

SEDM Performance and DRP

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Facility instrument on P60



Current performance

- Averaging 1.84 classifications per exposure hour
- New MLA (2018 June 19)
 - Gross throughput similar with new MLA, however:
 - Scattered light greatly reduced
 - Old MLA throughput was artificially boosted by scattered light
- Nearly Doubled Observing Efficiency
 - OLD: ~ 9 objects a night
 - NEW: ~ 16 objects a night with good classifications
 - 20 classified objects current record (20181229: 28 targets, 4 STDs)
 - Single exposure instead of A/B pair needed for scattered light
 - Shorter exposure times
- Fainter limiting magnitude
 - OLD: 18.5
 - NEW: 19.5

Report generated Sat Dec 29 08:48:59 2018

UTStart	Object	Exptime	Air	method	Allocation	Type	Subtype	z	Rlap
1:48:22	STD-GD248	120	1.082	auto_robot_lstep1	2018A-calib	STD			
1:53:19	ZTF18aczbkqp	1200	1.199	auto_robot_lstep1	2018A-BCS	Gal	-	0.0108	11.63
2:15:58	ZTF18acsxkov	2250	1.297	auto_robot_lstep1	2018A-RCF	QUALITY_5			
2:55:22	ZTF18acyocrv	1200	1.556	auto_robot_lstep1	2018A-BCS	la	91bg	0.024	6.26
3:18:08	ZTF18aczqtpt	1200	1.075	auto_robot_lstep1	2018A-BCS	NONE			
3:40:26	ZTF18acszyr	2250	1.257	auto_robot_lstep1	2018A-InfantSNe	QUALITY_5			
4:20:02	ZTF18adaimlf	2250	1.034	auto_robot_lstep1	2018A-BCS	la	norm	0.736	6.1
5:00:03	SN2018hti	1200	1.075	auto_robot_lstep1	2018A-SLSN	lc	norm	0.0552	5.82
5:43:13	STD-LB227	120	1.043	auto_robot_lstep1	2018A-calib	STD			
5:49:22	STD-LB227	120	1.045	auto_robot_lstep1	2018A-calib	STD			
5:56:21	STD-LB227	120	1.048	auto_robot_lstep1	2018A-calib	STD			
6:01:09	ZTF18adazblo	2250	1.979	auto_robot_lstep1	2018A-StrippedSNe	lc	broad	0.6043	5.52
6:40:23	ZTF18aczcumi	2250	1.655	auto_robot_lstep1	2018A-BCS	llb	-	0.0347	7.57
7:19:33	ZTF18aaflicyp	2250	1.381	auto_robot_lstep1	2018A-BCS	Gal	-	0.0279	17.99
7:59:44	ZTF18acwwowy	1200	1.823	auto_robot_lstep1	2018A-BCS	la	norm	0.0515	11.6
8:22:29	ZTF18aczdtgn	2250	1.641	auto_robot_lstep1	2018A-BCS	la	91T	0.0685	6.45
9:02:39	ZTF18acybdar	1200	1.515	auto_robot_lstep1	2018A-BCS	la	norm	0.0713	9.56
9:25:01	ZTF18acyyefr	2250	2.2	auto_robot_lstep1	2018A-BCS	Gal	-	0.0194	7.04
10:06:12	ZTF18acwwonp	1200	1.61	auto_robot_lstep1	2018A-BCS	la	norm	0.0303	19.67
10:28:14	ZTF18abwlpuf	2250	1.862	auto_robot_lstep1	2018A-BCS	NONE			
11:08:03	ZTF18acyctqi	2250	1.625	auto_robot_lstep1	2018A-BCS	IIP	-	0.0409	4.72
11:08:03	ZTF18acyctqi	2250	1.625	auto_redo084412_lstep1	2018A-BCS	la	norm	0.0789	9.77
11:47:31	ZTF18adalgmc	2250	1.887	auto_robot_lstep1	2018A-RCF	la	norm	0.0365	14.76
12:27:08	ZTF18aczemzj	1200	1.693	auto_robot_lstep1	2018A-BCS	la	norm	0.0615	13.99
12:49:08	ZTF18acustza	2250	1.892	auto_robot_lstep1	2018A-RCF	la	norm	0.7914	6.25
12:49:08	ZTF18acustza	2250	1.892	auto_redo084636_lstep1	2018A-RCF	IIP	-	0.0479	7.52
13:28:57	ZTF18acvilwk	1200	1.727	auto_robot_lstep1	2018A-BCS	la	91bg	0.6526	6.38
13:51:24	ZTF18acwyvet	1200	1.467	auto_robot_lstep1	2018A-BCS	Gal	-	0.1625	4.83

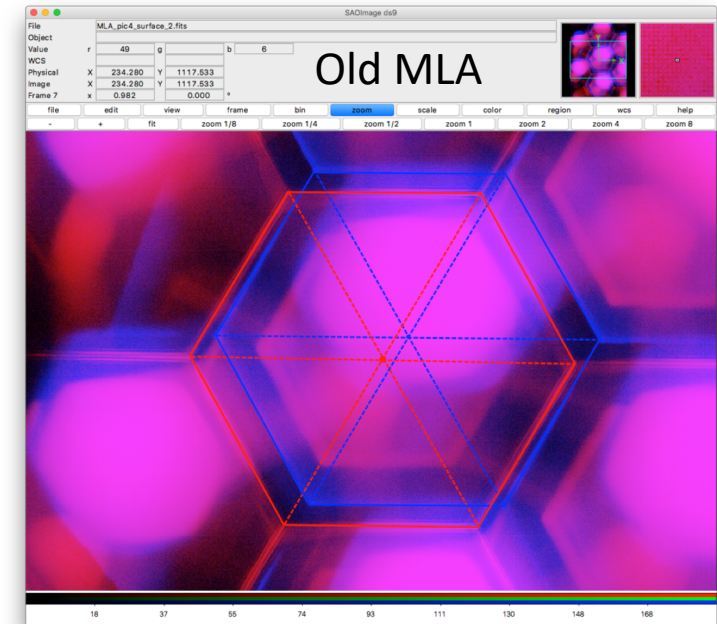
- 20 Redshifts
- 20 Classifications
- 4 STD Stars
- 28 Observations

Current performance

- Fully Automated Pipeline
 - Uses RCAM images to solve IFU WCS
 - PSF-fitting spectrophotometry
 - DAR compensation
 - Real-time uploads to marshal
 - M. Rigault, J. D. Neill, et al. 2019 in prep
- Reliability
 - Airmass limit ≤ 1.8
 - Hardware Enhancements in progress to remove limit

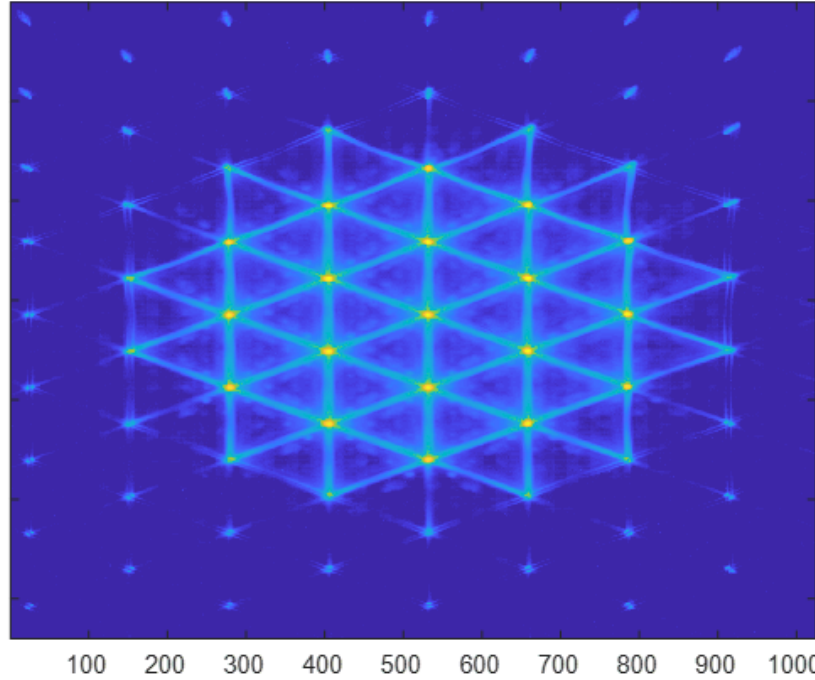
Jenoptic Micro Lens Array (MLA)

- Plano-convex design
 - Removes alignment problems between bi-convex lenslets
- Masked lenslet edges to control scattered light

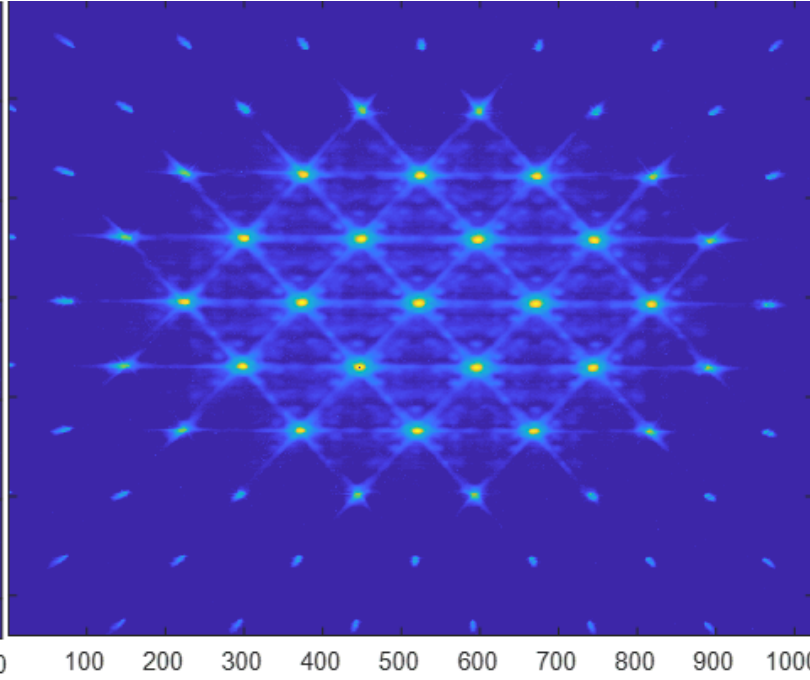


Compare Normalized Image of micro-pupils (log scale)

