Research progress and plan

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Introduction

- ## Started as a CERN-Japan fellow since April 2006
  - ### ATLAS trigger group (PH/ATR)
- ## Current work
  - ### Cosmic trigger at LVL2
    - Algorithm development and performance check
    - Integration of HLT algorithms into the online running
  - ### Development of trigger menu for early running
    - Development of python-based configuration for trigger menu
    - Responsible for the implementation of the menu
  - ### Study on di-muon trigger efficiency calibration
    - Editor for the B-physics CSC note 7
- ## Plans for the next year
- ## Summary

ATLAS trigger system
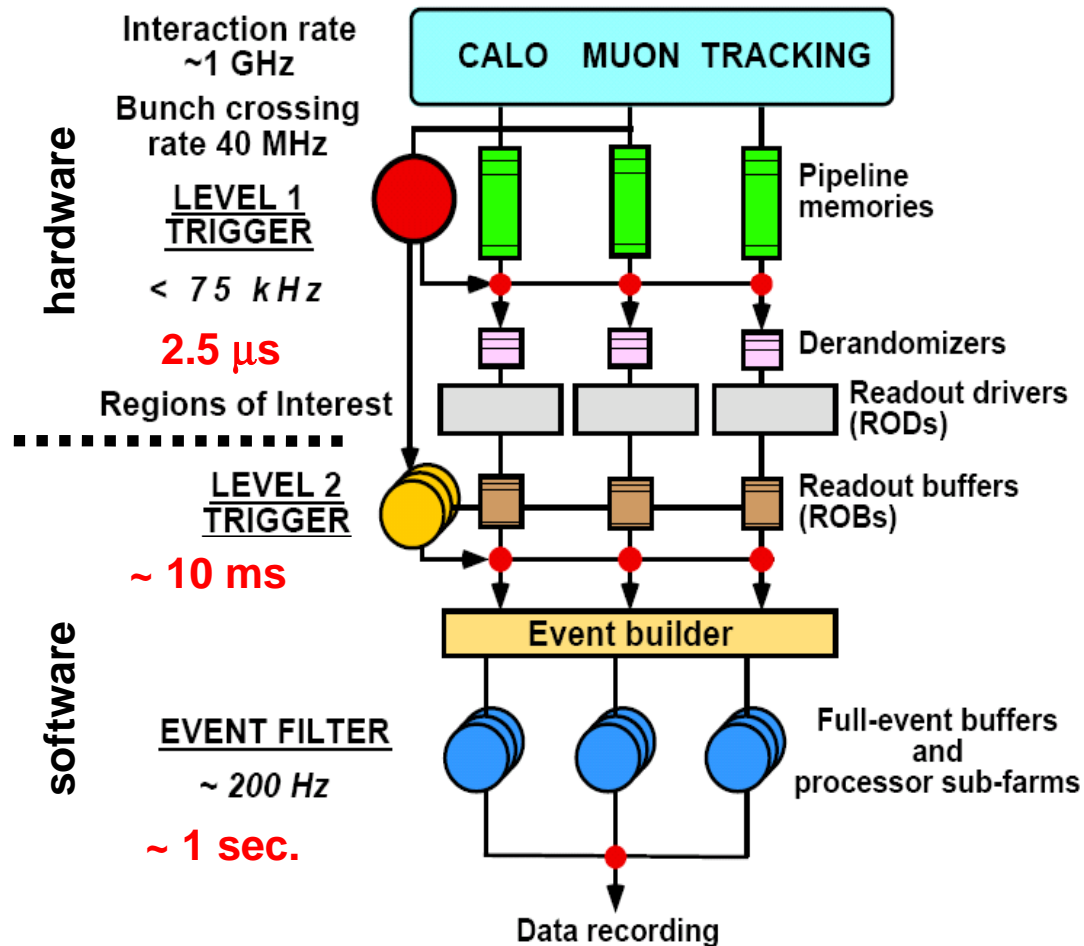
- **LVL1 trigger**
  Hardware based trigger
  Using information from the muon spectrometer and the calorimeter

- **LVL2 trigger**
  Software trigger processing data in the Region of Interest (RoI) defined at LVL1
 Processing time <10 ms

