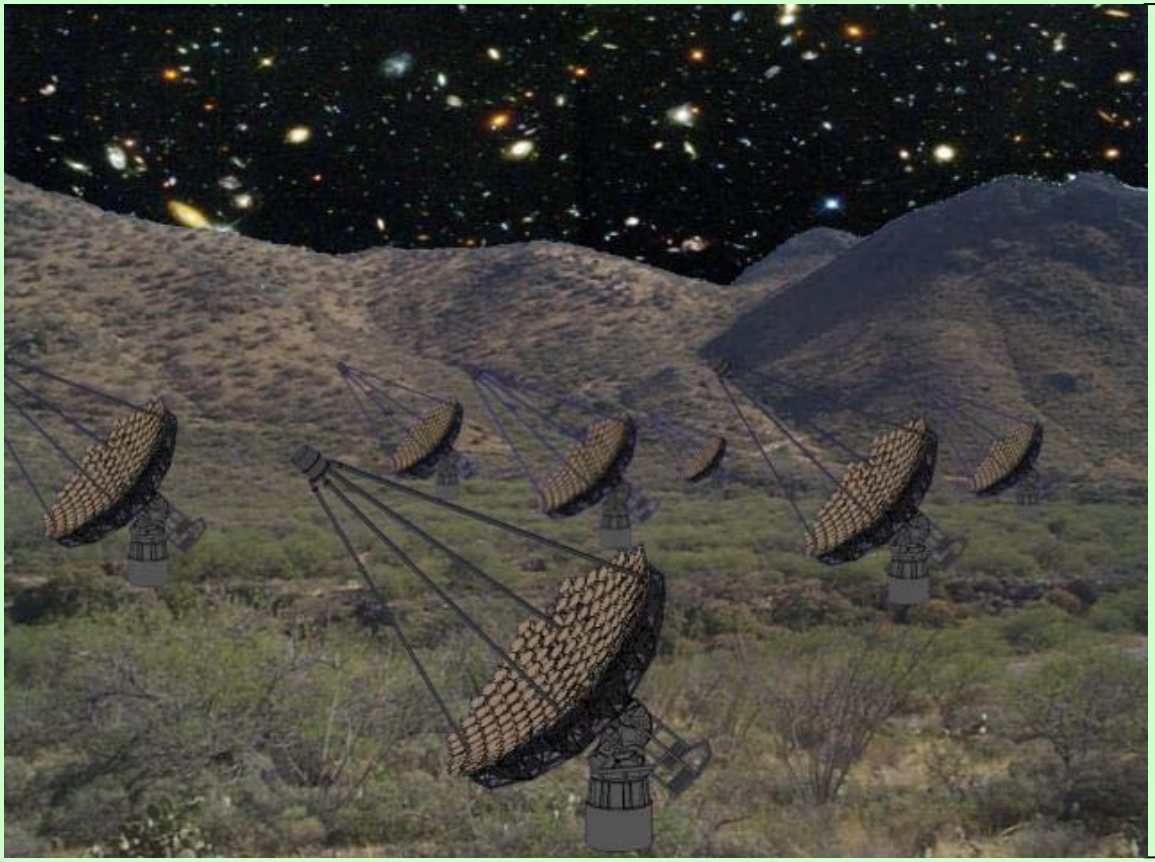
The VERITAS Project



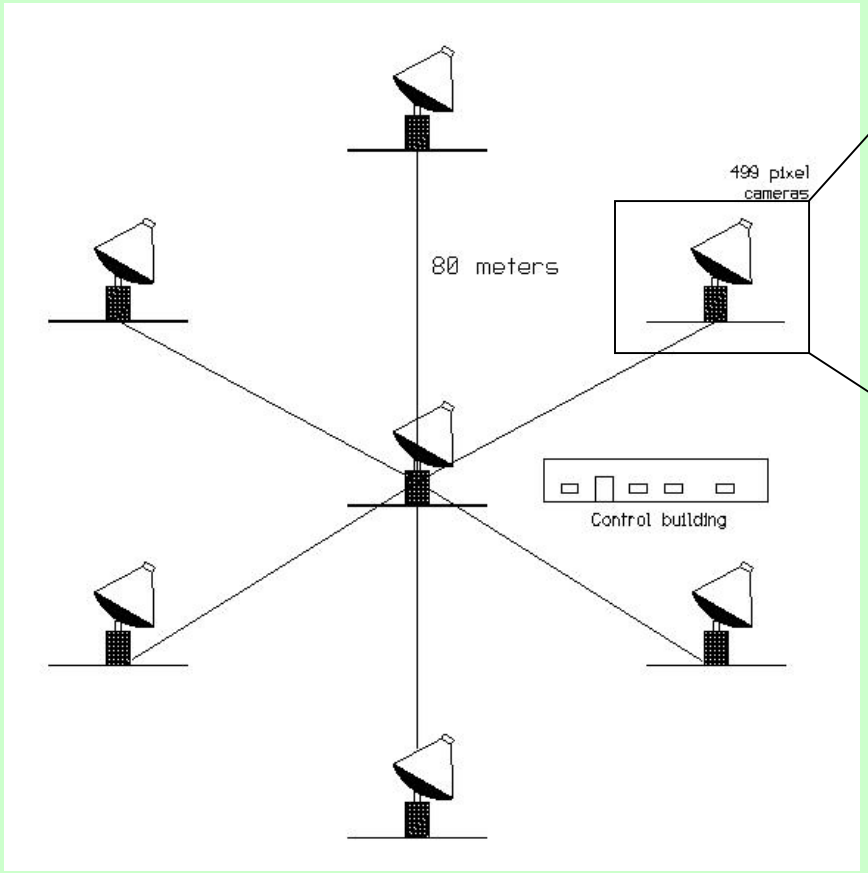
U.S.	Chicago
	Iowa State
	Purdue
	SAO
	UCLA
	Utah
	Washington U.
U.K.	Leeds
Ireland	UCD
Canada	McGill

