

X-shooter: the first of the VLT second generation instruments

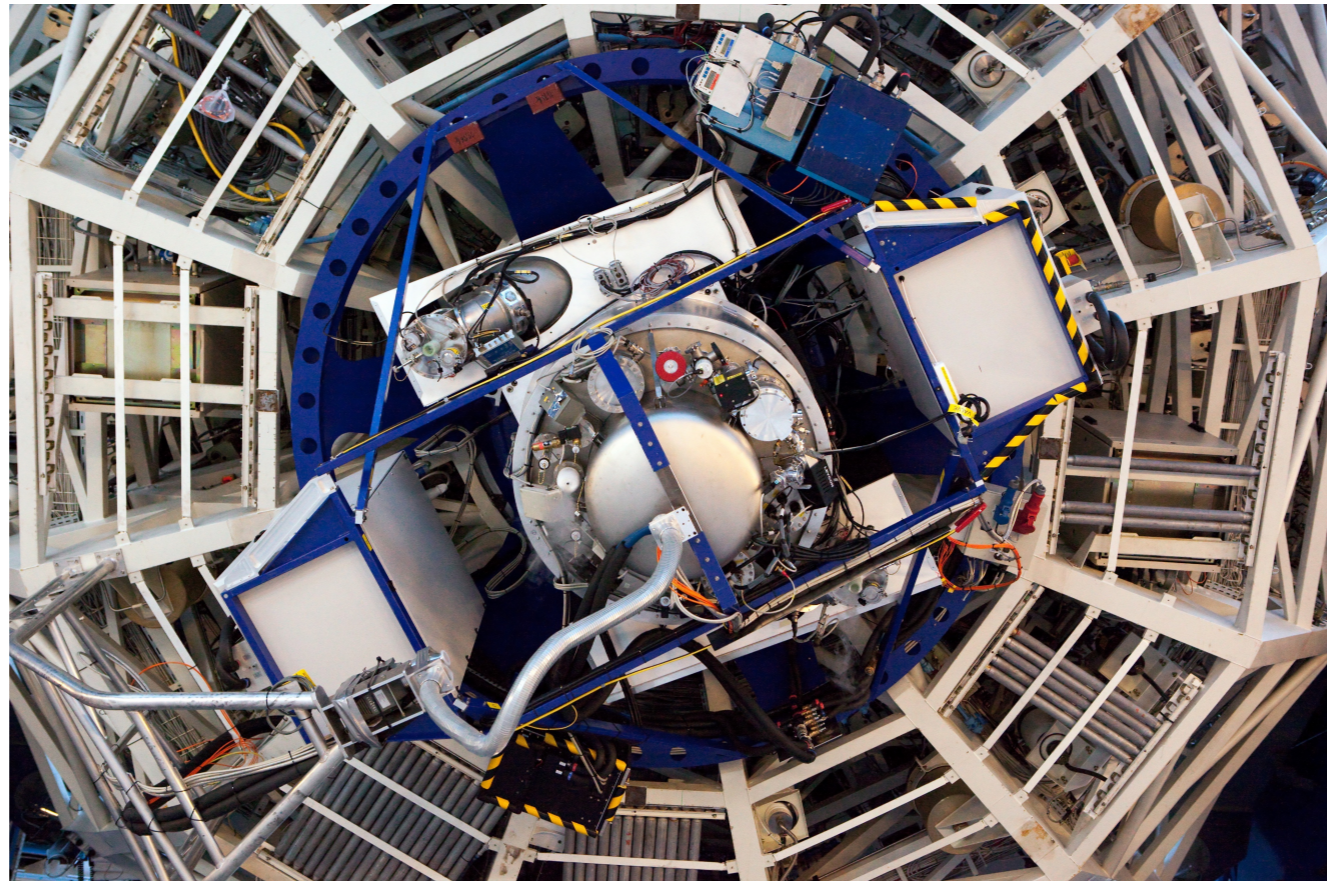
Andrea Mehner
(ESO Chile)

2017 ESO Calibration Workshop:
the second generation VLT instruments and friends

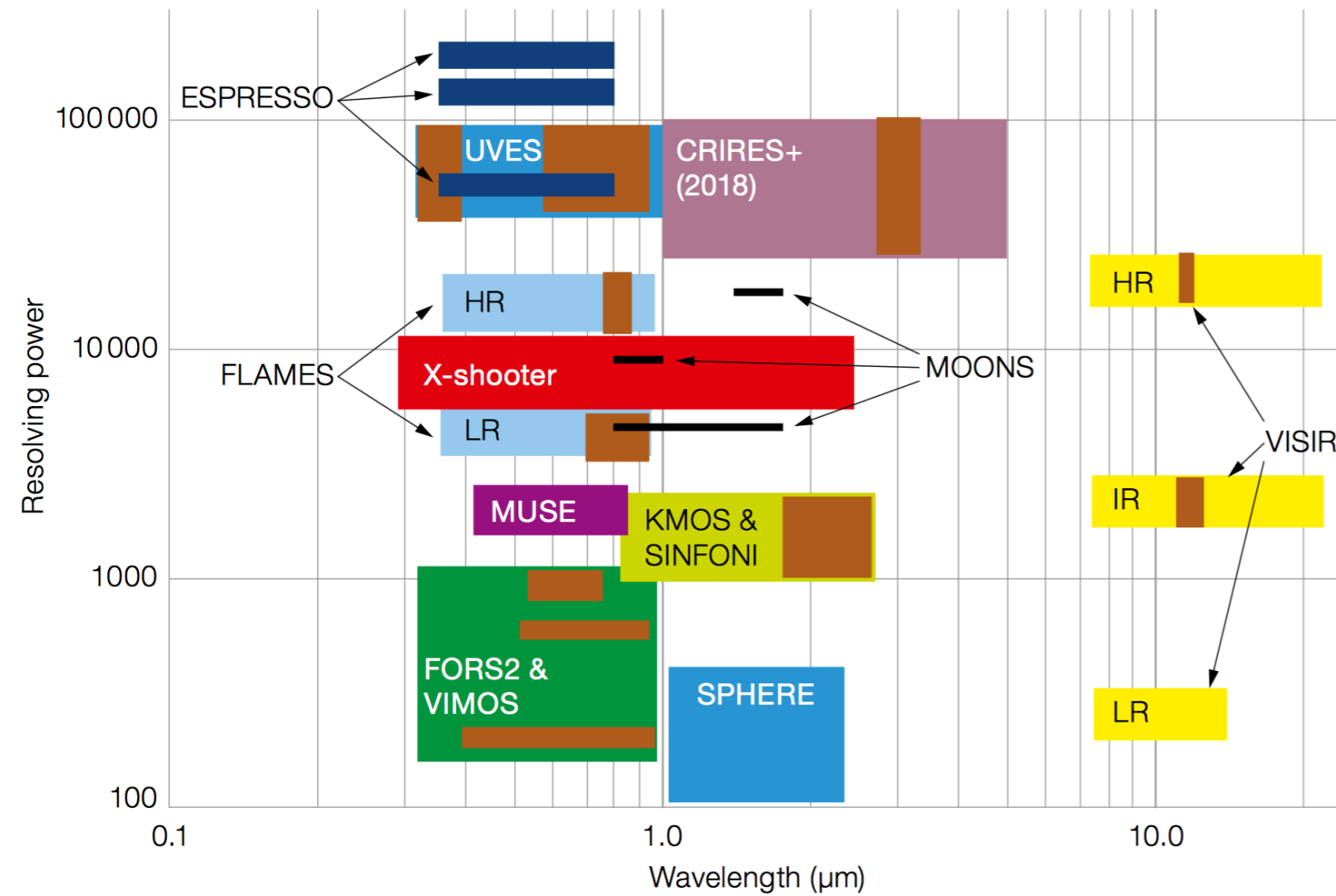


Outline

- X-shooter overview
- calibration plan (data analysis + instrument health)
- selection of raw/reduced data quality concerns

