# Update of *LightIonBraggPeak* test with Li and O data

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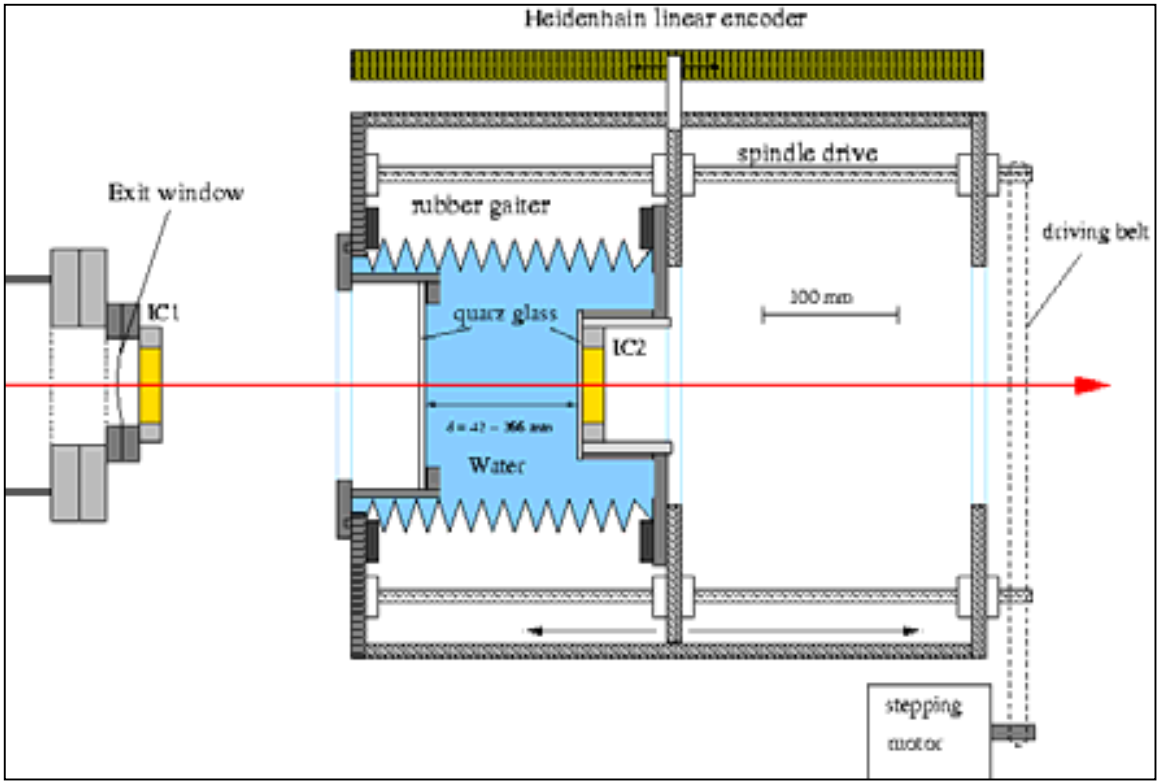
**24th Geant4 Collaboration Meeting**

Jefferson Lab, Newport News, VA (USA)

September 26th, 2019

# Experimental setup



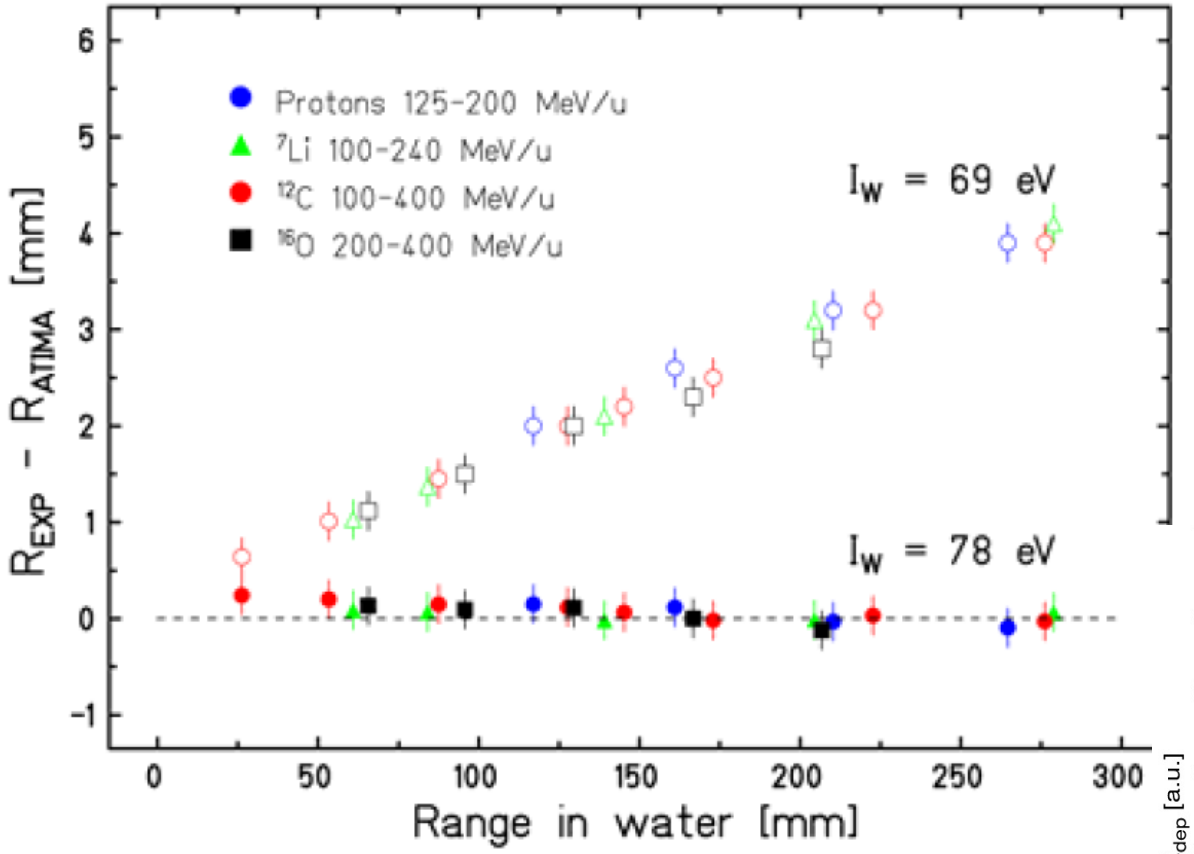



D. Schardt *et al.*, GSI Scientific Report 2007

- Relative ionization measurements (IC2/IC1).
- Precise measurement of absolute depth in water.
- Beam angular aperture negligible (defocused at collimator)
- Reported uncertainty of 0.2 mm for the mean range determination, using the 82% distal depth.

