# Front End G4beamline simulation update

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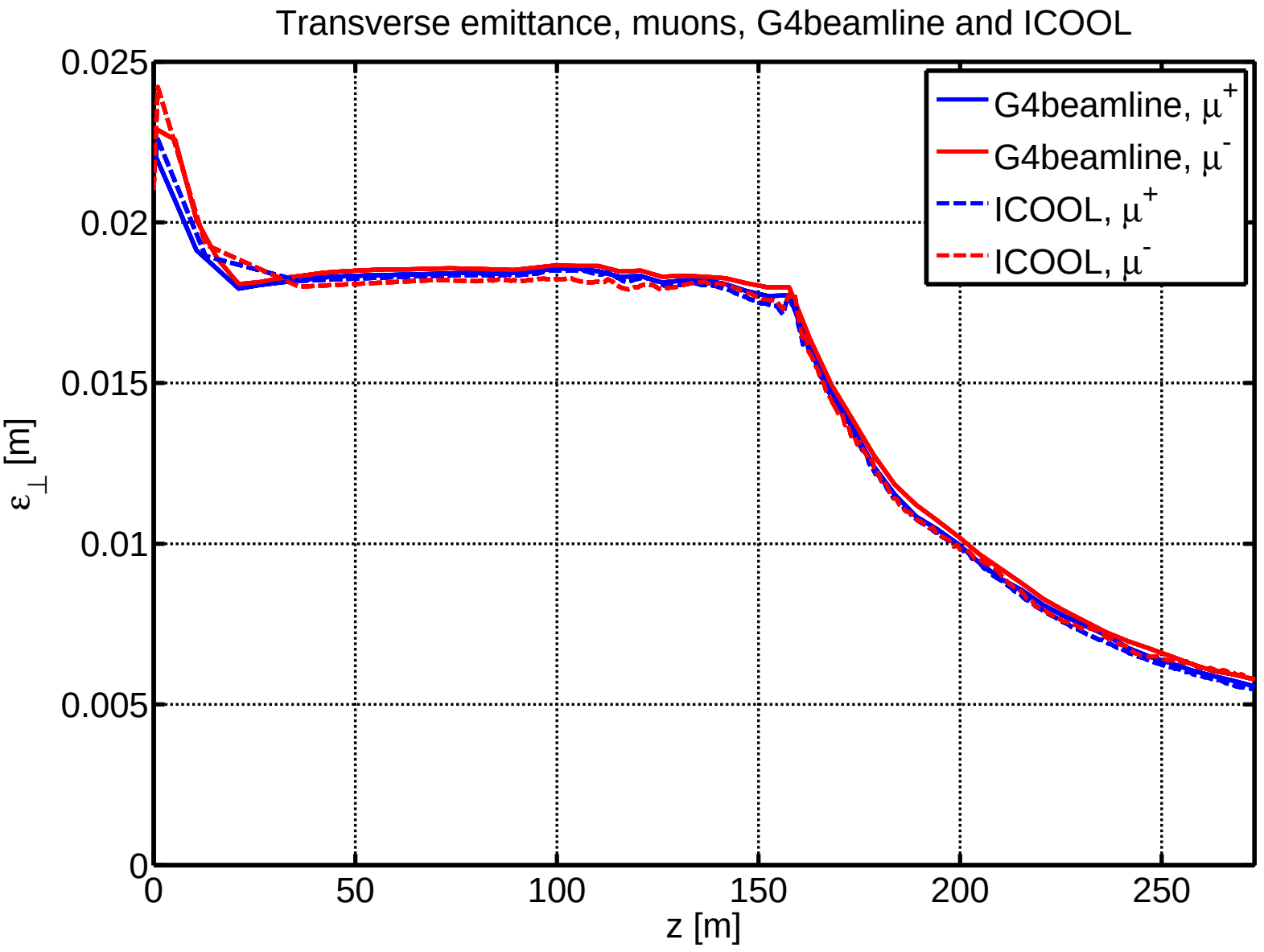
# More statistics + comparison with ICOOL

