First simulations 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

Biggest conecptual differences with respect to Geant 4

Conceptual difference 1

"ALL" physical processes and particles are included in the simulations. Essentially user only plays with energy thresholds

BAD Less flexibility for the user. Typically NOT all physic models/particles are of interest for user. This makes the code "slower"

GOOD The user does not need to care/understand details of the physics. Life is easier when there is "no choice"

This will permit to check:

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

1 - whether "we forgot" something in the Geant 4 sim (our fault)
2 - whether some processes are not correct (Geant 4 fault)
3 - or some processes in Mars15 are not correct (Mars15 fault)

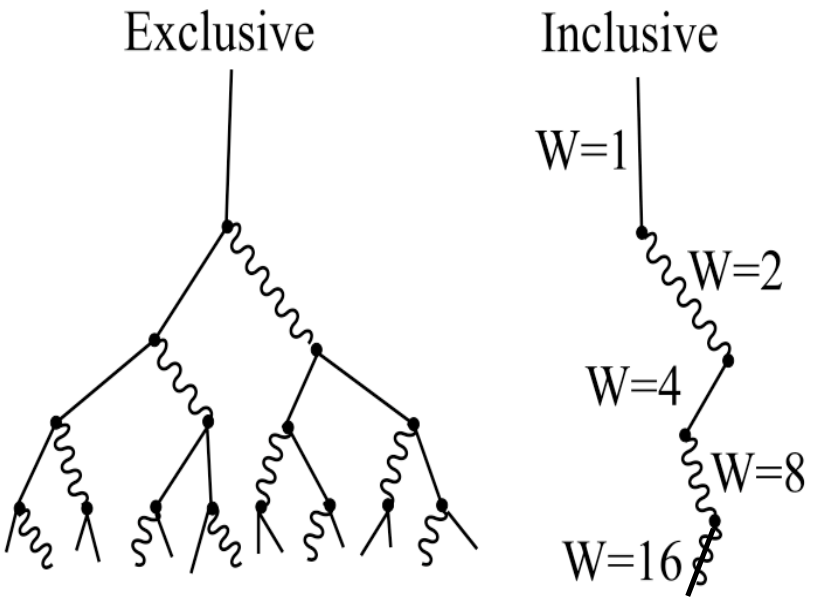
We have experimental data that can be used to validate

Biggest conecptual differences with respect to Geant 4

Conceptual difference 2

MC simulation is done following Feynman's inclusive approach: *R. P. Feynman, Phys. Rev. Lett. 23, 1415(1969)*

At an interaction vertex, a particle cascade tree is constructed using a fixed number of representative particles, and each particle carries a statistical weight which is equal, in the simplest case, to the partial mean multiplicity for the particular interaction.

