

ひさき (SPRINT-A) 搭載 EXCEEDによる恒星観測

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EXCEED/Hisaki チーム





Instrument overview

1. Entrance mirror

An off-axis parabolic, CVD-SiC coated,
 $D = 200 \text{ mm}$, $F = 8$

2. Slits and filters

Selectable by stepping motor, 3 types of
shape,
3 types of filters

3. Grating

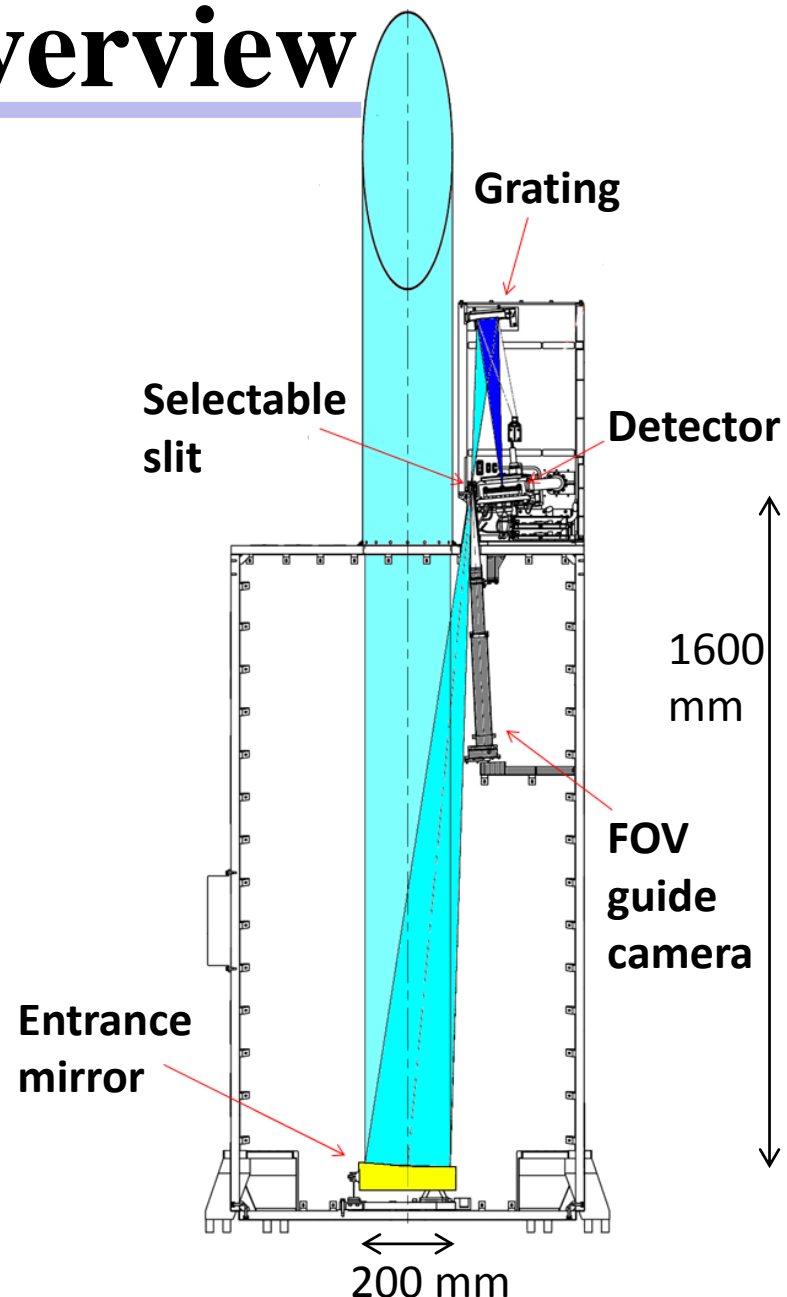
Laminar type, toroidal, CVD-SiC coated

4. EUV detector

Microchannel plate (MCP) + resistive anode
encoder (RAE), CsI photocathode

MCPs should be kept under vacuum

-> The window must be opened after launch



In-orbit calibration

Resolution

● Spectral resolution

-> Width of the emission lines during nominal observations of planets

1. Pointing accuracy

-> Images of FOV guiding camera

2. Plate scale

3. Spatial resolution

-> Width of the stars for spatial axis

Sensitivity

