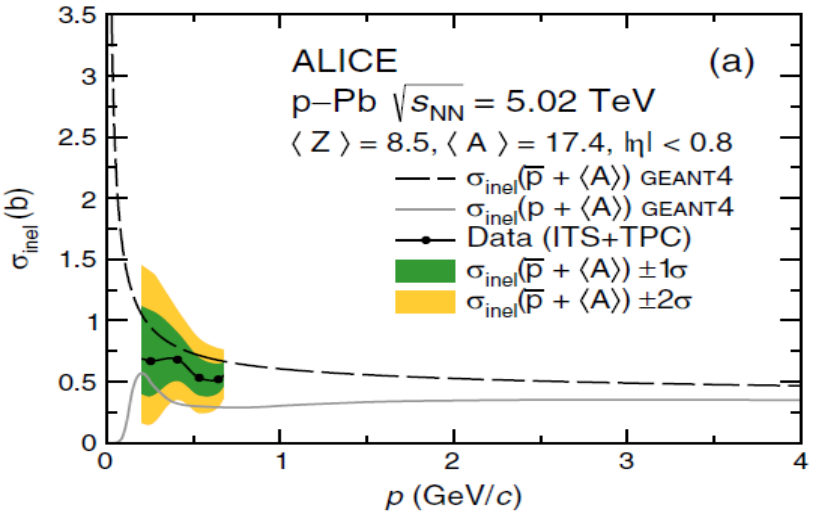
Light antinucleus-nuclus cross sections

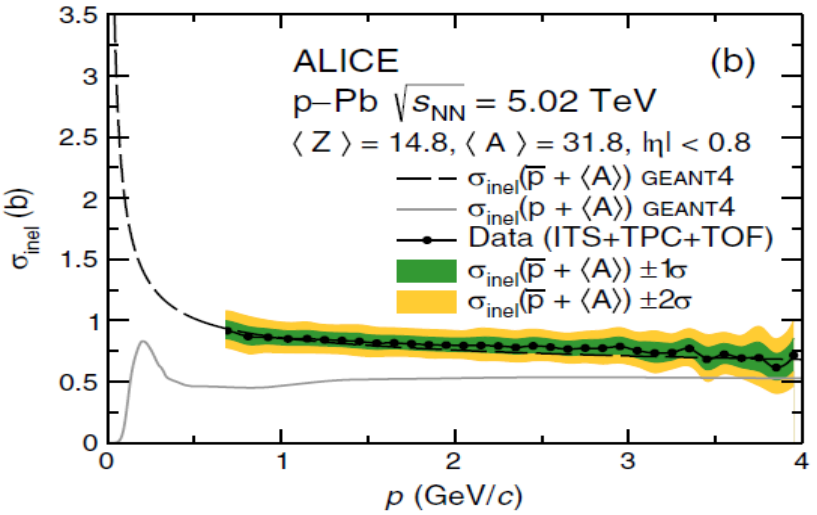
V. Uzhinsky

Measurement of the Low-Energy Antideuteron Inelastic Cross Section

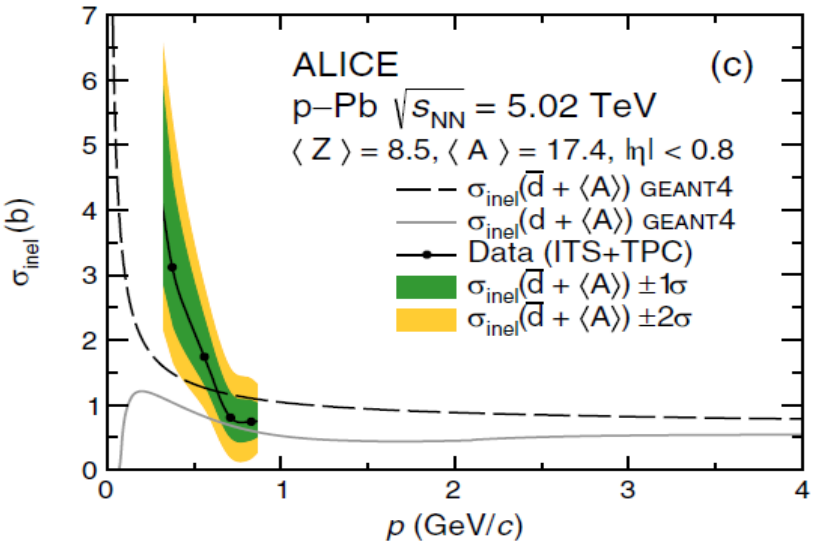
S. Acharya et al., ALICE Collab., PHYS. REV. LETT. 125, 162001 (2020)

