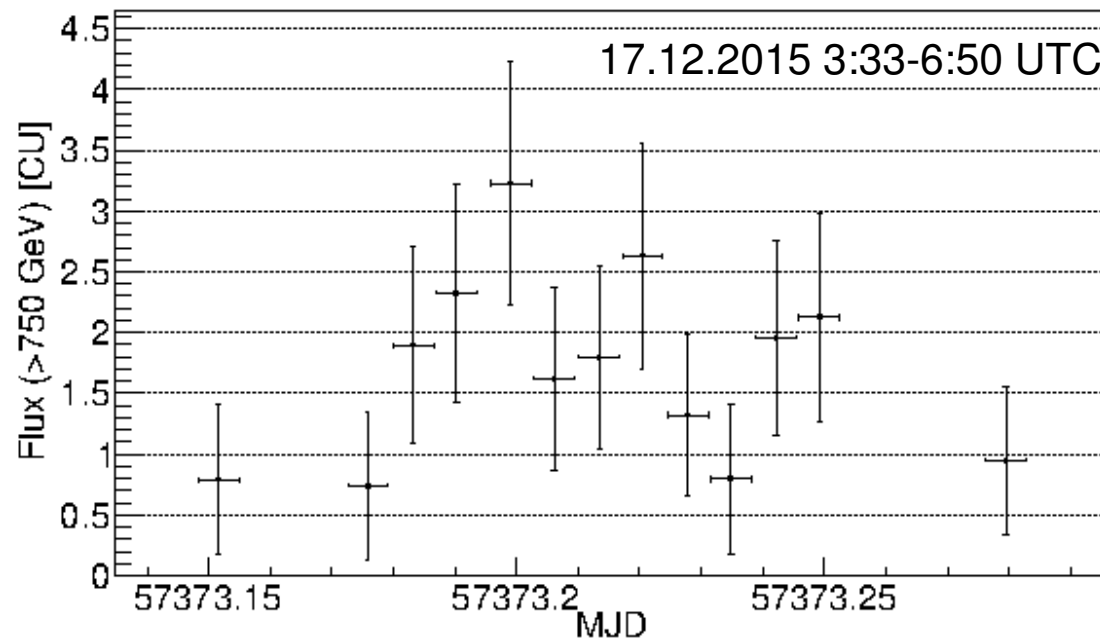


Time-resolved View of Blazar Flares Using Long-term Monitoring - Example of a Recent Flare of Mrk 421

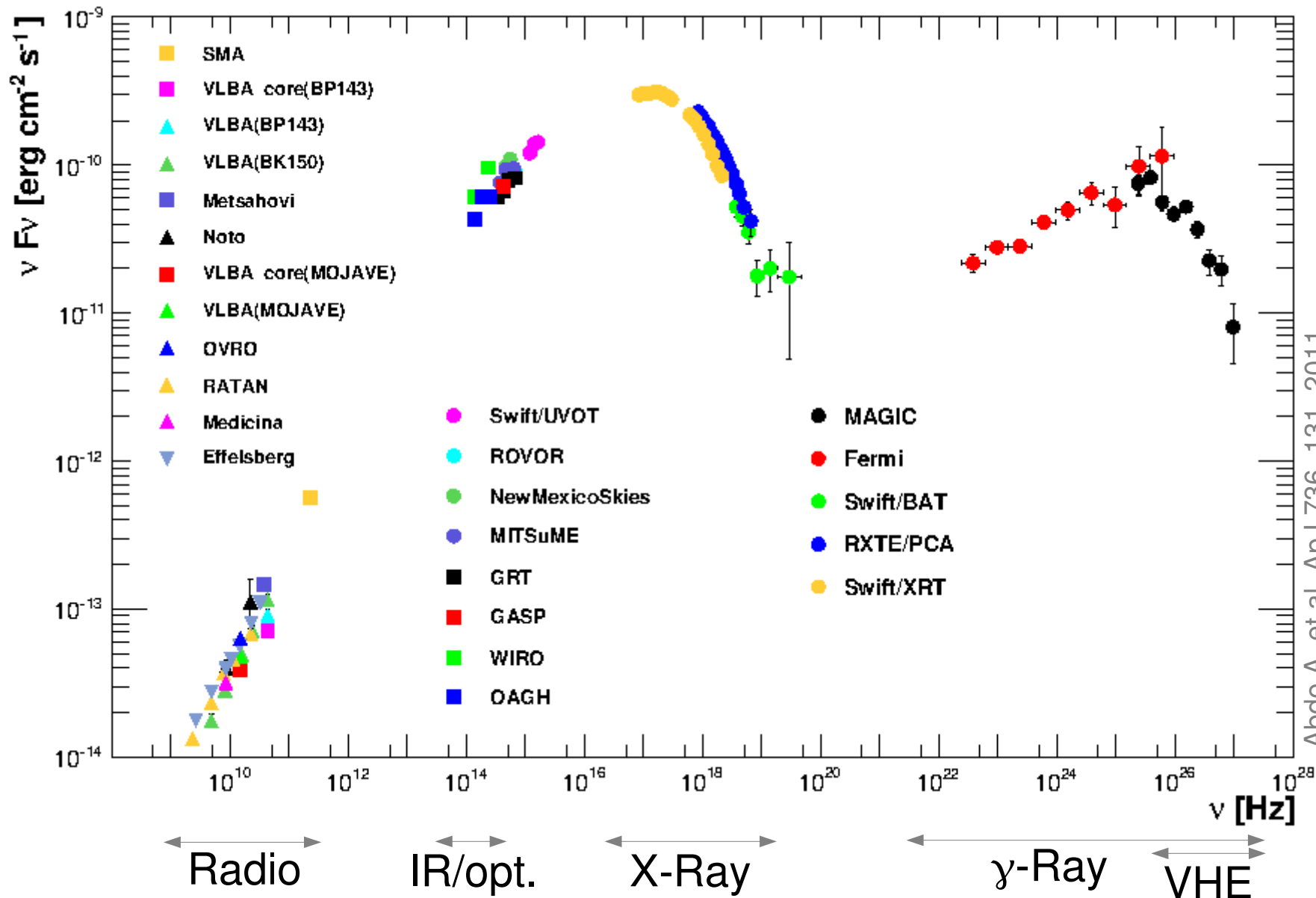
and 1ES 1959+650



D. Dorner for the FACT Collaboration and the proposal team
(A. Kreikenbohm, M. Kadler, T. Beuchert, D. Eisenacher Glawion,
N. Gehrels, M. Kreter, I. Kreykenbohm, M. Langejahn, K. Leiter,
K. Mannheim, C. Mueller, S. Richter, J. Wilms)

Spectral Energy Distribution

Mrk 421



Abdo A. et al. ApJ 736, 131, 2011



ToO Program Based on FACT Monitoring

- High energy peak: VHE monitoring [FACT]
- Monitoring in X-ray, optical, UV [Swift]
- Measure low energy peak [INTEGRAL / XMM Newton]



