The LAMOST Observations

Jianrong Shi
NAOC
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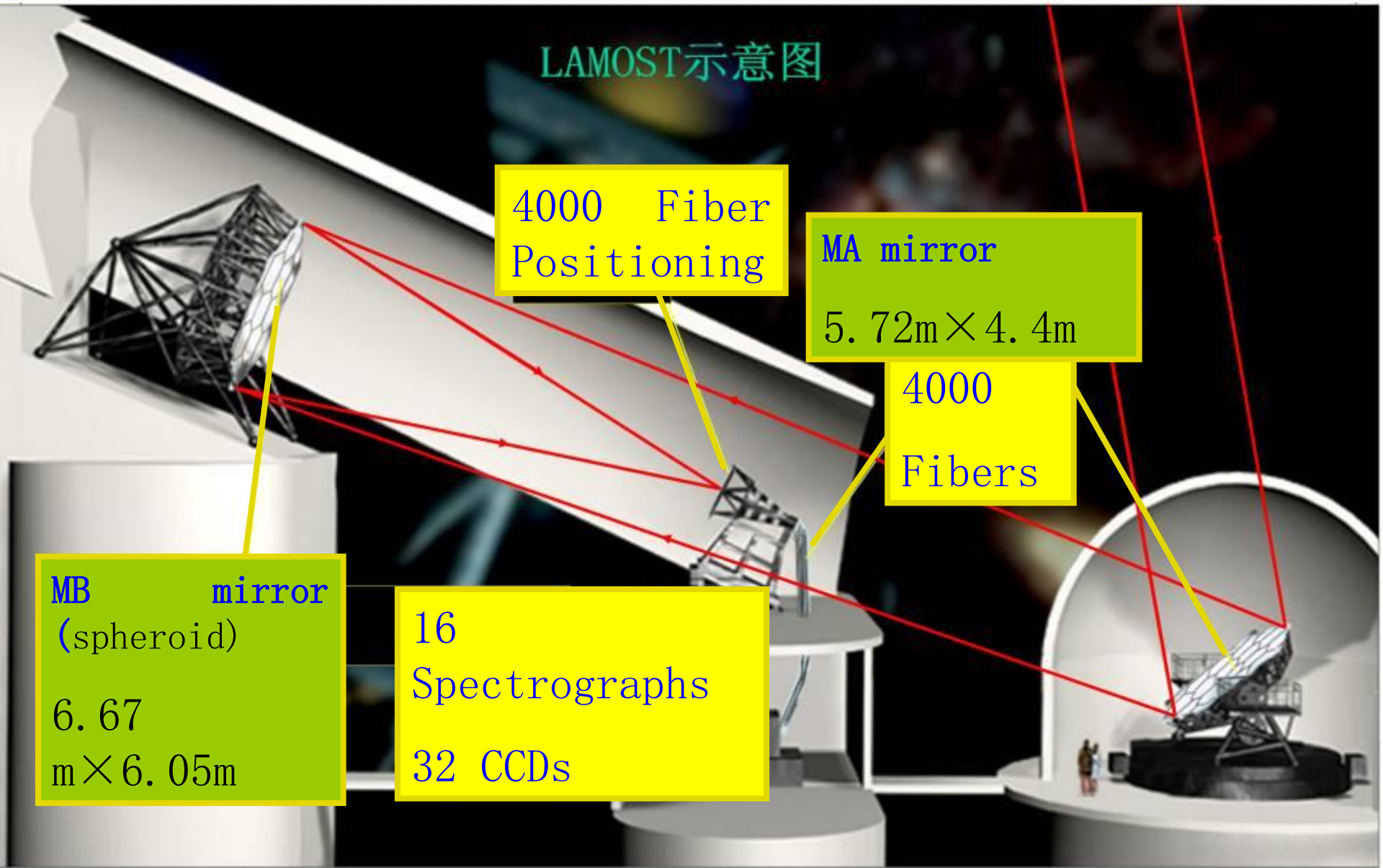
Overview

- The structure of LAMOST
- Observation preparation
- Selection of plates
- Five year survey results
- Medium resolution spectra

Structure of LAMOST



LAMOST telescope

Declination	-10°	60°	90°
Effective aperture	4.9m	4.2m	3.6m
Field of view	5 degree		3 degree

Seeing: 3-5 arcsec (dome + site)

- **Site seeing: < 2 arcsec ; Fiber size: 3.3 arcsec**
- **a field of view as large as 20 square degrees, the effective aperture varies from 3.6 to 4.9 meters in diameter (depending on the pointing). Enables it to take 4000 spectra in a single exposure at resolution R = 1800.**

Observation preparation

Step 1:

Focus the MB
(Shack-Hartman MA)

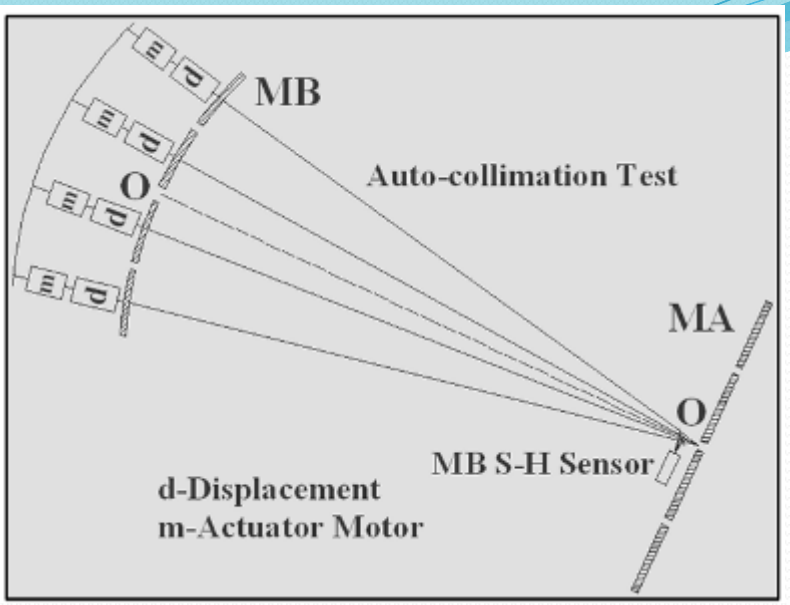
MB spheroid
6.67m×6.05m

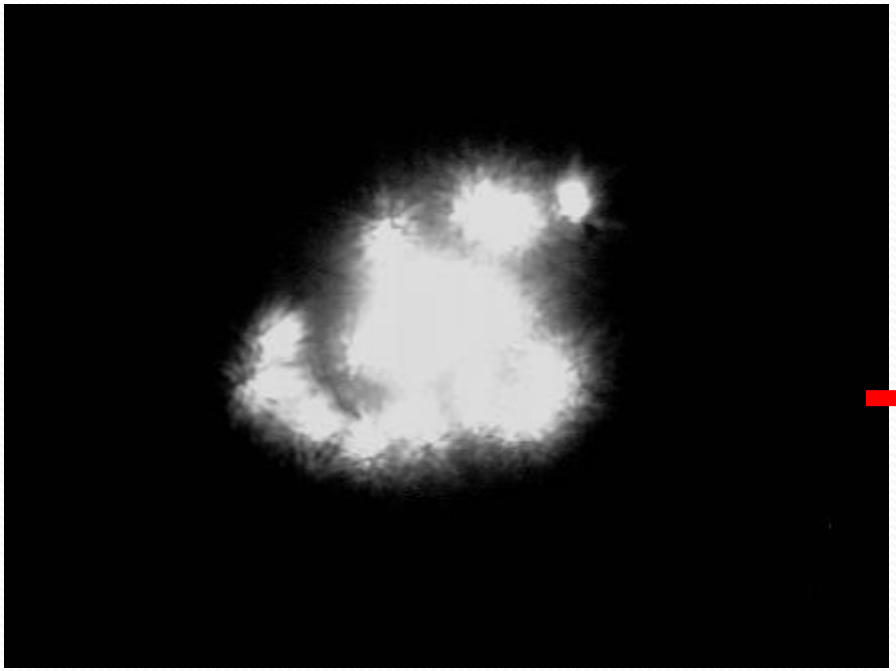
Focal length
20m

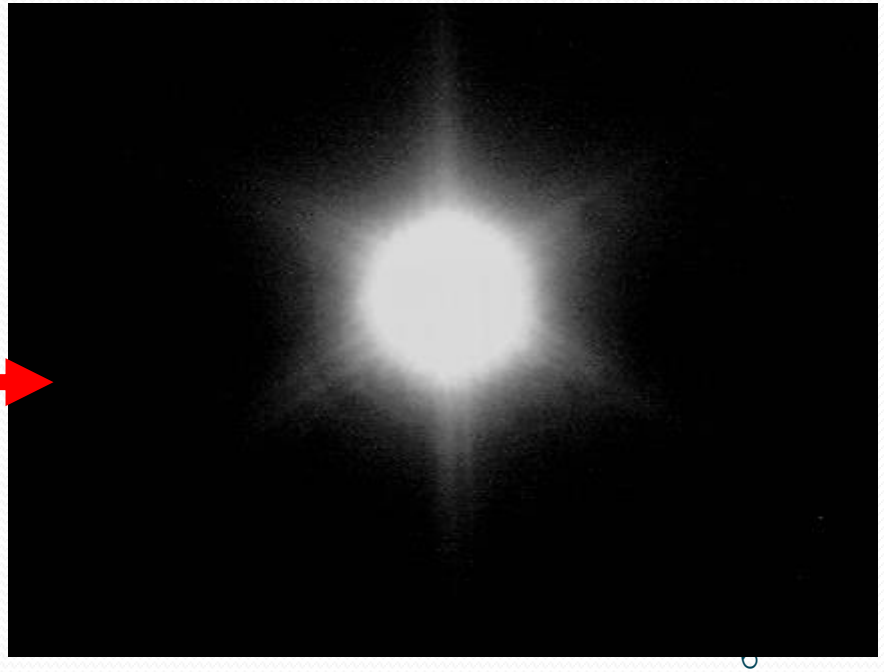
37sub-mirrors

~5 minutes

Segmented Active optics for 37 sub-mirrors of MB







Observation preparation

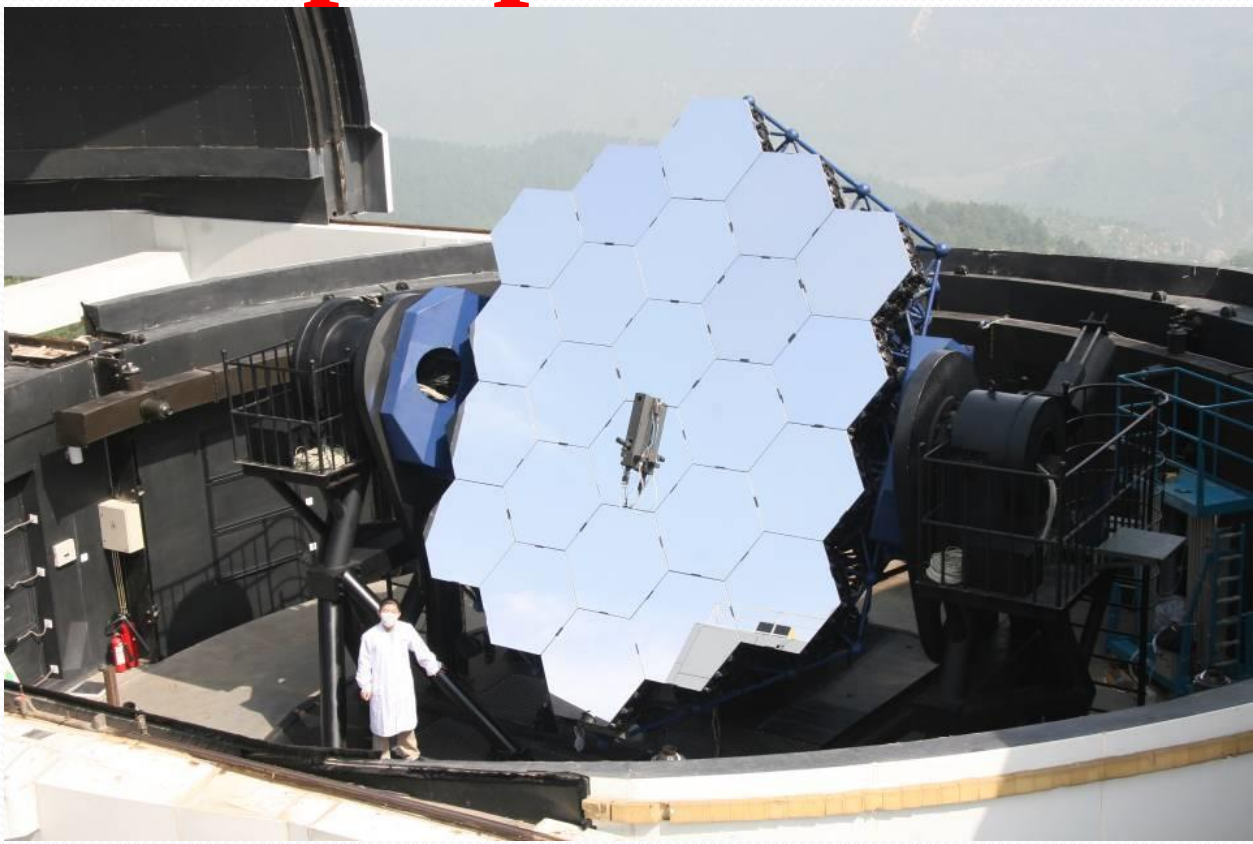
Step 2：

Focus the MA

and find the 4 guiding stars (will be 8)

