The Watcher Robotic Telescope

Lorraine Hanlon, Antonio Martin-Carrillo, David Murphy

Science Alerts Workshop, Liverpool – 10th November 2015

School of Physics
University College Dublin

Image: *Martin Jelínek*

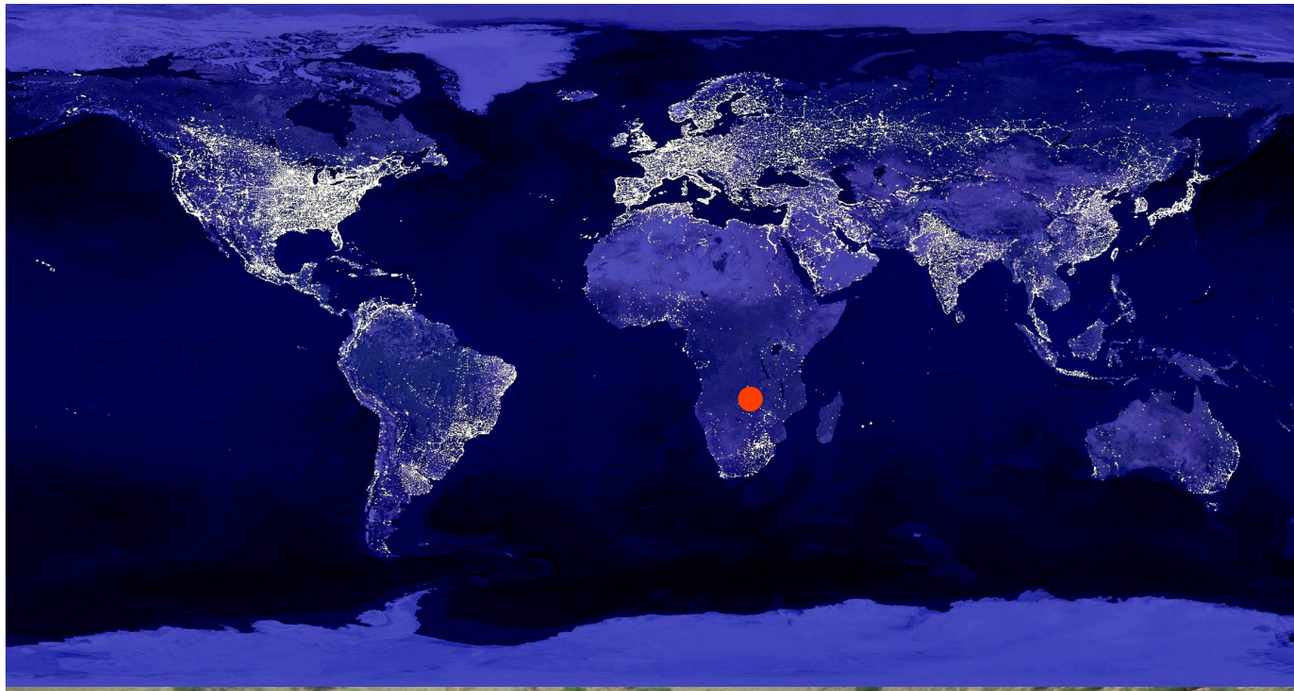
What is Watcher?

- A fully Robotic Telescope designed primarily for GRB prompt and afterglow observations
- 40cm Primary Mirror
- 10’ × 10’ Field of View
- Uses RTS2 open source telescope control software
- Developed by UCD in collaboration with:
  University of the Free State, South Africa,
  Instituto de Astrofisica de Andalucia,Spain,
  Astronomical Institute, Czech Republic.

Watcher Site

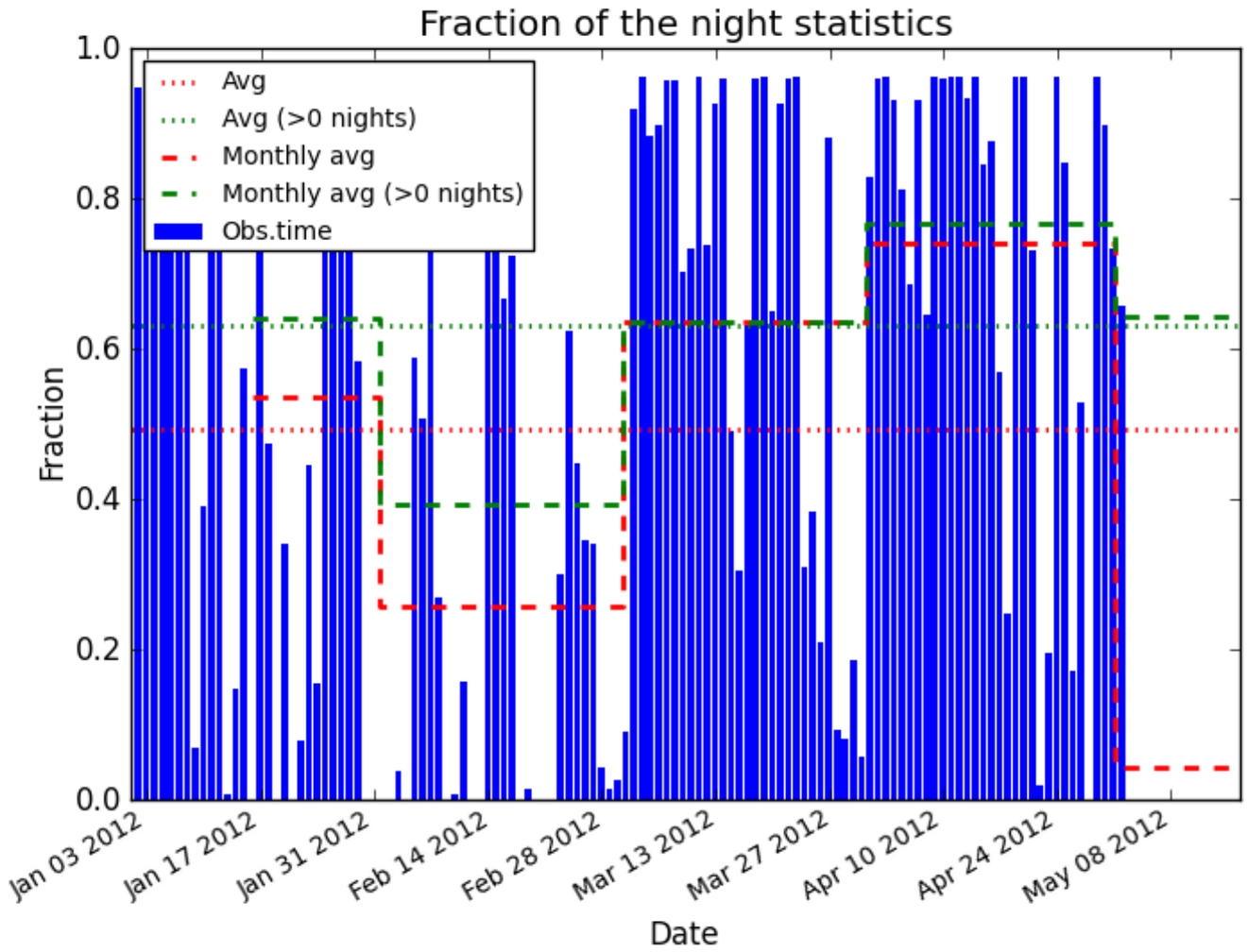
- Boyden Observatory,
  Bloemfontein, South Africa.

- 29º 02′ 20′′ South,
  26º 24′ 20′′ East,
  Elevation: 1387m.



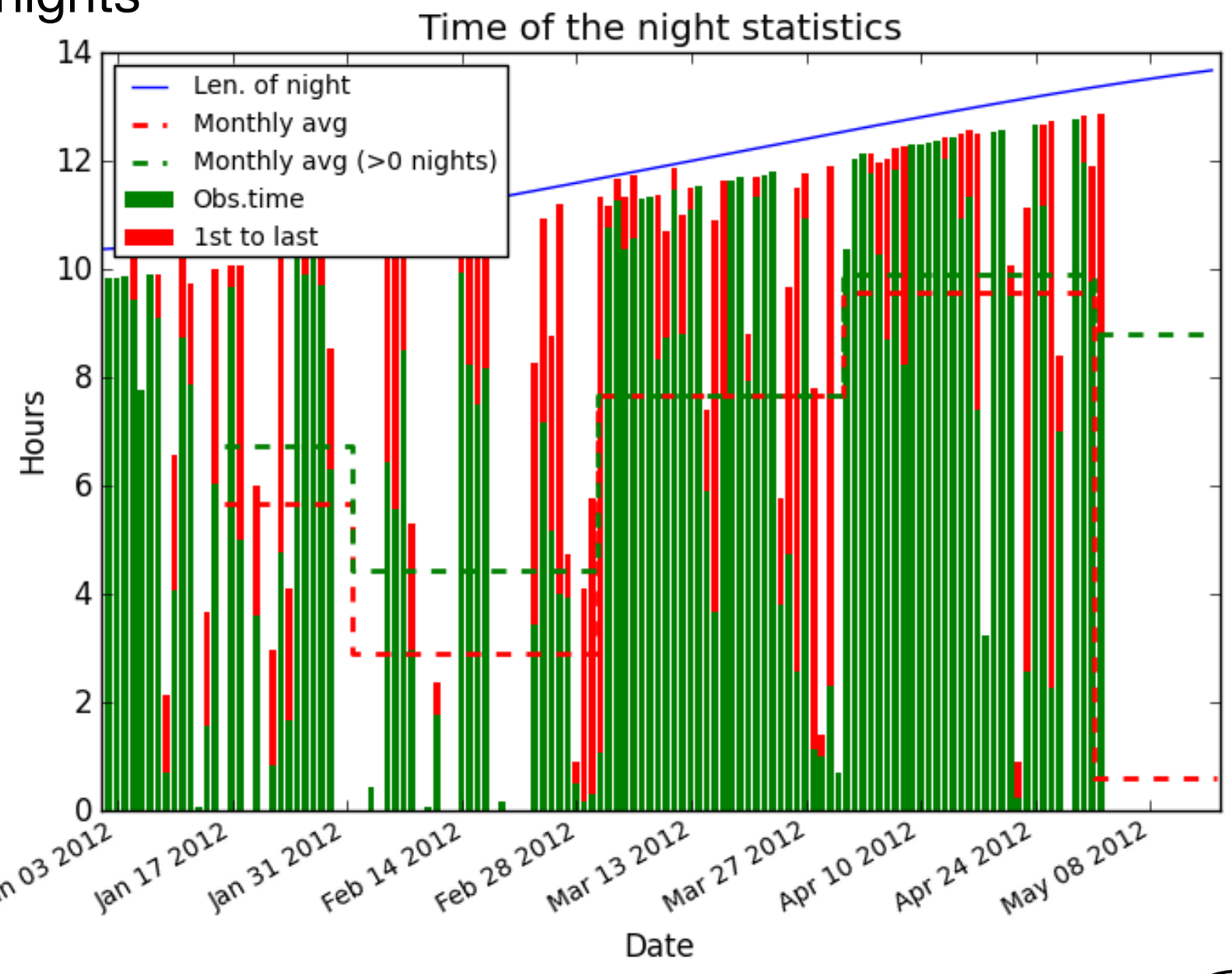
Watcher Site

- Approx. 200+ observing night per year.



