U.S. ATLAS

# 1.4 Tile Calorimeter

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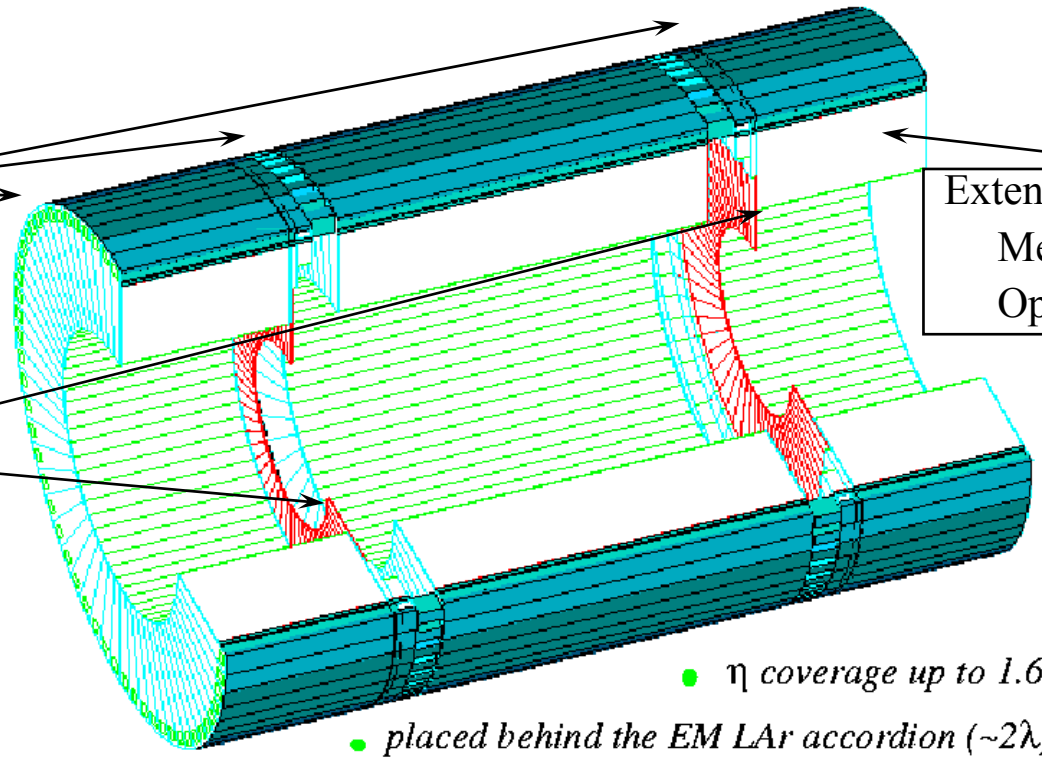
ANL