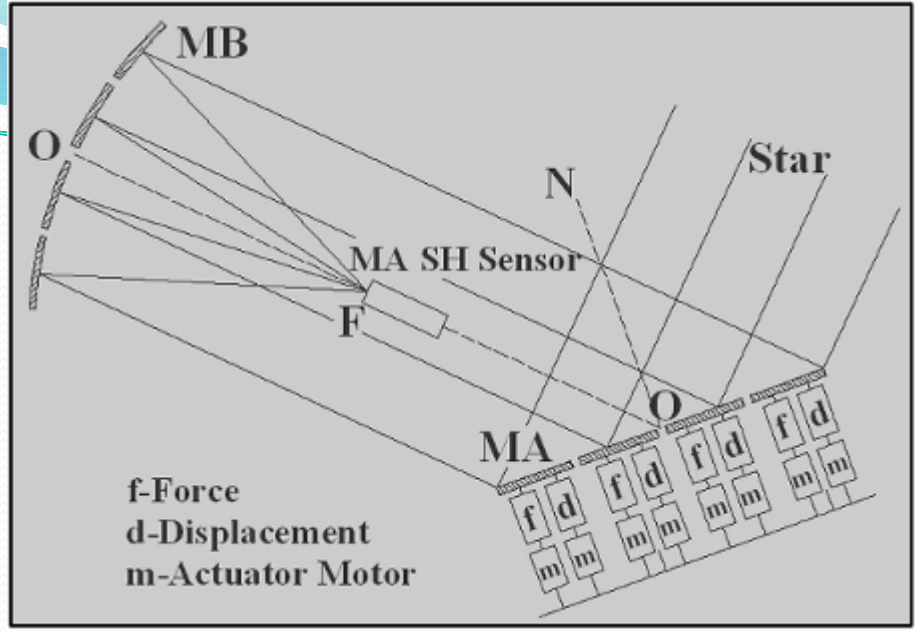
We need a center star V < 8 Mag.

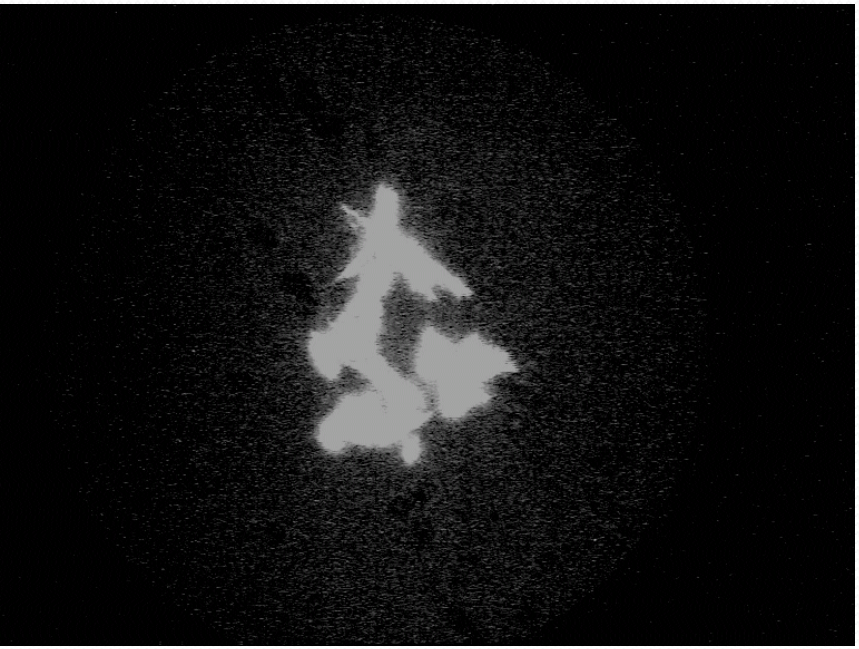
~25 minutes

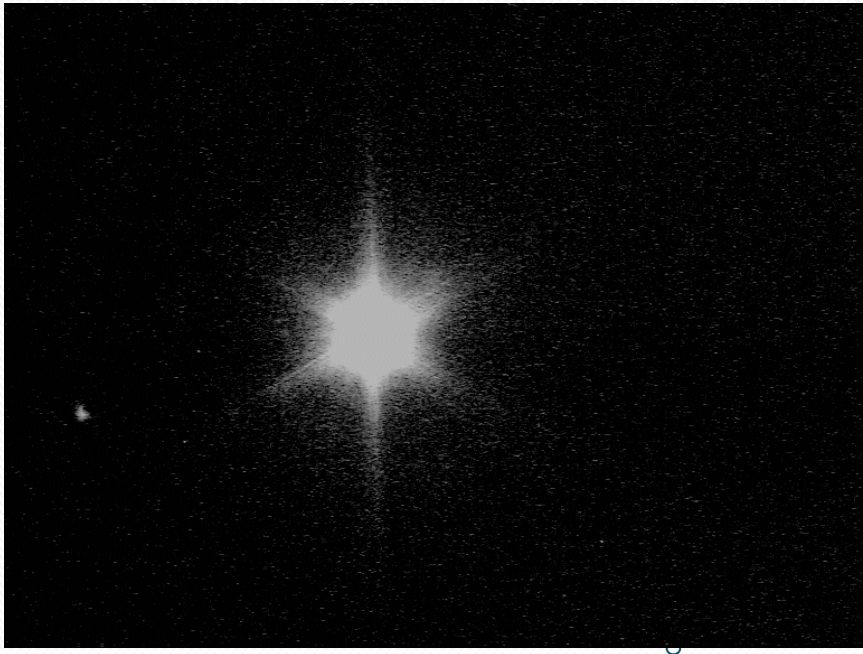


MA 5.72 m×4.4m Segmented and thin mirror active optics 24 sub-mirrors

Segmented and thin mirror active optics for 24 sub-mirrors of MA







Observation preparation

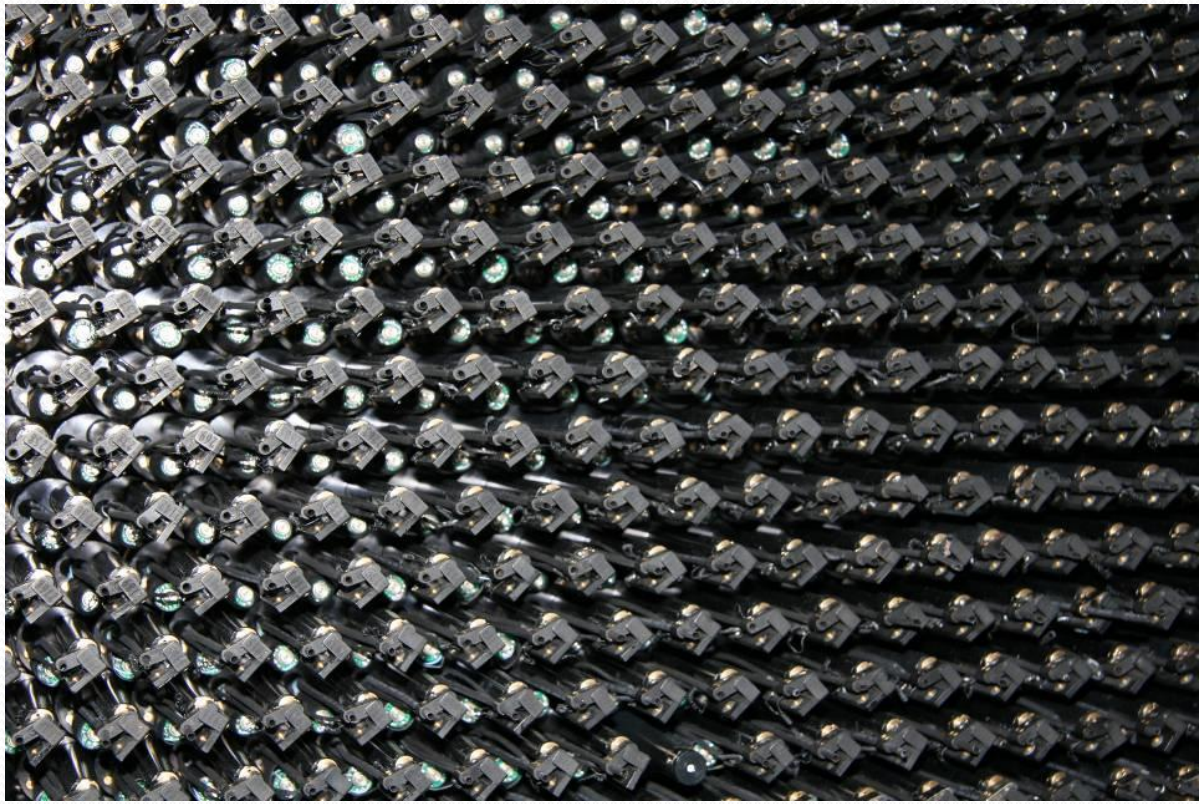
4000 fiber positioning units

Step 3:

Moving fibers

to positions

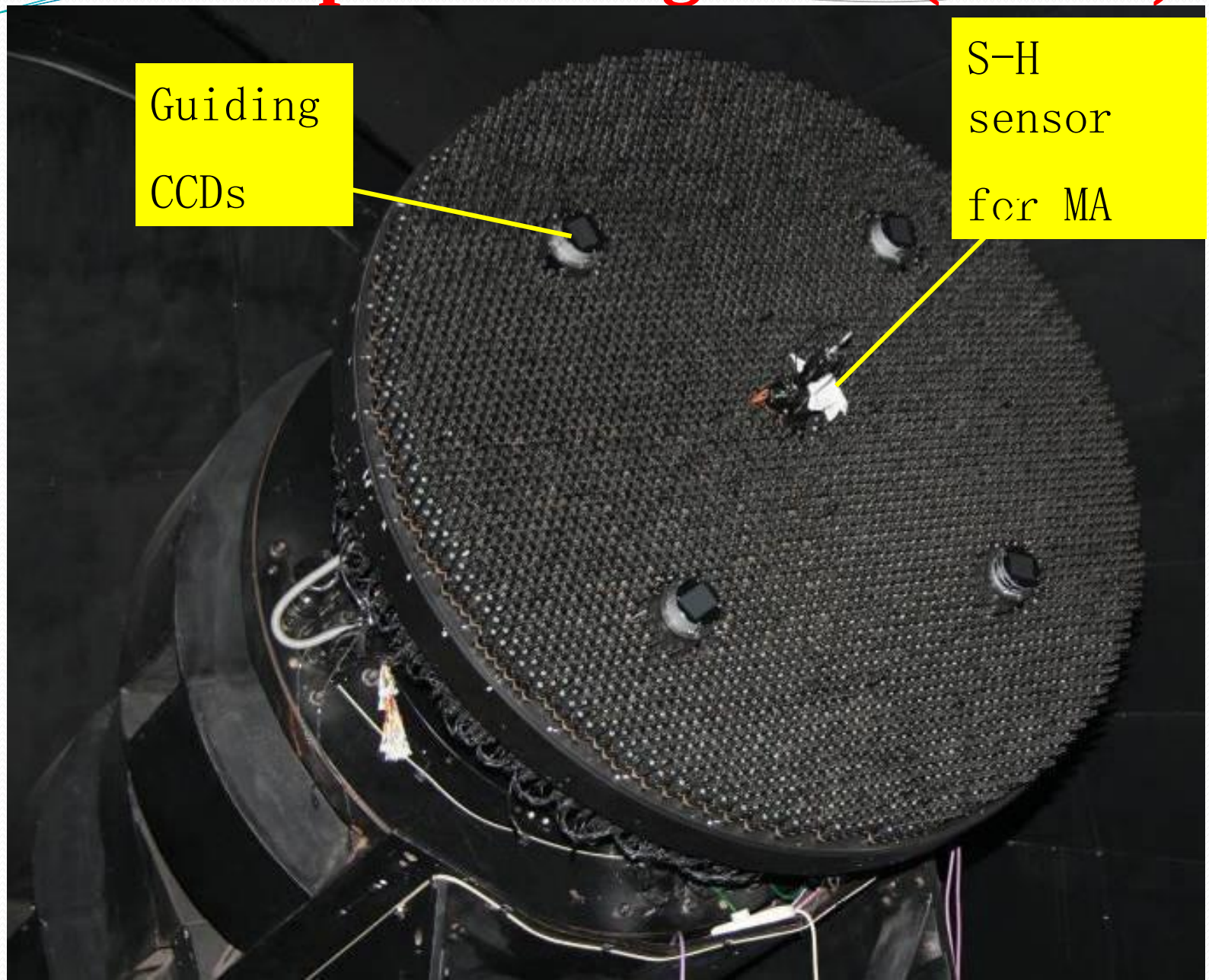
~ 10 minutes



Done during the focus

However, for the same center star, we need another ~10 minutes for a now plate (At the moment 4 minutes for readout)

4000 fiber positioning units (1.75m)



Observation preparation

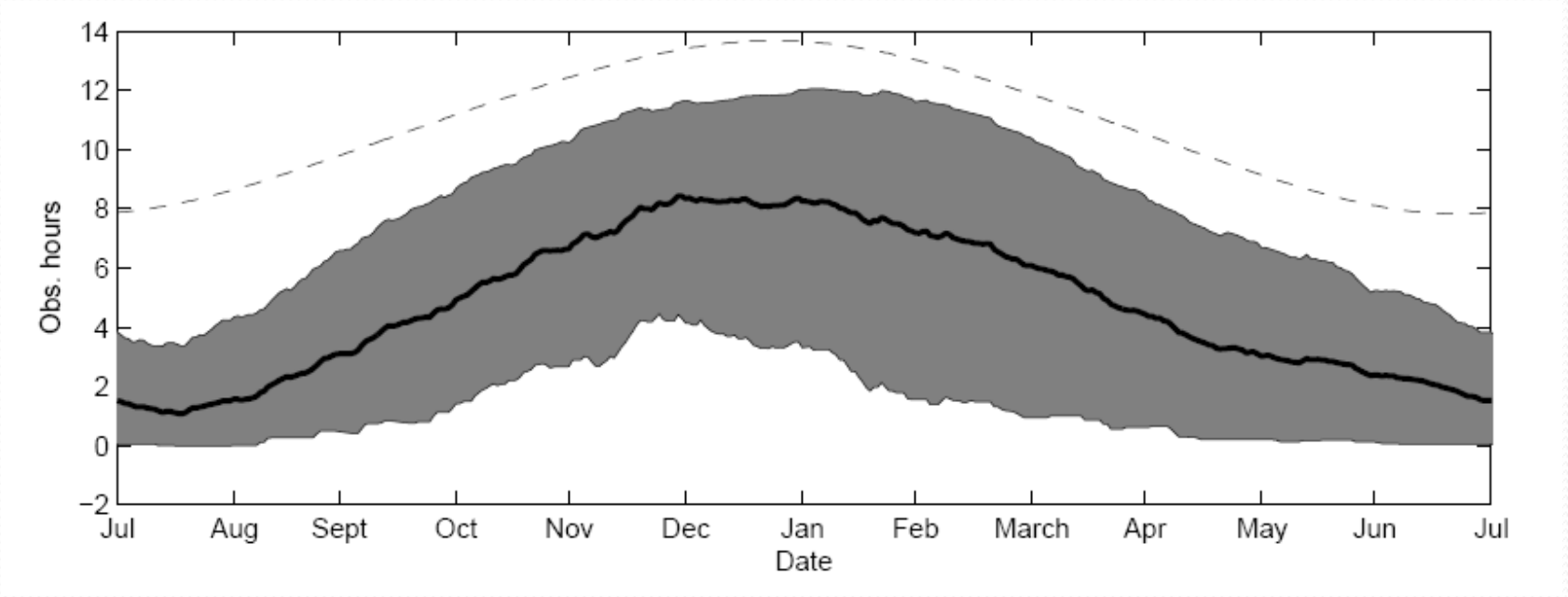
- **Focus MB ~ 5minutes**
- **Focus MA and search four guiding star ~ 25minutes**
- **Moving fibers ~10minutes**

(Which can be done during the focus)

We need ~30 minutes for preparation of a plate

The site conditions

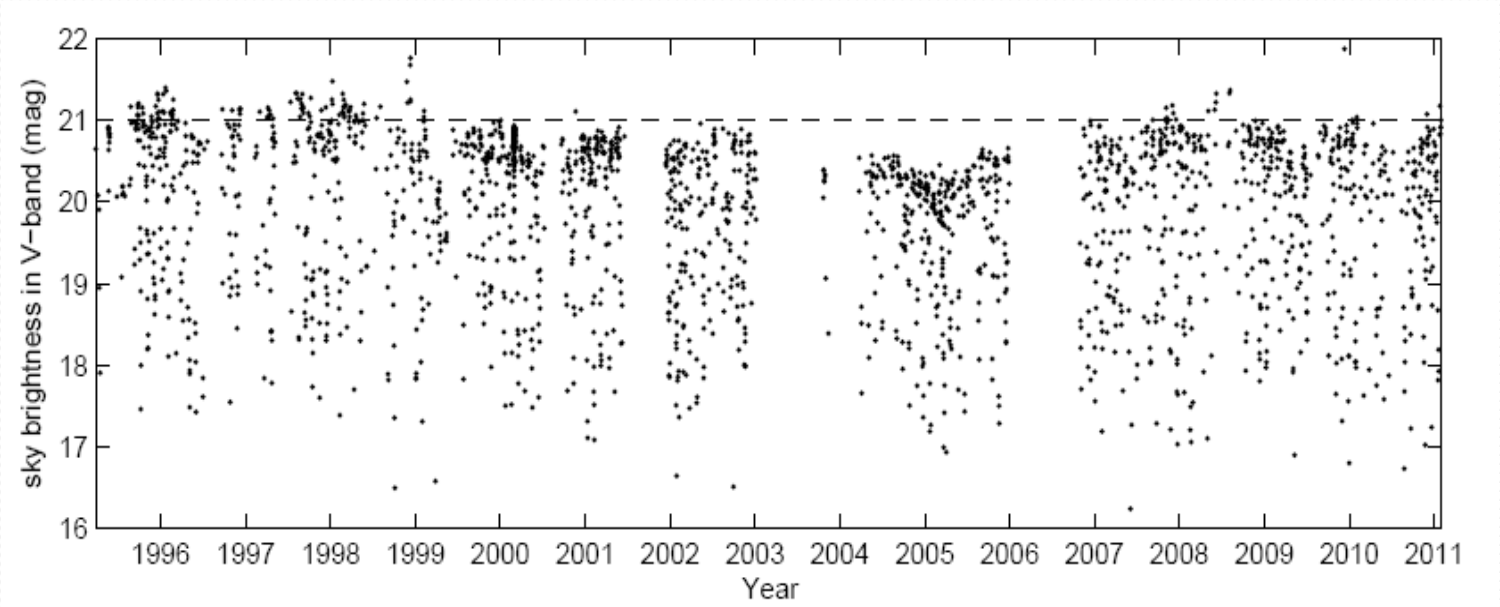
Weather



The statistics of the number of observational hours per night (BATC from 2004-01-01 to 2007-09-30). The dashed line shows the theoretical available time.

The site conditions

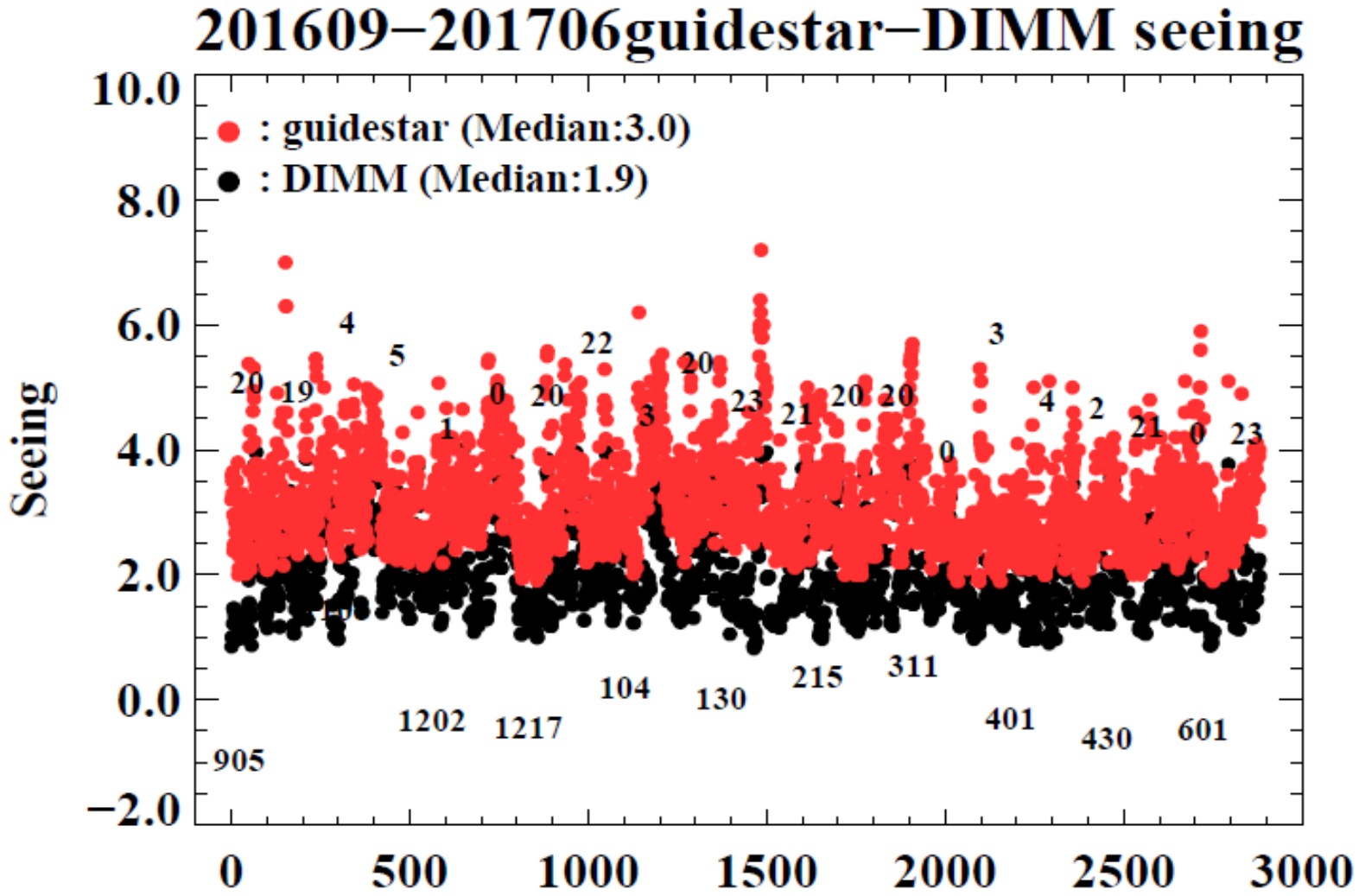
Sky brightness



The sky brightness in V band obtained from BATC Polaris monitor data, as a function of time from 1995 to 2011.