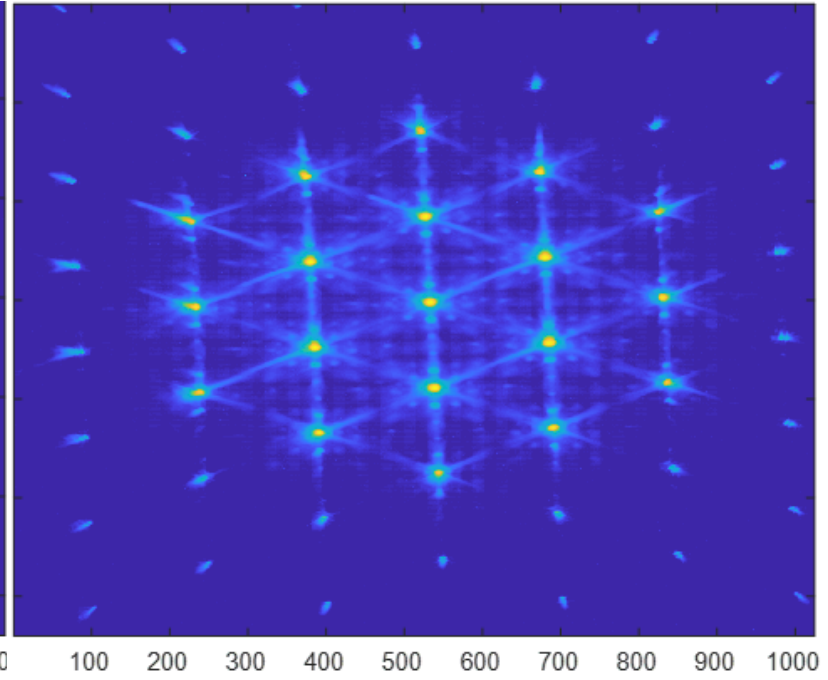
Original MLA



Jenoptic A (520)



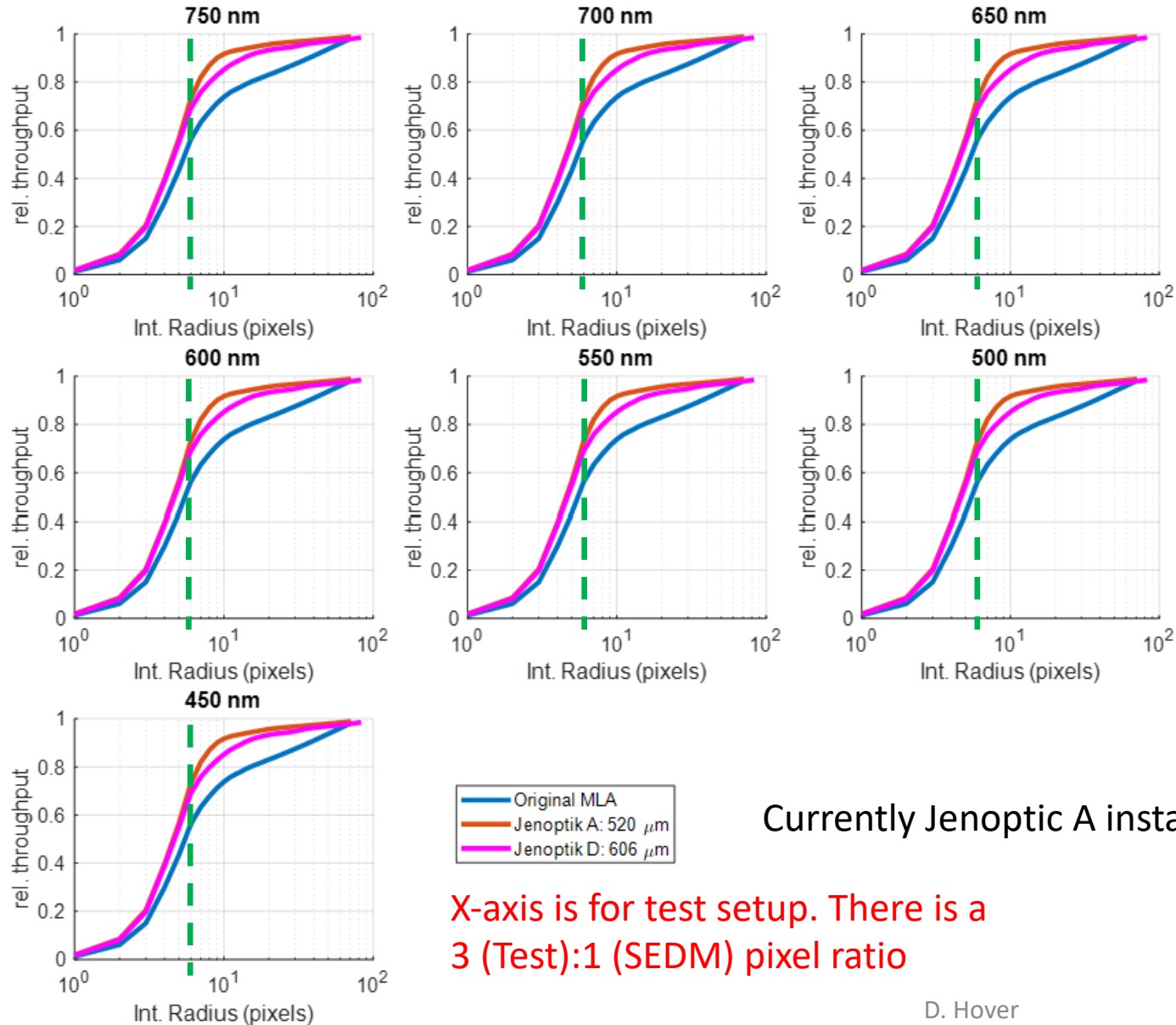
Jenoptic D (606)



New MLAs have less power in the “wings”.
Masking cuts throughput but controls light better.

Installed Jenoptic A

Relative Throughput vs Integration Radius



Green dashes indicate current DRP extraction radius

- Integrate detector counts on all centroids, normalized by all detector counts
- New MLAs have shallower diffraction tail (greater than 10 pixels)

Currently Jenoptik A installed

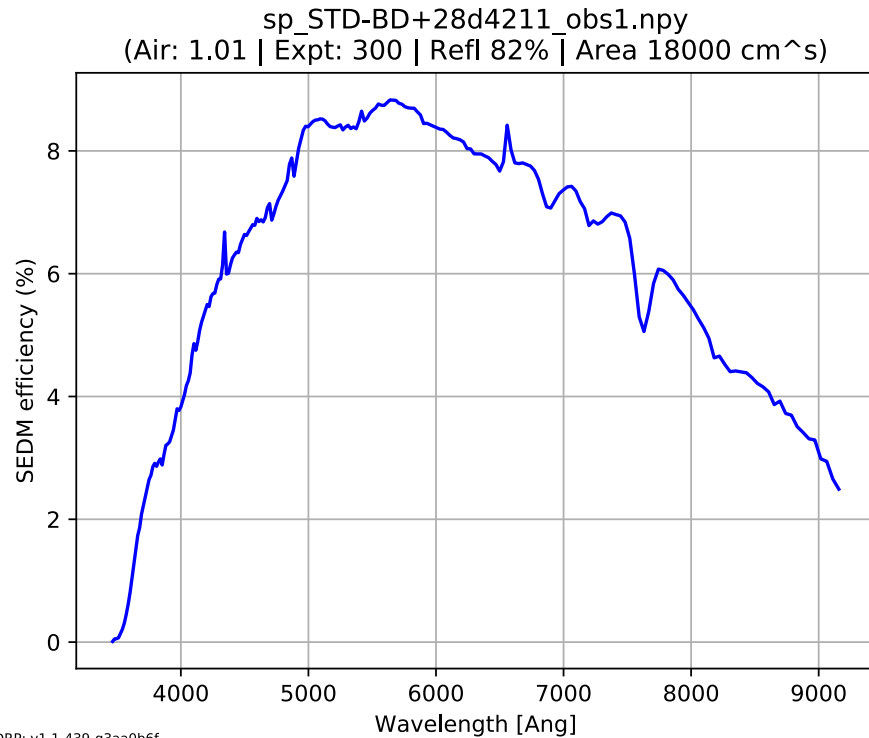
X-axis is for test setup. There is a 3 (Test):1 (SEDM) pixel ratio

Gross Throughput

Measured for each Standard Star!!

