

The ATLAS B physics trigger

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On behalf of the
B – physics trigger group

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LHC and ATLAS detector

Center of mass energy = 14TeV

Bunch – crossing rate = 40MHz

Luminosity:

$L = \sim 10^{33} \text{ cm}^{-2} \text{ s}^{-1}$ - most of B-physics will be measured here

□ $L = \sim 10^{34} \text{ cm}^{-2} \text{ s}^{-1}$ -

for High p_T discovery

physics, however will be

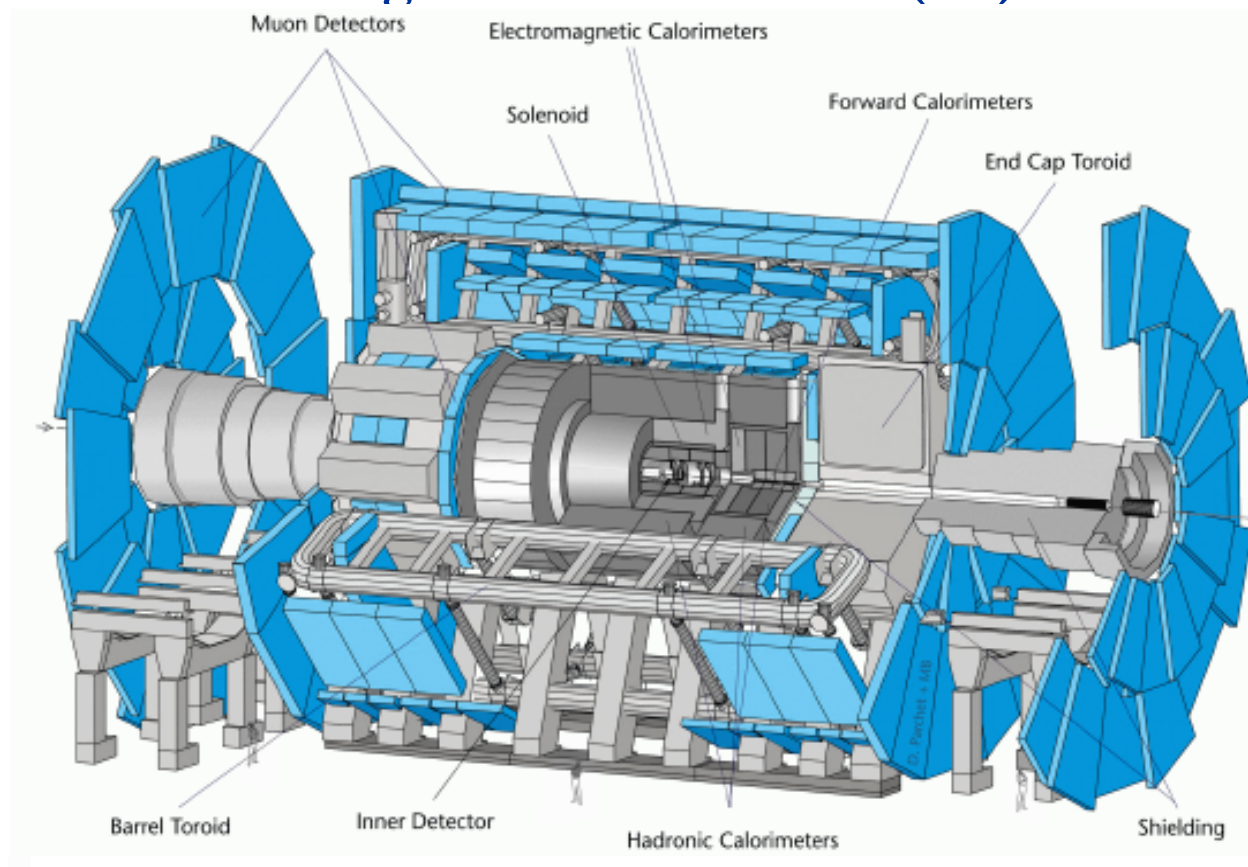
used also for rare B decays

p-pbar collision = 10^9 Hz

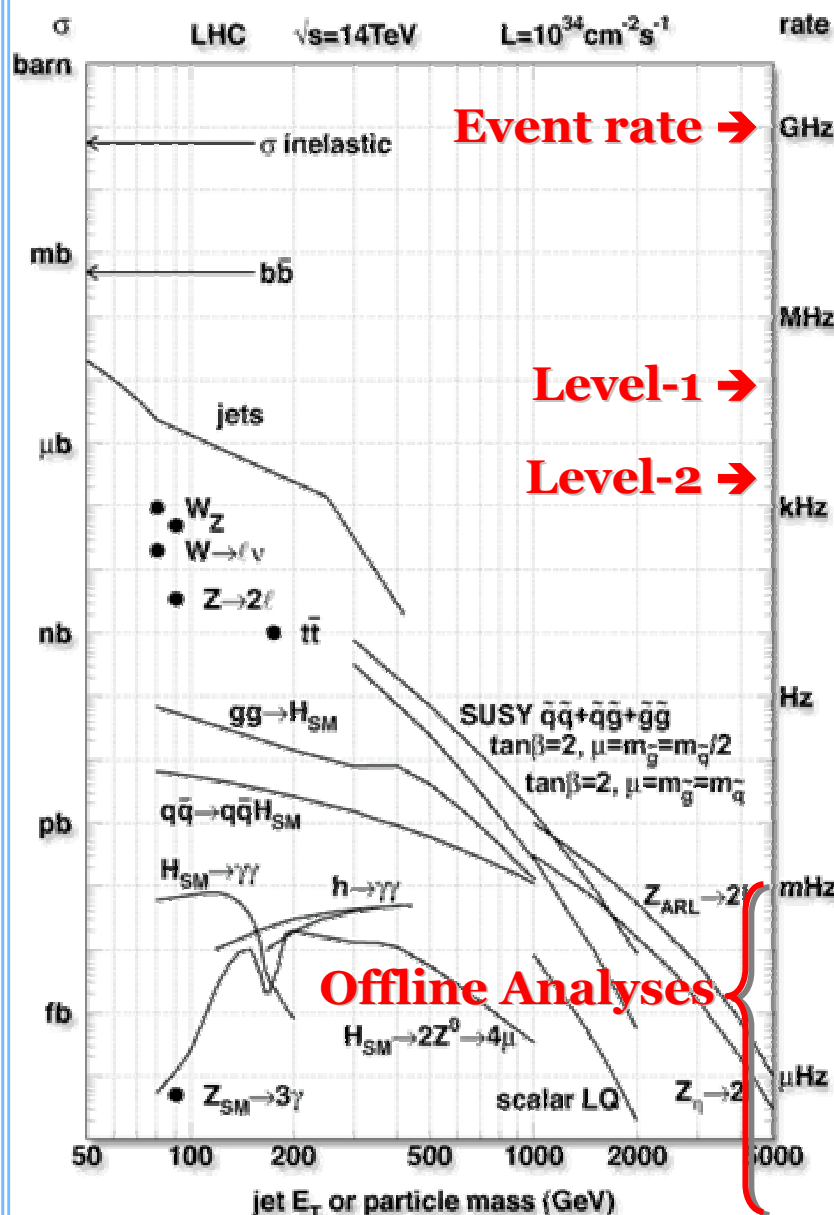
Bunch crossing interval = 25ns

Pileup = 23 ($L = \sim 10^{34} \text{ cm}^{-2} \text{ s}^{-1}$)

- **calorimeters: Electromagnetic**
 - **Liquid Argon and Hadronic Tile**
 - **Miscellaneous Drift Tubes (MDT)**
 - **detectors: Cathode Strip Chambers (CSC)**
 - **Resistive Plate Chambers (RPC)**
 - **(TRT) Thin Gap Chambers (TGC)**
- forming the Inner Detector (ID)



