VERA C. RUBIN OBSERVATORY

# Focal plane commissioning

LSST-France, 11 June 2024
Parallel session

# Ongoing activities

- Data replication
- LSSTCam / ISR

CCD configuration optimization

Data quality / investigations of puzzling effects

Bias correction strategy

PTC (Brighter-Fatter and gains)
Calibration validation

- CCOB
- CBP
- Photometry

# Data replication (Fabio+Thibault)

- Goal: to replicate in-dome calibration images from USDF to FrDF
  - To use FrDF's capacity for studying those data
  - Recorded in PREOPS-4853
- For LSSTCam focal plane tests data we used some components of the replication machinery we plan to use in operations
  - It worked reasonably well, even if we found some aspects to improve
  - Ingestion into FrDF's local butler was done by an ad-hoc solution: the long term solution is being developed and tested, first at SLAC then at EU DFs
- Replicating ComCam data would use the same tools we are currently testing for the operations phase
  - Our goal is to replicate that data to FrDF, after the 30 days-long embargo period during the commissioning phase
  - From our experience replicating Run6 data, the photodiodes files are needed and they were not part of the data automatically replicated

# CCD configuration optimization (Claire+Pierre An.+Pierre As.+Thibault)

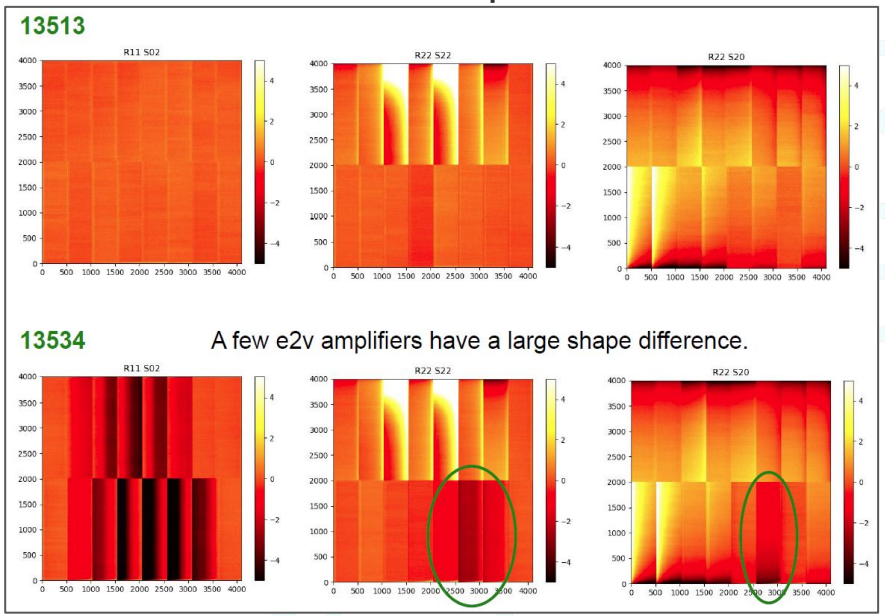
Ex: test of voltage configurations in Run 6

## New voltages for e2v

| | Pre Run5 | Run5 | Run 6a | new | |
|---|---|---|---|---|---|
| pclkHigh | 3.6 | 3.3 | 3.0 | 3.3 | Tearing / Persistence / P4 |
| pclkLow | -6.0 | -6.0 | -6.0 | -6.0 | Constraint from HV |
| sclkHigh | 3.9 | 3.9 | 3.9 | 3.6 | |
| sclkLow | -5.4 | -5.4 | -5.4 | -5.7 | |
| rgHigh | 6.1 | 6.1 | 6.1 | 5.8 | |
| rgLow | -4.0 | -4.0 | -4.0 | -4.3 | |
| rd | 11.6 | 11.6 | 11.6 | 11.3 | |
| od | 23.4 | 23.4 | 23.4 | 23.1 | |
| og | -3.4 | -3.4 | -3.4 | -3.7 | |
| gd | 26.0 | 26.0 | 26.0 | 26.0 | |
| Expectation | | Mitigation of Divisadero tearing | ~~Mitigation of Persistence~~ | Mitigation of incomplete reset? | |

