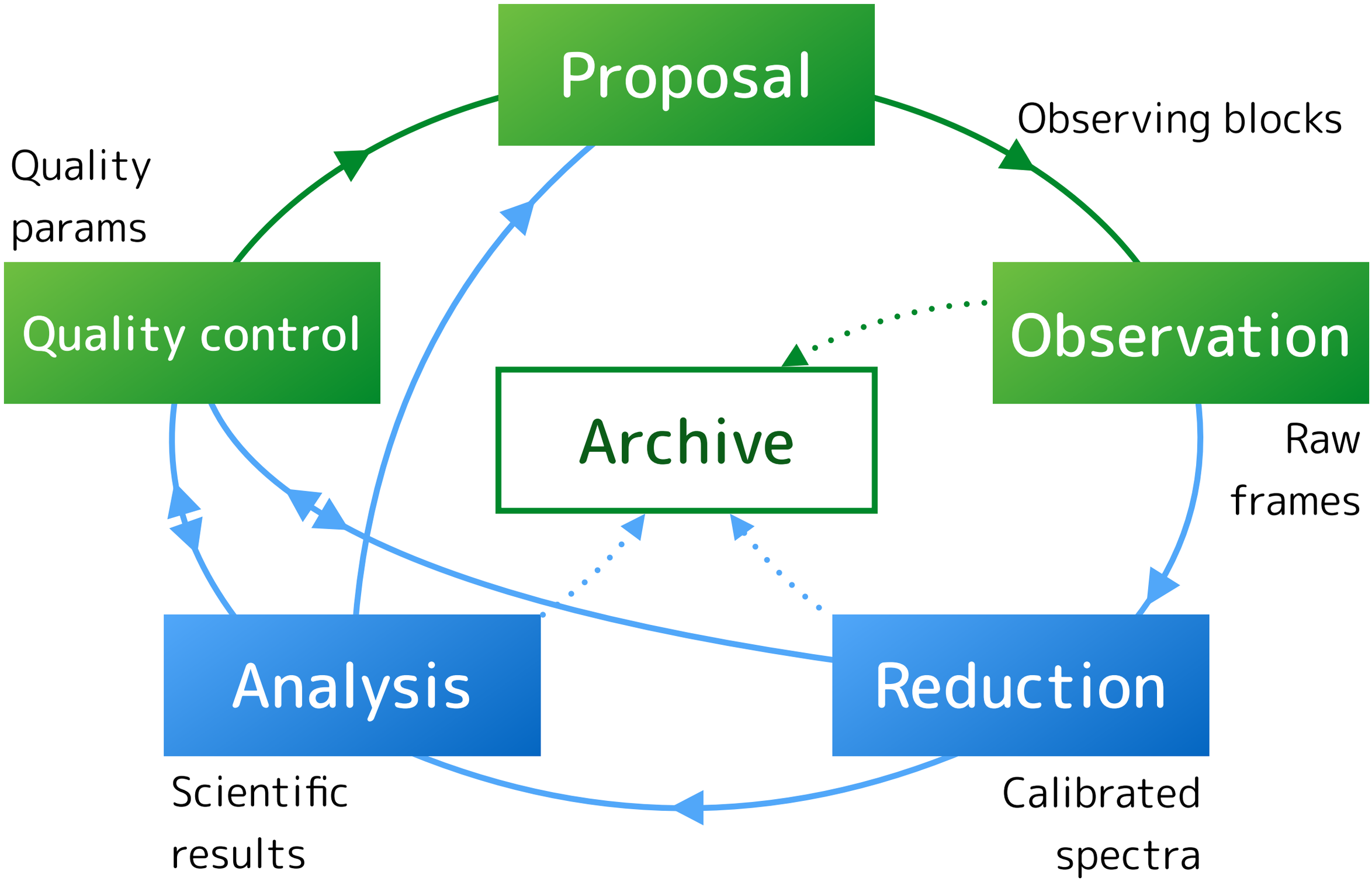
Crunching high-resolution spectra: today and tomorrow

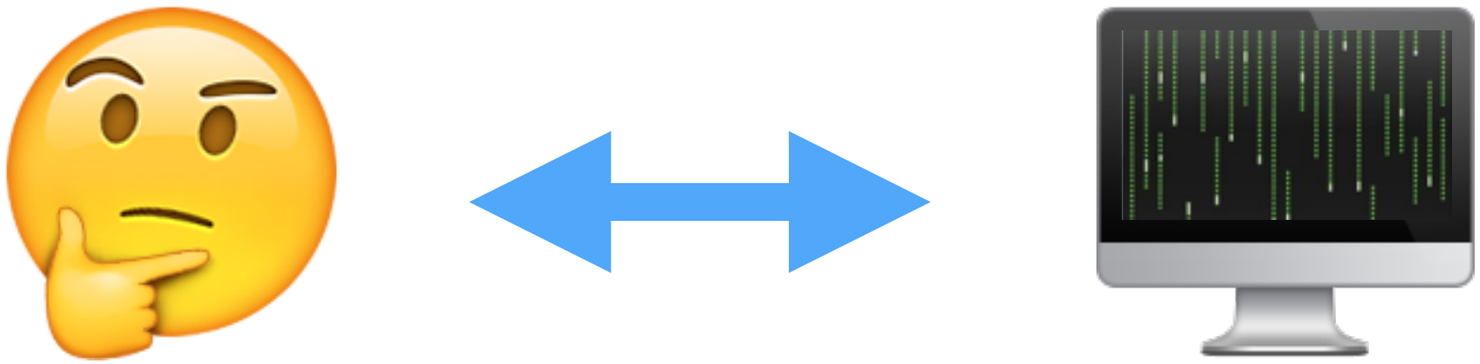
Guido Cupani, INAF–OATs

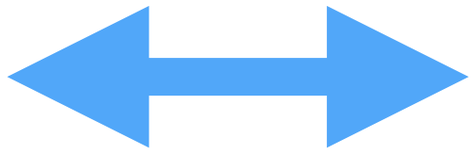
"Is it just me or have these numbers lost their crunchiness?"

Workshop Laboratorio Spettroscopia

INAF–OAR, 11 June 2019


Proposal
Observing blocks
Quality
params
Quality control
Observation
Archive
Raw
frames
Analysis
Reduction
Scientific
results
Calibrated
spectra