The site conditions

seeing



Selection of Plates

Depends on the observational conditions

240 minutes (total time), Weather, Moon phase, and seeing etc.

VB plates (9.0<r<14.0) 3*10minutes

B plates (14.0<r<16.3) 3*25minutes

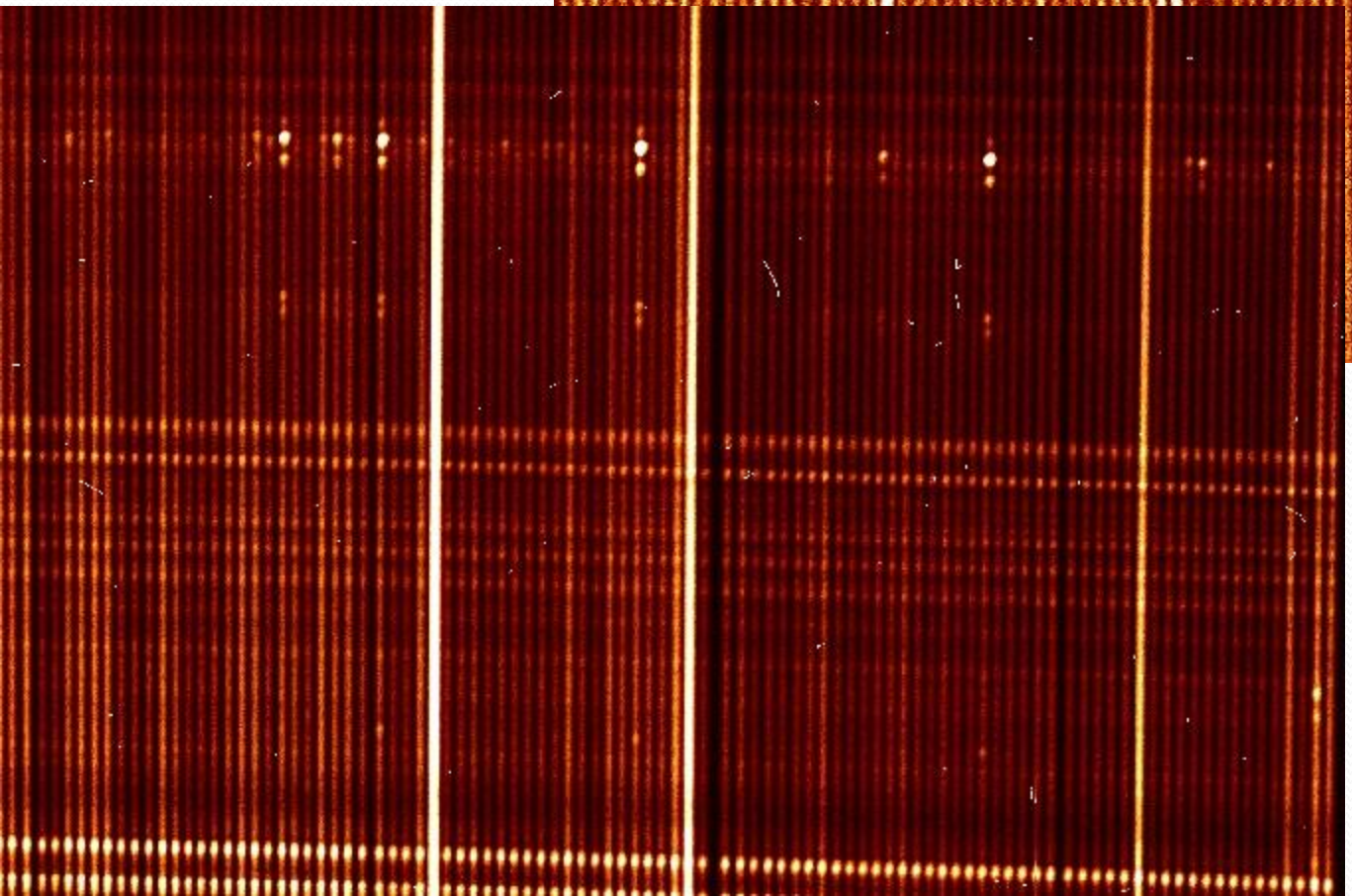
M plates (16.3<r<17.8) 3*30minutes

F plates (17.8<r<18.5) 3*30minutes

readout ~ 8minutes (reduced to 4 minutes)

