# The GPIES Data Cruncher:

## An Automated Data Processing System for the Gemini Planet Imager Exoplanet Survey

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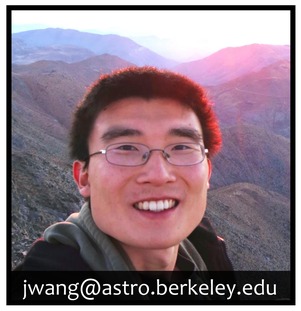



**Summary:**

- The Data Cruncher can automatically process all science and calibration data from the GPI Exoplanet Survey and more
- Sensitivity curves and multiple PSF subtraction products are produced one hour after the data are available
- The Super Data Cruncher can also run on a supercomputing cluster and reprocess the entire campaign in a few hours

## Crunchable Data

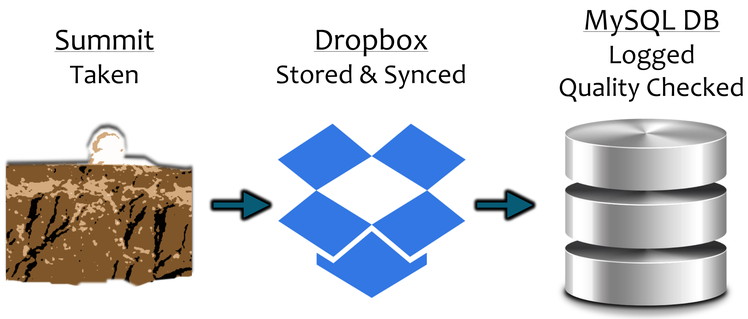
GPI Exoplanet Survey Science
- 1 hour *H*-band integral field spectroscopy planet search
- 10 minute *H*-band snapshot broadband imaging polarimetry
- 1 hour *H*-band deep broadband imaging polarimetry

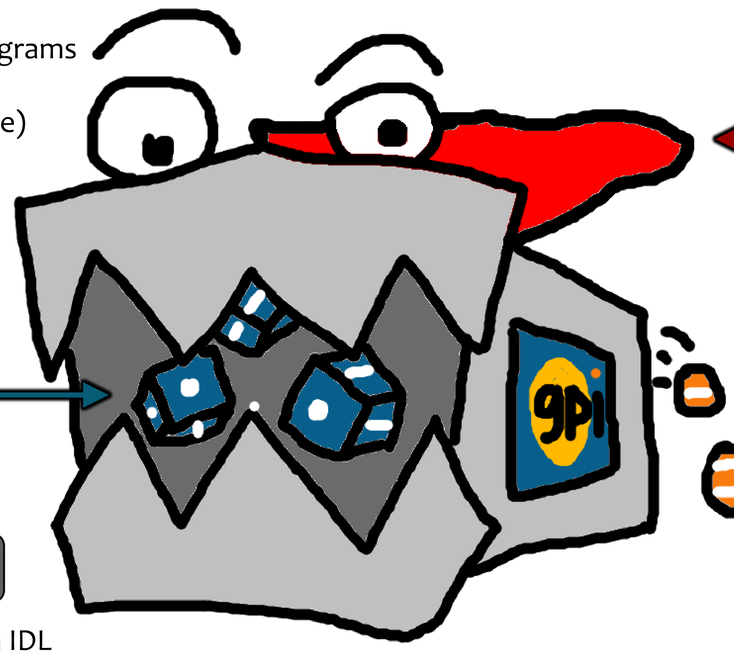
GPIES Follow-up
- Multi-epoch deep follow-up observations in multiple bands

GPI Queue Programs
- All coronagraphic data taken for GPIES members' queue programs

Calibrations
- All calibration data taken by GPI (which are publically available)

