ATLAS users and SLAC

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SLAC Users Organization Meeting
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Main Topics for Discussion

• Sizable number of regional ATLAS users
• Coordinated through US ATLAS Collaboration
• Users are all active in global ATLAS activities, but computing model fosters regional collaboration on common physics topics

• Computing support and leadership for Tier-2 center, data handling, and interactive computing pool
• Physics analysis collaboration
• ATLAS detector upgrade R&D
ATLAS experiment at LHC

Probe of “terascale” physics with 7+7 TeV proton beams; Initial luminosity $10^{32}$ cm$^{-2}$s$^{-1}$; design luminosity $10^{34}$ cm$^{-2}$s$^{-1}$

We have no new official schedule, but expect to close up in May to be ready for beam injection in June
Guess at New Physics Timeline

LHC vs time: a wild guess ...

- H, m_H ~ 115 GeV
- H -> 4l, m_H ~ 180 GeV
- m = 1 TeV SUSY (g, q)
- Z' -> e^+e^-, m = 1 TeV
- H -> 4l, m_H ~ 180 GeV
- m = 1 TeV SUSY (g, q)
- Z' -> e^+e^-, m = 1 TeV
- Extra-dimensions G -> e^+e^-
- m = 1.5 TeV
- Leptoquarks, m = 1.5 TeV
- Compositeness, \Lambda = 30 TeV
- m = 2.5 TeV SUSY (g, q)
- TeV-scale resonances from WW scattering
- m = 3 TeV SUSY
- Z', m = 6.5 TeV
- Compositeness, \Lambda = 60 TeV

- shutdown

SLHC

L = 10^{35}


year
Regional US ATLAS collaborators

- University of Washington
- University of Oregon
- Lawrence Berkeley National Laboratory
- Stanford Linear Accelerator Center
- Santa Cruz Institute for Particle Physics
- California State University, Fresno
- University of California, Irvine
- University of Arizona
- University of Wisconsin - Madison
- + other users who are SLAC residents
- **Totals 250+ collaborators** in CERN database
ATLAS Computing Model

Utilizes the GRID framework for distributed computing

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Tier 0 (CERN)

Tier 1 (10 worldwide)

Tier 2 (5 in US)

Tier 3

Data processing with full calibration

MC production

Dataset access

DPD

Interactive analysis: fits, plots

Raw/AOD/ESD

AOD

(final after A. Farbin)

Final Dress Rehearsal of data chain is in progress this month
Western Tier 2 Center

• WT2 at SLAC is a “super Tier-2” with some nodes set aside for T3-like interactive user analysis
• Scale eventually to O(1000) CPU, O(PB) disk
• Currently plenty of interactive CPU for early users; hope this will be true with more users
• xrootd, PROOF, and other data-handling expertise aids not only WT2 but also other ATLAS installations

• Feel pressure to have WT2 fully operational in 2009
  – Useful to begin prototyping analysis frameworks in 2008
  – Could run, assuming ATLAS upgrade, until 2020s(?)
Data Access

- Network connectivity challenges point to national lab involvement
- Leverage expertise gained on BaBar
  - Computing model has evolved toward BaBar’s!
- xrootd provides distributed access to user ntuples
- Some user-based work on PROOF for parallel analysis jobs
- Users working with WT2 board to make sure subscriptions for analysis datasets
- Recently began user analysis meetings for FDR (Final Dress Rehearsal) work
User Computing at SLAC

• Big advantage to users who have reliable access to all datasets at the Tier 2 centers

• Even more **important to have local interactive resources with access to datasets**
  – Available CPU for reducing AOD datasets
  – Disk space for storing Derived Physics Data ntuples

• Estimate $O(10)$ CPUs/user
  – One option: Tier 3 on every campus -- none in our region

• **SLAC ATLAS users are excited about access on interactive nodes as a part of the WT2 center**
Pooling “Local” Tier-3 Resources

- Tier-3 is not currently part of ATLAS computing budget -- any contributions come from institutions
- Must have excellent data connection to Tier-2
- Must have infrastructure for 10-20 nodes
  - These nodes are probably not used 100% of time
- Must have computing support for OS/software, data center operations

- Any possibility of hosting future Tier-3 contributions at SLAC for economy of scale?
  - Similar to model of CDF at Fermilab; ATLAS at NERSC
Physics Analysis

• West Coast Analysis Support Center exists at LBNL and provides analysis software support and training
• Works with SLAC to host and train WT2 users
• SLAC has been successful in forming small physics working groups with users (JetMET, hadronic state)
  – Reconstruction experts in US ATLAS are most often national lab staff or research physicists
• Excellent partnership with theory group in W/Z+jets, jet algorithms, SUSY, generators
  – West Coast LHC Theory Network attracts SLAC users from university theory groups
• SLAC ATLAS physics forum for presenting on-going work in informal atmosphere
Targeted Topical Workshops

• Bring together parties interested in specific topics for 3-5 days of intense work
  – Very good feedback from users who attend

• Hadronic Final State Analysis Forum (Jan 2008)
• Tier 2/3 Workshop (Nov 2007)
• Physics Workshop of the Americas (Aug 2007)
• Physics Analysis Retreat (Mar 2007)
• Fast Shower Simulation Workshop (Nov 2006)
• Also overlap with West Coast theory meetings
Future of Remote Users

• During current commissioning, all available hands are at CERN; not necessarily the case in the future
• If budgets allow, postdocs and senior grad students are at CERN instead of campus
• Faculty, junior grad students can benefit from local meetings and collaborative workshops
  – People with visa issues also fall in this camp

• Possibility of remote monitoring shifts
  – Looking into a remote monitoring station at SLAC
  – Already done for CMS at Fermilab
Local Computing Support Experts

- Not so much core software questions (LBNL) as specific questions about tuning jobs and data access for the WT2
- May be a different expert from the WT2 support team, but necessary to streamline operations and avoid wasting CPU
- Could overlap with leadership in physics reconstruction objects (jets, tracking, etc.)
  - Respond to queries like “What job options and data files do I need to get the most recent jet energy calibration?”
ATLAS Upgrade R&D

- Many Western U.S. institutes have interests in R&D toward major upgrades in 2015
- Silicon tracker (pixel & strips), trigger upgrades, forward det
- SLAC is part of LHC Accelerator Research Program (LARP)
- Expertise at SLAC exists as extension of collider program
Engineering Resources

- Often a challenge for university groups to maintain these resources over long time periods
- SLAC engineers have experience, mechanical and electrical, from many recent projects (SLD, BaBar, GLAST, etc.)
- Universities are already consulting with SLAC personnel on some projects (DAT, Pixels)
Additional Resources

- Any microelectronics fabrication facilities would be put to good use for prototyping and test components
- Simulation experts needed (GEANT4) along with experts on developing tracking algorithms in high-multiplicity environment
- Tracker production will involve high-throughput testing and construction
  - Would require infrastructure investment: probing stations, assembly robotics
Summary

• ATLAS users are preparing for first data and already pursuing detector upgrade R&D
• Western Tier-2 is a huge contribution from SLAC that is necessary to analyze data efficiently

• Users are very keen on interactive access at WT2 and understanding how to best use facilities
• Physics analysis collaboration clustering around seeds of interest -- SLAC group plays big role
• Upgrade R&D will benefit greatly from experience of SLAC personnel