GENERAL FRAME

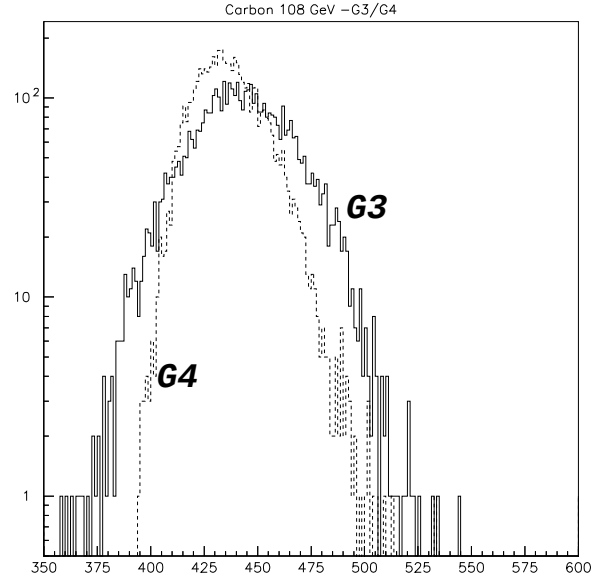
- Use example/extended/electromagnetic/TestEm3 from the G4 v5.0 distribution (also contains the G3 equivalent of this G4 code)
- Use same cuts in both **G3 and G4**
- no need to change default value of MeanExcitationEnergy for CsI (as previously stated).
- Use hLowEnergyIonisation package for ions

COMPARISON on 1.99 cm thick CsI block

Carbon example for IONS

108 GeV total kinetic energy (9 GeV per nucleon)

- G3: 443.0 MeV rms=24.12 MeV
- G4: 436.9 MeV rms=16.43 MeV



3 GeV total kinetic energy (250 MeV per nucleon)

- G3: 799.5 MeV rms=5.38 MeV
- G4: 815.0 MeV rms=5.59 MeV

- Mean values agree within $\pm 2\%$
- rms OK for low energies
- **rms disagree for relativistic energies**

How do we get IONS ???

Ions are extrapolated from protons following . . .

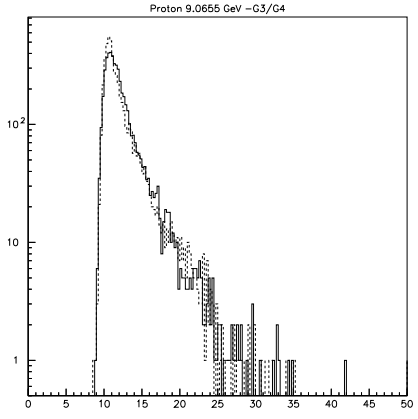
$$(\frac{dE}{dx})_{ion} = (Z^{eff}_{ion})^2 (\frac{dE}{dx})_{proton} \qquad \text{with } Z^{eff} \approx Z.$$

. . . for ions with kinetic energy:

$$T_{ion} = T_{proton} \frac{M_{ion}}{M_{proton}}$$

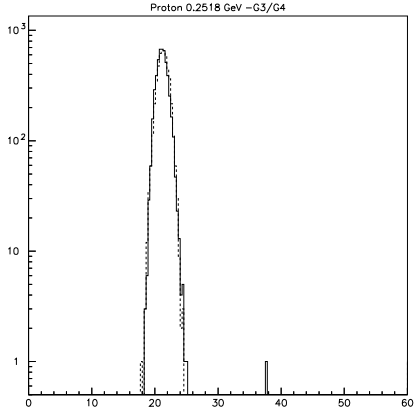
Proton with $T = 9.0655 GeV$:

- G3: 12.26 MeV rms=2.67 MeV
- G4: 12.07 MeV rms=2.66 MeV



Proton with $T = 0.2518 GeV$:

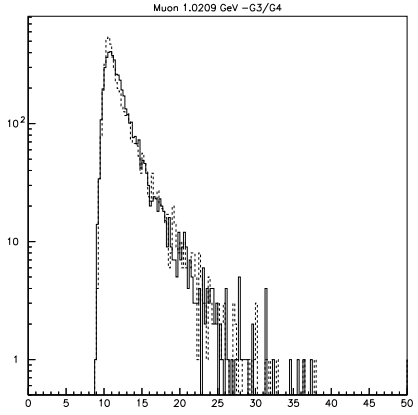
- G3: 21.19 MeV rms=0.91 MeV
- G4: 21.29 MeV rms=0.89 MeV



Consistency for Muons . . .

$\frac{dE}{dx}$ scales as $\gamma\beta$ . . .

For $T_p = 9.0655 GeV$ protons, this gives muons with $T_\mu = 1.0209 GeV$.



G3 and G4 for 1.0209 GeV muons

- G3: 12.26 MeV rms=2.71 MeV
- G4: 12.19 MeV rms=2.76 MeV

1.0209 GeV muons and 9.0655 GeV protons (G4)

- Proton: 12.07 MeV rms=2.66 MeV
- Muon: 12.19 MeV rms=2.76 MeV

G3 versus G4: SUMMARY the April 3, 2003...

1. Very good agreement between G3 and G4 for protons and for all energies
2. Very good consistency between muons and protons for same $\gamma\beta$
3. Good extrapolation of mean values for ions using $\Delta E_{Carbon} = 36 \cdot \Delta E_{Proton}$
4. Very good consistency for Ions at low energies
5. Very good consistency for mean values of relativistic Ions
6. Problem in dispersion (rms) of relativistic ions

PROBLEM is under investigation by the G4 team at CERN

but use of G4 seems anyway the best (to be confirmed . . .)