The End-to-End Pipeline for HST Sliltess Spectra: PHLAG

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Space Telescope-European Coordinating Facility

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Overview

- PHLAG: the Pipeline for Hubble Legacy Archive Grism data
- Available HST data
- Slitless spectroscopic data
- Calibration
- The structure of PHLAG
- The HLA User Interface
- Statistics / status

1. PHLAG: the Pipeline for Hubble Legacy Archive Grism data

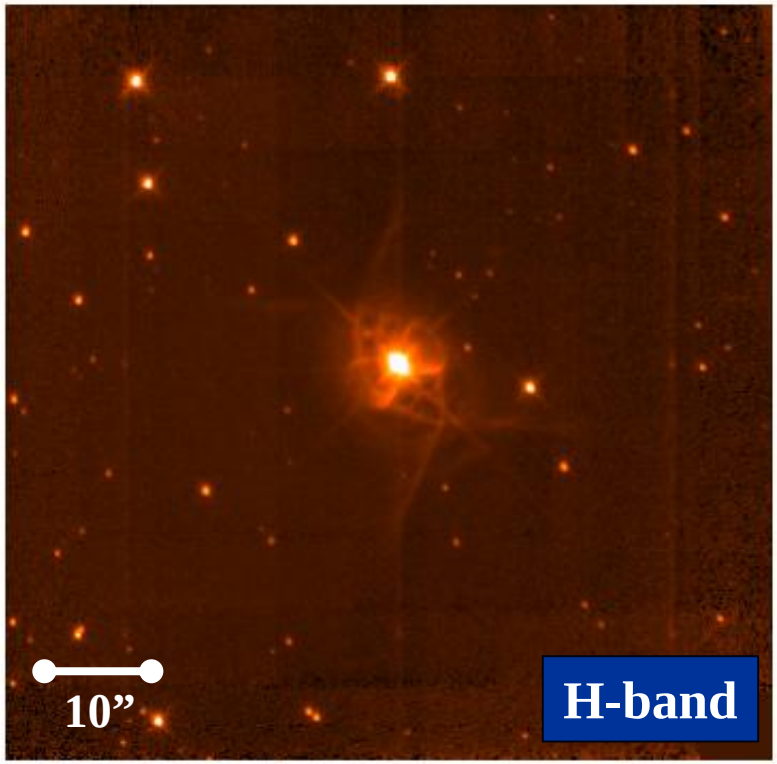
- Current archive:
  - Raw data
  - “on the fly calibration”
  - Requires many steps to get science ready data
  - Takes long time to get science ready data
- Hubble Legacy Archive (HLA):
  - Contains science ready data
  - Static data
  - Fast and easy to use
  - Compatible with VO tools

2. Available HST data

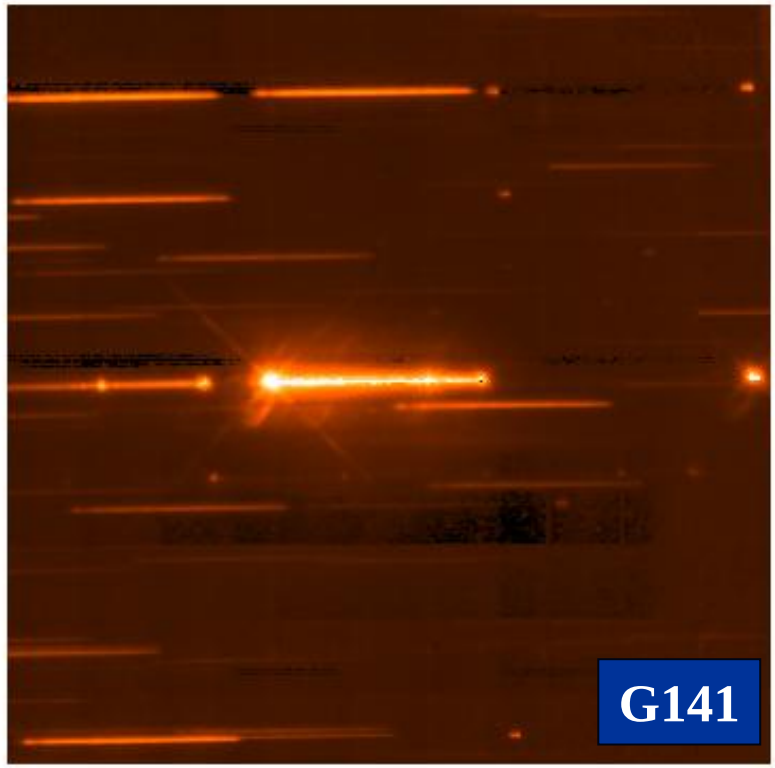
Channel	Disperser	Wavelength Range [Å]	Resolution [Å/pixel]	FOV ["]
ACS/WFC	G800L	5500 – 10500	38.5	202x202
ACS/HRC	G800L	5500 – 10500	23.5	29x26
ACS/HRC	PR200L	1600 – 3900	20 [@2500Å]	29x26
ACS/SBC	PR130L	1250 – 1800	7 [@1500Å]	35x31
ACS/SBC	PR110L	1150 – 1800	10 [@1500Å]	35x31
NIC3	G141	11000 – 19000	80	51x51

- **Further available:** NIC3/G096, NIC3/G206, STIS/G750L, STIS/PRISM, WFPC1/GRISM
- **After SM4: WFC3**

