

International
UON Collider
Collaboration



Target pion yields

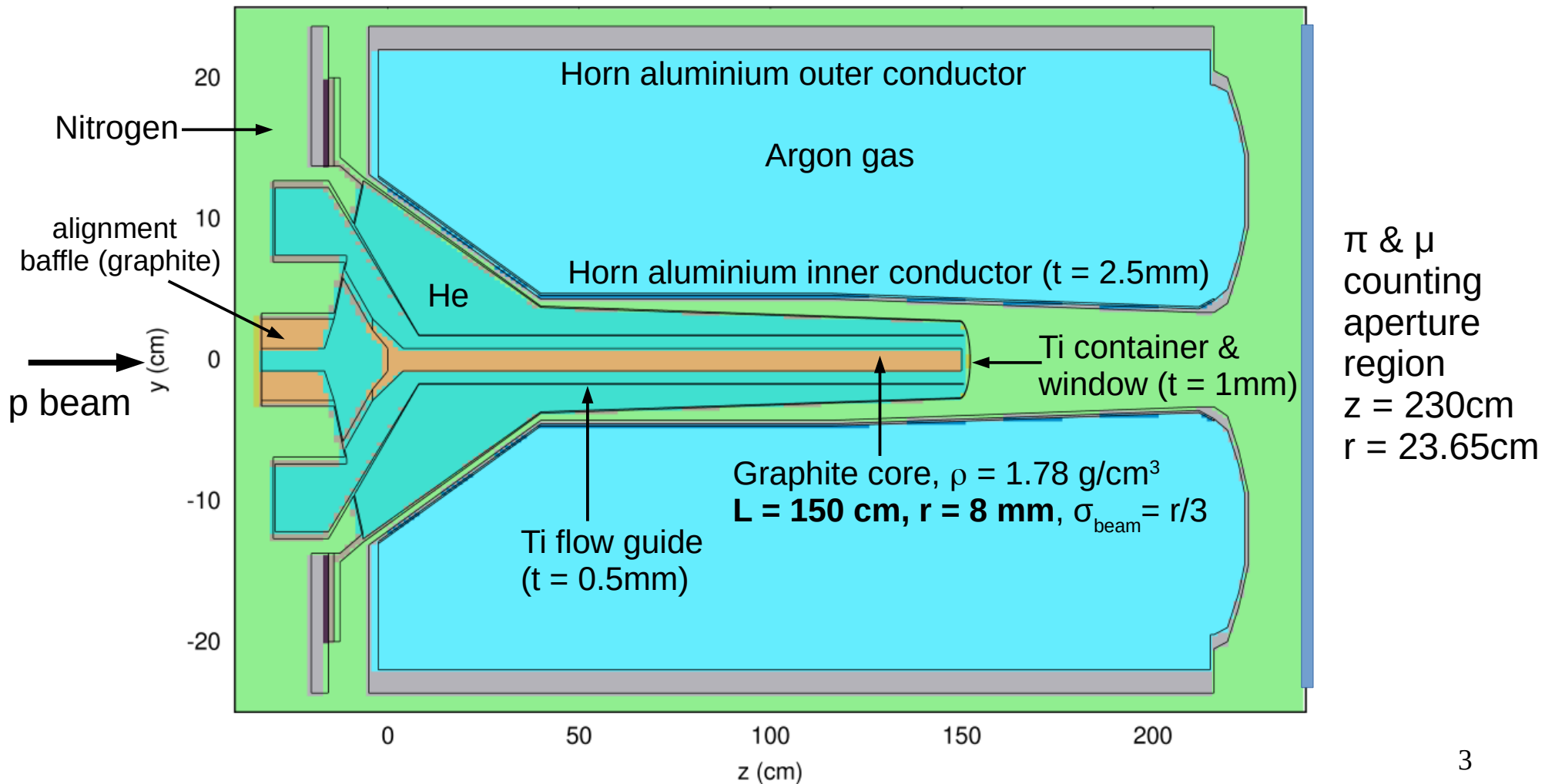
John Back
University of Warwick

12 October 2022

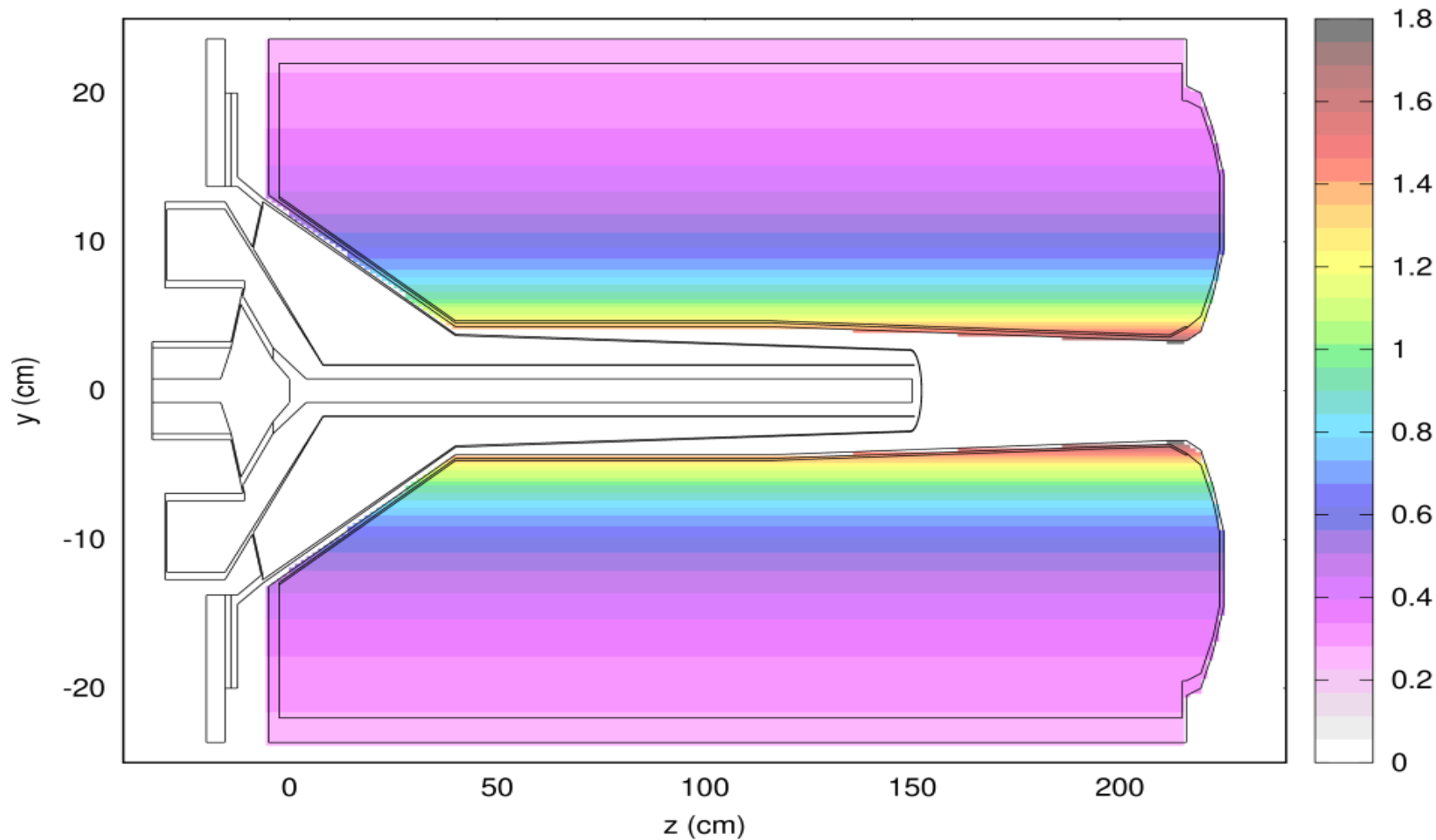
Introduction

- Revisiting target π & μ yields for muon collider
 - **Graphite target**
- Simulations using **Fluka 4-3.0** (Sept 2022 CERN release)
 - With “**LOW-PWXS**” point-wise low energy neutron interactions (<20 MeV)
- Geometries:
 - **IDS** (International Design Study) using **solenoidal field** (“**IDS120j**”)
 - **LBNF** (Long-Baseline Neutrino Facility) **target** inside **focusing horn**
- Plots of normalised, accepted π & μ yields versus proton beam KE
 - **Proton beam KE = 1 to 30 GeV**
 - Require π & μ **40 MeV < KE < 180 MeV** acceptance at various (r,z) planes

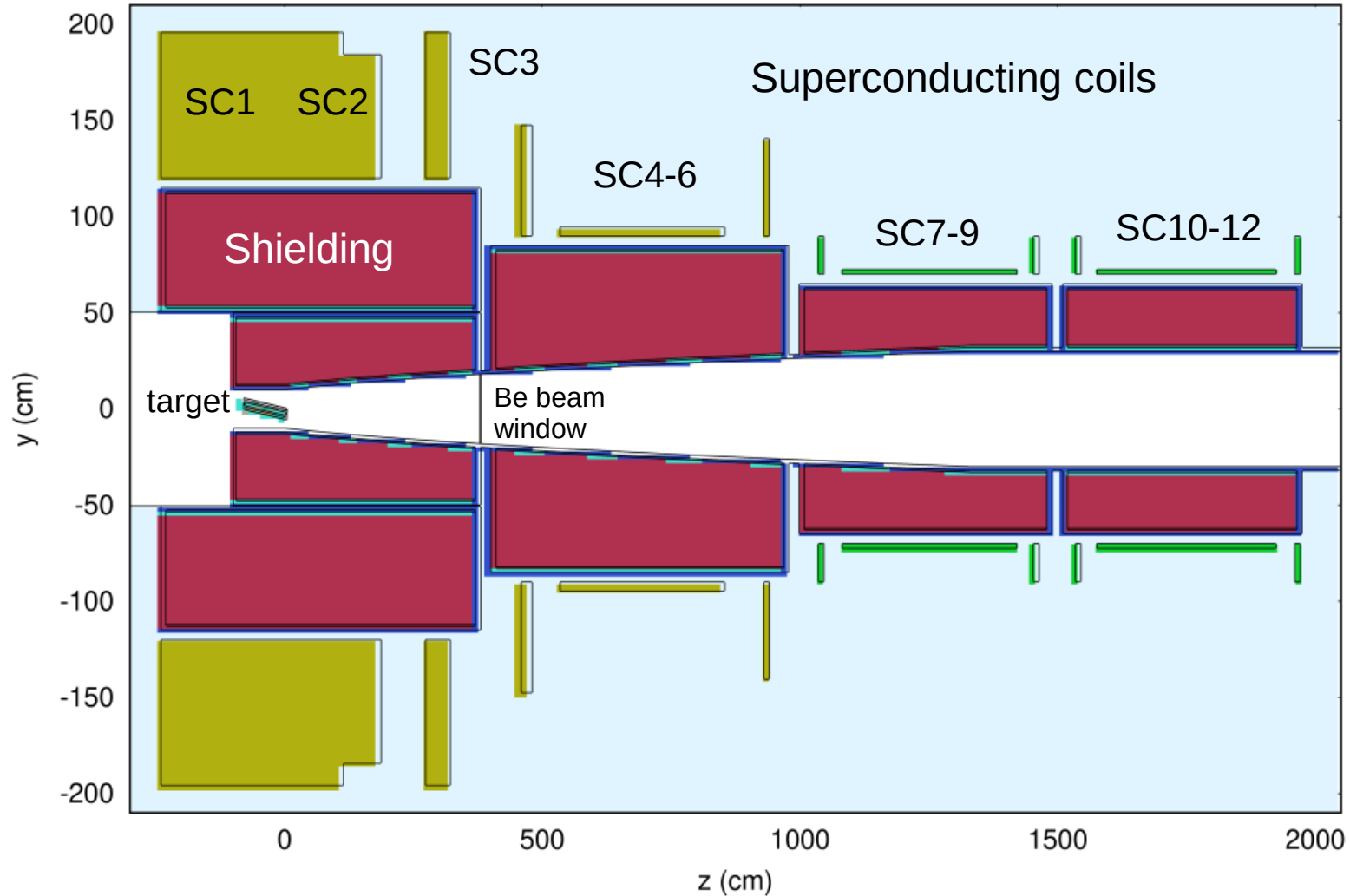
LBNF cantilevered graphite target & focusing horn ("A")