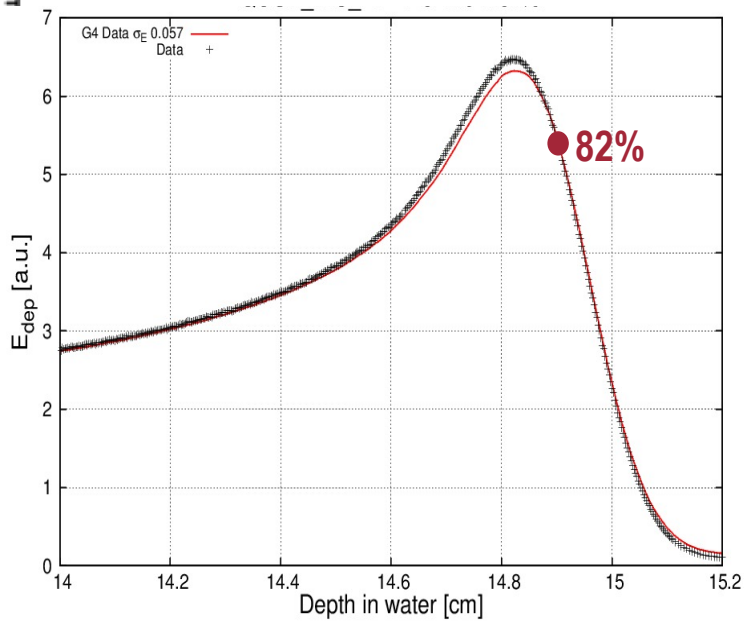
# Reference data





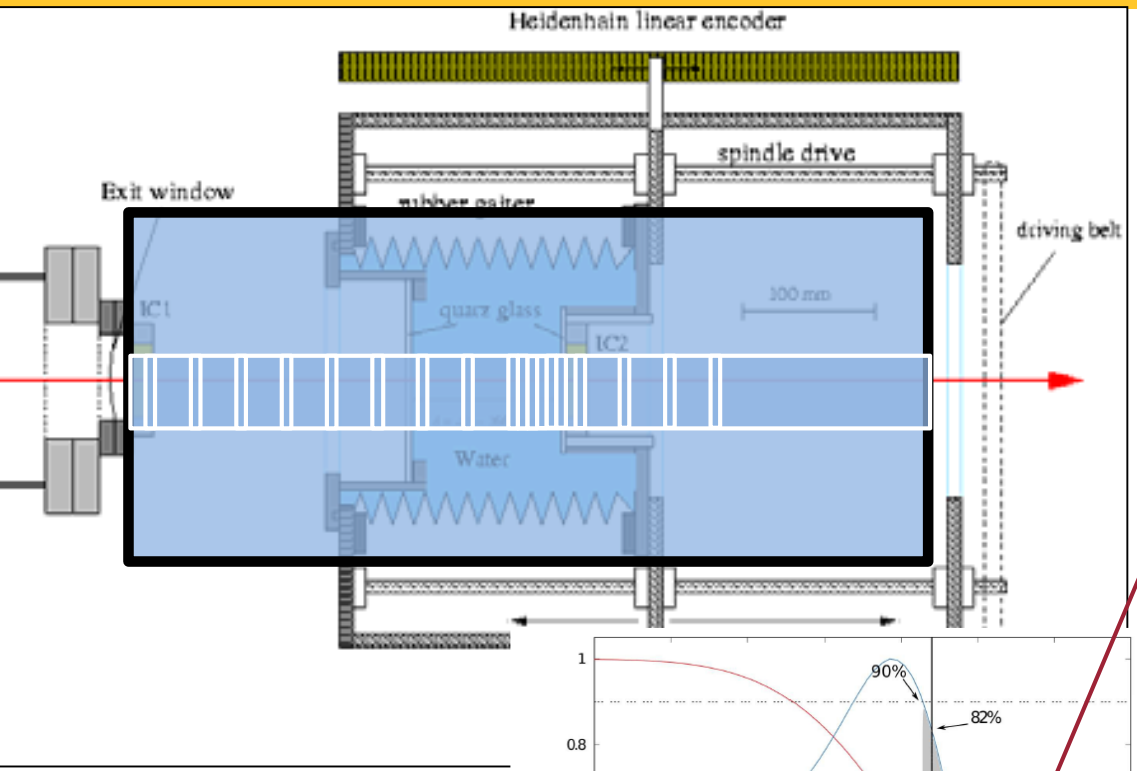

**D. Schardt et al., GSI Scientific Report 2007**

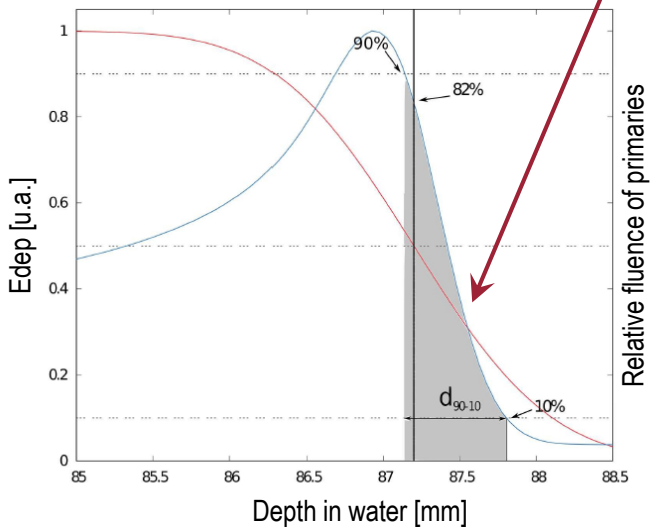
- "Range" defined as the **depth** where dose is **82%** of máximum, **distal to Bragg peak**



