EMIR Status and Short Term Plan

F. Garzón @ EMIR Team

EMIR PI

EMIR: general description

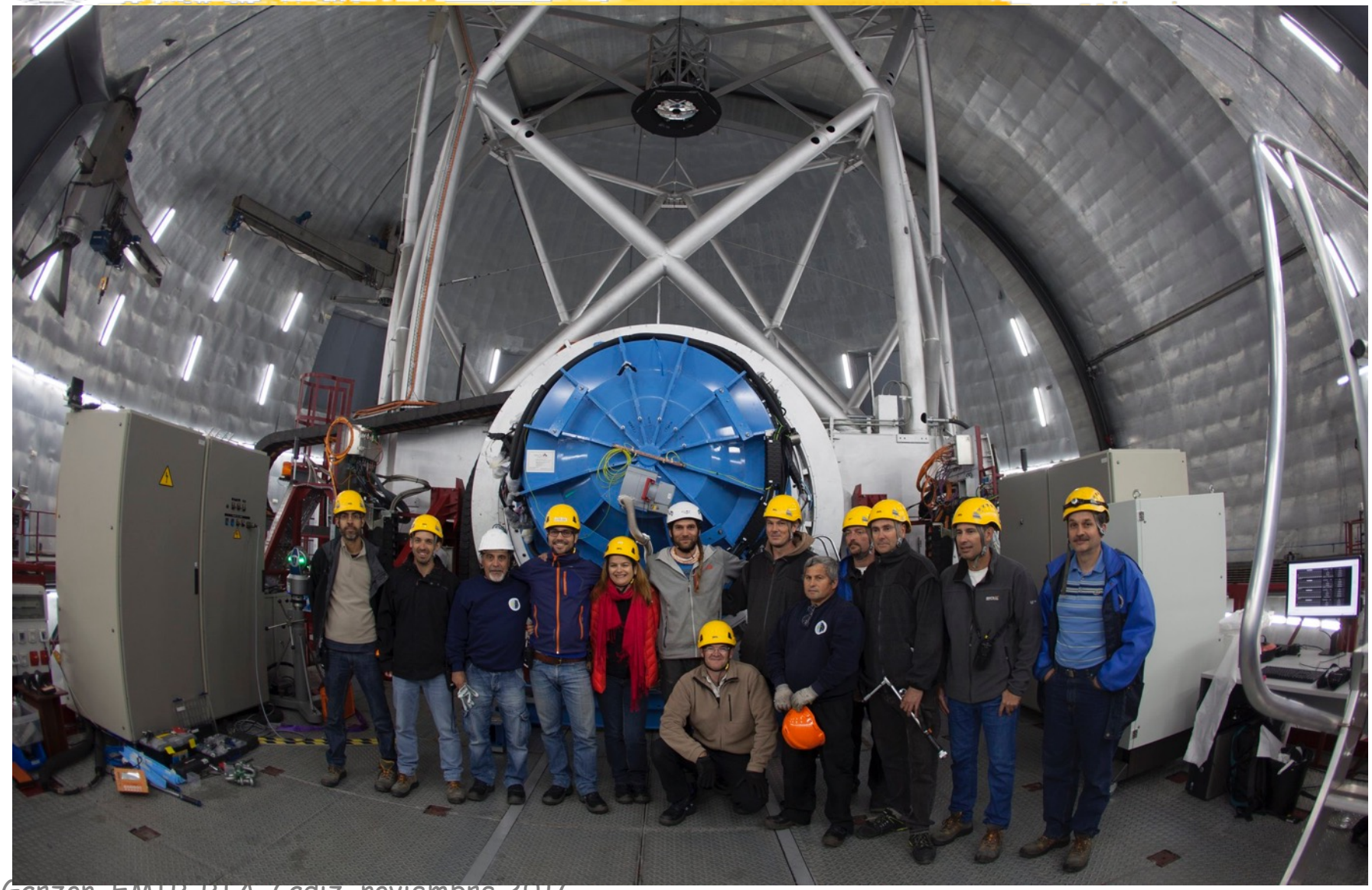
- EMIR is a NIR Imager and multi-object spectrograph, which will be a common user instrument for GTC

Spectral Range	0.9-2.5μm[1.1-2.5μm]	MOS mode	
Top priority	MOS in K band	FOV	6,7x4 arcmin (55 slitlets)
Spectral Resol.	5000,4250,4000 (JHK) ~1000 HK + YJ	Sensitivity	K~20.1 in 2h @ S/N=5 (continuum)
Spectral coverage	1 single window/exp.		1.4×10^{-18} erg/s/cm^2/Å @ S/N=5 (line)
Detector	HAWAI2 2048^2	Image mode	
Plate Scale	0.2 arcsec/px	FOV	6.7x6.7 arcmin
Image quality	θ_{80} < 0.3 arcsec	Sensitivity	K~22.8 in 1h @ S/N=5 in 0.6 arcsec aperture

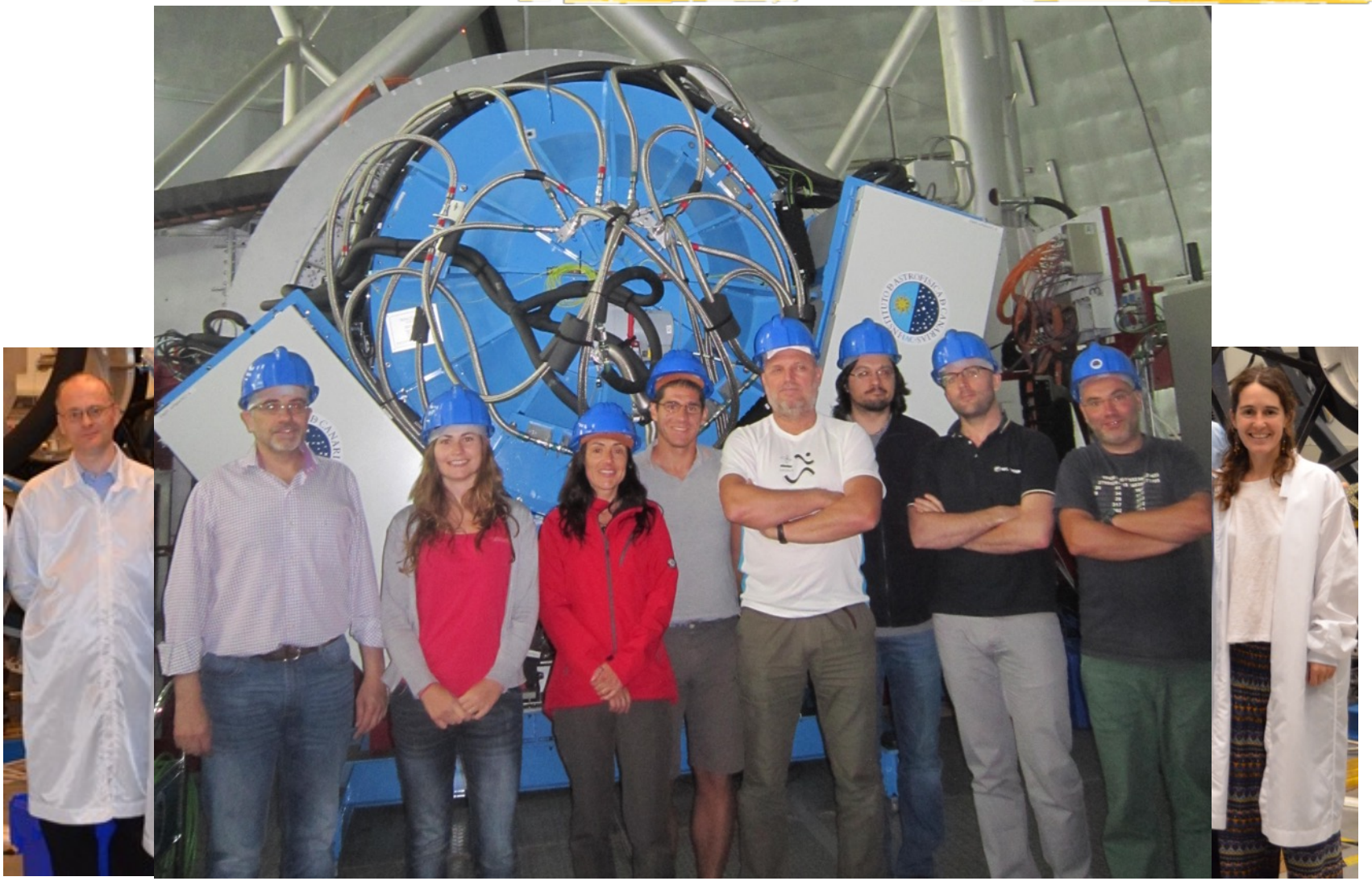
EMIR TEAM (now)

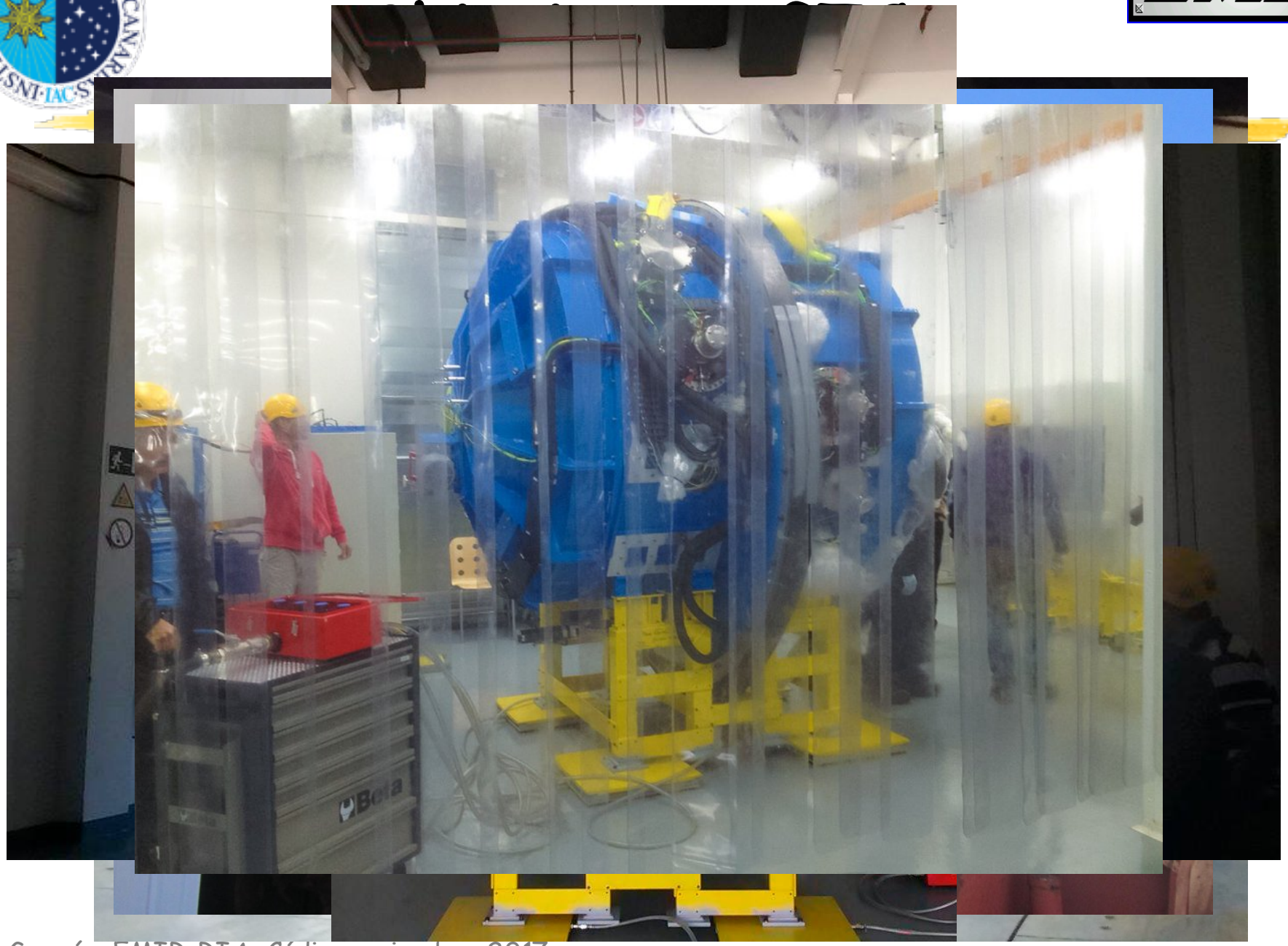
- IAC:
  - M. Barreto
  - ~~N. Castro (Cog.)~~
  - P. Fernández
  - ~~M. Insausti (Cog.)~~
  - ~~E. Joven~~
  - P. López
  - ~~E. Manjavacas~~ (Cog.)
  - ~~A. Mato~~
  - ~~M. Miluzzio (Cog.)~~
  - ~~M. Núñez~~
  - ~~H. Moreno~~
  - ~~J. Patrón~~
  - ~~J.L. Rasilla~~
  - ~~P. Redondo~~
  - ~~J. Rosich~~
- UCM:
  - ~~N. Cardiel (Cog. +)~~
  - J. Gallego
  - ~~S. Pascual (Cog. +)~~
- LAM
  - ~~R. Grange~~
  - C. Gry
  - ~~L. Martin~~
- LATT
  - ~~E. Bourrec~~
  - R. Pelló
- Sci. Team
- Externals
  - P. Hammersley (ESO, ST, Cog. +)
  - ~~J. Molgó (GTC, Cog. +)~~
  - ~~C. González (IoA, Cog.+)~~