4. Absolute sensitivity

-> Measurement of stars with known spectrum

5. Temporal variation of sensitivity

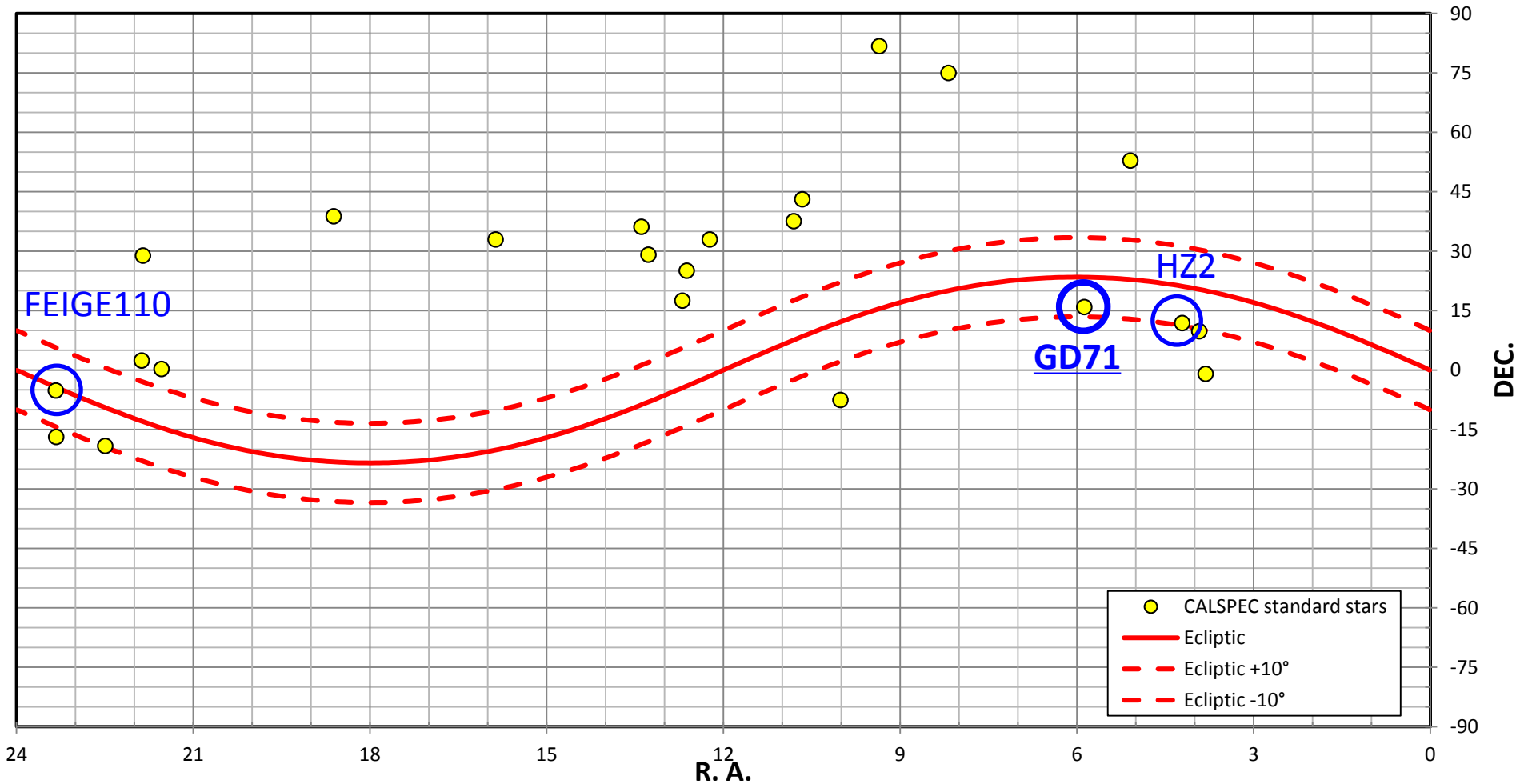
-> Long-term observation of the same star

Stellar
observation

Limitation for EXCEED stellar observation

- Target coordinate: $< \text{Ecliptic} \pm 10^\circ$
 - Observable region: 1/6 of all sky
- Sun-Earth-Target angle $> 20^\circ$
 - Observable season of each star is limited
- Without FOV guiding camera
 - > Pointing accuracy: 20-25 arc-sec
- 60'' or 140'' slit
- Effective area: 1-3 cm²
- Spatial resolution: 17 arc-sec

Observable area



• Three calibration stars (CALSPEC) observable by EXCEED : **GD71**, FEIGE110, HZ2

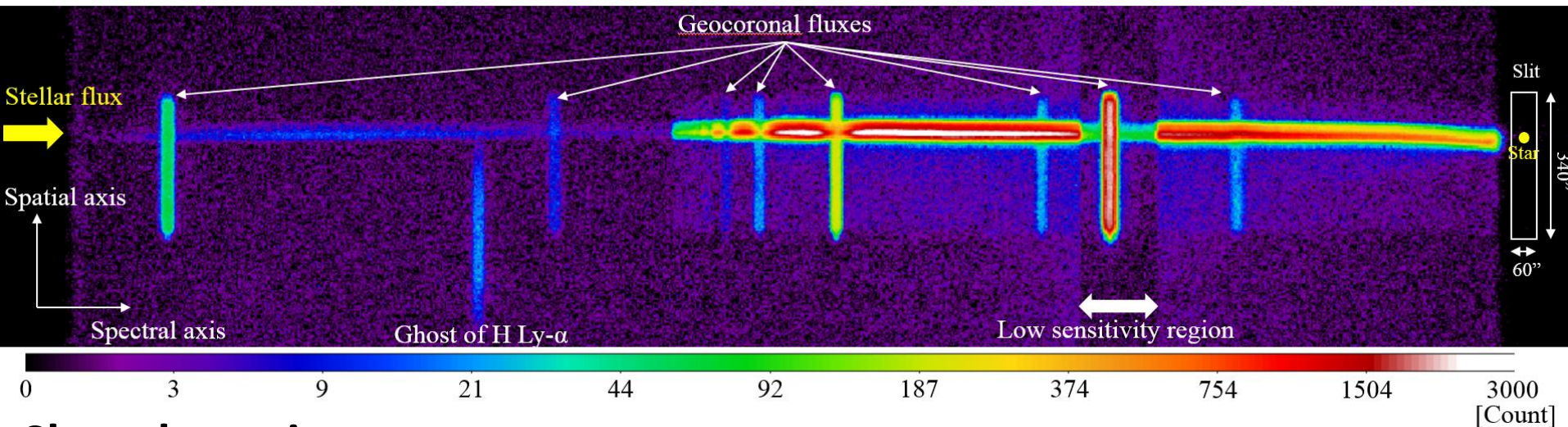
Spectral image of GD71 (2013/12/09)

2013/12/09-10

Exposure time = 31740 sec

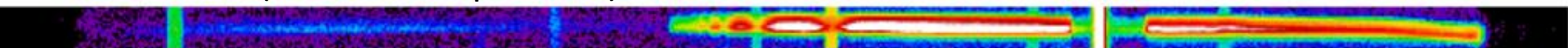
HV: -3.5 kV (nominal)