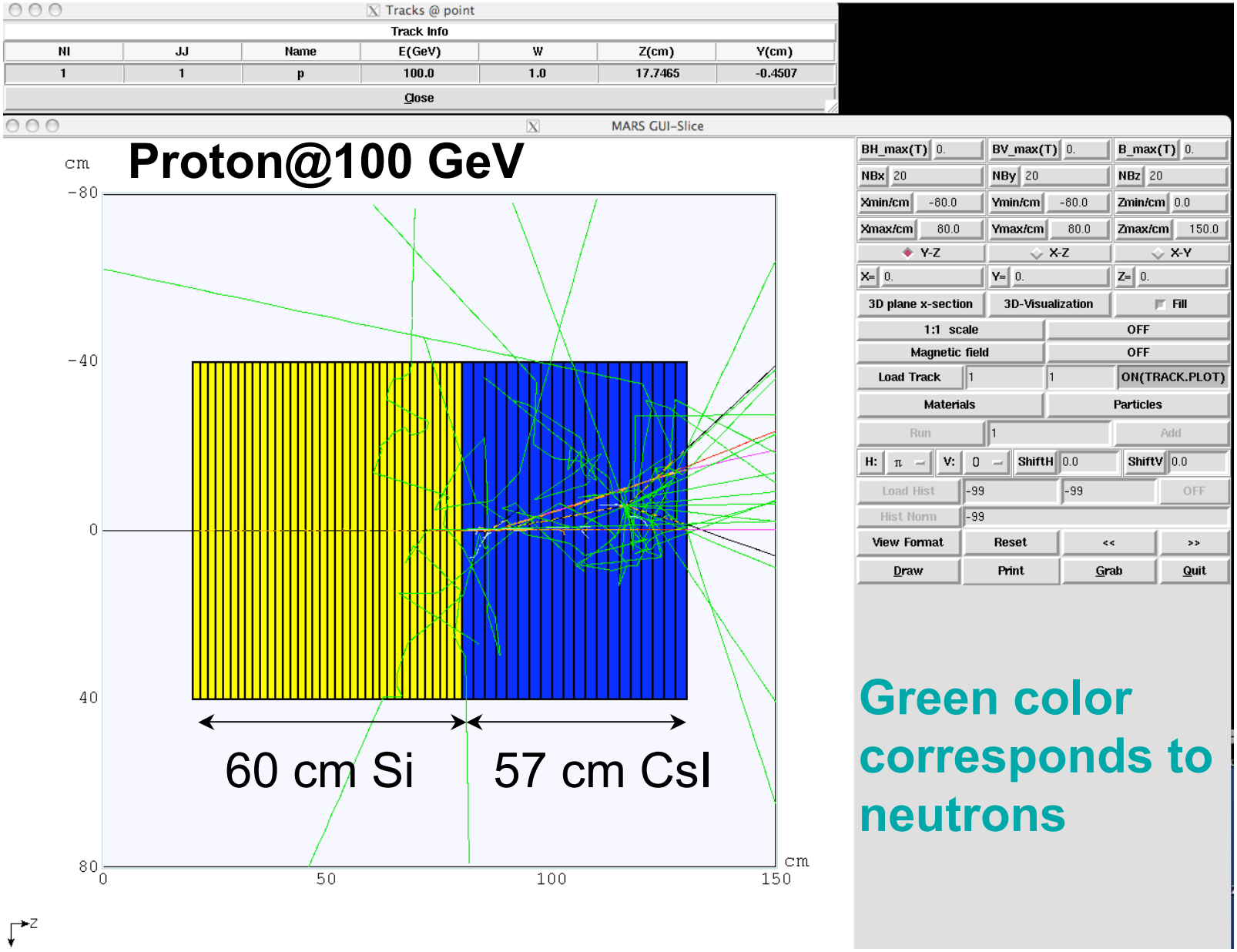


Energy and momentum are conserved on the average over a number of collisions, but not precisely conserved at any single vertex.

Exclusive approaches for hadronic processes possible. Total exclusive approach for hadronic processes in ~ month

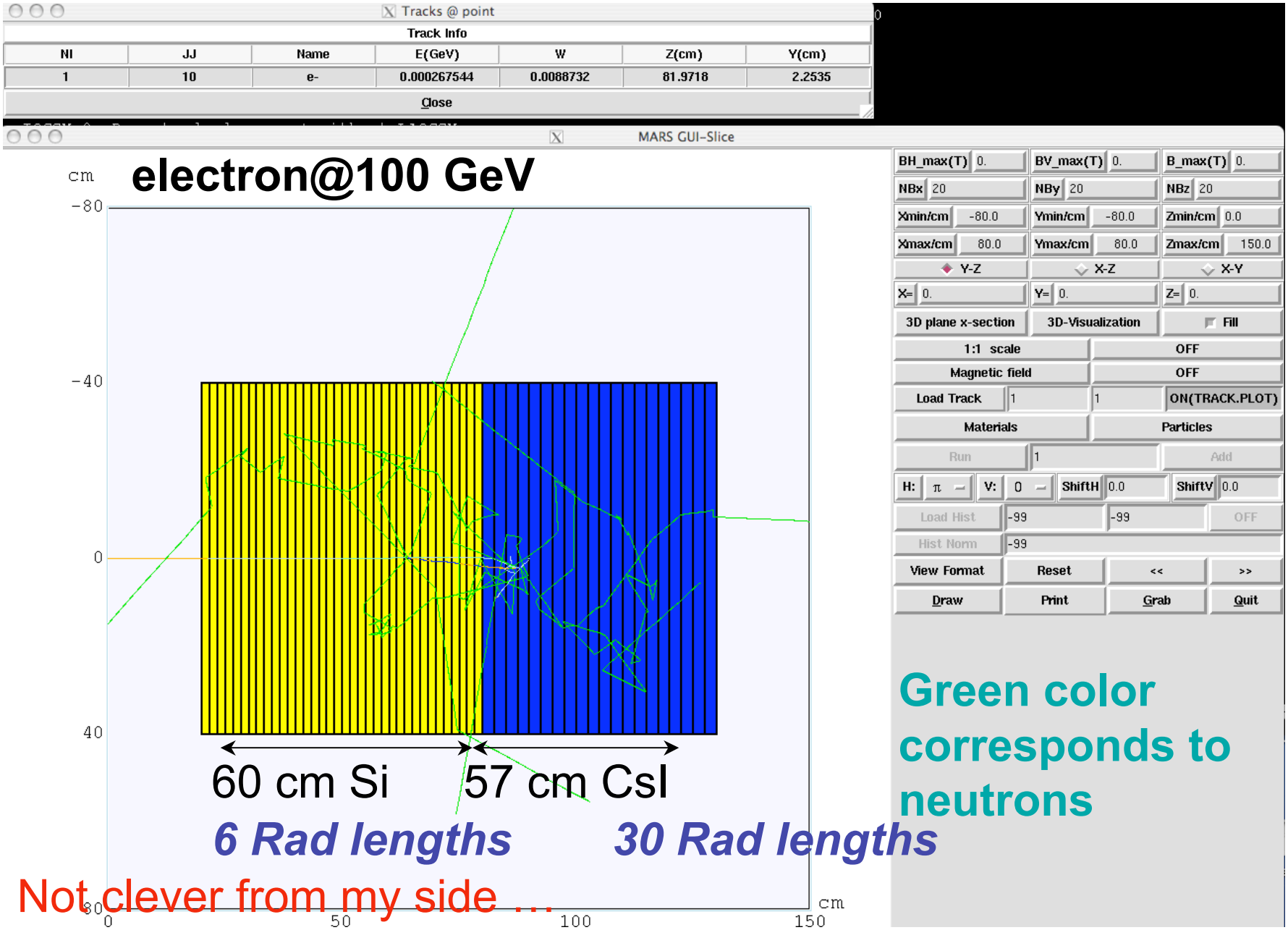
Exclusive approach for EM showers not possible. Planed (mix of Penelope and EGS5) in 1 year

