

# Status of Work at CERN



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CERN-KEK committee  
meeting

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1. Introduction
2. Status of current work
3. Plans for the future
4. Summary

# Introduction

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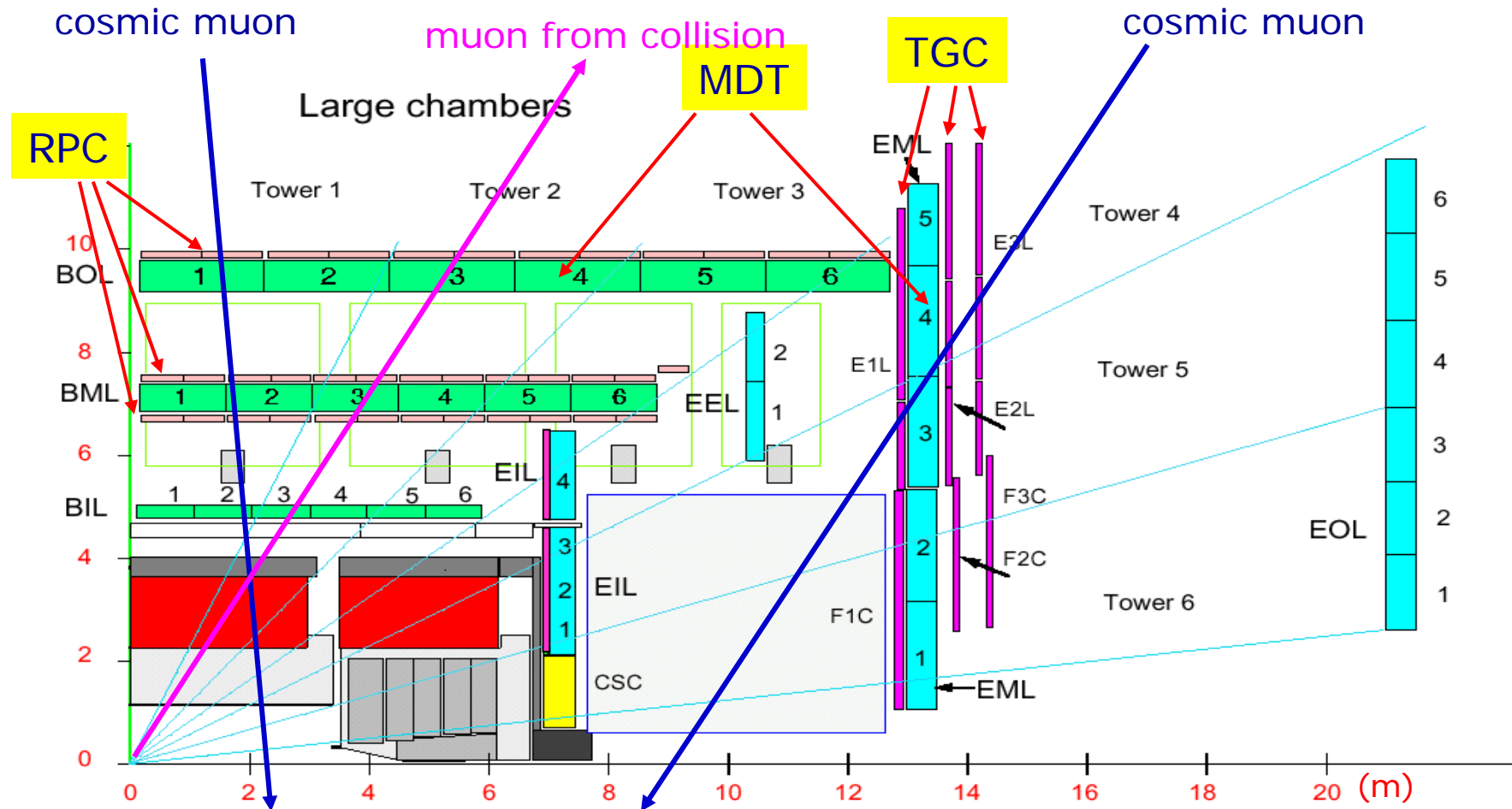
- ❑ Started as a CERN-Japan fellow in April 2006 in the ATLAS trigger group (ATR)
- ❑ The group covers a wide range of topics in the ATLAS trigger
  - LVL1 hardware commissioning
  - High Level Trigger (HLT) commissioning
  - Preparation for cosmic running
  - Trigger configuration
  - Event Filter algorithm development and validation
  - Study of trigger performance on physics events
- ❑ Also encouraged to participate in physics group activities
- ❑ At this phase of the experiment, I'm interested in working mainly on preparation for the data taking. And at the same time, be prepared to participate in data analysis for physics studies