ToO Program Based on FACT Monitoring

- High energy peak: VHE monitoring [FACT]
→ fast triggers
- Monitoring in X-ray, optical, UV [Swift]
→ check for orphan flares or time lags
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→ high-sensitivity spectra during/after flare



ToO Program Based on FACT Monitoring

- High energy peak: VHE monitoring [FACT]
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- Measure low energy peak [INTEGRAL / XMM Newton]
→ high-sensitivity spectra during/after flare
- Time-resolved SEDs
 - Measure time-scales
 - Check for correlations
→ Conclusion on emission mechanisms



First G-APD Cherenkov Telescope

2200 m a.s.l., Observatorio del Roque de los Muchachos, La Palma

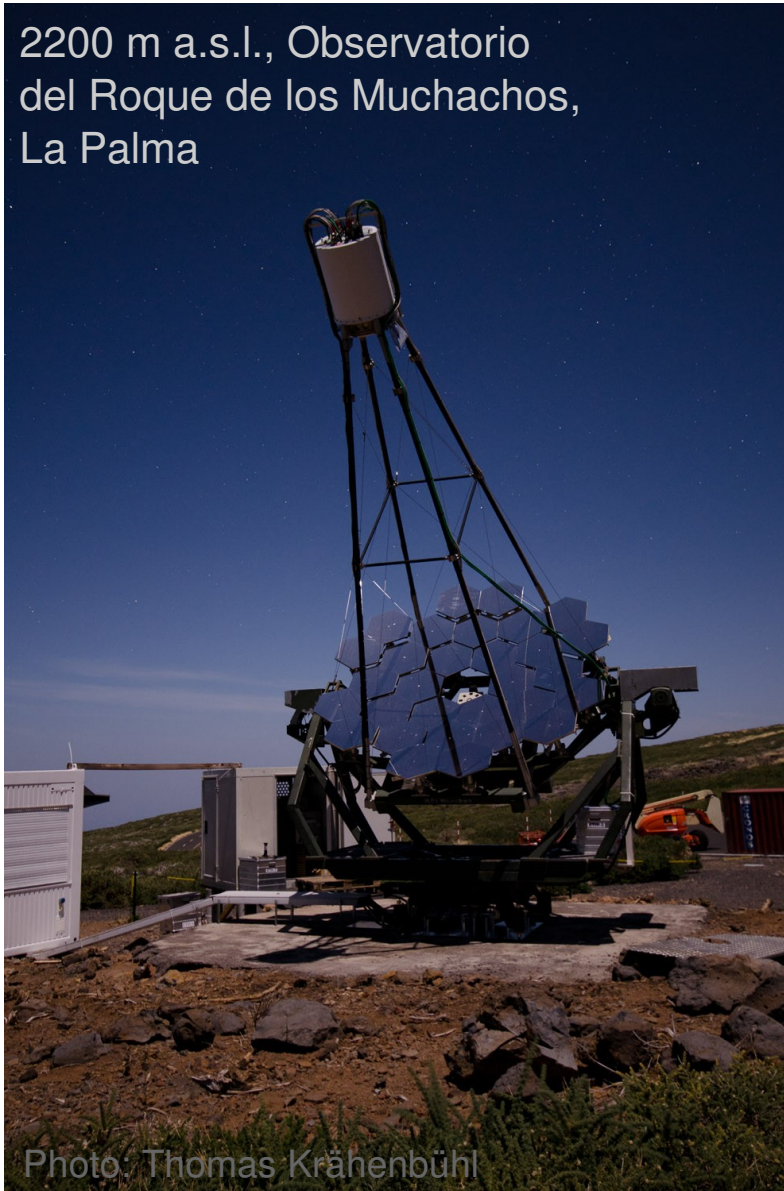


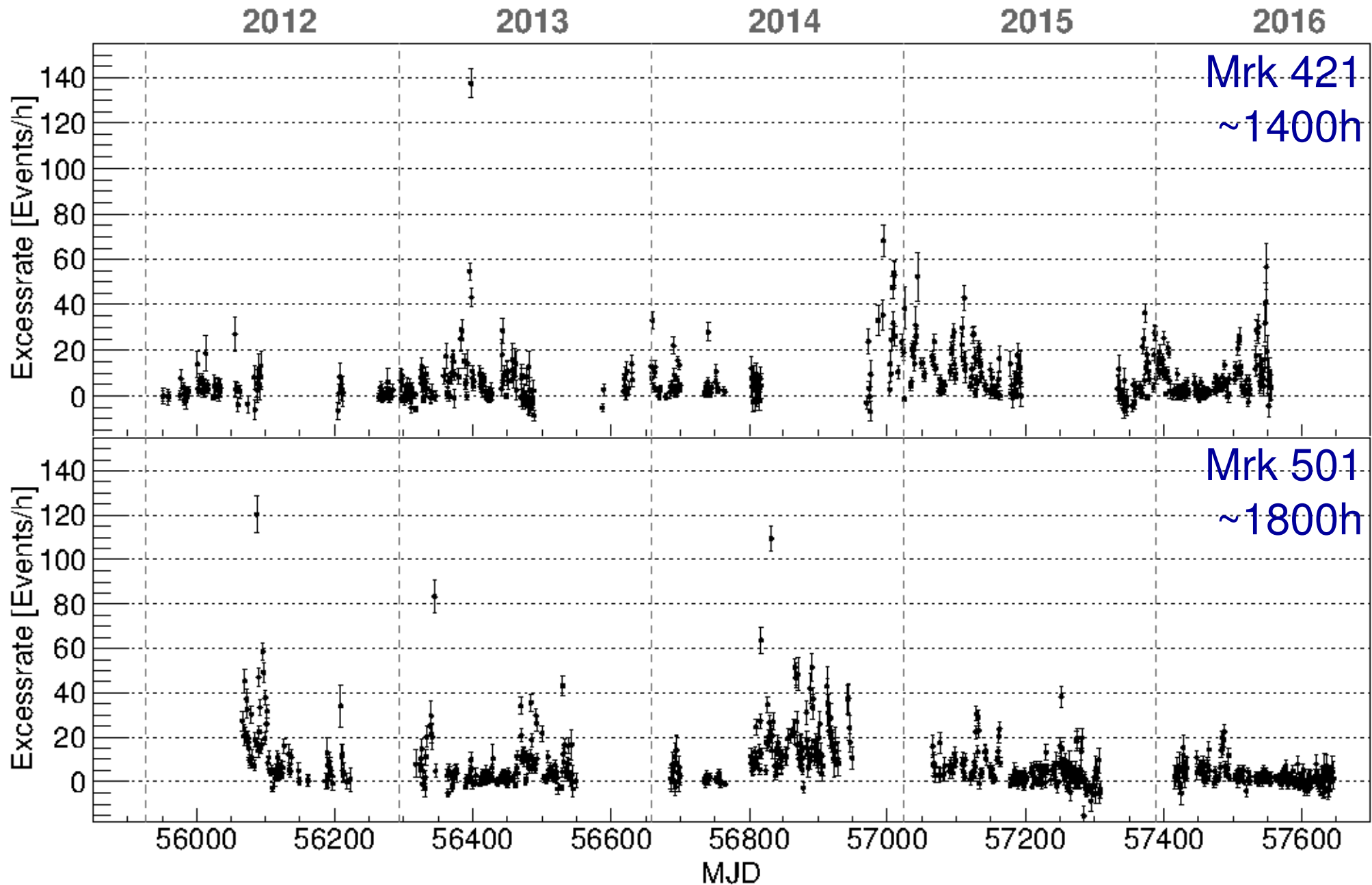
Photo: Thomas Krähenbühl

- Operational since Oct 2011
- Long-term monitoring of blazars at TeV energies
- 9.5 m² mirror area
- 4.5° FoV, 1440 pixels à 0.11°
- Silicon based photosensors (SiPM)
 - Stable detector performance
 - Observations during bright light→ Ideal for monitoring
- Energy threshold ~750 GeV

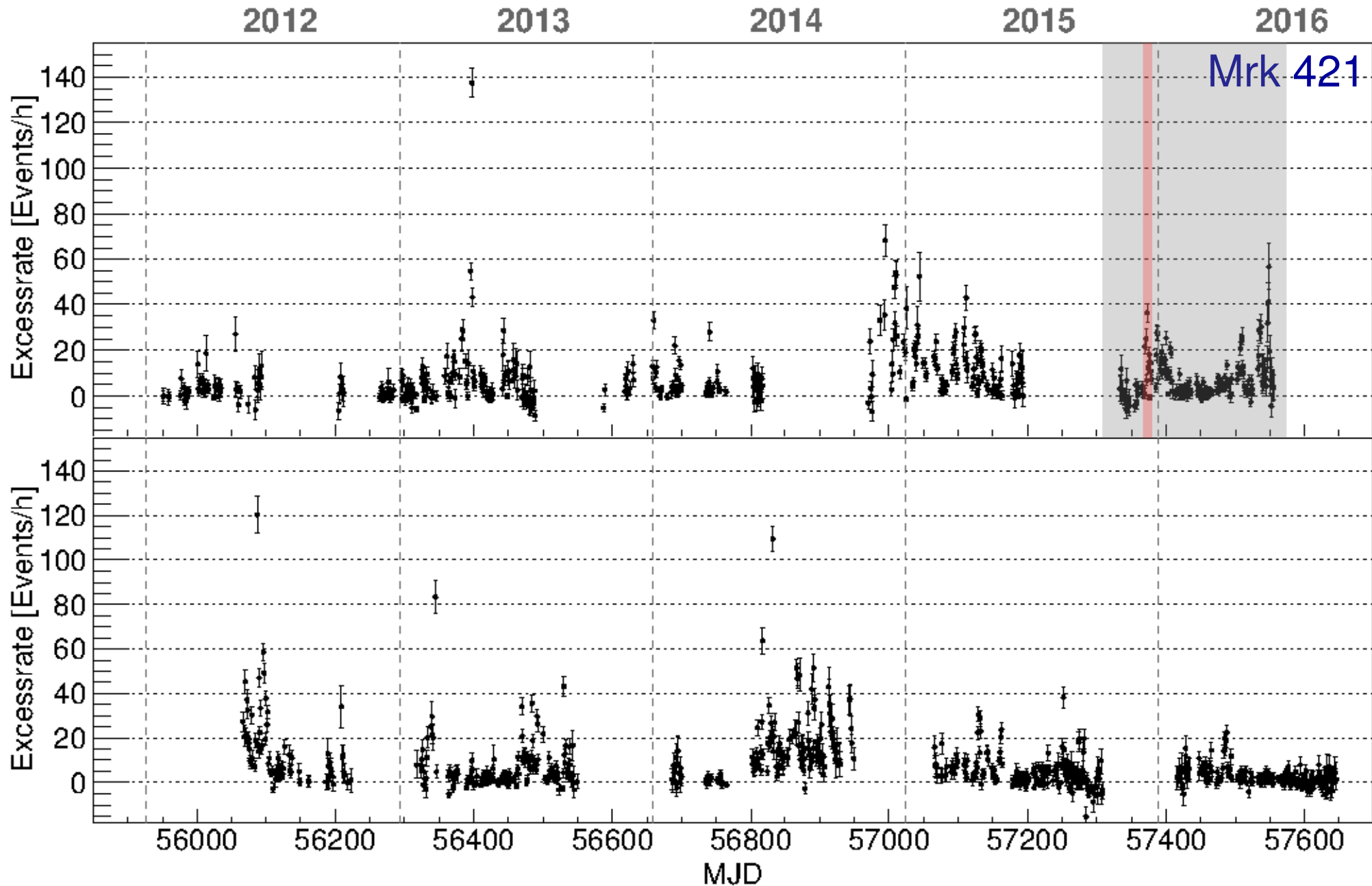
Anderhub H. et al. JINST 8, P06008, 2013
Biland A. et al, JINST 9, P10012, 2014



