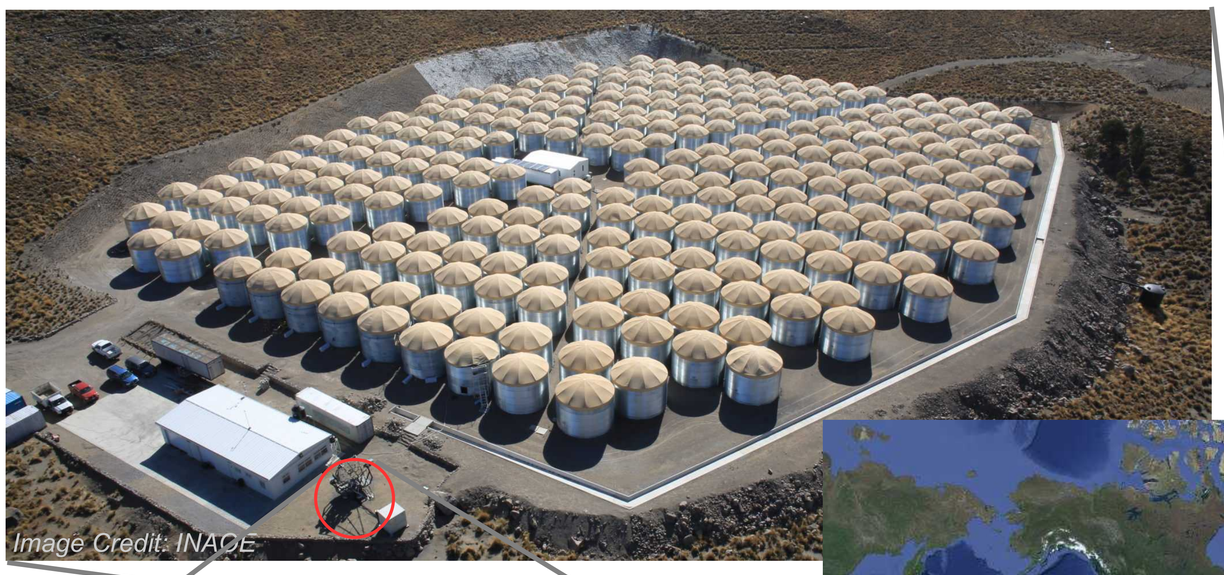
M@TE - Monitoring at TeV Energies

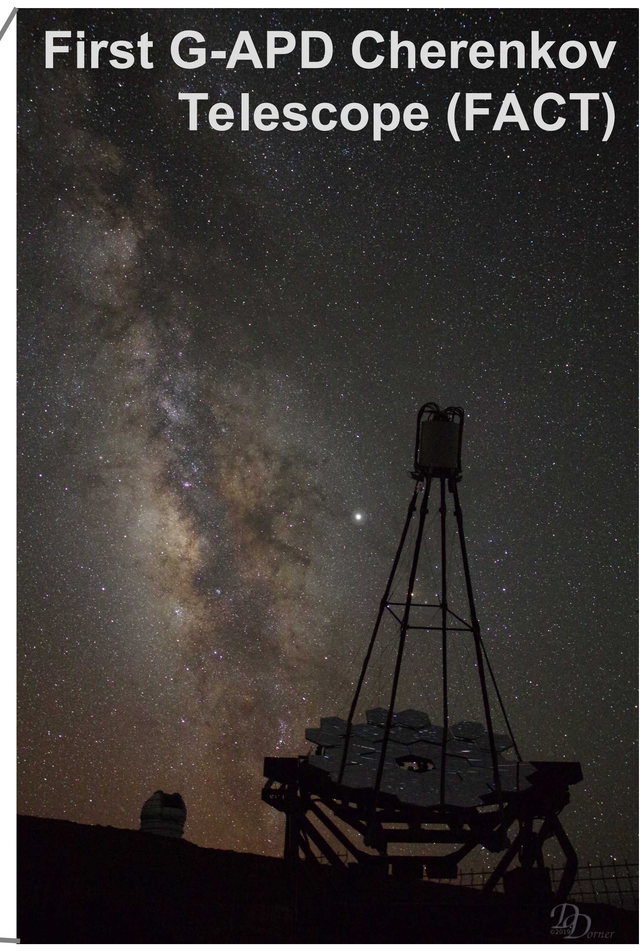
Thomas Bretz[1], Daniela Dorner[2], Magdalena González[3], Arturo Iriarte[3], Ruben Alfaro[3], Luis Martinez[3], Ibrahim Torres[4], Gagik Tovmassian[3], Daniel Durini[4]

Observations at TeV Energies

High Altitude Water Cherenkov Gamma-Ray Observatory (HAWC)



First G-APD Cherenkov Telescope (FACT)



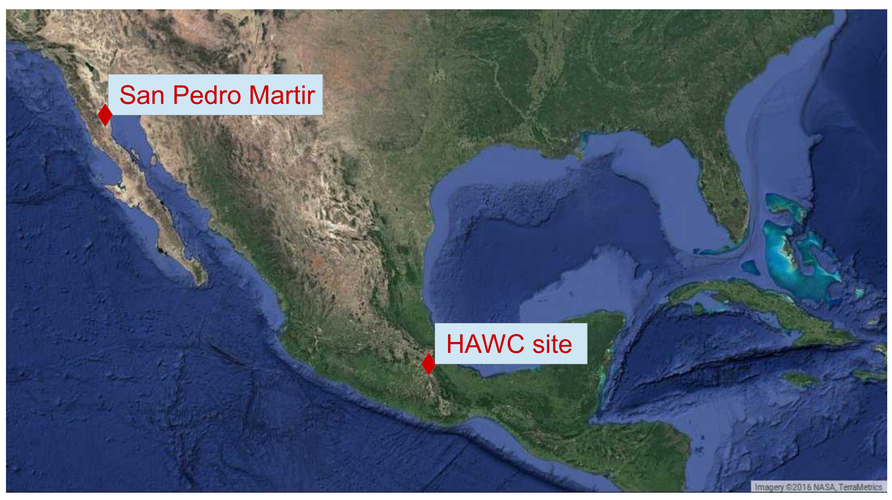
- 2 mounts from HEGRA available in Mexico
- 1st telescope readily installed at HAWC site (OMEGA project)
- 2nd mount ready to be installed in San Pedro Martir (M@TE)

