PRS/muon meeting

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CPU analysis of L2-L3 HLT muon

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Outline:

- Description of the software/hardware used,
- L2 CPU analysis,
- L3 CPU analysis,
- Conclusion;

Description of the software/hardware used:

- 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

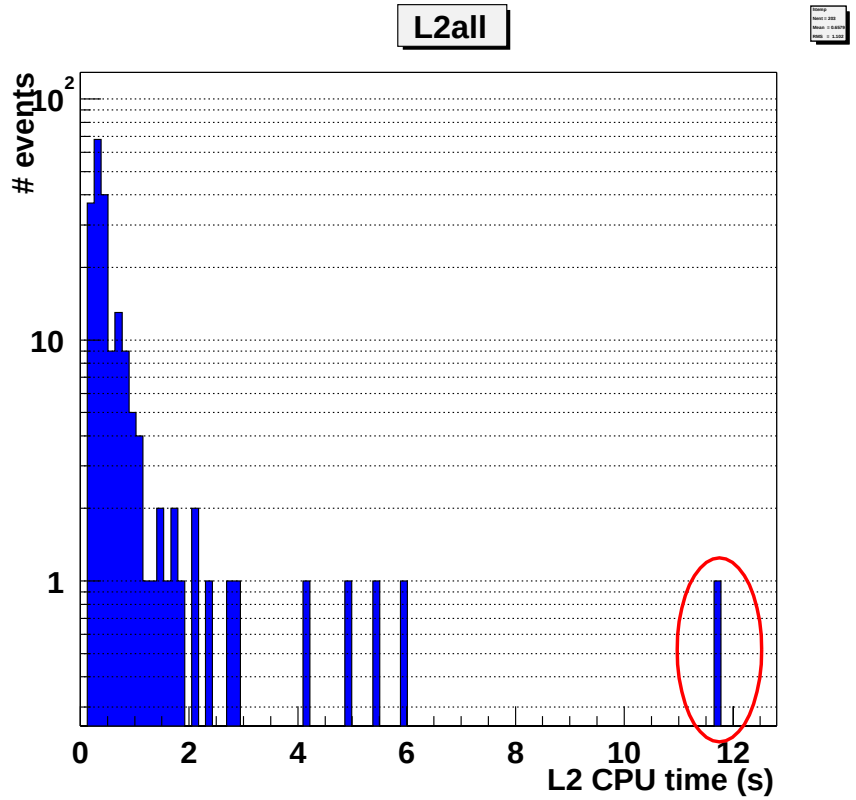
    of which:
    - Extrapolation inside DT/CSC chamber: ~ 30 ms/ev
    - Kalman update: ~ 20 ms/ev
    - Segment building: ~ 60 ms/ev

- Segment building
  - Barrel ~ 27 ms/ev for ~ 2.7 seg/ev (for events in proper η range)
  - Endcap ~ 45 ms/ev for ~ 4.7 seg/ev
- Geane propagation
  - total number of propagation: ~ 70
  - estimate of number of "long" propagation (across IRON): ~ 25
    - ~ 10 in barrel (navigation optimized) and
    - ~ 30 in endcap (not optimized!!!!)
  - total time spent: ~ 750 ms/ev

    (bigger than total L2 time: Geane is used also in L3 SeedGeneration)

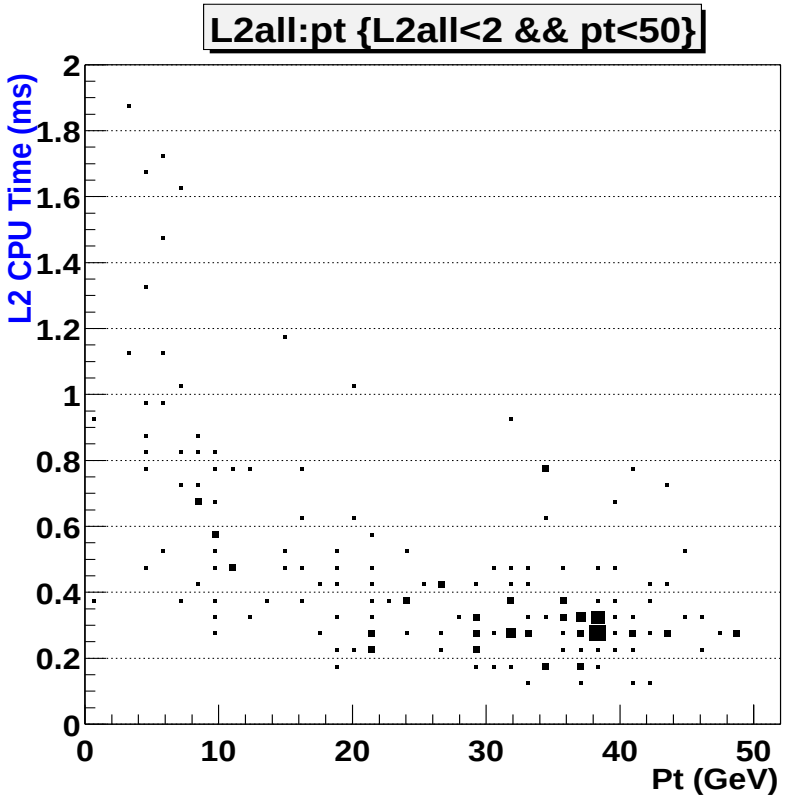
    90% CPU time in propagation across iron

