GLAST Large Area Telescope:

Collaboration Meeting

September 28-30, 2004

AntiCoincidence Detector: From Rome 2003 to SLAC 2004

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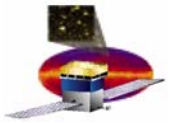
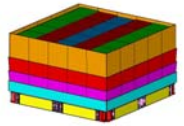


Anti-Coincidence Detector



- One year ago – where we were
- Top level tasks for this year. ACD people
- ACD system structure – major components
  - Detectors
  - Electronics
    - PMT
  - Mechanical structure
    - GSE
- ACD performance analysis
  - Conclusion

Tasks for this year. ACD people

We have solved numerous tasks during last years. For this year we have the only task – build flight ACD

One year ago – where we were

We were in Rome: Basic ACD design was finished

GAFE – final design has not chosen yet

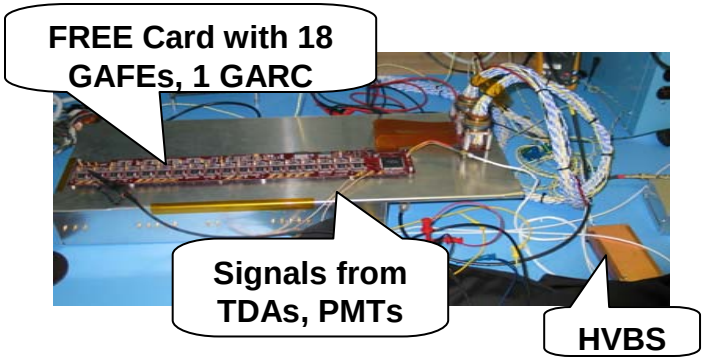
EGSE – not received yet

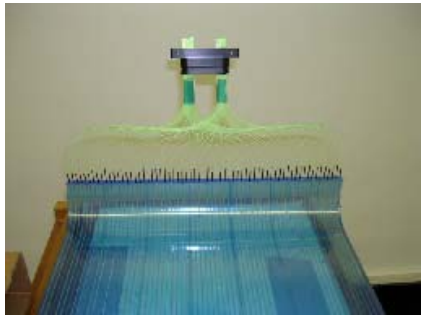
HVBS – designed, some parts not approved yet

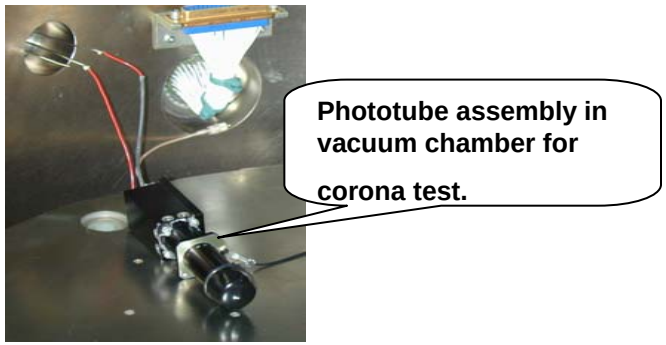
Mechanical structure – some panels built

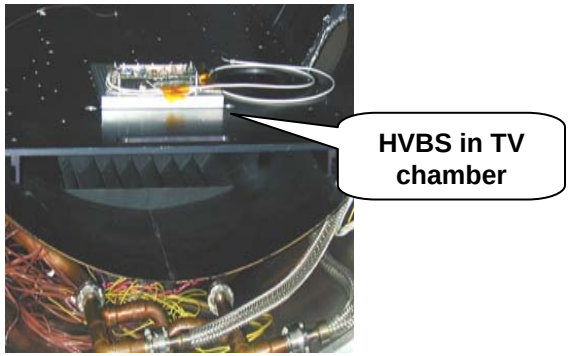
Tile Detector Assembly (TDA) - prototyped

PMT – ready for flight assembly







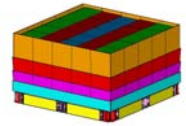


Where we are now ?

