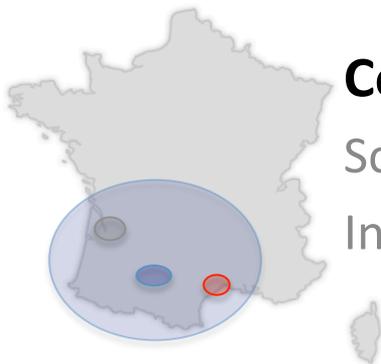
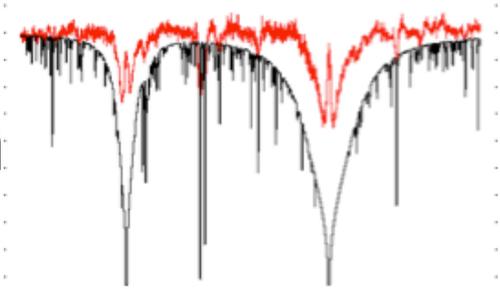




# Implémentation d'un service de convolution dans l'Observatoire Virtuel



## Collaboration OV-GSO

Scientifiques : Agnès Lèbre, Ana Palacios

Ingénieurs : Aurélien Emeras, Patrick Maeght,  
Michèle Sanguillon

# Plan



- Le contexte
- L'Observatoire Virtuel (OV) astronomique
- Nos motivations
- Le module de convolution : speconvol
- Le cas d'utilisation : specflow
- Les perspectives

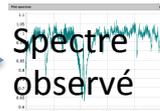
# Le contexte



Paramètres de l'étoile ?



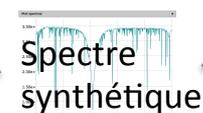
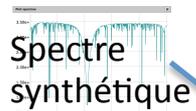
Position dans le ciel



Modèle et caractéristiques

Modèle et caractéristiques

Modèle et caractéristiques



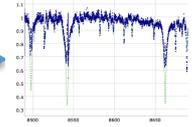
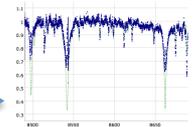
Programme de convolution

Observation simulée (spectre convolué)

Observation simulée (spectre convolué)

Observation simulée (spectre convolué)