Slit: 60"



Sky subtraction

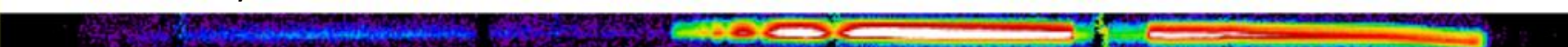
1. Raw data (with stellar spectrum)



2. Sky only (from same image as stellar spectrum)

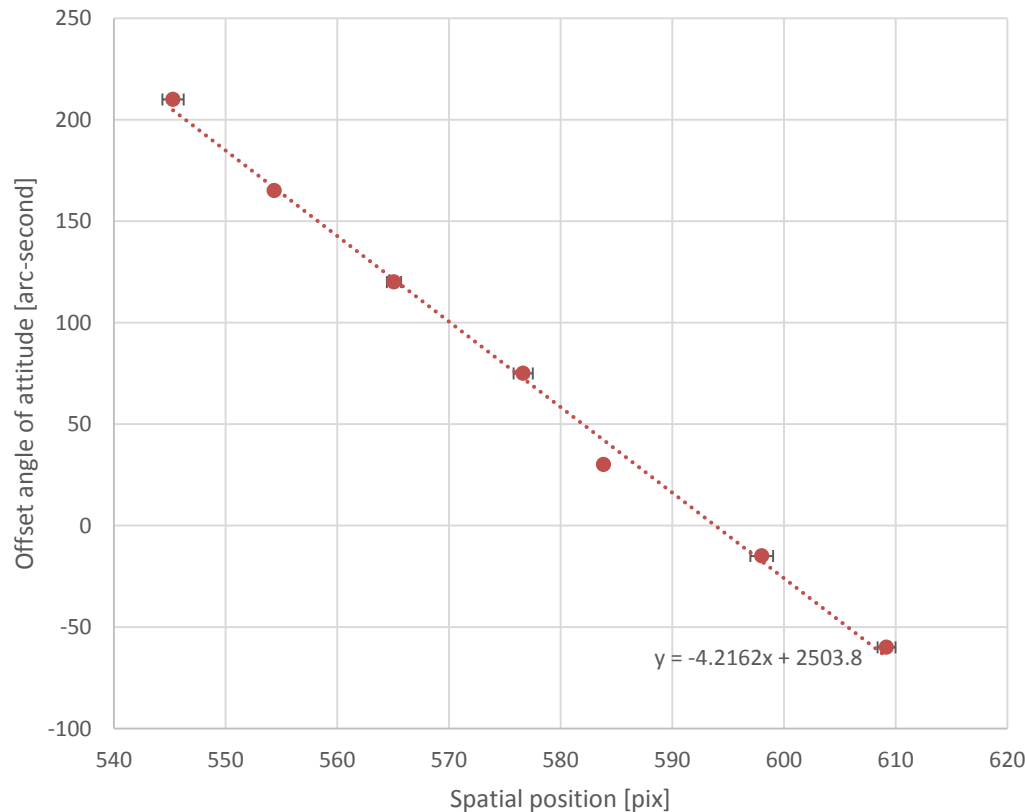


3. Raw - sky



Calibration: plate scale

- We changed the offset angle of attitude every 45 arc-seconds and observed GD71
- -> We measured the plate scale of EUV for spatial axis

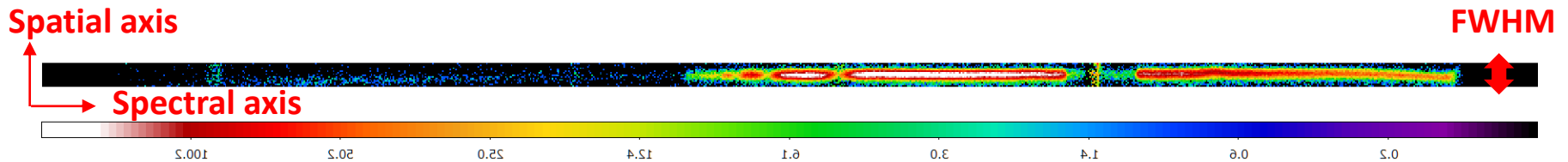
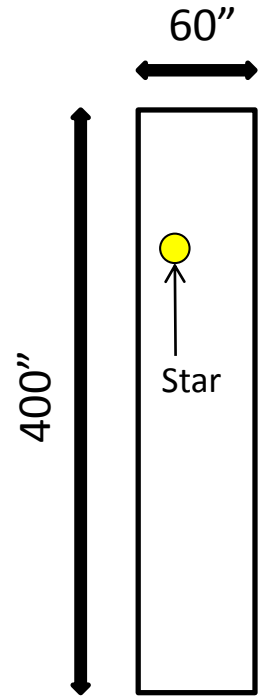


