Recent results and status of HEGRA

- ☆ Performance and Status of HEGRA
- ☆ Galactic Sources (1st Unidentified TeV source, Gal. plane scan)
- ☆ Extragal. Sources (Mkn 421, H1426+428, 1ES1959+650)
- ☆ Summary

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Status of the instruments

CTSystem:

Operation time: 1997-9/17/2002 (since 1998 5 telescope setup)

Observation: $>$6000 hrs of good data on $\approx$110 objects

Upgrades: None after 1998, HV-adjustments.

CT 1:

Operation time: 1992-2002

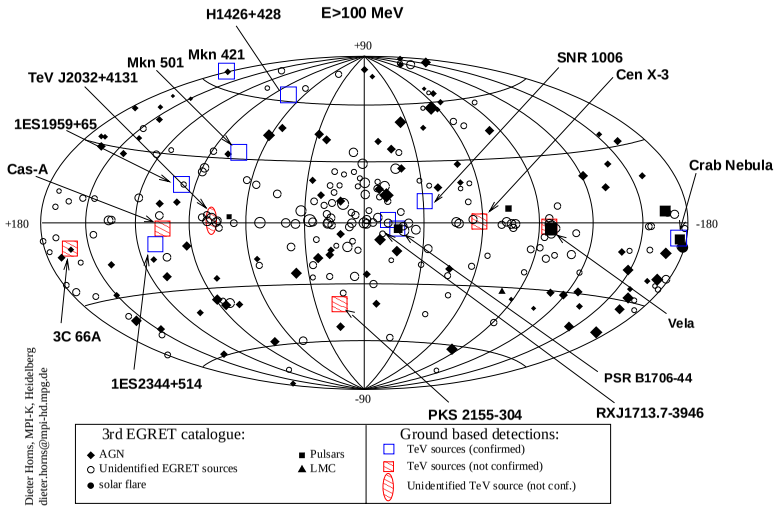
Observation: $>$6000+2000(moon) hrs of good data on 60 objects

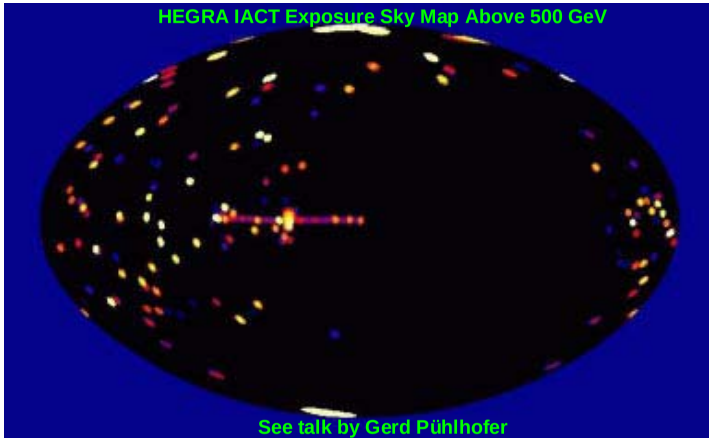
Upgrades: New camera (127 pix) 12/1994, alum. mirror (10 m^2) 12/1997

Dismantling of CTs in this year.

2 Telescopes will be operated by Brenda Dingus in Mexico at 4.4 km a.s.l.

The gamma-ray sky





- **HEGRA detected 7 sources (>2 discoveries)**
  - **Crab Nebula** (Konopelko et al. 1996, Aharonian et al. 1999)
  - **Cas-A** (Aharonian et al. 2001)
  - **Unid. TeV source in Cygnus** (Aharonian et al. 2002)
  - **Mkn 421** (Petry et al. 1996, Aharonian et al. 1999,2001, and 2002)
  - **Mkn 501** (Bradbury et al. 1997, Aharonian et al. 1997,1999a,1999b,1999c,2000a,2000b,2001a,2001b,2001c)
  - **1ES1959+650** (Götting et al. ICRC 2001)
  - **H1426+428** (Aharonian et al. 2002)