3. Slitless spectroscopic data

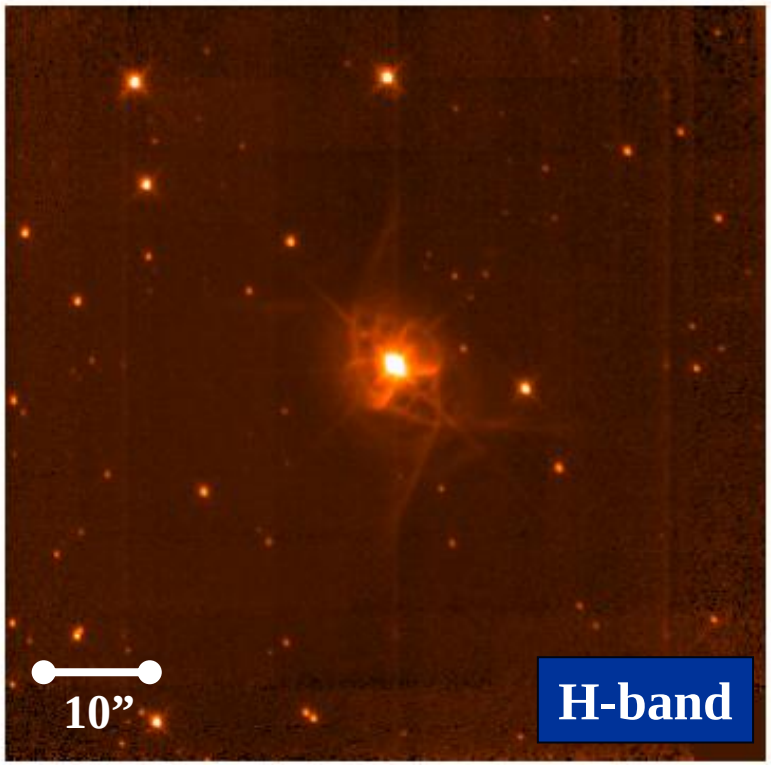


Direct image

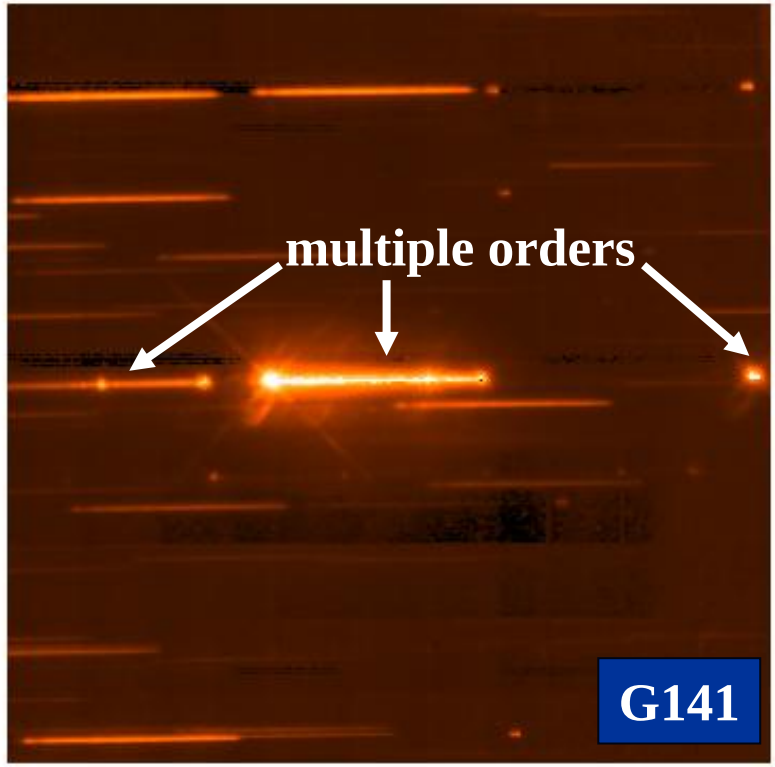


Slitless image

3. Slitless spectroscopic data



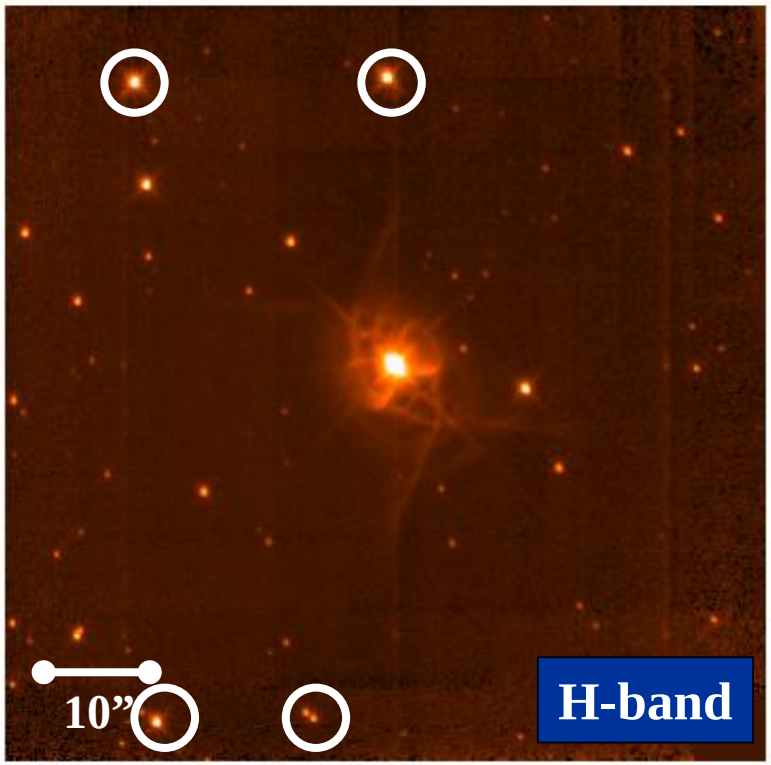
Direct image



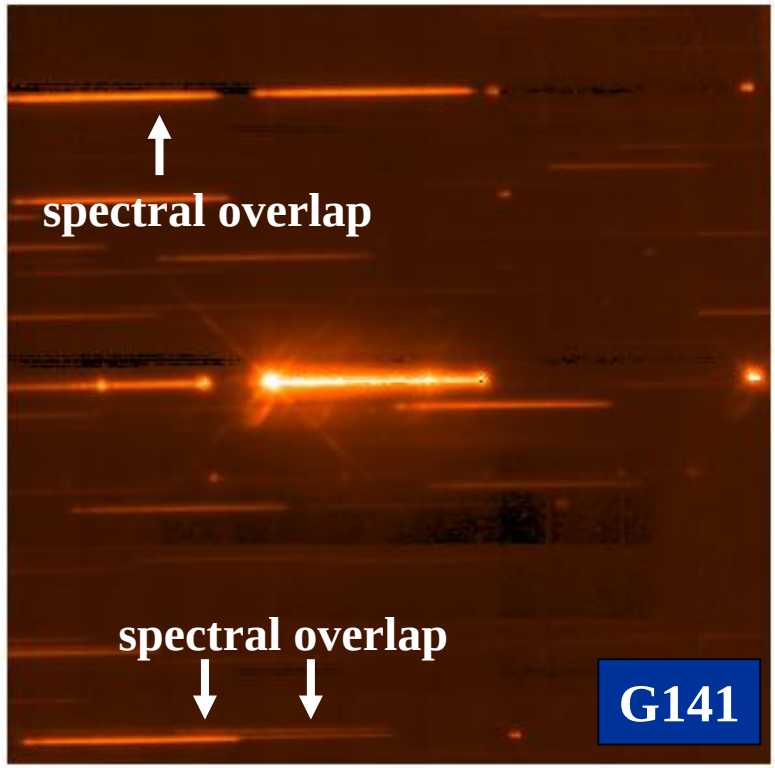
Slitless image

3. Slitless spectroscopic data

spectral overlap!



Direct image