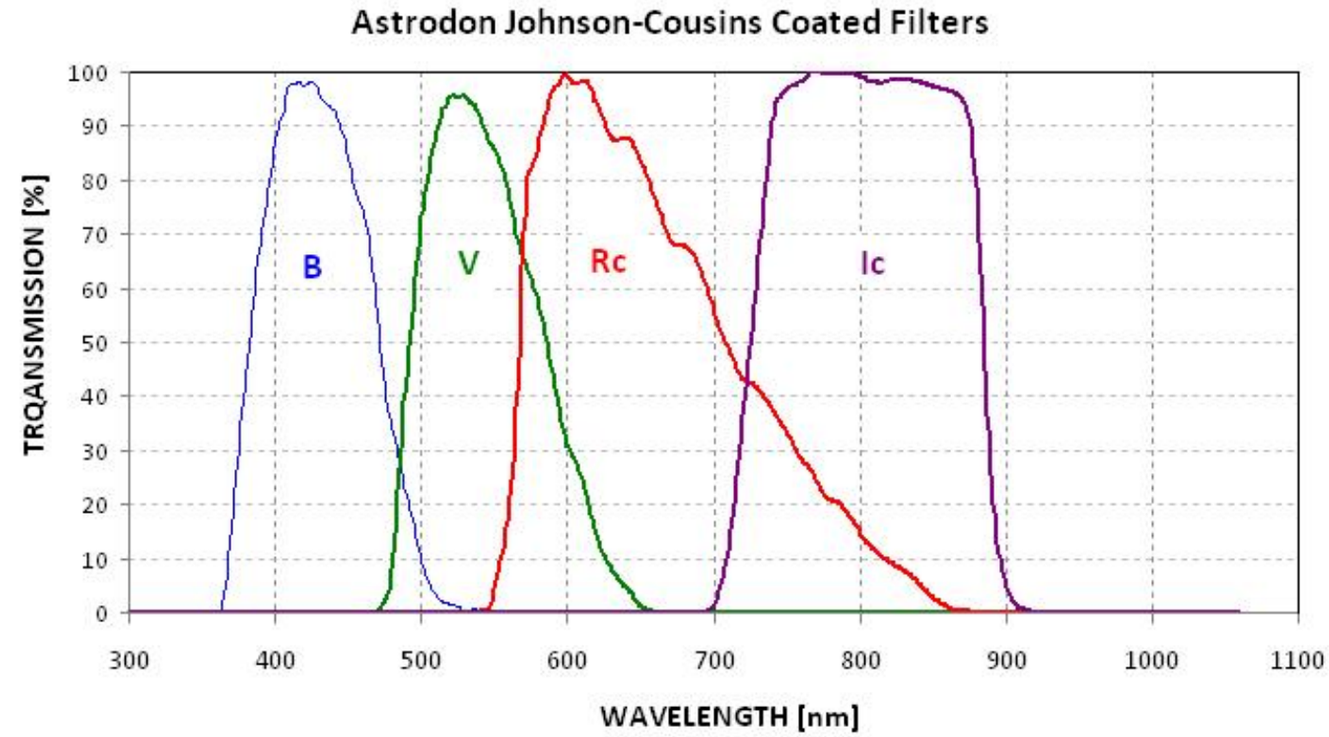
Watcher Site

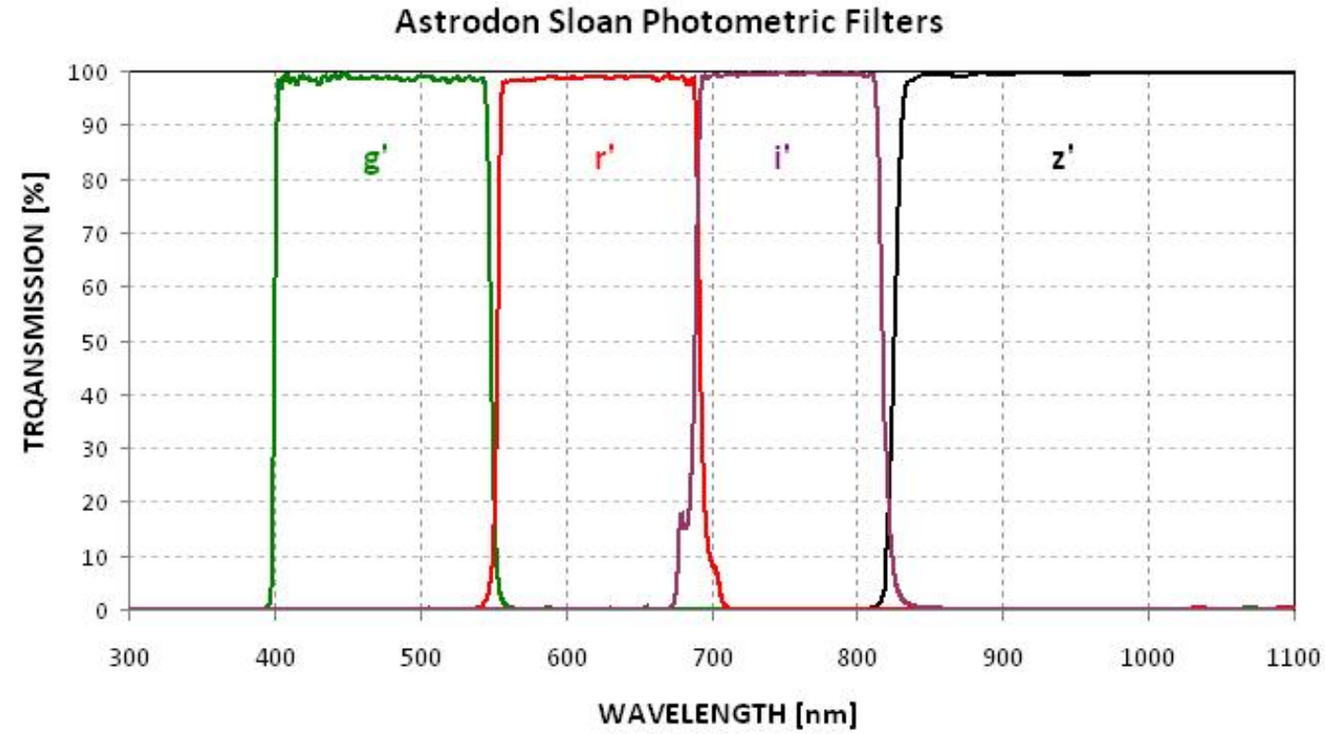
- Approx. 200+ observing nights per year.



Watcher Components

- Sloan filters (Astrodon)
- Electron Multiplication CCD (Andor) 1Kx1K, 13 μm pixels, >90% QE.





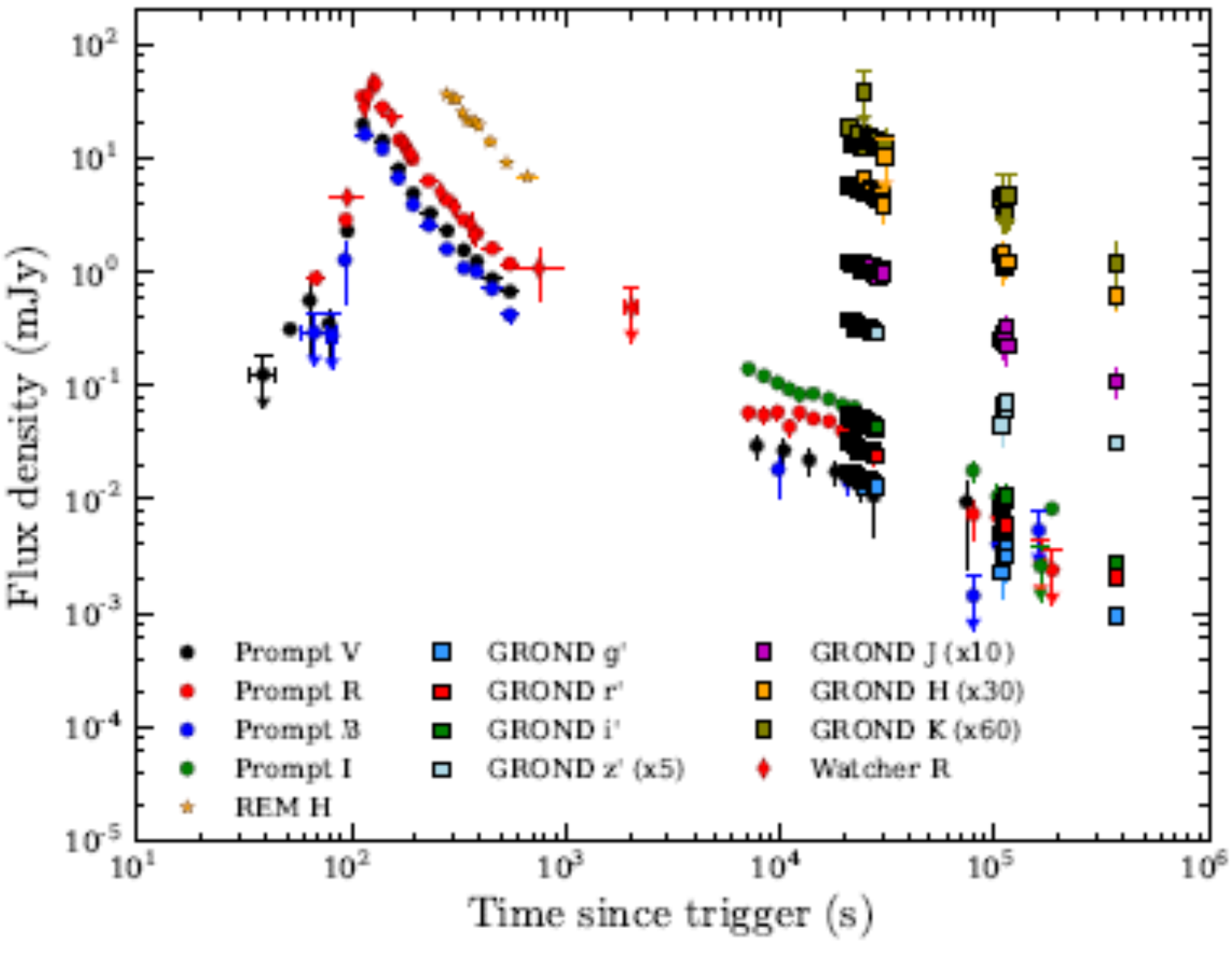
Watcher GRB Response

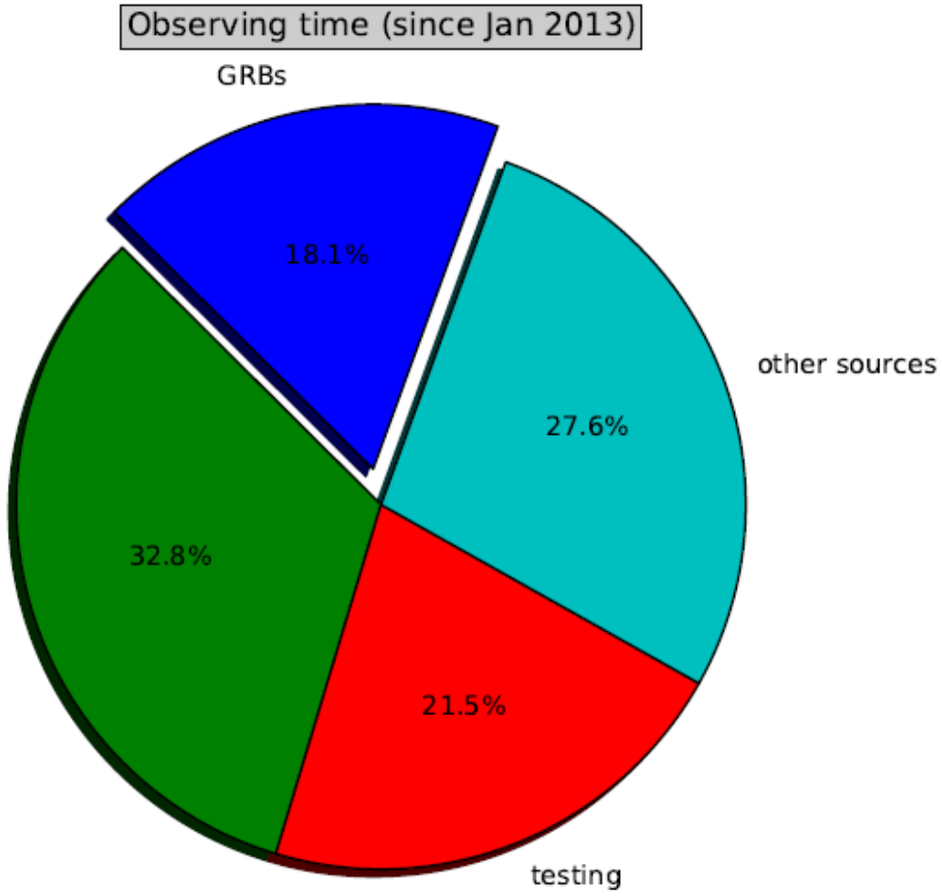
- Mean response time (when source observable at trigger): 35s
- GRB Observing Strategy:
    - t < 600: 5s r' EM mode
    - 600 < t < 7200: 60s r'
    - t > 7200: 120s r'

    t = time in seconds since trigger
- Limiting magnitude:
    - 60s: ~17.8
    - 3× 60s: ~18.5

Watcher's Main Targets

- GRBs – GCNs override all other scheduled targets.





Martin-Carrillo et al., 2014

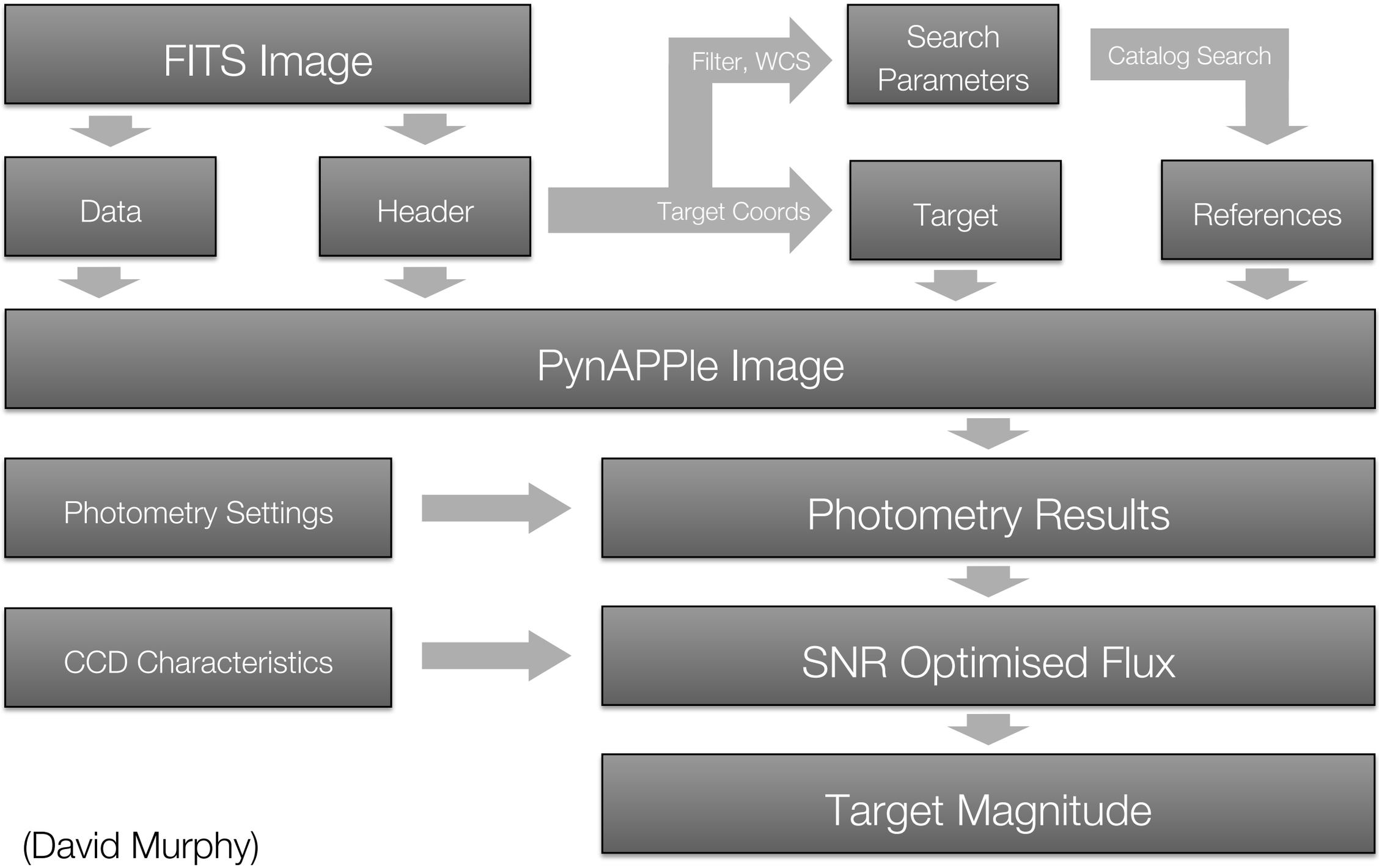
Watcher's Main Targets

- Blazars – monitoring of bright southern γ-ray blazars

NAME	USNO B1 mag.
PKS 2005-489	11.29
PMN J2022-4513	13.91
PKS 2155-304	12.54
AP Librae	11.06
CRATES J061733.67-17	13.15
PMN J0152+0146	11.82
3C 273	13.94
4C +04.77	9.98
BZB J0912+1555	13.46
S3 1741+19	11.4

- Others: e.g. ATELs, Gaia Alerts?