Performance of the instruments

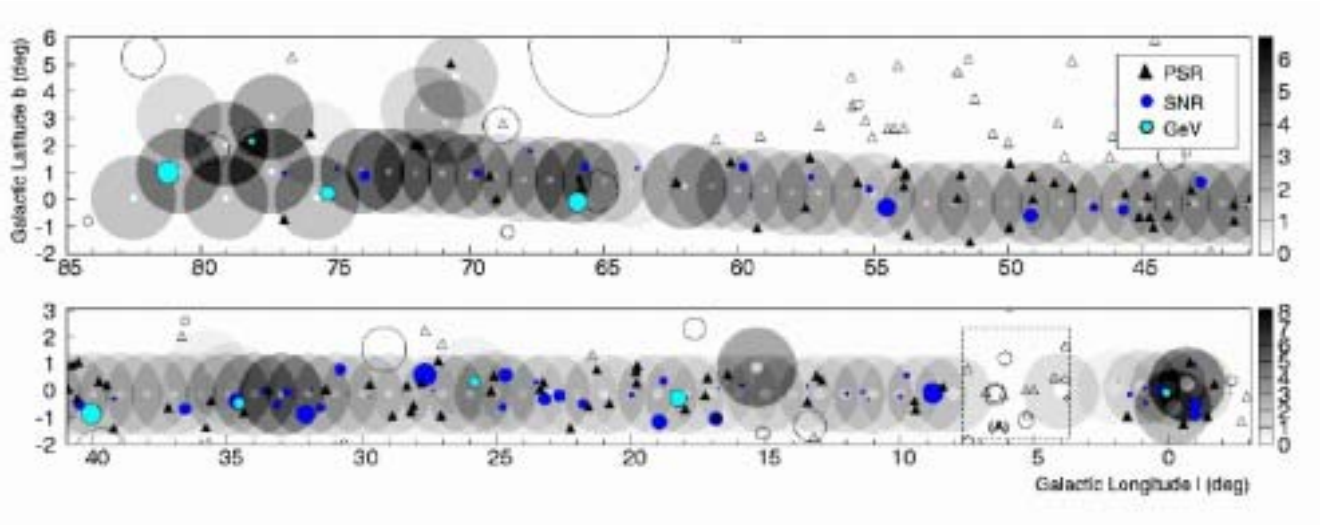
Figures of merit:

	Ang. resol.	Energy resol.	Thresh.[a]	γ-rate(Crab)[b]	CR-rate[b]	Signal/$\sqrt{hr}$[c]
	[°]	ΔE/E	[GeV]	[1/hr]	[1/hr]	$[\sigma/\sqrt{hr}]$
CTSystem	<0.1°	>10%	500-600	36	3.3	10
CT1	≈0.2°	>25%	700-900	28	23.3	3.3

[a] In zenith
[b] After cuts at z.a.<30°
[c] Calculated using Li&Ma Log-Likelihood

Galactic plane scan (CTSystem)

