FLUKA AS EVENT GENERATOR FOR PANDA

Olaf Hartmann

Stefan-Meyer-Institut, Wien

FLUKA

www.fluka.org

"FLUKA is a fully integrated particle physics MonteCarlo Simulation package."

"[…] FLUKA is non-transferable, non-sub-licensable and may not be distributed in any way, without express written consent, whether in original or modified form. Site-wise or collaboration-wise conditions can be agreed with the FLUKA Coordination Committee. […]"

First attempt to use it in the PANDA software in 2006 (Pavia group) …

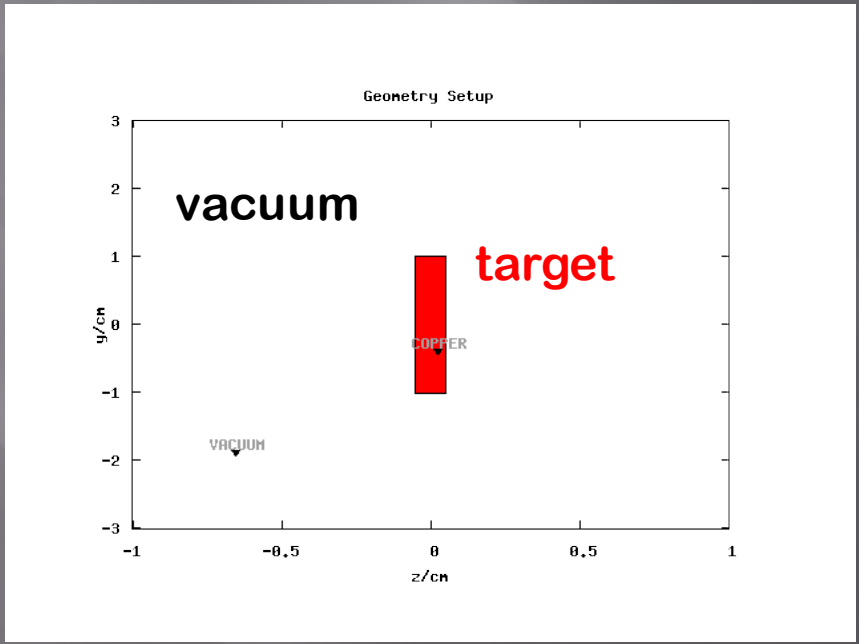
at the moment: FLUKA particle tracking within VMC

A simple setup

Solid target ^{12}C – wire with l = 1-2 cm, d = 1mm, 100µm
in vacuum, magnetic field B=(0,0,2T)
[gas targets ^{4}He, ^{1}H, d = 4 cm]