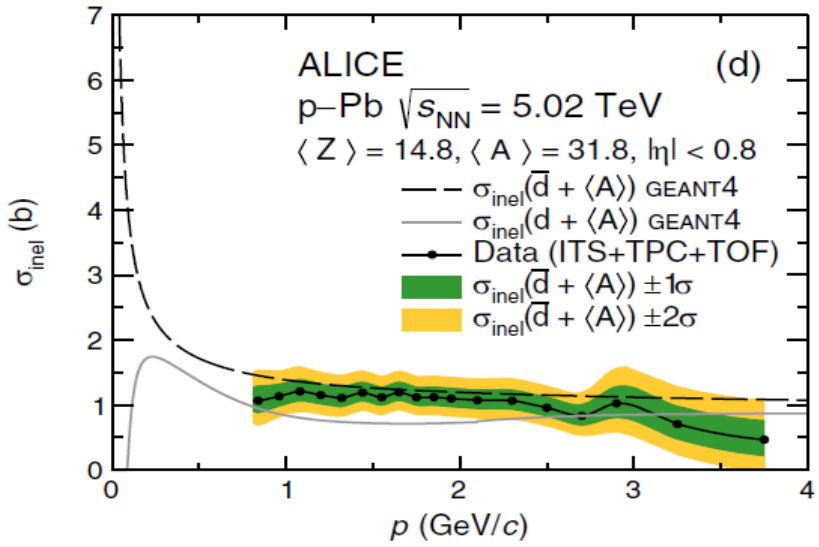
Anti P +A





Anti D +A

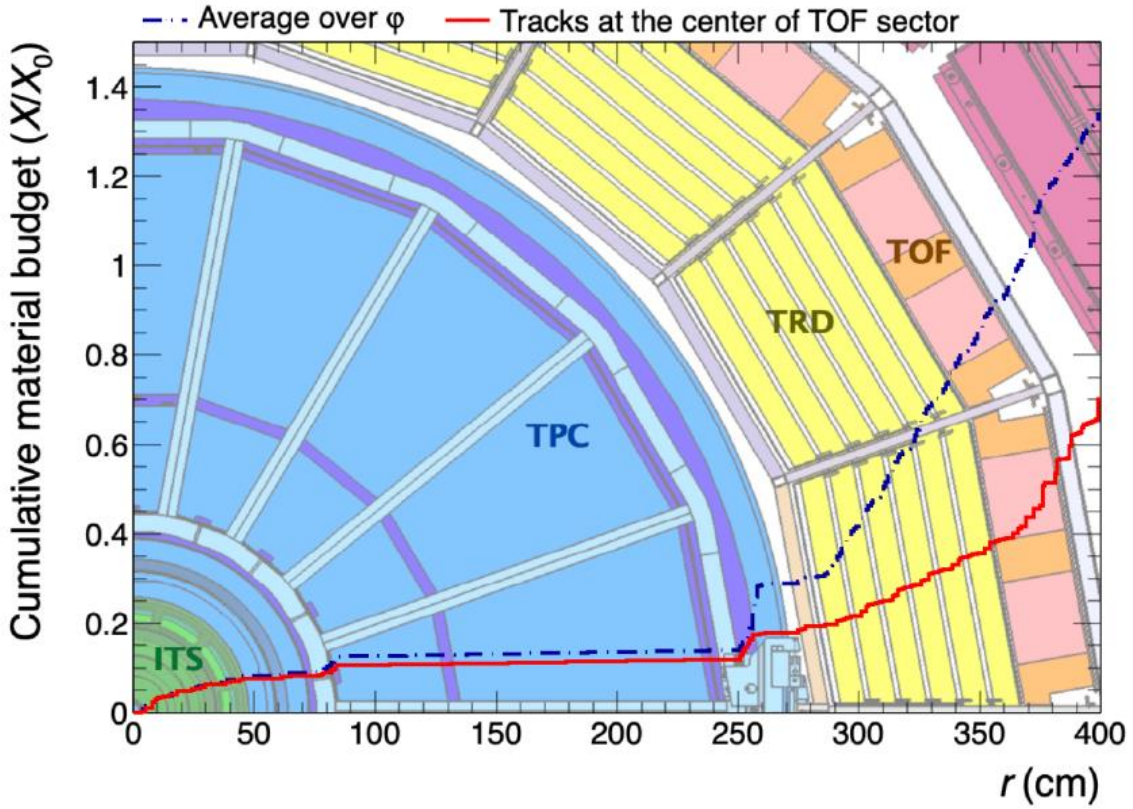




Geant4 essential underestimates X for anti-deuteron with light nuclei

ALICE method

