

# SEDM Status

## Oct 19, 2020

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Don Neill

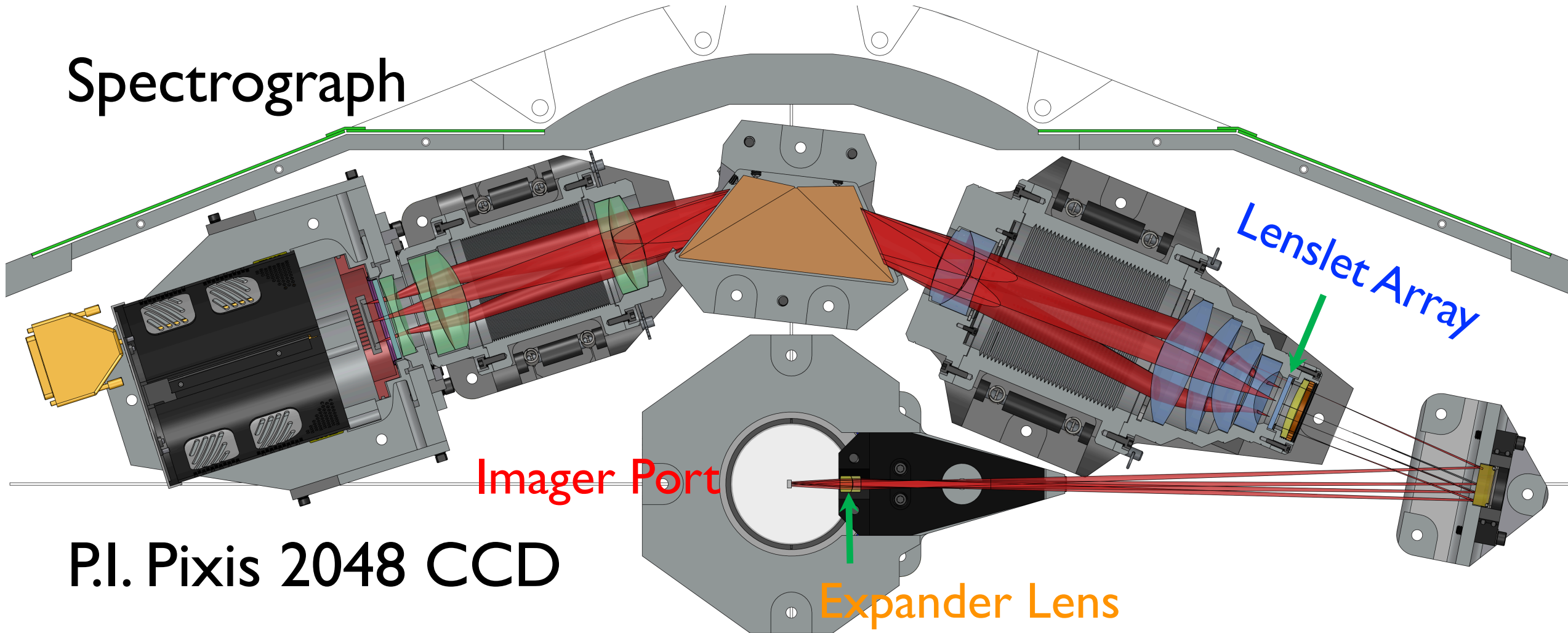
Richard Walters

# Facility instrument on P60



# Hyperspectral imaging spectrograph

Spectrograph



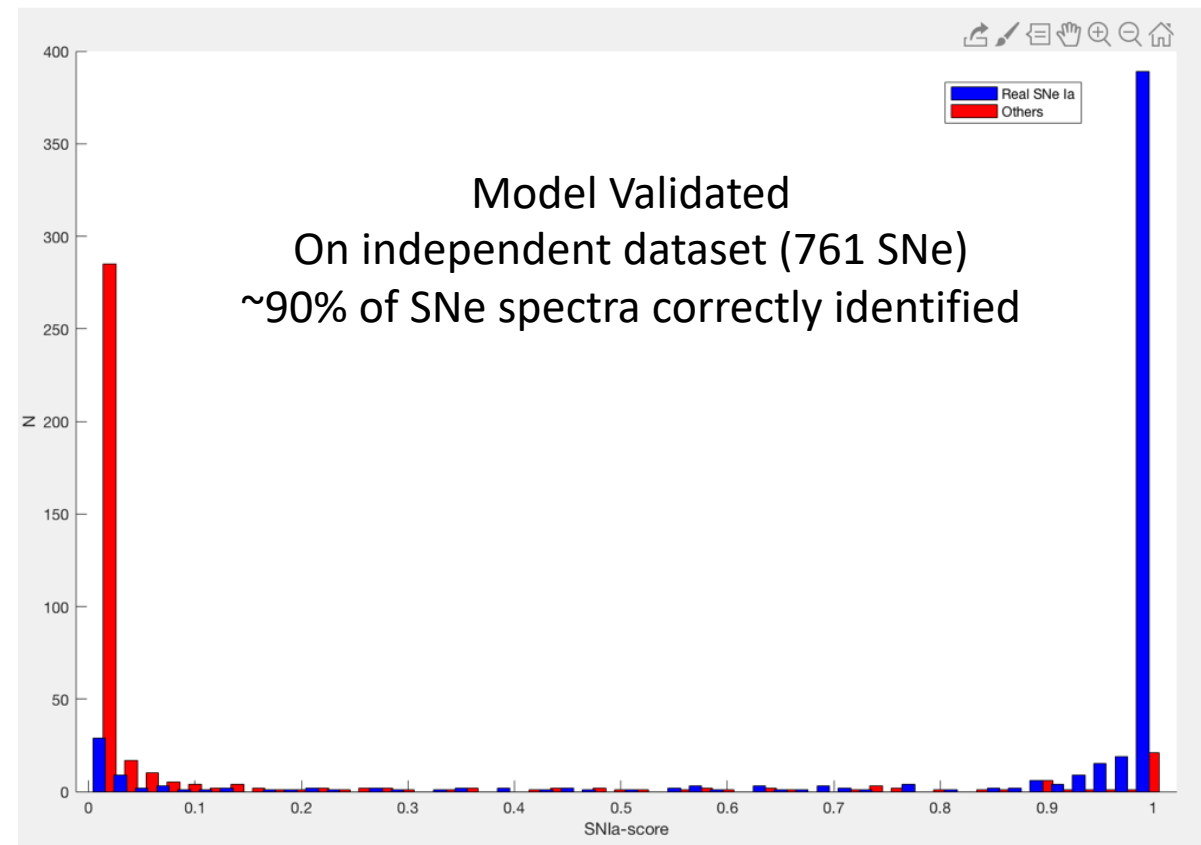
# SEDM Team

- Richard Walters – Operations
- Don Neill – Instrument Scientist
- Christoffer Fremling – Phot pipeline, ML classification
- Yashvi Sharma – ML classification of spectra
- Jeff Zolkower – Palomar Ops
- Nick Ganciu – SEDM master
- Reed Riddle – SEDMv2
- Mickael Rigault – IFU pipeline
- Young-Lo Kim – Contsep module, Cosmic Ray rejection
- Jeremy Lezmy – Stronghost subtraction