# Simulated setup



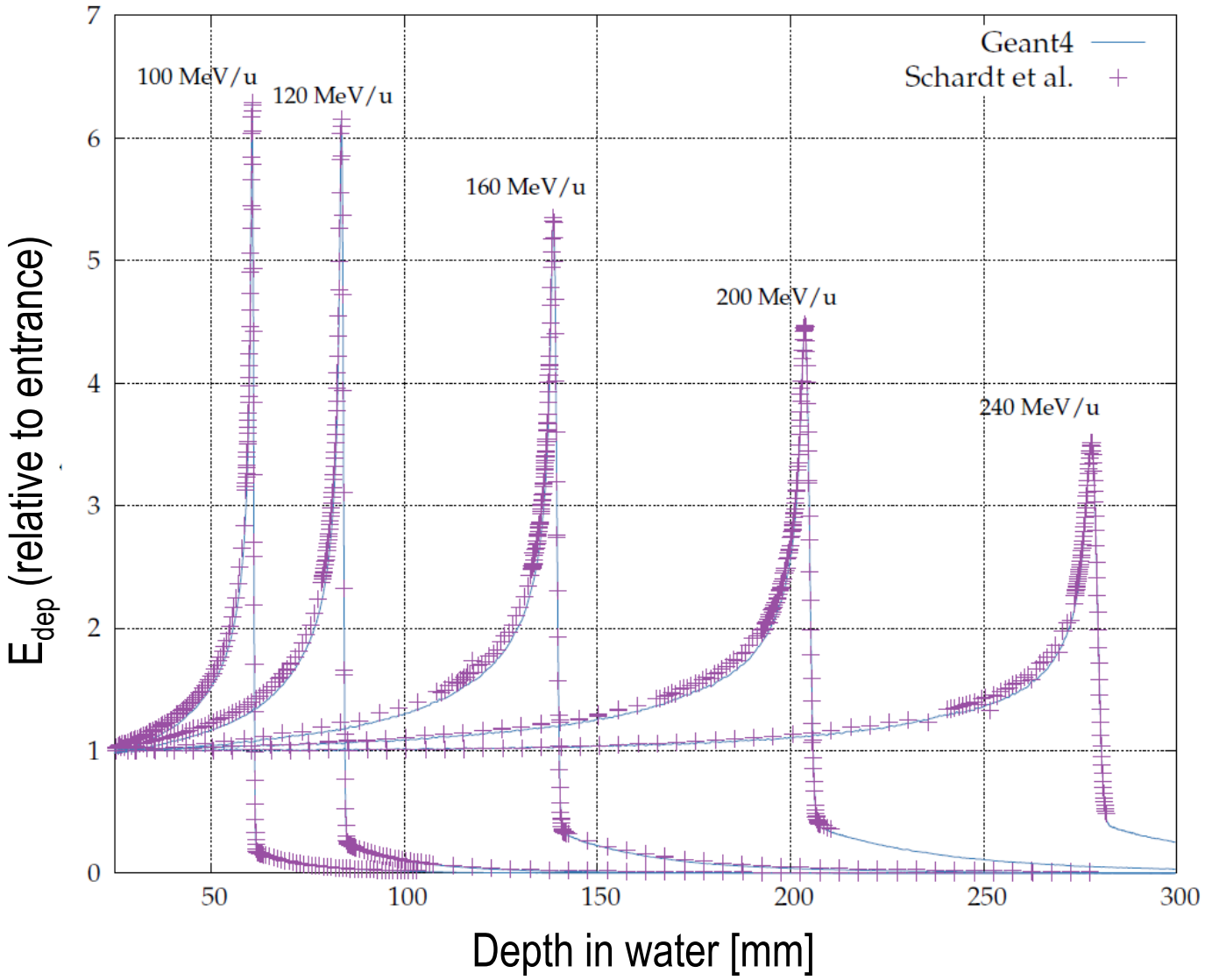



- **G4_WATER** tank.
- Water density corrected according to report (24ºC, **0.997 g/cm$^3$**).
- Beam energy spread set by matching experimental distal penumbra (**90%-10%**).
- Energy deposition scored in cylindrical voxels along beam axis, with same radius as IC2 (28 mm). Thickness of 50 µm, approx- water equivalent thickness of ICs.
- Pencil beam, no angular divergence.