✔ Goal-oriented

✔ Big picture

✔ Trainable

✘ Not scalable

✘ Not reproducible

✘ No goals

✘ Workflow

✔ Trainable

✔ Scalable

✔ Reproducible

A&A 594, A91 (2016)
DOI: 10.1051/0004-6361/201628161
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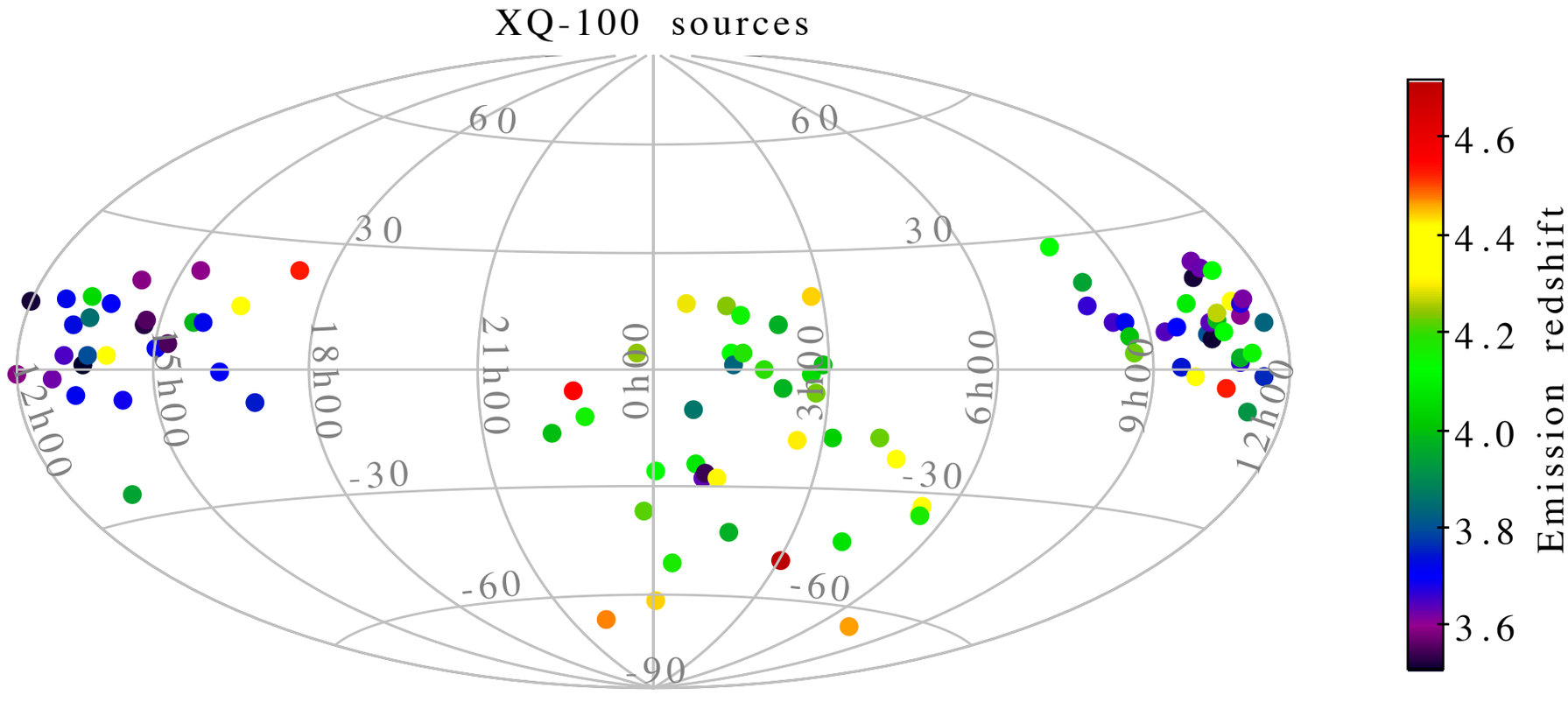
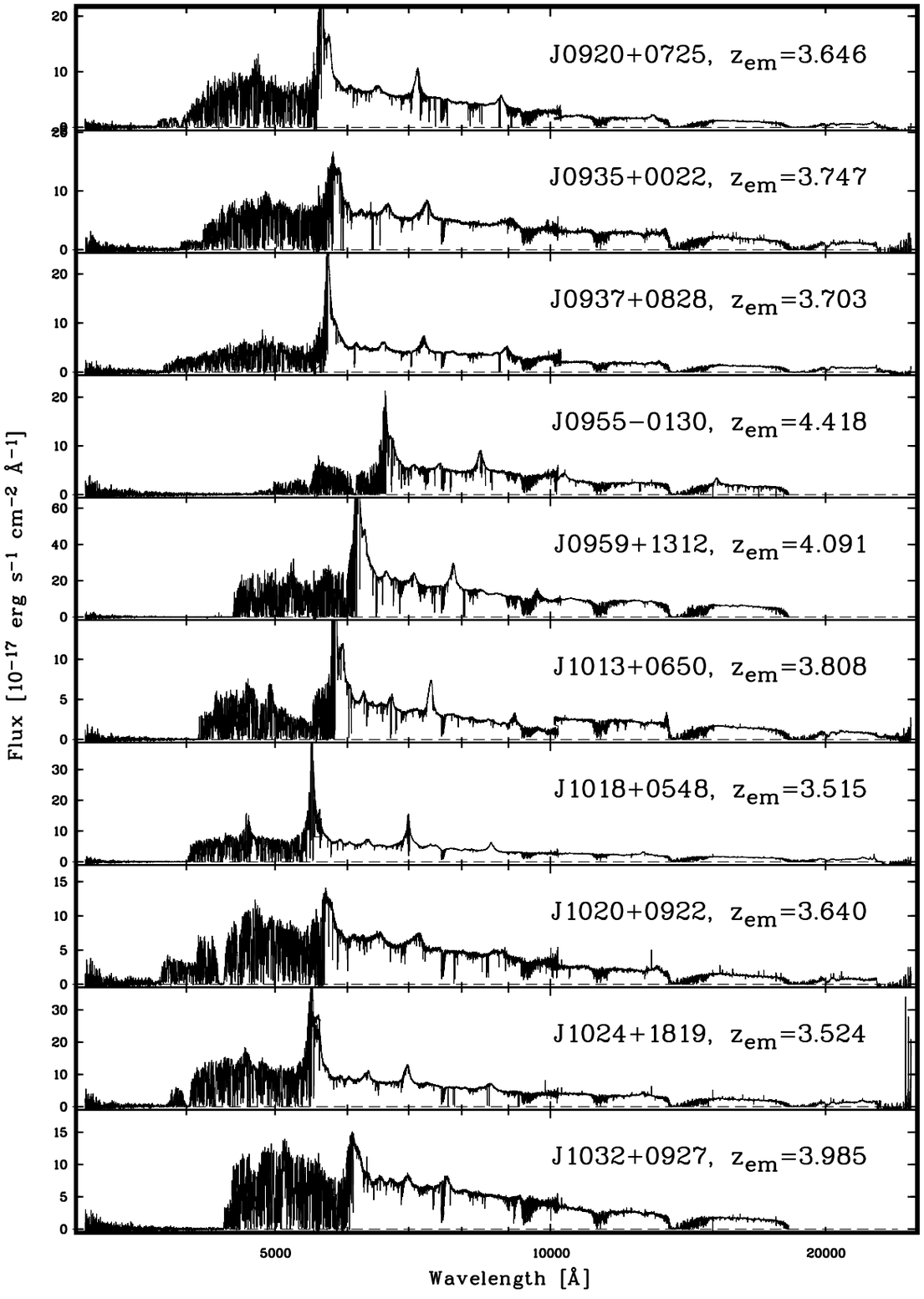
XQ-100

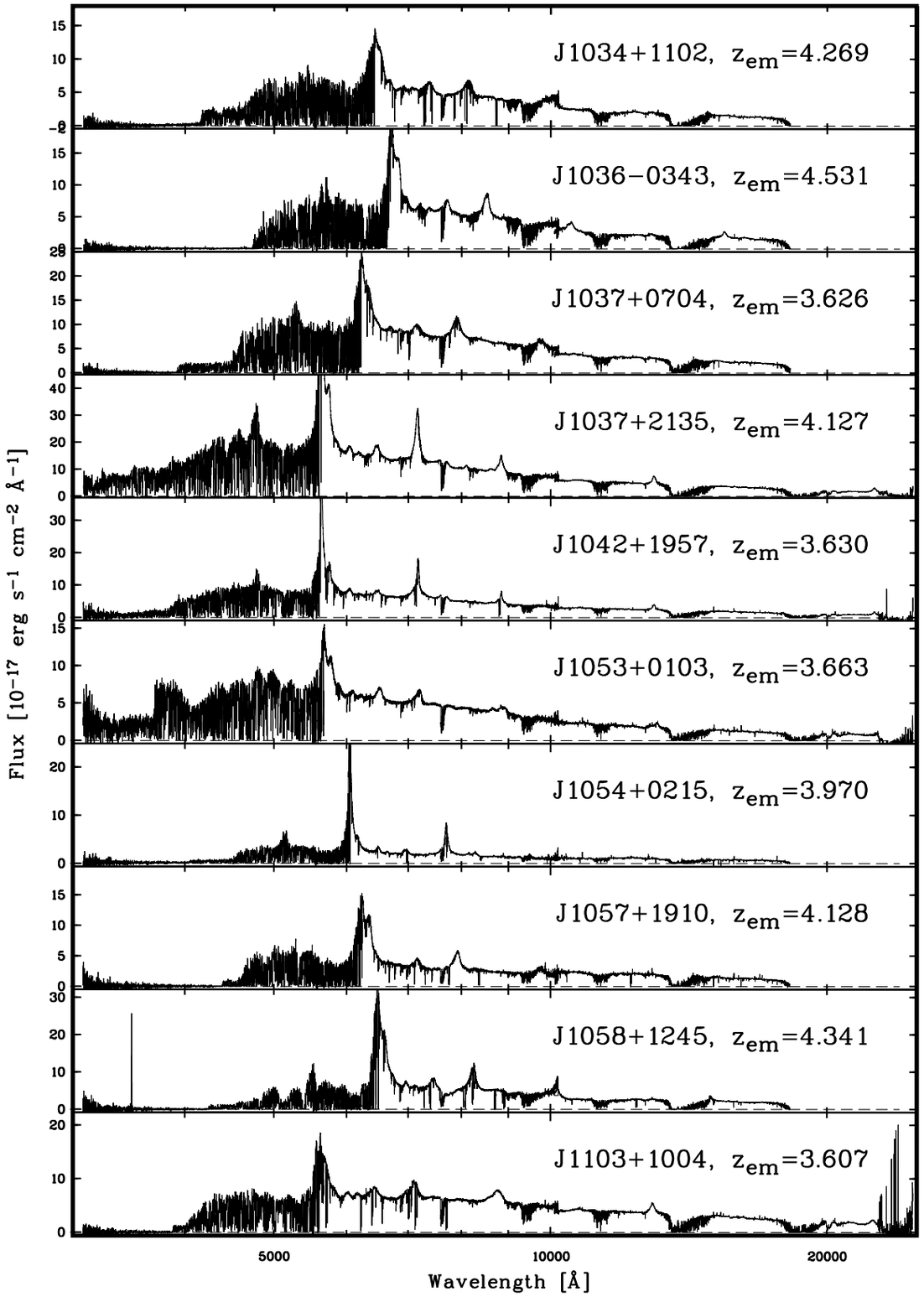
Astronomy & Astrophysics

XQ-100: A legacy survey of one hundred $3.5 \lesssim z \lesssim 4.5$ quasars observed with VLT/X-shooter★,★★

S. López[1], V. D'Odorico[2], S. L. Ellison[3], G. D. Becker[4,10], L. Christensen[5], G. Cupani[2], K. D. Denney[6], I. Pâris[2], G. Worseck[7], T. A. M. Berg[3], S. Cristiani[2,8], M. Dessauges-Zavadsky[9], M. Haehnelt,[10], F. Hamann[11], J. Hennawi[7], V. Iršič[12], T.-S. Kim[2], P. López[1], R. Lund Saust[5], B. Ménard[13,★★★], S. Perrotta[14,2], J. X. Prochaska[15], R. Sánchez-Ramírez[16,17,18], M. Vestergaard,[5,19], M. Viel[2,8], and L. Wisotzki[20]