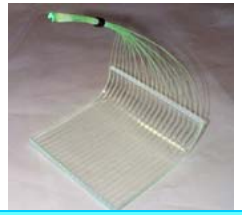
Now we are at SLAC and one more year closer to 2007

- Design finished in details
- All fabrication documentation is in place
- Most parts are ready for the integration to ACD
- Numerous problems, which are common for hardware fabrication phase, are solved (tens and tens of EO's, PR's, PFR's); some remaining being solved

ACD Assembly Flow and Build Status



Photomultiplier Tubes
145 / 194

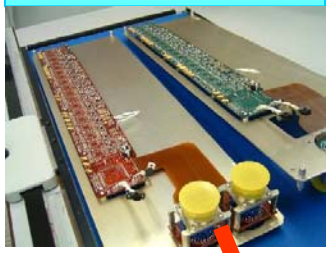


Tile Detector Assemblies
113 / 89

Fiber Ribbon Detectors
10 / 8

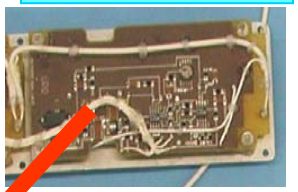
Clear Fiber Cables
69 / 65

Front End Electronics Boards
14 / 12

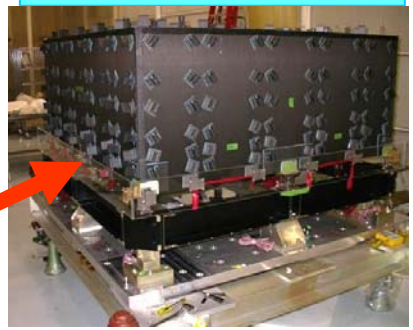


Photomultiplier Tube Assemblies
0 / 194

High Voltage Bias Supplies
30 / 24



Mechanical Structure
1 / 1



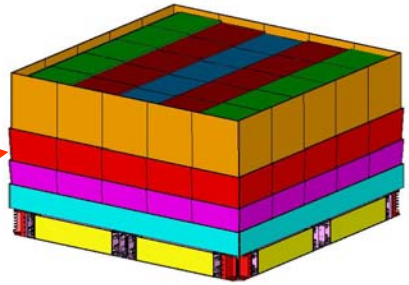
Electronics Chassis
0 / 8

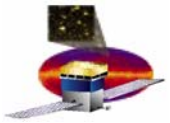
 # complete

 # required for flight

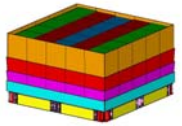
Thermal Blanket / Micrometeoroid Shield
0 / 1

ACD Assembly **0 / 1**





ACD Environmental Test Flow



Green – Flight

Yellow - Engineering

ACD Subsystem
- Low Level Sine
- Sine Burst
- Sine Vibe
- Opt. Performance
- Acoustic Vibe
- Mass Properties
- EMI/EMC
- ESD Compatibility
- Thermal Vac (4 cycles)
- Thermal Balance

P

TSA
- Performance Test
- Static Test of Tile Flexures ✓
- Tile Flexure NDI ✓
- Thermal Vac Conditioning (Shell only)
- Mass Properties

A

MMS/ Blanket
- Analysis ✓
- MMS Ballstic Test ✓
- Thermal Bal (Blnkt)

BEA
- Performance Test
- Mass Properties

Electronics Chassis
- Sine Vibe
- Random Vibe
- Thermal Vac

A

Electronics Chassis

Partial BFA + Chassis
- Modal Survey
- Sine Burst
- Sine Vibe
- Random Vibe
- Thermal Vac ✓
- EMI/EMC

Q

Mechanical Subsystem

Shell & BFA w/ Mass Simulation Models
- Low Level Sine
- Sine Burst
- Sine Vibe
- Acoustic Vibe
- Thermal Vac ✓