- **Event Filter**
  output rate < 200 Hz

Running HLT algorithm online

- LVL2 algorithm integration with the LVL1 system
  - Check on RoI data format sent from LVL1 and software for decoding detector data taken by real hardware
  - First integration test with RPC, LVL1 and LVL2 was done in February 2007 taking cosmic events
- LVL2 algorithm in the ATLAS combined run
  - HLT algorithm is running in the ATLAS combined cosmic run since the M3 week in June
  - Now lots of HLT chains are excercised in these runs (not only those specific to cosmic runs)
- Analysis of the algorithm performance using real cosmic runs and comparison with MC is under way
  - Cosmic muon algorithm has been working rather well
  - Prepare for using the algorithm to actively select cosmic events
  - Hope to summarize them in a note soon

Cosmic tracks at LVL2 (M5 run)

$$\sigma = 260 \, \mu\text{m}$$

(using drift time)
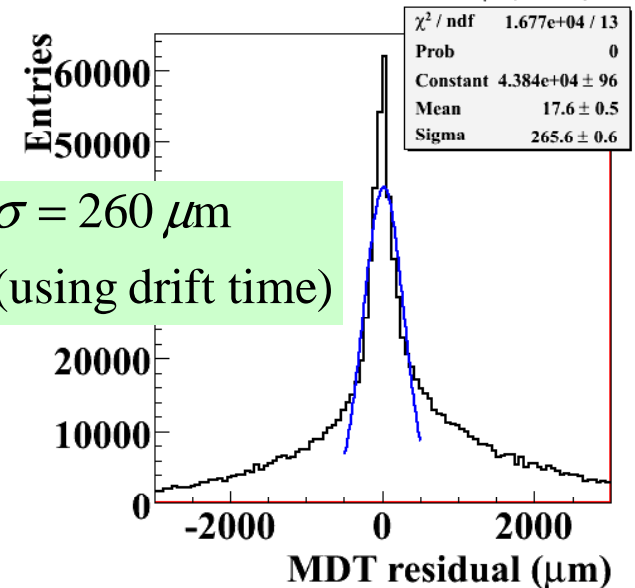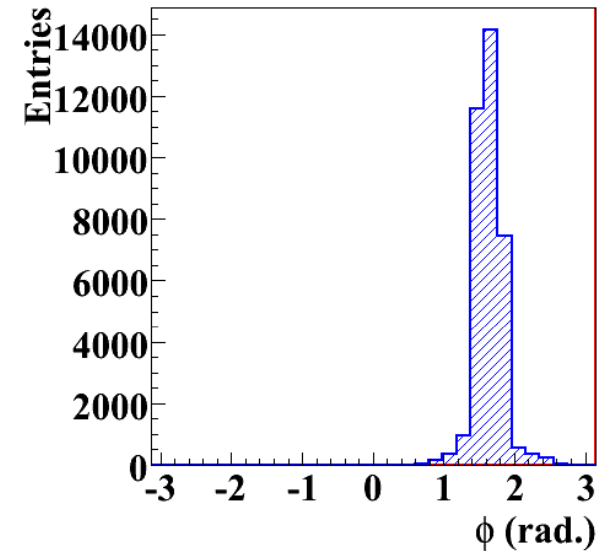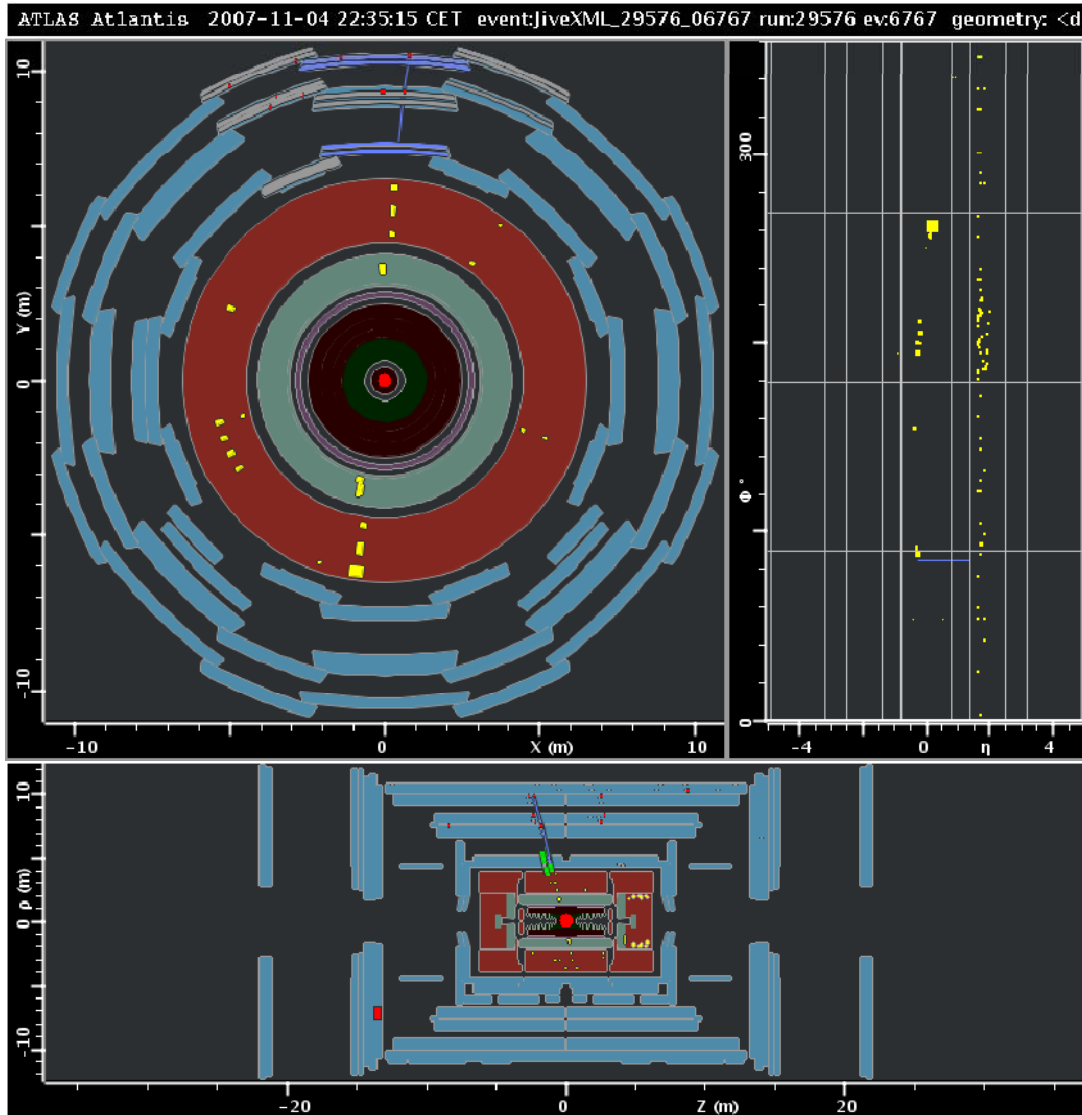
Correlation with offline muon