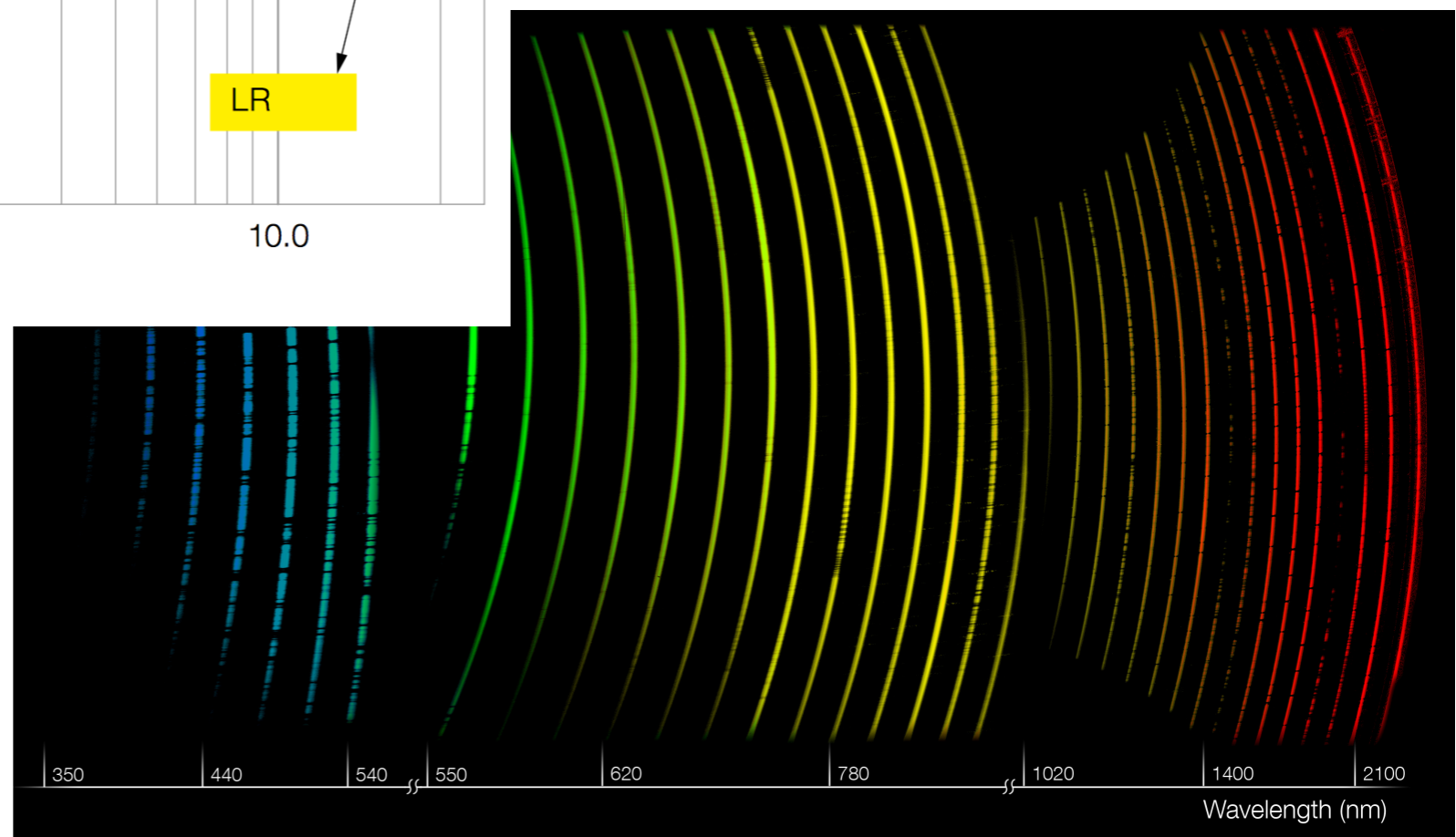


Why X-shooter?

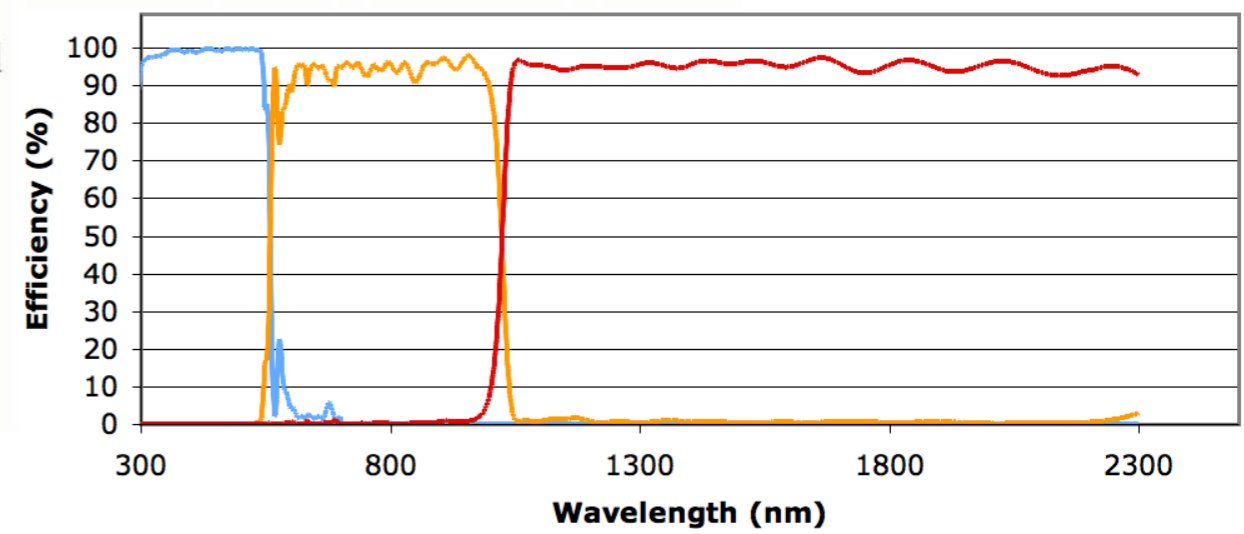
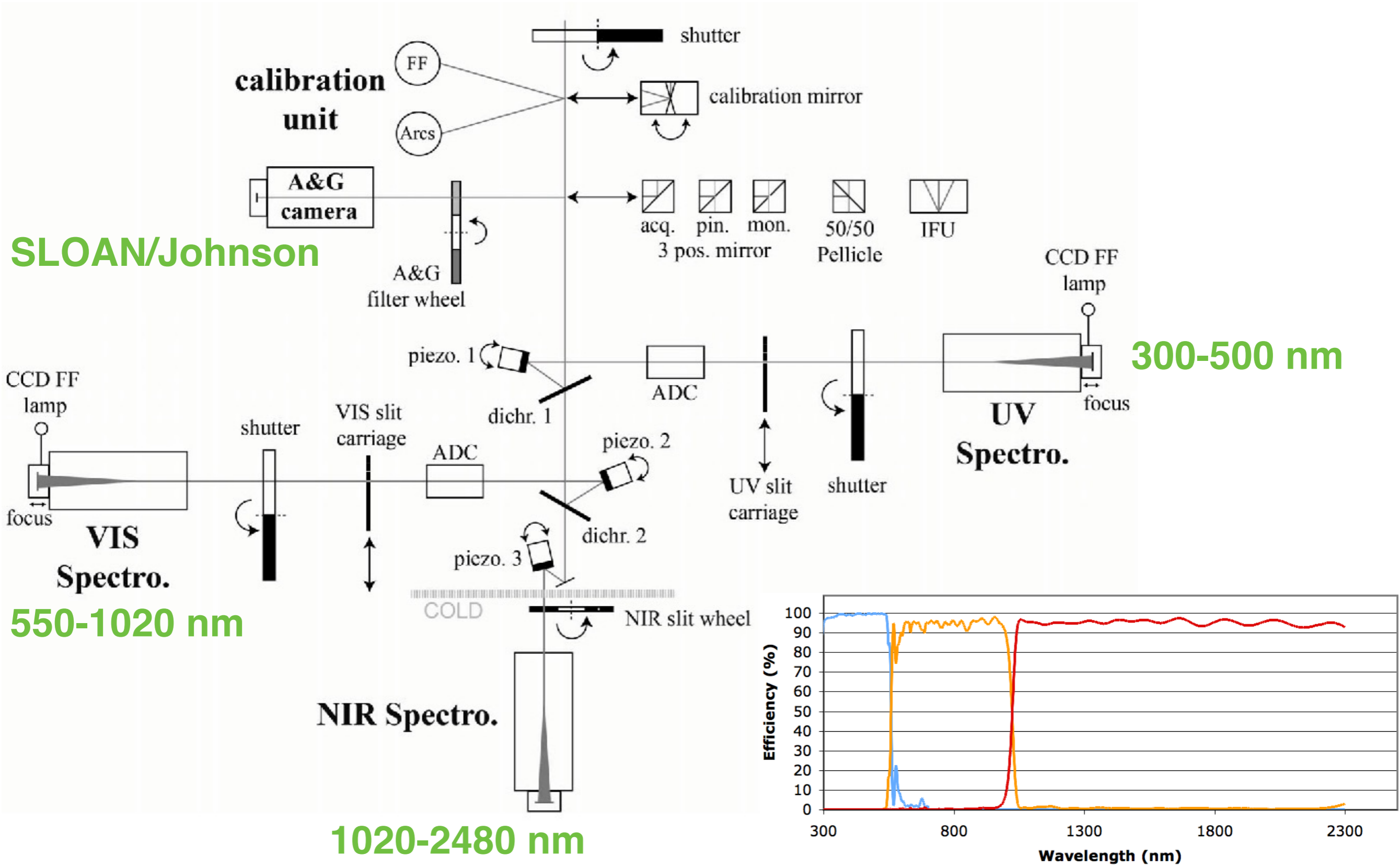


- simultaneous coverage from UV to near-IR (300-2400 nm)
- medium resolution
- high sensitivity

de Zeeuw (2016)



