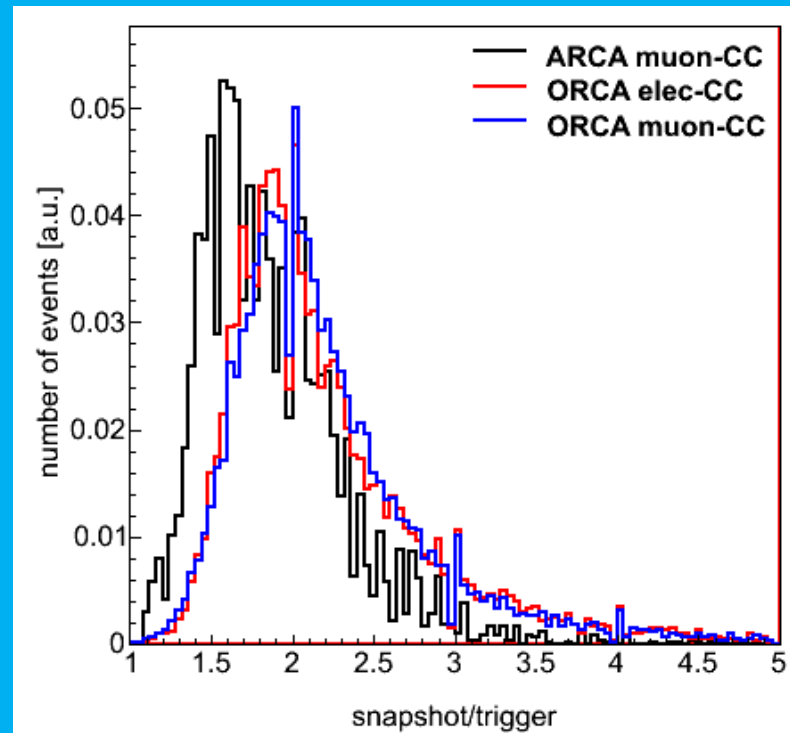


# New trigger for ORCA

M. de Jong

# Introduction (1/3)

- Report by Jannik (and others) that for ORCA, a (relative) large number of L0 hits is observed compared to number of L1 hits
- See also Analysis e-log entry [143](#)<sup>¶</sup>



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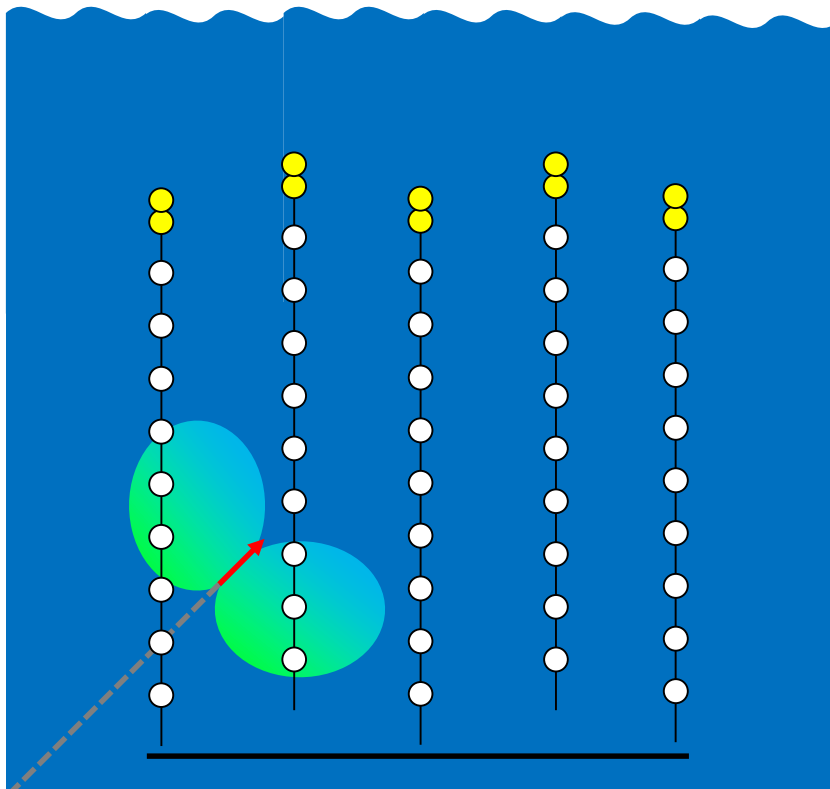
<sup>¶</sup> JTriggerEfficiency –B “0”