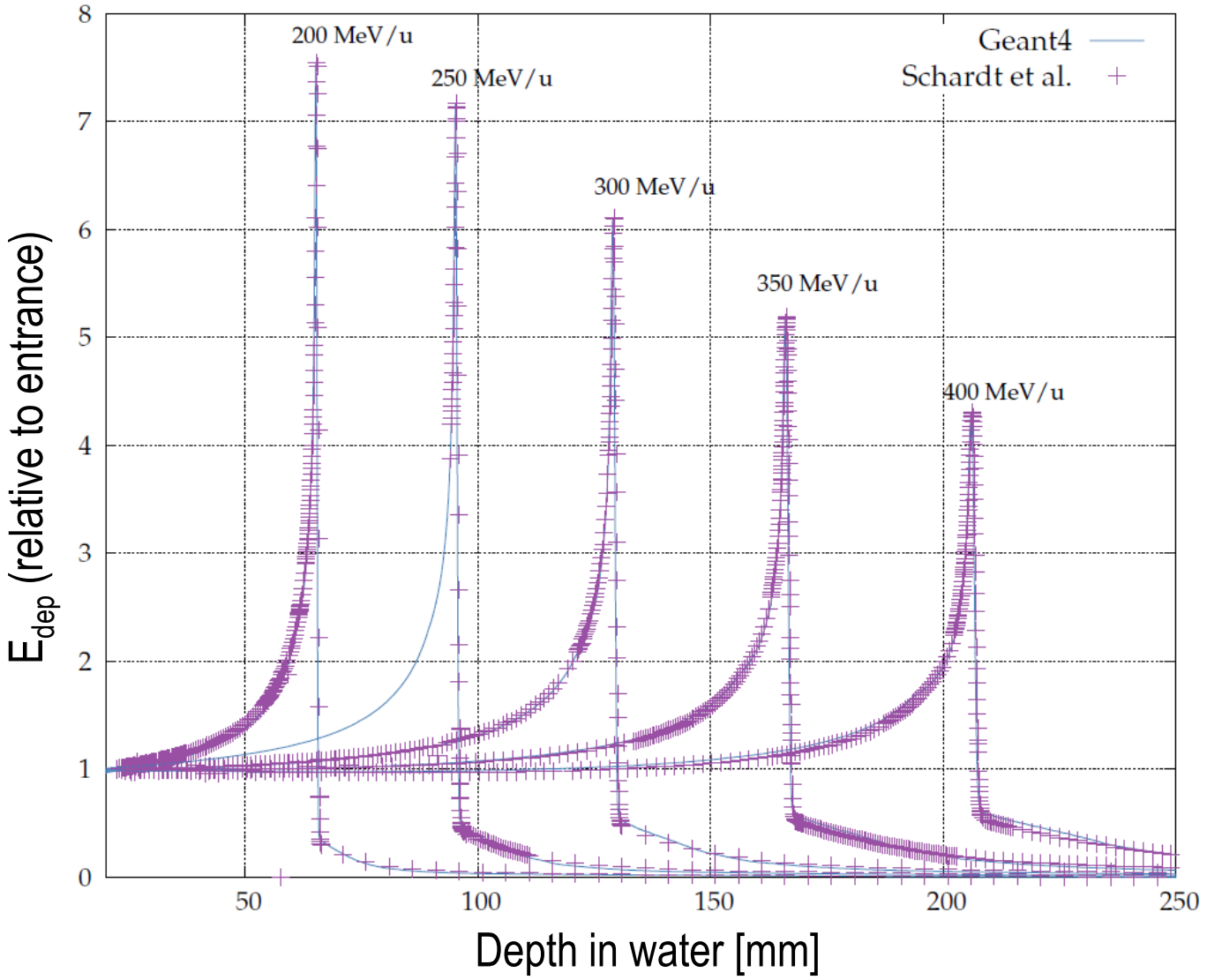
# New Incorporated data – Lithium-7





# New Incorporated data – Oxygen-16





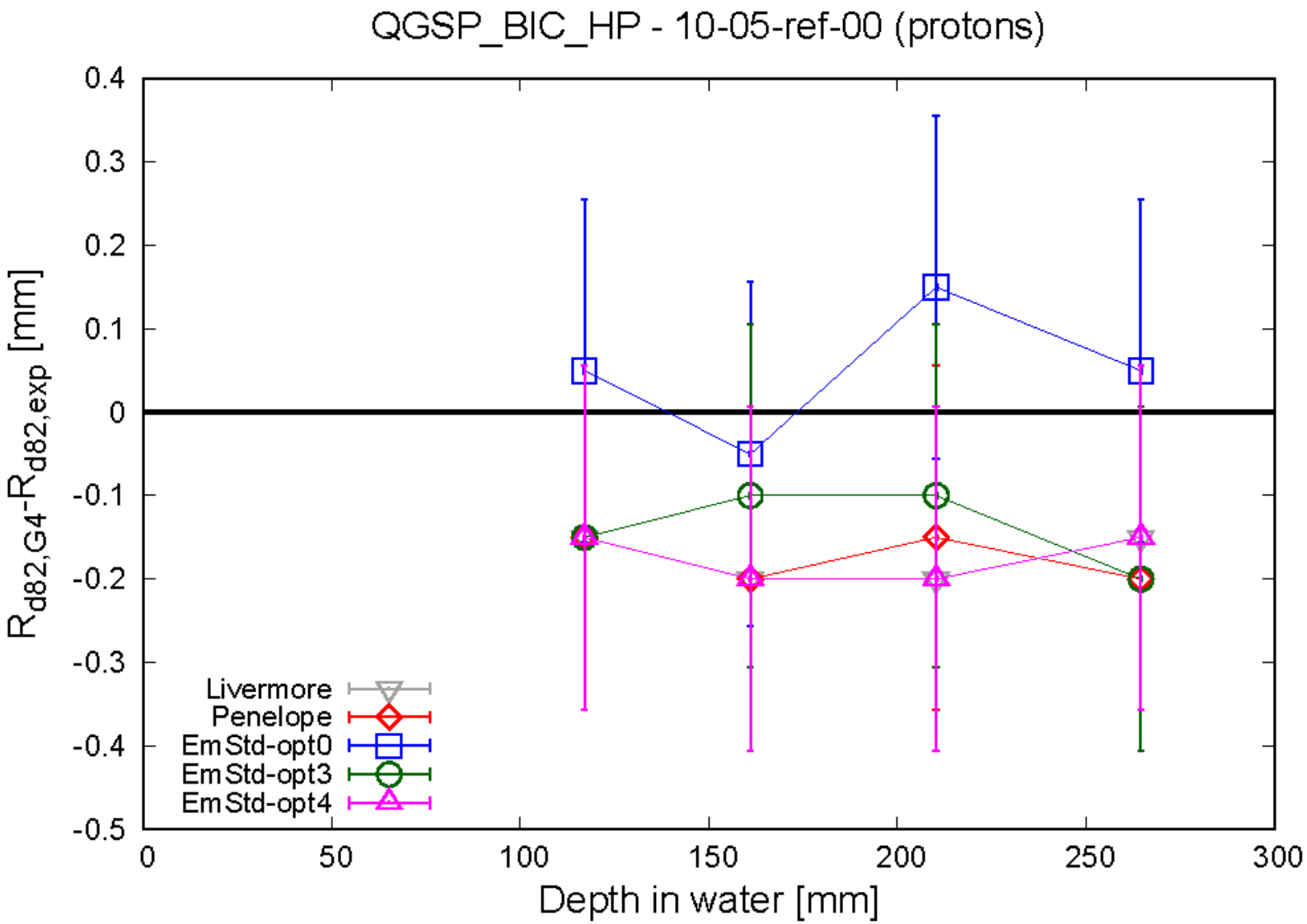
# Results



**geant4-10-05-ref-00**
**&**
**geant4-10-05-ref-06**

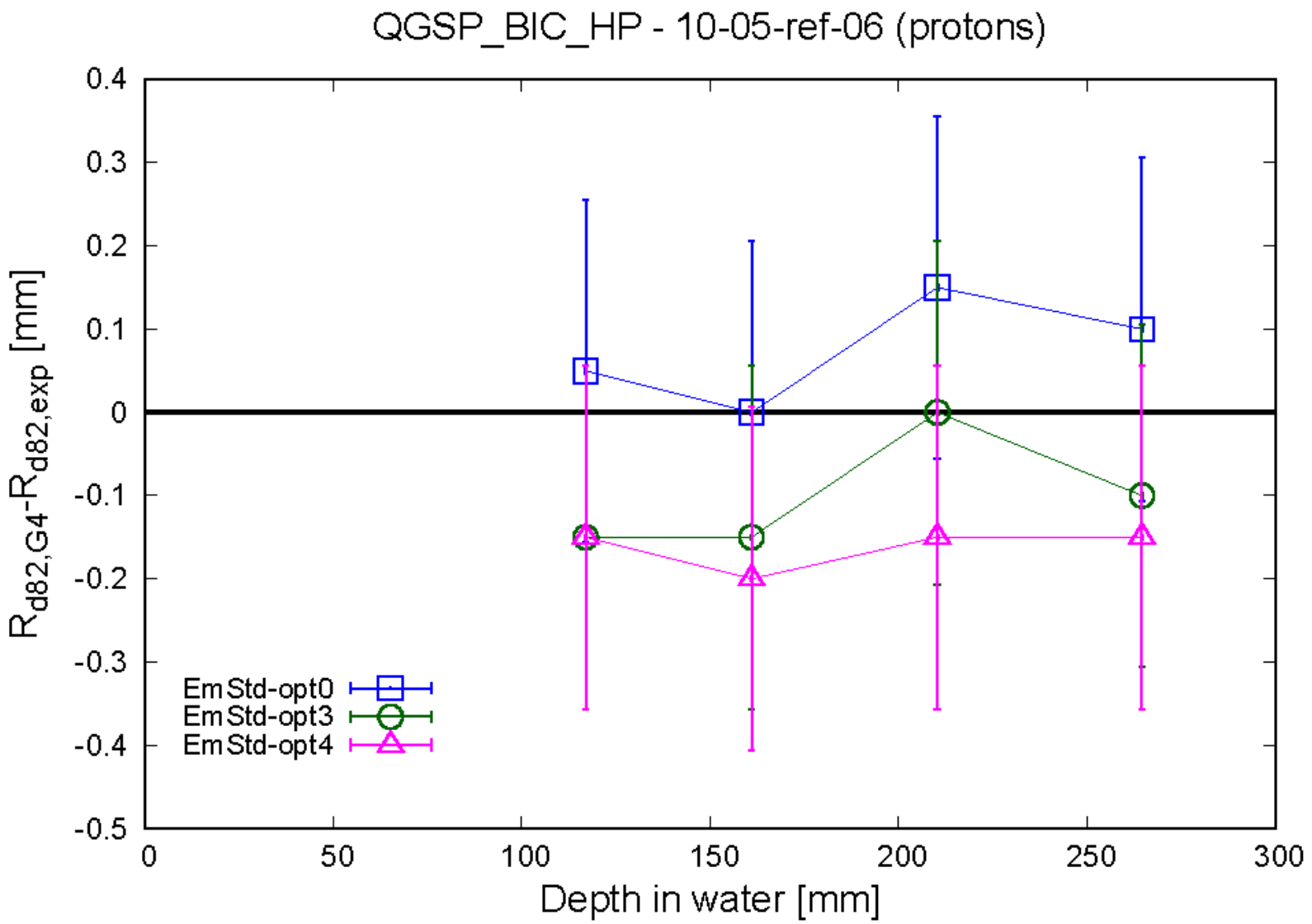
# Protons (125-200 MeV)