We can observe two B plates or more VB plates for one center star

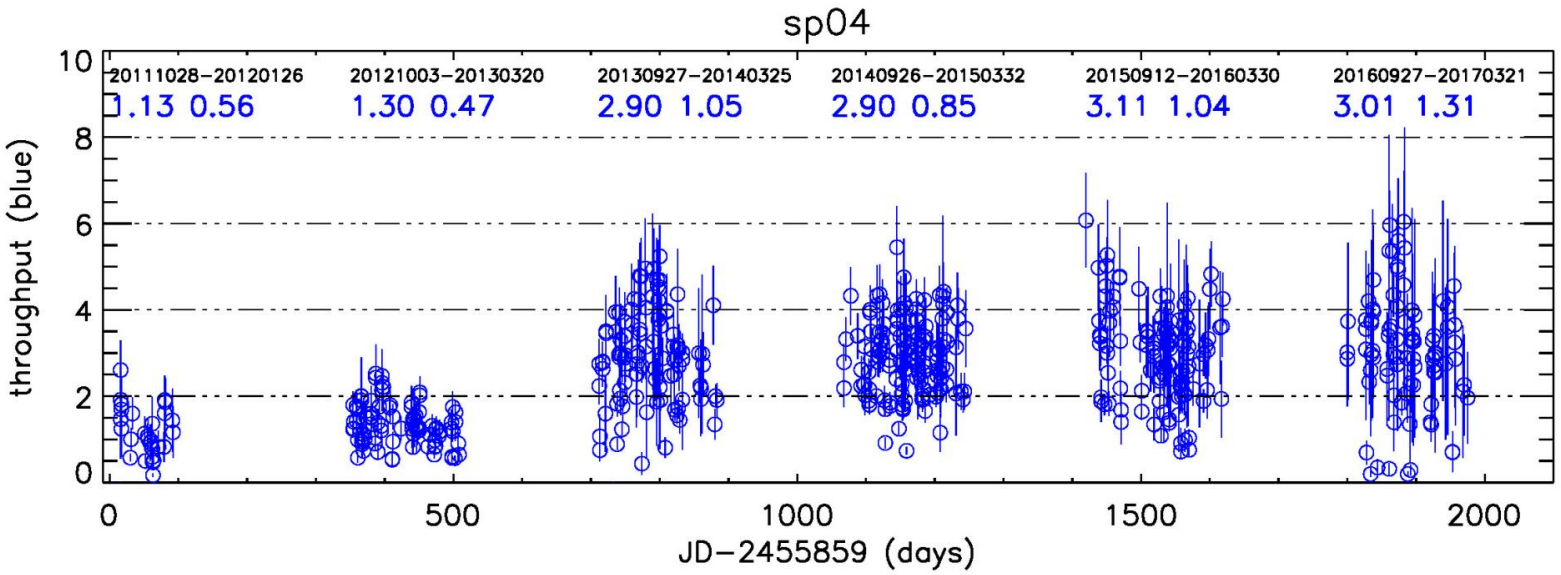
The image

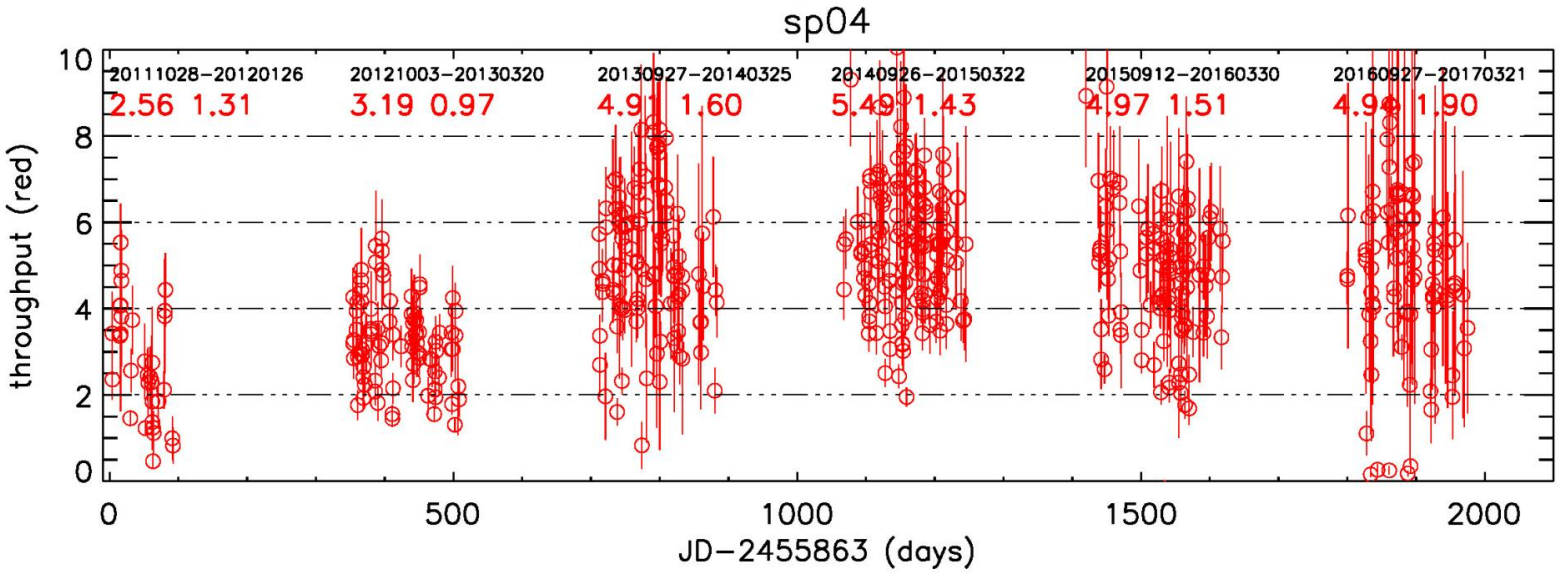


Right： blue region

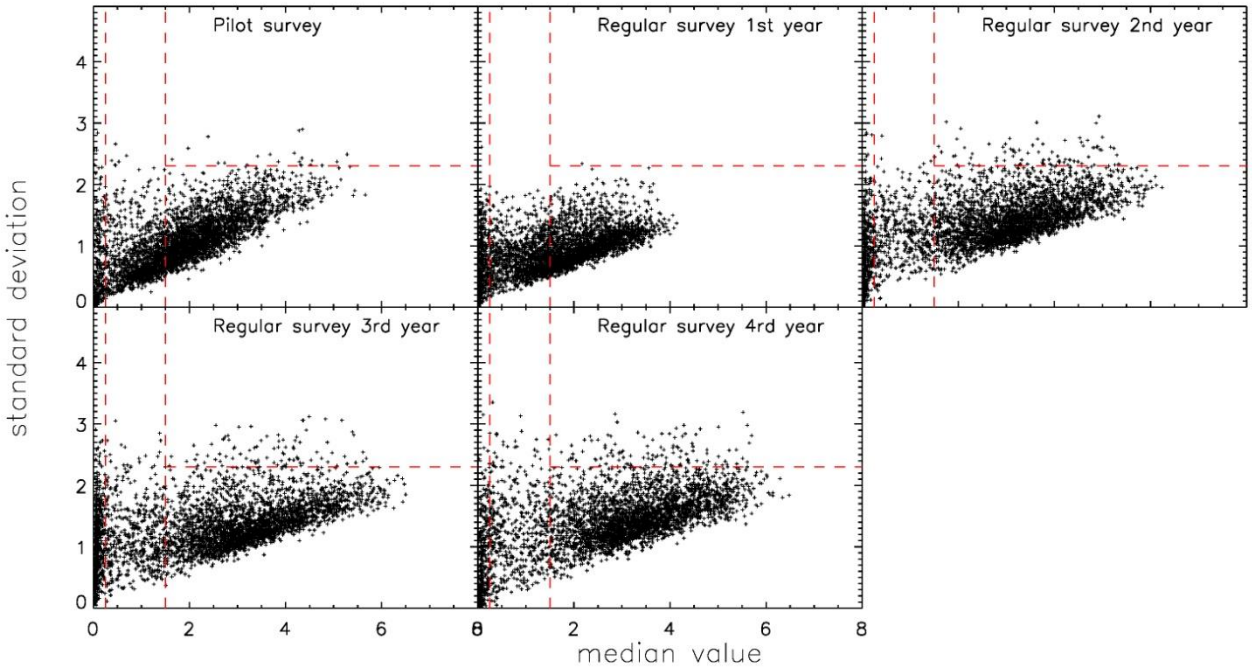
Left: red region

LAMOST throughpot





Throughpot of fibers

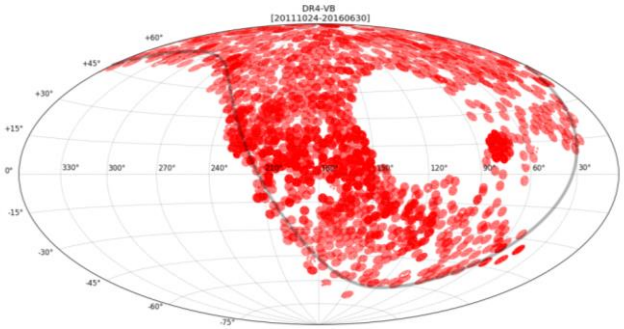


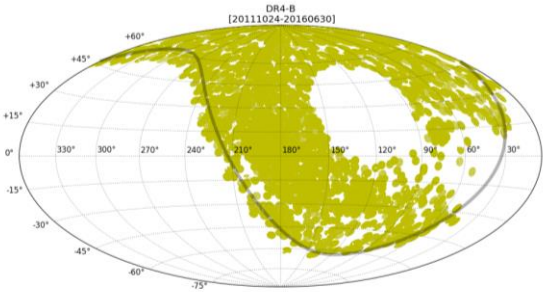
	Pilot	Regular 1st	Regular 2nd	Regular 3rd	Regular 4th
A dead:	83 (2.1%)	140 (3.5%)	166 (4.2%)	233 (5.8%)	228(5.7%)
B very low :	315 (7.9%)	448 (11.2%)	488 (12.2%)	524 (13.1%)	339(8.5%)
C low:	1211 (30.3%)	1202 (30.1%)	424 (10.6%)	489 (12.2%)	457(11.4%)
D high unstable:	21 (0.5%)	1 (0.0%)	81 (2.2%)	86 (2.2%)	113(2.8%)
E high:	2370 (59.3%)	2209 (55.2%)	2841 (71.0%)	2668 (66.7%)	2863(71.6%)

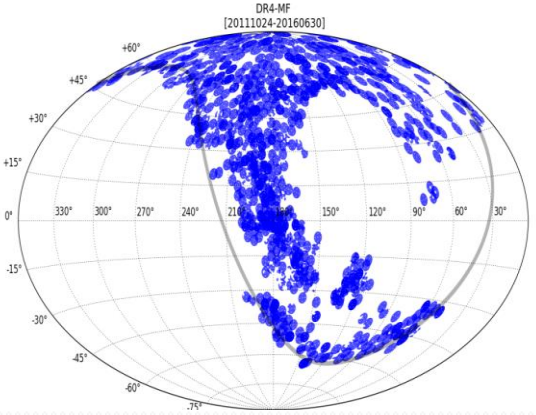
Survey results

	plates	Obs. （h）
Pilot:	**397**	**914**
First year:	**768**	**1278**
Second year:	**697**	**1356**
Third year:	**711**	**1413.5**
Forth year:	**763**	**1456**
Fifth year:	**682**	**1588**

(M:194, B:229, V:259)

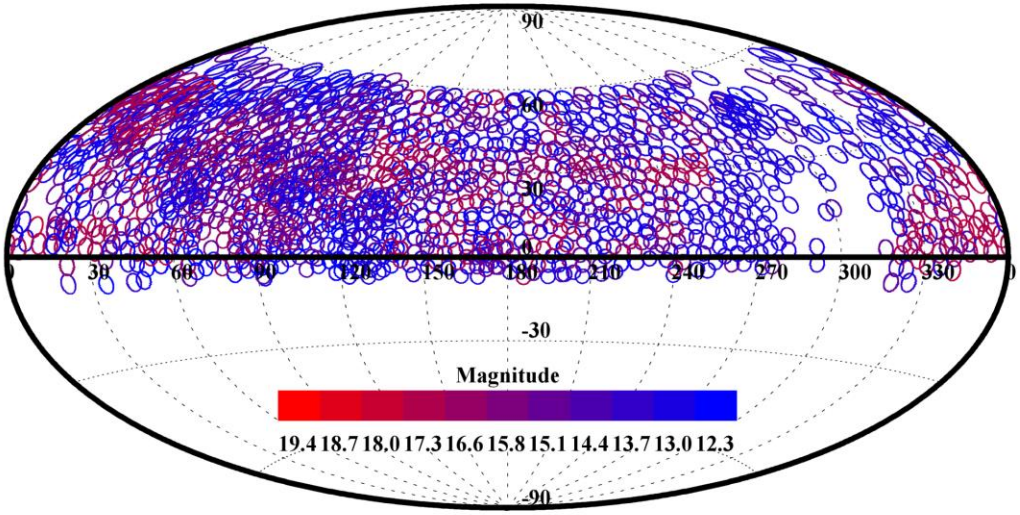


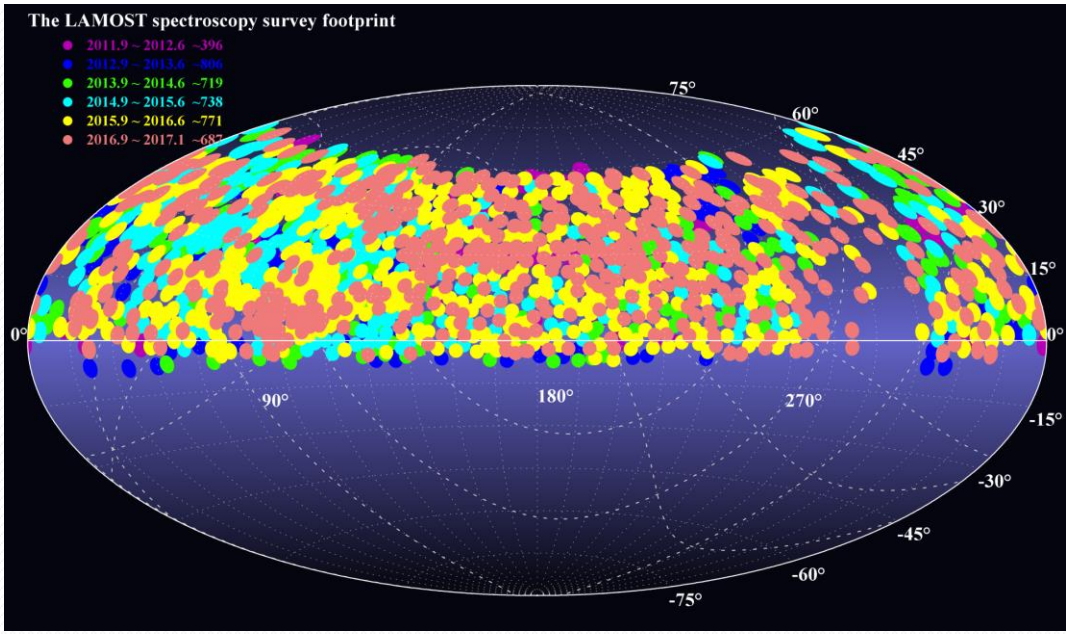




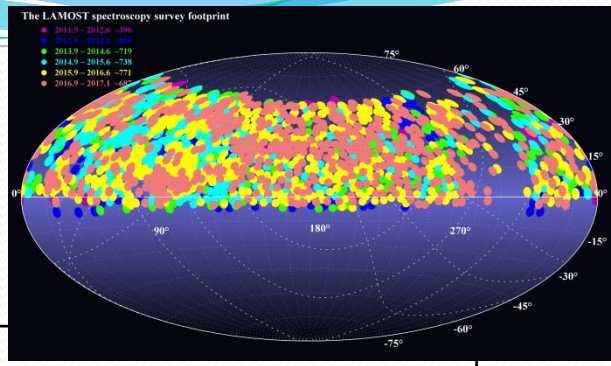
Observed Plates

From Pilot to the end of the first five year survey.





Survey results



- 2011.09-2012.06, Pilot survey
- 2012.09-2017.06, first five survey

DATA	S/N>10	Parameter catalog
DR1	1.74 m	1.06 m
DR2	3.27 m	2.20 m
DR3	4.62 m	3.15 m
DR4	6.07 m	4.20 m
DR5	~7.00 m	~5.00 m

The instrumental fail rate

The instrumental fail rate:

The ratio of the lost time due to the instrumental problem to the observation time

Pilot survey:	**12.5%**
First year:	**5.3%**
Second year:	**4.4%**
Third year:	**1.7%**
Forth year :	**1.5%**
Fifth year:	**3.8%**

Medium-resolution spectra

- **Accuracy： Vr < 1km/s**
- **18 elements abundances: such as Li、C、Na、Mg、Si、Ca、Sc、Ti、V、Cr、Mn、Fe、Co、Ni、Cu，Y、Sm and Nd etc.**
- **4000 fibers**
- **V <15 Mag.**
- **R ~ 7500**

	R～1800	R～7500
Vr	≤ 5km/s	≤1km/s
T_{eff}	200k	100k
Log g	0.2dex	0.1 dex
[Fe/H]	0.2dex	0.1 dex
[α/Fe]	0.2dex	0.1 dex

Wavelength: 4950-5350 & 6300-6800 Å

Medium-resolution spectra

At the beginning of Sep.