PynAPPIe Photometry



(David Murphy)

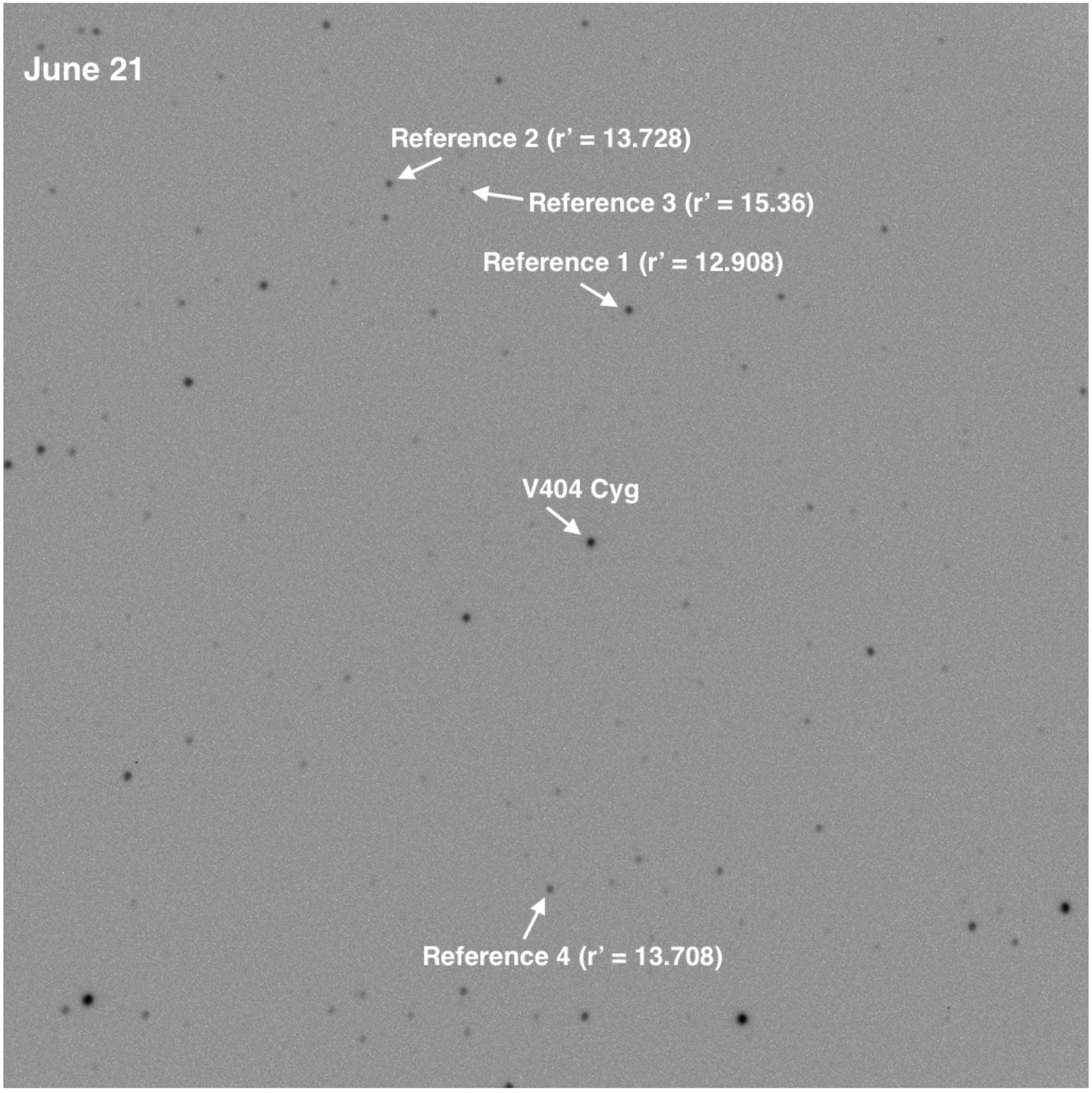
Watcher Observations of *V404 Cygni*

- First observation on June 15th at 23:15 UT in response to a *Swift* GCN alert, as soon as source was above the horizon.

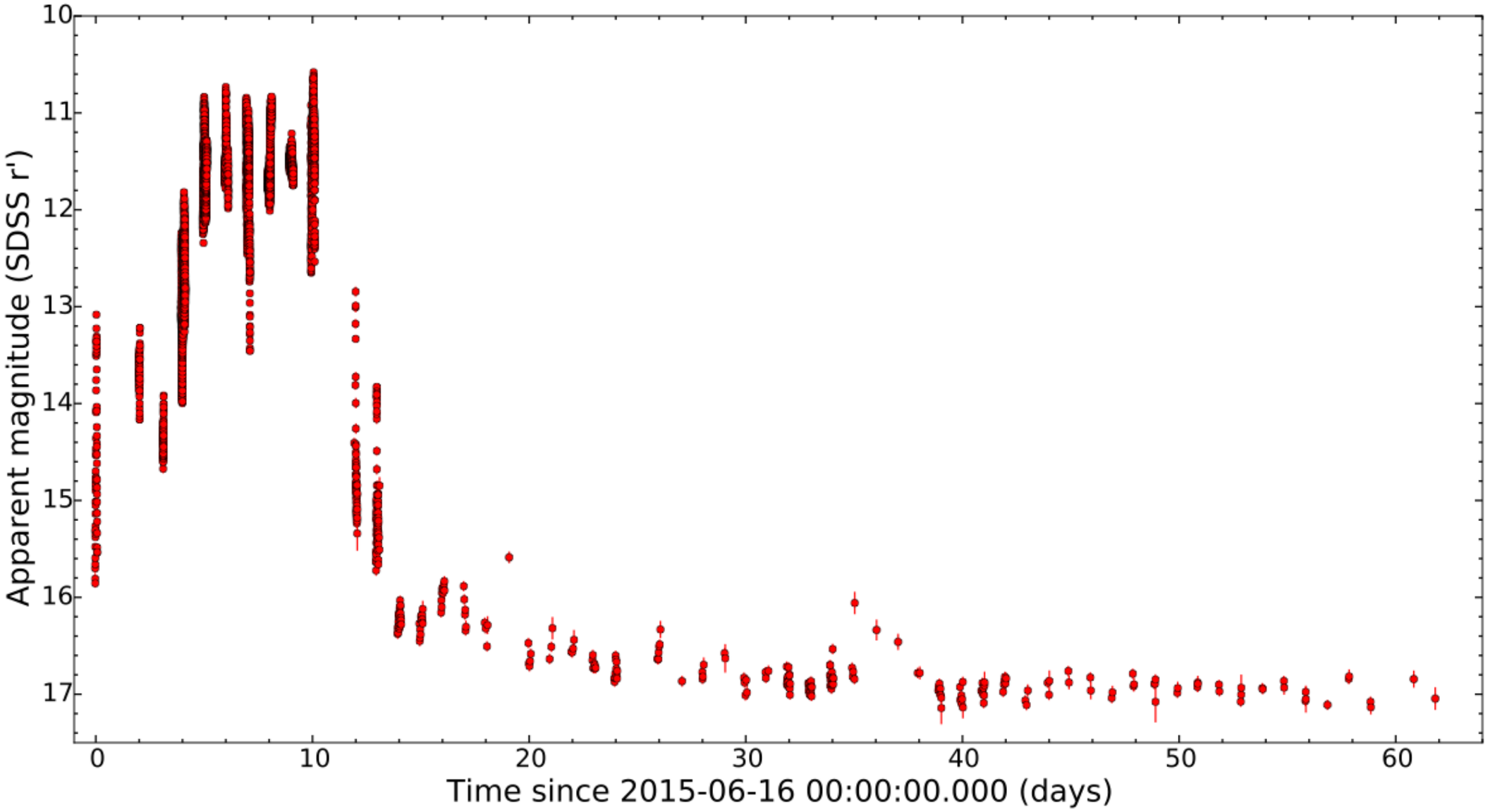
- Observations made mostly in the SDSS r' band (but also g' & i') with exposures ranging from 0.5 to 120 seconds (mostly 5 sec).

- Source was visible for ~3 hours each night around midnight.

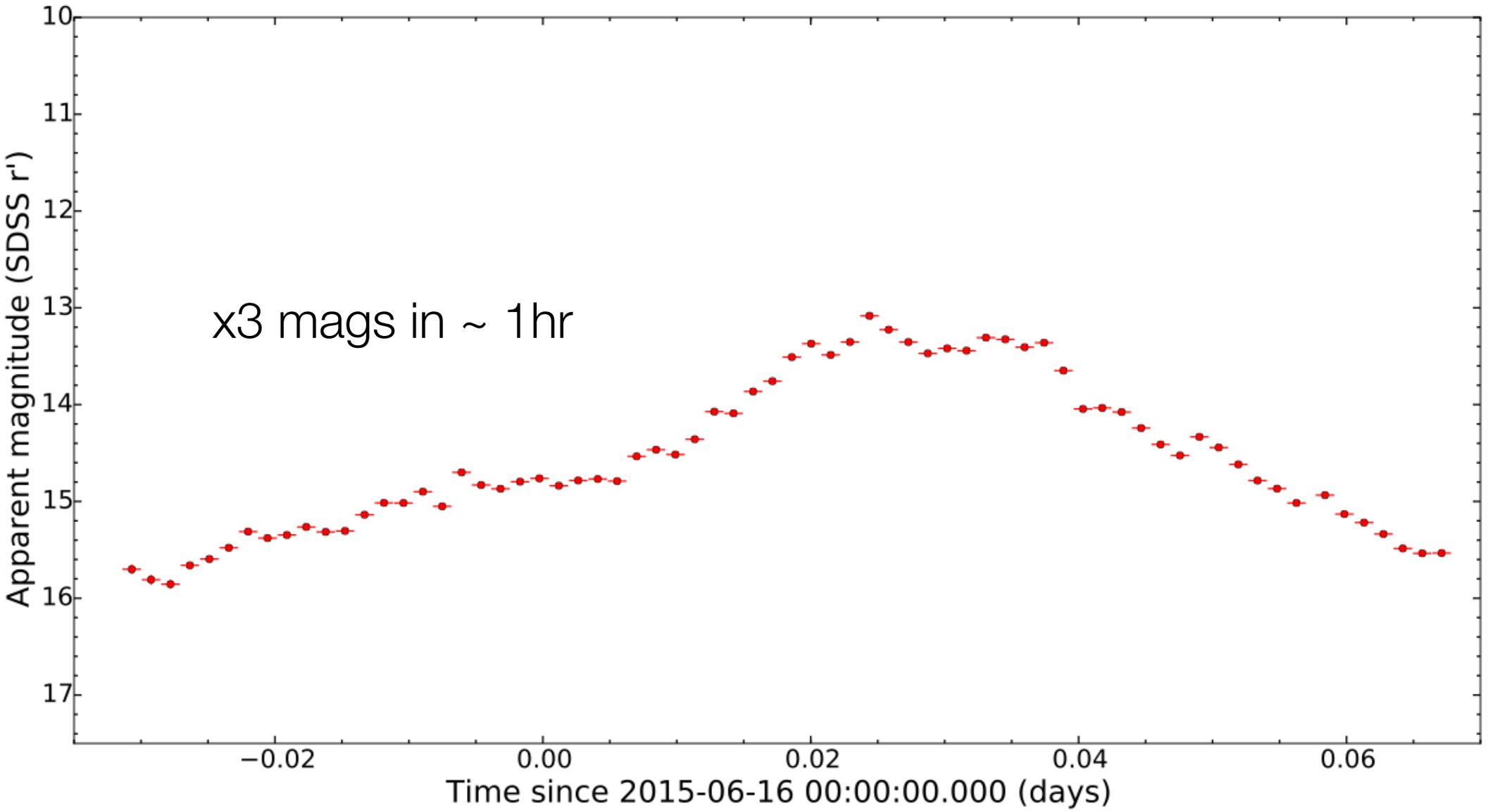
- Over 13,000 images so far, giving more than 8 days of open shutter time.


June 21
Reference 2 (r' = 13.728)
Reference 3 (r' = 15.36)
Reference 1 (r' = 12.908)
V404 Cyg
Reference 4 (r' = 13.708)