# Introduction (2/3)

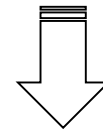
- Shower trigger based on a mix of L1 & L0 hits
- Total rates
  - $R_{L0} \cong 300 \text{ MHz}$
  - $R_{L1} \cong 2 \text{ MHz}$
- Typical time window
  - $\Delta T \cong 100 \text{ ns}$

$$R_{L0} \times \Delta T \gg 1$$

# Introduction (3/3)



size of shower  
(much) smaller than  
size of detector



limit distance  
between  
L1/L0 hits

# Algorithm (1/4)

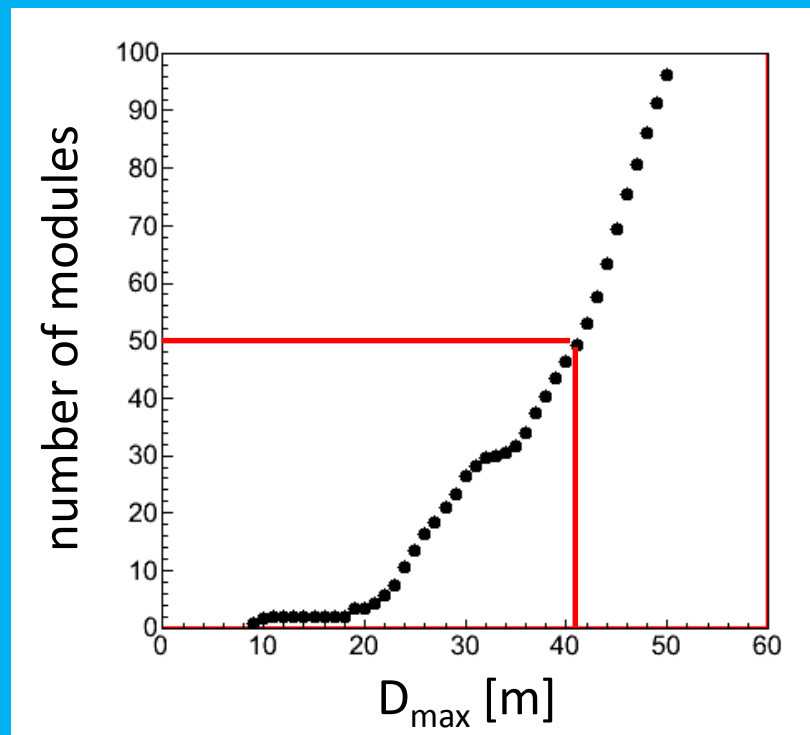
- Build 1D array of time sorted L1 hits
  - Total L1 rate in detector
    - $R_{L1} \cong 115 \times 18 \times 1 \text{ kHz} \cong 2 \text{ MHz} \Rightarrow \Delta T_{L1} \cong 0.5 \mu s$
- Build 2D array of time sorted L0 hits
  - organised by module index<sup>¶</sup>
  - Total L0 rate per module
    - $R_{L0} \cong 31 \times 5 \text{ kHz} \cong 150 \text{ kHz} \Rightarrow \Delta T_{L0} \cong 6 \mu s$

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<sup>¶</sup> Index refers to position of module in detector data structure

