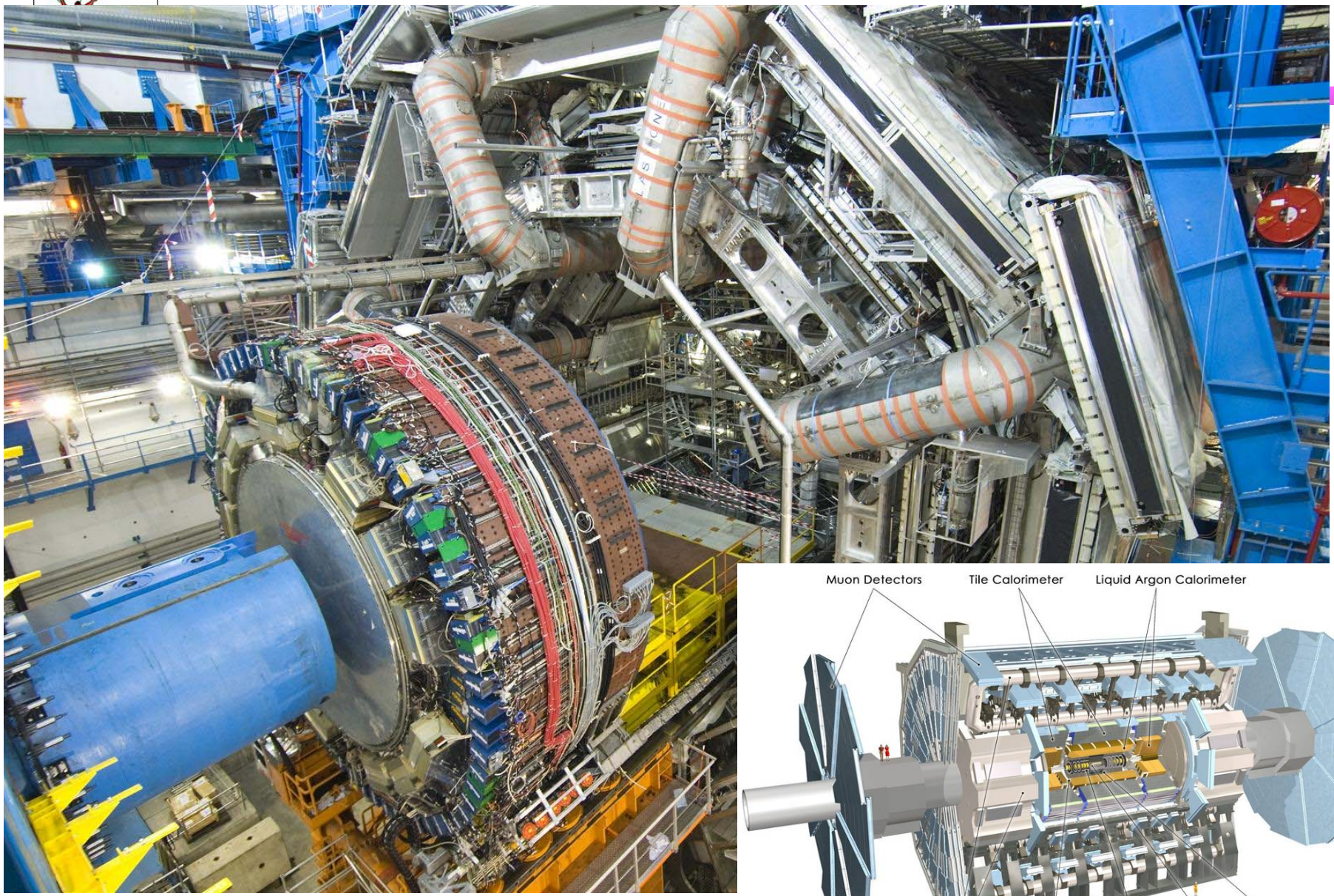
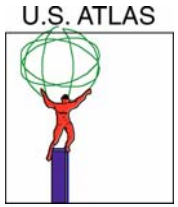
U.S. ATLAS

BNL Role's in ATLAS



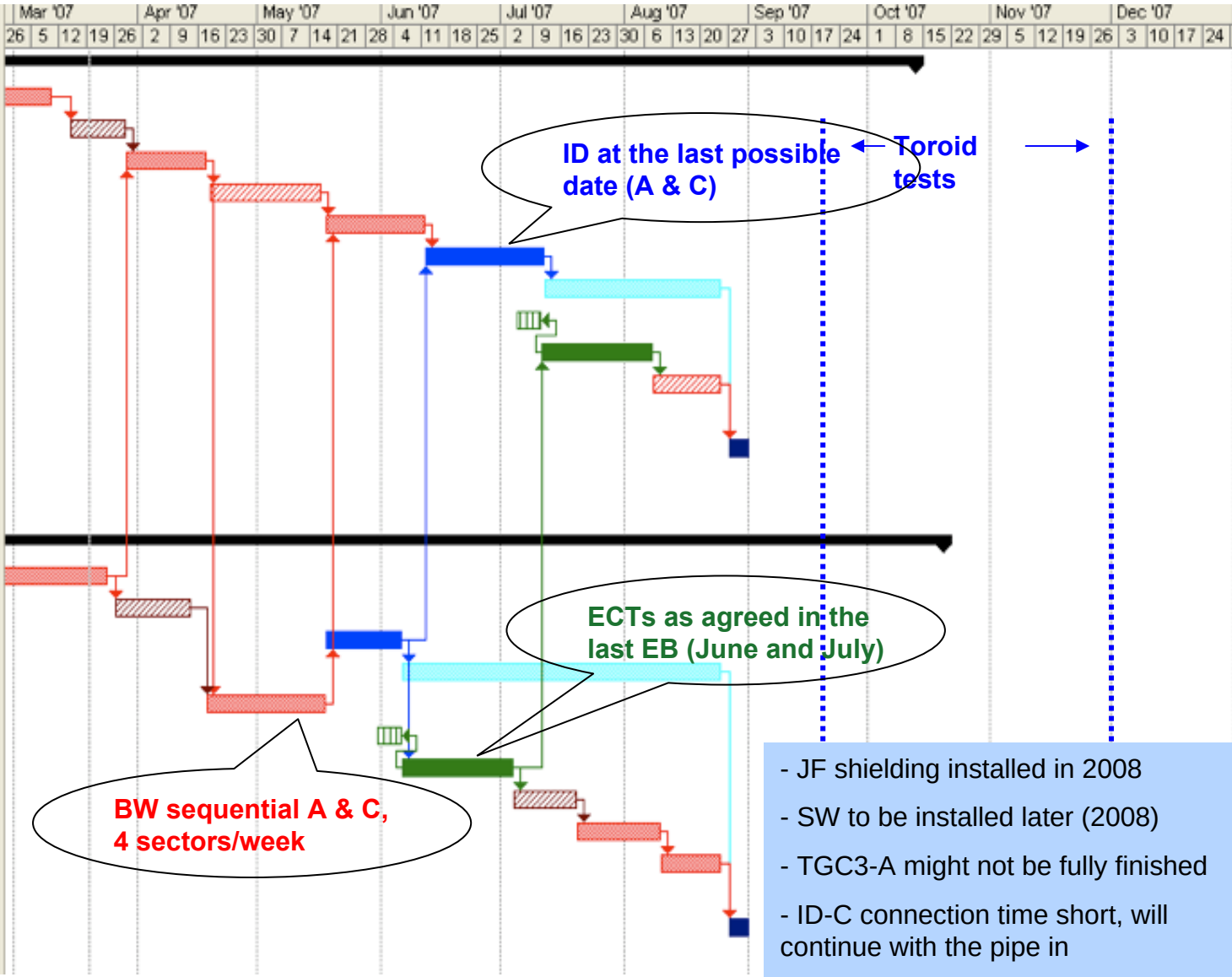


BNL's Role in ATLAS

- Overview of BNL Role in ATLAS (plenary) — H. Gordon
  - U.S. ATLAS Analysis Support Center
  - BNL Role in US ATLAS Management
  - BNL Role in Construction & Research program
- Overview of ATLAS Computing Facility (plenary) — M. Ernst
  - Tier I Center, Grid computing — (working well all around)
- Construction/Installation/Commissioning/ ATLAS Upgrade — H. Ma
  - Construction / Installation / Commissioning:
    - Liquid argon calorimeter
    - Cathode strip chambers (Muon system)
    - ATLAS Technical Coordination
  - ATLAS upgrade
    - Upgrade Project Office; Tracking; LAr; Muon
- ATLAS Software and detector performance — S. Rajagopalan
  - Core Software, Analysis Tools
    - Lots of effort in distributed data management
- Physics — K. Cranmer
  - Physics Analysis
  - Plus Parallel Session III (Parallel Theory)
    - Paige/Davoudiasl/Jackson
    - We have a new series of joint theory/experimenters seminars including BNL and Stony Brook.

Schedule 9.1 (working version) - Evaporative Heaters have Caused Delays – not a U.S. responsibility (+quad triplet?)