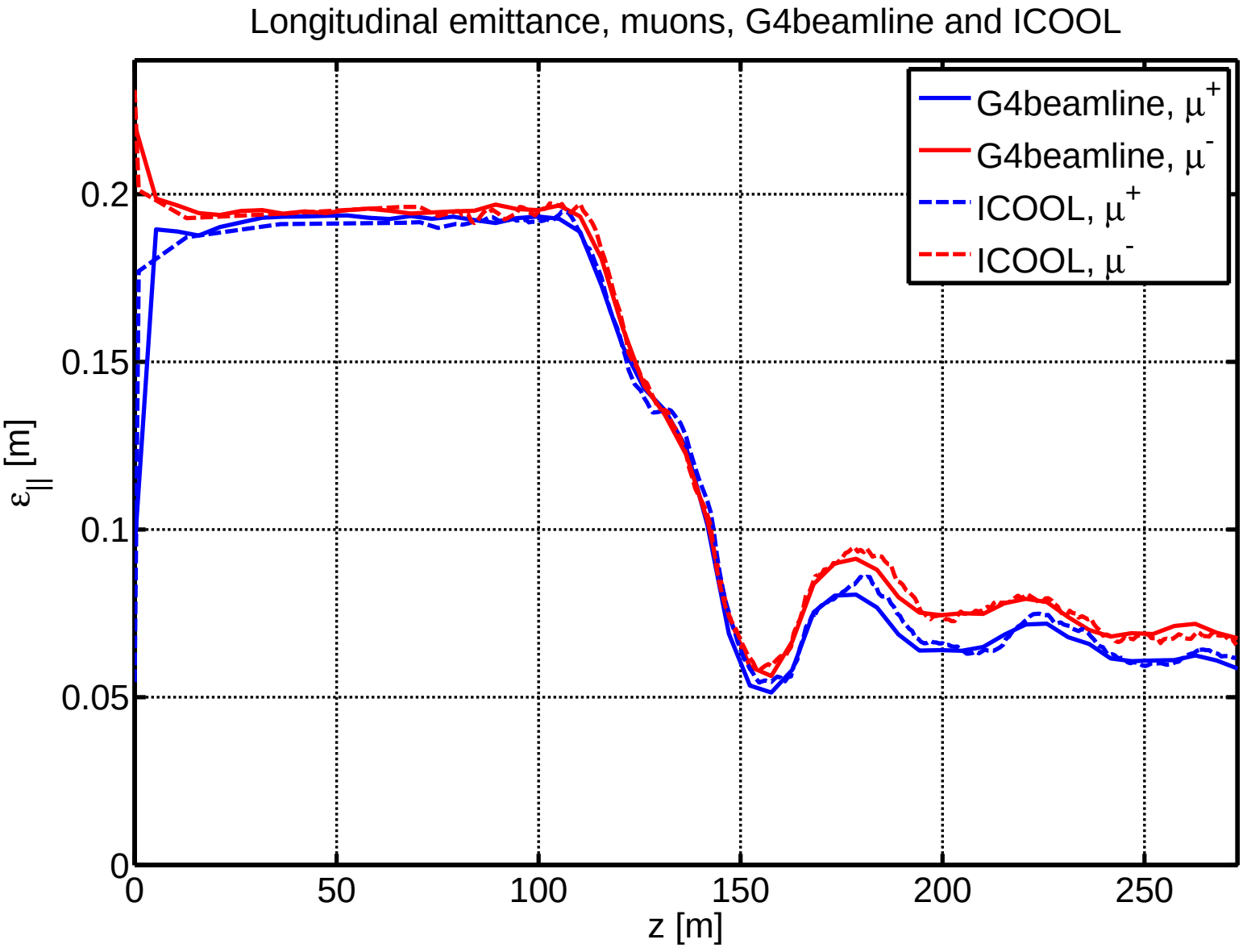
I show the results of comparison of G4beamline and ICOOL for:

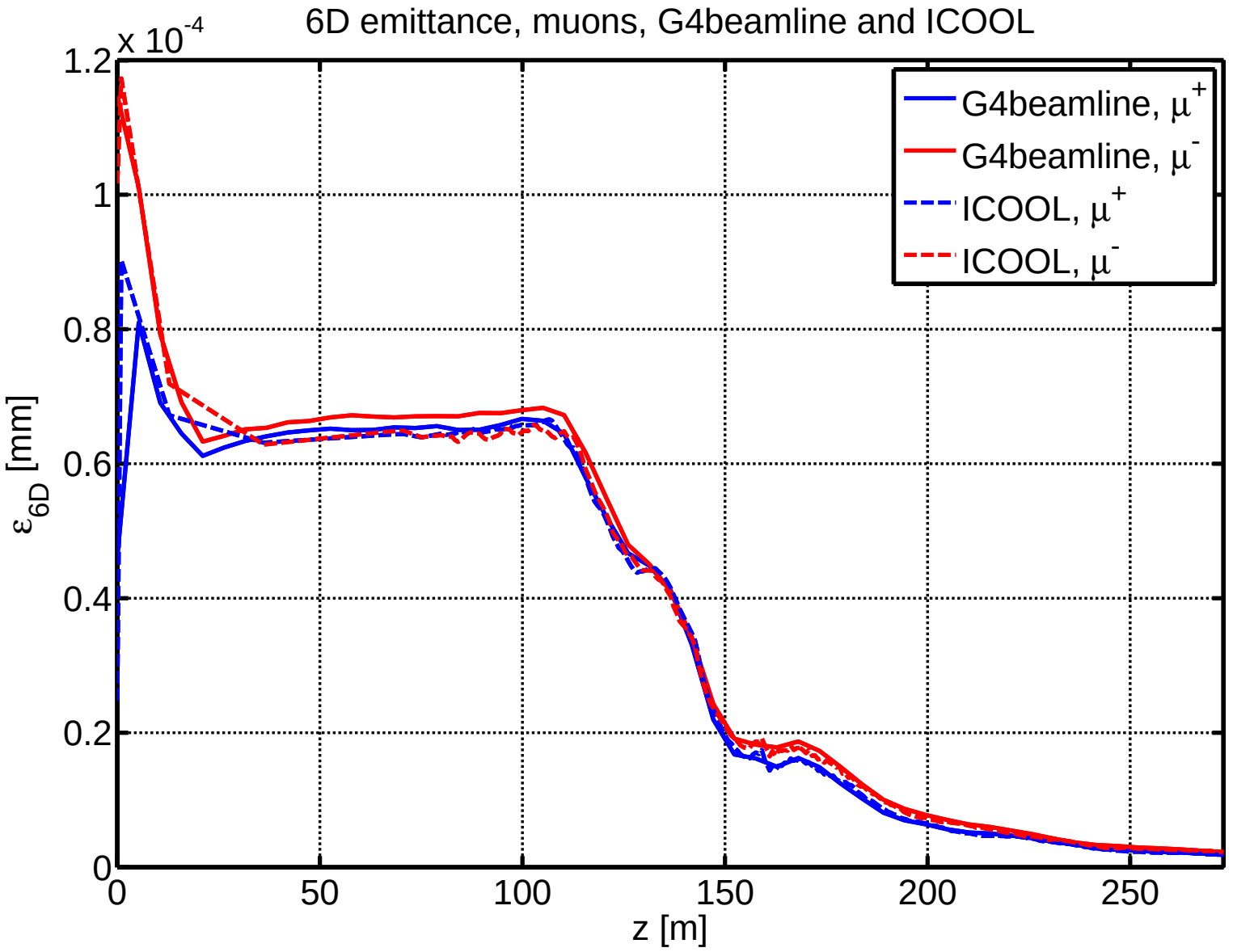
- G4beamline: all the particles I get from Harold (354269 positives and 142193 negatives) corresponding to 4e5 PoT.
- ICOOL: 1e5 positive particles and 1e5 negative particles (more particles get harder to manage, 100000 of each sign should be enough).
- Muon beam emittances are shown in the next few slides as well as particle yields per incident proton.