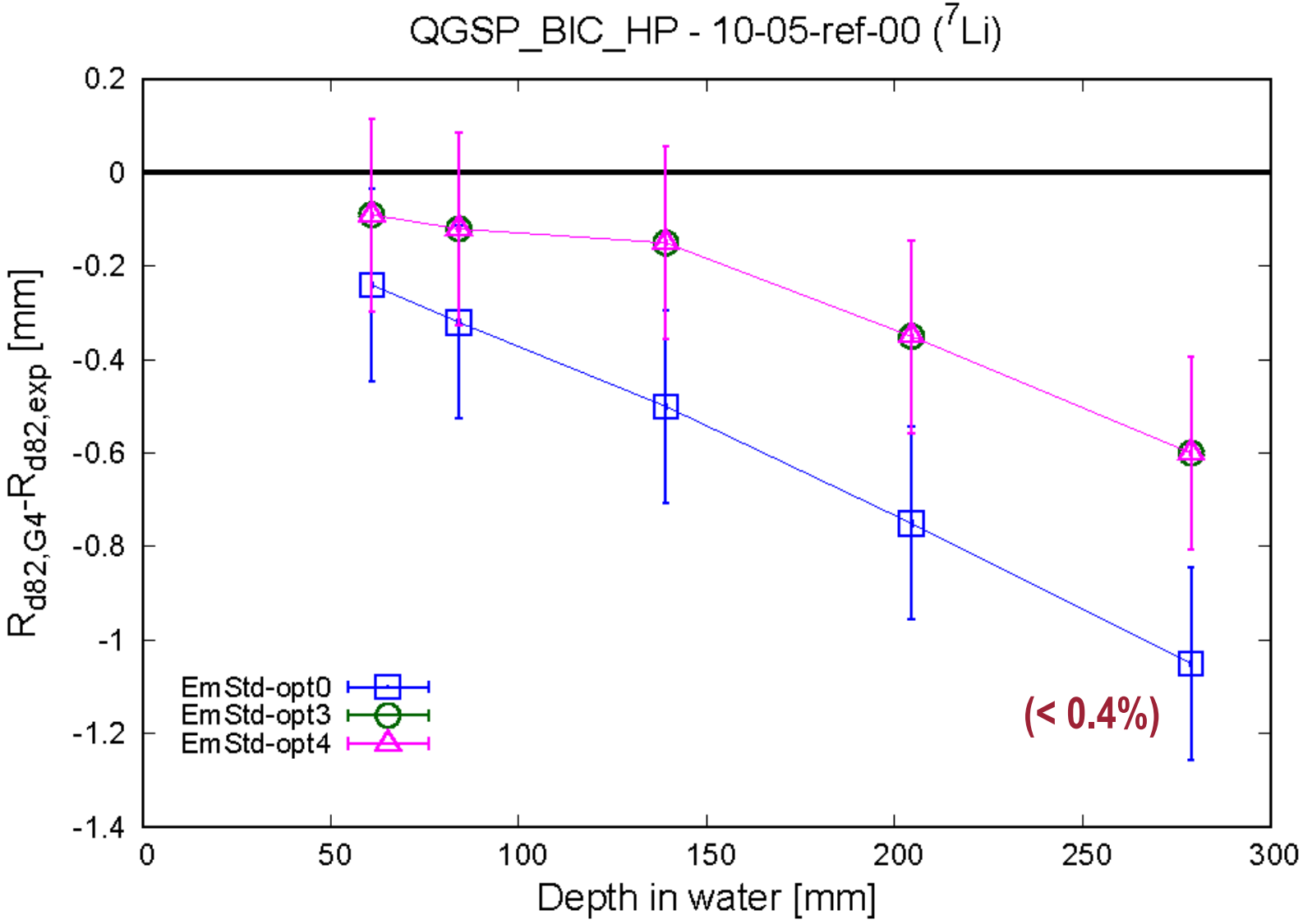
# Protons (125-200 MeV/u)