First trials… very simple stuff…



Green color corresponds to neutrons

First trials… very simple stuff…



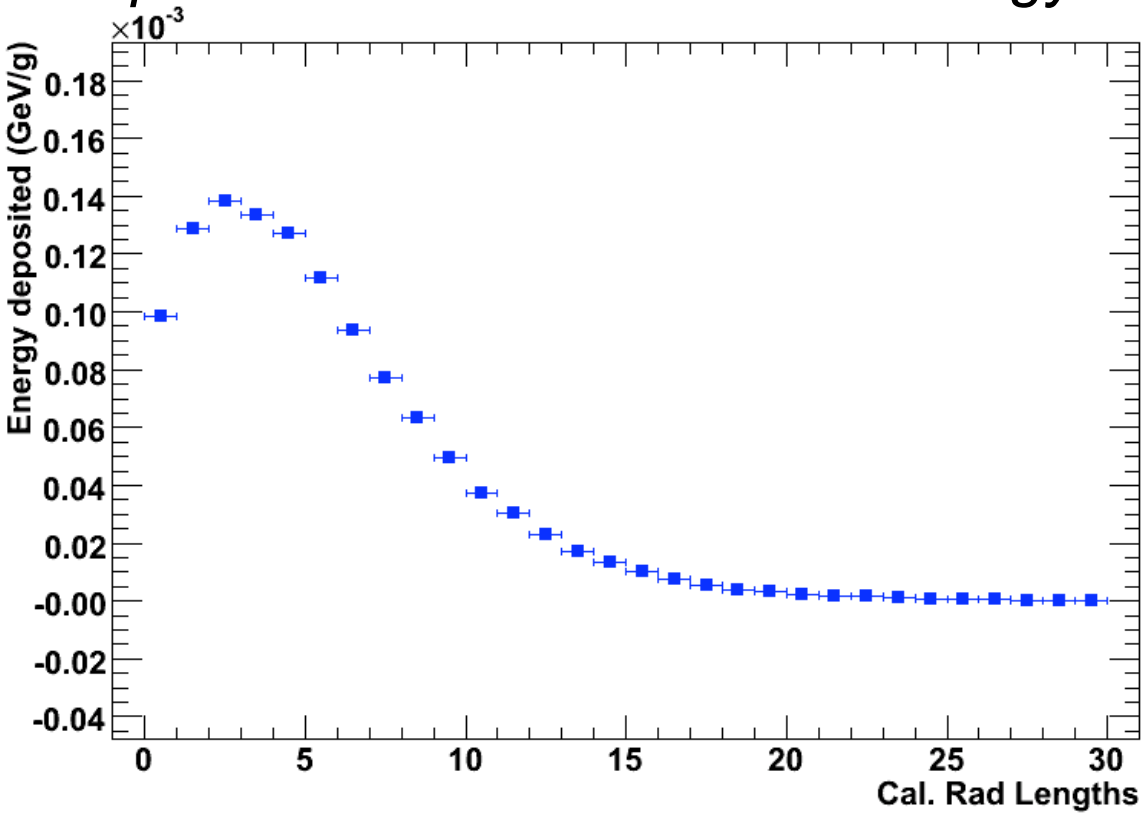
Not clever from my side …

Green color corresponds to neutrons

Energy deposited in calorimeter (e@100 GeV)

100kevts (40 min sim.)