Beam: antiprotons of 3.5 GeV/c, $\Delta p/p = 10^{-4}$, FWHM = 3mm

beam

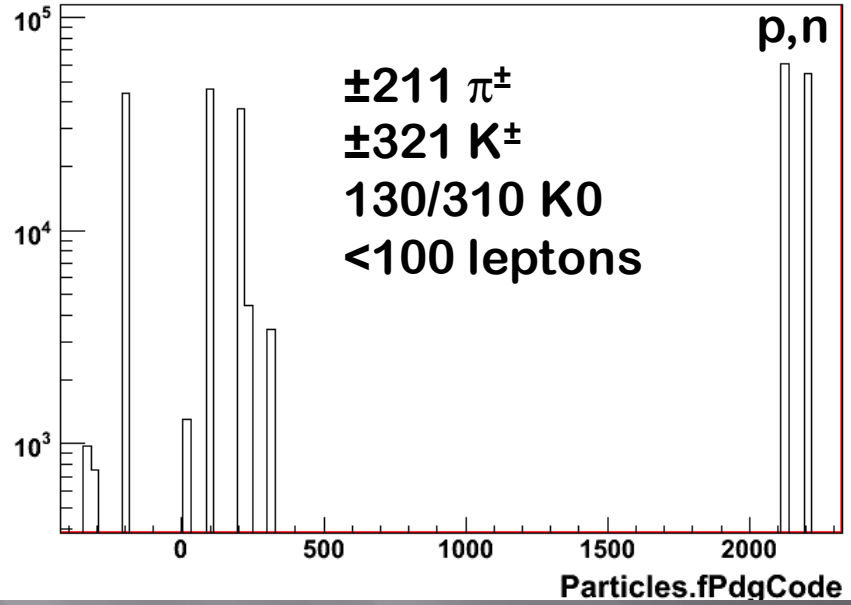


Scoring: all particles leaving the target volume

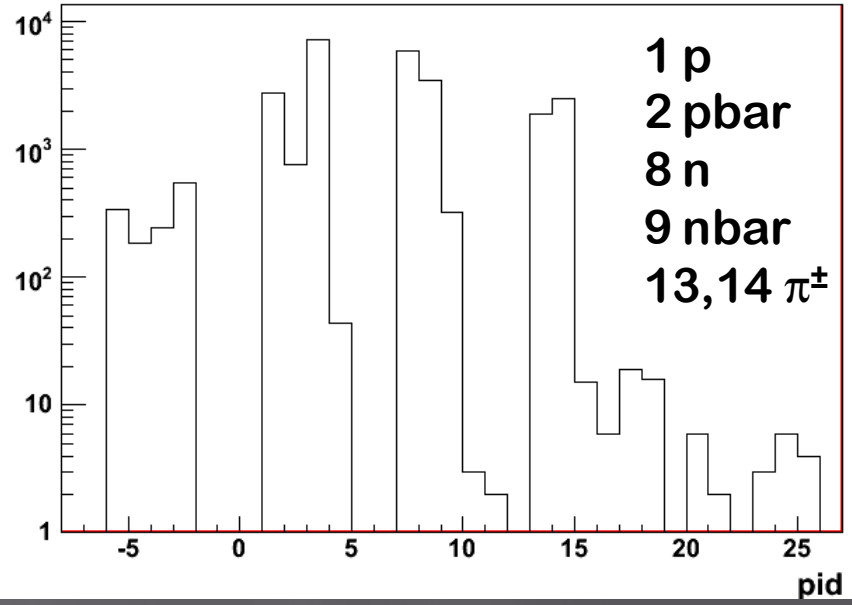
For comparison: UrQMD+SMM (PANDAGrid version)

pbar + ^{12}C – particles species

UrQMD+SMM



FLUKA

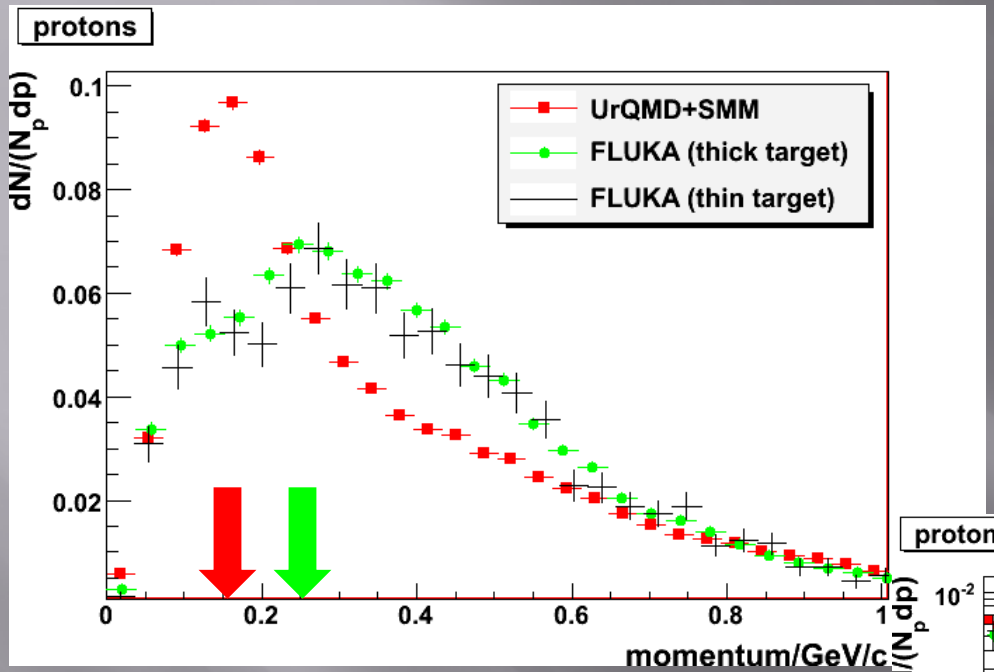


FLUKA uses the Monte Carlo code HADRIN
[K. Haenssgen, J. Ranft, Comp. Phys. Comm. 39, 37-51 (1986)]