## Current work LVL2 cosmic trigger

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- My main work now
  - Development of a dedicated LVL2 trigger for cosmic muons and its validation
  - Validation of the LVL2 trigger software and data formats using data taken by LVL1 and muon systems
  - Analyzing cosmic data taken with the muon chambers
  - Involving students under my supervision
- In context of ATLAS
  - Implement a way to select useful cosmic muons for detector studies
  - Debug the full trigger chain in a realistic setup
  - Integration of LVL2 system in the pit (with LVL1 and detector systems)
  - Commissioning of the HLT infrastructure and the software components used in the trigger

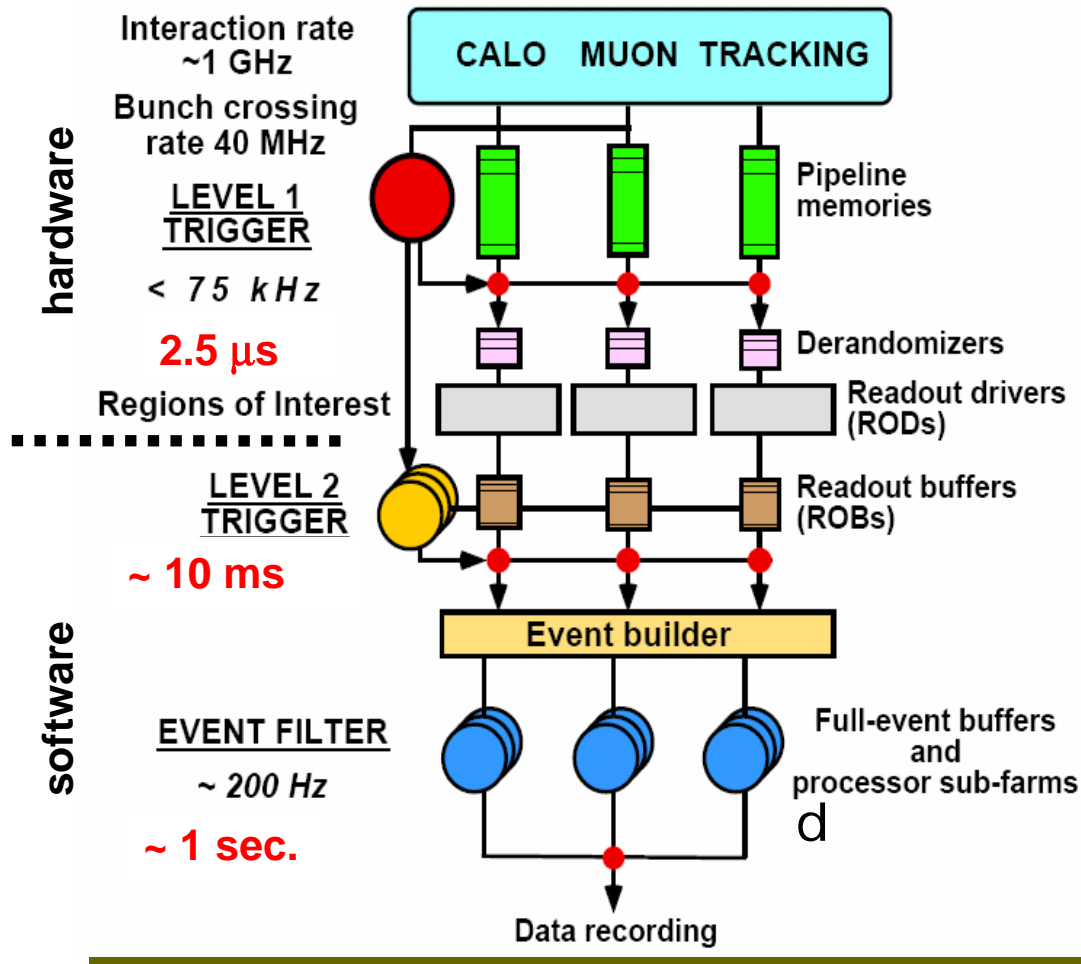
# Cosmic muons in ATLAS detector (in Y-Z view)



RPC, TGC: used for LVL1 trigger, requiring coincidences between different layers in a narrow window.