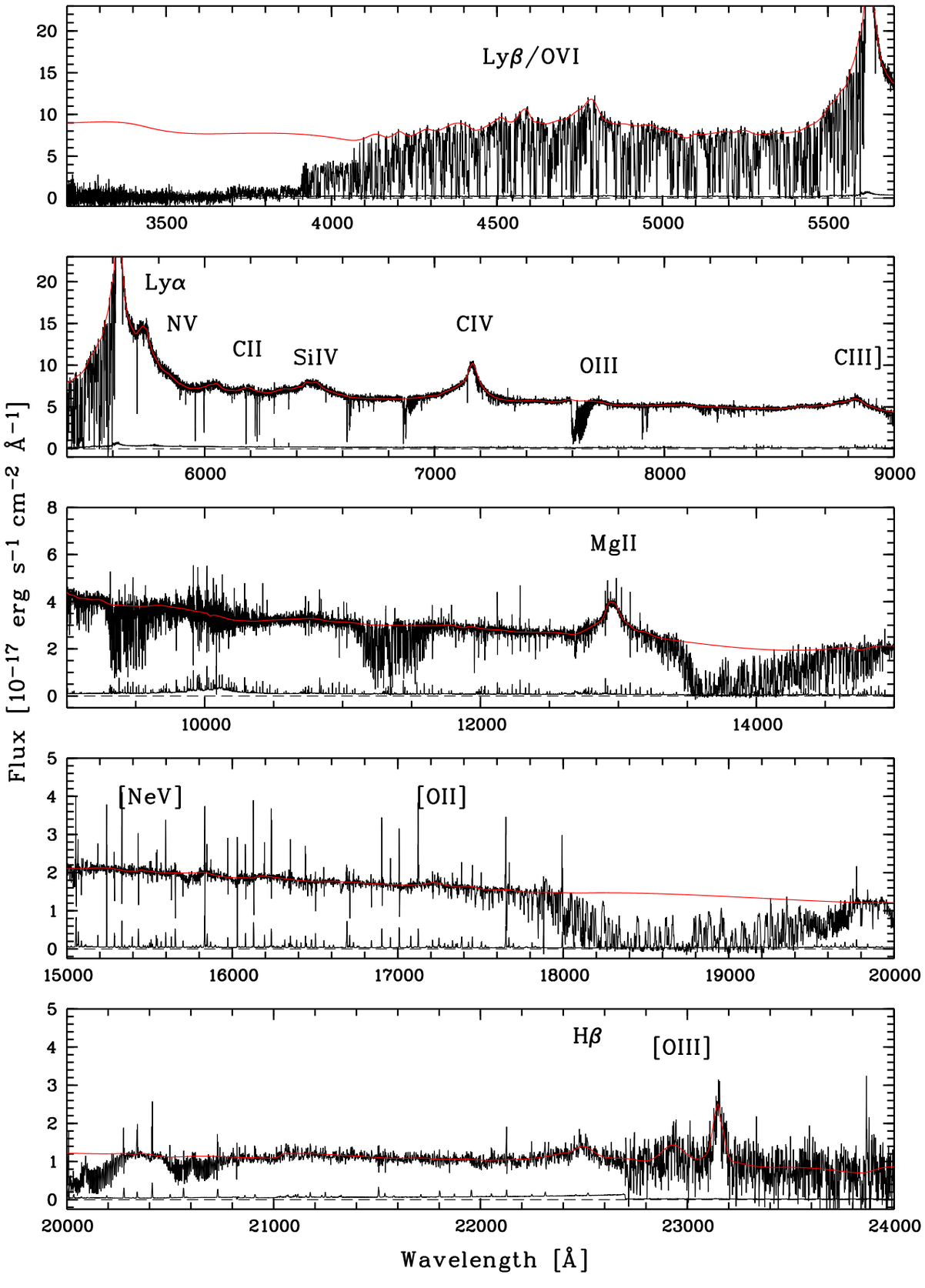


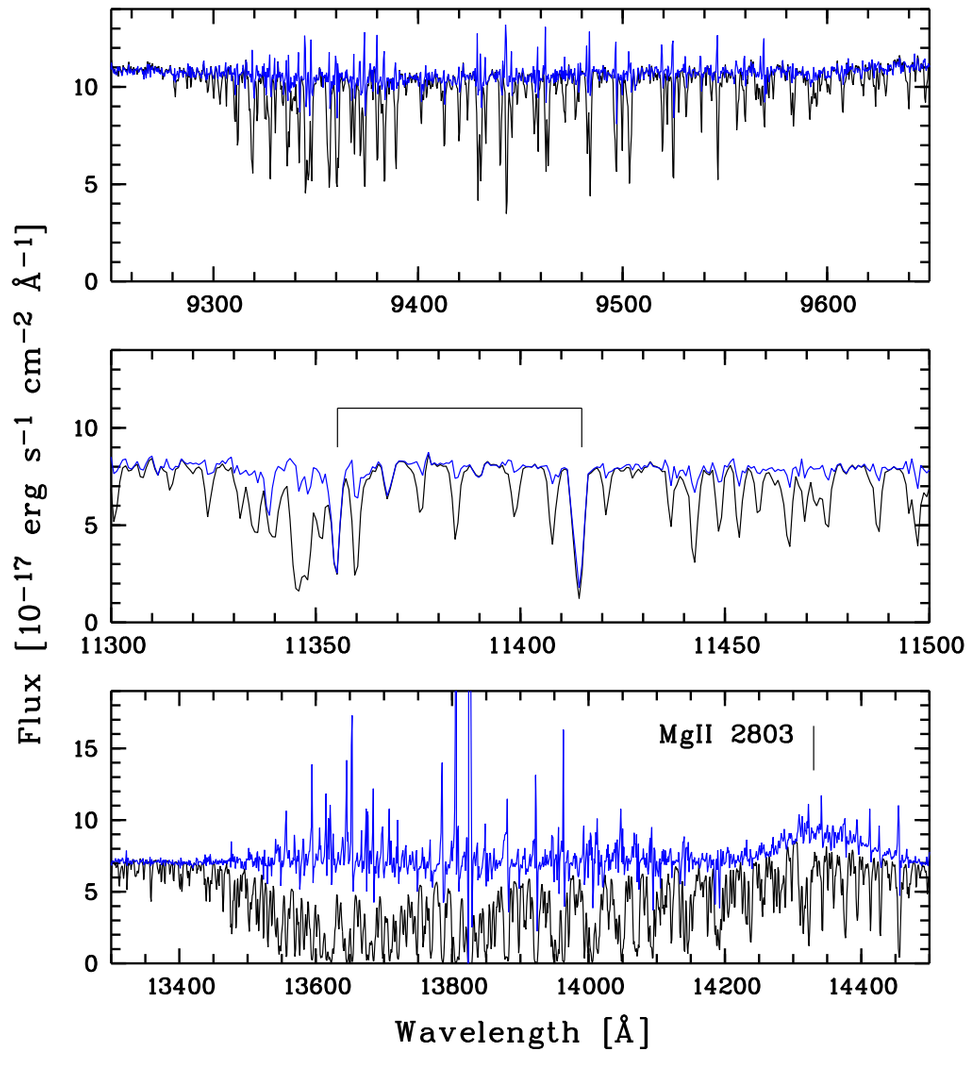

J0920+0725, z_{em}=3.646
J0935+0022, z_{em}=3.747
J0937+0828, z_{em}=3.703
J0955−0130, z_{em}=4.418
J0959+1312, z_{em}=4.091
J1013+0650, z_{em}=3.808
J1018+0548, z_{em}=3.515
J1020+0922, z_{em}=3.640
J1024+1819, z_{em}=3.524
J1032+0927, z_{em}=3.985
Flux [10^{-17} erg s^{-1} cm^{-2} Å^{-1}]
Wavelength [Å]


J1034+1102, z_{em}=4.269
J1036−0343, z_{em}=4.531
J1037+0704, z_{em}=3.626
J1037+2135, z_{em}=4.127
J1042+1957, z_{em}=3.630
J1053+0103, z_{em}=3.663
J1054+0215, z_{em}=3.970
J1057+1910, z_{em}=4.128
J1058+1245, z_{em}=4.341
J1103+1004, z_{em}=3.607
Flux [10^{-17} erg s^{-1} cm^{-2} Å^{-1}]
Wavelength [Å]

