FACT - the First G-APD Cherenkov Telescope
Multi-Wavelength View on TeV Blazars

***D. Dorner*[1], *M. Ahnen*[2], *D. Baack*[3], *M. Balbo*[4], *M. Bergmann*[1], *A. Biland*[2], *T. Bretz*[2], *K.A. Bruegge*[3], *J. Buss*[3], *S. Einecke*[3], *C. Hempfling*[1], *D. Hildebrand*[2], *G. Hughes*[2], *W. Lustermann*[2], *K. Mannheim*[1], *S. Müller*[2], *D. Neise*[2], *A. Neronov*[4], *M. Noethe*[3], *A.-K. Overkemping*[3], *A. Paravac*[1], *F. Pauss*[2], *W. Rhode*[3], *A. Shukla*[2], *F.Temme*[3], *J. Thaele*[3], *S. Toscano*[4], *P. Vogler*[2], *R. Walther*[4], *A. Wilbert*[1]

[2] ETH Eidgenössische Technische Hochschule Zürich Swiss Federal Institute of Technology Zurich
[3] technische universität dortmund
[1] Julius-Maximilians-UNIVERSITÄT WÜRZBURG
[4] ISDC

First G-APD Cherenkov Telescope

Photo: P. Vogler

Major Goals:

- Longterm monitoring of bright TeV blazars
- Proof of principle for the use of G-APDs* (aka SiPM) in Cherenkov astronomy

Facts about FACT

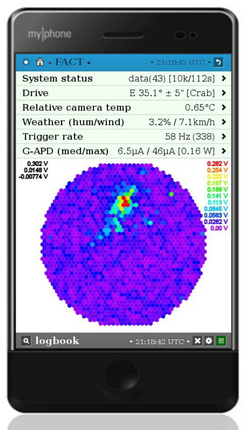
- Operation since October 2011
- Using Imaging Atmospheric Cherenkov Technique (IACT)
- Site: Observatorio Roque de los Muchachos, La Palma, Spain (2200 m a.s.l.)
- 9.5 m² mirror surface
- 4.5° field of view
- 1440 pixels (0.11° FoV each)
- Remote and automatic operation
- More details in [1] and [2]

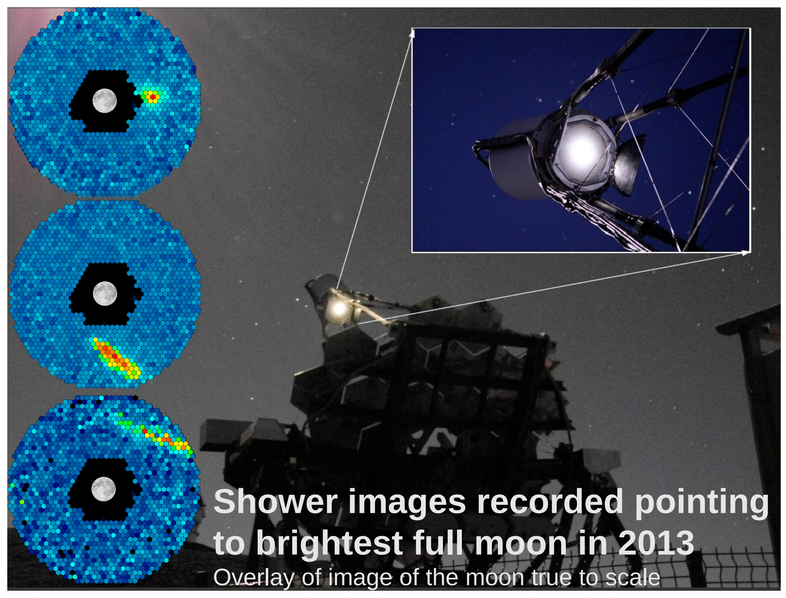
Ideal for Longterm Monitoring

G-APDs* robust and stable, no aging effects due to bright light

→ Observations during strong moon

→ Stable detector performance





Photos: D. Dorner, T. Krähenbühl, More details in [3]

Automatic and remote Operation [4]:

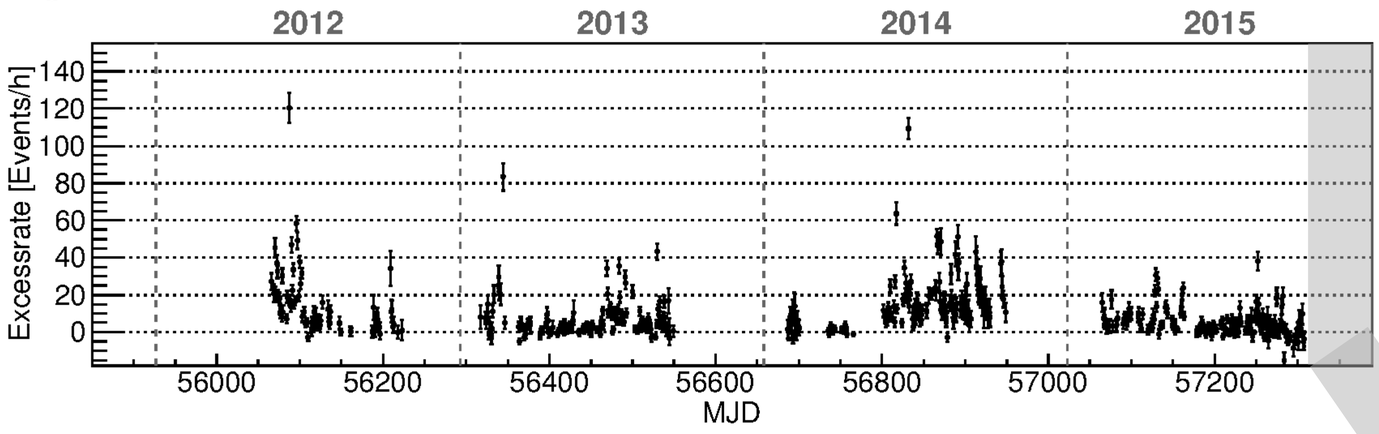
→ Stable and consistent data taking, high data taking efficiency

http://www.fact-project.org/smartfact

* G-APDs: Geiger-mode Avalanche Photodiodes

Longterm Monitoring @ TeV Energies

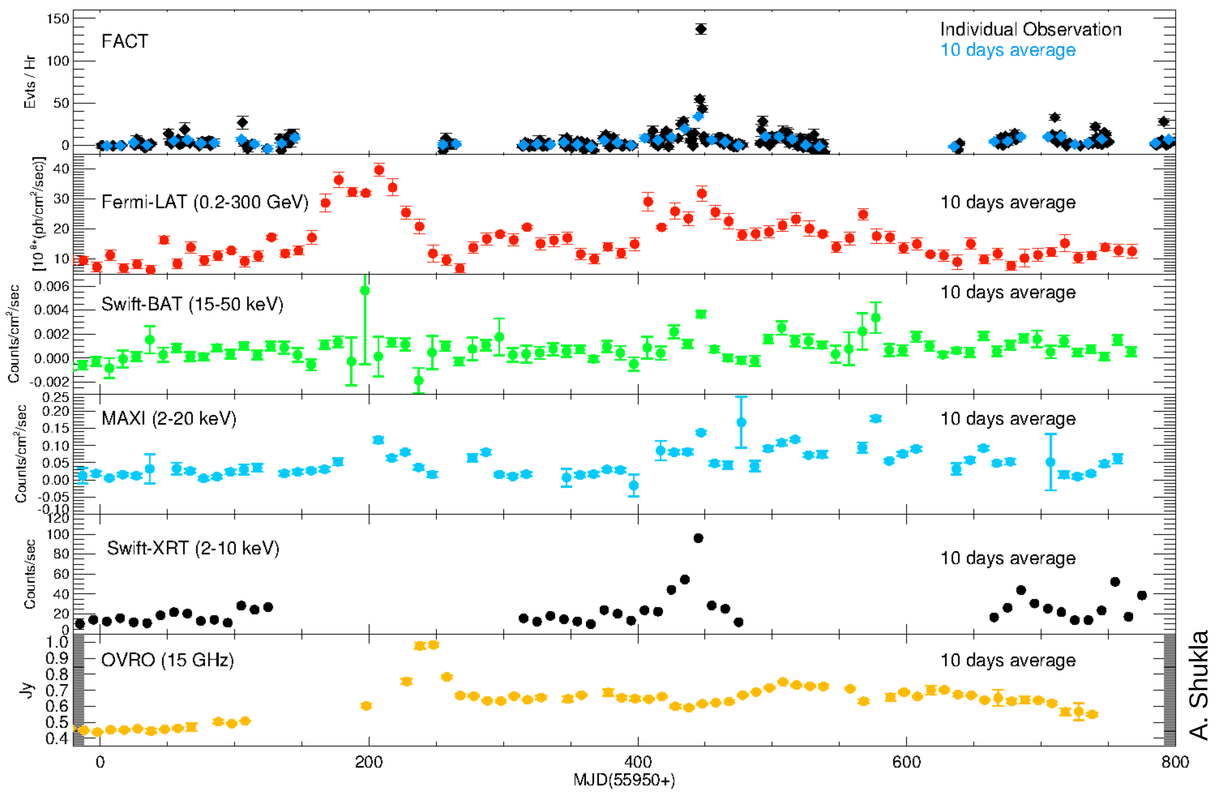
Large unbiased data sample
e.g. Mrk 501: ~ 1400 hours



