Recent AGN Observations by STACEE

(Solar Tower Atmospheric Cherenkov Effect Experiment)

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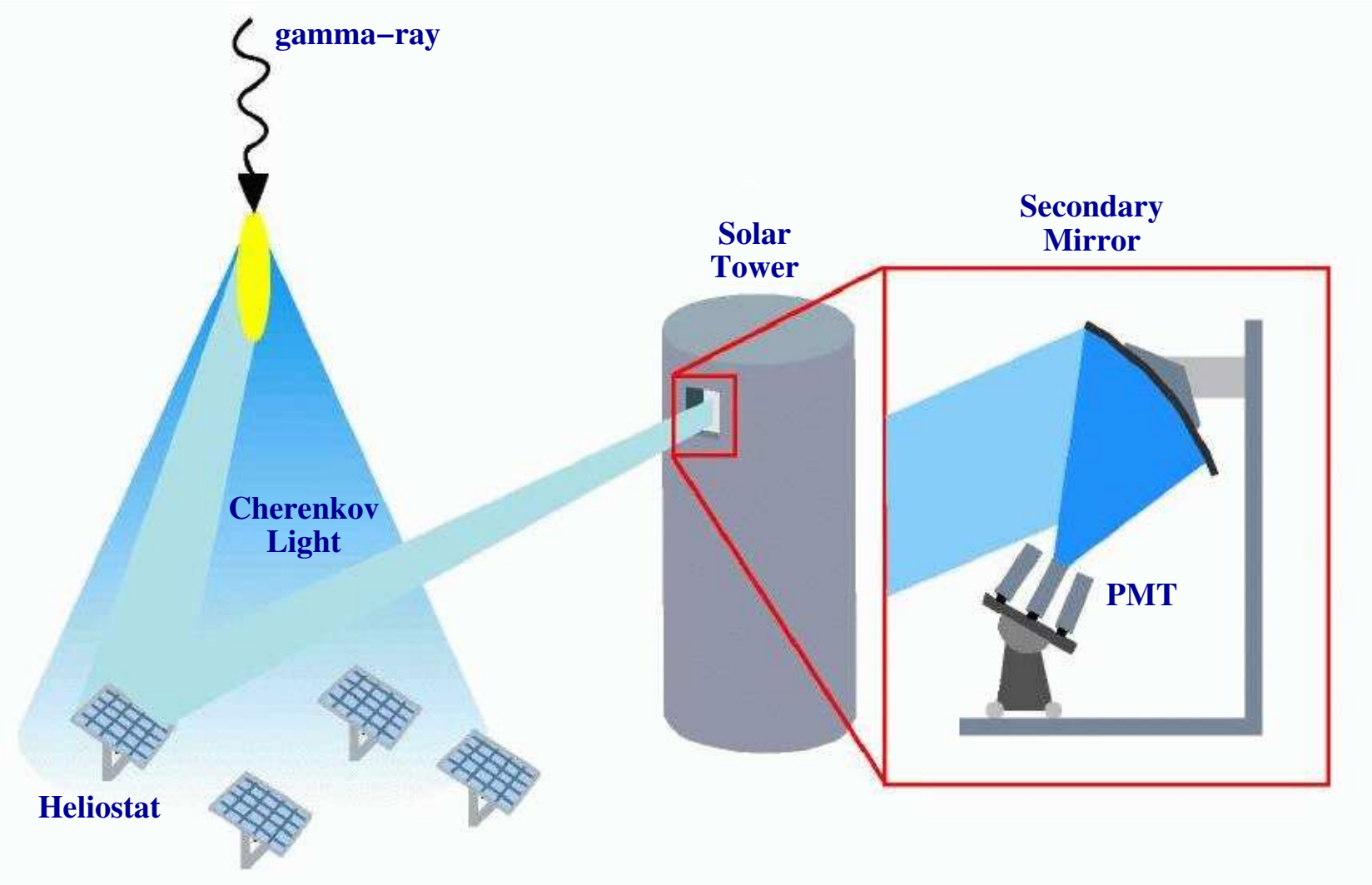
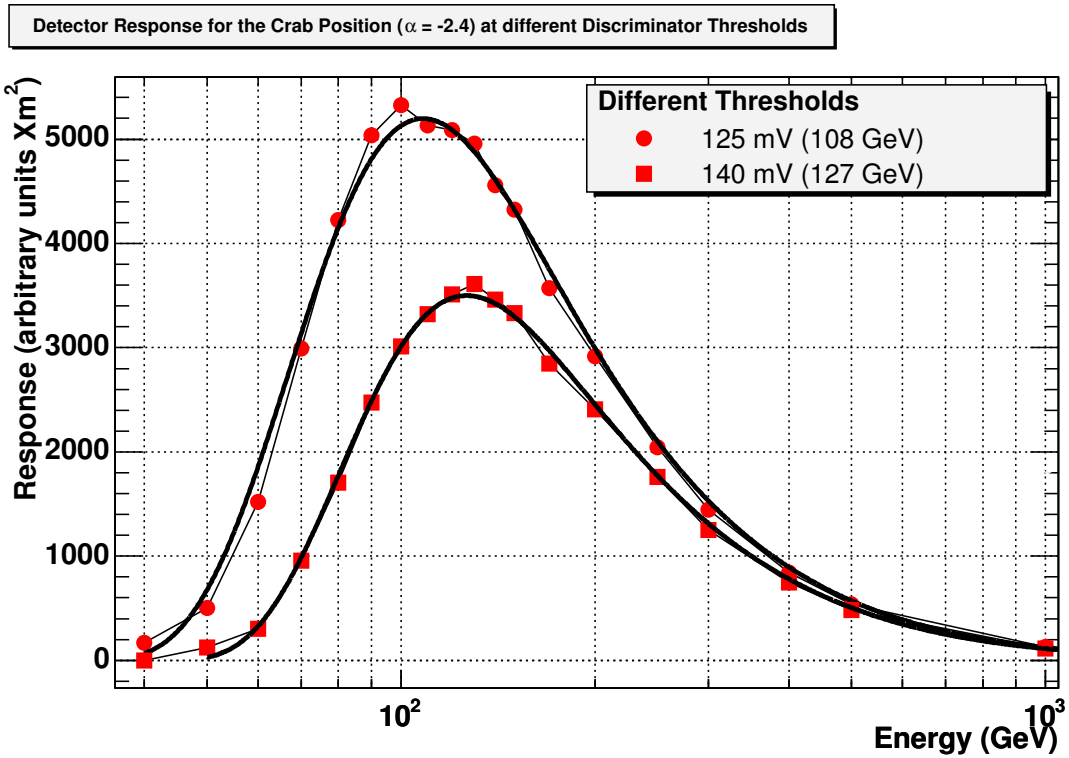
The Solar Tower Atmospheric Cherenkov Technique