Very preliminary results
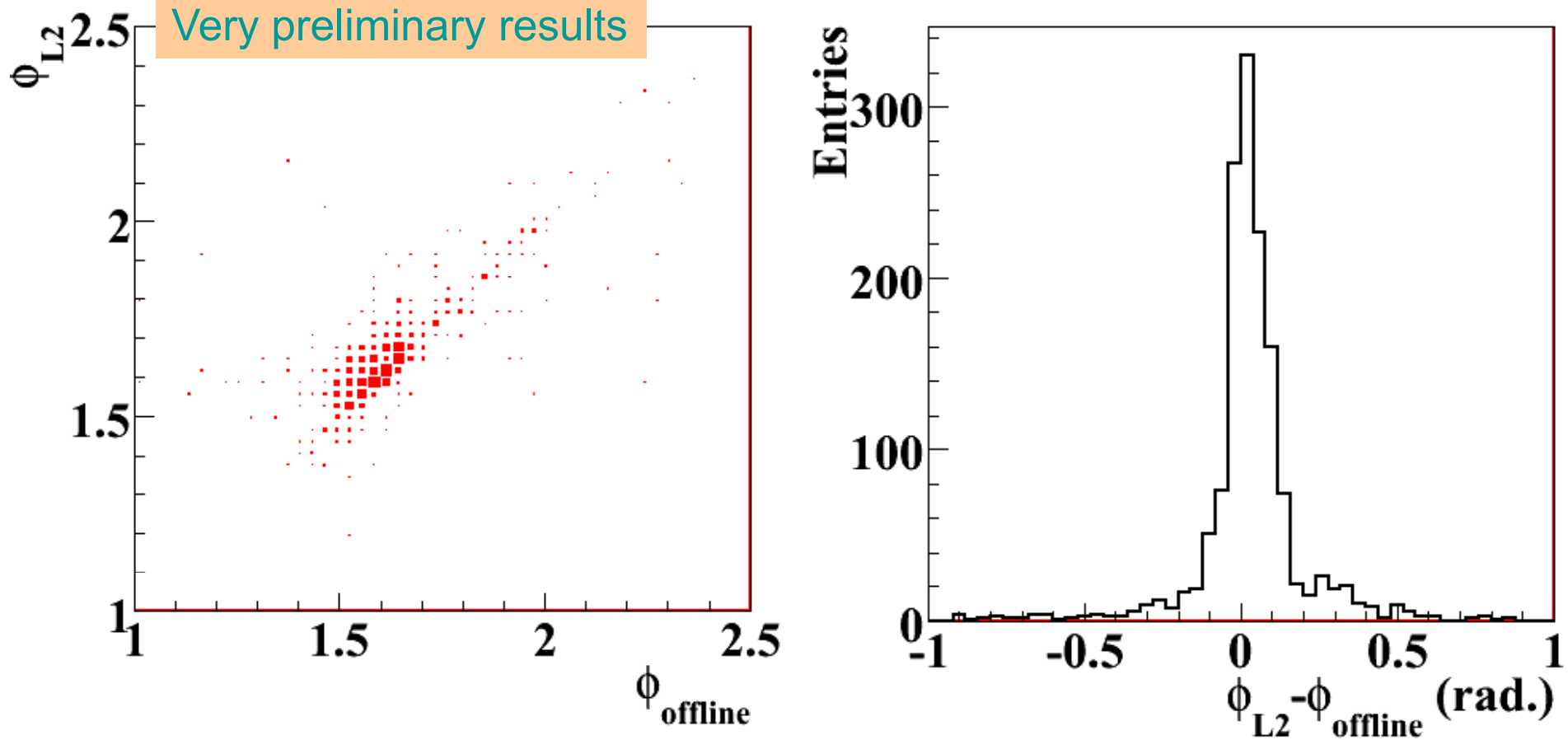
- Good correlation between muon tracks reconstructed at LVL2 and offline
- More detailed study ongoing (acceptance, efficiency at different cuts etc.)
- Comparison of data and MC
- → Internal note