- Yannick Copin – IFU pipeline (author of Nearby Supernova Factory pipeline)

# SEDM Accomplishments (as of 10-14-2020)

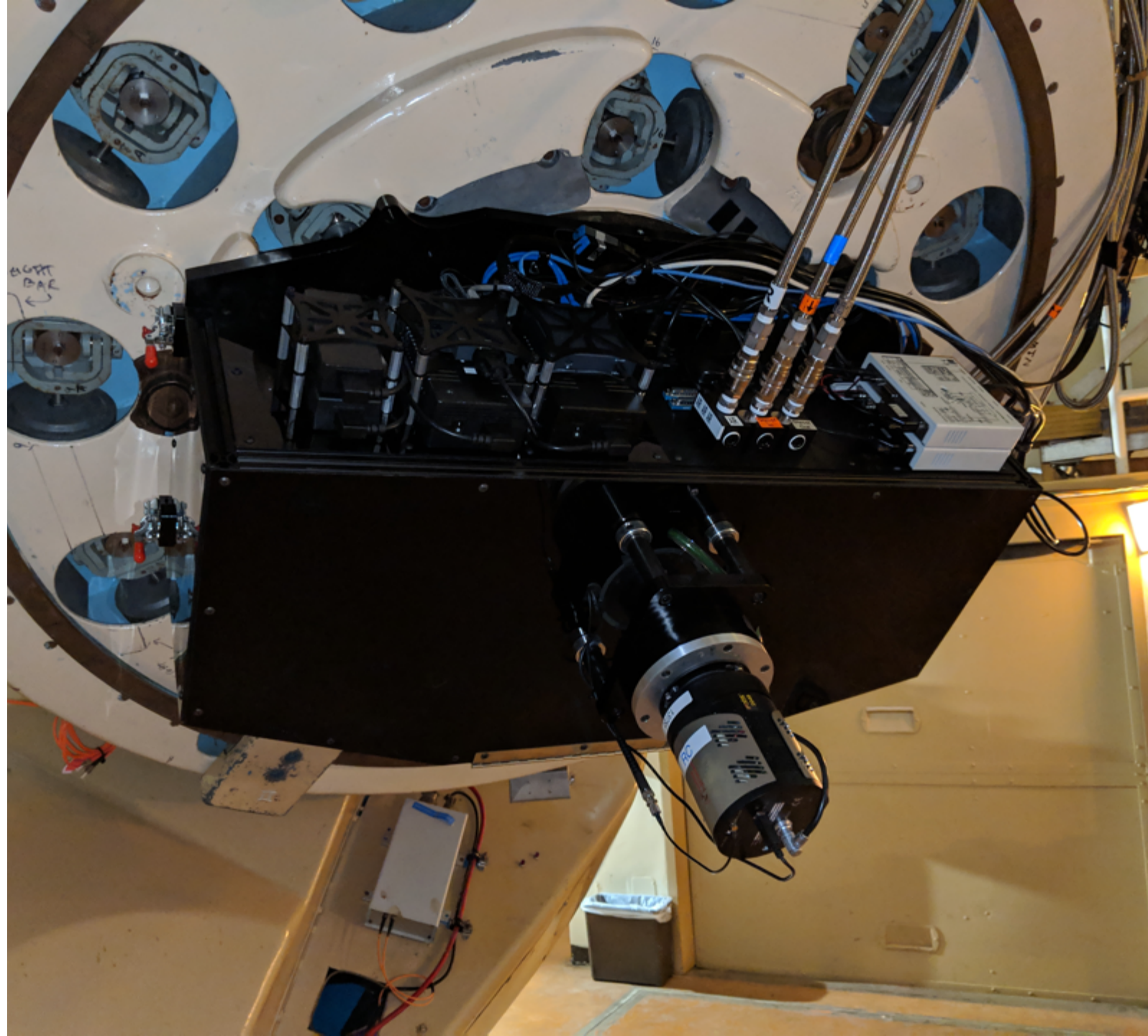
- **Leading classifier of SNe on TNS website**
  - 2224 having SEDM as official classifier, 43% since ZTF start
  - Since ZTF start a factor of 4.1 times next instrument
  - 2625 total classifications including supporting and non-SN
- Averages 11 spectra every night
  - Averaged over all nights including cloudy and engineering
- Averages 8 ZTF spectra every night
  - SN spectral completeness @  $r \leq 18.5$  > 90%
- Starting ML Classification Training
  - Already better than 90% accuracy
  - ~5000 SEDM spectra in training set
  - GOAL: automated ML classification on Fritz marshal