bule： 9

spectrograph

Wavelength：

4960-5330Å

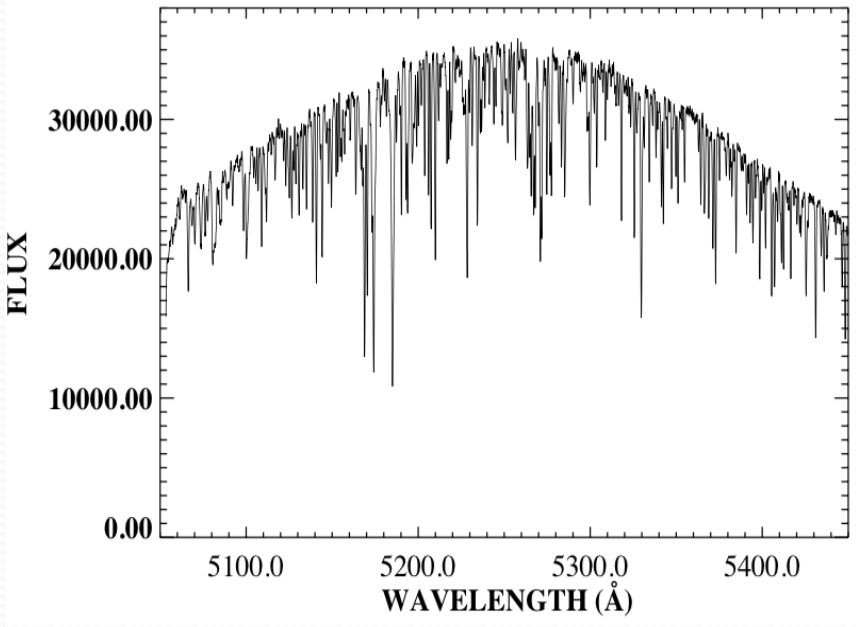
Red：7

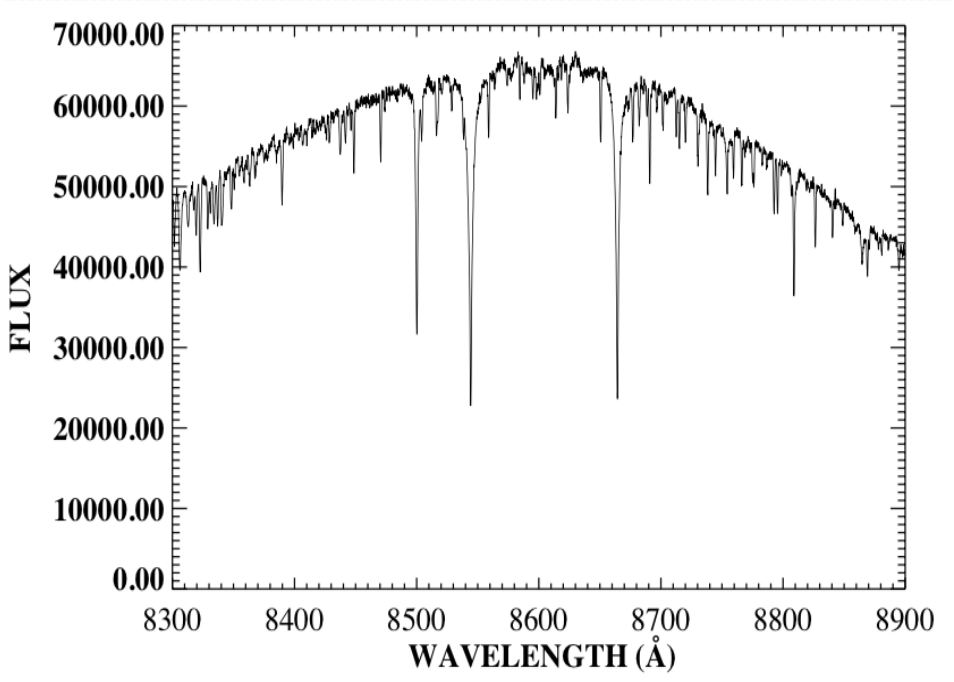
spectrograph

Wavelength：

Medium-resolution spectra

Early test observations:



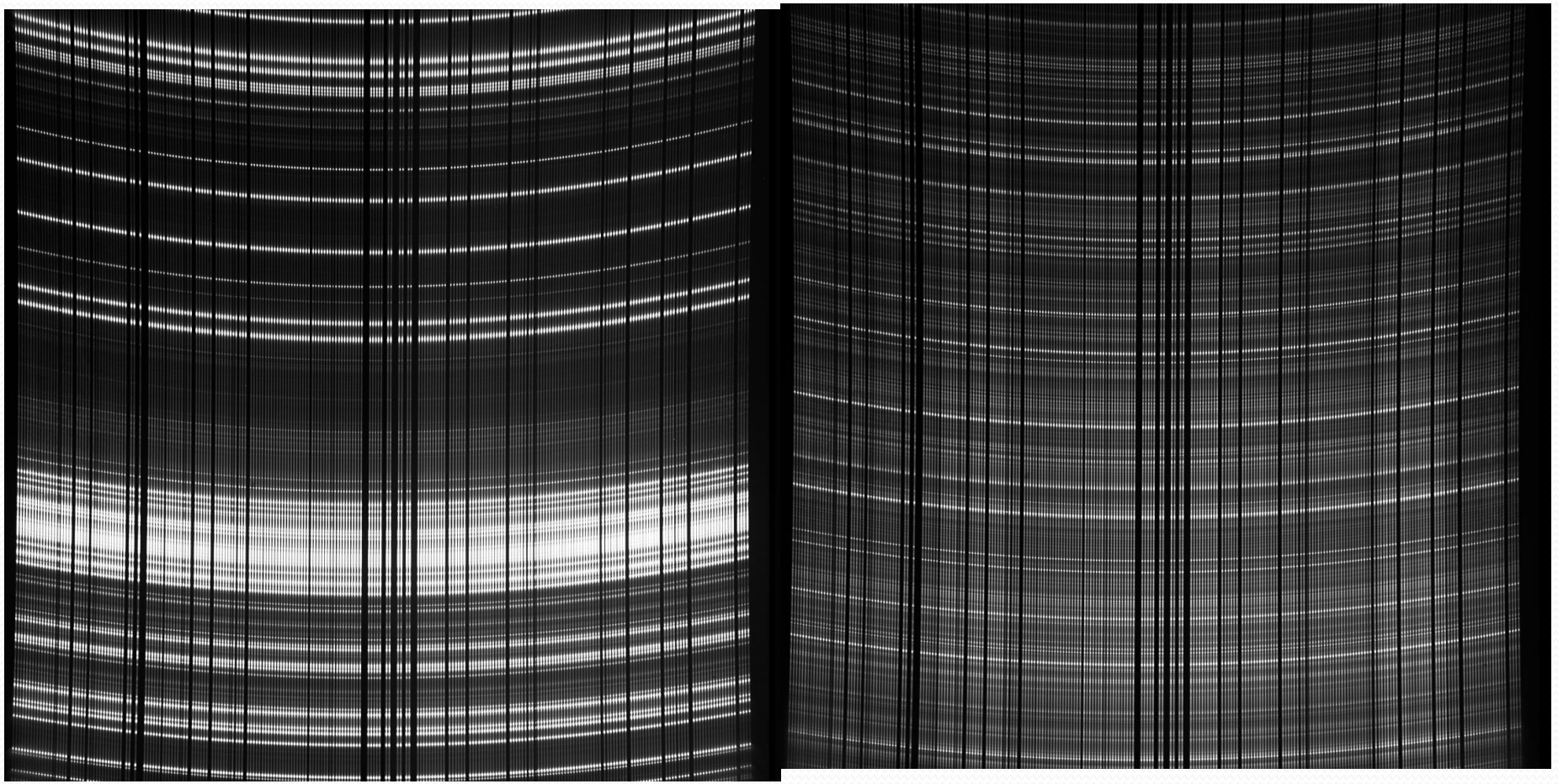


Red: 8300-8900 Å

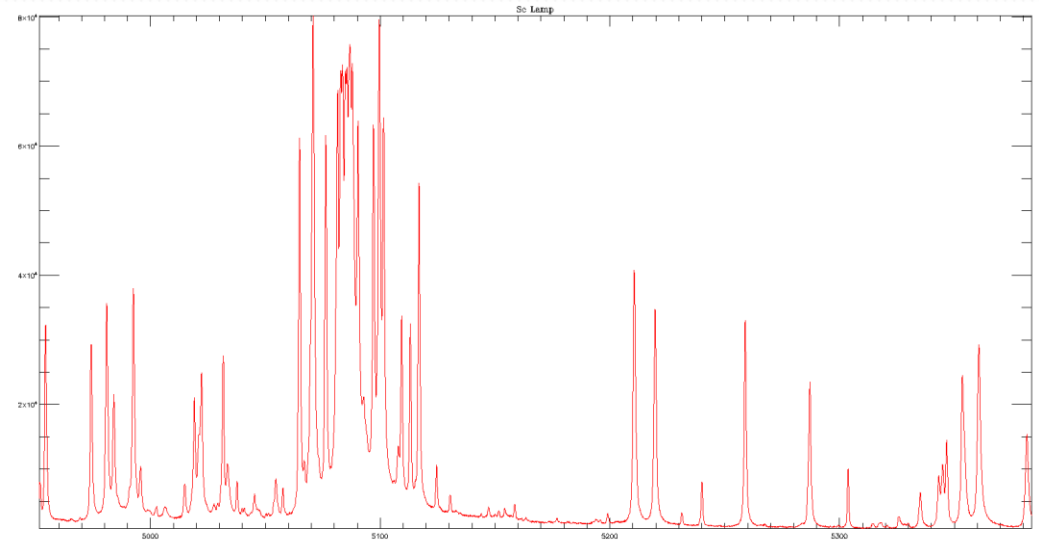
Medium-resolution spectra

Recent test observations (May and June):