	Task Name	Duration
1	**Side C**	**200 days**
2	MDT wheel	45 days
3	TGC2 tooling	10 days
4	TGC2 wheel	14 days
5	Wheels connection	20 days
6	TGC3 wheel	17 days
7	ID-C, Pixel installation	22 days
8	ID connection	32 days
9	ECT-C in SX1	4 days
10	ECT installation	20 days
11	EO + wheels finish	13 days
12	SW installation	15 days
13	***early close pipe***	5 days
14	***close pipe***	5 days
15		
16	**Side A**	**175 days**
17	TGC1 wheel	25 days
18	MDT tooling	15 days
19	ID-A	13 days
20	ID connection	58 days
21	MDT wheel	22 days
22	ECT-A in SX1	4 days
23	ECT installation	20 days
24	TGC2 tooling	12 days
25	TGC2 installation	15 days
26	TGC3 installation	11 days
27	SW installation	15 days
28	***early close pipe***	5 days
29	***close pipe***	5 days

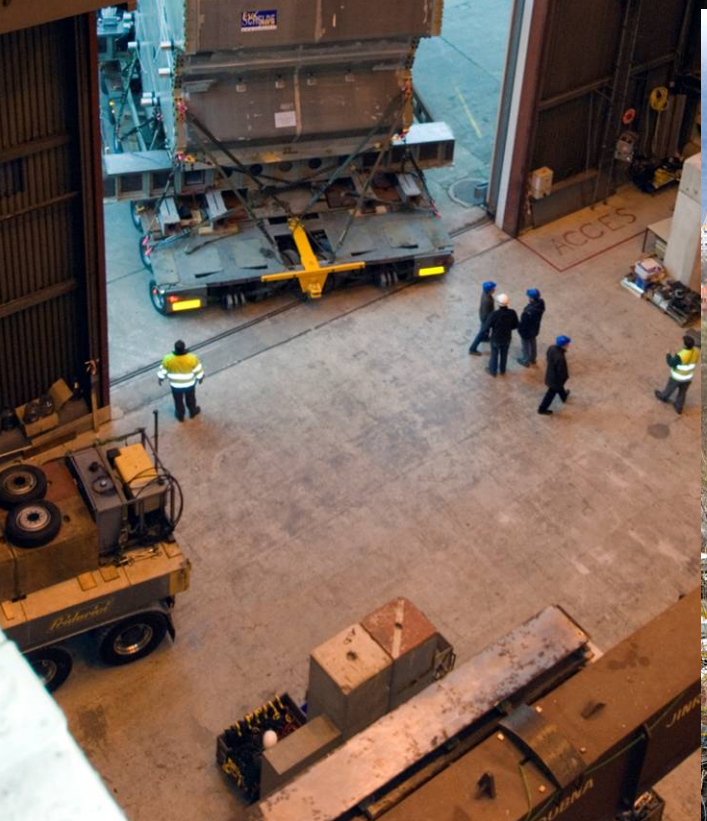


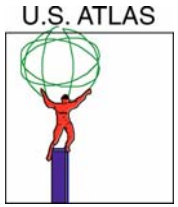
- JF shielding installed in 2008
- SW to be installed later (2008)
- TGC3-A might not be fully finished
- ID-C connection time short, will continue with the pipe in
- Inner beam pipes to be installed in July

End-Cap Toroids

The first End-Cap Toroid has been transported from Hall 191 to the outside test station in front of Hall 180 where it is being mechanically cold tested at LN temperature (cool-down went smoothly)

The integration of the second ECT is well advanced (cold mass has already been inserted into the vacuum vessel)





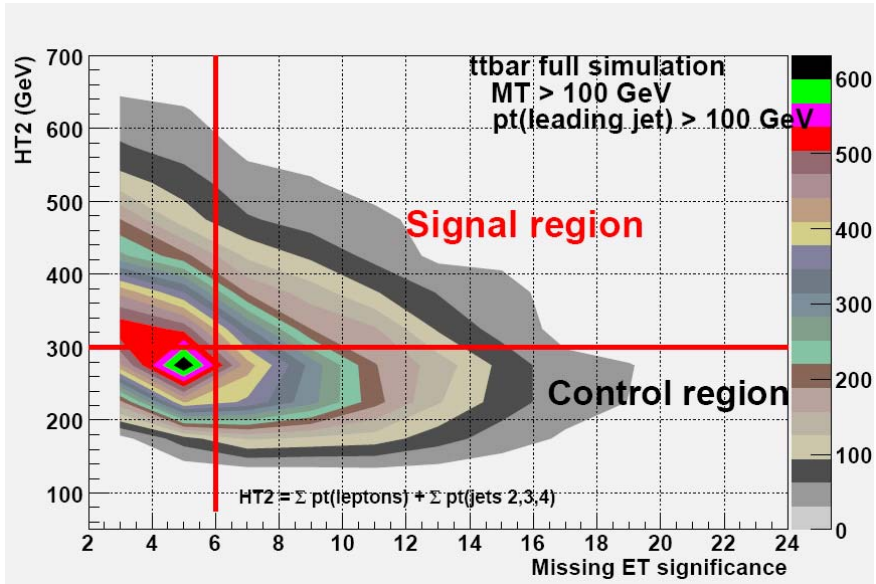
SUSY-related activities at BNL

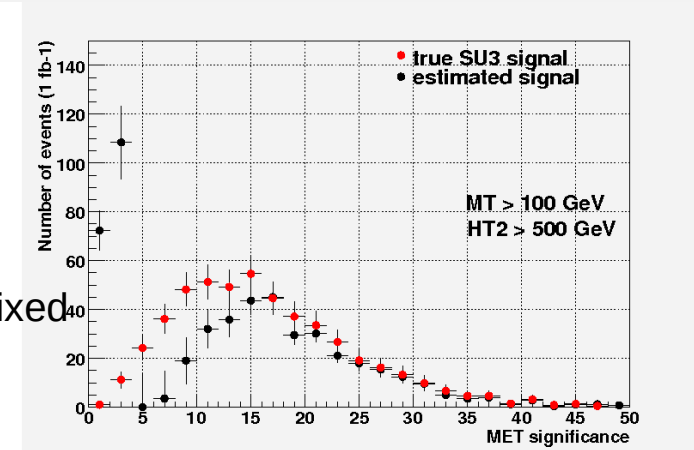
- **Focusing on discovery scenarios with early data (0.1-1.0 fb^{-1}) → inclusive searches**
  - **Jets + missing E_T + (0,1 or 2) leptons (e,μ)**
  - **Perhaps also tau channels**
- **Large effort devoted to understanding reconstruction, calibration of basic objects**
  - **Jets, missing E_T (Paige, Ma, Rajagopalan)**
  - **Electrons (Snyder, Ma, Rajagopalan)**
  - **Muons (Adams, Assamagan)**
  - **Taus (Cranmer, Cunha, Patwa)**
- **Development of triggering strategy (Redlinger, Cranmer, Rajagopalan), including control/calibration samples**
- **SUSY Search strategies (Paige – CSC Note editor)**

SUSY-related activities at BNL

- **Background estimation methods**
  - **Monte Carlo based: modeling of detector systematics very important – huge overlap with understanding reconstruction etc of basic objects above**
  - **"Data driven" methods (Redlinger)**
    - **More direct estimation of the background from the data itself, using control samples. Backgrounds from ttbar, W+jets, QCD multijet under study**
    - **Such samples will also be useful for Monte Carlo tuning**
- **Statistical issues (Cranmer, Redlinger)**
  - **Methods of treating systematic uncertainties e.g. in background estimates**
  - **Blind analysis**

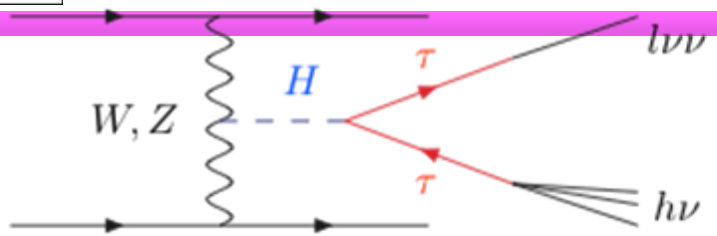
Top background estimation in 1-lepton channel.