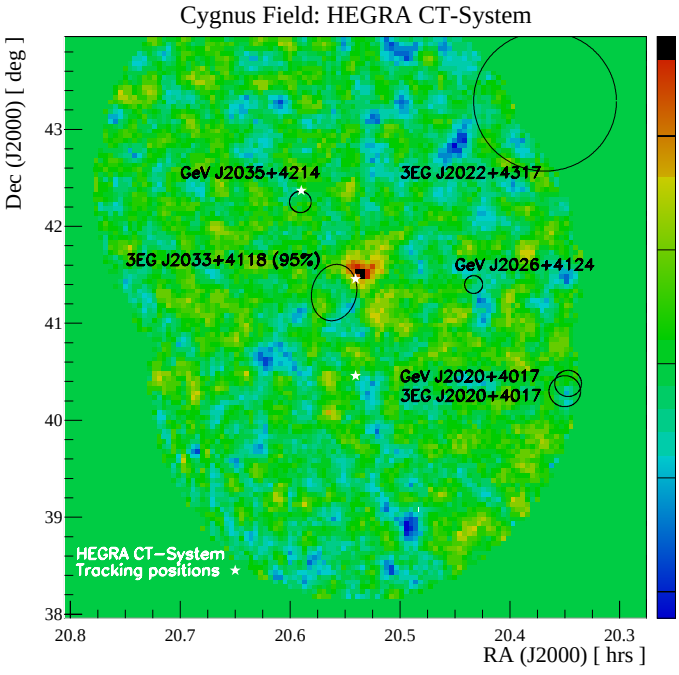
astro-ph/0209360, A&A in press

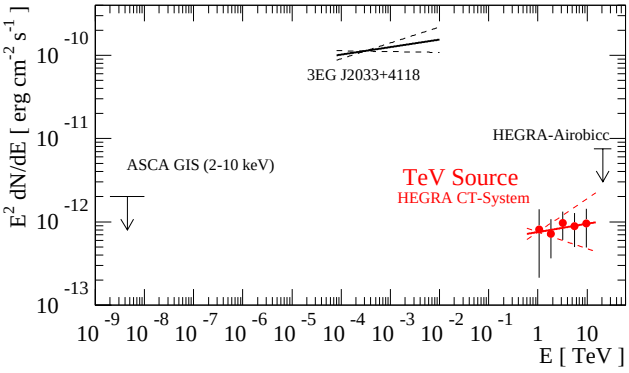


- ✿ short exposure scan (Sensitivity $>$ 0.3 Crab units)
- ✿ covers 1/4 of Galactic plane, 86 known pulsars, 63 known SNR, 9 GeV sources
- ✿ No signal seen (Upper limits $>$ 0.15 Crab units).

1st Unidentified TeV Source (CTSystem)

astro-ph/0207528, A&A in press



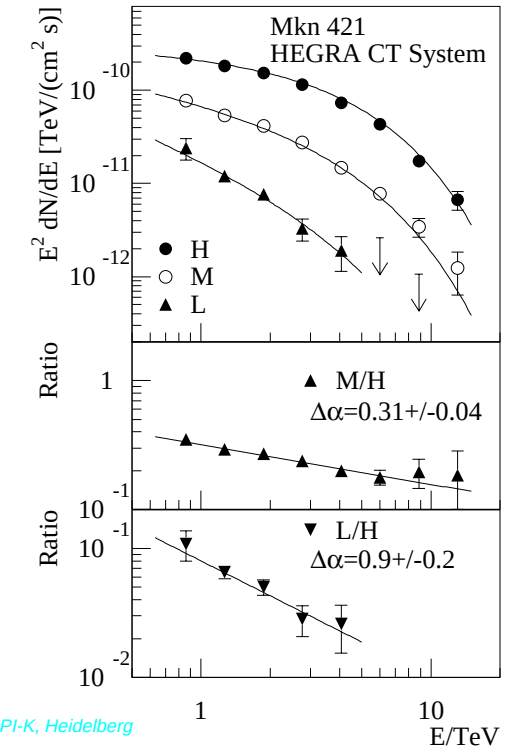


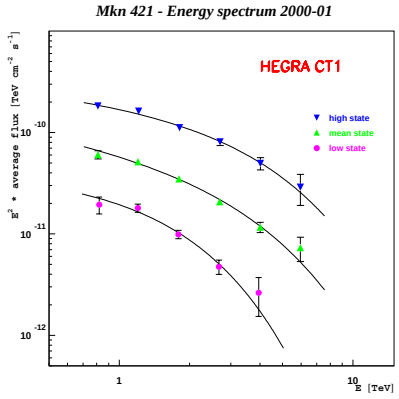
- ❒ $>$ 5σ excess discovered serendipitously (100 hrs)
- ❒ 0.5° north of Cyg X-3
- ❒ hard energy spectrum ($\alpha = 1.9$)
- ❒ possibly extended
- ❒ follow-up observations confirm result ($>$ 130 hrs)