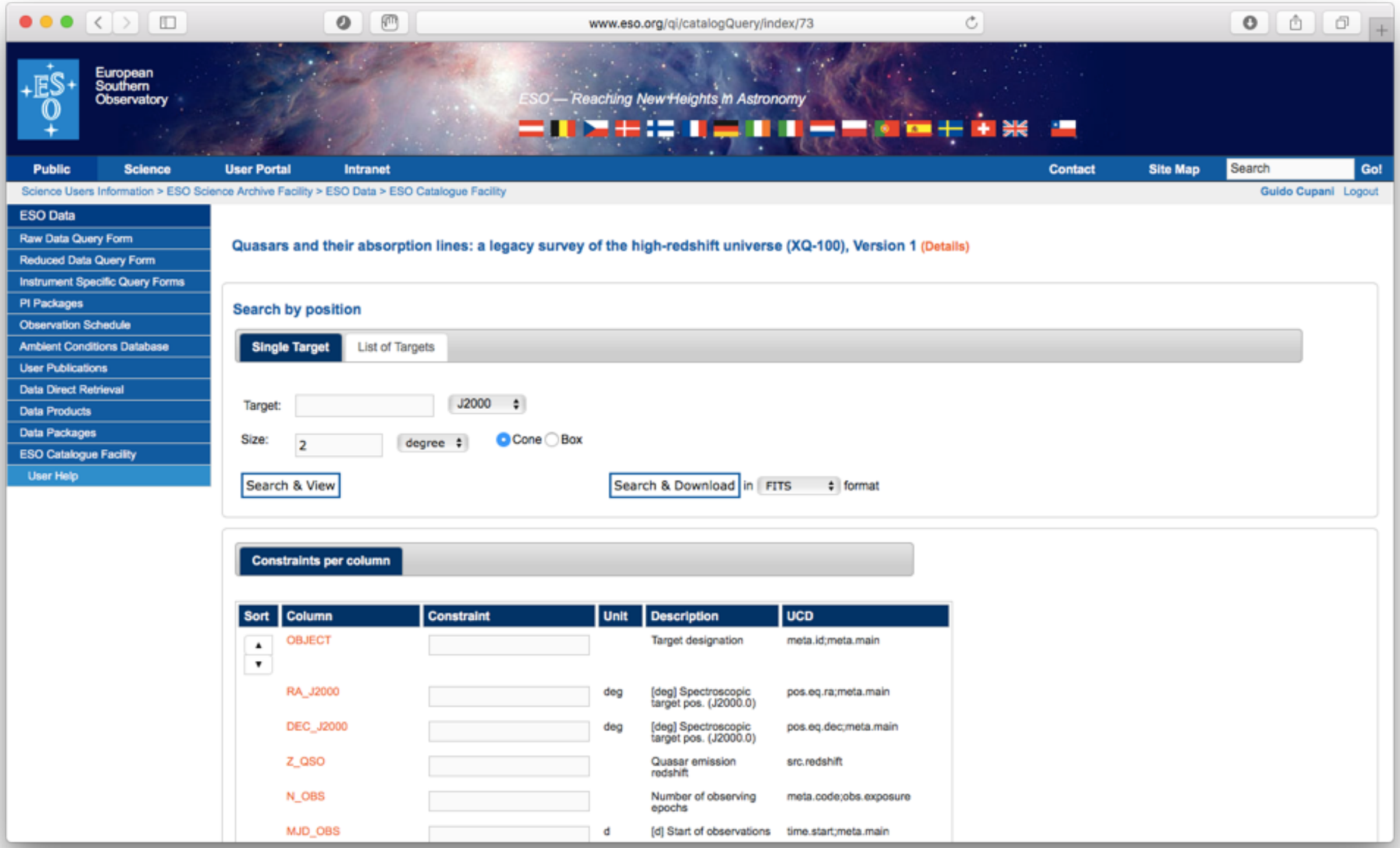
Redshift+continuum

Telluric correction





XQ-100


www.eso.org/qi/catalogQuery/index/73
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Quasars and their absorption lines: a legacy survey of the high-redshift universe (XQ-100), Version 1 (Details)
Search by position
Single Target
List of Targets
Target:
J2000
Size:
2
degree
Cone
Box
Search & View
Search & Download in FITS format
Constraints per column
Sort
Column
Constraint
Unit
Description
UCD
OBJECT
Target designation
meta.id;meta.main
RA_J2000
deg
[deg] Spectroscopic target pos. (J2000.0)
pos.eq.ra;meta.main
DEC_J2000
deg
[deg] Spectroscopic target pos. (J2000.0)
pos.eq.dec;meta.main
Z_QSO
Quasar emission redshift
src.redshift
N_OBS
Number of observing epochs
meta.code;obs.exposure
MJD_OBS
d
[d] Start of observations
time.start;meta.main

XQ-100

www.eso.org/qi/catalogQuery/results?catId=73&queryId=vuuq1uqmjx7wmsdv&countQ

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Quasars and their absorption lines: a legacy survey of the high-redshift universe (XQ-100), Release 1 (Details)

Query constraints

RA (J2000)	0.7 (00 03)
Dec (J2000)	-26.1 (-26 03)
Cone size	2 degree

New Query | Modify Query

Query Results

1 records found (out of 100) Download in FITS Format ☐ Only selected columns

Elapsed time: 2.114 s

Results 1-1 of 1 Show 10 results per page

Text boxes under columns select matching rows Apply Filter Clear Filter

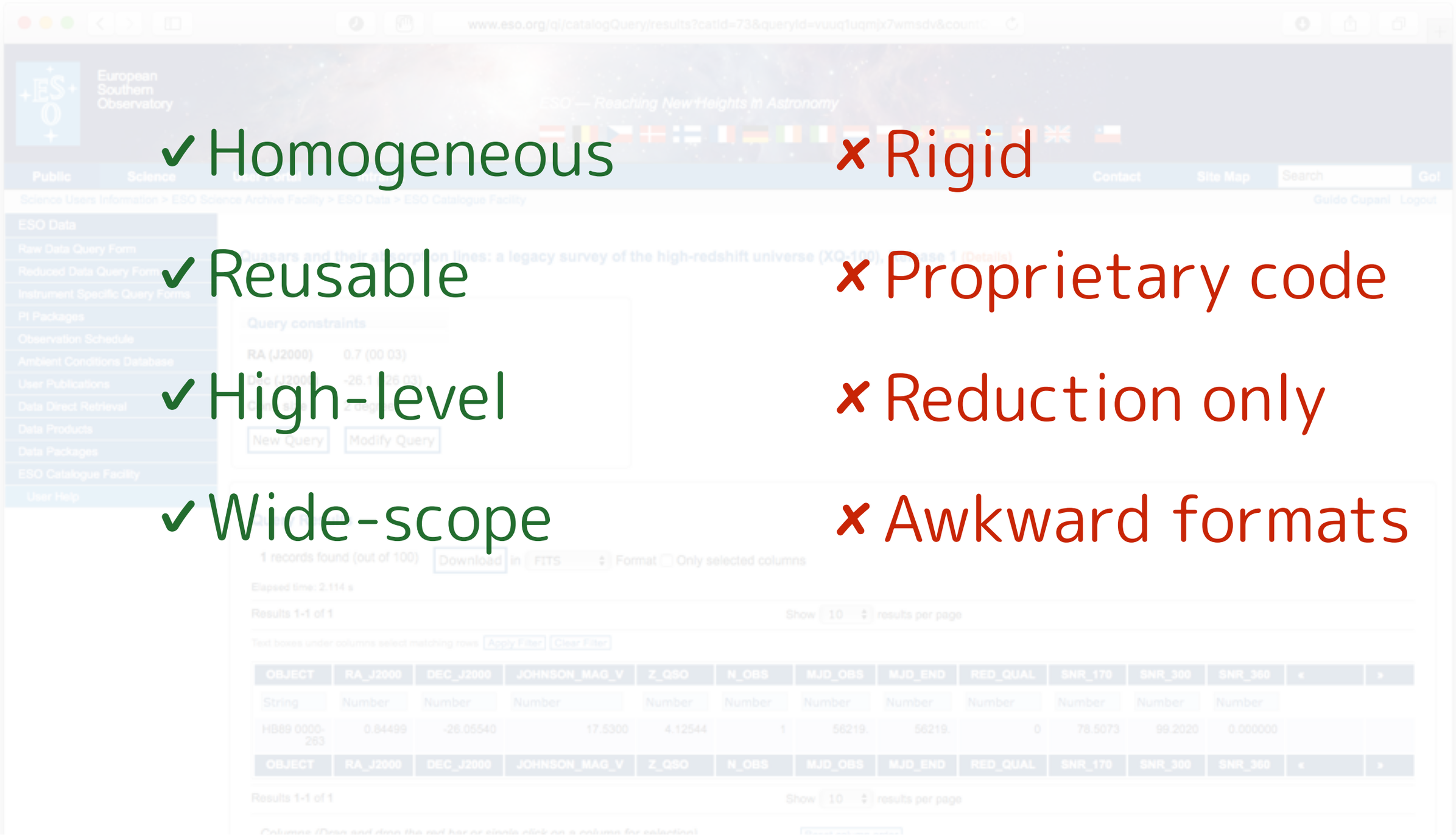
OBJECT	RA_J2000	DEC_J2000	JOHNSON_MAG_V	Z_QSO	N_OBS	MJD_OBS	MJD_END	RED_QUAL	SNR_170	SNR_300	SNR_360	«	»
String	Number	Number	Number	Number	Number	Number	Number	Number	Number	Number	Number		
HB89 0000-263	0.84499	-26.05540	17.5300	4.12544	1	56219.	56219.	0	78.5073	99.2020	0.000000		
OBJECT	RA_J2000	DEC_J2000	JOHNSON_MAG_V	Z_QSO	N_OBS	MJD_OBS	MJD_END	RED_QUAL	SNR_170	SNR_300	SNR_360	«	»

Results 1-1 of 1 Show 10 results per page

Columns (Drag and drop the red bar or single click on a column for selection) Reset column order