## Preliminary ML Classification Results May 1, 2020



# Recent Instrument Events

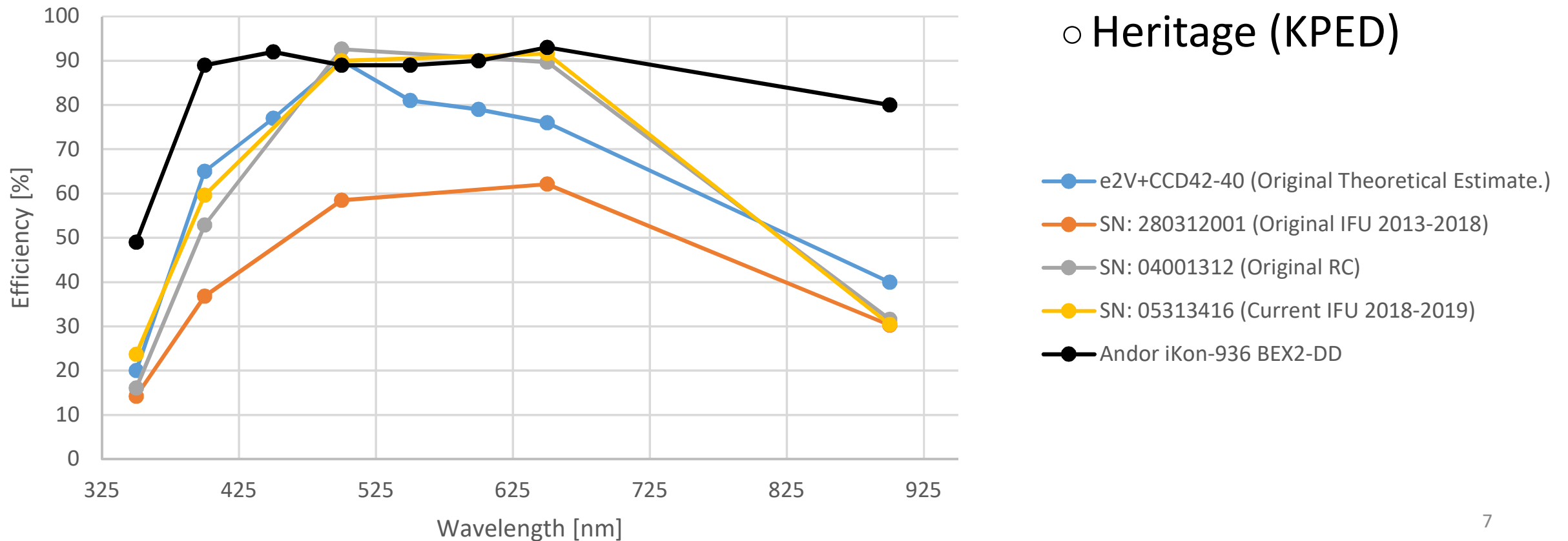
- Jul 2020: Computer mounted on P60 to make camera communication more reliable
- Aug 2020: Dry air system failure, operating without
- Oct 2020: RC USB board replaced and AtoD threshold adjusted
- Oct 2020: Dry air system repaired, may re-install soon



# IN2P3 Ordering Andor iKon-936 BEX-DD for SEDM

- Improve SEDM throughput and front-load software development for SEDMv2
- IN2P3 (France) will characterize and develop software API
- Install on SEDM early 2021

