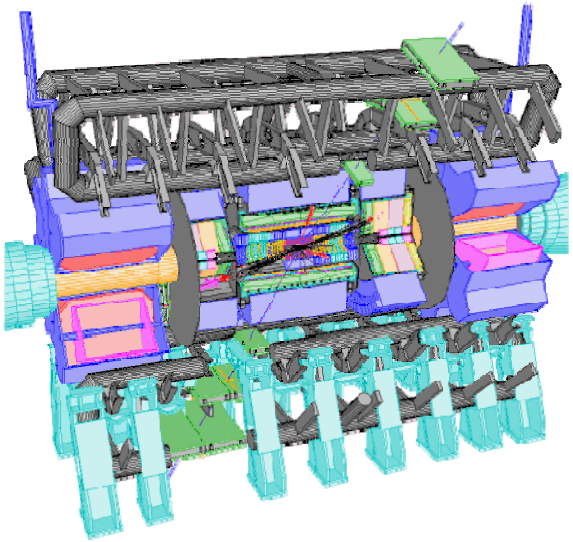
LIQUID ARGON CALORIMETERS
Status of
Production, Integration and Installation



ATLAS-MPI Meeting 13-March-2006

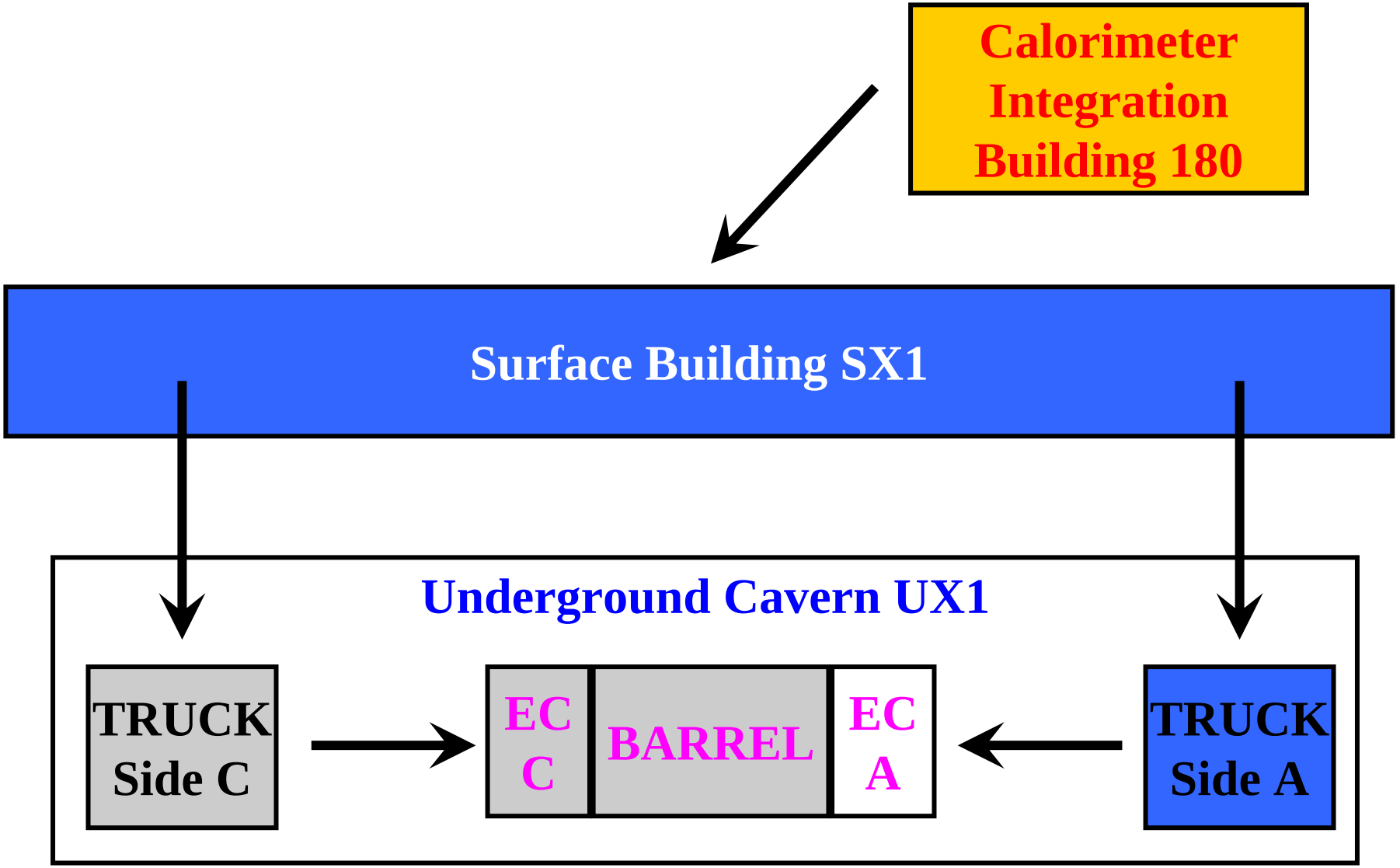
H. Oberlack