Trigger menu for early running

- Started working on the preparation of trigger menu for early running in 2008 (L=10^{31} and 10^{32} cm^{-2}s^{-1})
  - Have been responsible for implementing these menus
  - The first realistic menu including >100 L1 items and >200 HLT chains (includes also backup and calibration triggers
  - Menus will be used for MC production, FDR and TDAQ technical runs

- Developed a XML/python based tool for configuring the LVL1 menu and some for editting the HLT menu
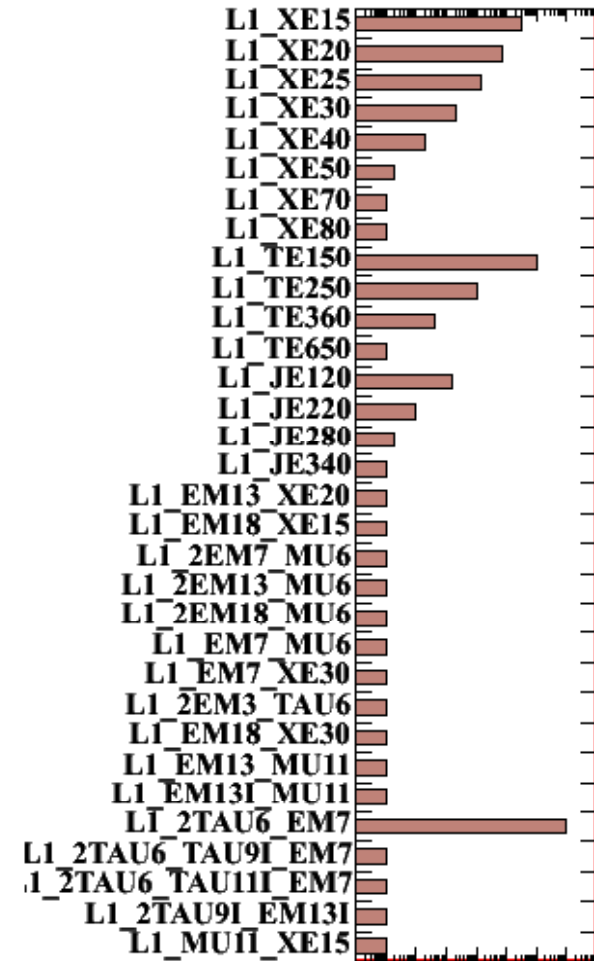 - Now moving towards using database and GUI tool