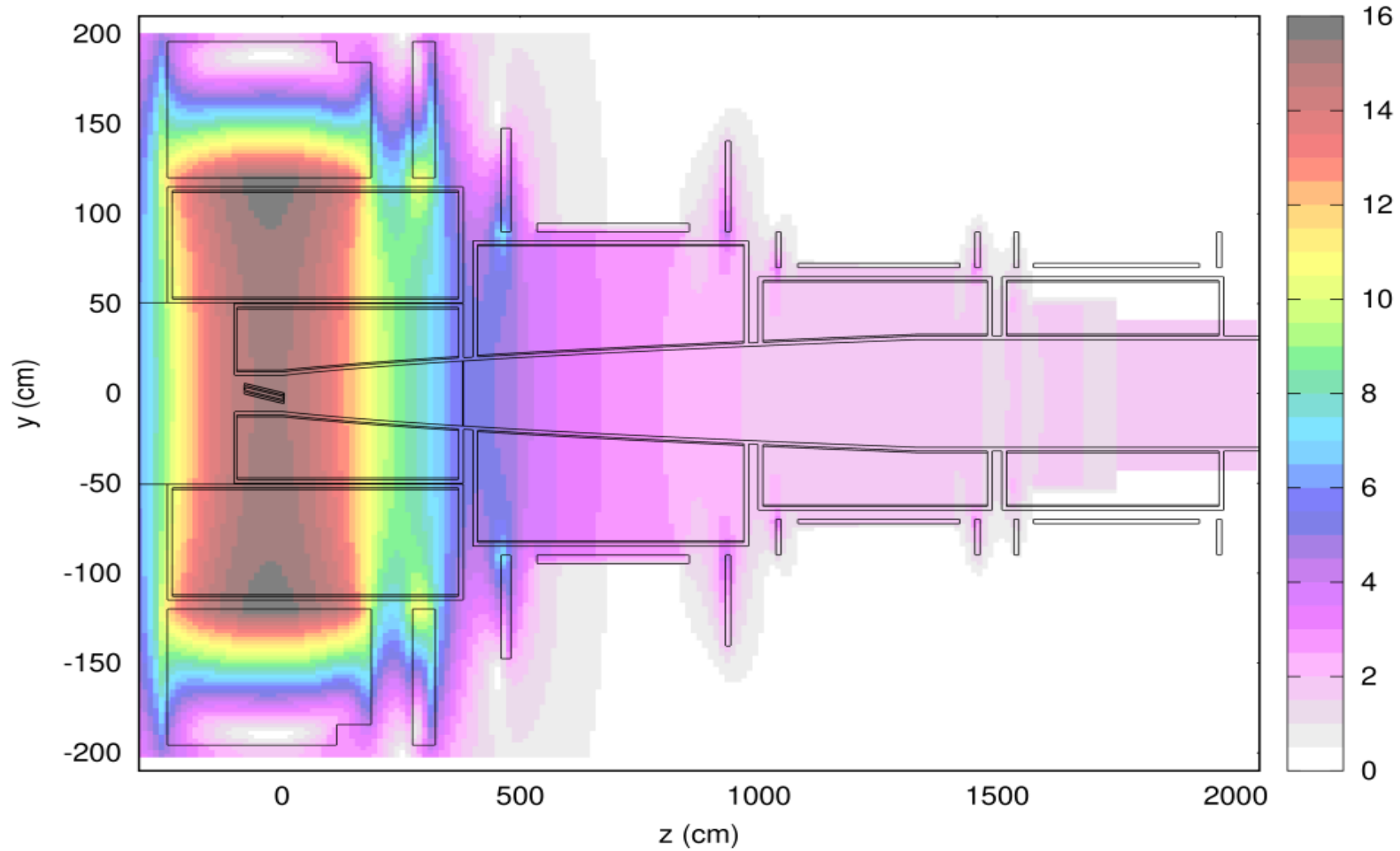
LBNF horn "A" magnetic field (T), horn I = 300 kA



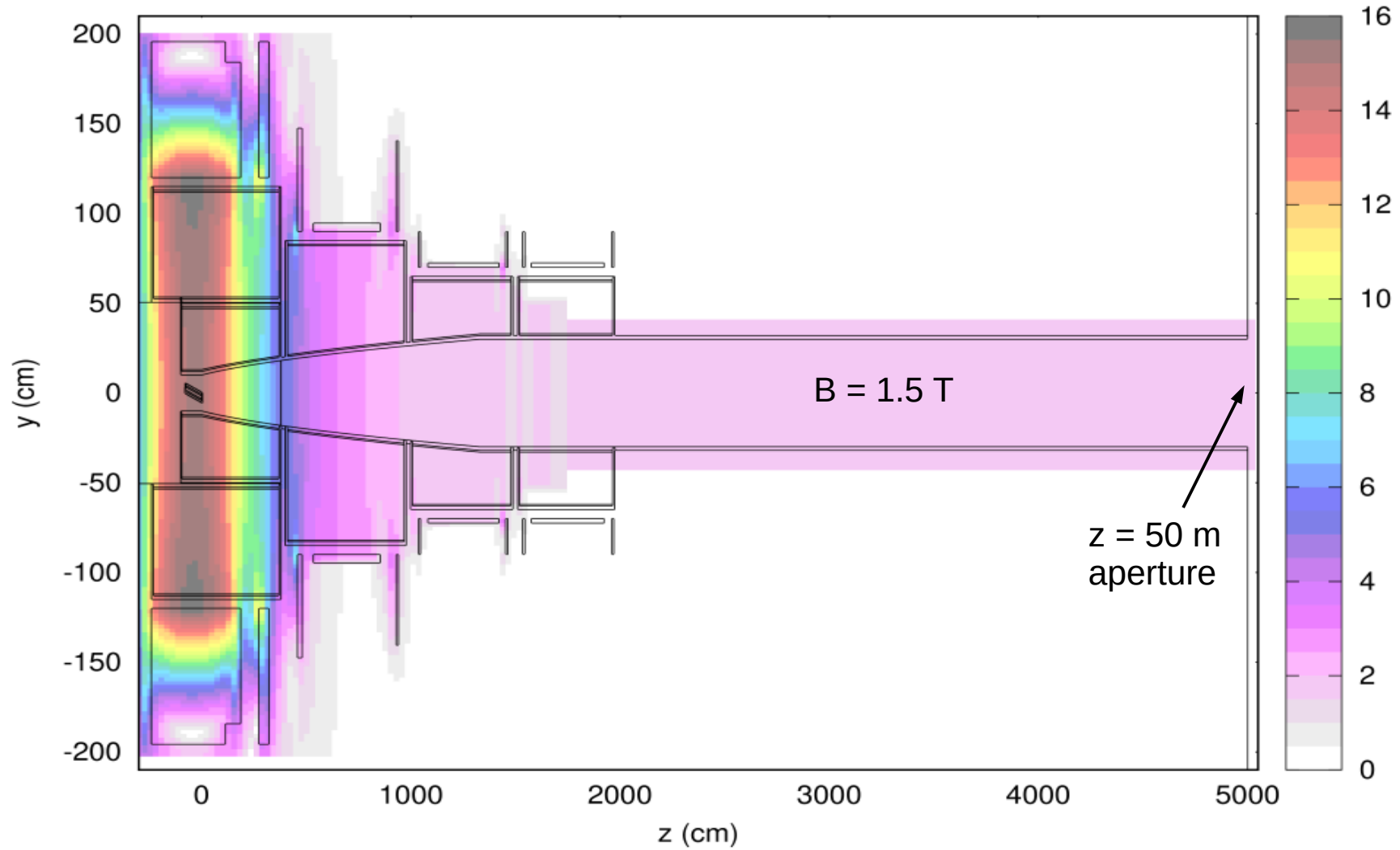
IDS120j geometry: 120 cm SC1 inner radius, 10th iteration (“j”)