3,4	e±
10,11	μ±
7	γ
<0	IMF

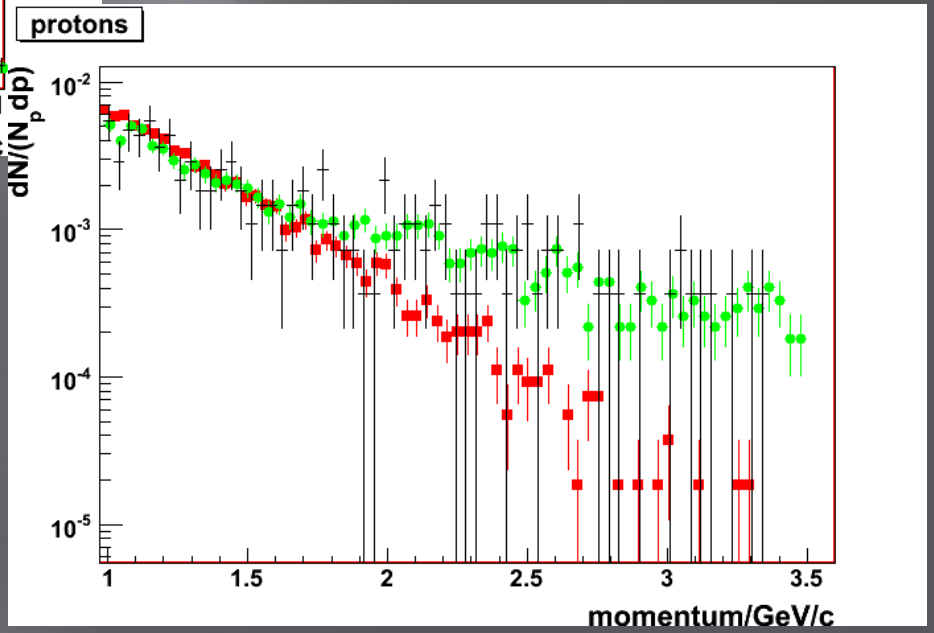
15,16	K
17,18	ΛΛbar
20,21	Σ
23	π^0
24,25	K^0K^{0bar}

proton momenta



yields are normalized by the total number of protons

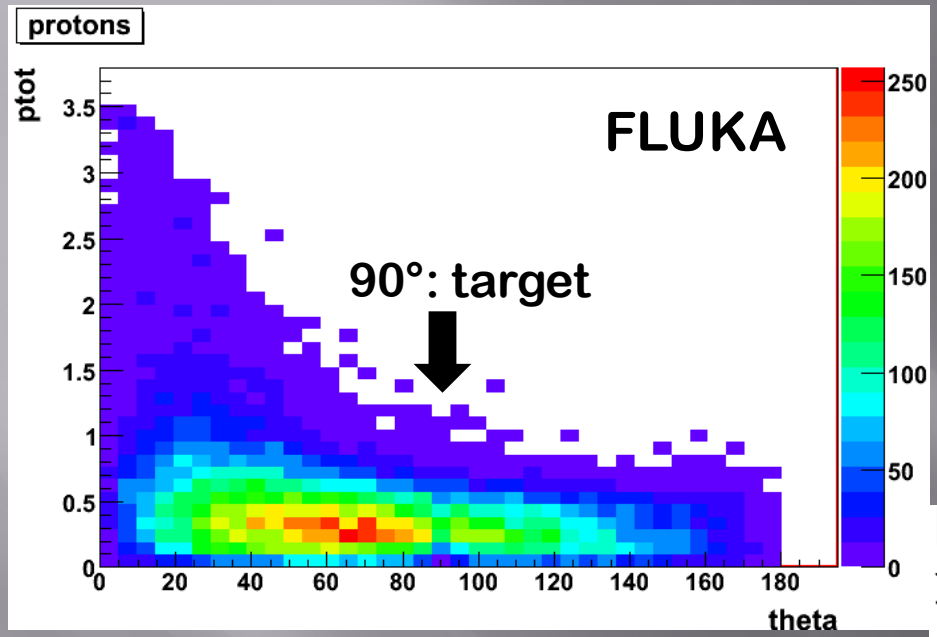
(repeat comparison with ^4He and H_2 target i.o.t. have data available)



