Overview of Beam Test

Benoit, Ronaldo and Eduardo

Nov 8 , 2005

thanks to Steve and Bill for helping to consolidate all the information

Current Activities and Timeline

- Meetings
  - Weekly coordination meetings by phone
    - Coordination group: Benoit, David, Luca, Ronaldo, Gary, Eduardo
    - Help Benoit, Ronaldo and Eduardo in the organization process
      - » Discuss organizational matters and planning
      - » Prepare for general VRVS meeting
  - Bi-weekly VRVS meetings
    - Involves all LAT Collaborators
    - Inform LAT collaborators of recent developments
    - Gather input from collaborators
  - Bi-weekly report in VRVS C&A meetings
    - Summary of latest activities
    - Benefit those who cannot be present on the beam test meetings
- Timeline
  - By early Dec, 2005
    - Response from CERN whether we are approved or not
  - Jan, 2006
    - Submit a beam test plan to the LAT collaboration
  - > end of July, 2006
    - Beam test starts
      - » Depends on CERN approval and schedule
  - Dec, 2006
    - Finalize data analysis
      - » Aggressive schedule!

Beam Test Objectives

- Science performance verification strategy
  - LAT phase space is huge
    - MC simulation used to verify requirements by analysis
    - Beam test used to tune and check the simulation and aspects of the reconstruction.
      - » Essential component of our overall strategy
- Objectives
  - See Beam test Rationale Document LAT-TD-02152-02
    - Undergoing update
  - Highest-energy performance
    - corrections for leakage, inter-tower gaps, and backsplash (SSD in TKR and ACD).
  - Electromagnetic showers (gamma, electron)
    - beams up to at least 100 GeV.
  - Check the PSF and Energy reconstruction methods.
    - Tagged photon beam particularly in ~GeV range.
  - Compare distributions of quantities related to those used in background rejection with hadron beams.
    - Not a direct test of end-to-end rejection -- instead, check relevant distributions
  - Check trigger performance (e.g., CAL-HI), comes “free” with same data

- Beam Test Hardware
  - Impractical to put full LAT in beam
  - Use spares
    - 2 TKR modules
    - 3 or 4 CAL modules
    - 2 to 5 ACD tiles
    - 4 TEM modules
    - 1 GASU (for trigger)
    - 1 PDU (for power distribution, if available)

