

# HEP Programs at ANL

HEP at ANL

HEPAP

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# HEP at Argonne

## Major Components

HEP at ANL

Accelerator R&D

Theory

Experiment

- **CDF**
- **ZEUS**
- **Soudan 2**
- **MINOS**
- **ATLAS**



## Advanced Accelerator R & D Activities at ANL

### HEP at ANL

Leading research group in research on wakefield phenomena for acceleration, particularly for dielectric based acceleration.

Operate a unique high current RF photocathode based linac.

Capable of collinear and parallel wakefield measurements.

Present focus:

- **generation, acceleration and propagation of high current, short beams**
- **dielectric wake field acceleration, generation of high power rf**
- **two beam acceleration for future linear colliders**



# Recent Progress in Advanced Accelerator R & D

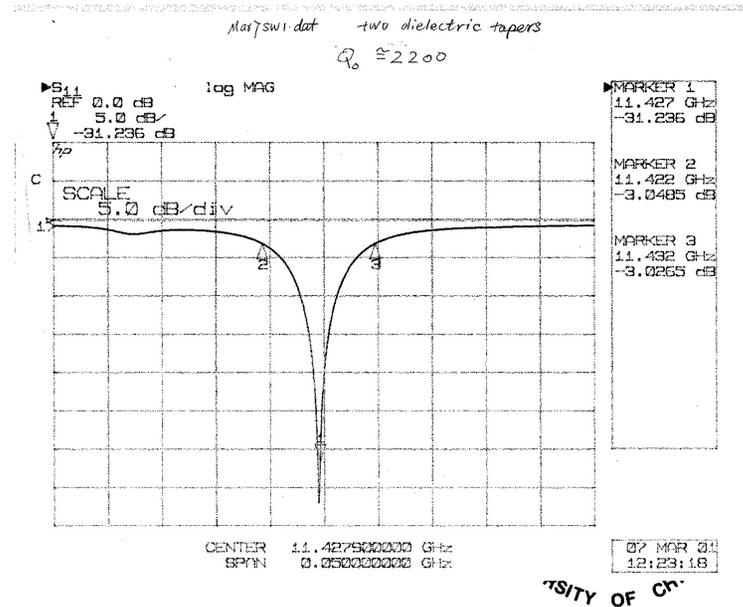
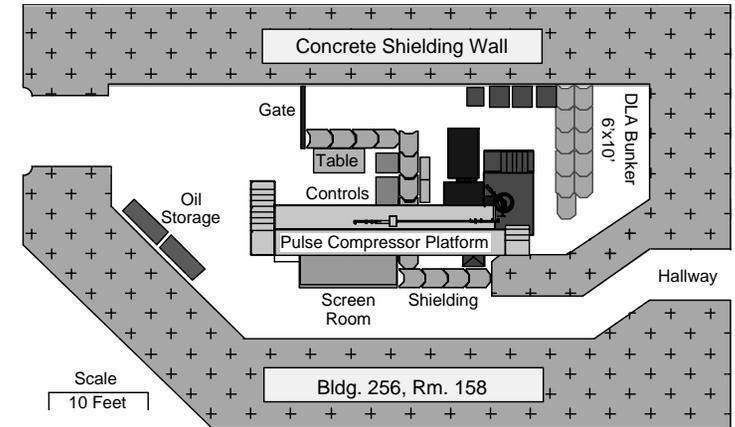
## HEP at ANL

Progress in two-beam acceleration with large transformer ratios

- Reported in October

Dielectric Loaded Accelerator

- We have established a dedicated high power test facility at NRL. Will test both standing wave and travelling wave structures up to 80 - 100 MV/m.
- Constructed a new standing wave accelerator, with good properties. (-30 dB coupling, S11). Measured Q agrees with theory very well.
- Developed a new hybrid iris/dielectric loaded structure, it reduces the iris field by a factor of 3 while maintaining high acceleration gradient on axis.