MPI für Physik, Munich

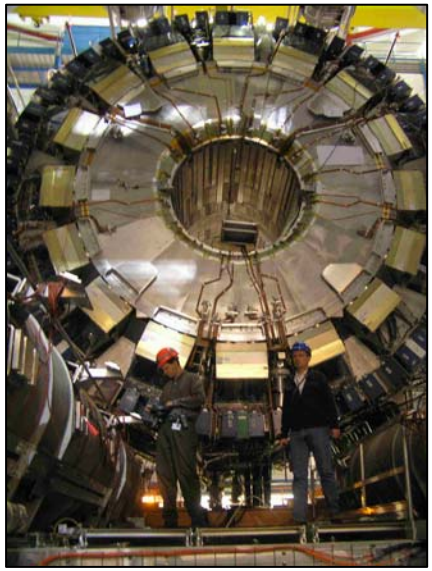
CONTENT

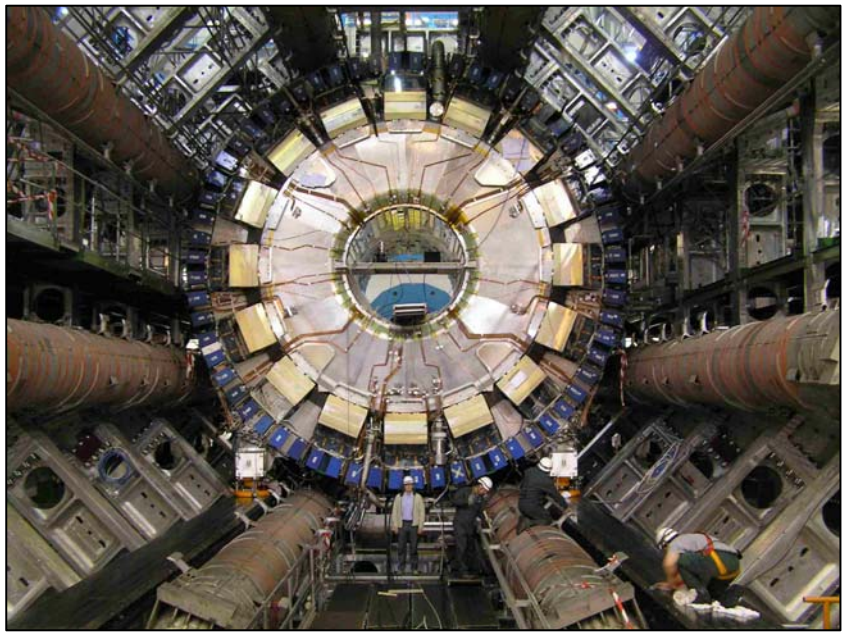
- Calorimeter Movements
- Electronics production
- LAr Installation and Commissioning at Point 1

