".
- De-reddening:** A checkbox is unchecked.
- λV :** A text input field is set to "0.00".
- Y-axis error:** A checkbox is checked.
- X-axis error:** A checkbox is checked.
- Graphic Mode:** A dropdown menu is set to "Points".

The central plot, titled "VOSpec Spectral Analysis Tool", shows Flux (Counts;linear) on the y-axis (ranging from 0.0 to 4.0) versus Wavelength (Angstrom;linear) on the x-axis (ranging from 0.35 to 1.05, with a multiplier of $\times 10^4$). The plot displays a red spectral line with numerous absorption features, characteristic of a star's spectrum.

Below the plot is a toolbar with various analysis tools, including a zoom tool, a pan tool, and a reset tool.

At the bottom of the interface, a list of files is shown, with the file **vega_narval_20sep07_int_Fast_I_001.tbl.fts** selected. Below the list, a status bar indicates "1 finished". To the right of the status bar are buttons for "RETRIEVE", "Unmark All", and "Reset".

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STEP 2

Search the bibliographic database for stellar parameters

The screenshot shows the VOSpec software interface. The title bar reads "VOSpec" and the logo for "eesa VO Virtual Observatory" is in the top right. The menu bar includes "File", "Edit", "View", "Operations", "Plastic", "SAMP", and "Help". The "SAMP" menu item is highlighted with a pink box. Below the menu bar is a toolbar with various icons, including a grid icon highlighted with a pink box. The main interface has several input fields: "Target", "Ra", "Dec", and "Size" (set to 1). A "Query" button is to the right of the "Size" field. On the left side, there are settings for "Wave Unit" (micron), "Flux Unit" (Jy), "RedShift" (0.00), "De-reddening", and " λ/V " (0.00). There are also checkboxes for "Y-axis error" and "X-axis error", both of which are checked. Below these settings is a "Graphic Mode" section with a "View" button. At the bottom of the interface, there are three buttons: "RETRIEVE", "Unmark All", and "Reset". The central area of the interface contains the following text:

The query of bibliographic DBs to search for a first guess of Teff, log g and [Fe/H].

To be done using TAP (?)

At the bottom of the interface, the text "Copyright ESAC - Villanueva de la Cañada - Madrid, Spain" is visible.

STEP 2

Search the bibliographic database for stellar parameters

Case of VEGA

The image displays two software interfaces side-by-side. The left window is VOSpec, titled 'VOSpec Spectral Analysis Tool'. It features a menu bar with 'SAMP' highlighted in a pink box. Below the menu is a toolbar with a question mark icon also highlighted in pink. The main area shows search parameters: Target 'Vega', Ra '279.234735', Dec '38.78369194', and Size '1'. A plot area is empty. Below the plot is a list of files under 'TBL Narval legacy', with the list itself circled in red. The right window is 'Server Selector'. It shows a list of services under 'Query by Service'. 'TBL Narval legacy' is checked and circled in red. Below this is a 'Query Outlook' section with two URLs: `http://tbllegacy.bagn.obs-mip.fr/cgi-bin/ssap/ssa_tbl?&POS=279.234735,38.78369194&SIZE=1` and `http://tbllegacy.bagn.obs-mip.fr/cgi-bin/ssap/ssa_tbl?&POS=279.234735,38.78369194&SIZE=1`. On the far right, a 'Query by params' panel shows a tree structure with 'TARGET.NAME Vega' circled in red. At the bottom of the VOSpec window, there are buttons for 'RETRIEVE', 'Unmark All', and 'Reset'. The footer of VOSpec reads 'Copyright ESAC - Villanueva de la Cañada - Madrid, Spain'.

Query Simbad or PASTEL in VizieR

STEP 3 Using bibliographical indication to query POLLUX for appropriate spectra

Example 1 T_{eff} , $\log g$ and $[\text{Fe}/\text{H}]$ listed as measurements in Simbad

Simbad Query

Measurements (20 types) :

CEL : 1 Fe_H : 21 GEN : 1 gj : 1 Hbet1 : 3 IRAS : 1 IRC : 1 ISO : 99 IUE : 65 JP11 : 5 MK : 33 oRV : 17

PLX : 5 PM : 3 pos : 2 ROT : 6 SAO : 1 TD1 : 1 UVB : 13 uvby1 : 7

display selected measurements display all measurements clear

[fe_h](#) (21)

Teff	log.g	[Fe_H c]	CompStar	CatNo	Reference
9450	4.00	-0.55	SUN	F684	1995A&A...294..536H
9450	4.00	-0.55	SUN	F637	1993A&A...274..335S
9500	4.05	-0.70	SUN	F627	1993A&A...276..142H
9400	3.95	-0.76	SUN	F579	1990ApJ...363..234V
9509	4.03	-0.72	SUN	F563	1990ApJ...348..712A
9692	3.94	-0.73	SUN	F491	1986PASJ...38..215S
9509	3.90	-0.55	SUN	F480	1986A&A...165..170G
9692	3.94	-0.58	SUN	F389	1981PASJ...33..189S
9692	3.9	0.00	SUN	F347	1980ApJ...241..736D
9692	4.1	-1.36	SUN	F326	1979A&A...79..174C
8542	-0.90		SUN	F310	1978ApJ...219..515B
7875	-0.50		SUN	F310	1978ApJ...219..515B
9692	4.0	0.02	SUN	F240	1974ApJ...189..101S
9164	4.0	-0.25	SUN	F116	1969A&A...3..169G
9509	3.7	-0.10	SUN	F111	1968Obs...88..160S
8129	-0.10		SUN	F109	1968MNRAS.139..313P
9509	4.0	-0.10	SUN	F101	1968ApJ...152..483C
10080	3.5	0.20	SUN	F85	1967cmrs..R...339A
	0.05		SUN	F82	1966AJ....71..181S
9000	3.8	0.06	SUN	F81	1966ApJ...146..880S
	-0.30		SUN	F21	1960ZA....49..129H