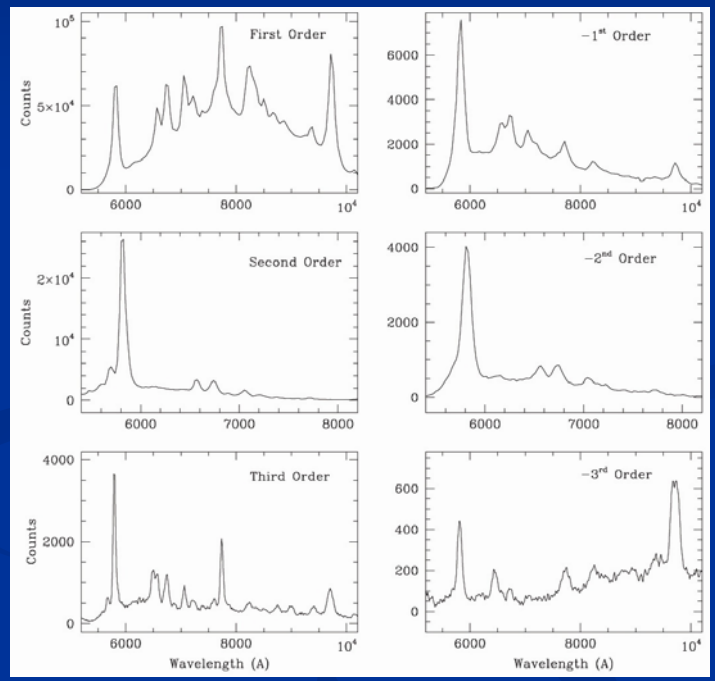


Slitless image

4. Calibration

- No (useful) onboard calibration lamps

  ⇒astronomical targets as calibrators
- Calibration **relative** to the direct image position
- Different object classes for wavelength calibration:
  - planetary nebula
  - Wolf-Rayet stars
  - QSO's
- Flux calibration: **white dwarfs**