Example: LVL1 menu

Prescales for L1 items in L=10^{31} menu (first 96 out of 137 items)
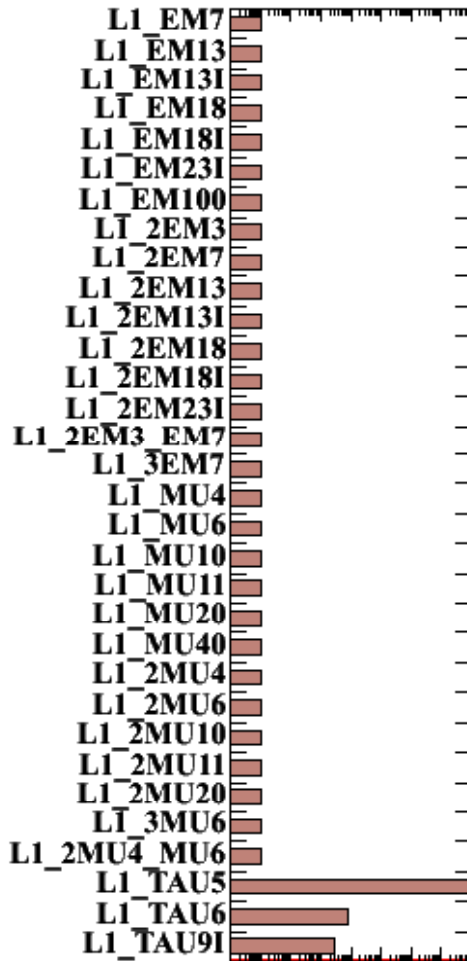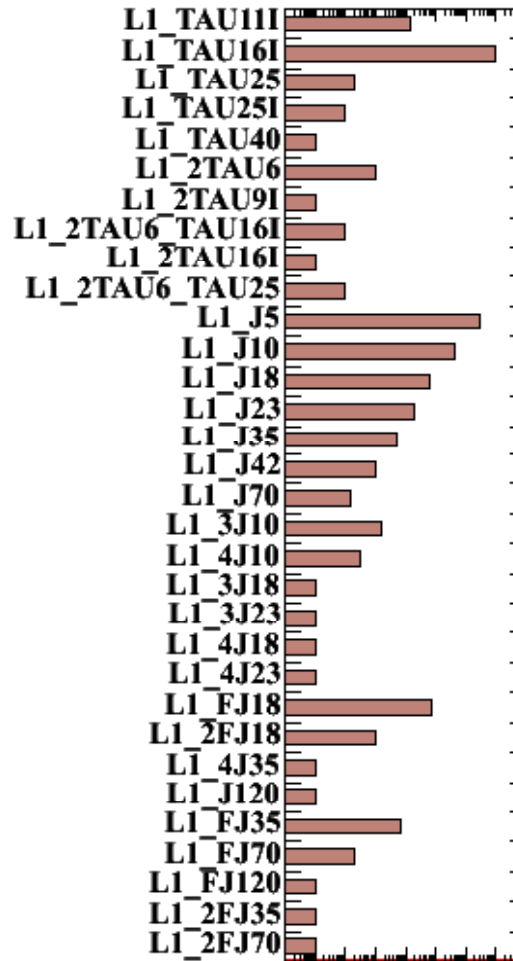
Study on di-muon trigger efficiency
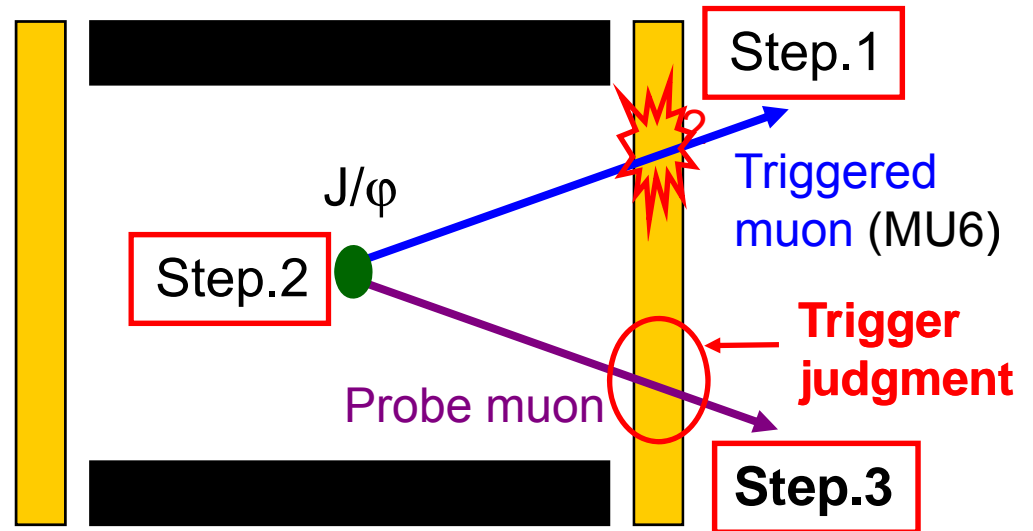