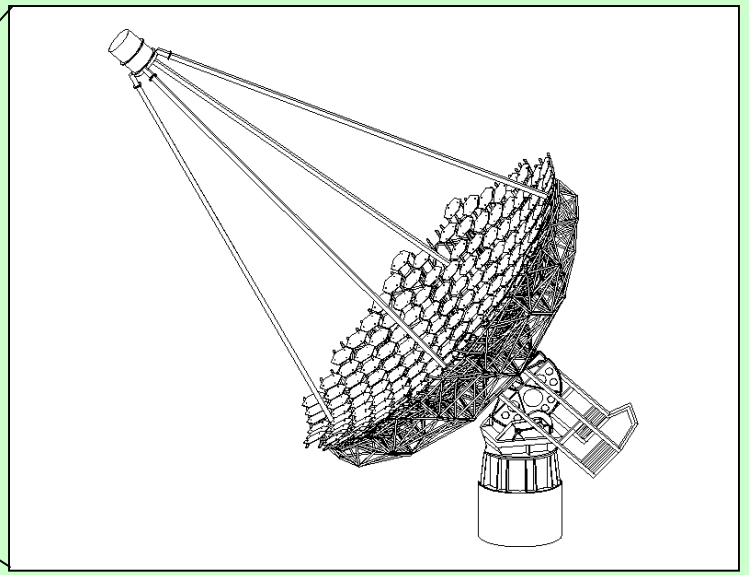
U. Tokyo Workshop
Sept 26, 2002

Rene Ong (UCLA)
for the VERITAS collaboration

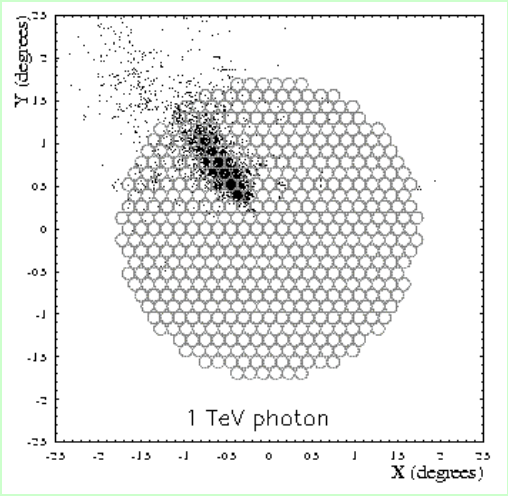
DESIGN

12m Reflectors





7-telescope Array



500 PMT Cameras
3.5^{o} FOV

ARRAY DESIGN

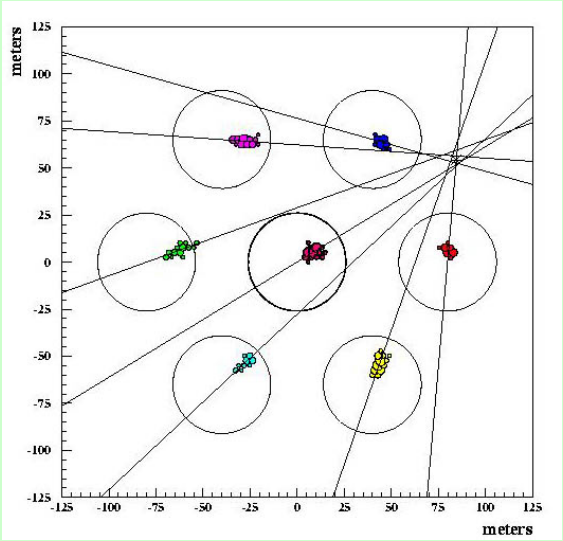
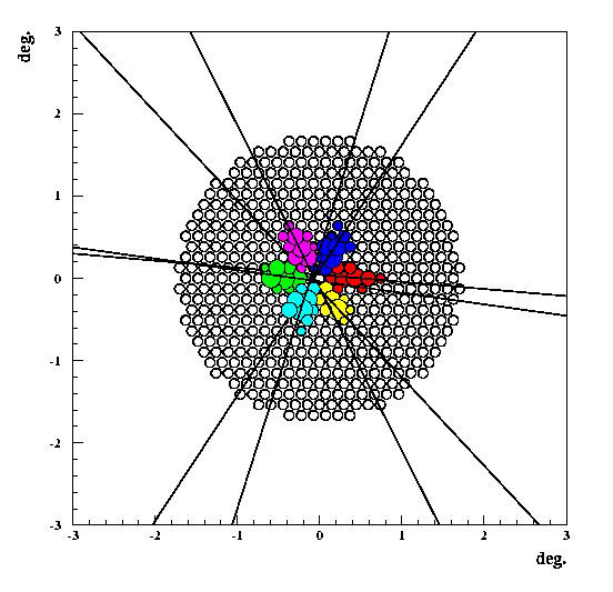


Figure showing multiple source viewing by VERITAS (removed because of size).

Shower Reconstruction

Camera Images



Combines heritage
Whipple 10m
HEGRA array

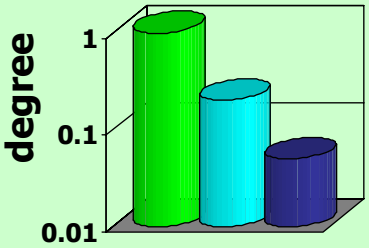
NEW FEATURES

Some key new features of VERITAS:

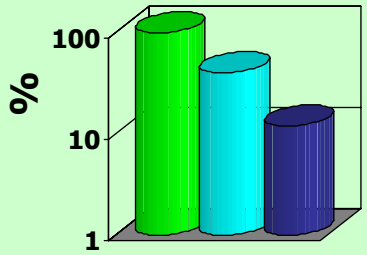
Telescope	Larger – 12m, Longer – f/1.0 excellent image concentration
High-speed Sampling	500 MHz FADCs
Flexible Triggering	Multiple triggering modes Patterns, Sub-Arrays, Image
Detector & Atmospheric Calibration	Multiple electronic/optical methods Photometry – stars, fixed sources

PERFORMANCE

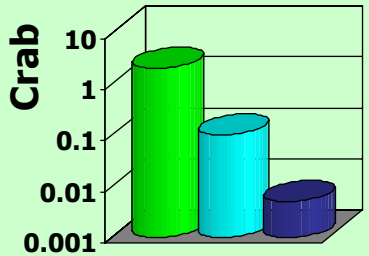
Angular resolution



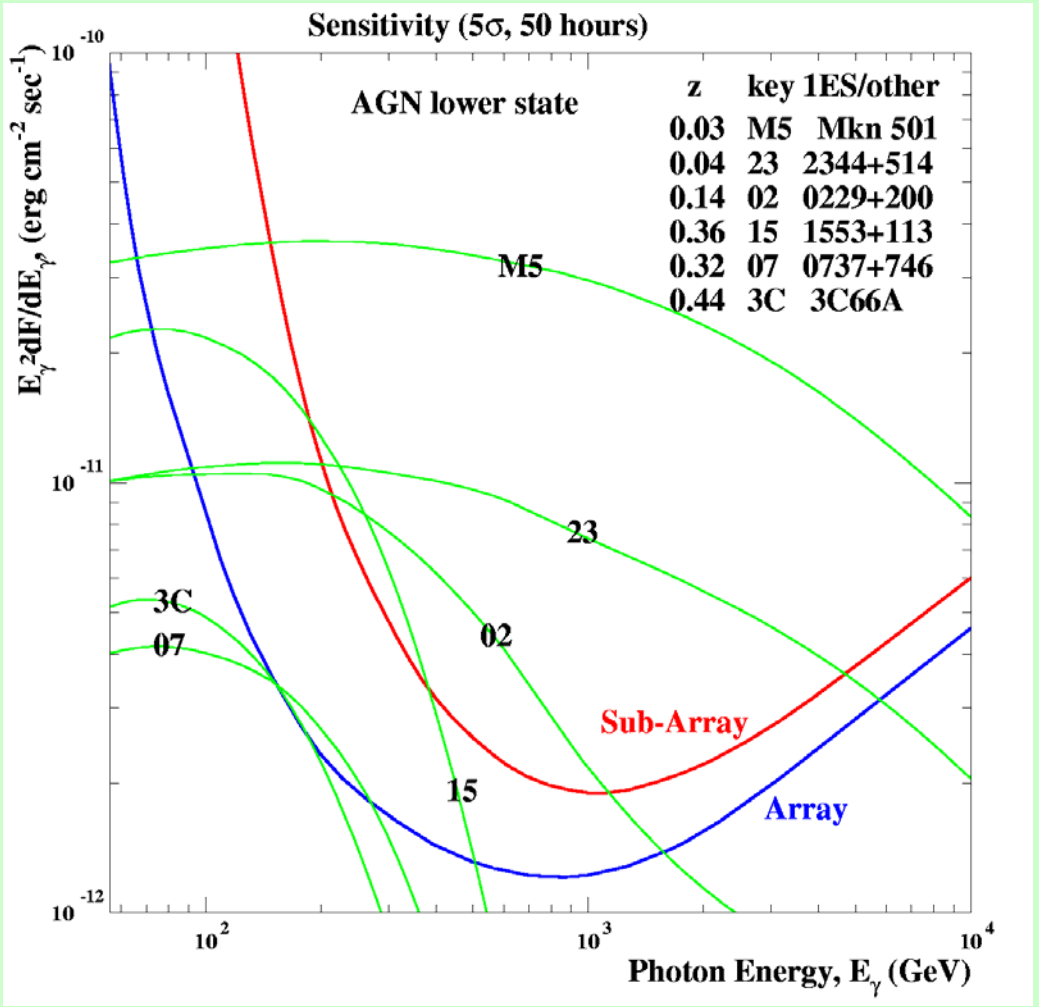
Energy resolution



Flux sensitivity (50hr, 5σ)