Layout: 4 arms



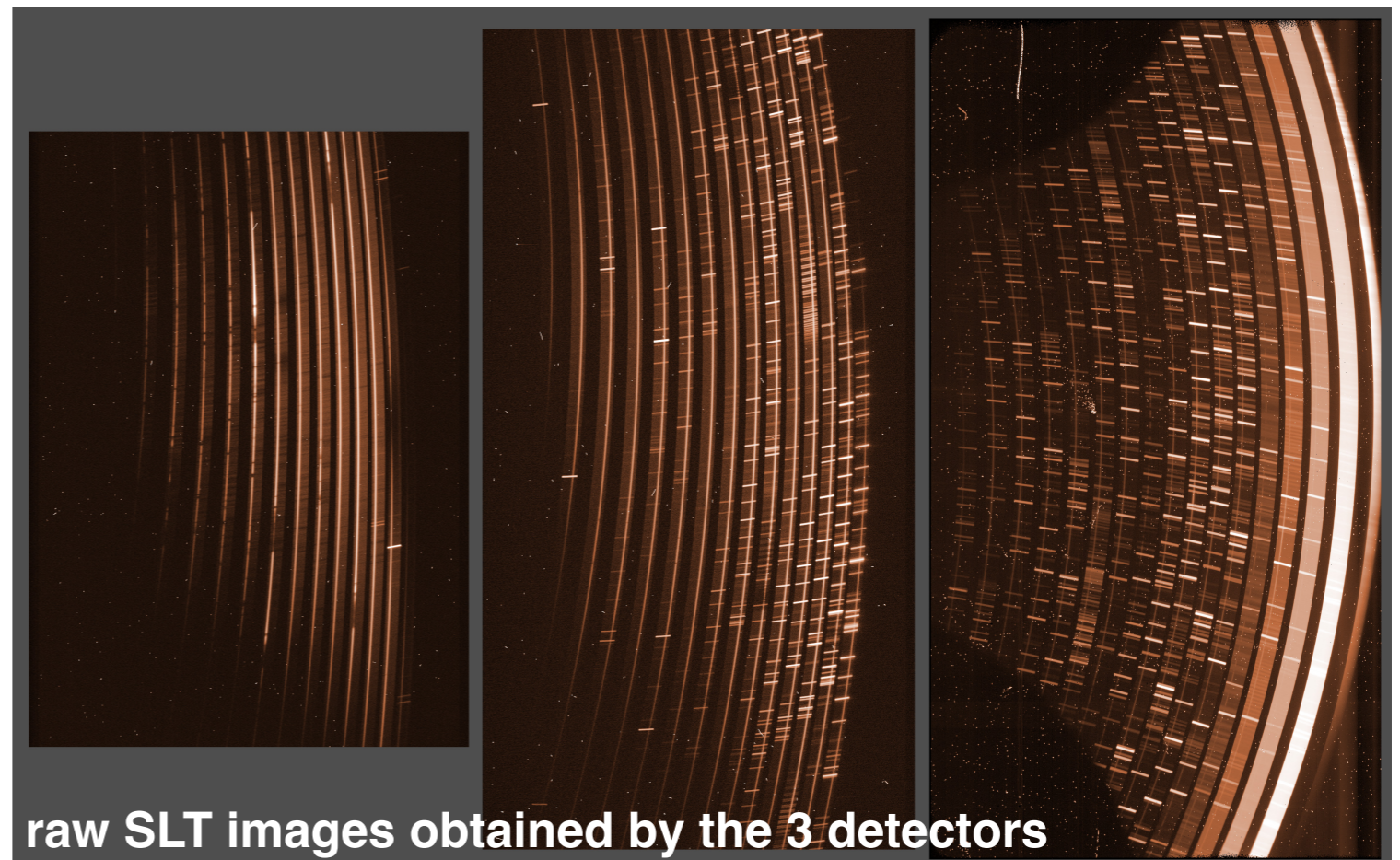
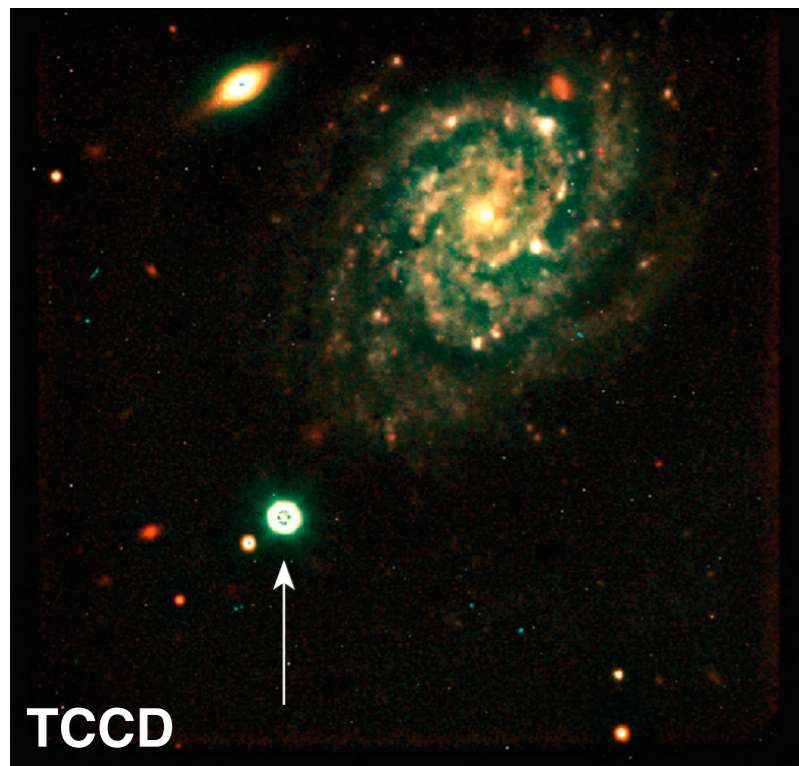
Instrument/observing modes

Instrument modes

- SLT (0.4"-5")
- IFU (4"x1.8")
- (IMG with TCCD)

Various observing modes

- stare
- nodding
- generic offset/fixed offset
- mapping
- synchronised



Nighttime calibration plan

Spectrophotometric standard stars

- instrument response
- relative flux calibration

future: replaced by tools like molecfit (night time used for calib plan 14% -> 5%)

Telluric standard stars

- telluric absorption lines

Optional (user provided, rare)

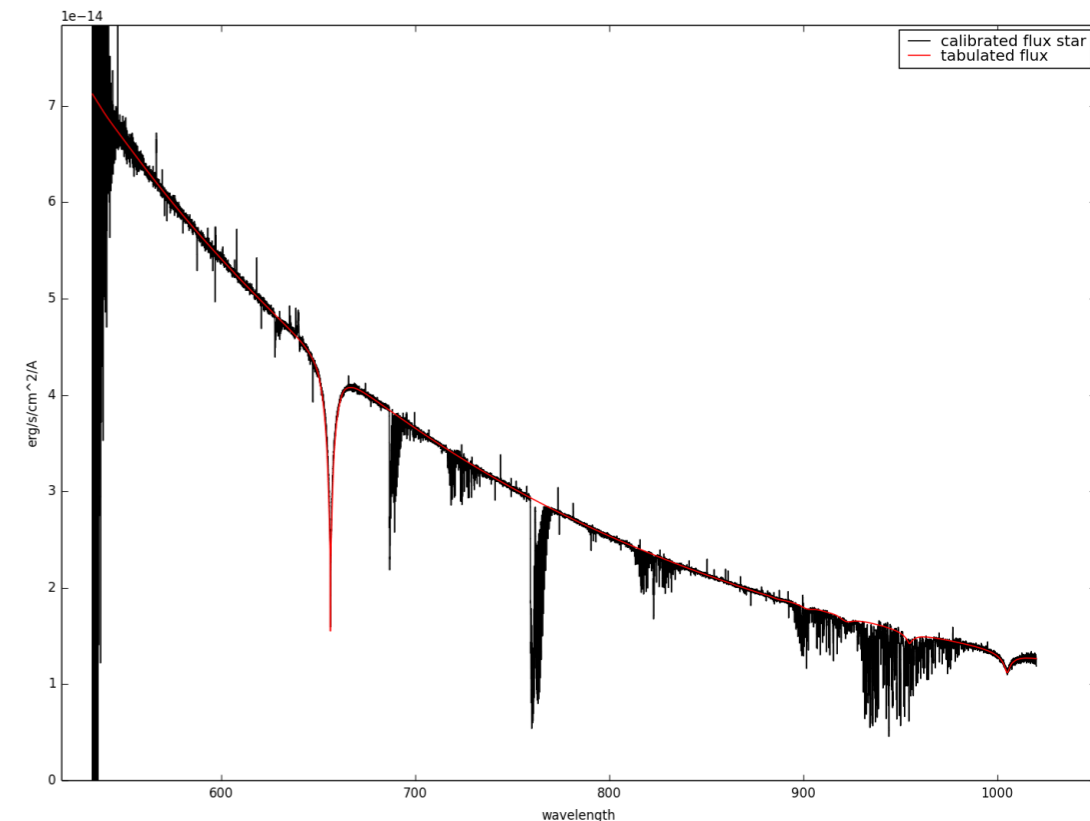
- radial velocity standards
- attached wave calibration