PAP Review of U.S. ATLAS
November 21-22, 2002

# ATLAS Tile Calorimeter (1.4)

Readout system in Girder 1.4.3

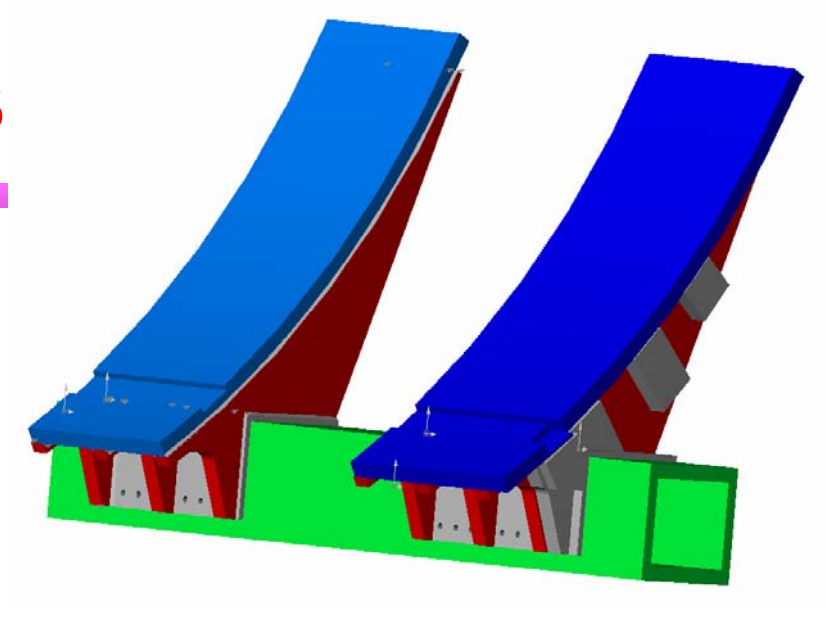
Intermediate Tile Calorimeter 1.4.4



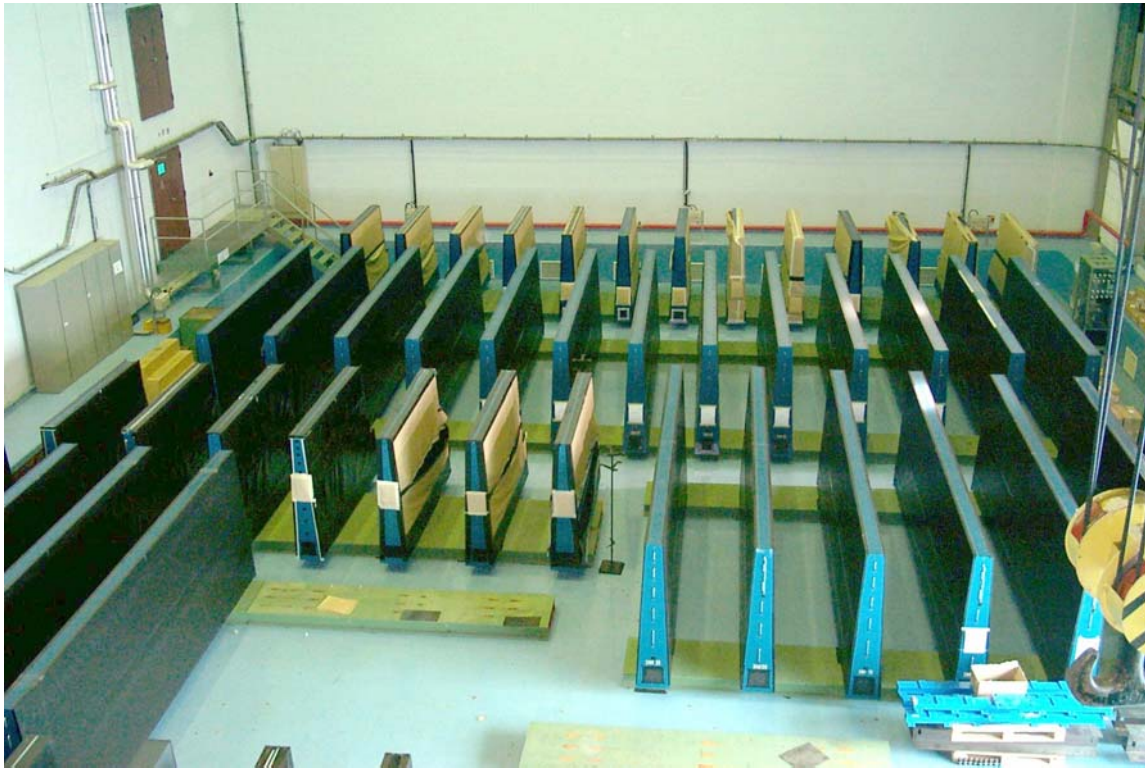
Extended Barrel Calorimeter
- Mechanics 1.4.1
- Optics 1.4.2

- *η coverage up to 1.6*
- *placed behind the EM LAr accordion (~2λ)*
- *outer diameter 8.5 m, 12.2 m long, 2900 tons, 64 wedges structure*
- *Fe-scintillator sampling calorimeter (ratio ~4:1), WLS fibres readout*
- *unconventional scintillator geometry, with tiles in the radial direction*
- *the calorimeter body and the massive iron outer support act as magnetic flux return for internal solenoid*

# Technical Status



- **1.4.1 Mechanics**
  - Submodule construction is complete
    - 596 total
  - Girder production & delivery is complete
  - All 65 modules mechanically assembled
  - 56 completed modules have been shipped to CERN
  - Final shipment to CERN is driven by instrumentation schedule (Dec 02 – Jan 03)
  - Saddle design almost complete



# Technical Status

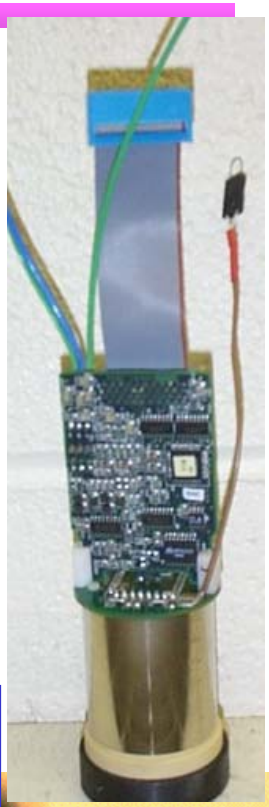
- 1.4.1 Mechanics
  - Installation tasks beginning with preassembly in building 185 (compare pictures with previous page)