# $^{7}$Li (100-240 MeV/u)





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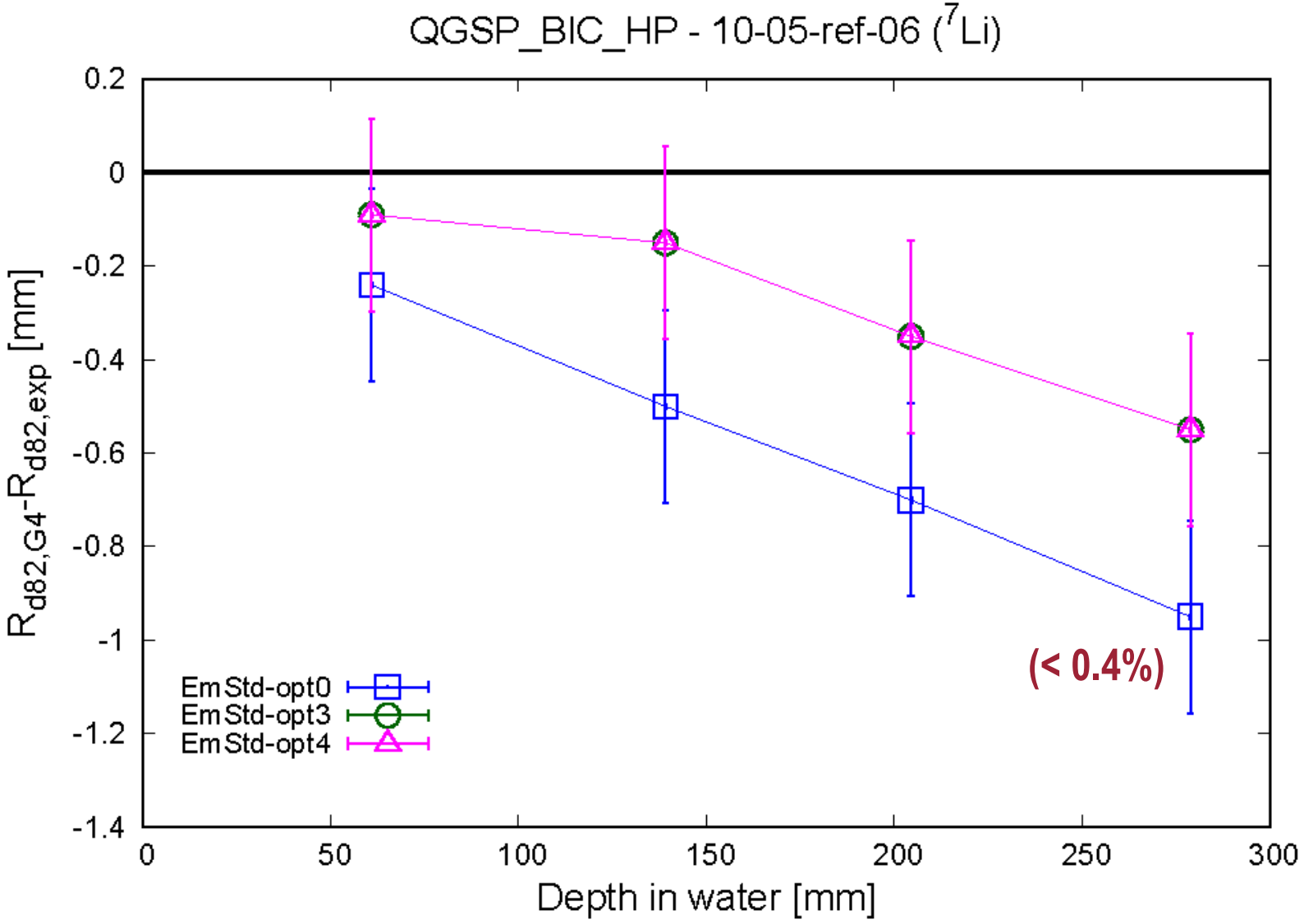
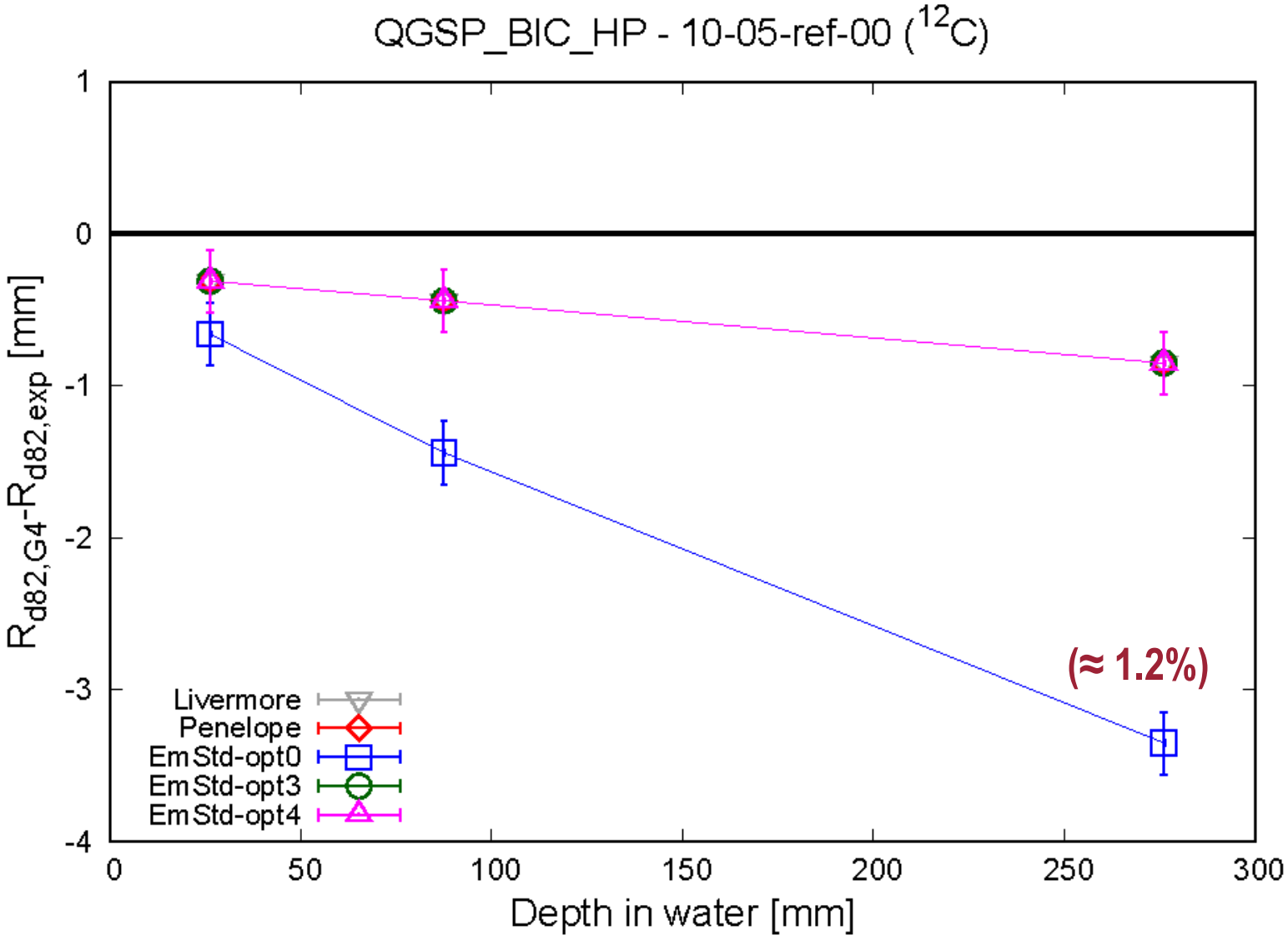


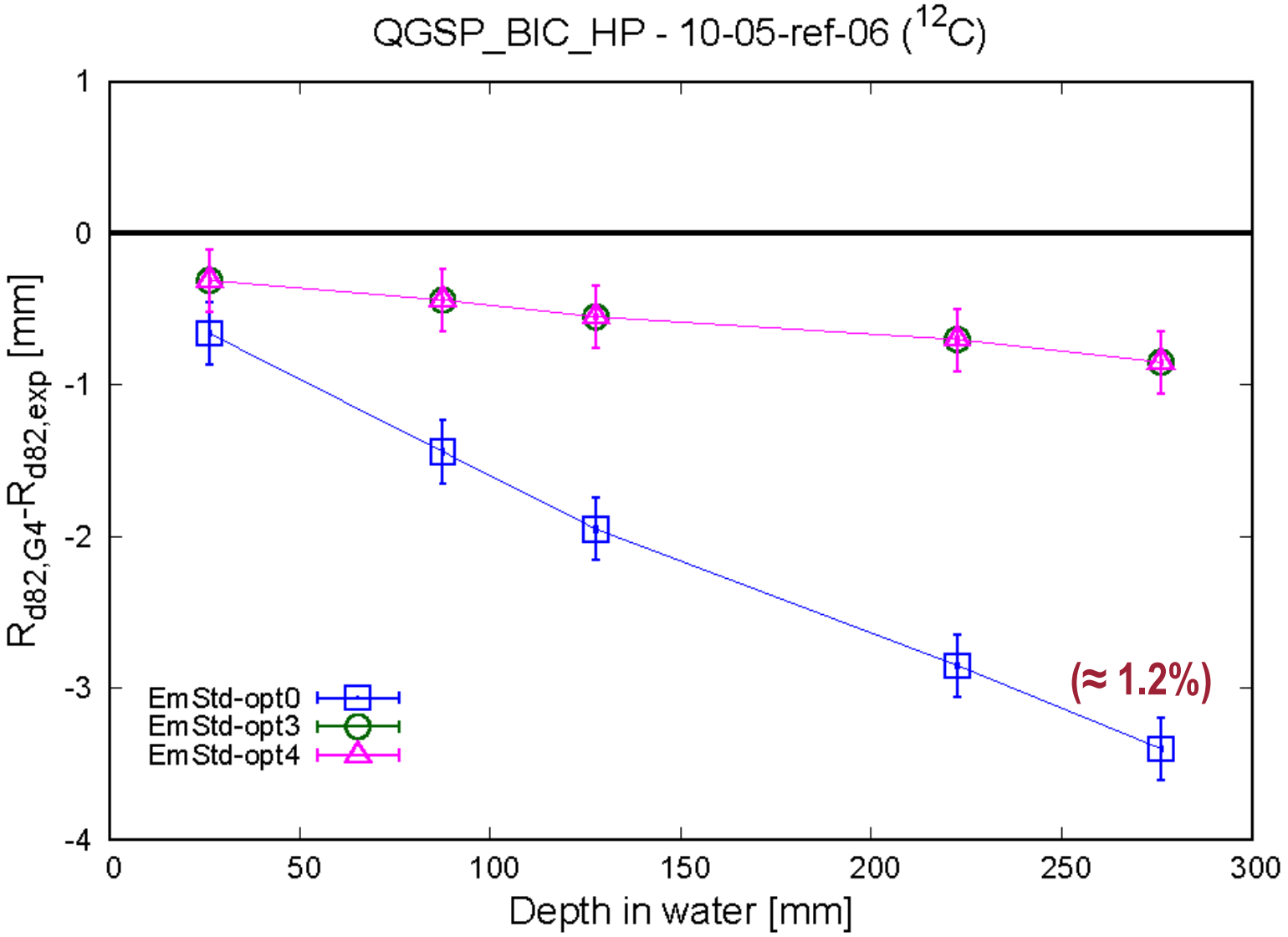
# $^{12}$C (100-400 MeV/u)





