Verification and validation tasks for ICOOL

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1. Definitions (John Cary)

"*Verification* is ensuring that the code is solving the equations correctly.
Validation is ensuring that the right equations are being solved."

For MAP cooling simulations we take verification to mean agreement with some other commonly-used code, and validation to mean agreement with cases where we know the answer, either theoretically or experimentally.

2. Verification tasks

Compare ICOOL simulations of interactions with matter with G4beamline.

materials = {H_2, LiH, Be}
absorber lengths = {300 μm, 1 cm, 5 cm}
momenta = {100, 200, 300} MeV/c
observables = {mean energy loss, scattering angle distribution, energy loss distribution, change in emittance}

3. Validation tasks

Particle tracking

For a given initial position and momentum, compare the final position and momentum after traversing the following fields with theoretical predictions.

3.1 180^o bend in uniform dipole field

3.2 one Larmor wavelength in uniform solenoid field

Spin vector tracking

For a given initial spin orientation, compare the final spin orientation after traversing the following fields with theoretical predictions.

3.3 uniform dipole field

3.4 uniform solenoid field

Interactions in matter

3.5 comparison of scattering angle distributions with MuScat
(see R. Fernow, MC note 336, April 2006)

3.6 comparison of mean energy loss in materials with MICE

3.7 comparison of scattering angle distributions with MICE

3.8 comparison of transverse emittance with MICE