### The ATLAS Trigger System

**Goal:** Record 1 collision of interest out of every 40,000 delivered by the LHC every millisecond.

**Challenges:**
- Enormous data volume
  - 1 collision every 25 ns with ~50 interactions
  - 100,000 s of readout channels
  - ~1.7 MB per physics event
- Diversity of the ATLAS physics program
  - Allocate bandwidth dynamically to accommodate physics priorities
- The LHC operates on its own schedule
  - Provides a variety of operating conditions and collision types
  - High luminosity, low luminosity, proton-proton collisions, heavy-ion collisions
- Planned and unplanned sub-system performance changes
  - New calibrations, interventions, upgrades, failures, etc...

ATLAS must always be ready to record LHC collisions!

### Software Release Structure

**Release Types**
- 20.11: "HLT Online" Reconstructed
- 20.3: "Simulation"
- 20.11.X.Y.Z: "Development" Release
- 20.11.X.Y: "Patch" Release
- 20.11.X.Z: "Base" Release

### Trigger Software Validation Cycle

**Team:**
- Trigger Operation Coordinator
- Trigger Signature Experts
- Menu Expert
- Release Expert
- Software Validation Expert
- Debug Stream & DQ Experts

**Tools:**
- JIRA
- AMI
- Prosys2
- HLT/ATLAS
- Typical Issues

**Enhanced Bias Data**

Most of the data processed by the HLT is rejected. Testing the HLT offline requires input data similar to that seen by the HLT online.

**Enhanced Bias (EB) datasets:**
- Are made using special triggers that accept the main L1 physics items
  - More weight to interesting/rare events
- Provide input data for offline HLT reprocessing
- Validates offline quality and data quality
- Benchmark EB datasets for each flavor of HLC run are taken

**Tools:**
- Compilation test
- Coordinated from each developer
- Developers must locally validate their software and menu updates
- Online integration

**Software Validation Expert**

- New software tags collected, release build and run nightly test
  - 12 hours
- Release deployed to the grid
  - 5 hours
- Investigate and resolve bugs, create new tags
- Collect, create and assign bugs

**Jet Expert:** Examine and validate performance

**Electron Expert:** Examine and validate performance

**Muon Expert:** Examine and validate performance

**Subjects:**
- Production of reprocessing performance metrics:
  - Average memory usage
  - Individual algorithm performance analysis
  - Estimated algorithm rates
  - Physics performance metrics
  - Reconstructed observable distributions compared to reference
  - Trigger signature efficiencies
  - ~1 hour

**The status of the cycle is summarized in the weekly trigger meeting.**

### Outlook

Upcoming improvements include:
- Multi-core grid processing for faster reprocessing jobs
- Streamlining the overall ATLAS data reconstruction process

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### Acknowledgments:
Thanks to the Natural Sciences and Engineering Research Council, Canada, for funding our efforts

### Development, Validation and Integration of the ATLAS Trigger System Software in Run 2