- A Cherenkov light collector
  - — detect γ-rays by sampling the Cherenkov wavefront
  - — Albuquerque, New Mexico

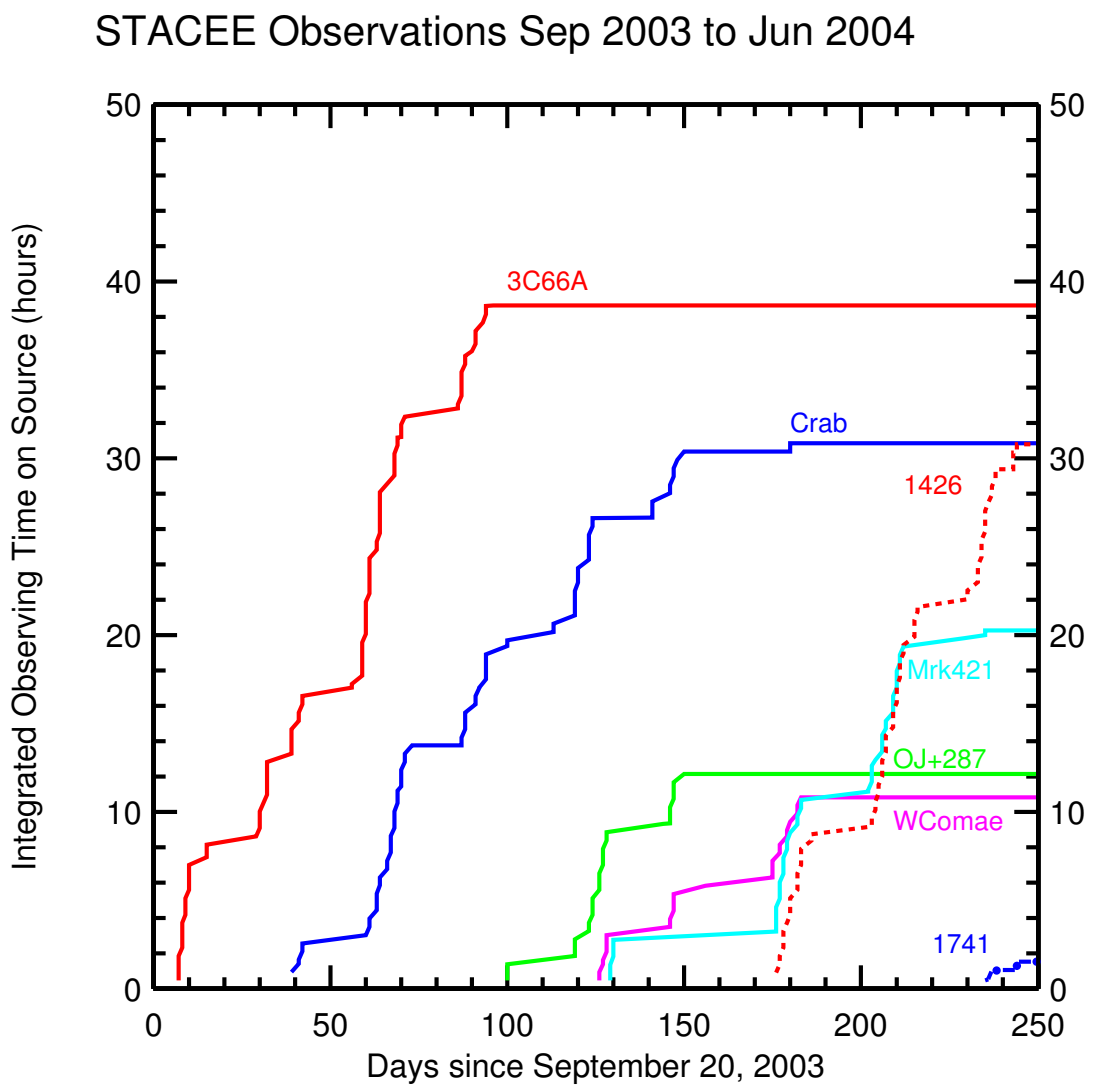
Why use a Solar Tower?



- Low energy threshold
  - — heliostats provide mirror area
  - — STACEE total mirror surface $\simeq$ 2400 m^2 ($\sim$100 m^2 for IACT)
  - — energy threshold in $\sim$100 GeV range