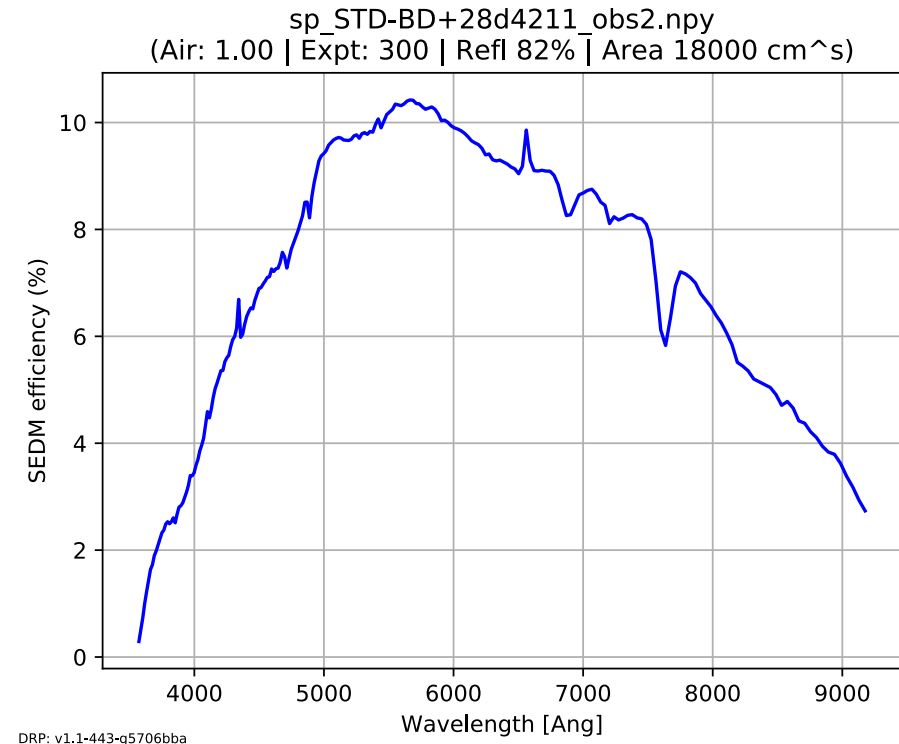
Before new MLA

20180617 BD+28d4211

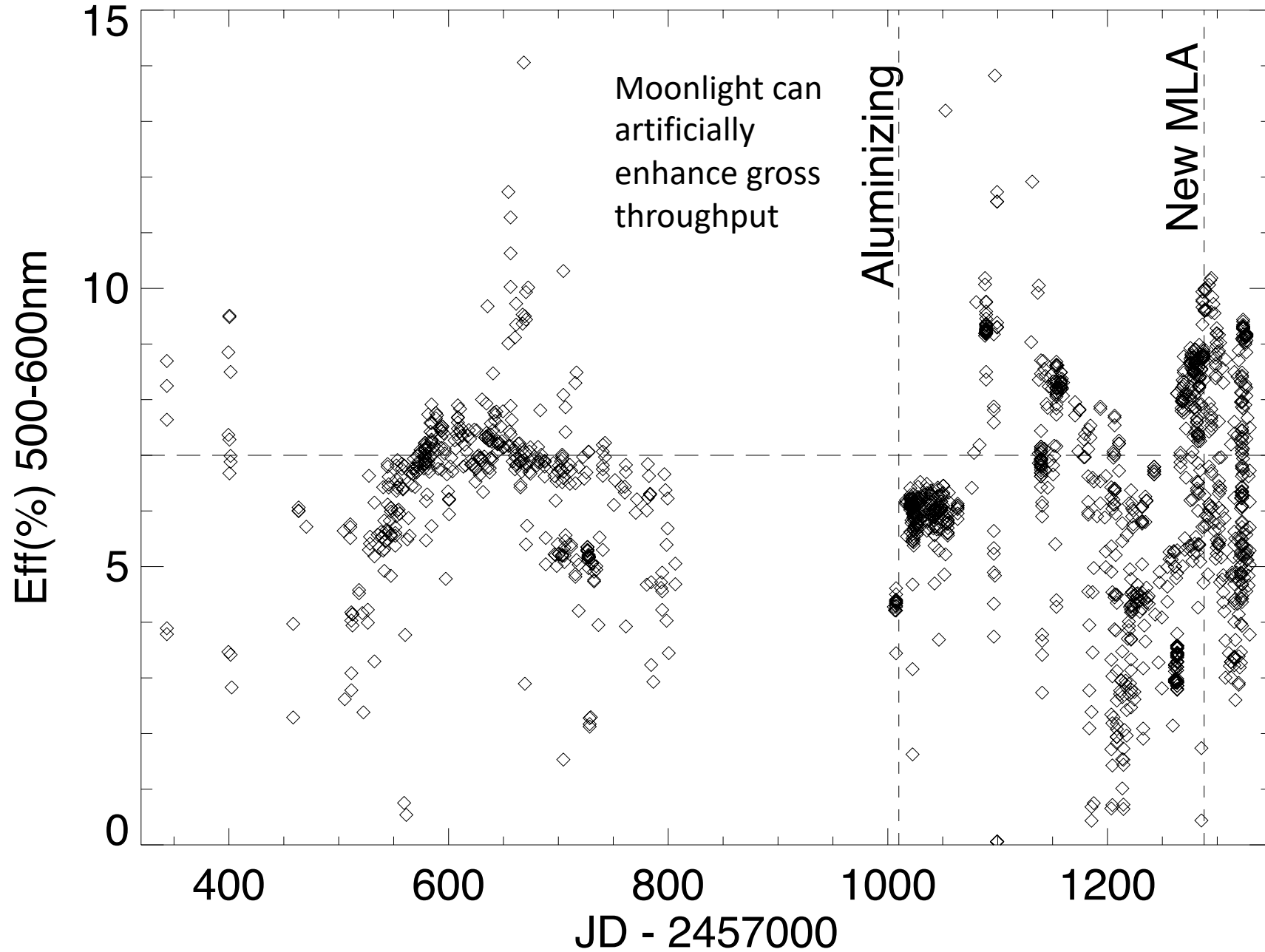


After new MLA

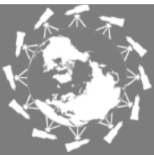
20180619 BD+28d4211



SEDM Instrument



Jenoptic A
Installed on
2018 June 19



ZTF18aaxwjmp SN Ia

16:51:37.37 +61:32:43.3
252.905708 +61.545373

[View another](#)

OVERVIEW

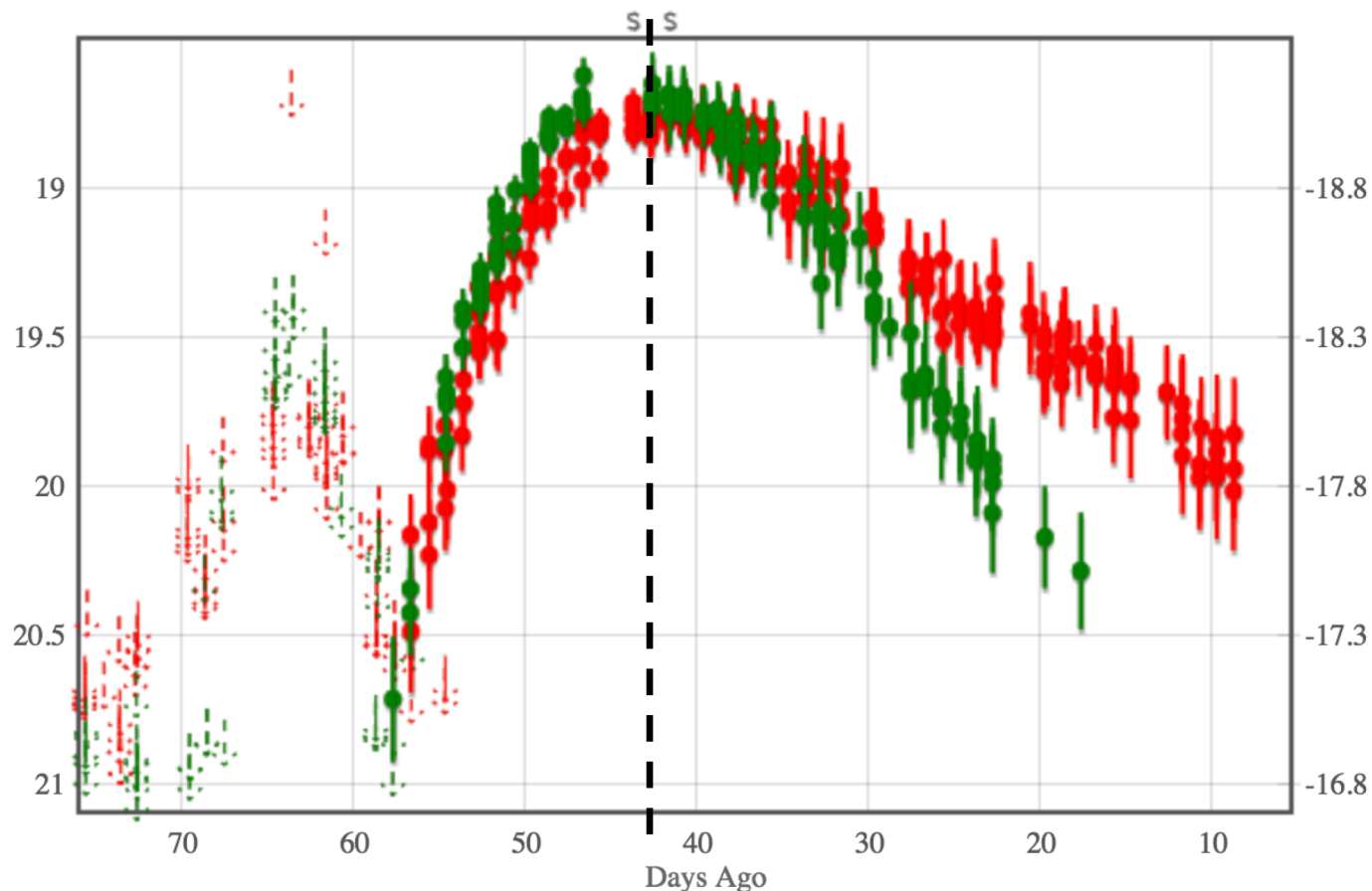
PHOTOMETRY

SPECTROSCOPY

OBSERVABILITY

EXAMINE  

New M_A installed



Zoom Full

Auto Zoom

Select All

Clear Selection

P48 g-band (None)

P48 r-band (None)

Update P48 Data

Export Light Curve

PTFIDE Photometry

[PTFIDE Photometry Queue \(user = PTF, password = palomar\)](#)

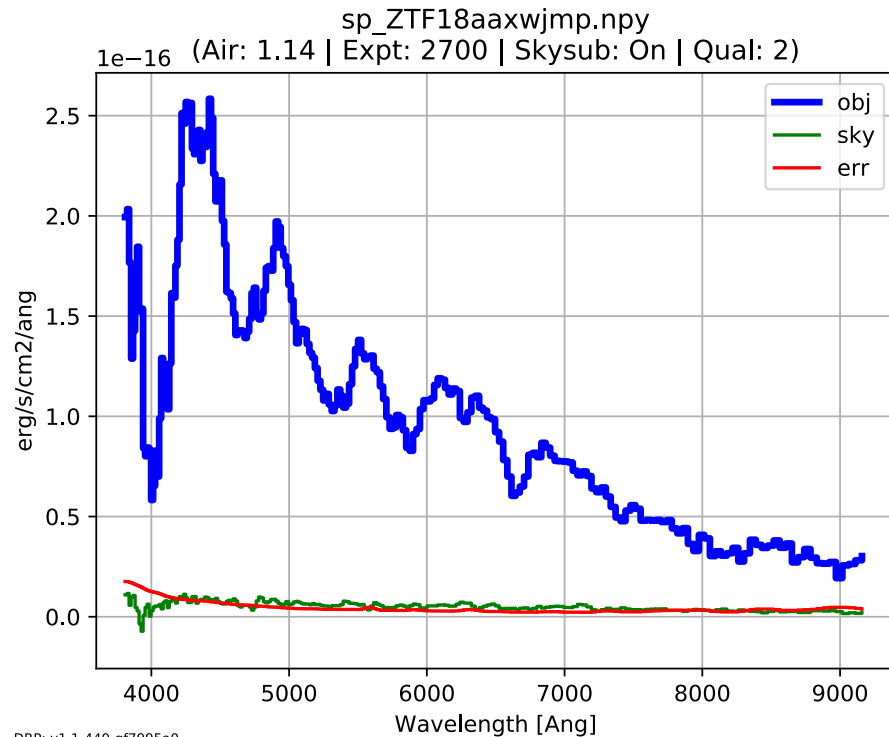
[PTFIDE Photometry Documentation](#)

