# PDS Data Review

# LCOGT Data

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September 15, 2023

document_lcogt

# LCOGT SIS

- Las Cumbres Observatory SIS support documents for
  - Sinestro cameras
    - Multiple 1-m telescopes
  - FLI imagers
    - Autoguider cameras for Sinestro  (Used only for time of impact observations)
- SIS describes the three data products
  - Raw Image data   (FITS files)
  - Reduced and calibrated image data   (FITS files)
    - Only include Didymos data
    - Bias subtracted, Flat fielded and trimmed
    - Astrometric WCS included
    - Converted to units of electrons  (On-field stars used to calibrate photometry)
  - Photometry tables
    - ASCII Tables for Sinestro
    - FITS binary tables for FLI
- SIS is very well written, detailed and informative
  - Typo  Pg 16:   "A separate "documen_lcogt" folder is created"

data_lcogtraw

data_lcogtcal

# Sinestro Raw & Calibrated Images

- Overview file in Documents data set
- Raw data: FITS images with detached XML labels
  - 4 extensions, one for each amplifier
  - 2080 x 2058 pixels per extension
  - 8388 images in 47 directories (by date and telescope)
    - All Didymos images
- Calibrated data: FITS images with detached XML labels
  - 4096 x 4096 pixels  (4 raw extensions merged into 1 image)
  - 8388 images in 47 directories (by date and telescope)
    - All Didymos images
  - WCS added to each frame
- No calibration files (flats, biases, darks)
- SIS describes master reduction files but I don't see them anywhere?
  - Raw frames aren't very useful without these

# Sinestro Image Data

- Data files are in good shape
  - Read with IDL FITS readers and PDS_READ
  - Read and displayed every image
- Tested to make sure data could be manipulated and measured
- Files are consistent between the raw and calibrated datasets
- Spot-checked:
  - XML Label information
    - Problem with orientations in raw data
  - Confirmed (against Gaia DR2) that the calibrated data do contain WCS
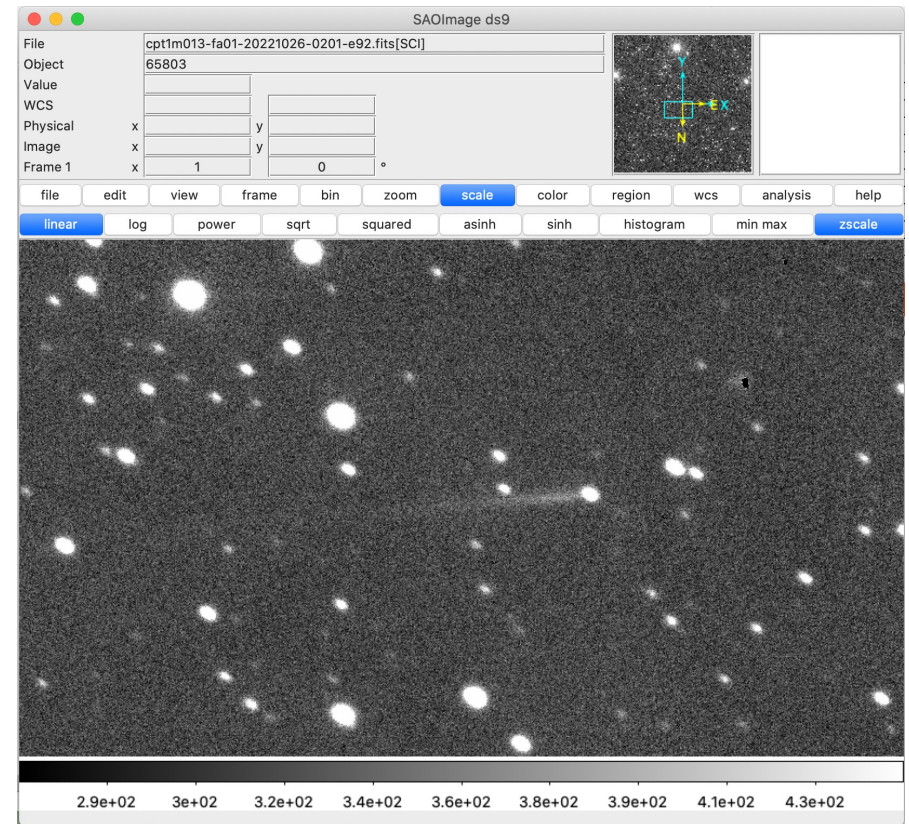- Did not try to reproduce the photometric measurements