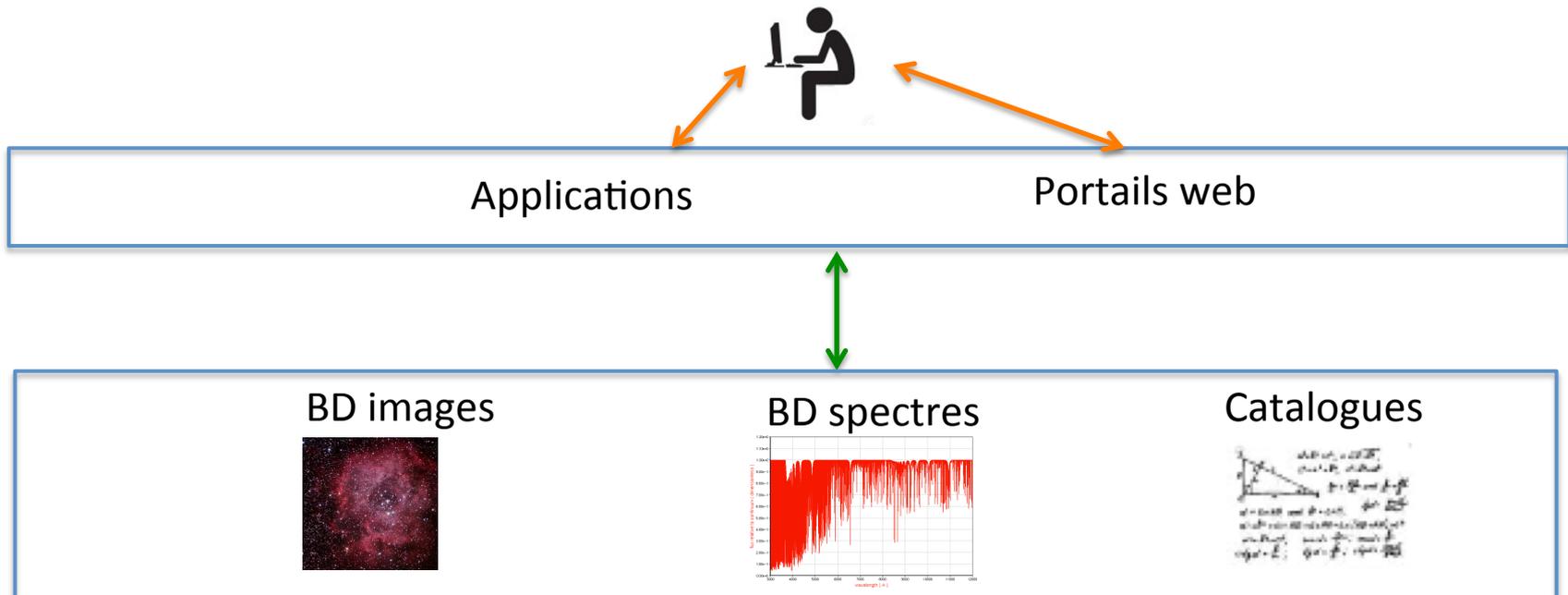
Outils de visualisation



# L'Observatoire Virtuel astronomique



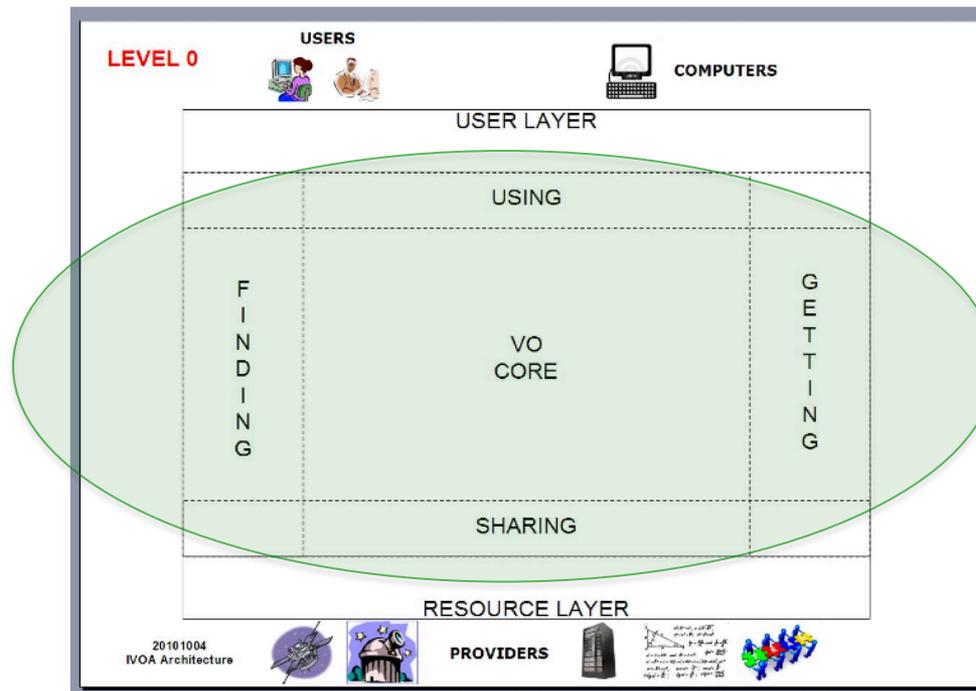
- Objectif : fournir un **accès transparent et homogène** aux énormes ensembles de données astronomiques réparties à travers le monde.



# L'Observatoire Virtuel astronomique



- **IVOA** : faciliter la coordination et les collaborations internationales nécessaires à la production des **standards d'interopérabilité** et d'**outils d'analyse et de visualisation**.