1 pix = 4.2 arc-seconds

Calibration: spatial resolution

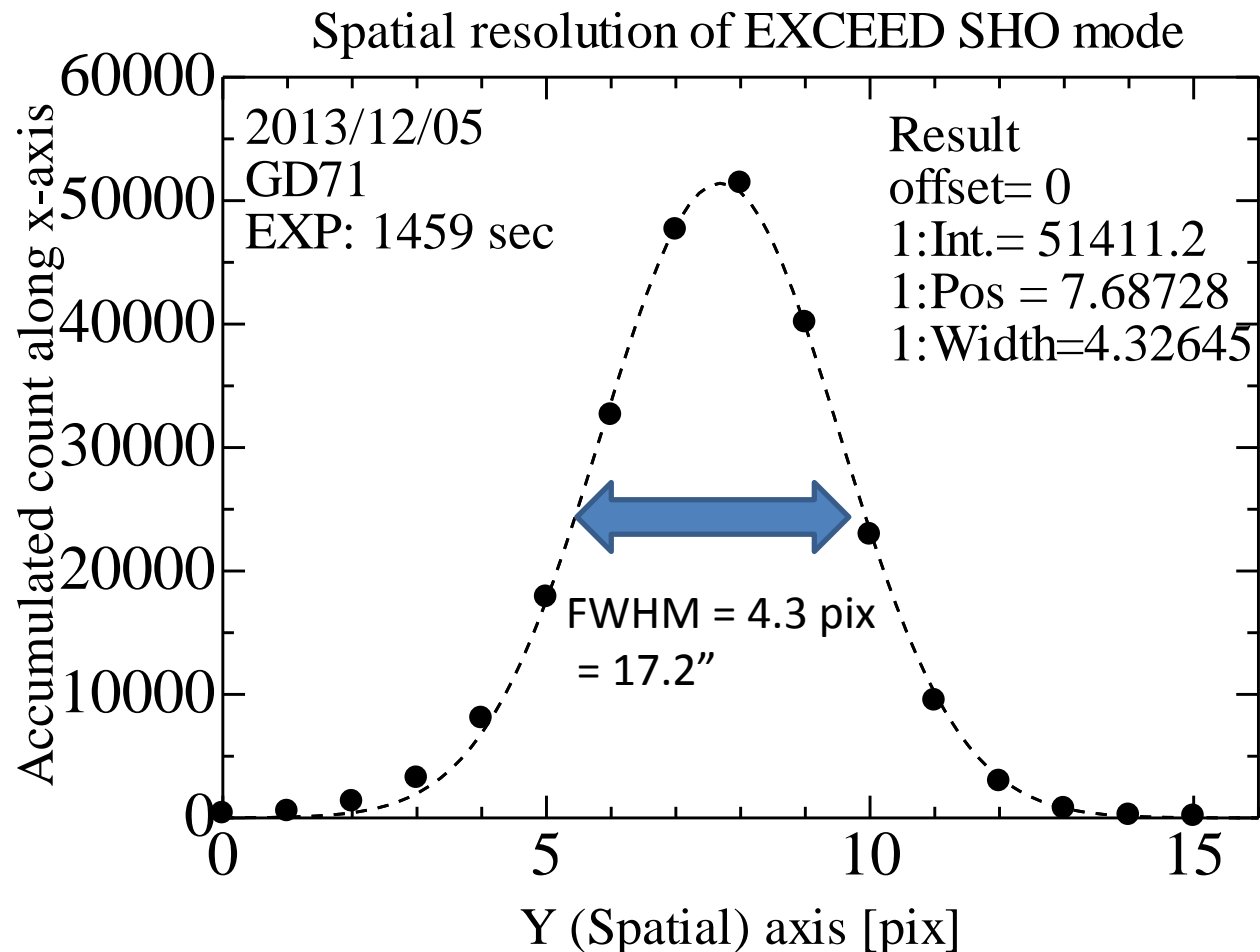
We measured the width of the stellar spectrum for the spatial axis

- Target: GD71
- Slit: 60"
- Frequency: once at initial observation



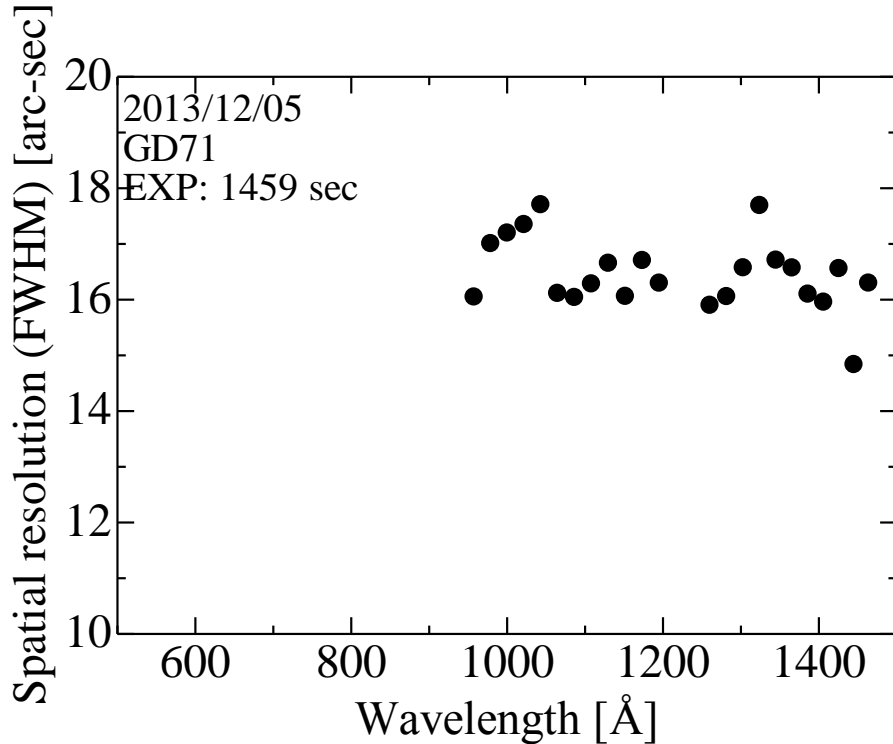
Calibration: spatial resolution

- All the counts along the spectral axis are accumulated
- -> This result includes pointing accuracy and distortion

