

# HITS

Heidelberg Institute for  
Theoretical Studies

Funded by the European Union's  
Horizon 2020 – Grant N° 824064



## MEGAVIS - Real-time spectra analysis and visualization with autoencoders

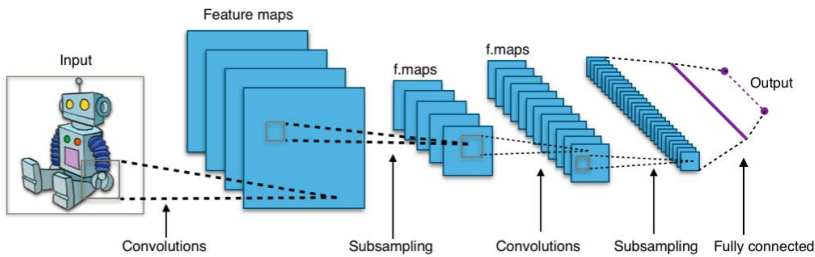
Antonio D'Isanto – Astrominformatics group  
AG Virtual Meeting – September 2020

# ESCAPE project

- ESCAPE: European Science Cluster of Astronomy & Particle physics ESFRI research infrastructures
- Accessibility to huge amounts of data provided by research infrastructures and facilities
- Bring together partners from astronomy and particle physics
- Deliver solutions to ensure integration of data, tools, services and software
- Build standards and ensure interoperability



# A new paradigm for data interaction → Science platforms

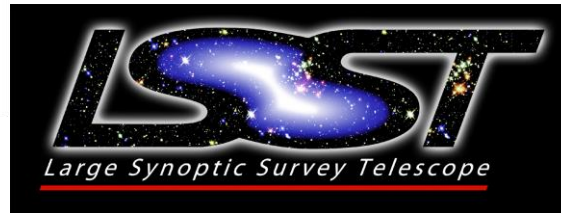


• Image from Wikipedia



Big Data by Nick Youngson CC BY-SA 3.0 Alpha  
Stock Images

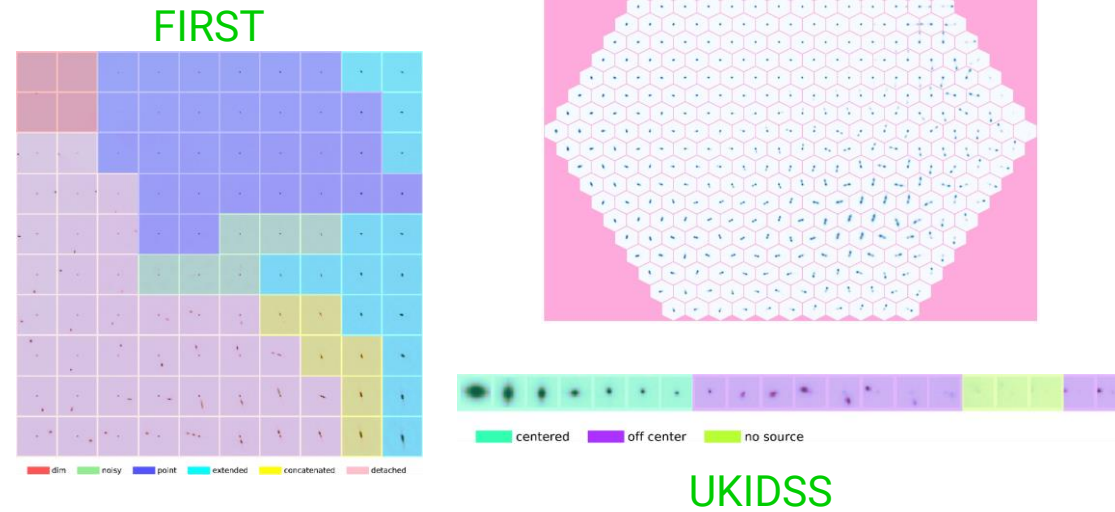
- Data analysis
- Data access
- Interaction with databases
- Bringing code to the data



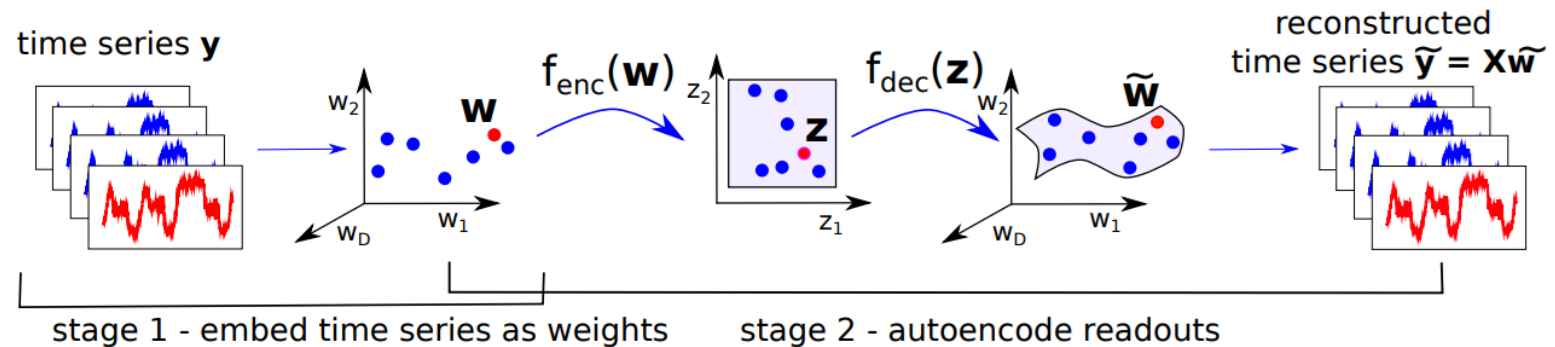
# Dimensionality reduction

The story so far...

- Radio galaxies



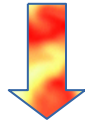
- Time series



# HARPS

- HARPS: the High Accuracy Radial velocity Planet Searcher at the ESO La Silla 3.6m telescope
- 267.487 high resolution spectra

→ multiple observations



7.535 unique sources



Image from Wikipedia



# UVES

- UVES: the Ultraviolet and Visual Echelle Spectrograph mounted on the VLT on Cerro Paranal
- 123.491 high resolution spectra for different classes of sources:
- Stars
- Galaxies
- Quasars

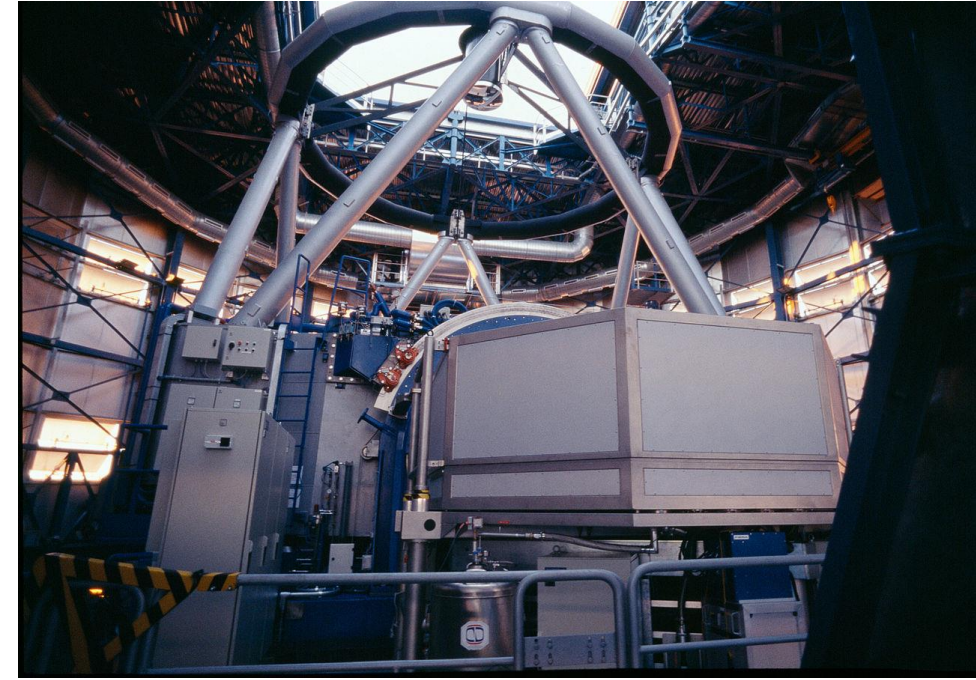
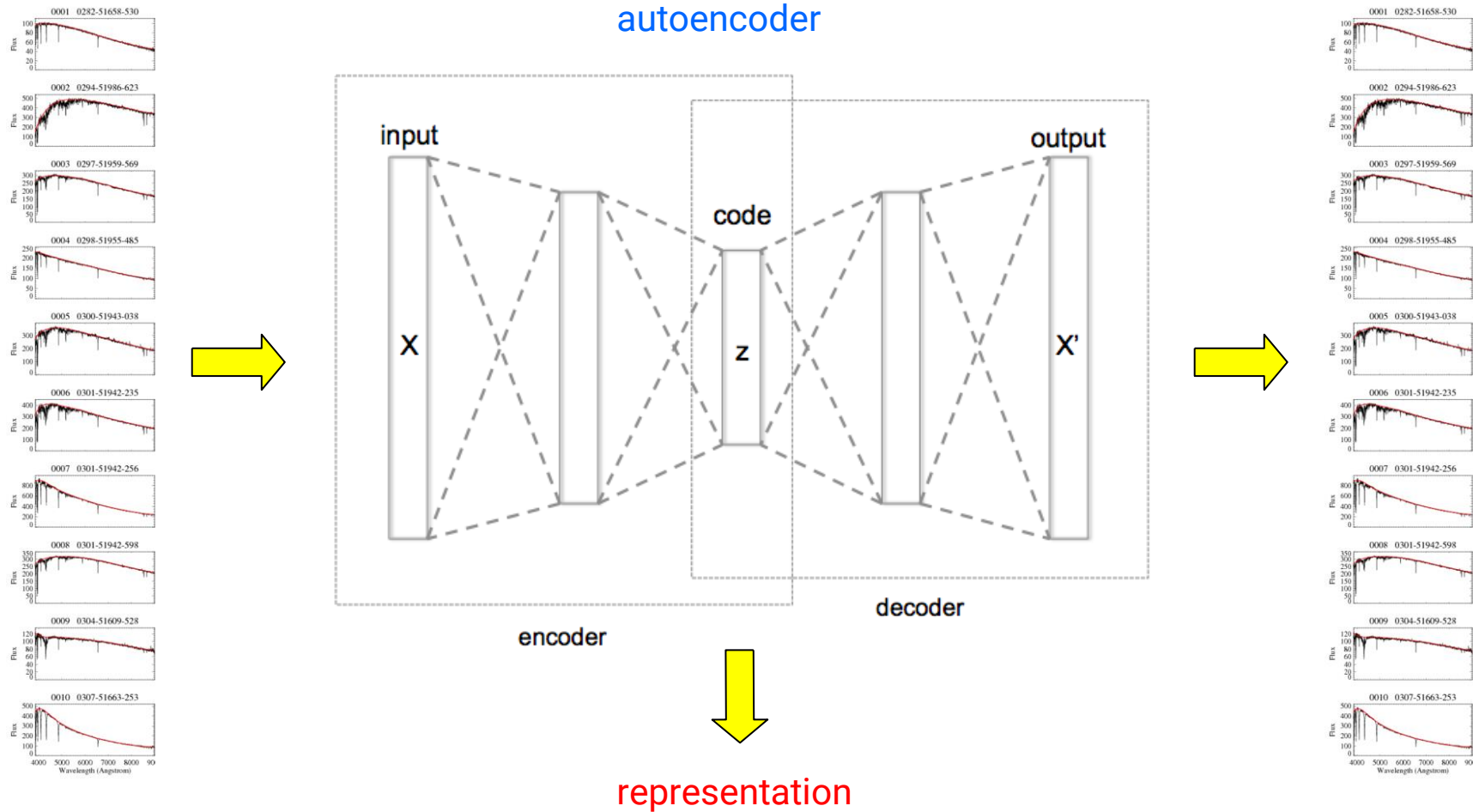