# Technical Status

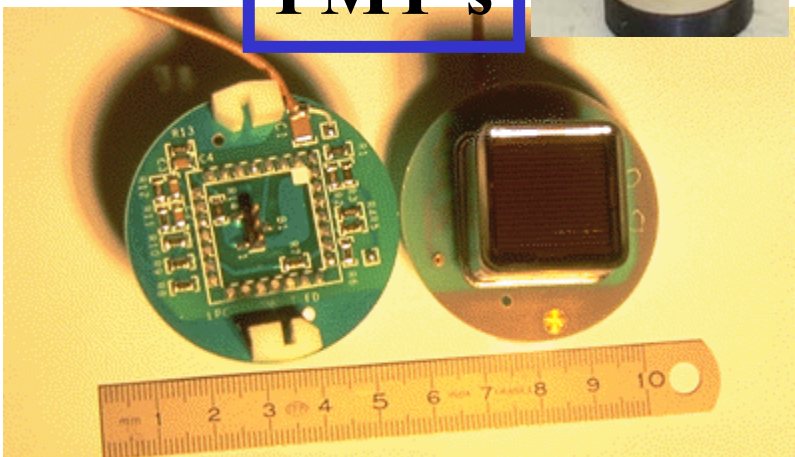
- 1.4.2 Instrumentation
  - 61 EB modules completed (of 65)
  - Expected finish Dec. 2002
  - All modules meet 10% uniformity specification
    - But a few early modules are being repaired at CERN

# Technical Status

- 1.4.3 Readout
  - STEP1 Testing completed for all 3500 Hamamatsu R-7877 PMTs (UI, UTA)
  - STEP2 underway for last 500.
  - 69 PMTs rejected & replaced (~ 2%)
  - Breakdown problem discovered in base
  - Front end 3-in-1 cards (10,600) complete
  - Mother Boards all delivered and 99% tested
  - Optical Interface Cards:
    - 17 pre-production boards burned-in, tested, shipped to CERN
    - All parts delivered to assembler
    - Assembly contract let and boards are being delivered



PMT's



# Technical Status

- 1.4.4 Intermediate Tile Calorimeter
  - Finished submodule production in May, 2002
  - Built 2 spares in June
  - About to place order for gap scintillator
  - Final drawings approved for crack (cryostat) scintillator boxes

# Tile Construction: What's Left?

- Final module instrumentation and ship to CERN (Jan. 2002)
- Complete production and testing of optical interface boards
  - But TTCrx boards are being redesigned….
- Gap scintillators
- Preassembly EBC 9/02 – 4/03
- Preassembly Barrel 4/03 - 12/03
- Preassembly EBA 12/03 - 8/04
- Install Barrel-EBC-EBA 5/04 – 11/05
- (Commissioning and Testing 2005-2006)
- (LHC turnon 2007)

# M&O Plan

- Pre-Operations
  - Mechanical Support
    - Module Validation
    - Integration
  - Electrical Support
    - Validation, Repairs, and Checkout
    - Integration
    - Pre-operational testing and checkout
  - Software Support
- Operations (Beam-on)
- Maintenance (Beam-off)
- Calibration & Monitoring