From Yousuke

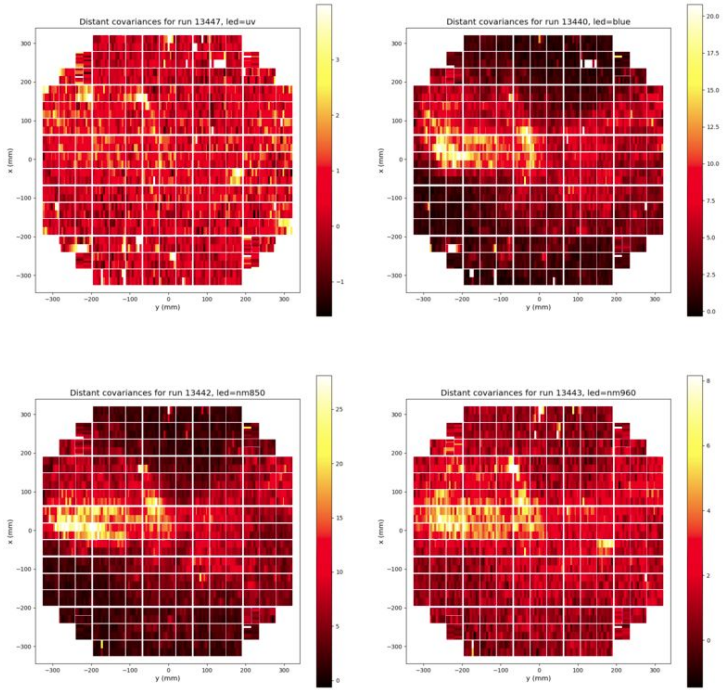
Bias shapes



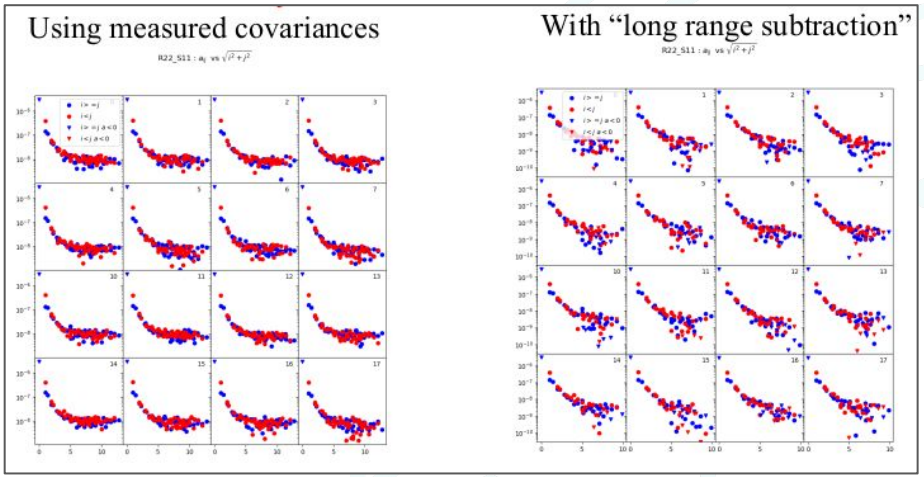

Noise, persistence, stability, etc.

# Data quality / investigations of puzzling effects (Claire+Pierre An.+Pierre As.+Thibault)

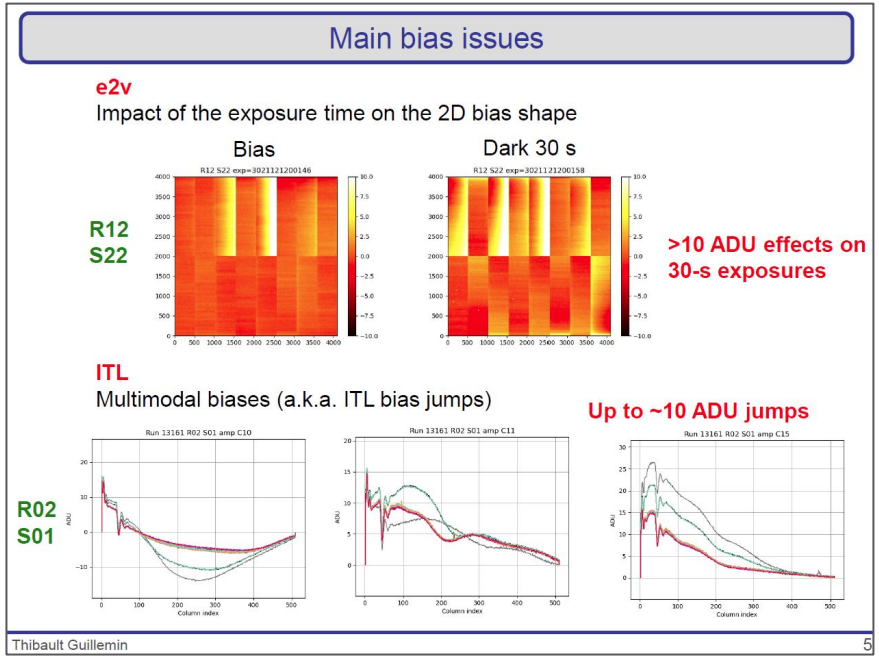
Ex: long range covariances in Run 6 flats