The integration team



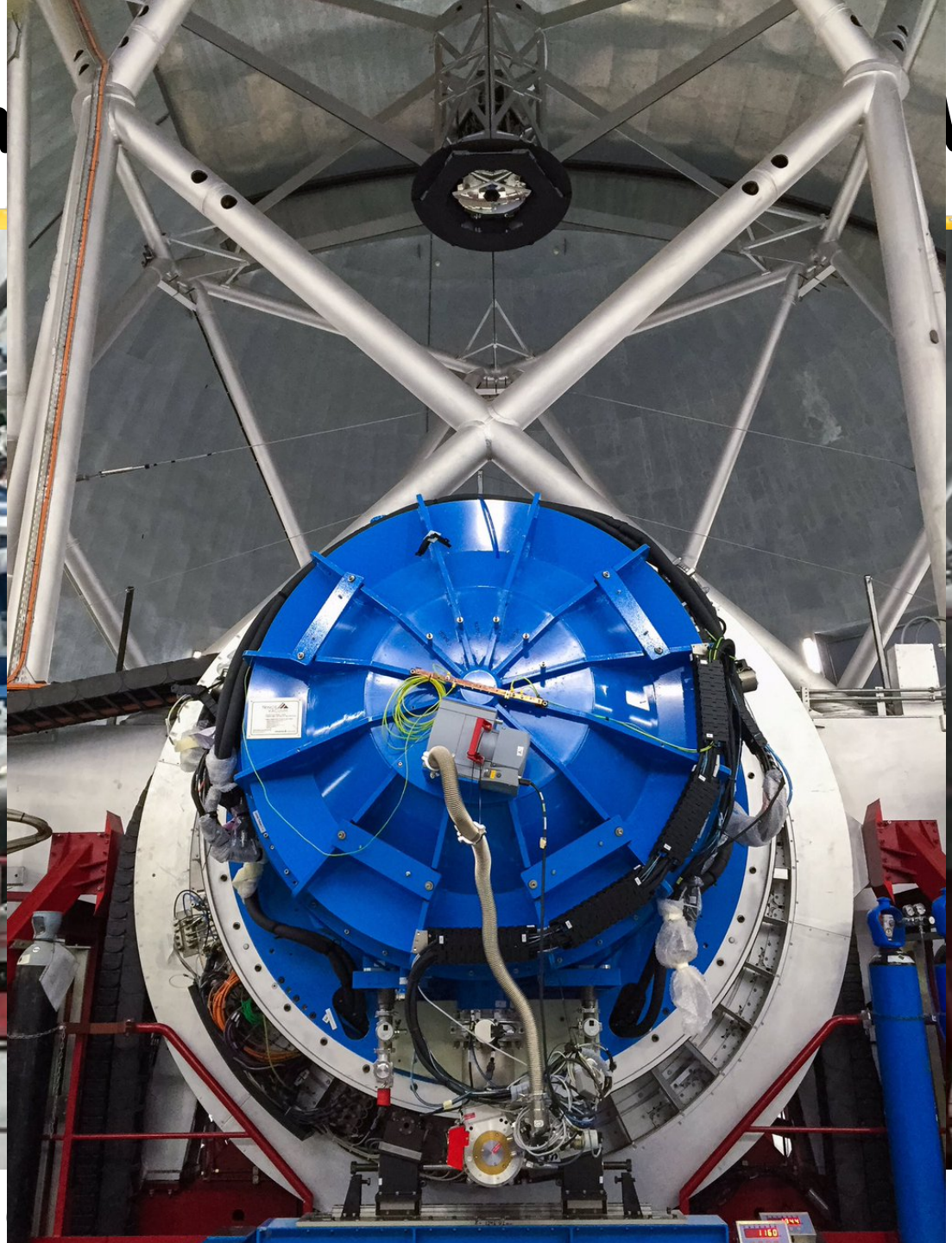
The commissinioning team

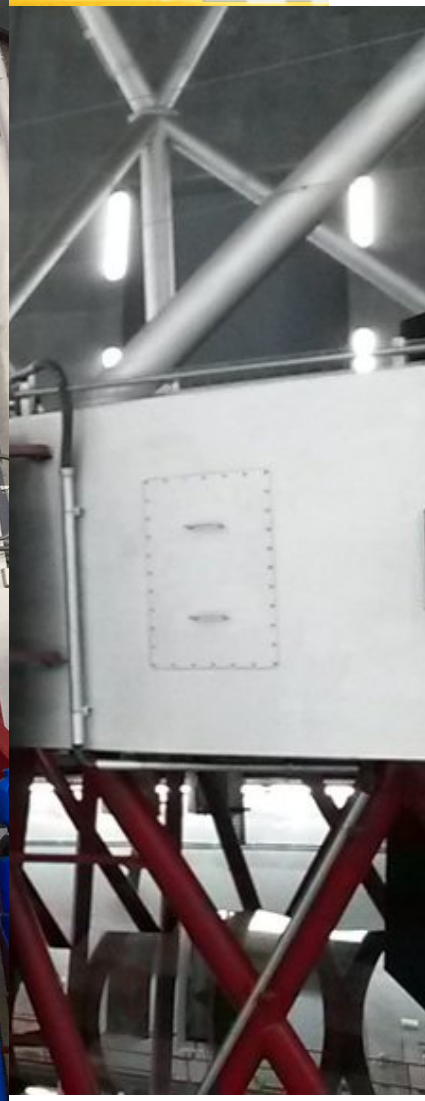



Beta

In







Commissioning resumé

- Shipping & integration:
  - May, 20th: EMIR arrives to the GTC
  - May, 23th: integration begin
  - June, 2nd: lifted to Nasmyth platform
- Comm1: 13-22 June 16, ½ nights.
- Comm2A: 7-12 July 16, ½ nights, + 14 July full night
- Comm2B: 24-27 July 16, full nights – 2h/night
- Comm3A: 13-19 September 16, ½ nights, + ½ Sept 29 + ½ Oct. 20.
- Comm3B: November 14th-19th, ½ nights
  - ~20 nights upto now

Detector performances

- GAIN: 3±0.47 e-/adu
- RON: 5.23 adu, 1 read ➜ 14.66 e^-, ramp*10
- DC: 0.09 adu/s ➜ 0.36 e^-/s
- Linear Range (<1%): 45571±727 adu
- Saturation (>5%): 46077±682 adu
- Cosmetic:
  - Bad pixels: 0.05%
  - Hot pixels: 1.11%

Some results

- Zero Points YJHKs:
  - ZP_J=25,14±0,17
  - ZP_H=25,26±0,21
  - ZP_{Ks}=24,81±0,33

  1adu/s

  - ZP_J=26,64±0,17
  - ZP_H=26,76±0,21
  - ZP_{Ks}=26,31±0,33

  $1e^-/s$
- Plate scale: 0.1945arcseg/px.
  - Geom. Dist. < 1.5%
- Pupil properly aligned w/o vignetting
  - Recalibration of the Grism Wheel positions
- Procedures for SKY & FLATS set
  - Dark flat problematic at GTC
  - SKY w & w/o sky frames
- Main observing mode sequences established