I. Vorobyev on behalf of the ALICE Collaboration, 4th Workshop on LHC detector simulations



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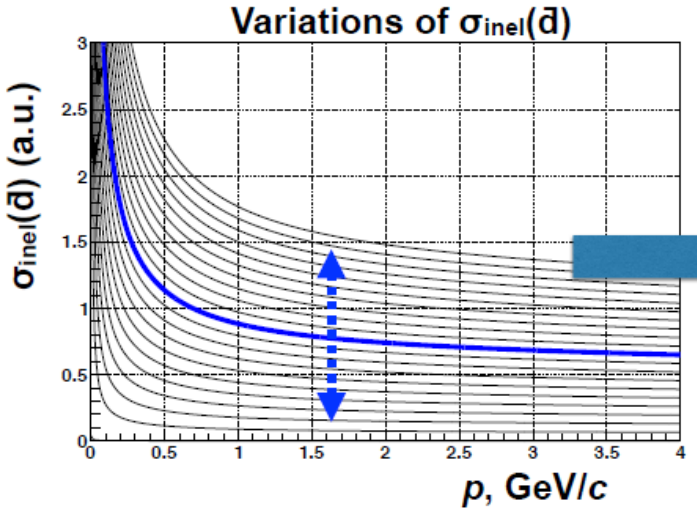
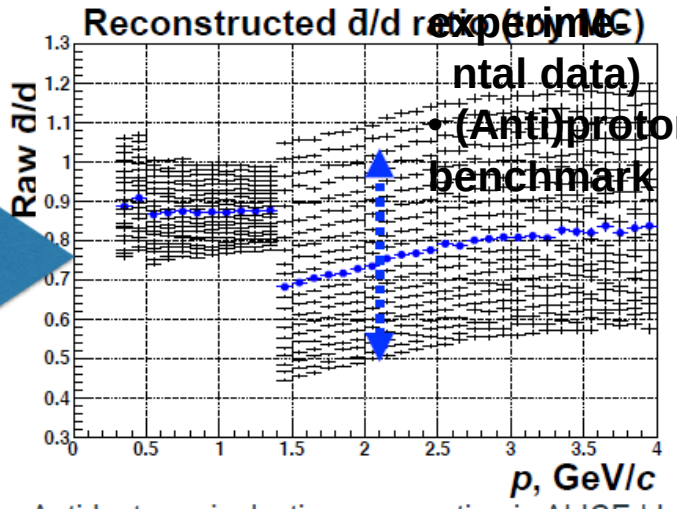
Idea of the analysis