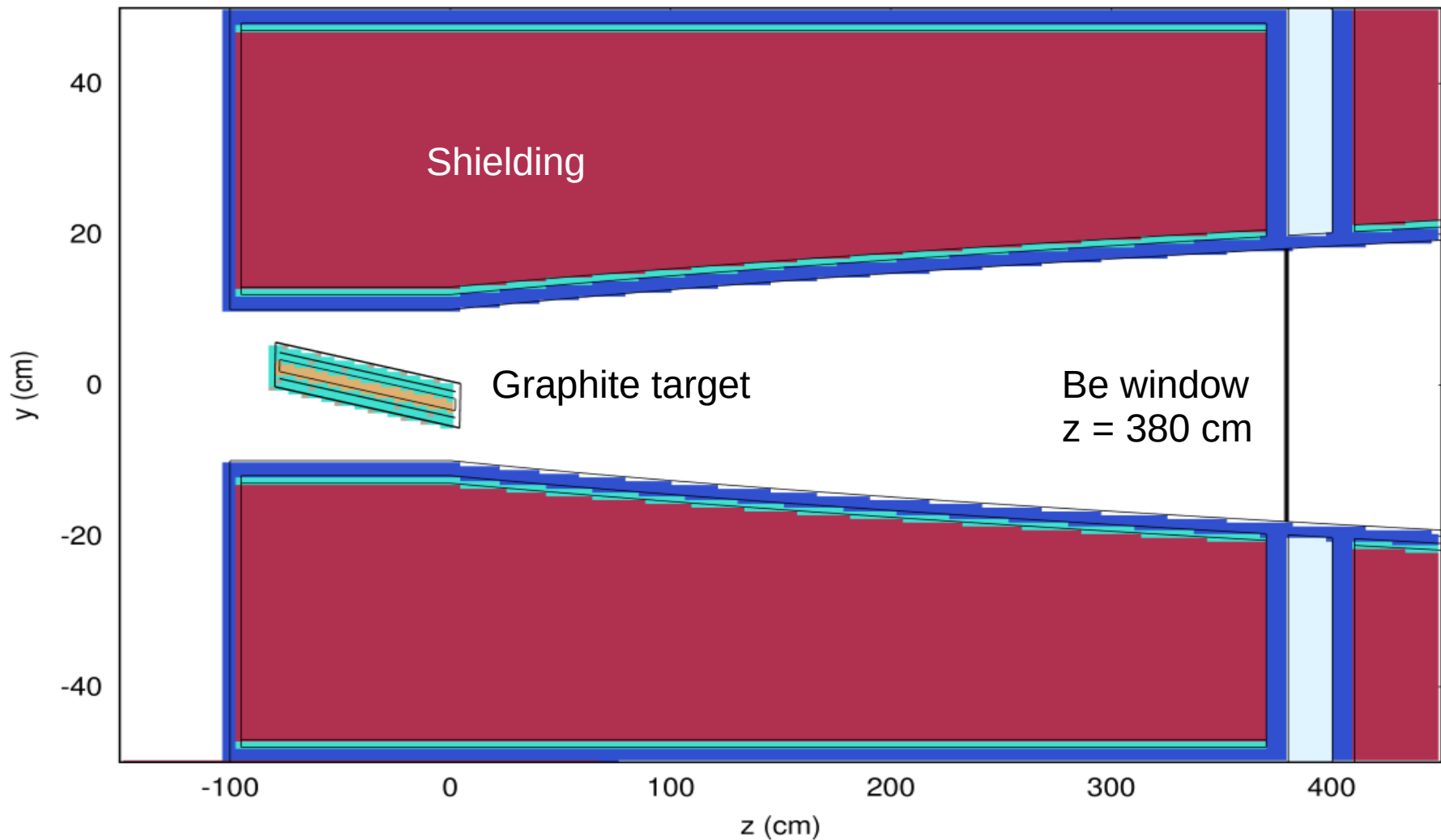
IDS120j B field: 15 T to 1.5 T



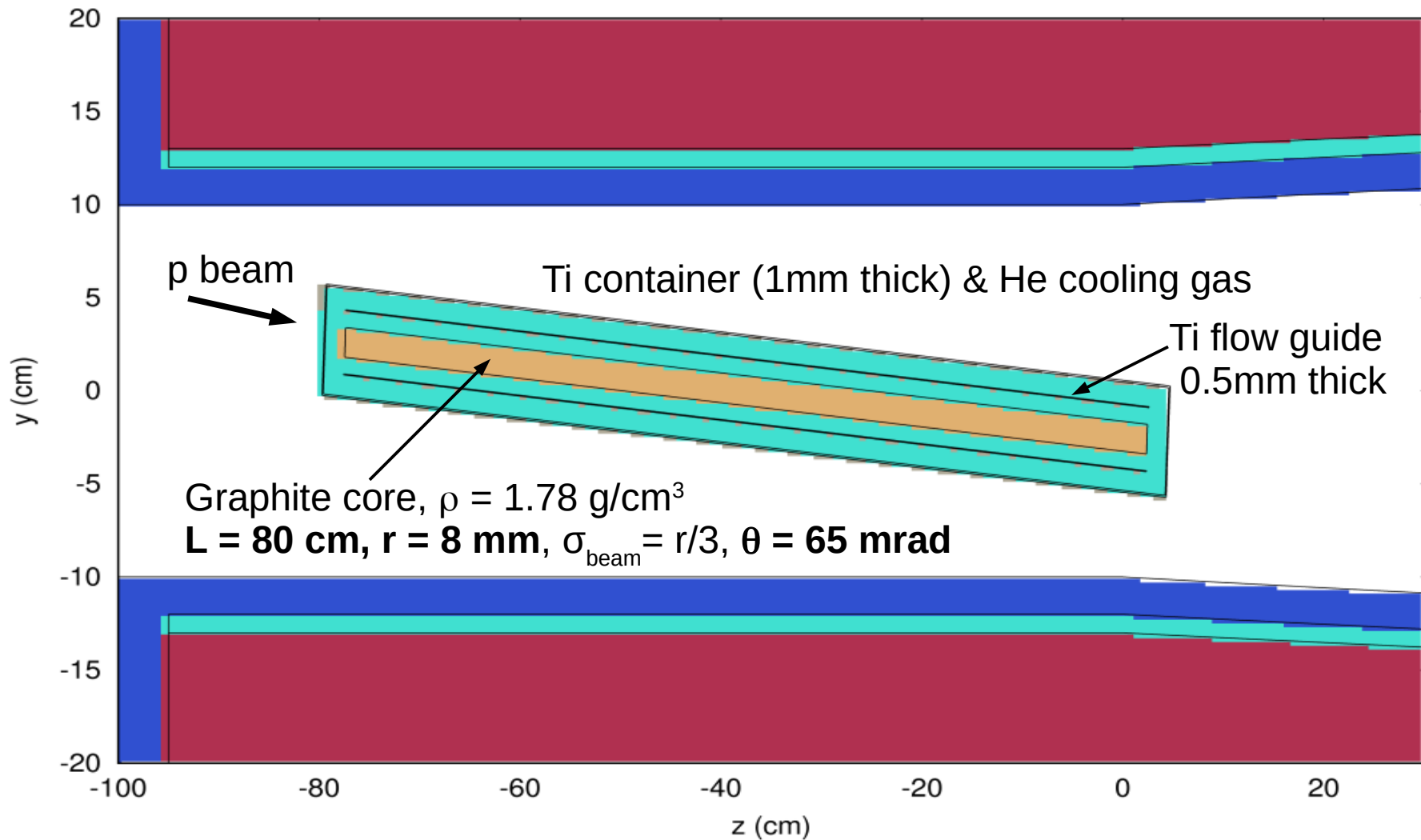
IDS120j B field (T)