Some pictures

NGC6811



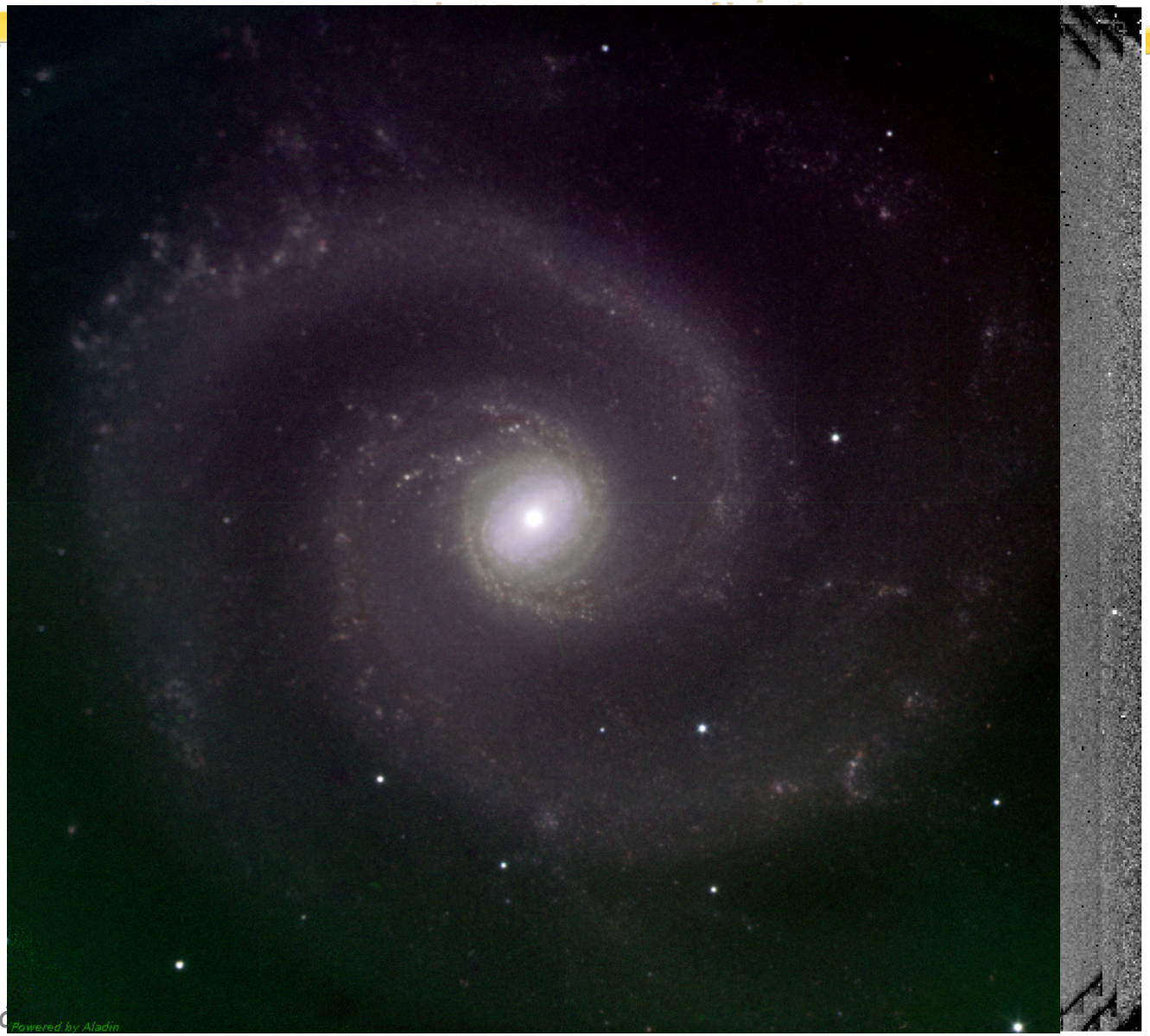
Some pictures

M57-Lyra



Some pictures

M51

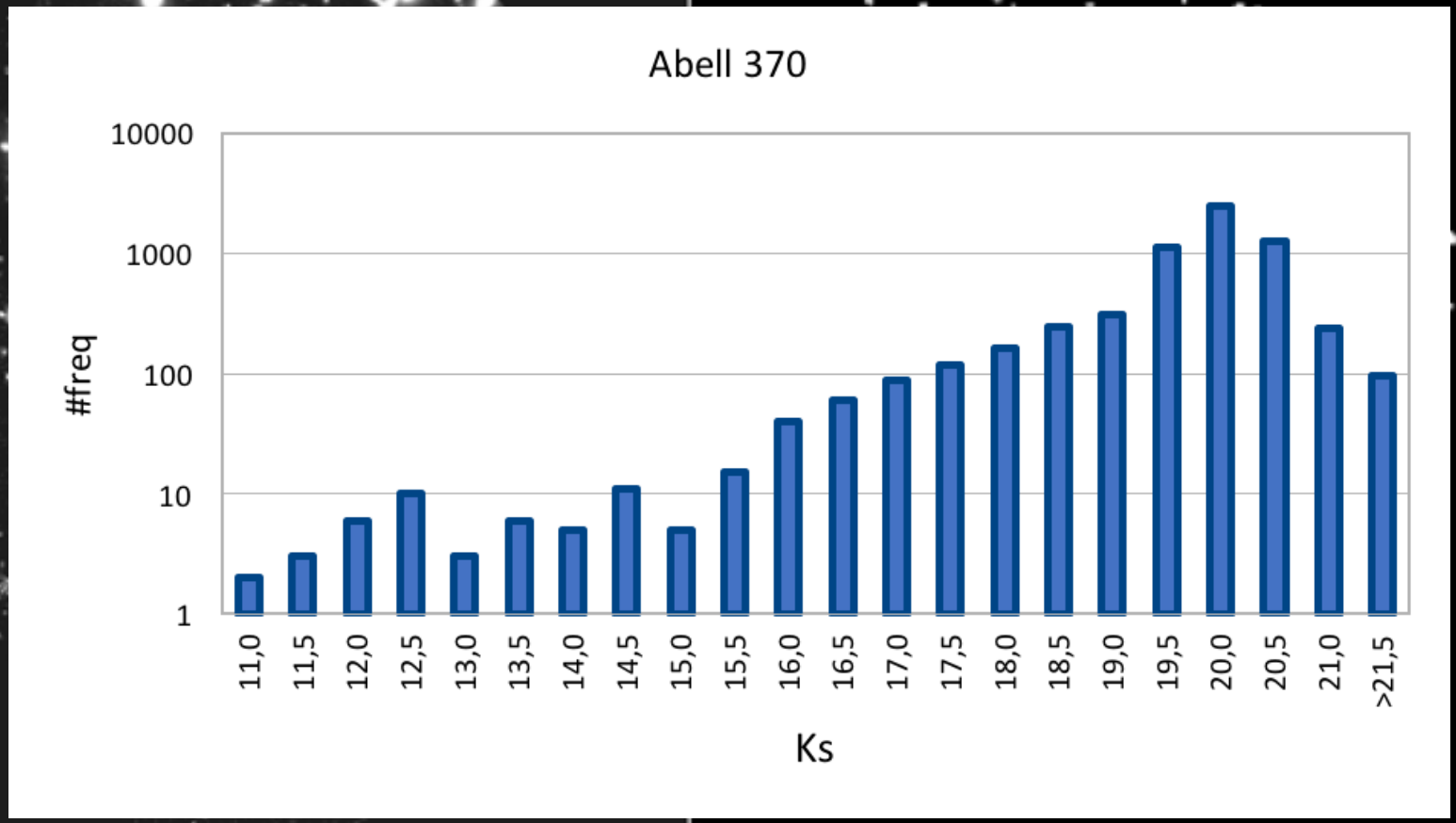


Some pictures

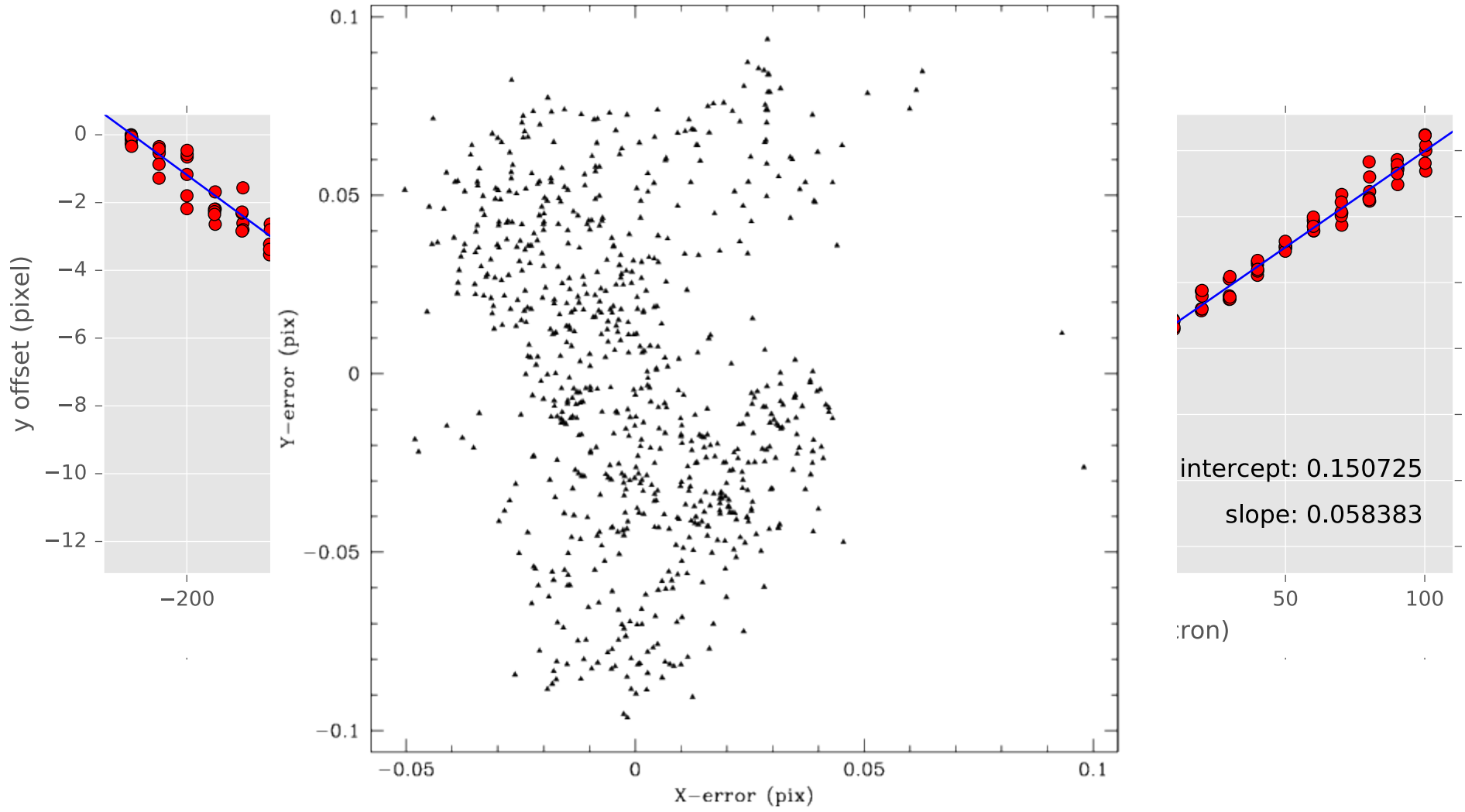
W43



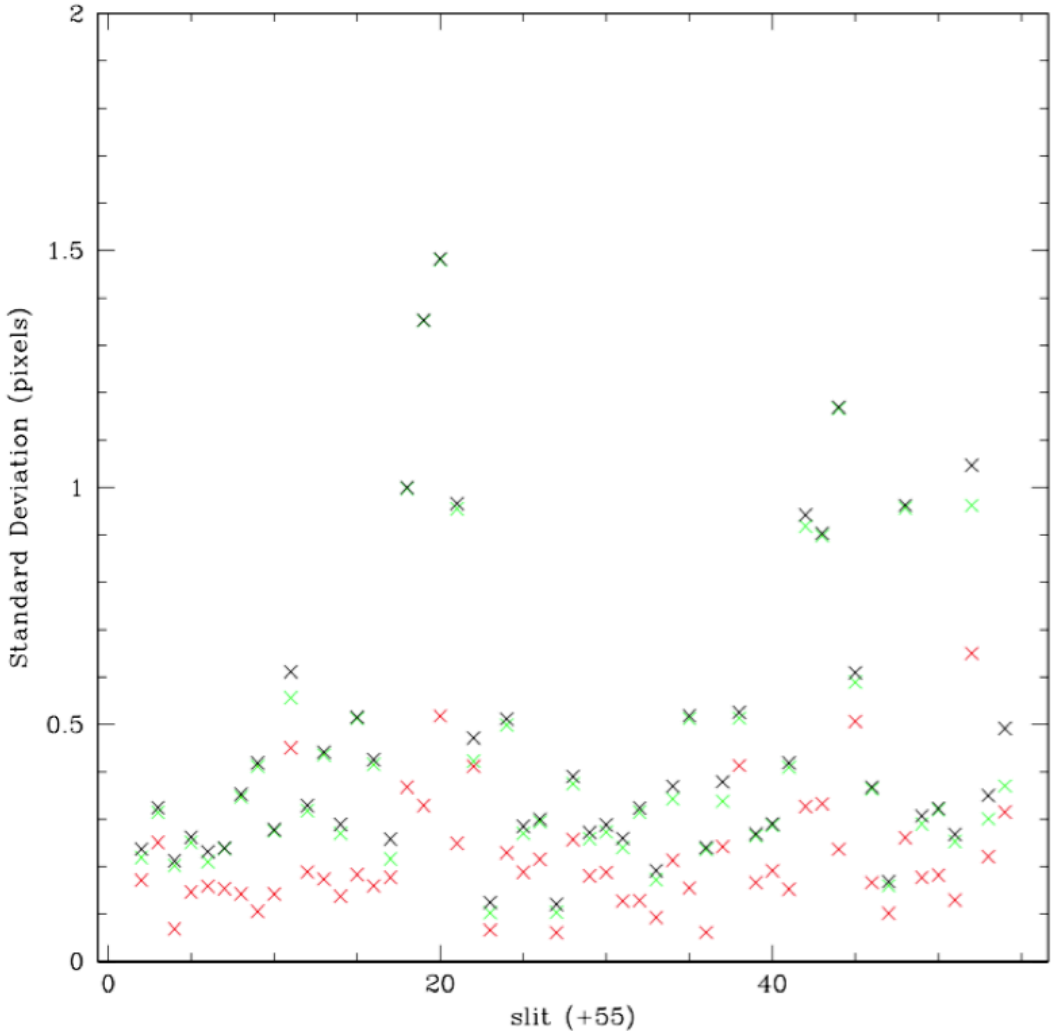
Abell 370


Abell 370
10000
1000
100
10
1
#freq
11,0
11,5
12,0
12,5
13,0
13,5
14,0
14,5
15,0
15,5
16,0
16,5
17,0
17,5
18,0
18,5
19,0
19,5
20,0
20,5
21,0
>21,5
Ks