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 construction starts**
2002	**VERITAS Phase-I, Four Telescope Proposal**
2003	**Prototype Telescope Operation**
2003-2005	**Construction of VERITAS-I**

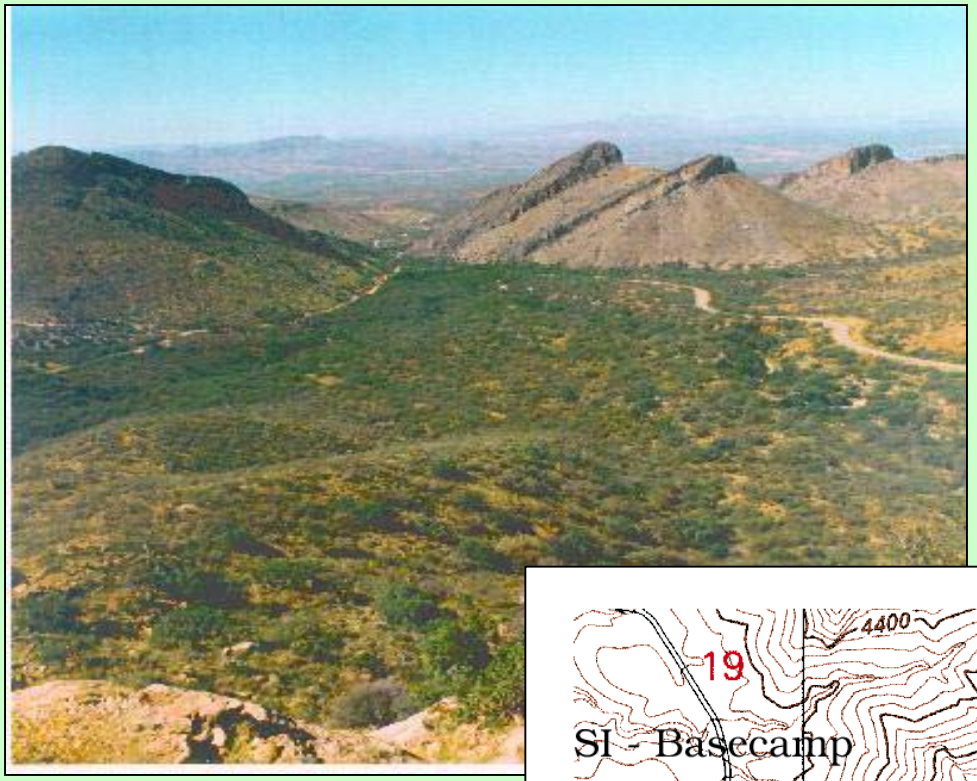
FUNDING

- 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.

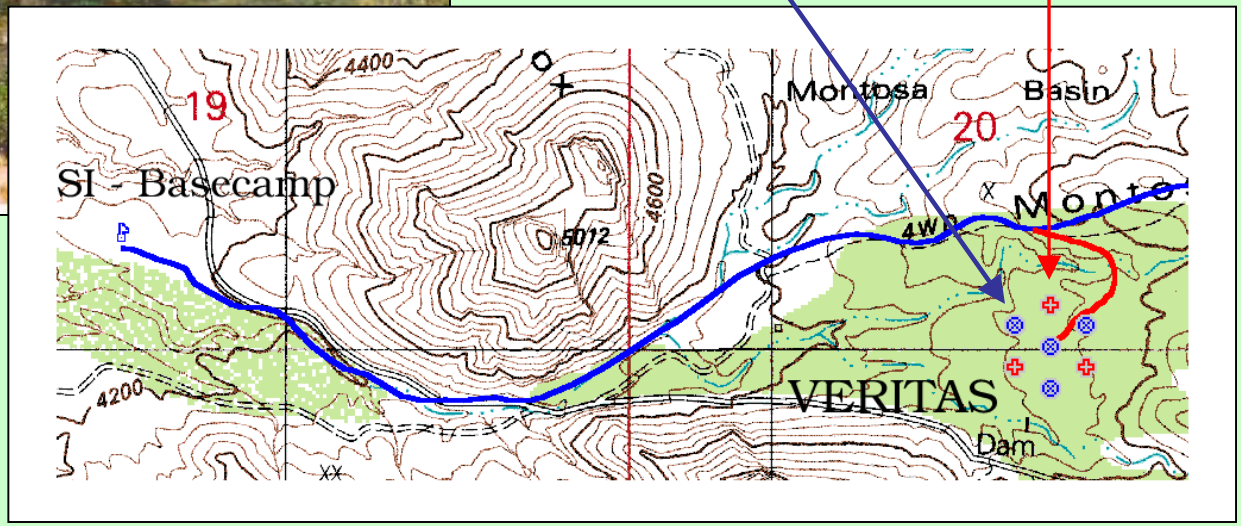
SITE



Mt. Hopkins, AZ
Near Whipple base camp

Initial 4 telescopes

Array completion

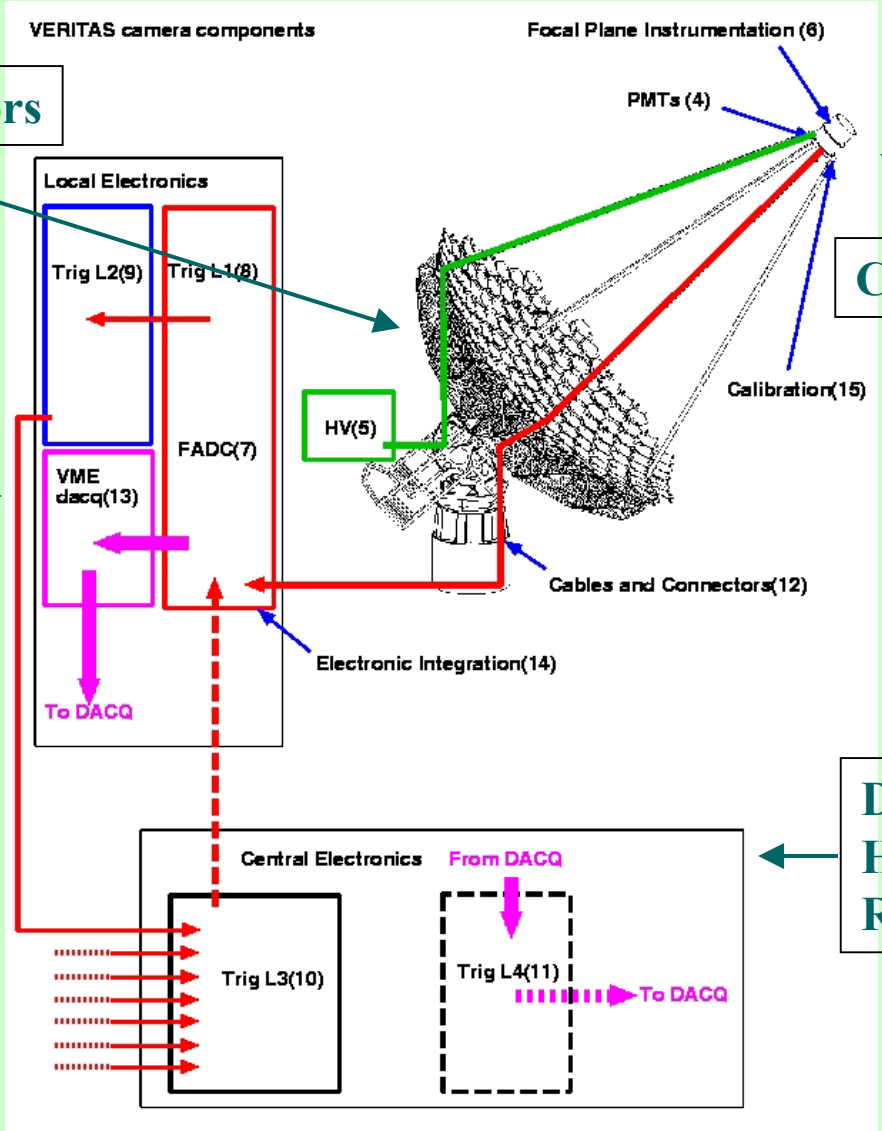


TECHNICAL PROGRESS

Telescope: mount, mirrors

Electronics:
FADCs, trigger

Work happening
on all these items.