MDT: Precision chamber for momentum measurement

# ATLAS trigger system



## Cosmic muon rates

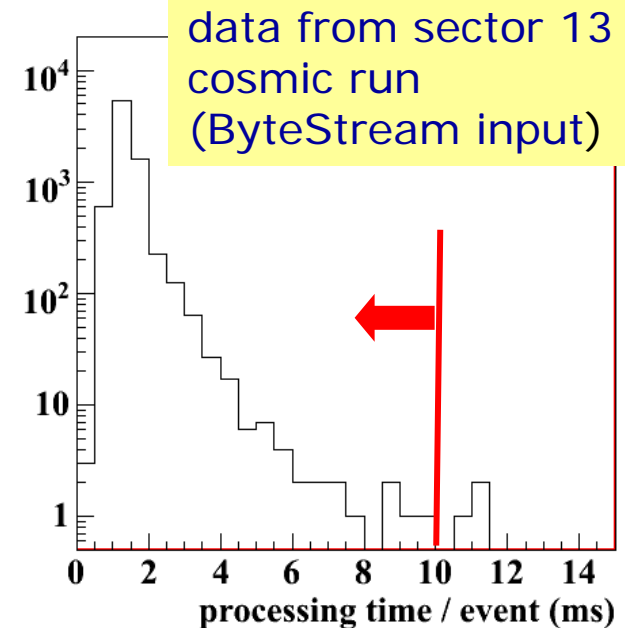
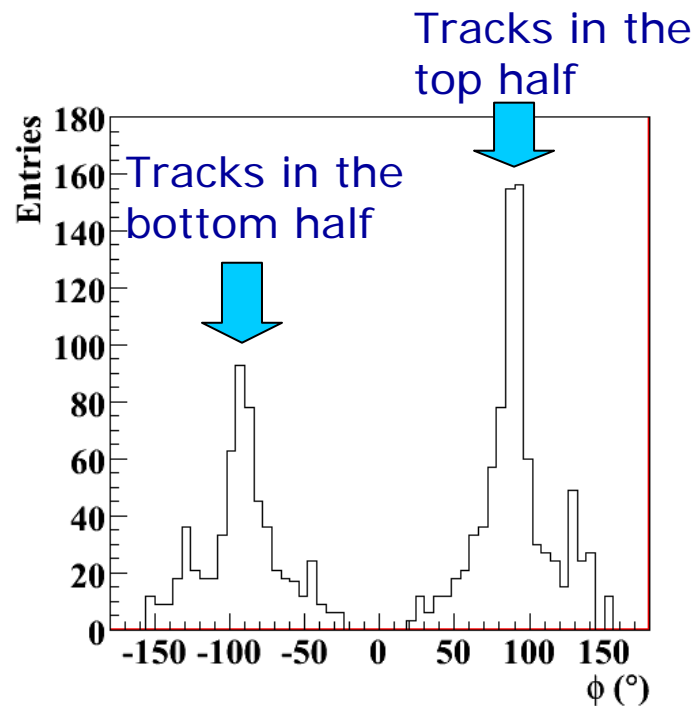
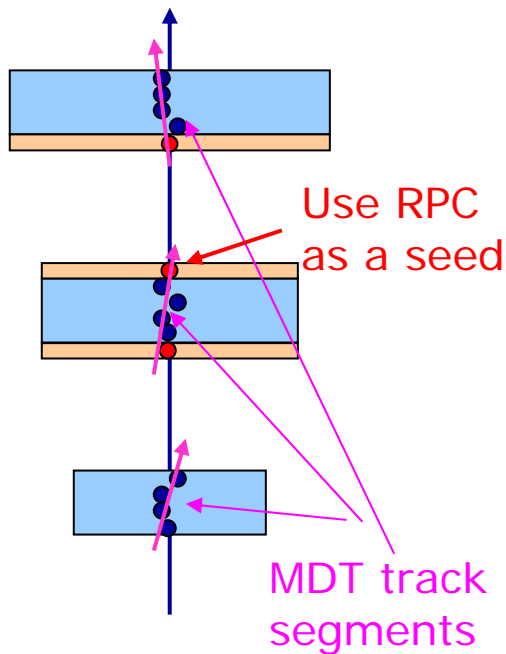
- LVL1 trigger output  
barrel region:  $\sim 600$  Hz  
endcap region:  $\sim 600$  Hz  
(simulation estimates)
- LVL2 trigger  
Further rate reduction to LVL1 triggered events  
Processing time  $< 10$  ms
- Event Filter output rate  
output rate  $< 200$  Hz