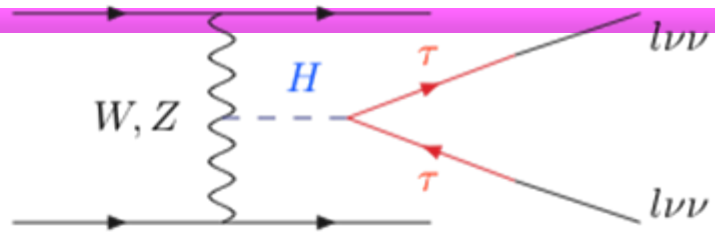


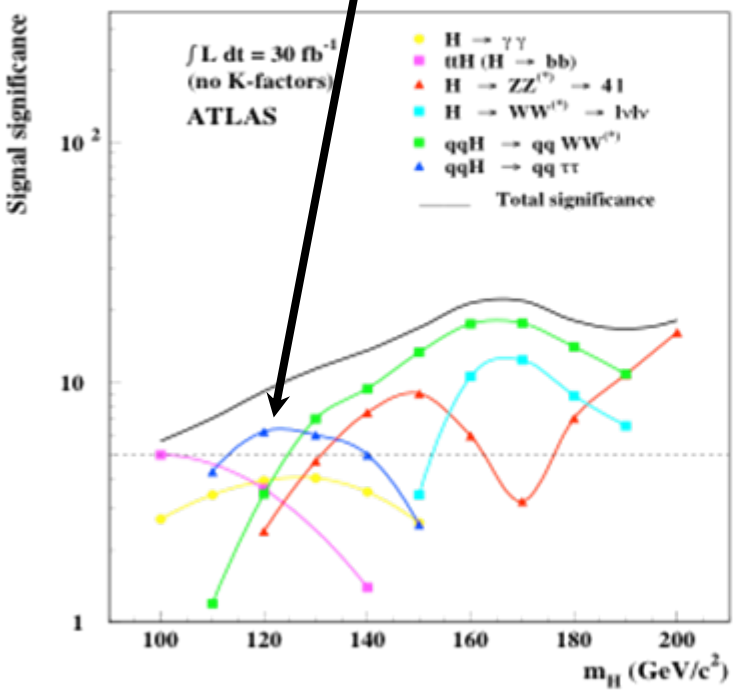


SUSY signal extracted from mixed sample of signal+background.

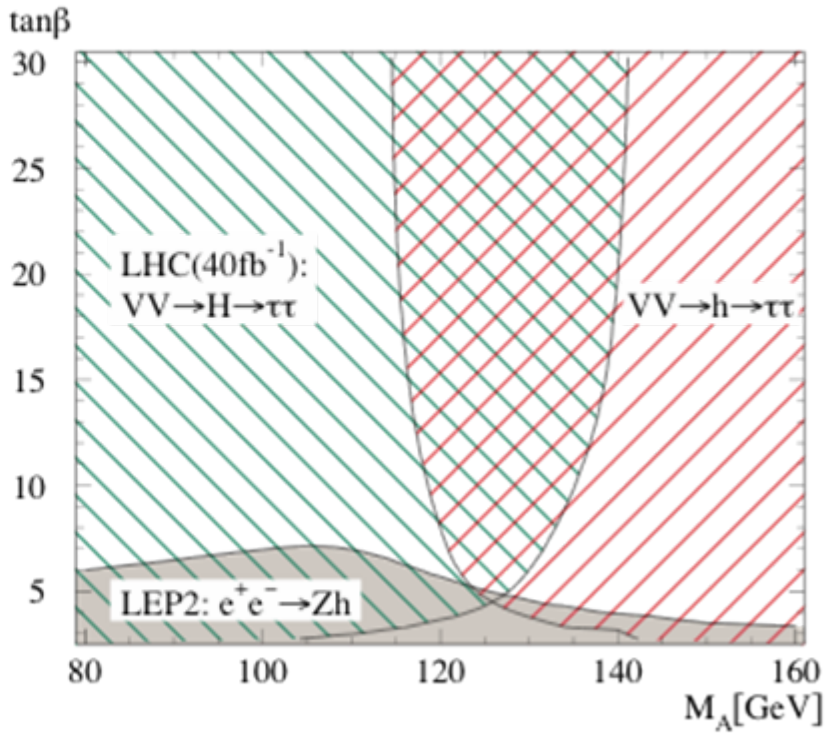
Vector Boson Fusion H→ττ







Standard Model (Atlas Scientific Note)

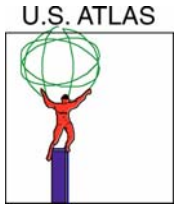


Plehn, Rainwater, Zeppenfeld hep-ph/9911385

Most powerful channel near LEP limit and very important for MSSM.

Vector Boson Fusion H→ττ

- Kyle Cranmer is the co-editor of the CSC note on the subject
  - The note has 42 contributors from 13 institutions
- BNL has taken an active role in this channel
  - Fabien Tarrade just joined BNL as a postdoc (thanks for the support!)
    - he worked on this analysis for his thesis
  - Abid Patwa (D0) just joined the ATLAS efforts
    - he brings expertise from Z→ττ measurements at D-Zero
  - Adam Cunha's contributions are also being included in the CSC note on tau performance
    - presenting work at tau performance meeting in Poland in March '07
  - Kyle Cranmer has been active in this analysis for several years
    - developing new techniques for mass measurement



General Approach to our Detector Involvement

- Construction responsibility matched to unique technical capability at BNL.
- Physics & Instrumentation Division were pioneers in R&D for both LAr calorimeter and cathode strip chambers.
- Contribution to the analysis builds on: detector expertise in the calorimeter and muon systems and Core software strength.
- Much of computing and software aims at insuring that the U.S. can easily access the ATLAS data: data management, Tier 1 and Tier 2's
- ATLAS upgrade concentrates on the tracking system and Calorimeter readout where we take advantage of unique developments. Major role in overall optimization via Upgrade PO activities.

Leading BNL Roles in ATLAS

K. Assamagan	Analysis Tools Coordinator
Kyle Cranmer	Co-Coordinator of ATLAS Jet/EtMiss High Level Trigger Trigger Steering Group
M. Ernst	International Computing Board (and Grid Deployment Board) Member of the World-wide LHC Computing Grid (WLCG) Management Board
H. Gordon Contact	ATLAS Executive Board-> Mike Tuts as of 3/07, National Physicist
F. Lanni	LAr Upgrade Coordinator
D. Lissauer	Leader of Technical Coordination Project Office (Task A); Head of Upgrade Project Office for Technical Coordination
H. Ma	Until 3/2007: LAr Database Coordinator, Co-coordinator of LAr Commissioning Analysis 2007: Calorimeter Performance Co-coordinator, LAr Management Group, ATLAS Soft Proj Mgm. Group LAr Speaker's Committee
S. Rajagopalan	Event Data Model Architecture; Until 3/2007: Calorimeter Performance Co-coordinator, LAr Management Group, ATLAS Soft Proj Mgm. Group 2007: Trigger Steering Group for Trigger Menu Integration
V. Polychronakos	Cathode Strip Chamber Leader