Q

TDA
- Optical Performance ✓

A

TDA
- Sineburst
- Sine Vibe
- Random Vibe
- Optical Performance ✓
- Thermal Vac

Q

TSA

Partial Shell Assy + TDA
- Static Loads
- Structural Element Coupons ✓
- Tested to Failure

Q

FREE Card
- Sine Burst
- Sine Vibe
- Random Vibe
- Elec. I/F
- Thermal Cycle ✓

A

FREE Card
- Low Level Sine
- Sine Burst
- Sine Vibe
- Random Vibe
- Elec. I/F
- Thermal Cycle ✓

Q

HVBS Card
- Sine Burst
- Sine Vibe
- Random Vibe
- Elec. I/F
- Thermal Vac ✓

A

HVBS Card
- Low Level Sine
- Sine Burst
- Sine Vibe
- Random Vibe
- Elec. I/F
- Thermal Vac ✓

Q

PMT Rail
- Low Level Sine
- Sine Burst
- Sine Vibe
- Random Vibe
- Performance
- Mass Properties
- Electrical I/F ✓
- Thermal Vac

Q

PMT Assy
- Random Vibe ✓ *
- Thermal Vac

Q

PMT
- Random Vibe (at Hamamatsu) ✓

Q

KEY

✓ - Complete

- Flight assy — Q - Qual Level
- Eng or Dev Unit — A - Accept level
- Flight Component — P - Protoflight level

* PMT assembly redesign and qualification is underway

Detectors – TDA's

ACD contains 89 tile detectors (TDA's) and 8 scintillating fiber ribbons

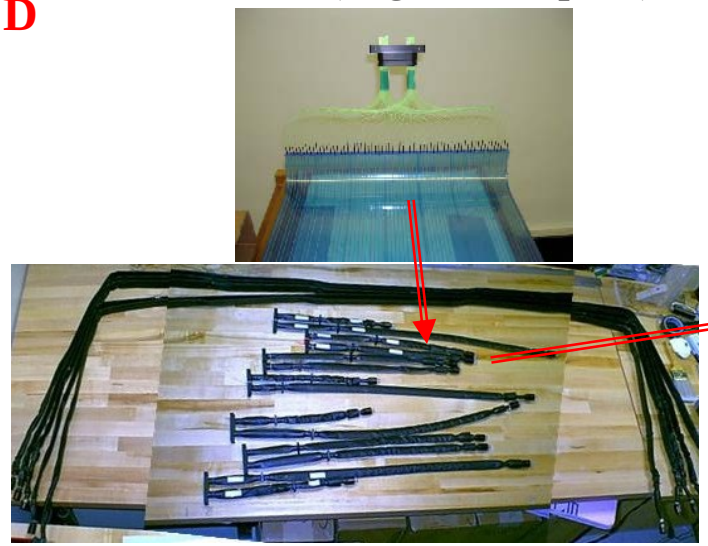
TDA: - 17 different designs depending on their place in ACD. There are spare tiles for every type

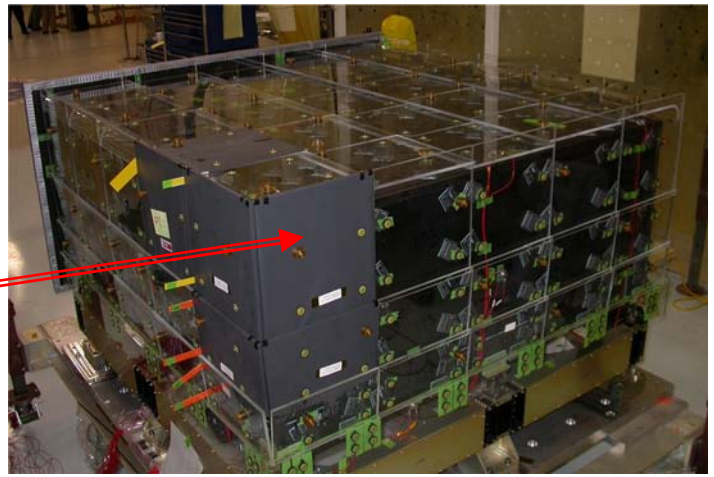
- every TDA except bottom row, has its own clear fiber cable (light guide) to connect detector with PMT