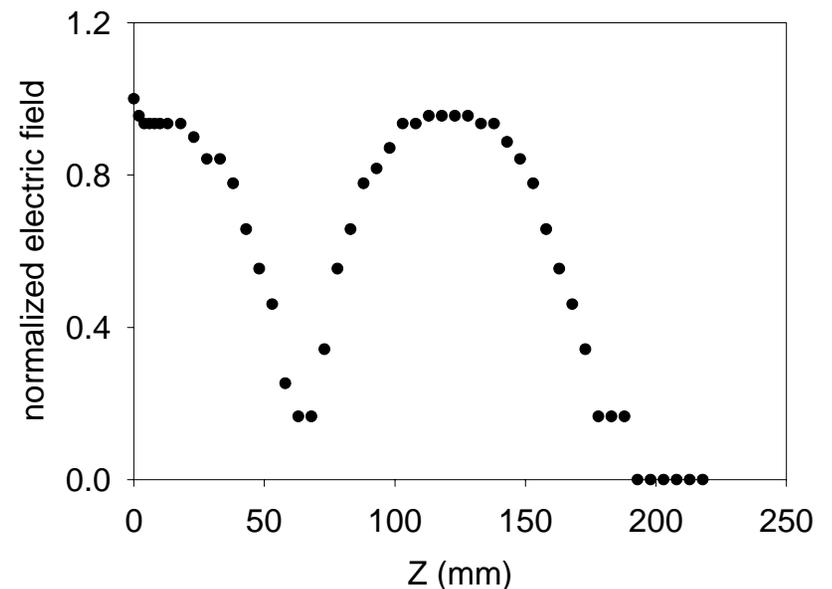
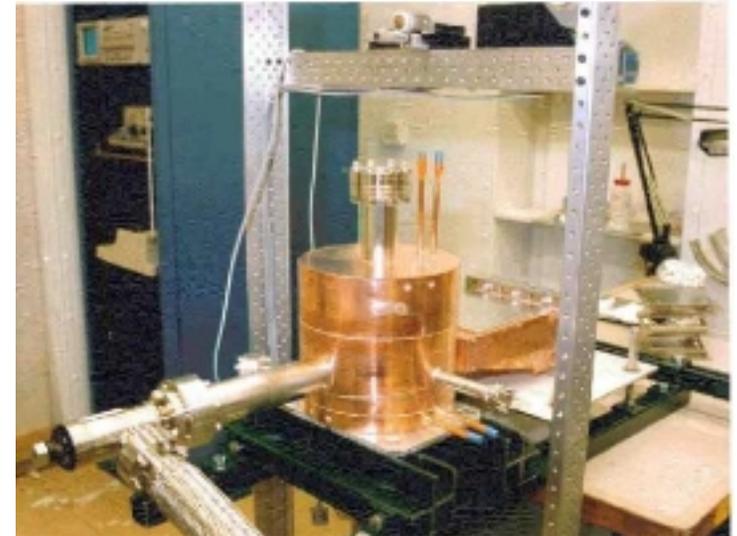


# Recent Progress in Advanced Accelerator R & D

## HEP at ANL

### AWA facility upgrade

- A new gun is being installed. This gun will produce a beam 10 times brighter (smaller emittance) and 5 times peak (much shorter) current than before.
- New laser delay trombone installed, currently conducting dielectric based two-beam acceleration experiment.



# Theory

HEP at ANL

## Staff

- E. Berger
- G. Bodwin
- D. Sinclair
- C. Wagner (joint U. Chicago)
- A. White
- C. Zachos

## Postdocs

- G. Chalmers
- B. Harris
- D. Kaplan (joint U. Chicago)
- Z. Sullivan
- T. Tait



# Theory

## HEP at ANL

Improved calculation of CP violation in the MSSM and its impact on EW Baryogenesis [Carena, Moreno, Quiros, Seco, Wagner]

Complete bases of Wigner Functions, important for all Noncommutative Soliton constructions, are introduced in comprehensive, efficient generating function form. [Curtwright, Uematsu, Zachos]

Bottom cross section

- Light gluinos decaying to bottom quarks and squarks may explain the high Tevatron bottom x-section. [Berger, Harris, Kaplan, Sullivan, Tait, Wagner]

Brane phenomenology

- By analyzing propagation of scalars in brane worlds, the size of extra dimensions is found to be bounded from above. [Carena, Delgado, Lykken, Pokorski, Quiros, Wagner]

Heavy quark Fragmentation Functions in popular models are shown to be consistent with HQET, in spite of recent challenges. [Bodwin, Harris]

The favorite method of comparing QCD to experiment (two-cutoff phase splicing) has been described in full detail [Harris, Owens]

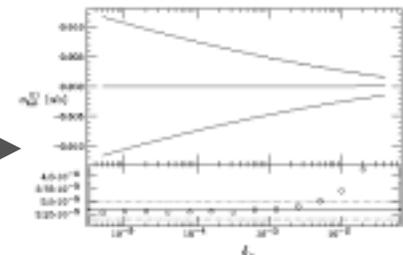
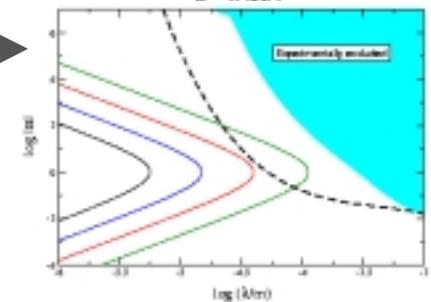
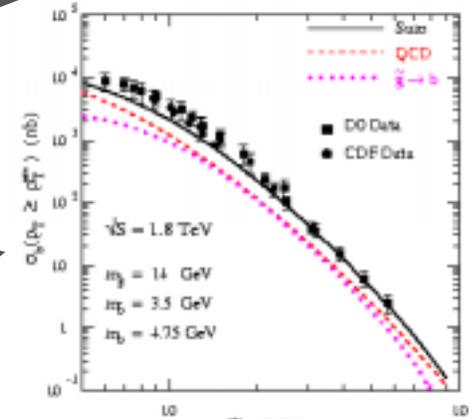
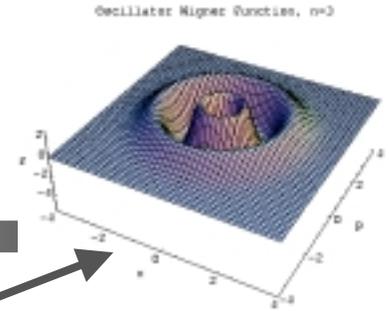