New since last year

BNL Deliverables to the ATLAS Experiment

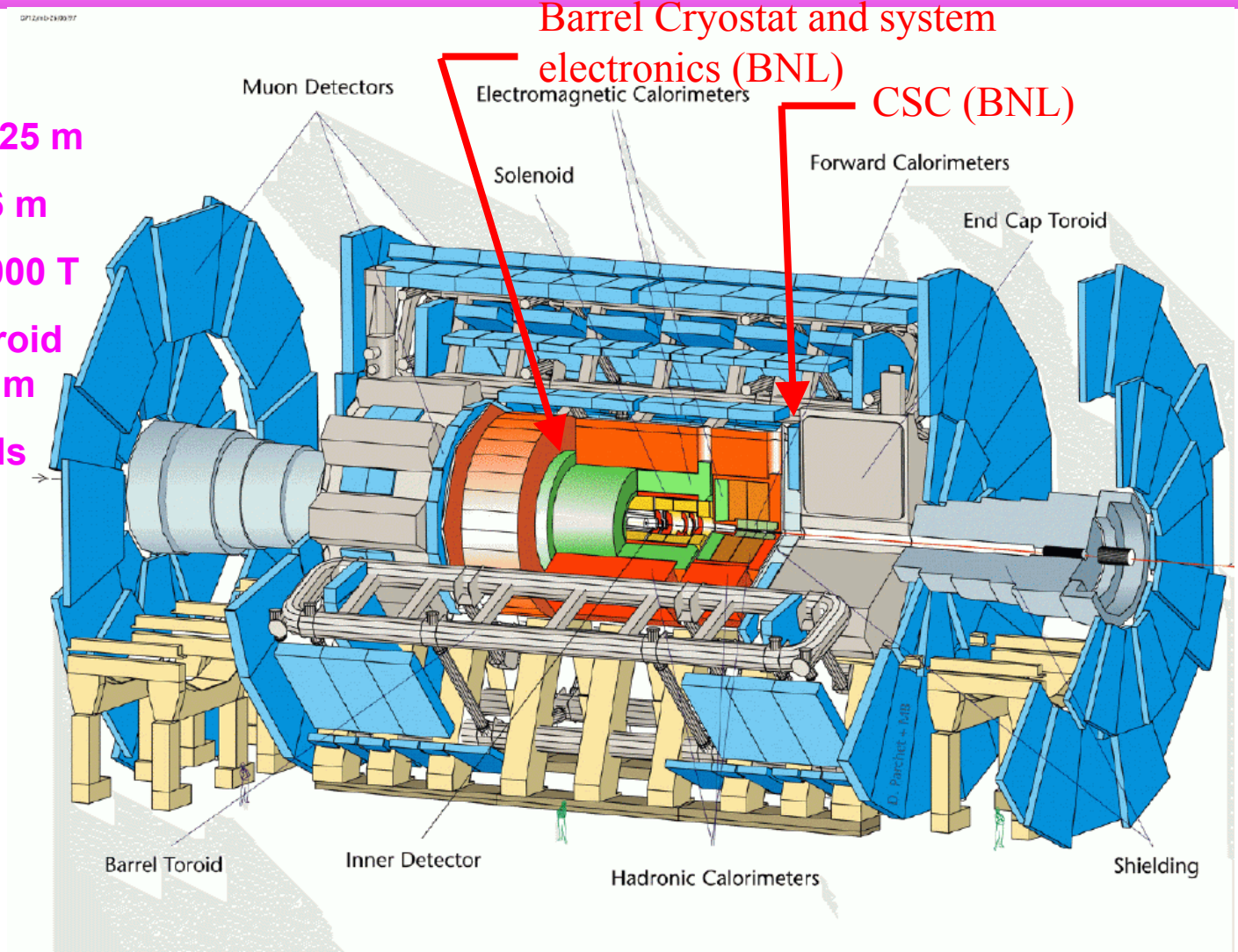
Diameter 25 m

Length 46 m

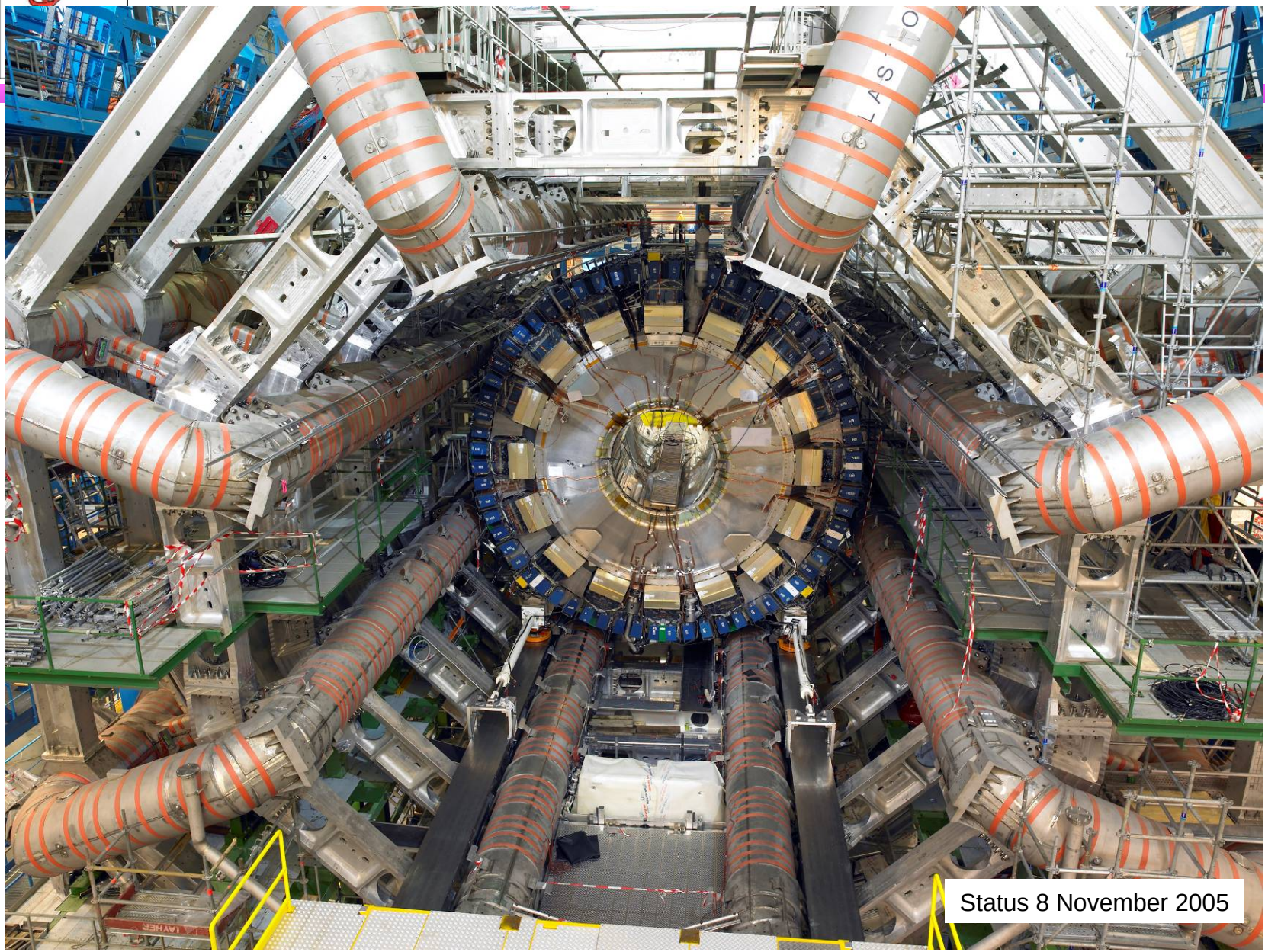
Weight 7000 T

Barrel Toroid length 26 m

 # Channels >10^8



Barrel TileCal and Liquid Argon at z=0

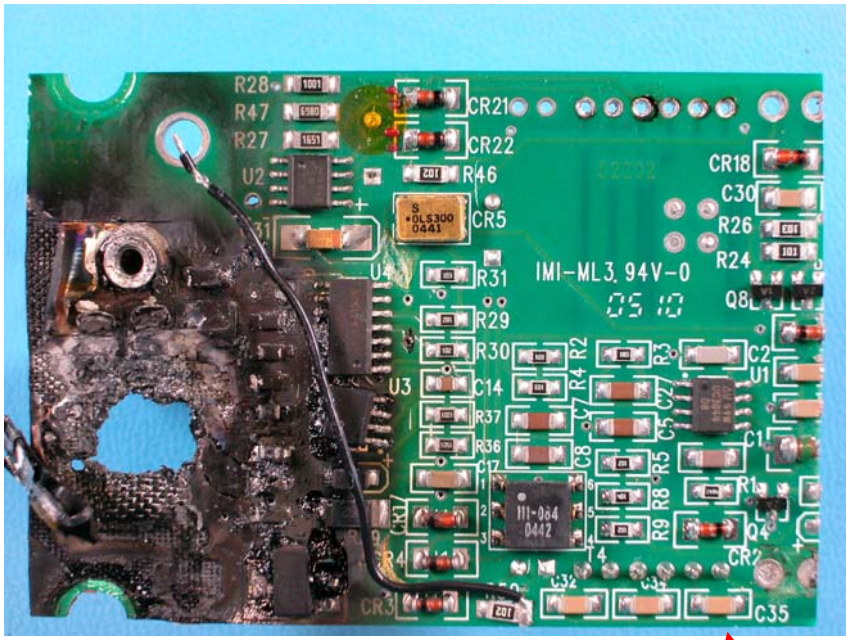


LAr FEBs and Power Supply System

LVPS location on the Barrel Cal.

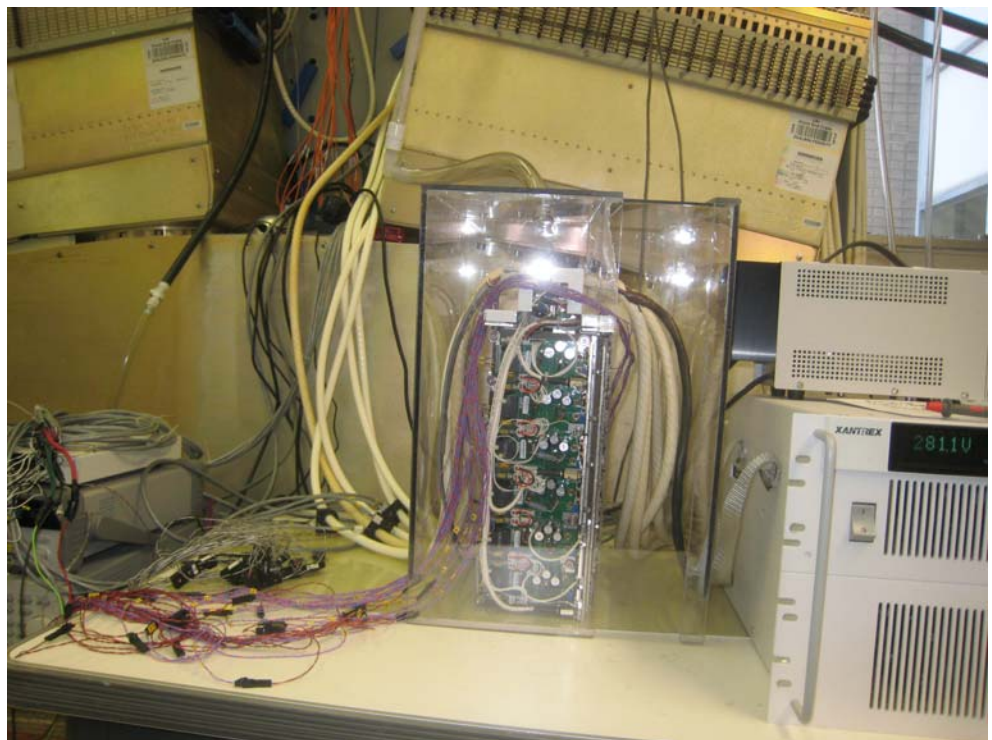
Front End Boards (FEB) in System Crates

Liquid Argon DC-DC Converters



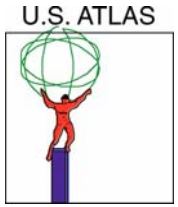
We had delivery of 70 units – but there were many failures: thermal and design issues were found.