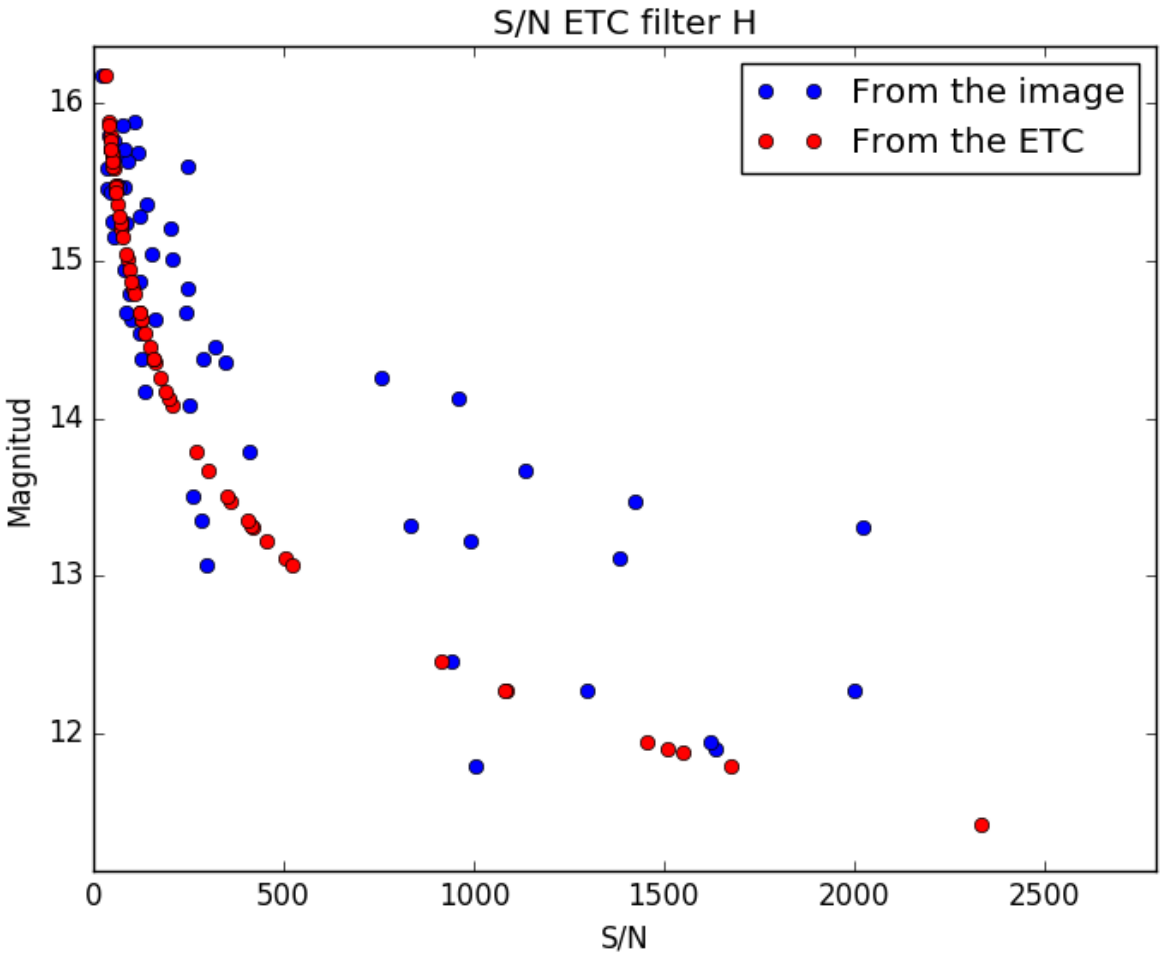
DTU calibration



CSU Calibration

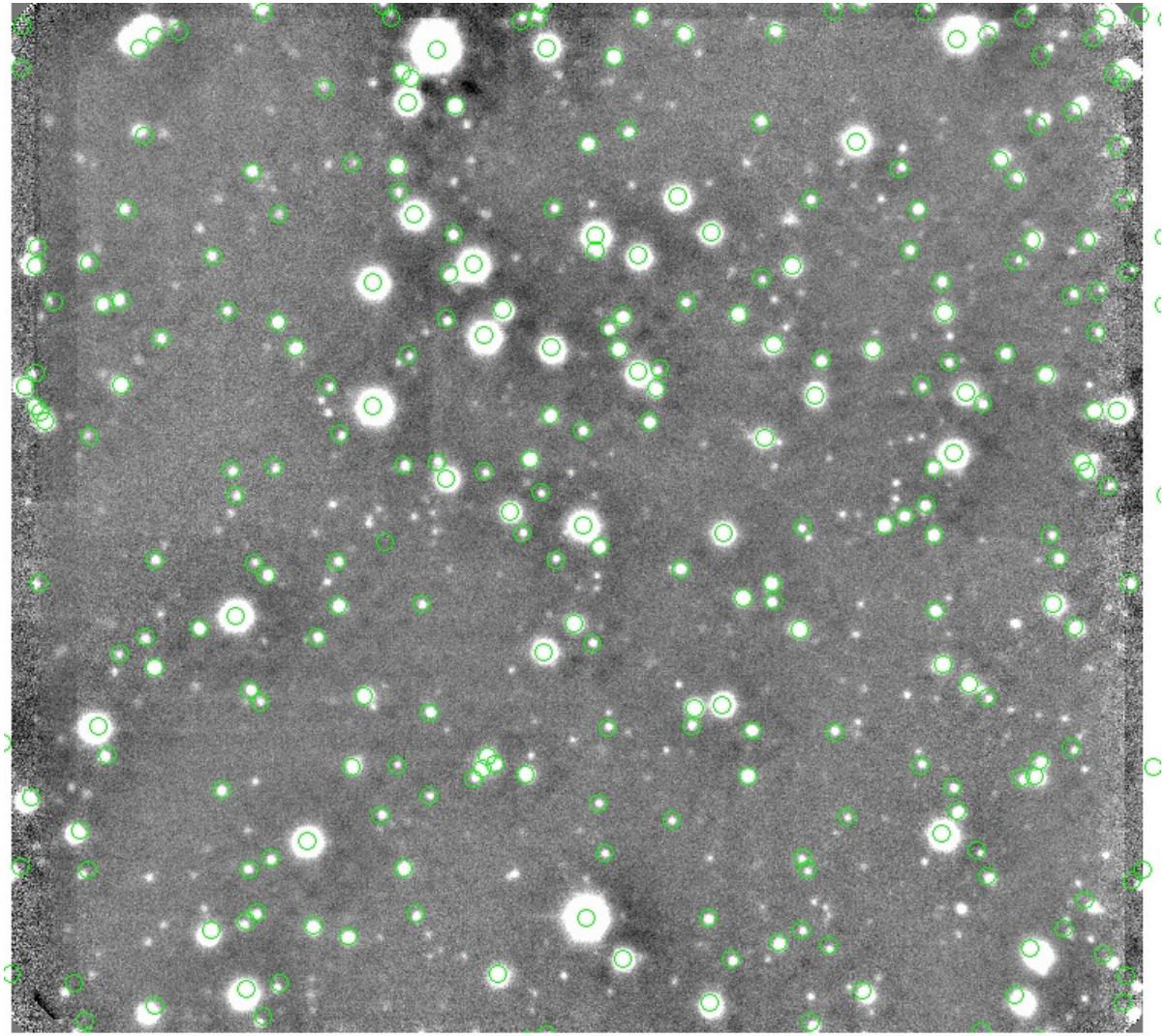


Some results



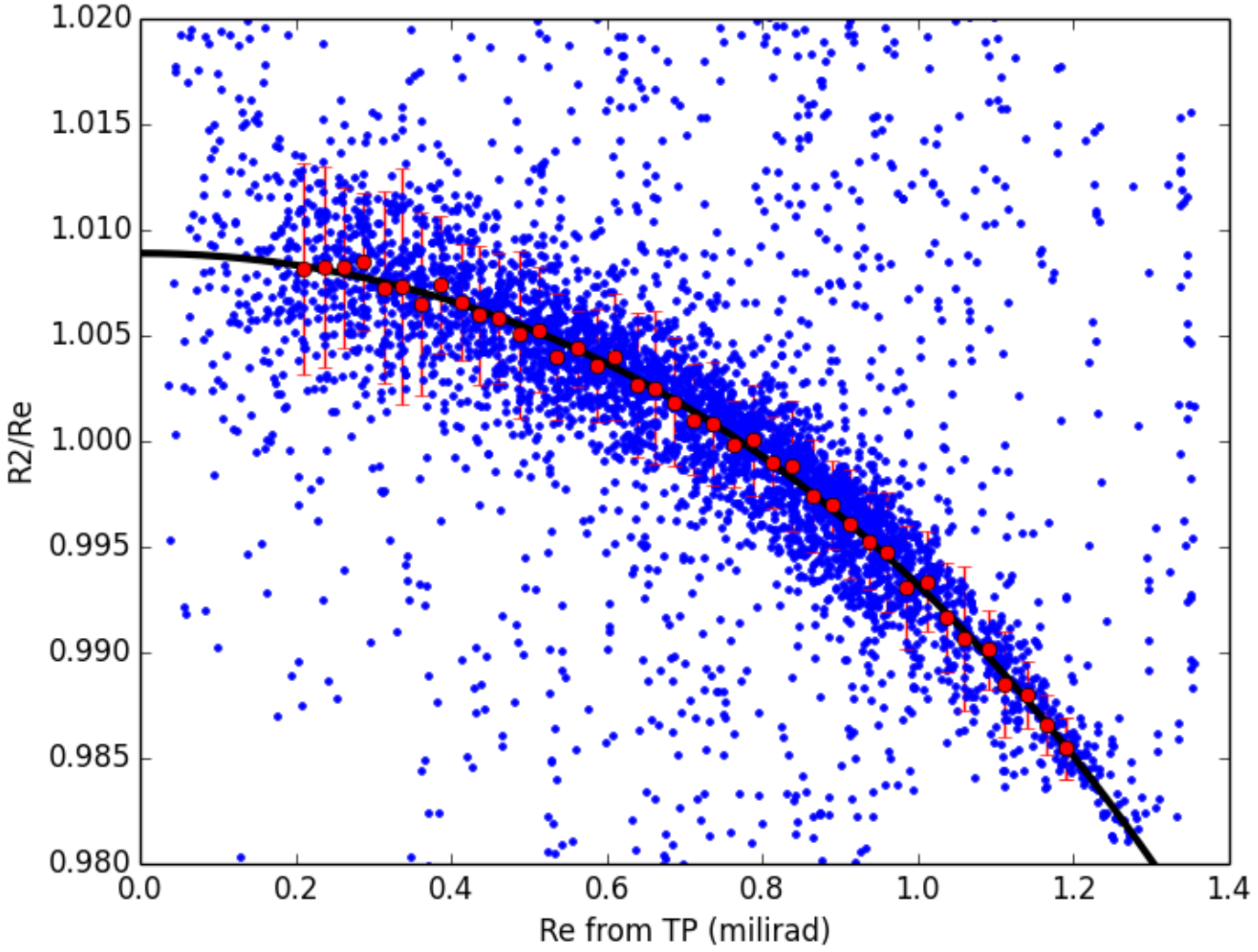
Some results

Astrometry:
6811 vs 2MASS

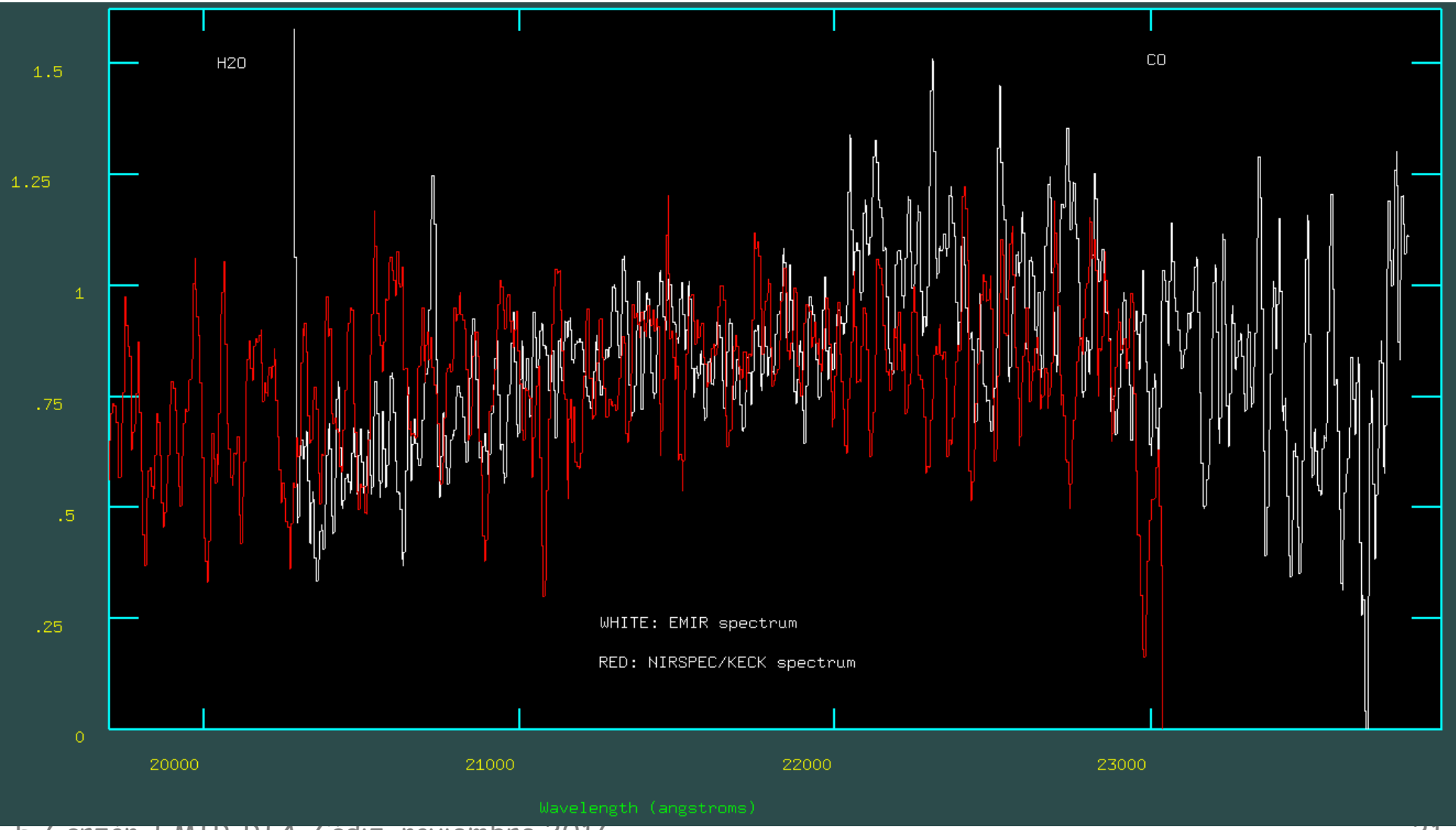


Some results

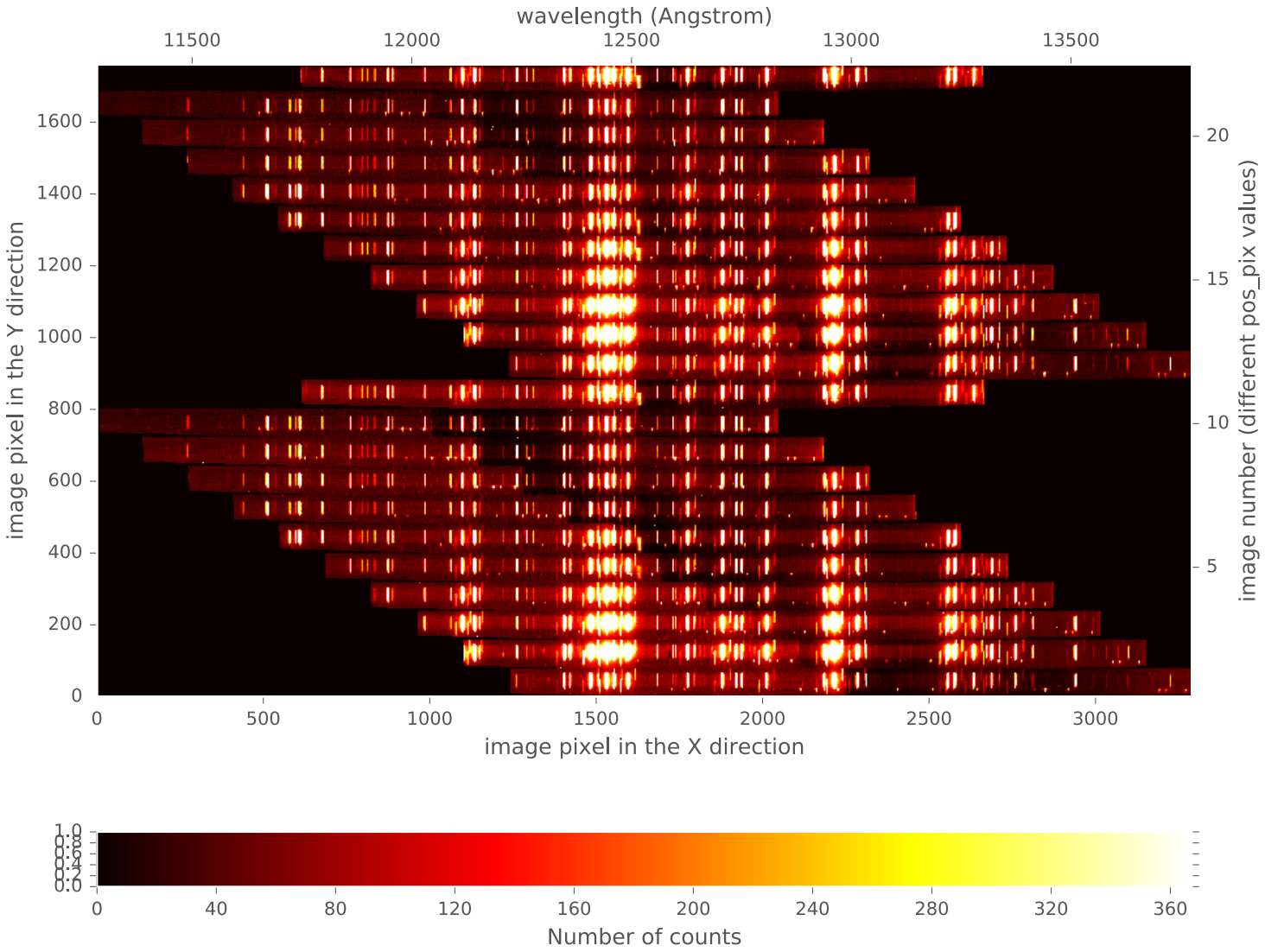
Astrometry:
Radial distortion



Calar21


H2O
CO
1.5
1.25
1
.75
.5
.25
0
WHITE: EMIR spectrum
RED: NIRSPEC/KECK spectrum
20000
21000
22000
23000
Wavelength (angstroms)

Spectral Arc



Arc, Grism J, slits 3 and 4 in 11 positions

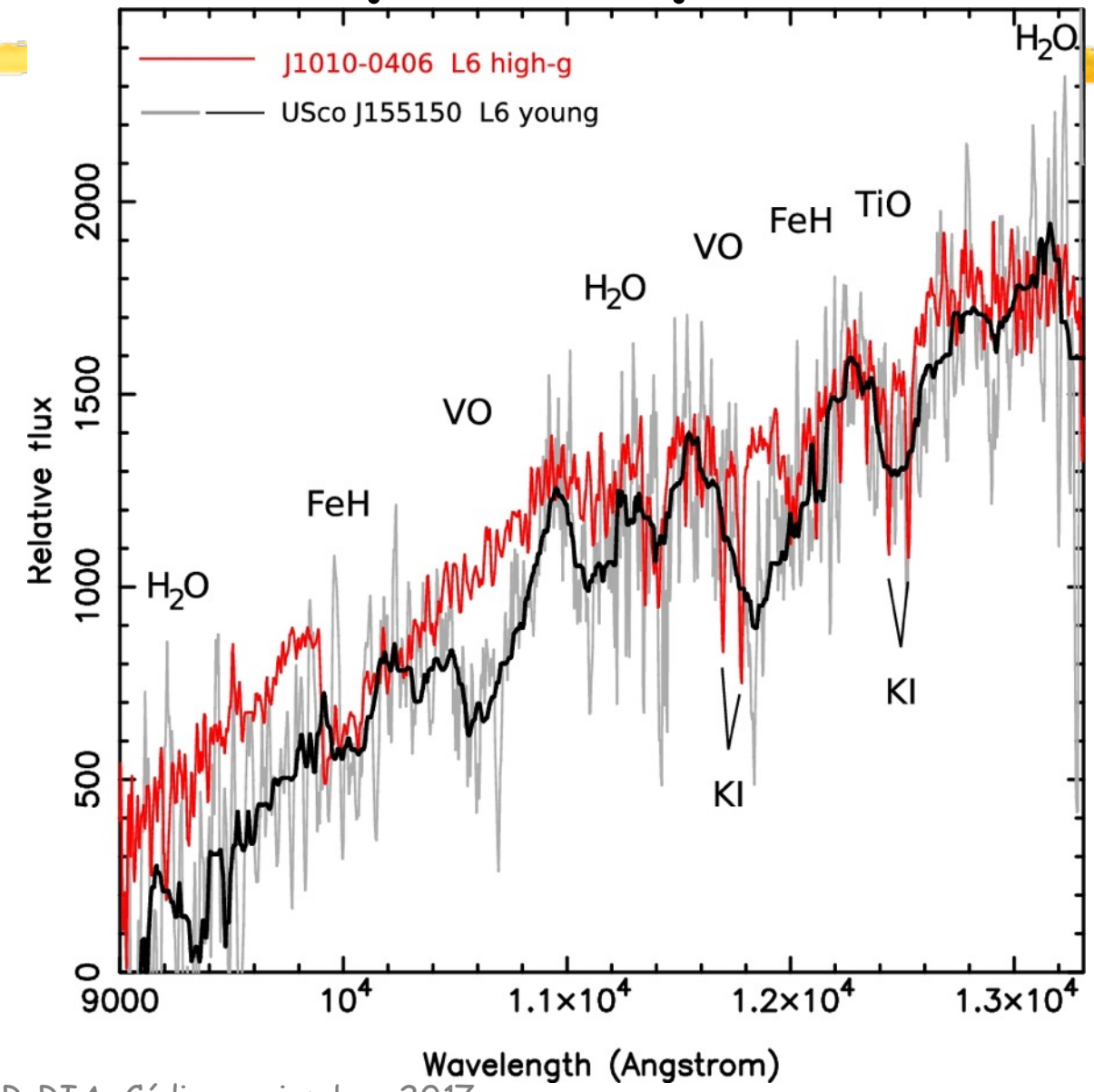
After commissioning

- Science Verification
  - January- June 2017
    - ~50h @ GTC
    - 11 programmes
- CAT 18A
  - September 17 - onwards