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



L2 CPU fluctuation

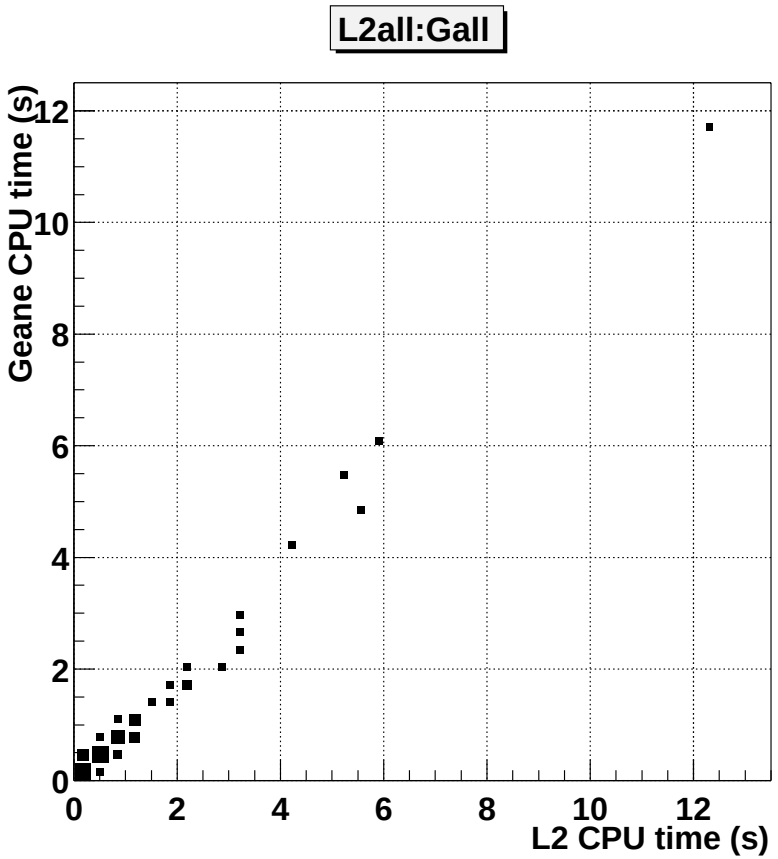
$pt_{gen} = 1.7$ GeV, $\eta = 1.07, pt_{L1} = 0$!