- No correction due to detector efficiency or absorption in detector material
- Correct for secondary (anti)deuterons from weak decays or spallations
- Constrain $\sigma_{inel}(\bar{d})$ via comparison with detailed Monte Carlo simulations based on Geant4
- Vary $\sigma_{inel}(\bar{d})$ in MC simulations, $\sigma_{inel}(d)$ is fixed to the one used in Geant4 (describes well the experimental data)
- (Anti)proton analysis as a benchmark

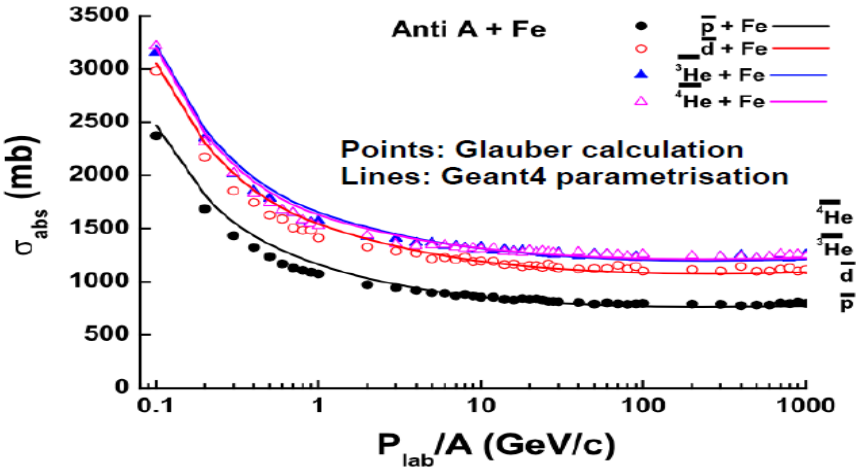


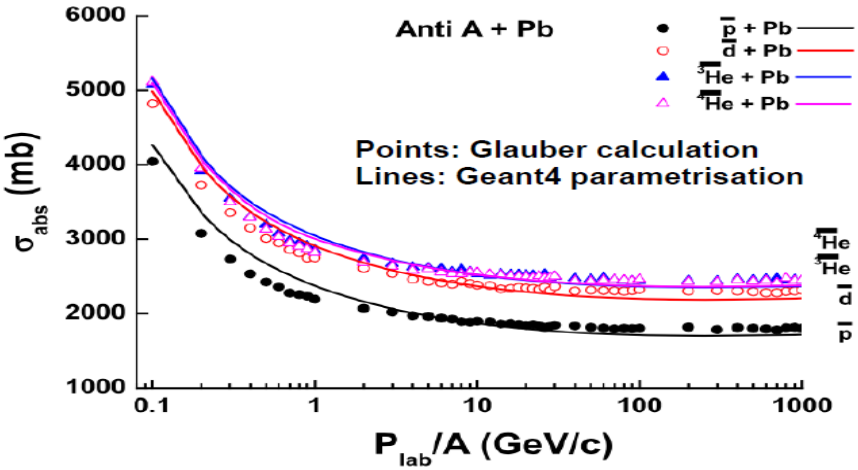


Antinuclei inelastic cross sections in Geant4 [1]