SEDM: Efficiency Plots



# Recent Telescope (P60) Events

- Oct 2020: Secondary vacuum system reworked, major leak discovered and repaired

## Open Items:

- RA axis cover
- Primary re-coat



# Recent Software / Operations Events

## Operations

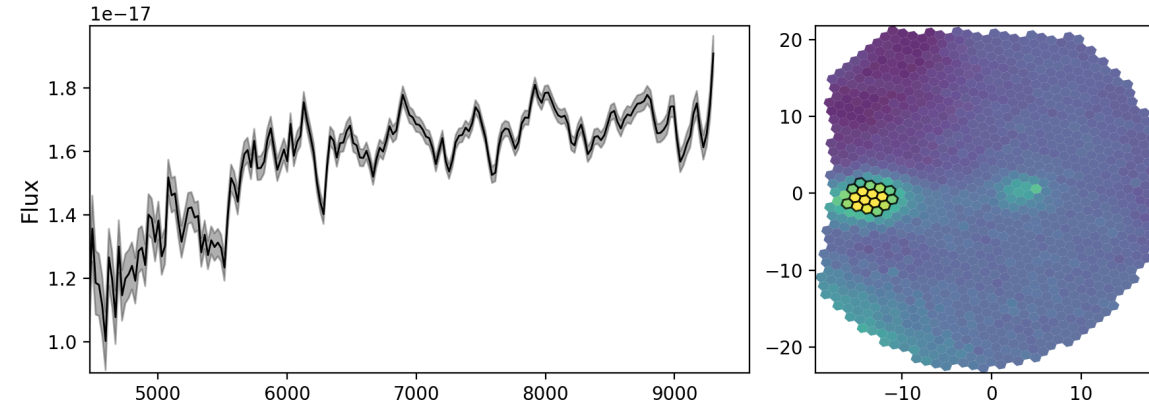
- Sep/Oct 2020: Fritz integration underway
  - Requests accepted
  - Spectra/comment uploaded
  - Still need end-to-end testing

## Pipelines

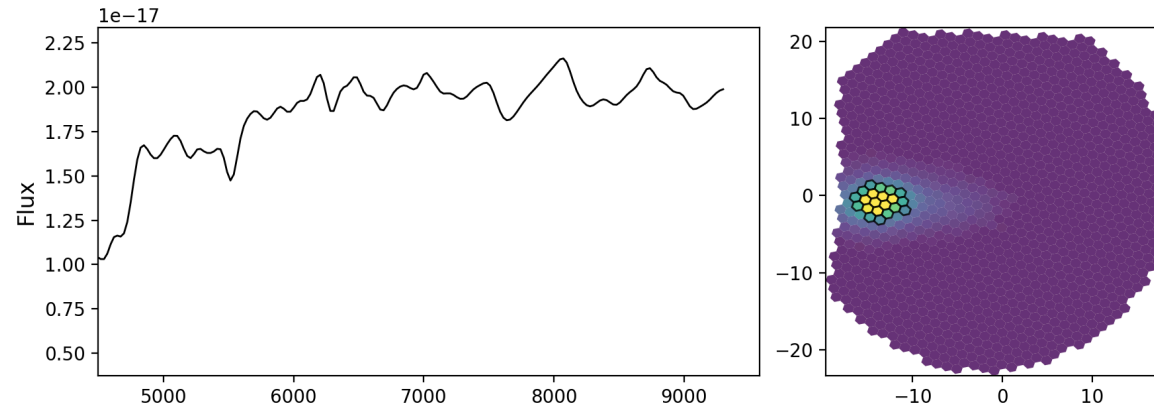
- IFU pipeline: Contour line separation implemented and automated
- Strong host modeling in development
- Cosmic ray spaxel rejection in development

# Preliminary Host Model

Data Cube



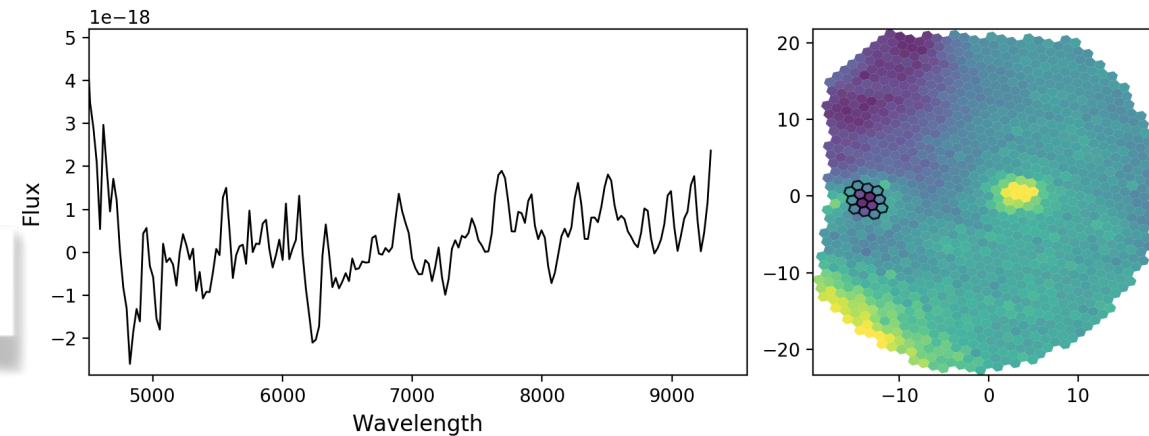
Model Cube  
Based on  
PanSTARRS  
images