Name	Unit	Datatype	Description

XQ-100



✓ Homogeneous

✓ Reusable

✓ High-level

✓ Wide-scope

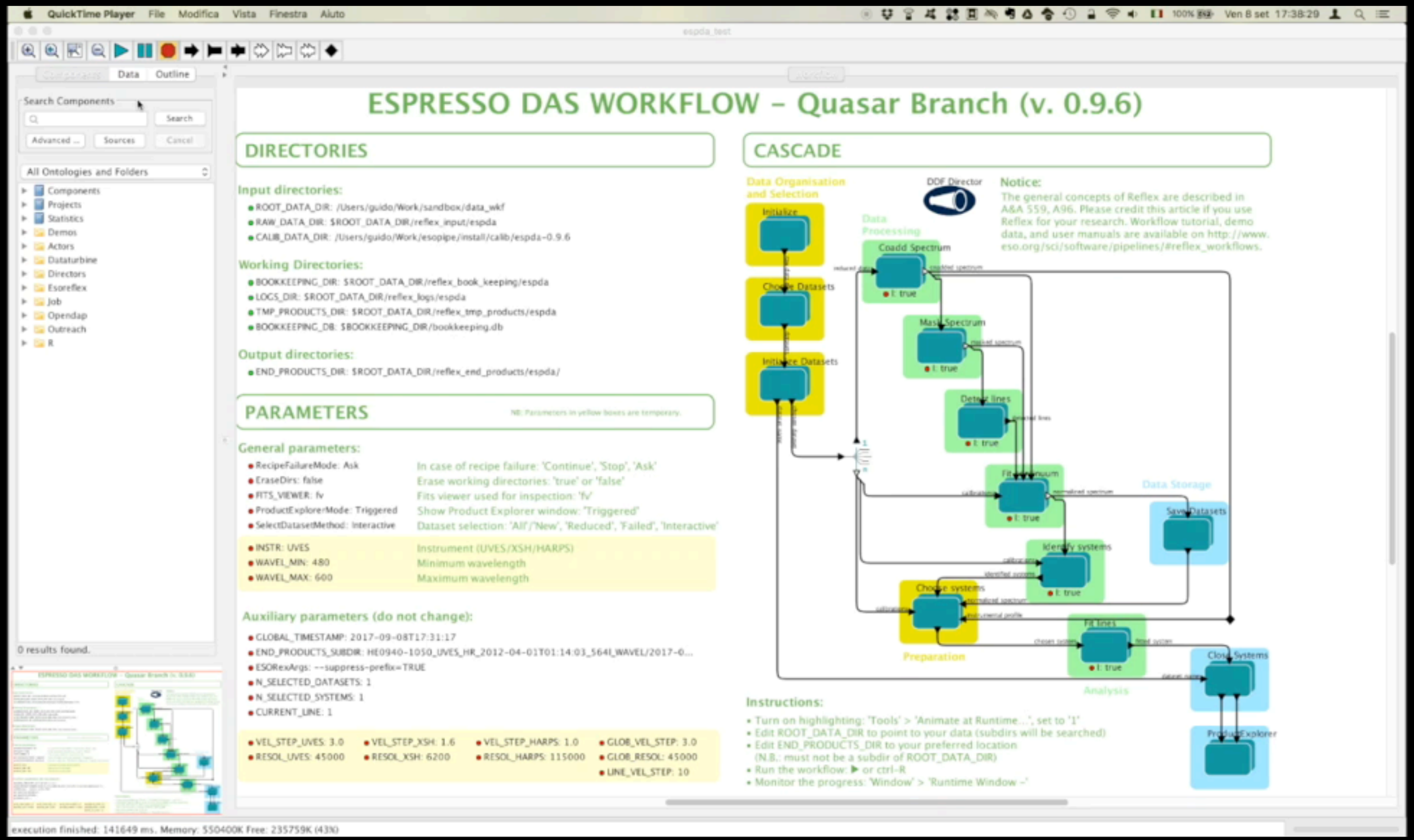
✗ Rigid

✗ Proprietary code

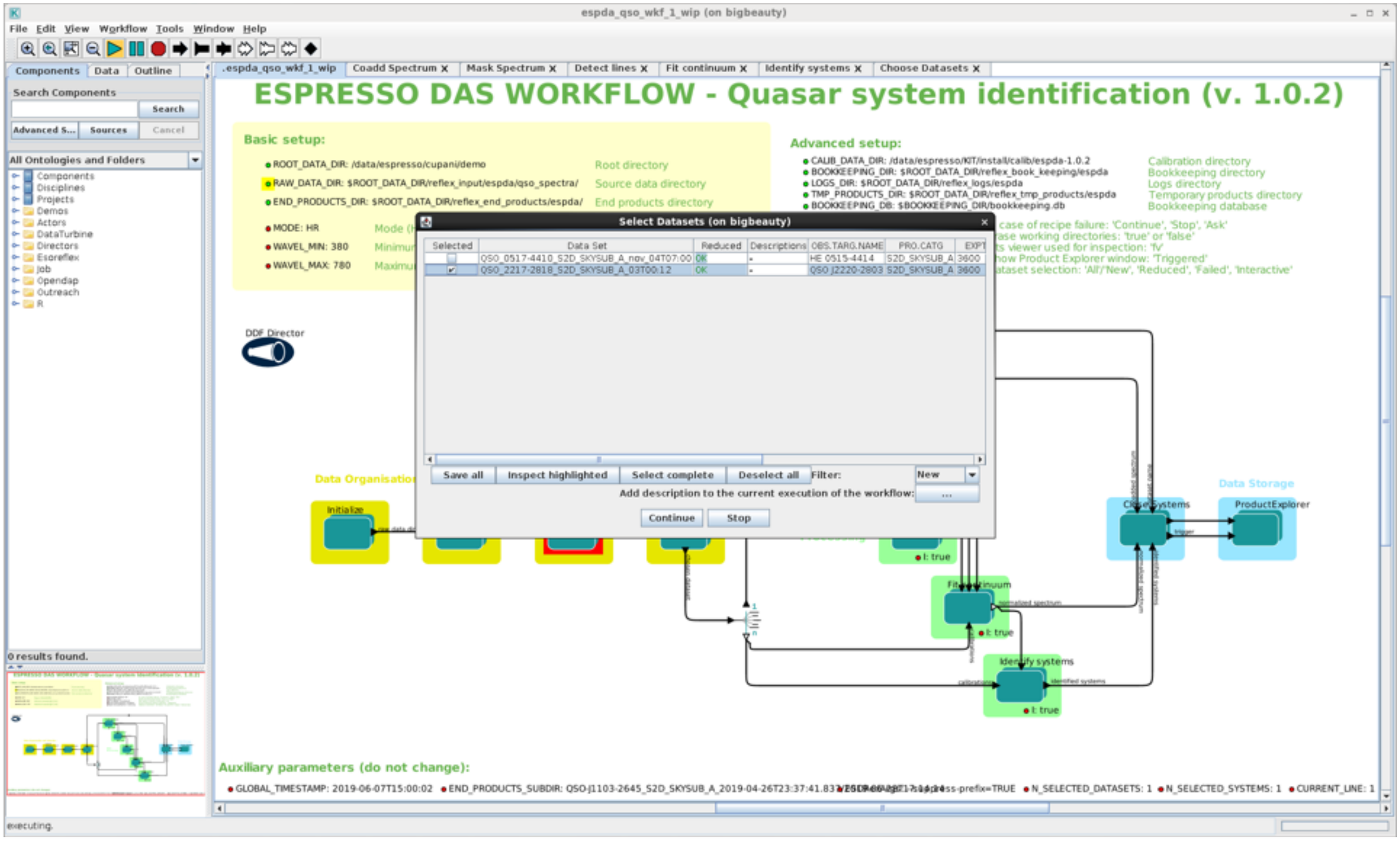
✗ Reduction only