# Image Orientation

- Calibrated images are ok
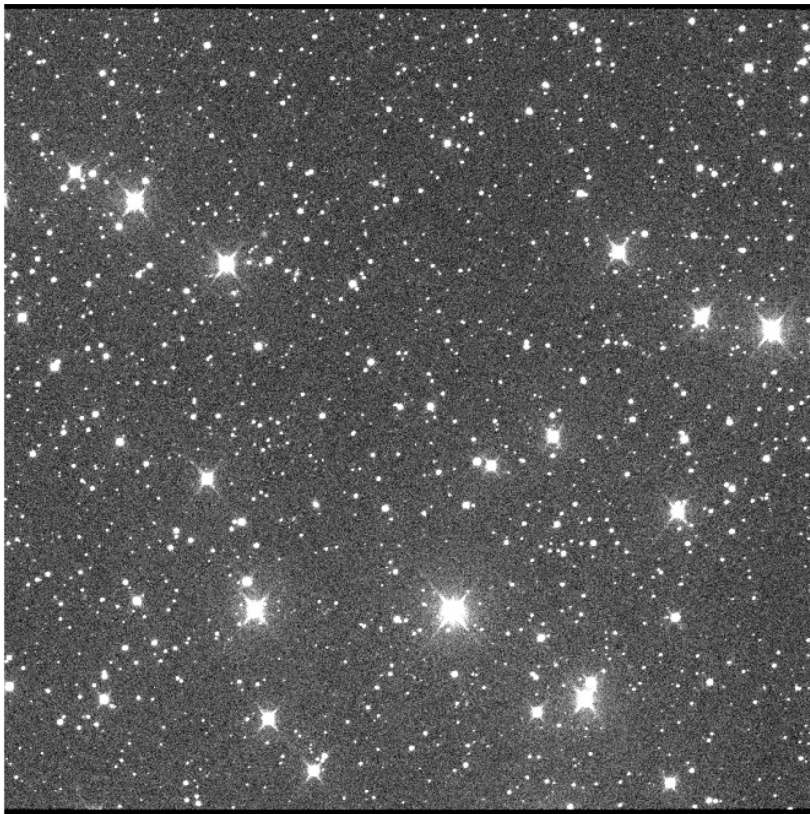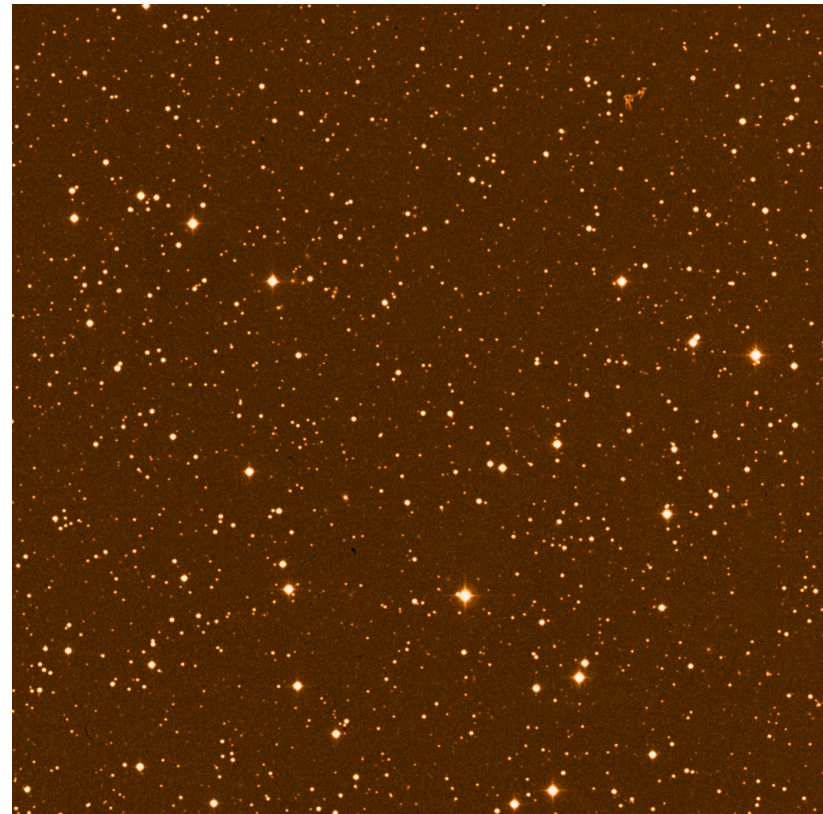- Image displayed according to the XML header display parameters matches Sky Survey image