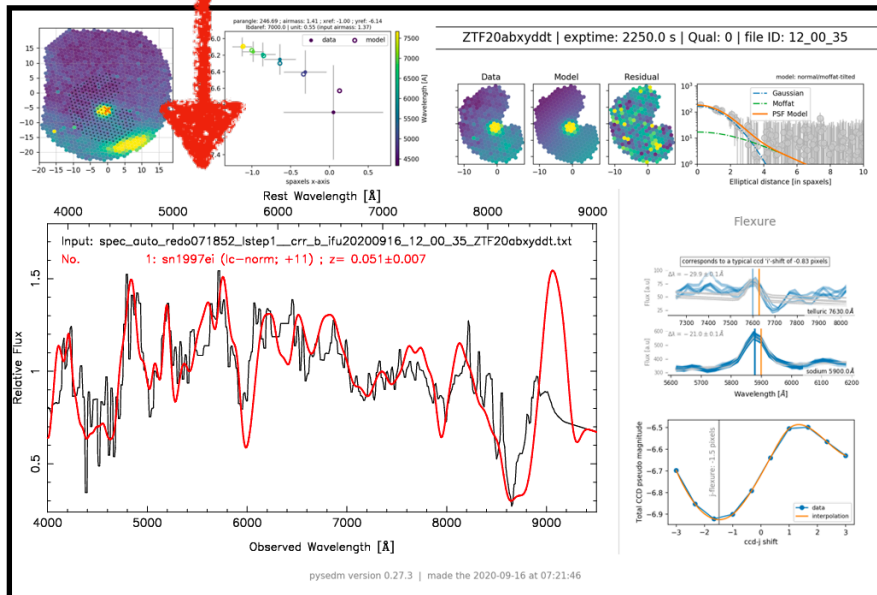
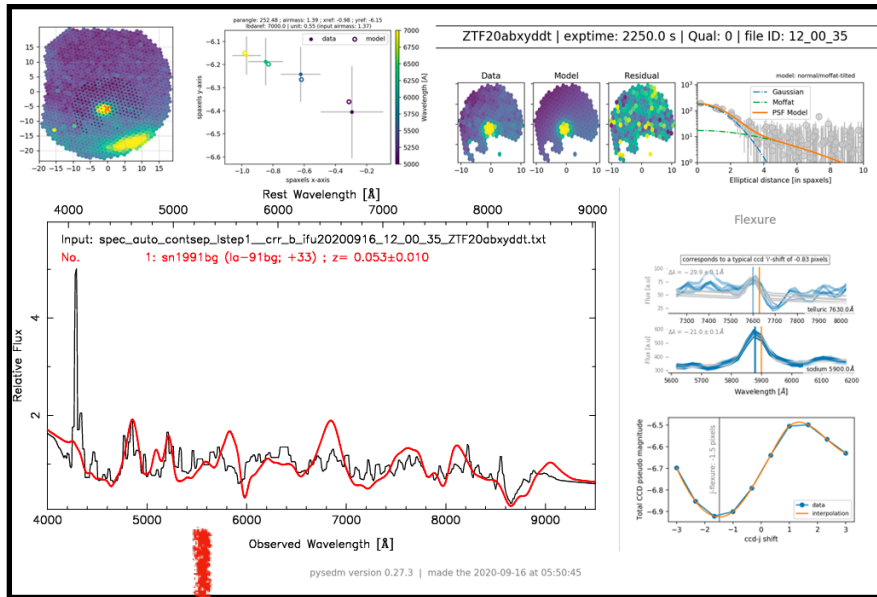
Residual Cube

$$Res = Data - \alpha Model$$

$\alpha \equiv$  correction scale factor

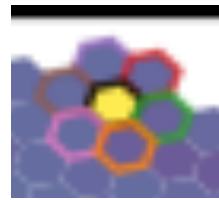


# Cosmic Ray Removal



-Idea-

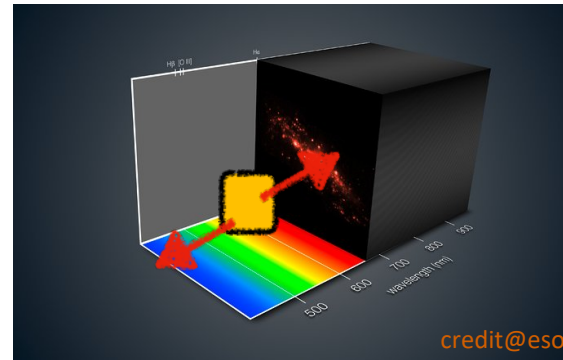
1. spatial filtering



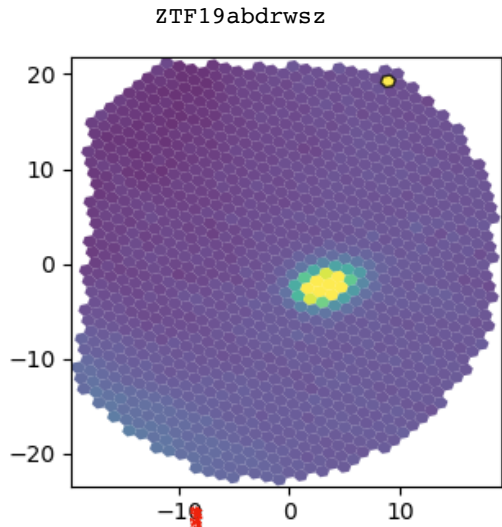
compare a spaxel flux with mean flux of 6 surrounding spaxels