IDS120j graphite target & Be beam window



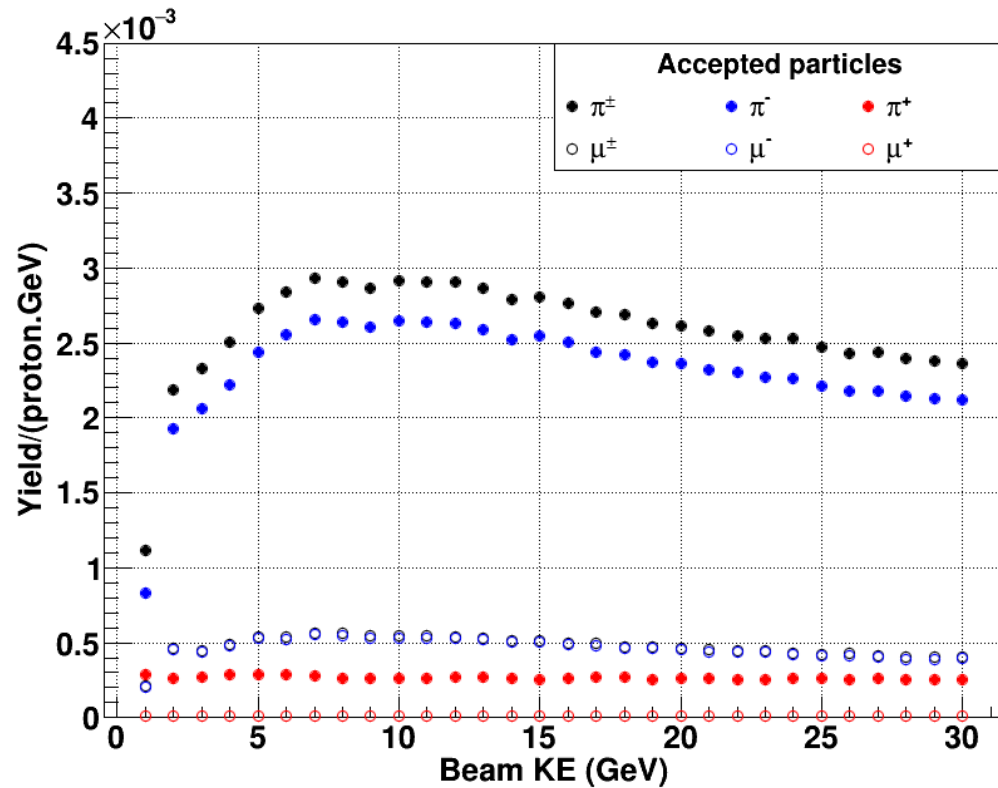
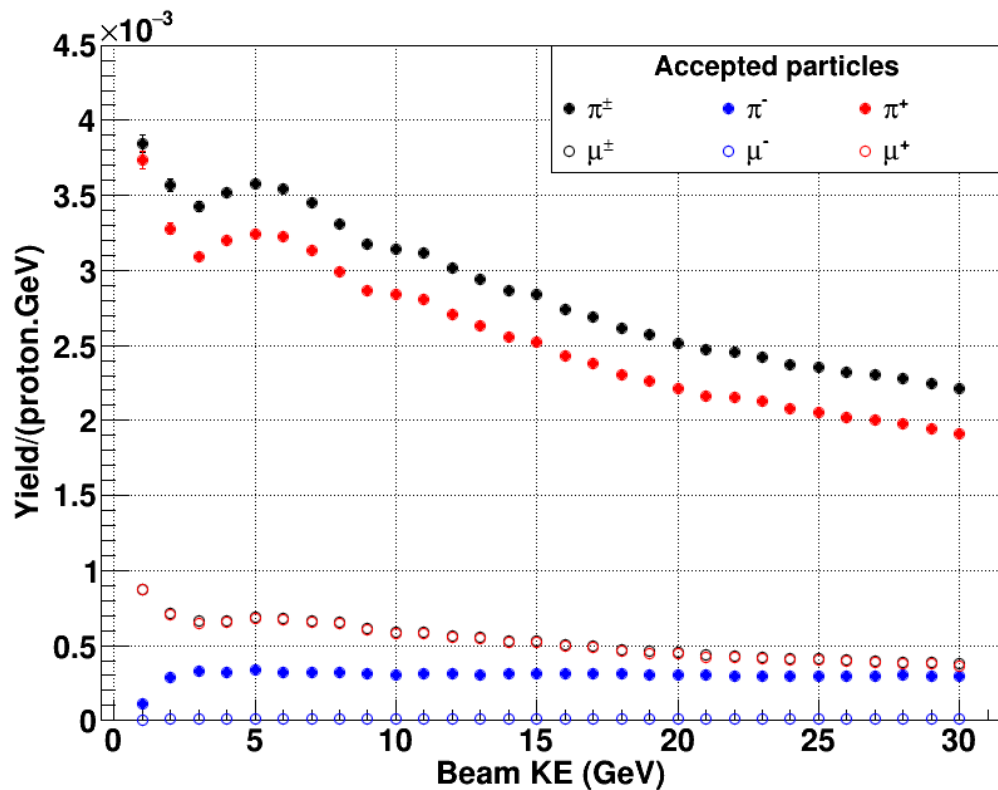
IDS120j graphite target



