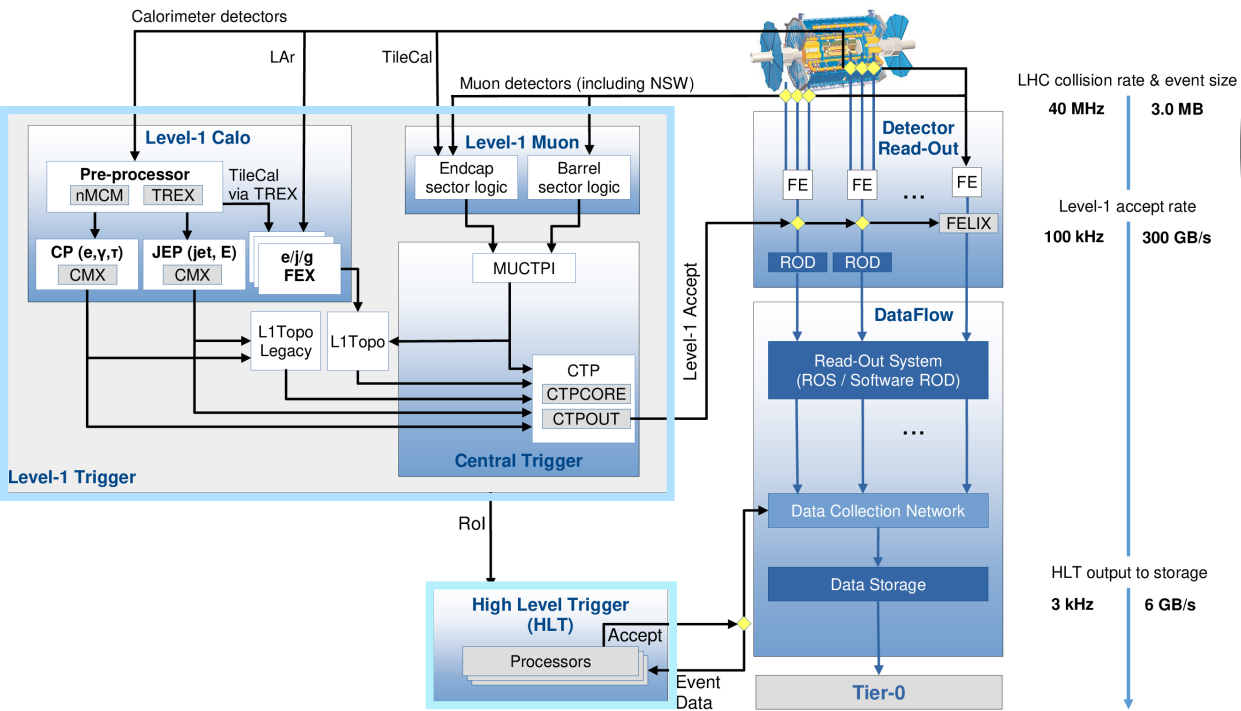


The ATLAS Trigger System

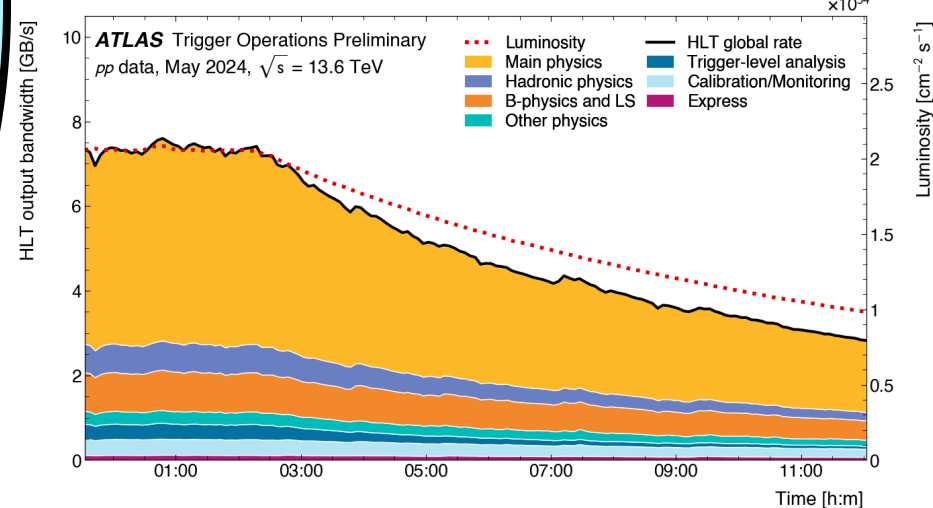
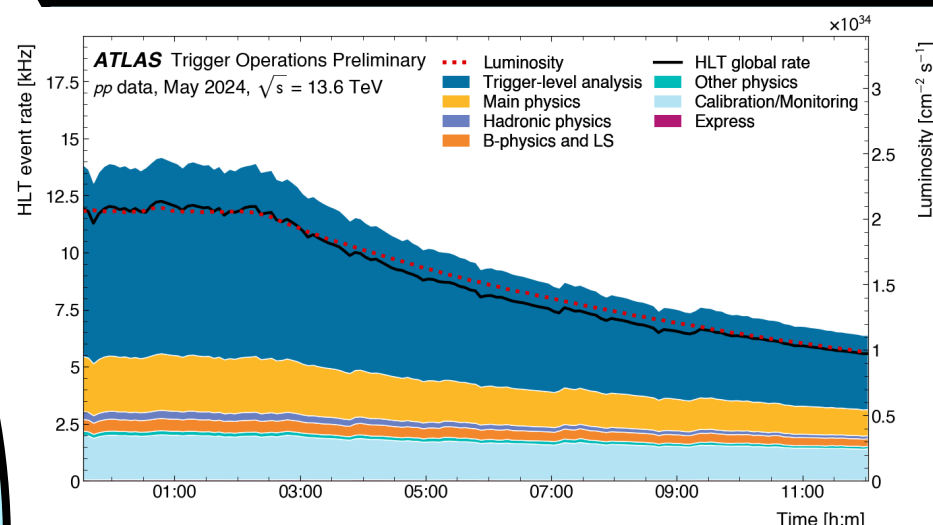
Fast, selective, flexible, simple and robust.



