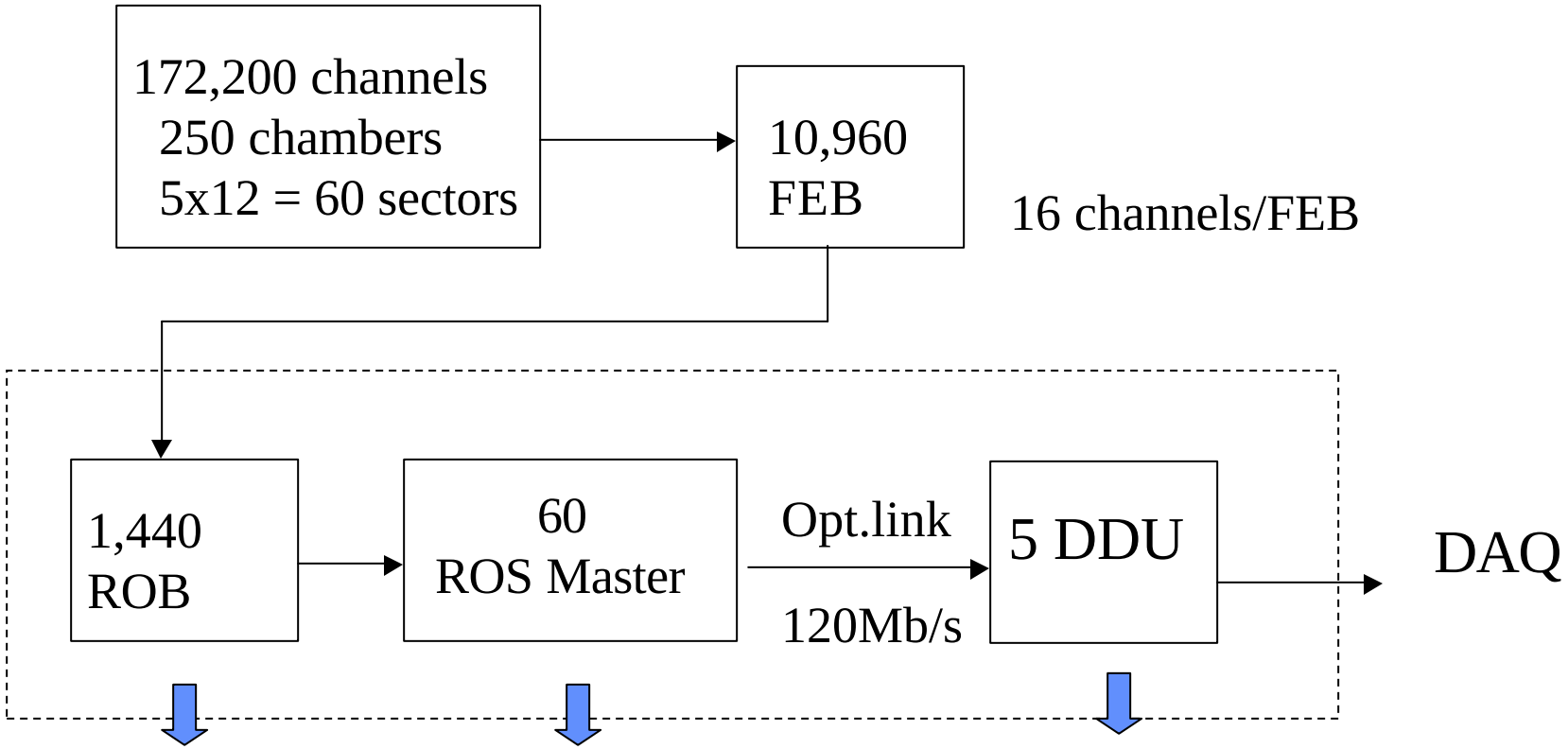
DT DAQ Path


172,200 channels
250 chambers
5x12 = 60 sectors
10,960
FEB
16 channels/FEB
1,440
ROB
60
ROS Master
Opt.link
120Mb/s
5 DDU
DAQ
On chamber
"MINICRATE"
In 1 ROB: 4
32-channels TDCs
1 per sector
(4 chambers)
1 per 12 ROSM
(preliminary;
DDU design yet to be finalized)

Data rate & size (I)

Fluxes:

a) ≤ 1 tracks/cm^2/s everywhere in the Barrel (punchthrough, μ)