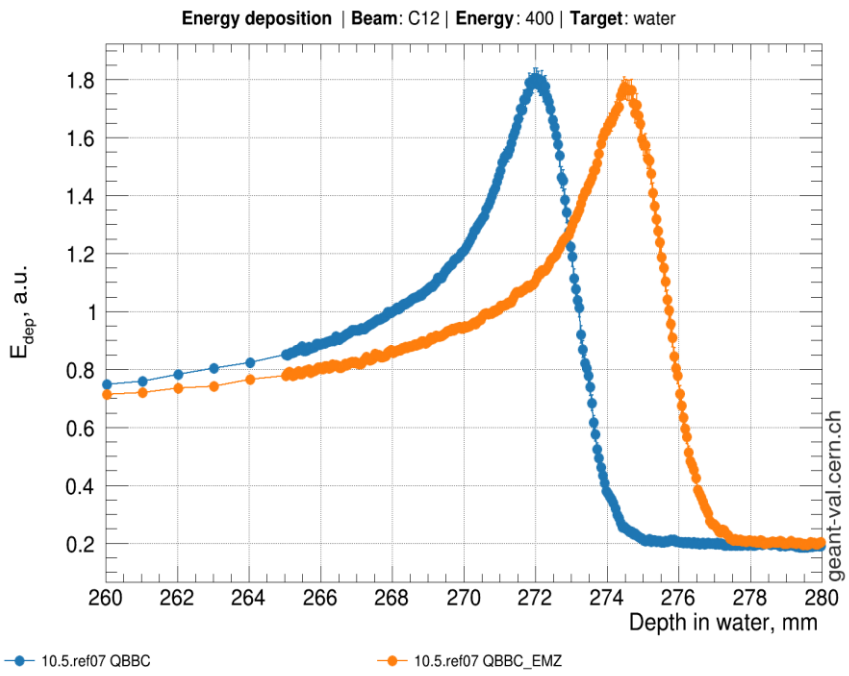
# $^{12}$C (100-400 MeV/u)