✗ Awkward formats

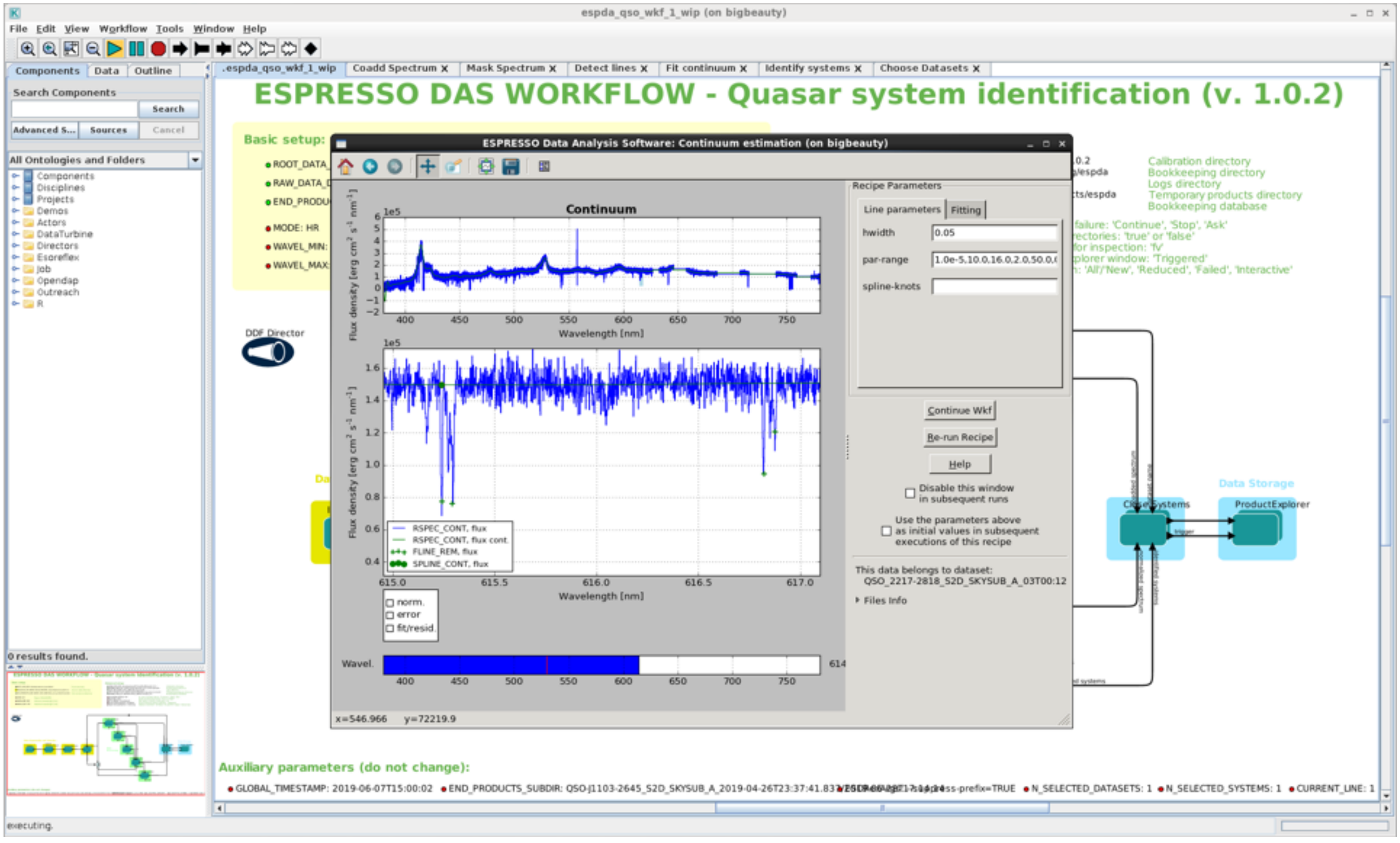
VLT-ESPRESSO DAS



VLT-ESPRESSO DAS



VLT-ESPRESSO DAS



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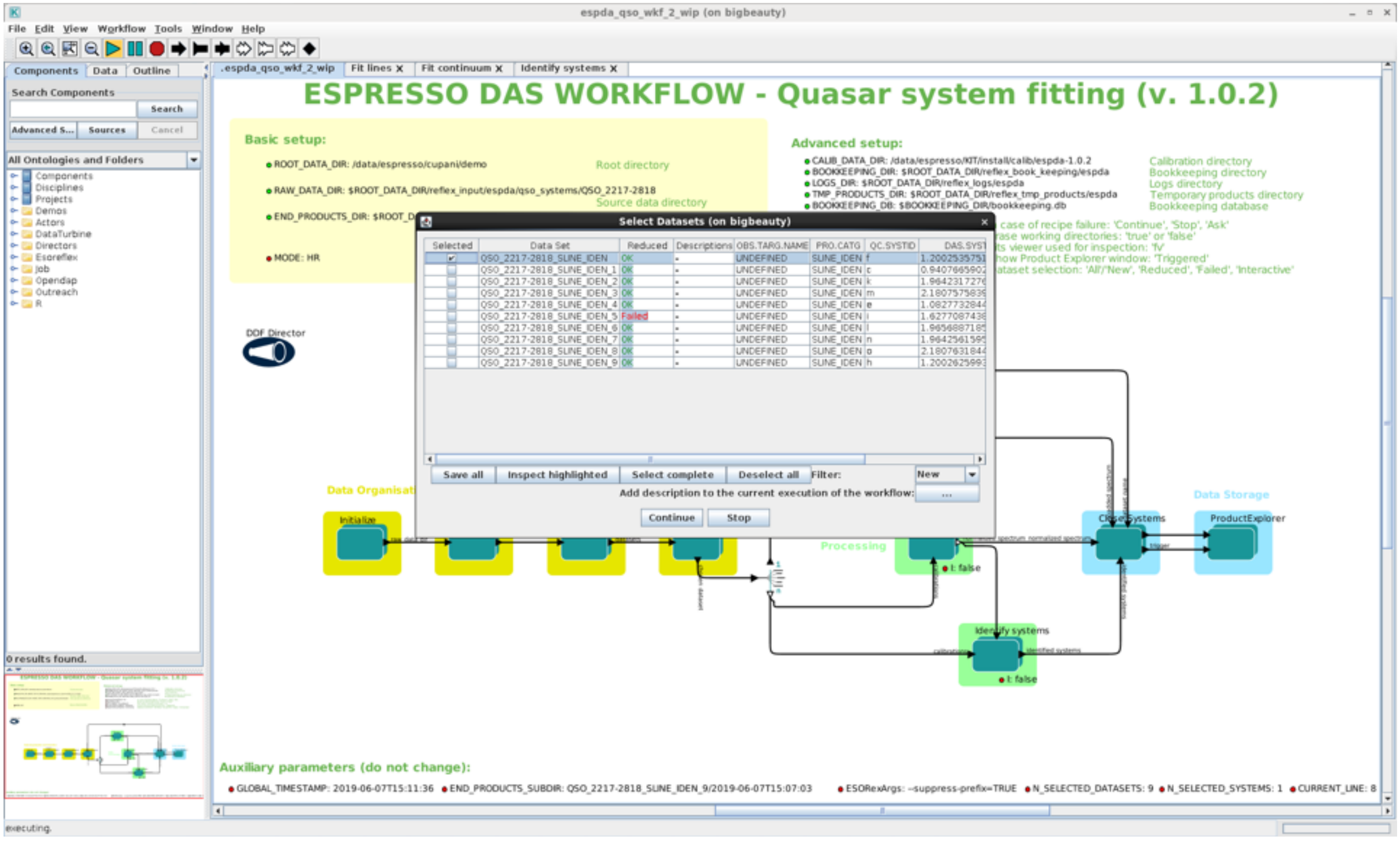