1. Use events triggered by a single muon trigger (≥1)
2. Reconstruct J/psi → mumu in offline
3. Find the matching offline muon to the triggered one
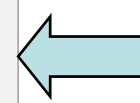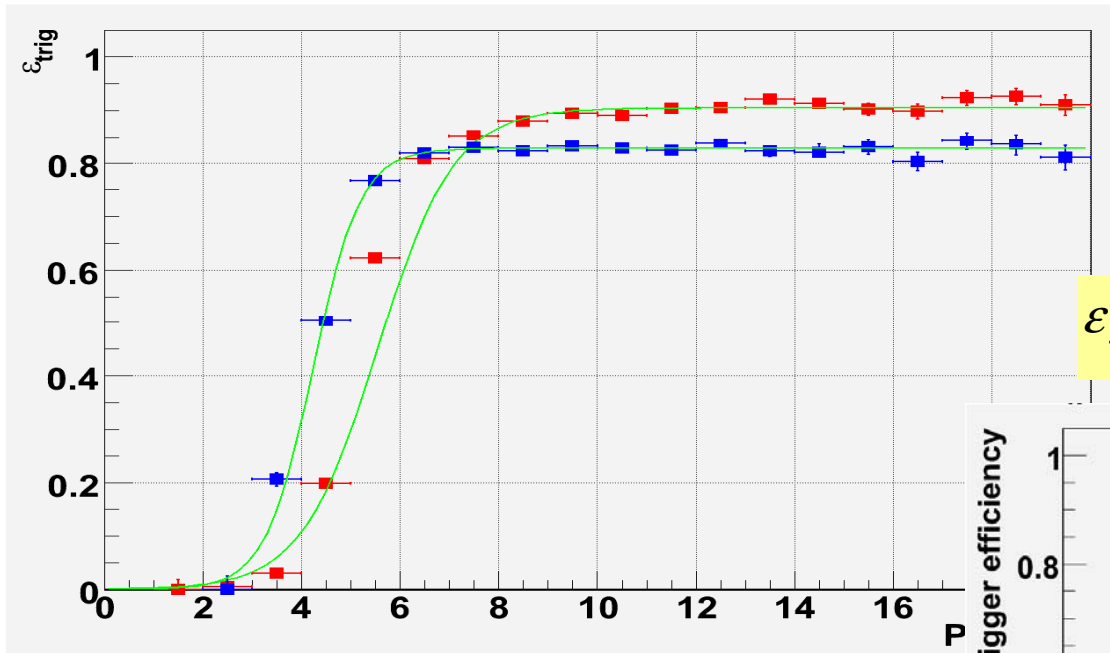4. Look at the other muon and see if it was triggered or not