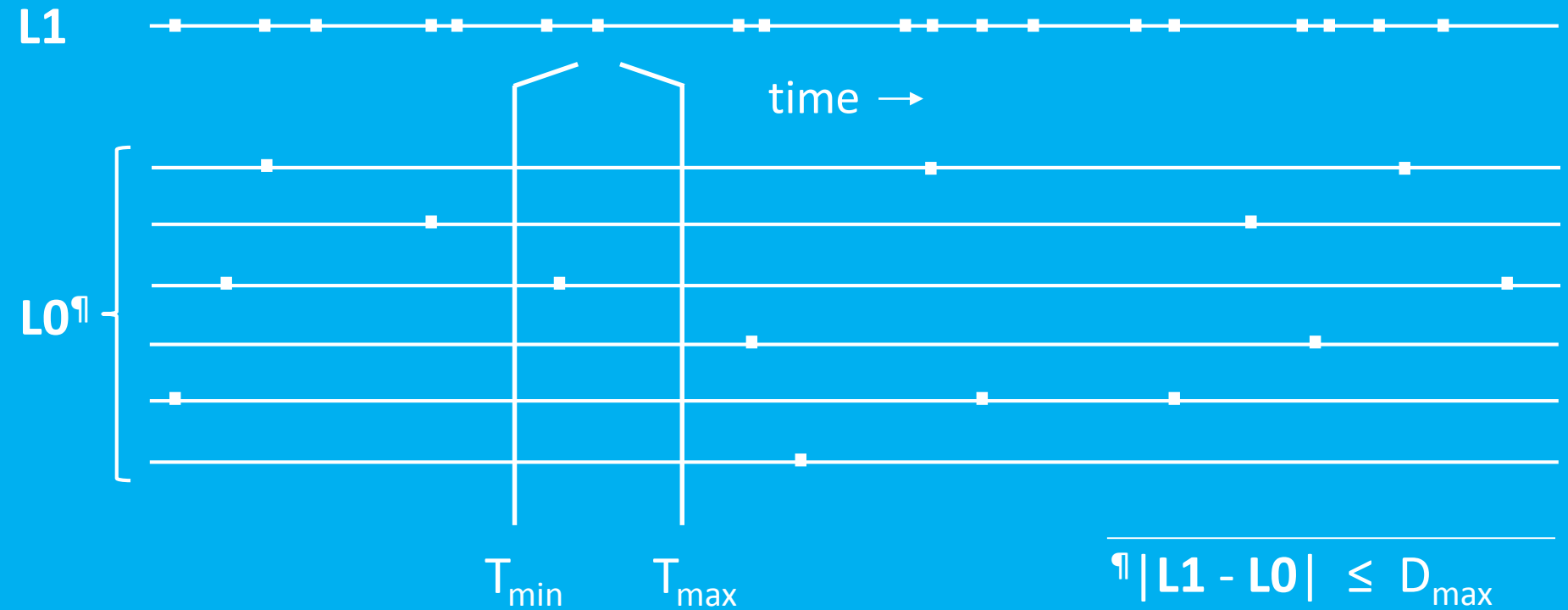
# Algorithm (2/4)

- Module map<sup>¶</sup>
  - list of modules within maximal distance



<sup>¶</sup> see <Jpp>/examples/JDetector/JModuleMapper

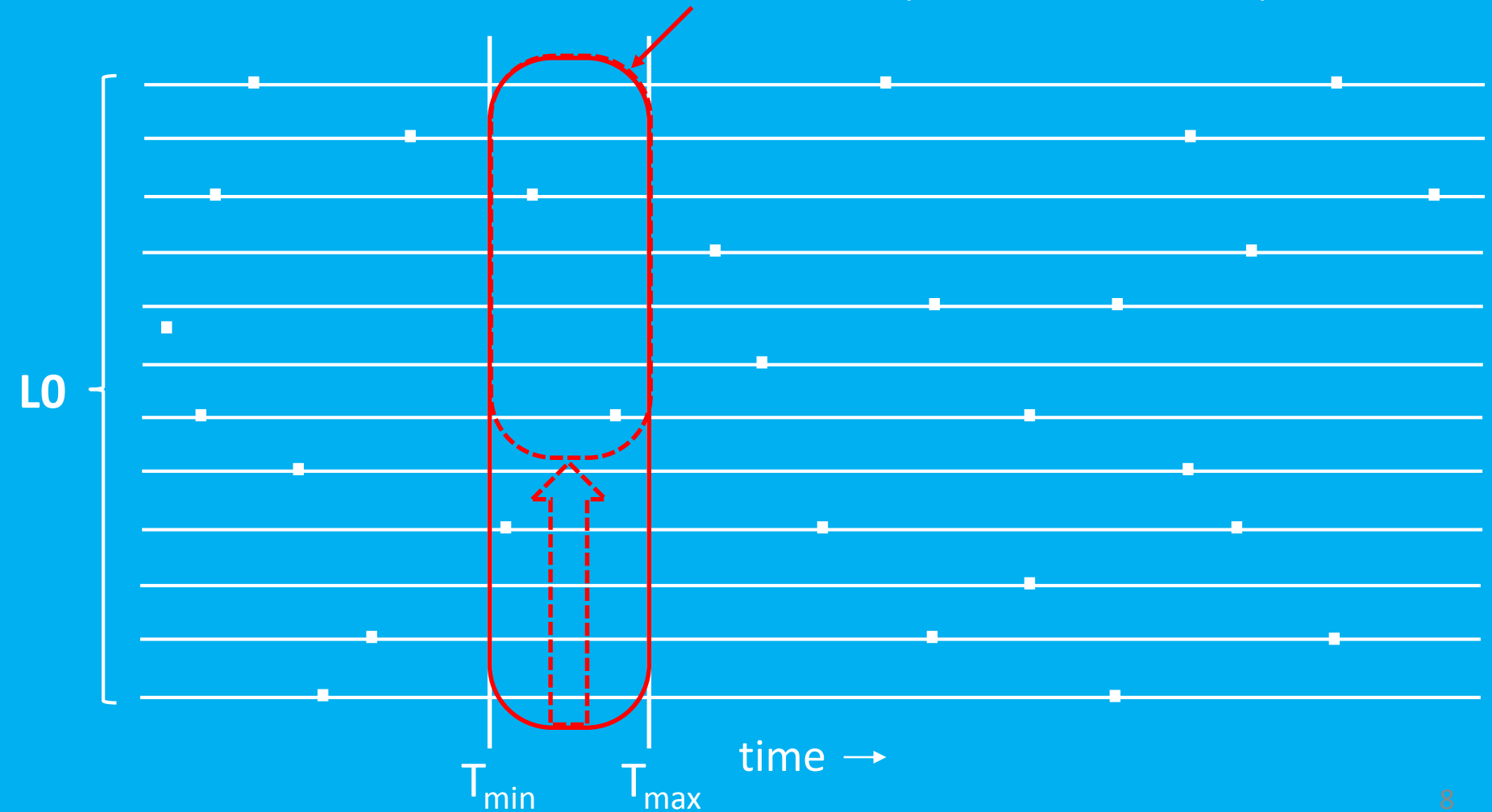
# Algorithm (3/4)