# M&O: Costs

## U.S. ATLAS M&&O Estimate
## WBS Profile Estimates

**Funding Source:** All | **Funding Type:** Research Program | 11/19/2002 4:10:31 PM

**Institutions:** All | **Estimate in Fixed FY'02 $k** | **Labor/Material:** Both

| WBS Number | Descriptio | FY 03 (k$) | FY 04 (k$) | FY 05 (k$) | FY 06 (k$) | FY 07 (k$) | FY 08 (k$) | FY 09 (k$) | FY 10 (k$) | FY 11 (k$) | FY 12 (k$) | Total (k$) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3 | U.S. ATLAS M&O Estimate | 566 | 652 | 774 | 781 | 995 | 713 | 711 | 711 | 779 | 711 | 7393 |
| 3.4 | Tile Calorimeter System | 566 | 652 | 774 | 781 | 995 | 713 | 711 | 711 | 779 | 711 | 7393 |
| 3.4.1 | TileCal - Specific Costs | 372 | 460 | 584 | 593 | 793 | 502 | 502 | 502 | 570 | 502 | 5380 |
| 3.4.1.1 | Pre-Operations | 372 | 460 | 584 | 570 | 163 | 0 | 0 | 0 | 0 | 0 | 2150 |
| 3.4.1.2 | Operations (Beam-on) | 0 | 0 | 0 | 0 | 393 | 319 | 319 | 319 | 319 | 319 | 1990 |
| 3.4.1.3 | Maintenance (Beam-off) | 0 | 0 | 0 | 23 | 236 | 182 | 182 | 182 | 251 | 182 | 1240 |
| 3.4.2 | Calibration & Monitoring | 176 | 174 | 172 | 172 | 23 | 23 | 23 | 23 | 23 | 23 | 829 |
| 3.4.2.1 | Pre-Operations | 176 | 174 | 172 | 172 | 0 | 0 | 0 | 0 | 0 | 0 | 694 |
| 3.4.2.2 | Operations (Beam-on) | 0 | 0 | 0 | 0 | 23 | 23 | 23 | 23 | 23 | 23 | 135 |
| 3.4.2.3 | Maintenance (Beam-off) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3.4.3 | Tilecal System Common Costs | 18 | 18 | 18 | 16 | 180 | 189 | 187 | 186 | 186 | 186 | 1184 |
| 3.4.3.1 | Pre-operations | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3.4.3.2 | Operations | 18 | 18 | 18 | 16 | 180 | 189 | 187 | 186 | 186 | 186 | 1184 |
| 3.4.3.3 | Maintenance | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

# M&O: Effort

**MANPOWER ESTIMATE SUMMARY IN FTEs per year**

WBSNo: 3.4 | Funding Type: Research Program | 11/19/2002 4:15:31 PM

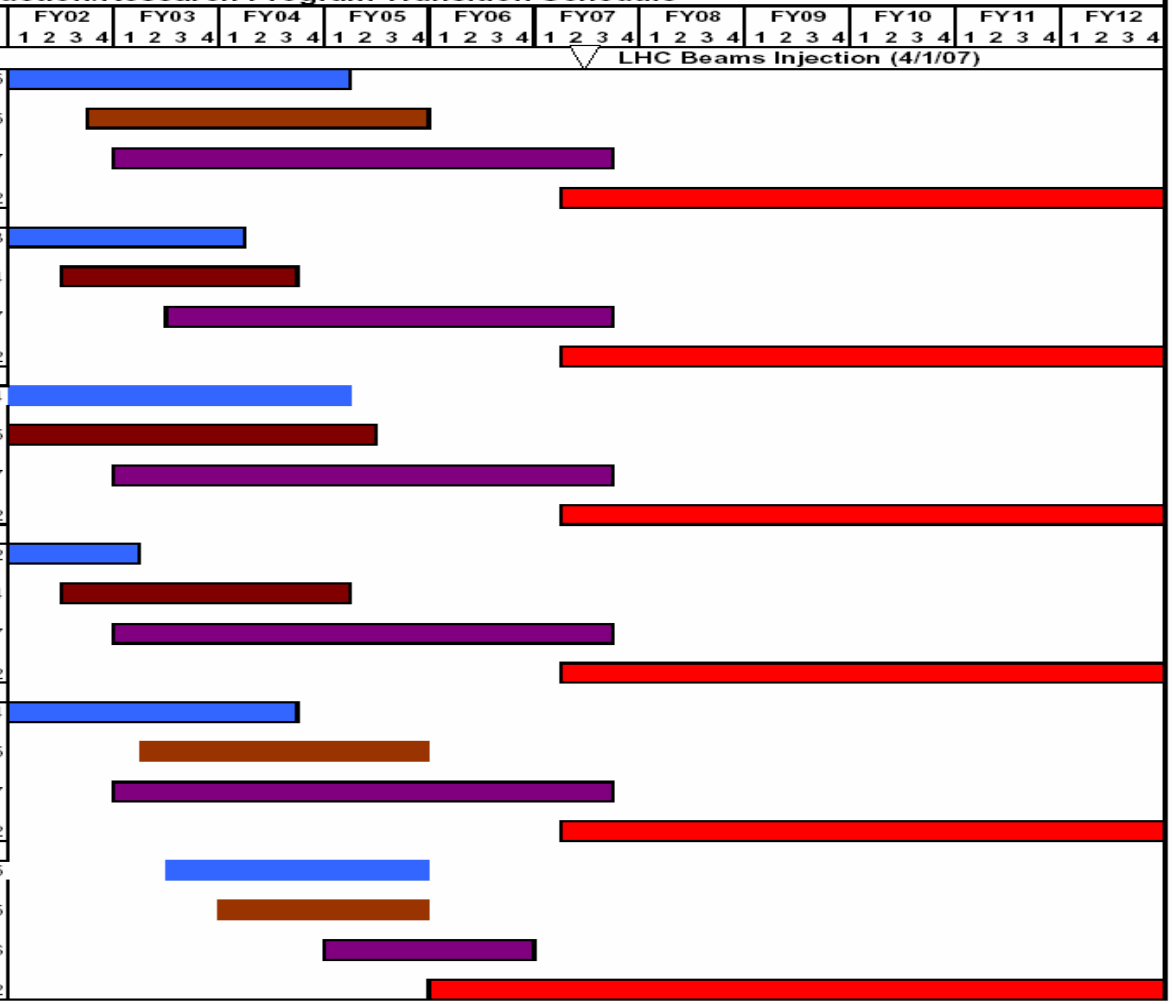
Description: Tile Calorimeter System | Institutions: All | Funding Source : All