Image from Wikipedia



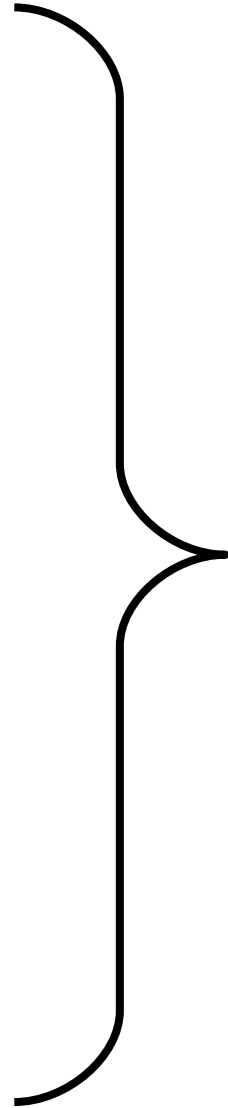
# The prototype

Development of a prototype for:  
Dimensionality reduction and analysis of spectra



# Prototype requirements

- **M**ulti-model
- **E**xplorative
- **G**eneral
- **A**gile
- **V**isualization
- **I**nteraction
- **S**upport VO



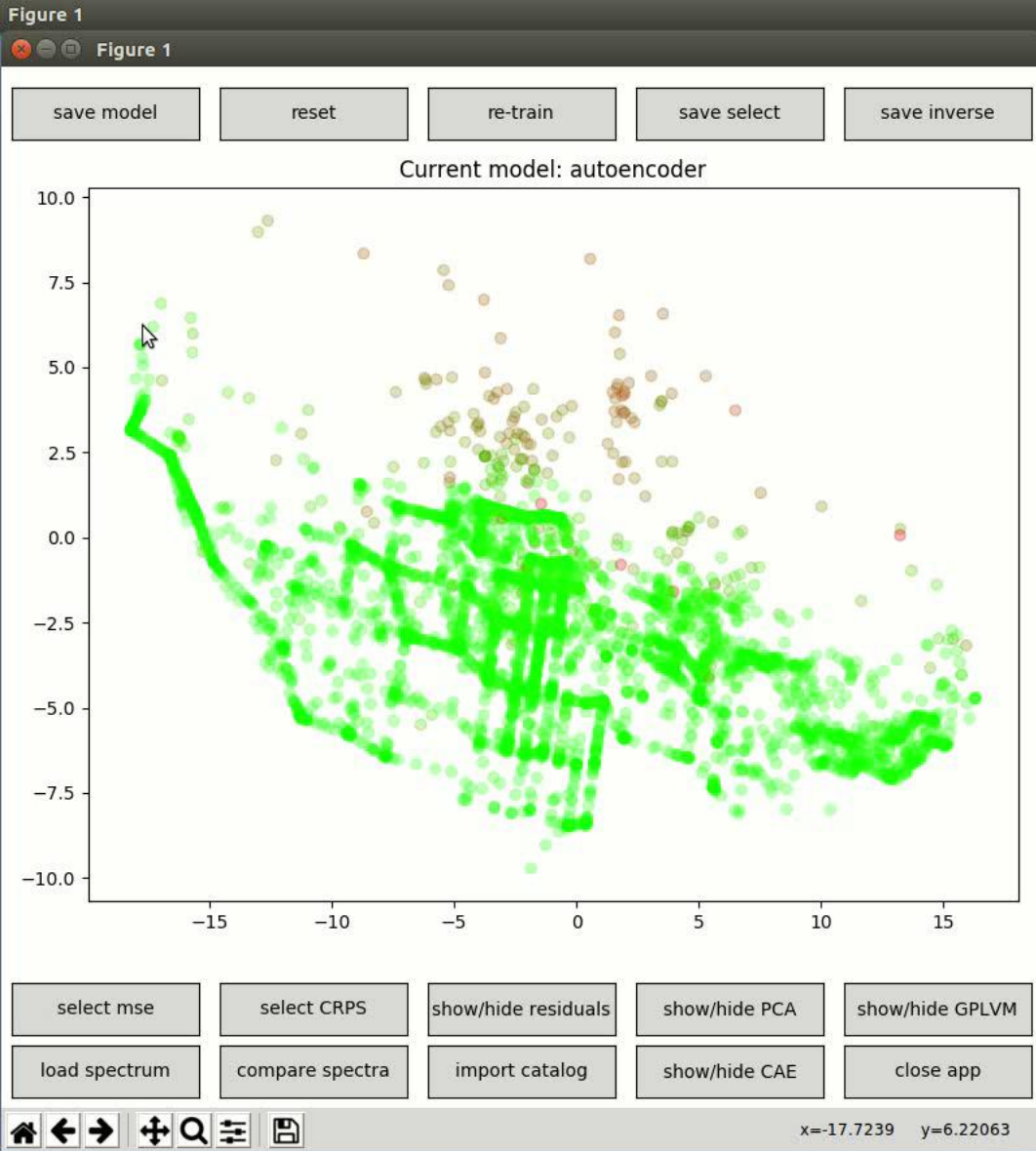


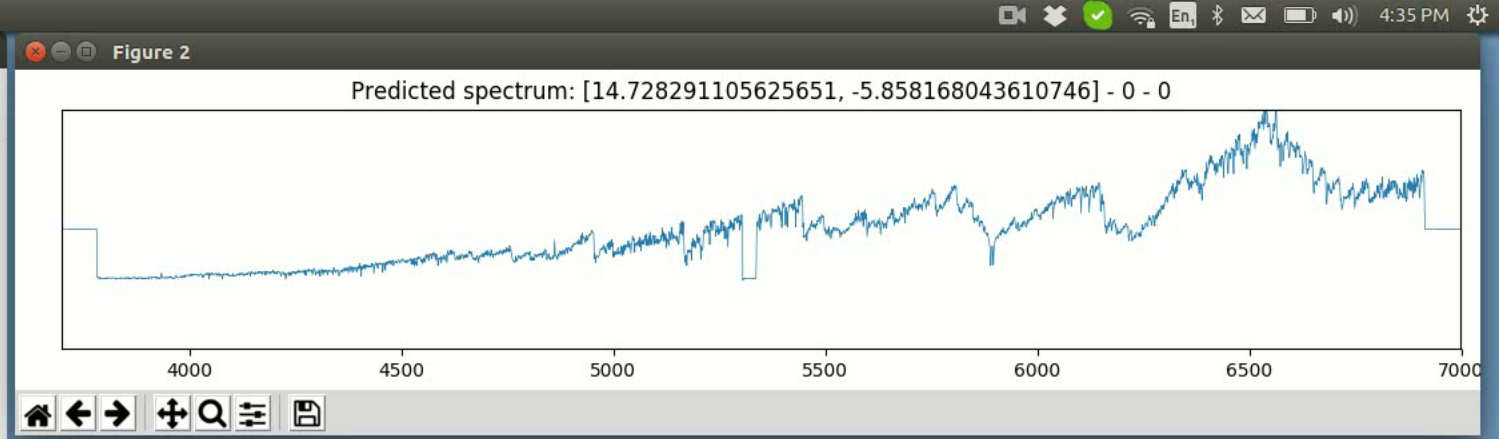
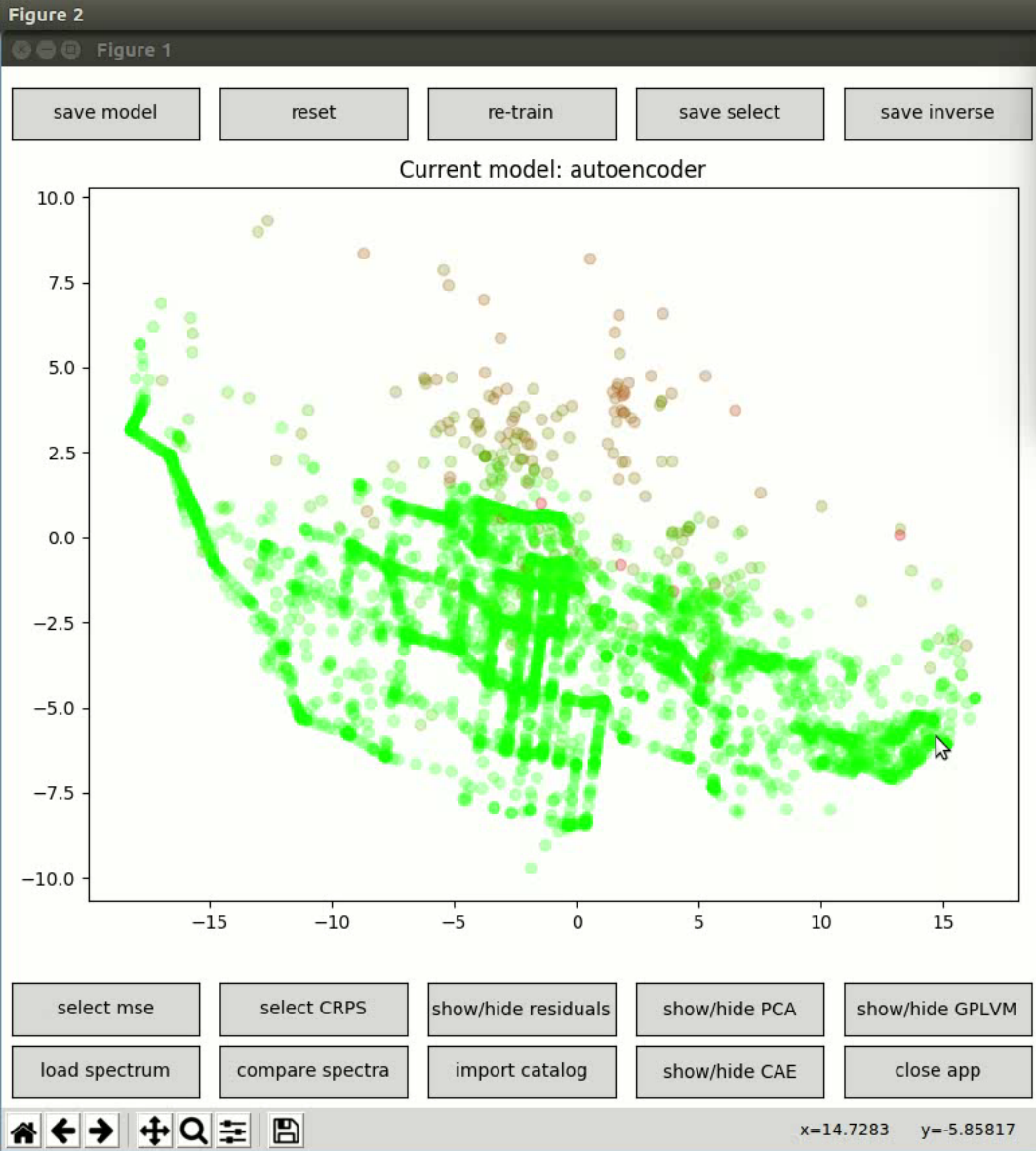
# A short demo