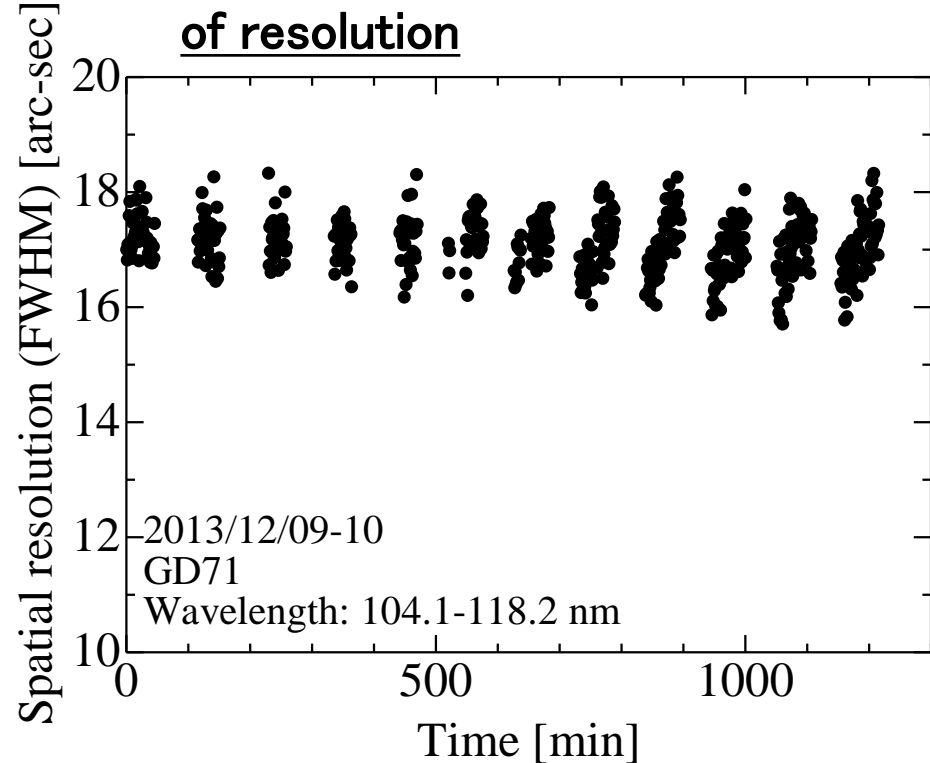


Calibration: spatial resolution

Resolution at each wavelength

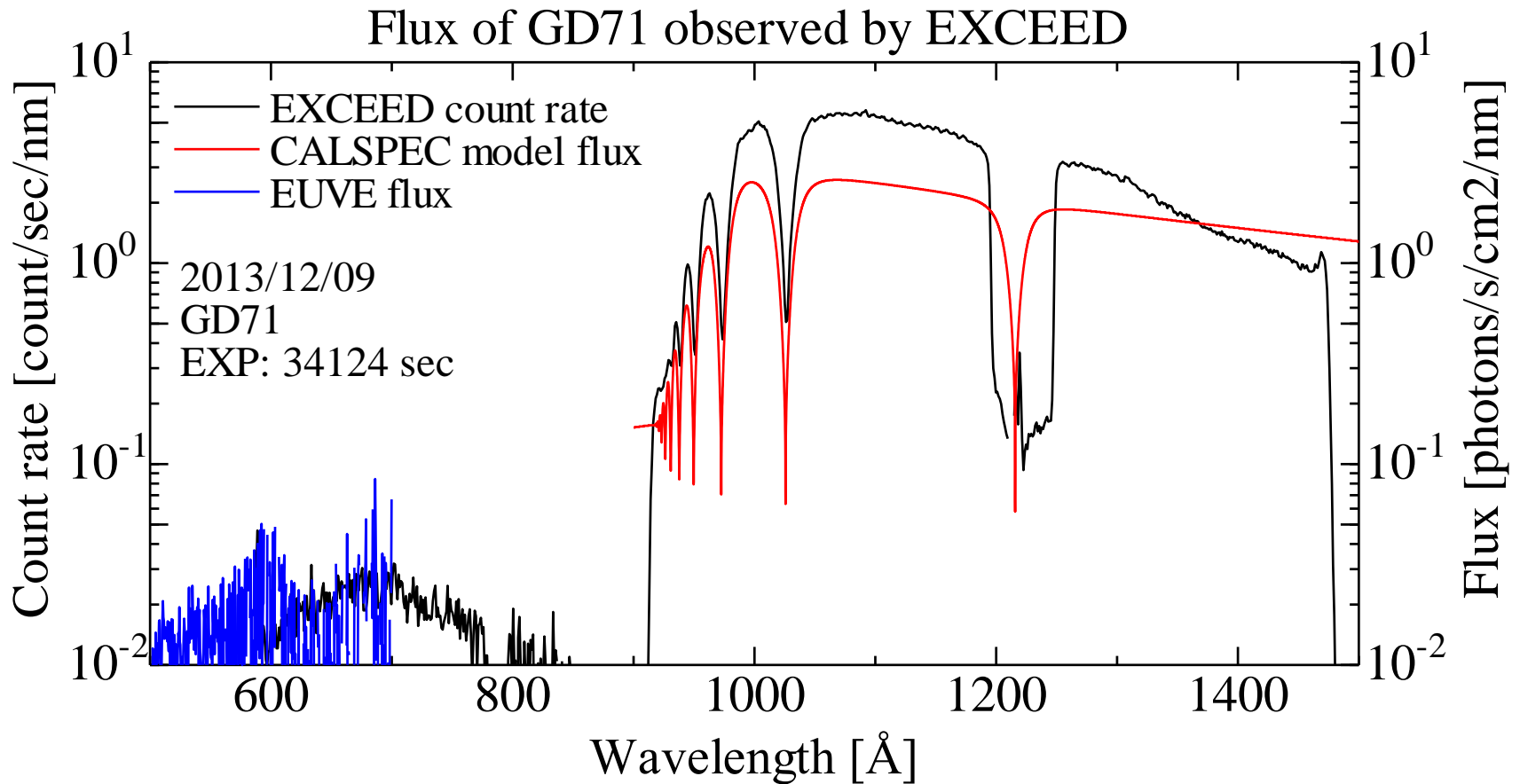


Temporal variation (every 1 min) of resolution

