

The VERITAS Project



U.S. Chicago
Iowa State
Purdue
SAO
UCLA
Utah
Washington U.

U.K. Leeds

Ireland UCD

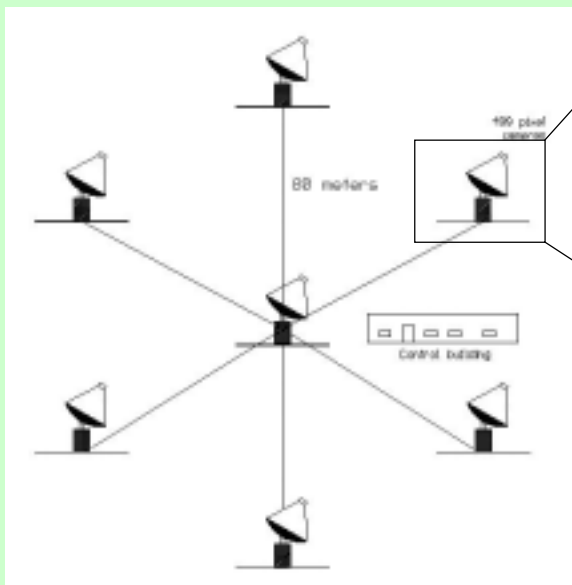
Canada McGill

U. Tokyo Workshop
Sept 26, 2002

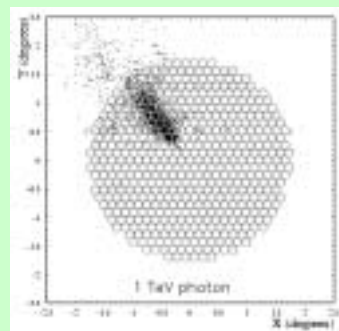
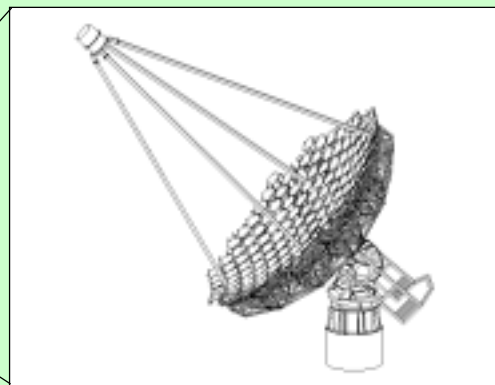
Rene Ong (UCLA)
for the VERITAS collaboration

DESIGN

12m Reflectors

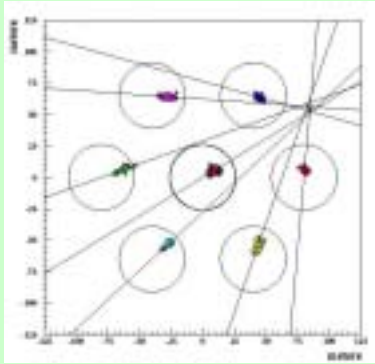


7-telescope Array



500 PMT
Cameras
3.5° FOV

ARRAY DESIGN

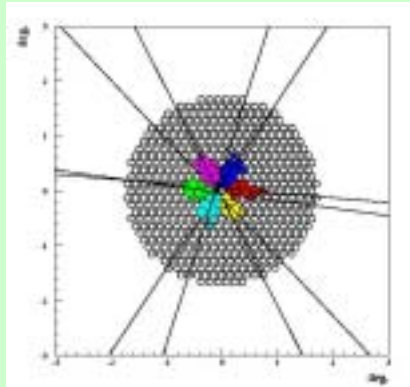


**Picture of Seven Telescopes
Observing 3 sources at once.**
(image too large for some PDF viewers)

Flexible Observing

**Shower
Reconstruction**

**Camera
Images**



**Combines heritage
Whipple 10m
HEGRA array**

NEW FEATURES

Some key new features of VERITAS:

Telescope

Larger – 12m, Longer – f/1.0
excellent image concentration

High-speed Sampling

500 MHz FADCs

Flexible Triggering

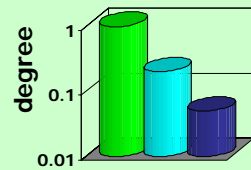
Multiple triggering modes
Patterns, Sub-Arrays, Image

Detector & Atmospheric
Calibration

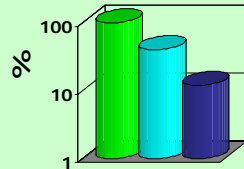
Multiple electronic/optical methods
Photometry – stars, fixed sources