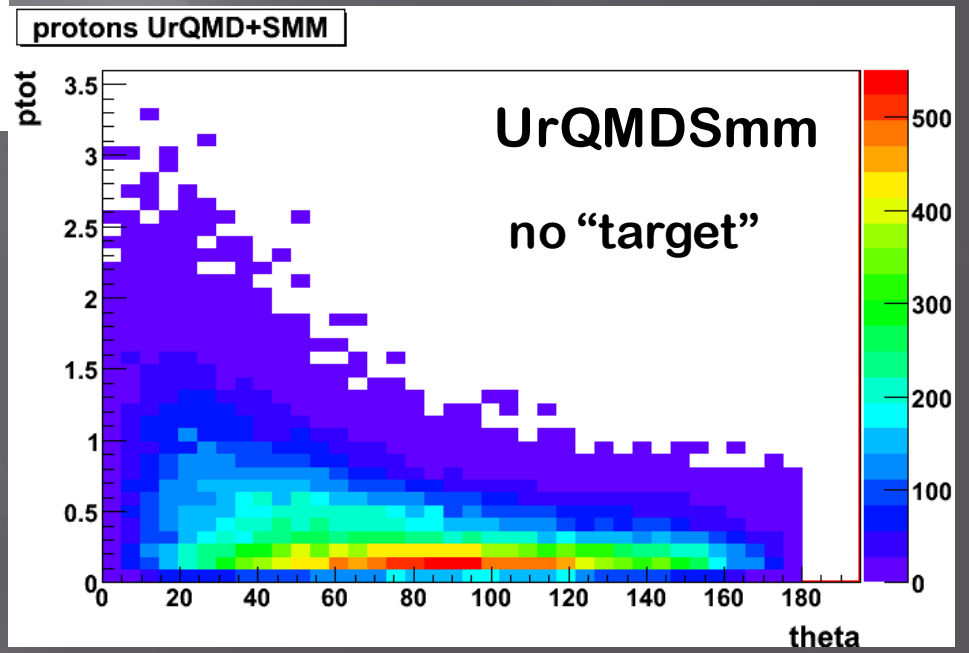
FLUKA: rescattering and absorption in the finite target