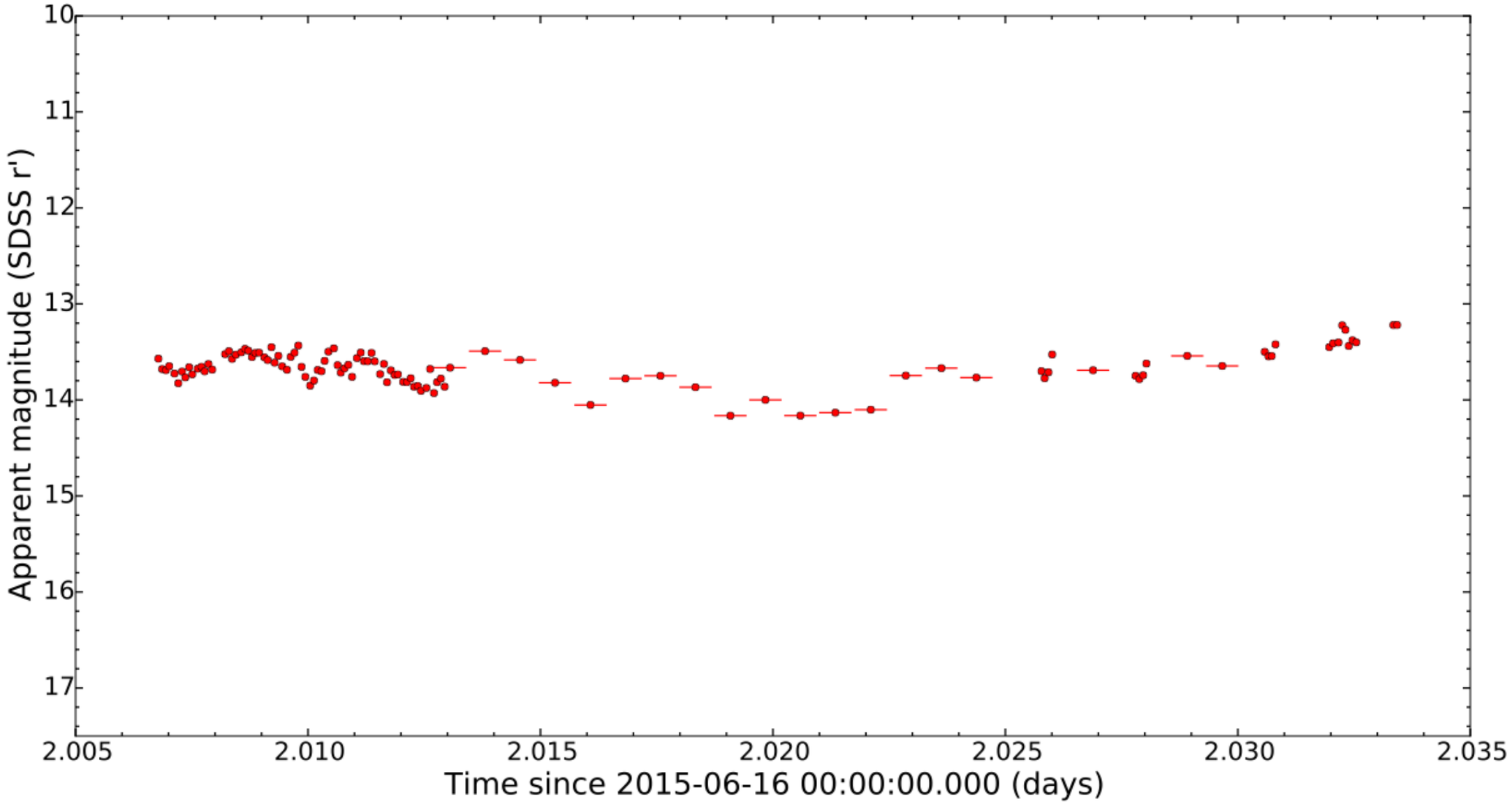
Light Curve - Complete



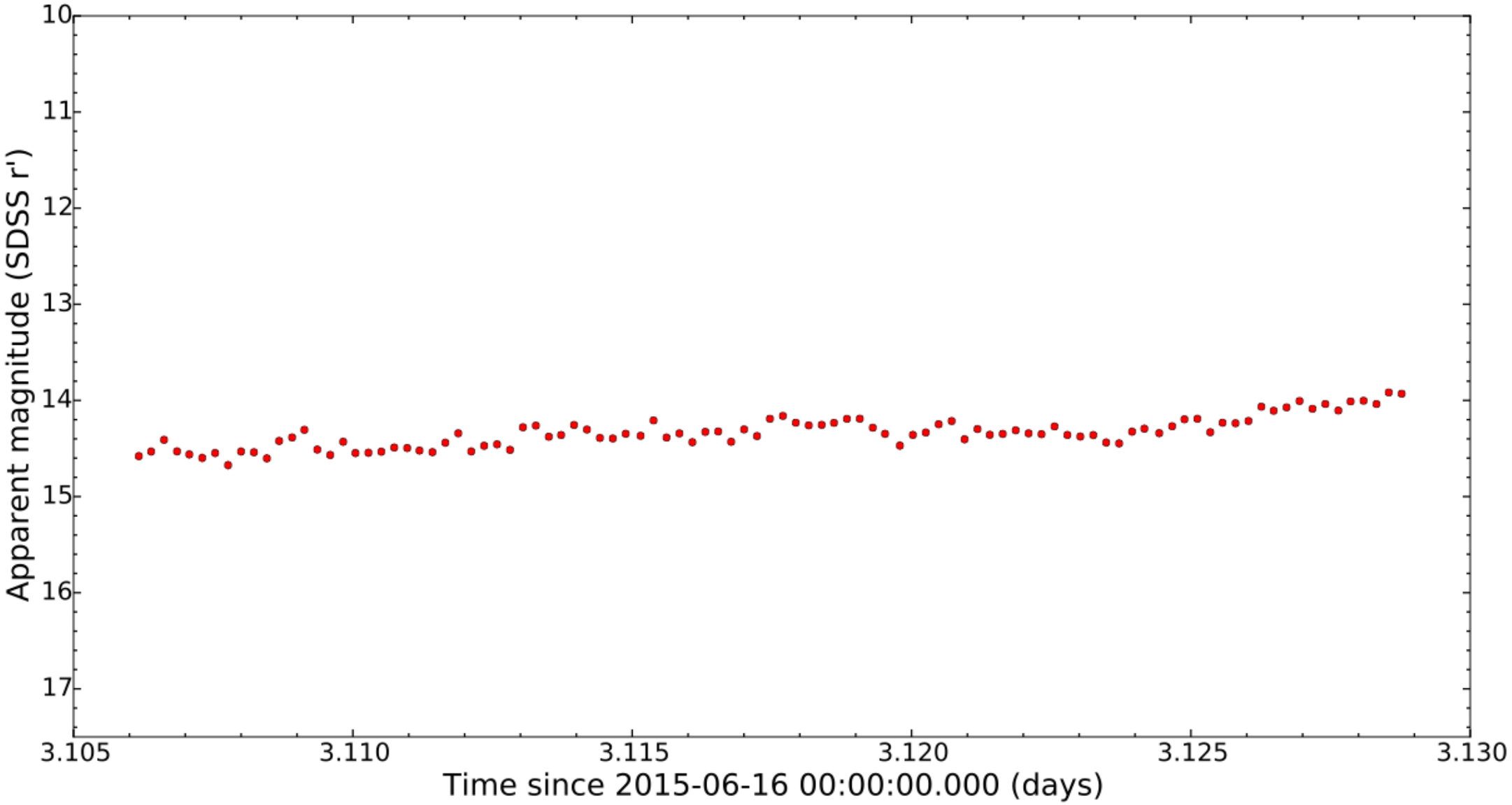
Light Curve - Day 0



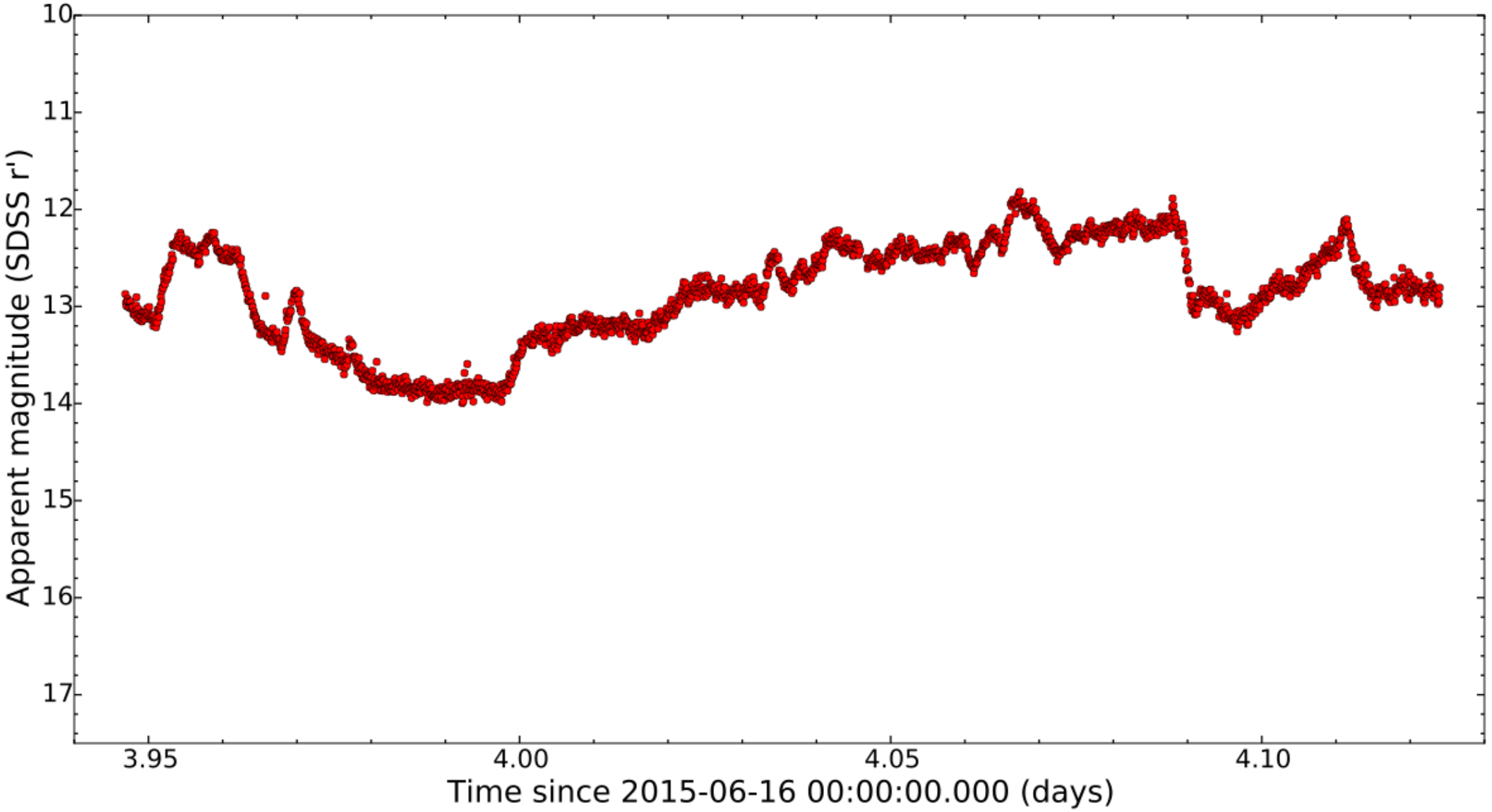
Light Curve - Day 2



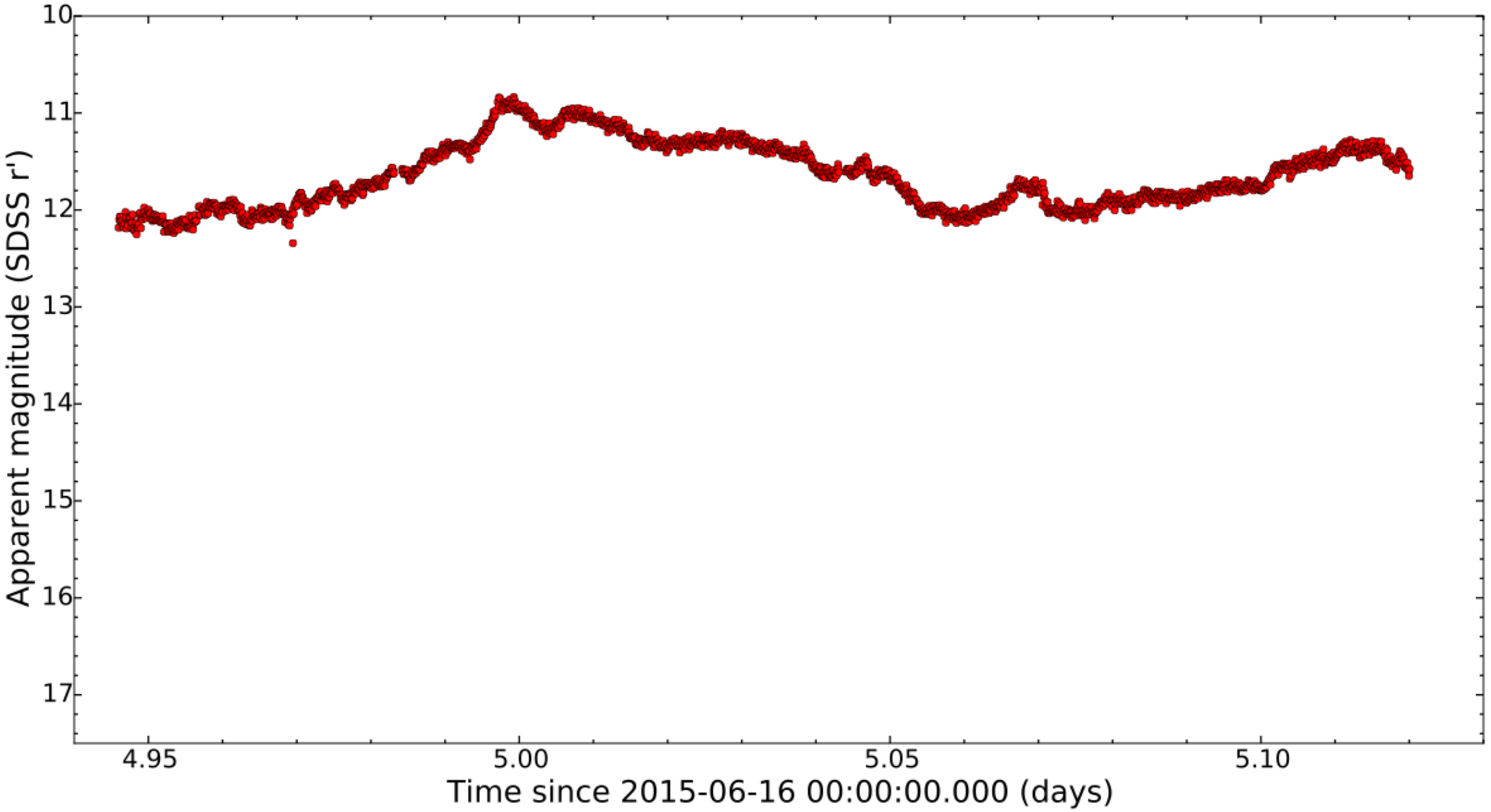
Light Curve - Day 3



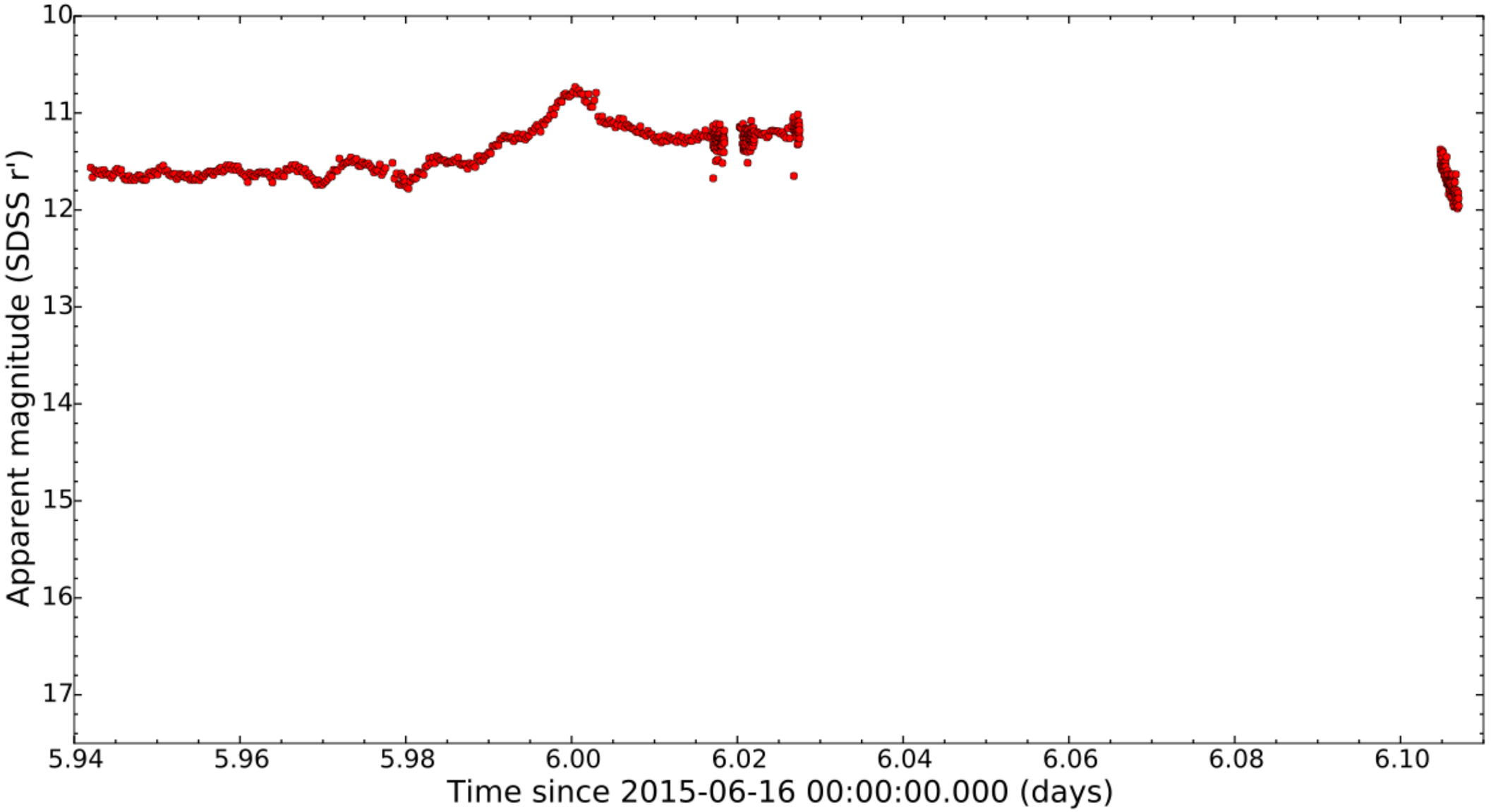
Light Curve - Day 4



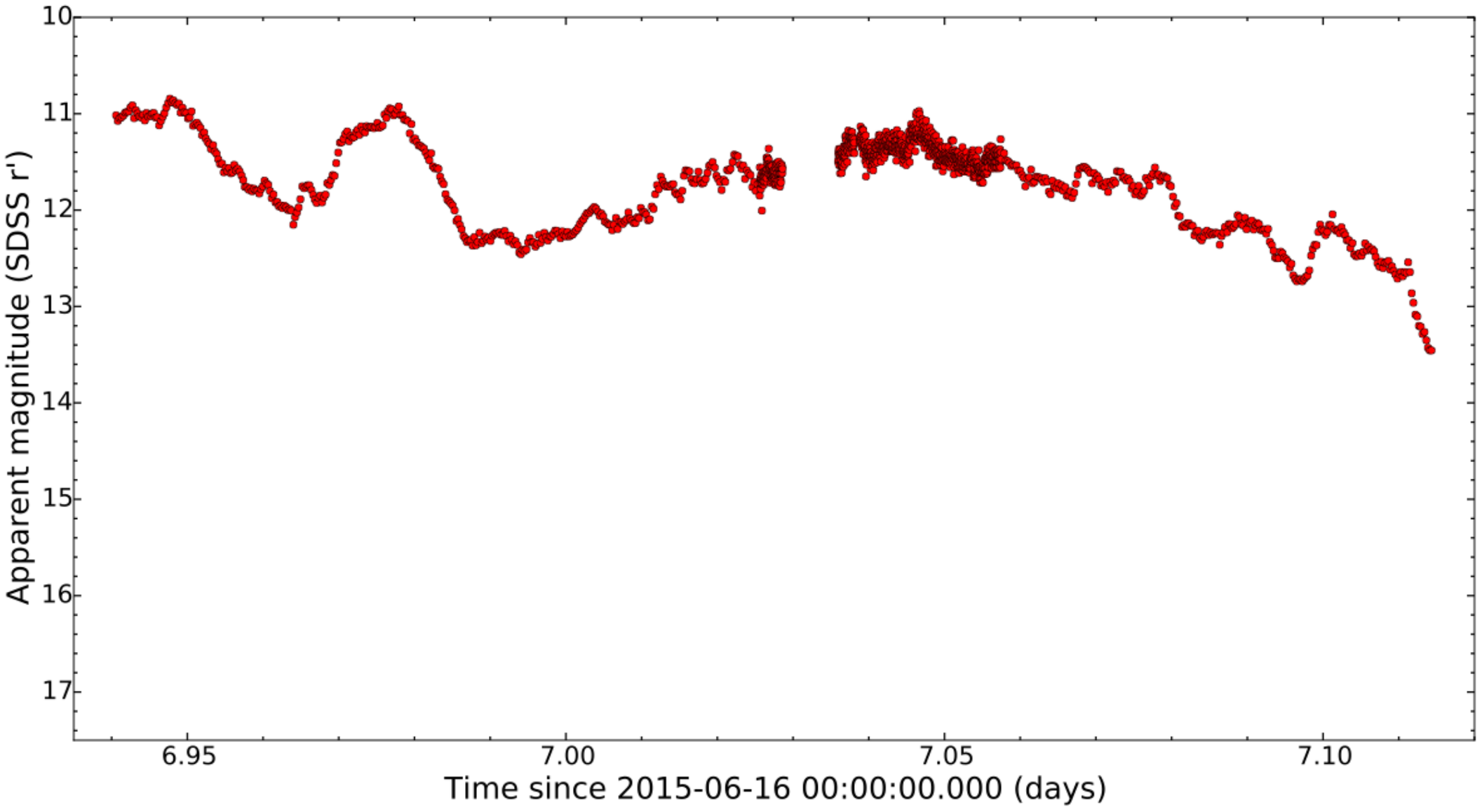
Light Curve - Day 5



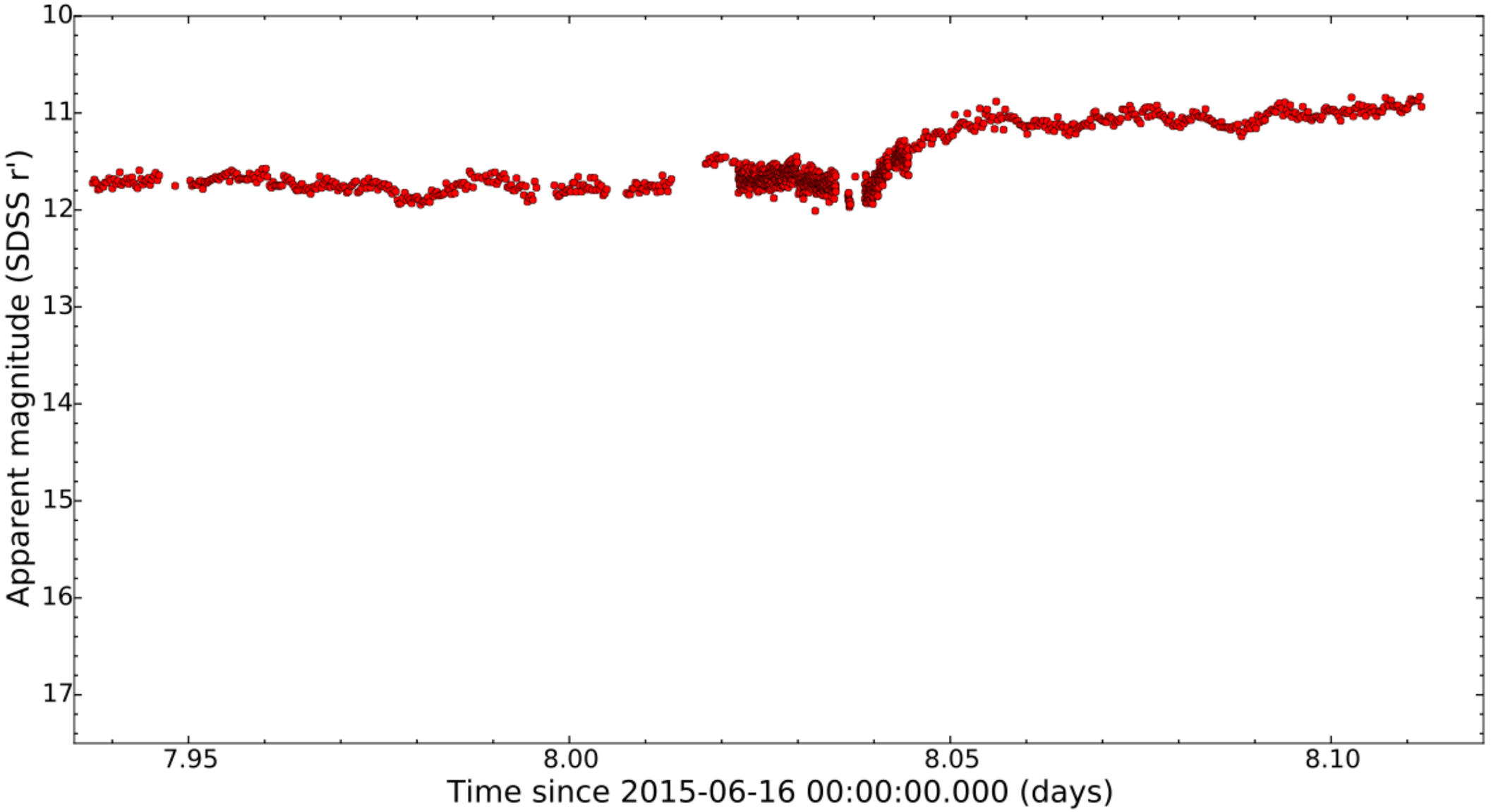
Light Curve - Day 6



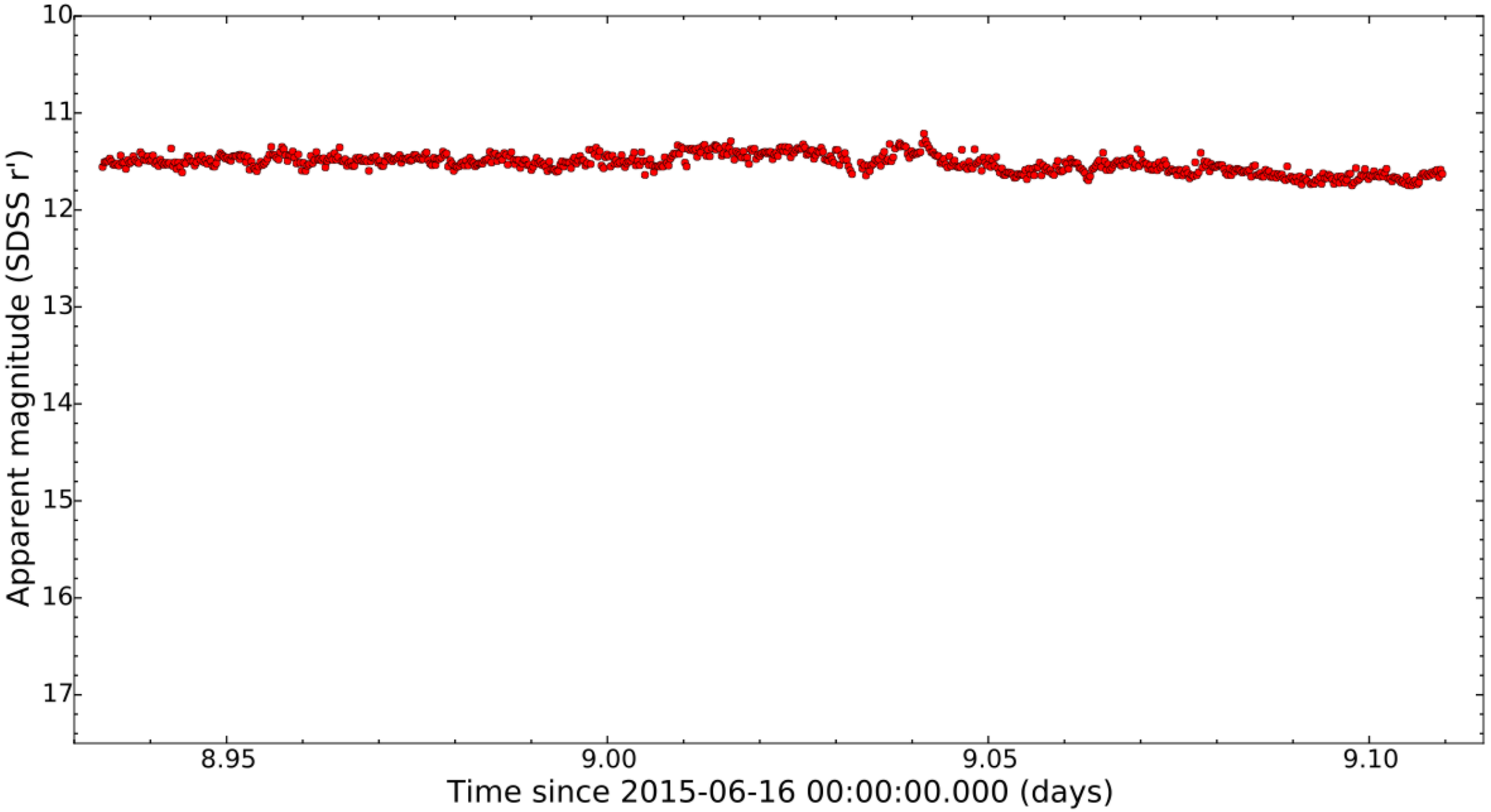
Light Curve - Day 7