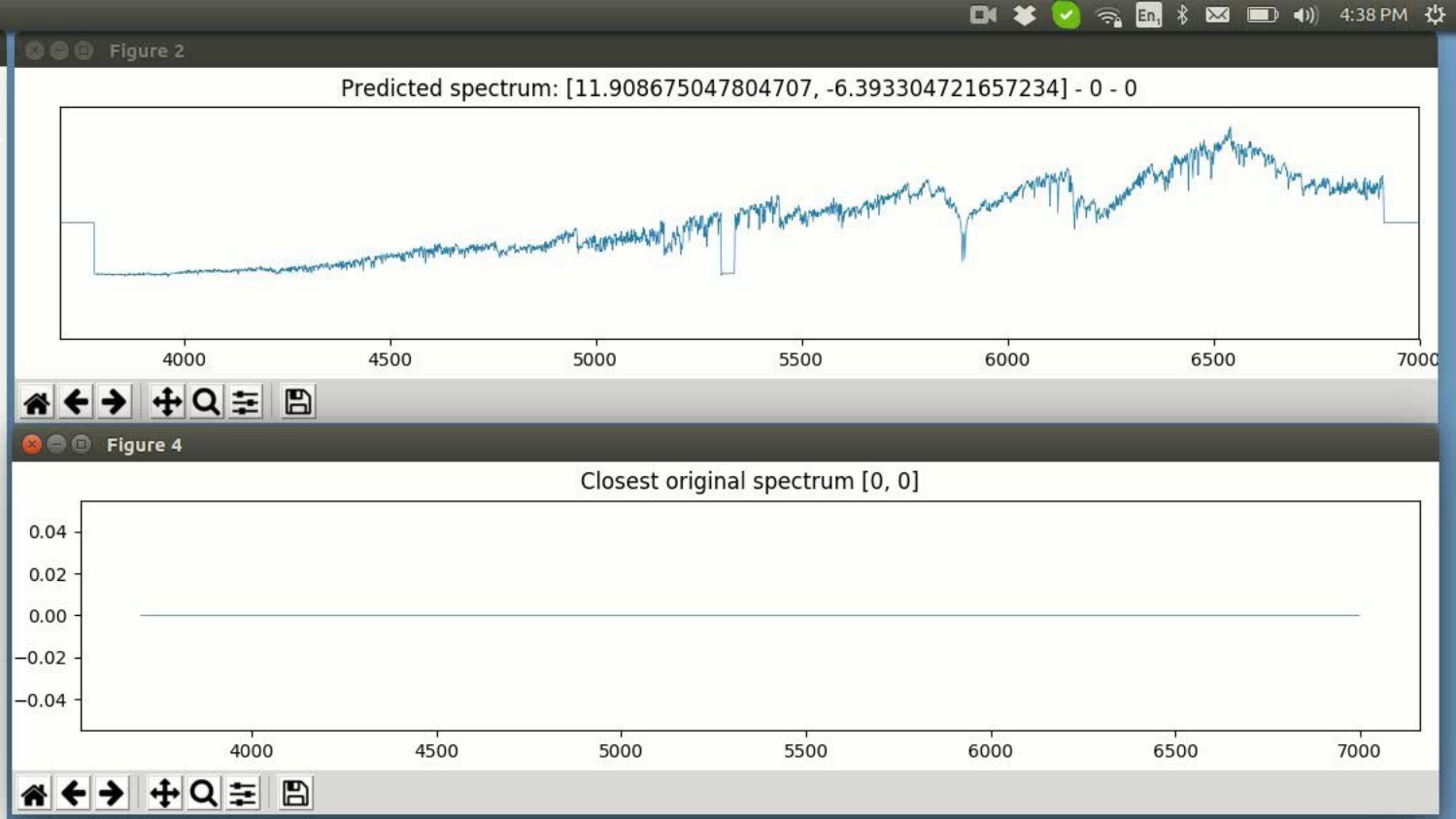
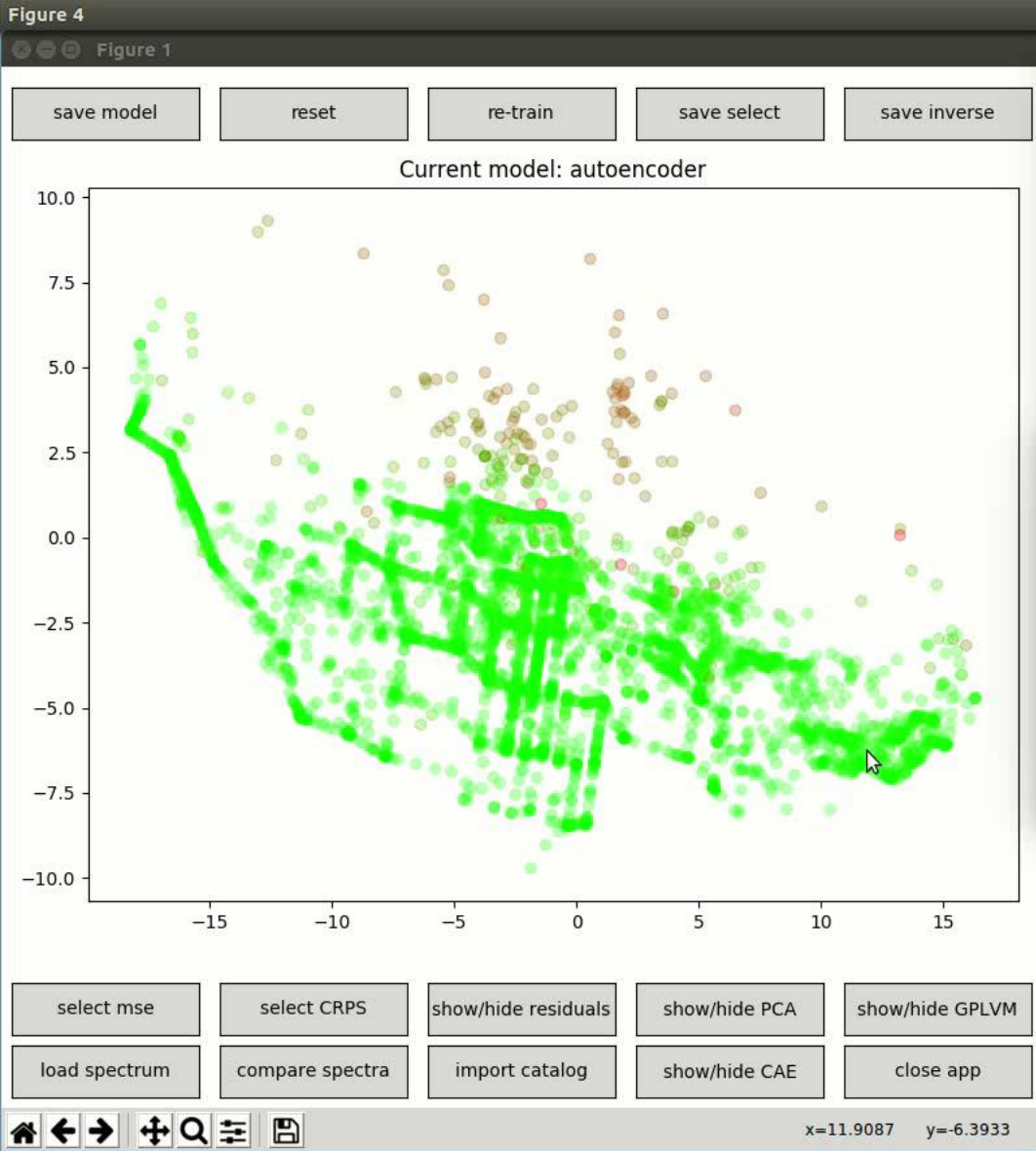
You are going to see only part of the available functionalities!