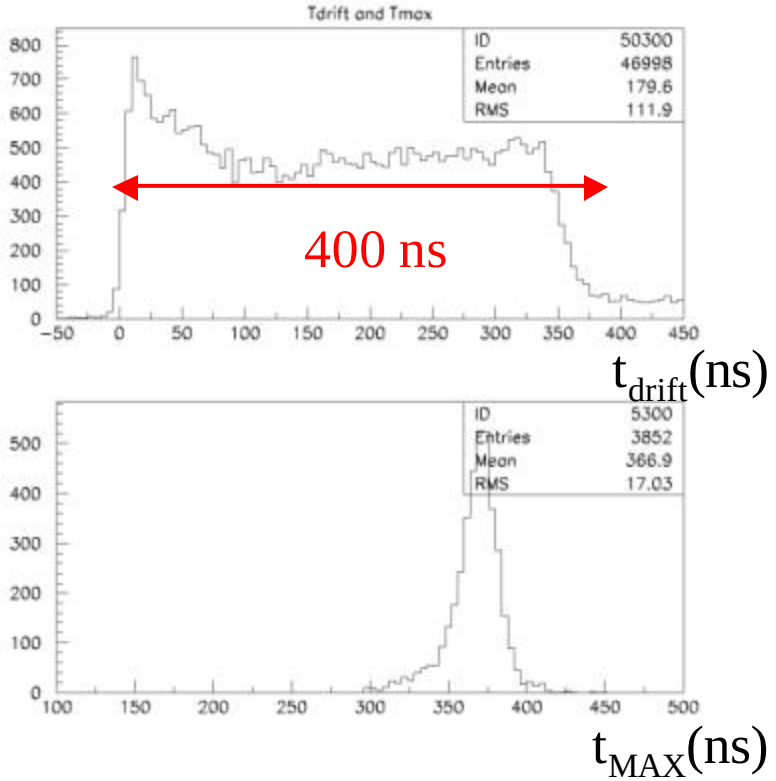
(=> may give a BTI candidate in L1 processor)

≅ 30 'tracks'/ trigger in the detector @ L1A rate = 100 KHz

=> (12+12+12+8)*30 = 44*30 ≅ 1300 hits/trigger

b) ≤ 10Hz/cm^2/s physical (uncorrelated) hits ($e^{\pm}$ from neutrons)

(=> 10 KHz/channel in worst case (MB1);
noise reduced by
Trigger_rate*TDC_window
< 5% at L1A rate =100KHz ; ⇒



a+b) ⇒ ≅ 1 % channel fired/trigger

4 bytes/channel

Data rate & size (II)

➡ Total size: 9 KB/event

(including an estimated 35% overhead in headers-trailers; this is in a specific ROS format proposal; final one yet to be defined)

➡ Small amount of data => all DT data transferred to DAQ @ each L1A

➡ L2 input @ 100 KHz: 900 MB/s to DAQ

=> 900 MB/s / 60 = 120 Mb/s bandwidth on ROS-DDU links

DT Calibration Methods & Runs

Calibration runs currently foreseen:

1) **Threshold run**

2) **t0 calibration**

3) **rates**

4) **extraction gap test**

Event size is not expected to exceed normal event size.

Each calibration should take just several minutes during fill (or taken during run)

5) alignment with real muons

- prompt muons ($p_T > 50$ GeV/c) from GMT
- 0.2 – 1 Hz muon/sector

4 days needed @ L=2 10^{33} to reach 200 μm precision

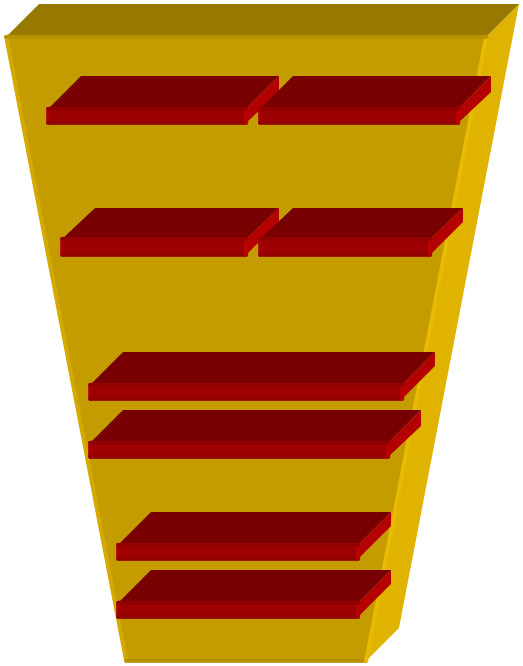
=> ~ 1 TB dedicated data stored for off-line alignment analysis