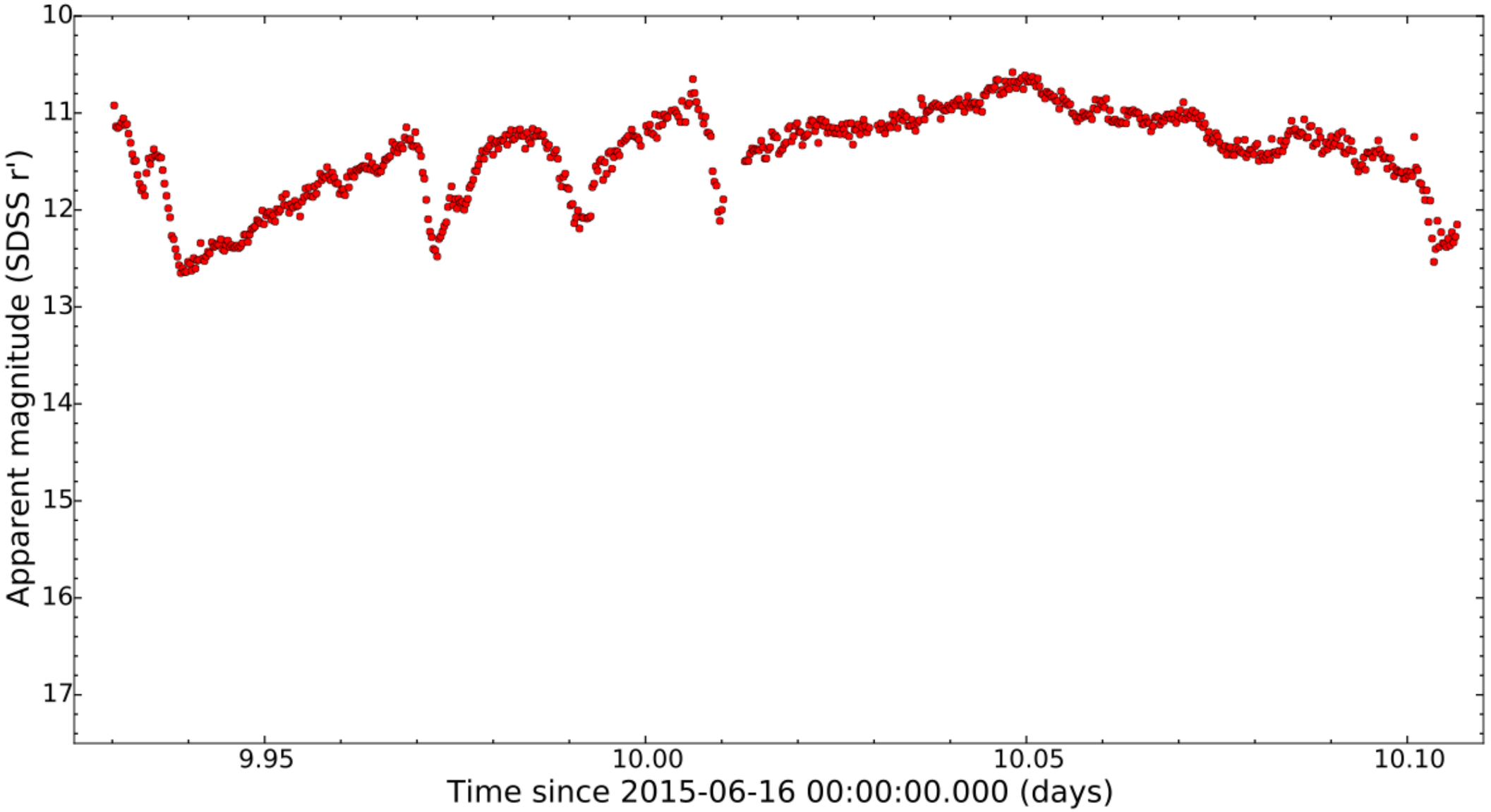
Light Curve - Day 8



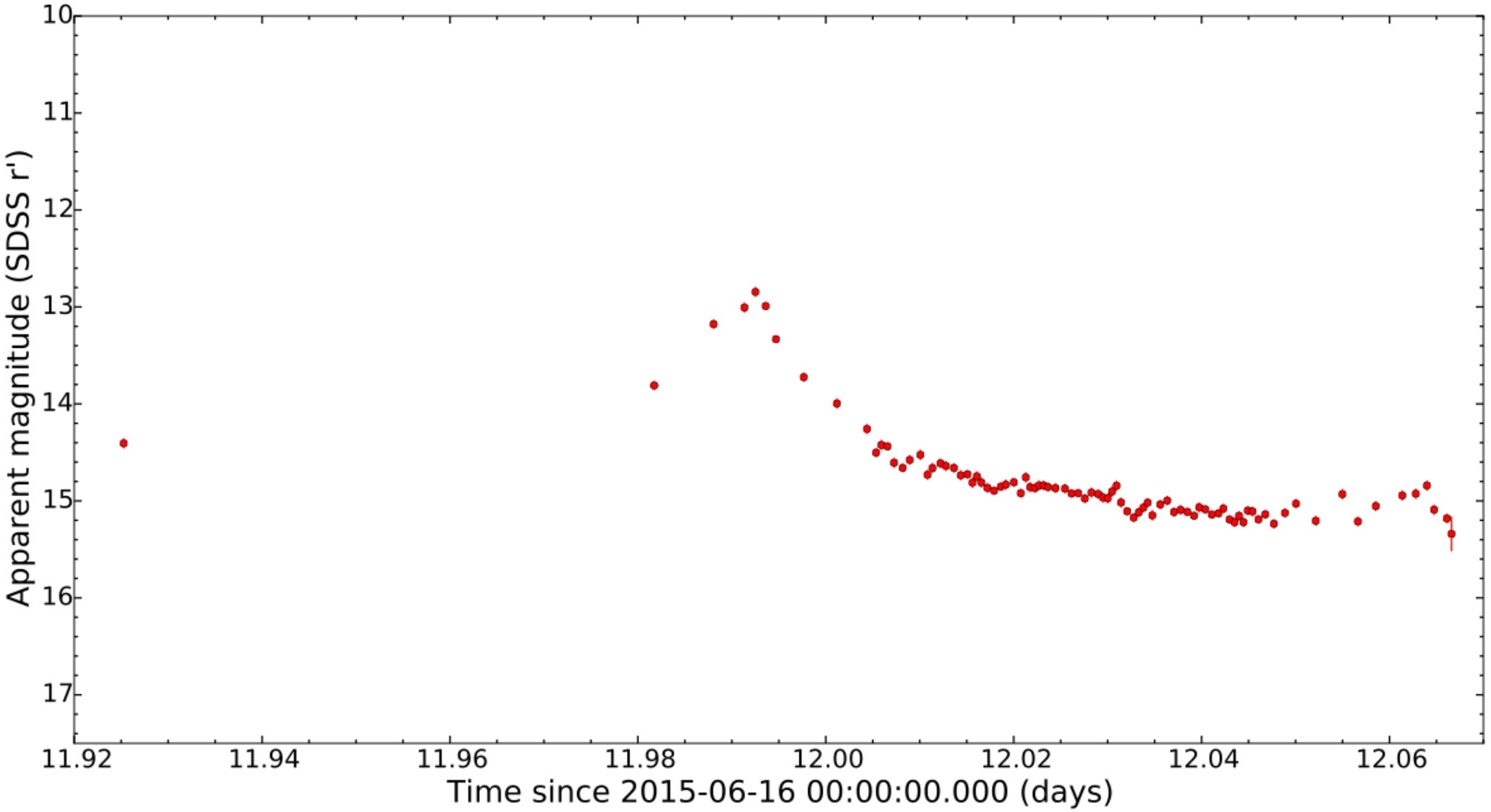
Light Curve - Day 9



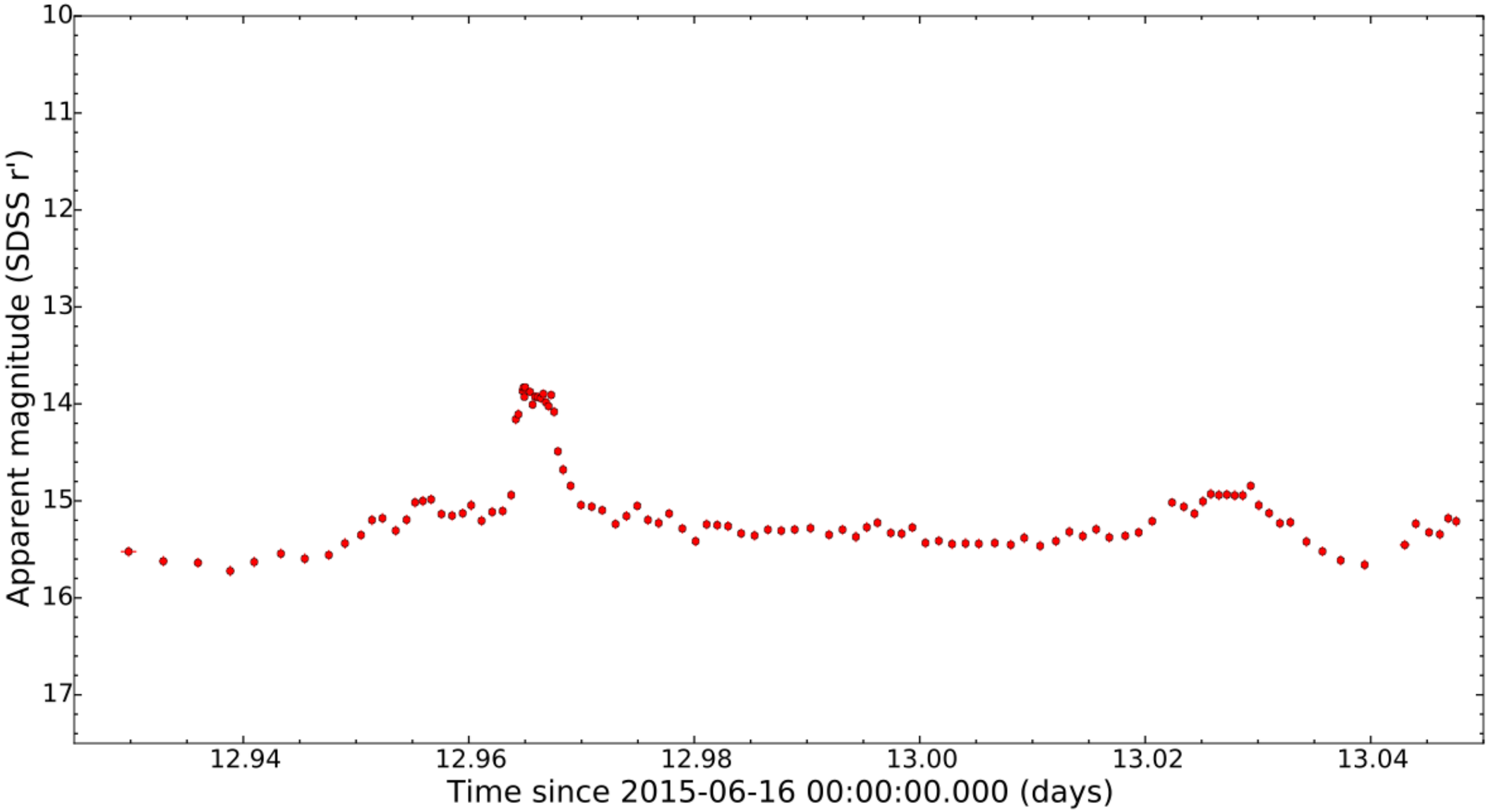
Light Curve - Day 10



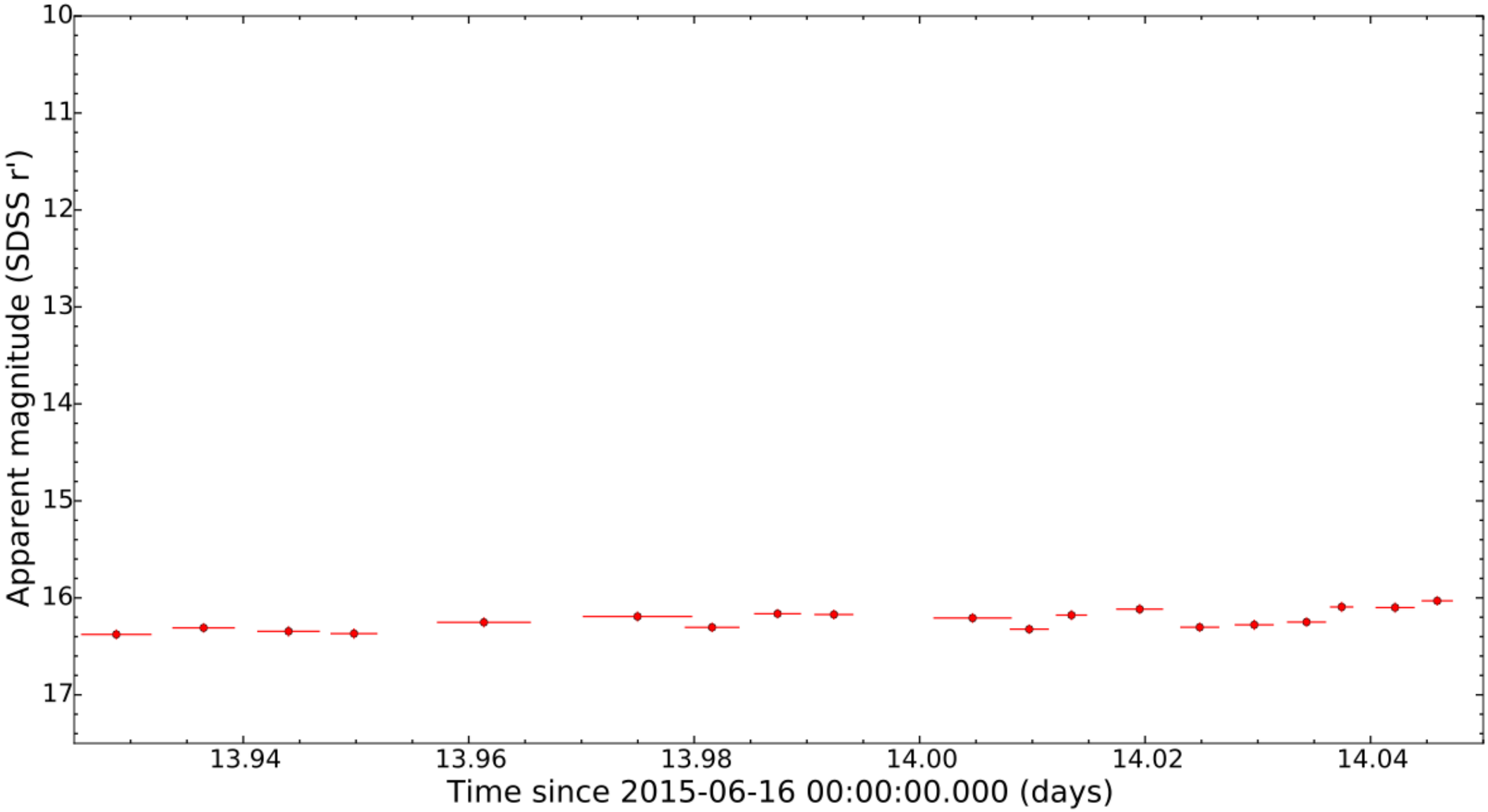
Light Curve - Day 12



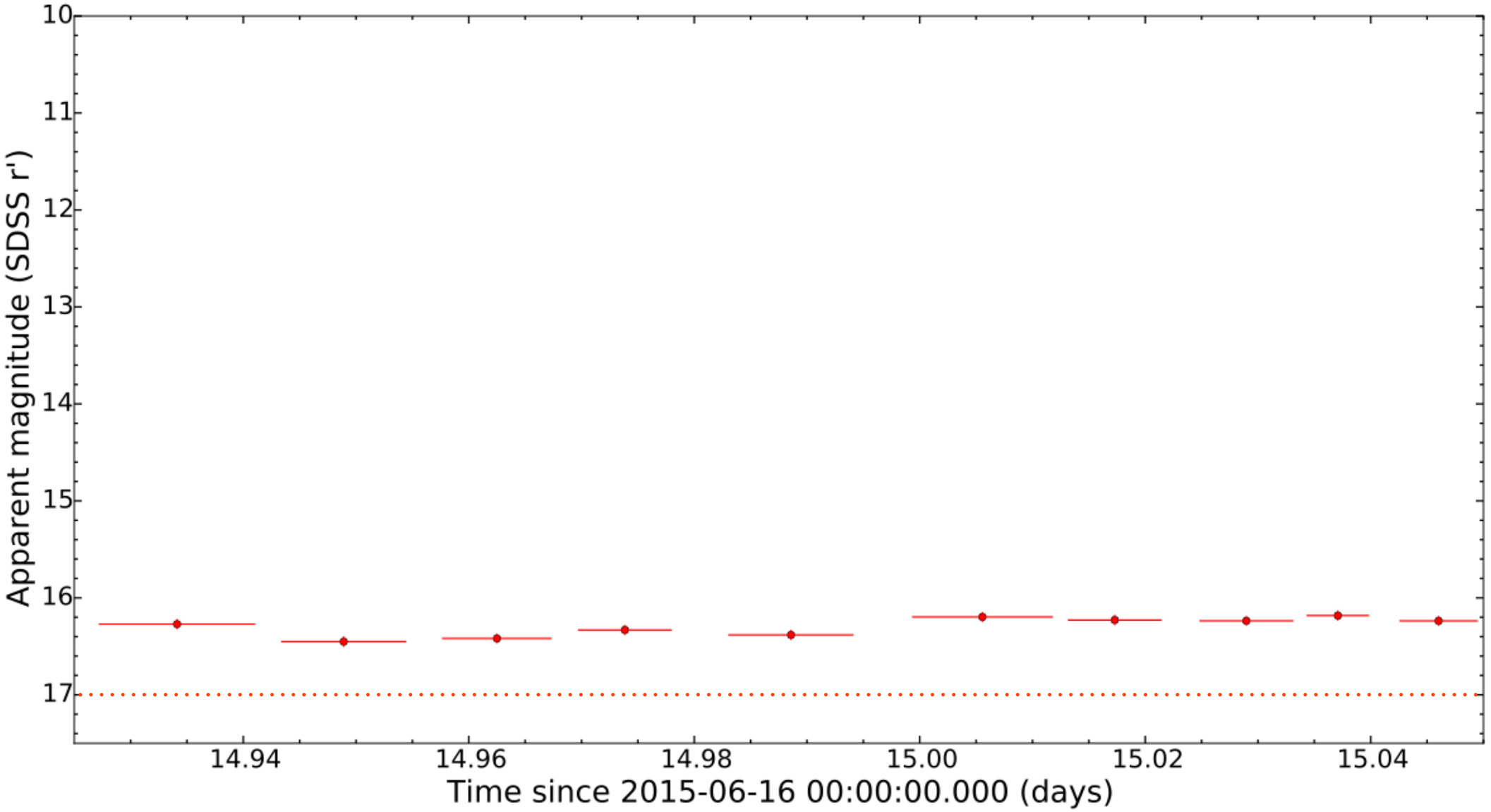
Light Curve - Day 13



Light Curve - Day 14

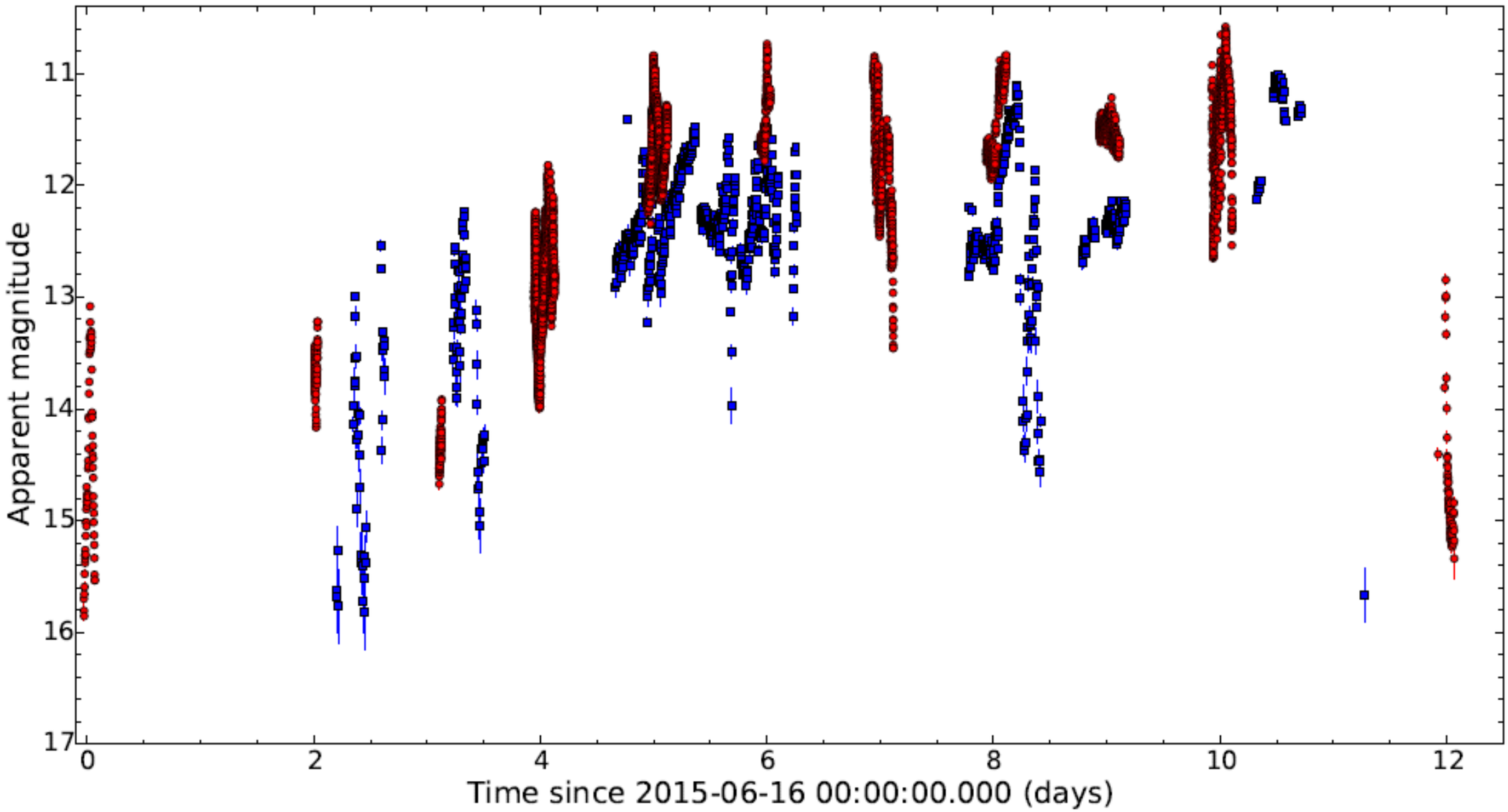


Light Curve - Day 15

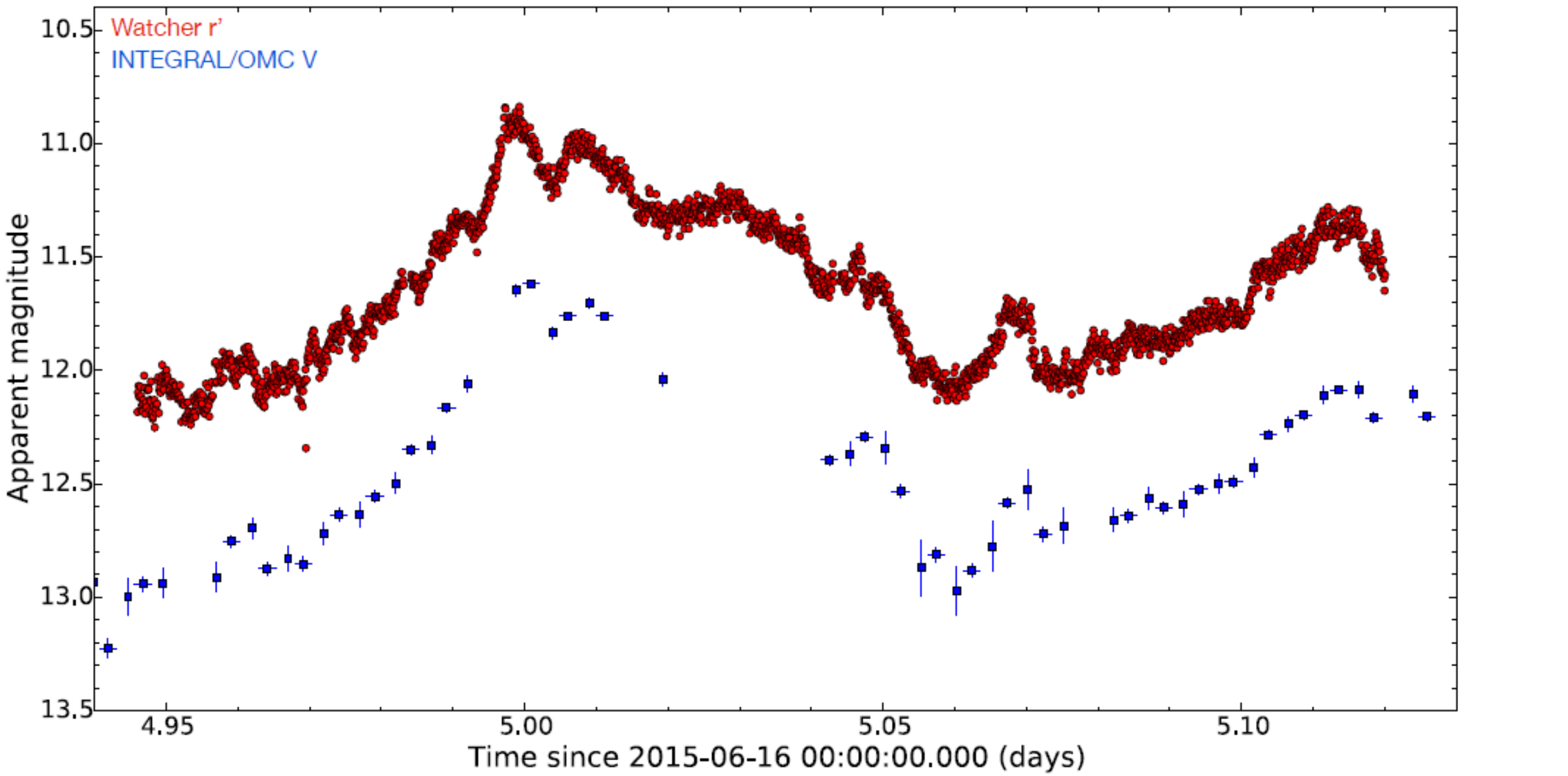


Comparison to *INTEGRAL OMC*

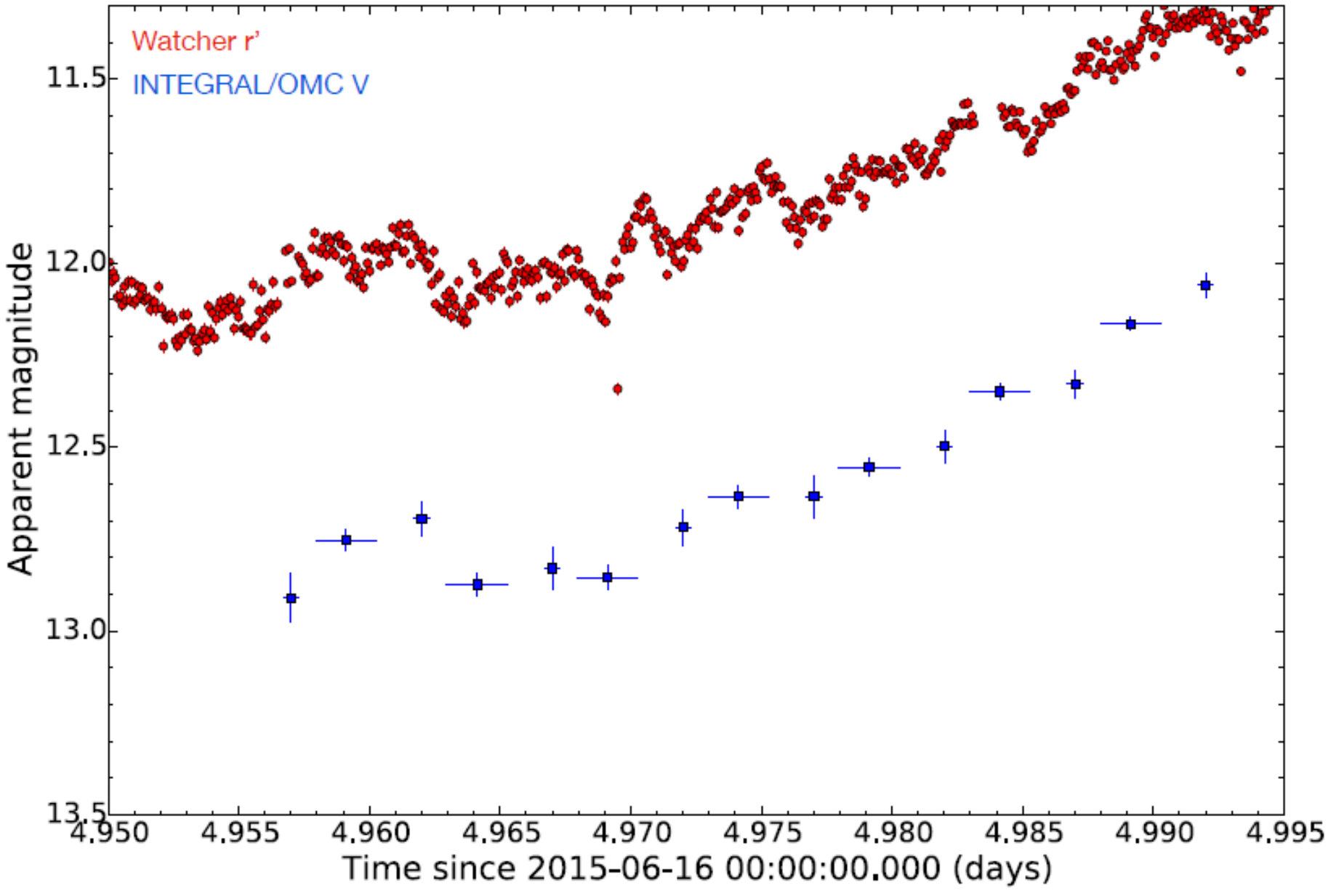