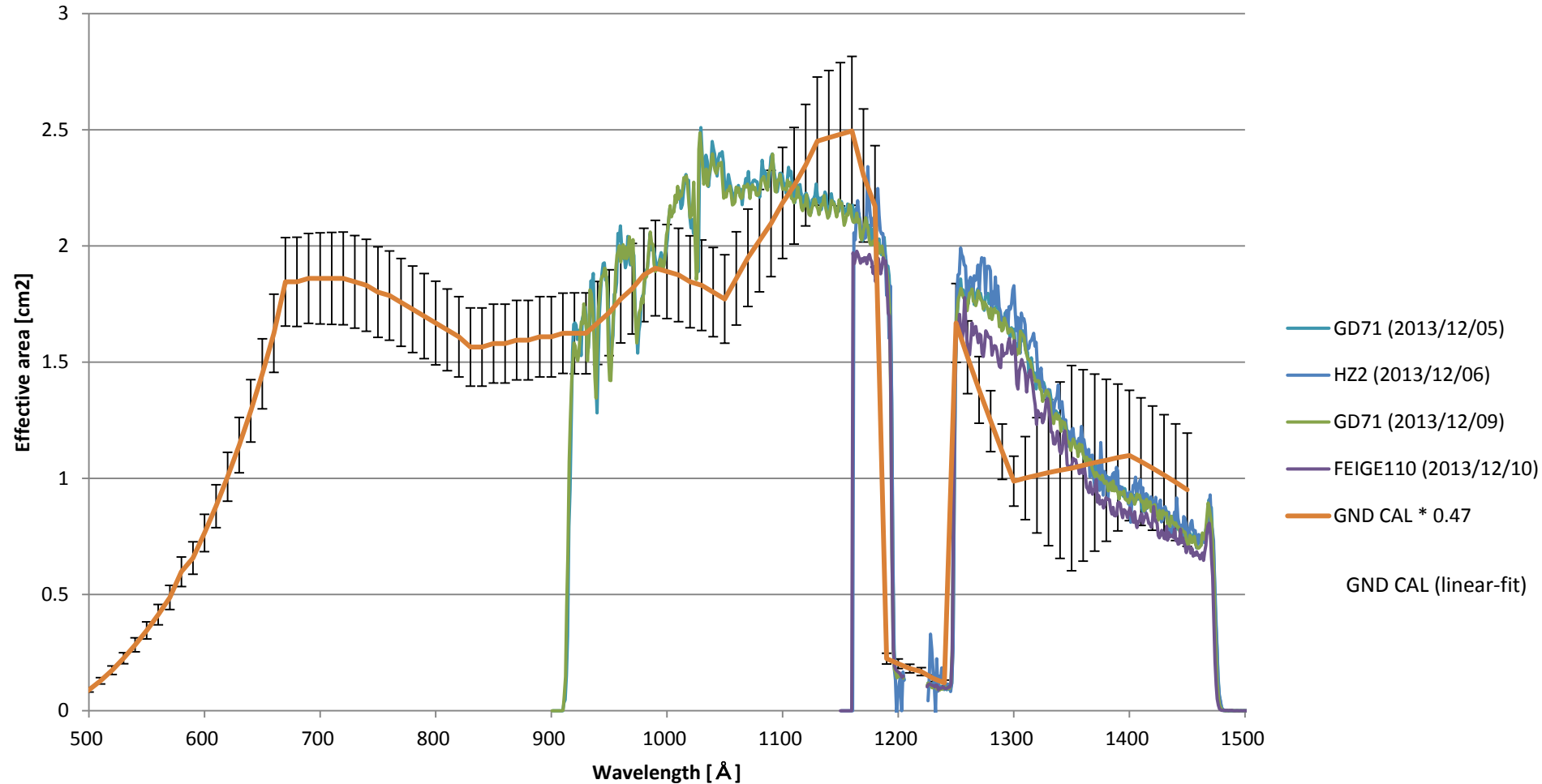


Spatial resolution without FOV guiding is **17.1 ± 0.5 arc-seconds**

Calibration: absolute sensitivity



Calibration: absolute sensitivity

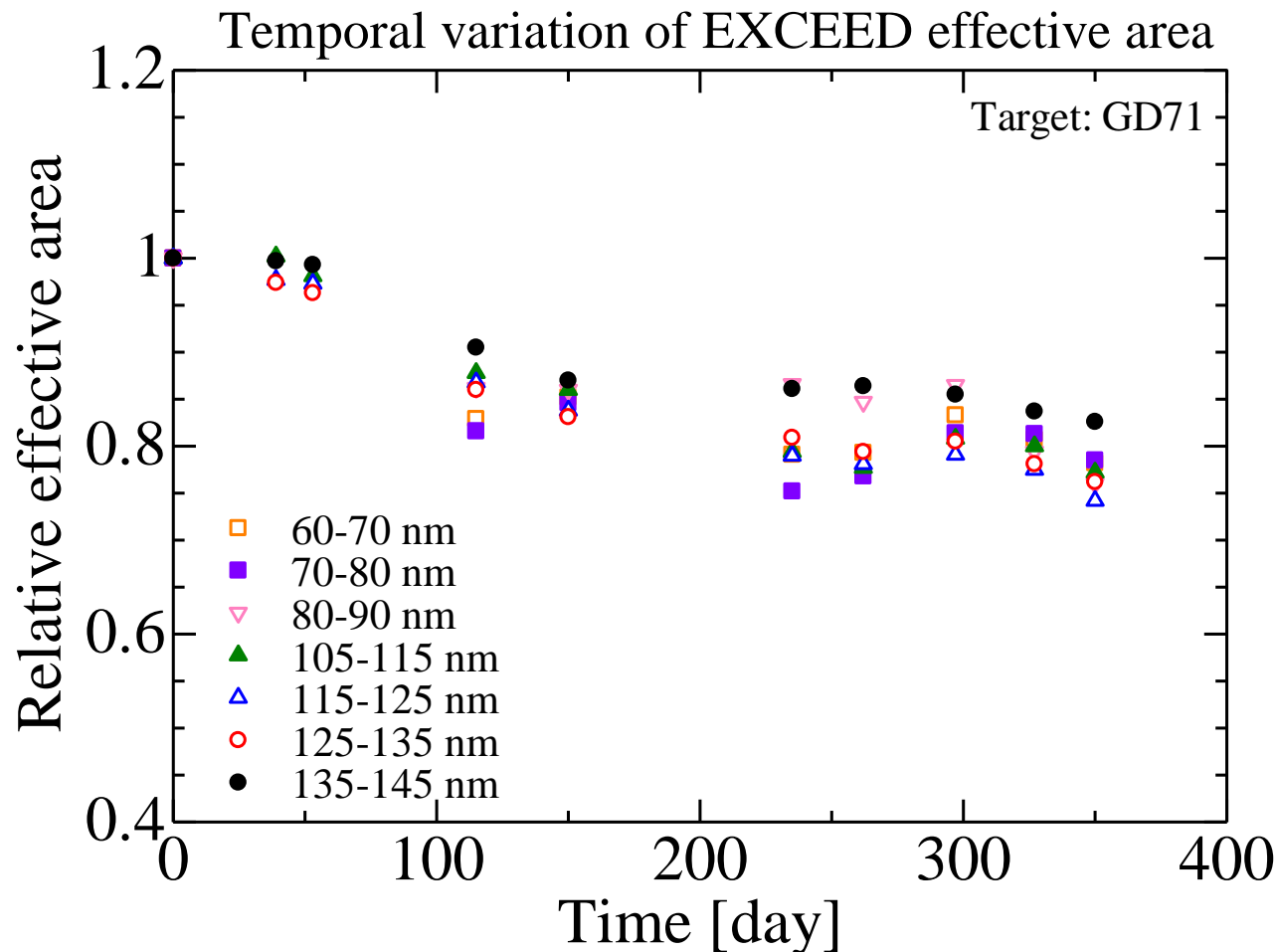