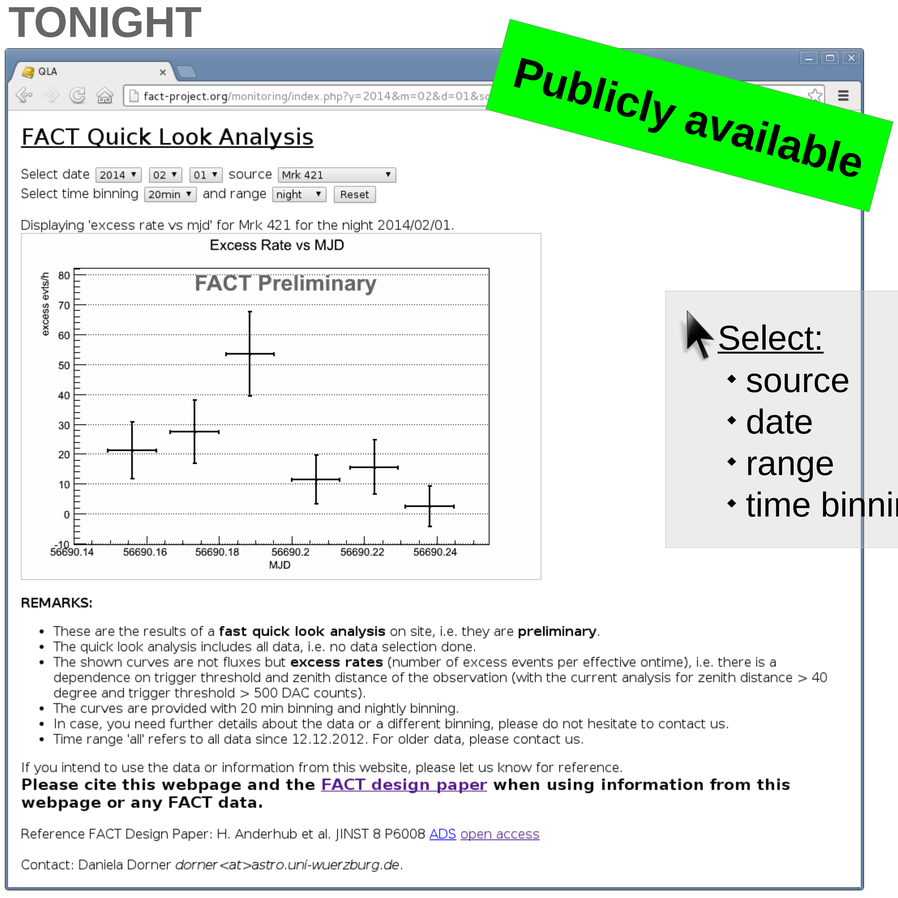
Quick Look Analysis and Flare Alerts

- Immediate processing on-site
- Available since December 2012
- Excess rates online after several minutes
- Results publicly available on website [5]
- Quick flare detection
- Eight flare alerts since March 2014
- Follow-up multi-wavelength observations
- Atel #6268 [6]

Multi-Wavelength View on Mrk 421



TONIGHT



Select:
- source
- date
- range
- time binning

Check out our results at:

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

Summary:

- Proof-of-principle for silicon-based photosensors (SiPM) in Cherenkov Astronomy
- Four Years of long-term monitoring: Mrk 421, Mrk 501, ...
- Multi-wavelength and Target-of-Opportunity observations

Acknowledgements: The important contributions from ETH Zurich grants ETH-10.08-2 and ETH-27.12-1 as well as the funding by the German BMBF (Verbundforschung Astro- und Astroteilchenphysik) and HAP (Helmoltz Alliance for Astroparticle Physics) are gratefully acknowledged. We are thankful for the very valuable contributions from E.~Lorenz, D.~Renker and G.~Viertel during the early phase of the project. We thank the Instituto de Astrofisica de Canarias allowing us to operate the telescope at the Observatorio del Roque de los Muchachos in La Palma, the Max-Planck-Institut für Physik for providing us with the mount of the former HEGRA CT 3 telescope, and the MAGIC collaboration for their support. Part of this work is supported by Deutsche Forschungsgemeinschaft (DFG) within the Collaborative Research Center SFB 876 "Providing Information by Research-Constrained Analysis", project C3.

References

[1] H.Anderhub et al. (FACT Collab), JINST 8 (2013) P06008, arXiv:1304.1710
[2] A.Biland et al. (FACT Collab), JINST 9 (2014) P10012, arXiv:1403.5747
[3] M.L.Knoetig et al. (FACT Collab), ICRC 2013, ID 695, arXiv:1307.6116
[4] http://www.fact-project.org/smartfact
[5] http://www.fact-project.org/monitoring
[6] Stegmann et al. (HESS Collab.) Atel 6268

Affiliations:

[1] Universität Würzburg, Germany - Institute for Theoretical Physics and Astrophysics, Emil-Fischer-Str. 31, 97074 Würzburg
[2] ETH Zurich, Switzerland - Institute for Particle Physics, Schafmattstr. 20, 8093 Zurich
[3] Technische Universität Dortmund, Germany - Experimental Physics 5, Otto-Hahn-Str. 4, 44221 Dortmund
[4] University of Geneva, Switzerland - ISDC Data Center for Astrophysics, Chemin d'Ecogia 16, 1290 Versoix

Corresponding author: ***dorner@astro.uni-wuerzburg.de***