2. spectral filtering

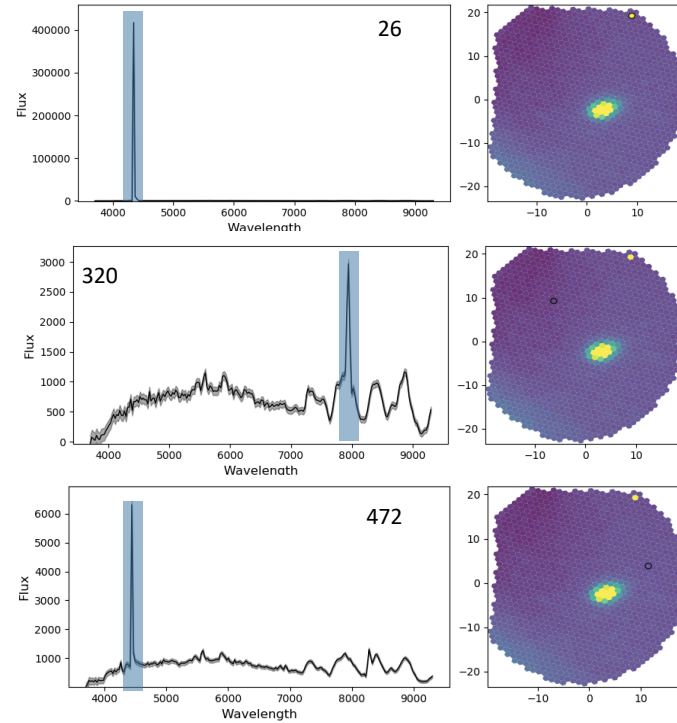
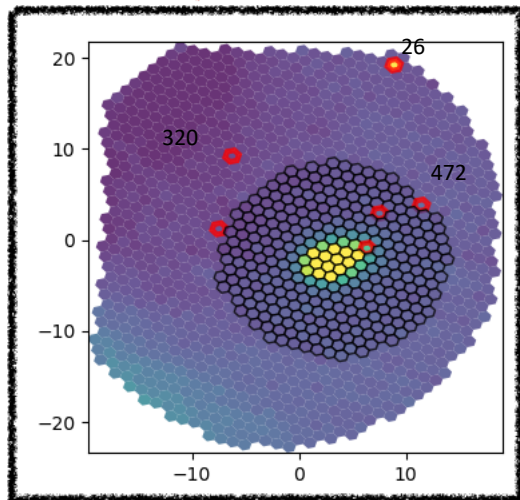
compare a spaxel flux with mean flux of 2 spaxels in wavelength bin before and after.



# Cosmic Ray Removal

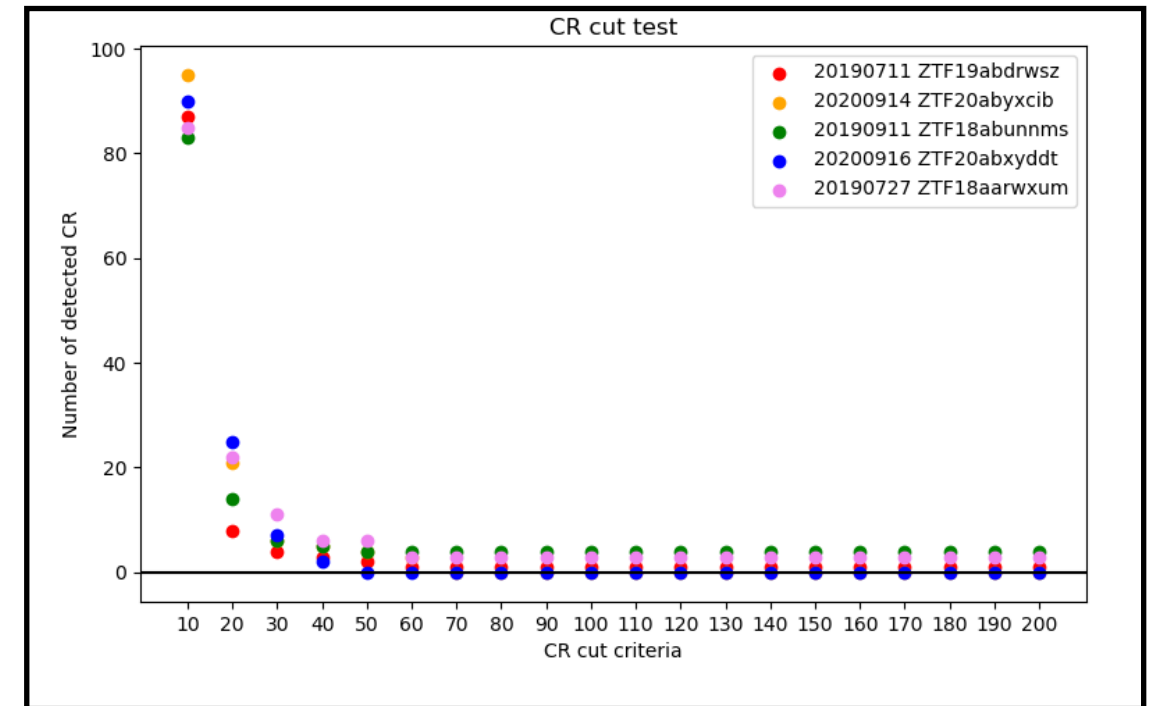


~8s/1datacube  
by byecr



Mean ( $cut=20$ )