- every TDA has passed acceptance test which includes "tomography" to map light yield uniformity over the tile area

- light yield from every TDA (created by cosmic muons) was measured with assigned clear fiber cable to determine light attenuation in cable

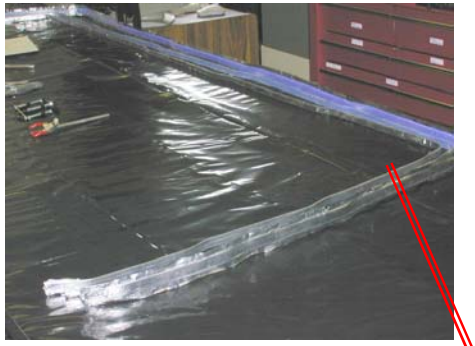
- **113 TDA's** (flight and spare) **are made and tested; ready for integration in ACD**

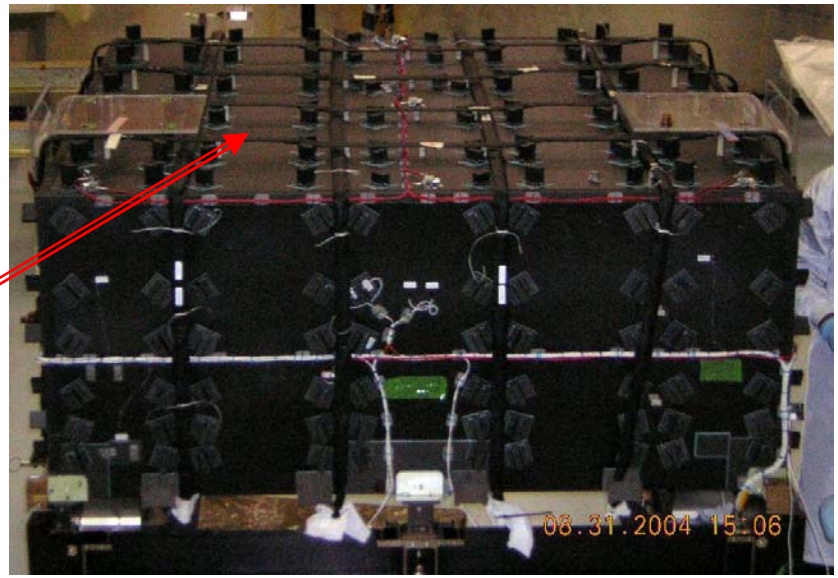




Detectors – fiber ribbons

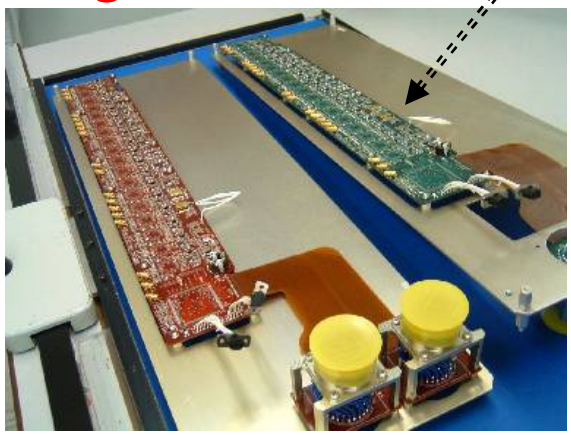
- There are 8 scintillating fiber ribbons in ACD to seal the gaps between TDA's. It was shown that without ribbons ACD would not achieve required charged particle efficiency
- There are 4 different ribbon configuration of that 8
- **All ribbons (plus spares) are built and tested,** yielding ~ 4 photoelectrons from muon passing in the middle of ribbon