Level 1 Trigger

Fast custom-made electronics (FPGAs)

- **L1Muon:** coincidence patterns within parameterised geometrical “trigger roads” to identify muon candidates
- **L1Calo:** calorimeter energy deposits as inputs to calculate TOBs
- **L1Topo:** inputs from L1Calo and L1Muon, applies real-time kinematic and angular selections at L1
- **CTP:** inputs from all L1 Trigger systems, identifies Rols with coarse information
 - Geometrical region in $\eta\phi$ in the muon spectrometer and calorimeters
 - Type of object (EM, tau, jet, muon objects)
 - Threshold passed (pT, ET)



High Level Trigger

- Fast custom-made software on commercial CPUs
- Offline-like algorithms to reconstruct objects and applies physics selection
- Fast and Precision reconstruction,
 - each with different **steps**
 - each step uses an **algorithm**
 - all contained in a **chain**

Streams
collection of events or event fragments in the same data-set depending on HLT decision

Rates Analysis

Run 3 Enhanced Bias Dataset
used to record events for trigger rate predictions

unprescaled rate predictions

Rates Analysis

rates.json

Trig Rulebook

prescaled rate predictions
L1prescales.json
HLTprescales.json

metadata.json
csv files

Rates Analysis

Web Interface

Trigger Configuration

- Dependent on software release (Athena) used for the run
- Use Athena to create the **Super Master Key (SMK)**
 - Defines one unique Trigger configuration
- **SMK** determines the **L1** and the **HLT Menu**
- **Bunch Group Key (BGK)** which reflects the LHC filling pattern

Trigger Menu

- Collection of L1 items and HLT chains and the corresponding set of rules
- *Defines the rate each chain is allowed to write out*
- Composition and trigger prescales are optimised for several luminosity ranges
- Only items and chains in the menu can get a prescale defined

Rulebook

- Defines the rules to compute the **PSKs**
- classes containing lists of L1 items and HLT chains and the information on how to compute the prescales

Why do we need to analyse the rates?

Limited total output rate and we want to make sure we use it optimally!

Prescale Keys (PSKs)

Not all triggers need to run at full rate!

- simply too high
- sub-sample sufficient

Apply prescales to reduce rate.

Display Rate Chain HLT Summary

Cost Value Comparison New Processing Request View P1 Logs View Request Logs View Installed SW

Home → Directory: cprat → Run: 24053mainVBF_29655 → Range: All → Summary: HLT Rate Chain HLT

Rates prediction for user specified L = 2.00e+34 cm⁻²s⁻¹

Rate Comparison: Paste the full URL of another Rates Summary page here

Luminosity Point: 2.00e+34 cm⁻²s⁻¹ Generate

File of rates: data/cprat/cost/Monitoring_24053mainVBF_29655/rates.json

Table parsed from CSV file: data/cprat/cost/Monitoring_24053mainVBF_29655/csv/Table_Rate_ChainHLT_HLT_All.csv

Name	Group	Weighted PS Rate [Hz]	Weighted PS Rate Err [Hz]	Unique Rate [Hz]	Unique Rate Err [Hz]	Express Rate [Hz]	Express Rate Err [Hz]	Prescale	Express Prescale	ID	Raw Active Events	Raw Pass Events
HLT_1035_pt_ef_presel730_L14J40	RATE:A	12.3419	6.0831	0.0000	0.0000	0.0000	0.0000	1.0	-1.0	655	1070	5
HLT_1040_L14J40	RATE:A	1.5189	1.5189	0.0000	0.0000	0.0000	0.0000	2.0	Multiple	662	1070	1
HLT_1040_pt_presel730_L14J40	RATE:A	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	2.0	Multiple	542	1070	0
HLT_2e12_InvMass_mu10_L12eEM18MUP	Primary	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0	-1.0	165	168	0
HLT_2e17_InvMass_bose_L12eEM18M	RATE:A	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	-1.0	1.0	175	0	0
HLT_2e17_InvMass_bose_nogel_L12eEM18M	RATE:A	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	-1.0	-1.0	176	0	0
HLT_2e17_InvMass_L12eEM18M	Primary	21.1670	8.0004	10.0619	3.8031	0.0000	0.0000	1.0	-1.0	22	541	7
HLT_2e17_InvMass_g20_Rgt_Presel_L12eEM	Support	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0	-1.0	32	541	0
HLT_2e17_InvMass_g20_Rgt_Presel_L12eEM	Support	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0	-1.0	24	541	0