Scientific Verification (17A)

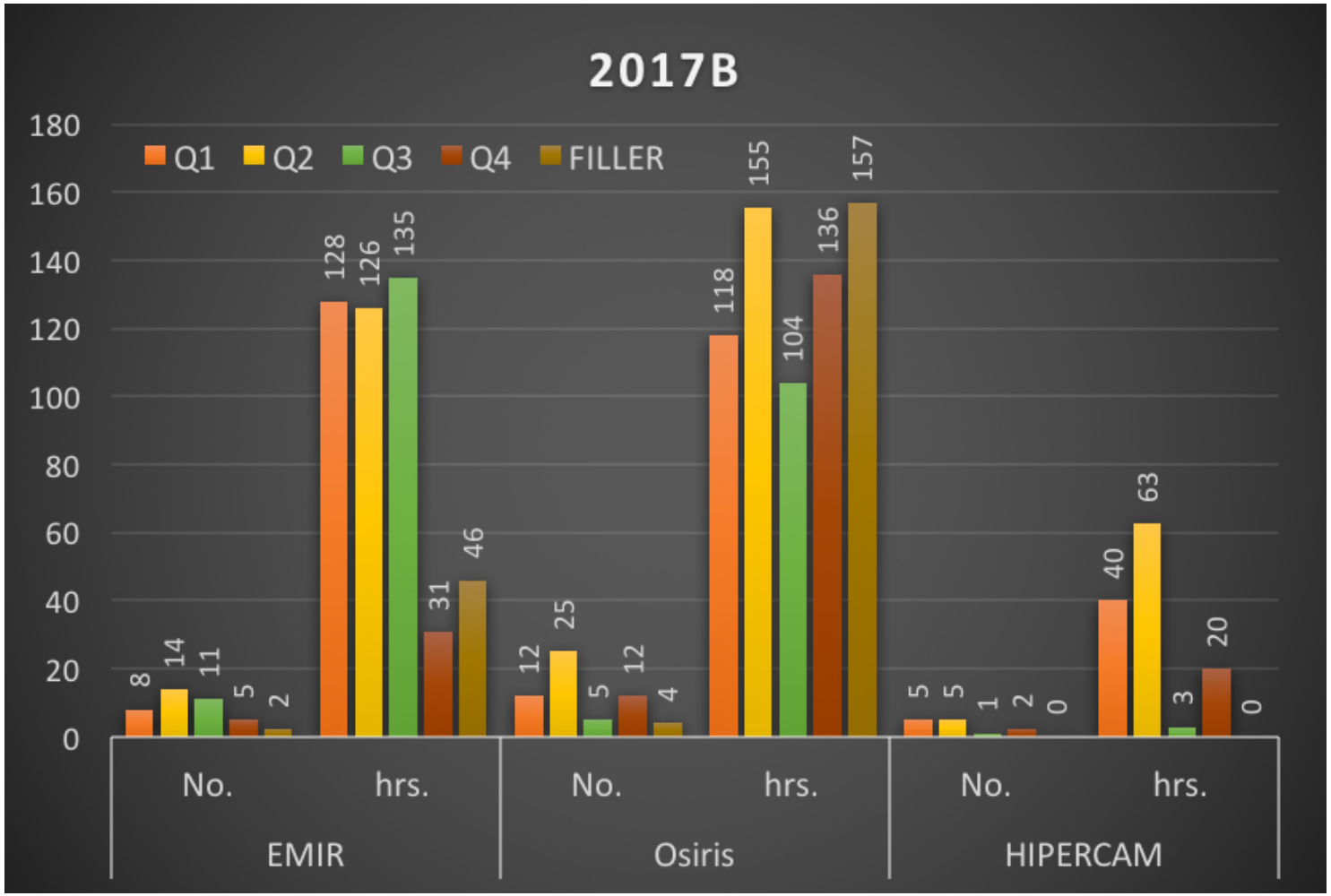
- January to June 2017
- 38 proposals submitted, requesting ~250h (Tint)
  - 11 selected
- 1st time GTC staff operating EMIR by themselves
- 50h@GTC allocated (Tint ~ 85h total)
  - Not fully observed
    - Problems with hardware (Jan. almost lost)
    - Problems with ECS
      - ✓ Good opportunity to tune
    - In short, low efficiency

1er espectro publicado



Lodieu et al, 2018

EMIR @ CAT 17B

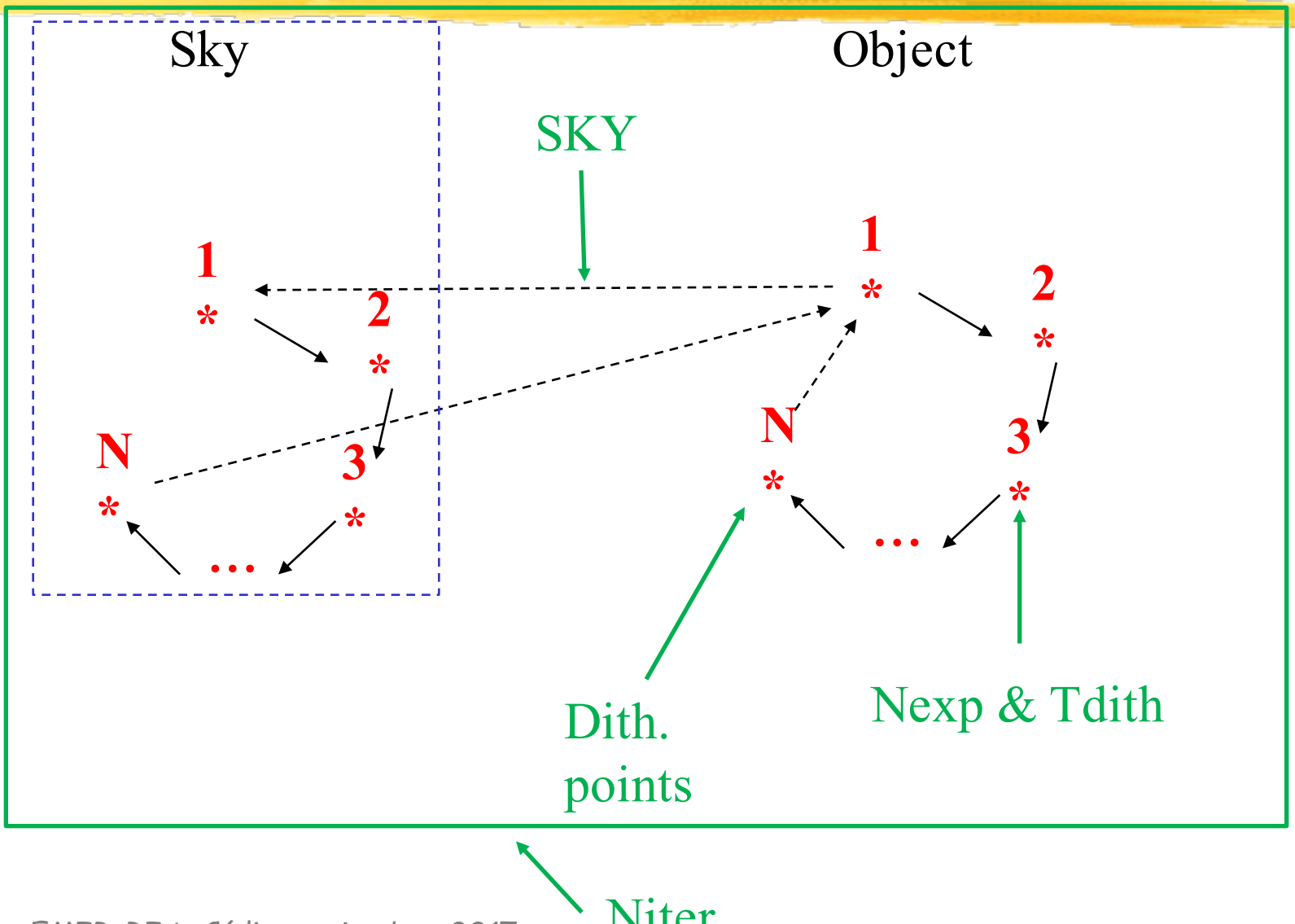


From July 17

Obs Modes in place

- There are DRP recipes for each mode (wait for Sergio Pascual).
- FLATBB /FLATfil
- STARE_IMG
  - SKY- y/n
  - Dither pattern: 1,4,7
- LS/MOS
  - ABBA
  - SKY
- Obs. Sequence built using Ton-source + mode spec (use of efficiency calculator tool)