Fit SN Ia Light Curve

MLA Upgrade Performance

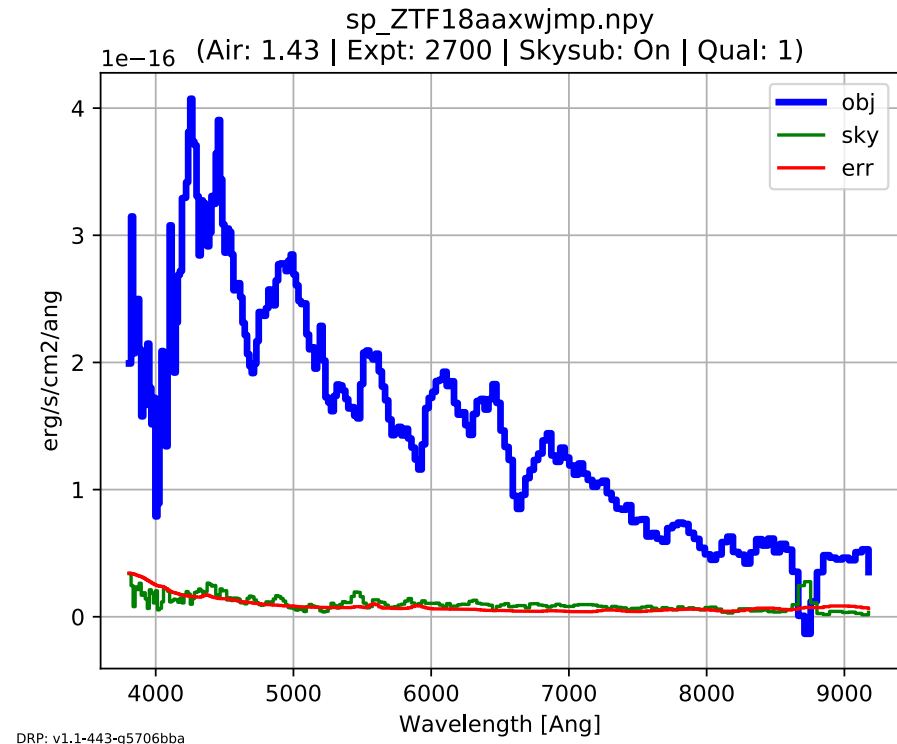
Old MLA: 2018 June 18

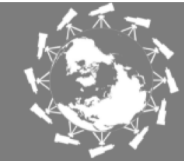
A/B pair 18.7 g mag 2700s



New MLA: 2018 June 20

A/B pair 18.7 g mag 2700s





ZTF18aaytovs SN Ia 91T-like

17:45:53.40 +31:42:38.0
266.472504 +31.710562

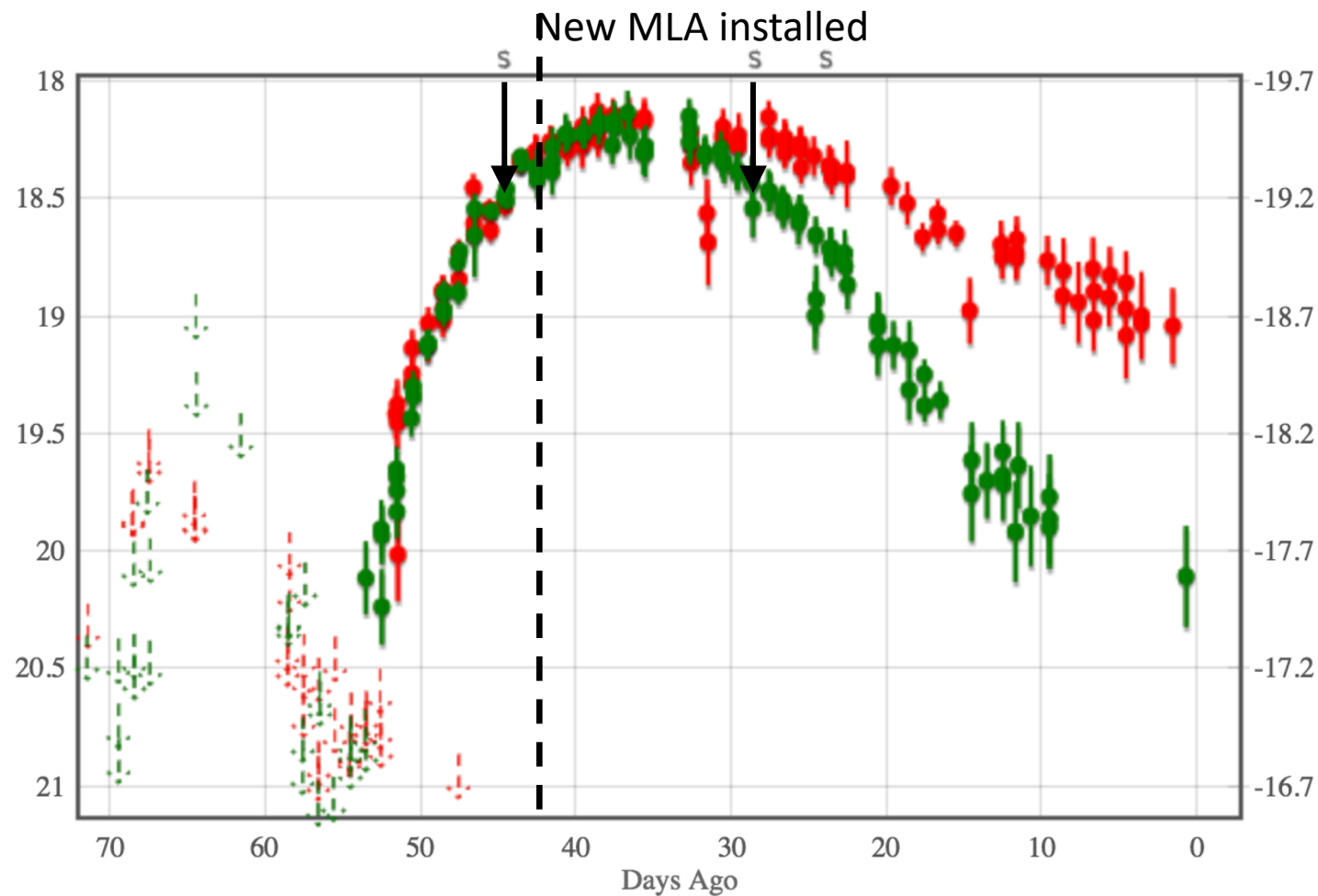
OVERVIEW

PHOTOMETRY

SPECTROSCOPY

OBSERVABILITY

EXAMINE  



Zoom Full

Auto Zoom

Select All

Clear Selection

P48 g-band (None)

P48 r-band (None)

Update P48 Data

Export Light Curve

PTFIDE Photometry

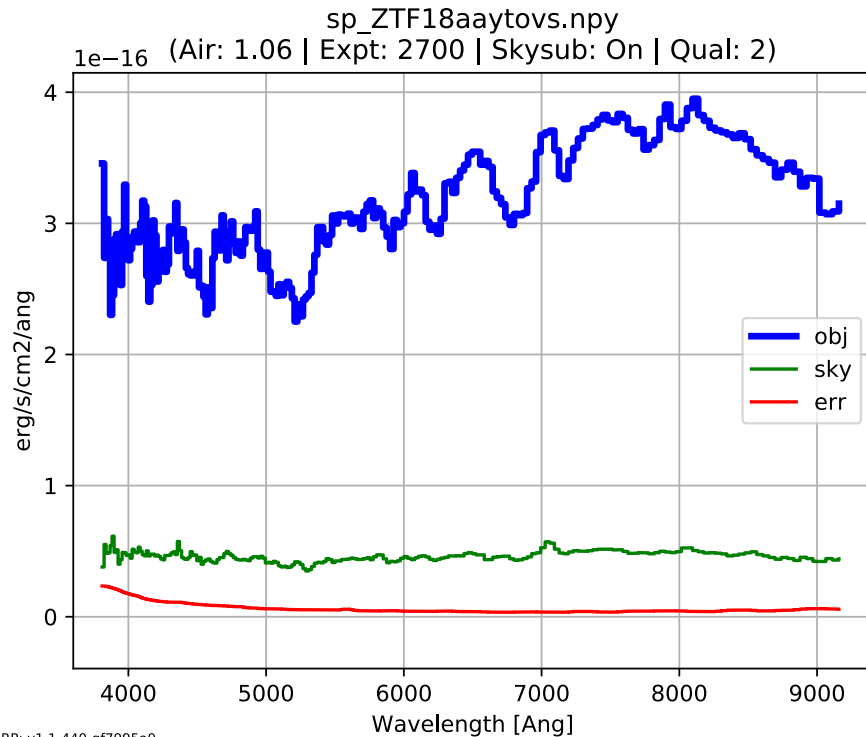
[PTFIDE Photometry Queue \(user = PTF, password = palomar\)](#)

[PTFIDE Photometry Documentation](#)