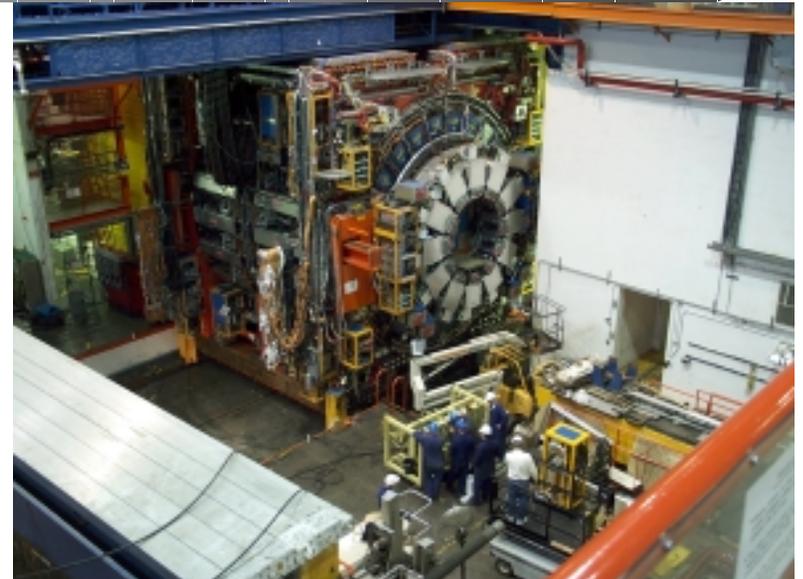
FIG. 6. The next-to-leading order contribution to the total cross section for producing a massive quark pair in electron-positron annihilation via single photon exchange. The two-body (negative) and three-body (positive) contributions together with their sum are shown as a function of the soft cutoff  $\lambda_s$  with the collinear cutoff  $\lambda_c = \lambda_s/200$ . The bottom enlargement shows the sum (open circles) relative to  $\sigma^{(0)}$  (dotted line) of the analytical result (solid line) given in [10], [1.10].

# CDF

## HEP at ANL

### Upgrade for Run 2 (ANL tasks)

- Refurbish Central EM Calorimeter
- Shower Max Detector DAQ
- Calorimeter Isolation Trigger
- Central Outer Tracker
- Muon Upgrade Leadership
- Offline Software Upgrades
- Online Software and Databases
- High Voltage Monitoring
- Shower Max Detector Trigger



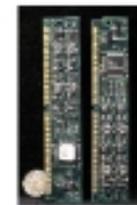
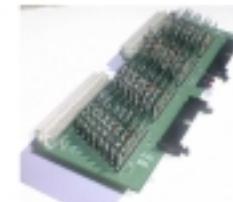
### Electronics Path

Ace Traning  
Karen Byrum  
02/15/2001



Proamps

Proamps on Aux Card



SQUIDs

SQUIDs on SMD cards



# CDF

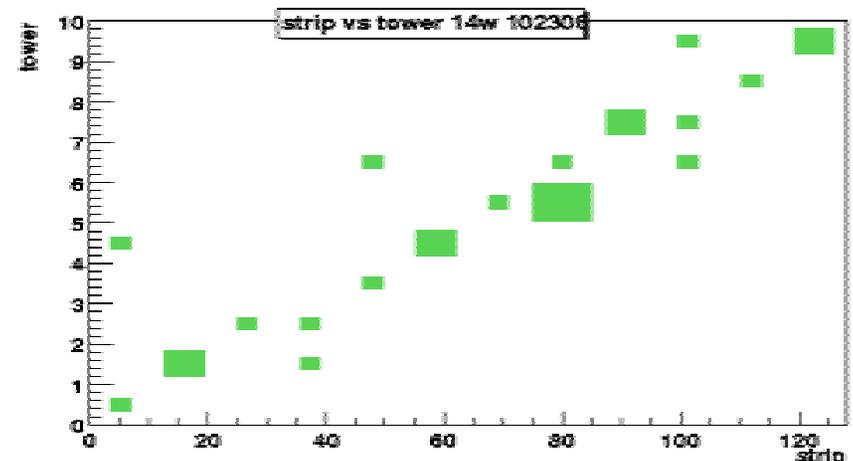
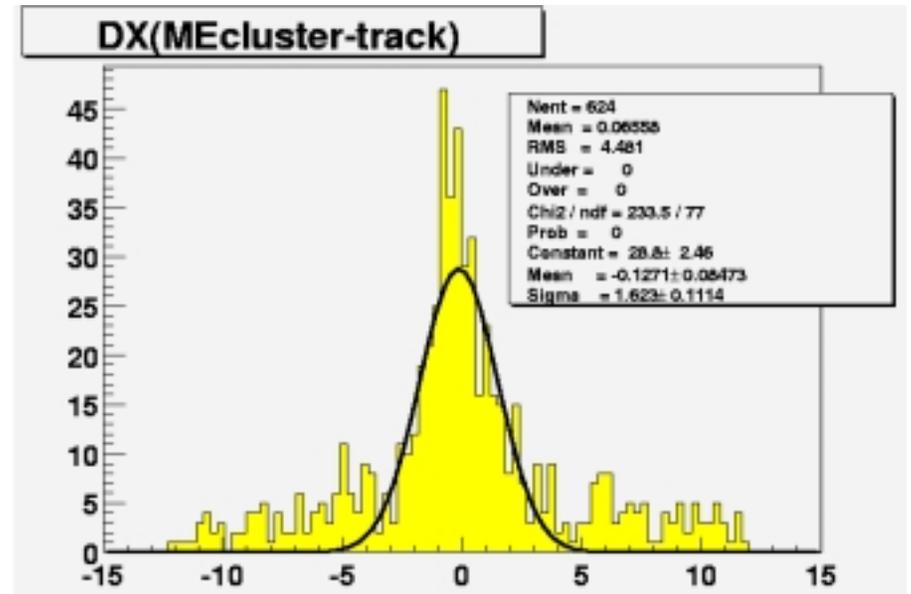
## HEP at ANL