Figure: P. Fortin, McGill

STACEE Observations 2003/2004

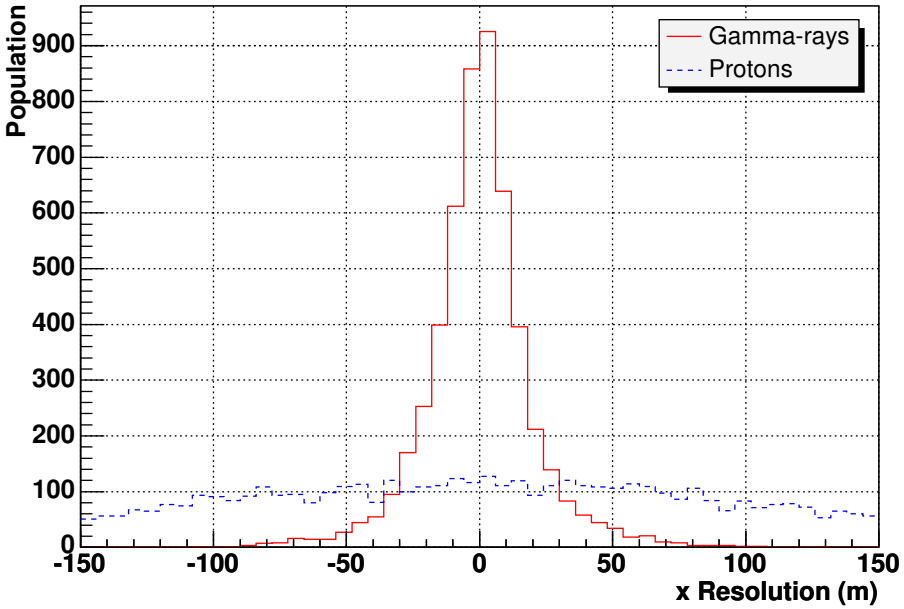


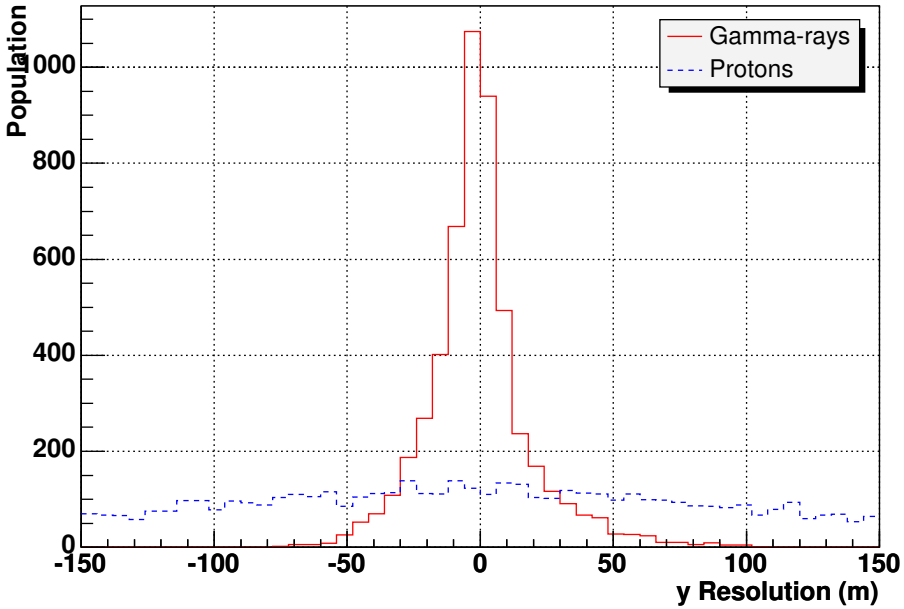
- STACEE observes in ON/OFF mode
  - — typically 28 mins ON source followed by 28 mins OFF source
  - — OFF-source data used for hadronic background quantification

Summary of 2003/2004

- Hardware: stable detector
  — complete with 64 heliostats and 64 FADCs
- Data Analysis: significant progress
  — using full power of FADC data
  — improved core/energy reconstruction and padding analyses
- WComae: upper limits publication
  — Scalzo et al., ApJ, 607:778-787 (2004)
- 3C 66A: $\sim$17 hours of clean on-source data
  — preliminary result from data analysis
- H1426+428: $\sim$23 hours of clean on-source data
  — preliminary result from data analysis
- Markarian 421: ~ 8 hours of clean on-source data
  — detected in high state, Spring 2004

Event Reconstruction





- Core location using two independent methods
  - — early work encouraging, resolution of $\sim$19 m for γ-rays
  - — study ongoing using simulations and real data
- Gamma/hadron separation and spectral analysis
  - — under development
  - — improvement in sensitivity expected using new techniques