PERFORMANCE

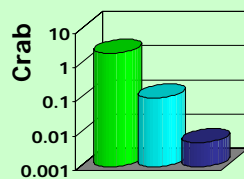
Angular resolution



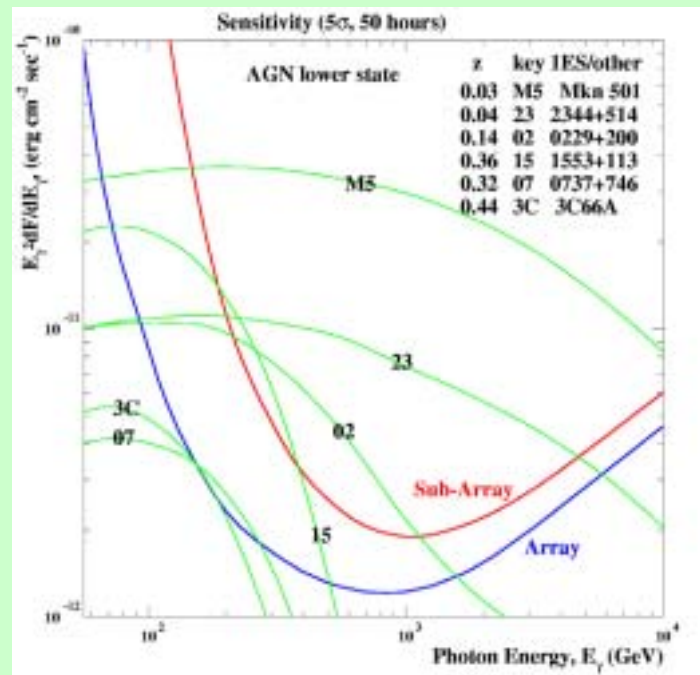
Energy resolution



Flux sensitivity (50hr, 5 σ)



Whipple (<1990) Whipple (now) VERITAS



TIMELINE

- 1995** **First discussions, Padova-IV**
- 1998-2000** **Full design of VERITAS**
National committee, agency reviews
Approved scientifically – but no money.
- 2001** **Prototype Telescope start**
- 2002** **VERITAS Phase-I, Four telescope array**
- 2003** **Prototype Telescope Operation**
- 2003-2005** **Construction of VERITAS-I**

FUNDING

- U.S. is committed to many projects in particle astrophysics.
- VERITAS is a moderate-sized project.
- Coordinate funding between 4 government agencies.

→ Delay in securing full funding.
(PPARC has started funding)

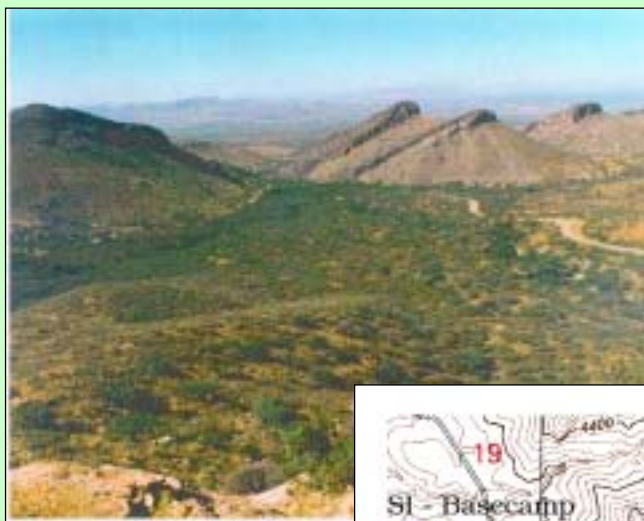
Collaboration is:

Actively involved in construction of Prototype Telescope.

Continuing the operation of Whipple 10m.

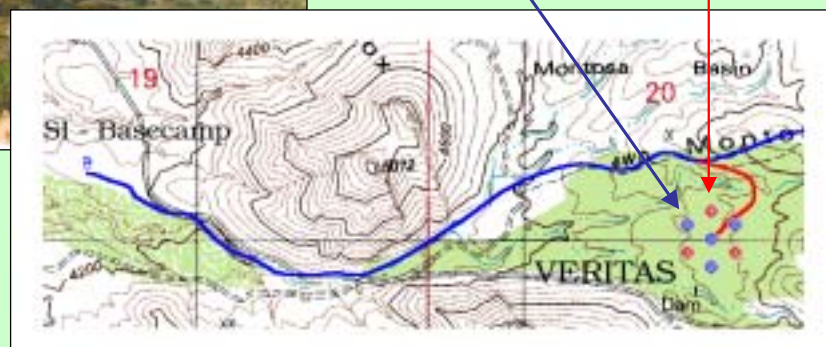
Completely committed to construction of 7-telescope array.