Most upgrades completed earlier

Central EM calorimeter PMTs are ready for physics

Plug shower max is fully instrumented, working

Central shower max is about 1/3 instrumented and on course to be finished during the April or May ~2 week shutdown (during which the bulk of the silicon detector will be plugged in, and accelerator work will be done).



# ZEUS

HEP at ANL

## Upgrades

- New PMT bases being produced at PSU according to ANL design. Testing procedure is being established.
- Construction of Straw Tube Tracker electronics completed. Detector being assembled at DESY. Tracking efficiencies per tube of better than 96% have been measured. (Maximum efficiency due to geometrical limitations around 97%)
- Global Tracking Trigger collecting data from Cosmic Rays traversing the Micro-Vertex Detector



# ZEUS

HEP at ANL

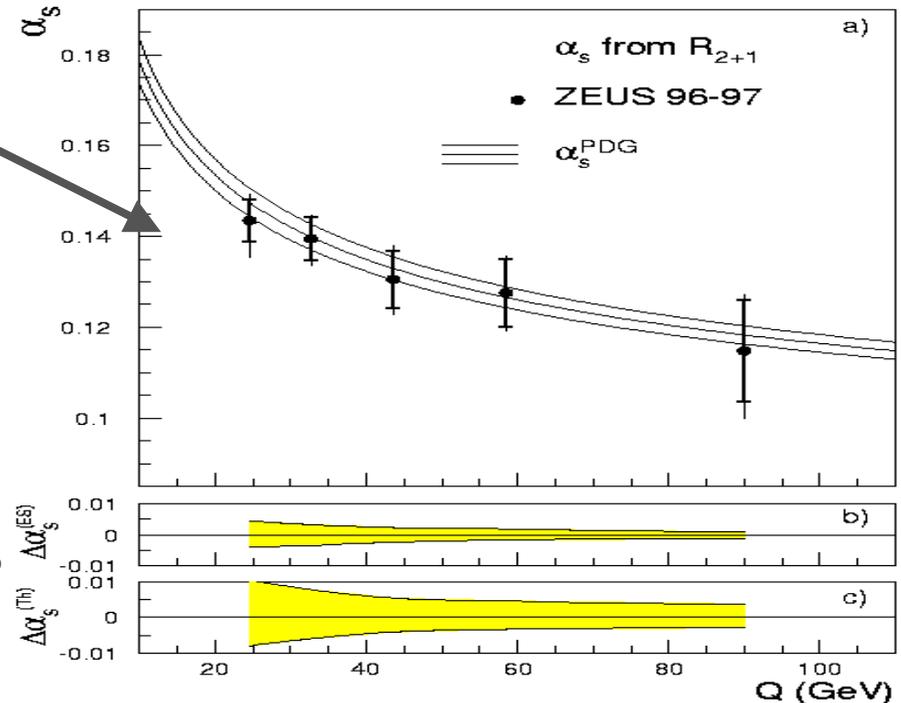
ZEUS

## Physics Results

- High precision measurement of  $\alpha_s$  with 3% experimental error {the theoretical error due to the scale uncertainty is 5%}
- First measurement of  $Z^0$  production cross section {4 events + 4 events background: cross section < 1 pb!!!}

## Other News

- In September 2000 successfully completed the long positron run.
- Delivered luminosity now totals 193 pb<sup>-1</sup>
- Restart of machine somewhat delayed: no significant luminosity until later in the year, then 150 pb<sup>-1</sup>/yr
- Barrel Presampler shown to improve jet energy resolution by ~14%. Further studies using Energy Flow Objects is forthcoming.



# MINOS

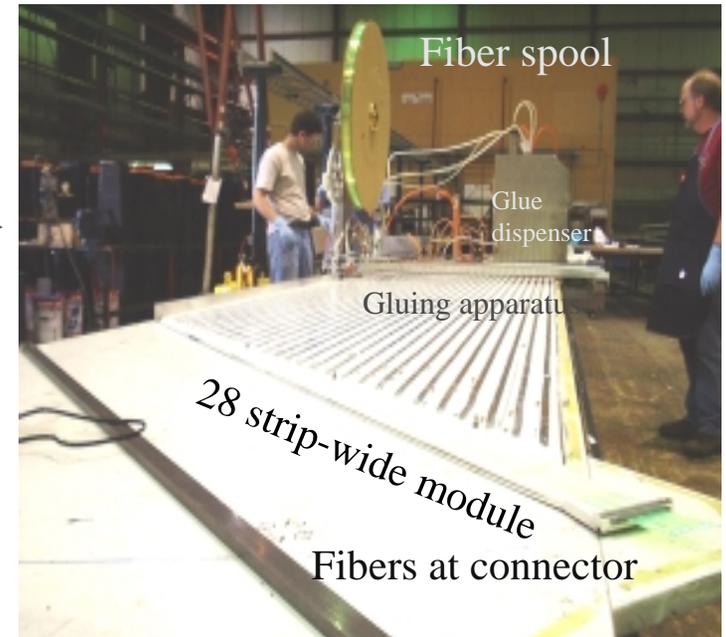
## HEP at ANL

Near detector module factory has been set up and commissioned in Bldg 369.

