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First Level Trigger
MC results

- $e/\mu/\pi$ trigger rates/efficiencies
- TFU loads
- ARTE frame acception

RIh

(pre)Trigger conditions

electrons:

- $ktrig = 500$
- ECAL prediction: 0.5×0.5 of nominal cell size
- $0.5\ GeV/c < p_T < 10\ GeV/c$
- $5\ GeV/c < p < 200\ GeV/c$
- $2.75\ GeV/c^2 < M(e^+e^-) < 5\ GeV/c^2$

RIh

(pre)Trigger conditions

muons:

- Multiple scattering: $\pm 1\sigma$ in addition to geometrical prediction
- $0.5\ GeV/c < p_T < 10\ GeV/c$
- $5\ GeV/c < p < 500\ GeV/c$
- $2.75\ GeV/c^2 < M(\mu^+\mu^-) < 5\ GeV/c^2$

high-p_T particles:

- $1.5\ GeV/c < p_T < 6\ GeV/c$
- $5\ GeV/c < p < 500\ GeV/c$
- $4.5\ GeV/c^2 < M(\pi^+\pi^-) < 12\ GeV/c^2$
- Energi assimetry: $\left|\frac{E_{\pi^+} - E_{\pi^-}}{E_{\pi^+} + E_{\pi^-}}\right| < 0.5$

Rlh

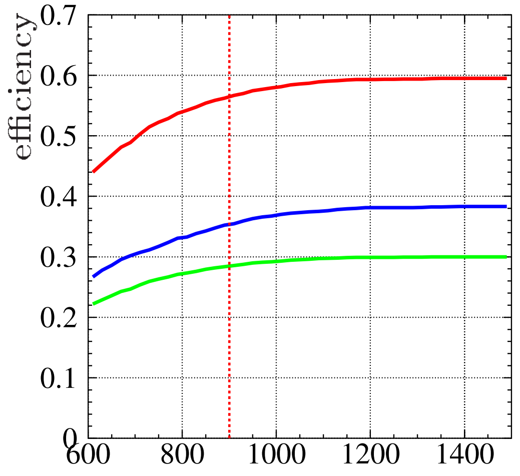
Signal efficiencies and FLT rate for combined statistics

Signals considered:

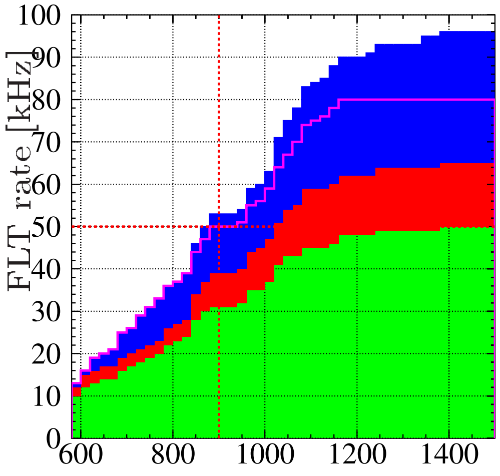
- $B \to J/\psi \to e^+e^-$
- $B \to J/\psi \to \mu^+\mu^-$
- $B \to \pi^+\pi^-$

FLT output rate:

- Inelastic events
- Poison distributed
- 5 interactions per BX



Energy in inner ECAL $[GeV]$



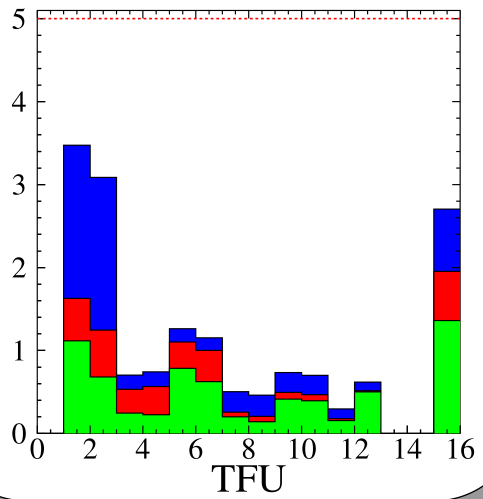
Energy in inner ECAL $[GeV]$

Multiplicity cut (inner ECAL energy cut) provides necessary 50 kHz of output rate keeping signal efficiency on reasonable level