Retrieve the most recent determinations (for instance)

External archives :

Archive data at [HEASARC - High-Energy Astrophysics Science Archive Research Center](#)

Terminé

STEP 3

Using bibliographical indication to query POLLUX for appropriate spectra



Example 2 Teff , log g and [Fe/H] exist in PASTEL via VizieR

Catalog Selection Page

Simple Target | **List Of Targets**

Target Name (resolved by [Sesame](#)) or Position: J2000 arcmin

Target dimension: Radius Box size

PASTEL Query

Radial Vel. Opt. IV X Y The PASTEL catalogue (Soubiran+, 2010-) [Similar Catalogs](#) [ReadMe+ftp](#)

B/pastel [Post annotation](#)

1. B/pastel/pastel The catalogue of stellar atmospheric parameters (Version 2011-04-19) (31724 rows)

Simple Constraint | **List Of Constraints**

Query by **Constraints** applied on Columns (Output Order: + -)

Show	Sort	Column	Constraint	Explain (UCD)
<input type="checkbox"/>	<input type="checkbox"/>	recno	<input type="text"/>	Record number within the original table (starting from 1) (meta.record)
<input checked="" type="checkbox"/>	<input type="checkbox"/>	ID	<input type="text"/> (char)	Designation (Note 1) (meta.id;phys.atmol.configuration)
<input checked="" type="checkbox"/>	<input type="checkbox"/>	RAJ2000	<input type="text"/> "h:m:s" (n)	Right Ascension J2000 (from Simbad) (pos.eq.ra;meta.main)
<input checked="" type="checkbox"/>	<input type="checkbox"/>	DEJ2000	<input type="text"/> "d:m:s" (n)	Declination J2000 (from Simbad) (pos.eq.dec;meta.main)
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Bmag	<input type="text"/> mag (n)	Johnson B magnitude from Simbad (phot.mag;em.opt.B)
<input type="checkbox"/>	<input type="checkbox"/>	e_Bmag	<input type="text"/> mag (n)	Standard error on Bmag (stat.error;phot.mag;em.opt.B)
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Vmag	<input type="text"/> mag (n)	Johnson V magnitude from Simbad (phot.mag;em.opt.V)
<input type="checkbox"/>	<input type="checkbox"/>	e_Vmag	<input type="text"/> mag (n)	Standard error on Vmag (stat.error;phot.mag;em.opt.V)
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Jmag	<input type="text"/> mag (n)	2MASS J apparent magnitude (phot.mag;em.IR.J)
<input type="checkbox"/>	<input type="checkbox"/>	e_Jmag	<input type="text"/> mag (n)	2MASS J total magnitude uncertainty (stat.error;phot.mag;em.IR.J)
<input type="checkbox"/>	<input type="checkbox"/>	Hmag	<input type="text"/> mag (n)	2MASS H apparent magnitude (phot.mag;em.IR.H)

ALL cols

(n) indicates a possible blank or NULL column

VizieR Result Page-Mozilla Firefox

Fichier Édition Affichage Historique Marque-pages Outils Aide

http://vizier.u-strasbg.fr/viz-bin/VizieR-4

Les plus visités Getting Started Latest Headlines SAO/NASA ADS Cust... Dictionnaire Français...

SIMBAD query res... http://tb...rval.html h705 IVOA Recommend... VizieR Result Page VOTable Plot

ASTRONOMIQUES DE STRASBOURG

VizieR Result Page

▶ Show the target form

Search Criteria

[Save in CDSportal](#)

Keywords

B/pastel

Tables

B/pastel
..pastel

Constraints

vega
(2 arcmin)