- maintain hit iterator for each L0 frame
- increment hit iterator until  $\text{hit} \rightarrow \text{getT}() \geq T_{\min}$

# Algorithm (4/4)

clusterize( .. , .. , JMatch3G)





# JTriggerMXShower

- parameters (with default values)

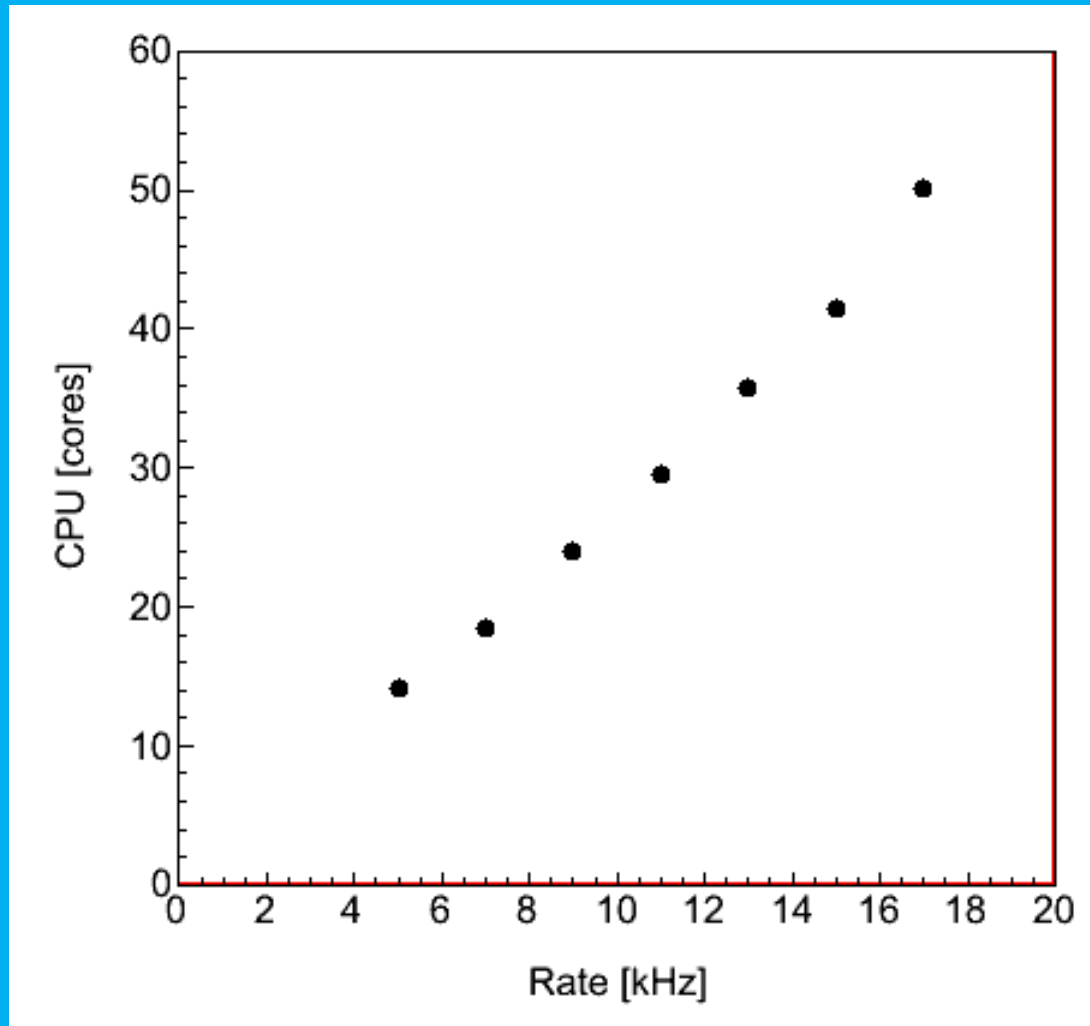
`triggerMXShower.enabled` = 0;