Aim

• Develop a method to measure trigger efficiency from data
• Understand what calibration trigger we need to do this (S/N, prescale, etc.)

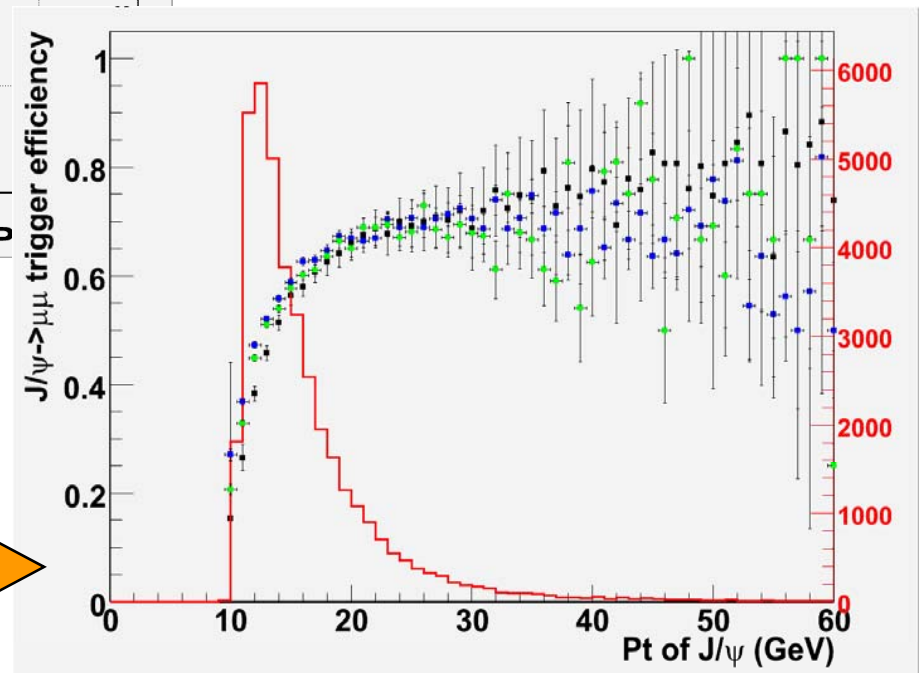→ Finish writing a note by the end of the year

Results

Muon trigger efficiency in the barrel and endcap

$$\varepsilon_{J/\Psi}\left(p_T^{J/\Psi}\right) = \int_{\vec{p}_{\mu_1},\vec{p}_{\mu_2},\cos\vartheta^*} \varepsilon_{1\mu}\left(\vec{p}_{\mu_1}\right)\varepsilon_{1\mu}\left(\vec{p}_{\mu_2}\right)$$

• Single muon trigger efficiency obtained by the tag-and-probe method
• J/ψ trigger efficiency

Plans for the next year

- ## Cosmic trigger at LVL2
  - Algorithm is running stably in last months during combined runs
  - Performance study with data and improvement of the selection

- ## Development of trigger menu for early running
  - Deployment of the trigger database and tools
  - Prepare for the first data taking and understanding the trigger

- ## Study on di-muon trigger efficiency calibration
  - Finish the note
  - Muon trigger study with first data

- ## Physics study
  - W/Z+jets production

Summary

- Worked mostly on HLT commissioning for cosmic runs in the first half of 2007
  - In February 2007, L2 algorithm was integrated with LVL1 and ran on real cosmic data for the first time
  - Integration of HLT cosmic algorithm in the M3 combined run in June 2007
- Started working on trigger menu development
  - Responsible for trigger menu implementation and testing
- Plans
  - Trigger menu development
  - Physics study on W/Z+jets production