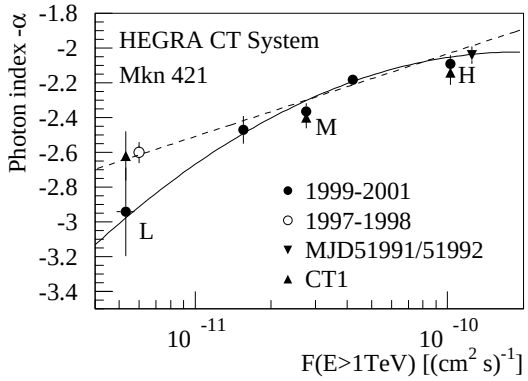
☛ See talk by G. Rowell.

Spectral variability Mkn 421 (2000&2001)

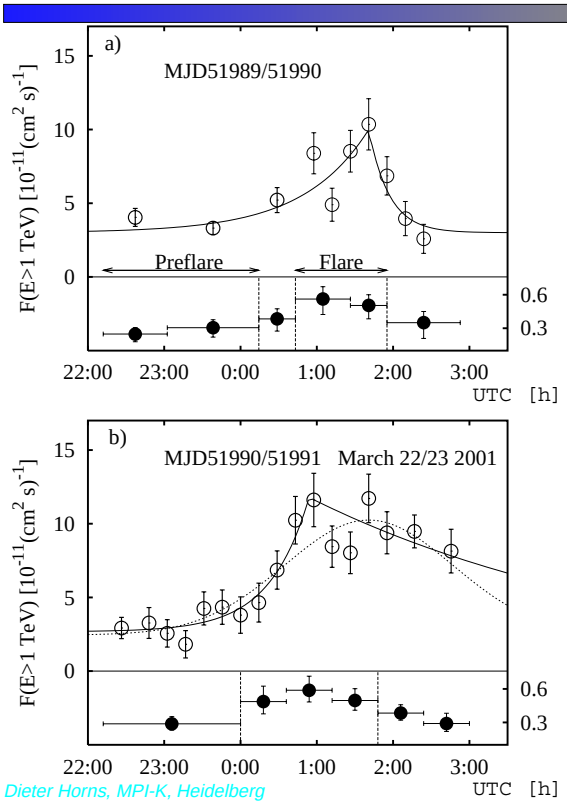