WR star observed with WFC/G800L

5. The structure of PHLAG

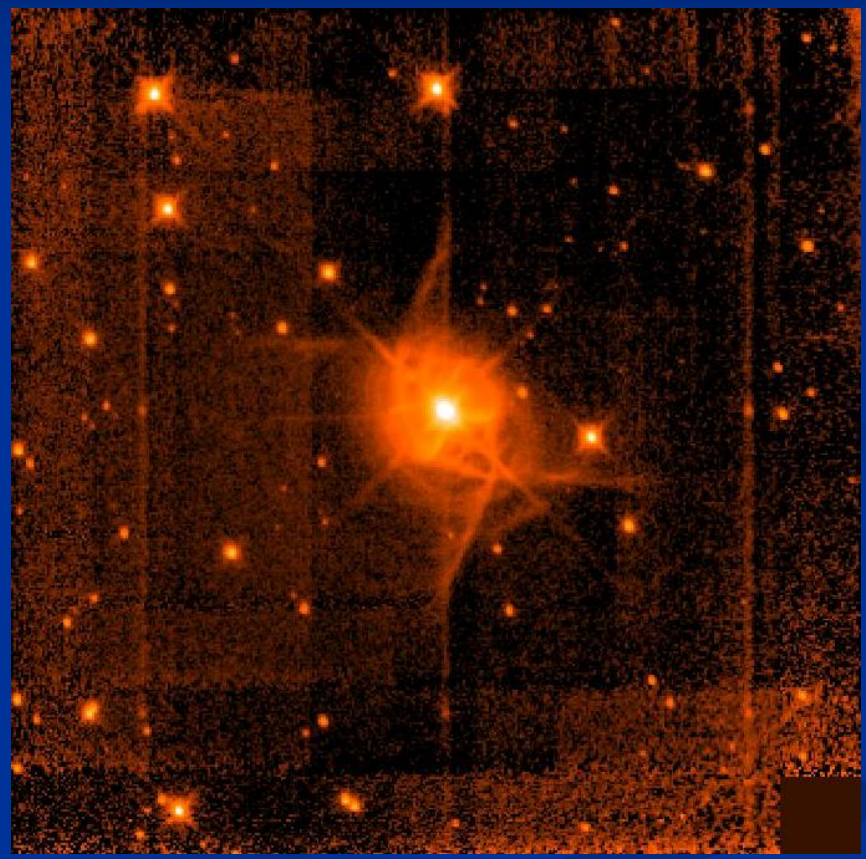
- Developed for NICMOS G141 pilot project
- End to end: start with the raw data, end with extracted 1D spectra in the archive
- Modular, not monolithic; consists of a series of reduction steps
- Uses external software: SExtractor, pyraf, MultiDrizzle, aXe, aXe2web
- Implemented in Python

Modules of PHLAG

1. data preparation
2. data retrieval (calnic)
3. background
4. image combination (MultiDrizzle)
5. object detection (SExtractor)
6. spectral extraction (aXe)
7. quality control
8. metadata
9. data ingestion