# L'Observatoire Virtuel astronomique



- Les données constituent un "ciel virtuel" auquel l'astronome accède de façon transparente et continue avec son "téléscope" (son ordinateur)



Applications

Portails web



PROTOCOLES DE L'OBSERVATOIRE VIRTUEL



Ressources

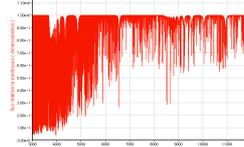
Annuaire

BD images

BD spectres

Catalogues

Stockage /  
Calcul



# Nos motivations



Bases de données  
Accessibles  
depuis l'OV

Position  
dans le ciel



Spectre  
observé

Spectre  
synthétique

Modèle et  
caractéristiques

Modèle et  
caractéristiques



Spectre  
synthétique

Modèle et  
caractéristiques

Spectre  
synthétique

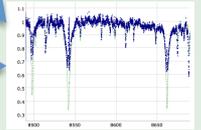
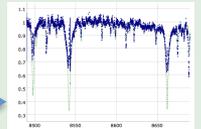
**Programme de  
convolution**

Observation simulée  
(spectre convolué)

Observation simulée  
(spectre convolué)

Observation simulée  
(spectre convolué)

Outils de  
visualisation  
OV

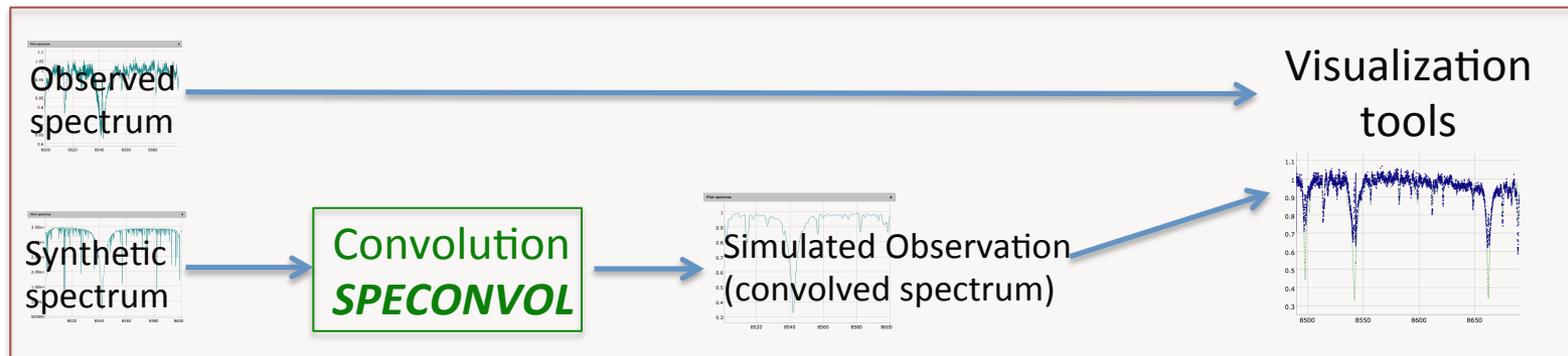


**WORKFLOW**

# Nos motivations



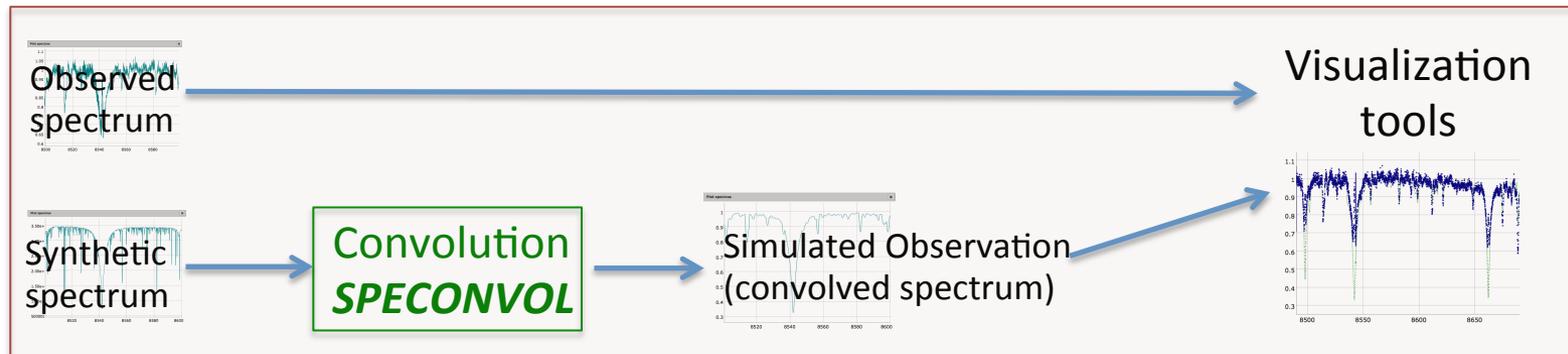
Use case : *SPECFLOW*



# ***SPECONVOL*** : Objectifs



Use case : ***SPECFLOW***



Sur une portion d'un spectre synthétique :