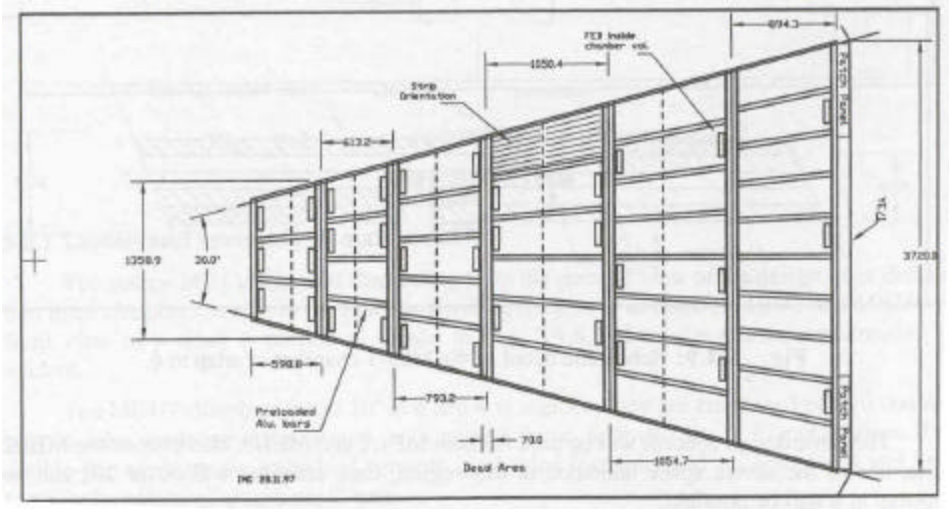
(under certain assumptions on DB/B, see eg. T.Rodrigo et al. CMS-TN 96-005)

RPC Muon System

- Six barrel stations in radius
- Four endcap stations in z
- 612 total chambers
- 160K channels
- Digital output
- ~0.6 kB event size (3% of CSC+DT) mostly from noise hits