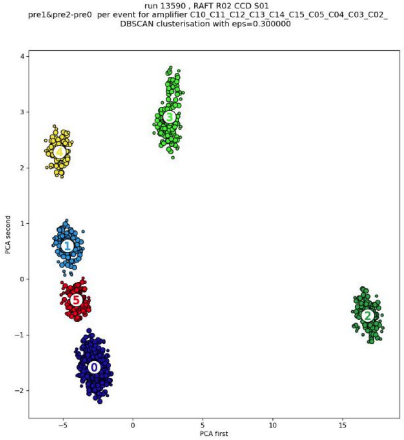

– Effect depends on LEDs (pattern and intensity)
– Needed to model this effect for PTC analysis



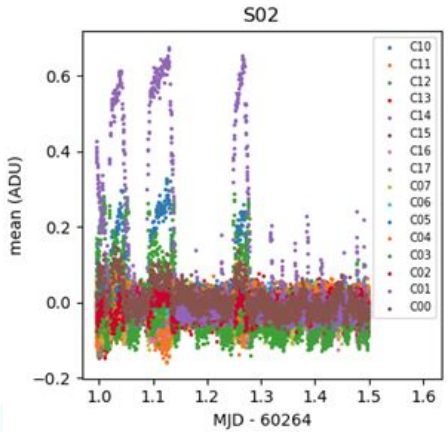
# Bias correction strategy (Pierre An.+ Thibault)




eo_pipe studies
of OpSim runs




R22, MD15_1D



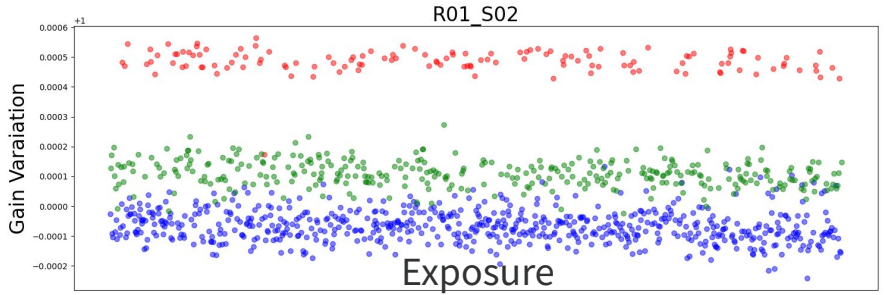

Identification of
ITL families

# Brighter-Fatter (Pierre As.)

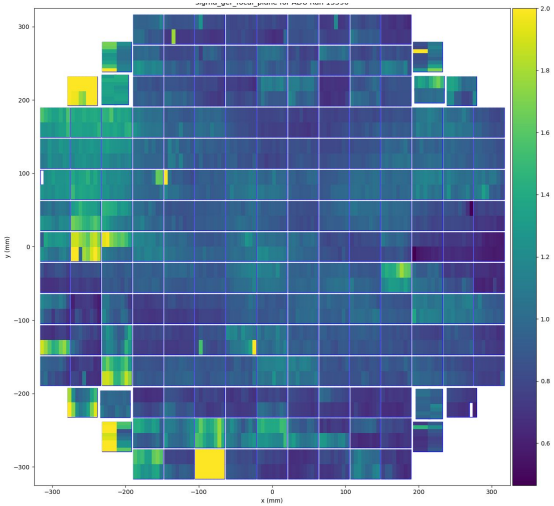
- On Auxtel, because of the fine image sampling (FWHM ~ 10 pixels) the BF effect is probably far too small to provide an interesting test on the sky.
- Comcam is the next opportunity. There are flat series already available, but we could rely on the in-dome flat system. For non-linearity, the illumination monitoring system should deliver a proper reference, once properly configured.
- Regarding DM code, the situation is confusing:
  - The non-linearity fit is implemented but not available yet (nor its performance characterized, AFAIK)
  - For image BF-correction, there are competing options, and I don’t know how decisions will be made.
  - I would advocate that comcam will be an excellent sandbox.