- pouvoir convoluer par :
  - profil radial-tangential (macro-turbulence )
  - profil rotationnel (rotation)
  - profil gaussien (instrument)
- pouvoir appliquer aussi :
  - un décalage en vitesse radiale

# ***SPECONVOL*** : Implémentation



- Web service :
  - Développé en python sous plone/zope
  - Appel à un programme fortran
- Modèle de données :
  - Simulation Data Model (description des paramètres d'entrée et du résultat de la simulation)
- Protocole d'accès aux données:
  - Simple Spectral Access Protocol
- `<PARAM datatype="float" name="INPUT:V_ROT" ucd="phys.veloc.rotat" unit="km/s" utype="SimDM:/resource/protocol/InputParameter" value="">`
  - `<DESCRIPTION>`  
Rotational velocity for rotational broadening
  - `</DESCRIPTION>`
  - `</PARAM>`
- Enregistrement
  - Le service est enregistré dans l'annuaire :  
<ivo://ov-gso/ssap/speconvol>



# ***SPECFLOW*** :

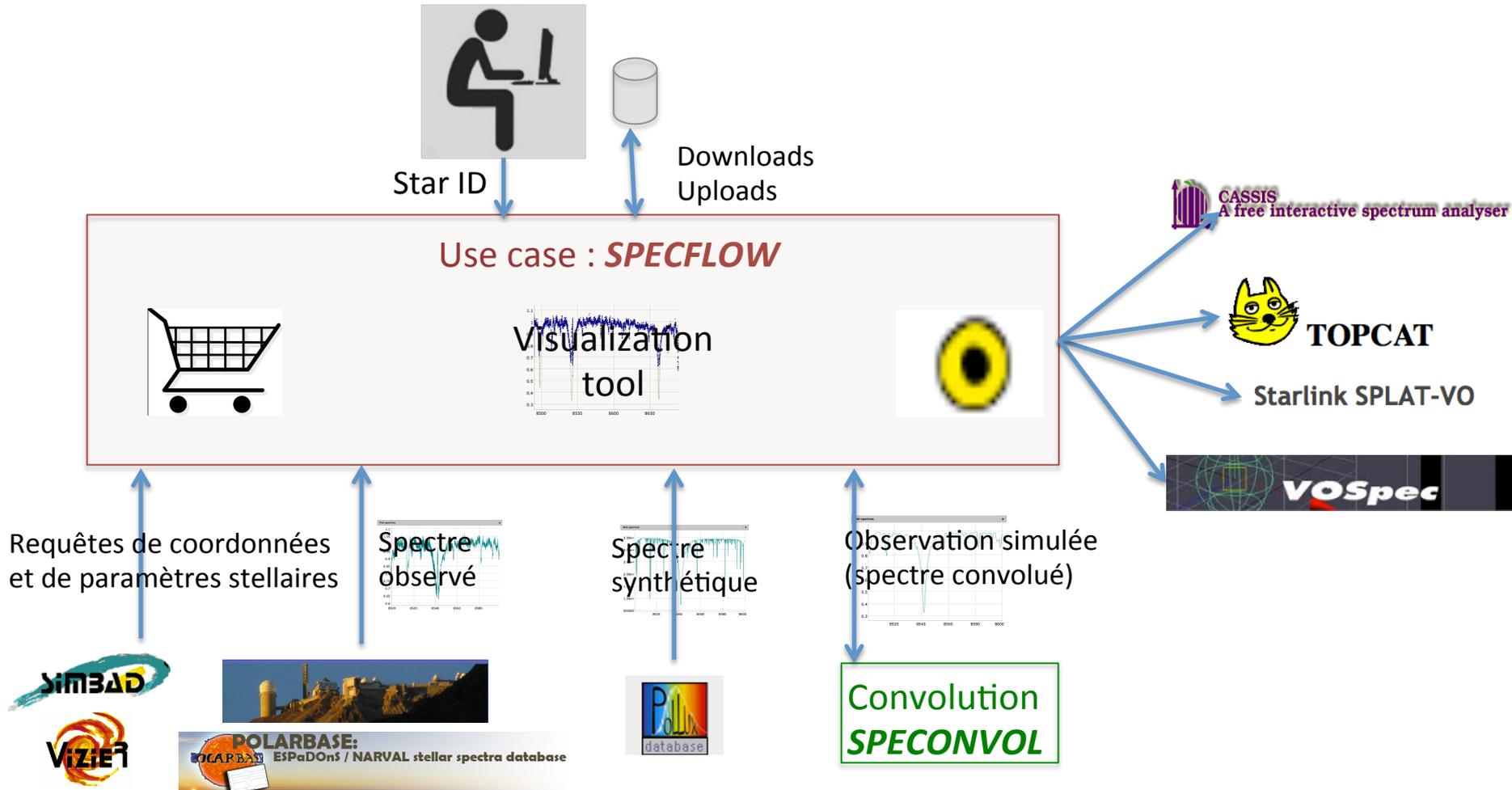
## un cas d'utilisation de *speconvol*

Outil web (<http://bass2000.bagn.obs-mip.fr/specflow>)

pour comparer deux portions de spectres : une provenant d'un spectre **observé** (de la BD TBLegacy ou de la BD PolarBase) et l'autre provenant d'un spectre **synthétique convolué** (de la BD Pollux et ensuite convolué).

interagissant avec des ressources et outils VO (Simbad, VizieR, TBLegacy, PolarBase, Pollux, speconvol, TOPCAT, VOSpec, SPLAT-VO, CASSIS)

# SPECFLOW : Fonctionnement



# ***SPECFLOW*** : Implémentation



- Application web
- Côté client :
  - Modèle MVC : javascript
- Côté serveur :
  - Page web : php, jquery, ajax
  - Logique métier (OV et stockage) : python

# SPECFLOW : Démo

**VO SPECFLOW** Home Stellar parameters Observed spectra Synthetic spectra Convolution

## Welcome to SPECFLOW

This application is meant to transform portions of synthetic spectra (100 AA to 500 AA) into simulated observations to compare them with observed spectra.

To achieve this, SPECFLOW allows to perform a convolution of the synthetic spectra with a rotation profile, an instrumental profile and a turbulent microturbulence velocity profile, and to doppler shift it according to the radial velocity of the star it is meant to represent.