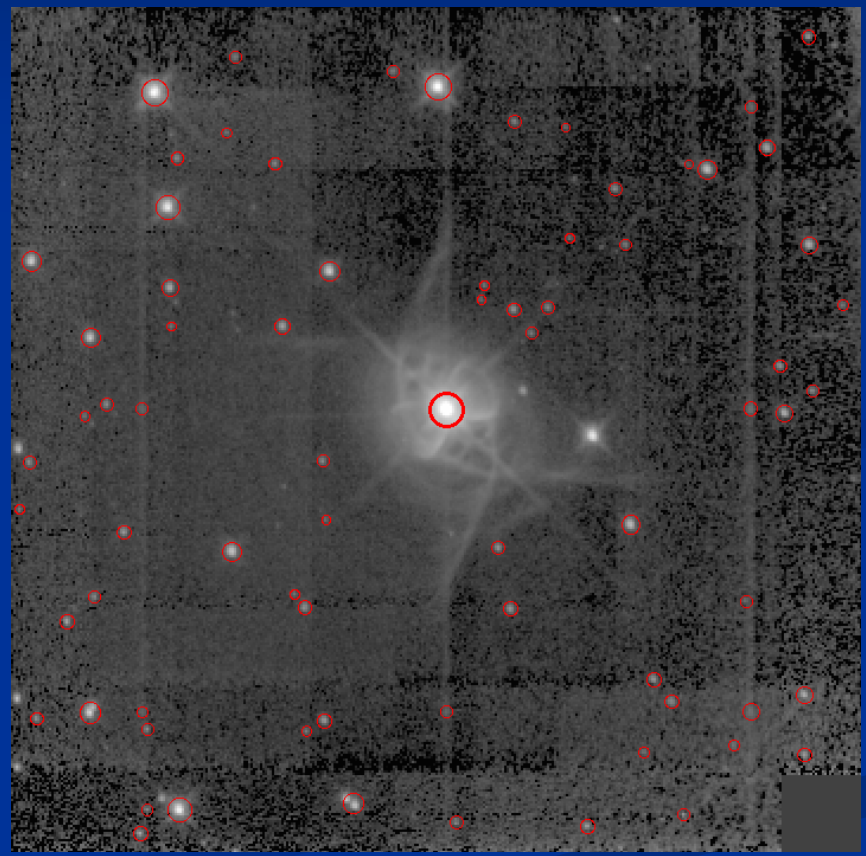
Image combination

- “Best” filter
- Using MultiDrizzle
- Standard settings

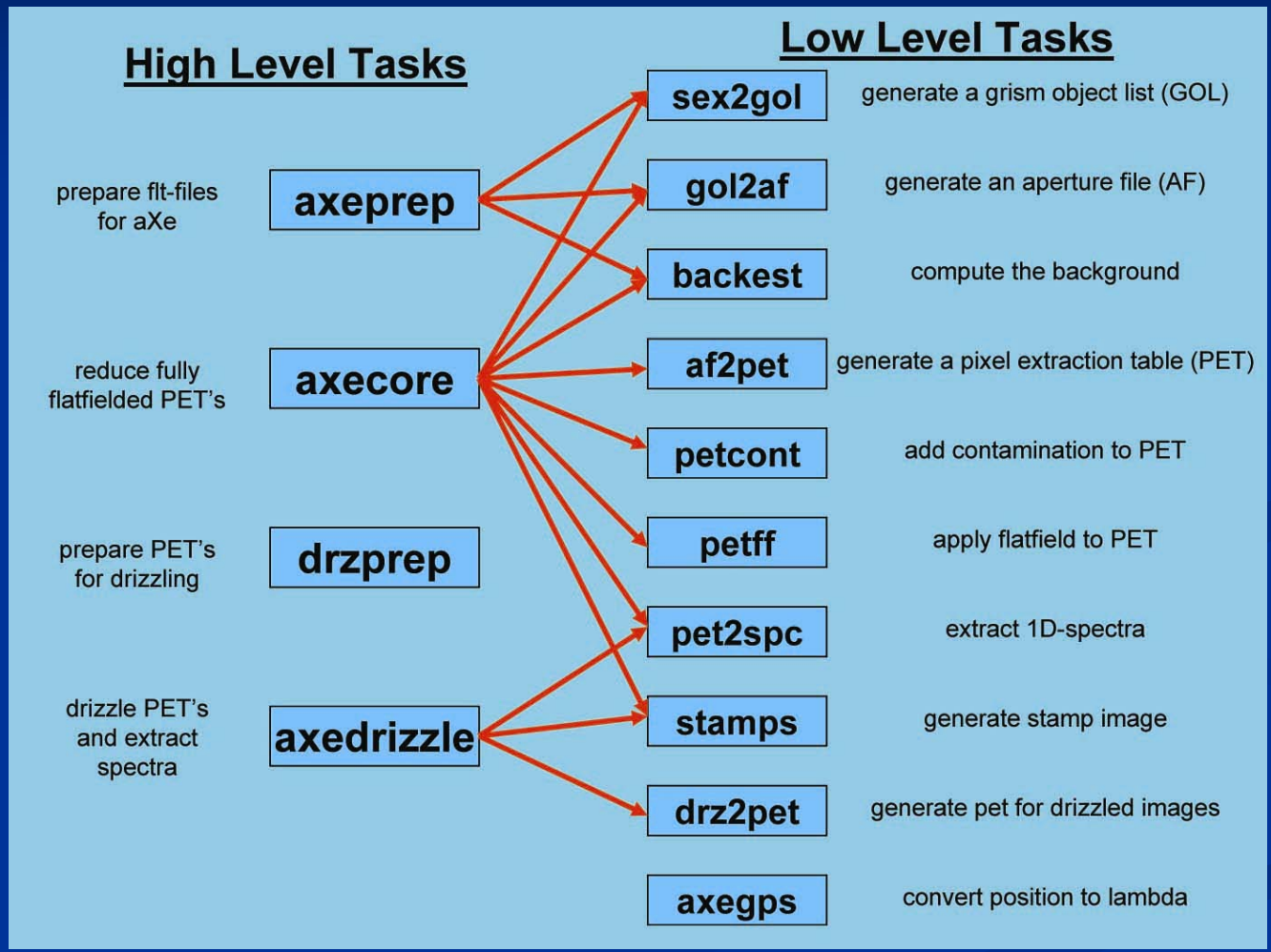


Object detection

- SExtractor
- Conservative settings
- Prime aim: get all objects for spectroscopy
- “Reasonable” photometry
- Boundary objects, splitting still problematic