SITE



Mt. Hopkins, AZ
Near Whipple base camp

Initial 4 telescopes Array completion



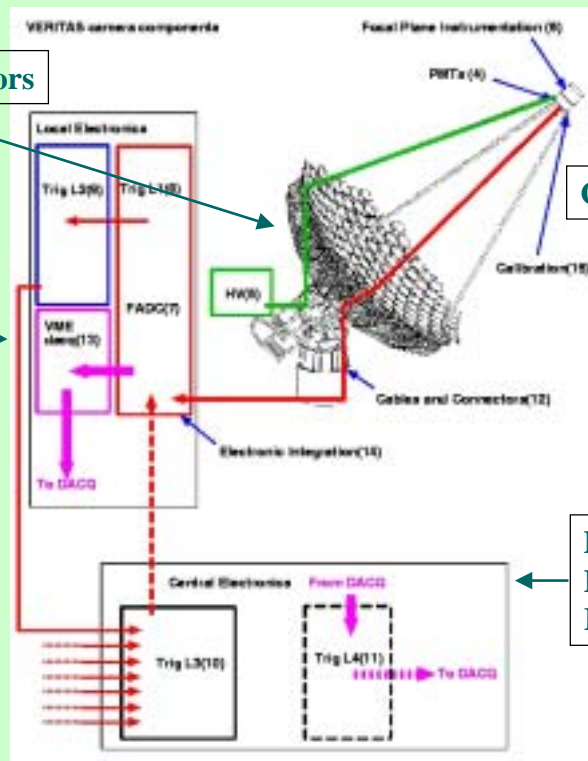
TECHNICAL PROGRESS

Telescope: mount, mirrors

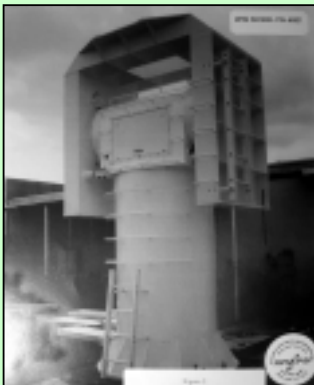
Electronics:
FADCs, trigger

Camera: PMTs, amps

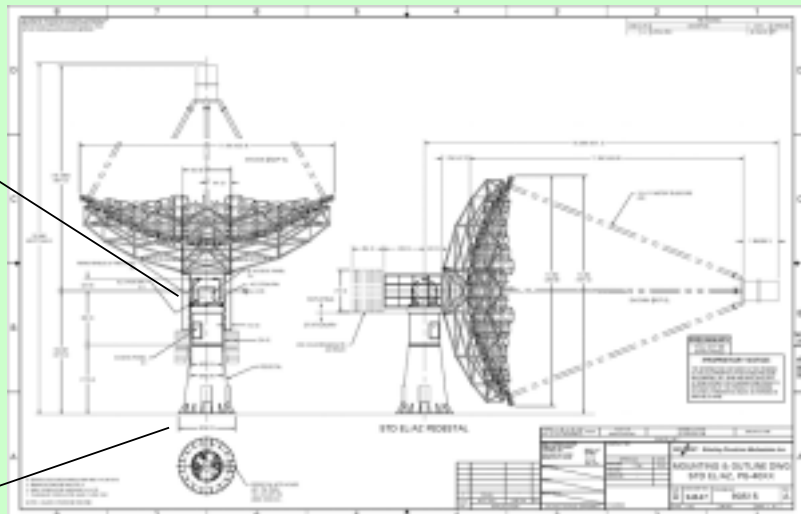
DAQ:
High speed
Readout & analysis



TELESCOPE



Pedestal



Overall Optical Support Structure
Accommodates 12m mirror

MIRRORS



Measuring Set-up

Radius $R = 23.92 \text{ m} \pm 0.4\%$

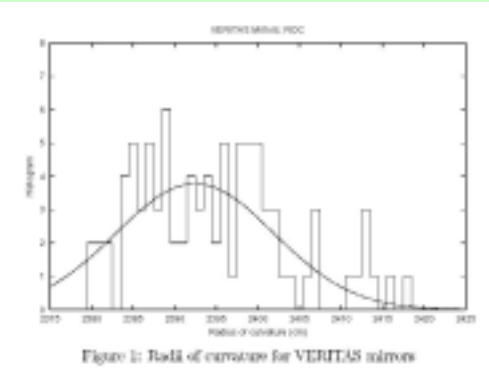


Figure 1: Radii of curvature for VERITAS mirrors

Blur $C (95\%) < 5 \text{ mm}$

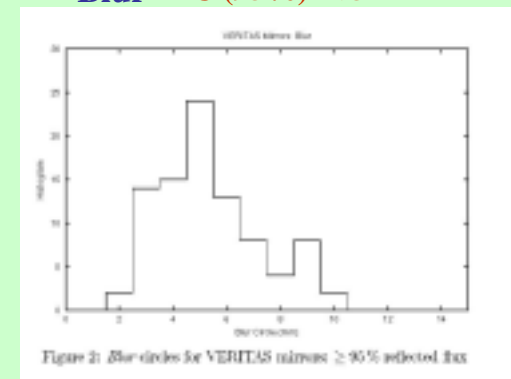
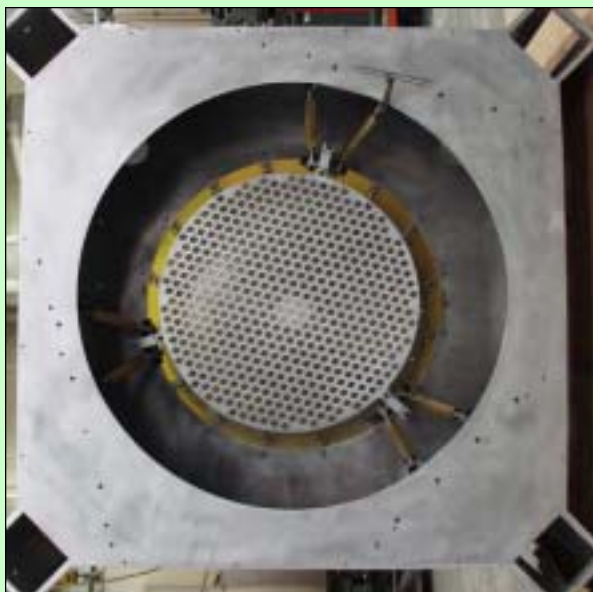