Sites in Mexico

- HAWC site
  - 19° N 97° W
  - ~5.3 h to La Palma
  - 4100 m a.s.l.

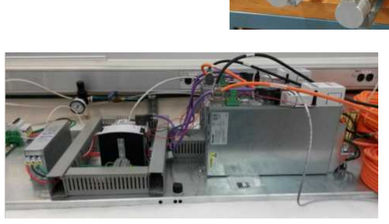
  → Cross-calibration with HAWC
  i.e. **First cross-calibration of Imaging Air Cherenkov and Water Cherenkov techniques**
- San Pedro Martir
  optical site close to CTA candidate site
  - 31° N 115° W
  - ~6.5 h to La Palma
  - 2800 m a.s.l.

  → **Unbiased long-term monitoring** in San Pedro Martir
  → **Continuous observations up to 12 hours**
  Towards 24/7 monitoring (DWARF network [11])



M@TE Monitoring at TeV Energies

- Improved SiPM camera
  - **Sensors purchased**
- Software available for most parts from FACT
  → Quick look analysis [4,5]
  → Web-interfaces, e.g. Smartfact [6]
  → Slow control software (FACT++) [7, 8]
  → Analysis software packages [9,10] (Mars, Fact-Tools)
- **New drive being installed at the HAWC site**
- **Mirrors purchased and characterized**
- **Monte Carlo simulations being adapted**
- **Site in San Pedro Martir selected for long-term monitoring**



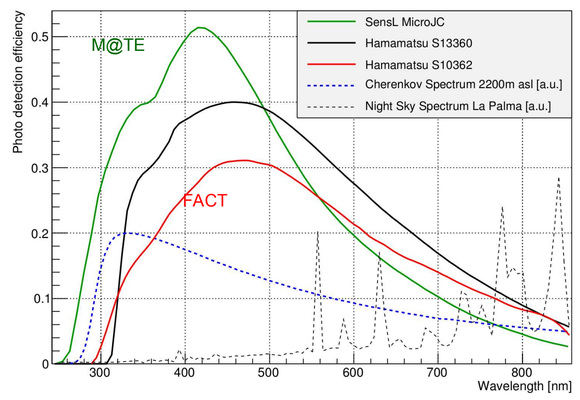
SiPMs: Ideal for Monitoring

- Stable and robust [1]
  → Stable telescope performance
  → Robotic operation [2]
  → High data taking efficiency
- Observations in bright ambient light
  → Observations during full moon [3]
  → Closing gaps
  → Increased duty cycle
  → More complete data sample

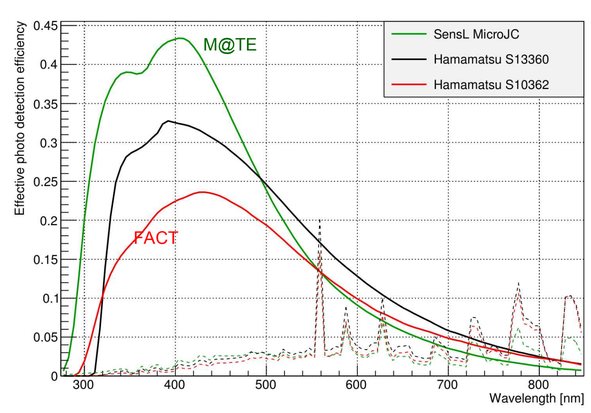
Improved Sensitivity

- New generation of SiPMs

→ Increased photon detection efficiency
→ Cherenkov light yield increased by factor 1.6 compared to FACT
→ Lower energy threshold



fold with Cherenkov spectrum / night sky background



Summary and Conclusion

- Improved SiPM camera
  → Lower energy threshold (< 1 TeV)
  → Improved timing resolution (tens of minutes)
- Unbiased continuous monitoring
  → ~400 hours/source/year
- Combined observations with FACT
  → 12 hours continuous observations

References
[1] A. Biland et al. (FACT Collab), JINST 9 (2014) P10012
[2] A. Biland et al. (FACT Collaboration), ICRC 2013
[3] M.L. Knoetig et al. (FACT Collaboration), ICRC 2013
[4] D. Dorner et al. (FACT Collaboration), eConf C14102.1
[5] http://www.fact-project.org/monitoring
[6] http://www.fact-project.org/smartfact
[7] T. Bretz et al. (FACT Collaboration), IEEE 2014
[8] H. Anderhub et al. (FACT Collab), JINST 8 (2013) P06008
[9] C. Bockermann et al., ECML/PKDD 2015
[10] T. Bretz, D. Dorner, apsp.conf, 681
[11] M. Backes et al., ICRC 2009

Affiliations:
[1] RWTH Aachen, Aachen, Germany
[2] Universität Würzburg, Würzburg, Germany
[3] Universidad Autonoma de Mexico, Mexico City, Mexico
[4] INAOE, Puebla, Mexico

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