Events rate too high to collect all events

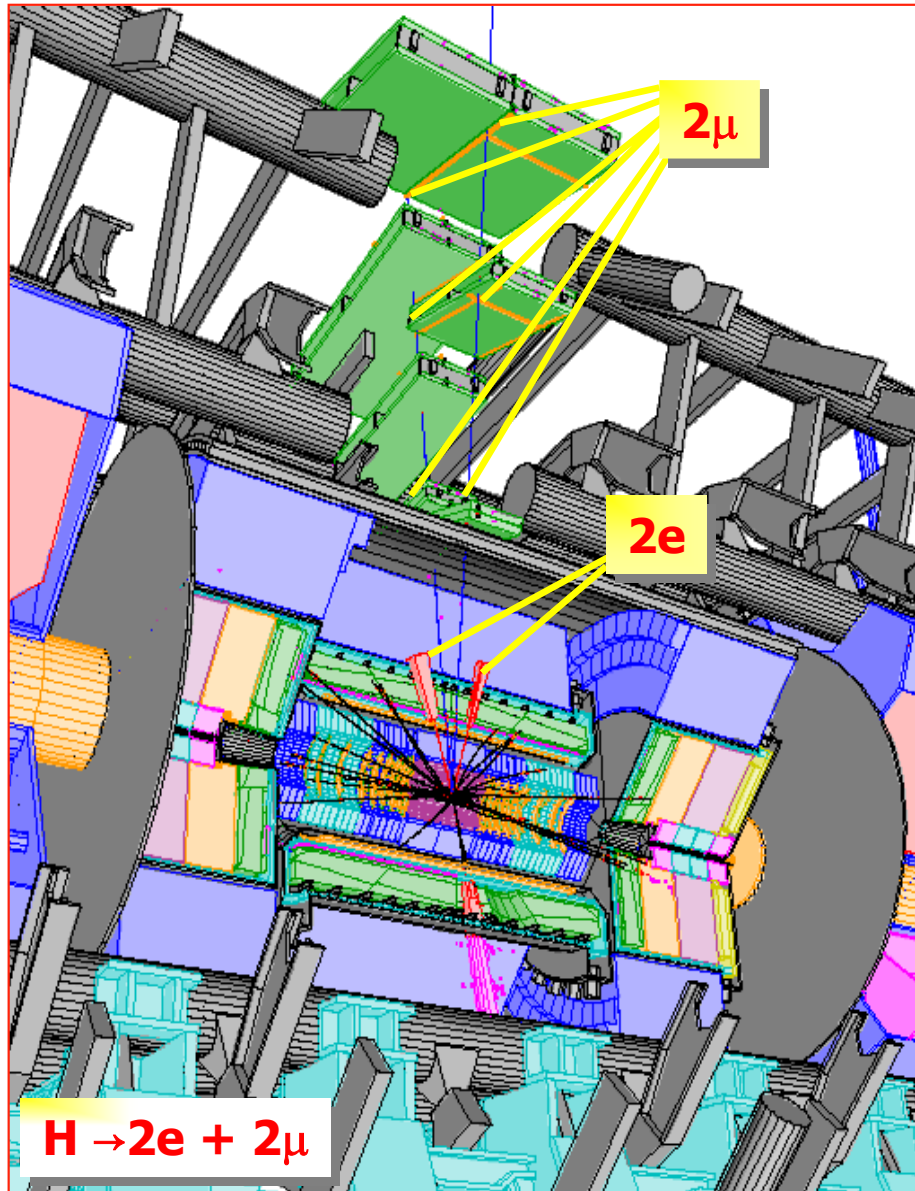


- 99% of bunch crossing end up with non-b events
- The selection of physics signals requires the identification of **objects** that can be **isolated** from the high particle density environment.

Object	Examples of physics coverage
e	Higgs, B-physics , new gauge bosons, extra dimensions, SUSY, W, top
γ	Higgs, extra dimensions, SUSY, B-physics
μ	B-physics , Higgs, new gauge bosons, extra dimensions, SUSY, W, top
Jets	SUSY, compositeness, resonances, B-physics

The Trigger system and Region of Interest mechanism

Reduces the high data rate by selecting interesting events through 3 steps:



hardware

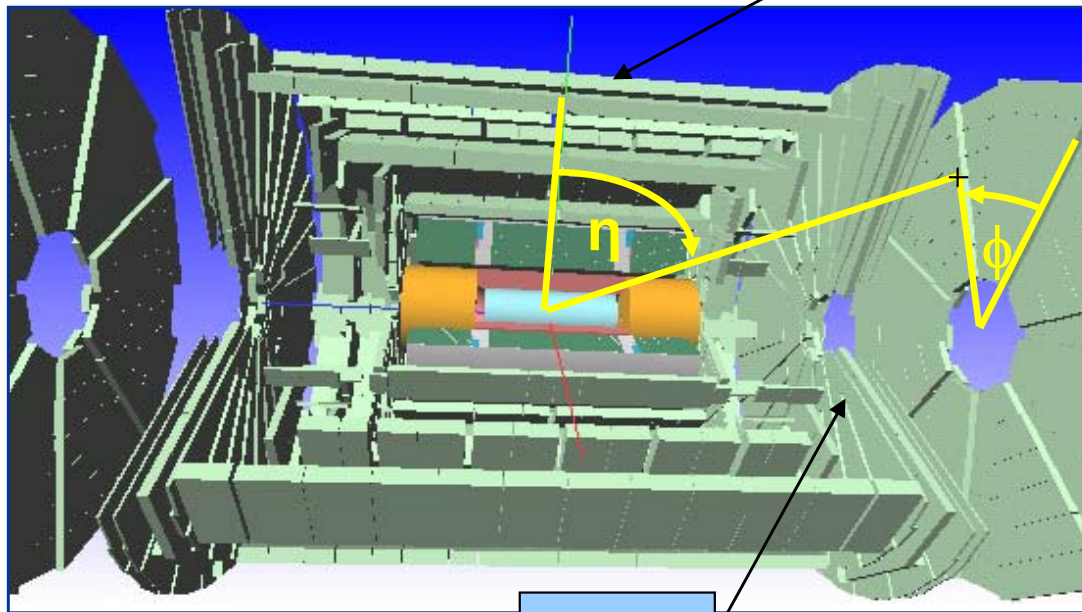
- LVL1 decision made:
 - Muon Trigger Chambers and Calorimeter data to find $e, \gamma, \tau, \text{jet}, \mu$ **candidates** above thresholds
 - Identifies Regions of Interest
 - Processing time $2.5 \mu\text{s}$

software

- LVL2 uses **Region of Interest** data
 - Combines information from all detectors
 - Performs fast rejection.
 - Processing time 10 ms
 - Output rate $\sim 2\text{kHz}$
- Event Filter
 - Can be “seeded” by LVL2 result
 - potential full event access
 - Processing time 1s
 - Output rate $\sim 200\text{Hz}$