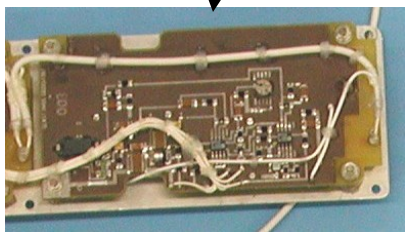




Electronics

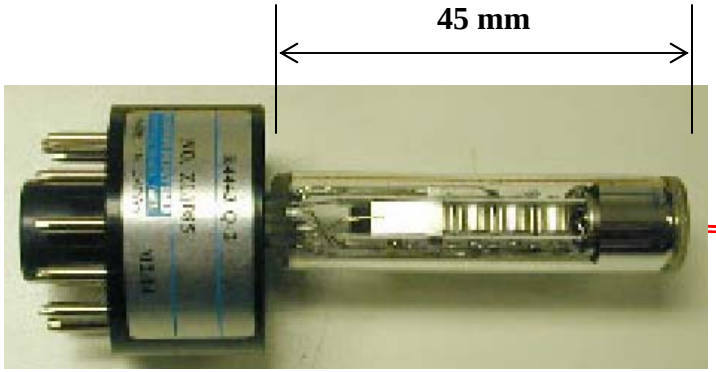
- There are 12 Front End Electronics Boards (FREE) in ACD + 2 spares
- Each board can support up to 18 channels. It contains front end analog (GAFE) ASIC per each channel and one digital (GARC) ASIC
- Each FREE has two High Voltage Units (HVBS), main and redundant, to power PMT's (24 to fly + 6 spares)
- Each FREE will be integrated in chassis with PMT's
- **All FREE boards, including HVBS, are made, tested and ready for integration in ACD**

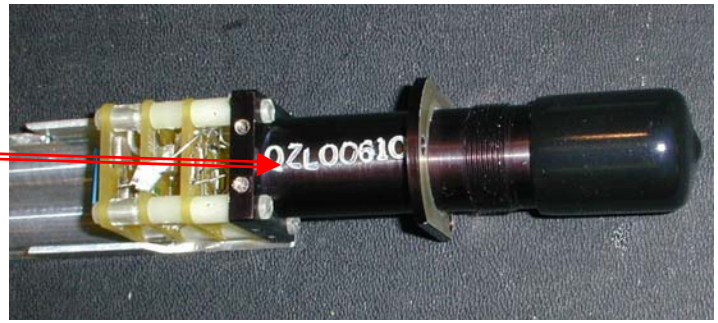




PMT

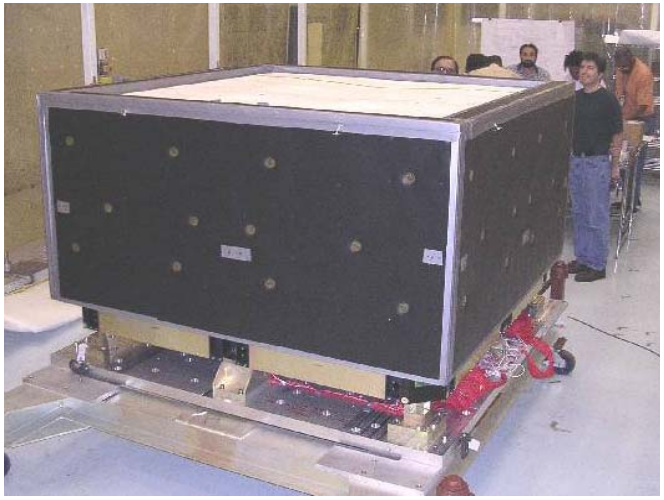
- There are 194 PMT's in ACD
- We use Hamamatsu R4443 tubes, which is a ruggedized version of popular R647 tube
- Each tube has its own low current (<2 μA) resistor divider, big challenge to build in such limited space
- Currently this is a biggest problem in ACD – we are modifying PMT housing to reduce thermal stress on PMT at low temperature. The new design is now being qualified