LBNF geometry: π & μ yields

Horn I = +300 kA

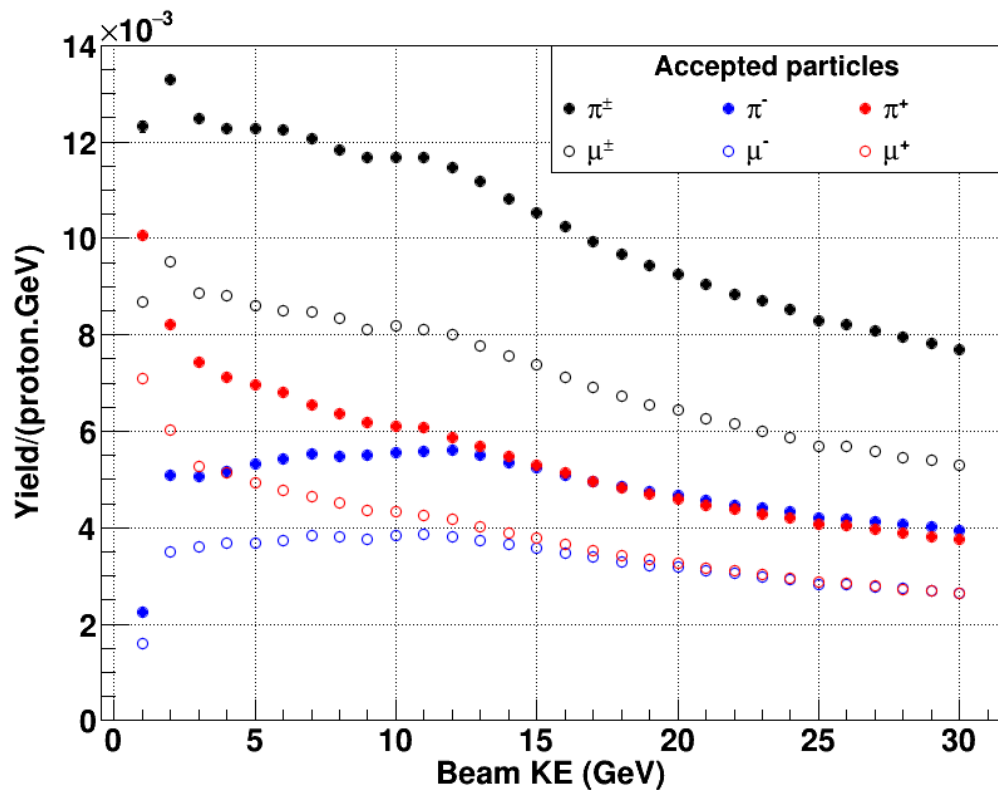
Horn I = -300 kA



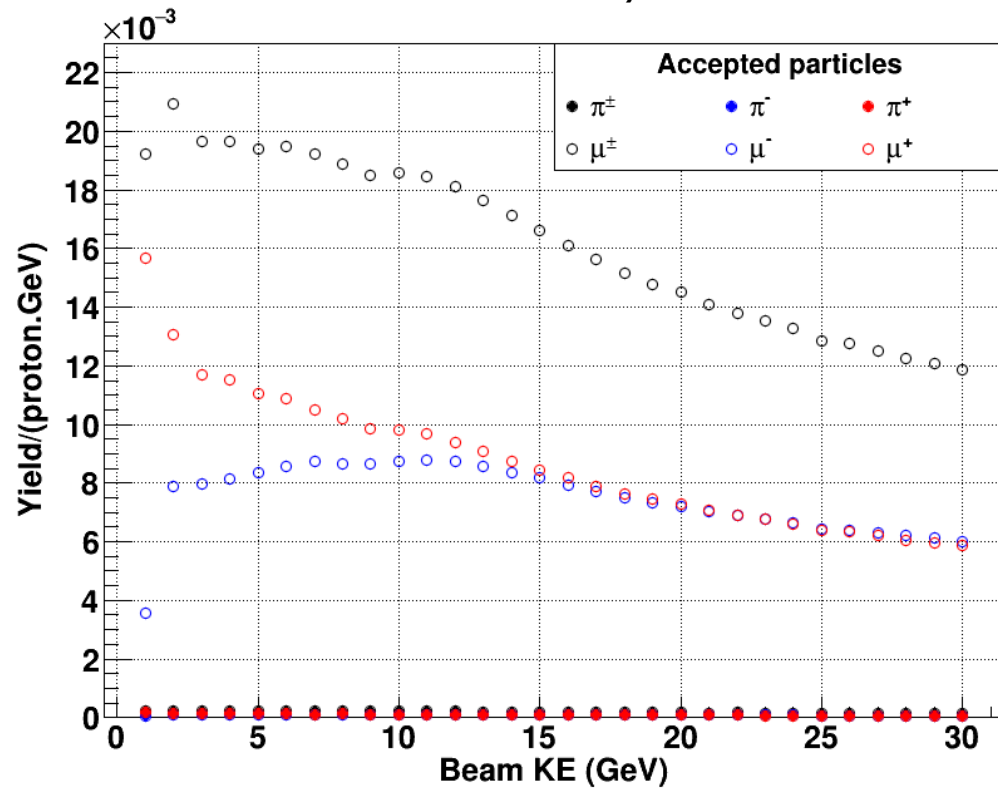
$z = 230$ cm, $r < 23.65$ cm, 40 MeV $<$ KE $<$ 180 MeV