`triggerMXShower.numberOfHits` = 7;

`triggerMXShower.DMax_m` = 43;

`triggerMXShower.TMaxExtra_ns` = 20;

# CPU<sup>◇</sup> usage (1/2)



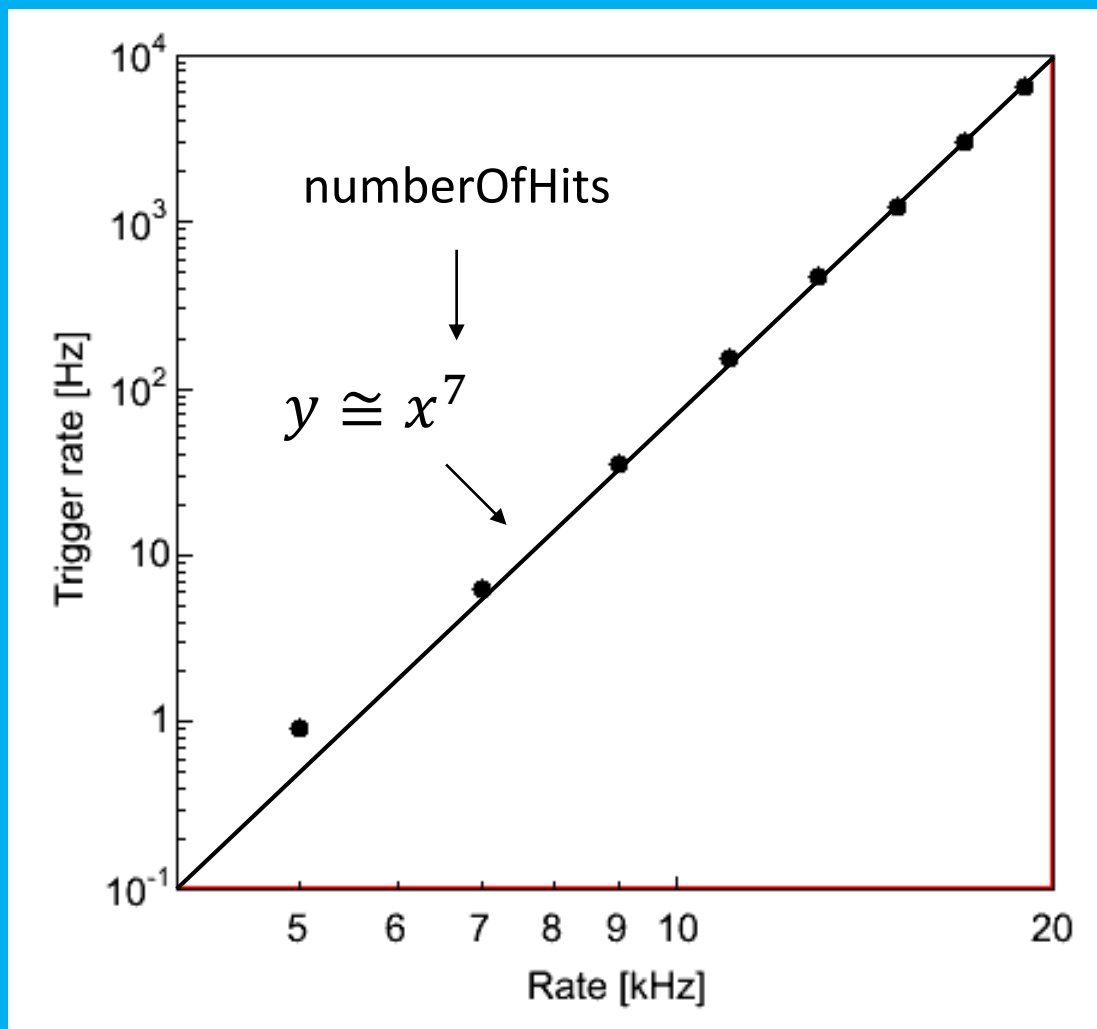
# CPU<sup>◇</sup> usage (2/2)