(Raw event size may be as large as collision events, if no zero suppression is applied)

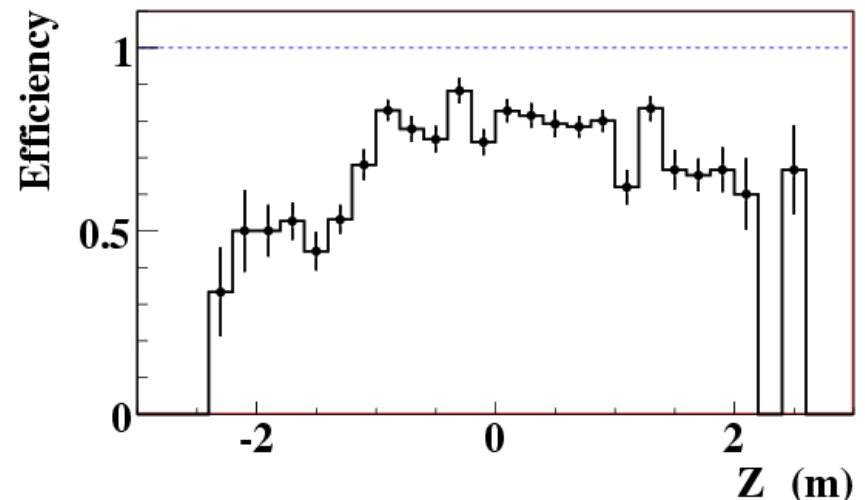