Efficiency monitoring

- monitor instrument health

XSHOOTER: STD
Calibrated Std

r.XSHOO.2016-12-29T07:59:35.576_tpl_0000.fits[0]
LTT3218
Tabulated Flux



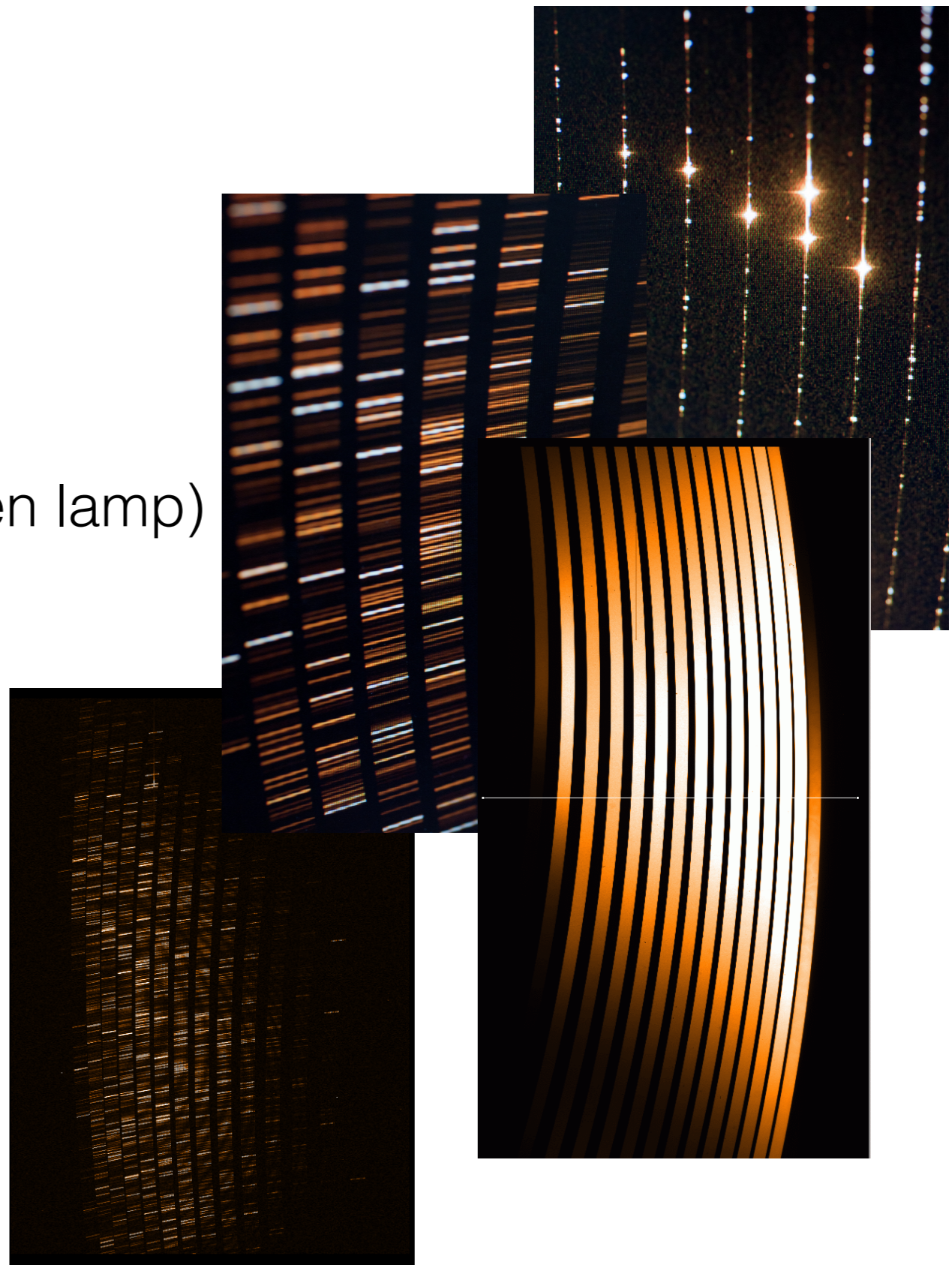
Daytime calibration plan

Data analysis

- bias
- dark
- flat
- fmtchk (single pinhole + ThAr)
- orderdef (single pinhole + halogen lamp)
- wave (multiple pinhole + ThAr)

Instrument health

- dark
- arc
- linearity
- ADCs+IFU
- reference acquisition position



Issues

X-shooter data quality concerns

Raw data

instrument: (1) mechanical failure of ADCs
(2) moving acquisition reference
(3) humidity effects
(4) readout noise in VIS arm

catalogue: (5) unsuitable telluric standard stars

Reduced data

pipeline: (6) IFU
(7) sky subtraction

CalSelector/reflex workflow/phase3: (8) bad UVB response



X-shooter data quality concerns

Raw data

instrument: (1) mechanical failure of ADCs
(2) moving acquisition reference
(3) humidity effects

better quality criteria, better data flow monitoring
-> detect data quality issues
-> best possible data (products)

Reduced data

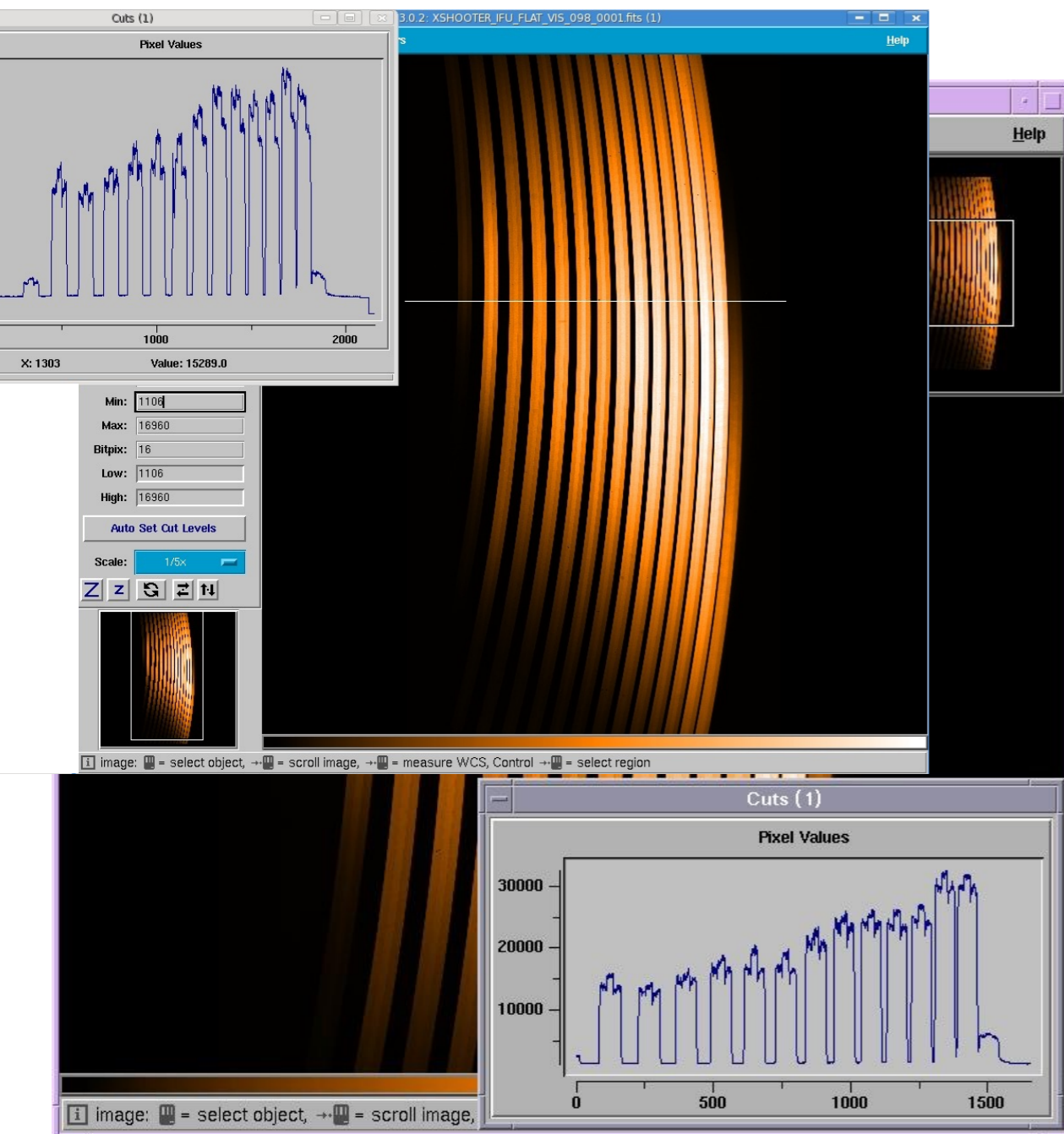
pipeline: (6) IFU
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CalSelector/reflex workflow/phase3: (8) bad UVB response

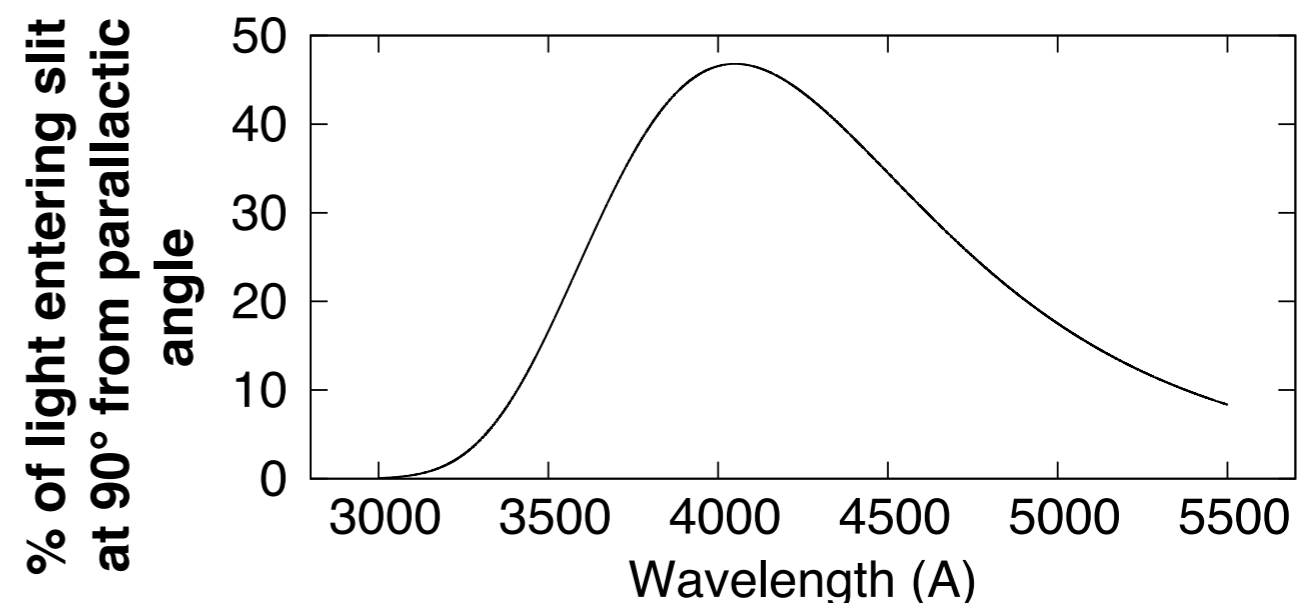
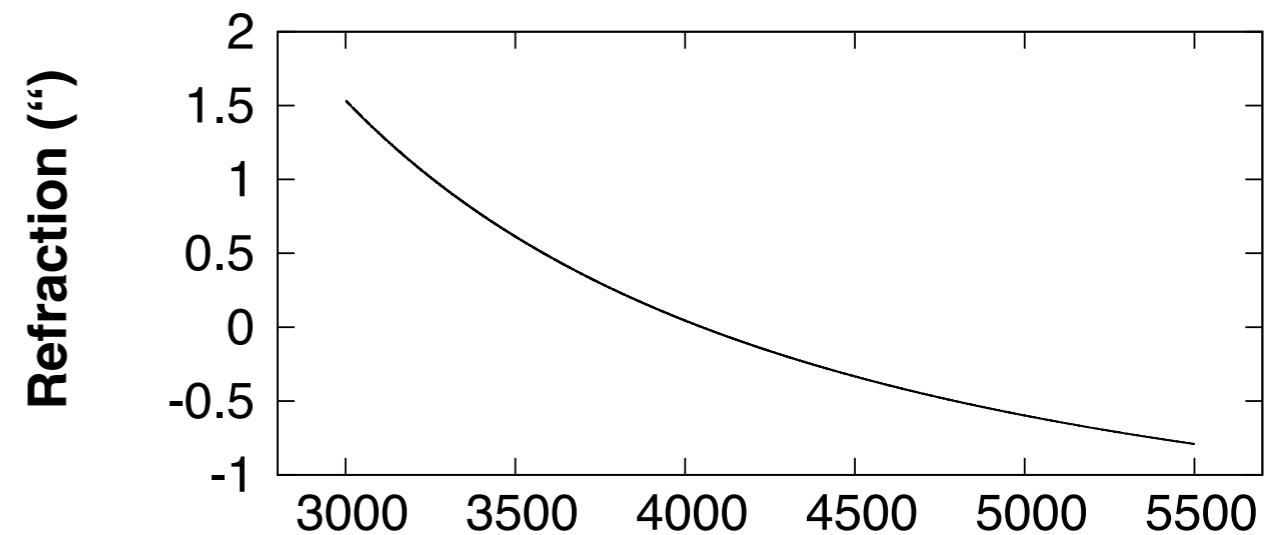