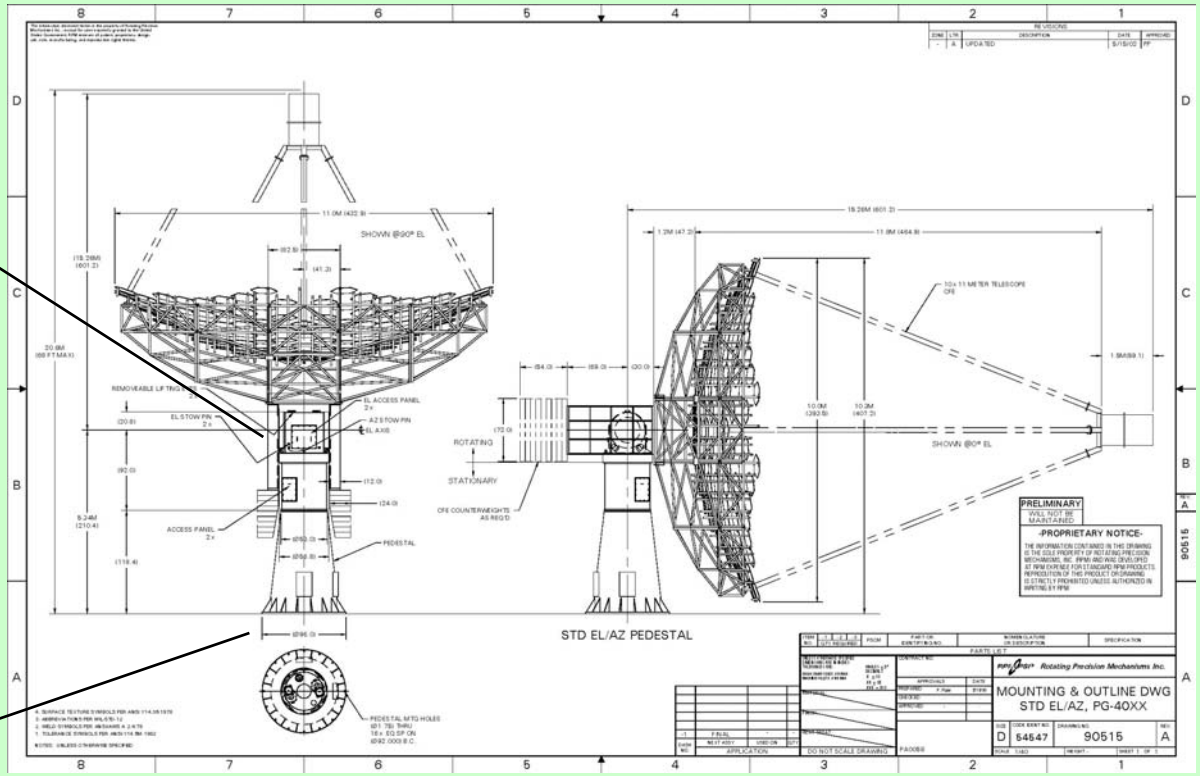


Camera: PMTs, amps

DAQ:
High speed
Readout & analysis

TELESCOPE

Pedestal



Overall Optical Support Structure
Accommodates 12m mirror

MIRRORS

Measuring Set-up

Radius **R = 23.92 m +/- 0.4%**

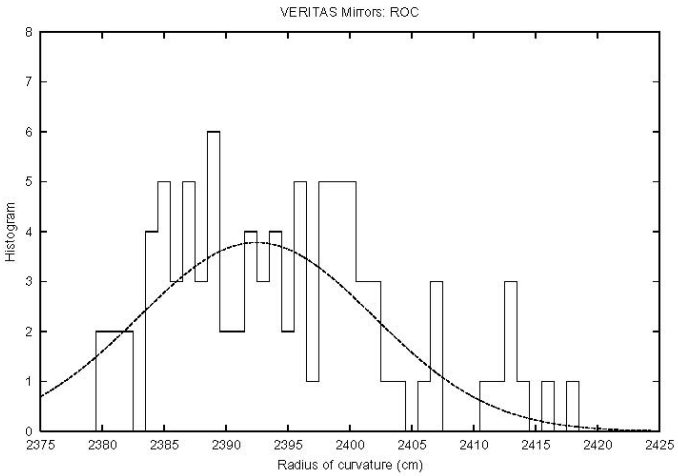


Figure 1: Radii of curvature for VERITAS mirrors

Blur **C (95%) < 5mm**

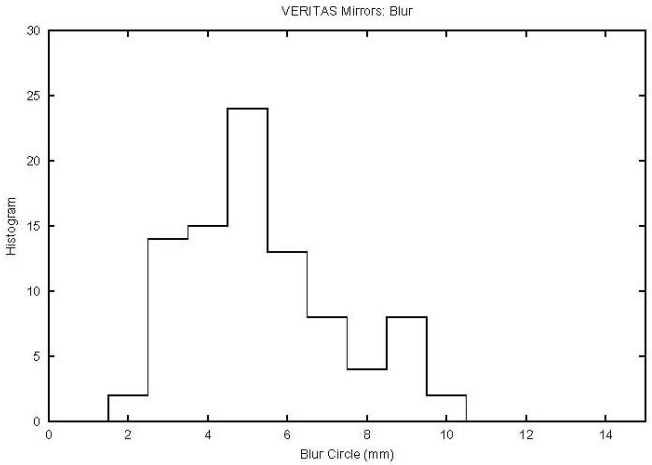
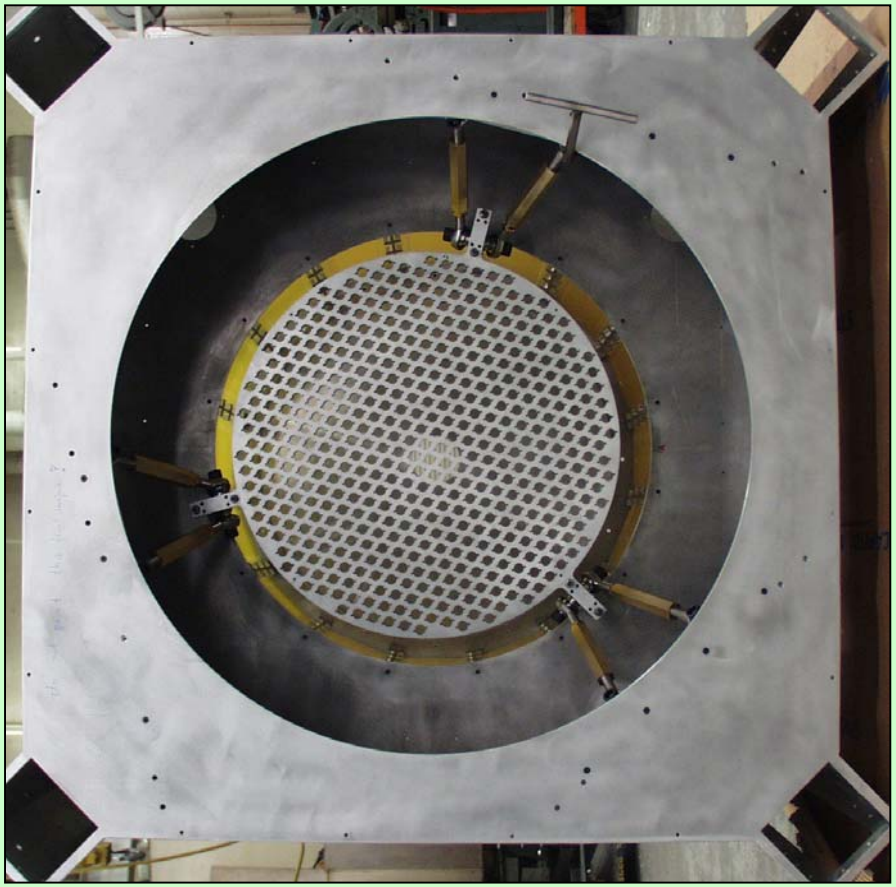