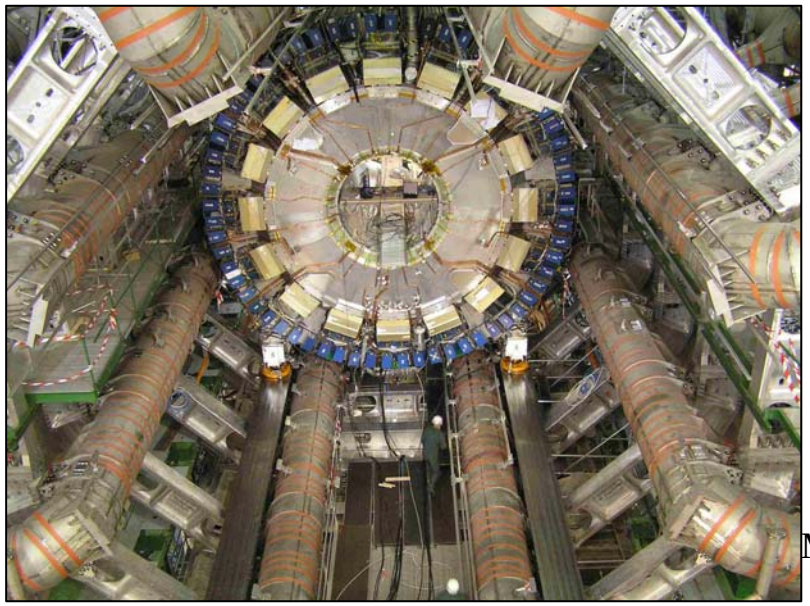
CALORIMETER MOVEMENTS

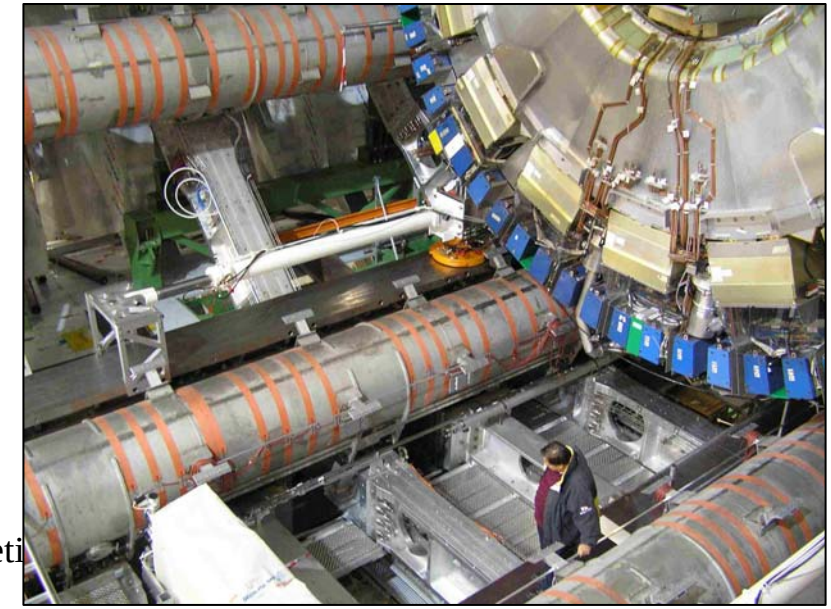


Barrel Calorimeter: Move to IP & Final Alignment





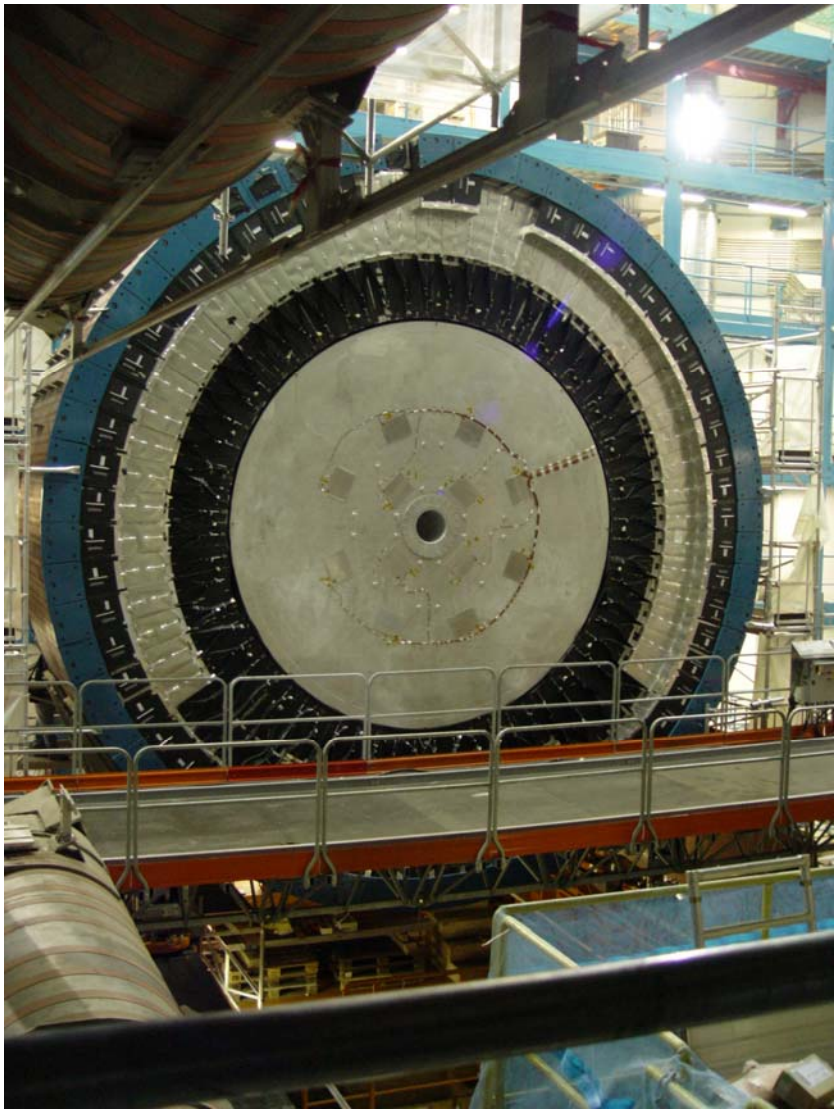




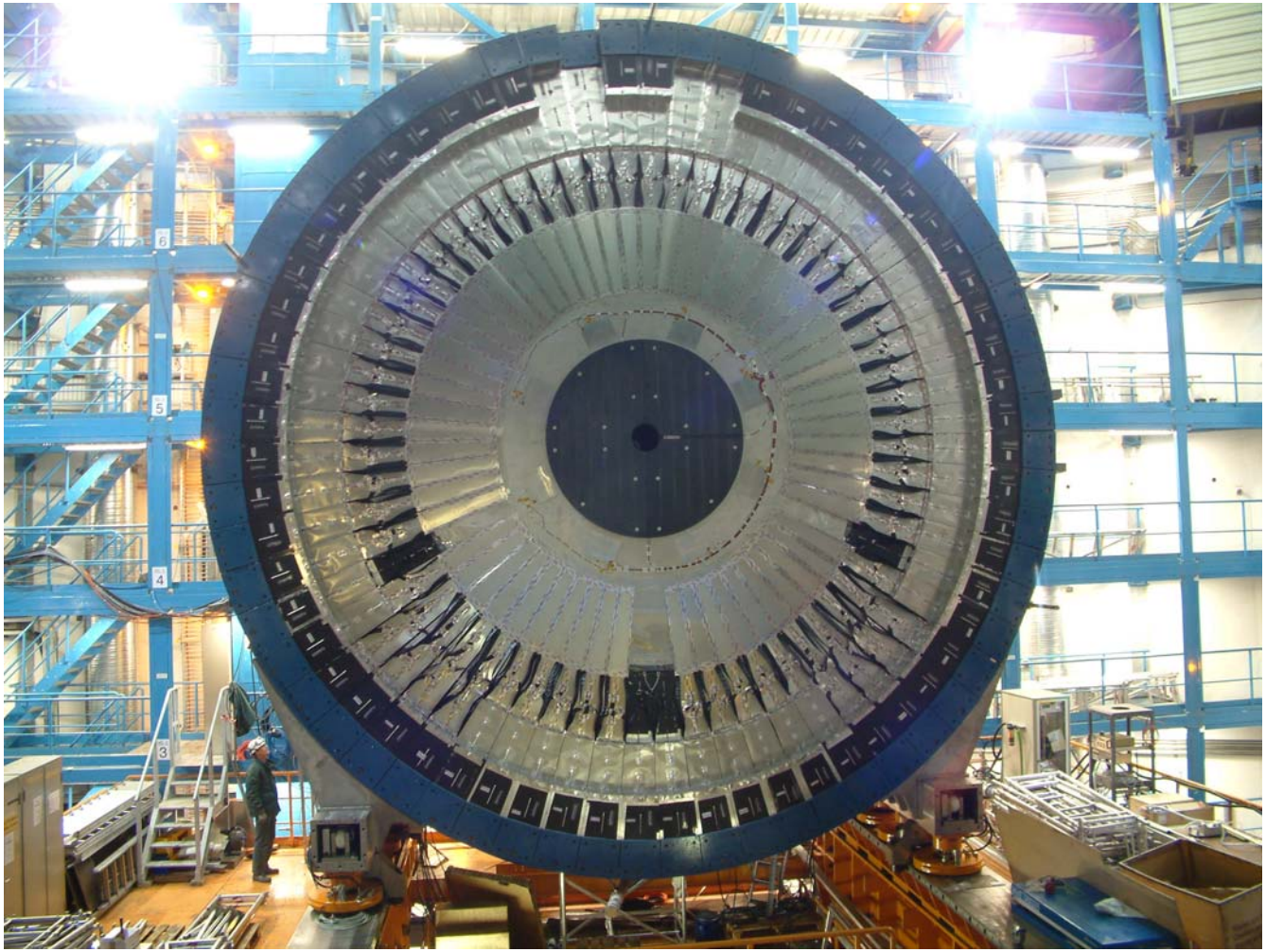
LAr BARREL CALORIMETER

- **July-04:**
  Cold commissioning of the barrel calorimeter in B180 finished.
- **Oct-04:**
  Lowering to the truck position C in the pit.
  Placement in Tilecal within very few mms.
- **Mar-05:**
  Installation of on-detector infrastructure (crates, cooling,...) finished.
  Start installation of front-end electronics.
- **Sep-05:**
  Move barrel calorimeter to IP position.
  Continue installation and commissioning 1 of FE electronics.
- **Jan-06:**
  Start of commissioning phase 3 (‘expert week‘)
- **03-Apr-06:**
  Start of final cool-down (6 weeks).