Good description of Glauber calculations with parameterisations

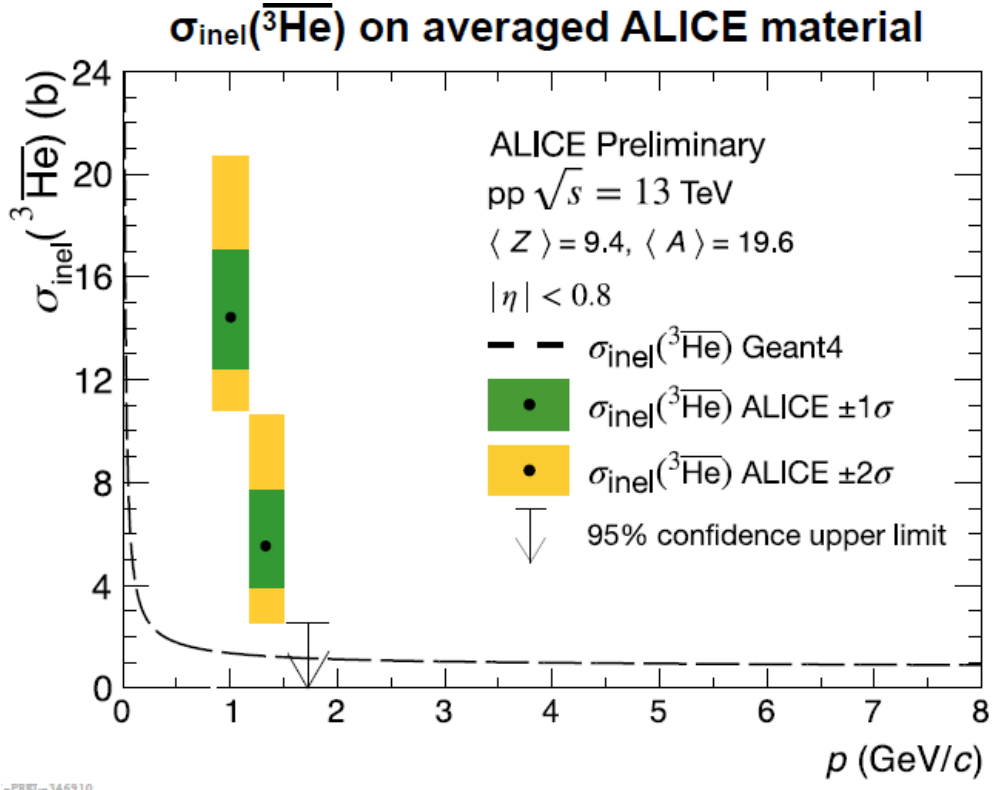
The parameterisations are used in Geant4 in 100 MeV/c < p/A < 1000 GeV/c momentum range