# Gain correction (Pierre An.+Yassine)

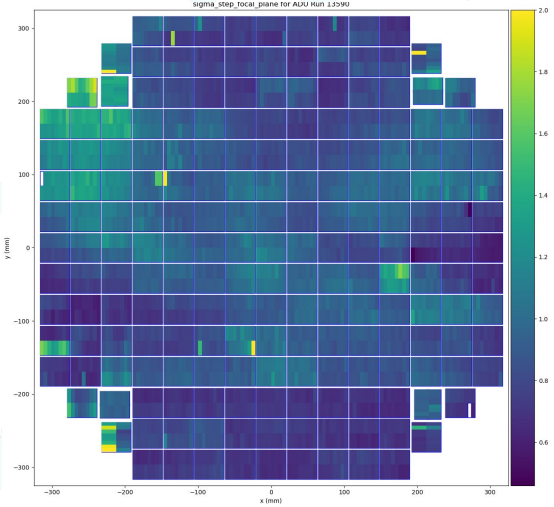
Some itl ccds present gain variations as seen in R01_S02 for run 13590 (one color per gain value organized per “family”) :




If we take those gain values per family into consideration we can reduce itl’s raft dispersion and bring them to e2v level :



On the left general dispersion, on the right dispersion with family identification



# Calibration validation (Thibault)

Mainly just following this activity recently…
Critical activity with a LOT of things to validate
Calibration Rehearsal 27-29 May

**Validation chain**

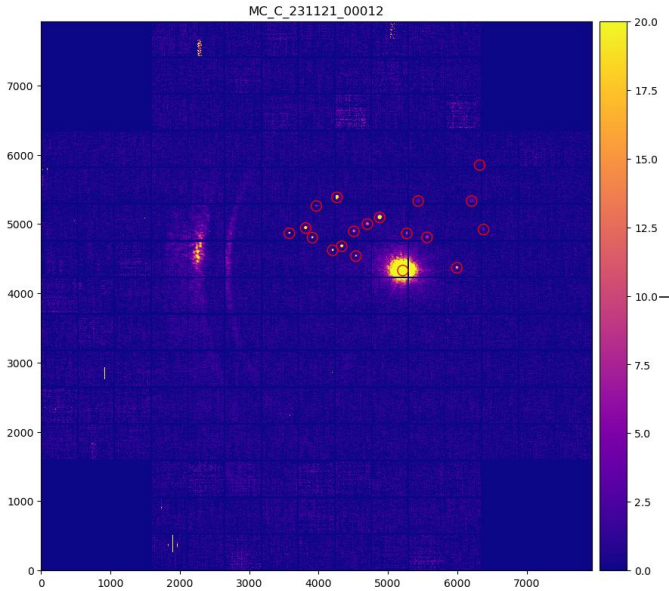
cp_pipe → calibration collections
→ cp_verify → statistics results
→ analysis_tools → metrics/plots
→ web report for TAXICAB

Web report (Chris Waters)

- Use butler to find all relevant input datasets:
  - analysis_tools plots and metrics.
  - cp_verify focal plane residual mosaics and final result table.
  - cp_pipe focal plane calibration mosaics.
- Copy input datasets to output `src` directory, with:
  - FITS mosaics converted to PNG plots.
  - analysis_tools metric bundles converted to tables.
  - cp_verify results converted to tables.
- Iterate over calibration type (bias, dark, etc), generating:
  - An index page containing focal plane results and metric bundle tables.
  - An exposure page containing per-exposure plots and metrics, organized by exposure.
  - A detector page containing per-detector plots and metrics, organized by detector.
- Clearly label everything with the butler collection, dataset_type, dataId.
- The full camera will need navigation helpers.