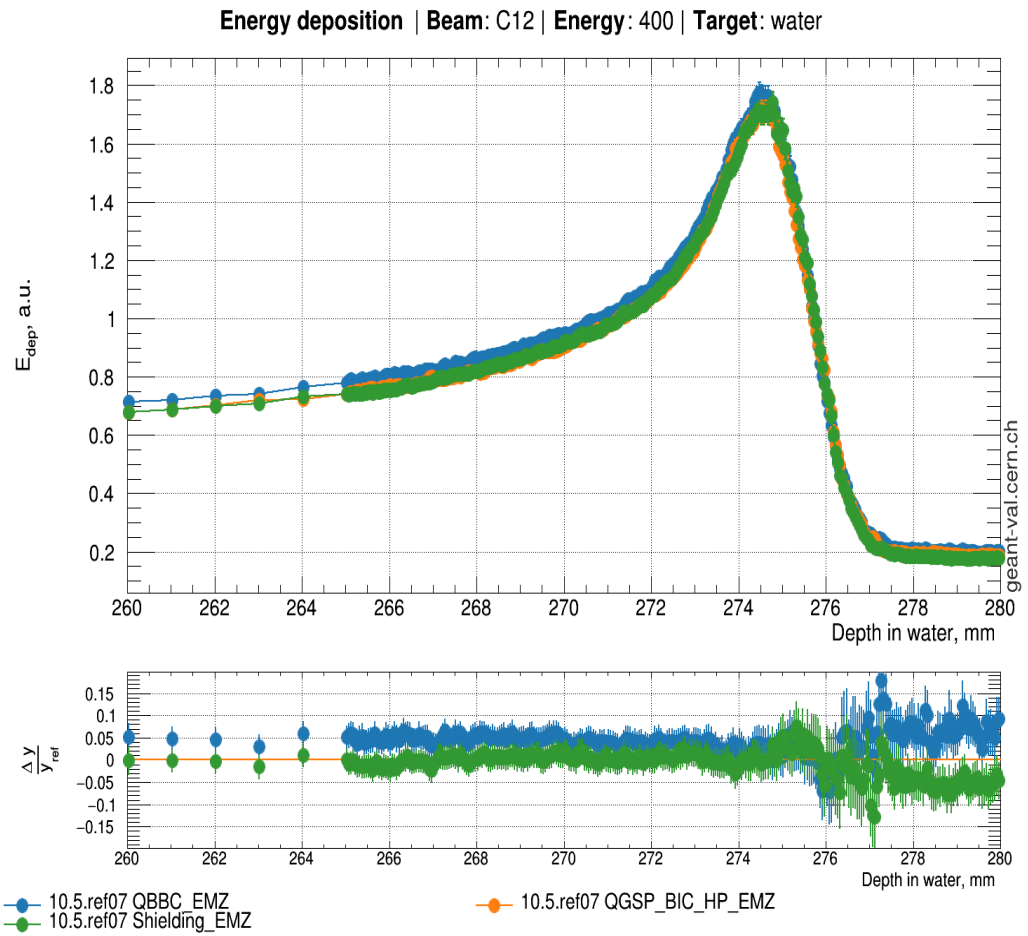


# $^{12}C$ @ 400 MeV/u (geant4-10-05-ref-07)





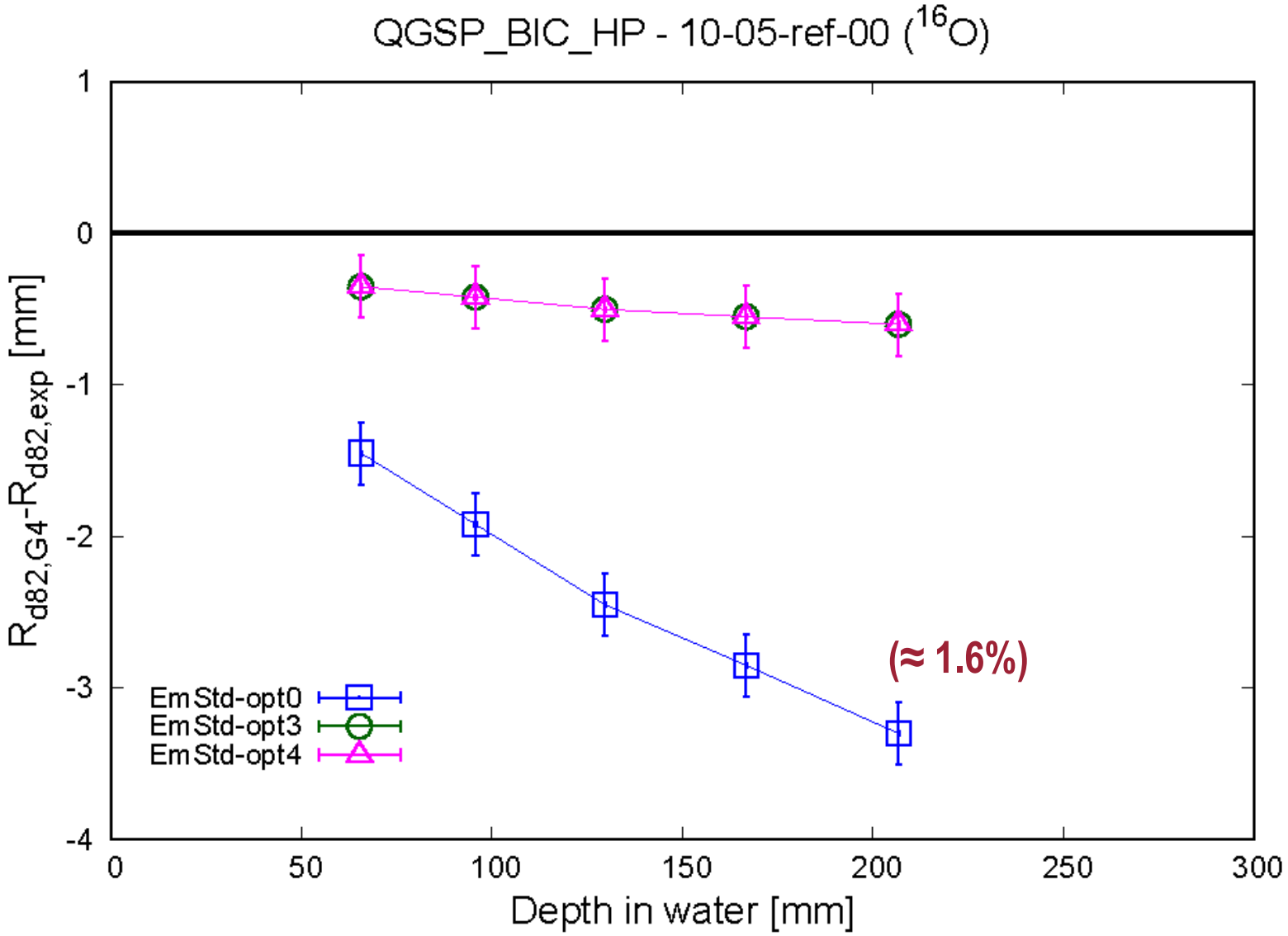

- Same hadronic PL (**QBBC**)
- Illustrative plot **EM-option0** vs **EMZ**




- All using **EMZ**
- **QBBC** vs **Shielding** vs **QGSP_BIC_HP**
- No significant impact on depth of 82% distal

# $^{16}$O (200-400 MeV/u)





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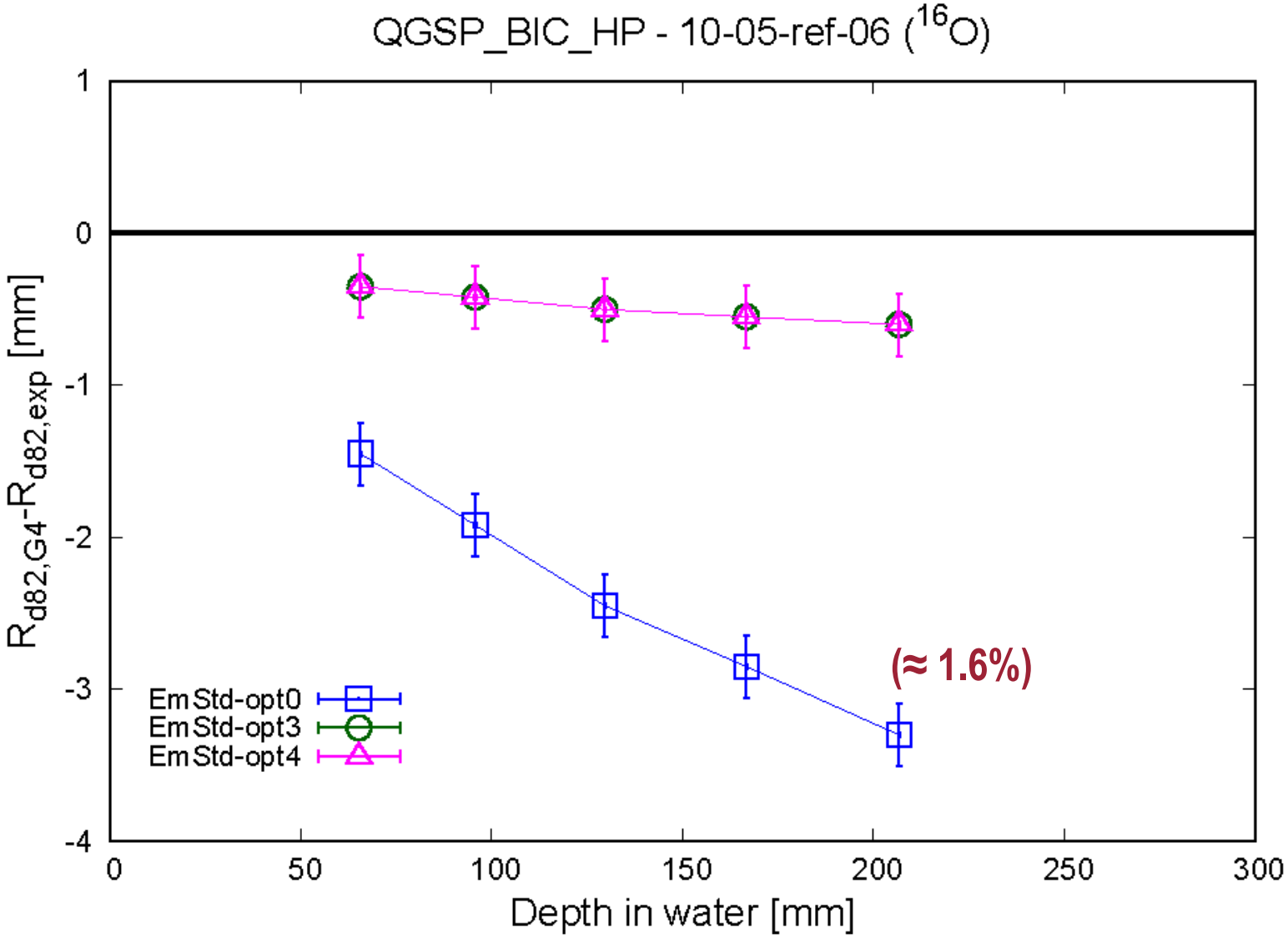

# Conclusions



- $^{7}$Li & $^{16}$O beam data included in our Bragg curve tests
  - Five different nominal energies, covering up to ~ 25 cm in water
- New $^{12}$C ion data @ 250 and 350 MeV/u
- 82% distal depths → stable across reference tags and hadronic PL
- Significant changes in Bragg curve shape with QGSP_BIC_HP & Shielding
- Working on updated code to be included into geant-val