Preferences

max: 50

HTML Table

All columns

▶ **Compute**

Mirrors

CDS, France

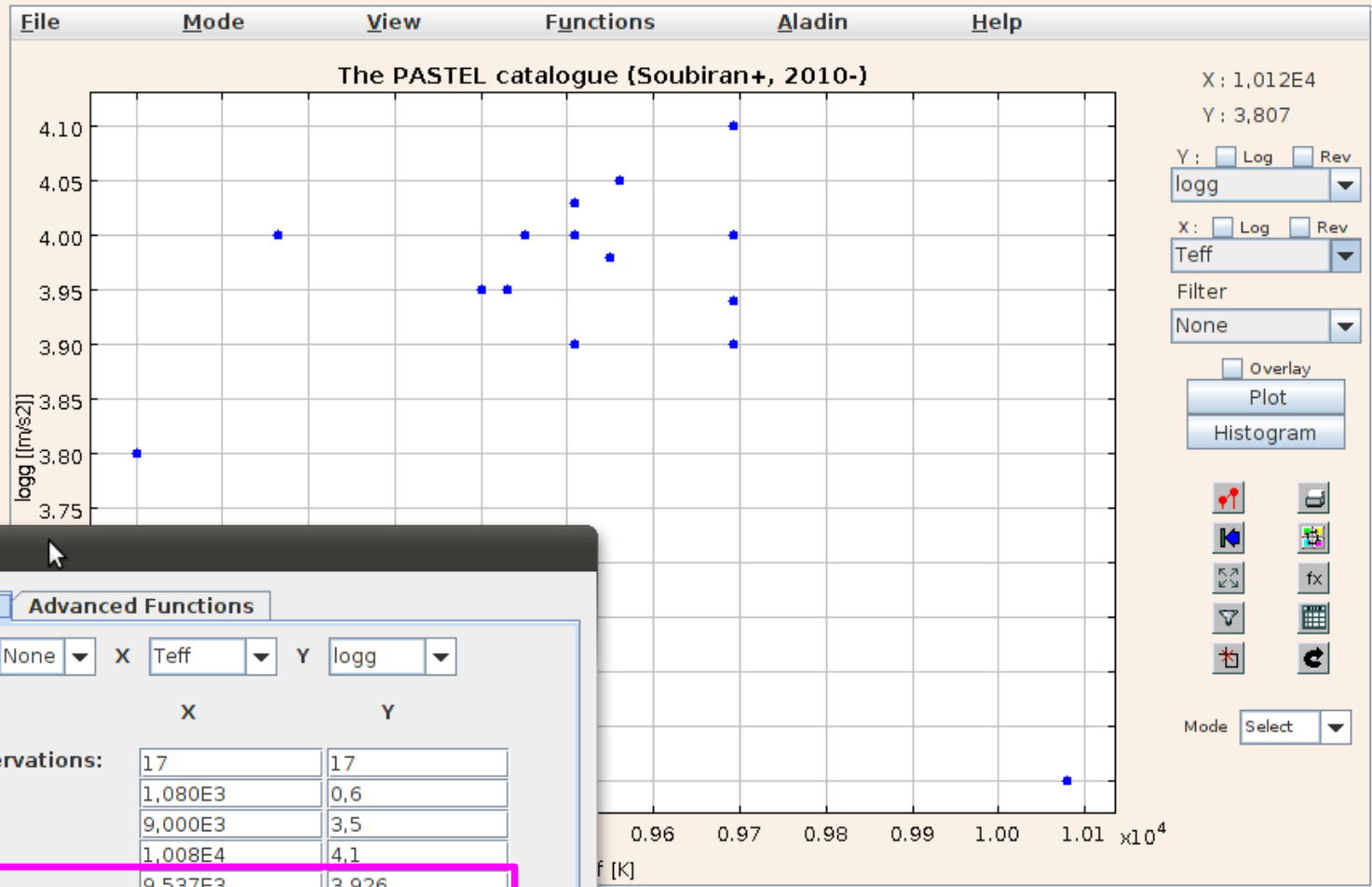
B/pastel/pastel [The PASTEL catalogue \(Soubiran+, 2010-\)](#) [ReadMe+ftp](#)

[Post annotation](#) The catalogue of stellar atmospheric parameters (Version 2011-04-19) (31724 rows)

Full	ID	RAJ2000 "h:m:s"	DEJ2000 "d:m:s"	Bmag mag	Teff K	logg [m/s2]	[Fe/H] [Sun]	n_	e_ [Sun]
1	HD172167	18 36 56.3364	+38 47 01.291	0.030			0.05		
2	HD172167	18 36 56.3364	+38 47 01.291	0.030			-0.30		
3	HD172167	18 36 56.3364	+38 47 01.291	0.030			-0.54		
4	HD172167	18 36 56.3364	+38 47 01.291	0.030	7875		-0.50		
5	HD172167	18 36 56.3364	+38 47 01.291	0.030	8129		-0.10		
6	HD172167	18 36 56.3364	+38 47 01.291	0.030	8542		-0.90		
7	HD172167	18 36 56.3364	+38 47 01.291	0.030	9000	3.80	0.06		
8	HD172167	18 36 56.3364	+38 47 01.291	0.030	9164	4.00	-0.25		
9	HD172167	18 36 56.3364	+38 47 01.291	0.030	9400	3.95	-0.76		
10	HD172167	18 36 56.3364	+38 47 01.291	0.030	9430	3.95	-0.57	0.12	
11	HD172167	18 36 56.3364	+38 47 01.291	0.030	9450	4.00	-0.55		
12	HD172167	18 36 56.3364	+38 47 01.291	0.030	9470				
13	HD172167	18 36 56.3364	+38 47 01.291	0.030	9509	3.70	-0.10		
14	HD172167	18 36 56.3364	+38 47 01.291	0.030	9509	3.90	-0.55		
15	HD172167	18 36 56.3364	+38 47 01.291	0.030	9509	4.00	-0.10		
16	HD172167	18 36 56.3364	+38 47 01.291	0.030	9509	4.03	-0.72		
17	HD172167	18 36 56.3364	+38 47 01.291	0.030	9549	3.98	-0.43		
18	HD172167	18 36 56.3364	+38 47 01.291	0.030	9560	4.05	-0.70		
19	HD172167	18 36 56.3364	+38 47 01.291	0.030	9692	3.90	0.00		
20	HD172167	18 36 56.3364	+38 47 01.291	0.030	9692	3.94	-0.58		
21	HD172167	18 36 56.3364	+38 47 01.291	0.030	9692	3.94	-0.73		
22	HD172167	18 36 56.3364	+38 47 01.291	0.030	9692	4.00	0.02		
23	HD172167	18 36 56.3364	+38 47 01.291	0.030	9692	4.10	-1.36		
24	HD172167	18 36 56.3364	+38 47 01.291	0.030	10080	3.50	0.20		