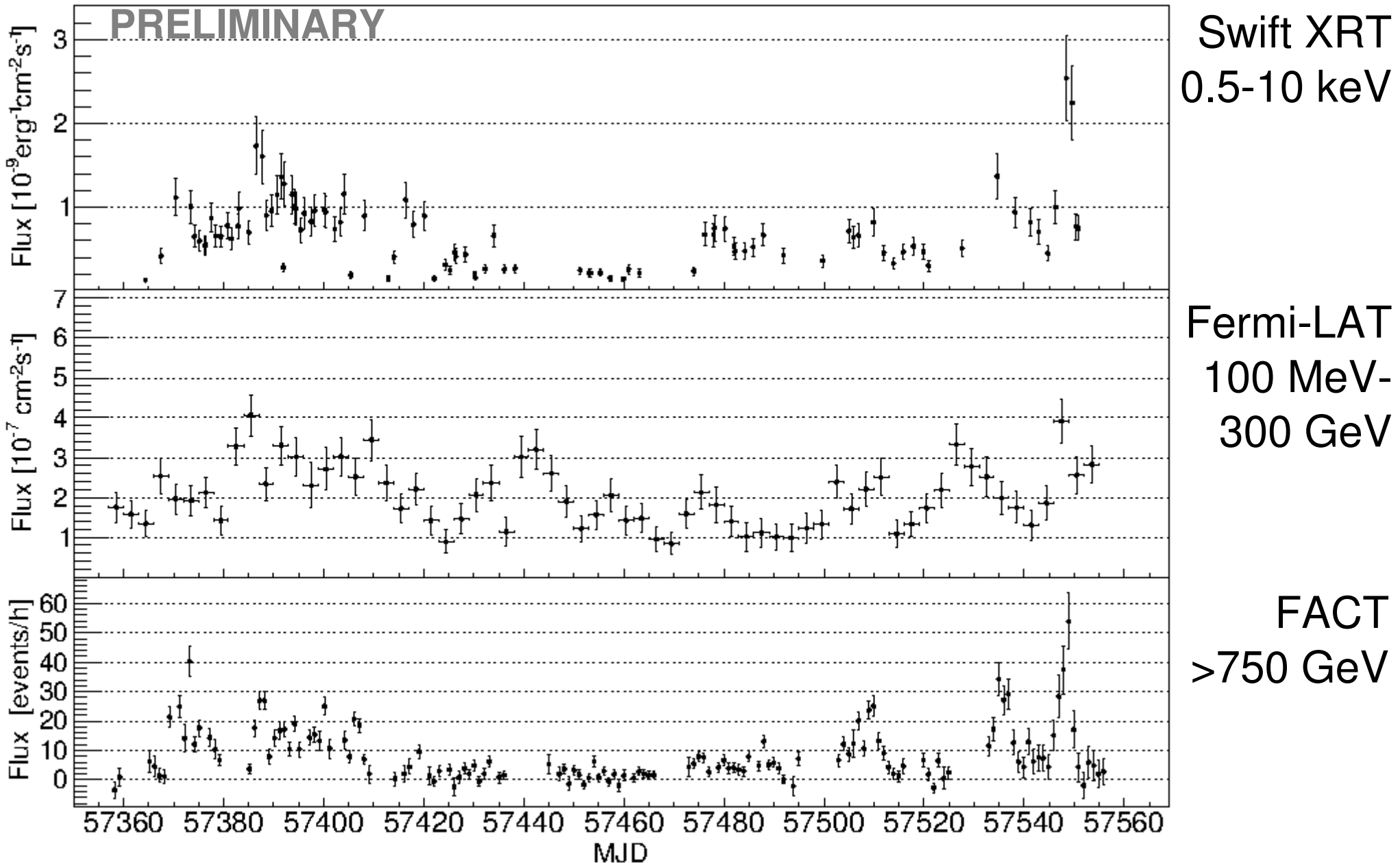
Long-term Monitoring



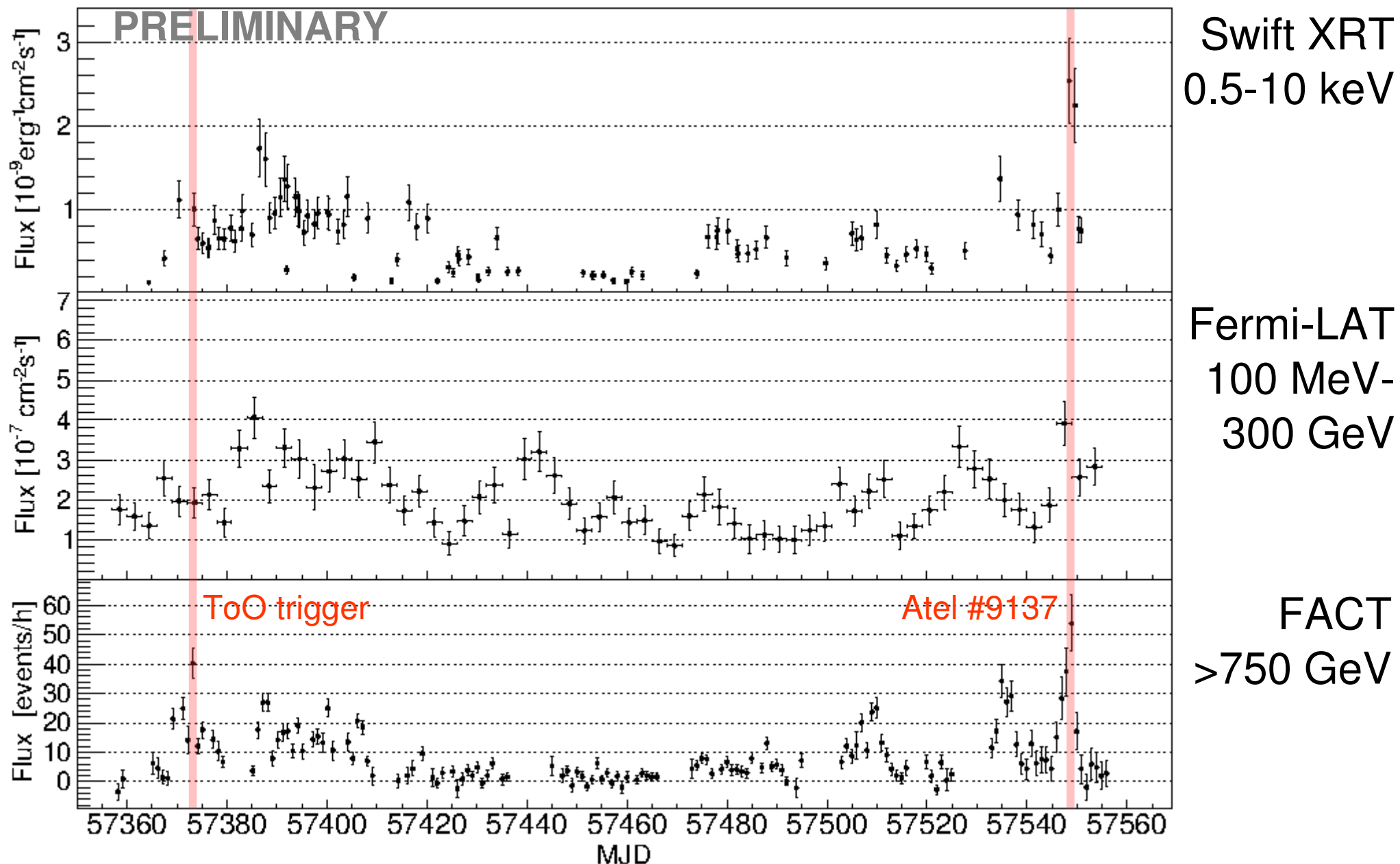
Mrk 421: Recent Flaring Activity



Mrk 421: Dec 2015 – Jun 2016



Mrk 421: Dec 2015 – Jun 2016



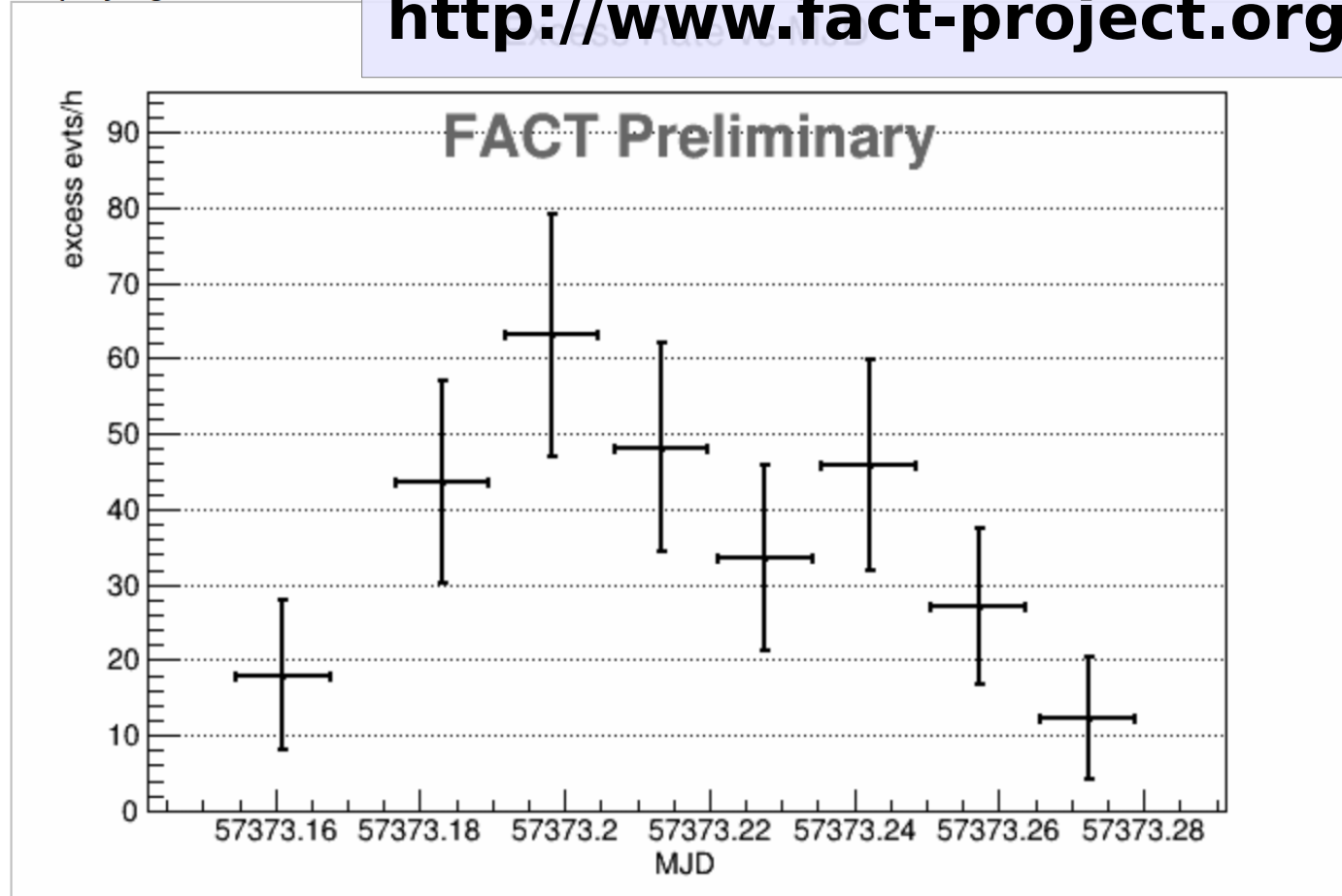