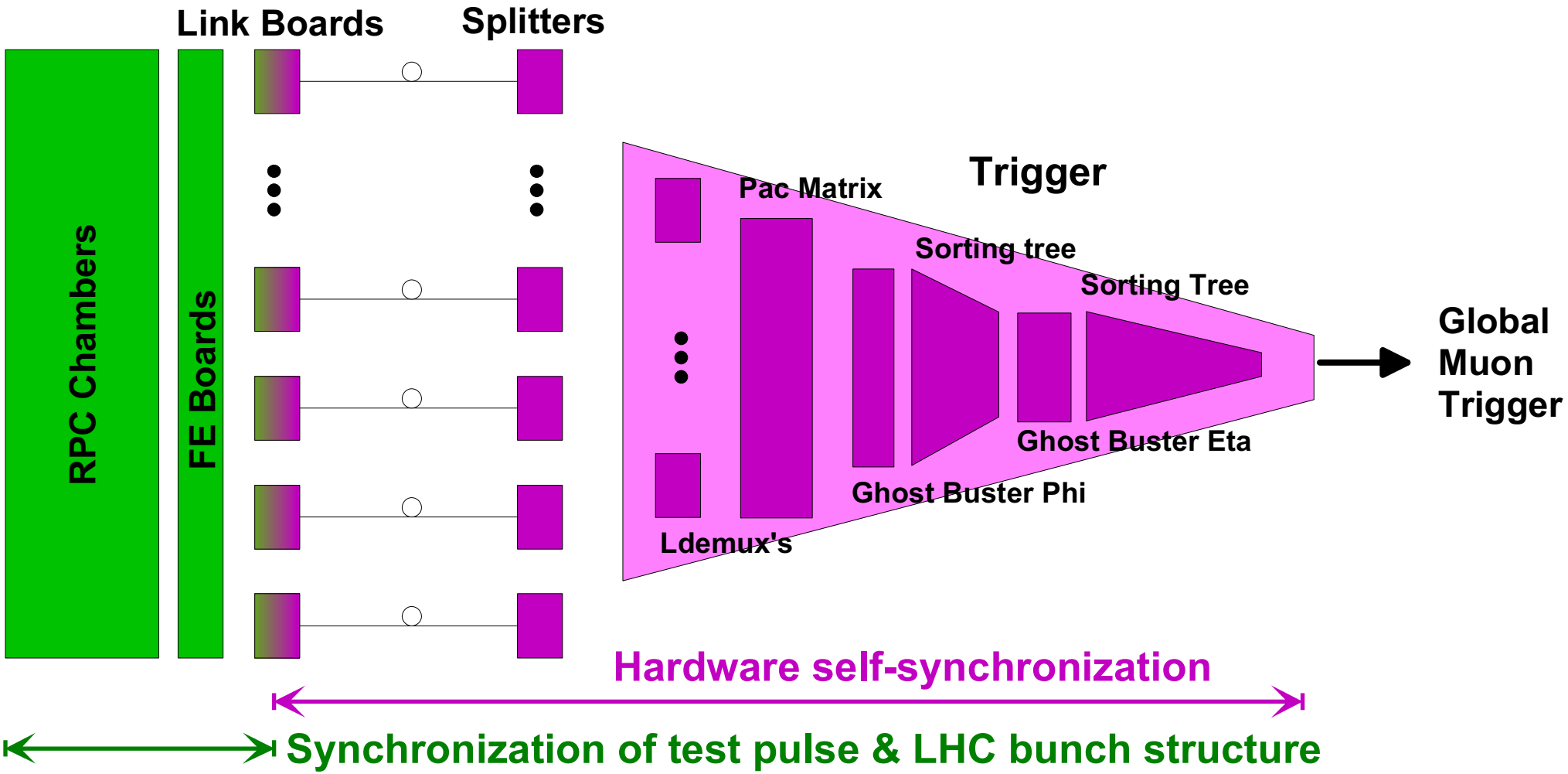
Barrel sector





Endcap sector

RPC Muon Trigger - synchronization, calibration architecture



• RPC calibration flow: current ideas

Start-up = every open/close CMS
125MB = 1 Kev x 5 bx x 200 Kchannels

Calibration run type	when	duration	Data volume	Processed in	Results used by
Synchronisation No beam	Start-up	10 min	125 MB	Local system + offline	L1 (via DCS)
Synchronisation Beam on, MinBias	Start-up	2 h	5.5 MB (bx histograms)	Local system + offline	L1 (via DCS)
Synchronisation Beam on, MuonTrigger	Start-up + monthly	2 h	140 MB (data + histograms)	Local system + offline	L1 (via DCS)
Test patterns Physics run	Every gap (including 38 bx gaps)	Gap length	Data not stored	Local system	L1 (via DCS)
Test patterns No beam	Daily, btwn fills	15 min	140 MB (data + histograms)	Local system + offline	L1 (via DCS)
Monitoring Physics run	always	Non stop	12 MB/hour (histograms + scalers)	Local system	L1 (via DCS)
PAC calibration Physics run	always	Non stop	Normal event data	offline	L1

L2 / L3 CPU Analysis:

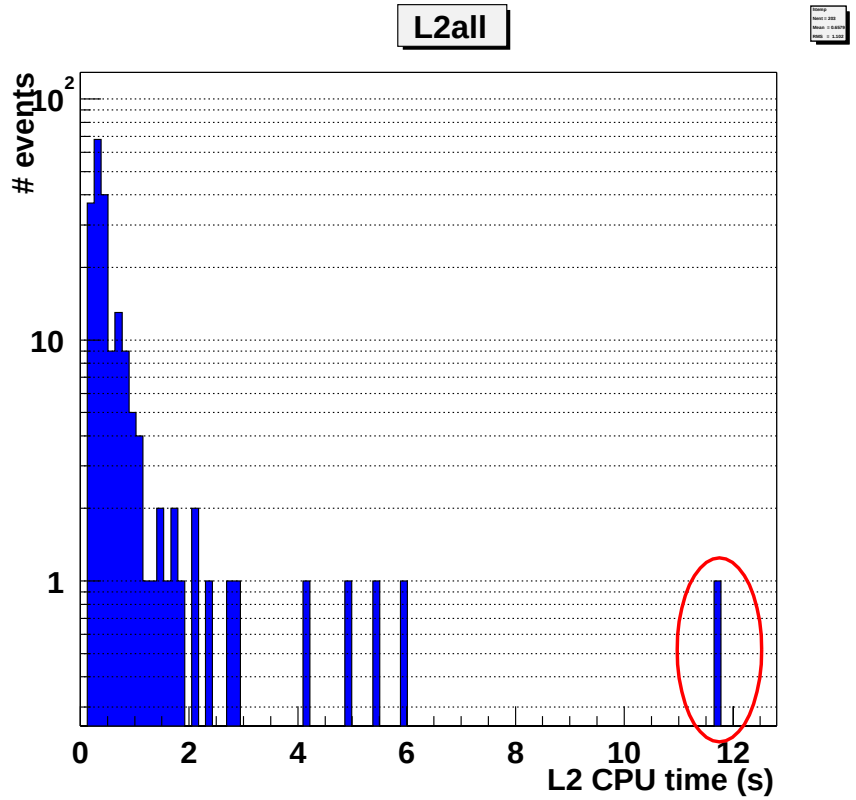
- Dataset used: $W \rightarrow 1\mu + X$, full PU, $\sim 5000\, ev$ used
- L2 software is official (`Muon/MuonTrackFinder` & `MuonReco`, ORCA 5_3_4) plus navigation optimization:
  - in short only the chamber reacheable within FTS $\pm$ error are used.
  - not yet in ORCA release, will be soon.
  - $\sim 5 \div 7$ times faster w.r.t. "released" L2.
- L3 "official";
- hardware: AMD Athlon MP $1800+$ $1526.$ MHz, $512\, MB$ ram
  (it's approx 33% faster than a PIII $1000.$ MHz)
- Time measurement from `TimingReport` class by Vincenzo.