Production assembly of near detector scintillator modules is beginning.

Caltech and Minnesota far detector module factories have been set up and commissioned, using tooling engineered and built at Argonne.

Both the Minneapolis and Caltech factories are in routine production.



# MINOS

HEP at ANL

Excavation of the new MINOS detector cavern at Soudan was completed in December and the cavern outfitting is about half done.

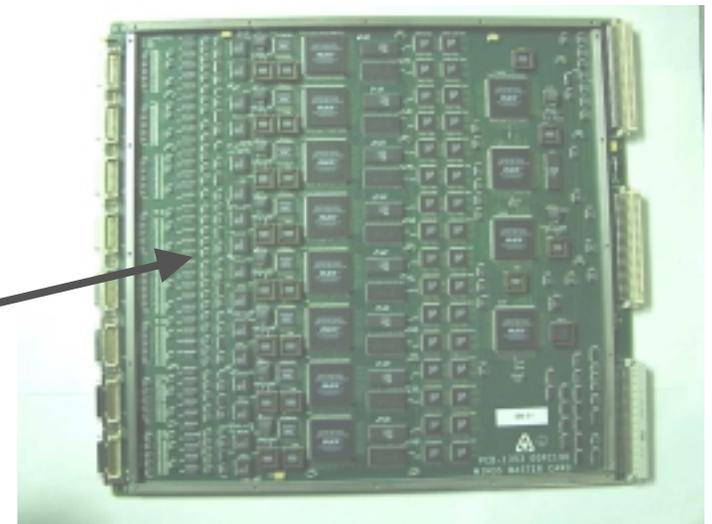
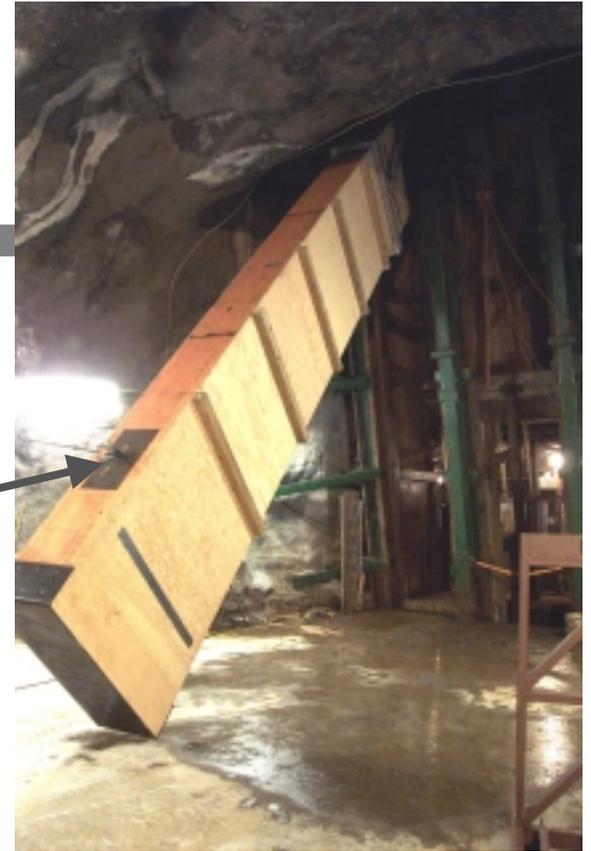


# MINOS

## HEP at ANL

### Other recent milestones

- The first scintillator module crate (empty) was moved underground on March 17 as a test. First full crate of modules is scheduled to be moved underground on March 31.
- ANL has performed radioactivity tests on the first "heats" of steel that will be used for MINOS far detector planes. (2 out of 3 passed)
- The mechanical setup of the Soudan module mapper was completed by Frank Skrzecz at Soudan. Mapping will begin in early April.
- The ANL electronics group has built and tested the first master module for the MINOS near detector. This complex device performs as expected and more complex system tests by physicists are now getting underway.