Figure 2: Blur circles for VERITAS mirrors $\geq 95\%$ reflected flux

CAMERA



Camera Box Construction

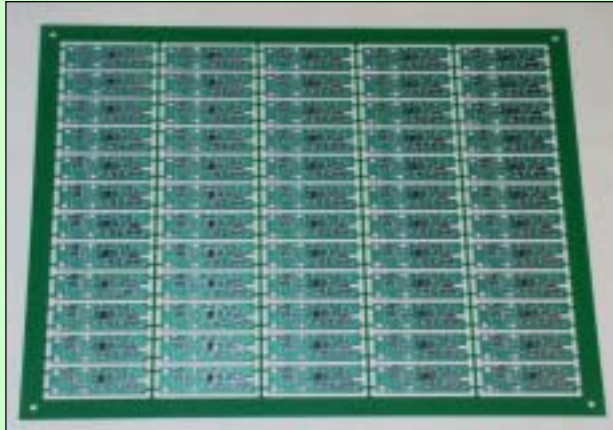


PMT Installation

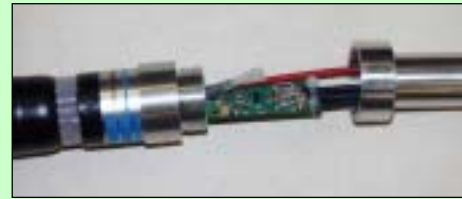


Cabling inside

FRONT-END



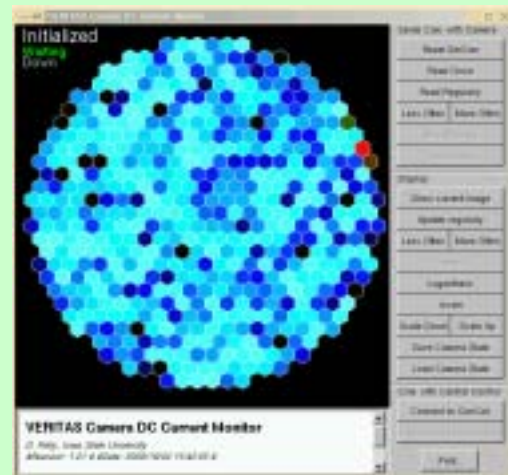
Amplifiers



PMT Assembly



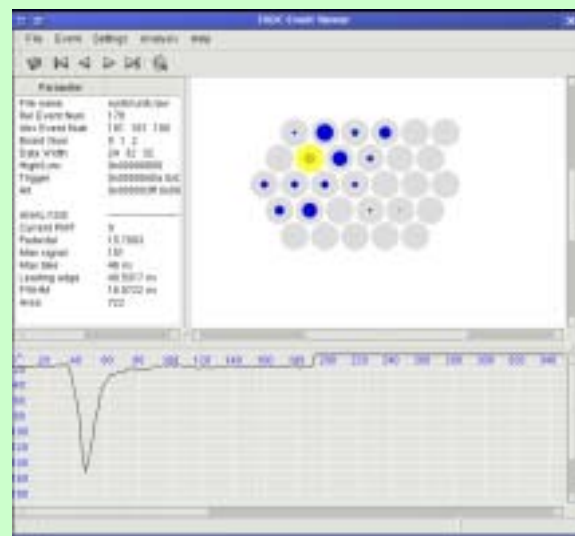
Current Monitoring



Flash-ADCs

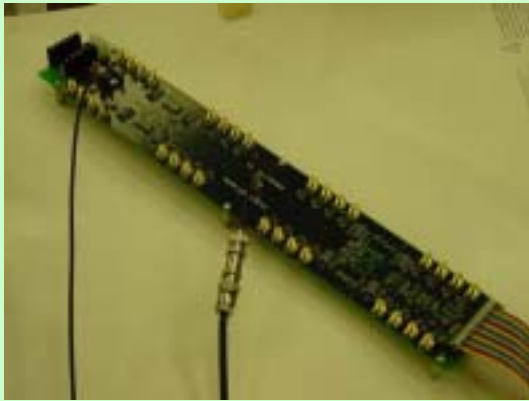


Completed FADC Board
10 chans, 9U VME



Cherenkov Waveform

Calibration



Charge Fanout Board



Charge Injection System

Full System Test

Purpose:

Verify design and performance of the electronics, including PMTs, front-end, FADCs, CFD, HV, cabling, etc.

Major test objectives:

- Bandwidth of system
- Noise of system
- Operation of FADCs
- Operation of CFDs

**VERITAS PMTs
in Whipple**



System Test



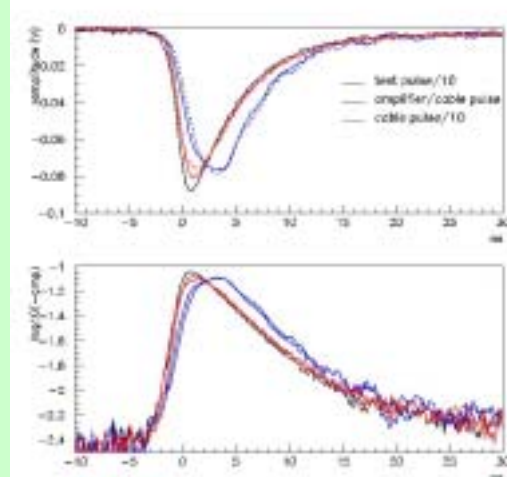
Const. Fraction Discriminators



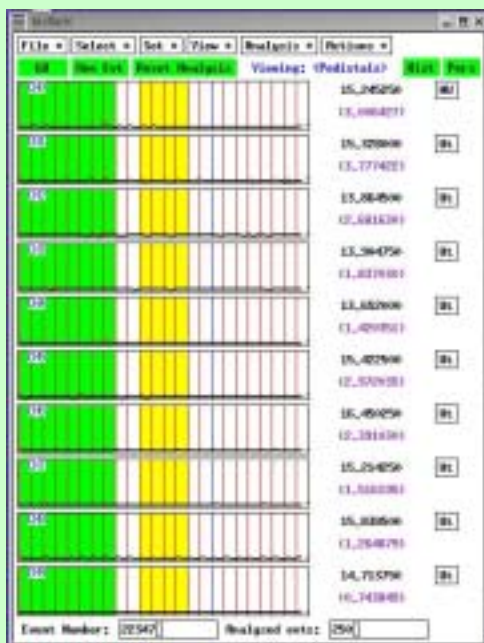
High Bandwidth Cable & Signal



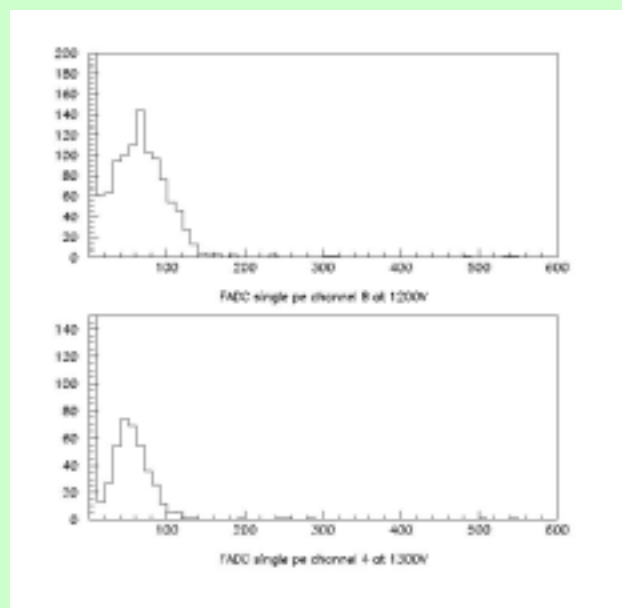
HV Control



Performance

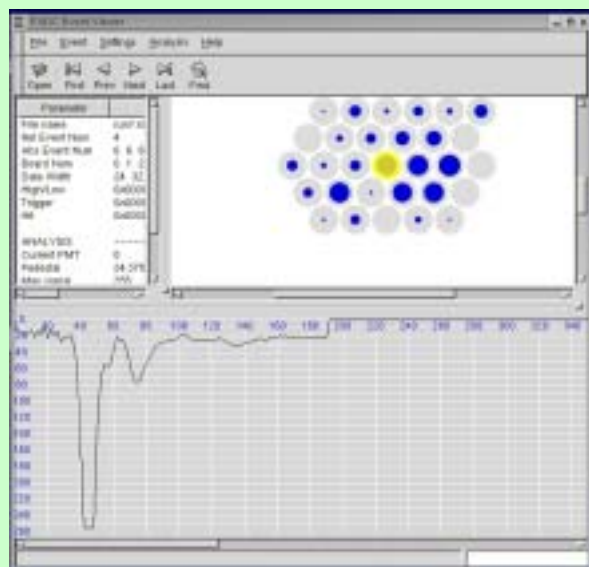


PMT/Amp/Cable/FADC
Noise Level – ok!

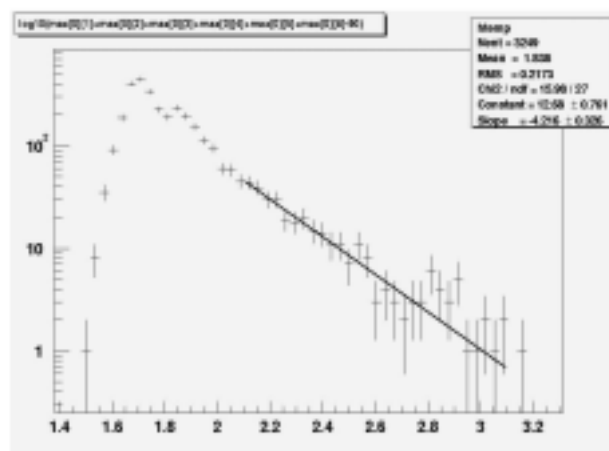


Single – pe Distributions

Cherenkov Events



Large Event – gain switch



Pulse-height Reconstruction



Meeting in 2003



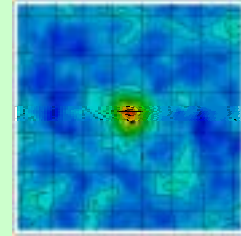
**2nd VERITAS Symposium on
TeV Astrophysics of Extragalactic Sources**

**April 24-26
Adler Planetarium, Chicago IL, USA**

<http://gamma2003.uchicago.edu/>



SUMMARY



Progress on VERITAS is steady, but slower than we would like.

- **Design of VERITAS Phase 1 is complete.**
- **Extensive work being carried out on Prototype**
 - **Full system test verifies design, performance.**
 - **Prototype operational in May, 2003.**
- **Expect to start array construction in early 2003.**