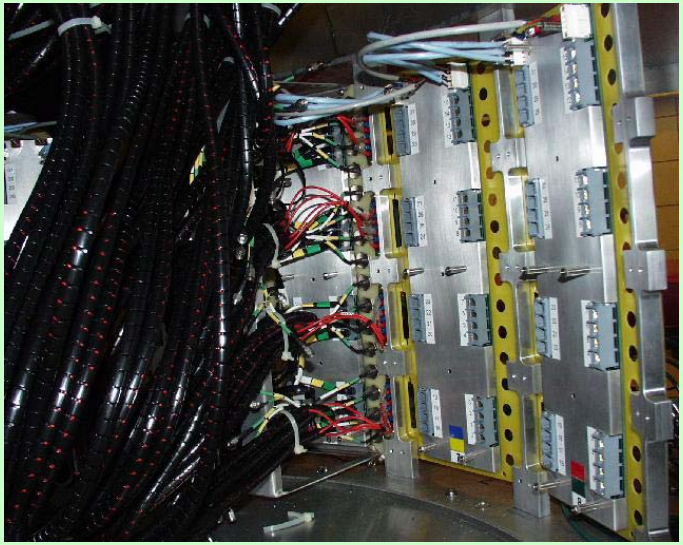
Figure 2: *Blur* circles for VERITAS mirrors: $\geq 95\,\%$ reflected flux