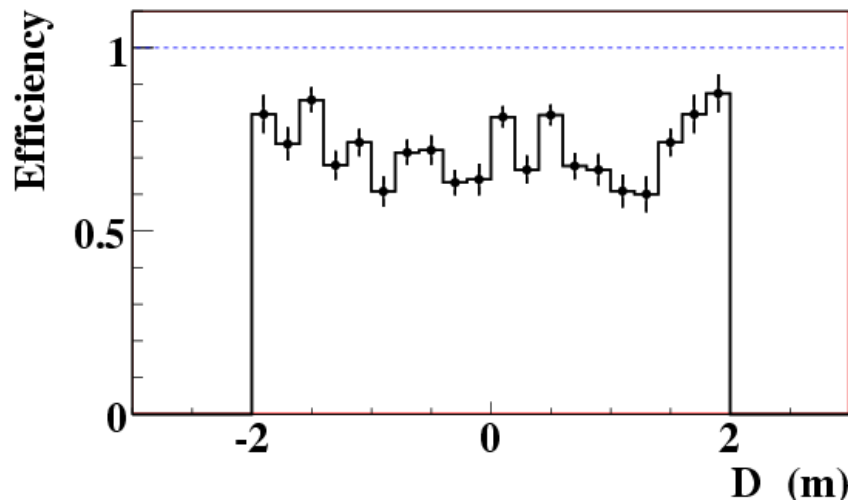
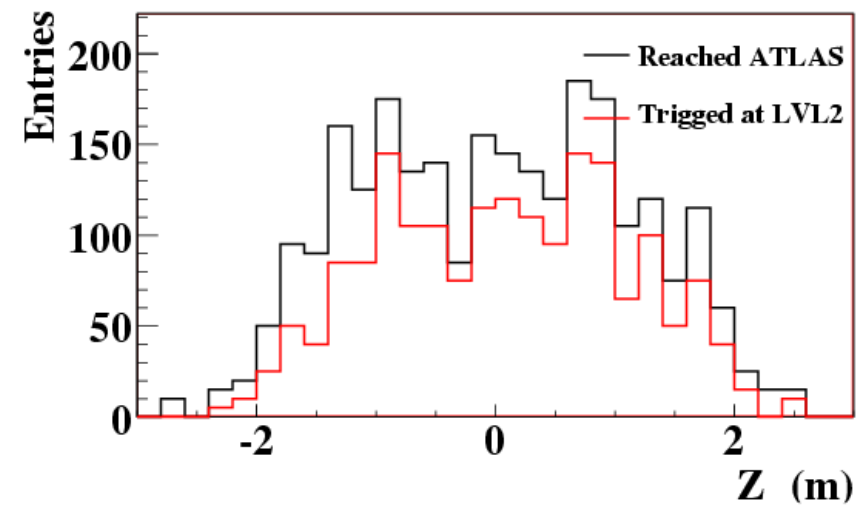
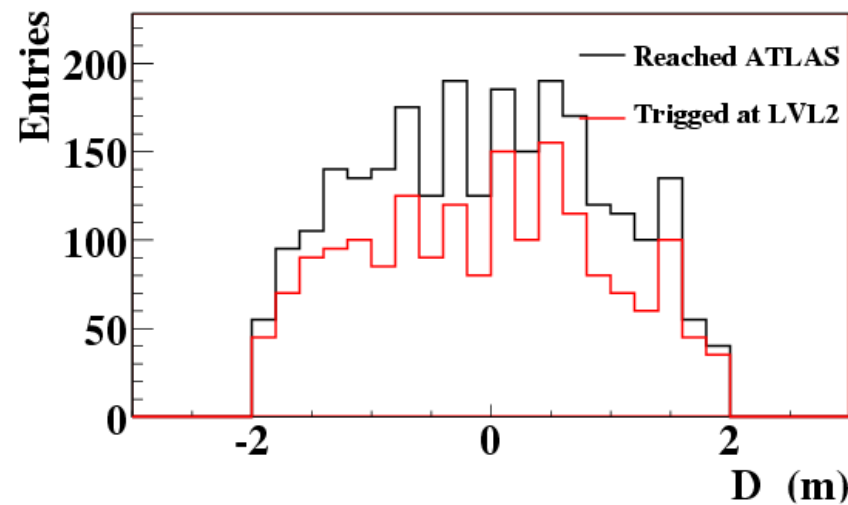
# Algorithm development and performance (1)