(1/8) Mechanical failure of ADCs

- material wear in low temperatures, ADCs disabled in 2012
- installation of **new ADC drives** in May 2017

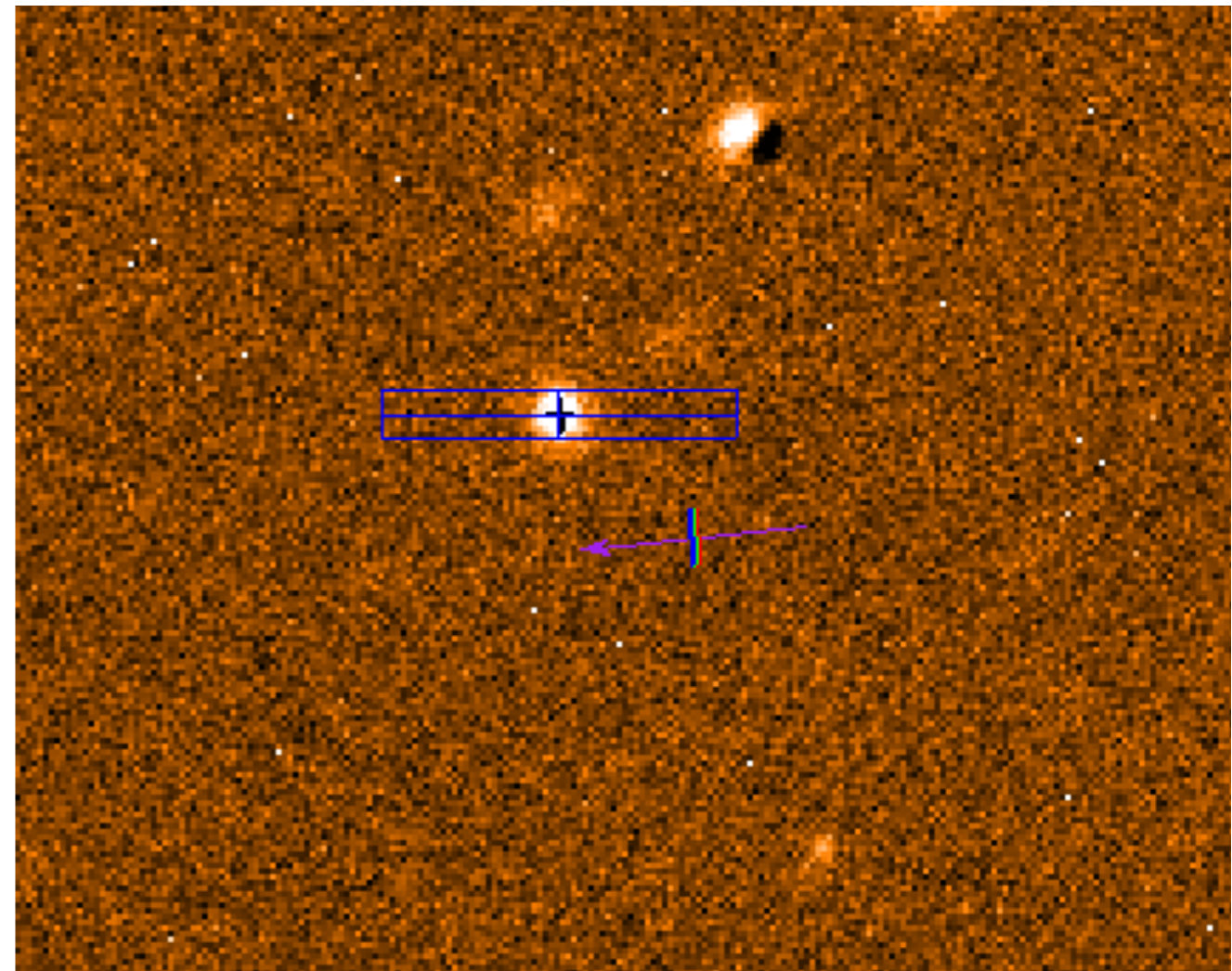


UVB, 0.5" slit, airmass 1.3, seeing 0.8"



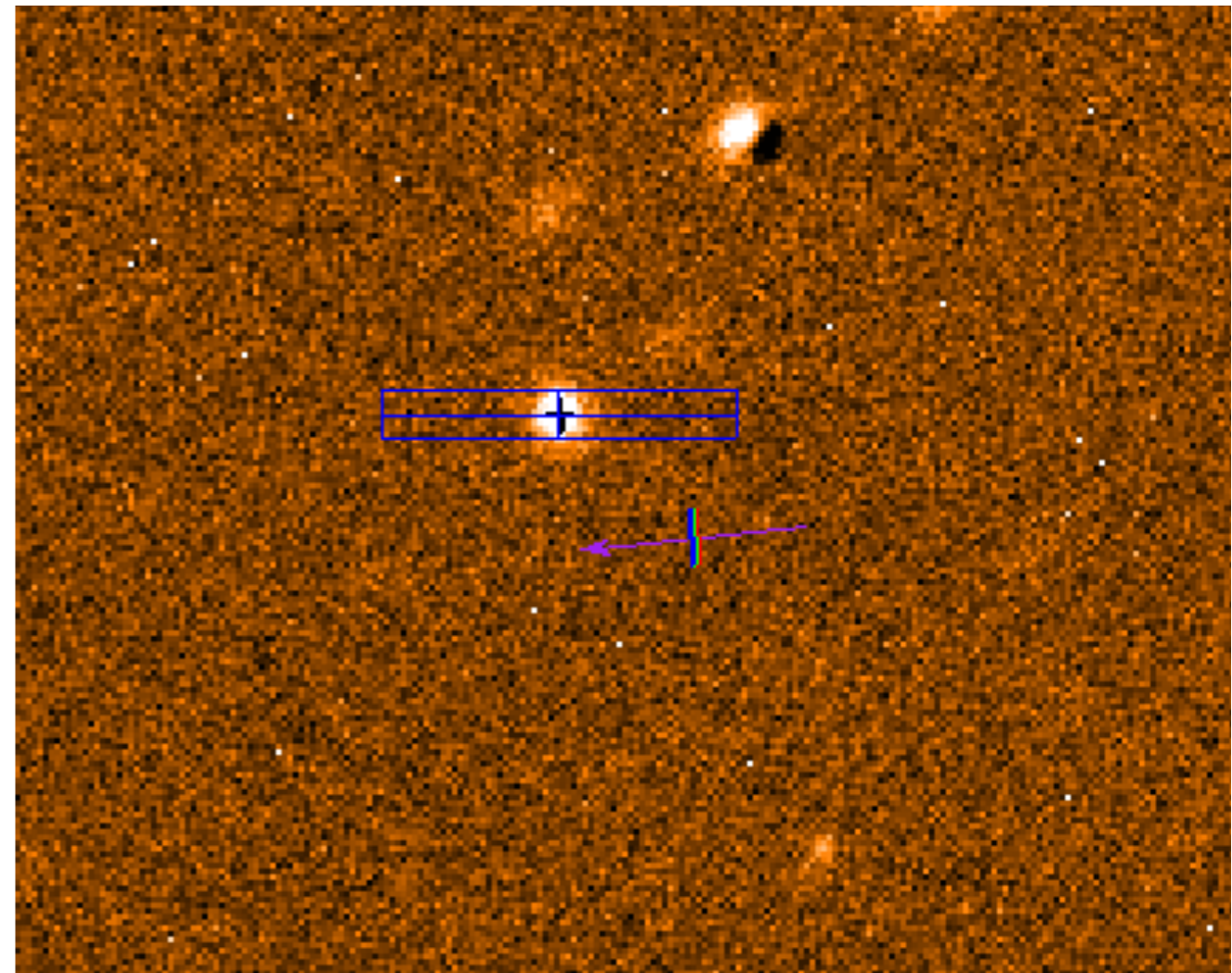
(2/8) Moving acquisition reference

- X-shooter acquisition is performed “blindly”
- imperfect target centering due to moving function, incorrect software update
- -> loss of flux, wavelength shift
- **check of reference position** every day