CAMERA



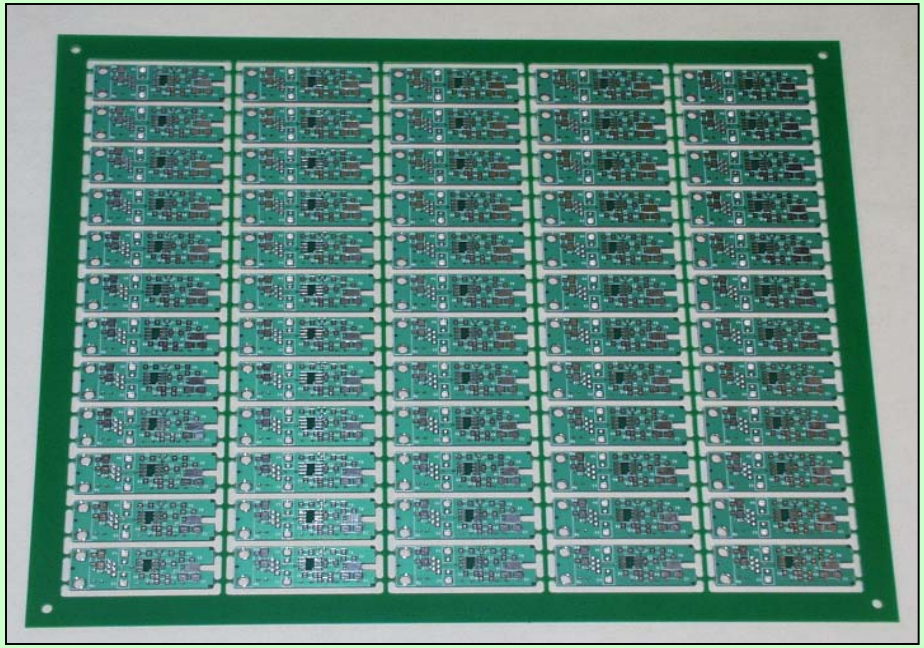
Camera Box Construction

PMT Installation

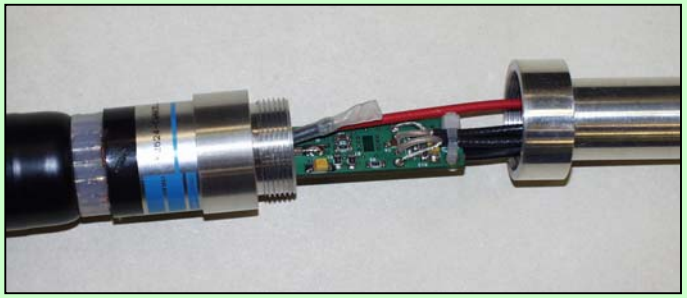


Cabling inside

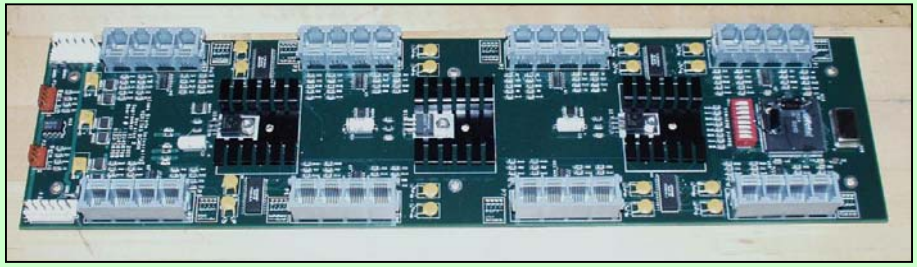
FRONT-END



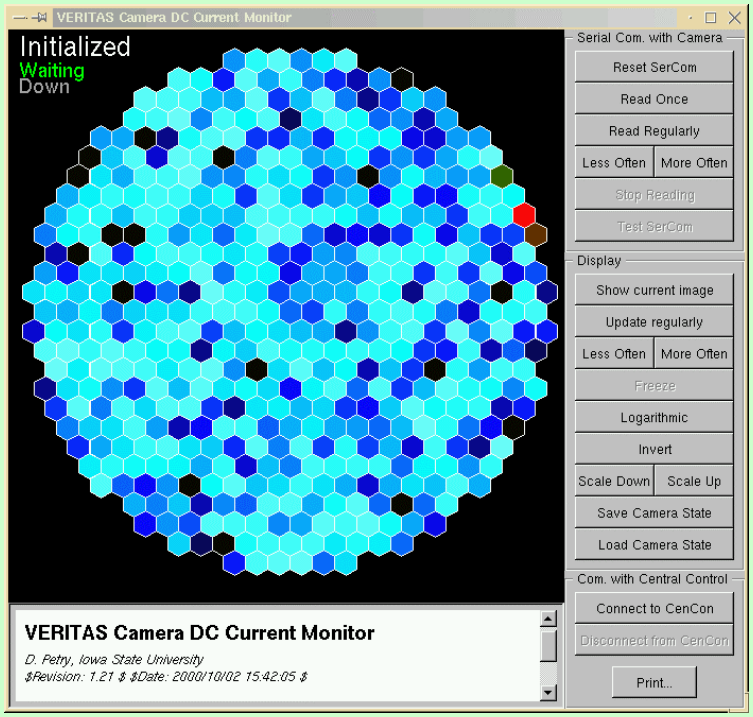
Amplifiers



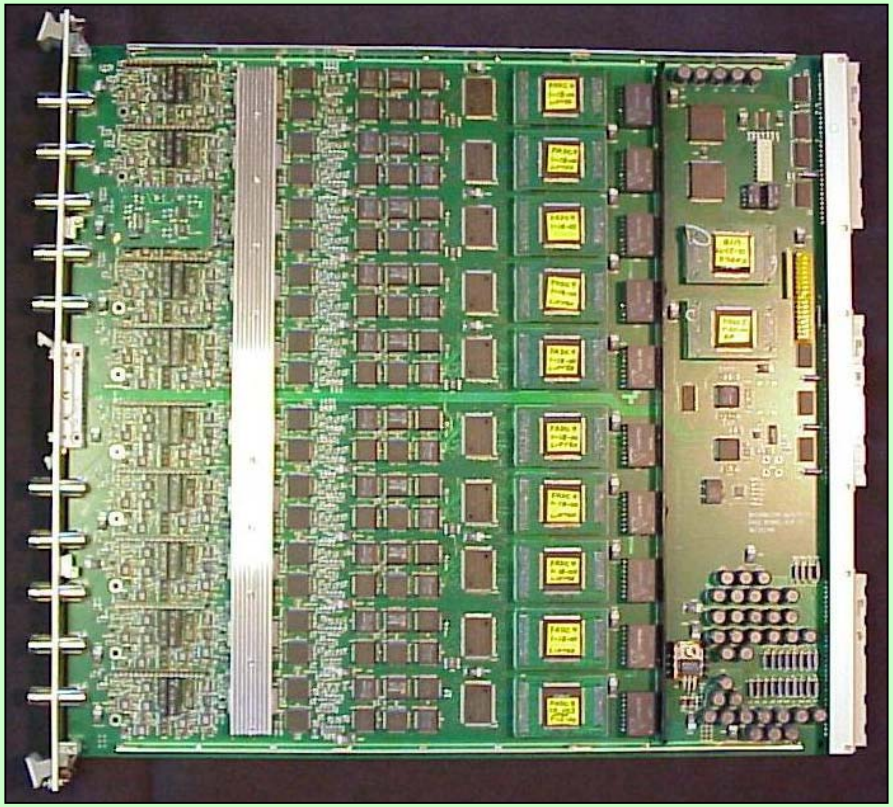
PMT Assembly



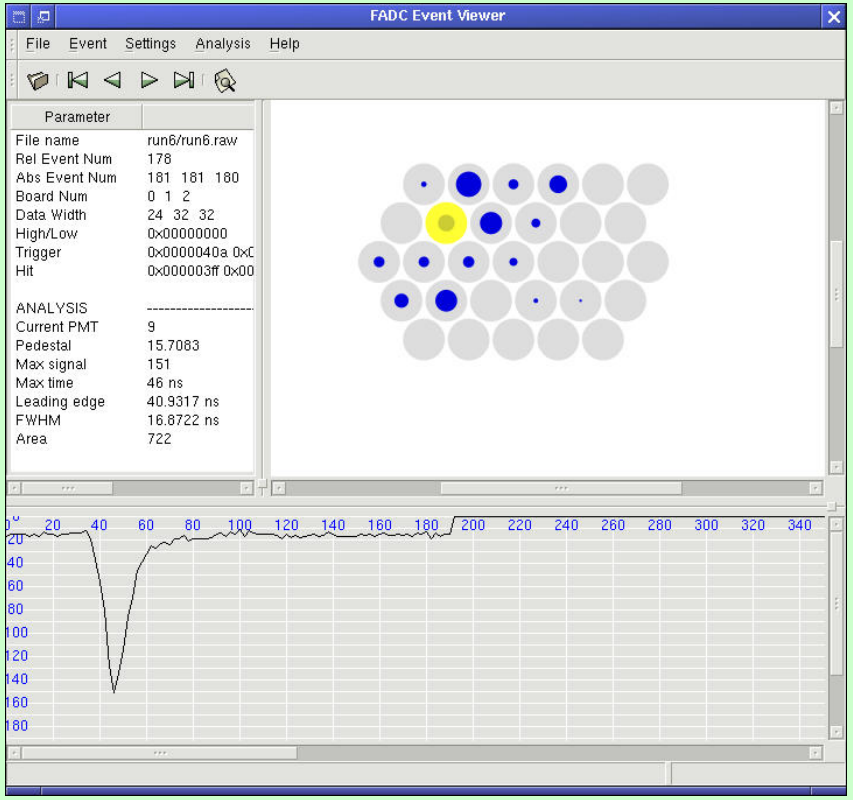
Current Monitoring



Flash-ADCs

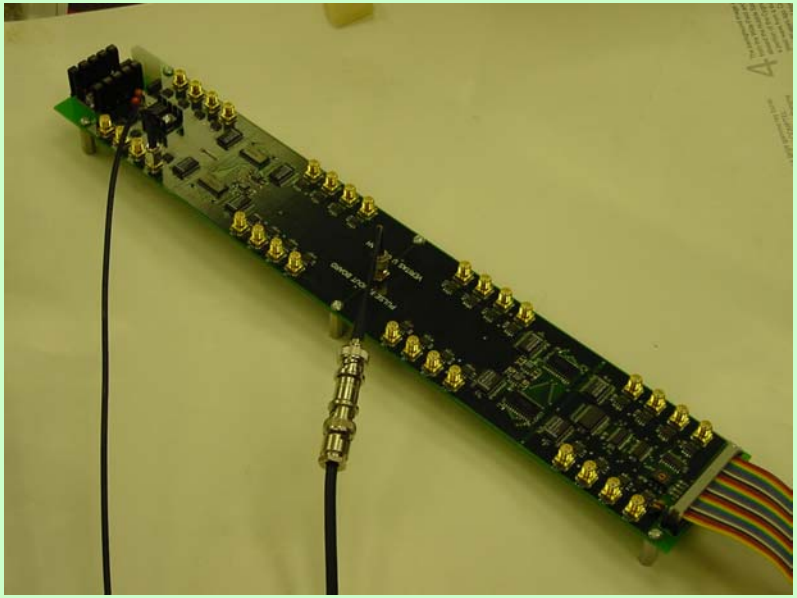


Completed FADC Board
10 chans, 9U VME