This is the first retrofitted unit which passed all specifications in April 2007. Old design operated at 80% of spec at 37°C while the new design runs at 120% of spec at 37C while the new design runs at 120% of spec at 37°C.



LAr DC-DC Power Supplies - Covered under M&O (Maintenance)

- A new Task Force formed in October 2006 significantly strengthened by engineers from the Collider Accelerator Department (CAD)
- A 3 prong action plan was developed and executed:
  - Found a new vendor to reverse engineer the existing power supplies – original vendor claimed intellectual property rights and would not release the drawings, etc.
    - Complete
  - Found a new vendor to do a Worse Case Circuit Analysis (WCCA) to determine whether the circuit is sound and can be salvaged
    - Completed. Found significant problems with the components and design. About 50 components needed to be changed – some due to Task Force, most from WCCA firm and some from the retrofitter – all added value.
  - Found a new vendor to do the retrofitting
    - We are in the process of retrofitting the 70 supplies
    - We have tested the first supply extensively and found it to work well and within all specifications (including coherent noise)
    - The vendor can retrofit 10 supplies/week once we test the first supplies at CERN
    - First shipment to CERN of four supplies left the U.S. for CERN 4/12/07!!!

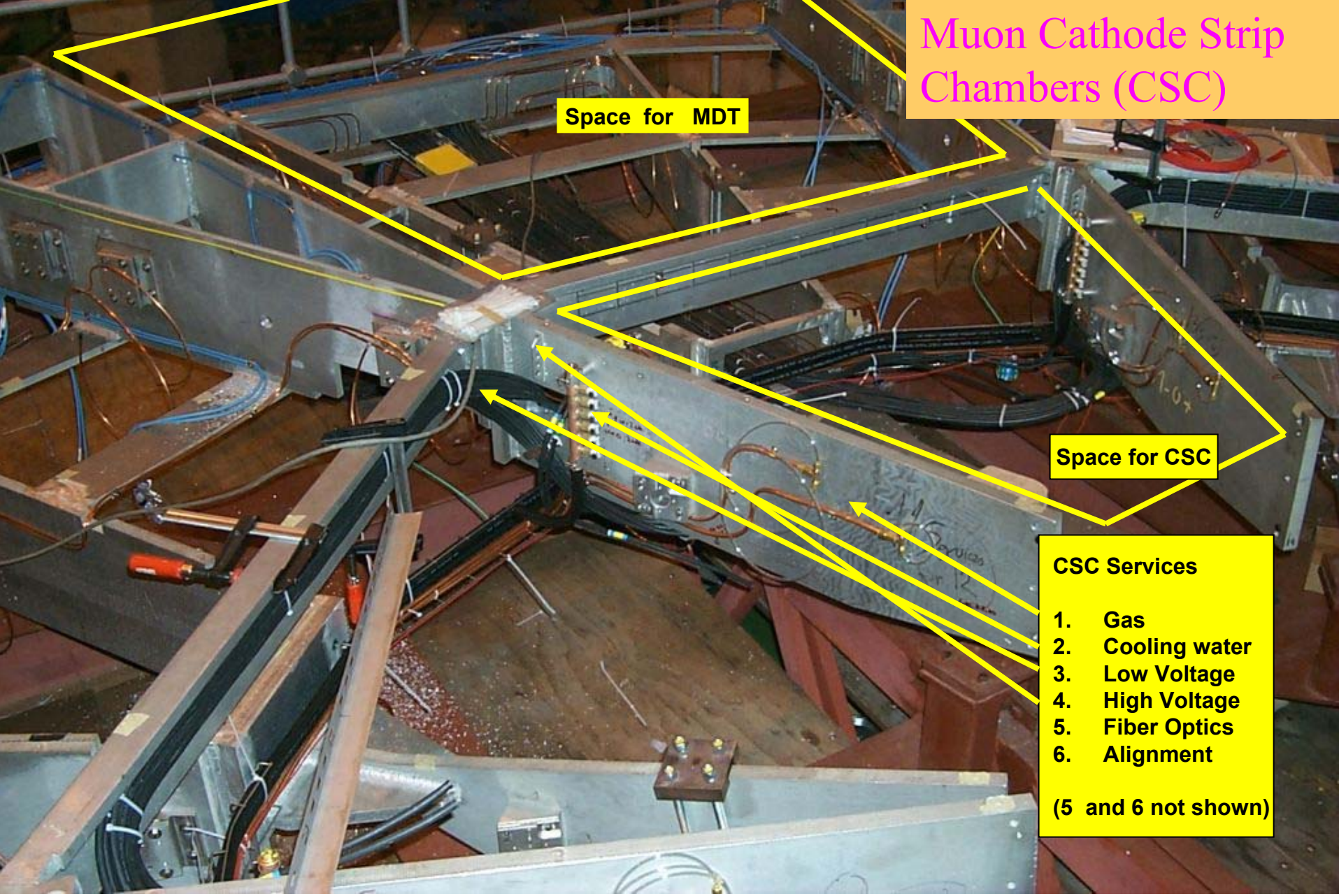


Liquid Argon Low Voltage PS Backup Solution

- In parallel we sent out a request for a totally new design
- Bids are being evaluated

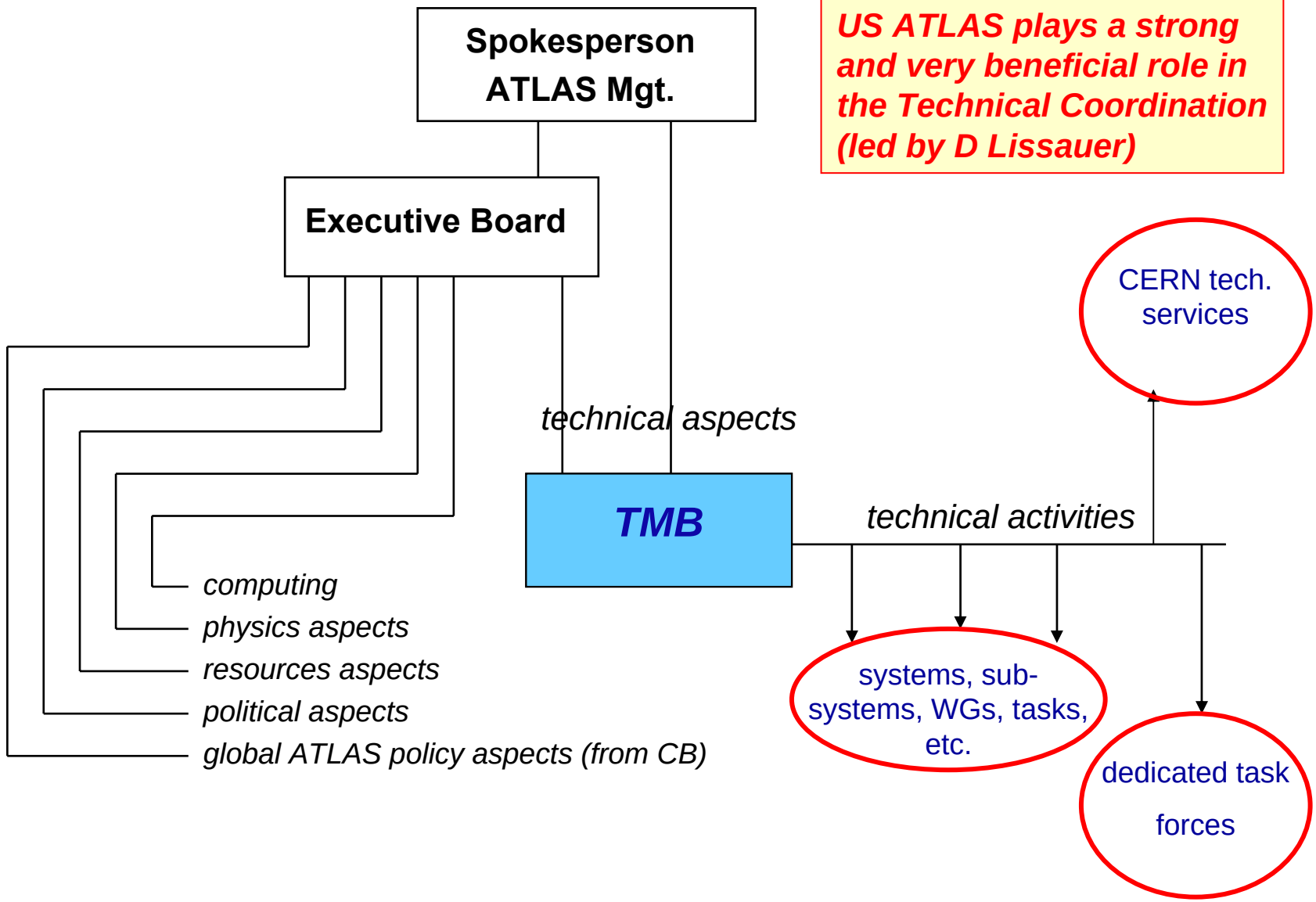
Cathode Strip Chambers (CSC)
Chamber Preparation Lab (Bat 184)
Cosmic Ray Test Setup