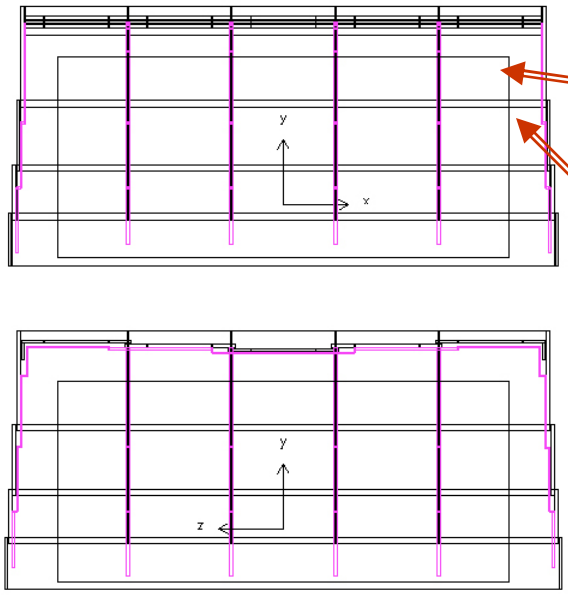
Mechanical structure

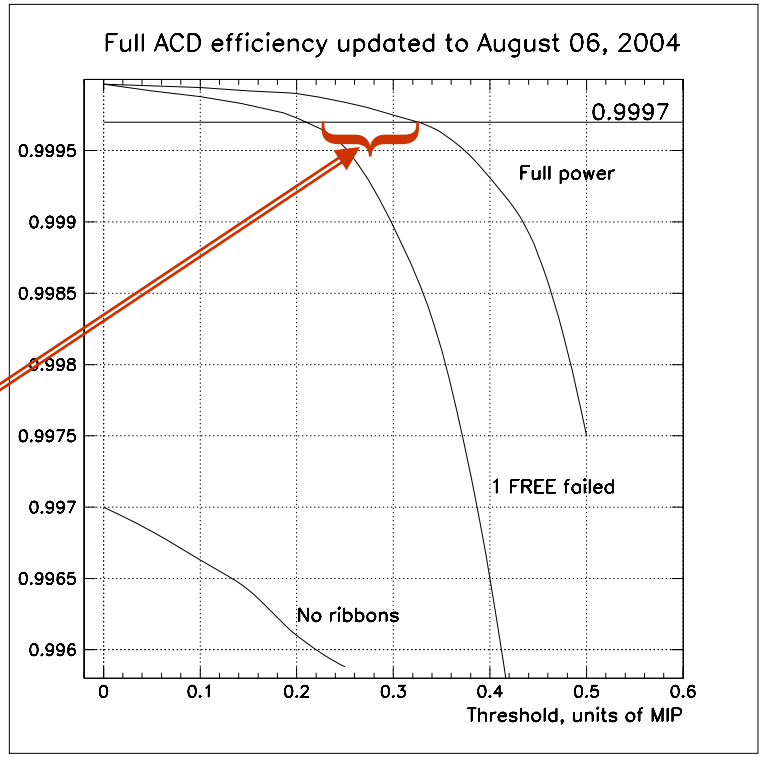
Built, fully tested, equipped with accelerometers and thermistors and ready to host ACD detectors



ACD Performance analysis

- Now we have real and exact ACD geometry
- Now we have all flight detectors performance measured
- Following the concept presented in Rome, all this was put in ACD simulations to determine single charged relativistic particles detection efficiency





ACD meets 0.9997 efficiency requirement, but margins are not big

How to get data out from ACD: EGSE

- ACD hardware is being built – have to test the data coming out of it
- It was a long waiting time to receive EGSE test stand!
- G3 test script progress:
  - Most scripts have been written and tested
    - EMI Test Scripts have been defined
    - Still have an issue with event rates, including some crashes of the system – issues are being worked.

Conclusion

- Flight ACD integration has started

- Most problems solved

- Remaining issues: PMT housing and data taking (EGSE)

Dream…

- And, of course, very heavy struggle to keep schedule and budget