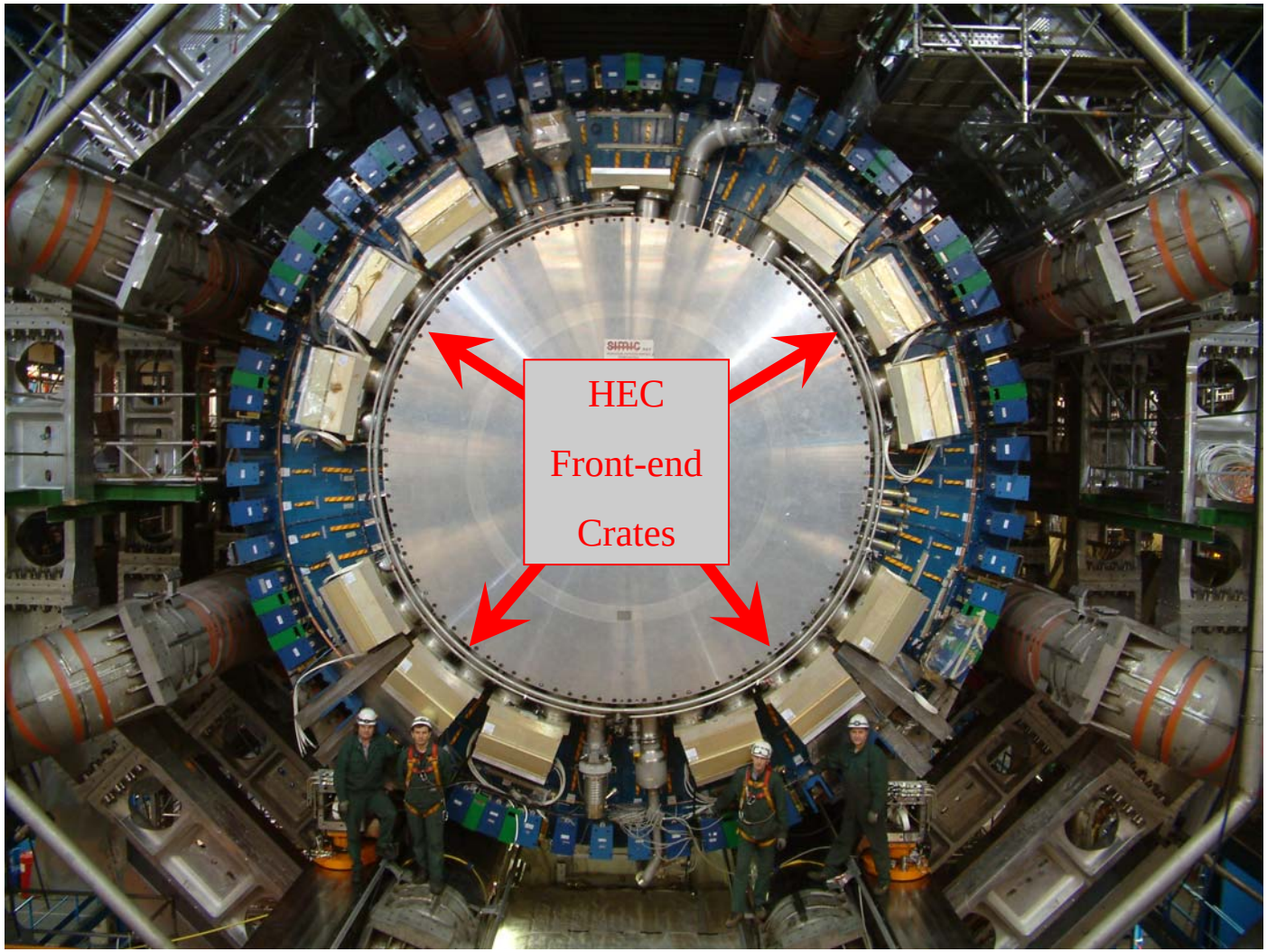
LAr END-CAP C: Lowering into Pit

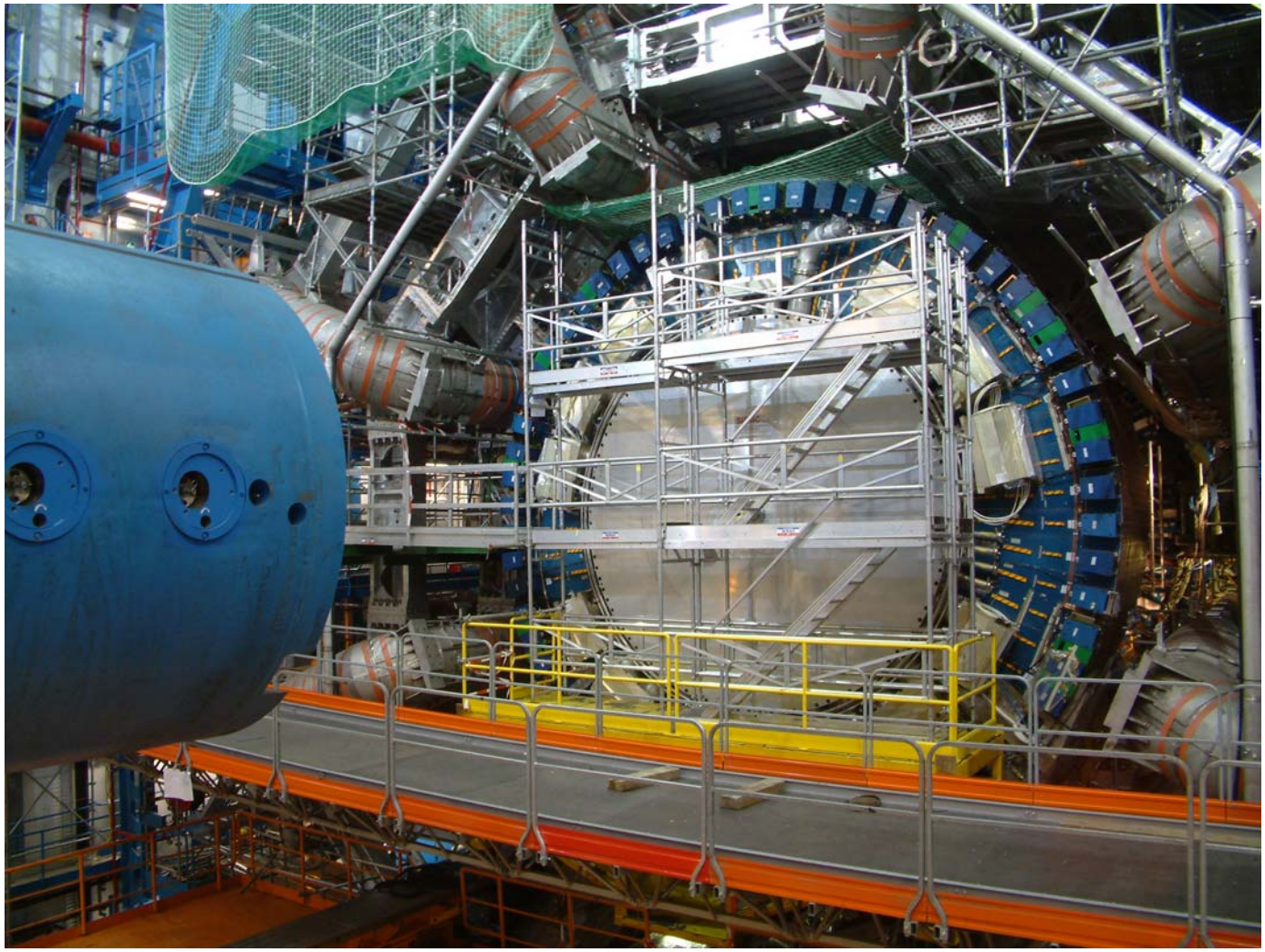


Calorimeter End-cap C Frontside



Calorimeter End-cap C Backside





LAr END-CAP C

- **Mar-05:**
  Cold commissioning of the ECC calorimeter in B180 finished.
- **Dec-05:**
  Lowering into the truck position in the pit.
  Placement in Tilecal within very few mms.
- **Feb-06:**
  Start installation of on-detector infrastructure (crates, cooling, ...).
- **27-Feb-06:**
  Move ECC to final 'Detector open position'
- **Mar-06: (Tentative date)**
  Start installation of front-end electronics.
- **May-06: (Tentative date)**
  Start of commissioning phase 3 ('expert week')

LAr END-CAP A: Transport to SX1

LAr END-CAP A in SX1

LAr END-CAP A

- **Sep-05:**

  Cold commissioning of the ECC calorimeter in B180 finished.
- **Jan-06:**

  Transport from B180 to SX1.
- **18-Apr-06: (Tentative date)**

  Lowering into the truck position (side A) in the pit.

  Placement in Tilecal.
- **Mid-June-06: (Tentative date)**

  Installation of on-detector infrastructure (crates, cooling, ...).
- **Junly-06: (Tentative date)**

  Start installation of front-end electronics.

LAr Back-End Electronics

Large amount of work successfully performed in the last few months !