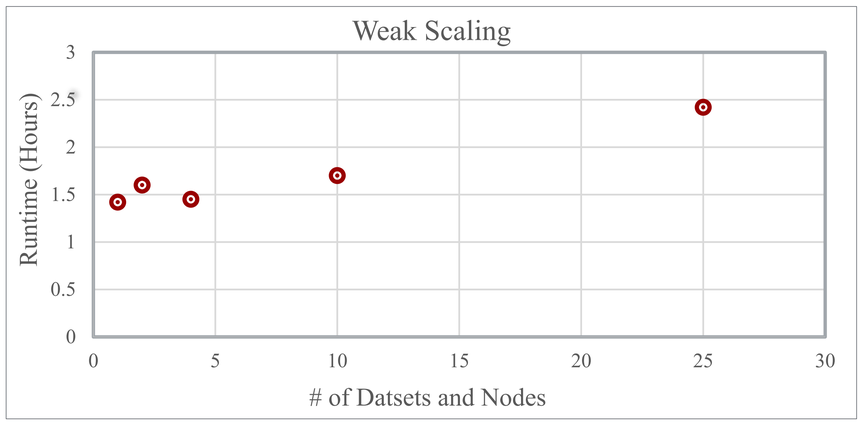
### Data Flow



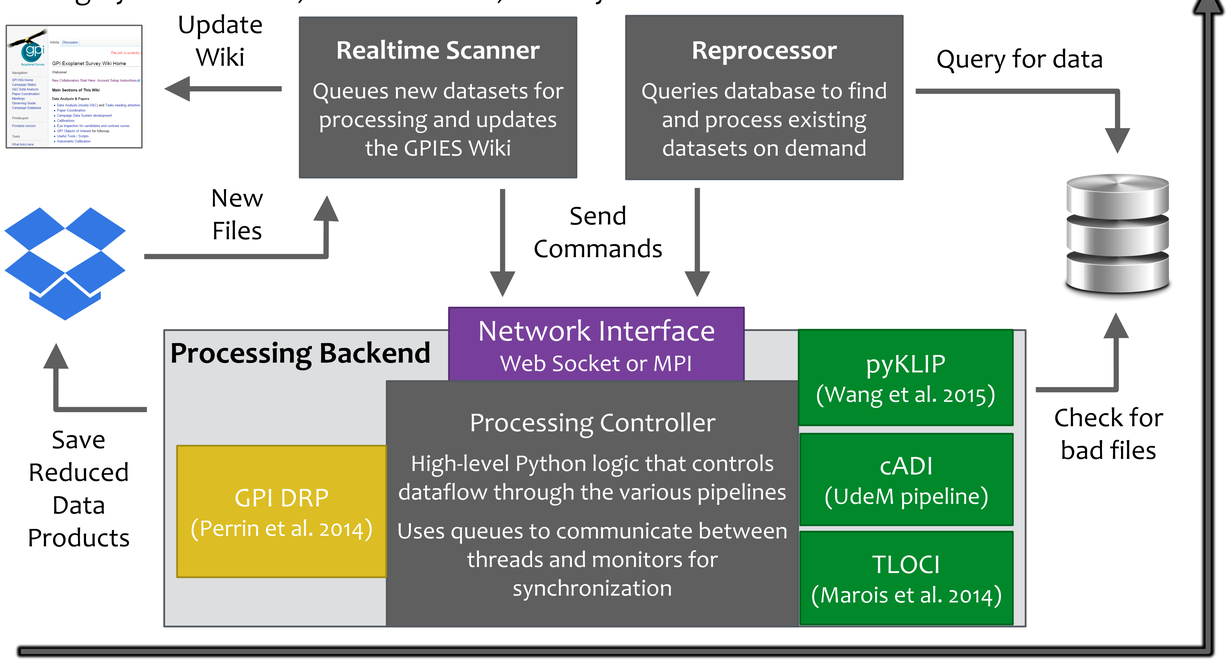

## Super Data Cruncher

- Runs on NERSC's Edison supercomputer (5576 nodes, 133,824 cores, 357 TB RAM)
- Uses MPI for inter-node communication
- < 100 lines of code needed to implement the Super Data Cruncher
- Reprocesses the entire campaign in a few hours




## Architecture

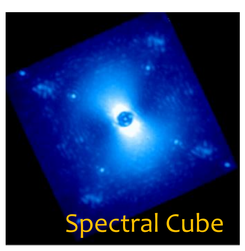
- Written in Python with some pipeline components written in IDL
- Highly modularized, multithreaded, and asynchronous

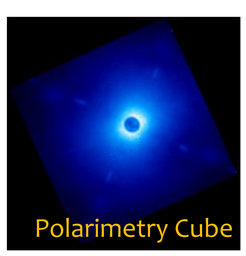



## Reduced Data Products

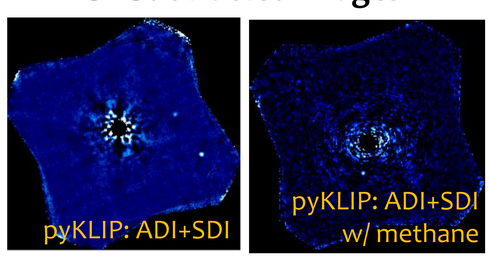
- All data products produced within ~1 hour of the data being available
- All data are synced to Dropbox for accessibility

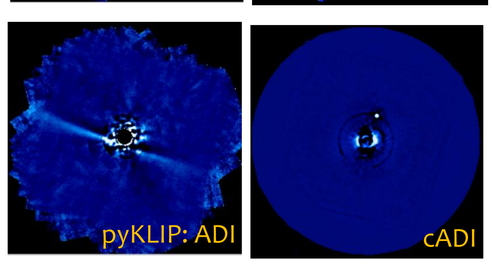
### Datacubes



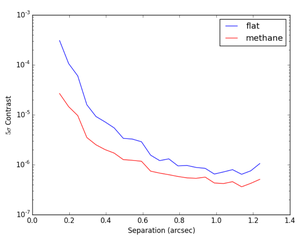




### PSF Subtracted Images

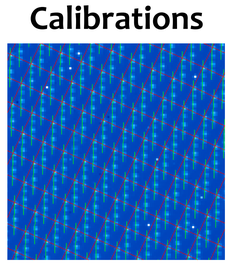



### Contrast Curves




### Calibrations



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**References:**

Marois, C., Correia, C., Galicher, R., et al. 2014, Proc SPIE, 9148.
Perrin, M. D., Maire, J. , Ingraham, P., et al. 2014, Proc SPIE, 9147.
Wang, J. J., Ruffio, J.-B., De Rosa, R. J., et al. 2015, Astrophysics Source Code Library, record ascl:1506.001.