Through the tab "Observed spectra", you will be able to:

- select a star, retrieve its parameters from a query to SIMBAD and the catalogs in VizieR
- select the temperature, metallicity, gravity and microturbulence velocity from the results of the VizieR's catalogs query
- select and observed spectrum of the selected star from the TLegacy database or upload your own spectrum
- store the selected spectrum into the VOTPSpace for further plotting (with VOSPEC or with a local display device) and/or downloading

Through the tab "Synthetic spectra", you will be able to:

- select a range in temperature, metallicity, gravity and microturbulence velocity according to the results of the VizieR's catalogs query
- search the POLLUX database for high resolution synthetic spectra corresponding to these parameters or upload your own spectra
- convolve portions of the selected spectra to transform them into simulated observations
- apply the doppler shift associated to the radial velocity of the star selected in the "Observed Spectra" tab
- store the resulting spectra into the VOTPSpace for further plotting (with VOSPEC or with a local display device) and/or downloading

Please connect to the VO tool of your choice to further simulate your data.

RESET [Color palette] [Font size: A-, A, A+] [i] Last update : Thursday, August 28 2014 @ 19:06 (CEST +2:00)

**PREVIEW**  
VIEW [Spectral plot icon]

**VO**  
[Monitor icon]

**CART**  
CART [Shopping cart icon]

**TOOLS**  
TOPCAT  
VOSpec  
Splat VO  
VOPlot  
Cassis

# SPECFLOW : Démo

**VO SPECFLOW** Home Stellar parameters Observed spectra Synthetic spectra Convolution

Search for stellar parameters

**QUERY**

Star ID

Catalog

**RESULTS**

**Simbad**

- Source : Simbad query
- Description :
- meta.main : None
- src.class : \*\*
- pos.eq.ra;meta.main : 059.333275
- pos.eq.dec;meta.main : +50.855156
- PHYS.VELOC.ROTAT : None
- spect.dopplerVeloc.opt : -1.80
- src.spType : G8II