Mrk 421 – Flare December 2015

FACT Quick Look Analysis

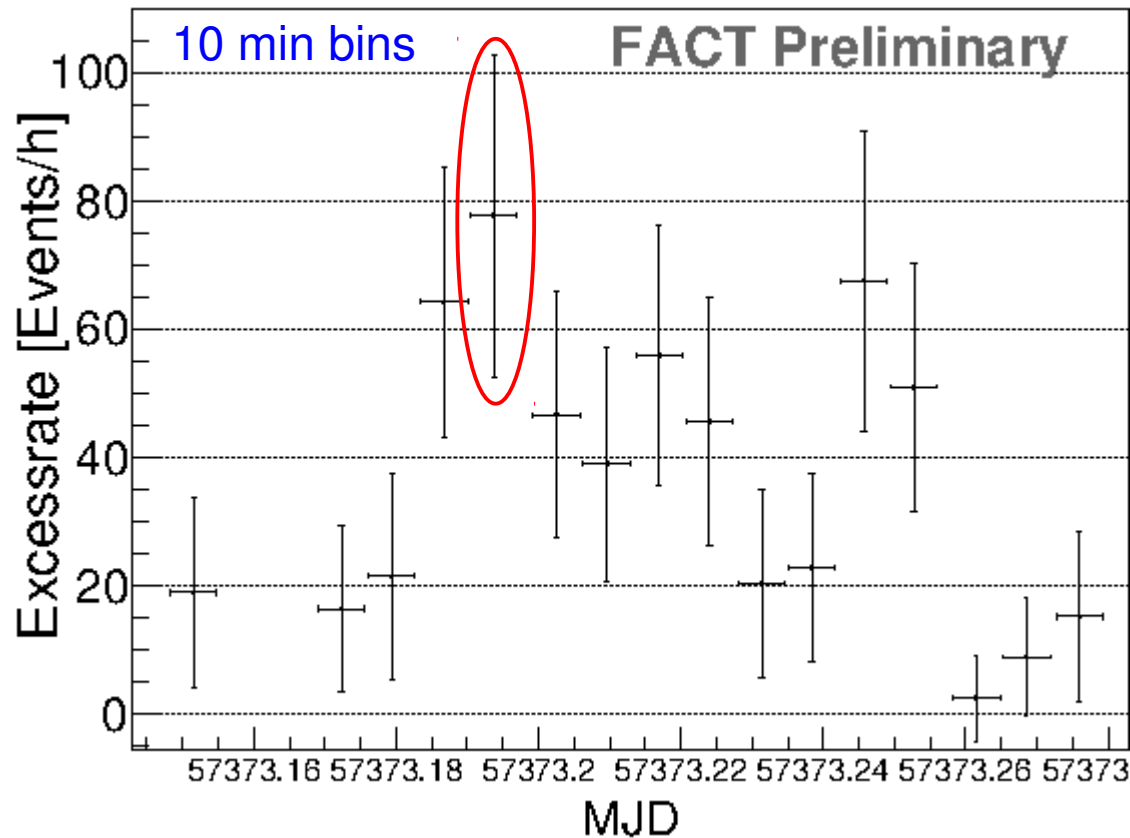
Select date 2015 : 12 : 16 : source Mrk 421 :
Select time binning 20min : and range night : Reset

Displaying 'excess rate vs mid' for Mrk 421 for the night 2015/12/16.