mean is shifted
FLUKA more smooth

proton phase space

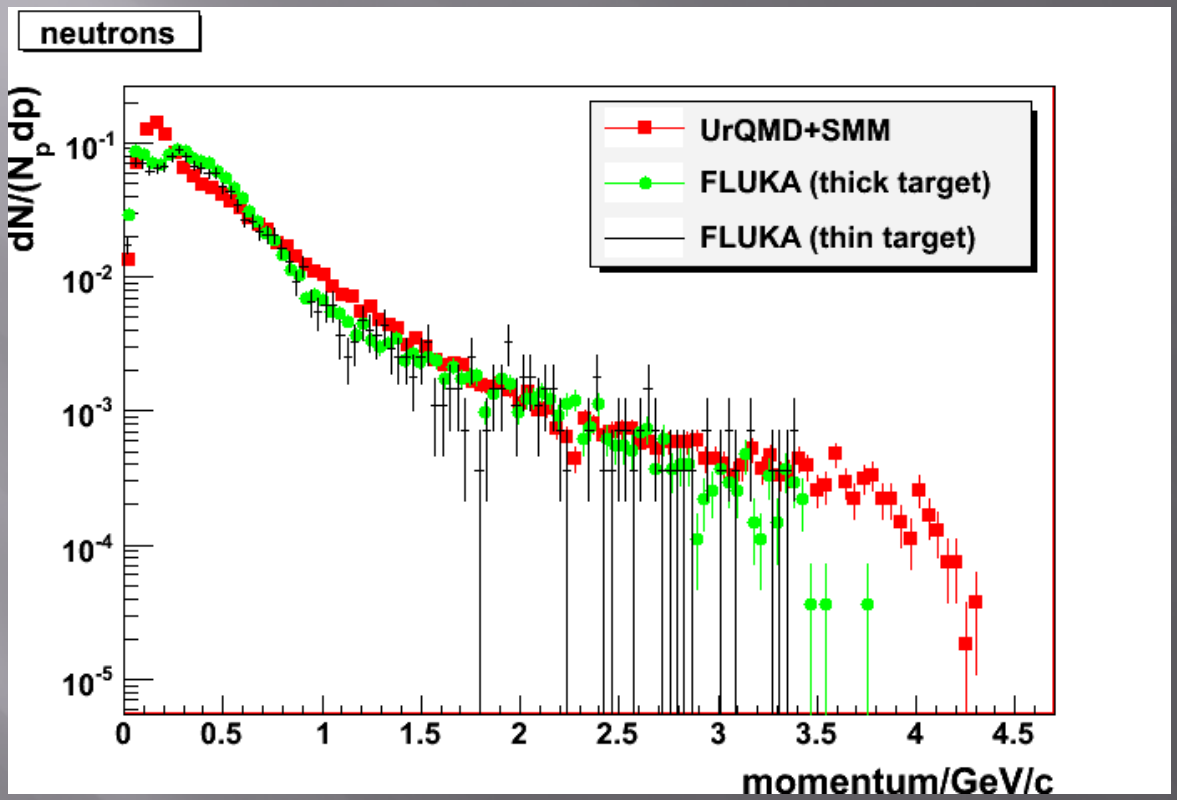


backward yield suppressed



(backward) protons
with momenta < 300 MeV/c

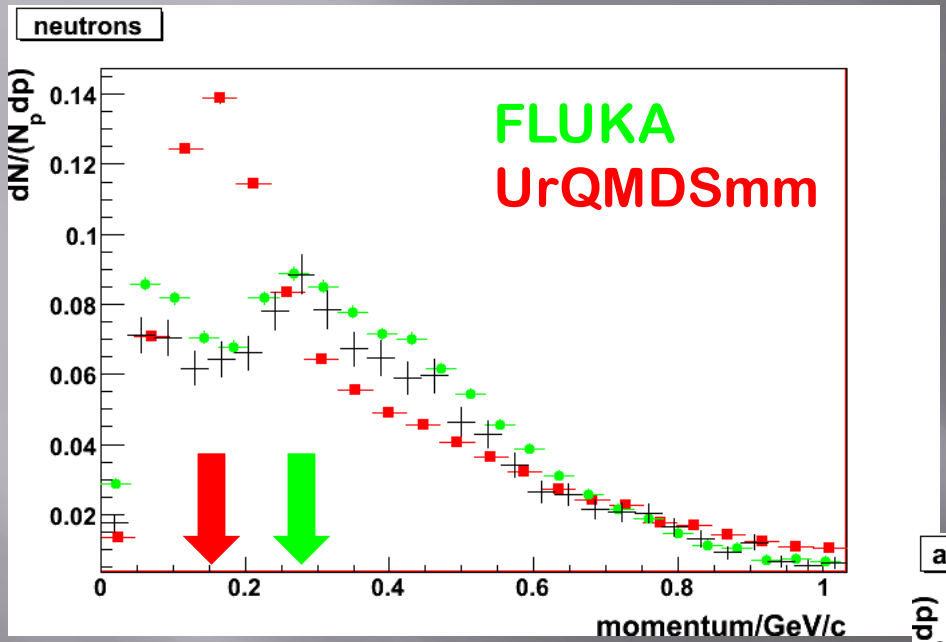
neutrons



mean shifted like in the proton case