TFU full load, $e/\mu/\pi$ contributions

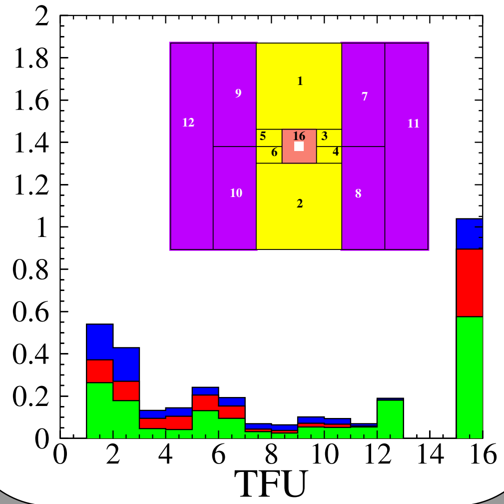
Hardest conditions

(messages to TC01)



Rate to TPM

(messages from PC01)

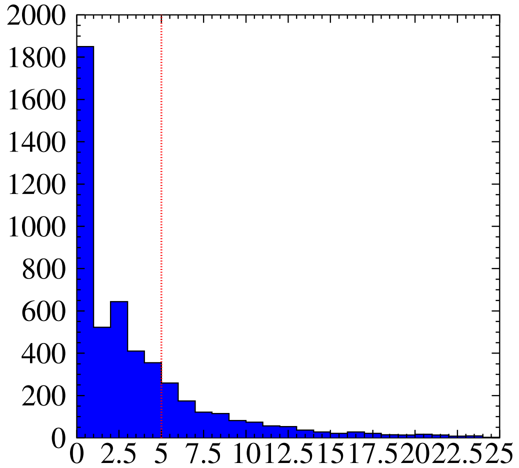


Rates are less than maximum ...

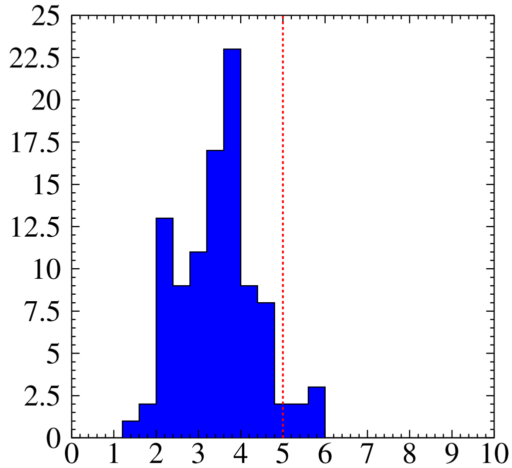
Is it enough?

TFU peak load:
TFU1 in TC01 as the most loaded

Messages per 1 BX



Average over 50 BX



- $\sim 8\%$ efficiency loss seems to be too much
- Multiplicity cut (E_{inner}-cut) was not applied
- Could the splitting of sections 1&2 help us?
- More accurate study is needed

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L1SIMU in the context of general HERA-B software

- FLT simulation should base on standard version of the HERA-B GEANT
  - the most up to date detector configuration
  - the most debugged codes
  - compatibility with another HERA-B packages
  - no care about the detector simulation part
- ARTE becomes *de facto* the standard HERA-B software frame
- Efforts are needed from both ARTE and L1SIMU sites to incorporate L1SIMU into original ARTE frame accurately.
- Intermediate solution was applied
  - to fit the L1SIMU to present database
  - to unblock the next levels development