Fit SN Ia Light Curve

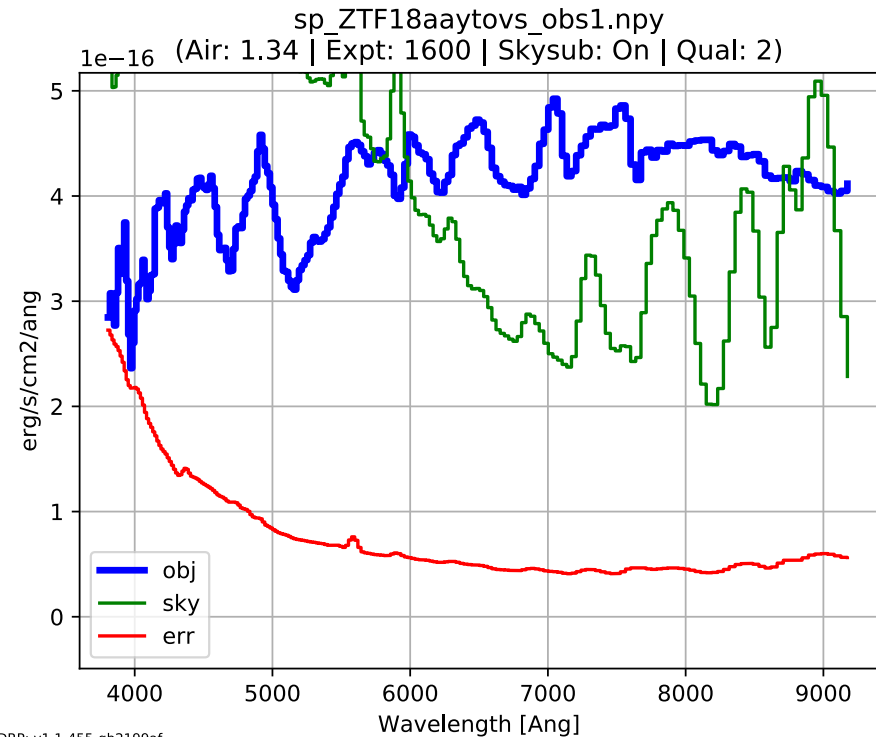
MLA Upgrade Performance

Old MLA: 2018 June 17
A/B pair 18.5 g mag 2700s



DRP: v1.1-440-gf7995a0

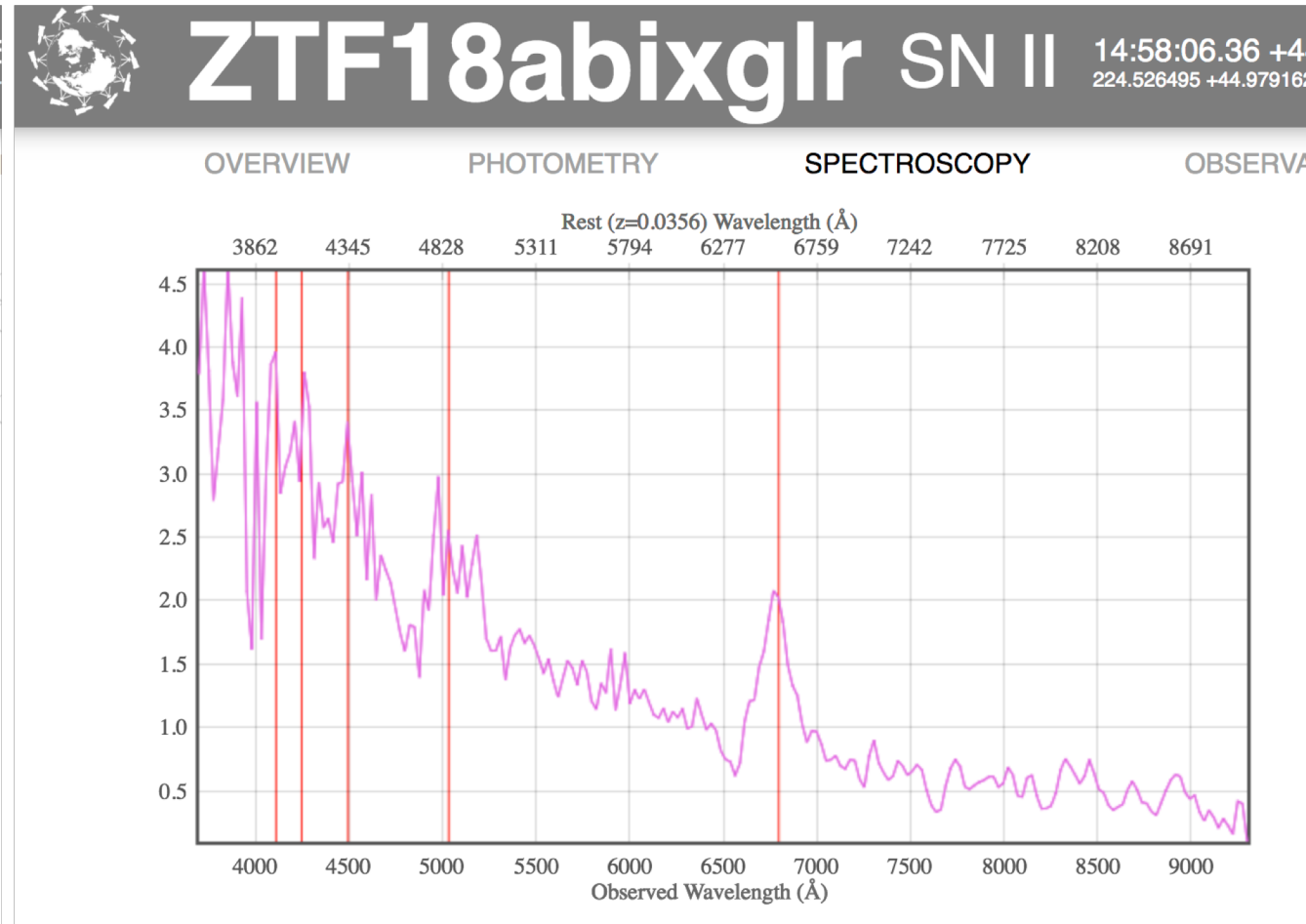
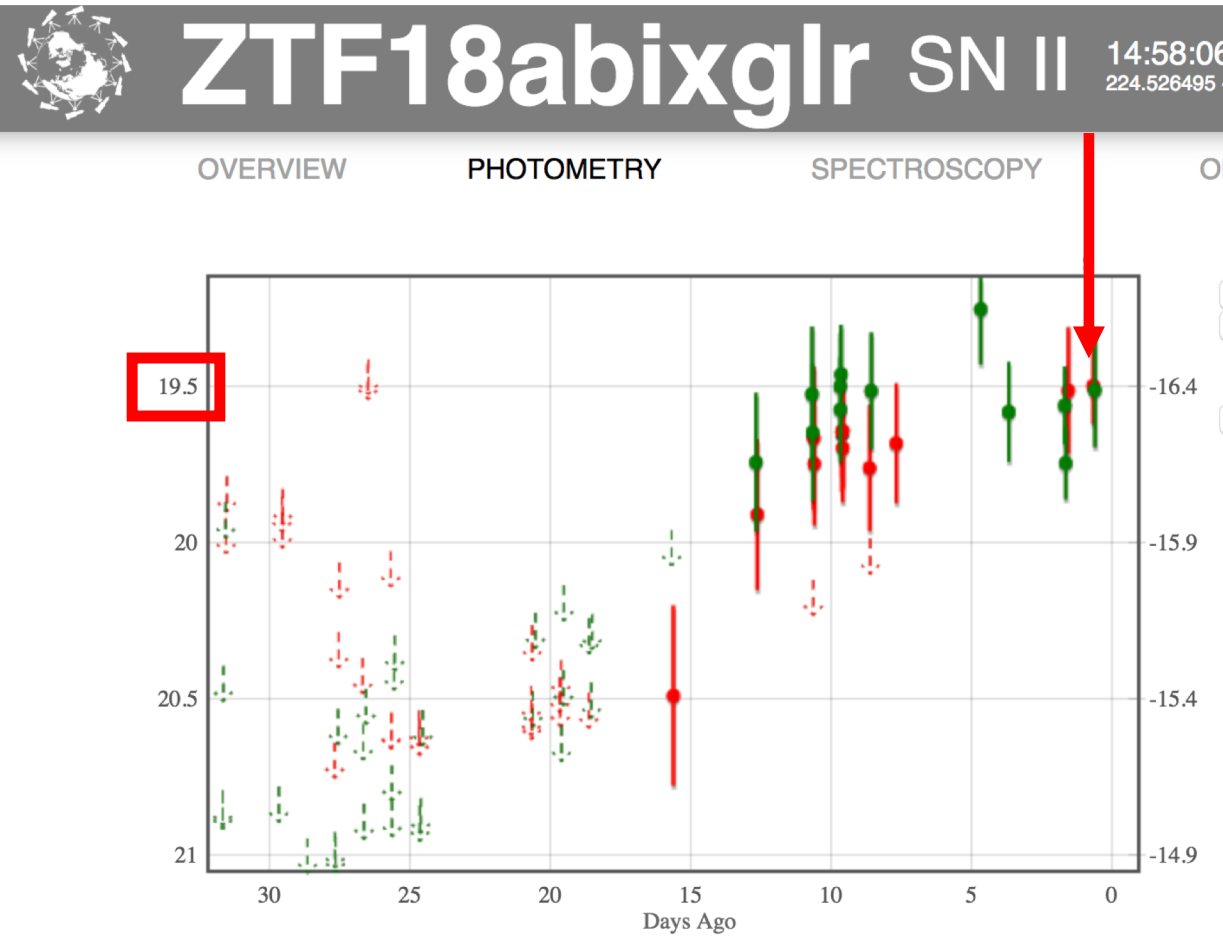
New MLA: 2018 July 03
Single 18.5 g mag 1600s



DRP: v1.1-455-gb2199af

Pushing fainter: ZTF18abixglr at 2430s

(instead of 2700s)

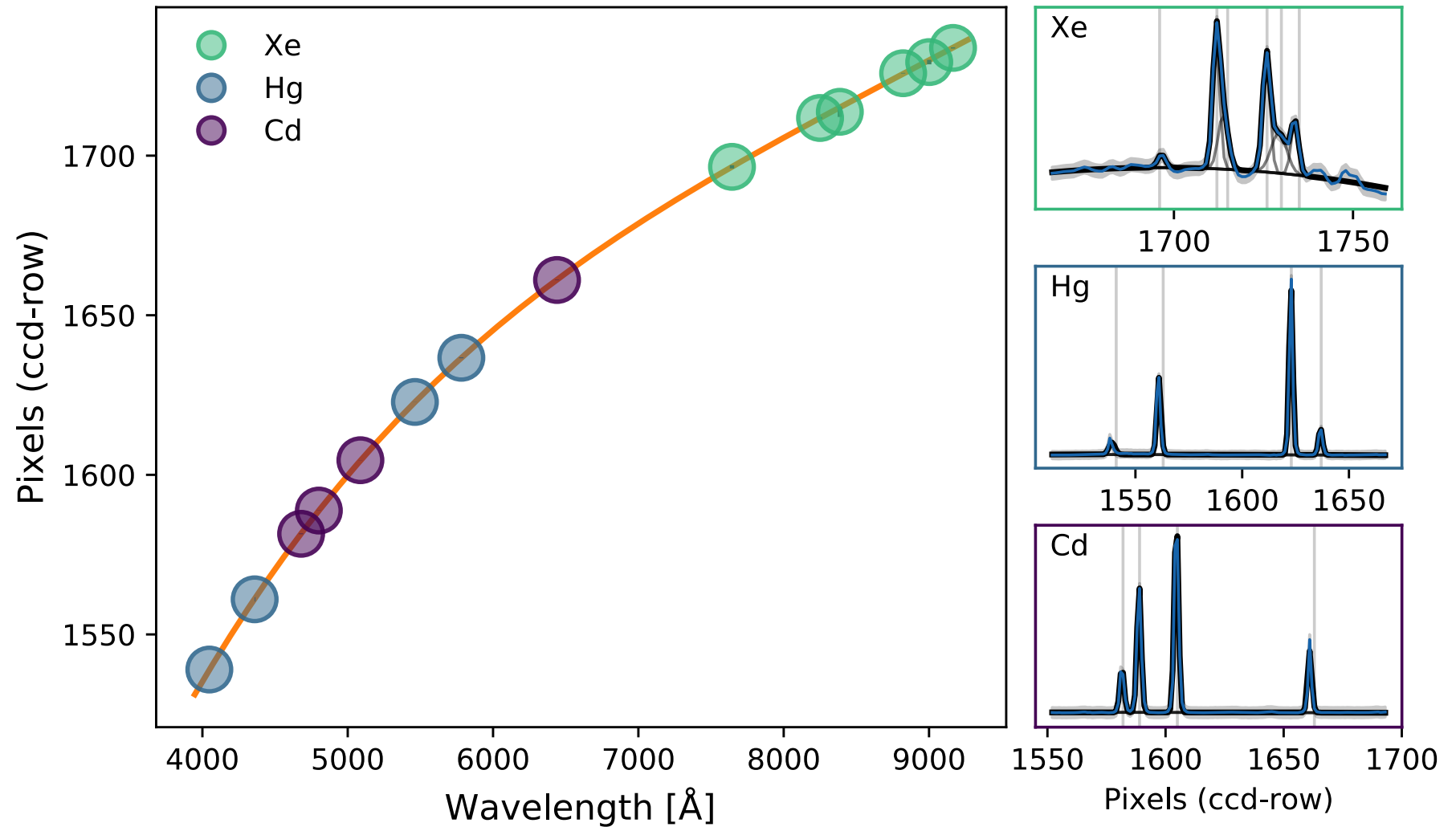


New SEDM Pipeline (pysedm)