# CCOB Narrow Beam (Johan)

Camera Optics alignment and transmission measurement

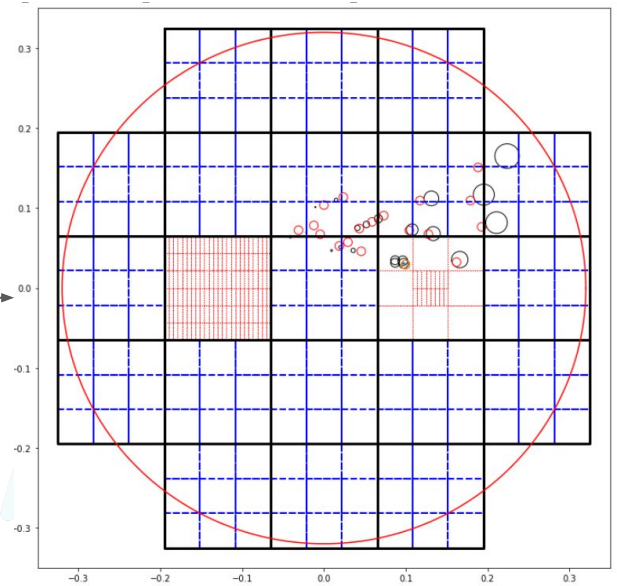



Narrow beam Run 6 data

Geometry

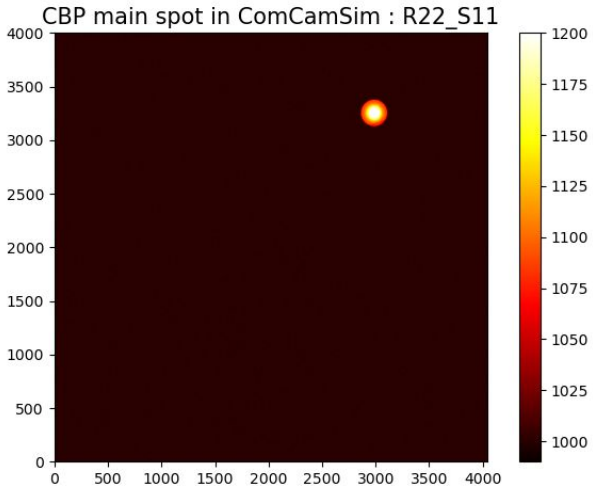
Ray Tracing Simulation

Ghosts Match ?



# CBP (Jérémy+Nathan)

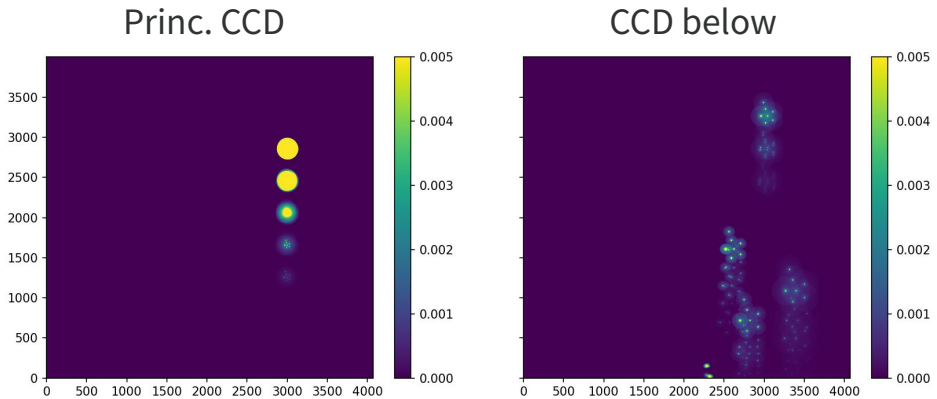
CBP spot in ComCam Image simulation with Batoid + ImSim




Goal : photometry with this spot

Ongoing : Normalize spot flux depending on exptime
→ In collaboration with Harvard student