All particles considered in the energy deposition



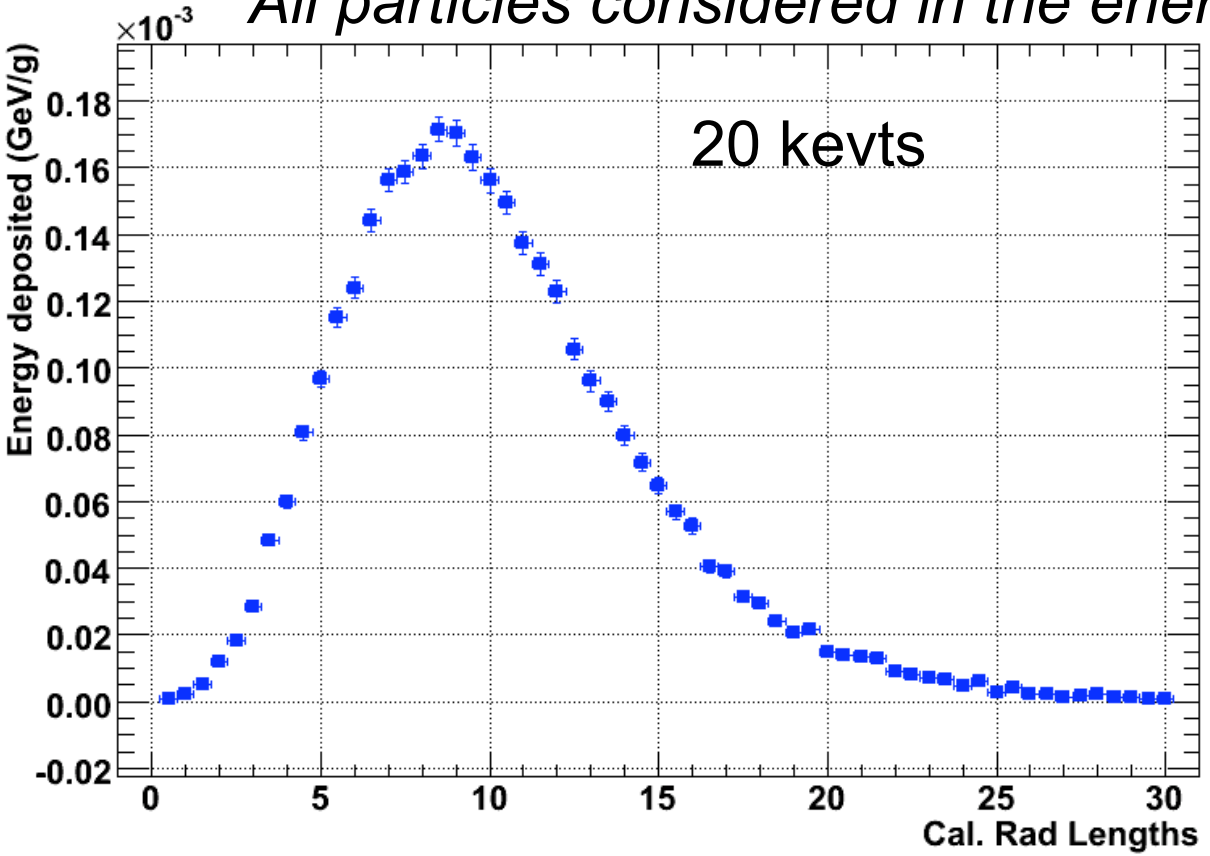
Energy deposited in calorimeter (e@100 GeV)

New simulation:

replace Si by Vacuum, shower now starts at CsI calorimeter

Increase sampling in calorimeter by factor 2

All particles considered in the energy deposition



Need to produce more events, and then compare with similar Geant 4 sim.

CONCLUSIONS

Comparison Glast/Geant4-Mars15 on simple geometrical detectors ongoing

Goal is validate the physics we have in the Glast/Geant4 simulations

Now I start getting used to the MARS15 stuff… simple stuff already available

Dedicated stuff (say E deposited by only electrons, or only protons, or number of particles in a given section of the instrument) can be obtained easily… well… it was not trivial to find it. But once it is known, it is simple … some modifications in a single fortran function (mfill, in file m1507.f). Easy even for a non-fortran person; information is dumped onto ascii files.