<http://www.fact-project.org/monitoring>



Target of Opportunity Observations



FACT Observations:

2015-12-17 3:33-6:50 UTC

Triggered

→ *INTEGRAL*

→ *Swift*

INTEGRAL Observation:

~164ks

start: 2015-12-18 11:00 UTC

stop: 2015-12-20 10:47 UTC

Detections:

20-40 keV: 7 sigma

40-80 keV: 5 sigma

3-10 keV: 17 sigma

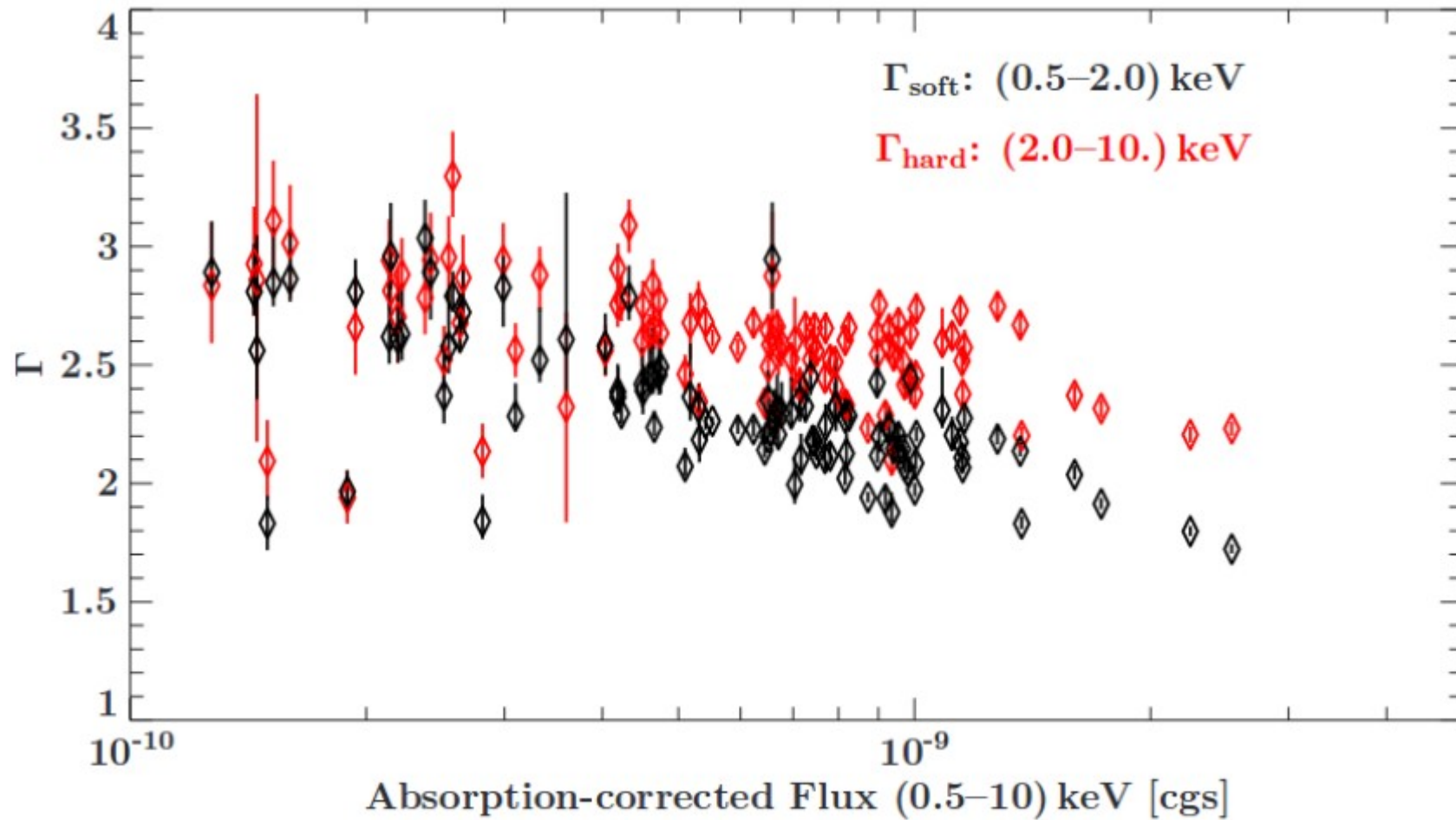
Swift-XRT Observations / Follow-up:

daily ~5ks: 2015/12/19 - 2015/12/20

daily ~1ks: 2015/12/20 - 2016/01/18

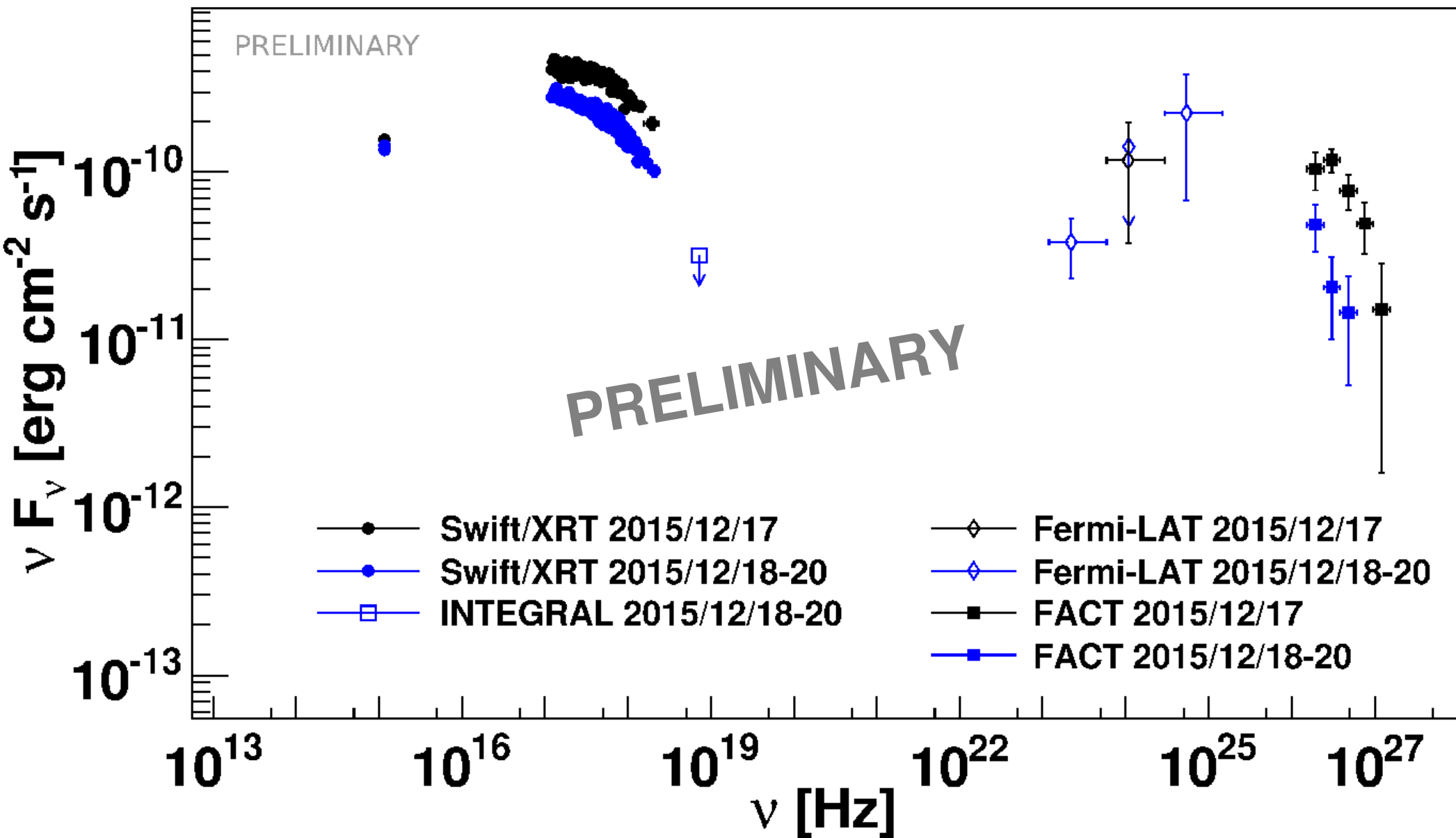
every 2nd day ~1ks: 2016/01/29 - 2016/02/20