| Level             | Live time<br>[ms] | CPU time<br>[ms] | Ratio<br>CPU/Live |
|-------------------|-------------------|------------------|-------------------|
| calibration       | 100               | 65               | < 1               |
| L0 (sort)         | 100               | 800              | 8                 |
| L1                | 100               | 25               | < 1               |
| L2                | 100               | 70               | < 1               |
| Time slice router | 100               | 100              | 1                 |
| Trigger           | 100               | 400              | 4                 |
| Total             | 100               | 1460             | 15                |

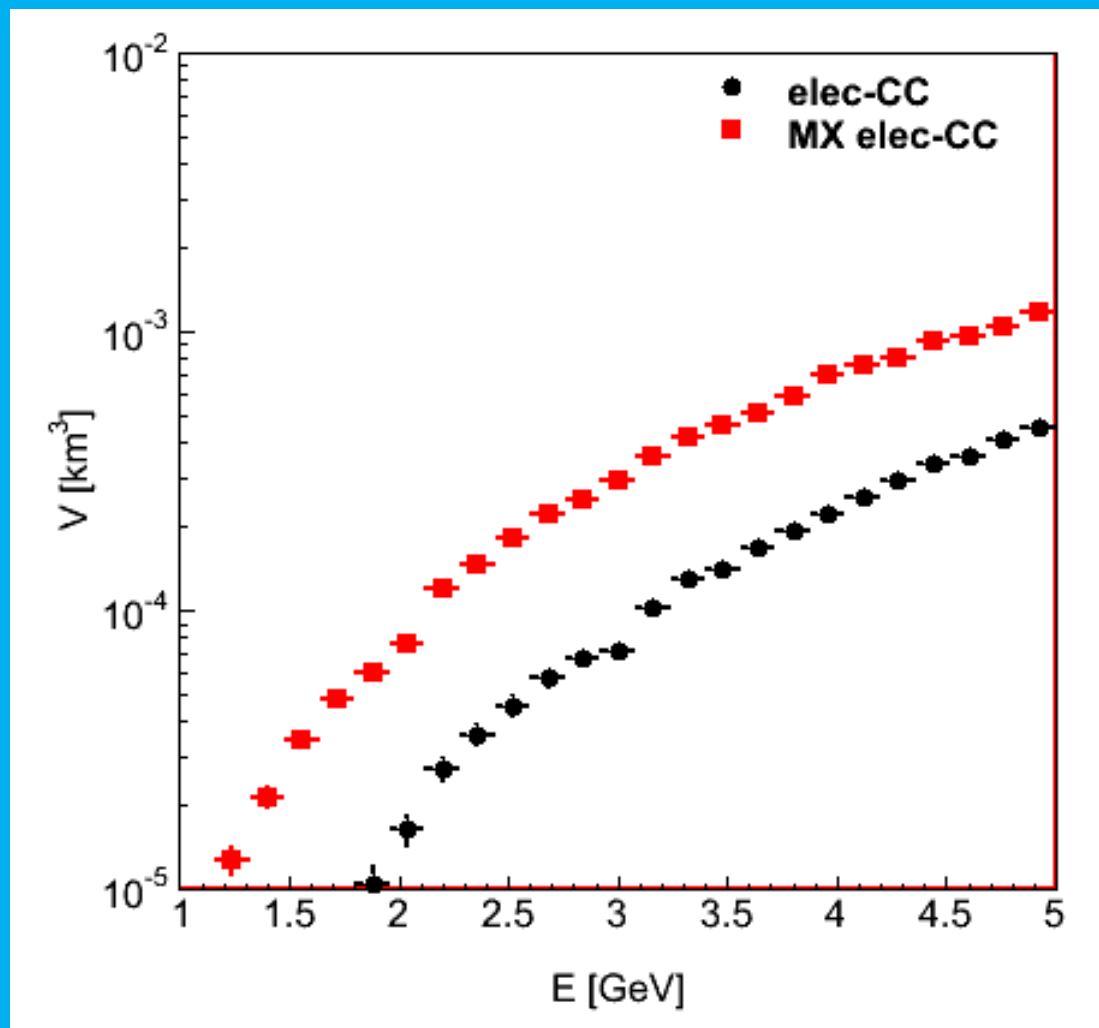
!