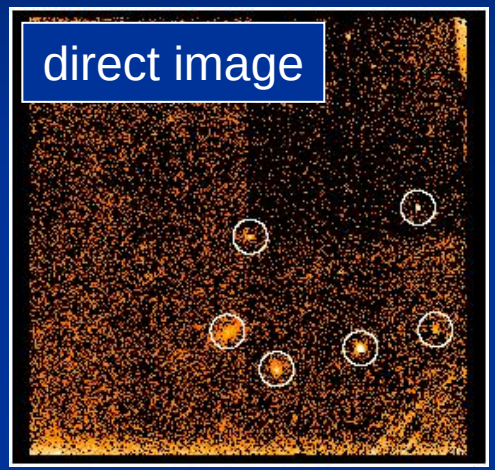


Spectral extraction: aXe software

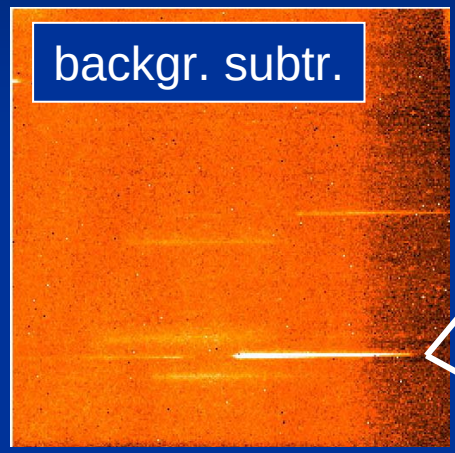


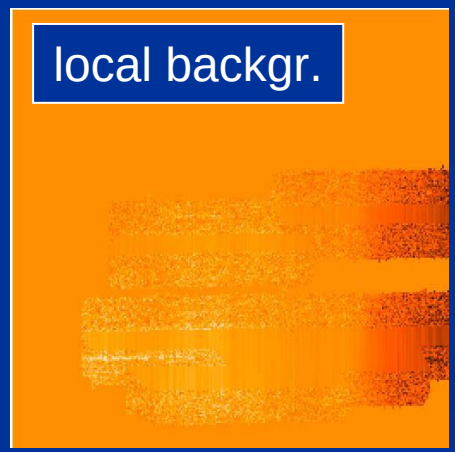
Example of a spectral extraction

input



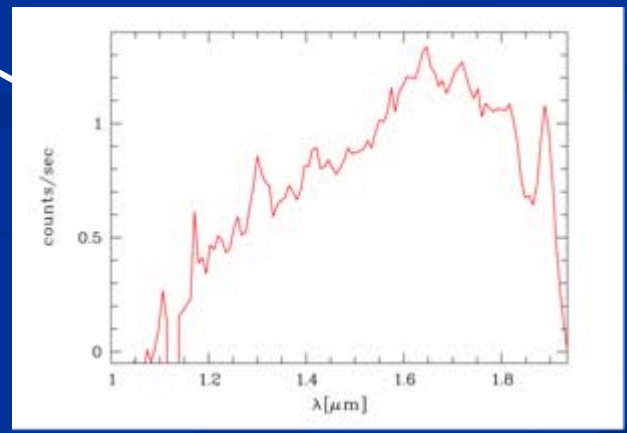
intermediate steps





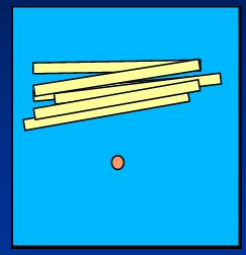
result

stamp image

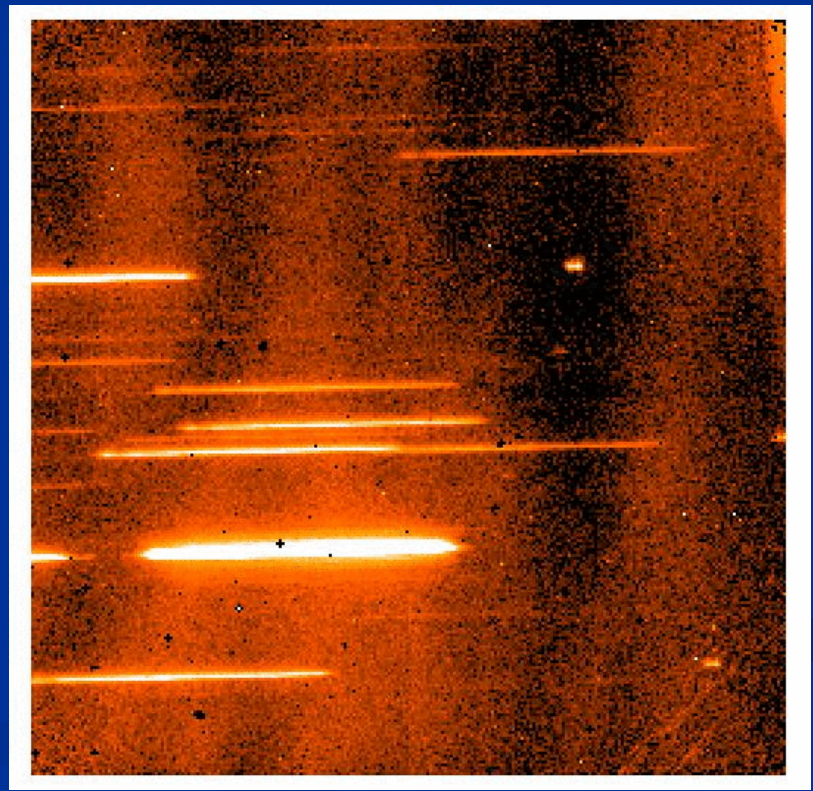


extracted spectrum

Re-adjustment of trace

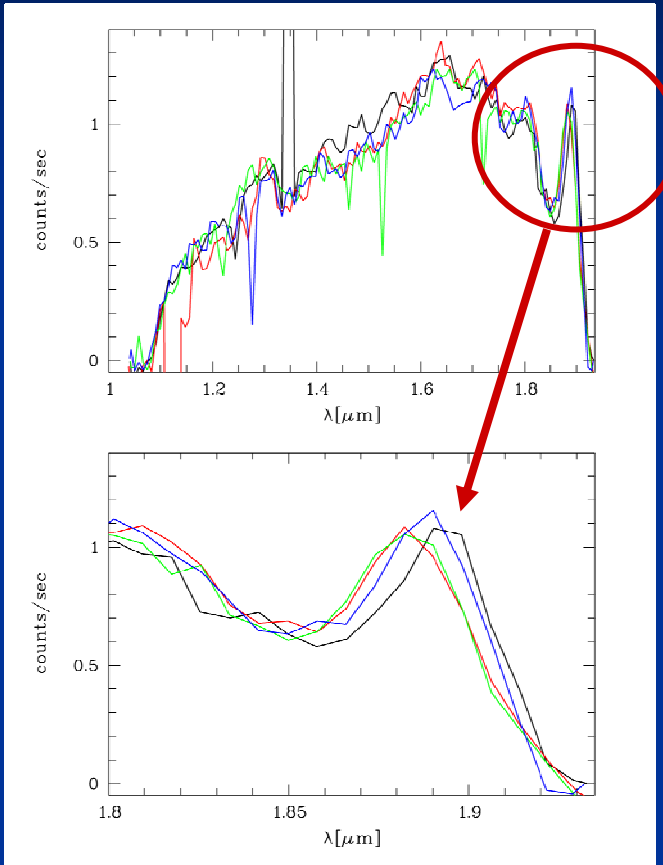


- Filter wheel position is not reproducible
- Unstable trace
- Individual trace solution for every grism image
- Fitting of object traces
- Differences: ± 1pix over trace length