Available Visualisations:

- [Plot the results with the VOPlot utility](#)



Plot Statistics

Basic Functions | **Advanced Functions**

Filter: None | X: Teff | Y: logg

	X	Y
No of observations:	17	17
Range :	1,080E3	0,6
Minimum :	9,000E3	3,5
Maximum :	1,008E4	4,1
Mean :	9,537E3	3,926
Variance :	5,200E4	0,02
Standard deviation :	228,044	0,14
Skew :	-0,161	-1,734
Kurtosis :	1,195	2,71

Entire Data
 Only Plot Data
 Only Selected Point Data

Calculate Close Box Plot

Compute and retrieve the mean value for Teff, log g and [Fe/H] as, for instance, given by VOTable Plot

STEP 4

Query POLLUX database to retrieve appropriate spectra

Server Selector

Query by Service

Green services are online and support params selected

- PGos3: X-ray SSP models
- PGos3: evolutionary synthesis models repository
- POLLUX Database**
- POLLUX Database(2)
- POPSTAR with Chabrier IMF
- POPSTAR with Ferrini IMF
- POPSTAR with Kroupa IMF
- POPSTAR with Salpeter (1955) IMF with m=(0.15-100)Msun.
- POPSTAR with Salpeter (1955) IMF with m=(0.85-120)Msun.
- SED@ Evolutionary Synthesis Models
- SSA Service for Synthetical Spectra (TMAP)
- Synthetic photometry for COND 2000 models
- Synthetic photometry for DUSTY 2000 models.
- Synthetic photometry for Kurucz models
- Synthetic photometry for NextGen models
- TLUSTRY RSTAR2000

Query by params

Tree

```
Qu...
├── TARGET.NAME Vega
├── Simple Qu...
│   ├── POS 279.234735,38.78369194
│   └── SIZE 1
├── Advanced Qu...
├── Service Specific Qu...
│   ├── TBL Narval lega...
│   └── POLLUX Database
│       ├── teff_min 9500
│       ├── teff_max 9500
│       ├── logg_min 3.500
│       ├── logg_max 4.000
│       ├── vturb_min 2.000
│       ├── vturb_max 2.000
│       ├── meta_min -1.000
│       ├── meta_max -0.500
│       └── model ALL
```

Made use of mean values computed from PASTEL query

Query Outlook

Refresh Add SSA/TSA Select All SSA

```
http://tblegacy.bagn.obs-mip.fr/cgi-bin/ssap/ssa_tbl?&POS=279.234735,38.78369194&SIZE=1
-----
http://tblegacy.bagn.obs-mip.fr/cgi-bin/ssap/ssa_tbl?&POS=279.234735,38.78369194&SIZE=1
-----
http://pollux.graal.univ-montp2.fr/ssaserver/tsap?&vturb_max=1.000&teff_min=3000&meta_m
http://tblegacy.bagn.obs-mip.fr/cgi-bin/ssap/ssa_tbl?&POS=279.234735,38.78369194&SIZE=1
-----
http://pollux.graal.univ-montp2.fr/ssaserver/tsap?&vturb_max=1.000&meta_max=-5.000&logg
```

Insert Param Value

Point mouse on param label to see description

-1.000 Add

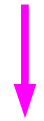
Query Reset

STEP 5

Visualize the results of query :