Cosmic muons in ATLAS detector
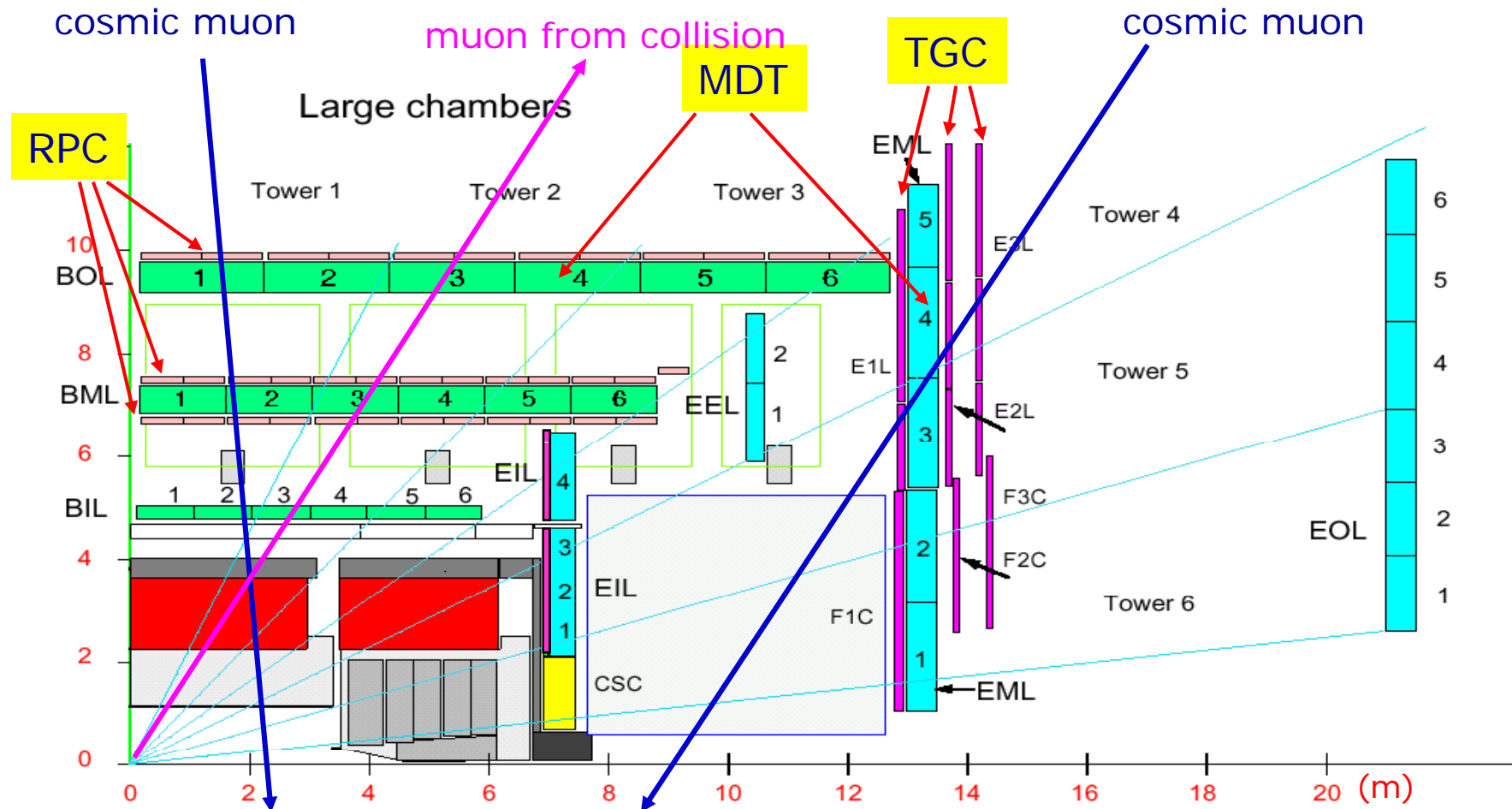
RPC, TGC: used for LVL1 trigger, requiring coincidences between different layers in a narrow window.
MDT: Precision chamber for momentum measurement