Image  tfn1m001-fa11-20230125-0070-e00

DSS field, N up, E left

# Image Orientation

- **Raw image extensions don't match sky orientation**
  - Each extension/amplifier needs its own line_display_direction and sample_display_direction?
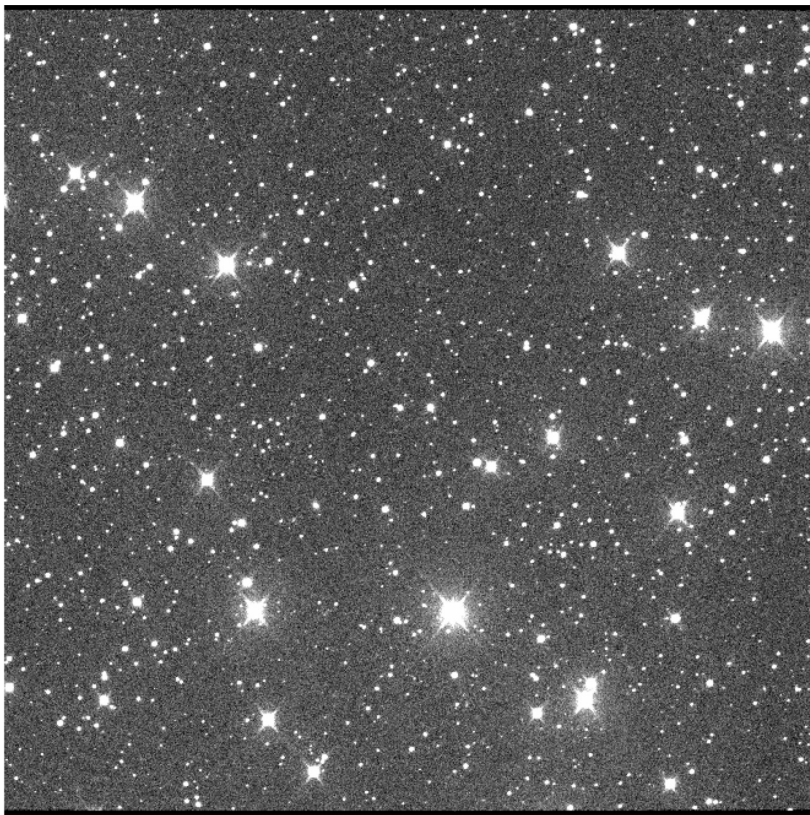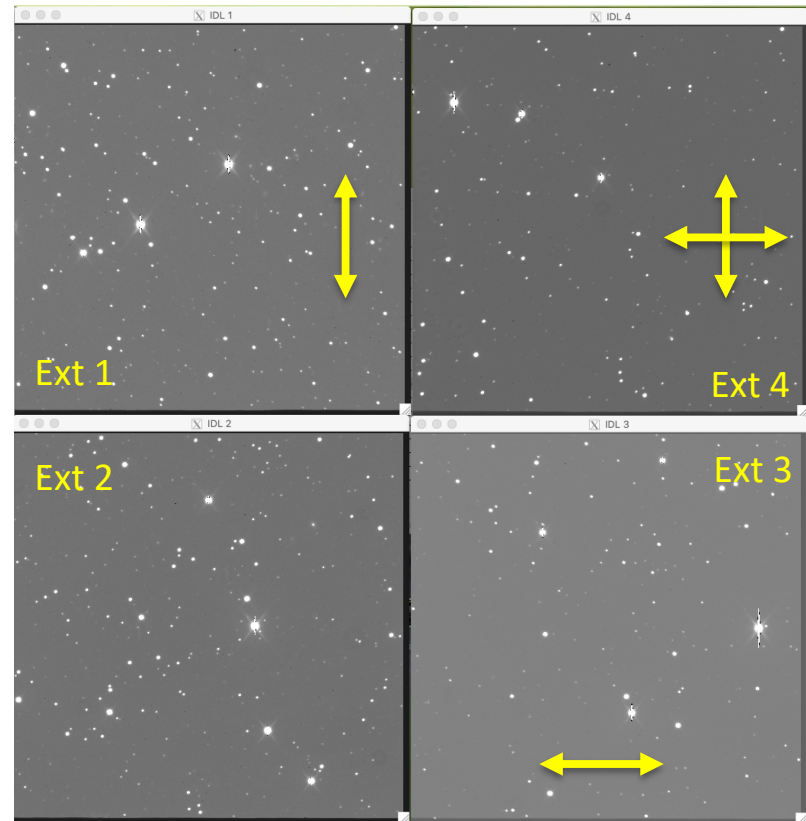  - Or each extension needs flipped properly