	cr_spaxel_index	cr_lbda	cr_lbda_index	cr_diff_sigma
0	26	4339.269406	25	460.946224
1	26	4364.840183	26	58.254559
2	26	4390.410959	27	34.331051
3	320	7944.748858	166	23.862911
4	472	4441.552511	29	40.466043
5	504	3930.136986	9	20.588522
6	574	4518.264840	32	21.487887
7	627	4006.849315	12	22.178812



# SEDMv2 Project Status

A large, white, dome-shaped telescope structure, likely the Lick Observatory, is the central focus of the image. It sits atop a hill covered in dense, green and brown trees. The sky is a clear, pale blue. To the left of the main dome, there is a smaller, similar structure. The main dome has a balcony with a person standing on it. The text 'SEDMv2 Project Status' is overlaid on the left side of the image in a large, blue-outlined font.

D. Neill

J. Fucik

R. Walters

R. Riddle

M. Rigault

# Big Picture

*“no mean plans”*

- **World domination!**
- Robotic follow-up for ZTF-II, LSST, all time-domain!
- With KP84+ could achieve 100% completeness down to 19+ mag
- Win by focusing on classification:
  - Low resolution -> high throughput  
-> many classifications
- Infrastructure and coordination are important: Web/DB
- Future SEDMs: southern/eastern hemispheres?