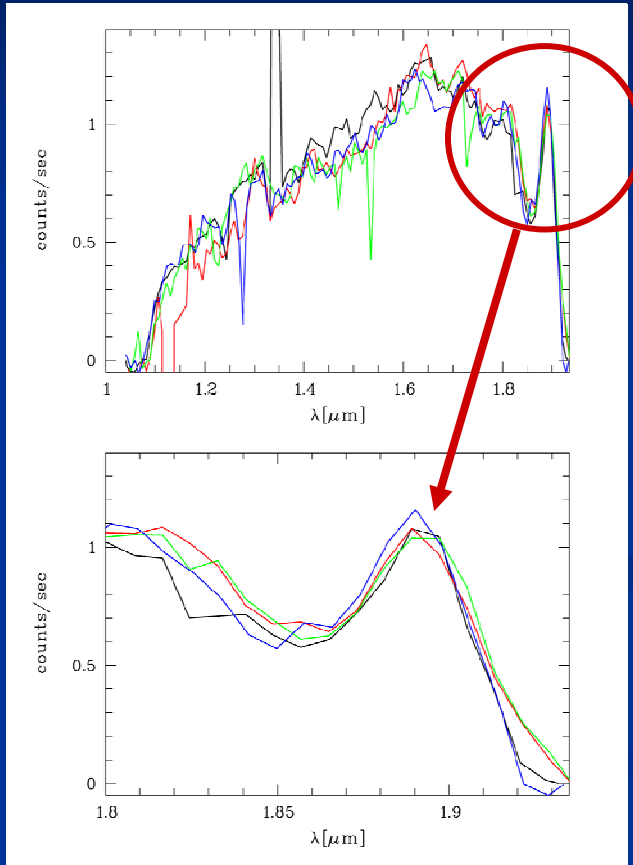


Re-adjustment of wavelength

original

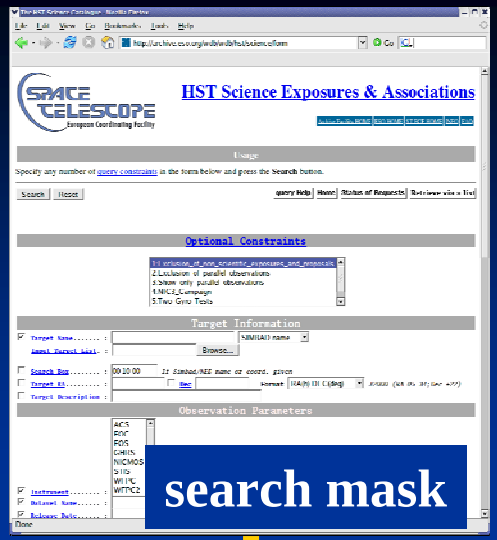


readjusted

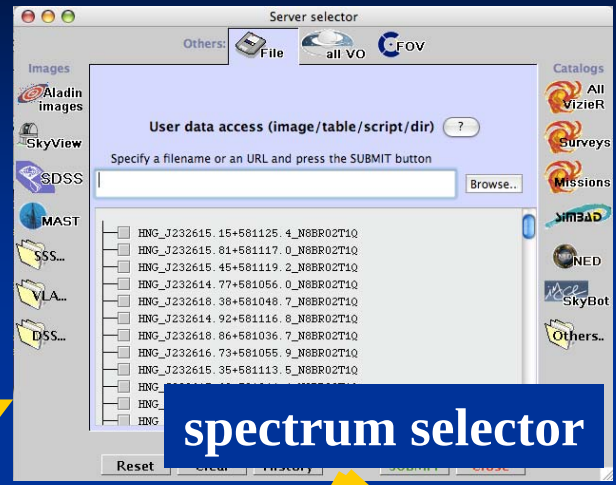


Shift determined with cross-correlation techniques

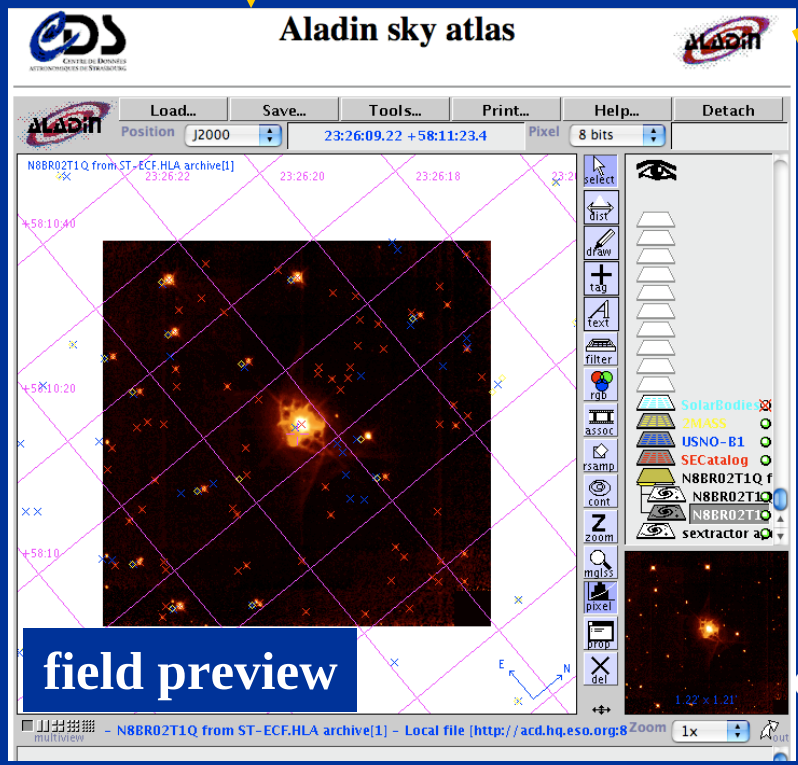
6. The HLA User Interface



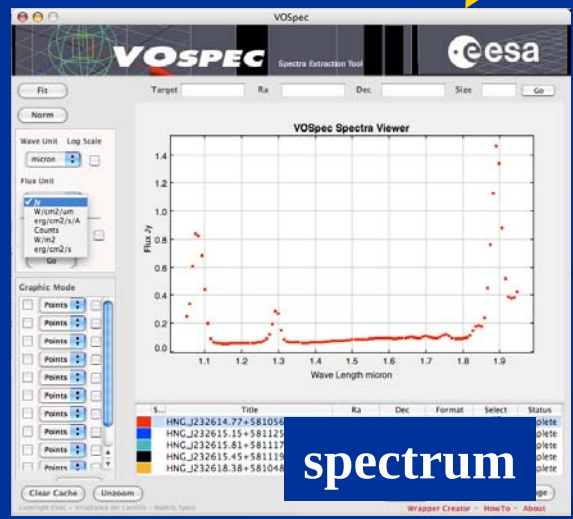
search mask



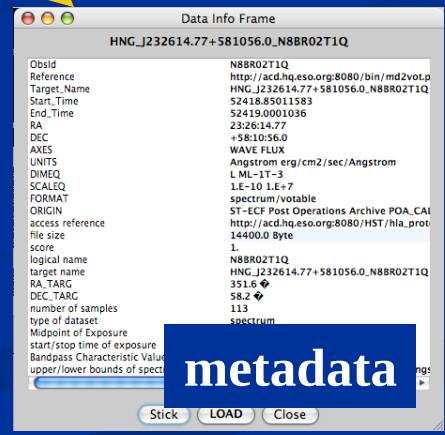
spectrum selector



field preview



spectrum