IDS120j geometry: π & μ yields

Be window: $z = 380$ cm, $r < 18.1$ cm



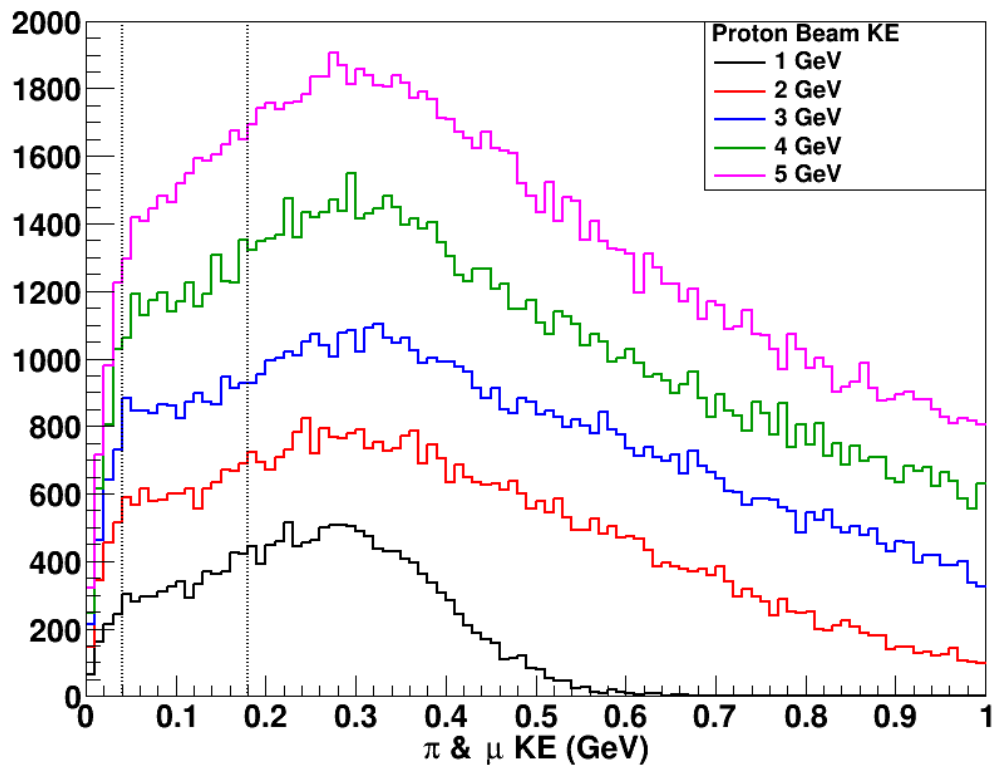
$z = 50$ m, $r < 30$ cm



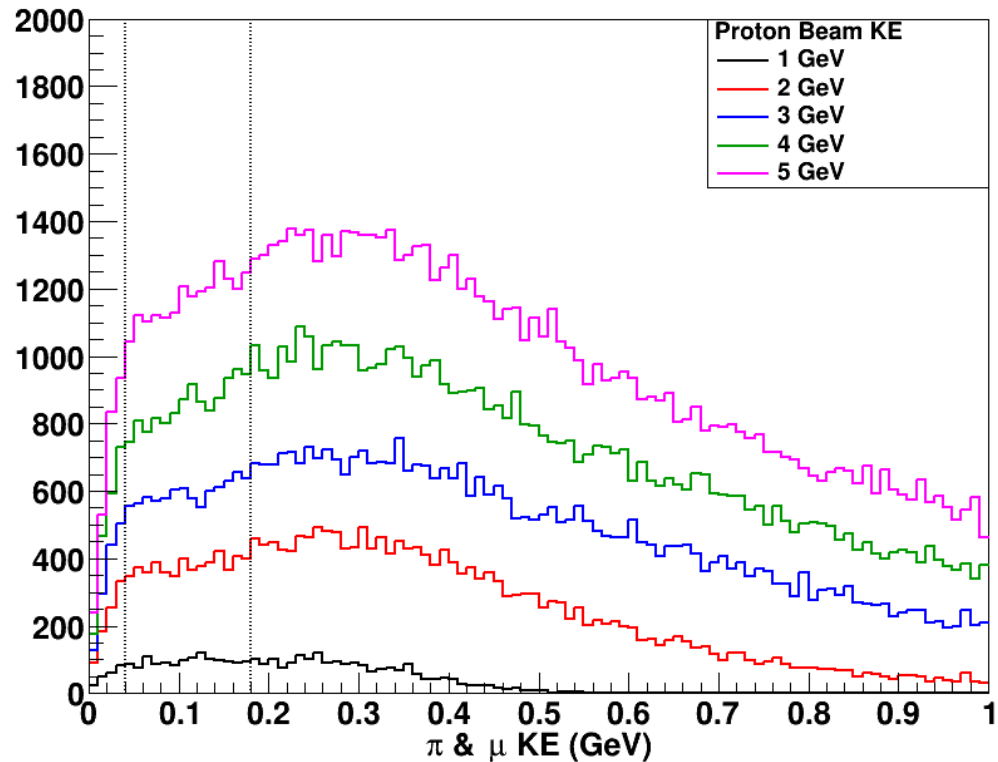
40 MeV $<$ KE $<$ 180 MeV

LBNF geometry: π & μ KE distributions

Horn I = +300 kA



Horn I = -300 kA

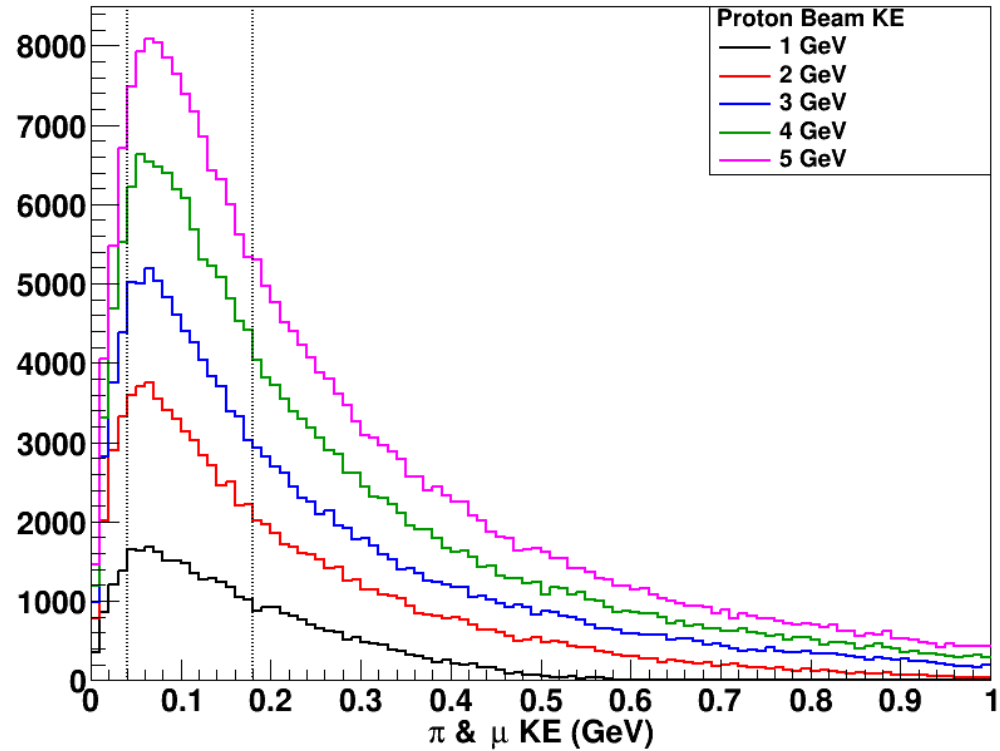
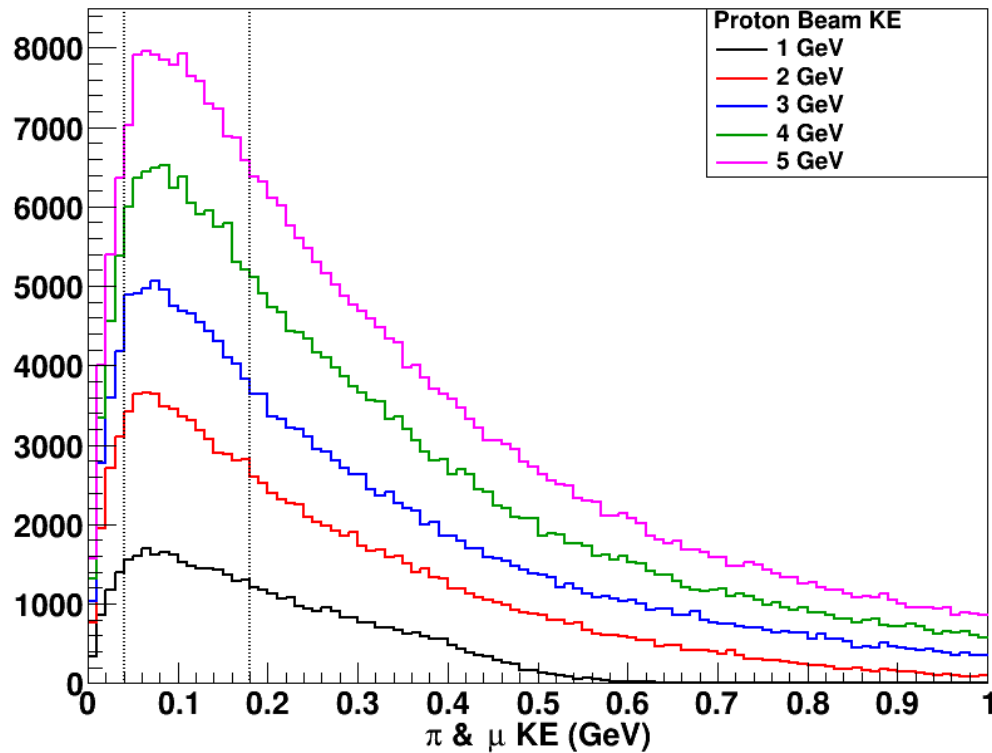