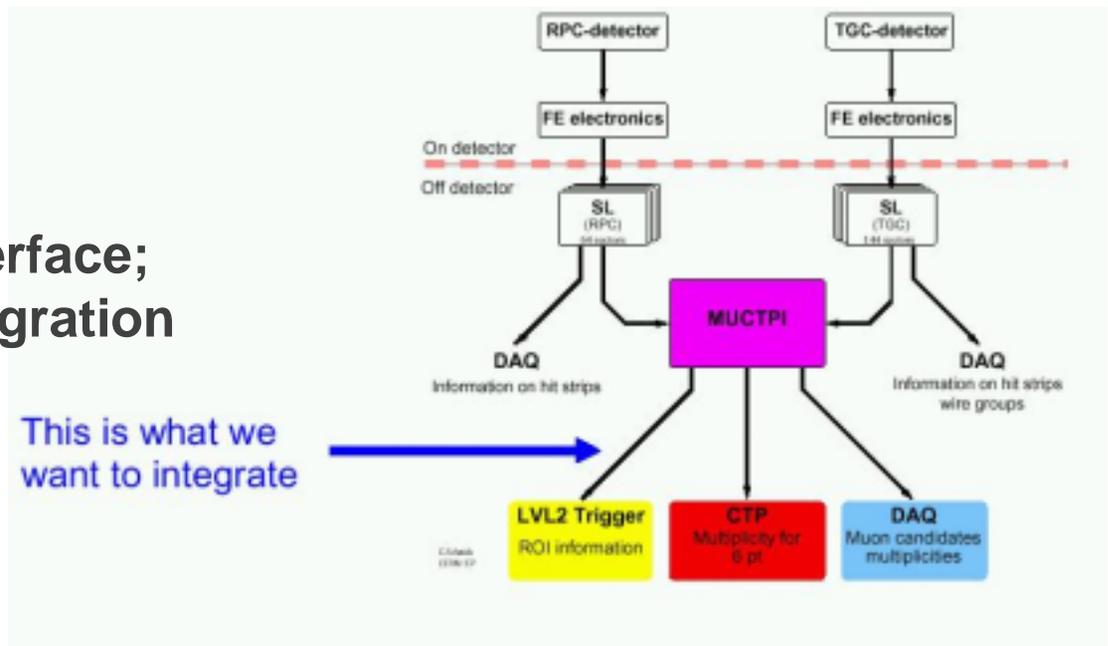


# ATLAS

## HEP at ANL

### Trigger

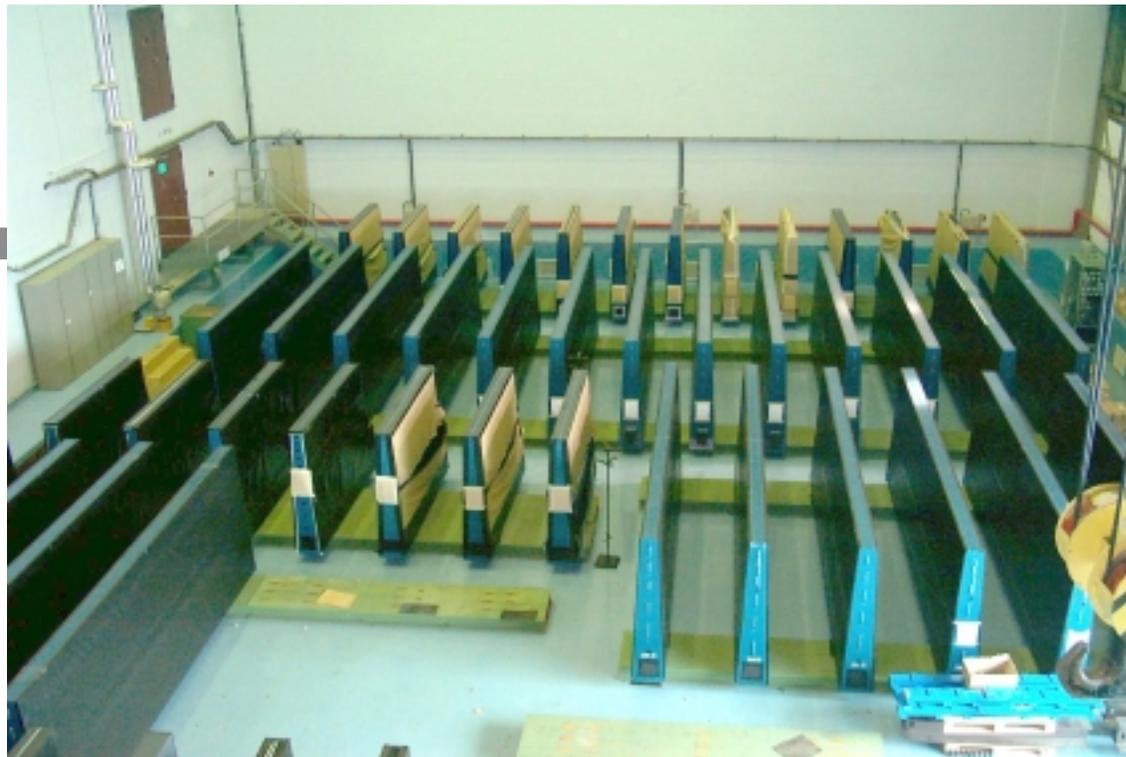
- ANL + MSU: Trigger supervisor, Region-of-interest builder, calorimeter trigger
- 1999-2000: Pilot project to measure performance and choose network technology
- Reference Software
- 2001: LVL1/HLT Interface; Muon testbeam integration