normalized

NARVAL spectrum + theoretical spectra



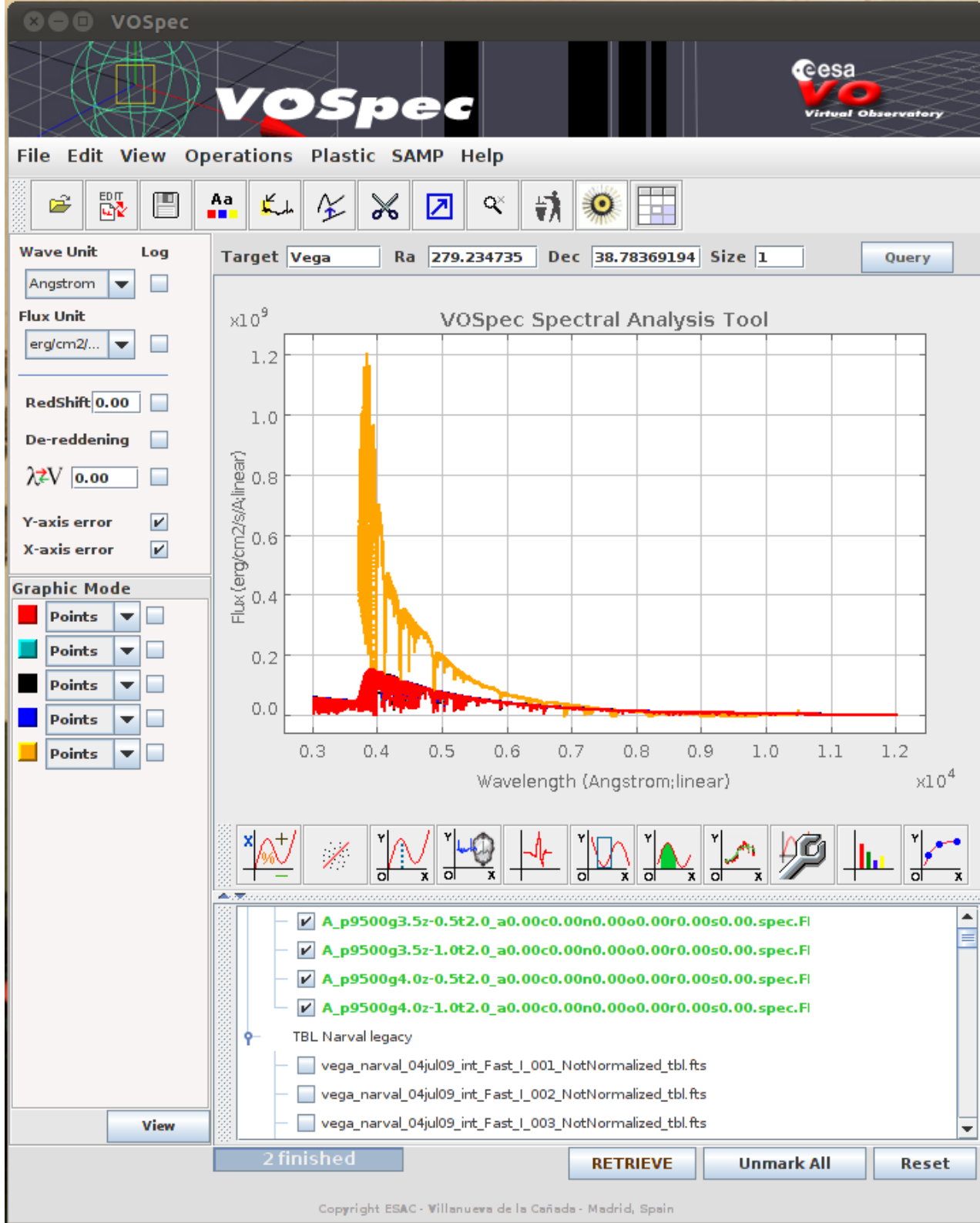
At present impossible from the web only using VOSpec :