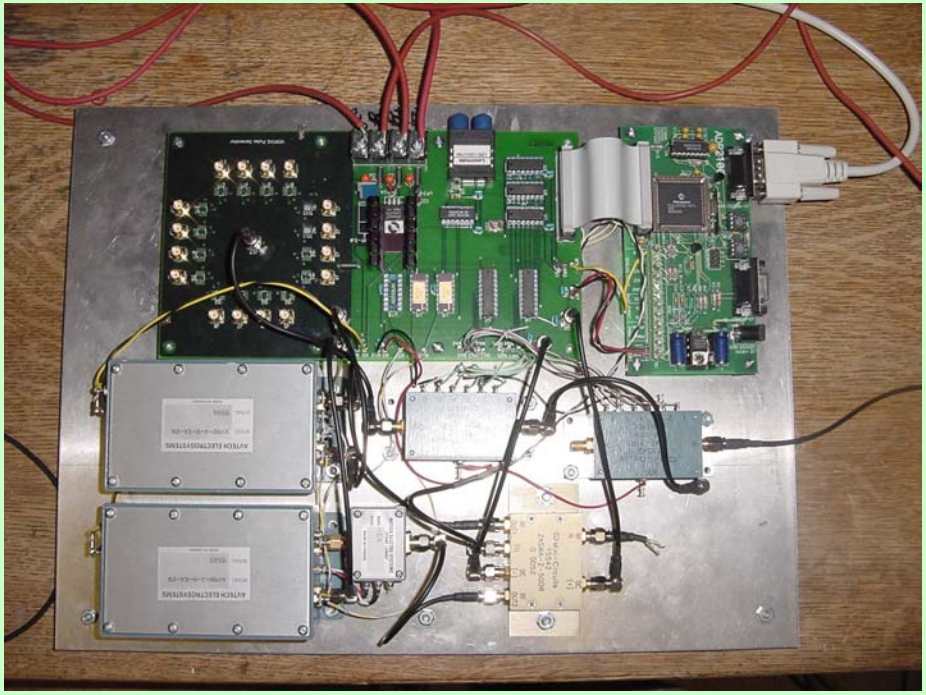


Cherenkov Waveform

Calibration

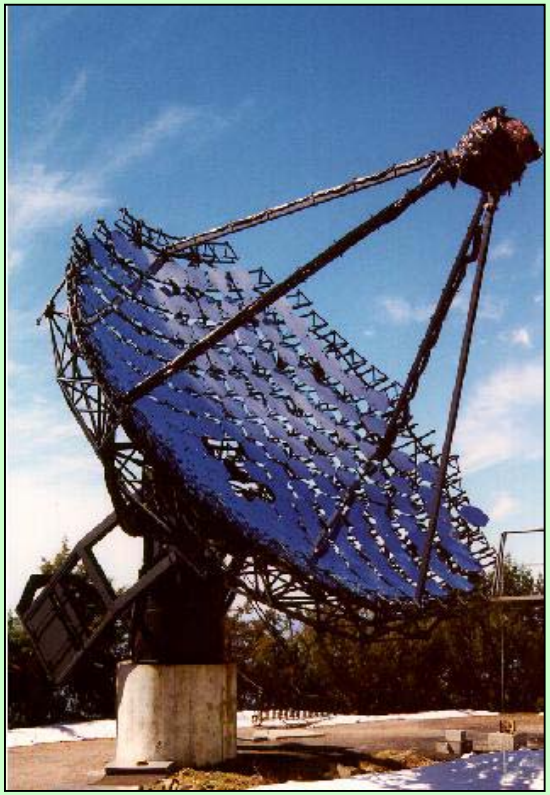


Charge Fanout Board



Charge Injection System

Full System Test



Purpose:

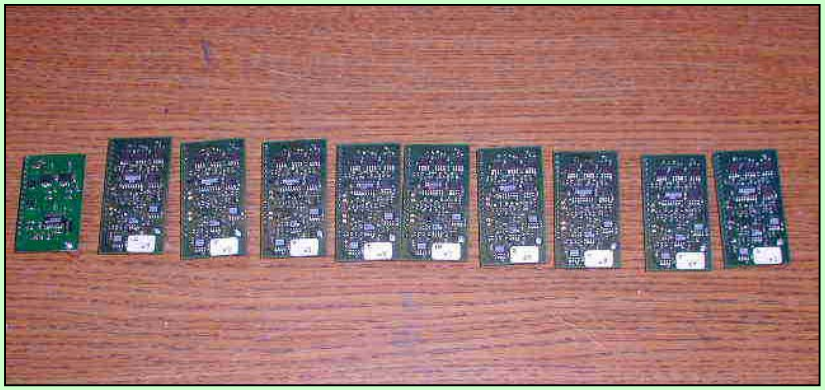
Verify design and performance of the electronics, including PMTs, front-end, FADCs, CFD, HV, cabling, etc.

Major test objectives:

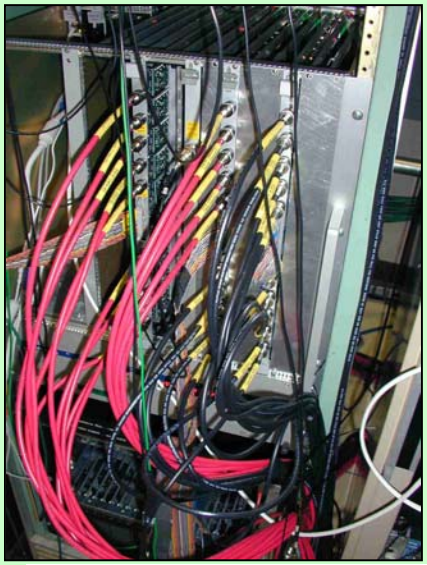
- **Bandwidth of system**
- **Noise of system**
- **Operation of FADCs**
- **Operation of CFDs**