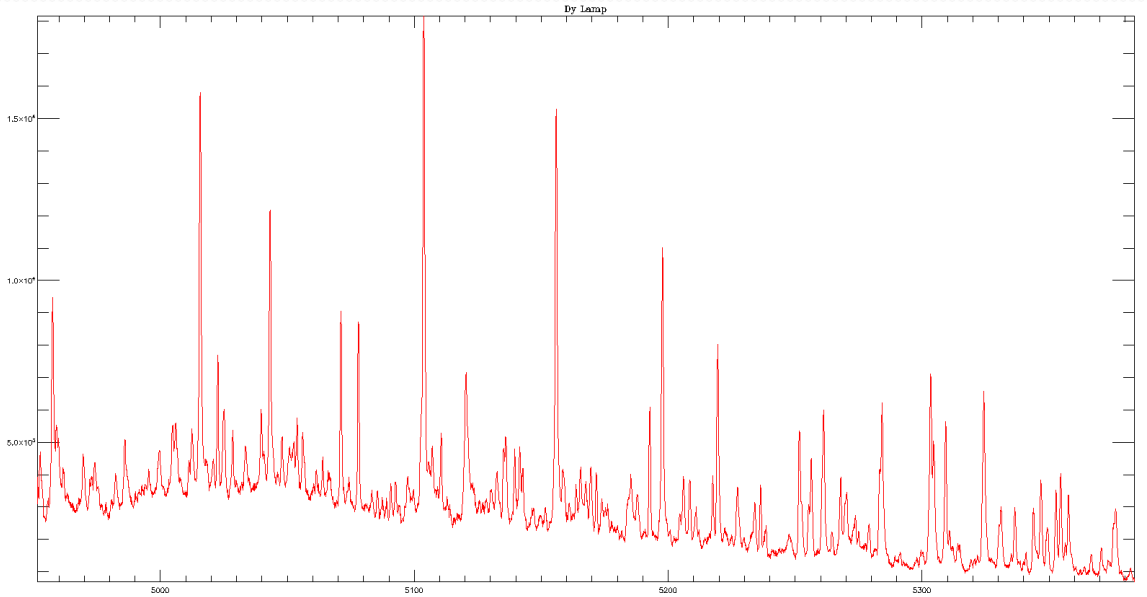
Blue lamp



Medium-resolution spectra



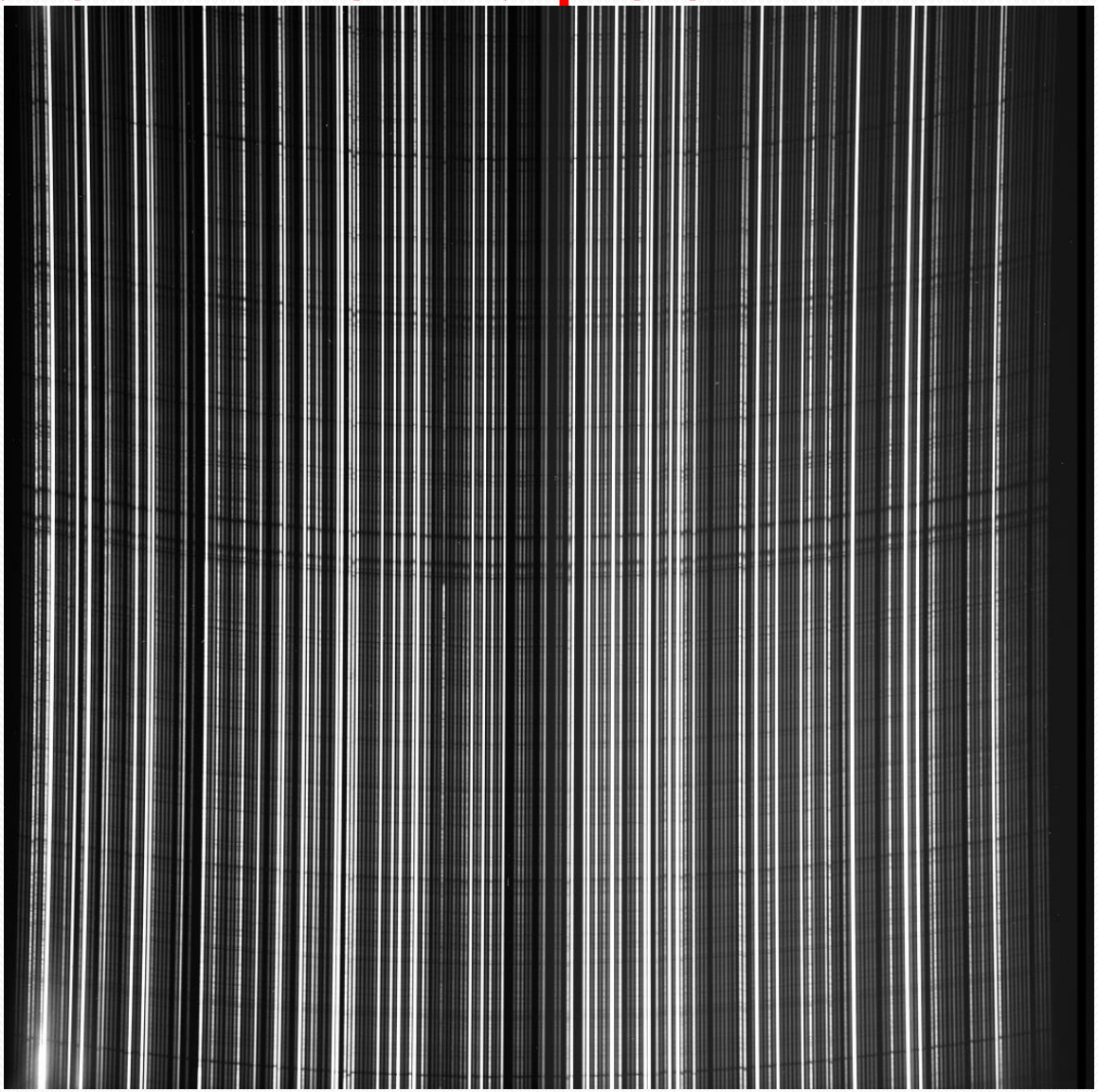
The Sc and Dy lamp spectra



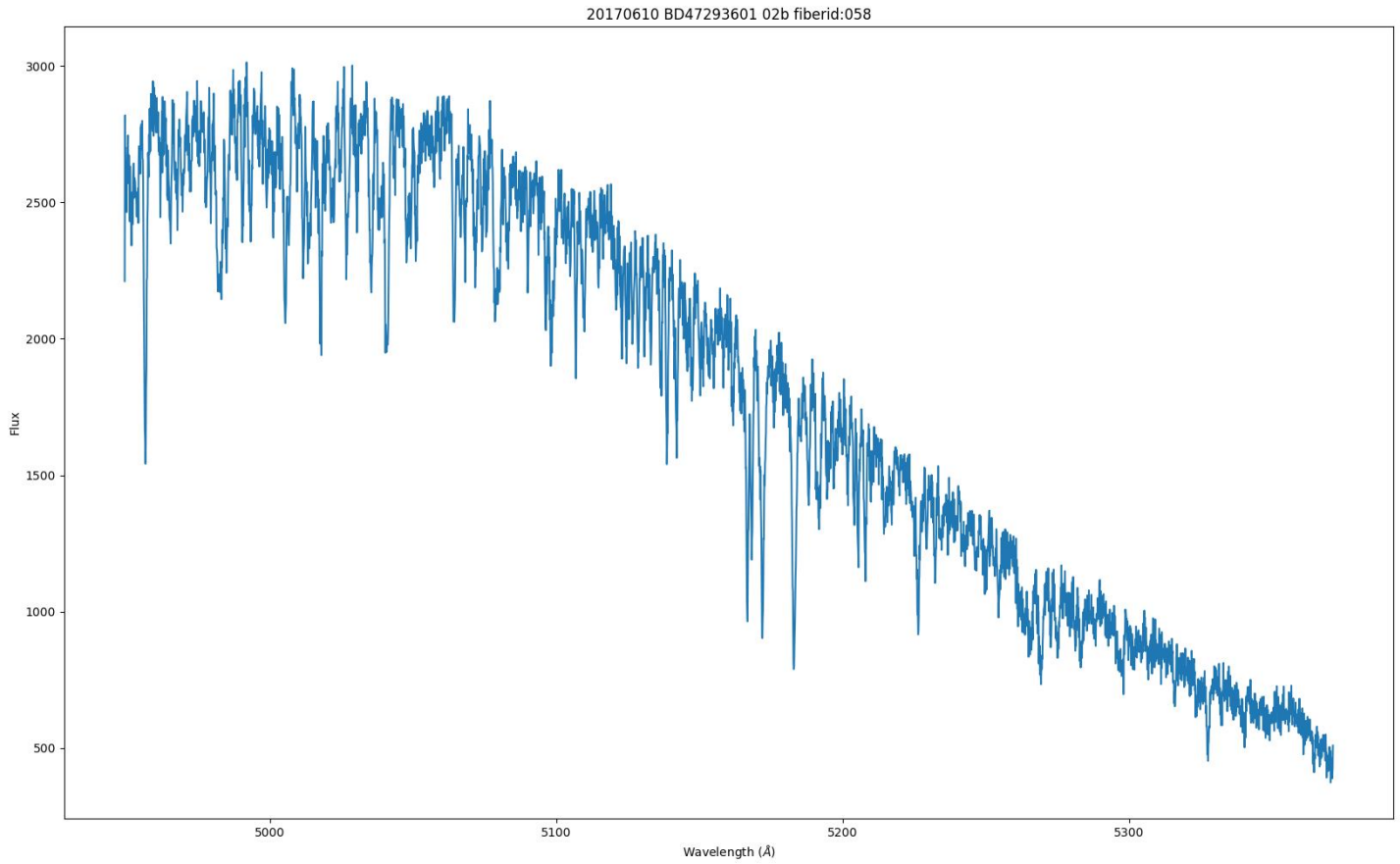
Medium-resolution spectra

The image of observed spectra

4960-5350Å

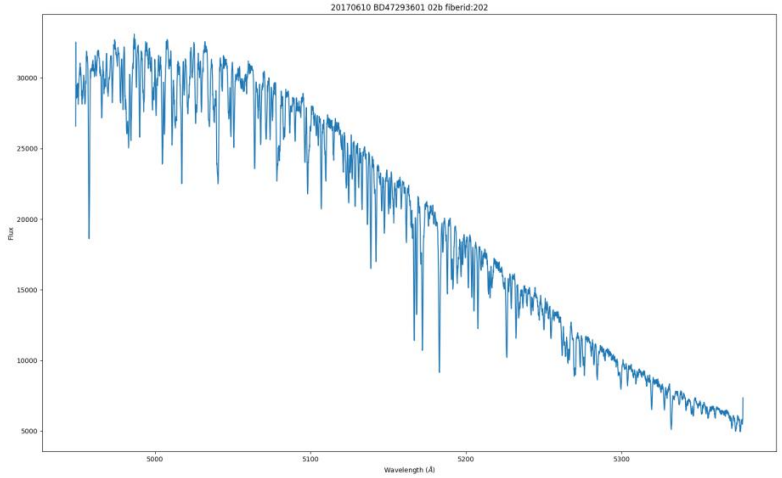


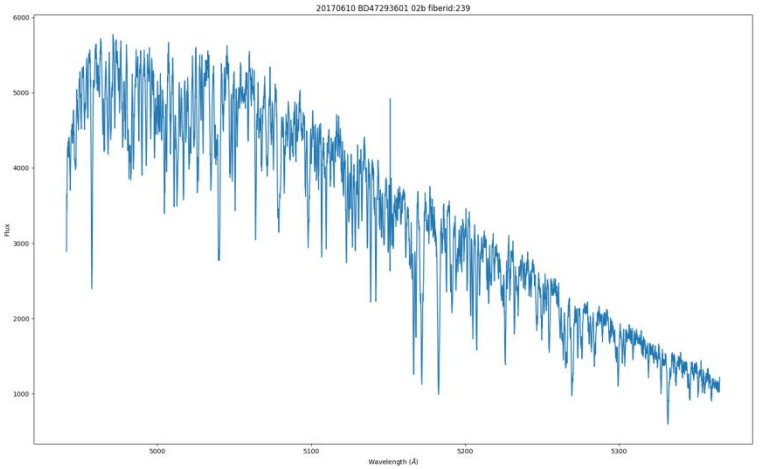
Medium-resolution

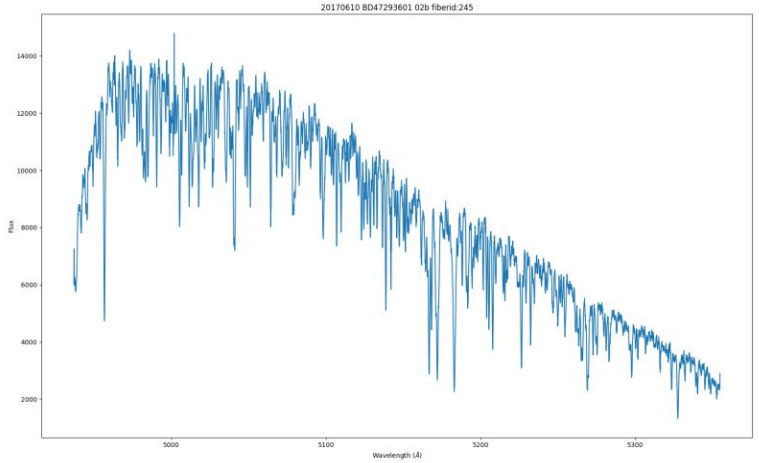


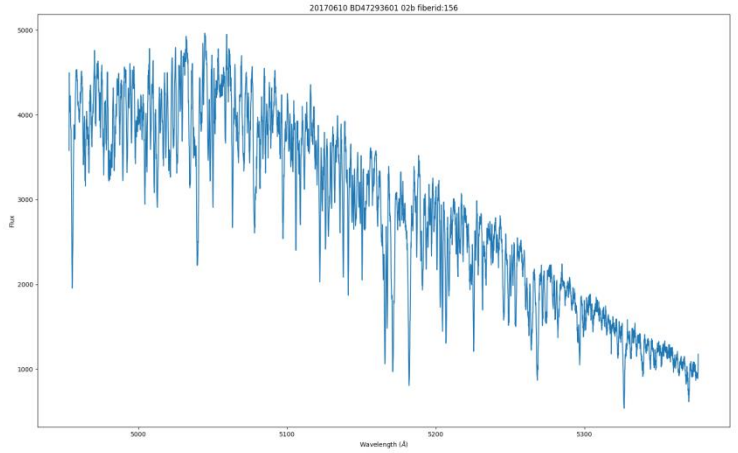
Spectrum: blue 4960-5350Å

Medium-resolution spectra







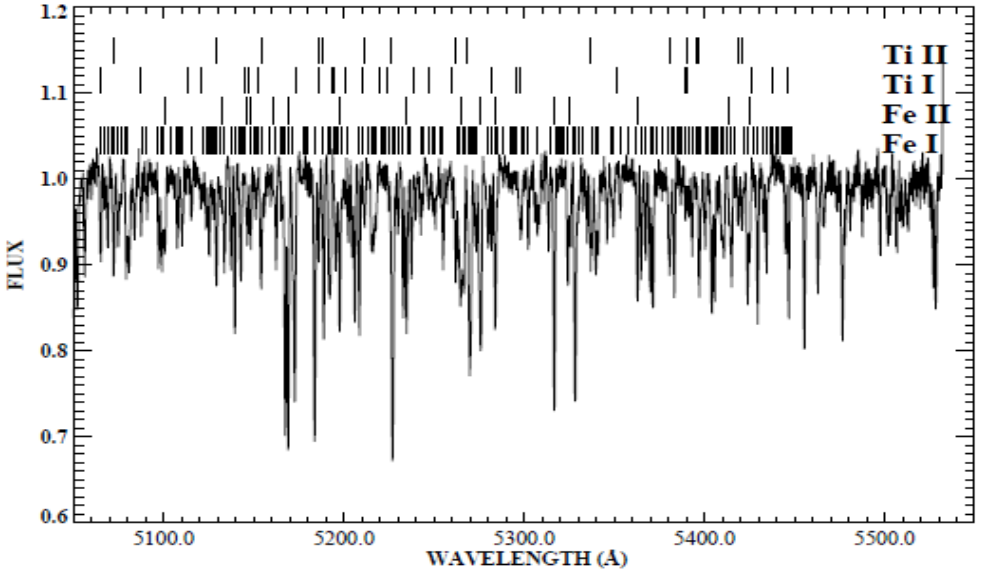


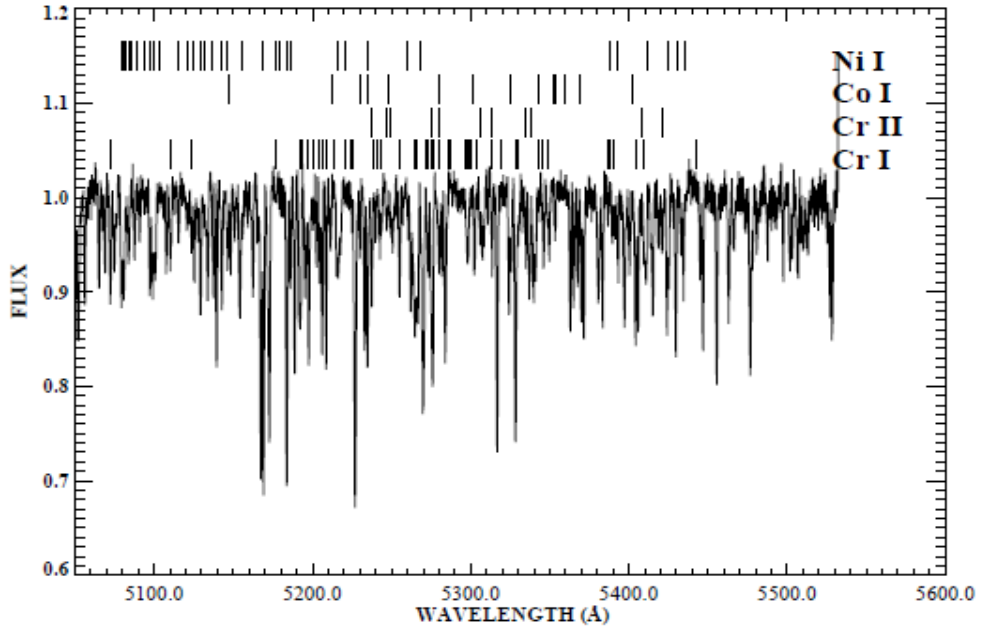
Medium-resolution spectra

- Blue region

  more metal lines, thus Vr < 1km/s