(2/8) Moving acquisition reference

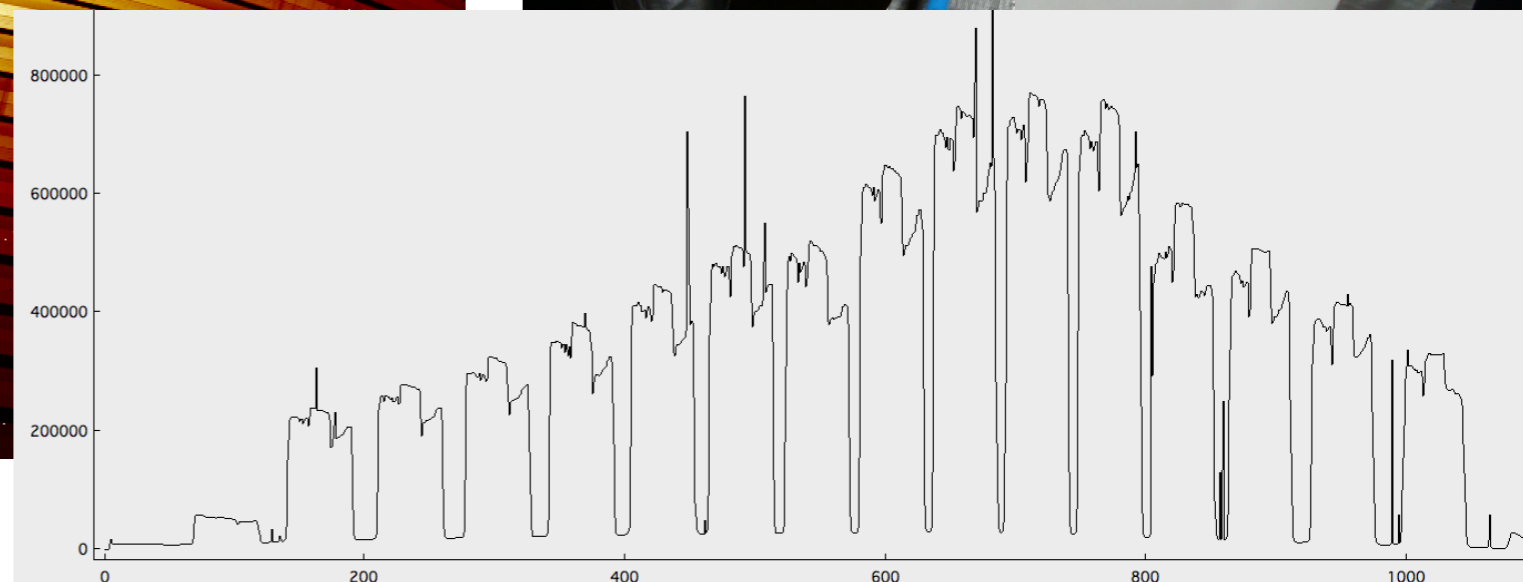
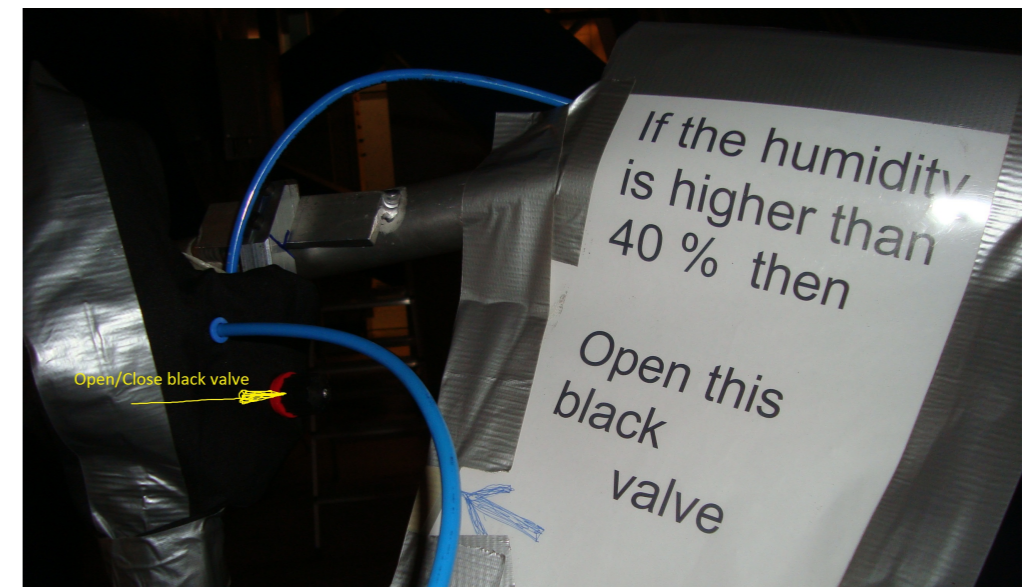
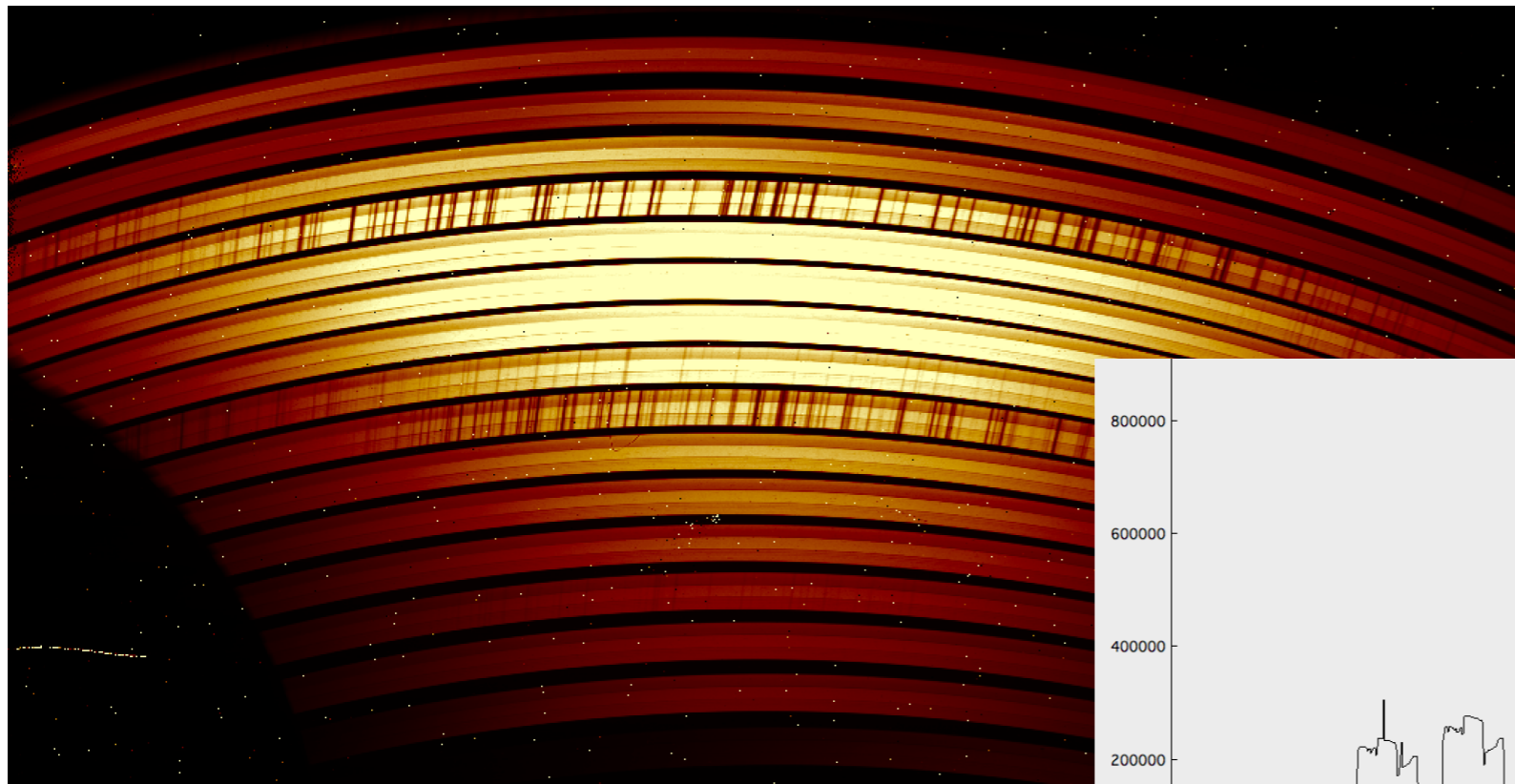
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**monitor moving functions
and functions that perform
“blind” operations!**

(3/8) Humidity effects

- condensation occurs on the NIR entrance window
- coating on dichroics soak up water
- affecting all three arms for up to two weeks
- manual **airflow system** installed in 2015
- **correlate selected quality parameters with weather parameters**