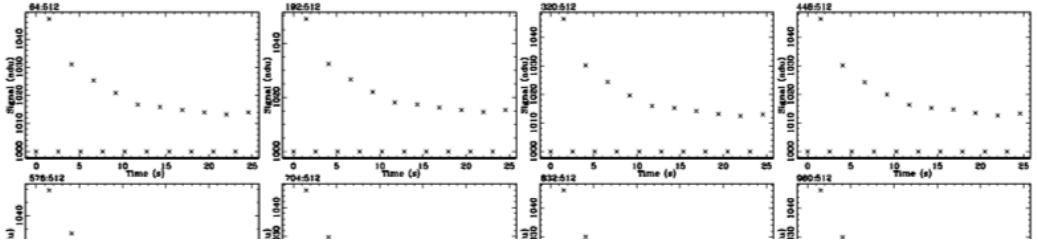
Obs. Sequence structure

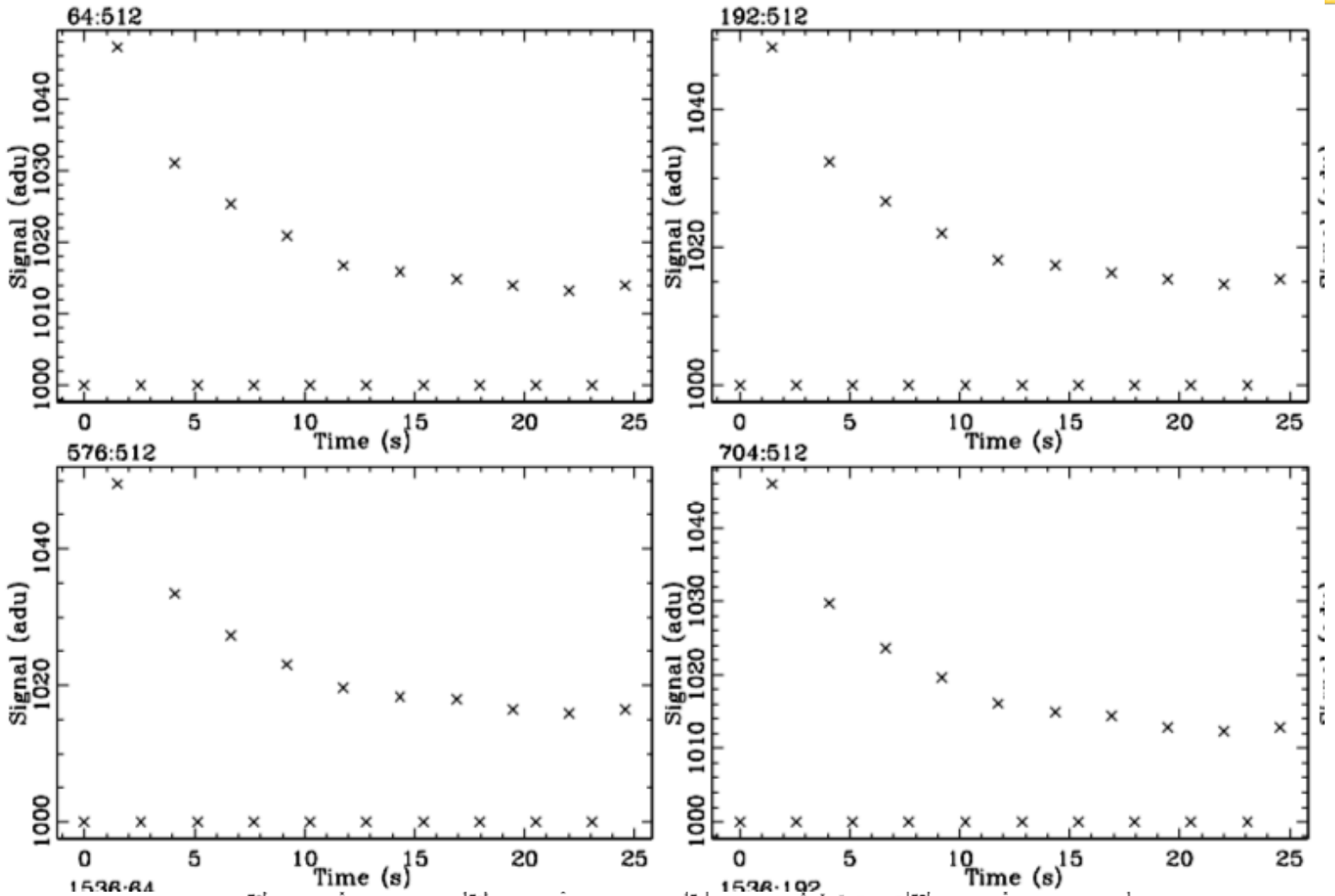


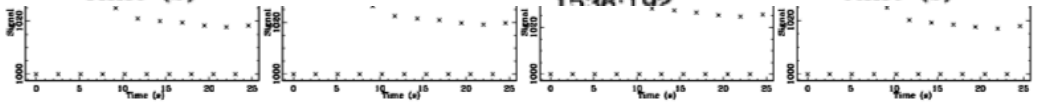
Detector Tint's

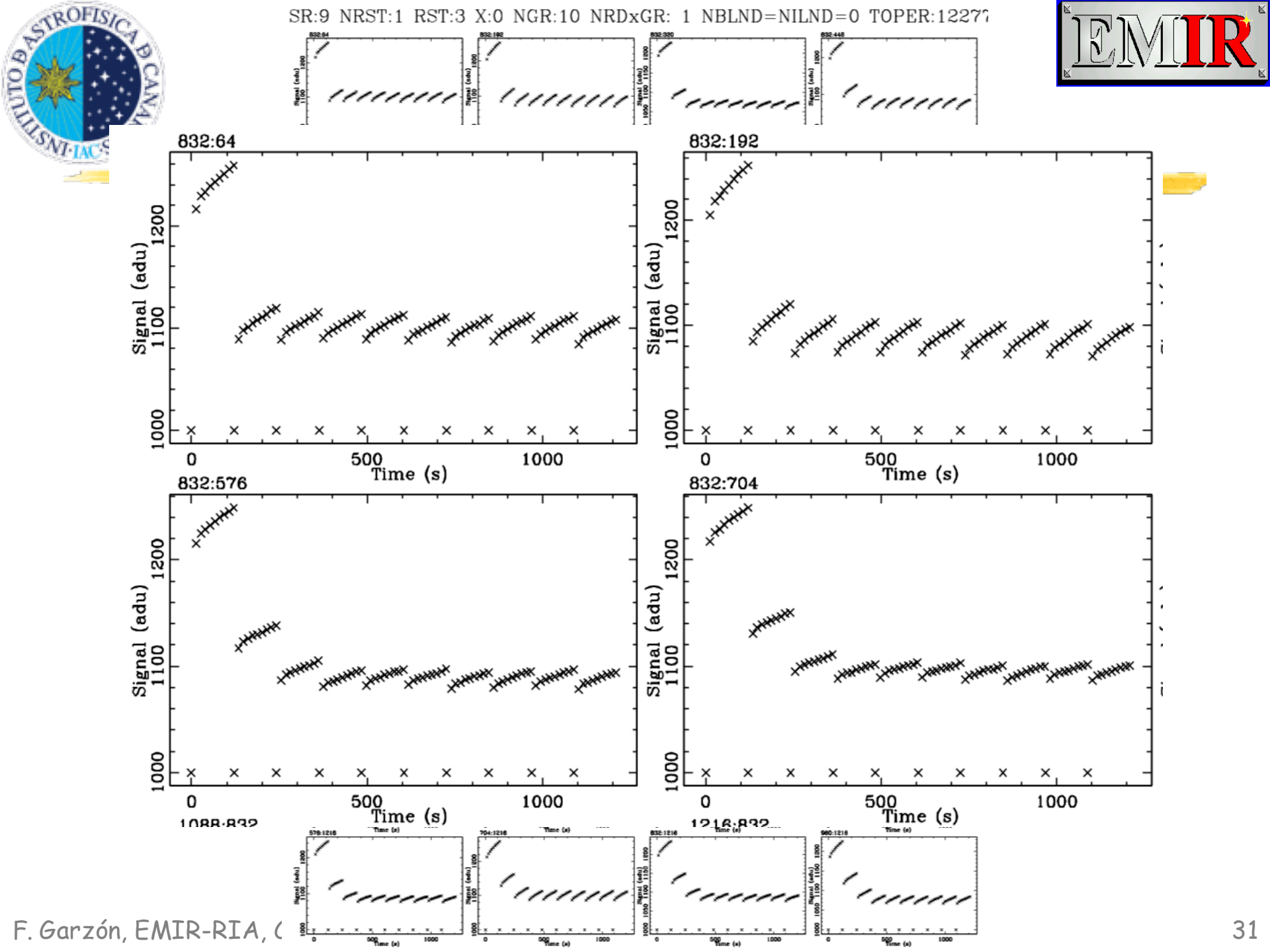
- Due to drifts in detector reads with time
- Calibrated only for a set of detector's conf.:
  - CDS: 1.5, 2, 3, 4, 5, 6, 7, 8, 9, 10, 15 s
  - RAMP:
    - [20s,30s]@5reads
    - [60s,120s]@10reads
    - [160s:360s:40s]@(10+3*i)reads
- User can define a subset with Tmin/Tmax

SR:1 NRST:1 RST:3 X:0 NGR: 2 NRDxGR: 1 NBLND=NILND=0 TOPER: 443



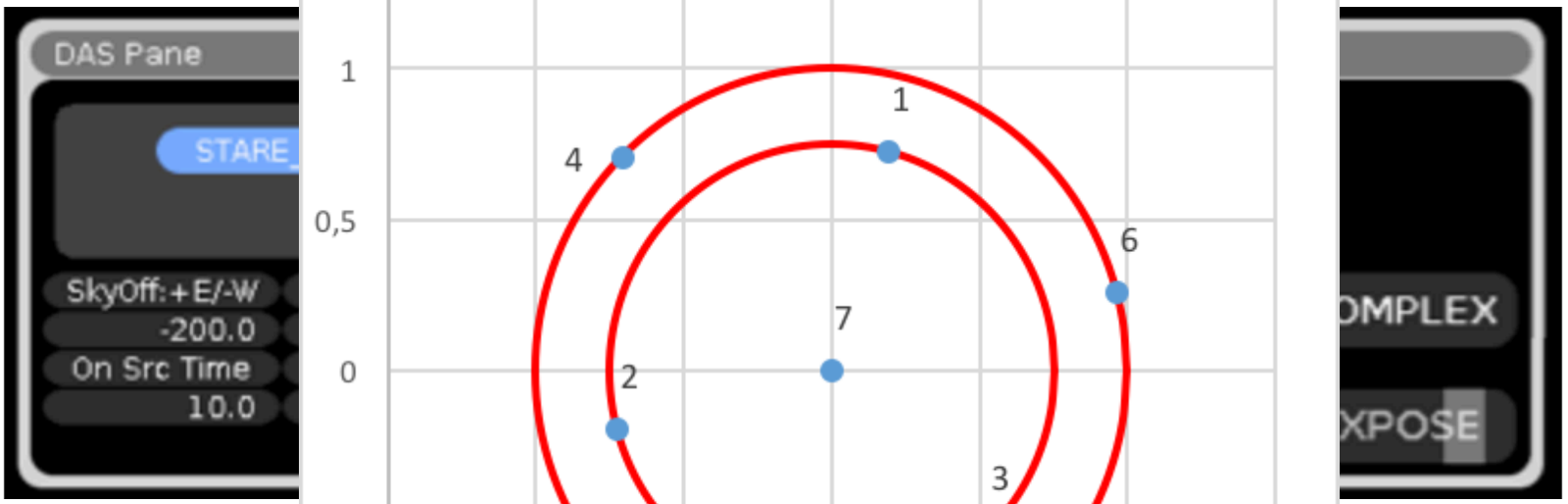





SR:9 NRST:1 RST:3 X:0 NGR:10 NRDxGR: 1 NBLND=NILND=0 TOPER:12277
832:64
832:192
832:576
832:704
Signal (adu)
Time (s)
1000
1100
1200
0
500
1000

STARE_IMG

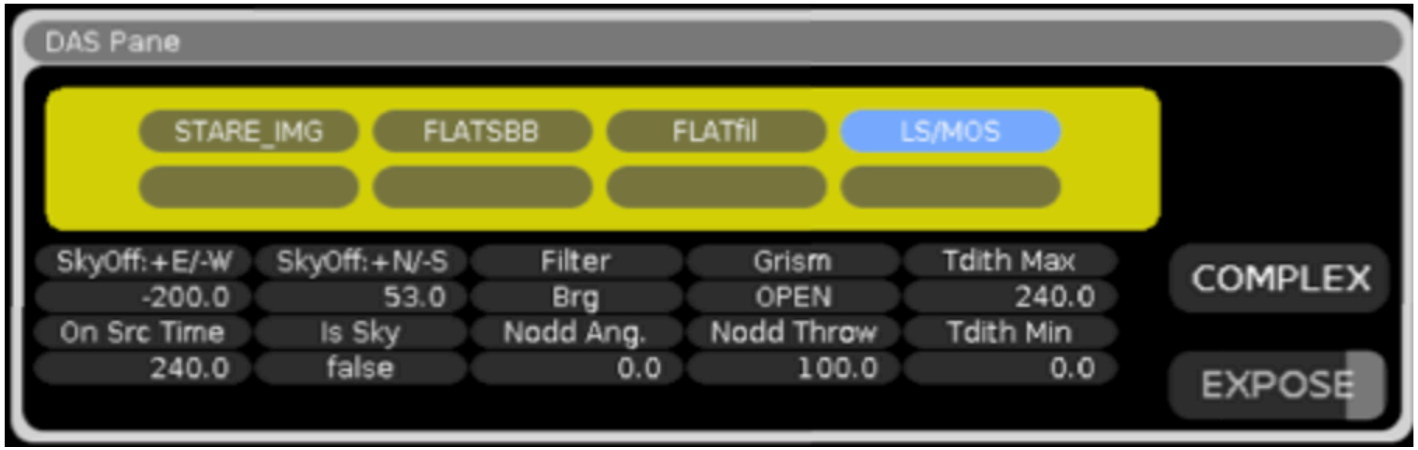
- Control P



- User para
  - Sky: y
  - Tsrc: |
  - Filter
  - Dither

LS/MOS

- Control Panel

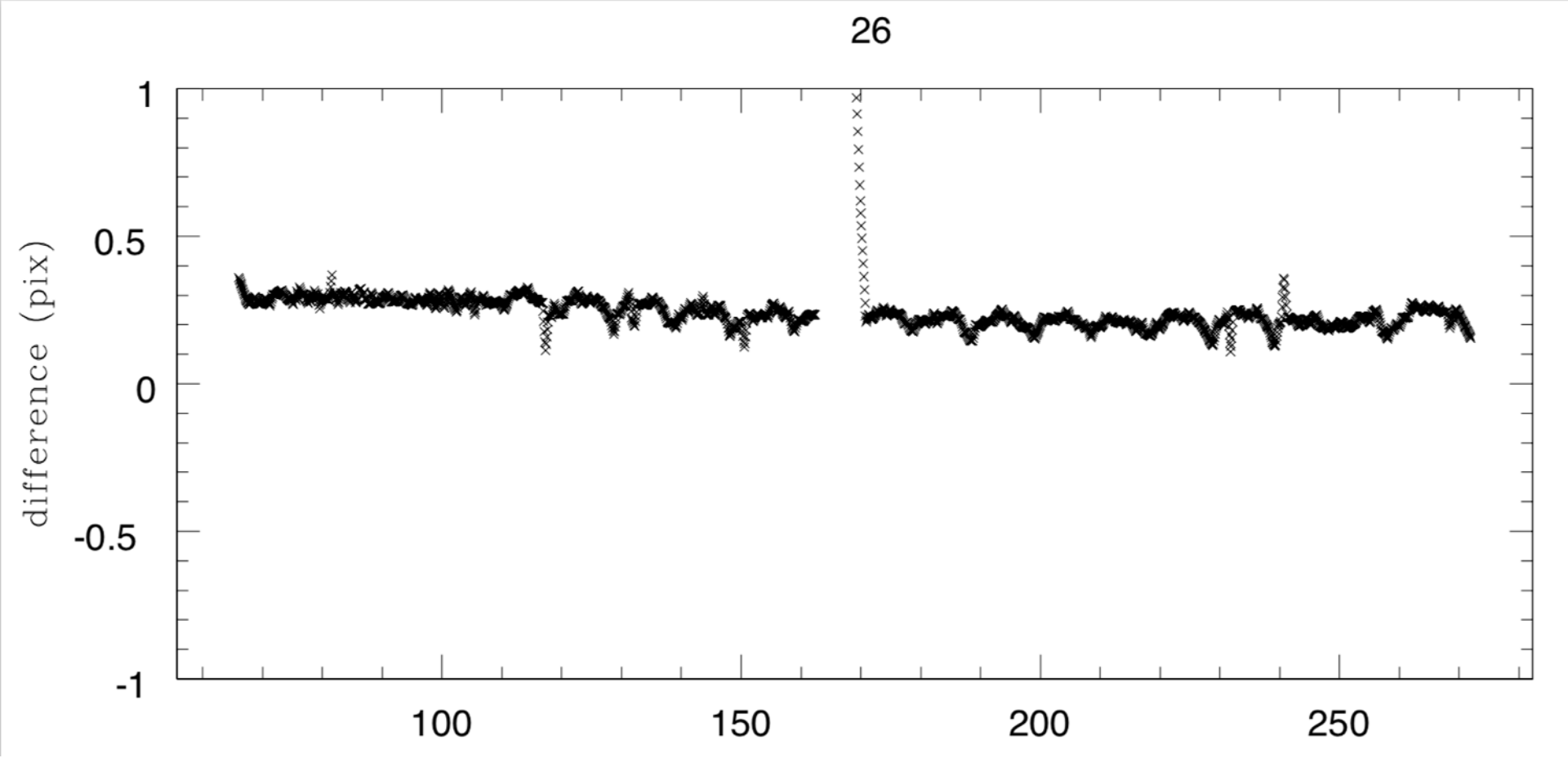


- User parameters:
  - Sky: y/n
    - Y: Sky Off: E/W["] + N/S["]
    - N: Nodd Throw ["] (Nodd. Ang. to 0)
  - Tsrc: [s] + tdith_[Max,Min]
  - Grism + Filter (no check on compatibility)