WComae Upper Limits

- Background:
  — an EGRET blazar, hard (α = 1.73) spectrum (undetected by IACTs)

- STACEE Dataset:
  — 10.5 hours of on-source data

- Results:
  — flux upper limits above 100 GeV for leptonic models,
  above 150 GeV for hadronic models (lowest yet for WComae)
  — strongly constrain EGRET power law extrapolation
  — upper limit below SPB 2 hadronic model prediction

- Further details:
  — Scalzo et al., ApJ, 607:778-787 (2004)

SPB model: Mücke & Protheroe 2000; Aharonian 2000; Mücke et al., 2003

WComae Upper Limits

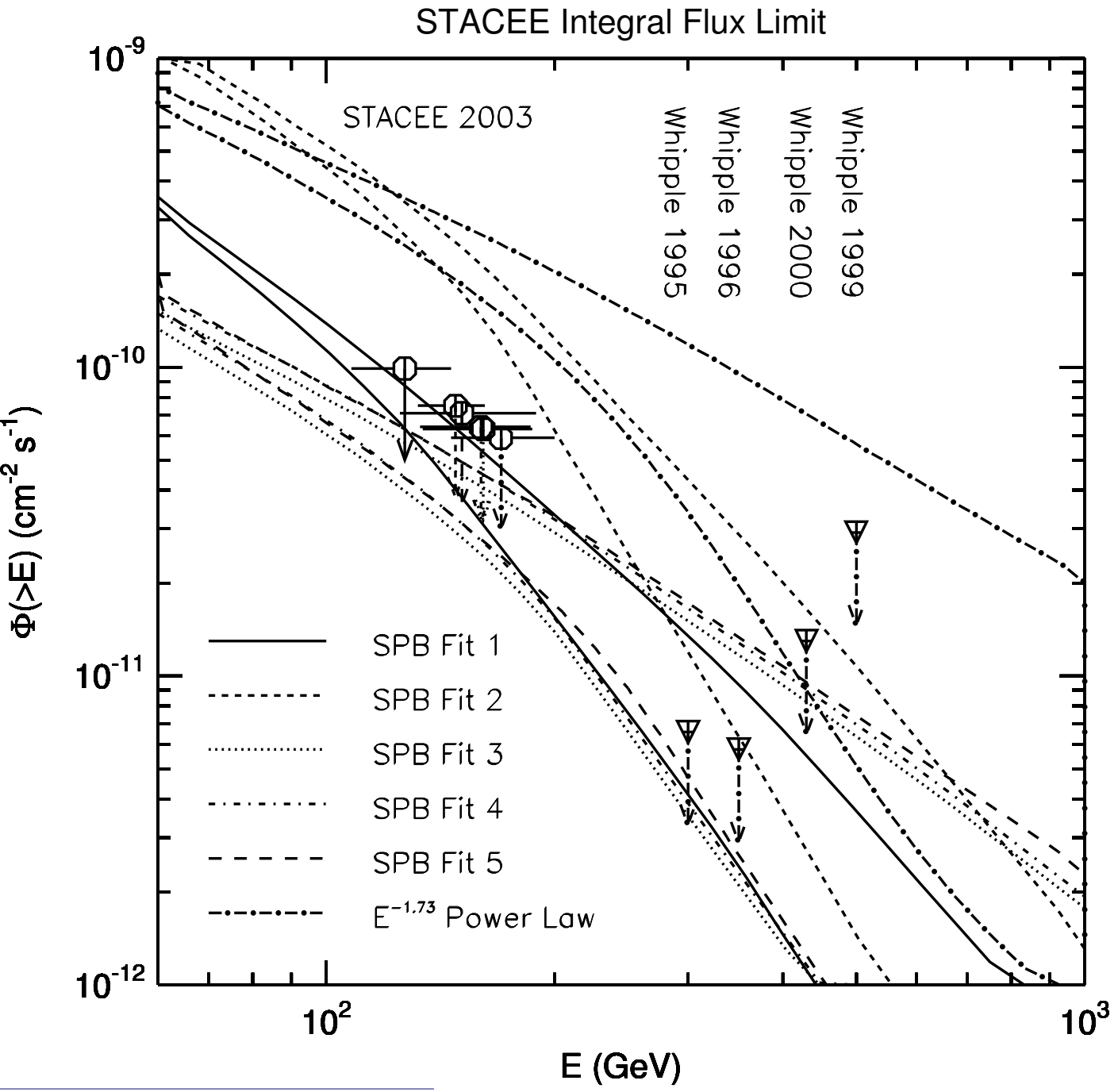


Figure: Scalzo et al. 2004

3C66A

- Background:
  - EGRET detected LBL, z=0.444
  - detection reported by Crimean Astrophysical Observatory Neshpor et al., (1998)
- STACEE Dataset:
  - 16.9 hours of on-source data
- Preliminary results:
  - on-source excess at 2.81 σ
  - 1.53 γ/min
- Further details:
  - Bramel et al., poster at this conference

H 1426+428

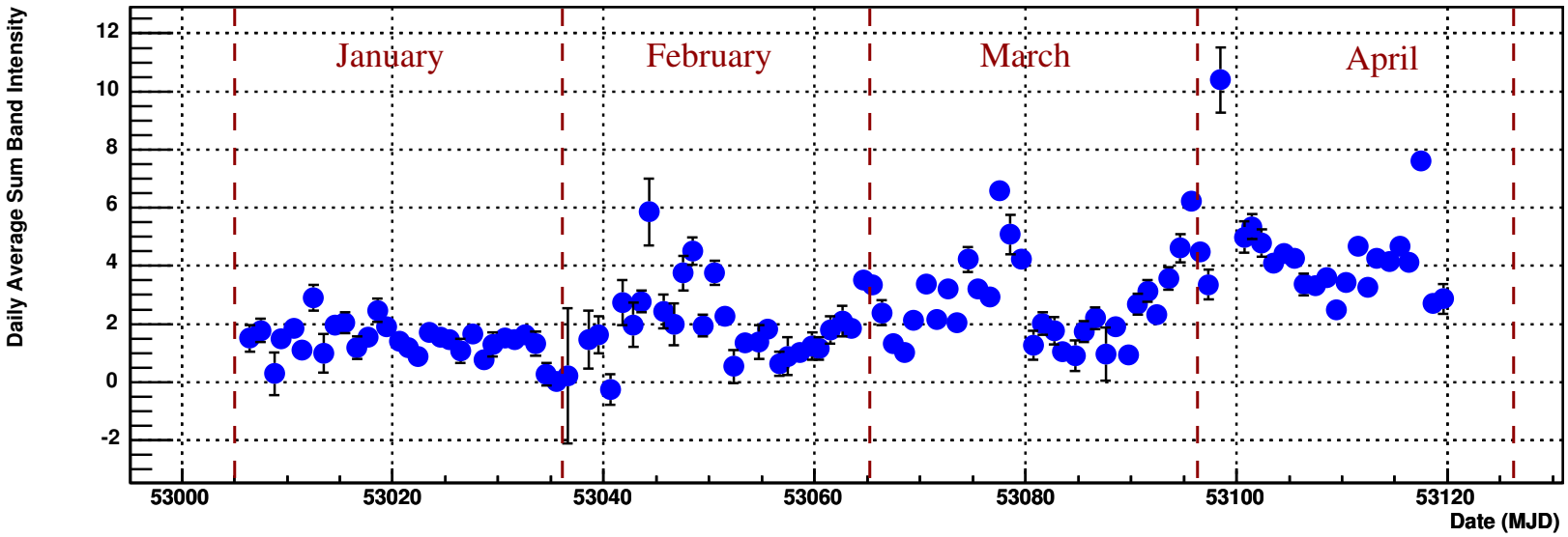
- Background:
  - — extreme HBL, weak VHE source detected by IACTs
  - — soft spectrum, spectral index of 3.5 (Petry et al., 2002)