<sup>◇</sup> Intel(R) Core(TM) i5-4570 CPU @ 3.20GHz  
Random background as a function of multiplicity 5000, 500, 50, 5, 0.5 Hz, respectively

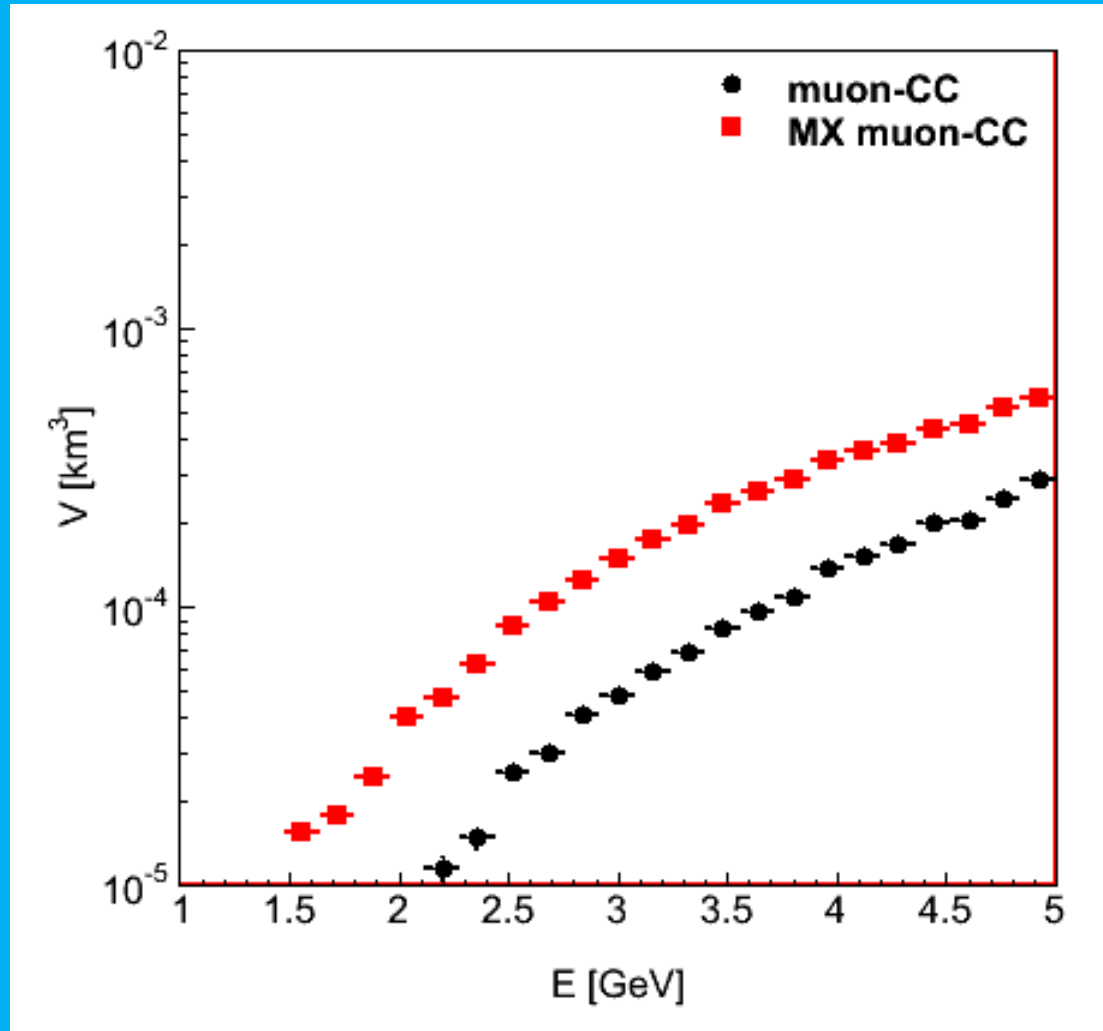
# Random background



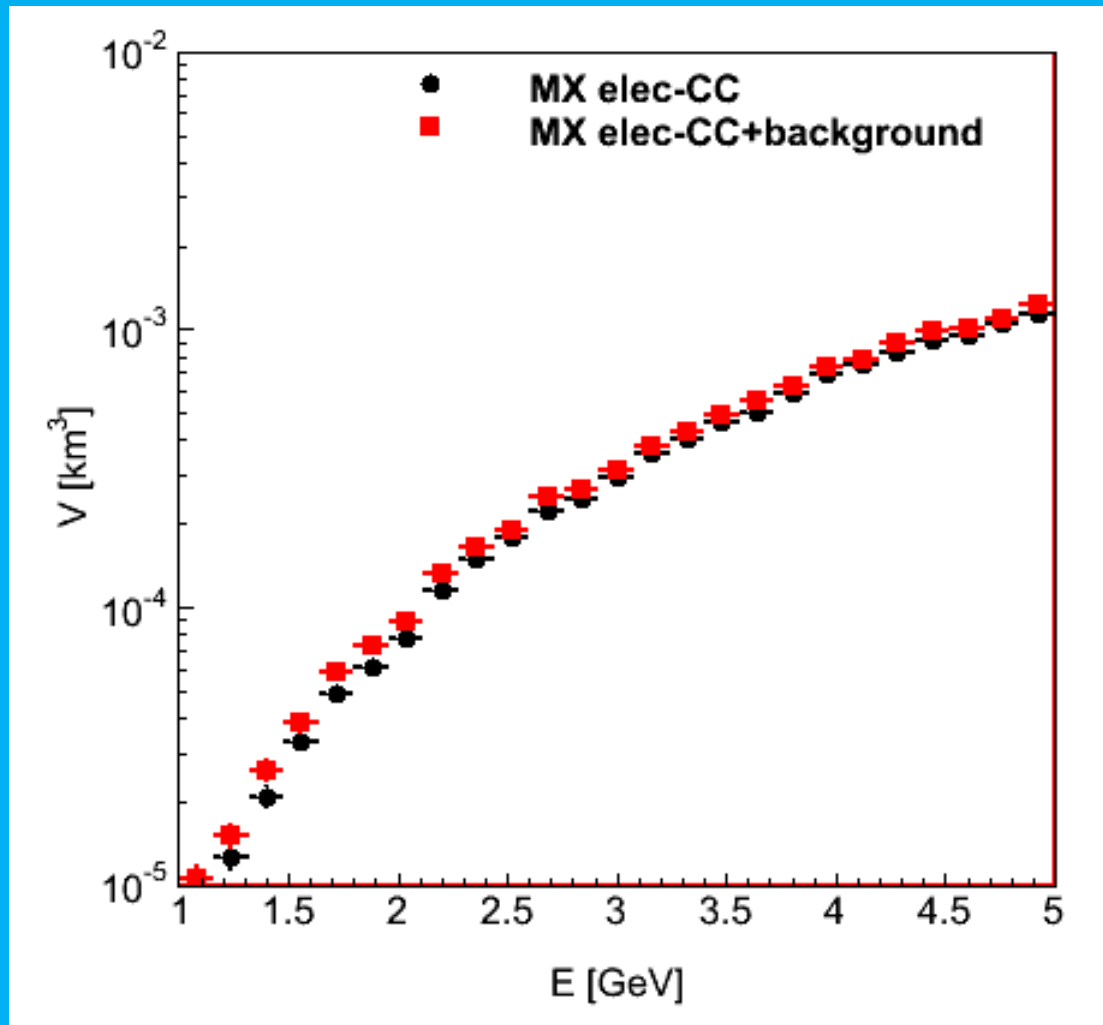
# Effective volume $v_e$



# Effective volume $\nu_\mu$



# Effective volume $v_e$



# Status & Outlook

- New ORCA trigger available
  - CPU power consumption very low
  - reasonable purity
  - improved efficiency
  - input parameters to be (fine) tuned...