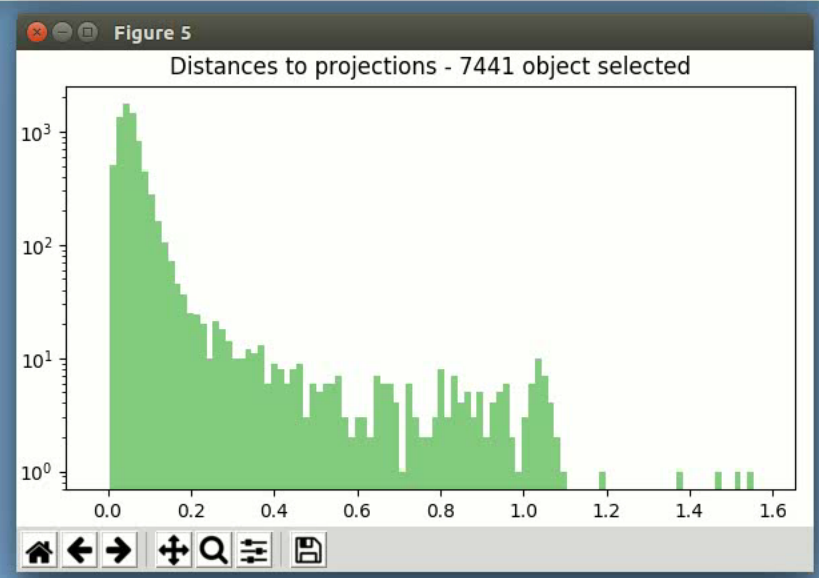
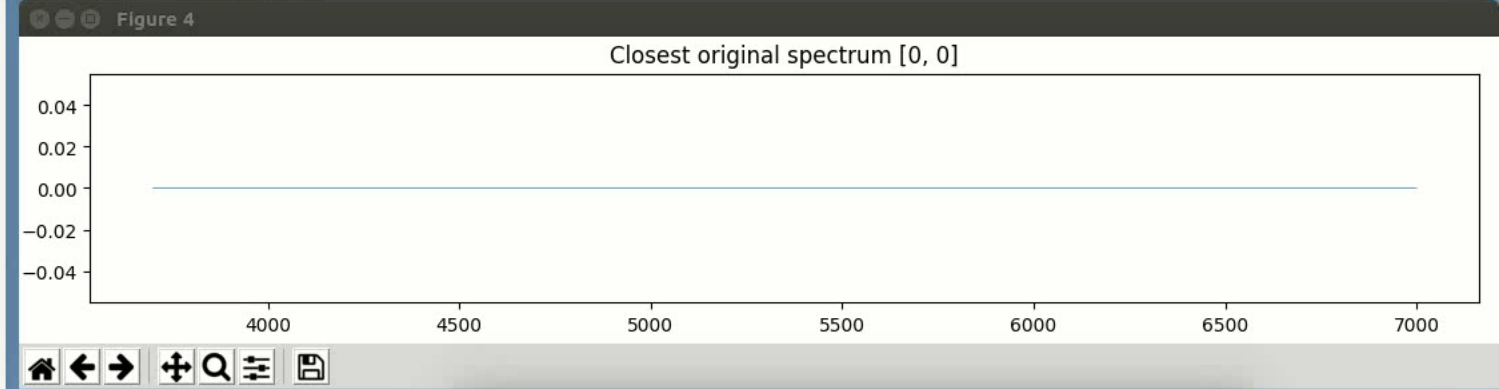
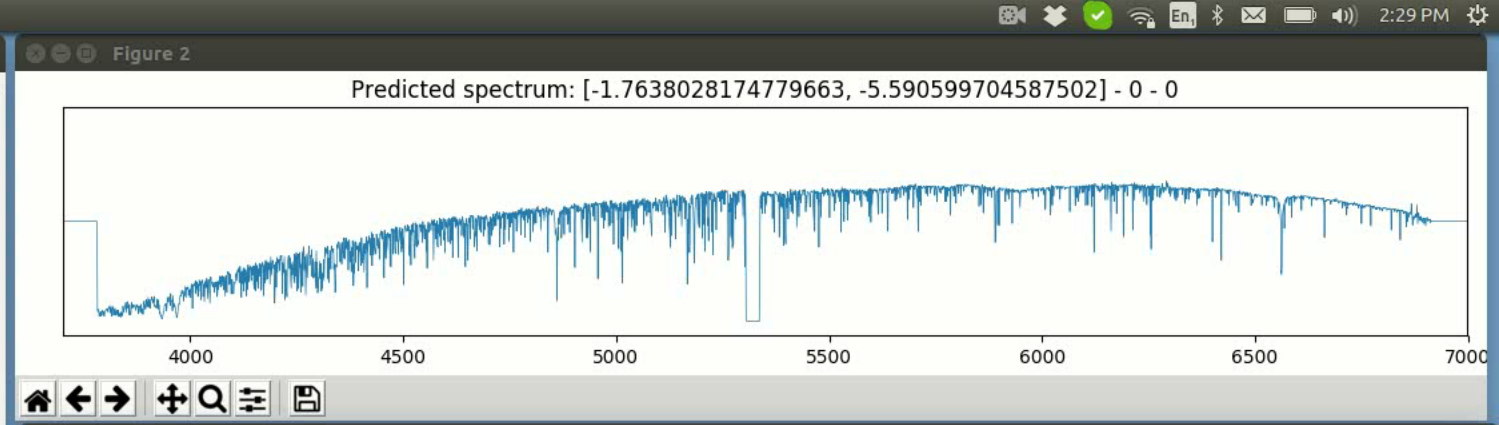
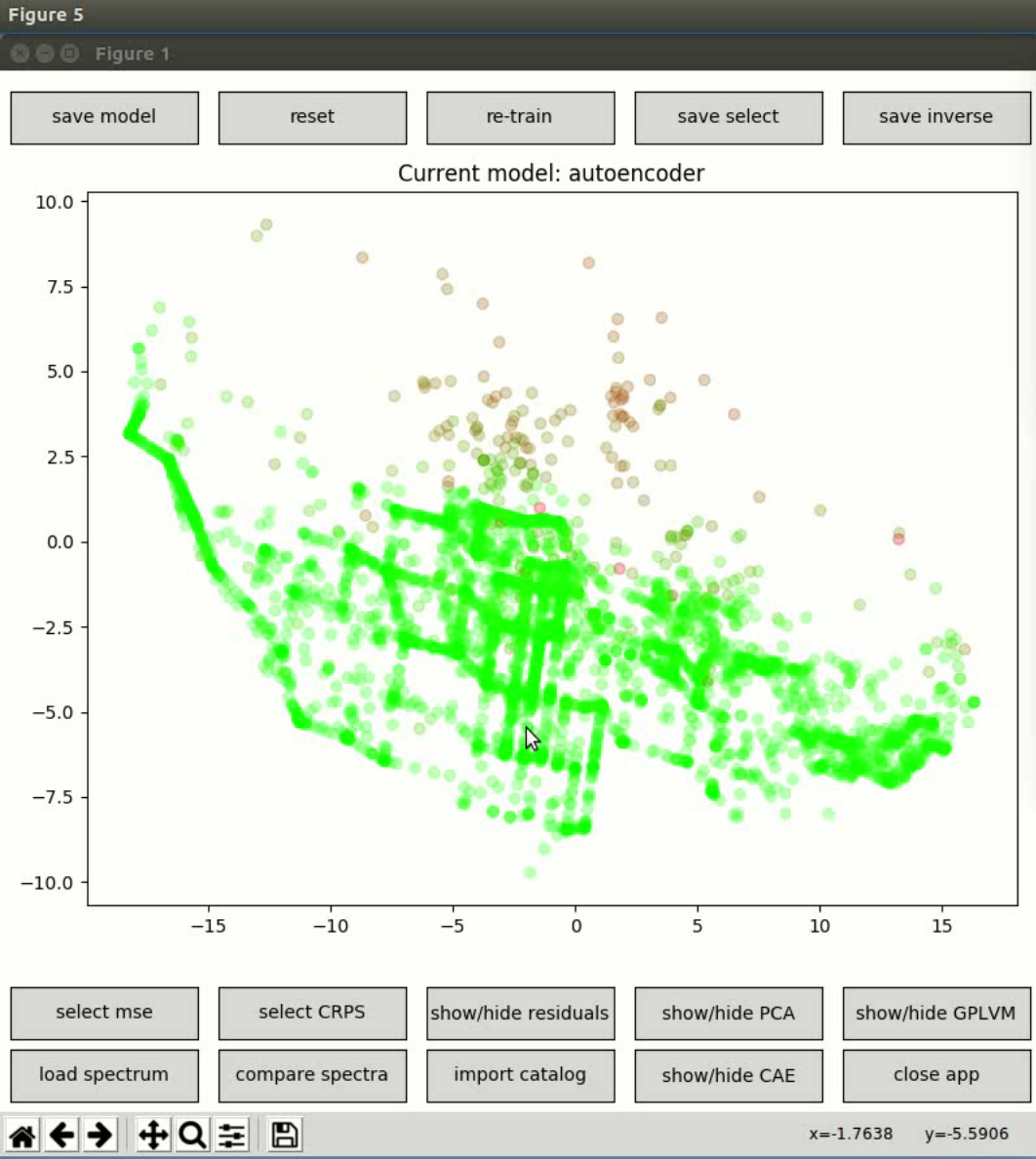
**If interested, please ask or contact me!**