- **BE Modules Production Status**
  - **ROD motherboard production:**
    - **164 boards installed and 29 more ready for installation.**
    - **Start of production of the 2nd series of 21 boards as soon as all components available**
  - **All except 4 ROD-crates have been delivered**
  - **All other boards in place or stored at EMF**
- **BE Electronic installation and commissioning in USA 15 is progressing without special problems**
- **ROD/ROS being connected.**
  - **TDAQ decided to unstage the LAr ROS system**
- **EMF Setup:**
  - **Full setup with both Back-end and Front-end electronics.**
  - **1 ROS PC with 4 Robins.**
  - **Used to test software and debug hardware, in a very effective way**
- **A complete hardware setup has been used during the "Expert Week"**

LAr Front-End Electronics Production

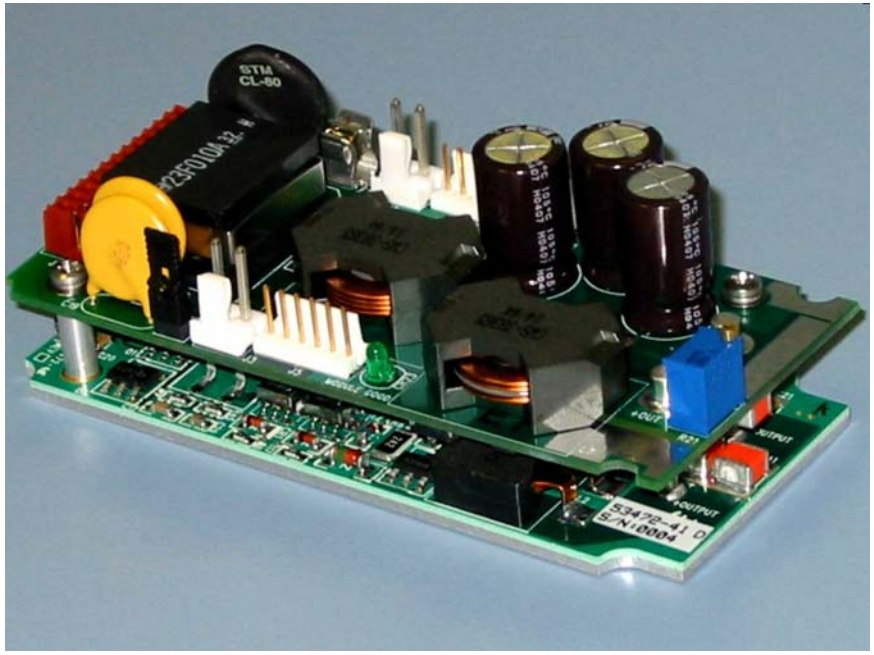
- **FEB production has been completed at Nevis**
  - **FEB production tests are almost completed at Orsay**
  - **FEB production tests can not be finalized at BNL for preamps shortage**
- **Production of most other boards is well underway, it should be completed by June '06.**
  - **CALIB board: Enough for barrel, boards for ECs to come.**
  - **FEC Controller board: Enough for barrel, boards for ECs to come.**