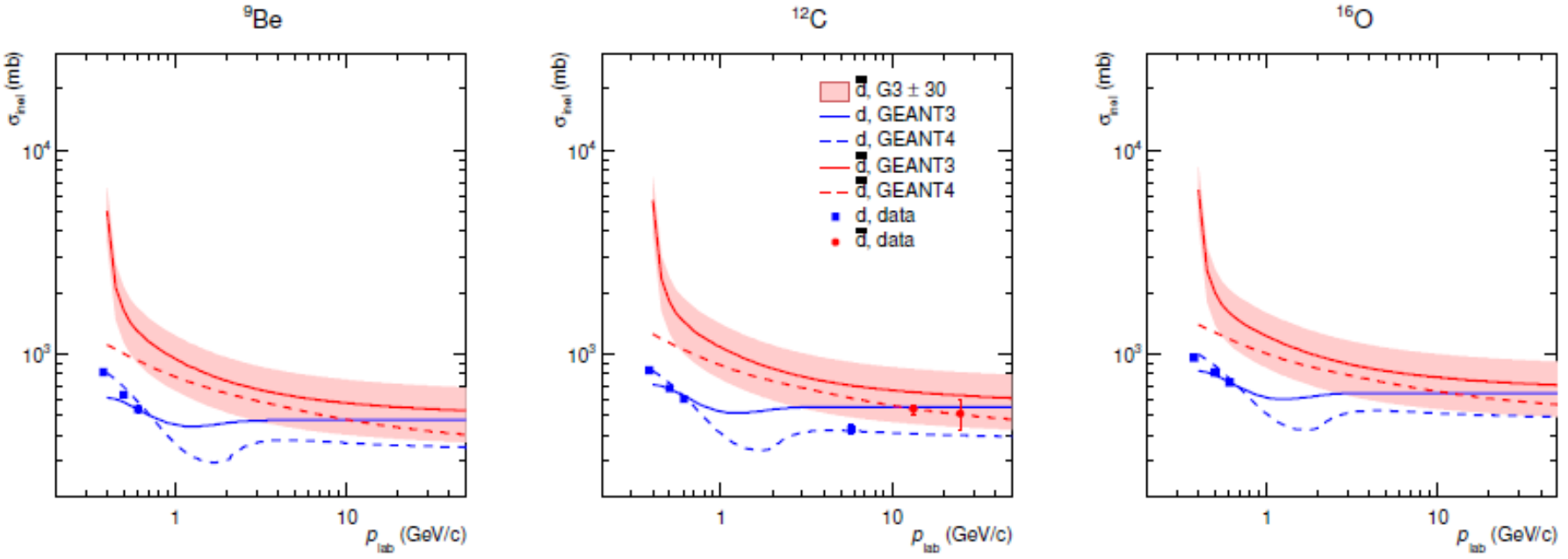


New ALICE results: steeper rise of inelastic c.s. at very low momentum!

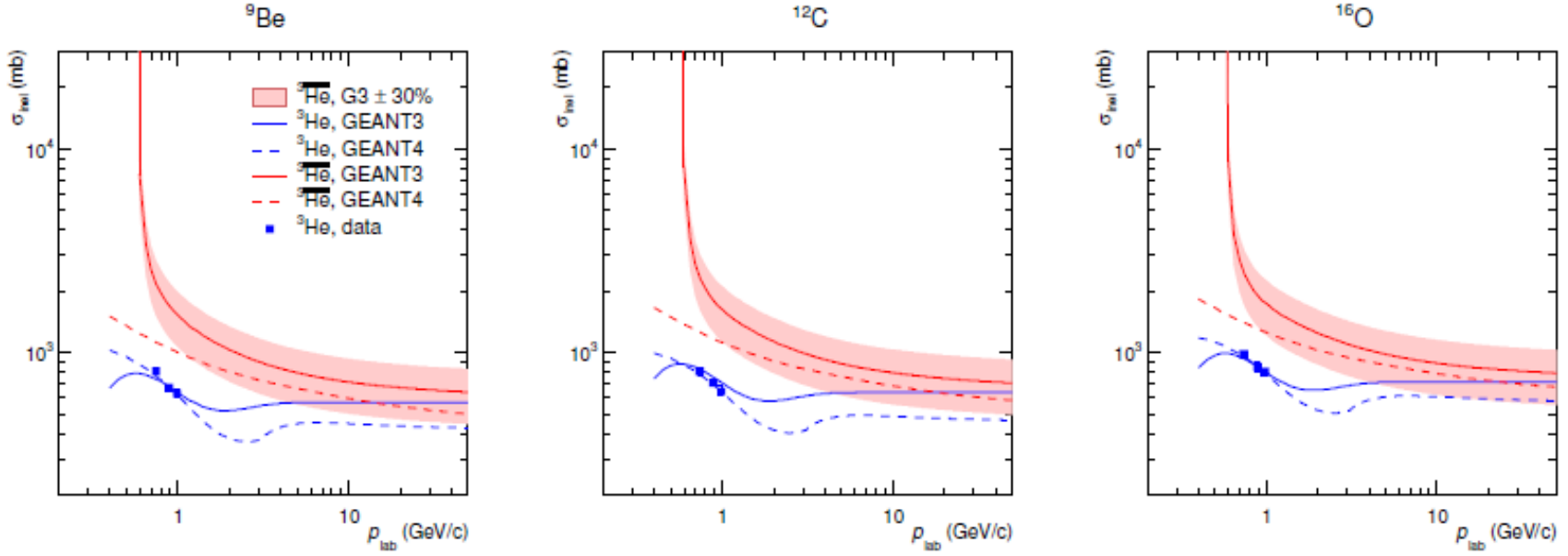
Preliminary results for $\sigma_{inel}(^3\overline{He}$-anti)