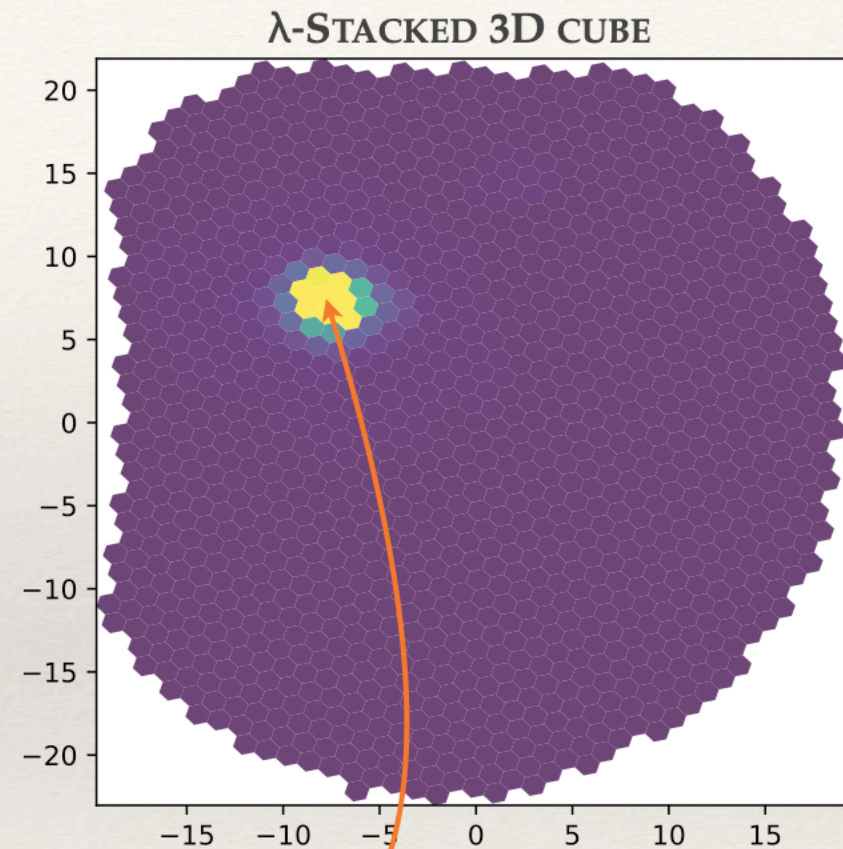
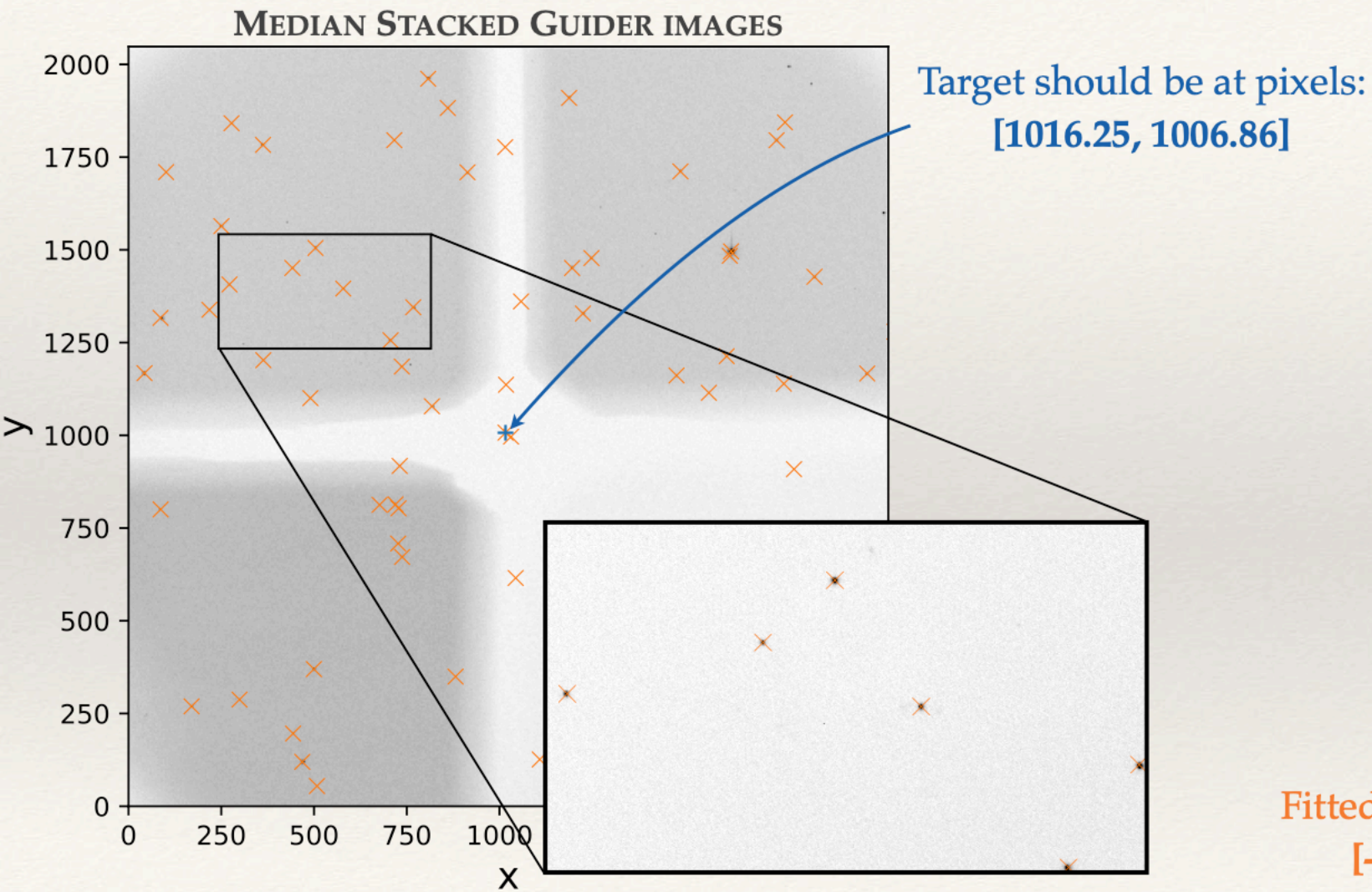
- Better wavelength solution
- Automated extraction location
- Telluric / DAR correction
- PSF extraction instead of aperture
- Integrated with astropy
- Based on SNIFs pipeline
- Github repository ([MickaelRigault/pysedm](https://github.com/MickaelRigault/pysedm))
- Rigault, Neill, et al. 2019 (in prep, subm. to ZTF pub board)

Wavelength Solution

- Deblending
- More lines



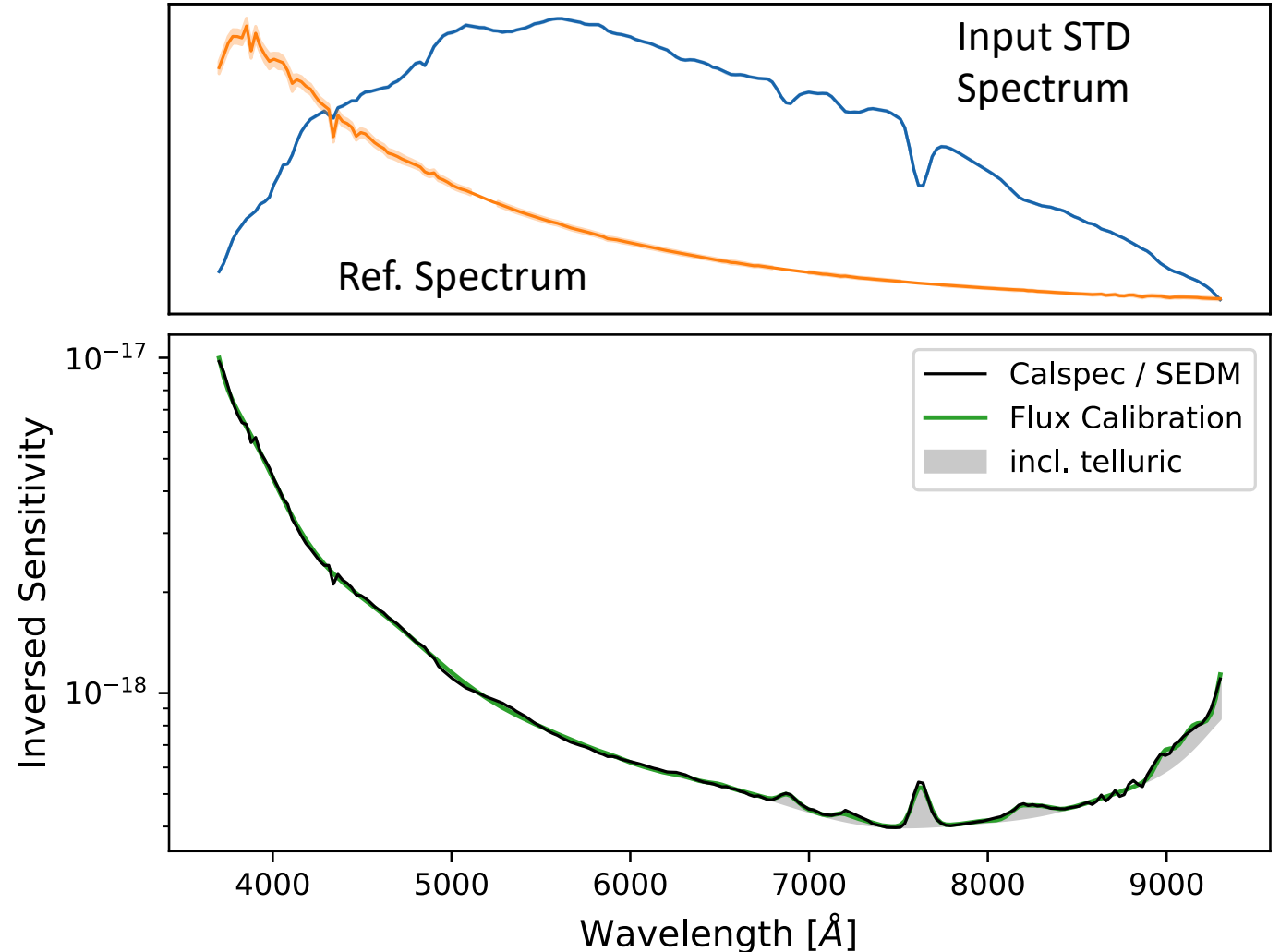
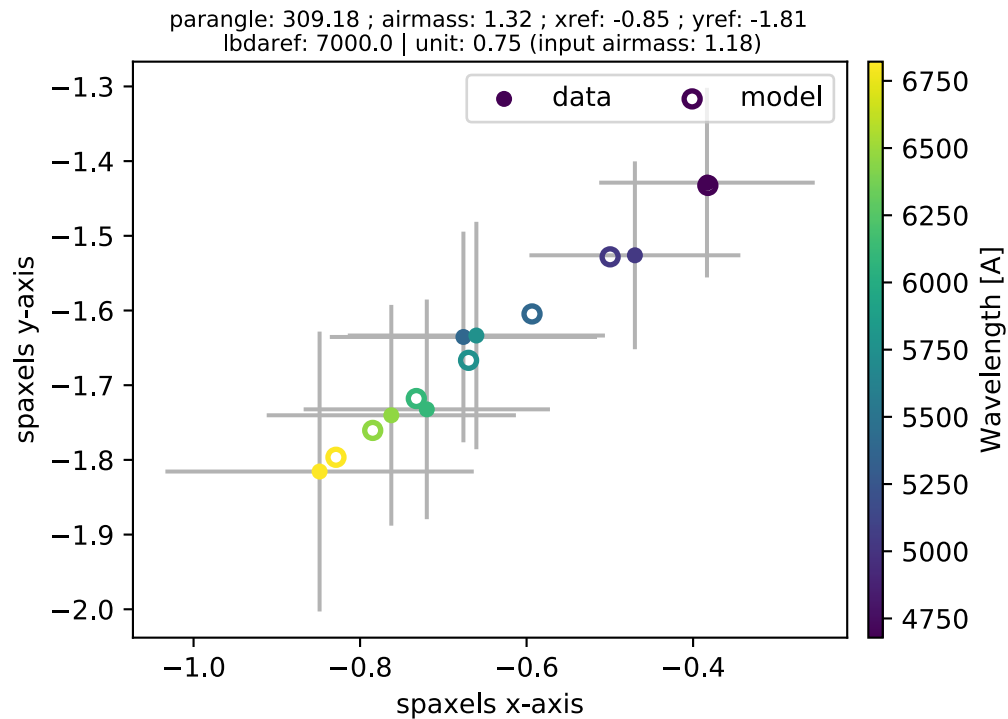
Guessing IFU position | *use of guider images*