Muon Cathode Strip Chambers (CSC)



Small wheel "C" in horizontal position – Installation of MDT and CSC Services

Technical Management Board - TMB (Chaired by the Technical Coordinator)



US ATLAS plays a strong and very beneficial role in the Technical Coordination (led by D Lissauer)

David Lissauer is a Leader in ATLAS Technical Coordination

- *Highlights from TC Activities in '06 (Installation & Commissioning)*
  - *Infrastructure Highlights*
  - *Detector Installation Progress, Status and Plans.*
    - *Toroid Magnet – Barrel and EC*
    - *Muon System – Barrel Muons, EC Muons assembly*
    - *Calorimeter System – Barrel System, EC System*
    - *ID Detector*
    - *Counting & control rooms – Combined Runs*
- *Upgrade PO Activities*
    - *Organization*
    - *TC functions*
- *US Involvement in TC -*
  - *TC/Upgrade Project Office* — *BNL*
  - *Configuration Control – Envelopes* — *BNL*
    - *Placement Specifications – sign off* — *BNL*
    - *Floor stability monitoring.* — *BNL*
    - *Beam Pipe Installation* — *BNL,LBNL*
  - *Access/Installation – Tooling and strategy* — *BNL,ANL*
  - *Movements – Design, control system* — *ANL, BNL, Brandeis*
  - *Pixel Installation – Beam Pipe* — *LBNL*

The BNL ATLAS Tier 1 Is Operating at a World Class Level

- **BNL Tier 1 is largest ATLAS Tier 1 and is delivering capacities consistent with this role**

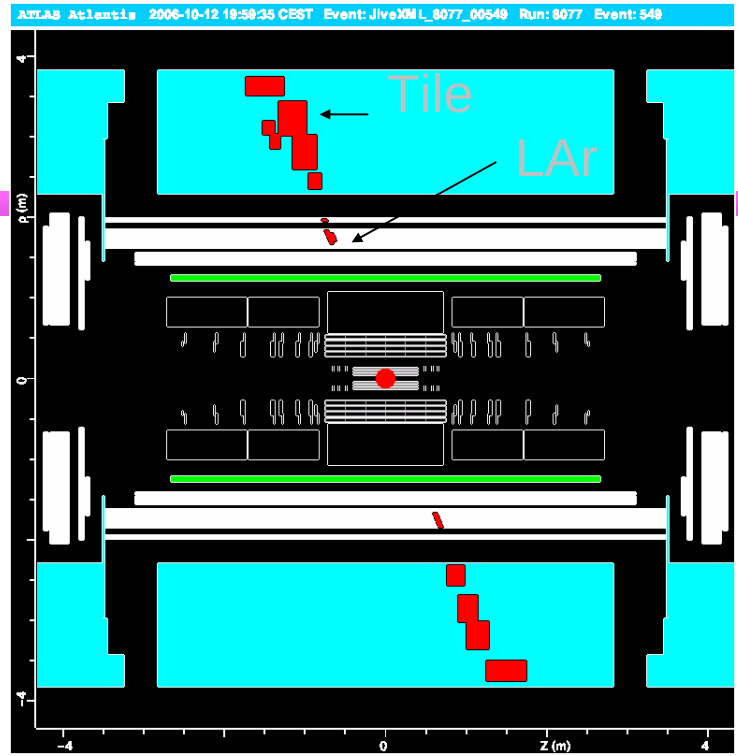
WLCG Accounting: ATLAS Tier-1's + CERN Apr - Oct 2006

	CPU use		disk occupancy		tape occupancy	
	KSI2K-days	% of total	TB at end of period	% of total	TB at end of period	% of total
CERN Tier-0 + CAF	95,858	28%	182	48%	469	35%
ASGC	13,413	4%	20	5%	13	1%
BNL	88,184	26%	48	13%	357	27%
CC-IN2P3	24,264	7%	15	4%	153	12%
CNAF	20,108	6%	18	5%	95	7%
FNAL	4,619	1%	-	0%	-	0%
FZK-GridKA	23,195	7%	26	7%	115	9%
NDGF	18,761	6%	28	7%	-	0%
NL LHC/Tier-1	14,574	4%	10	3%	18	1%
PIC	6,207	2%	8	2%	54	4%
RAL	27,672	8%	14	4%	54	4%
TRIUMF	1,876	1%	7	2%	-	0%
TOTAL	**338,731**	**100%**	**376**	**100%**	**1,328**	**100%**

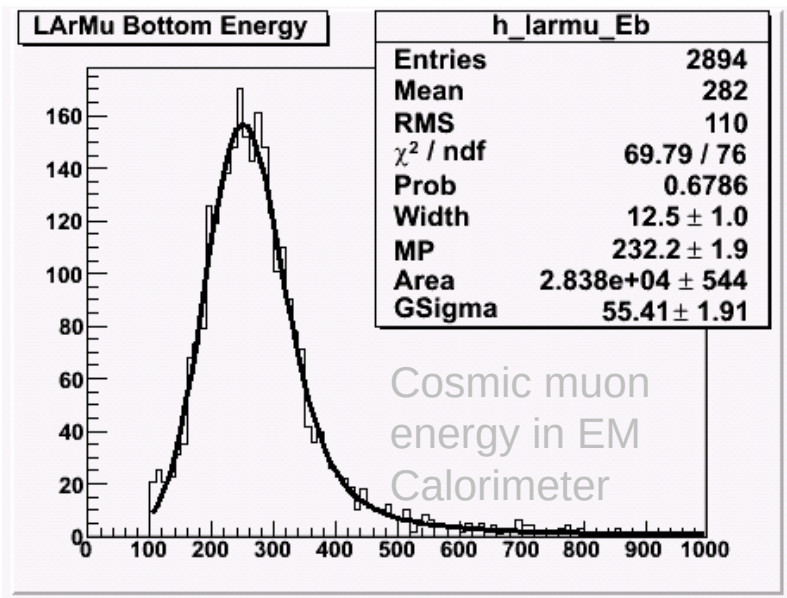
Calorimeter Performance

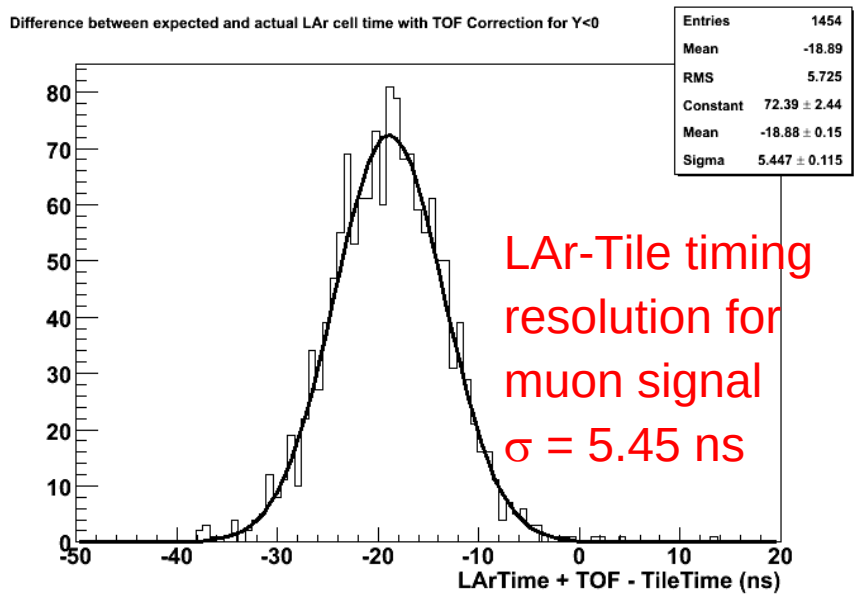
- **Co-coordinator for Calorimeter Performance**
  - S. Rajagopalan has coordinated this effort for 4 years, recently stepped down to continue trigger work
  - H. Ma assumes this role in 2007
  - Coordinating all calorimeter related software development, and responsible for calorimeter performance
- **EM calorimeter calibration**
  - S. Snyder leads the effort of EM cluster level corrections
    - Co-editor for note "EM Calorimeter Calibration and Performance"
  - Electron identification in calorimeter
    - Optimizing the variables, improving efficiency

Calorimeter Commissioning Analysis



- **H. Ma: LAr calorimeter commissioning analysis co-coordinator**
  - Electronics calibration
    - Calibrating 180k channels
  - Cosmic muon data analysis
    - Collected cosmic muon data in Aug/Oct 2006
    - Evaluating calorimeter performance