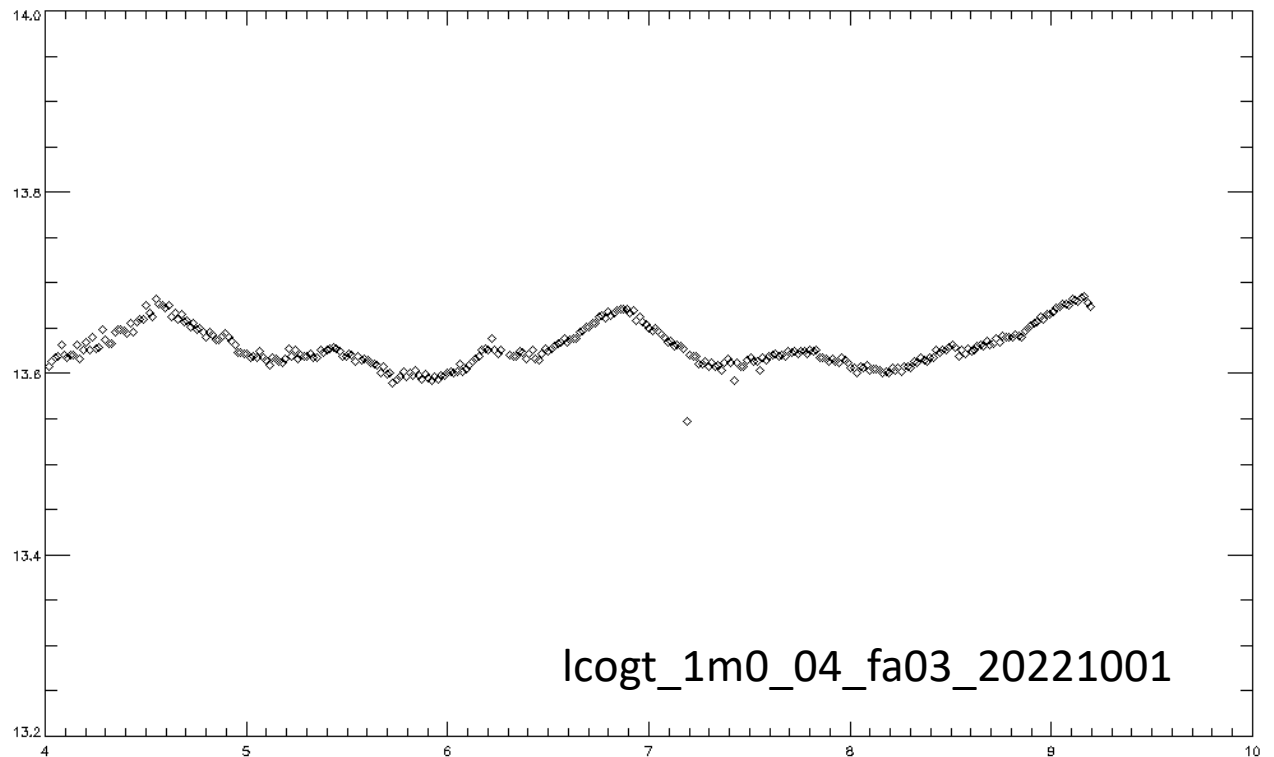Image  tfn1m001-fa11-20230125-0070-e00

Same frame in raw data extensions

data_lcogtddp

# Sinestro Photometry

- Overview file
  - Short summary of the data reduction and photometry measurements