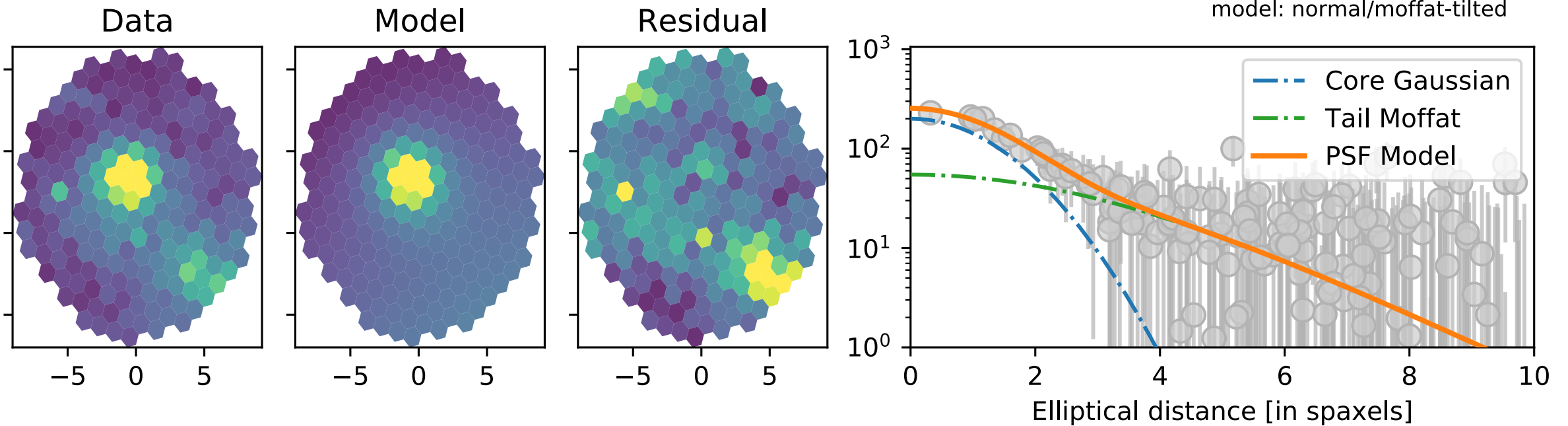
Fitted IFU position:
[-7.64, 7.36]

Telluric and DAR Corrections

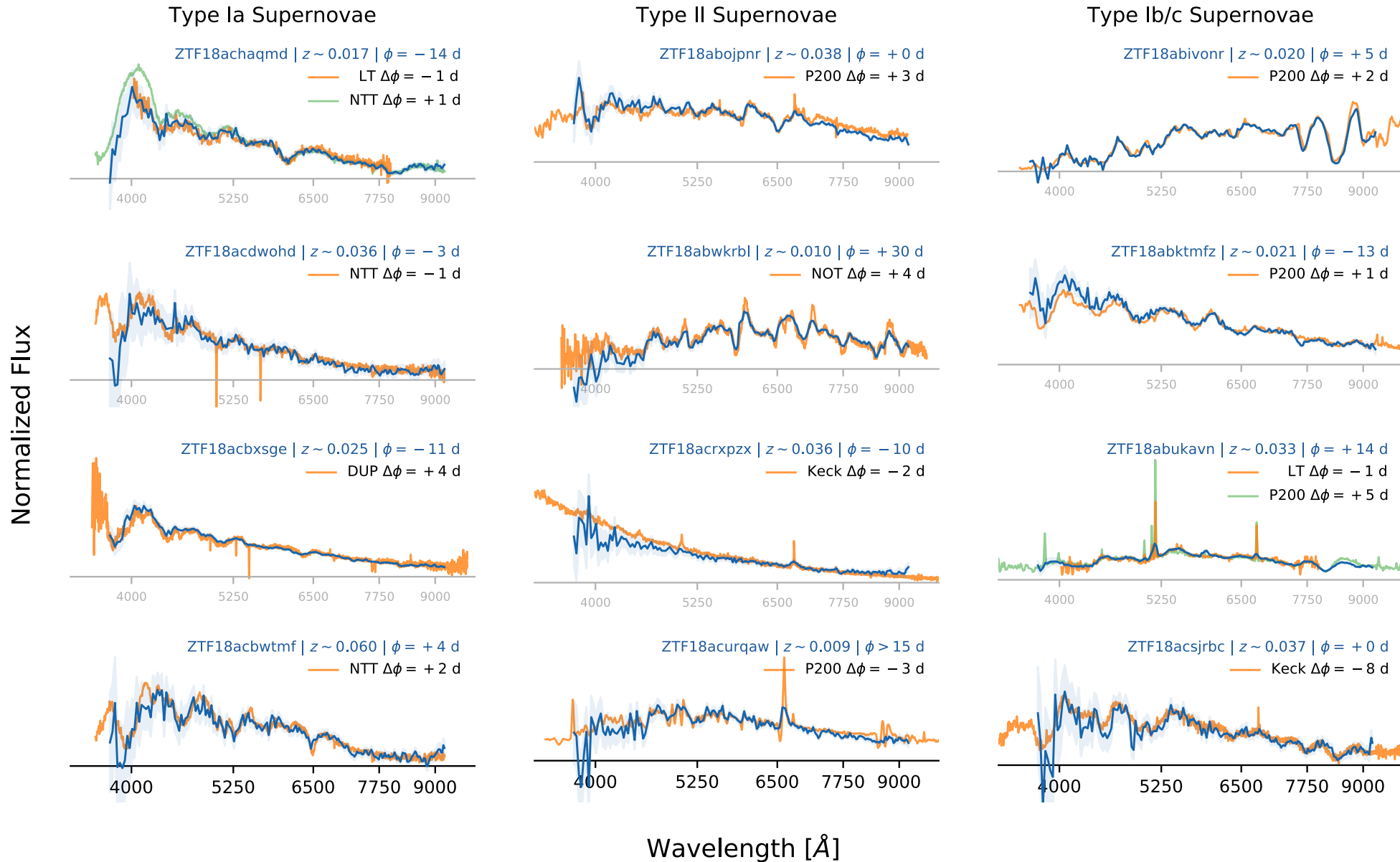
- Telluric a function of airmass
- DAR fitted from data