Aharonian et al. 2002, A&A 393, 89

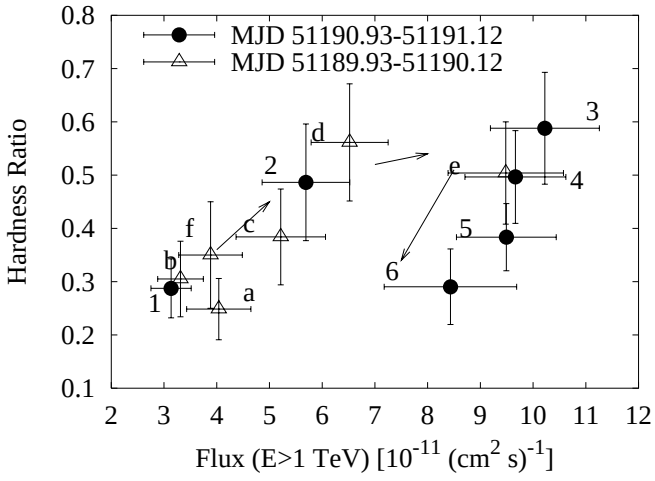




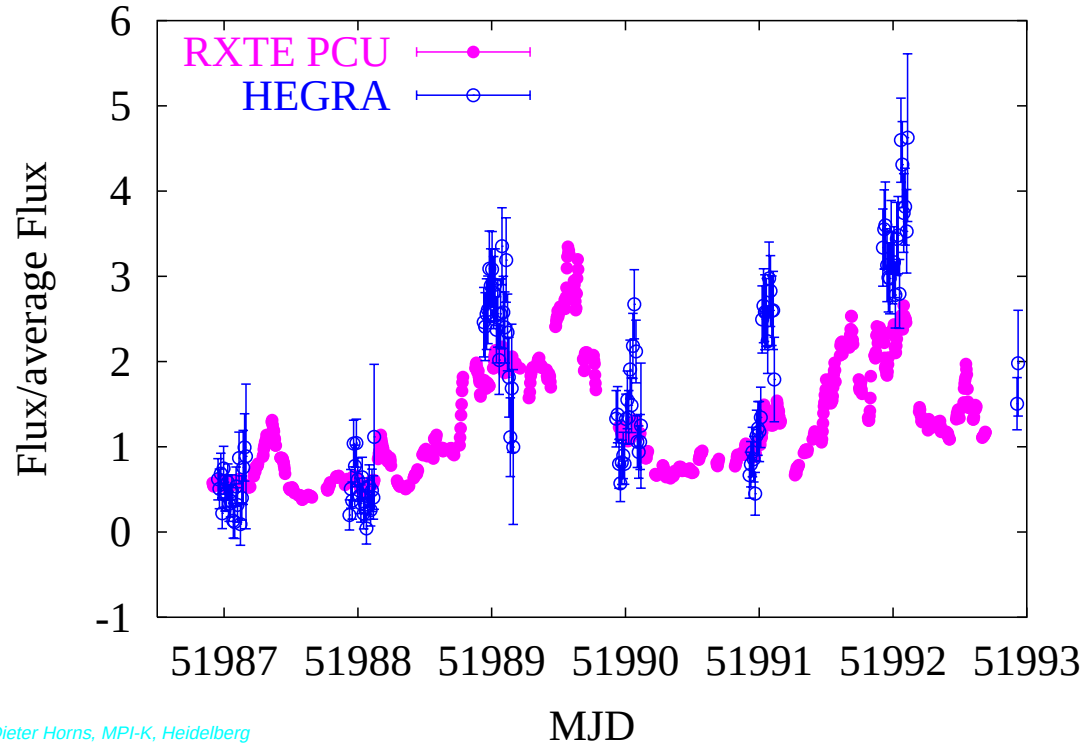


Diurnal spectral variability (CTSystem)

