

## First Comparisons with MARS 15:

### Towards a comparison Geant4-Mars15

A comparison of GLAST/Geant 4 type simulations with an independent (cross-checked) code will be useful to disentangle the origin of the MC-data differences (number of hits, energy deposited in calorimeter...)

Potentially: wrong calibrations + wrong MC sim.

**Method to follow: comparison, on simple geometry, of energy deposited, number of charge particles...**

*In case of wrong MC sim: If the problem is due to a wrong geometry implementation, this comparison will not help*

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Descriptions/code and useful info on MARS15

<http://www-ap.fnal.gov/MARS/>

Code started 30 years ago (fortran... of course...)

This is a “cross-checked” code. Several applications in various labs: Fermilab, CERN, KEK and SLAC

<http://www-ap.fnal.gov/MARS/applications.htm>

## Possible outputs of the comparison:

*0 - There is good agreement between the 2 MCs (GREAT)*

*1 - We find differences in the results:*

*1.1 - “we forgot” something in the Geant 4 sim (our fault)*

*1.2 - Some processes are not correct (Geant 4 fault)*

*1.3 - Some processes in Mars15 are not correct (Mars15 fault)*

We have experimental data that can be used to validate

# The VERY simplest case:

100 GeV electrons

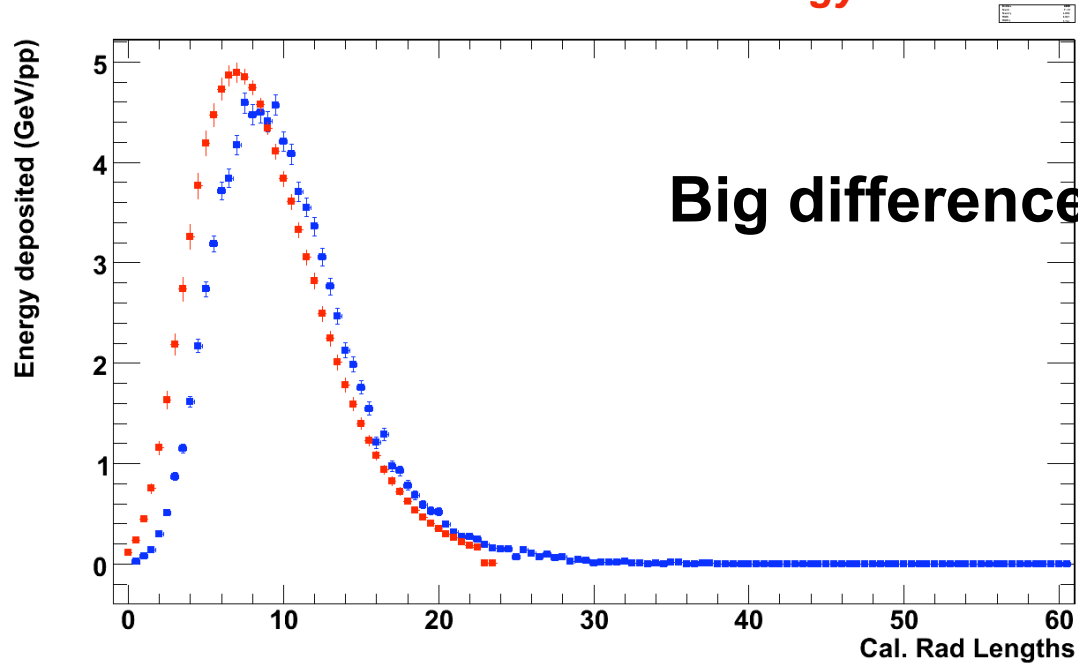
on a 30 rad lengths (~60 cm) CsI calorimeter,

Calorimeter split into 60 identical parts (no gaps !)

MARS15 (20kevts; David)

GEANT 4 (50 evts; Benoit)

*Energy measured only for the first 24 rad lengths*



**Big differences !!!**

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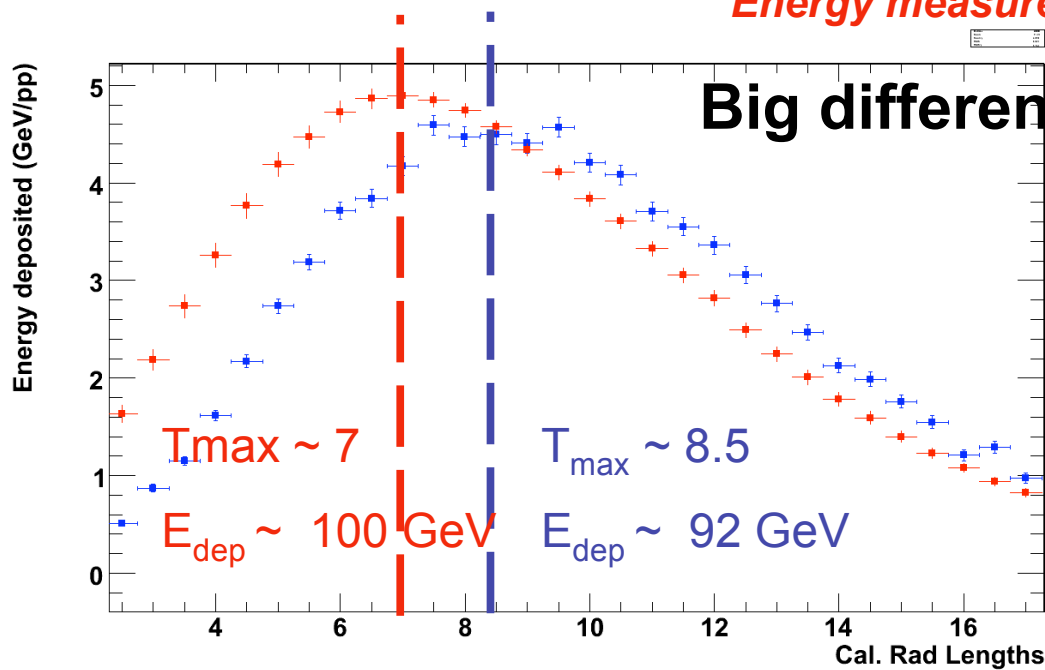
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From general grounds,  
one expects

$$T_{\max} \sim \ln(E/E_c) \sim 7$$

$$E = 100 \text{ GeV}$$

$$E_c (\text{CsI}) = 121 \text{ MeV}$$

$$E_{\text{deposited}} \sim 100 \text{ GeV}$$

So... there is a problem with the MARS 15 simulation

## Concluding remarks

I checked and re-checked the simulation, change materials, dimensions.... The missing energy was always there, as well as the 1.5 rad length shift

Contacted Nikolai Mokhov (author of MARS15). He kindly revised my example and finally concluded that there is a problem in the MARS15 code, apparently related to the low energy ( $\sim 20$  MeV) electrons.

Apparently we chose the wrong sim. Code for this comparison...

Trying now with EGS...

I had problems installing EGSnrc in my laptop/noric

Yet Hiro has a working version (4.4) running on a SUN machine at SLAC