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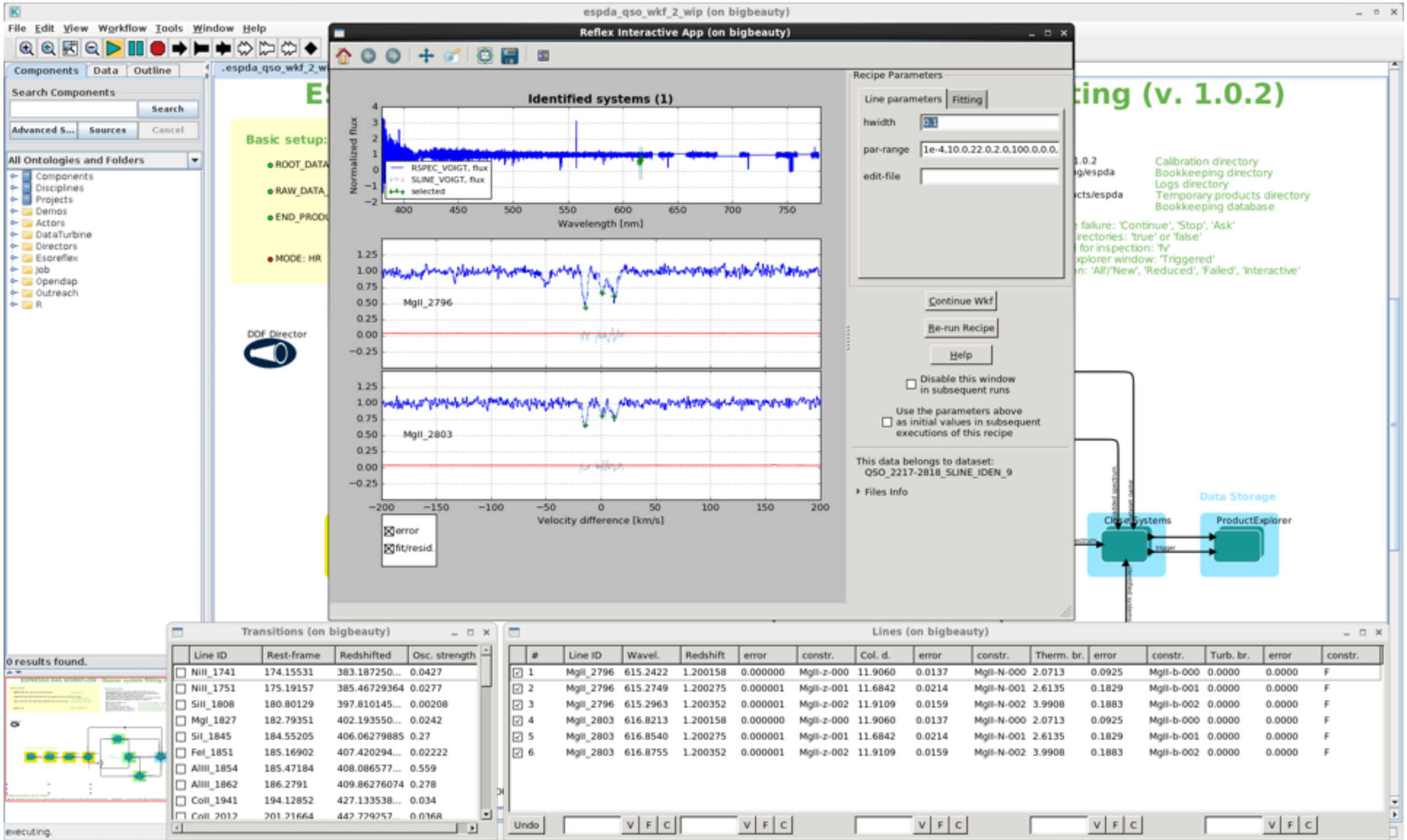
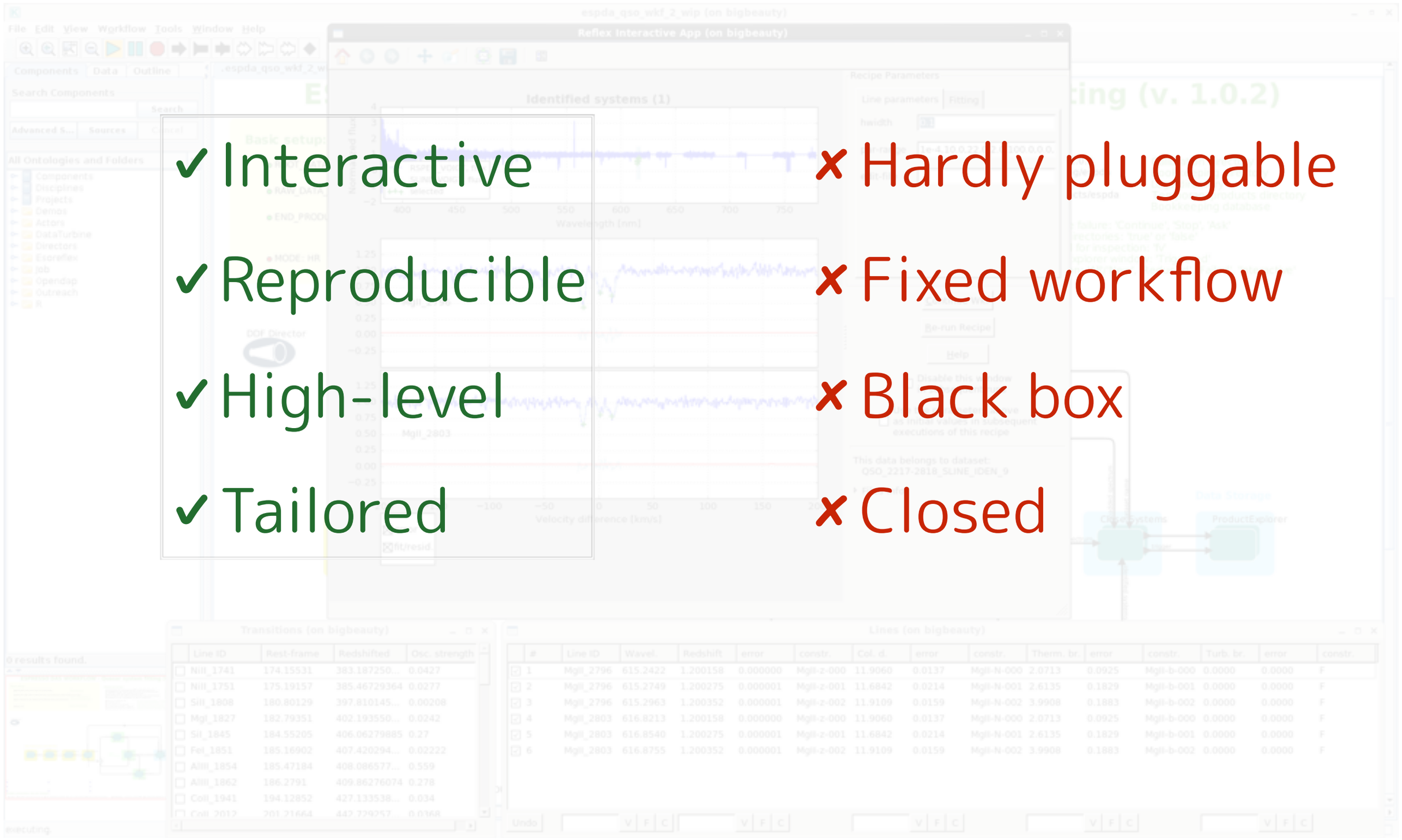
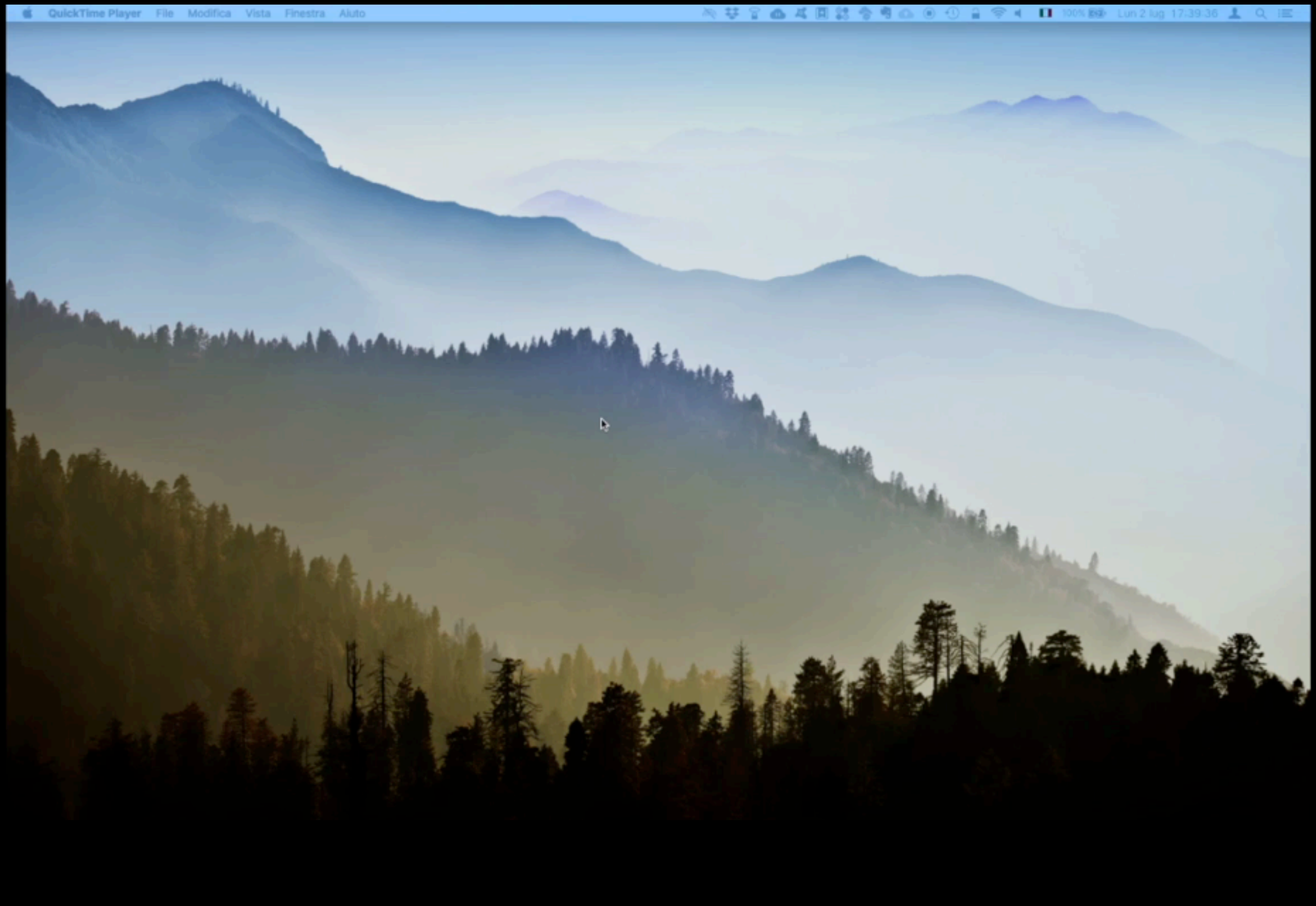