L2 CPU analysis (I):

- L2: ~ 780 ms/ev large fluctutation (see after)
  - Seed generation ~ 25 ms/ev
  - Trajectory builder: ~ 680 ms/ev
  - Vertex constraint ~ 75 ms/ev
- Trajectory builder: ~ 680 ms/ev
  - Forward K. filter (FTSRefiner): ~ 460 ms/ev (bigger initial error)
  - Backward K. filter: ~ 220 ms/ev

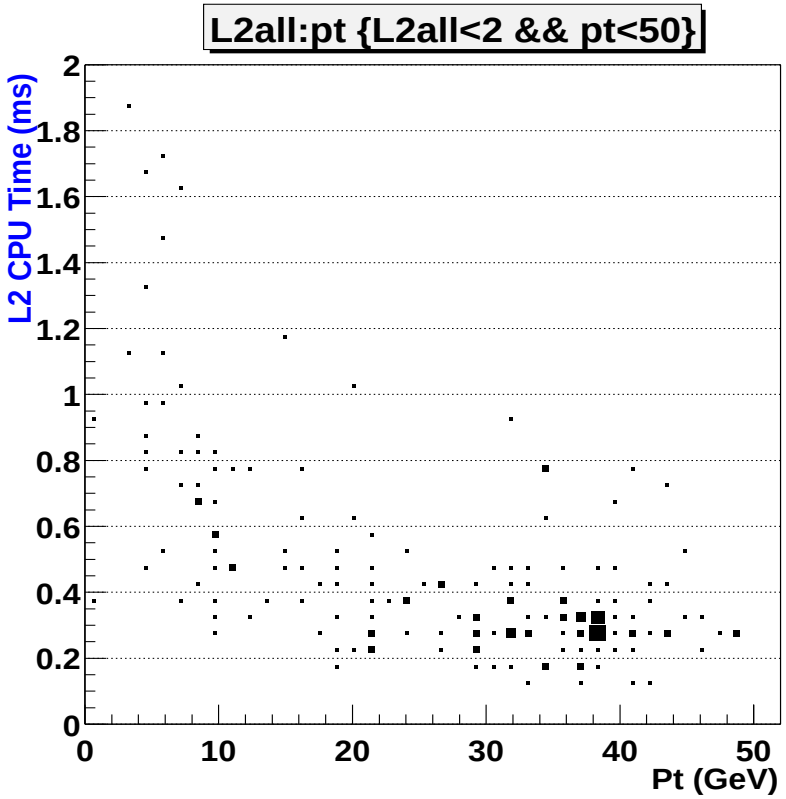
    of which:
    - Extrapolation inside DT/CSC chamber: ~ 30 ms/ev
    - Kalman update: ~ 20 ms/ev
    - Segment building: ~ 60 ms/ev

L2 CPU analysis (III) (based on $\sim 200\ ev$):