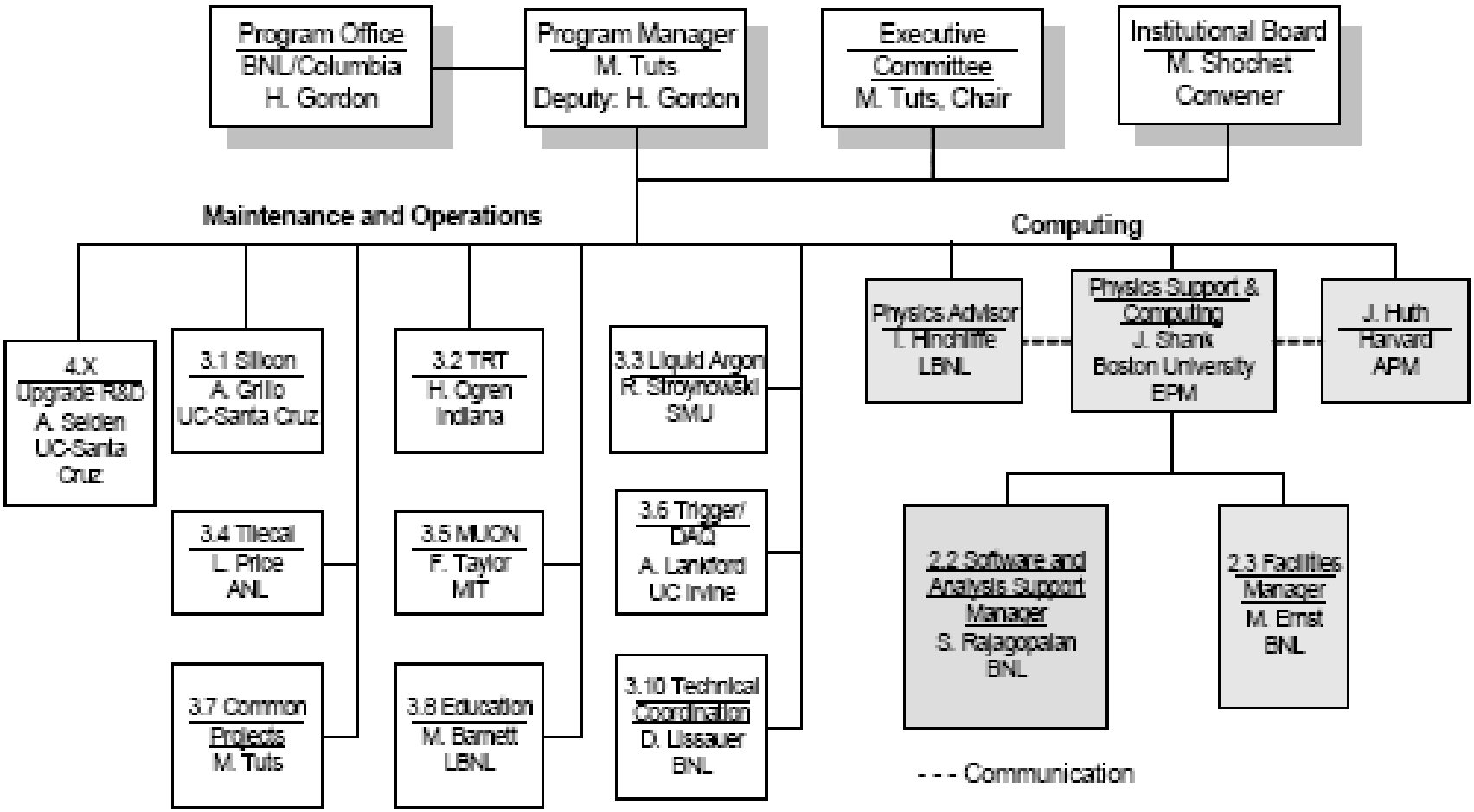


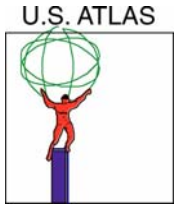


U.S. ATLAS

Research Program Organization

U.S. ATLAS Research Program Organization as of February 1, 2007





BNL Roles in U.S. ATLAS

- **H. Gordon, Construction Project Manager;**
  Deputy Research Program Manager
- **S. Rajagopalan, Software Subsystem Manager, WBS 2.2**
- **T. Wenaus, Distributed Software Manager, WBS 2.2.4**
- **A. Undrus, Software Infrastructure, WBS 2.2.6**
- **H. Ma, BNL Analysis Support Center Coordinator, WBS 2.2.7.1; Shuwei Ye, Analysis Support**
- **M. Ernst, Computing Facilities Manager, WBS 2.3 (R. Popescu, Deputy)**
- **P. Nevski, Grid Production, WBS 2.3.4**
- **D. Lissauer, Technical Coordination Subsystem Manager WBS 3.9,**
- **T. Maeno, K. Assamagan – Analysis Support Group**
- **K. Cranmer, Trigger Forum; F. Paige, SUSY Forum**

U.S. ATLAS Project and Research Program Management

- BNL is the Host Lab for the 41 U.S. institutions in ATLAS
- We have (almost) constant reviews
- We are active in the transition from a successful Construction Project to the Research Program which includes:
  - Construction Project achieved CD-4A Sept. 30, 2005 – 97% + Complete
    - CD-4B is planned to complete Sept. 30, 2008
  - M&O – consisting of pre-operations and commissioning
    - Highlight LAr M&O
    - Technical Coordination and New Upgrade Project Office
  - Computing: Highlight PanDa
  - Upgrade R&D: Highlight Stave Measurement Device
- We are responsible for (monthly and quarterly) reports, budgets, MOUs, and other exercises

Analysis Support Centers (ASC)

- **Main task:**
  - **Provide US ATLAS physicists with regional resources, tutorials, support, leadership and focal point for meetings**
- **3 ASCs:**
  - **Argonne National Lab: Midwest region**
  - **Brookhaven National Lab: Eastern region**
  - **Lawrence Berkeley National Lab: Western region**
- **Choice of 3 centers is motivated by the ability to tap into the considerable infrastructure and human resources available at those laboratories**
- **Also, it facilitates access to support and expertise for US physicists at 'nearby' Universities**

(2) Analysis Support Centers

- **ASC Role (cont'd):**
  - **Expertise:**
    - **Basic software support as indicated above**
    - **Some members of the ASG will be stationed at an ASC, this reinforces areas of expertise that already exists regionally:**
      - **ANL: Hadron calorimetry, jet reconstruction & calibration**
      - **BNL: LAr calorimetry, e/gamma ID, trigger for e/gamma, jets, missing E_T + regional groups for Muon tracking and ID, analysis tools, b-tagging**
      - **LBNL: Inner Detector tracking, b-tagging, vertexing**
    - **Physics analysis through ASC physicist involvement in ATLAS physics**
  - **Coordination:**
    - **ASC coordinators oversee local support activities**
    - **ASG chair coordinates the activities at the 3 ASCs:**
      - **Tutorial and analysis support coordination across ASCs**
      - **Monthly meeting between ASC coordinators and ASG chair**
      - **Compilation of ASC-use metrics to assess effectiveness**

BNL ASC MOU section

Name	Software/Detector Performance		Physics Analysis	
	ATLAS Fraction	Area of Expertise	ATLAS Fraction	Area of Activity
Ketevi Assamagan	60%	Physics Analysis Tools Muon performance	20%	Higgs BSM
Kyle Cranmer	80%	Physics Analysis Tools MET/Jet/tau Trigger	20%	Higgs SUSY
Denis Damazio	40%	Calorimeter and egamma Trigger	20%	Standard Model
Hong Ma	70%	LAr Calorimeter Egamma performance Commissioning	10%	Standard Model
Frank Paige	30%	Jet & MissingET reco Physics validation	50%	SUSY
Srini Rajagopalan	60%	Athena Framework LAr Calorimeter Egamma reco/perf	10%	SUSY
George Redlinger	20%	Trigger performance	80%	SUSY
Scott Snyder	50%	Core and Calorimeter Software EM calibration	20%	Higgs
Iuliu Stumer	50%	Magnetic Field		
Total commitment	4.6FTE		2.3FTE	

BNL ASC MOU Section

Name	Available ASC Fraction	ASC Support Areas	Source of Support
David Adams	20%	Data management	US ATLAS Research Program/SW
Ketevi Assamagan*	20%	Analysis Tools	BNL HEP Core Program
Wensheng Deng	20%	Production Data management	US ATLAS Research Program/Production
Hong Ma	15%	ASC coordination Tier-1 usage	BNL HEP Core Program
Tadash Maeno*	10%	Distributed Analysis	US ATLAS Research Program/SW
Pavel Nevski	20%	Production/Validation	US ATLAS Research Program/SW
Alex Undrus	50%	Basic Software support	US ATLAS Research Program/SW
TOTAL	1.55FTE		

Analysis Support Center at BNL (ANL and LBNL also have Excellent Centers)

- Users feedback from Aug 06 Analysis Jamboree at BNL:

Question (1=poor, 5=excellent)	Average
Analysis software tutorials	4.7
Analysis Support Center infrastructure	4.4
Analysis Support Center help	4.7
Analysis Jamboree format	4.5
Would you attend another at BNL?	19 Yes 1 maybe

"The tutorials were extremely useful... impressed with the way they were prepared"

"Support people were very helpful and generous with their time"

BNL's Analysis Support Center

- Users feedback from Dec 06 Analysis Jamboree at BNL:

Question (1=poor, 5=excellent)	Average
Analysis working sessions	4.8
Analysis Support Center infrastructure	4.6
Analysis Support Center help	4.8
Analysis Jamboree format	4.5
Would you attend another at BNL?	12 Yes 2 maybe