**Vizier**

Average

- phys.temperature.effective : 4900.0
- phys.gravity : None
- phys.abund.Fe : None
- phys.veloc.rotat : None
- phys.veloc.microTurb : None
- spect.dopplerVeloc.opt : None
- src.spType : None

**Show details**

**Mean of stellar parameters**

phys.temperature.effective	phys.gravity	phys.abund.Fe	phys.veloc.rotat	phys
<input type="text" value="4900.0"/>	<input type="text" value="None"/>	<input type="text" value="None"/>	<input type="text" value="None"/>	<input type="text" value="Non"/>

**Details**

<input checked="" type="checkbox"/>	Source	phys.temperature.effective	phys.gravity	phys.abund.Fe	phys.veloc.rotat	phys
<input checked="" type="checkbox"/>	I/61B	None	None	None	None	None
<input checked="" type="checkbox"/>	I/99	None	None	None	None	None
<input checked="" type="checkbox"/>	I/122	None	None	None	None	None
<input checked="" type="checkbox"/>	I/131A	None	None	None	None	None
<input checked="" type="checkbox"/>	I/141	None	None	None	None	None
<input checked="" type="checkbox"/>	I/146	None	None	None	None	None
<input checked="" type="checkbox"/>	I/171	None	None	None	None	None
<input checked="" type="checkbox"/>	I/176	None	None	None	None	None

PREVIEW  
 VIEW  
 VO  
 CART  
 TOOLS  
 TOPCAT  
 VOSpec  
 Splat VO  
 VOPlot  
 CASSIS

Last update : Thursday, September 18 2014 @ 14:06 (CEST +2:00)

# SPECFLOW : Démo

The screenshot displays the VO SPECFLOW web interface. At the top, there are navigation tabs: Home, Stellar parameters, Observed spectra, Synthetic spectra, and Convolution. The main section is titled "Search for observed spectra" and is divided into "QUERY" and "RESULTS" columns.

**QUERY**

- From local disk:
- From: TLegacy database
- RA:
- DEC:
- SIZE:
- 
- Test:

**RESULTS**

- hd232862\_narval\_16sep08\_pol\_Normal\_V\_01\_tbl.fts
- hd232862\_narval\_19sep08\_pol\_Normal\_V\_01\_tbl.fts
- hd232862\_narval\_20sep08\_pol\_Normal\_V\_01\_tbl.fts
- hd232862\_narval\_21sep08\_pol\_Normal\_V\_01\_tbl.fts
- hd232862\_narval\_25sep08\_pol\_Normal\_V\_01\_tbl.fts
- hd232862\_narval\_26sep08\_int\_Normal\_I\_001\_tbl.fts
- hd232862\_narval\_26sep08\_int\_Normal\_I\_002\_tbl.fts
- hd232862\_narval\_26sep08\_int\_Normal\_I\_003\_tbl.fts
- hd232862\_narval\_26sep08\_int\_Normal\_I\_004\_tbl.fts
- hd232862\_narval\_26sep08\_pol\_Normal\_V\_01\_tbl.fts
- hd232862\_narval\_27sep08\_int\_Normal\_I\_001\_tbl.fts
- hd232862\_narval\_27sep08\_int\_Normal\_I\_002\_tbl.fts
- hd232862\_narval\_27sep08\_int\_Normal\_I\_003\_tbl.fts
- hd232862\_narval\_27sep08\_int\_Normal\_I\_004\_tbl.fts
- hd232862\_narval\_27sep08\_pol\_Normal\_V\_01\_tbl.fts
- hd232862\_narval\_28sep08\_pol\_Normal\_V\_01\_tbl.fts
- hd232862\_narval\_29sep08\_pol\_Normal\_V\_01\_tbl.fts
- hd232862\_narval\_30sep08\_pol\_Normal\_V\_01\_tbl.fts

**RIGHT SIDEBAR**

- PREVIEW**:  (with a spectral plot icon)
- VO**:  (with a monitor icon)
- CART**:  (with a shopping cart icon)
- TOOLS**: , , , ,

**FOOTER**

RESET      Last update : Thursday, August 28 2014 @ 19:06 (CEST +2:00)

# SPECFLOW : Démo

The screenshot displays the VO SPECFLOW web interface. At the top, there are navigation tabs: Home, Stellar parameters, Observed spectra, Synthetic spectra, and Convolution. The main heading is "Search for synthetic spectra".