Absolute sensitivity of EXCCED has been successfully calibrated
above 900Å

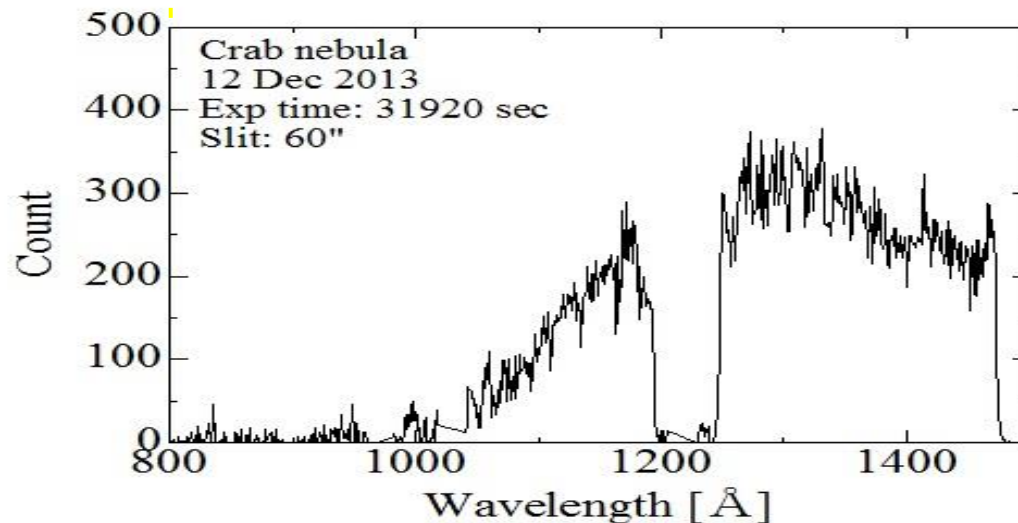
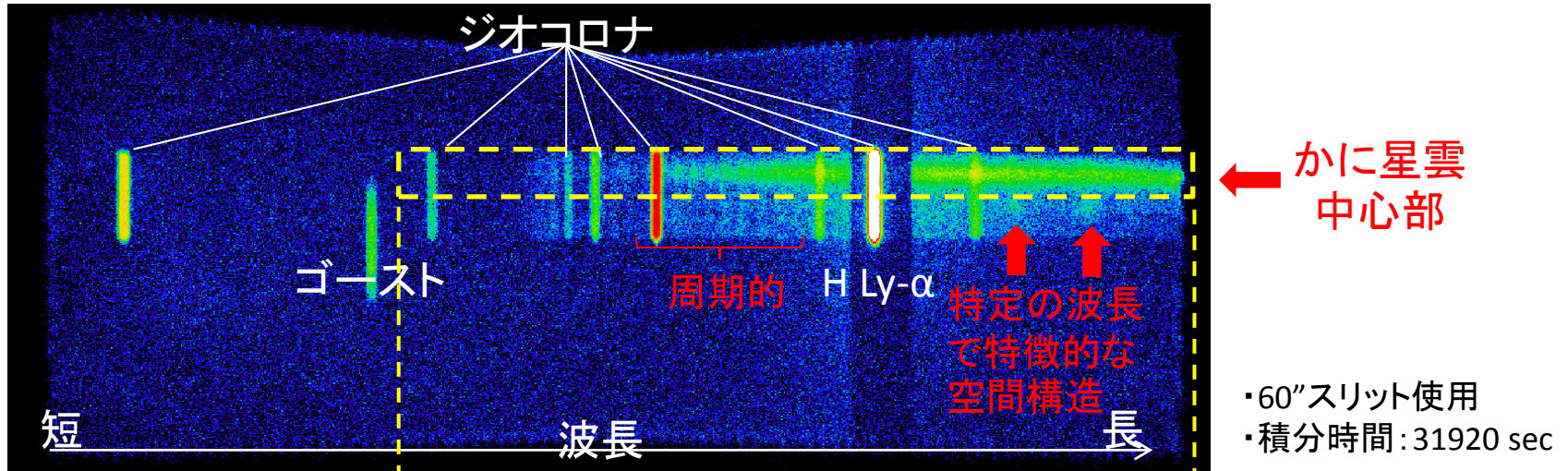
Temporal variation of sensitivity