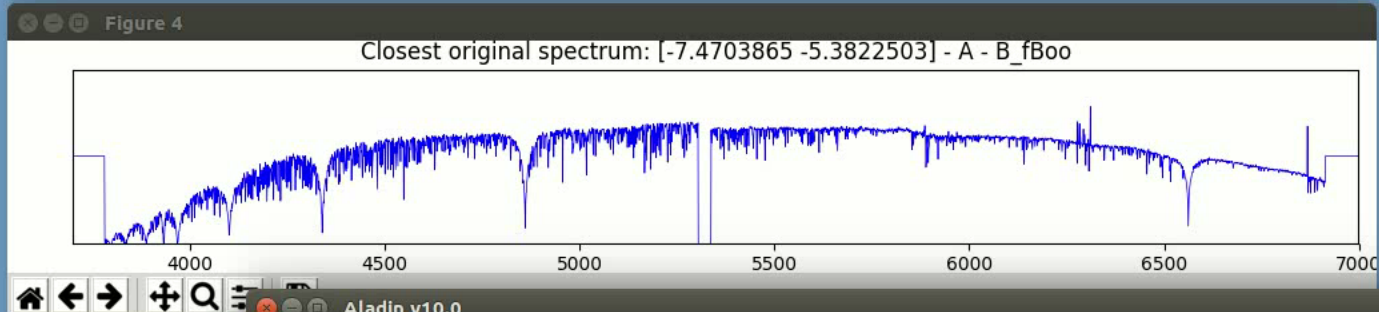
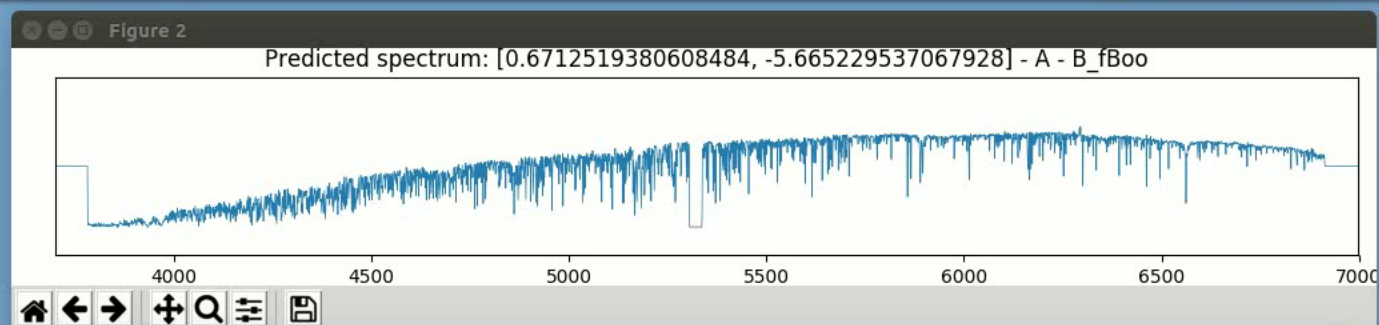
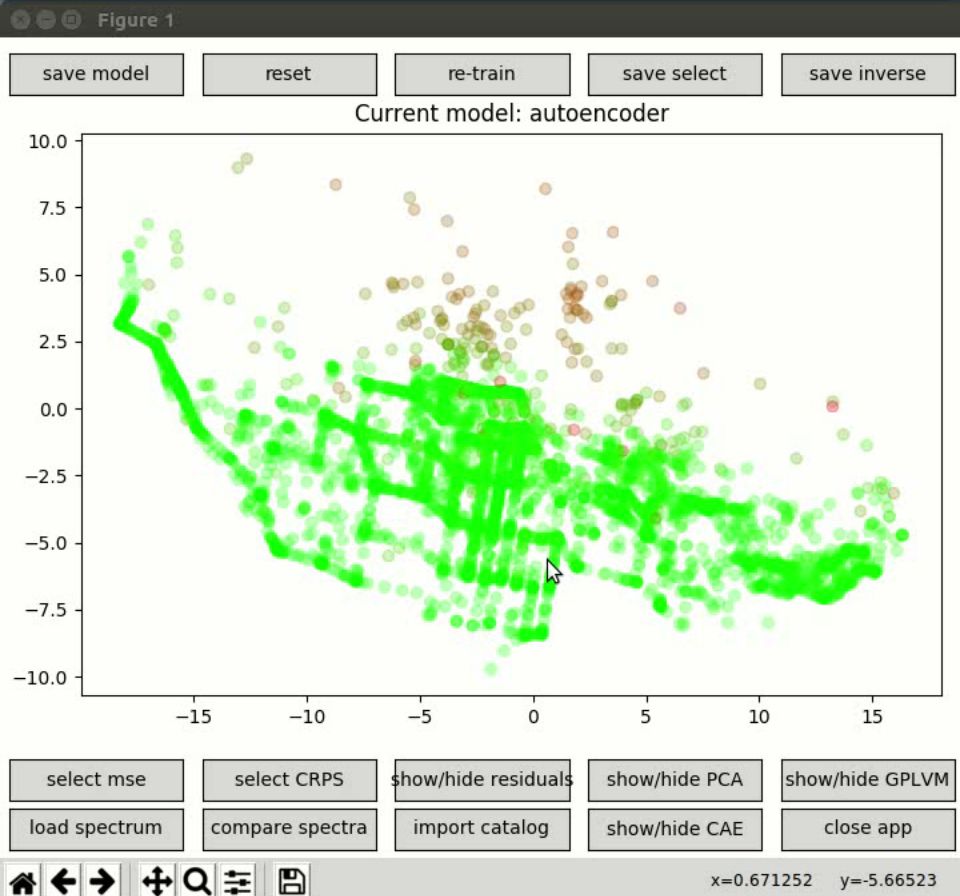












Aladin v10.0

File   Edit   Image   Catalog   Overlay   Coverage   Tool   View   Interop   Help

Available dat.   Command    Frame    Projection

DSS   SDSS   2MASS   WISE   GALEX   PLANCK   AKARI   XMM   Fermi   Gaia   Simbad   NED   +

- DSS colore
- DSS2 Red (F+
- DSS2 NIR (X+
- DECaLS → 4
- Mellinger co
- IPHAS → 3
- J-PLUS-DR1 (Jul
- MINI-PAS-PDR2
- BASS → 2
- DES DR1 LineA co
- GTC Public Arch
- infrared → 124
- radio → 61
- ias-lines → 43
- ia base → 59
- alog → 22856
- pe → 16
- illary → 14

select  from

coll.   sort   view   grid   study   wink   north   hdr   multiview   matchy

Navigation icons: select, pan, zoom, dist, phot, draw, tag, moc, spect, filter, cross, xy, rgb

Welcome to Aladin,  
your professional sky atlas.

- Discover all astronomical data available over the net!
- Compare them with your own data.
- Prepare your observation missions.

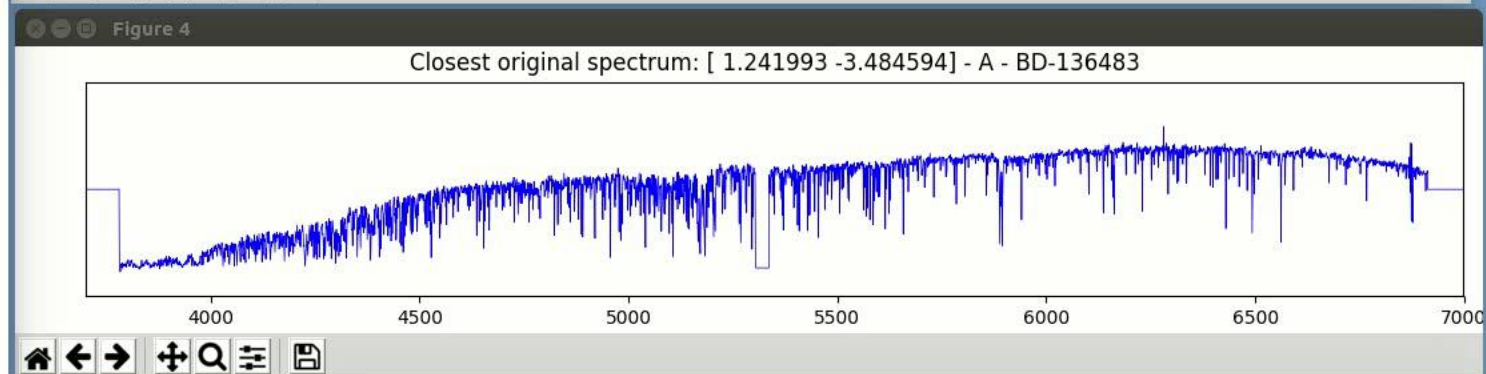
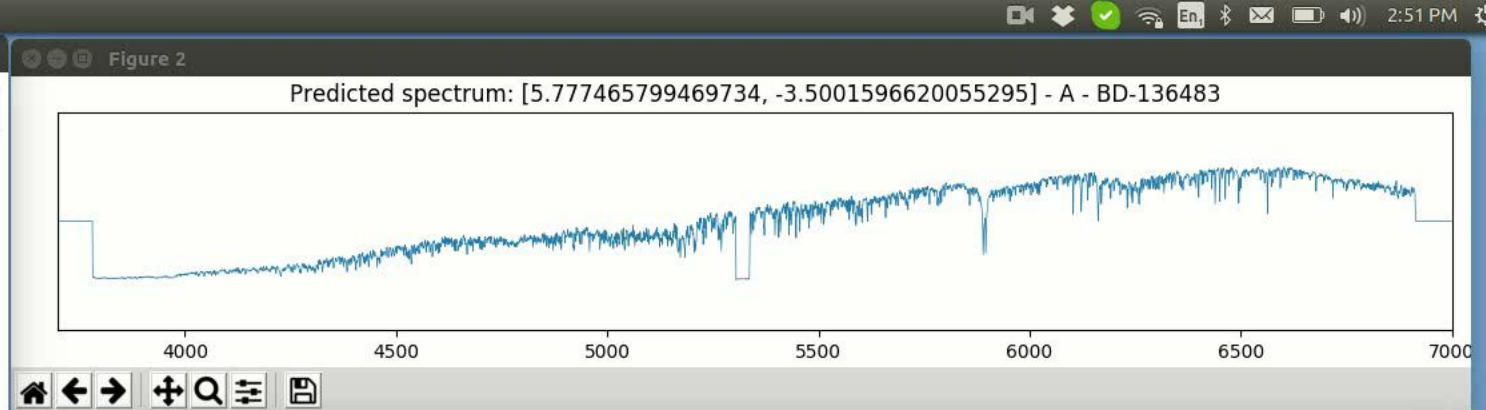
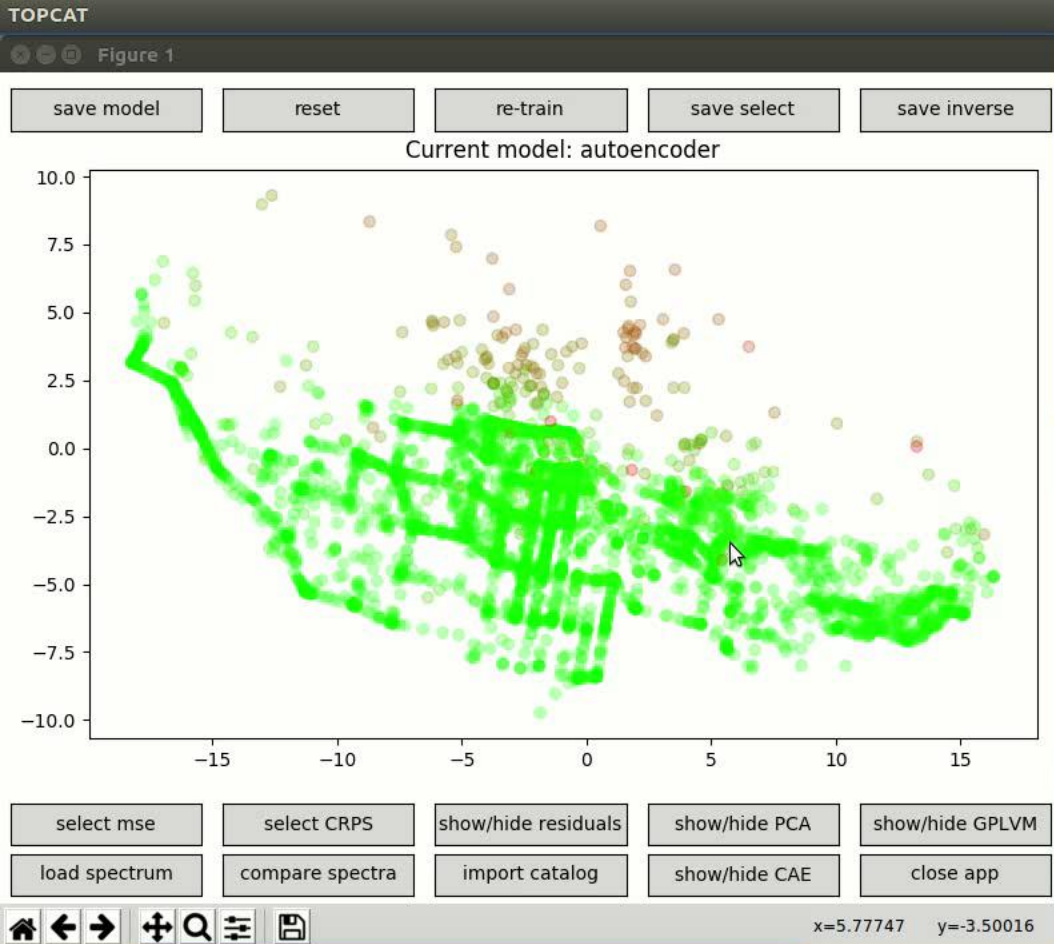
epoch

size

dens.