Mrk 421 – Swift-XRT Observations



harder-when-brighter trend

Mrk 421 – Flare December 2015



MWL and ToO Activities

- Target-of Opportunity Campaigns

- 2013: *XMM-Newton* / *Swift*

- 2015: *INTEGRAL* / *Swift*

Successful ToO Dec 2015

- Ongoing in 2016:
INTEGRAL, *Swift* and
XMM-Newton

- Granted for 2017:

- *INTEGRAL*, *Swift*

- *AstroSAT*

- Multi-Wavelength Observations

- Multi-Messenger:
AMON Network

- MWL campaigns

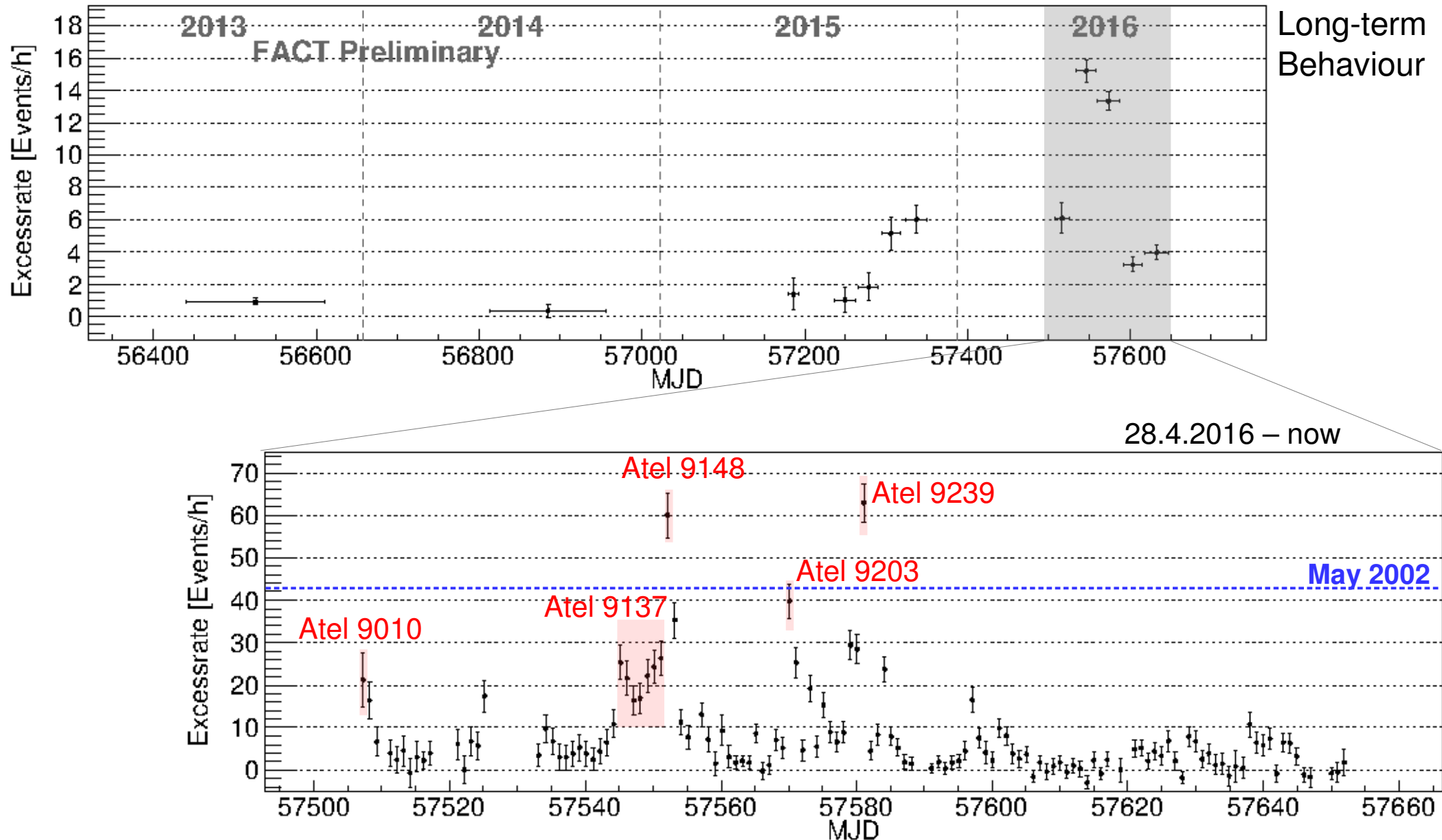
- Observations
triggered by *FACT*
alerts