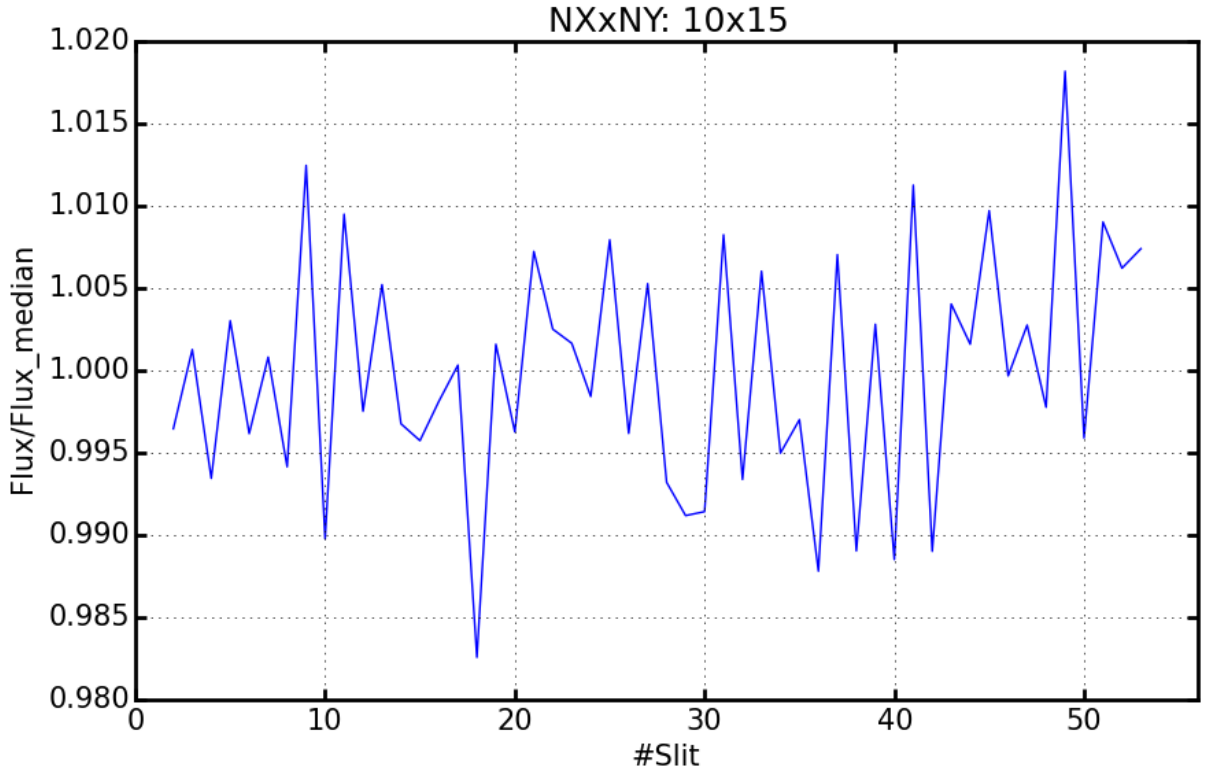
CSU calibration

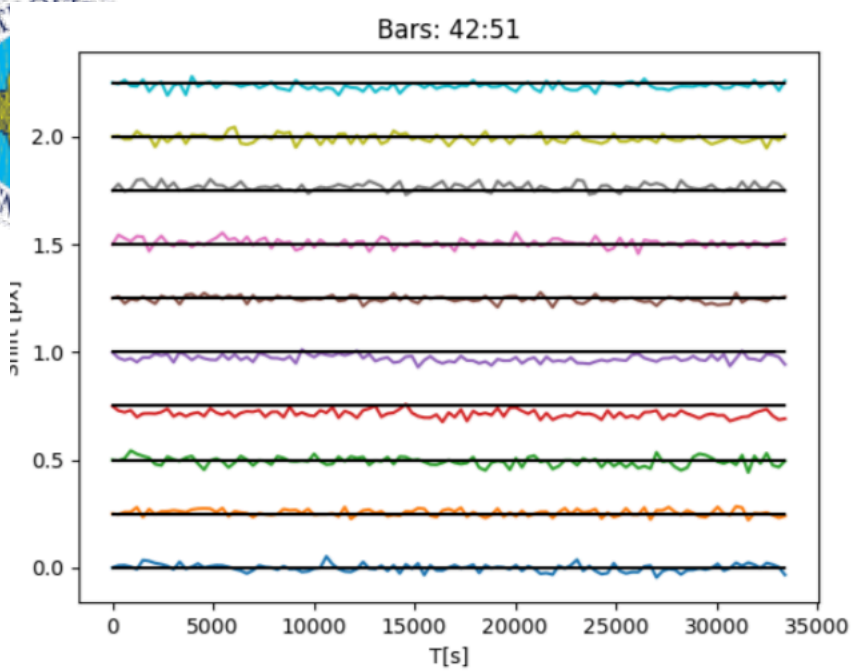
- The unit has:
  - 110 bars
  - 4 sensors per bar
  - Each bar moves ~ 270mm
  - Full length divided un 440 segments
  - Positions derived on each segment using a cubic poly fit to each sensor:
    - 13 params/segment + segment ID
- Improve accuracy in positioning each bar

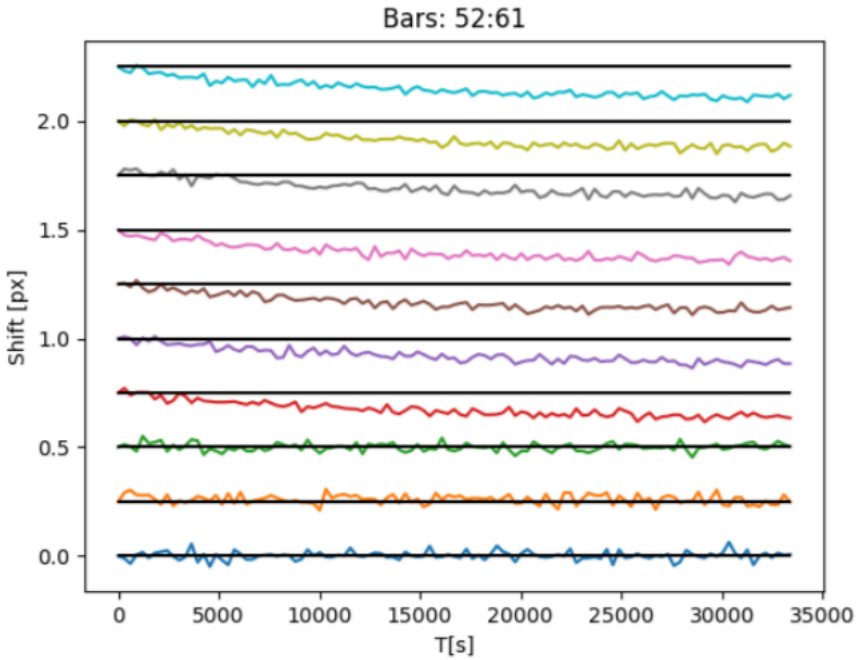
CSU calibration

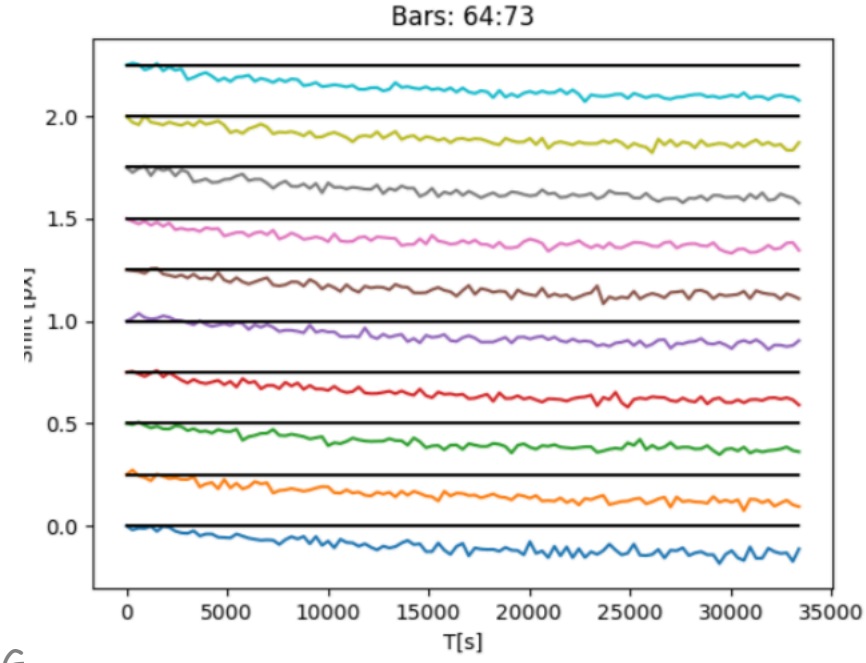


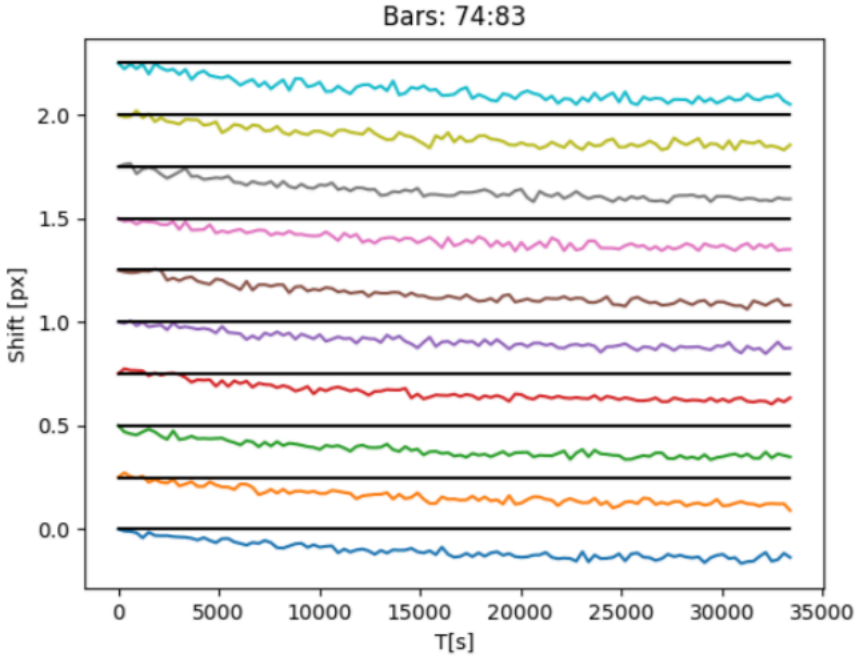
CSU LS improvements




Bars: 42:51
Shift [px]
T[s]

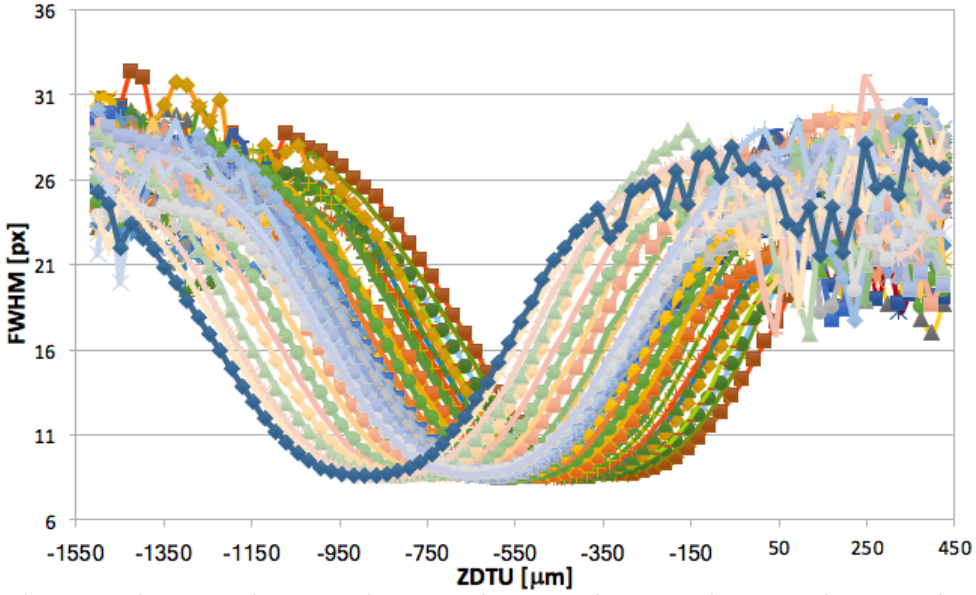

Bars: 52:61
Shift [px]
T[s]


Bars: 64:73
Shift [px]
T[s]

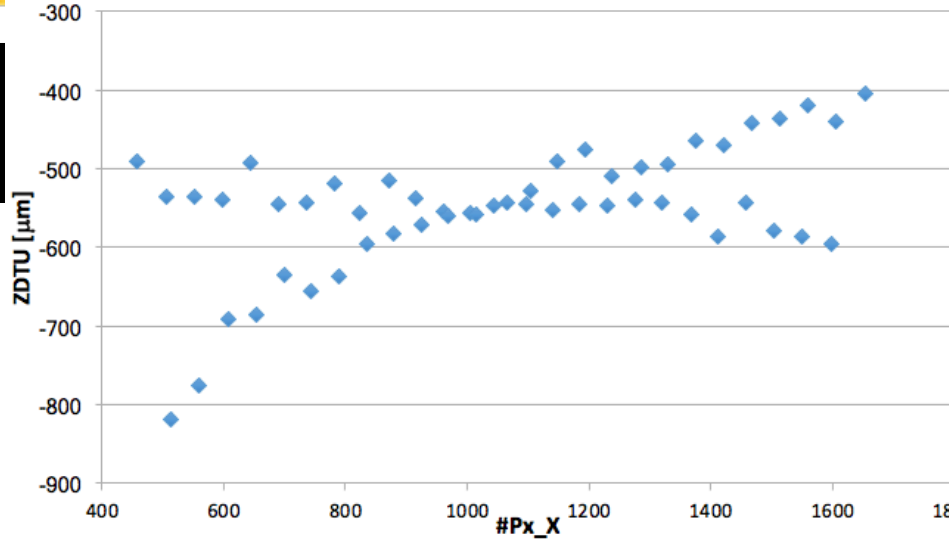

Bars: 74:83
Shift [px]
T[s]