VERITAS PMTs in Whipple

System Test

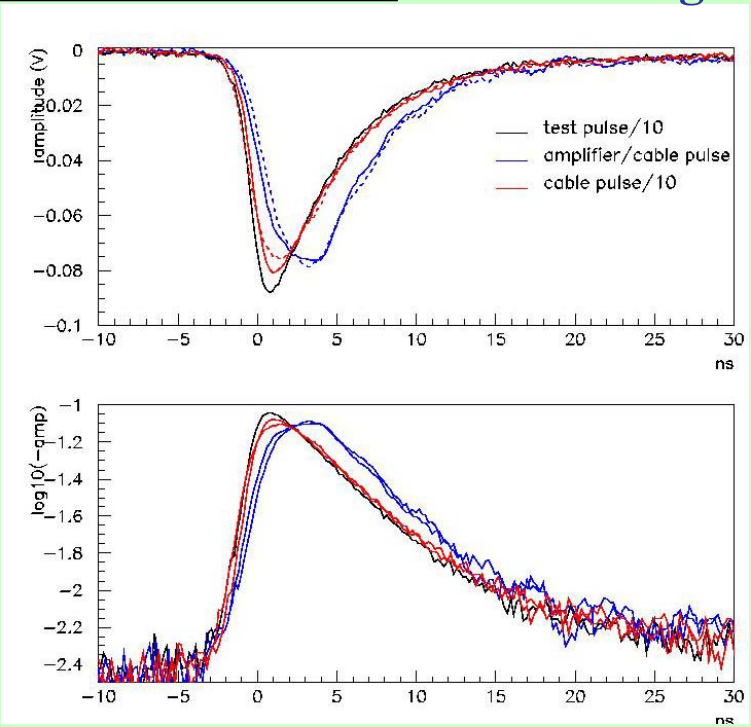


Const. Fraction Discriminators

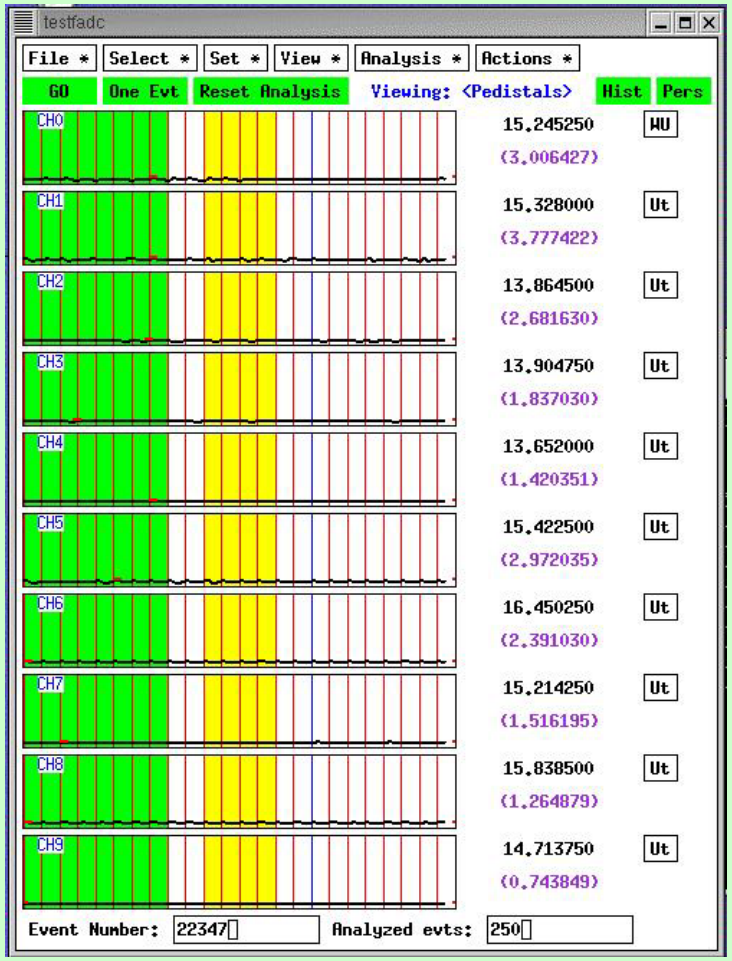


High Bandwidth Cable & Signal

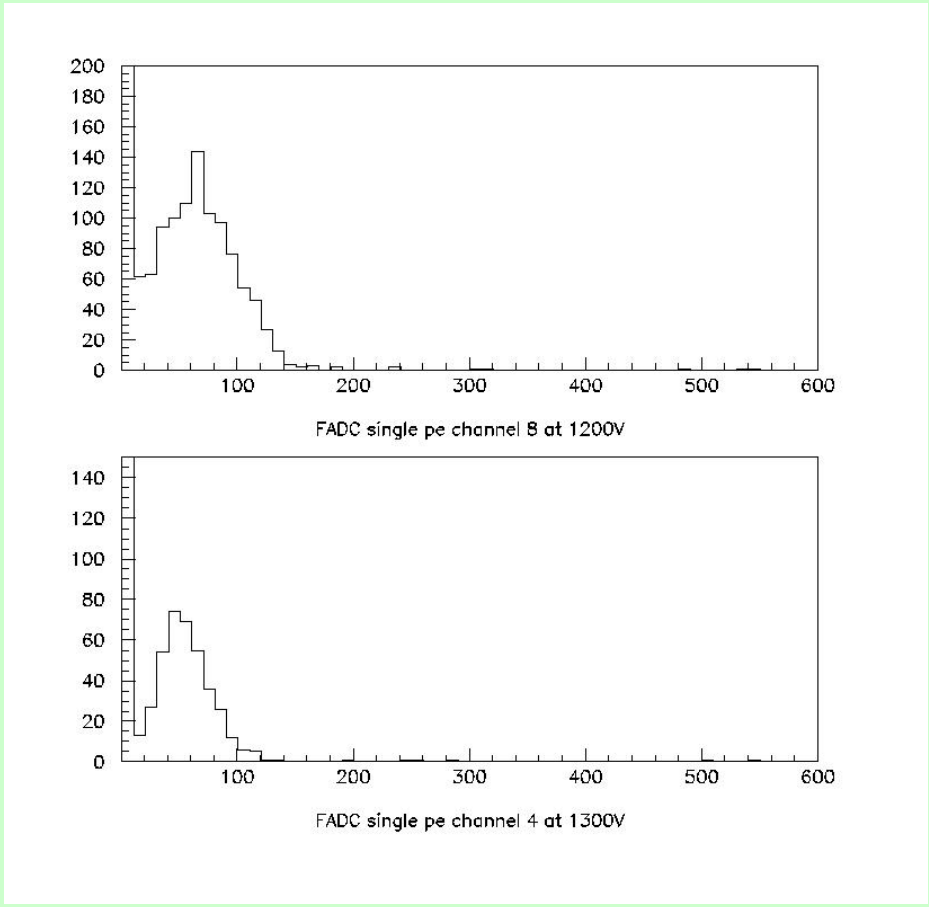
HV Control



Performance

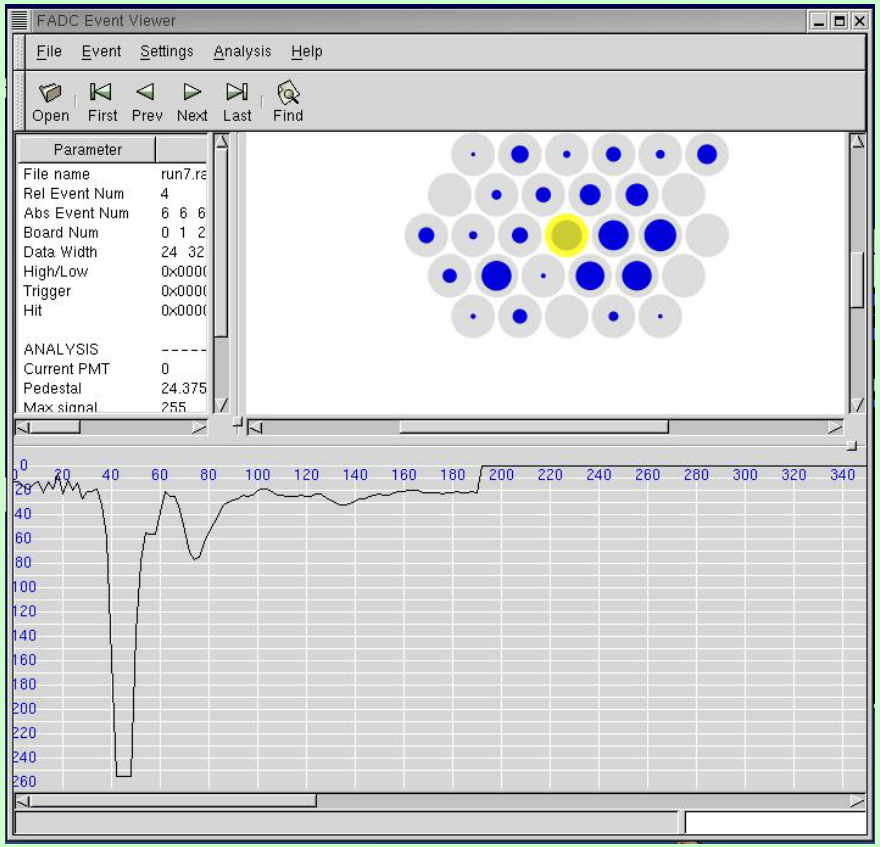


PMT/Amp/Cable/FADC
Noise Level – ok!

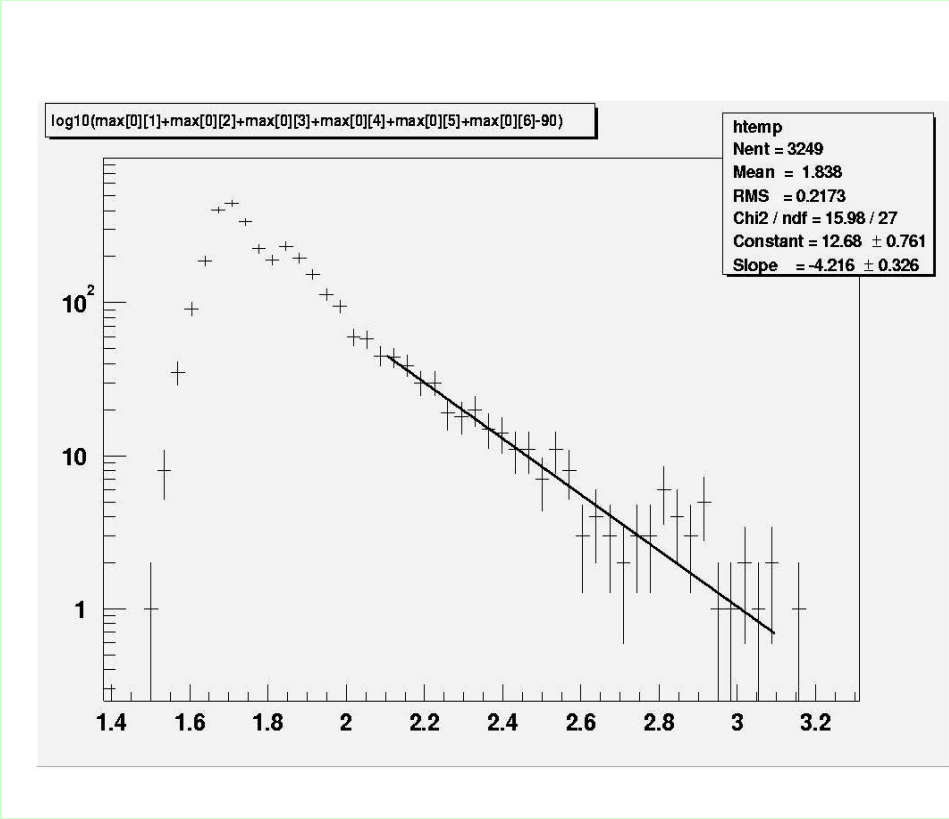


Single – pe Distributions

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.**