6 Atels in 2016

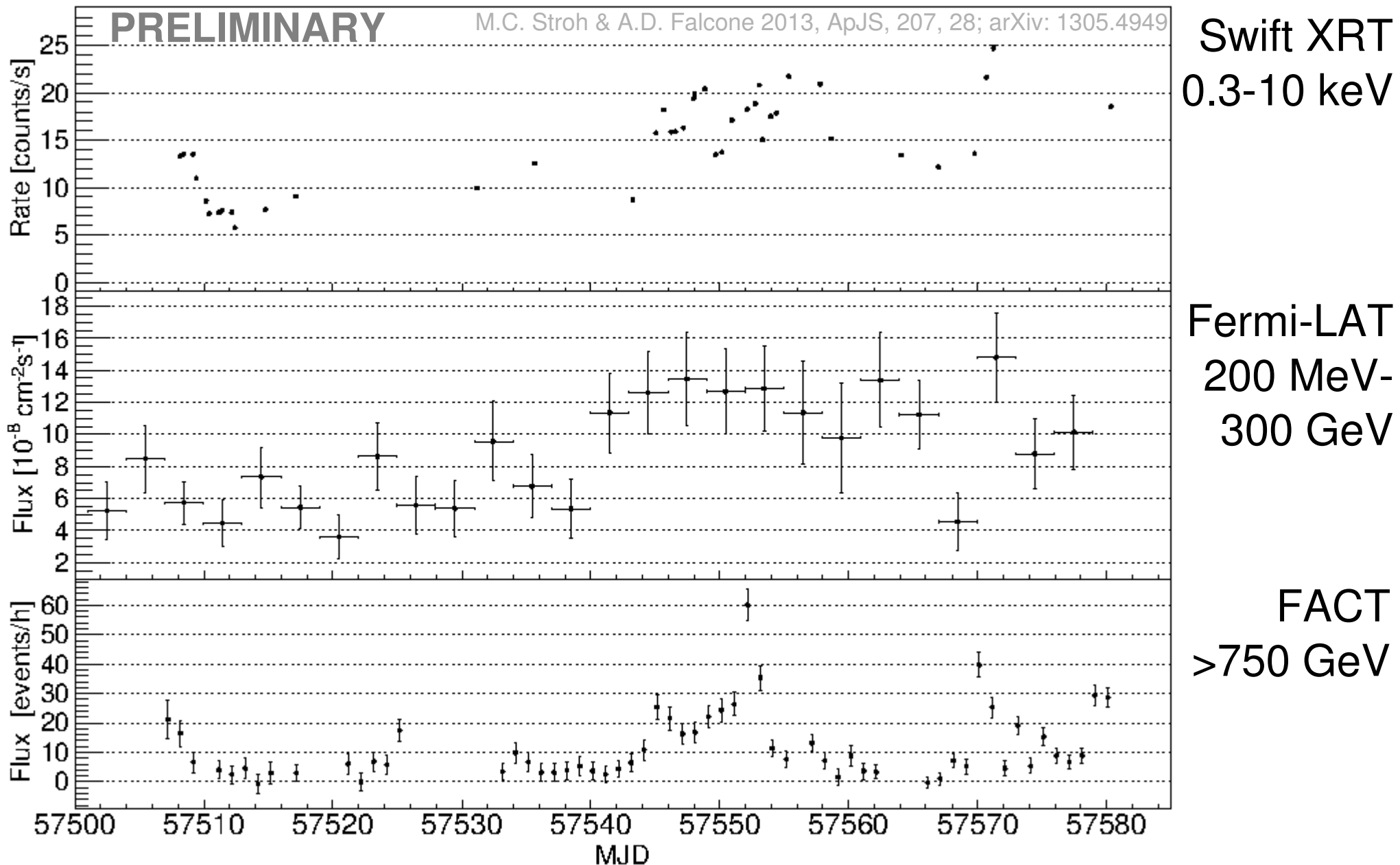
38 alerts since March 2014



Recent Flares of 1ES 1959+650

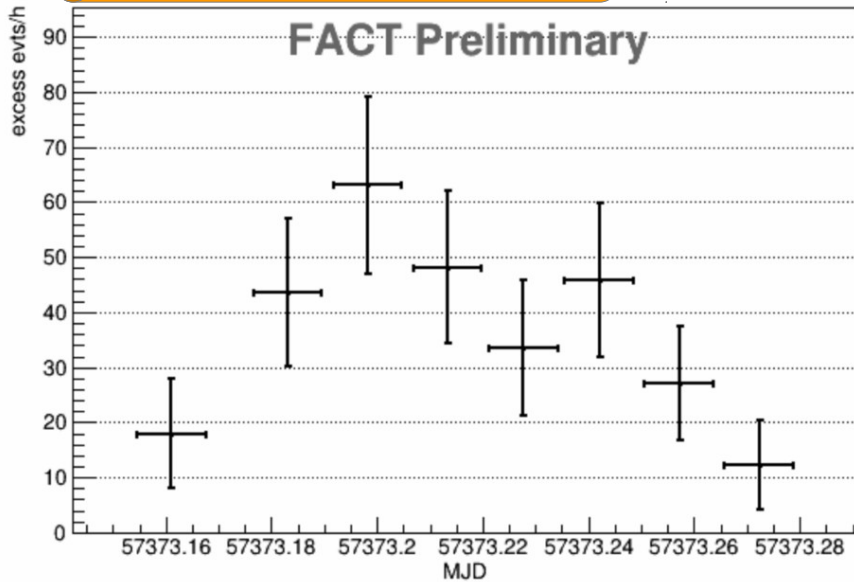


Recent Flare of 1ES 1959+650

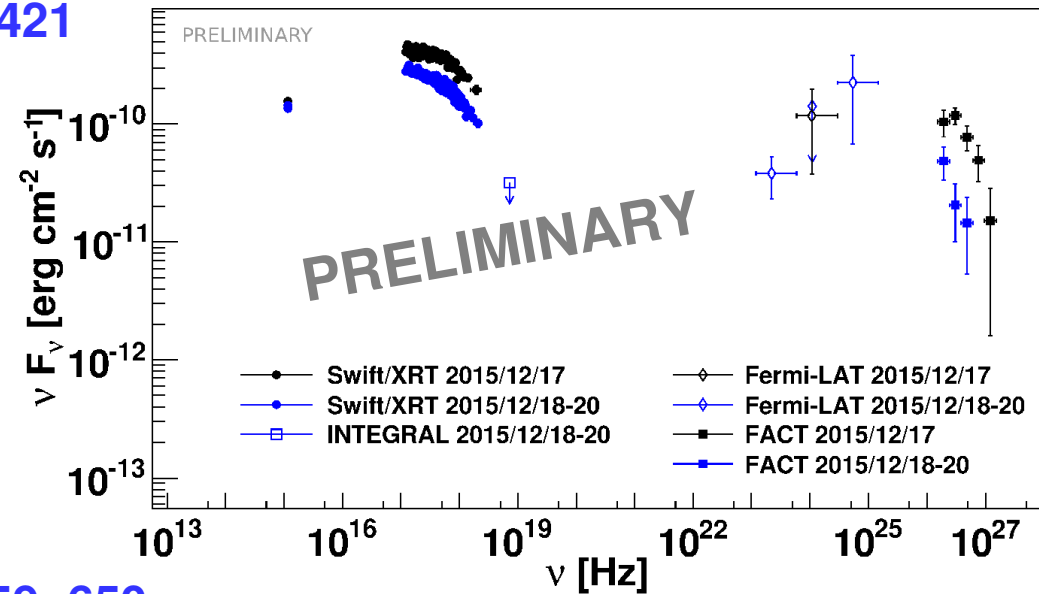


Workshop
MWL Monitoring
Dec 7-9
Germany

FACT Monitoring for Time-resolved SEDs



Mrk 421



1ES 1959+650