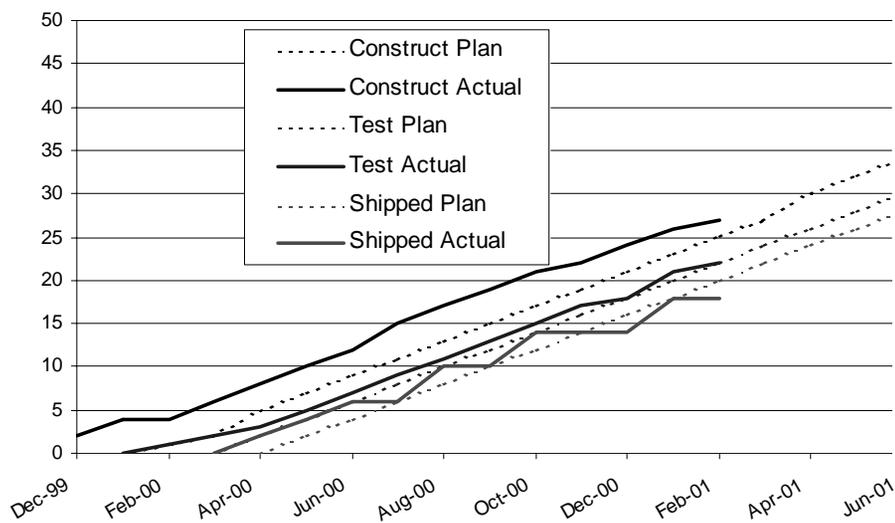
# HEP at ANL

## Tile Calorimeter

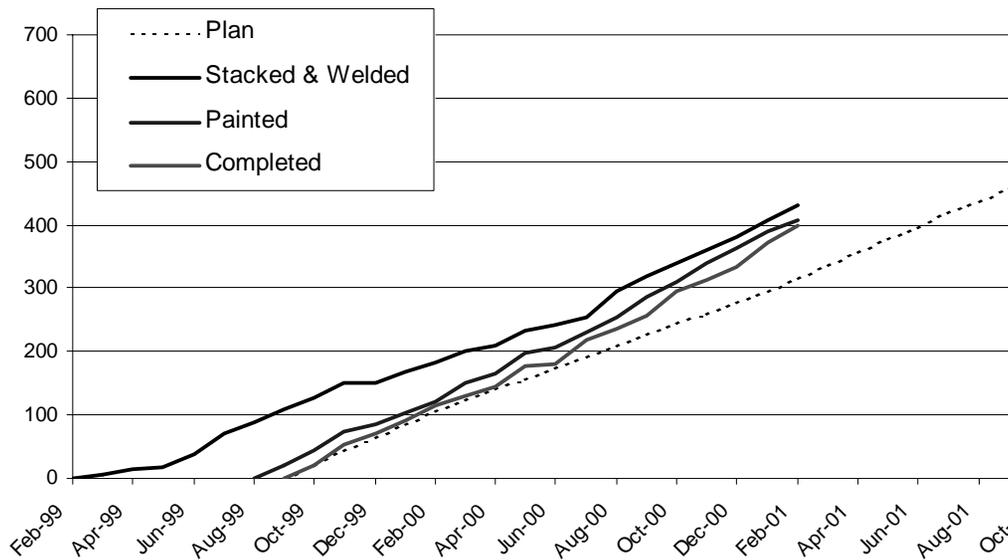
- Barrel Hadronic Calorimeter
- ANL, Chicago, Illinois, MSU, UTA
- ~50% point in production