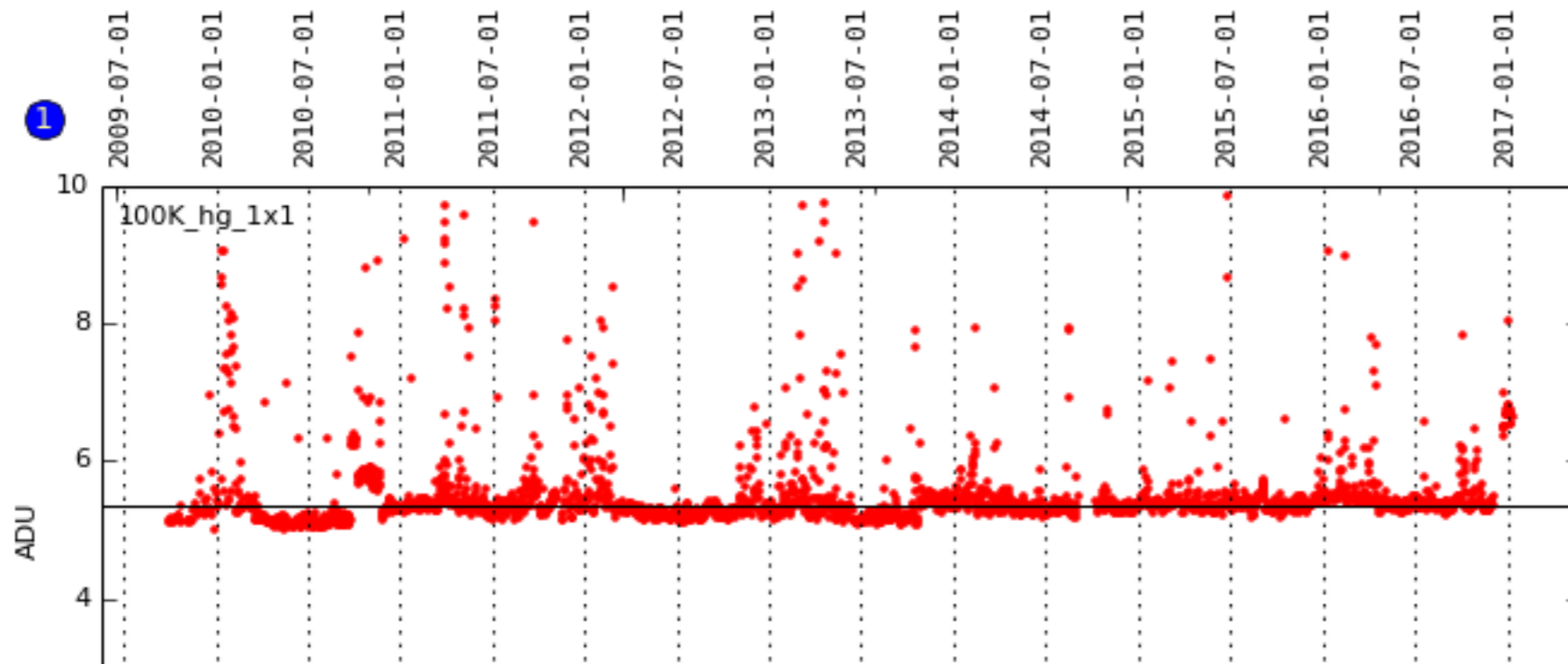
(4/8) High readout noise in VIS arm

- likely due to cabling and grounding
- concern for faint targets
- **no solution** found
- **provide users with easier access to relevant health parameters?**

HealthCheck Monitor
HOME | UsersGuide
ALL INSTRUMENTS
FULL reports
XSHOOTER: score overview
UVB
detector: bias
detector: parameters
distortion correction
format stability
wavelength calib.
lamps: arc & flat
efficiency
VIS
detector: bias
detector: parameters
distortion correction
format stability
wavelength calib.
lamps: arc & flat
efficiency
SNR
NIR
detector: dark
detector: parameters
distortion correction
format stability
wavelength calib.
lamps: arc & flat
efficiency
SNR
Acquisition Camera
detector
QC XSHOOTER

XSHOOTER trending system: HEALTH CHECK report
Last update: 2017-01-01T11:01:29 (UT) (0d 08h:17m ago) | now: 2017-01-01T19:19:12 (UT) | QC pipeline: xshoo-2.8.5 (installed 2016-12-20)
same group: med_master ron_raw ron_master struct_x struct_y
General news:
XSHOOTER news:
Report news: edit
DATE*: 2016-12-25 report | NLT 2016-12-26 report | NLT 2016-12-27 report | NLT 2016-12-28 report | NLT 2016-12-29 report | NLT 2016-12-30 report | NLT 2016-12-31 report | NLT
Raw CAL displays: raw raw raw raw raw raw raw
Product quality: products products products products products products products
scores&comments | FULL | history | plot tutorial | contact | daily/often; important to check | *Date on this monitor changes at 21:00 UT
XSHOOTER: read-out noise of raw BIAS (last 90 days)
QC data range: 2016-10-04 ... 2016-12-31*
100K_hg_1x1
100K_hg_1x2
100K_hg_2x2
100K_lg_2x2

XSHOOTER: read-out noise of raw BIAS (FULL range, 2658 days, close-up)
QC data range: 2009-10-01 ... 2017-01-08*



(5/8) Unsuitable telluric standard stars

- 2009-2015: 1079 B-type telluric standard stars observed (Simbad database)
- 19% of those are: Be stars, binaries, SGs, LPV, strange line profiles
- **clean catalogue + molecfit**
- **investigate earlier, especially with ELT!**

The screenshot displays the XSHOOTER calChecker interface, which is used for monitoring calibration completeness. The main window is titled "CAL XSHOOTER calChecker: calibration completeness monitor". It features a header with the last update date (2015-03-13T14:41:10 UT) and a server link (www.eso.org HQ). Below the header, there are sections for "General news" and "XSHOOTER news". The central part of the interface is a large table with columns for observation ID, instrument, filter, date, time, and status. The table is color-coded: green for successful observations and red for failed ones. A "Product quality" section shows a list of products with their respective statuses (e.g., "ok", "analyzed: [1]"). On the left side, there are panels for "Science Files" (listing observation files and their parameters) and "Instrument Setup" (configuring the instrument, slit width, and readout). At the bottom, there are "Star Search Parameters" and a table of star names and their coordinates. A text box overlaid on the bottom left of the screenshot reads: "If science OB is left uncalibrated, the observation will be shown in red."

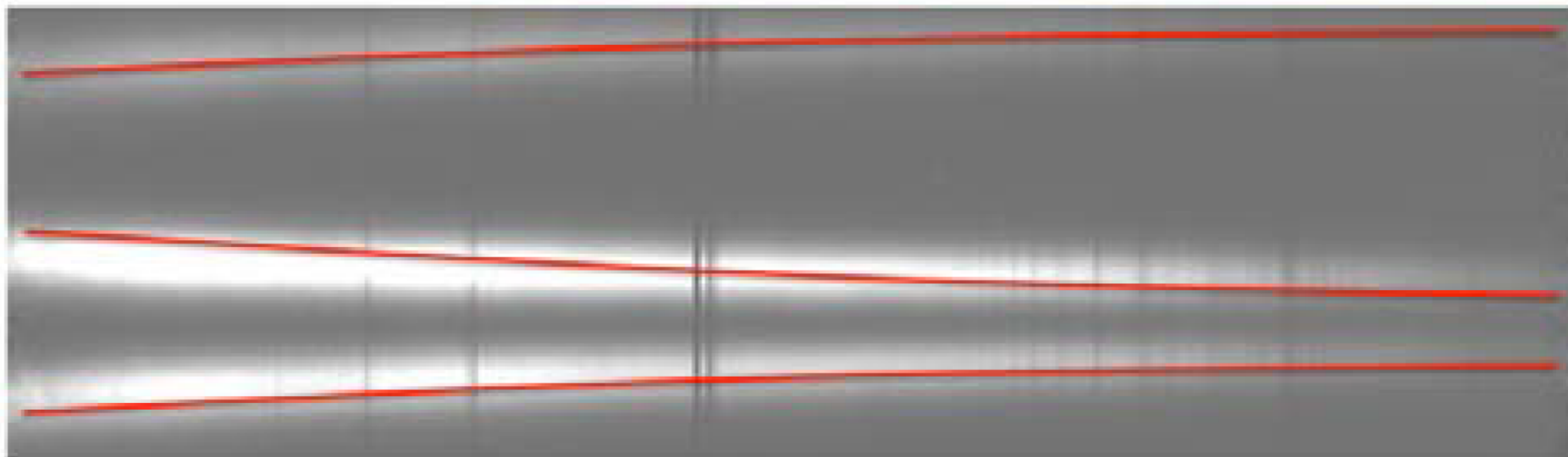
(6/8) Pipeline: IFU

no science-ready IFU products

- 2012-2016: 334 hours for 35 programs
- only 15% of programs published (8 papers)