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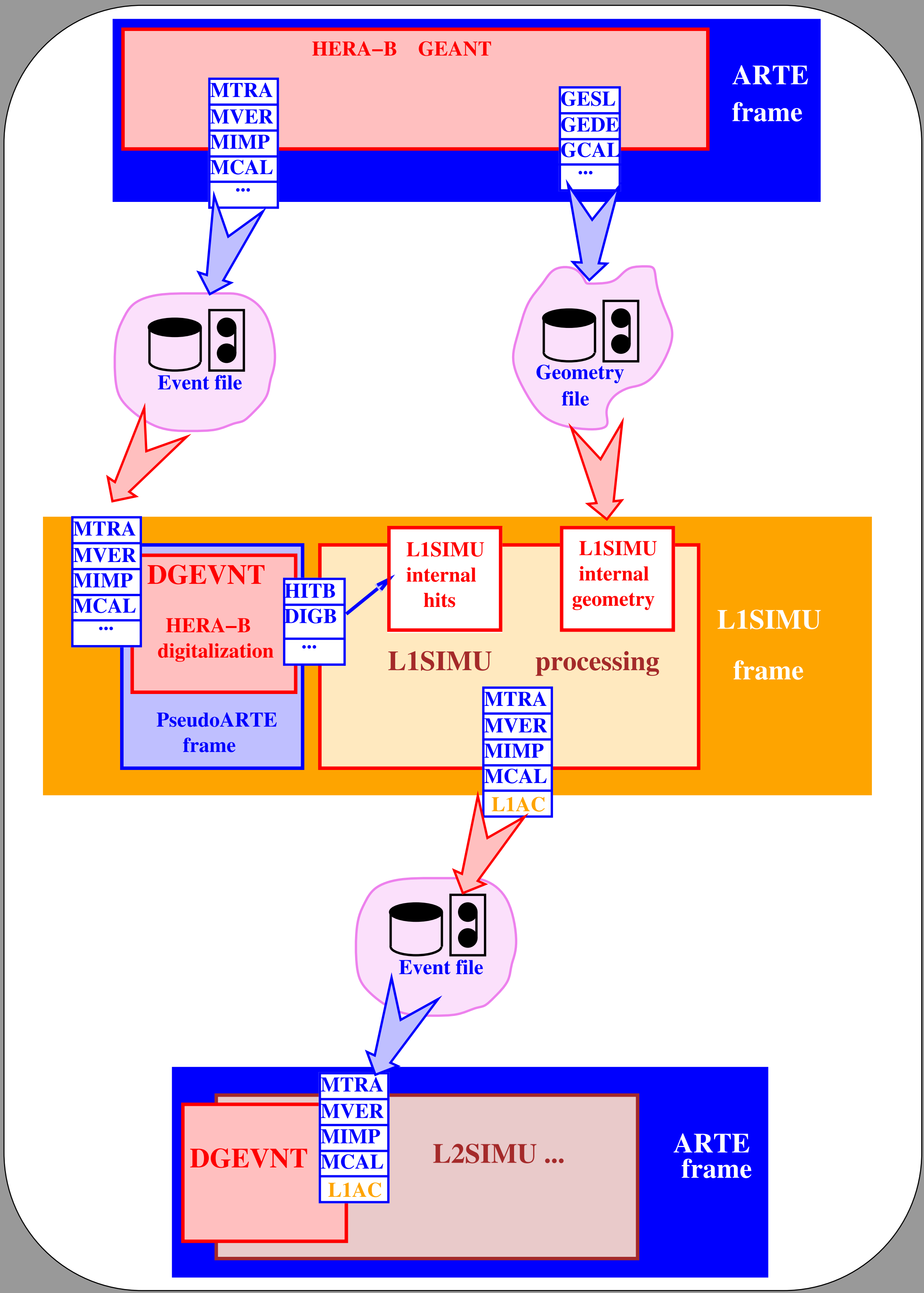
HBGEANT→L1SIMU→L2SIMU... data flow



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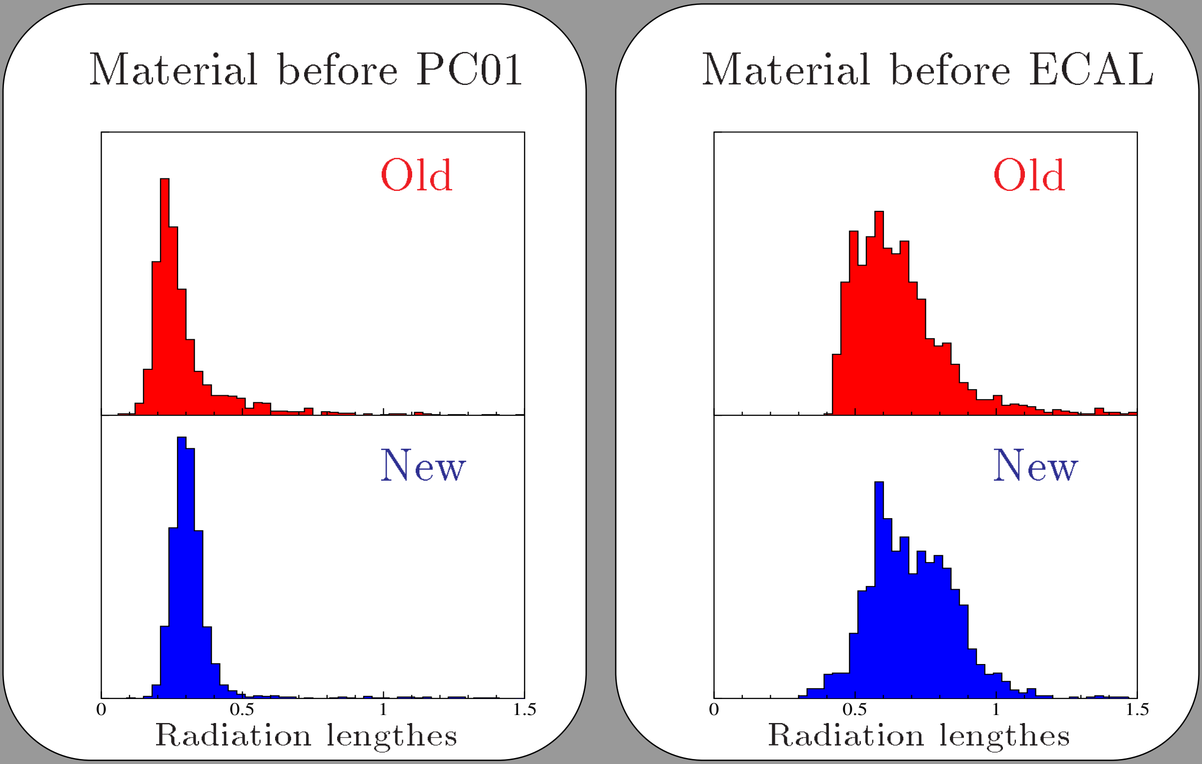
Comparison of Old⇔New versions of HERA-B GEANT