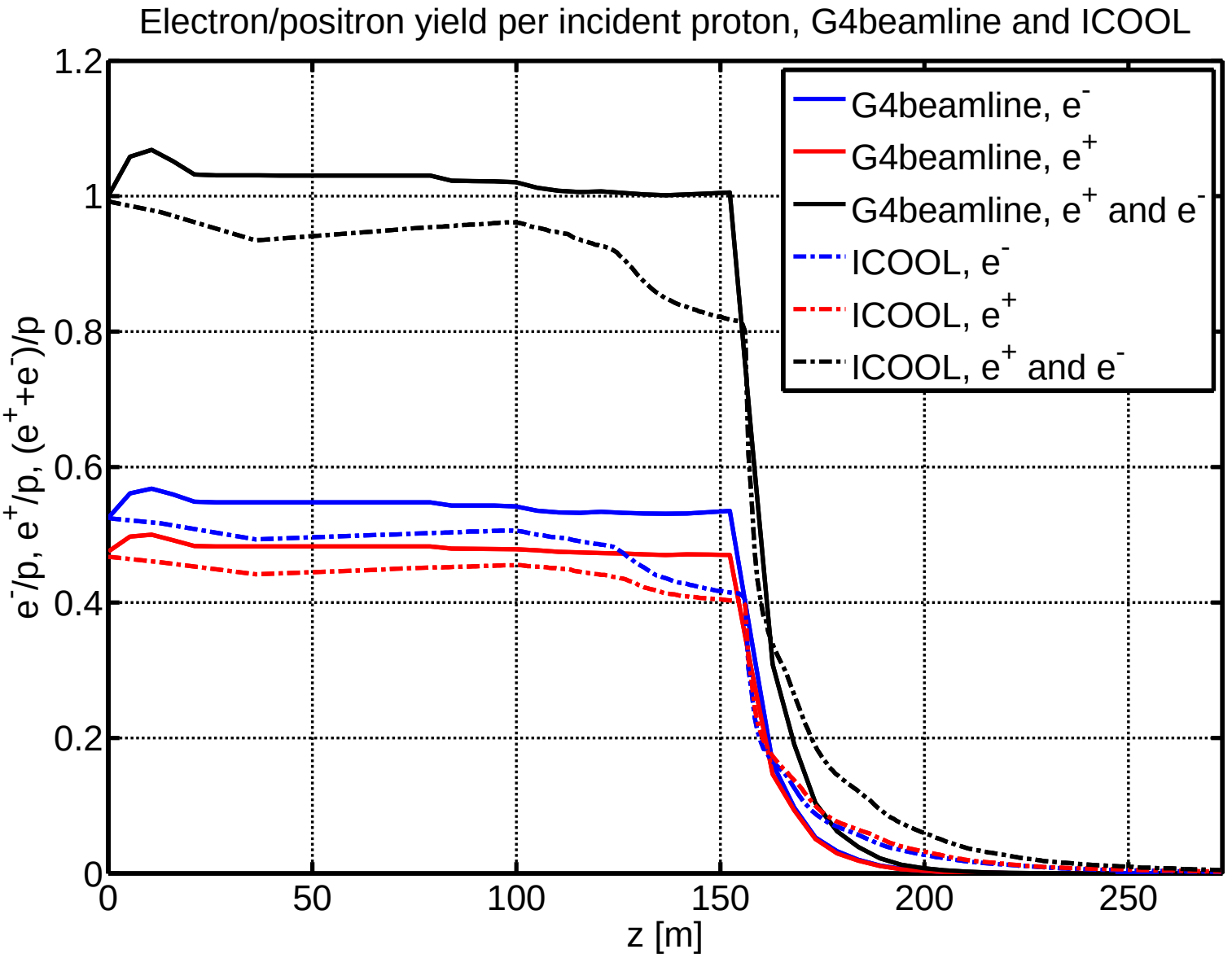
Energy deposition study in G4beamline is underway.