$z = 230$ cm, $r < 23.65$ cm, dotted lines = 40 MeV $<$ KE $<$ 180 MeV

IDS120j geometry: π & μ KE distributions

Be window: $z = 380$ cm, $r < 18.1$ cm

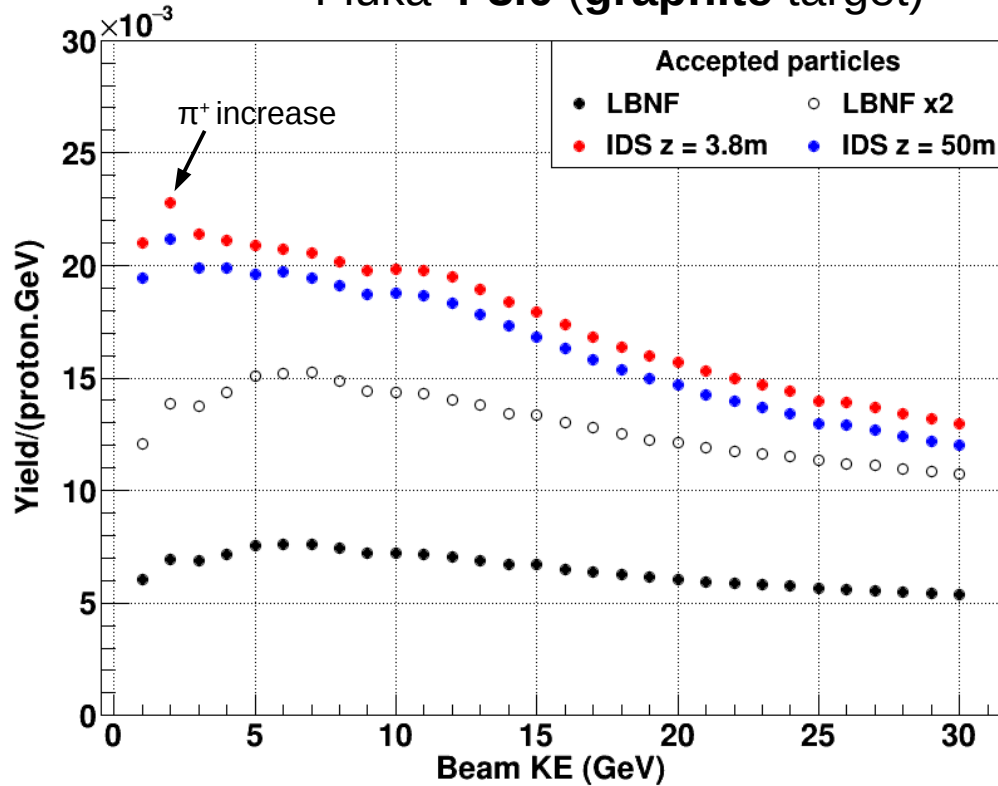
$z = 50$ m, $r < 30$ cm



Dotted lines = 40 MeV $<$ KE $<$ 180 MeV

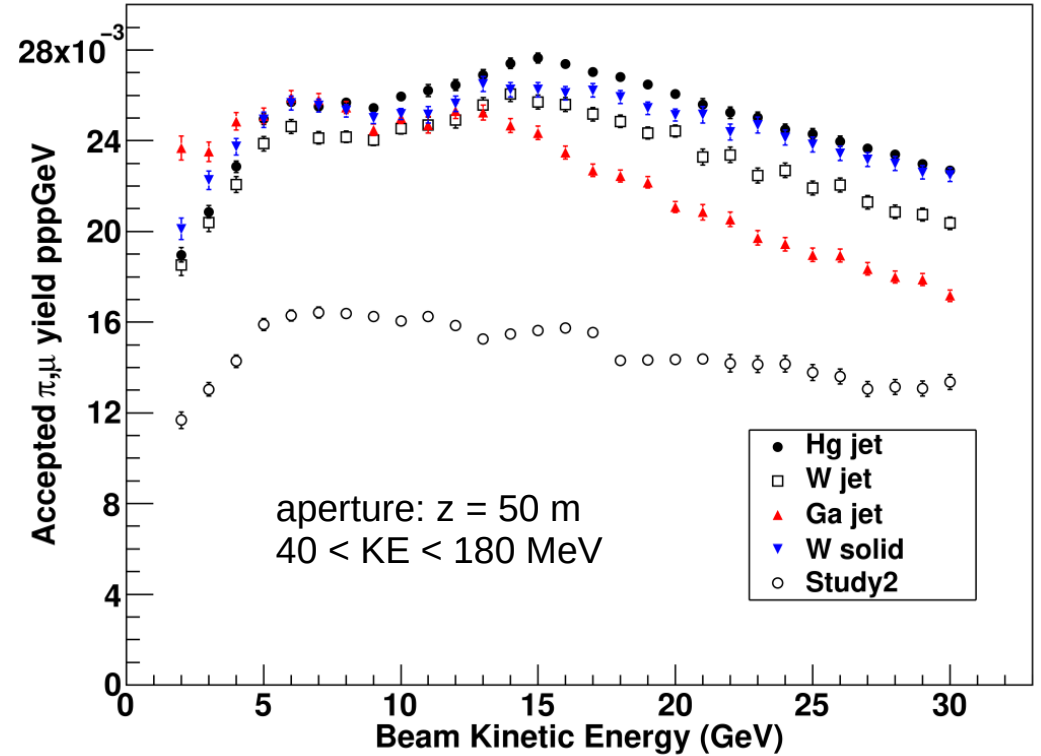
Summary: combined π^\pm & μ^\pm yields

Fluka 4-3.0 (graphite target)



“LBNF” = 2 horns (I = +300kA & -300kA)
 “LBNF x2” = 2 x 2 horns (each with a target)

Fluka 2011.2.13 (EUROnu study)



Phys. Rev. ST AB **16**, 021001 (2013)
Fig 6 (charged-averaged) scaled by factor of 2