# Current Status Overview



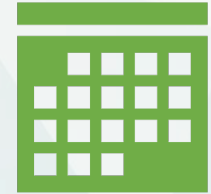
**Design: 90% complete**

Review on Jan 30, 2020



**Budget: Funded through private  
donation and partnership**

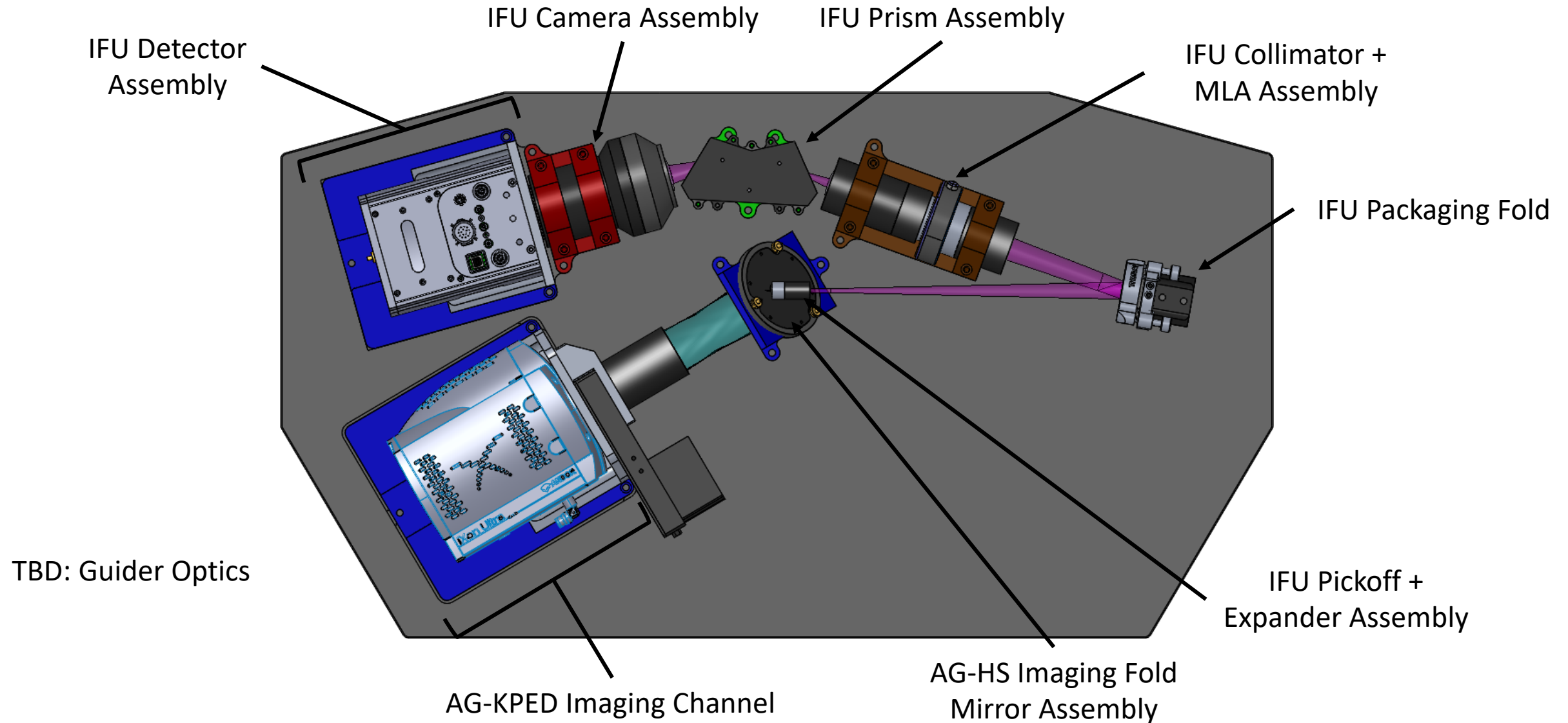
Need to secure KP84 first



**Schedule: Unknown**

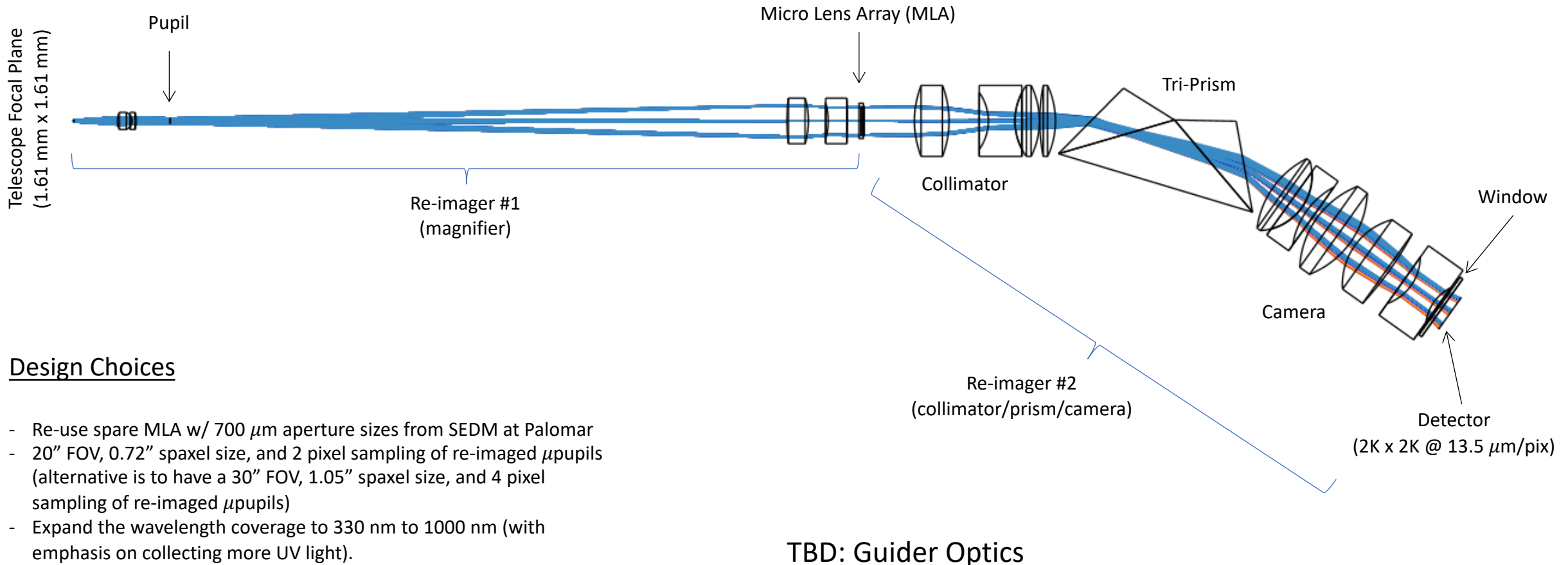
Expect KP84 call Jan. 2021  
Loss of lead engineer (M. Feeney)

# SEDM-KP: Mechanical Design



# Spectrometer Optical Layout

The Spectral Energy Distribution Machine (SEDM) is a low resolution ( $R \sim 100$ ) integral field spectrograph with high optical transmission ( $> 50\%$ ).



## SEDM for ZTF II

- Improve SEDM throughput/efficiency
- Automated Transient Classification
- SEDMv2 on KP84
- Fritz marshal integration

# Acknowledgements & Web pages

- Please cite:
  - Blagorodnova, Neill, Walters et al. 2018 (SEDM instrument)
  - Rigault, Neill, Blagorodnova et al. 2019 (*pysedm* pipeline)
- Acknowledge:
  - SED Machine is based upon work supported by the National Science Foundation under Grant No. 1106171
- SEDM Status:
  - [pharos.caltech.edu/monitor](http://pharos.caltech.edu/monitor)
- Documentation:
  - [www.astro.caltech.edu/sedm](http://www.astro.caltech.edu/sedm)
- Data access:
  - [pharos.caltech.edu](http://pharos.caltech.edu)
  - Account required ([rsw@astro.caltech.edu](mailto:rsw@astro.caltech.edu))
- Twiki:
  - [http://www.oir.caltech.edu/twiki\\_ptf/bin/view/ZTF/SEDM Operations](http://www.oir.caltech.edu/twiki_ptf/bin/view/ZTF/SEDM%20Operations)