Primary purpose is to constrain systematic uncertainties in science analysis

Objectives: more details…

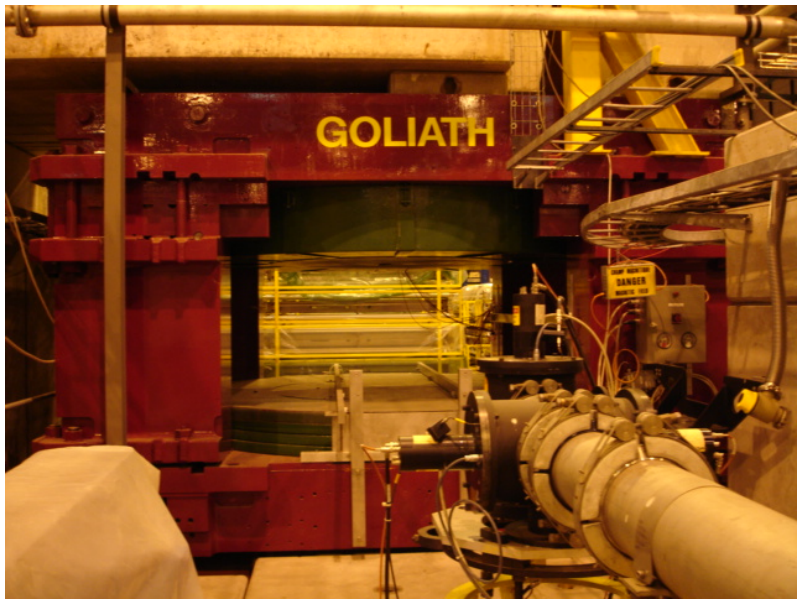
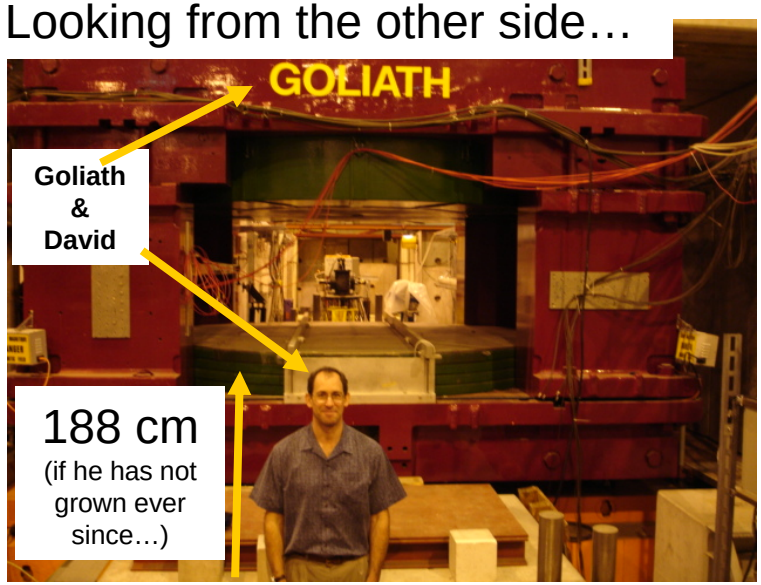
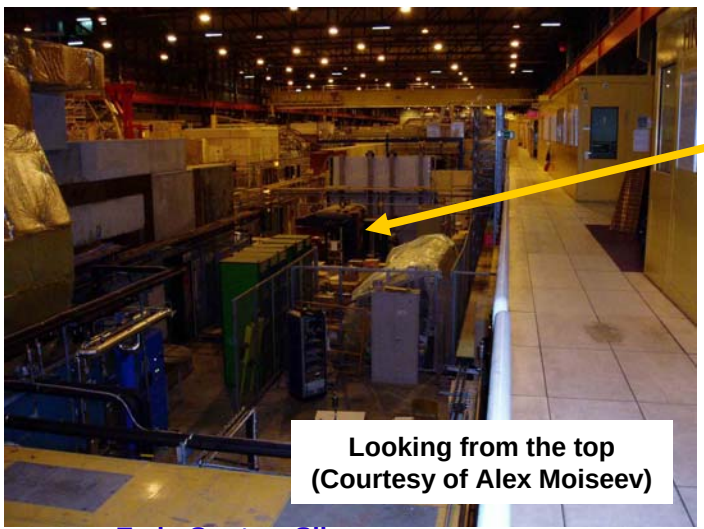
- 1. PSF and Effective Area
  - Measure PSF and reconstruction efficiencies (by region, angle);
  - check analysis and CTs; tune G4 parameters for TKR topologies.
    - <100 MeV to >3 GeV tagged photons on- and off-axis
- 2. Electromagnetic shower
  - Calibrate Energy and Measure Energy Resolution
    - Tune simulation parameters and check energy reconstruction algorithms
    - Check corrections near edges
    - Shower profiles
      - <100 MeV to >3 GeV tagged photons and ~1 GeV to >250 GeV electrons
- 3. Backsplash
  - Measure TKR and ACD tile multiplicities, rates and topologies from backsplash
    - 50 GeV, 100 GeV and >150 GeV electrons
- 4. Hadronic shower & Background rejection
  - Modeling of shower topologies in the CAL;
    - Stubs and other TKR topologies from upward-going energy
      - » TKR topologies; TKR-CAL matching
  - Compare data and MC input distributions used by classification trees for analysis of background rejection
    - 1 to 15 GeV protons (incident in the CAL) , higher energies available @ SPS
- 5. Characterize Trigger/Timing
  - CAL-HI trigger
    - use >20 GeV electron data
    - other useful checks with same data set. (no special runs needed)
  - Trigger functionality
    - At different rates with high energy particles
  - System timing
    - high energy beams
- Data Analysis Plan
  - Need prioritized list of plots
  - re-estimate required statistics (based on needed precision)
  - Define minimum success as soon as possible

Low Energy Tagged Beam Area (PS)

Photo from document written by Michela Prest for the AGILE test beam

High Energy Beam Area (SPS)

Looking from one side…



Looking from the other side…