**QUERY**

From local disk

**Import**

From

Min/max range of stellar parameters

Teff

logg

metallicity

vturb

**Search**

**RESULTS**

Pollux

50 files

- NORMFLUX\_M\_p5000g3.5z-0.25t1.0\_a0.10c0.00n0.00o0.00r0.00s0.00\_VIS.spec.FITS
- NORMFLUX\_M\_p5000g4.0z-0.25t1.0\_a0.10c0.00n0.00o0.00r0.00s0.00\_VIS.spec.FITS
- NORMFLUX\_M\_p5000g4.5z-0.25t1.0\_a0.10c0.00n0.00o0.00r0.00s0.00\_VIS.spec.FITS
- NORMFLUX\_M\_p5000g5.0z-0.25t1.0\_a0.10c0.00n0.00o0.00r0.00s0.00\_VIS.spec.FITS
- NORMFLUX\_M\_p5250g3.5z-0.25t1.0\_a0.10c0.00n0.00o0.00r0.00s0.00\_VIS.spec.FITS
- NORMFLUX\_M\_p5250g4.0z-0.25t1.0\_a0.10c0.00n0.00o0.00r0.00s0.00\_VIS.spec.FITS
- NORMFLUX\_M\_p5250g4.5z-0.25t1.0\_a0.10c0.00n0.00o0.00r0.00s0.00\_VIS.spec.FITS
- NORMFLUX\_M\_p5250g5.0z-0.25t1.0\_a0.10c0.00n0.00o0.00r0.00s0.00\_VIS.spec.FITS
- NORMFLUX\_M\_s5000g0.0z-0.25t1.0\_a0.10c0.00n0.00o0.00r0.00s0.00\_VIS.spec.FITS
- NORMFLUX\_M\_s5000g0.5z-0.25t1.0\_a0.10c0.00n0.00o0.00r0.00s0.00\_VIS.spec.FITS
- NORMFLUX\_M\_s5000g1.0z-

RESET

Last update : Thursday, August 28 2014 @ 19:06 (CEST +2:00)

**PREVIEW**  
**VIEW**

**VO**

**CART**  
**CART**

**TOOLS**  
TOPCAT  
VOSpec  
Splat VO  
VOPlot  
Cassis

# SPECFLOW : Démo

The screenshot displays the VO SPECFLOW web interface. At the top, there are navigation tabs: Home, Stellar parameters, Observed spectra, Synthetic spectra, and Convolution. The main content area is titled "Convolutions of chosen synthetic spectrum" and is divided into two columns: "QUERY" and "RESULTS".

**QUERY**

Synthetic spectrum selected from Pollux Database (FITS file)  
NORMFLUX\_M\_p5000g5.0z-0.25t1.0\_a0.10c0.0...

Central wavelength Line Central wavelength (A)  
Halpα 6560

Wavelength width (A) 100

	Value	Unit
Macroturbulence velocity	2	km/s
Rotational velocity	27	km/s
Instrumental profile	105	mA