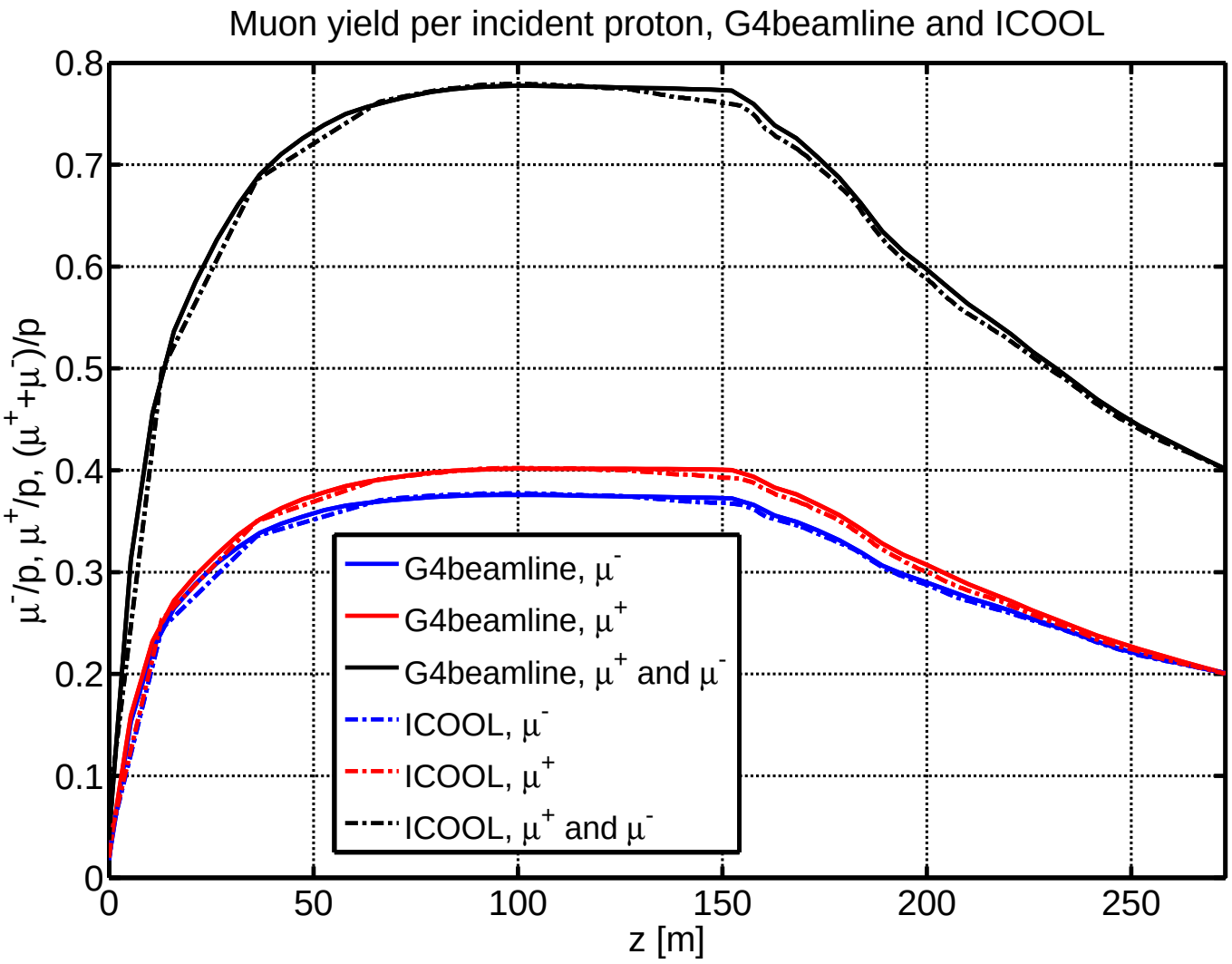
All numerical results are available at `http://muon.ucr.edu/~snopok/frontend`. If you need particular data files, let me know and I'll make them available too (some can be huge).


Transverse emittance, muons, G4beamline and ICOOL
G4beamline, μ+
G4beamline, μ-
ICOOL, μ+
ICOOL, μ-
ε⊥ [m]
z [m]
0.025
0.02
0.015
0.01
0.005
0
0
50
100
150
200
250