POLLUX data on **3 columns** normalized flux is 3rd column

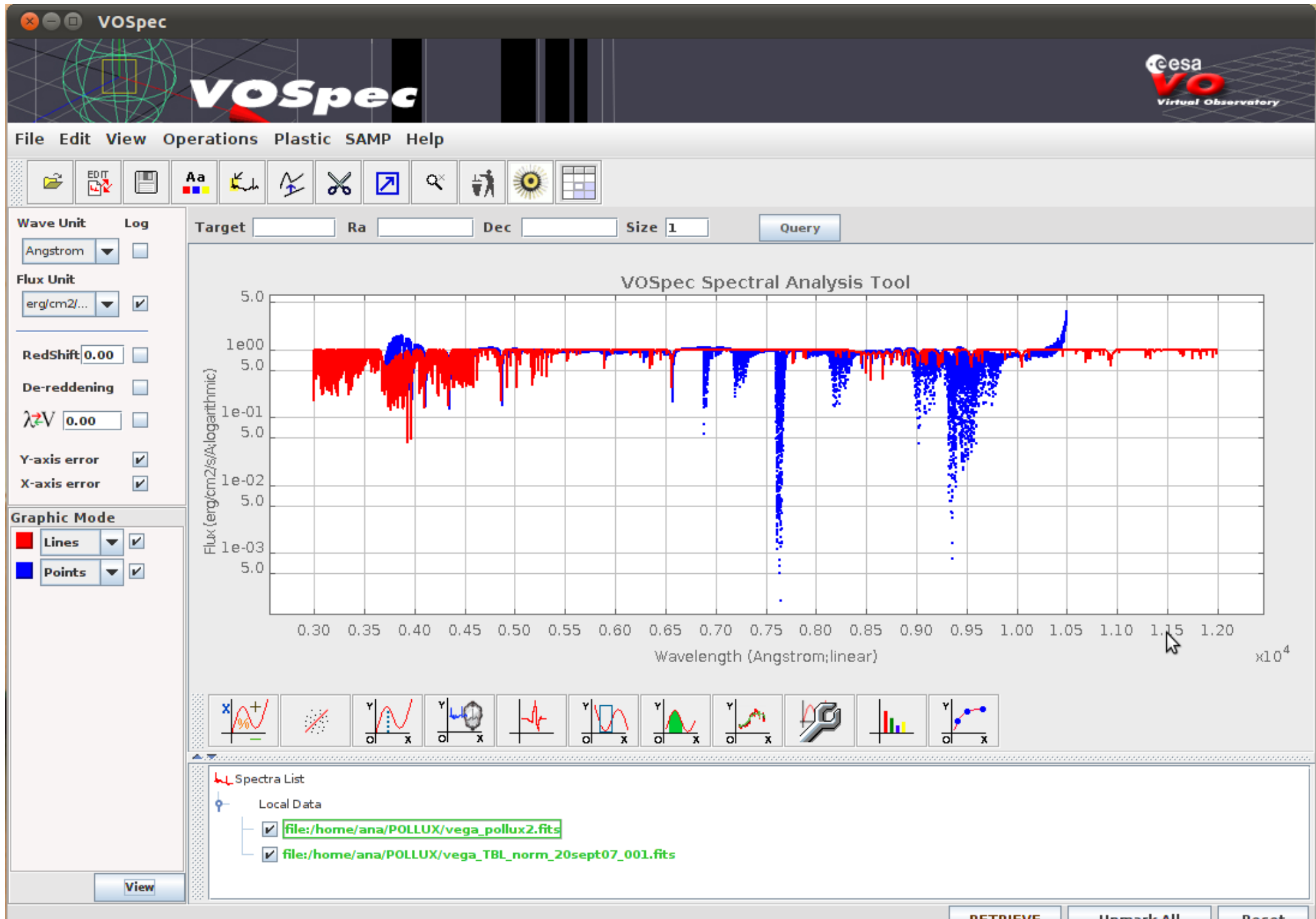
→ *need to download spectrum locally*

Normalized fluxes bear **no unit** by definition : this is not supported by VOSpec

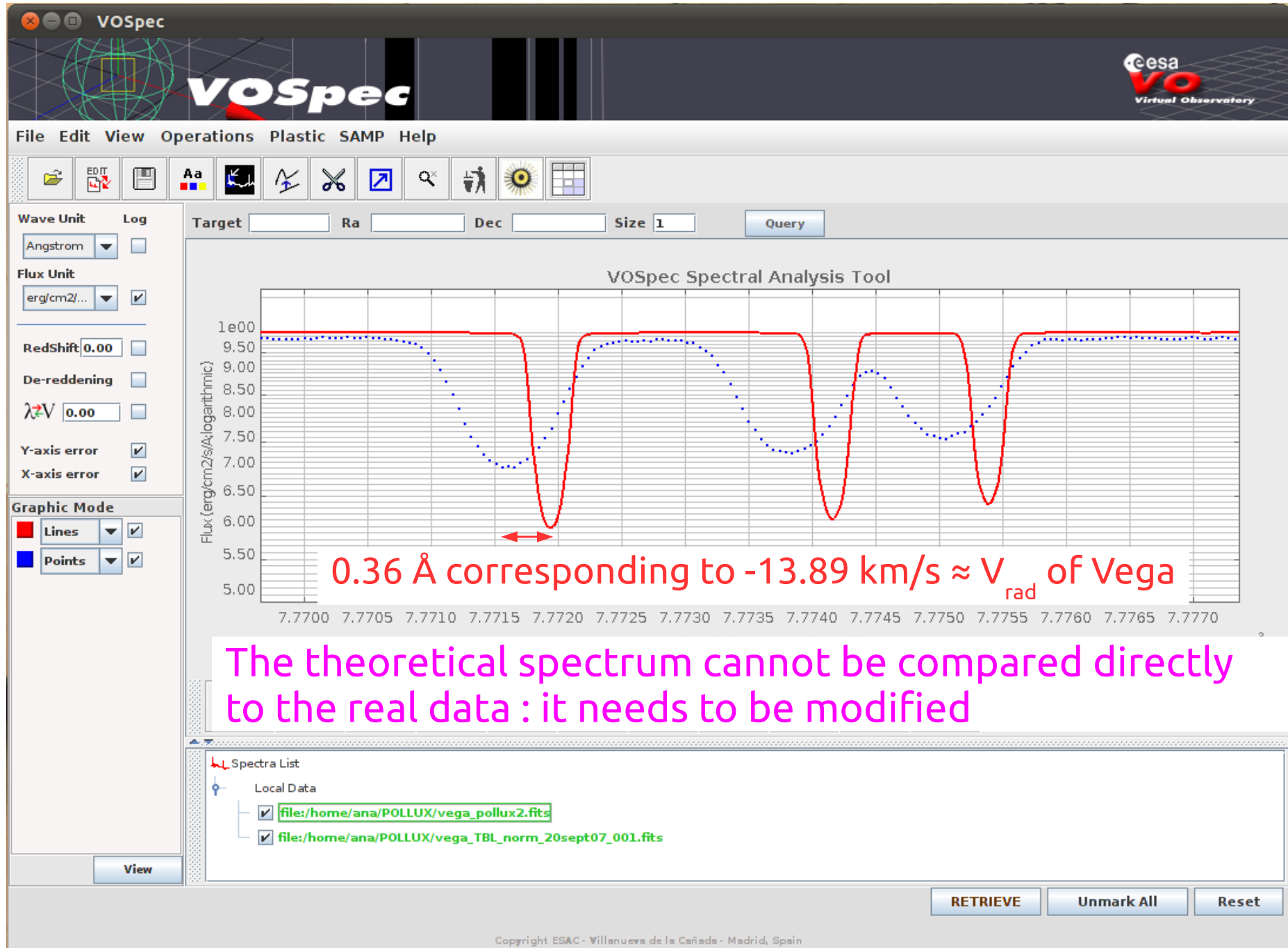
→ *need to use a fake unit*



STEP 5 Visualize the results of query : normalized NARVAL spectrum + theoretical spectra