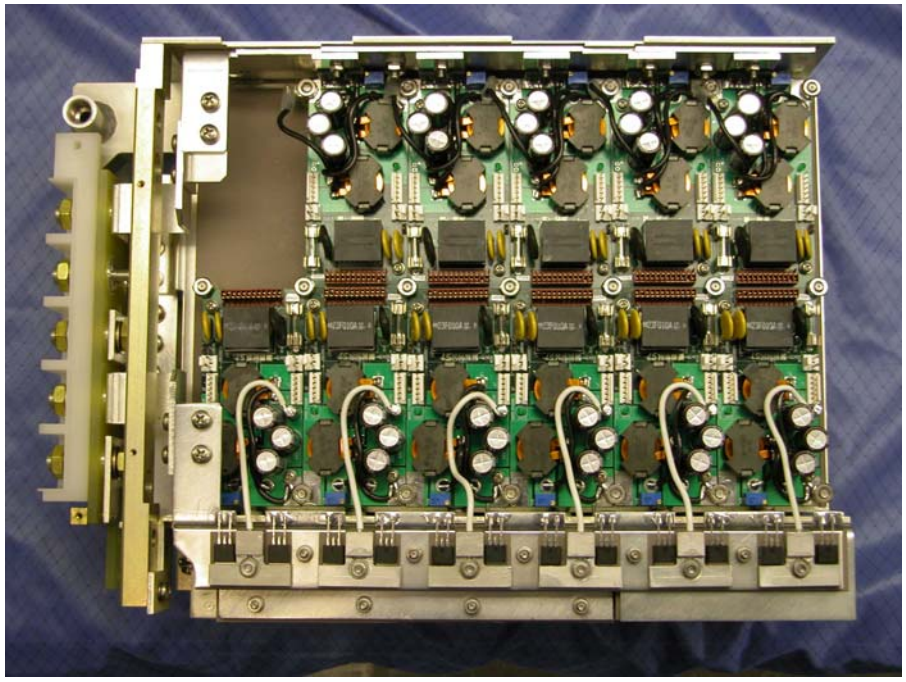
- **Main issues**
  - **The shortage of (25 Ohm, 5 mA) preamplifiers that is preventing BNL from completing the FEBs for FCAL and EMEC inner wheel: → *Recent problem.***
  - **The lack of "final" LV power supplies**
  - **The continuing problems with the HV power supplies**

LV PS Background

- **LAr LVPS must meet some challenging spec's, including:**
  - **Total power ~ 3 kW, distributed over 7 voltage lines**
  - **Low output ripple, due to stringent coherent noise performance requirement**
  - **On-detector location, between Tilecal fingers, implies:**
    - **compact size (i.e. high power density)**
    - **water-cooling only**
    - **very high reliability requirements**
    - **radiation tolerance**
- **Design is built around DC/DC converter modules, using commercial power MOSFETs which were tested and demonstrated to be radiation-tolerant**
  - **N+1 redundancy scheme requires 27 modules per supply**

LV PS Background





LV Power Supplies

- **Various problems have been identified in the MDI power supplies:**
  - **Cap problems → solved in October 2005**
  - **Inductor problems → identified and solved in Dec. 2005**
  - **Issues on the mechanics of the modules → recently solved**
  - **Current Sharing and Stability between modules → solution proposed**

- **Corrective actions have been suggested by BNL and accepted by MDI**
  - **LVPS review results in December**
  - **Need for extra-air cooling → considered a must for long term operations**
  - **NDA signed by BNL**
  - **MDI should delivery 4 "final" LVPS next week**
  - **A schedule for retrofitting existing LVPS has been organized.**
    Still an "optimistic" 5pcs/week delivery is taken into account

Recent LV PS Developments

- **Vendor (MDI) has started retrofitting of "final" LV PS units**
  - **Replacing capacitors, inductors, installing Belleville washers**
  - **Have enough inductors in stock for only 4 LV PS; remaining inductors to be delivered in April**
- **MDI has so far delivered 3 LVPS with all modifications made**
  - **Last one was delivered to BNL earlier this week (originally expected mid-Feb.)**
- **Testing at BNL includes tests of performance and current sharing of individual power modules ("bricks")**
  - **This is (so far) NOT done at MDI, where individual modules are tested only before final LVPS assembly**
  - **BNL has found problems with individual modules on ALL 3 LVPS**
    - **First has +6V module that does not always turn on properly (returned to MDI)**
    - **Second has +6V module that drops to 5.75 V for 50% load (returned to MDI)**
    - **Third has -4V modules that drops to -3.75 V for 90% load (still undergoing tests @BNL)**
  - **Tests of Belleville washers for first 2 LVPS show they are making good contact**