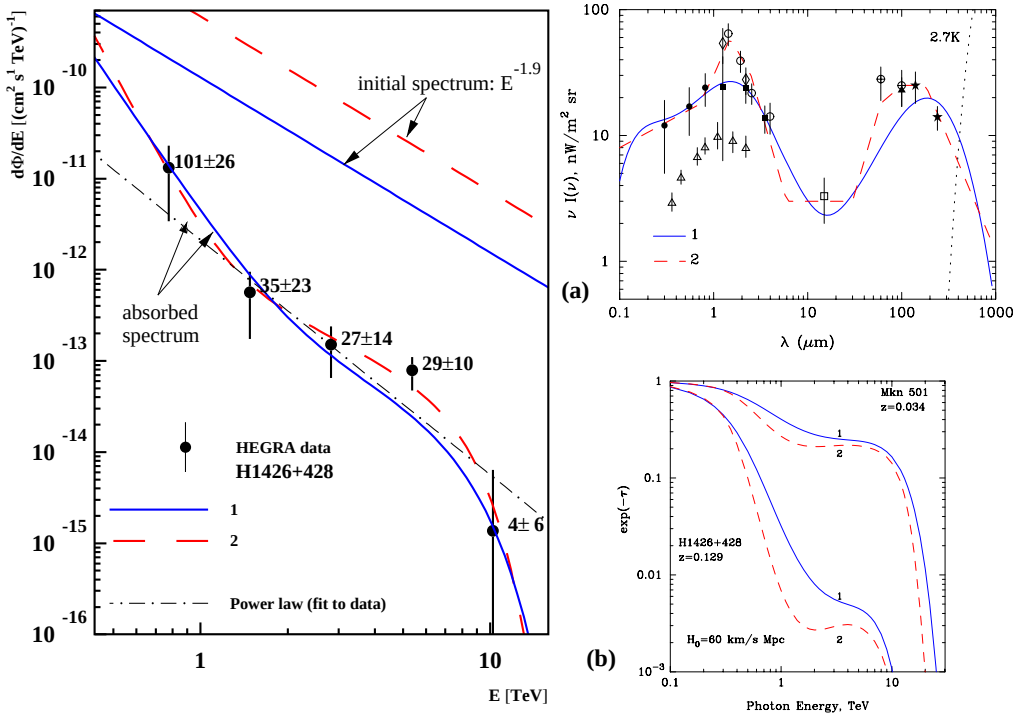




Multi-wavelength observations Mkn421

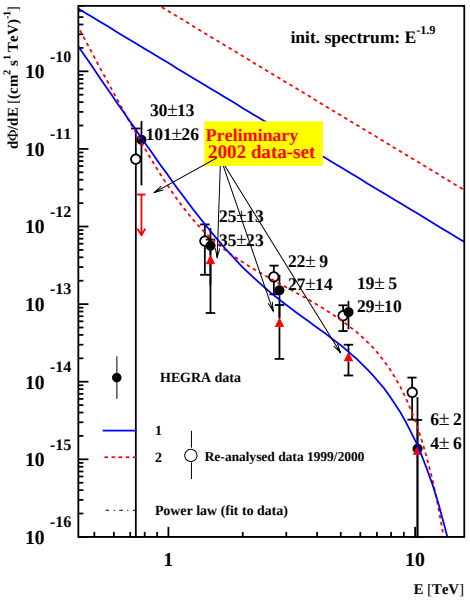


H1426+428, 1999&2000



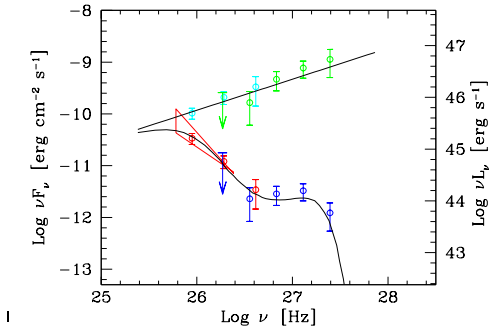
- Extreme synchr. BLLac (Costamante et al.)
- 40 hrs of observation (1999&2000): S=5.8 σ
- z=0.129 2< τ(5 TeV)<5
- Indication of absorption
- > 200 hrs observations carried out in 2002

H1426+428, 1999-2000 re-analyzed& 2002 data

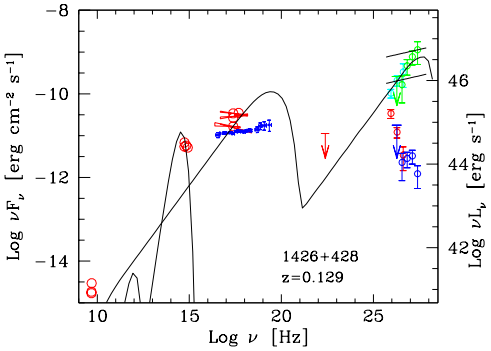


- re-analysis confirms flattening
- 2002 data confirms flattening
- 2002 flux low

Combining HEGRA, VERITAS,& CAT:



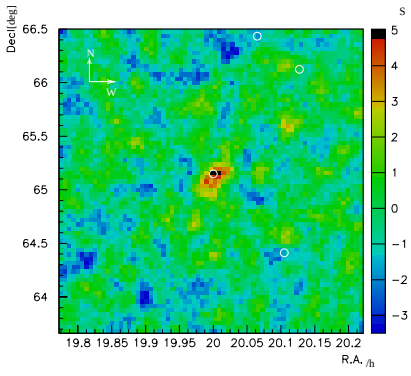
Absorption corrected: $\alpha = 1.4$

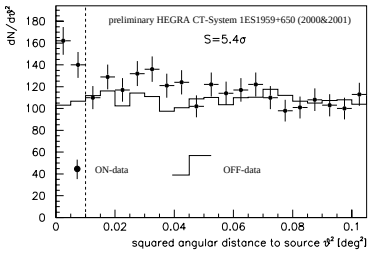


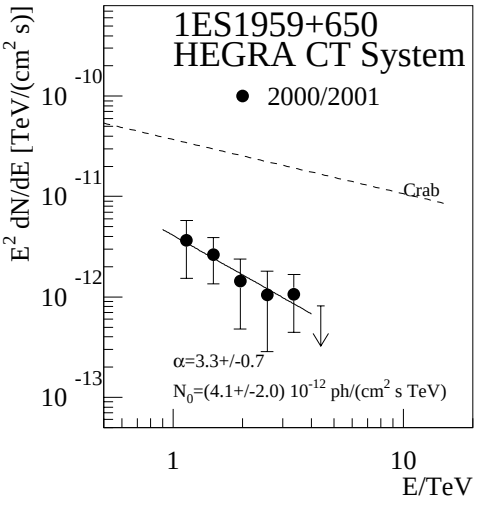
Modeling with finite injection time SSC & external seed photons

1ES1959+650 2000&2001 (CTSystem)

See also Poster S25:

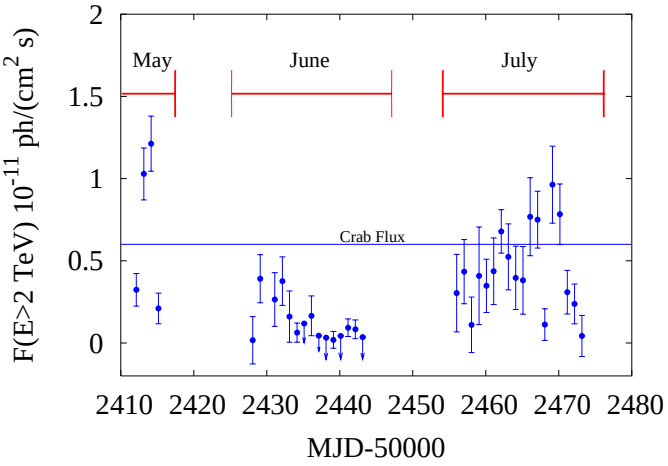


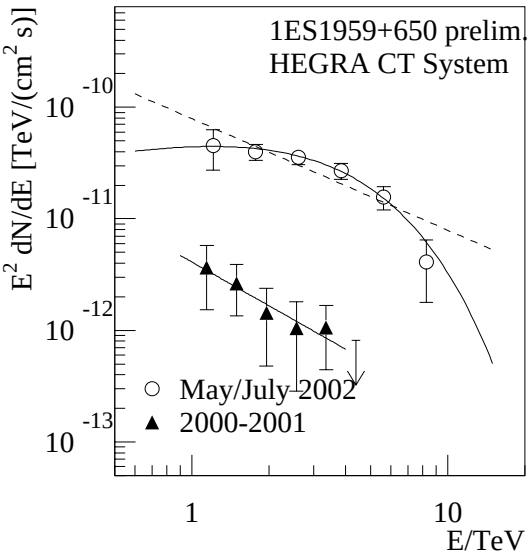




- 94 hrs of good data in 2000&2001
- Detection at $S = 5.4\sigma$
- Integral flux 8 % of Crab-Nebula
- Photon index 3.3 ± 0.7

1ES1959+650 2002 (CTSystem)