Tile Calorimeter Module Construction  
Line of Balance



Tile Calorimeter Submodule Construction  
Line of Balance

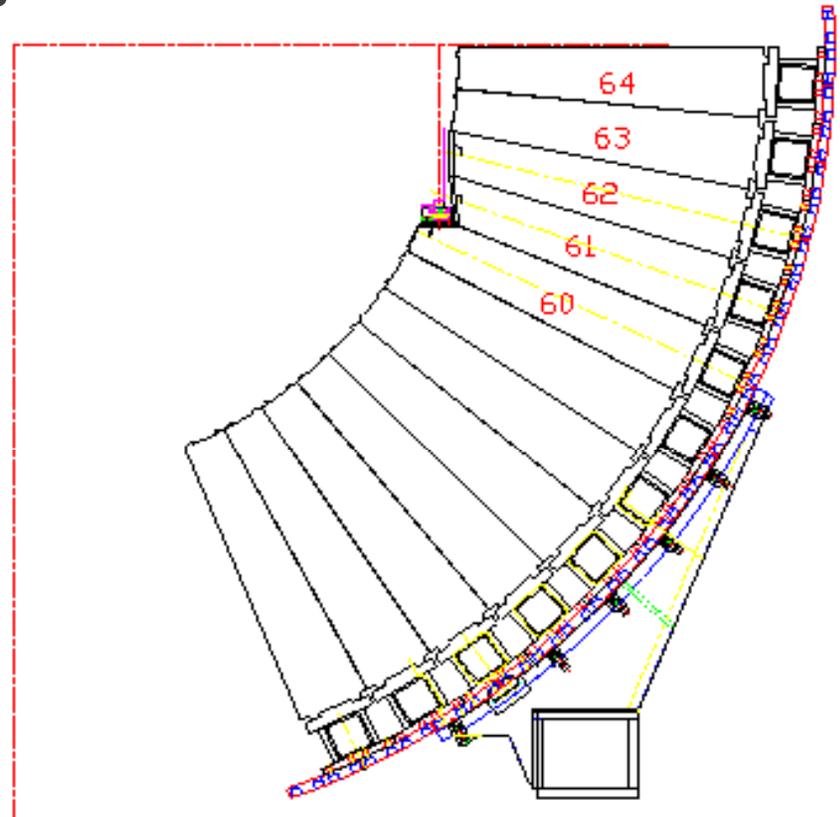
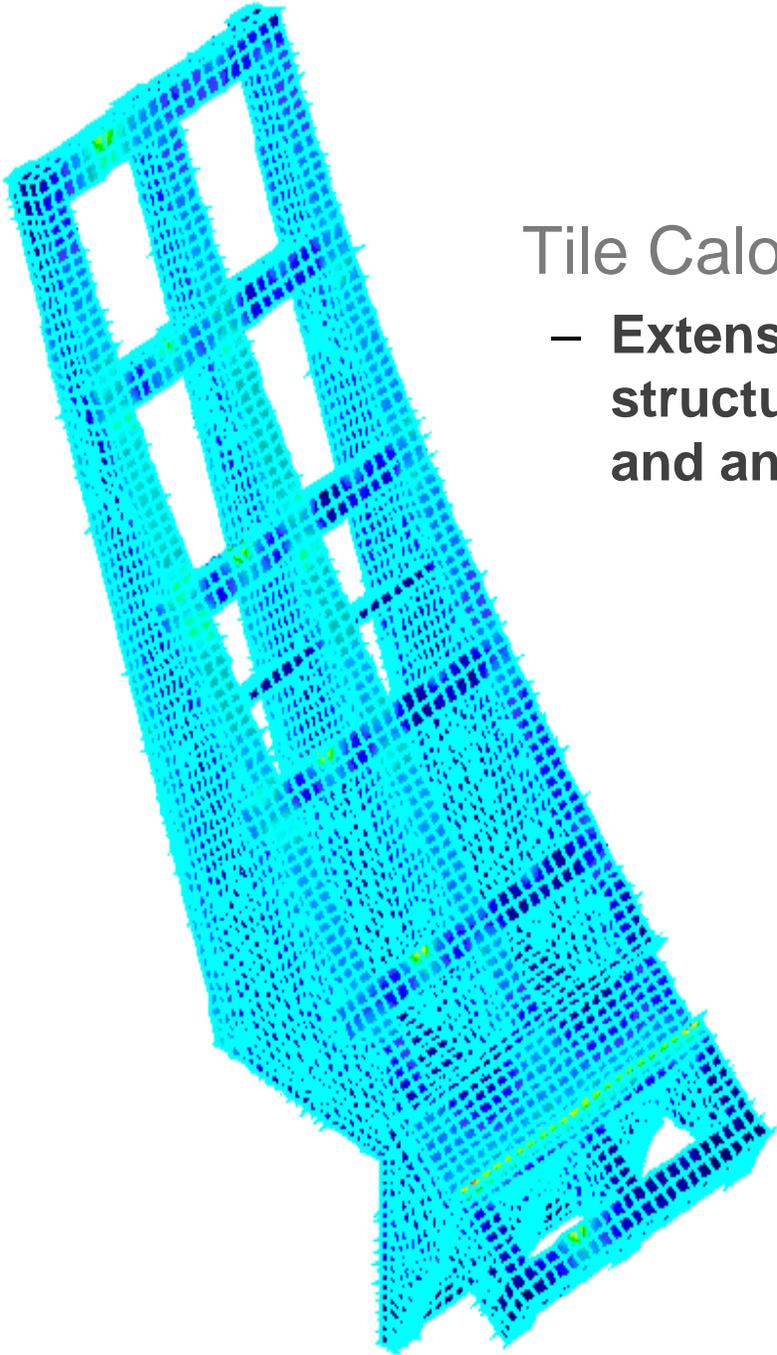


# ATLAS



## Tile Calorimeter

- Extensive work on structural design and analysis



# ATLAS

## HEP at ANL

### Computing

- **Primary ATLAS software responsibilities:**
  - ♦ *coordination of global ATLAS database effort*
  - ♦ *responsible also for integration of ATLAS data management into grid environments*
  - ♦ *coordination of Tile Calorimeter database and detector-description efforts*
- **Personnel:**
  - ♦ *Physicists: T. LeCompte, E. May, R. Wagner*
  - ♦ *Computer Professionals: D. Malon, A. Vanachine, G. Chisholm, S. Eckmann, C. Lain*
- **Recent Accomplishments:**
  - ♦ *First persistency services for ATLAS control framework*
  - ♦ *Arbitrary self-contained user objects stored and retrieved in Objectivity/DB through ATLAS control framework (Athena)*
  - ♦ *Persistence for output of physics generators, including Isajet, Pythia, single particle guns, ... (HepMC)*
  - ♦ *Persistence for output of ATLAS fast simulation (Atlfast)*
  - ♦ *First enabling of detector data service in ATLAS framework*



# ATLAS

HEP at ANL

## Computing

### – Near-Term Activities:

#### ◆ *Enhancement of existing software:*

- Persistence support for interobject references
- Collection registration prototype
- Initial implementation of clustering support
- Coexistence of multiple persistence/conversion services

#### ◆ *Planning and integration activities:*

- ANL is leading and has primary responsibility for an effort to deliver an ATLAS data-handling architecture design document
- First draft May 2001
- This document will form the basis for ATLAS planning as well as evaluation of technology choices.
- Continued coordination between the ATLAS data effort, PPDG and international grid activities.



# Summary

HEP at ANL

Argonne has a broad, vital program

- **Accelerator R&D, Theory, Experiment**

Wakefield acceleration offers promising directions

ZEUS continues to provide rich physics

- **Push toward precision measurements with higher luminosity**

CDF soon back as physics producer in Run 2 after extended upgrade

ATLAS Computing work is now proceeding strongly, joining work at Argonne on hadronic calorimetry and trigger

MINOS has entered detector fabrication stage