| | FY03 | FY04 | FY05 | FY06 | FY07 | FY08 | FY09 | FY10 | FY11 | FY12 | Calculated Total | Entered |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Faculty | | | | | | | | | | | .0 | .0 |
| Sr Research Scientist | | | | | | | | | | | .0 | .0 |
| Term Scientist | | | | | | | | | | | .0 | .0 |
| Post Doc | | | | | | | | | | | .0 | .0 |
| Grad Student | | | | | | | | | | | .0 | .0 |
| Mechanical Engineer | .2 | .2 | .2 | .2 | .5 | .2 | .2 | .2 | .2 | .2 | 2.5 | .0 |
| Electrical Engineer | .5 | .3 | .4 | .2 | .5 | .2 | .2 | .2 | .2 | .2 | 2.9 | .0 |
| Technicial | 2.6 | 3.2 | 3.6 | 3.5 | 2.8 | 1.9 | 1.9 | 1.9 | 1.9 | 1.9 | 25.3 | .0 |
| Computer | .5 | .6 | 1.2 | 1.4 | 1.9 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 | 11.8 | .0 |
| Designer | | | | | | | | | | | .0 | .0 |
| Administrator | | | | | | | | | | | .0 | .0 |
| Contract Labor | | | | | | | | | | | .0 | .0 |
| **TOTAL LABOR** | 3.8 | 4.3 | 5.4 | 5.4 | 5.7 | 3.6 | 3.6 | 3.6 | 3.6 | 3.6 | 42.4 | .0 |

# U.S. ATLAS: High Level Schedule

U.S. ATLAS
Level 2
Construction/Research Program Transition Schedule

| Subsystem | Category | Start Date | Compl Date |
|---|---|---|---|
| Silicon | Construction | N/A | 1/31/05 |
| | Installation | 7/1/02 | 9/30/05 |
| | Pre-Operations | 10/1/02 | 6/30/07 |
| | Operations | 1/2/07 | 9/28/12 |
| TRT | Construction | N/A | 12/31/03 |
| | Installation | 6/3/02 | 6/1/04 |
| | Pre-Operations | 4/28/03 | 6/30/07 |
| | Operations | 1/2/07 | 9/28/12 |
| LAr | Construction | N/A | 10/19/04 |
| | Installation | 10/1/01 | 2/14/05 |
| | Pre-Operations | 10/1/02 | 6/30/07 |
| | Operations | 1/2/07 | 9/28/12 |
| Tile | Construction | N/A | 12/2/02 |
| | Installation | 6/3/02 | 12/3/04 |
| | Pre-Operations | 10/1/02 | 6/30/07 |
| | Operations | 1/2/07 | 9/28/12 |
| Muon | Construction | N/A | 7/1/04 |
| | Installation | 3/3/03 | 9/30/05 |
| | Pre-Operations | 10/1/02 | 6/30/07 |
| | Operations | 1/2/07 | 9/28/12 |
| TrigDAQ | Construction | 4/1/03 | 9/30/05 |
| | Installation | 10/1/03 | 9/30/05 |
| | Pre-Operations | 10/1/04 | 9/29/06 |
| | Operations | 10/1/05 | 9/28/12 |



# Conclusions

- The major parts of the Tile construction project will be complete by January
  - On schedule except for gap scintillator
- PreOps starting now
- Preassembly and installation FY 2003-2005
- M&O will continue until LHC turnon with test beam, cosmics, and electronics testing