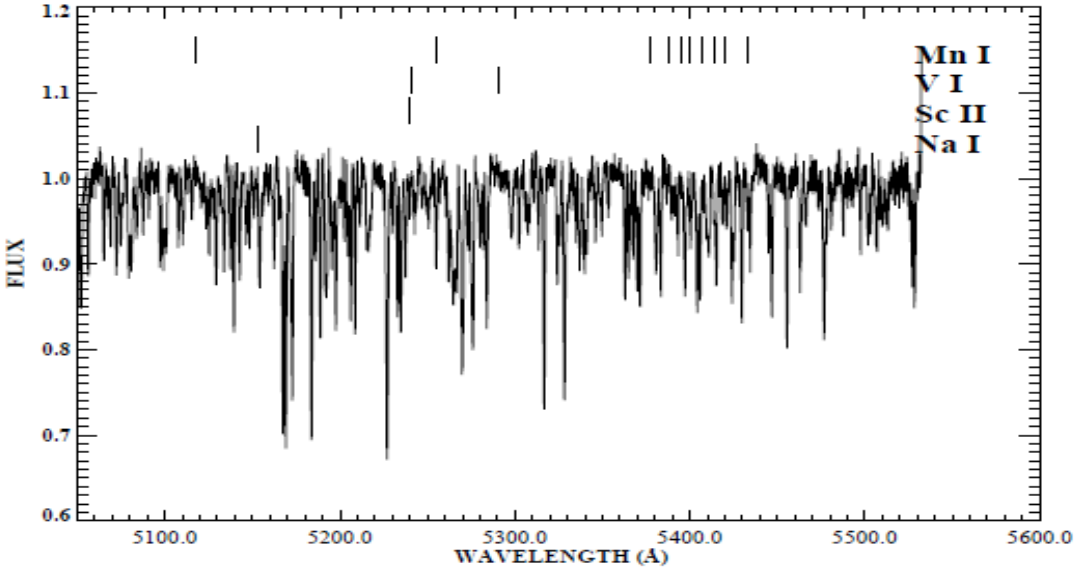
- Element abundances: C, Na, Mg, Si, Ca, Sc, Ti, V, Cr, Mn, Fe, Co, Ni, Cu, Y, Sm and Nd etc , while Li for the red region (17

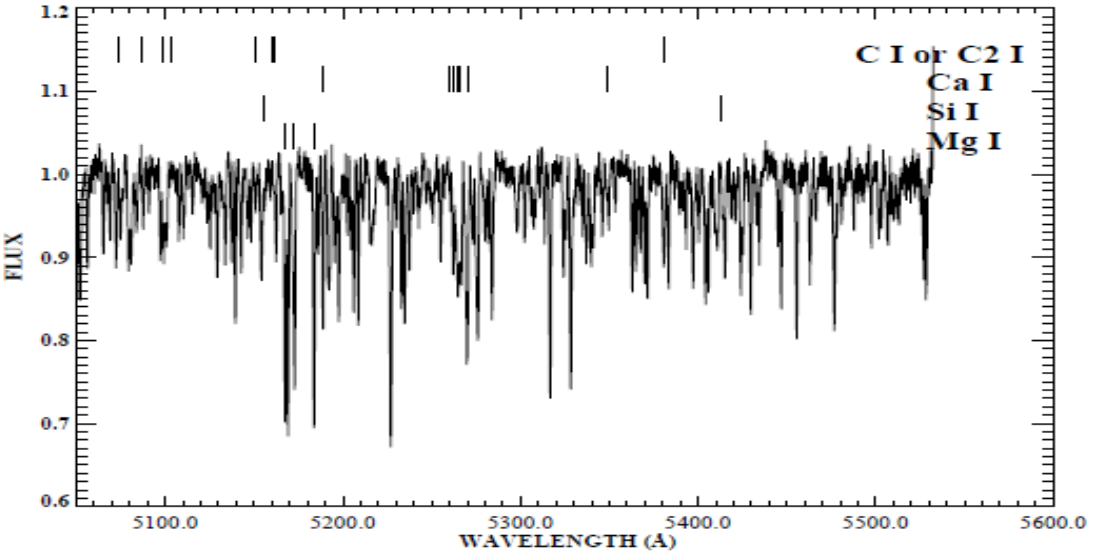




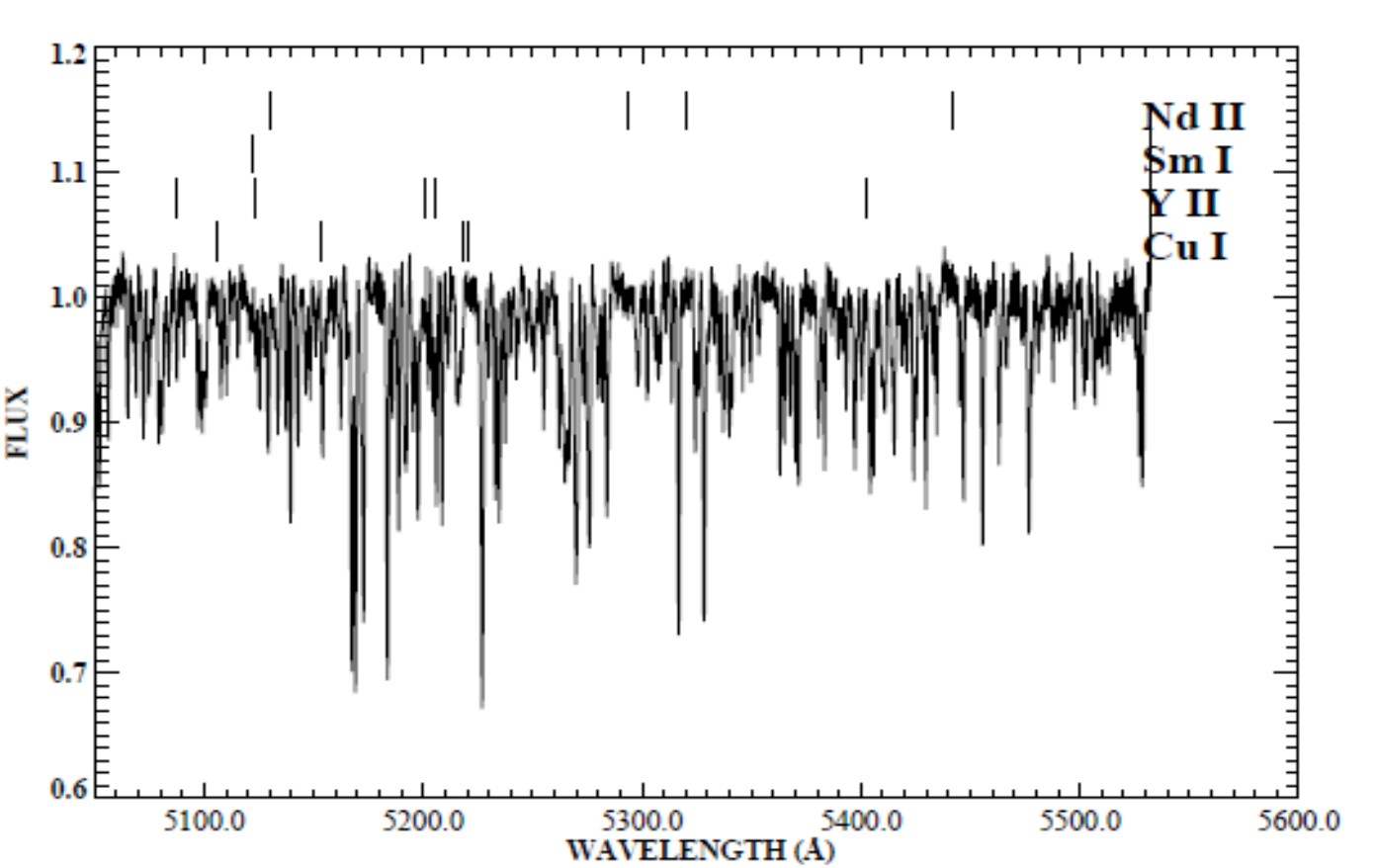
Medium-resolution spectra

For objects of V < 15 Mag. S/N > 20 for an exposure of 30m.





Medium-resolution spectra



For K giants high S/N spectra can be derived

Discussions

- **Observation preparation ： 30m**
- **Selection of plates： VB, B, M and F**
- **First five year survey: 7.0M (S/N >10)**
- **Medium resolution spectra**

Test observation from Sep. 2017 – June 2018

and begin the survey from Sep. 2018

Thank You !