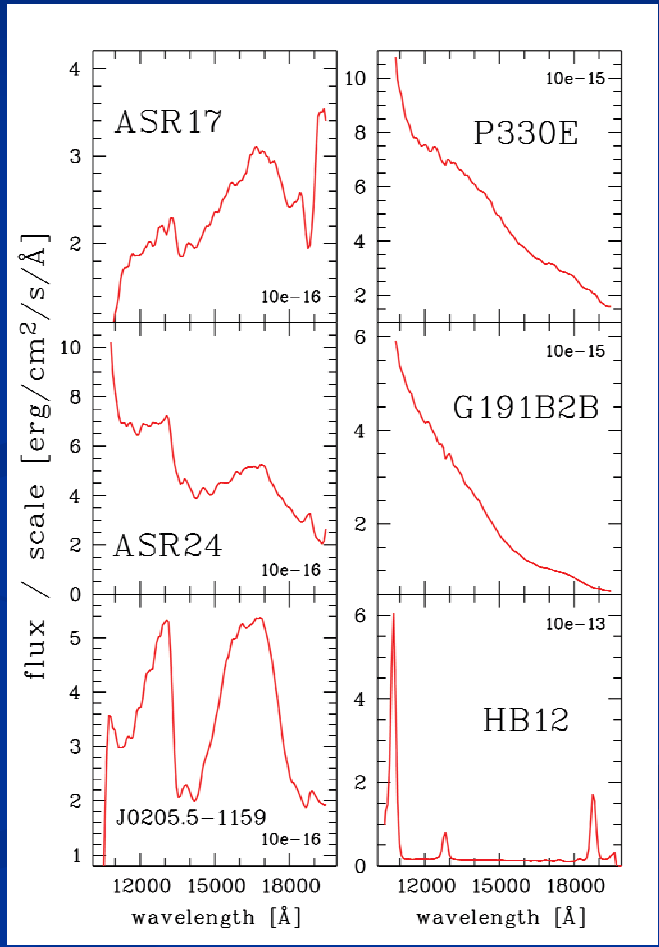


metadata

Calibration Workshop
Martin Kümmel

7. Statistics / Status

- PHLAG run on the whole NICMOS G141 data in December 2006
- ~ 1000 datasets
- ~ 5000 grism images
- 8 day of computing time (single linux box)
- ~ 40 000 spectra



Further information:

→ **ST-ECF Newsletter:**

→ **HLA webpage: www.stecf.org/archive/hla.php**

→ **aXe webpage: www.stecf.org/instruments/ACSgrism/axe**

… or ask now!