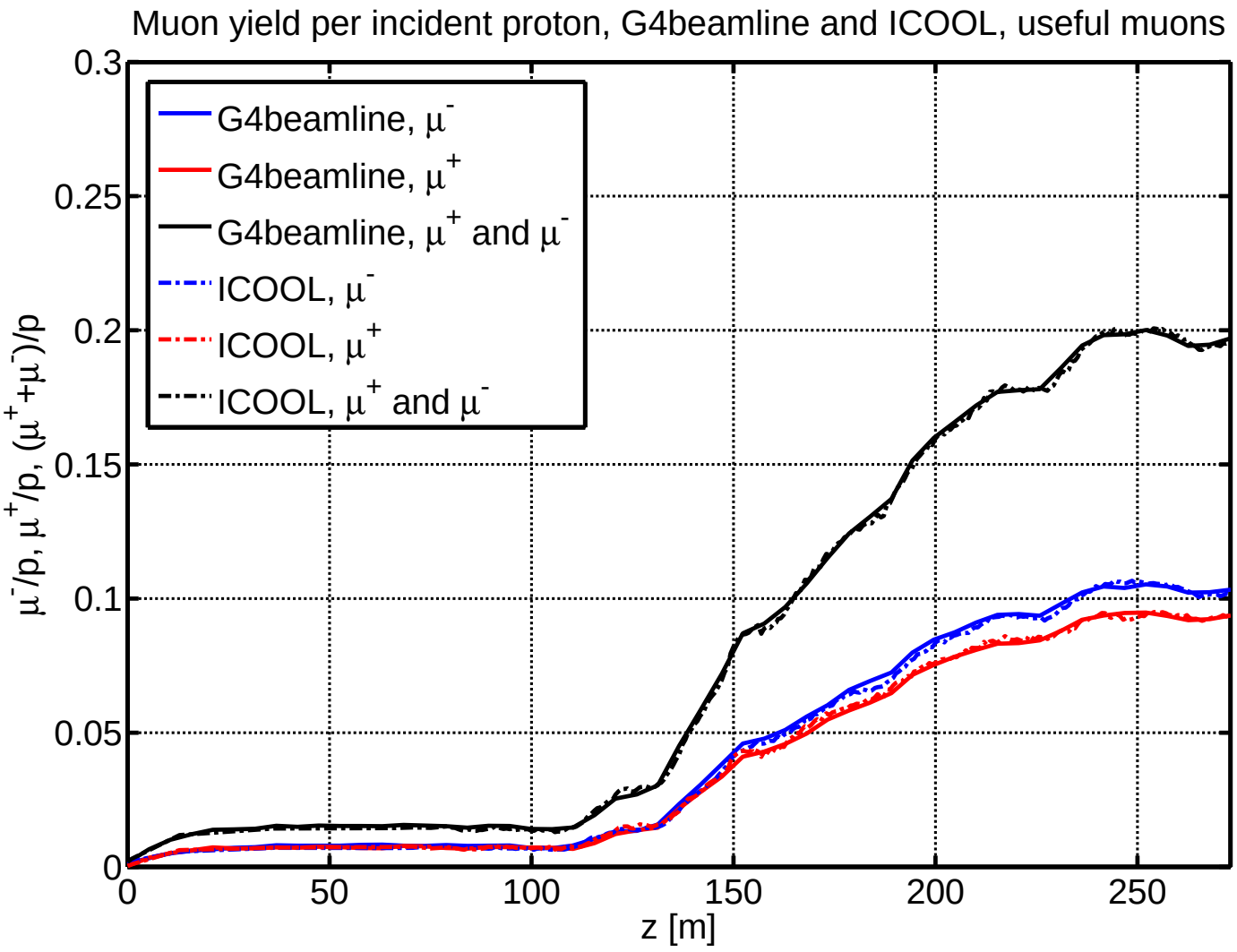

Longitudinal emittance, muons, G4beamline and ICOOL
G4beamline, μ+
G4beamline, μ-
ICOOL, μ+
ICOOL, μ-
ε|| [m]
z [m]
0
0.05
0.1
0.15
0.2
0
50
100
150
200
250


6D emittance, muons, G4beamline and ICOOL
x 10^-4
1.2
1
0.8
0.6
0.4
0.2
0
ε6D [mm]
0
50
100
150
200
250
z [m]
G4beamline, μ+
G4beamline, μ-
ICOOL, μ+
ICOOL, μ-