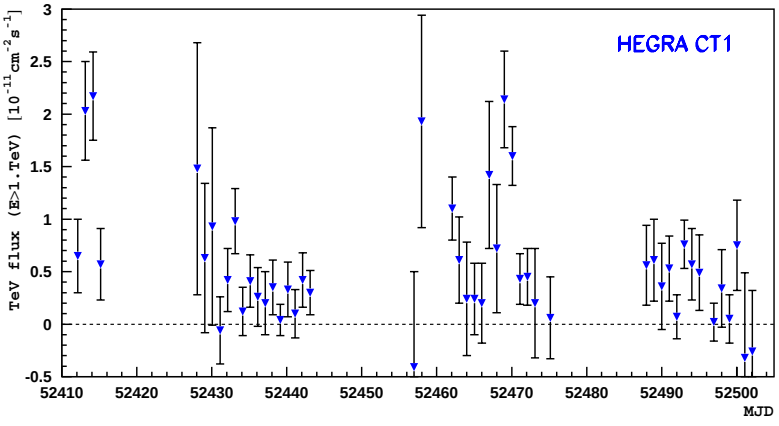


✳ **Strong variability & spectral hardening in 2002**

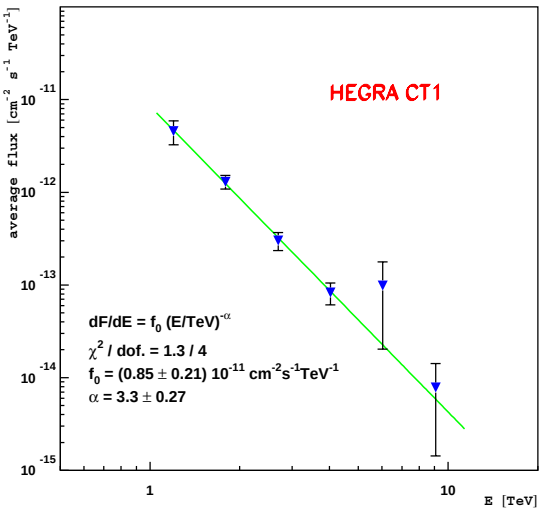
For details see POSTER S25

1ES1959+650 2002 (CT1)

1ES 1959+650 - Lightcurve 2002

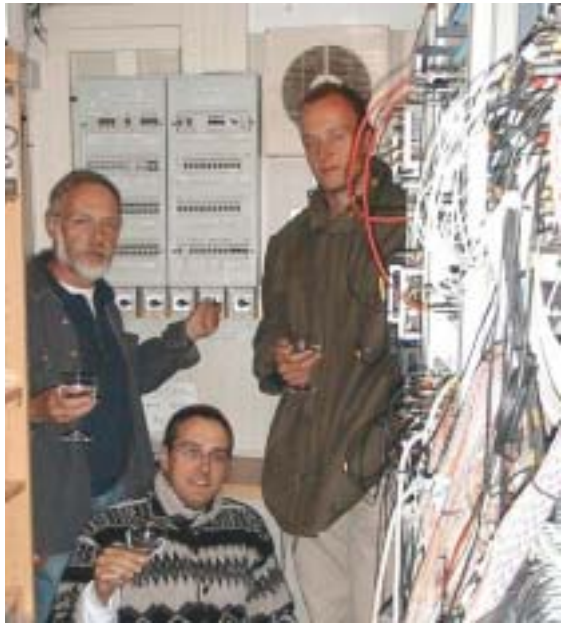


1ES1959+650 - Energy spectrum 2002



Similar results obtained with CT1

Last light at HEGRA



Early morning hours of Sep-17-2002

End of shift, end of operation

Summary:

- Surveys
  - 0.4 srad survey with > 5000 hrs of data (see later talk)
  - Galactic plane survey
  - Serendipitous discovery of unid. source in Cygnus region (see later talk)
- Extragal. sources
  - Spectral variability observed for Mkn 421
    Close correlation with flux
  - H1426+428: New data confirms flattening
    Indication for absorption
  - 1ES1959+650: Detection in low state
    flat spectrum in high state (2002) (see poster S25)