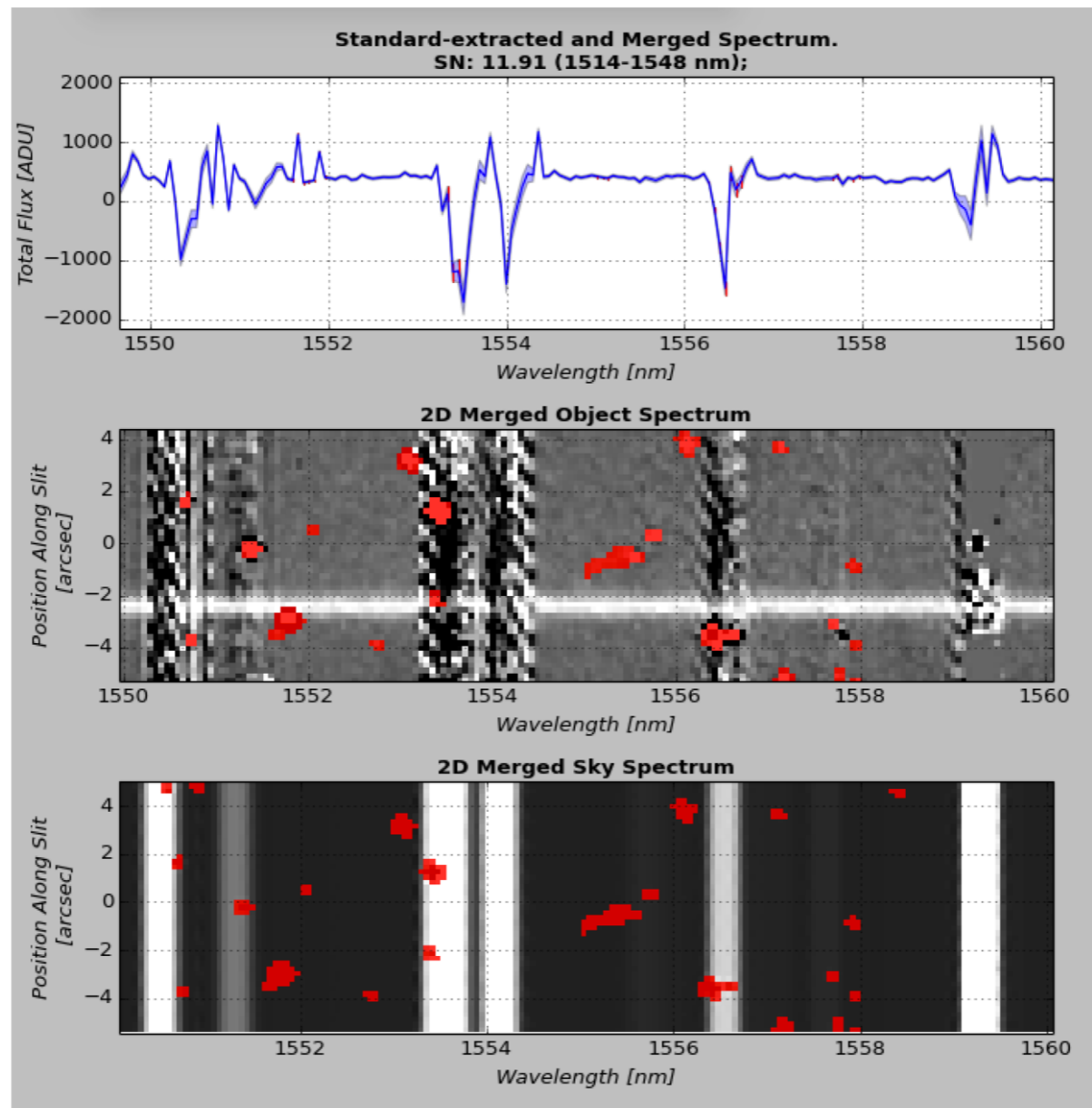
no operational costs, but:

- frustrated users, very few proposals
- not scientifically competitive (MUSE+SINFONI+ERIS)
- **decommission or pipeline project to either improve or downgrade to a simple image slicer mode?**
- **science-ready pipeline products!**



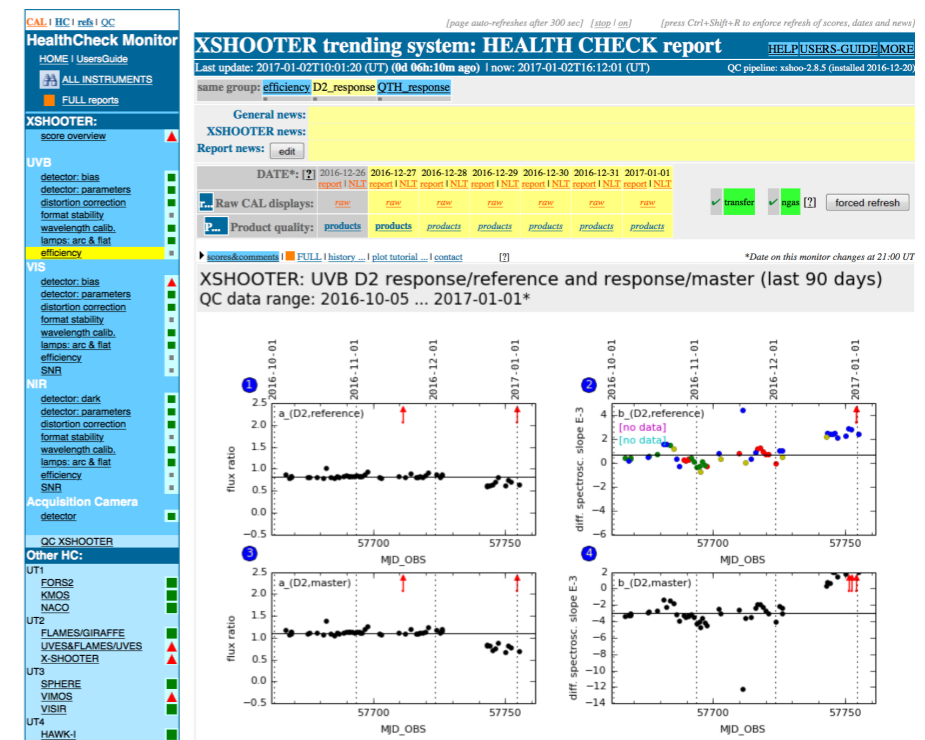
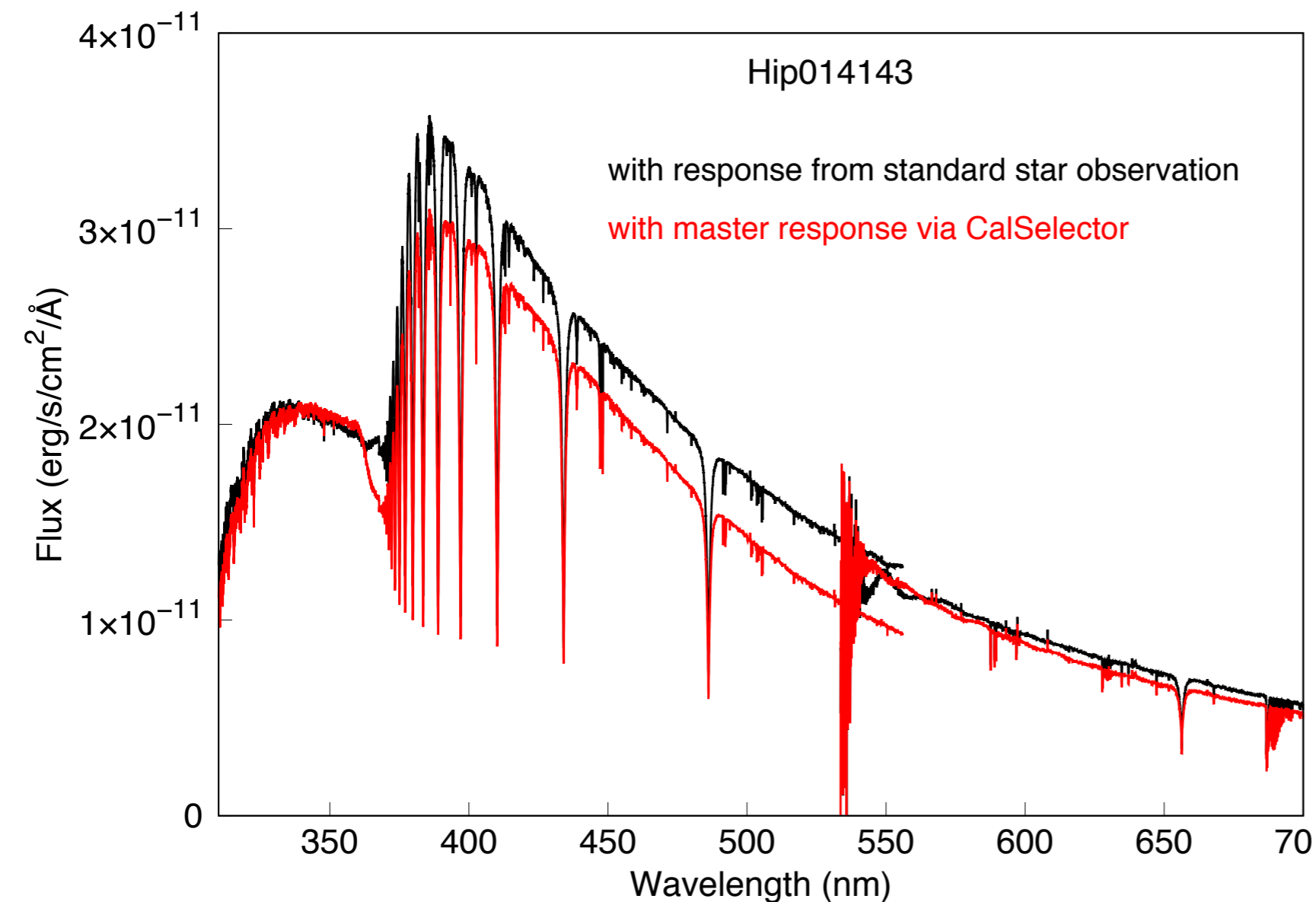
(7/8) Pipeline: sky subtraction

- optimal extraction needed (SDP project... since 5 years)
- solution to come in 2017 from **CRIRES+ consortium?**



(8/8) Master calibrations: response

- artefact at the Balmer jump, different flux level
- due to two (variable) flat field lamps in the UVB
- **health check**
- **validity, no default usage of master calibrations?**



Conclusions

- ESO's goal:** provide the community with the best possible (raw/reduced) data
- **define:** better requirements and quality criteria and parameters from the start of operations, based on instrument specifics (and limitations regarding resources)
 - **monitor:** the entire data flow and quality parameters to
 1. identify instrumental problems
 2. improve data (products) delivered to the community