opac.

zoom



Starlink SPLAT-VO: A Spectral Analysis Tool

File Edit View Options Operations Interop Help

Global list of spectra:

Properties of current spectra:

Short name:

Full name:

Format:

Columns: Coordinates   Data

Colour:  Save   Reset

Composite: 100%

TOPCAT

File Views Graphics Joins Windows VO Interop Help

Table List

Current Table Properties

Label:

Location:

Name:

Rows:

Columns:

Sort Order:

Row Subset:

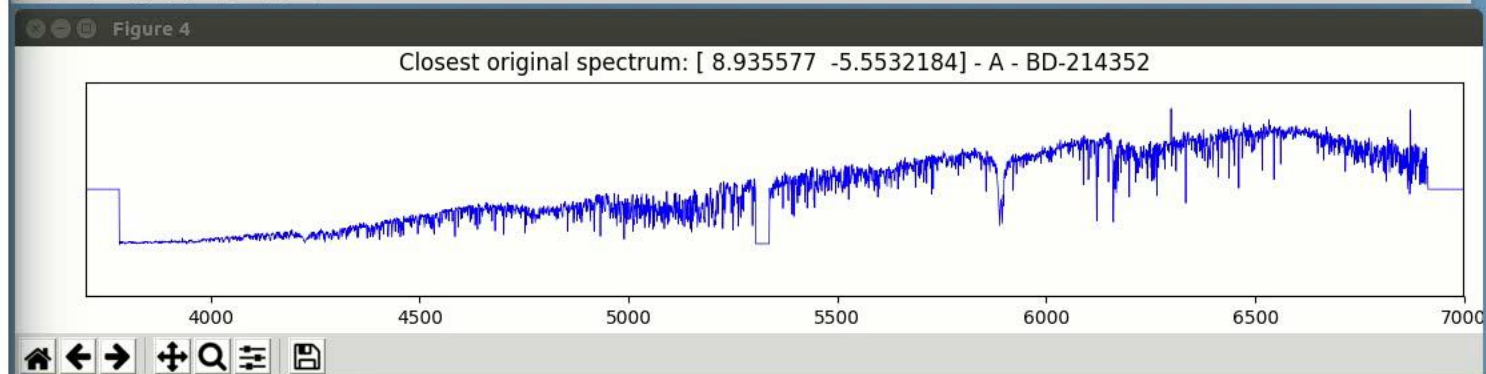
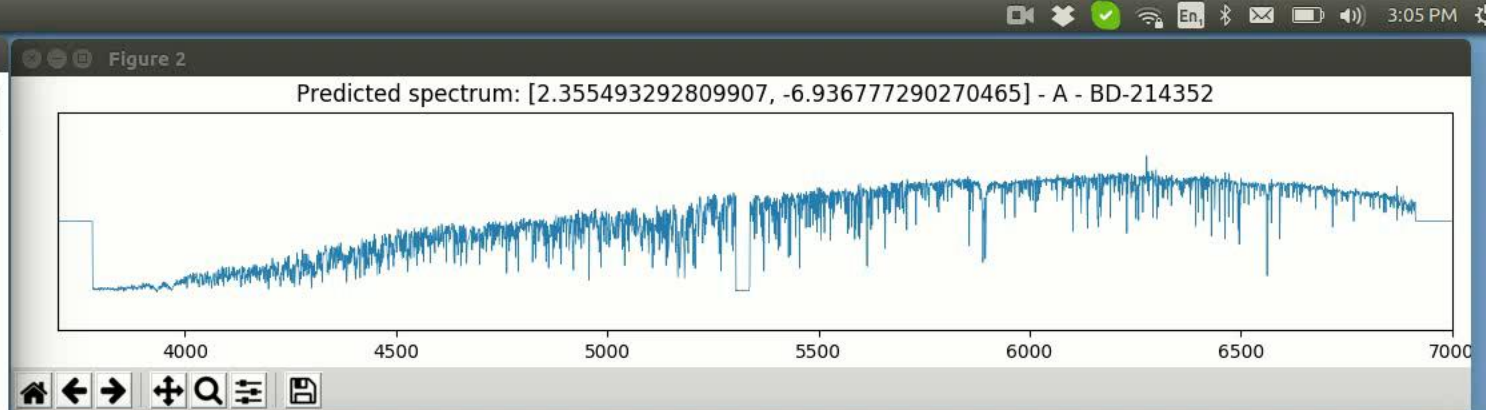
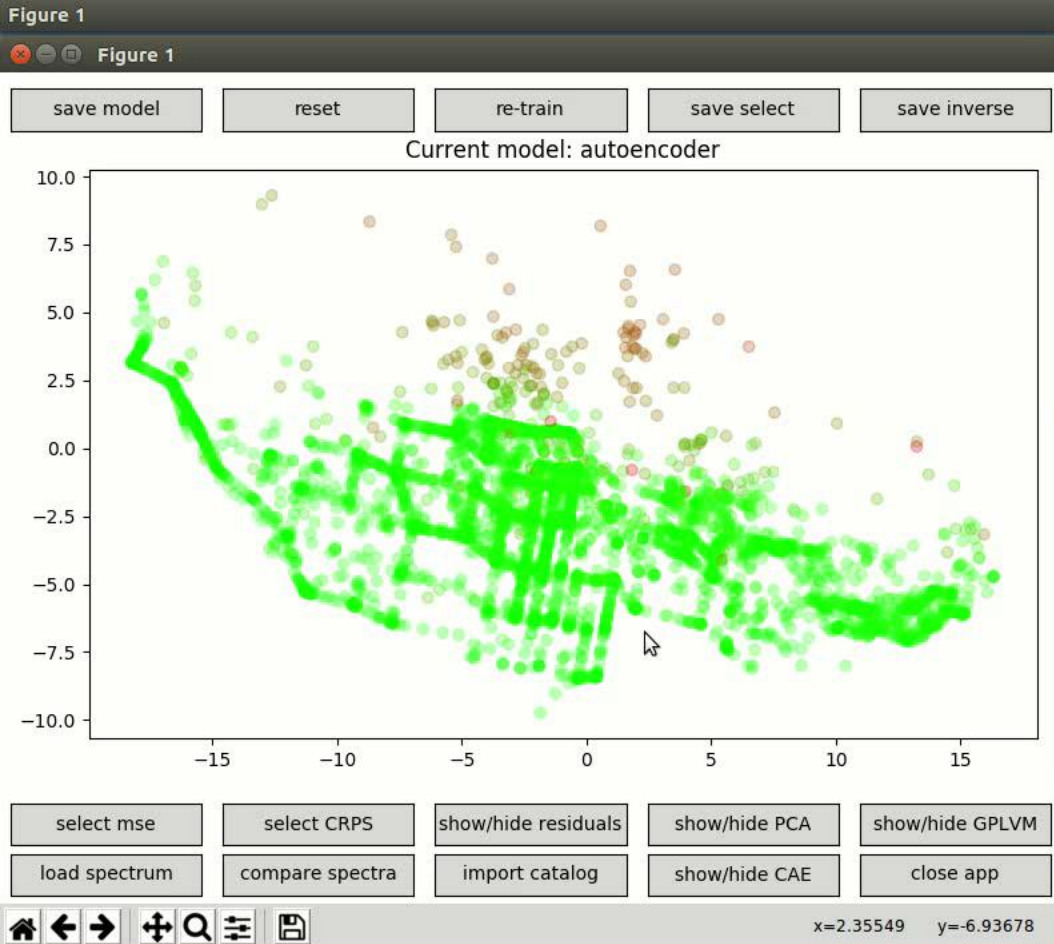
Activation Actions:

SAMP

Messages:

Clients:

180 / 3547 M



TOPCAT

File Views Graphics Joins Windows VO Interop Help

Table List

11: Selection file
--------------------

Current Table Properties

Label: Selection file

Location: samp:Selection file

Name: Selection file

Rows: 10

Columns: 6

Sort Order:

Row Subset: All

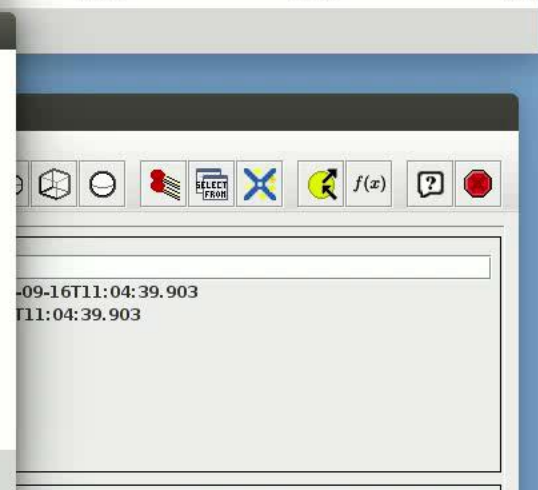
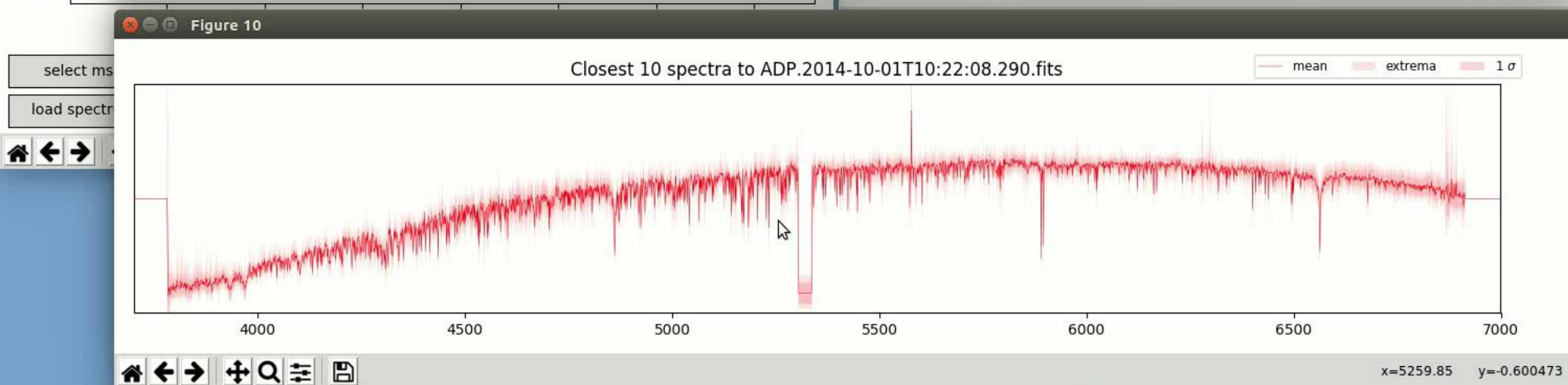
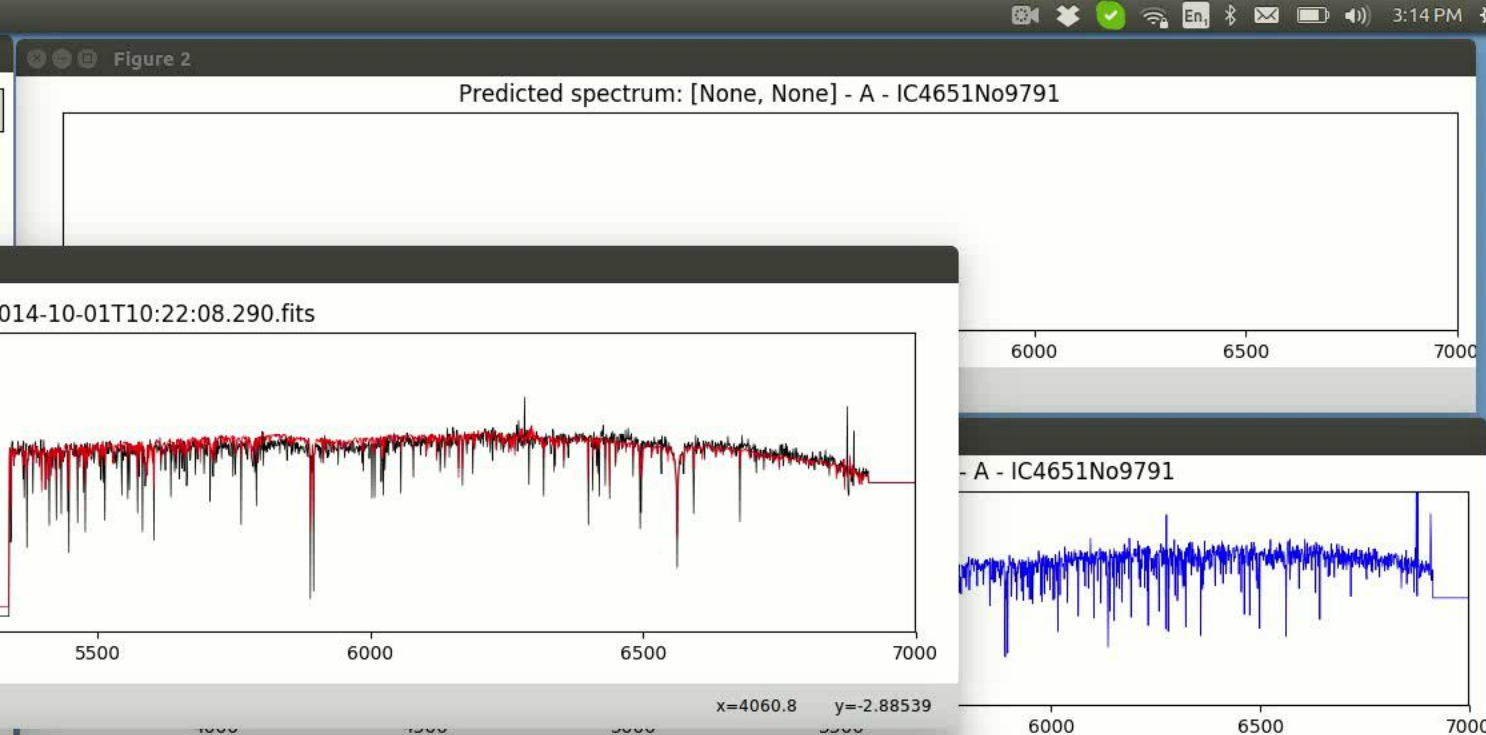
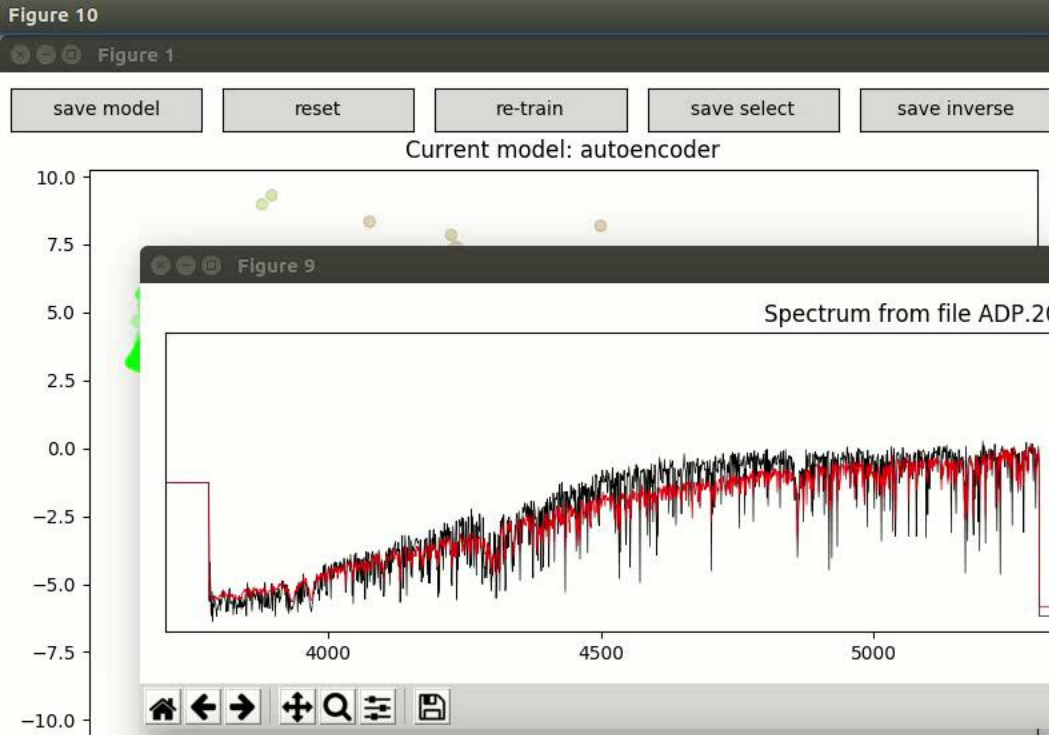
Activation Actions: 0 / 0

SAMP

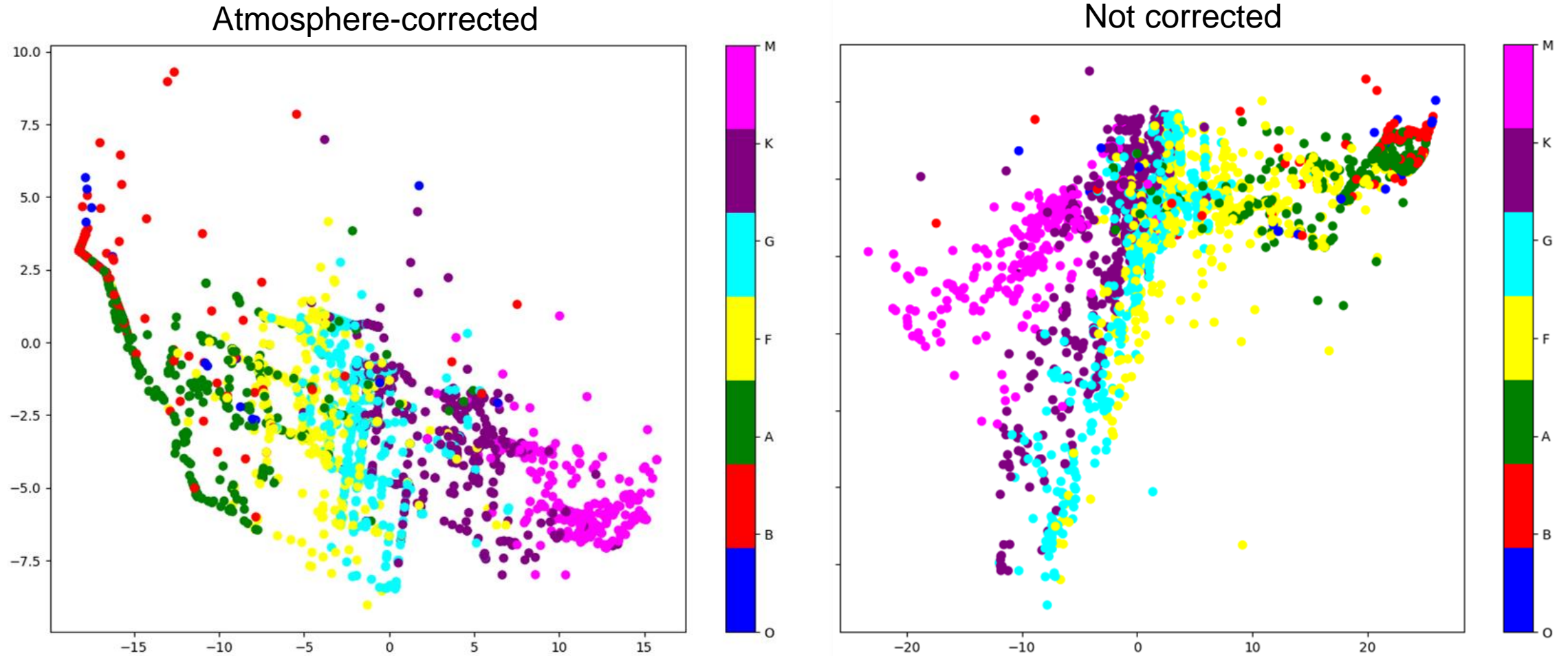
Messages:  Clients:

204 / 3547 M

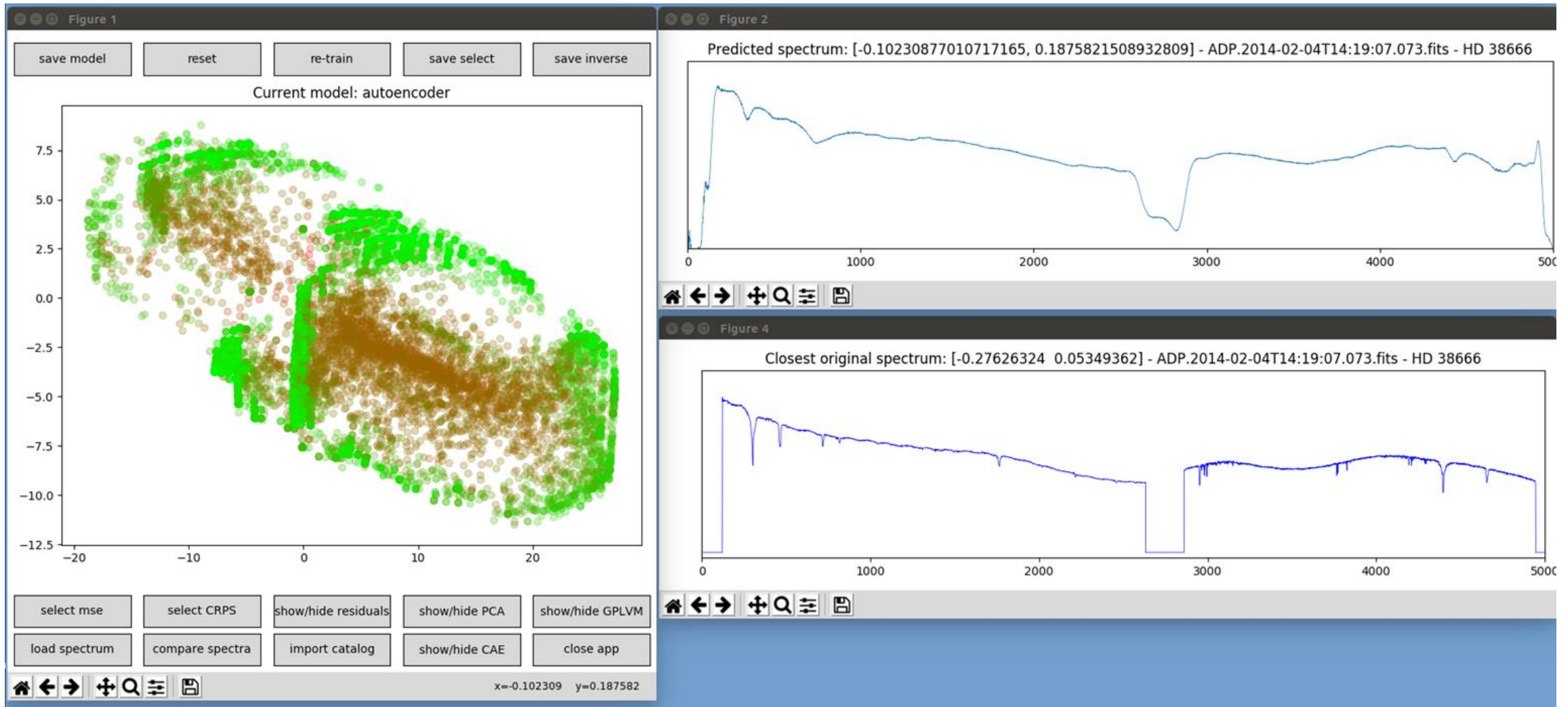




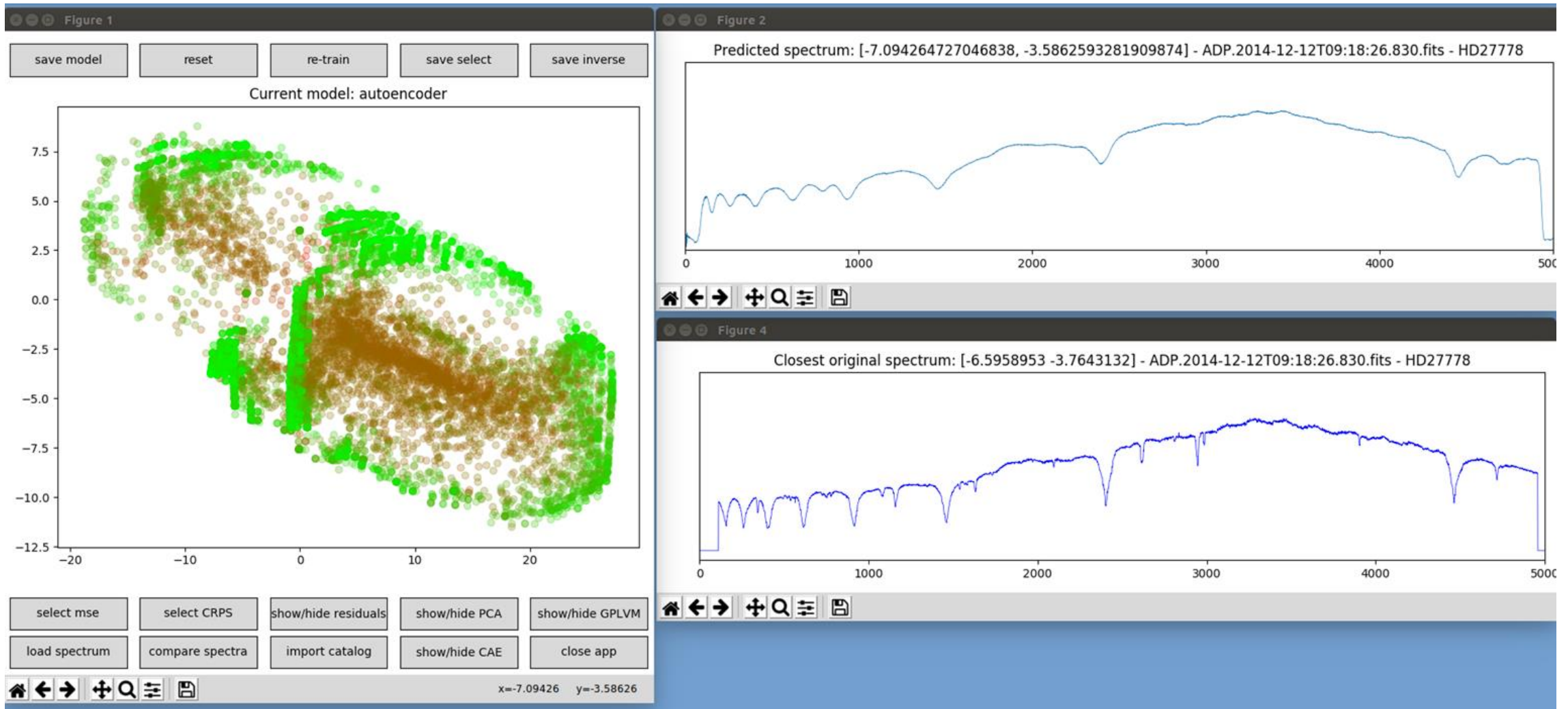
# Spectral class sequence in HARPS data



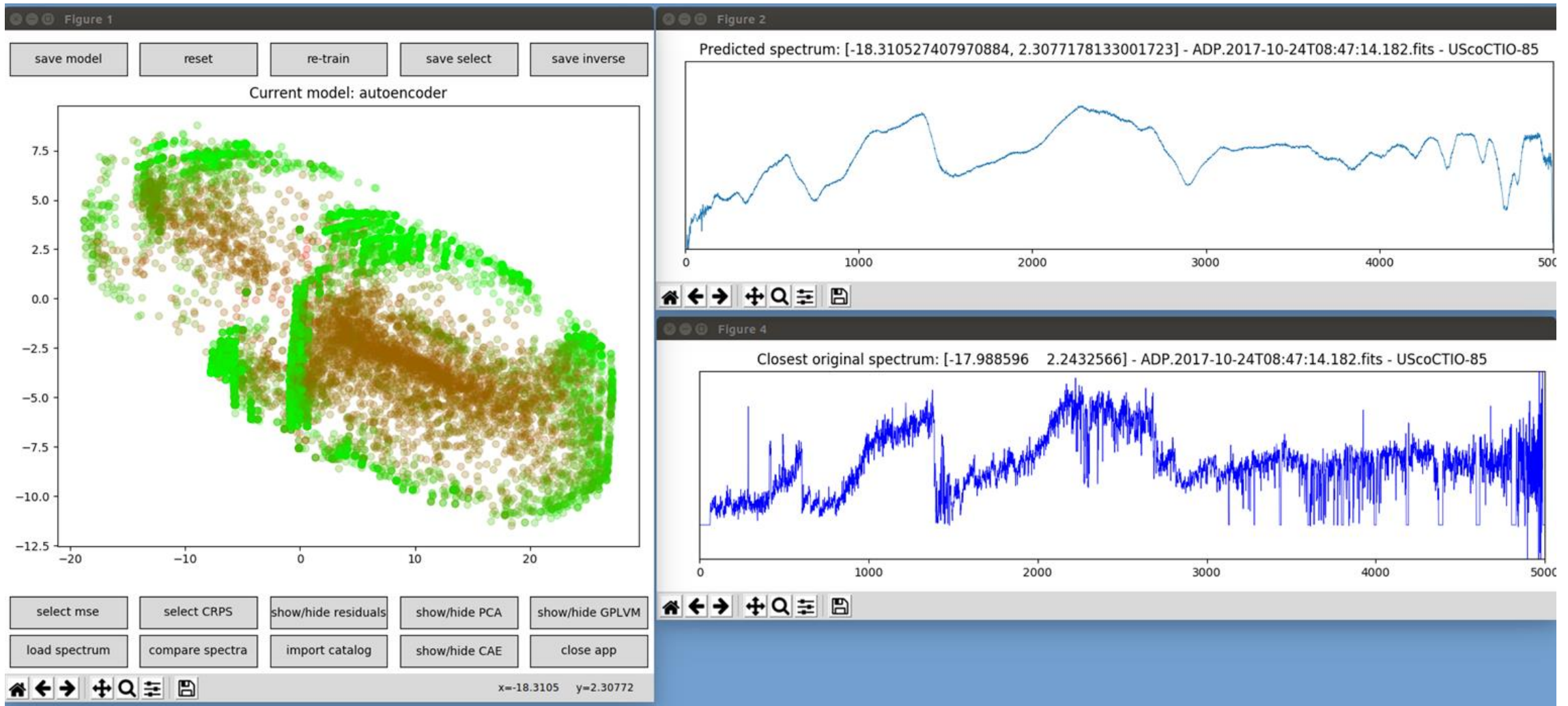
# Continuum detection with UVES data - I



# Continuum detection with UVES data - II



# Continuum detection with UVES data - III



# Conclusions

- ESCAPE project is going to be a step to build a new infrastructure for data-intense astronomy.
- A lot of work to do:
  - data products access
  - building standards
  - building infrastructures
- Development of a first prototype → big potential and future integration in Jupyter Notebook/Lab and web services
- Allowing to search within archive in a novel, explorative way → not explicit via criteria but implicit through similarity.
- **Please give suggestions! What would you like to have in such a tool?**





Visit us online! (and stay healthy...)



@HITStudies



/TheHITSters



/HITStudies



/the\_hitsters