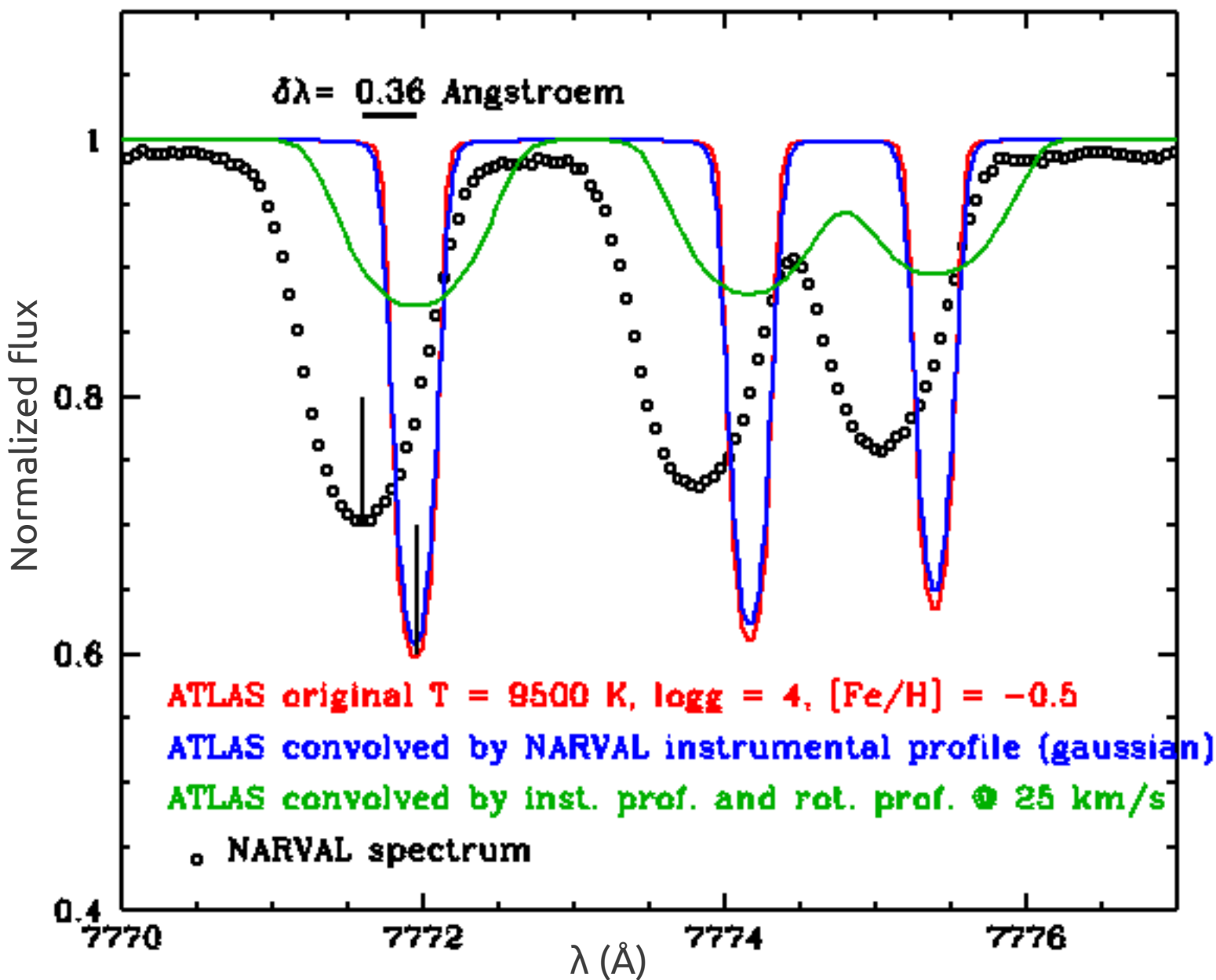


STEP 6 Modify the POLLUX spectrum to make it a simulated obs.



STEP 6 Convolve the POLLUX spectrum with instrumental and rotation profiles

Vega : NARVAL data vs ATLAS/SYNSPEC spectrum



Radial velocity of -13.9 km/s and rotational velocity around 20 km/s

STEP 1bis

Search for HD232862 in TBL Legacy using VOSpec

The screenshot displays the VOSpec interface with the following components:

- Server Selector (Left Panel):** A list of services with checkboxes. The service **TBL Narval legacy** is selected and circled in red. Other services include Hubble Space Telescope Spectra, HyperLeda FITS Archive, INES: The IUE Newly Extracted Spectra, International Ultraviolet Explorer, OMC: The INTEGRAL Optical Monitoring Camera, and others.
- Query by params (Right Panel):** A tree view showing the query structure. The parameters **TARGET.NAME HD232862**, **POS 59.333275,50.8551556**, and **SIZE 1** are highlighted with a red circle.
- Query Outlook (Bottom Left):** A section containing a **Refresh** button, an **Add SSA/TSA** button, and a **Select All SSA** checkbox. Below these are two identical URL strings: `http://tblegacy.bagn.obs-mip.fr/cgi-bin/ssap/ssa_tbl?&POS=59.333275,50.8551556&SIZE=1`.
- Insert Param Value (Bottom Right):** A section with the instruction "Point mouse on param label to see description" and a **Text Param** input field.