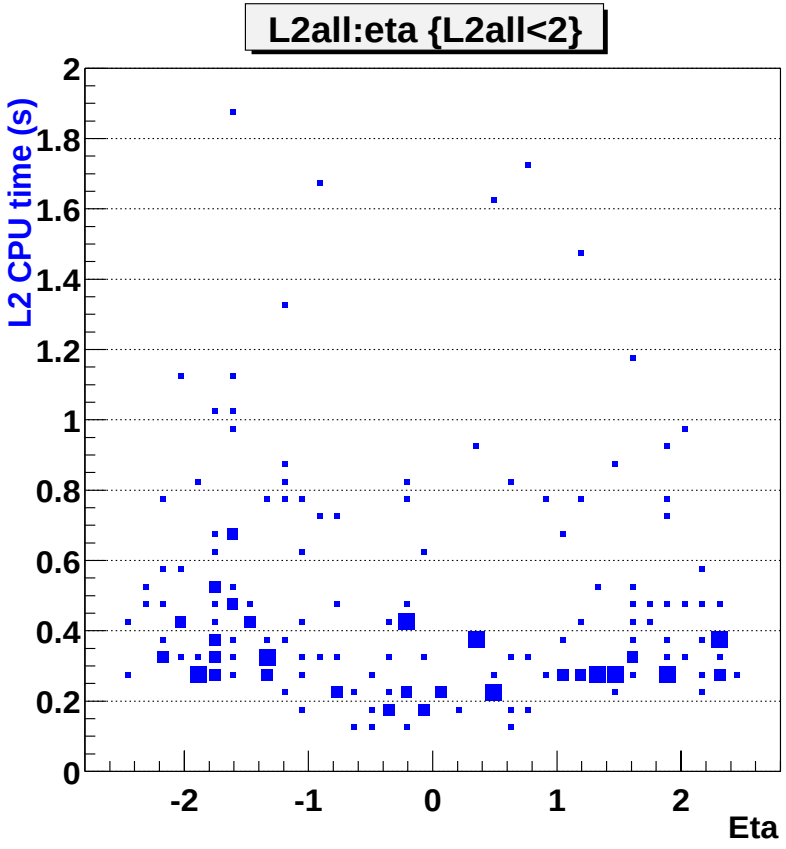


L2 time vs. pt

slower for low p_T

L2 CPU analysis (IV):





all L2 time is spent inside Geane!

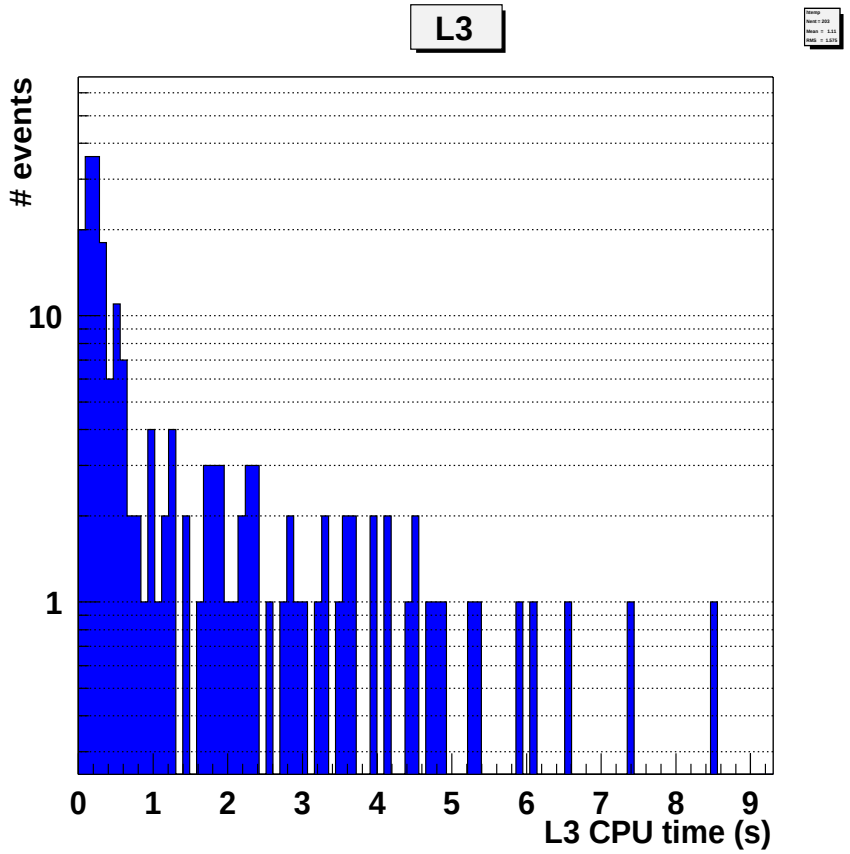
$\sim$ slower in the endcap

L3 CPU analysis:

L3: ~ 1680 ms/ev

large fluctuation (see $\Rightarrow$)

- Seed generation ~ 90 ms/ev
- Trajectory builder: ~ 1580 ms/ev
- Trajectory smoother: ~ 8 ms/ev
- no η correlation, slower for low p_T muons.



Comment and conclusion:

- First CPU analysis on muon HLT!
- So far we worked on efficiency, p_T resolution, . . . (and more work is needed), no (or few) optimization for timing.
- L2:$\sim 780\ ms$ dominated by geane extrapolation!
  - reduce the number of extrapolation needed,
  - explore alternative to geane (improved Gtf for non const $\vec{B}$ field, geant4, LUT, . . .)
- L3:$\sim 1680\ ms$ large fluctuation, mostly combinatorial
  - reduce the size of muon cone?
- Lot of works still to be done.