- Different inner tracker geometry
  - inner acceptance:
    $12 \times 16\ mrad^2 \Leftrightarrow 20 \times 20\ mrad^2$
- Changes in material distribution



Difference is not large

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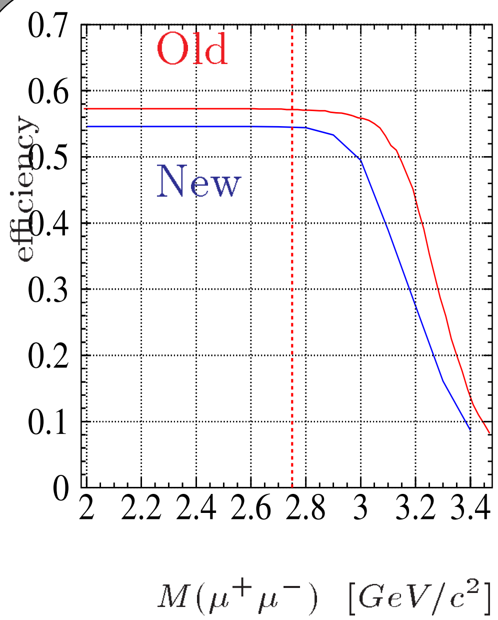
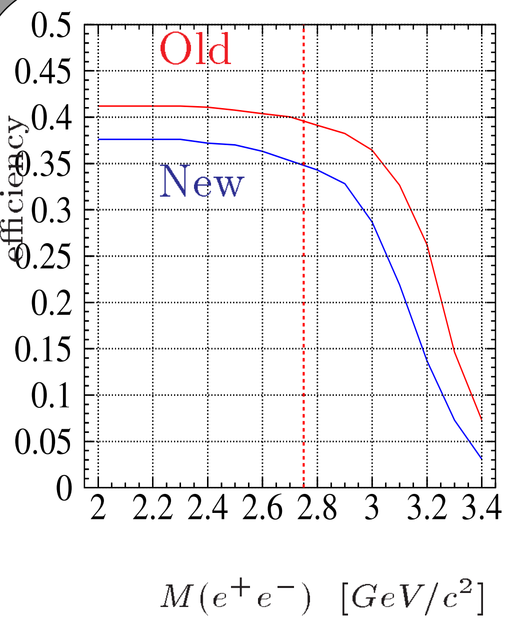
Comparison of Old⇔New versions: simulation results

Muons:
only geometrical acceptance could affect on

Electrons:
sensitive to material distribution





Versions seems to be in agreement.

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Conclusions

- L1SIMU package processes all base types of pretrigger in a single frame
- FLT provides the necessary suppression factor of 200
- Optimization of TFU units distribution should be performed
- Additional triggers (dileptons, $lepton - \pi$ etc.) could be easy incorporated and studied
- L1SIMU package accepts the modern version of HB-GEANT
- After the HB-GEANT version update/debug the regular production run could be started to collect statistics for the following trigger levels