STEP 1bis

Search for HD232862 in TBL Legacy using VOSpec

The screenshot displays the VOSpec software interface. At the top, the title bar reads "VOSpec". Below it is a menu bar with "File", "Edit", "View", "Operations", "Plastic", "SAMP", and "Help". A toolbar contains various icons for file operations and analysis. The main search panel includes fields for "Target" (HD232862), "Ra" (59.333275), "Dec" (50.8551556), and "Size" (1), with a "Query" button. The central area is a "VOSpec Spectral Analysis Tool" with a grid plot. The left sidebar contains settings for "Wave Unit" (Angstrom), "Flux Unit" (Counts), "RedShift" (0.00), "De-reddening", and "λV" (0.00). Below this is a "Graphic Mode" section. At the bottom, a list of search results is shown, with the selected file "hd232862_narval_28sep08_pol_Normal_V_01_tbl.ft" circled in red. The status bar at the bottom indicates "1 finished" and includes buttons for "RETRIEVE", "Unmark All", and "Reset".

Target: Ra: Dec: Size:

Wave Unit: Log

Flux Unit:

RedShift:

De-reddening:

λV:

Y-axis error:

X-axis error:

Graphic Mode

- hd232862_narval_28sep08_int_Normal_I_001_NotNormalized_tbl.ft
- hd232862_narval_28sep08_int_Normal_I_002_NotNormalized_tbl.ft
- hd232862_narval_28sep08_int_Normal_I_003_NotNormalized_tbl.ft
- hd232862_narval_28sep08_int_Normal_I_004_NotNormalized_tbl.ft
- hd232862_narval_28sep08_pol_Normal_V_01_NotNormalized_tbl.ft
- hd232862_narval_28sep08_pol_Normal_V_01_tbl.ft**
- hd232862_narval_29sep08_int_Normal_I_001_NotNormalized_tbl.ft

1 finished


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SIMBAD query result

[other query modes](#) [Identifier query](#) [Coordinate query](#) [Criteria query](#) [Reference query](#) [Basic query](#) [Script submission](#) [Output options](#) [Help](#)

Object query : HD 232862 C.D.S. - SIMBAD4 rel 1.179 - 2011.05.09CEST15:58:14

Available data : [Basic data](#) • [Identifiers](#) • [Plot & images](#) • [Bibliography](#) • [Measurements](#) • [External archives](#) • [Notes](#) • [Annotations](#)

Basic data :
HD 232862 -- Double or multiple star query around with radius arcmin

Other object types: * (HD,AG,BD,GEN#,PPM,SAO,UBV,YZ,[HFE83]) , ** (**,WDS)

ICRS coord. (ep=J2000) : **03 57 19.986 +50 51 18.56 (~) [298.33 270.49 0] B [1988A&AS...74..449R](#)**

FK5 coord. (ep=J2000 eq=2000) : **03 57 19.986 +50 51 18.56 (~) [298.33 270.49 0] B [1988A&AS...74..449R](#)**

FK4 coord. (ep=B1950 eq=1950) : **03 53 35.88 +50 42 44.3 (~) [370.68 336.40 0] B [1988A&AS...74..449R](#)**

Gal coord. (ep=J2000) : **150.1882 -01.9076 (~) [298.33 270.49 0] B [1988A&AS...74..449R](#)**

Proper motions *mas/yr* [error ellipse]: **54.9 -75.0 [4.4 4.0 0] B [1988A&AS...74..449R](#)**

Radial velocity / Redshift / cz : **V(km/s) -1.80 [0.20] / z(-) -0.000006 [0.00000] / cz -1.80 [0.20] (~) D [1999A&AS..139..433D](#)**

Spectral type: **G8II C ~**

Fluxes (2) : **B 10.33 [~] C ~**
V 9.46 [~] C ~

Spectral type and radial velocity are available

References (12 between 1850 and 2011) display [reference summary](#)

Simbad bibliographic survey began in 1950 for stars (at least bright stars) and in 1983 for all other objects (outside the solar system).

from: to:

Measurements (6 types) :

IUE : 2 MK : 1 PM : 1 pos : 1 SAO : 1 UBV : 3

No direct access to T_{eff} , $\log g$, $[\text{Fe}/\text{H}]$

Have a way to
 * propose a range of T_{eff} and $\log g$ from the analysis of the spectral type
 * browse the bibliographic resources to retrieve the information

External archives :
 Terminé

Conclusions



The use of the Virtual Observatory for spectroscopic analysis is promising yet limited at present

- Tools (VOSpec)
 - units
 - more than 2 columns without local retrieval
 - query of bibliographical databases
 - convolution applet
 - radial velocity correction
 - spectral type interpreter
- Data Model
 - handle axis without units / normalized spectra
 - polarimetry specificities
 - degree of precision of theoretical spectra ?
- Access Protocols
 - linking to bibliographic databases
 - multi-column data (ex : spectropolarimetry with ESPaDoNS/NARVAL)