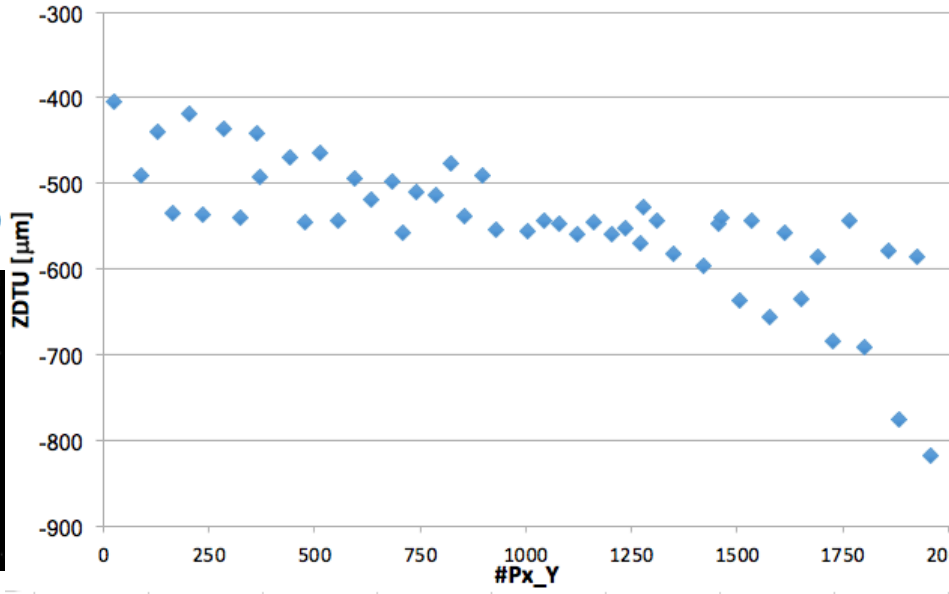
Detector tilt



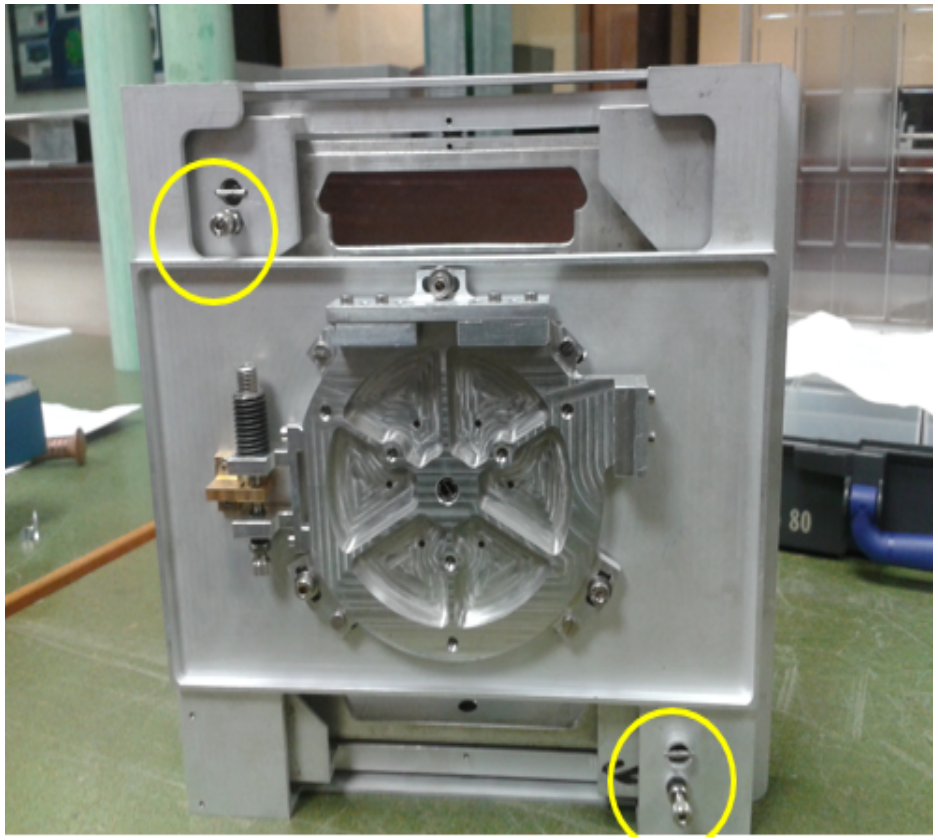


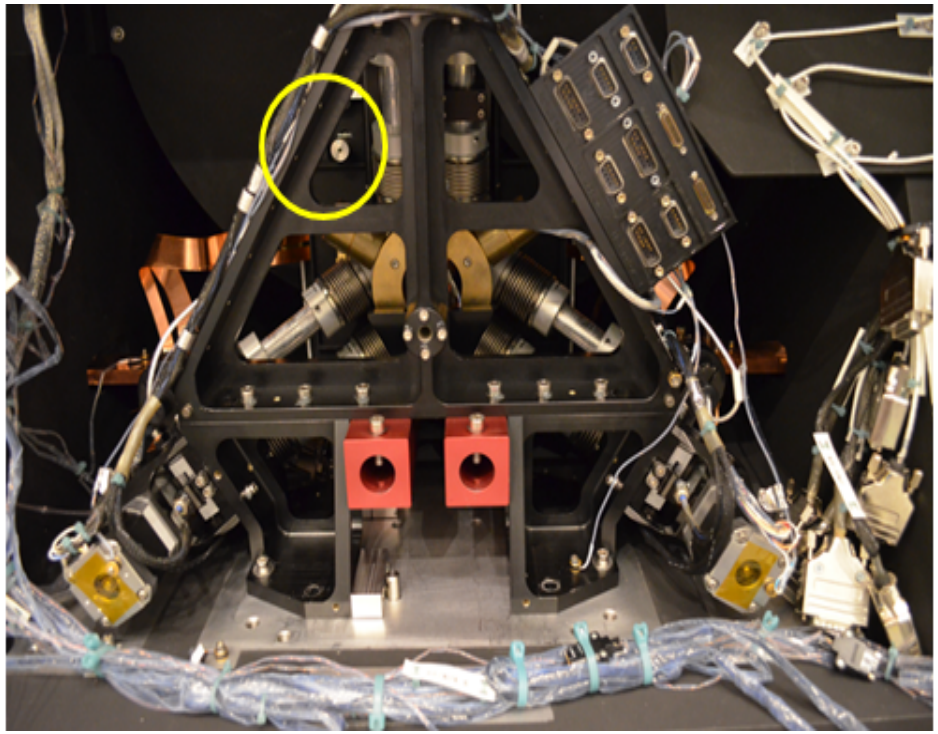




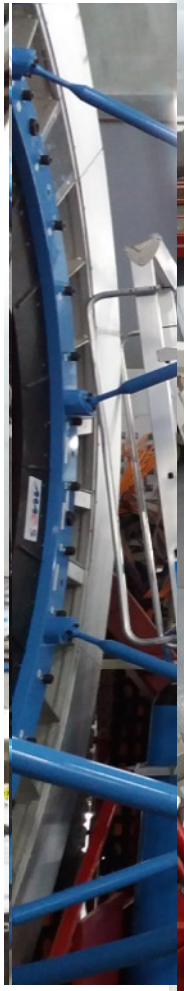


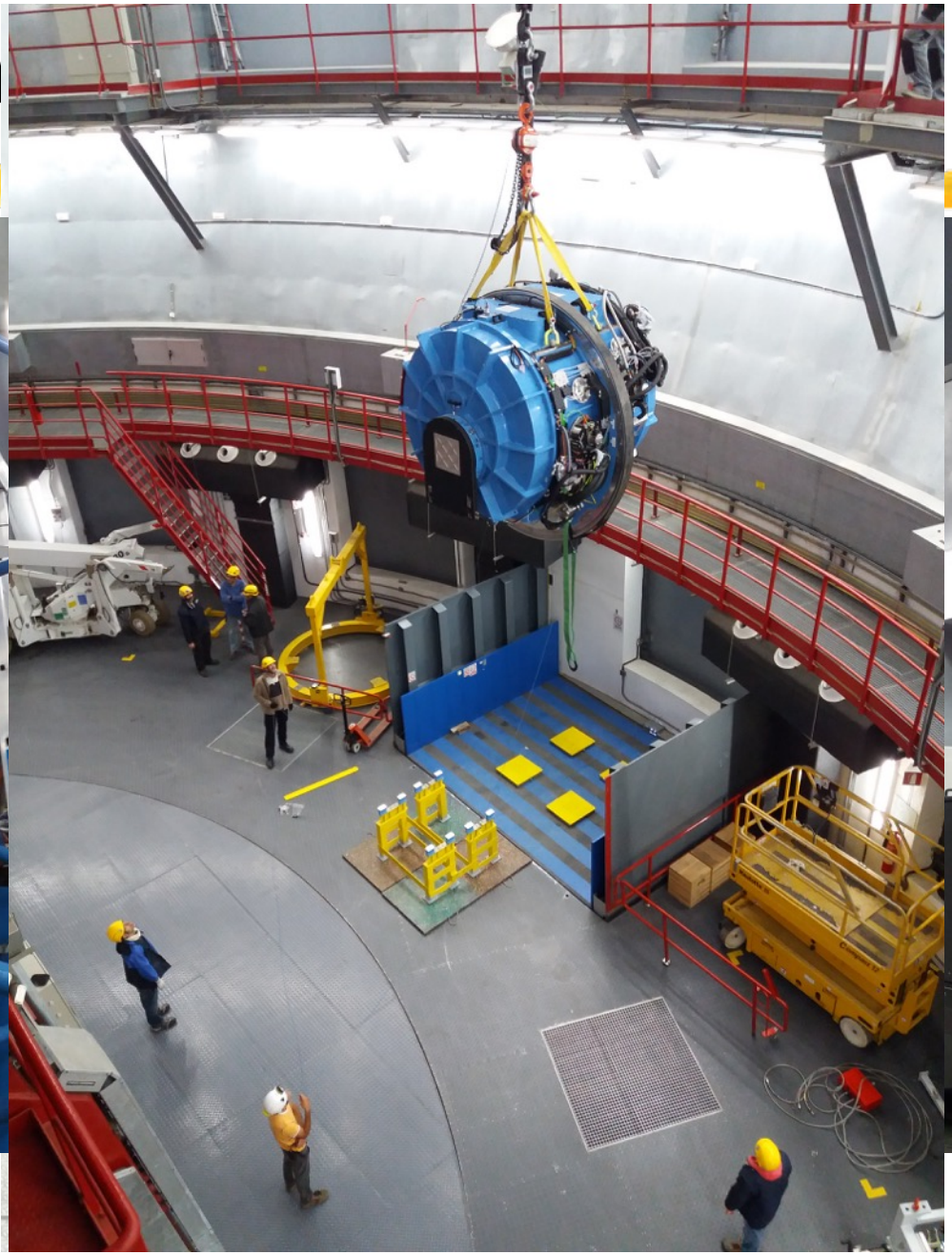
Detector tilt

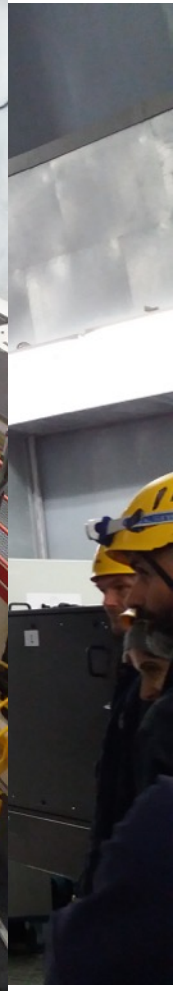




M







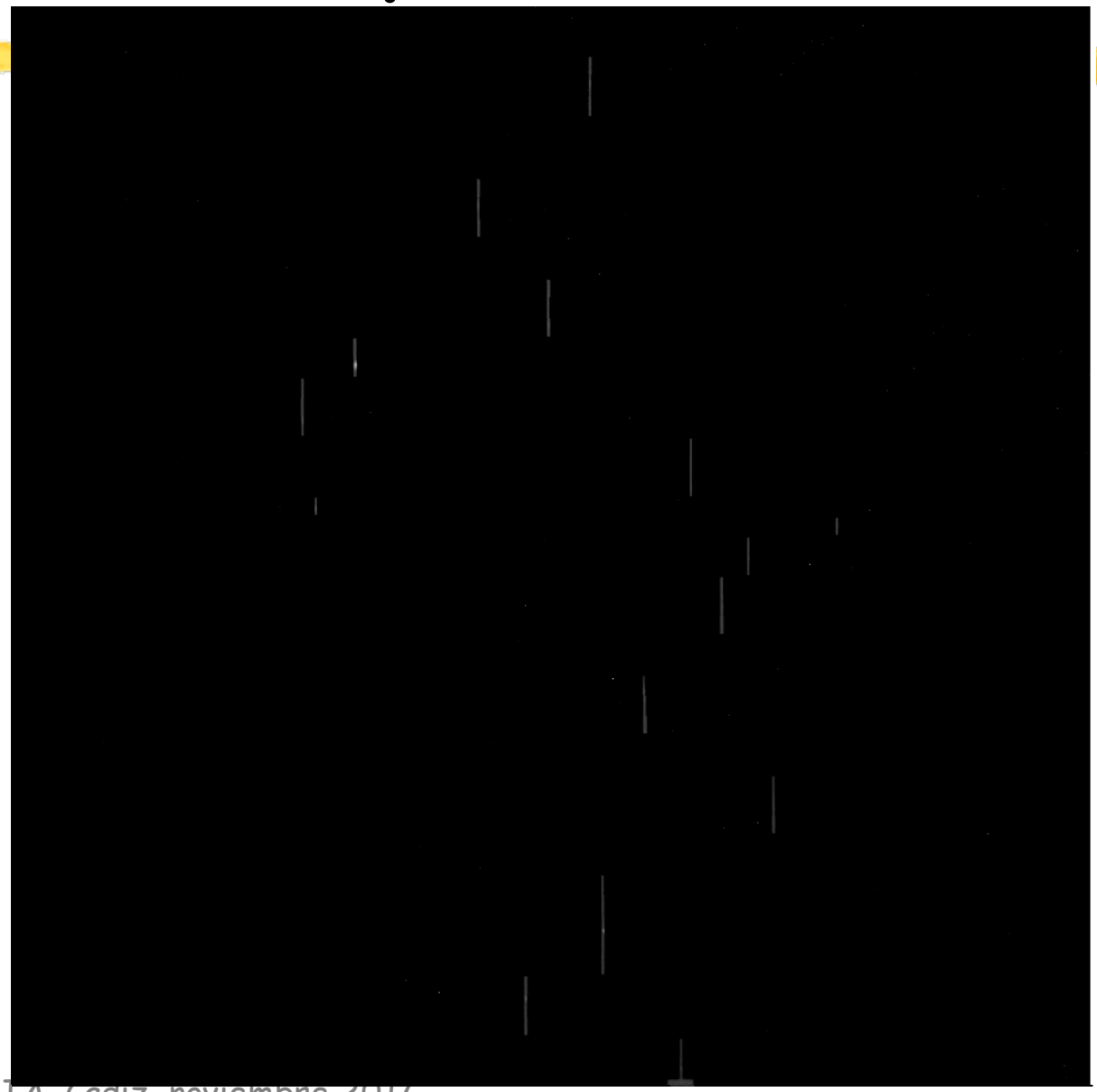
Maintenance downtime

- Begin on November 1st at Nasmyth
- Emir dismounted on Nov. 8th
- In clean room at GTC since then
- Two main maintenance tasks:
  - Correction of detector tilt
  - Replacement of part of the CSU piezos
  - Internal cleaning and other minor things
- Cooldown to check functionality before sitting back at Nasmyth
- EMIR back in operation by mid January 18 (TBC)

Next steps: MOS comm.

- The concept of MOS mode was stablished during the past commissioning
  - MOS pattern + LS mode
  - Good astrometry is essential

Next steps: MOS comm.



Next steps: MOS comm.



MOS comm. plan

- Two periods:
  - 1st technical:
    - test the feasibility of the conf. methods:
      - ✓ From target list to CSU pattern, through the OSP
      - ✓ Test scripts to transfer from OSP output to CSU input
      - ✓ Test DRP functionalities to derive correction in pointing
        - Check number of reference stars
    - Test spectrum extraction (DRP) and spectral calibration

MOS comm. plan

- Two periods:
  - 2nd scientific verification:
    - Validated the MOS modes in an ample range of scientific targets
      - ✓include faint sources, i.e., long integration time