- STACEE Dataset:
  - — 7.5 hours of on-source data (2003)
  - — 15.1 hours of on-source data (2004)

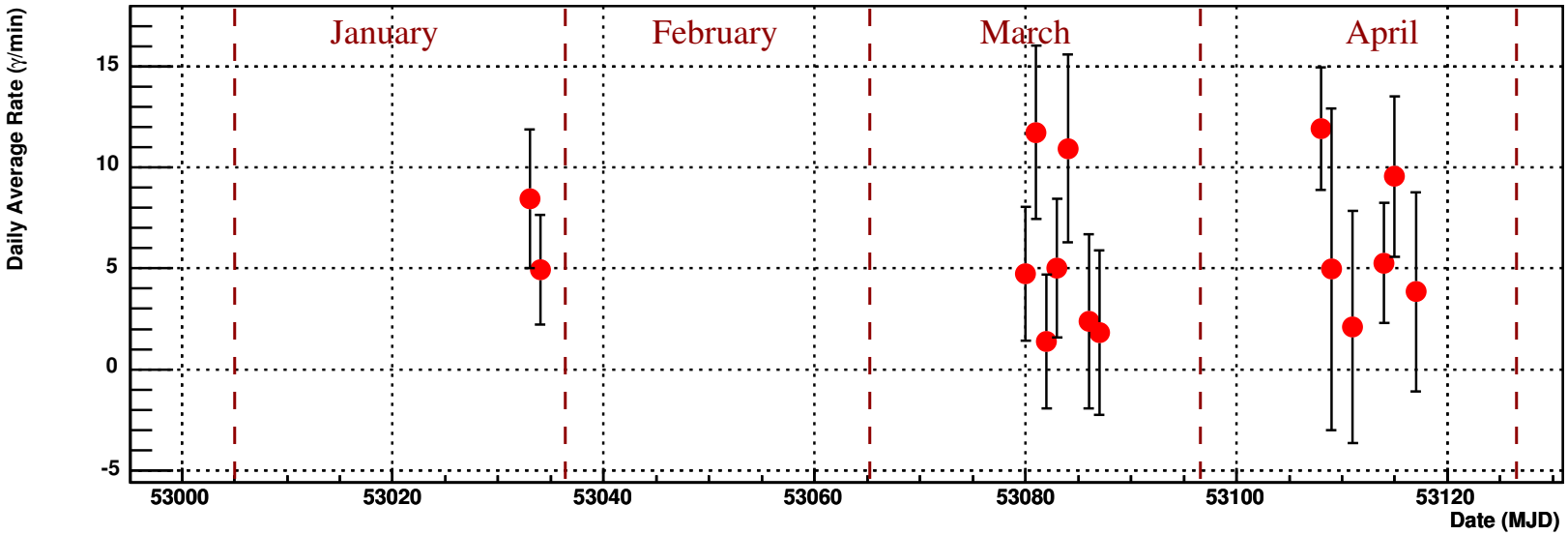
- Preliminary results:
  - — on-source excess at 2.9 σ (2003)
  - — on-source excess at 1.1 σ (2004)
  - — combined on-source excess at 2.5 σ (1.34 γ/min)

Markarian 421 – Preliminary Results

RXTE ASM Lightcurve



STACEE Lightcurve



— high state according to RXTE ASM during spring 2004

— 7.9 hours on-source, combined significance of 5.9σ

Current/Future Work

- Hardware: pre-amplifier upgrade (2004)
  - — move FADCs closer to PMTs, operate with lower energy threshold
  - — faster, cleaner system
- Data analysis: gamma/hadron separation (continuous)
  - — fully exploit FADC information
  - — spectral analysis
- Observations: AGN, pulsars, GRBs, others
  - — observations to continue until (at least) mid-2006
- Outlook: good!
  - — large dataset
  - — analysis continuously improving
  - — new pre-amps, lower energy threshold