- Data: 47 tables of photometry from 47 dates  (ASCII)
- Data look like Didymos lightcurves



lcogt_1m0_04_fa03_20221001

data_lcogt_fliraw

data_lcogt_flical

# FLI Raw & Calibrated Images

- Overview files
  - Copies much of the calibration information from the SIS
  - <span style="color:red">Includes steps for Sinestro that are not relevant to this data set</span>
- Raw data: FITS images with detached XML labels
  - 512 x 512 and 1024 x 1024 pixels
  - 2043 images in 3 directories (by different instrument)
    - All Didymos images

- Calibrated data: FITS images with detached XML labels
  - 500 x 507 pixels   and 1024 x 1024 pixels
  - 2043 images in 3 directories (by instrument)
    - All Didymos images
  - WCS added to each frame

# FLI Image Data

- Data are in good shape
  - Read with IDL FITS readers and PDS_READ
  - Read and displayed every image
- Tested to make sure data could be manipulated and measured
- Files are consistent between the raw and calibrated datasets
- Spot-checked:
  - XML Label information
    - Just contains basic info
    - Orientation/WCS problems
- Did not try to reproduce the photometric measurements
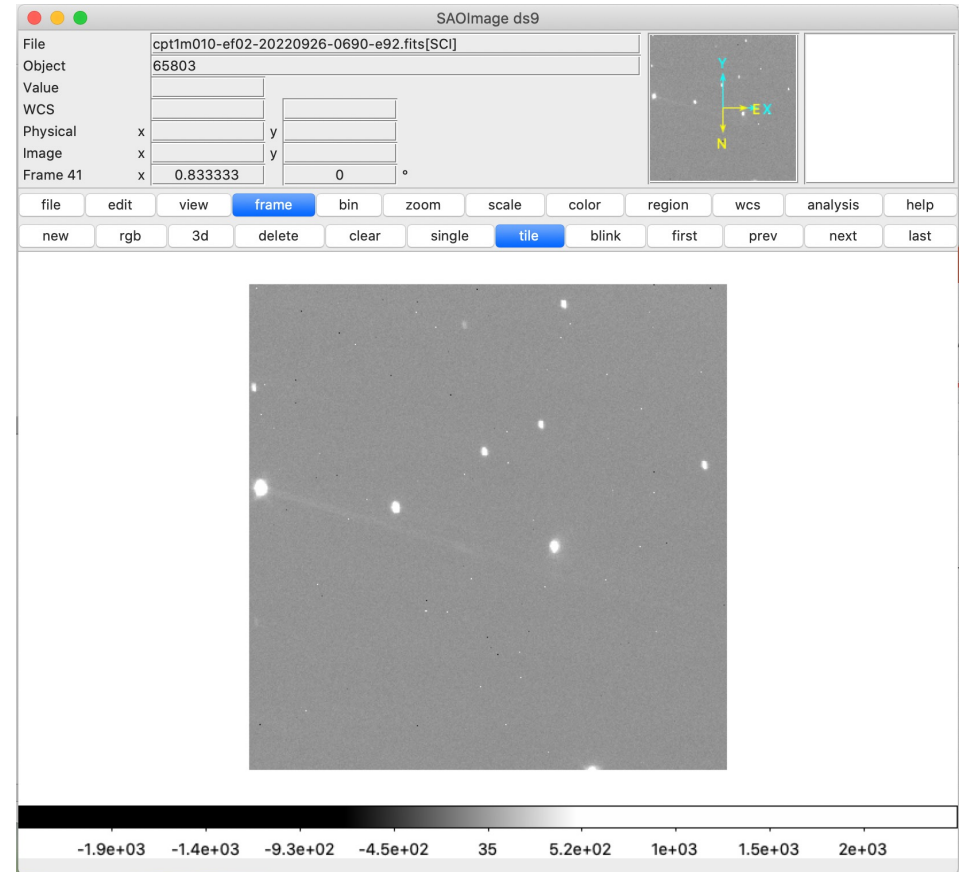
# WCS Problems