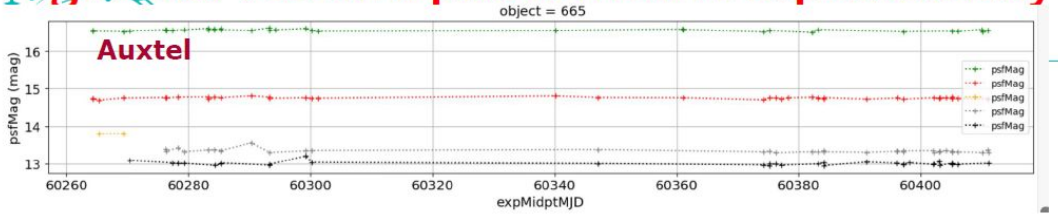
Ghosts simulation with Batoid

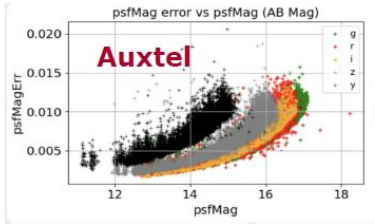


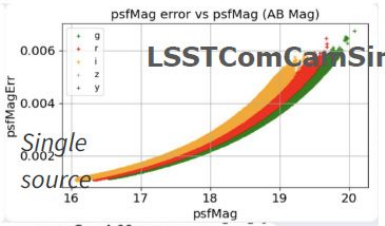

Goal : use Ghosts positions for photometry + Rubin-CBP alignment

# Photometry (Sylvie)

## Light-Curves and photometric repeatability

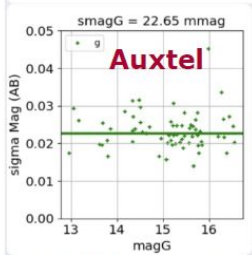


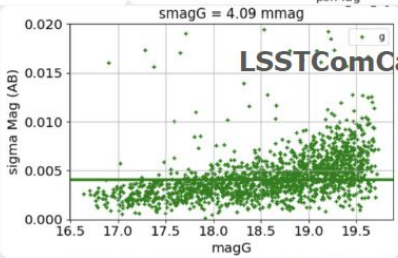




*Single source*

*Single source*




***Photometric repeatability**:*

*all sources a given object*

| band | AUXTEL | LSST |
|---|---|---|
| g | 23 mmag | 4.8mmag |
| r | 21mmag | 4.7mmag |
| i | | 4.8mmag |
| z | 23mmag | |
| y | 36 mmag | |

*Auxtel does not follows requirements on photometric repeatability*



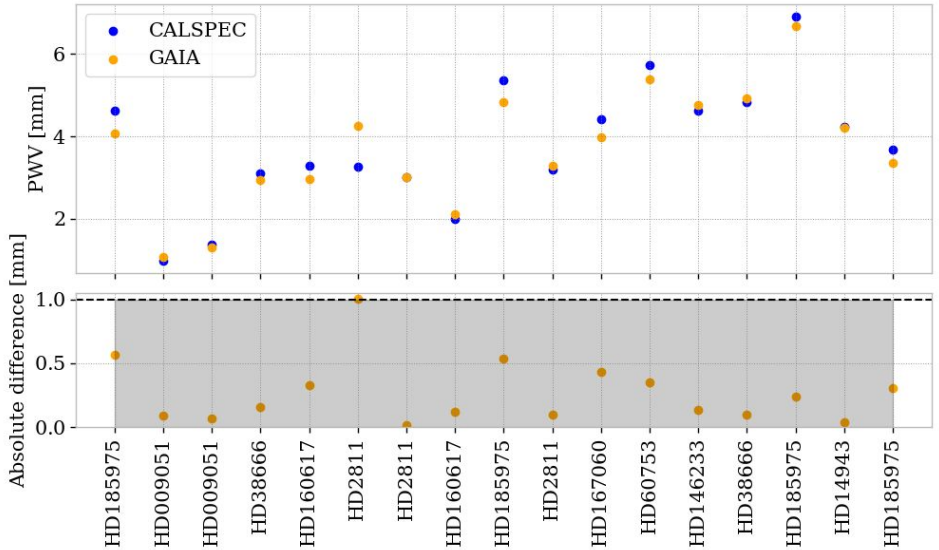


Acronyms & Glossary

# AuxTel standards (Philippe+Nicoleta+Corentin)

- Standard spectra used in AuxTel from CALSPEC and no coverage of the full LSST sky, nor the DDF.
- **First test:** using GAIA spectra as standards in the spectroscopic extraction of AuxTel and comparison with CALSPEC
- Conclusive feasibility study, still a lot of work on GAIA catalog and spectra
- See presentation in AuxTel parallel

Precipitable water vapor measurement by AuxTel with CALSPEC and GAIA spectra



# Ccd saturation and SNe Ia (Julie+Philippe)

- ccd saturation -> impact on low-z (z≲0.05) SNe Ia
- Estimate gain/ccd full well using run5

$$Flux = flux[pe/seconde] \times temps\,de\,pose \times f(seeing)$$