- Developed an algorithm to find tracks in the muon chambers
- Main difference from the physics muon trigger is the better acceptance for tracks not pointing to the origin and arriving at random timing

- Implemented in the LVL2 framework
- Works both in barrel and endcap region
- Performance checked with simulated cosmic tracks
- Execution time well below 10 ms

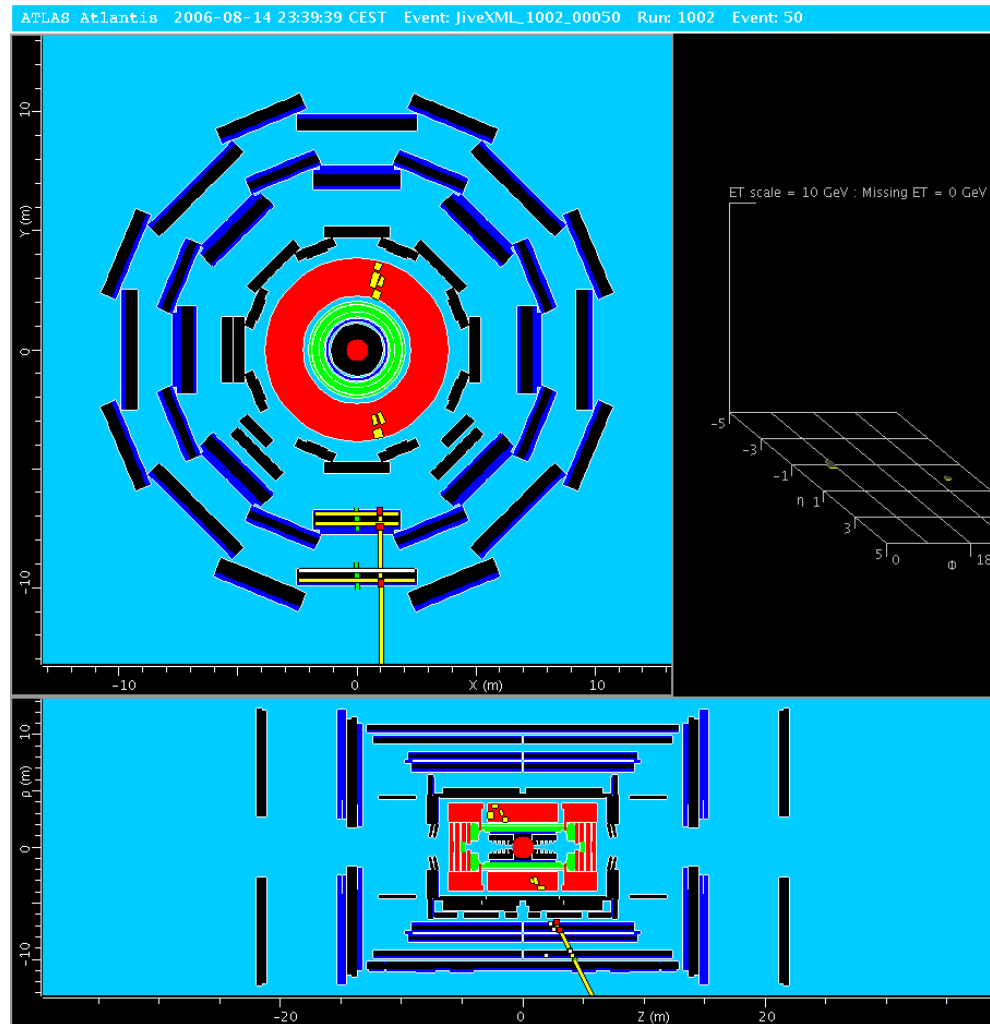


## Algorithm development and performance (2)



Efficiency is basically flat in the region covering the Inner Detector (ID). Evaluation of the acceptance of the algorithm is currently limited by the distribution of generated cosmic sample.

# Integration in the pit



- This summer, the first cosmic ray data were recorded in a combined run with RPC, MDT, TileCal and LVL1
- Checked offline the possible problems of running the LVL2 algorithm over these data
- Identified several problems related to the data format and cabling maps (together with the LVL1 and muon detector group)
- Now fixes are fed back into the software. Presently, working on integrating LVL2 with LVL1 and detectors



## Ongoing work and plans

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- Integration of the LVL2 trigger into the ATLAS system in Point-1 and performance measurement of the LVL2 trigger
  - Some real cosmic ray data were taken with a subset of muon chambers (RPC, MDT) with LVL1 trigger
  - Now, working to integrate the LVL2 system and run the algorithm online with detectors
  - Performance measurement and diagnostic tools for the trigger system with the final setup
- Validation of the muon trigger slice on physics processes
  - Having developed a cosmic trigger in the LVL2 framework, also got familiar with LVL2 trigger in general
  - Expect to start soon
- Preparation for physics analysis (longer term)
  - W/Z production, etc.

## Summary

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- ❑ Started working on LVL2 cosmic trigger. Good project to get involved in the LVL2 integration and commissioning, and also to learn about muon trigger.
- ❑ So far, developed an algorithm to be used in cosmic data taking and now working on the integration into ATLAS at Point-1
- ❑ Future plans
  - Commissioning of the LVL2 system for data taking
  - Preparation for physics analysis
- ❑ Now, writing an internal note summarizing the algorithmic part of the LVL2 trigger
- ❑ Participated in DPF/JPS 2007 to give a talk on 'B $\rightarrow\mu^+\mu^-$  rare decay at ATLAS'