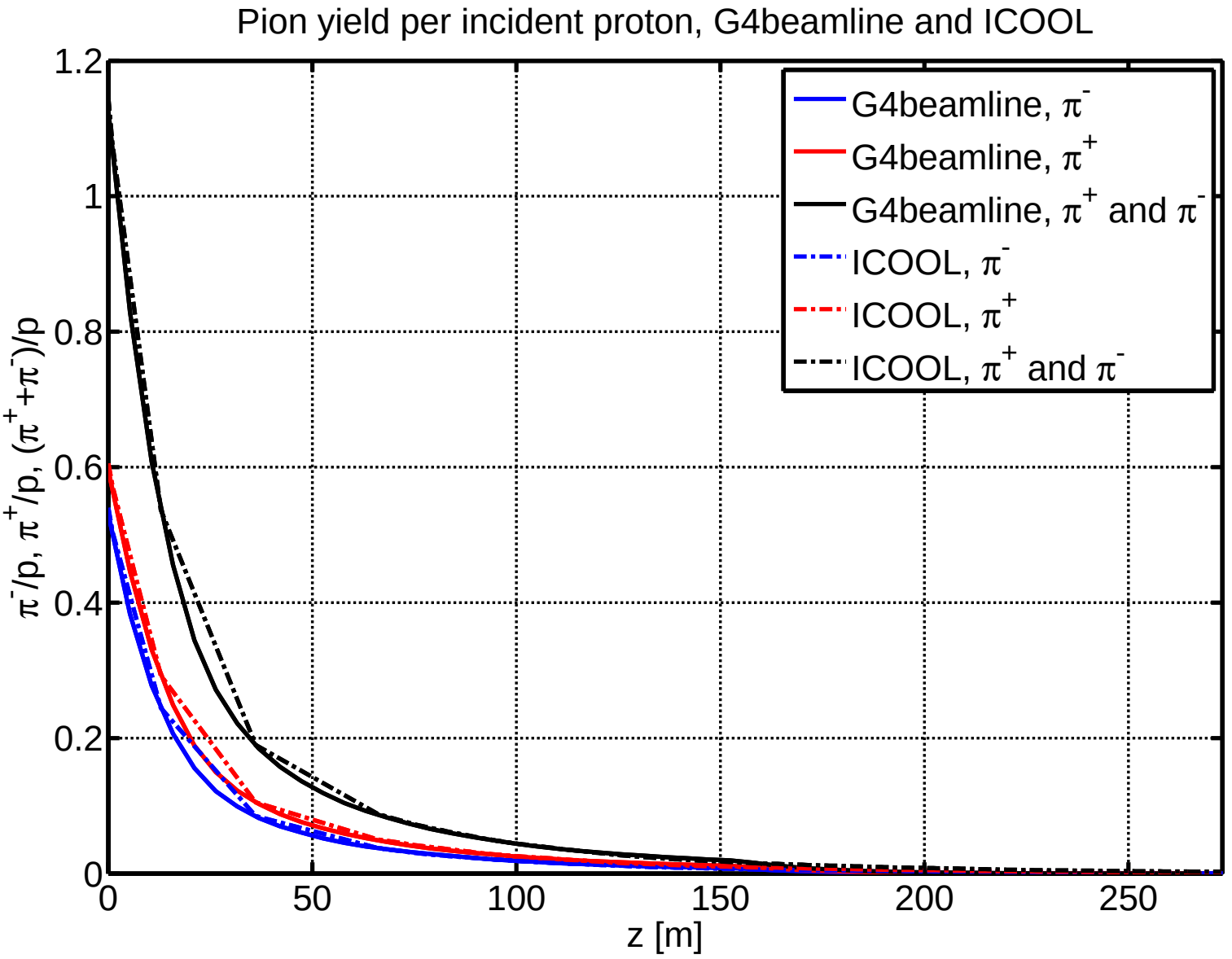

Electron/positron yield per incident proton, G4beamline and ICOOL
G4beamline, e-
G4beamline, e+
G4beamline, e+ and e-
ICOOL, e-
ICOOL, e+
ICOOL, e+ and e-
e-/p, e+/p, (e++e-)/p
z [m]
0
0.2
0.4
0.6
0.8
1
1.2
0
50
100
150
200
250