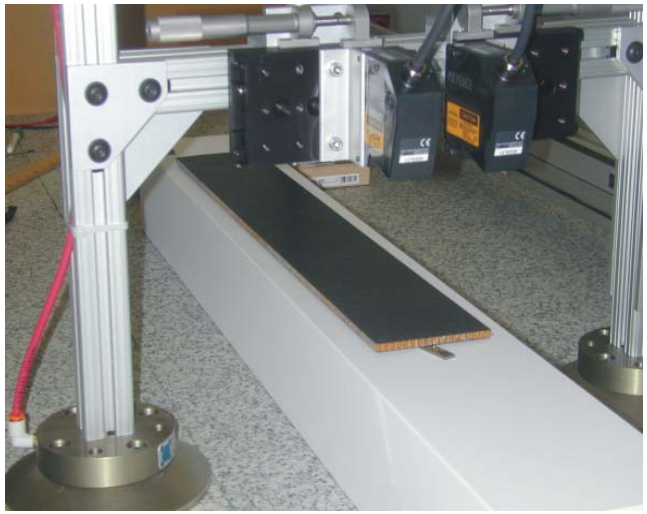
"Great and generous help… very receptive to feedback"

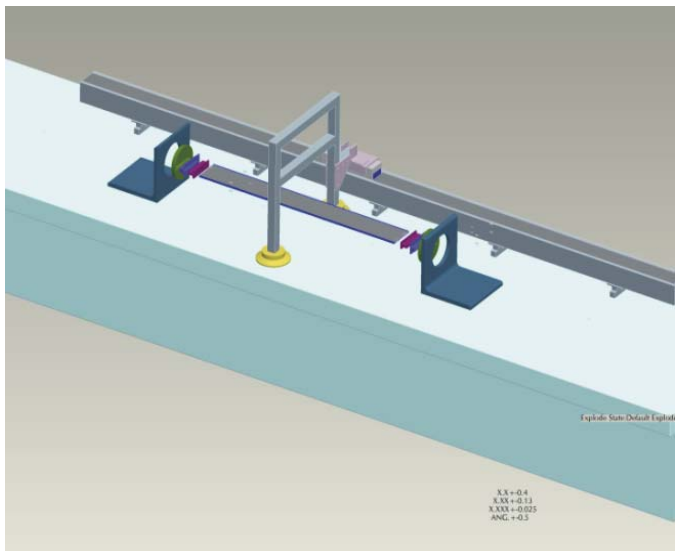
"The [analysis support] team is first rate"

Analysis Support Activities

- **BSM CSC Notes Jamboree, 18-20 Dec 06 at BNL ASC**
  - Focus on Exotics and SUSY CSC Notes with US editors:
    - Dileptons + diphotons
    - Leptons + Jets
    - Lepton + Missing Et
    - Inclusive SUSY
    - Heavy Flavor background for SUSY
  - Subgroups formed and led by these editors
    → stimulate increased collaboration among US physicists
    → get new people involved
  - Analysis code examples provided by editors
  - Specific CSC notes issues/needs addressed & worked on
  - Physics analysis tools experts from BNL ASC participated
- **Next Jamboree is May 14-18, 2007**

BNL Stave Measurement Station for Upgrade R&D – David Lynn

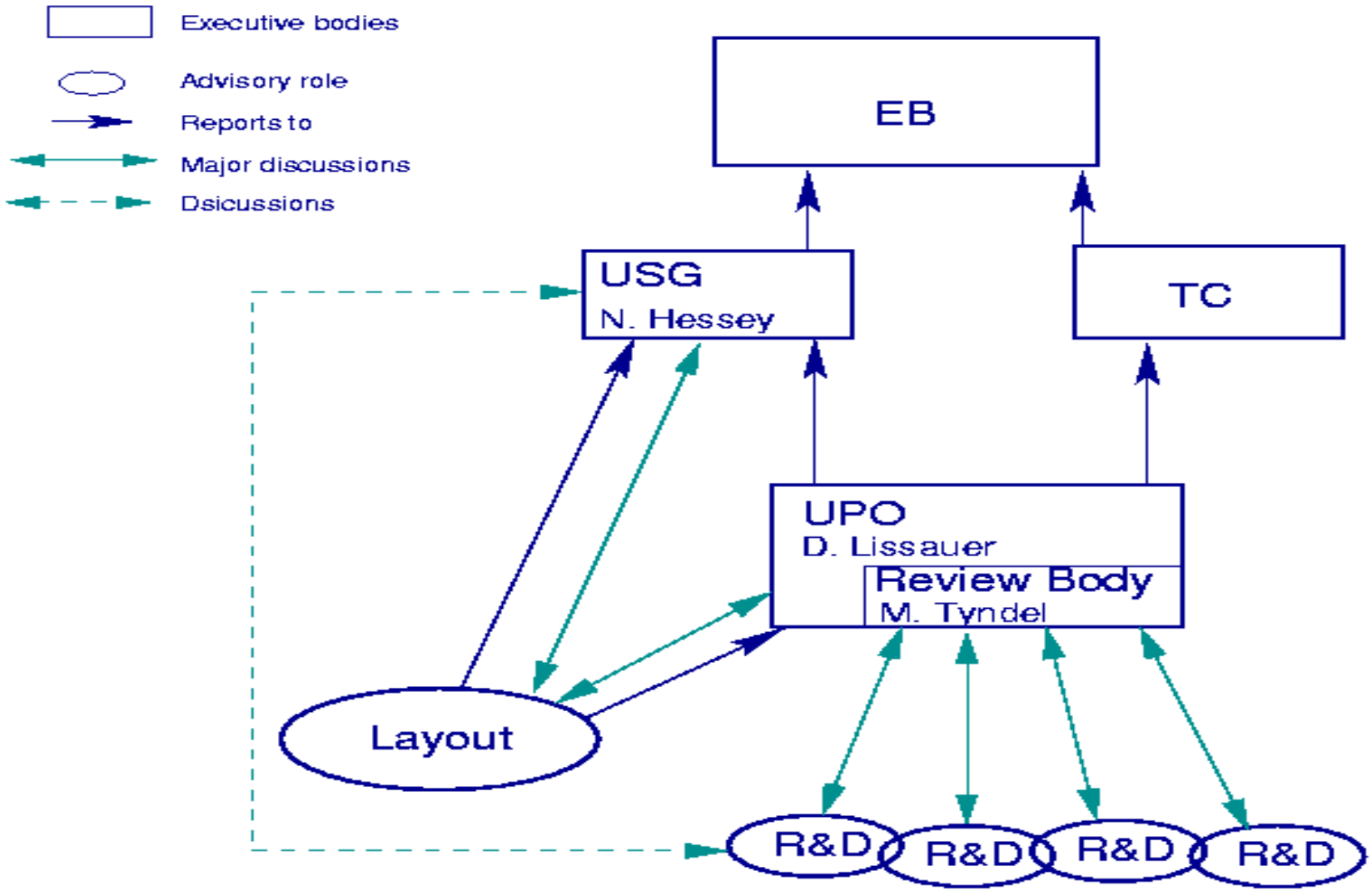




- BNL Stave Sag Measuring Station is close to complete
- Better than 1 um accuracy

Will cool staves down to -40 Deg C(F)

ATLAS Upgrade Organisation



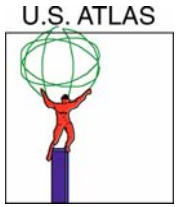
Upgrade Project Office (PO) (D. Lissauer, head)

1. *ATLAS upgrade PO is being established to implement the ATLAS organization for the upgrade R&D.*
   - *Planning, Review, Configuration Control, Safety, Infrastructure Services, Integration*
2. *Resources from the collaboration will be needed to fill key positions in the upgrade plan. (As manpower become available in the institutions please contact us to see how best to integrate the effort – especially from outside institutions)*
3. *The PO will play an active role in maintaining the R&D focused on the ATLAS upgrade needs.*

Summary

- BNL physicists supported from the CORE Research Program are playing leading roles in ATLAS (and U.S. ATLAS)
- As the data comes out of ATLAS in FY08+ we would like to grow the program by about 2 FTEs (postdocs) + travel since so much of the activities will be at CERN and the physics of the LHC is so promising.
- KA110102 – Budget Issues (k$)

FY06 Actuals	FY07 Pres. Req	FY07 Revised Request	FY08 Revised Request	FY09 BY Request
4,166	4,655	4,679	5,617	6,104
13.76 FTEs		15.71 2 PD (+$250k)	18.66 +3 Post Docs	18.72 Same level as 08



Conclusions

- **BNL is playing a leading role in U.S. ATLAS and ATLAS overall:**
  - **Physics**
  - **Management**
  - **Detector Construction/Technical Coordination → Installation→ Commissioning →M&O**
  - **Computing**
  - **Upgrade R&D**
  - **We are really excited with the physics starting soon!**
- **The erosion of the "Core Research" Program support prevents us from reaching our full potential**
  - **BNL has little flexibility in funding since the budgets are less than flat-flat**
  - **Many Core Research supported physicists have critical responsibilities**
  - **Therefore we need support for a couple of more post-docs for physics analysis.**