Radial velocity (km/s) -1.80

Output file format FITS

**Process**

**RESULTS**

**Convolution**

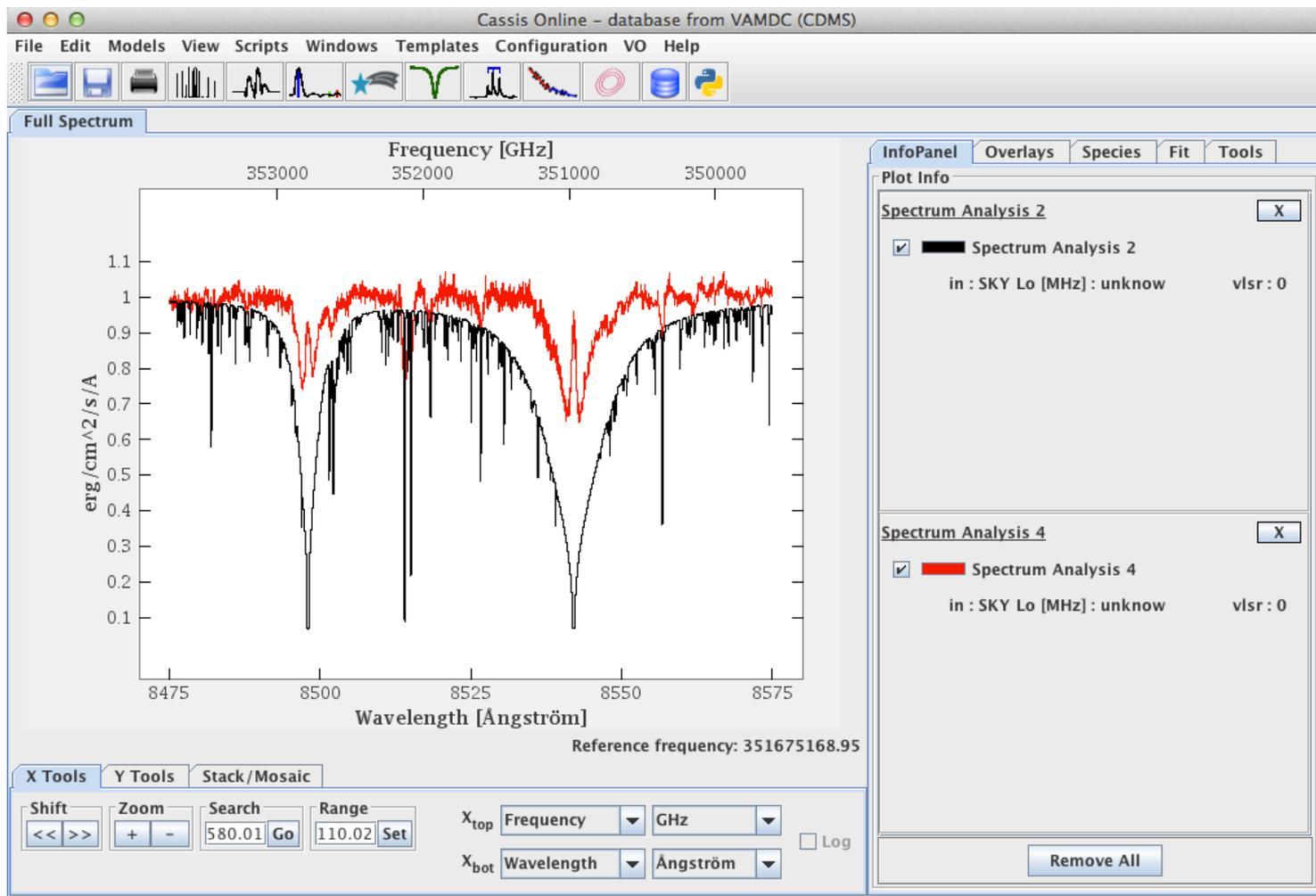
CONV\_T2R27G105mA\_L6560\_W100\_S-1.80\_M\_p5000g5.0z-0.25t1.0\_a0.10c0.00n0.00o0.00r0.00s0.00\_VIS.spec.FITS

On the right side, there is a vertical sidebar with the following elements:

- PREVIEW**: A "VIEW" button with a line graph icon.
- VO**: A button with a computer monitor icon.
- CART**: A button with a shopping cart icon.
- TOOLS**: A list of buttons: TOPCAT, VOSpec, Splat VO, VOPlot, and CASSIS.

At the bottom of the interface, there is a "RESET" button, a color calibration bar, and a status bar that reads "Last update : Thursday, September 18 2014 @ 14:06 (CEST +2:00)".

# SPECFLOW : Démo



# Perspectives



- Intégration de **speconvol** dans des outils d'analyse/visualisation
- Etendre l'utilisation de **specflow** à d'autres bases de spectres observés et de spectres théoriques
- Promotion de **specflow** à des fins d'enseignement

Je vous remercie de votre attention.