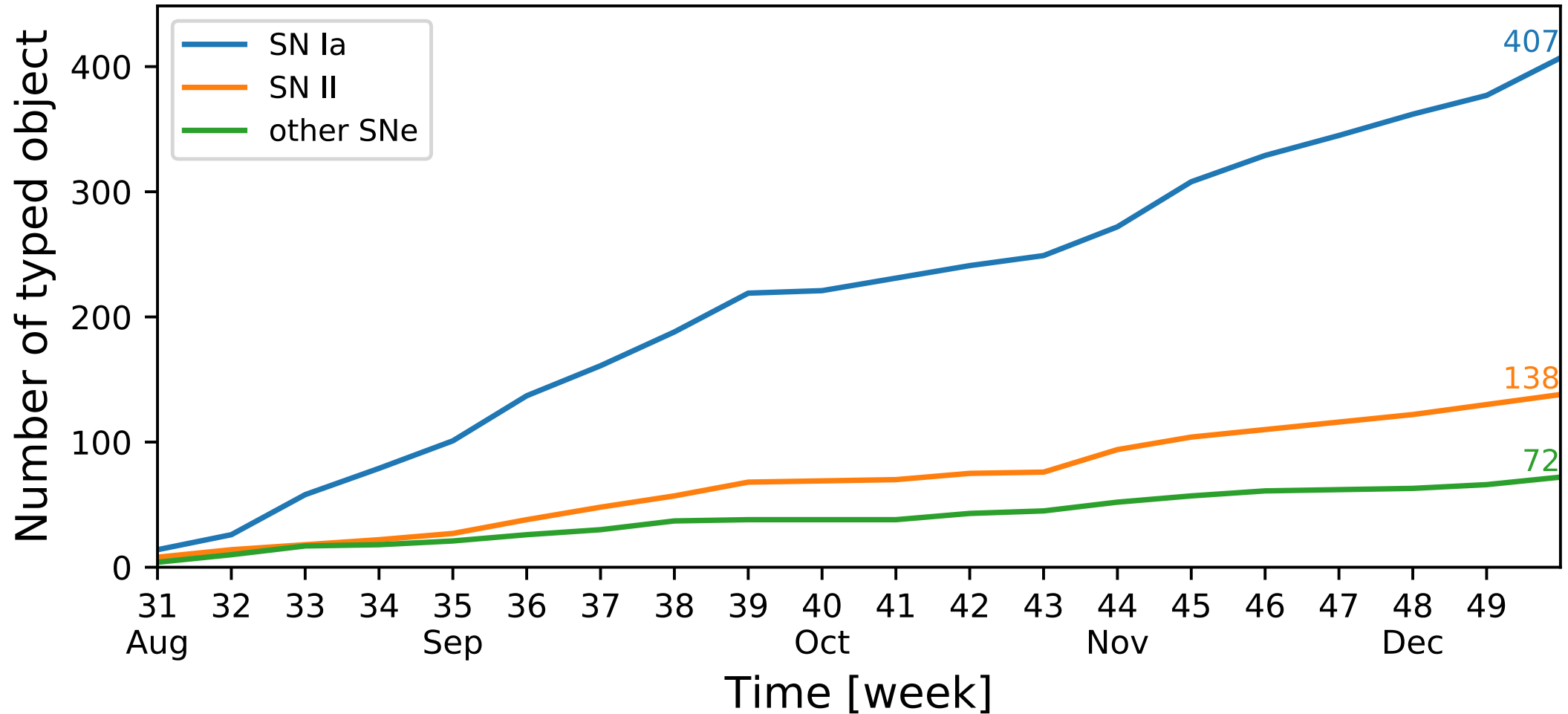
PSF-fitting Spectrophotometry



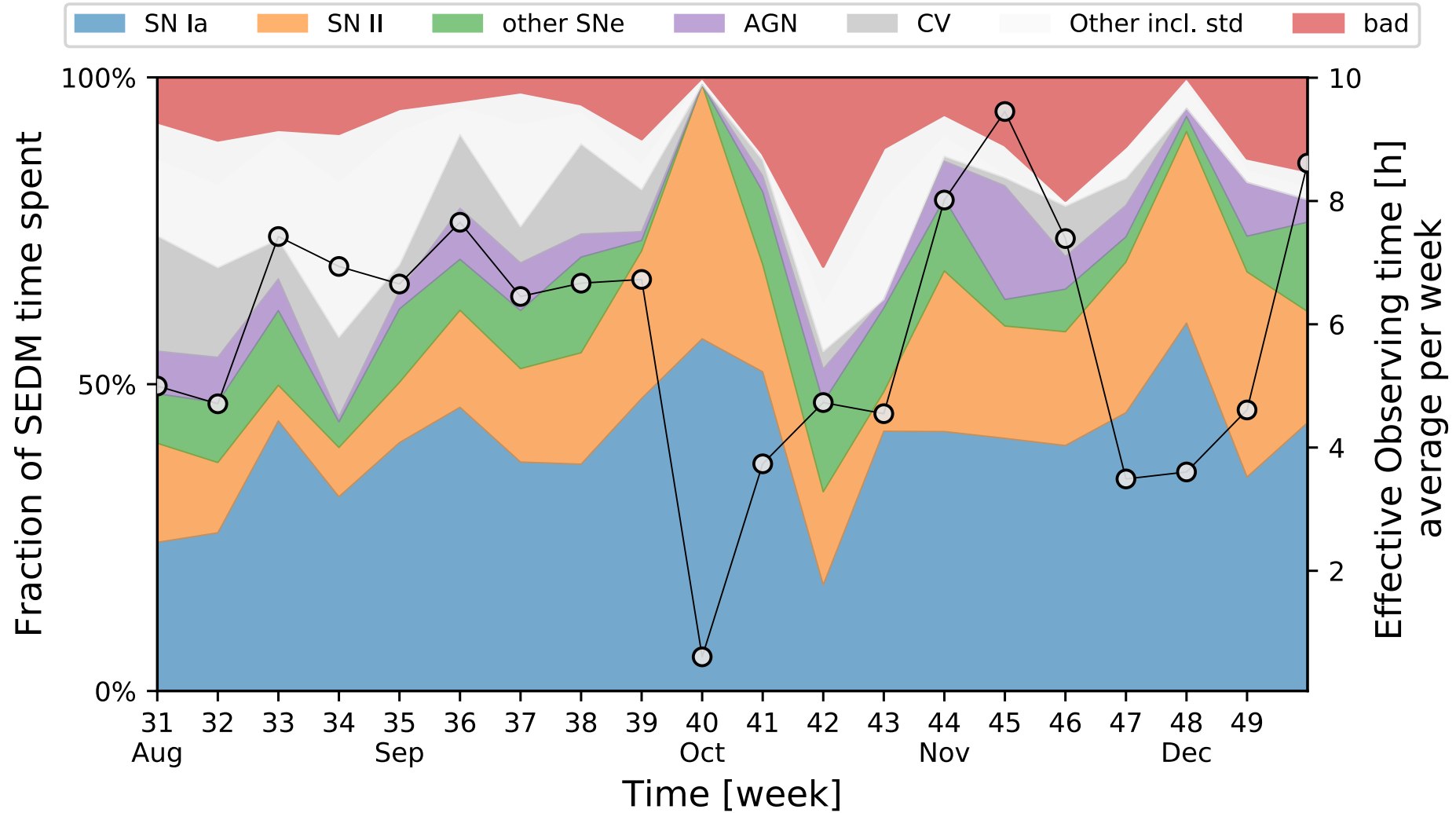
Comparison with other Spectrographs



Resulting Classifications

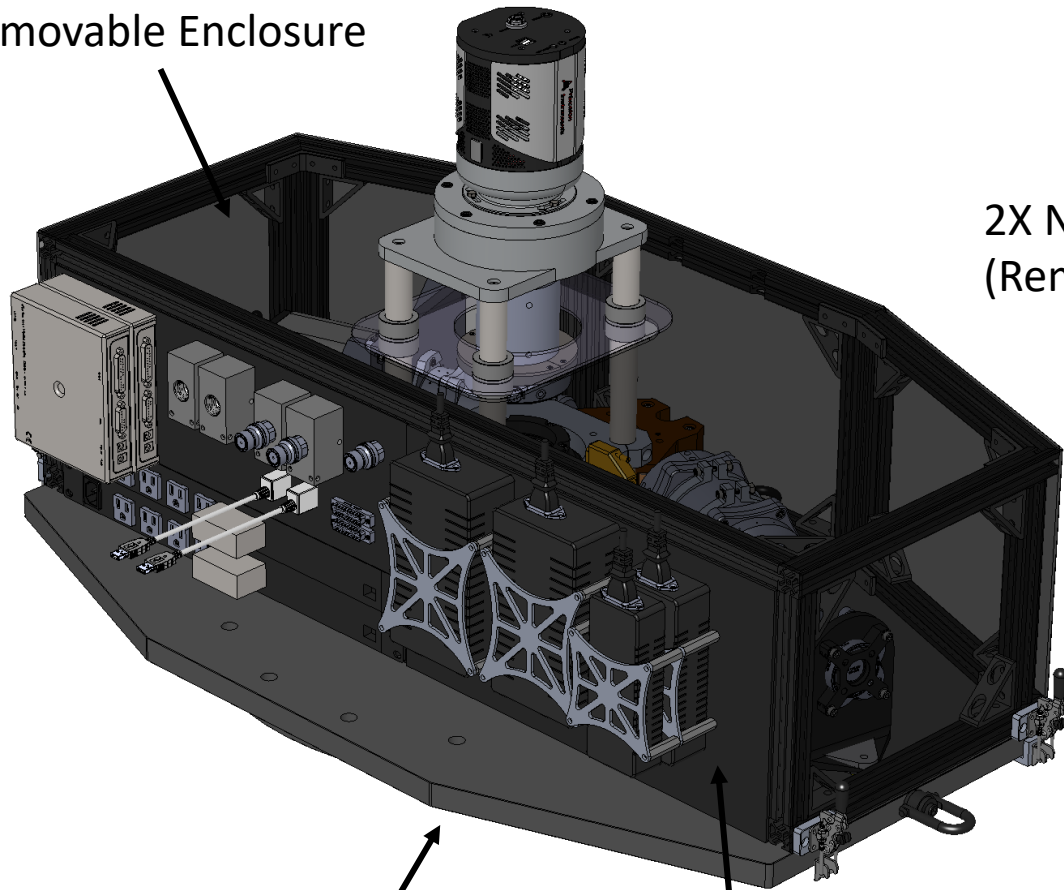


Classifications Distribution / Observing Time



SEDM: Enhancement

Removable Enclosure



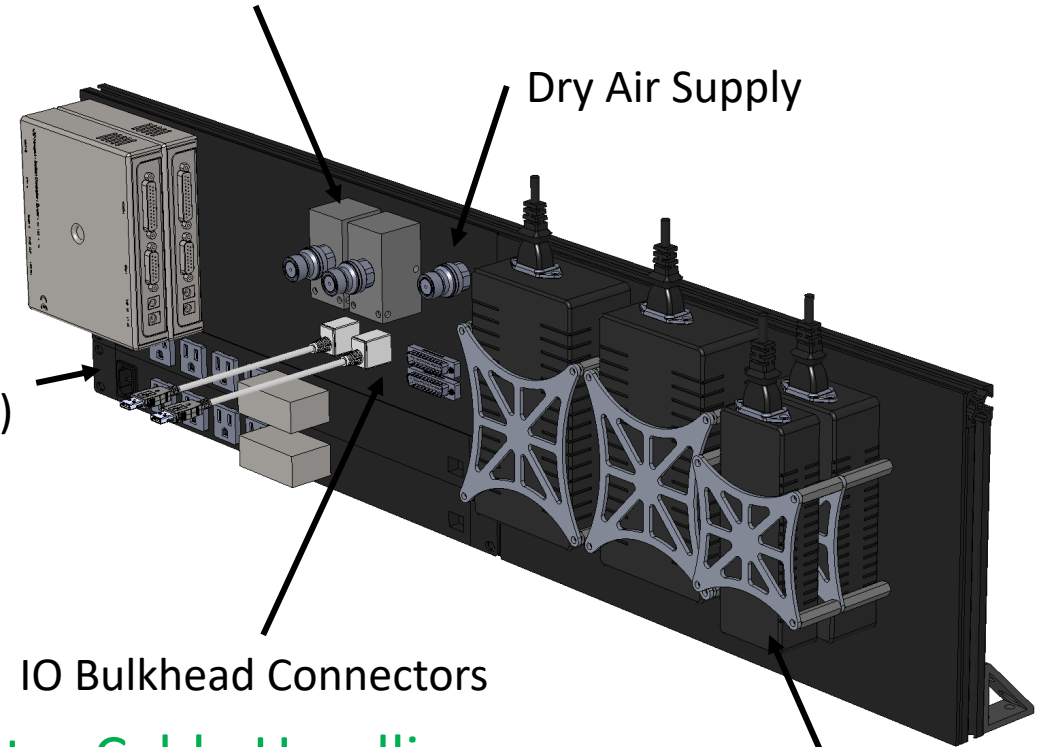
New Optical Bench

Instrument IO Panel

QDC Manifold Glycol Plumbing

Dry Air Supply

2X NPS
(Remote Shutoff)



IO Bulkhead Connectors

PSU Management

- Better Cable Handling
- Removes airmass limit
- Lightweight Optical Bench
- Easier/More Reliable Maintenance

SEDM in production

- Documentation
 - www.astro.caltech.edu/sedm
- Current status
 - pharos.caltech.edu/login
- New pipeline
 - github.com/MickaelRigault/pysedm