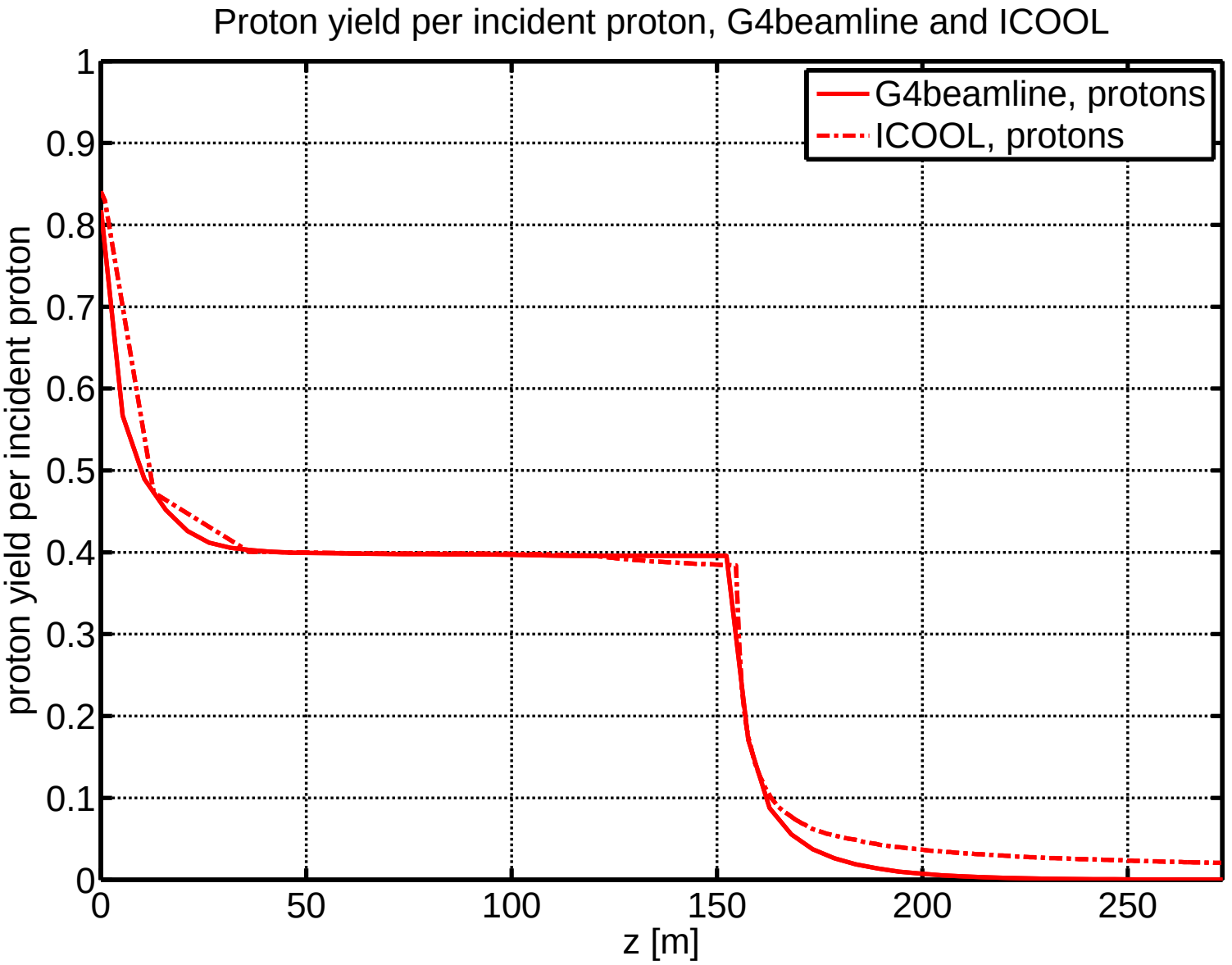

Muon yield per incident proton, G4beamline and ICOOL
μ⁻/p, μ⁺/p, (μ⁺+μ⁻)/p
z [m]
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0
50
100
150
200
250
G4beamline, μ⁻
G4beamline, μ⁺
G4beamline, μ⁺ and μ⁻
ICOOL, μ⁻
ICOOL, μ⁺
ICOOL, μ⁺ and μ⁻

All muons




Useful muons ($p \in [100, 300]$ MeV/c, trans. cut 0.03, long. cut 0.15)


Pion yield per incident proton, G4beamline and ICOOL
G4beamline, π-
G4beamline, π+
G4beamline, π+ and π-
ICOOL, π-
ICOOL, π+
ICOOL, π+ and π-
π-/p, π+/p, (π++π-)/p
z [m]
0
0.2
0.4
0.6
0.8
1
1.2
0
50
100
150
200
250


Proton yield per incident proton, G4beamline and ICOOL
G4beamline, protons
ICOOL, protons
proton yield per incident proton
z [m]
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
0
50
100
150
200
250

# Comments/concerns

Comments:

- Emittances, muon and pion yields show very good agreement between the two codes.
- Some discrepancy in the beginning of the channel (0 to 70 m) for pions and protons is not an issue, just a lack of points on the ICOOL graph.

Concerns:

- Why electron/positron yields differ so much between G4beamline and ICOOL?
- What causes the difference in proton yield between G4beamline and ICOOL in the cooler (z>154 m)?