We will measure the relative sensitivity of EXCEED every 2 weeks ~ 1 month.

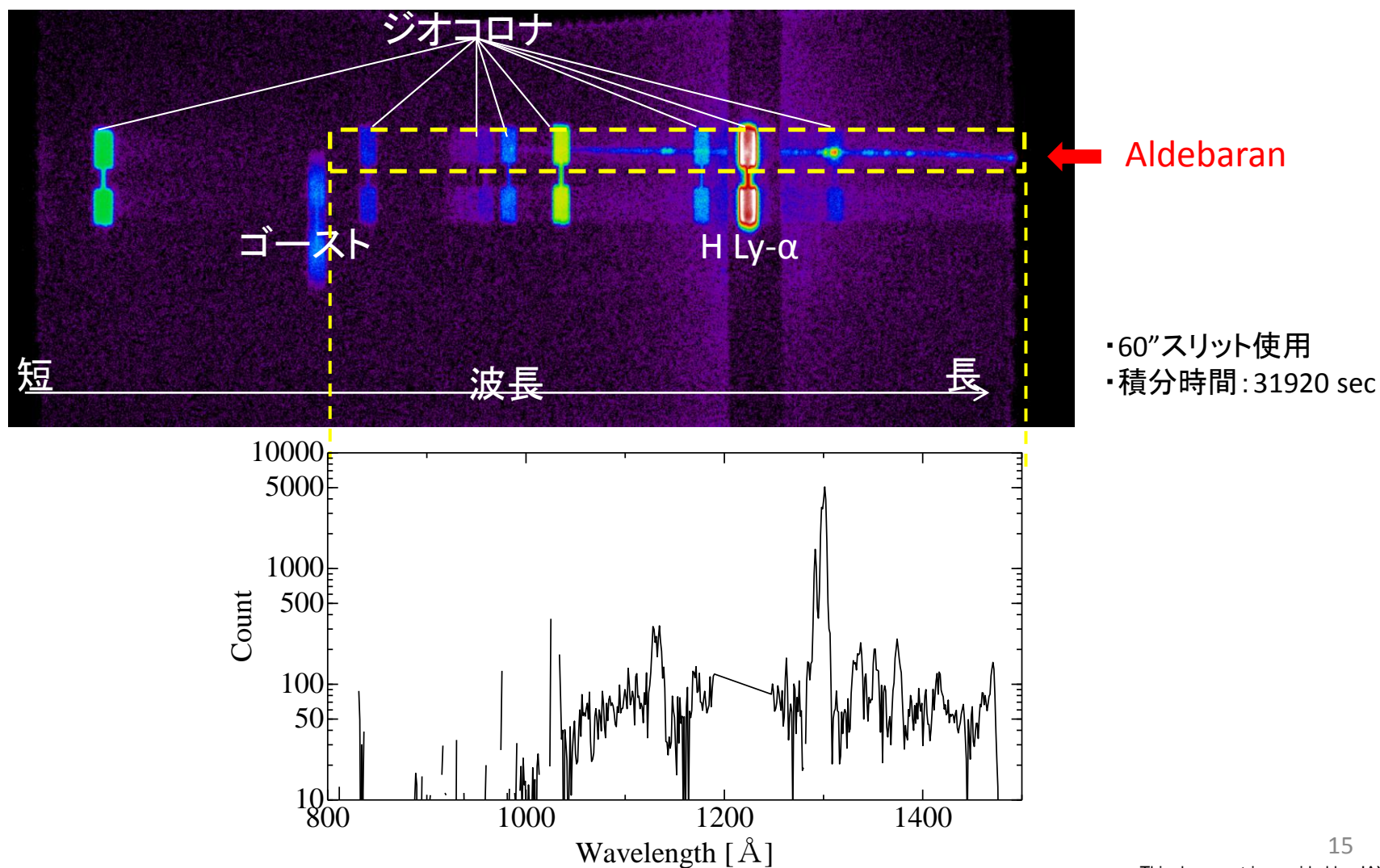
-> **Degradation of ~20% has been found**



Stellar observations: Crab nebula



Stellar observations: α Tau (Aldebaran)



今後の恒星観測計画

- 較正観測は1か月に1回程度の頻度で継続
- 次回恒星観測キャンペーンは2015年8月頃の約1か月間（惑星観測不適期）
- 天文汎用解析ツール（X-specなど）に向けたインプットデータテーブルを準備中
- 2015年3月（TBD）：観測リクエスト受付
- 2015年6月（TBD）：観測計画立案
- 2015年8月：恒星観測キャンペーン実施