L2 CPU fluctuation

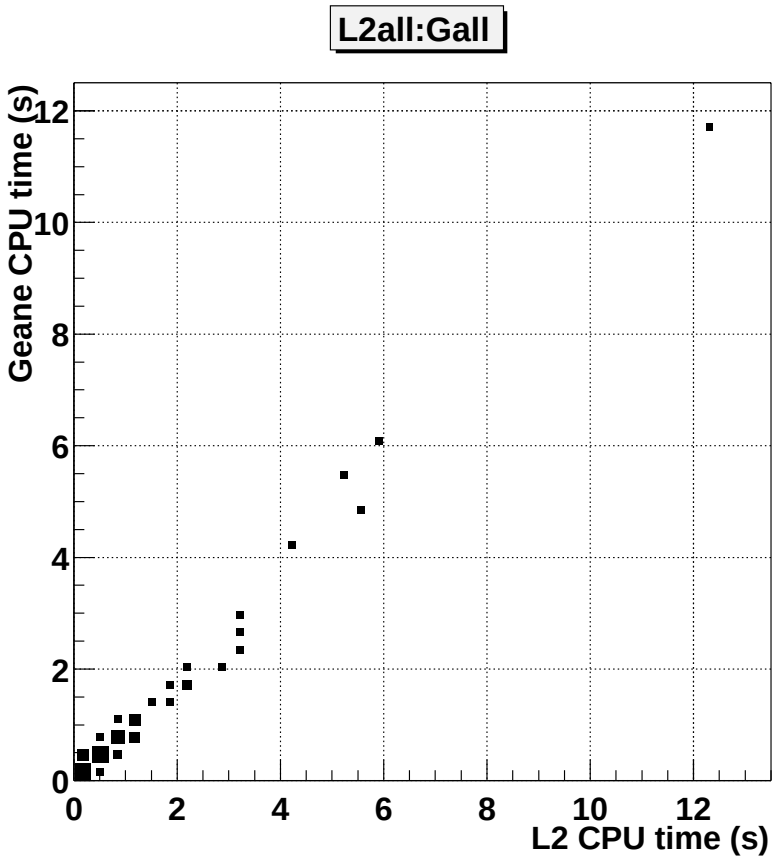
$pt_{gen} = 1.7$ GeV, $\eta = 1.07, pt_{L1} = 0$!

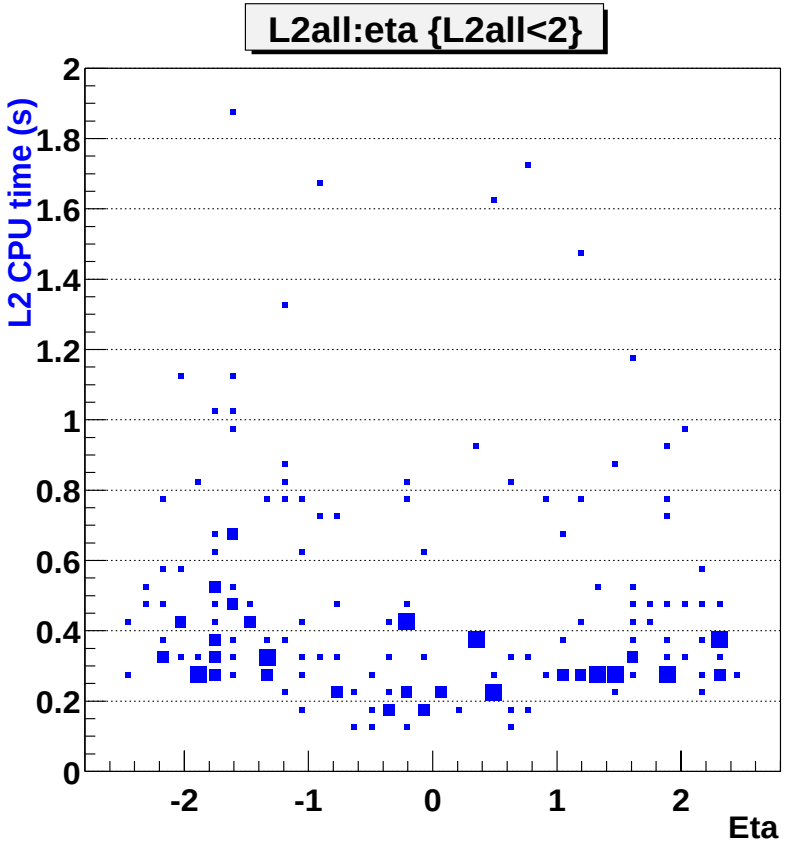


L2 time vs. pt

slower for low p_T

L2 CPU analysis (IV):





all L2 time is spent inside Geane!

$\sim$ slower in the endcap