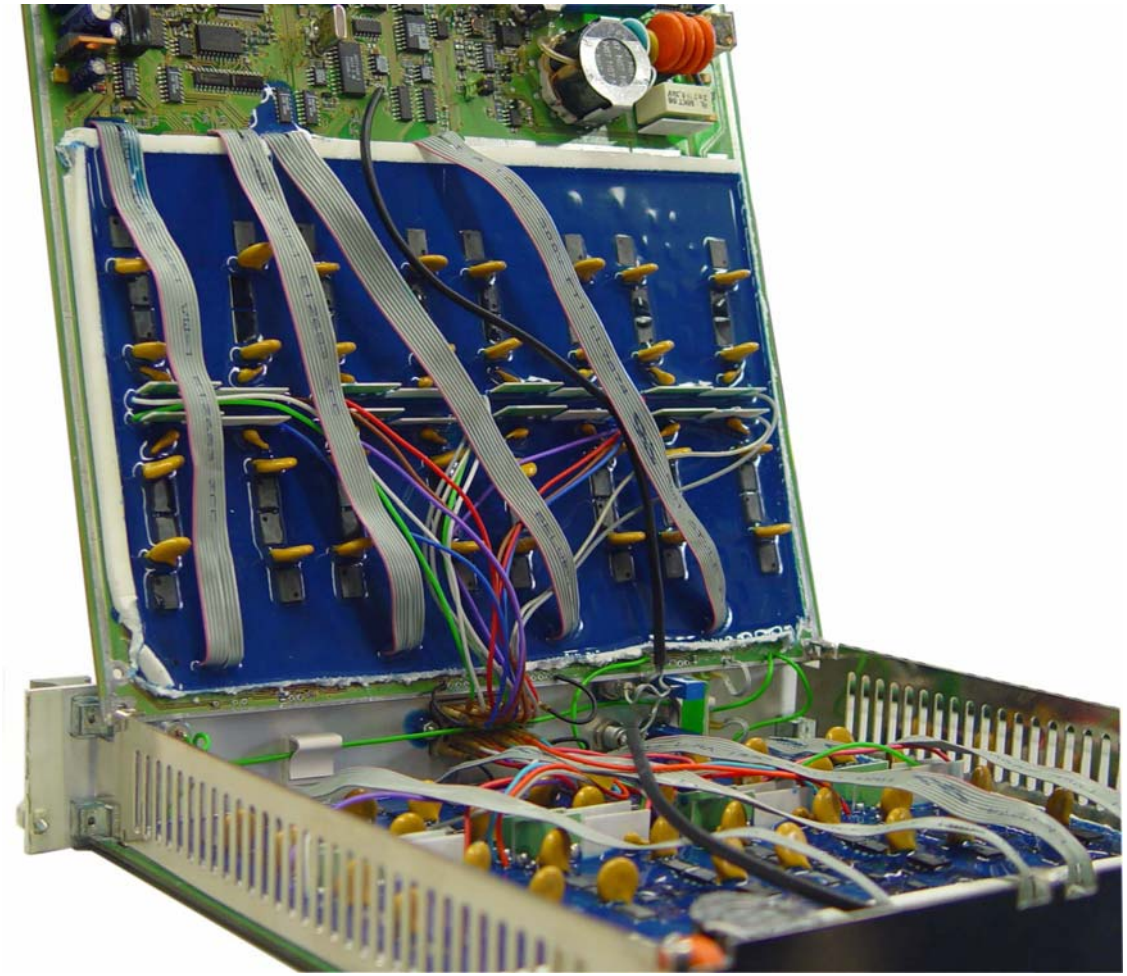
Next Steps for LV PS

- **Follow up with MDI on recent test results and problems to see how to proceed**
- **Given new problems, BNL is pushing (again) to get MDI to test individual modules in integrated LVPS before shipment to BNL**
  - **In addition to test station, BNL is providing a technician to perform testing at MDI**
  - **Individual module testing could be one of this person's tasks**
- **MDI has agreed to set up 2nd test station to relieve bottleneck in testing**
  - **BNL is providing all of the equipment and infrastructure**
  - **Target is to reach situation where goal of 5 LVPS per week is more realistic**

HV PS Background

- HV PS are located in USA15, so no need for radiation-tolerance
- Some features of the LAr HV PS
  - Typical Vmax ~ 2.5 kV
  - 32 channels per dual-width 6U VME module, individually set
  - Need scheme for fast discharge of detector
- After CERN-based tendering process, contract was awarded to ISEG
- Significant operational experience gained during, for example, cold tests of the various detectors in B180
  - A variety of different problems have been discovered
  - By now, had to replace 3 different components (cap, diode, opto-coupler)
  - Continued problems were blamed by ISEG on “dirty” environment and conditions in B180
- More recently, we have started operating modules in USA15
  - A new (leakage current) problem, causing disabled channels to run up in V
  - ISEG has confirmed that they see the same effect

Potted HV Power Supply



Recent HV PS Developments

- **Team including Philippe Farthouat (CERN), H. Braun (Wuppertal), M. Rijssenbeek (Stony Brook), D. Makowiecki (BNL), M. Kobel (Dresden) visited ISEG on Feb. 8**
  - **With NDA signed, were able to get access to more technical information**
- **As follow-up of visit, a set of tests and investigations has been performed in Dresden and at CERN**
  - **A report has been recently circulated to the LAr HV Task Force**
  - **Results suggest that the leakage currents are NOT coming from the conformal coating or the PCB**
  - **Instead, problem arises from the use of two voltage regulator circuits in series which, in case of imbalance, can be operated close to or outside their maximum voltage specifications**
  - **To fix this problem, report suggests changes are needed at the schematic and layout level**

HV Power Supplies Next Steps

- **Transmit recent test report to ISEG**
  - **Discuss with ISEG their conclusions, proposals how to proceed**

- **In parallel, we are exploring options with alternate vendors**

  - **CAEN has given us an informal offer, based on their A3535 module developed for the ATLAS muons**
    - **Some modifications are needed to satisfy rad'n tolerance requirements of muons (we don't need rad-tol)**
    - **In meantime, to do some testing and gain some experience, we are borrowing one prototype module from the muons (INFN Milano group is making the necessary arrangements)**
    - **Some mods (eg. for fast discharge) would have to be developed for LAr**

  - **As suggested by Philippe Farthouat, we have initiated contact with Dubna group which developed HV PS for TRT**