Level1: Muons

RPC



TGC

- To indicate a μ candidate, a hit must be accompanied by hits in the other detector layers, within the **coincidence window**.

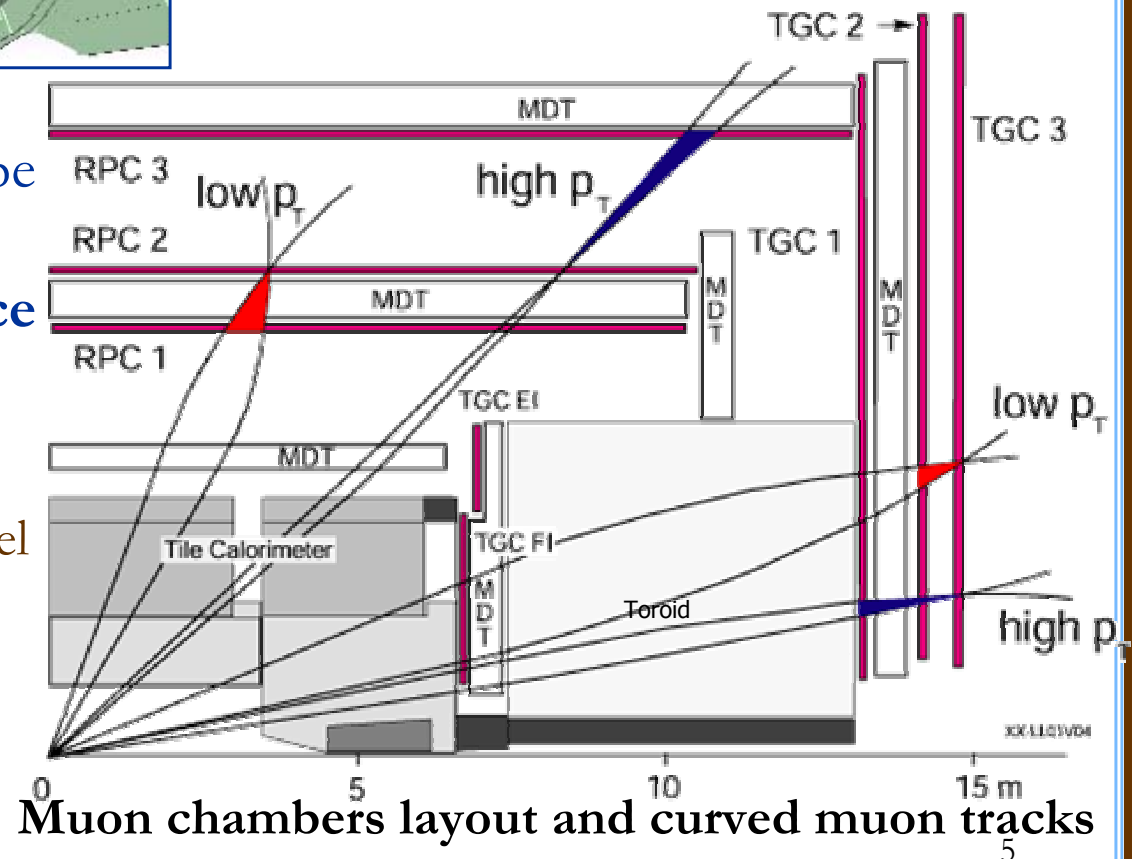
- Low p_T μ – 3/4
- High p_T μ – 3/4 + 1/2 (2/3) for barrel (end-cap)

- Trigger efficiency

- 85% low p_T ; 87% high p_T

Trigger Chambers:

- Barrel region ($|\eta| < 1.1$):
 - Resistive Plate Chambers (RPC)
- End-cap region ($1 < |\eta| < 2.7$):
 - Thin Gap Chambers (TGC)



Level1: Muon trigger

To reduce background from decay in flight of $\pi/K \rightarrow \mu$ typical threshold in Level1 scheme for low luminosity ($L \sim 10^{33} \text{ cm}^{-2}\text{s}^{-1}$) is **6GeV**