GEANT3/4 cross-sections for (

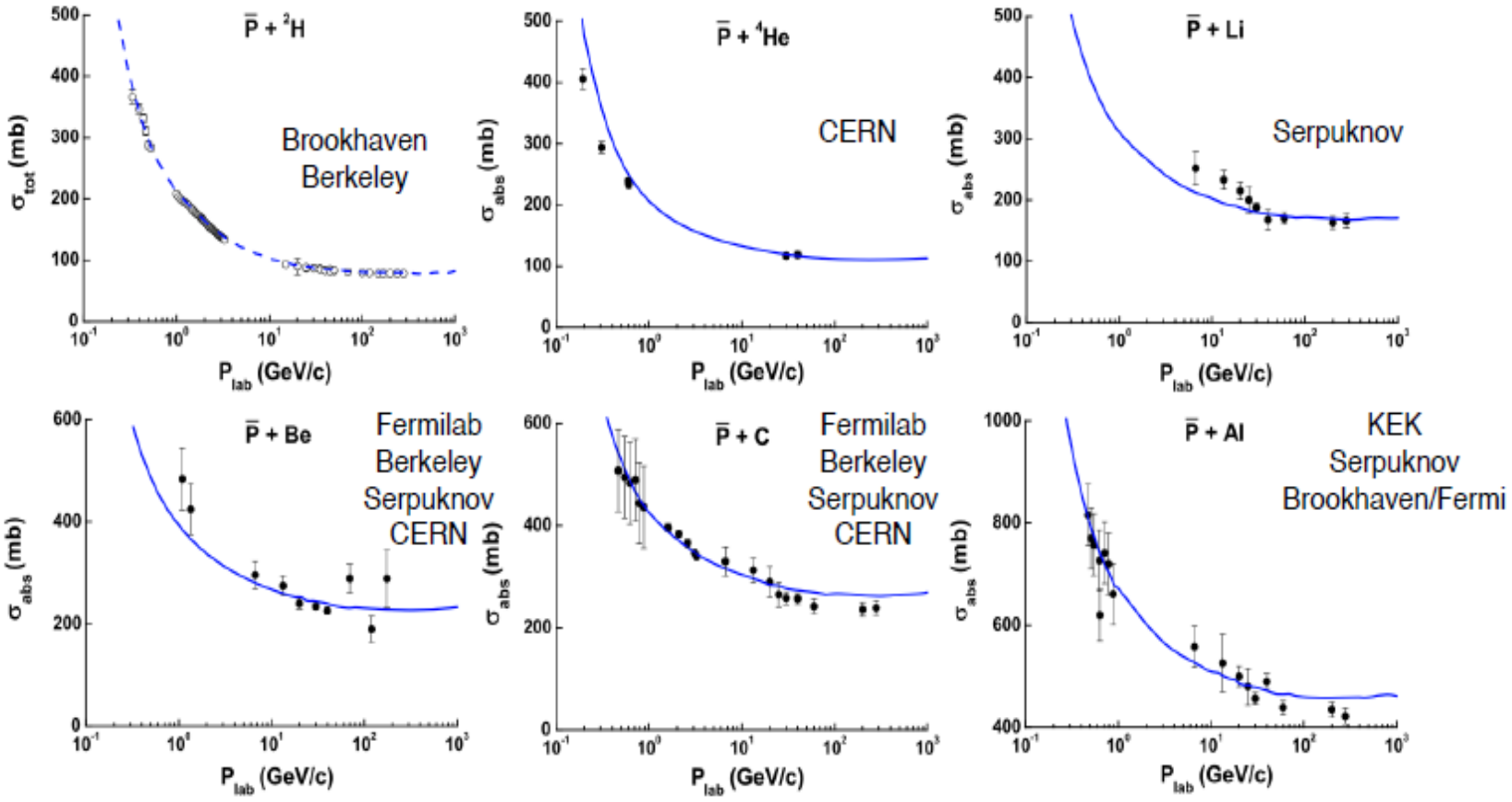


GEANT3/4 cross-sections for (anti)$_3$He



Geant4: Glauber calculations vs data

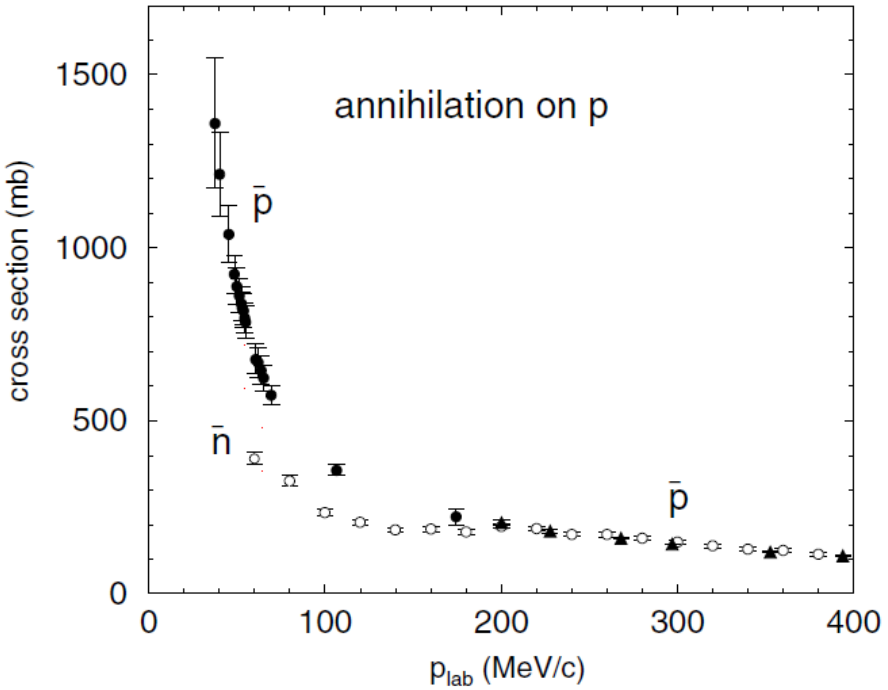
Lines are Glauber calculations, points are various exp. data [1]



[1] Phys. Lett. B705, 235 (2011)

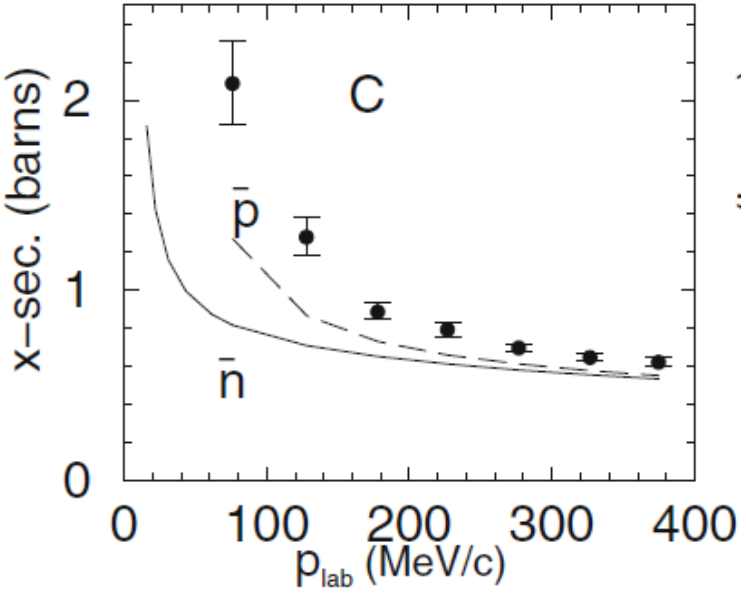
Low-energy antinucleon-nucleus interaction revisited

E. Friedman, Hyperfine Interact (2015) 234:77–84



$$\sigma_R = \pi R^2 \left(1 + \frac{m+M}{M}\frac{Ze^2}{RE_{lab}}\right)$$

$$\sigma_R = \pi R^2 (1 + \frac{2mZe^2}{\hbar^2 k_{lab} k R})$$



Experimental annihilation cross sections for anti-*p* and anti-*n* on the proton, see text for references. Open circles for anti*n*, filled circles and triangles for anti-p.

Thus, it would be better to revise anti-p A calculation with inclusion of the Coulomb interactions. The same should be done for anti-A A.