VLT-ESPRESSO DAS

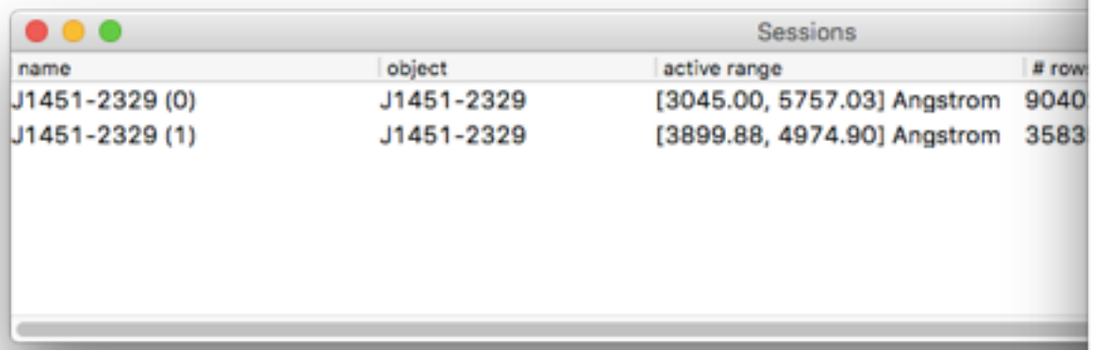


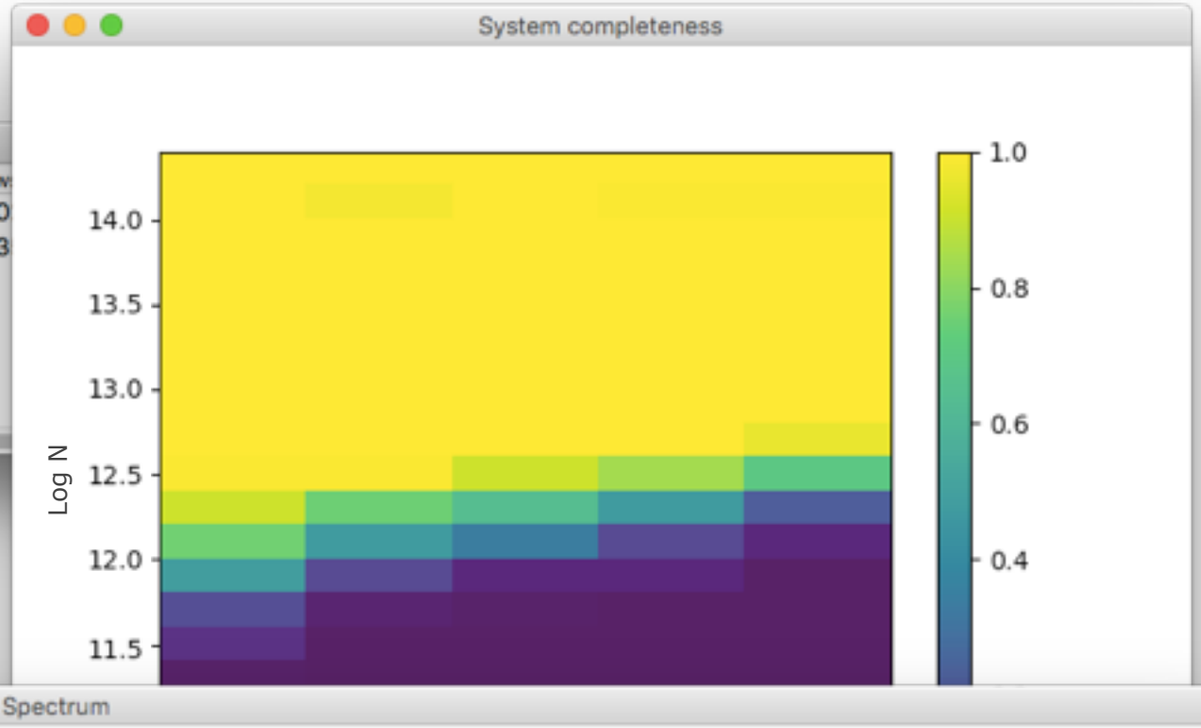
- ✔ Interactive
- ✔ Reproducible
- ✔ High-level
- ✔ Tailored
- ✘ Hardly pluggable
- ✘ Fixed workflow
- ✘ Black box
- ✘ Closed

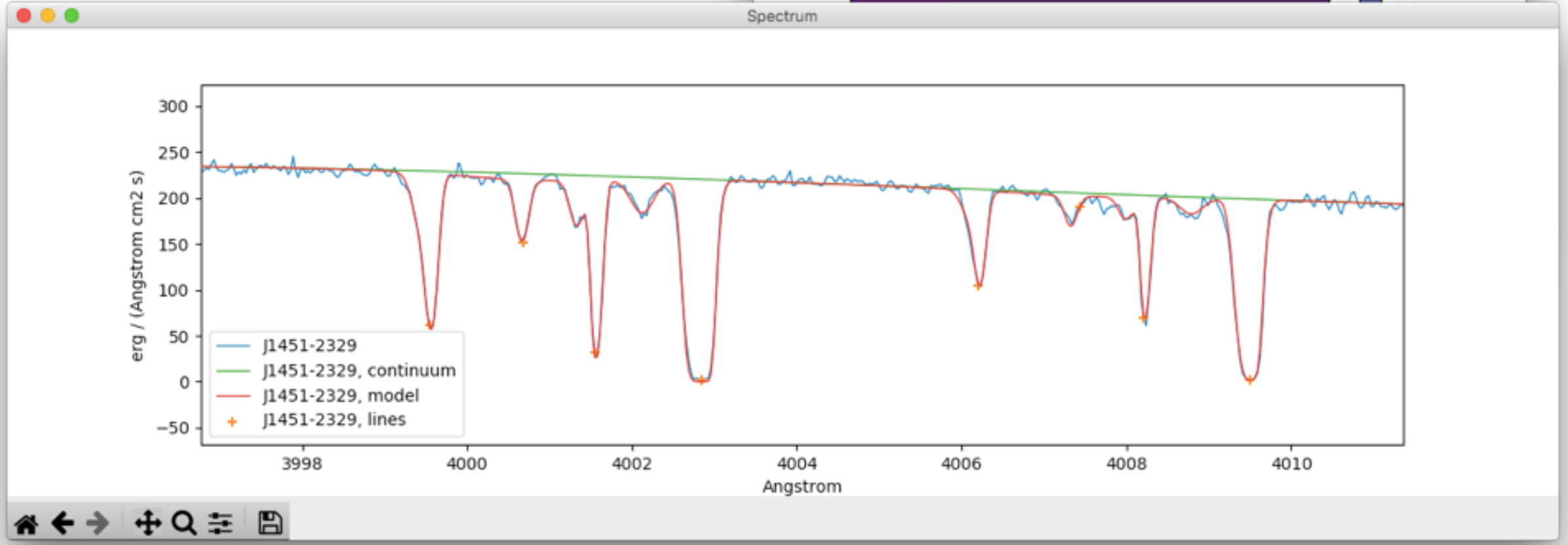
ASTROCOOK


QuickTime Player File Modifica Vista Finestra Aiuto
Lun 2 lug 17:39:36

ASTROCOOK


Sessions
name
object
active range
row
J1451-2329 (0)
J1451-2329
[3045.00, 5757.03] Angstrom
9040
J1451-2329 (1)
J1451-2329
[3899.88, 4974.90] Angstrom
3583


System completeness
Log N
14.0
13.5
13.0
12.5
12.0
11.5
1.0
0.8
0.6
0.4


Spectrum
erg / (Angstrom cm2 s)
300
250
200
150
100
50
0
−50
3998
4000
4002
4004
4006
4008
4010
Angstrom
J1451-2329
J1451-2329, continuum
J1451-2329, model
J1451-2329, lines

ASTROCOOK

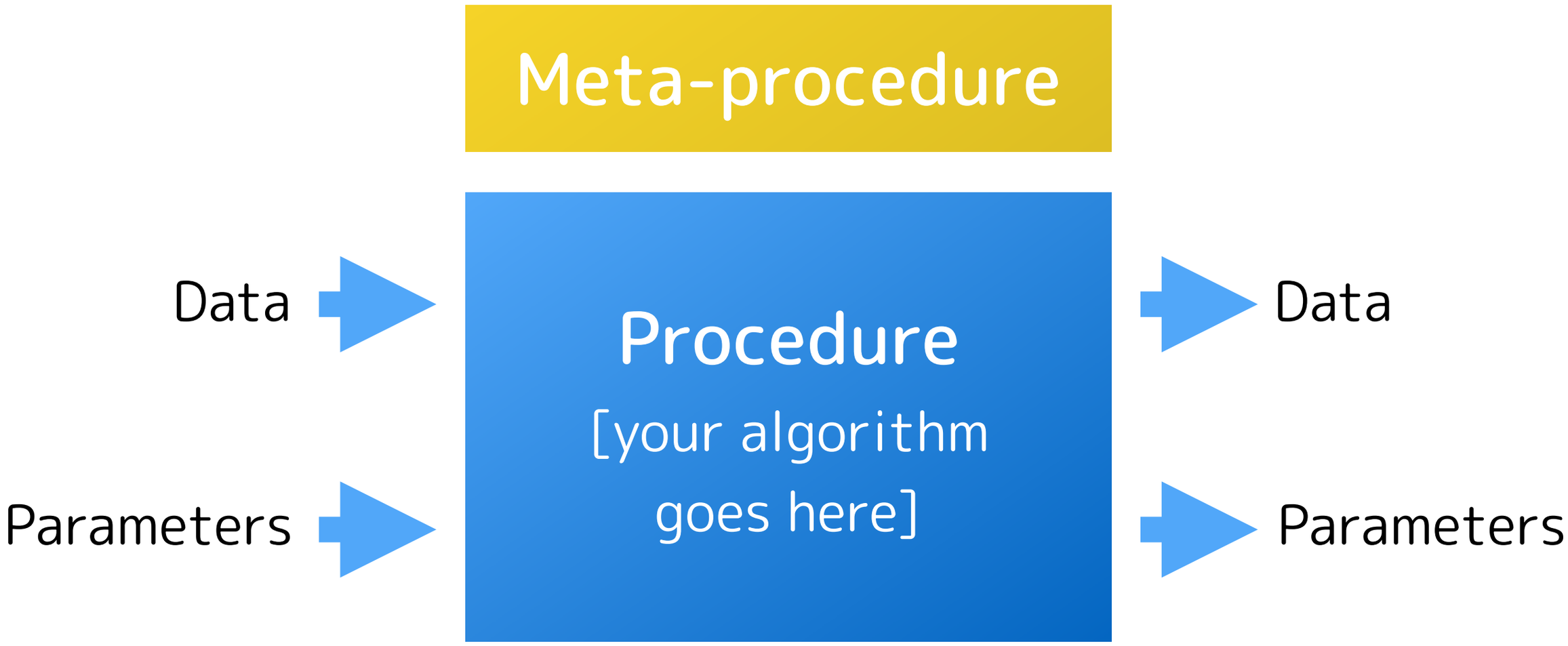
✔ Python

✔ GUI

✔ Expandable

✔ Recipe Model

✘ A lot of work!


Meta-procedure
Data
Procedure
[your algorithm goes here]
Data
Parameters
Parameters

Meta-recipe

Meta-proc

Meta-proc

Meta-proc

…

Procedure

Procedure

Procedure

…

Recipe

Meta-recipe

Meta-recipe

Meta-recipe

Recipe

Recipe

Recipe

…

Meta-proc

Meta-proc

Meta-proc

Meta-proc

Procedure

Procedure

Procedure

Procedure

…

Self-sustaining ecosystem

Meta-recipe | Meta-recipe | Meta-recipe

Recipe | Recipe | Recipe | …

Meta-proc | Meta-proc | Meta-proc | Meta-proc

Procedure | Procedure | Procedure | Procedure | …

Self-sustaining ecosystem

Narrower scope

consolidate our resources in Astrocook

Wider scope

implement a widespread ecosystem

Narrower scope

INAF-OATs: 👤👤+👤👤

🗓️ 2-3 years

Wider scope

Laboratorio: 👤👤👤👤👤…

🗓️ long-term (ELT era)