- Celestial_North_Clock_Angle = 0 deg in labels but In images, North is down (~180 deg)

- Some of the WCS solutions are not accurate
  - Problem is noted and "solved" in the DDP dataset, but not in this one
  - Document that some of the WCS in the headers data cannot be trusted and point to DDP dataset
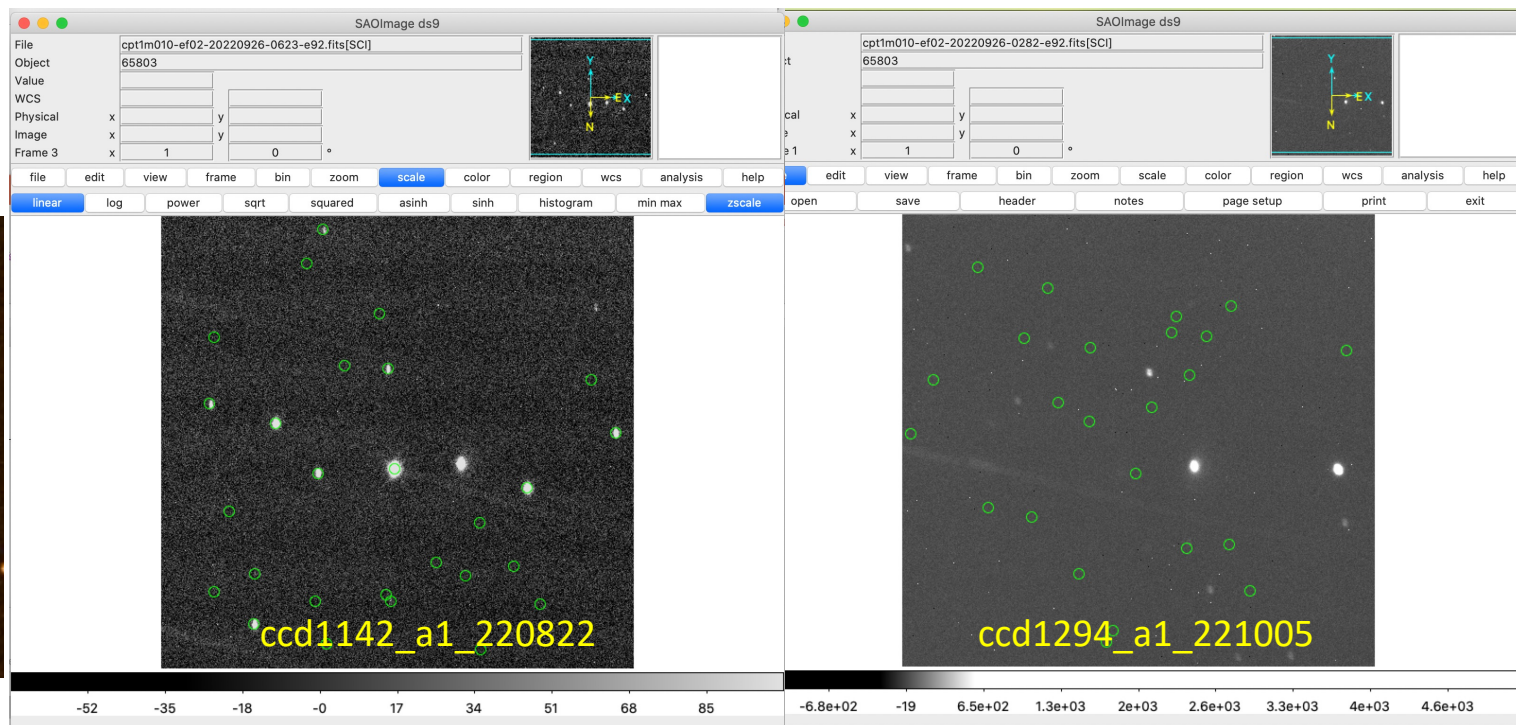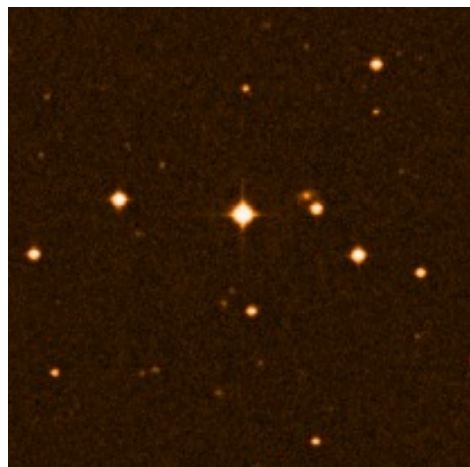
data_lcogt_fliddp