Overlap on days 5, 6, 8, 9



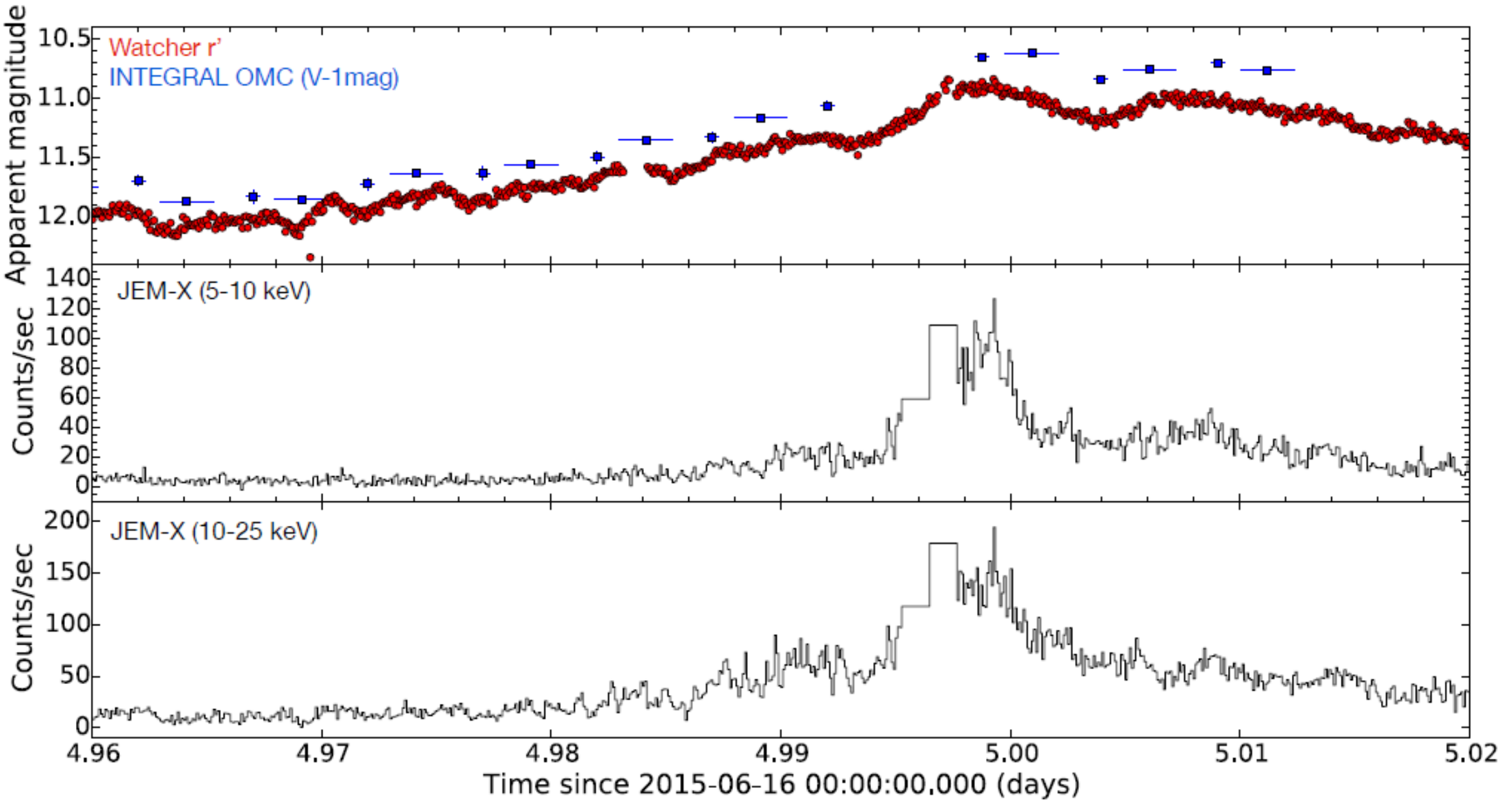
Comparison to *INTEGRAL OMC – DAY 5*



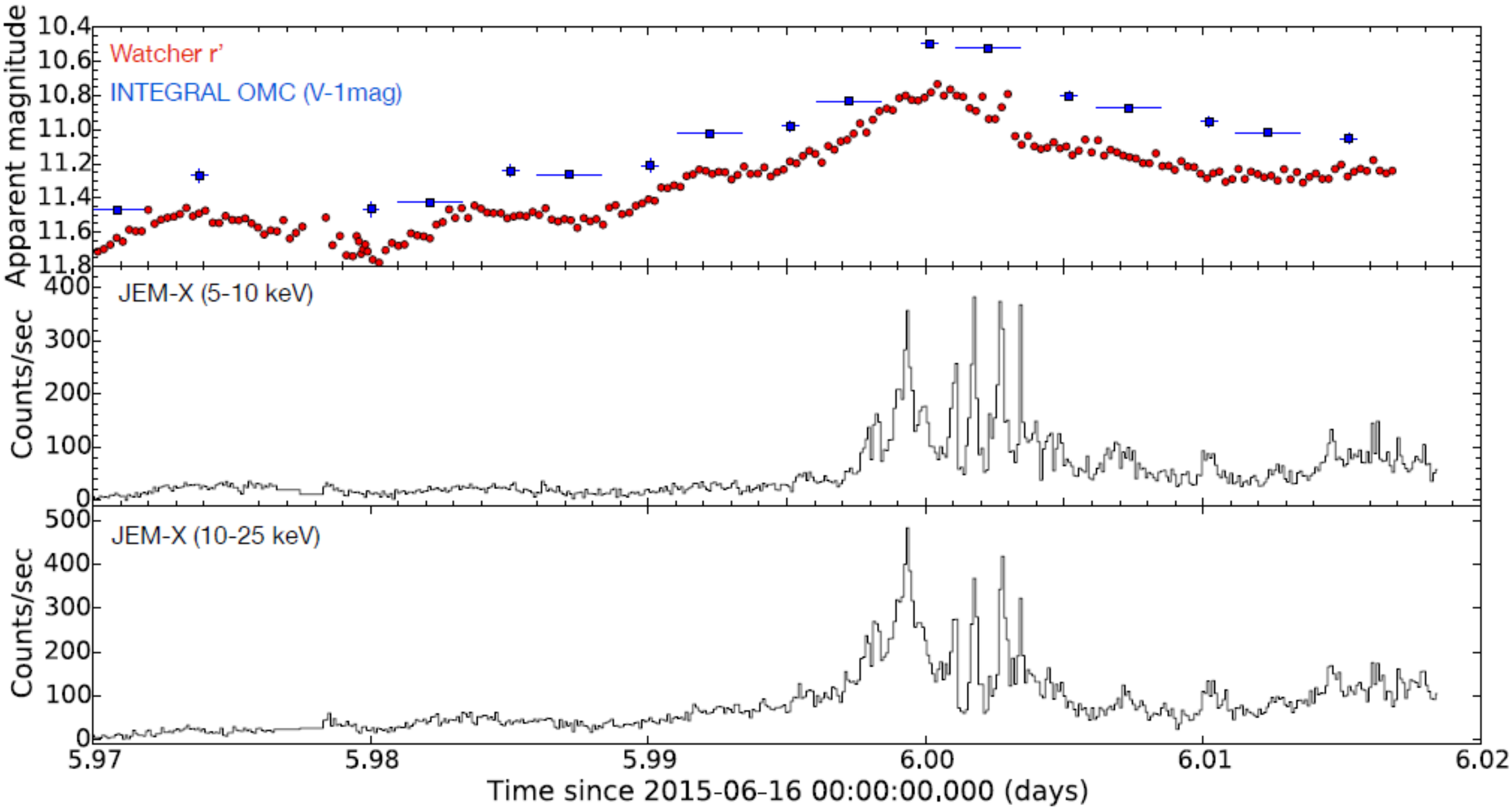
Comparison to *INTEGRAL OMC – DAY 5*



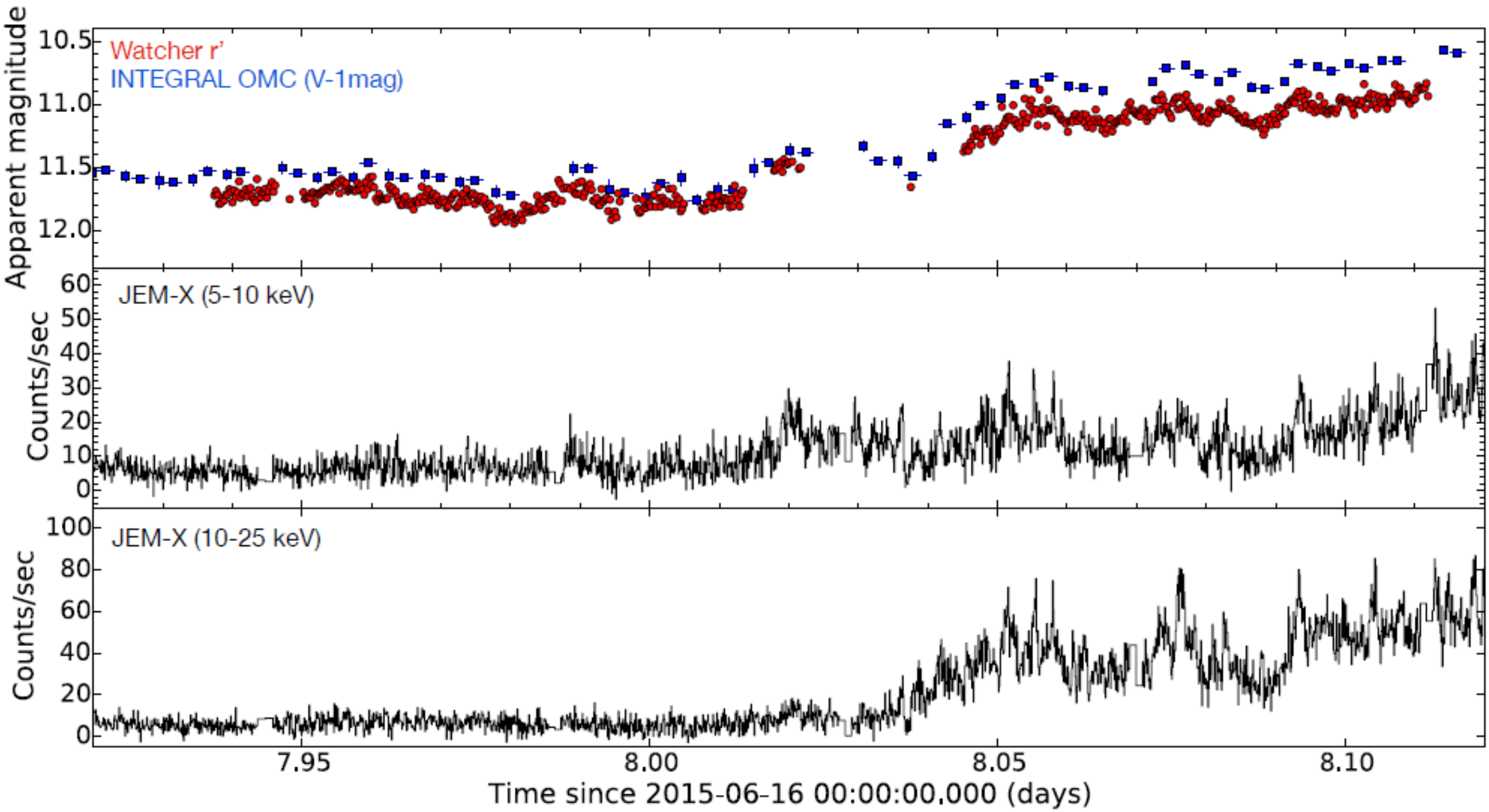
Comparison to Jem-X & OMC Day 5



Comparison to Jem-X & OMC Day 6



Comparison to Jem-X & OMC Day 8



Gaia Added Value Interface Platform (GAVIP)

- Contract with ESA to develop GAVIP
- Purpose is **not** to duplicate existing systems
- Allow user-contributed programs (which may include existing DPAC code) to be executed near the Gaia archive

Gaia Added Value Interface Platform (GAVIP)

- User-contributed programs are packaged within a framework, along with tools and packages, to form ‘Added Value Interfaces’ (AVIs).

- GAVIP hosts these AVIs using Docker containers, a lightweight form of virtualisation.

- GAVIP will be hosted at ESAC

- Splinter session/ hands-on @ DPAC Plenary in Leiden next week.

In conclusion….

- Watcher is a small, but capable, robotic telescope for transient science & monitoring
- Plan to upgrade in 2016 to 60cm + high speed Astelco mount (part of BOOTES network)
- Scope in schedule for Watcher to respond to Gaia Alerts
- GAVIP will become a useful platform to run own analysis tools on the Gaia archive

watchertelescope.ie
@WatcherUCD

Acknowledgements

- Martin Topinka
- Petr Kubanek
- Martin Jelínek
- Stanislav Vítek
- Pieter Meintjes
- Brian van Soelen
- Hendrik Van Heerden
- Soeb Razzaque
- Aquib Moin

PARAMETER SPACE

Sheila McBreen, Daniel Vagg, Derek O’Callaghan, Fionn O hOgain, David Lynn