# FLI Photometry

- Overview file
  - Short summary of the data reduction and photometry measurements
  - Includes note about WCS problem
- Data files are binary FITS tables
  - Why does this one deviate from all the other datasets?
  - 3 tables of photometry from 3 instruments

- Spot-checked: Data look like Didymos lightcurves

lcogt_cpt_ef02_20220926_3010137_65803
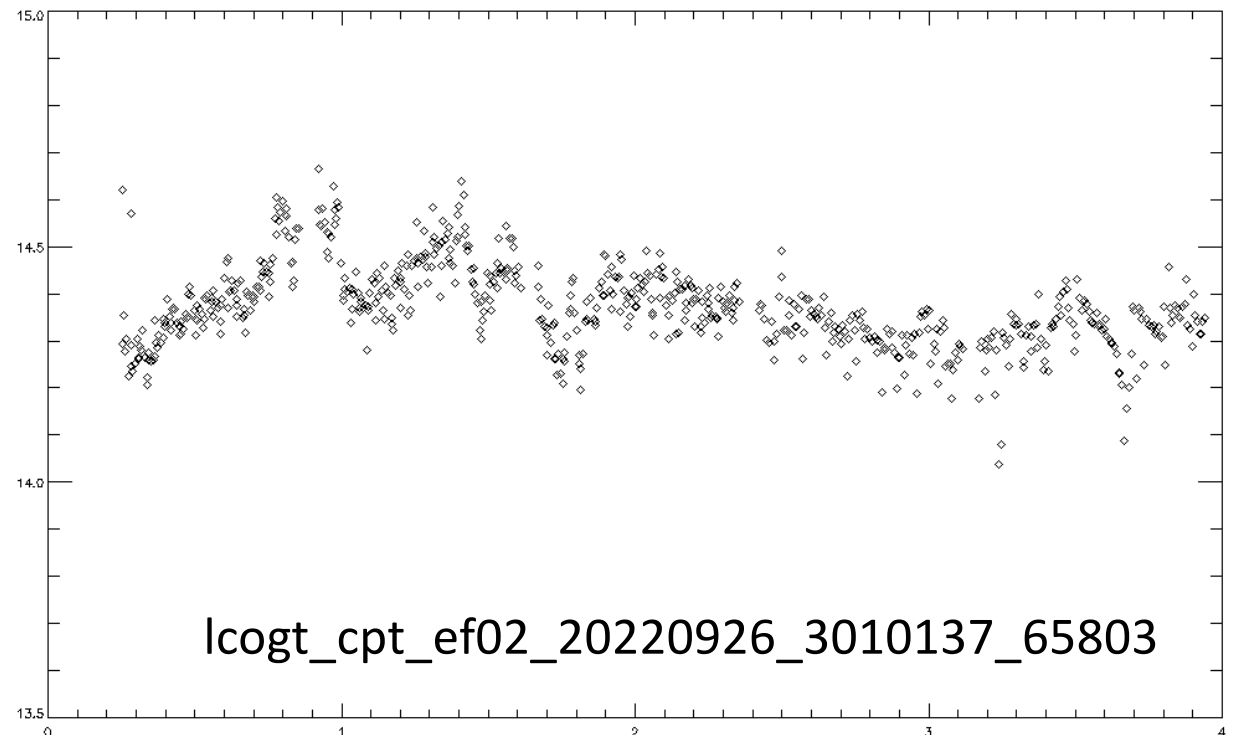
# LCO Issues

- Need to address orientation issues in both Sinestro and FLI

- Include calibration files

- Some minor documentation issues

- Change FLI FITS binary tables to ASCII?

  Data are not certifiable