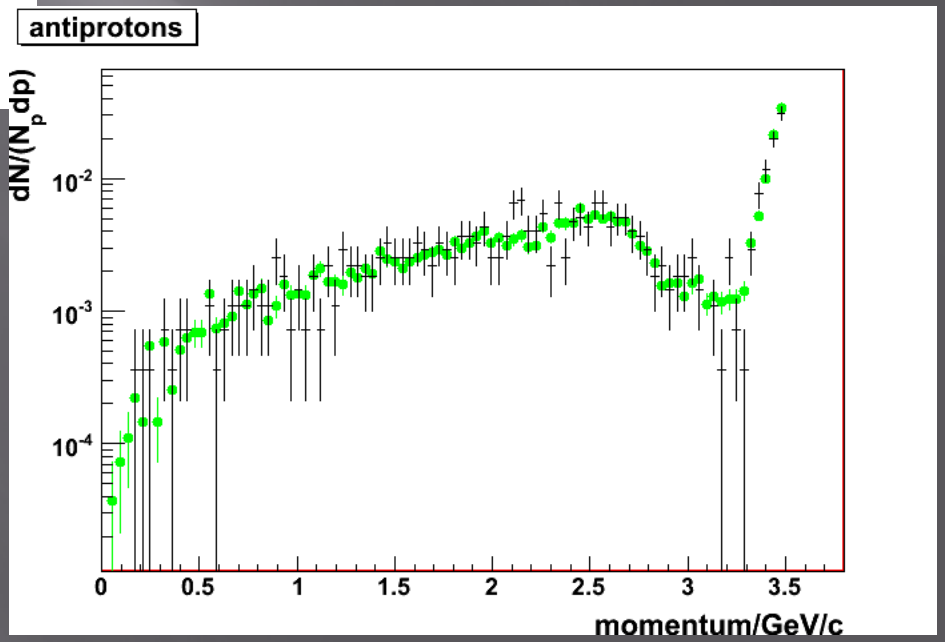
high momenta tail:
more n in UrQMDSmm,
more p in FLUKA

neutrons and antiprotons

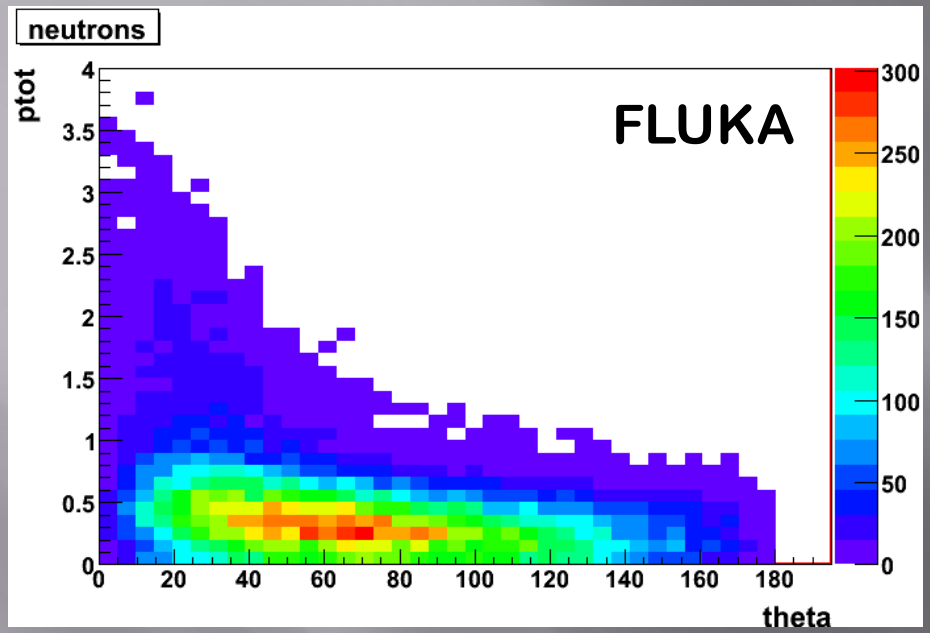


momenta < 250 MeV/c
suppressed in FLUKA

FLUKA: scattering/energy loss of antiprotons
UrQMDSmm: no antiprotons

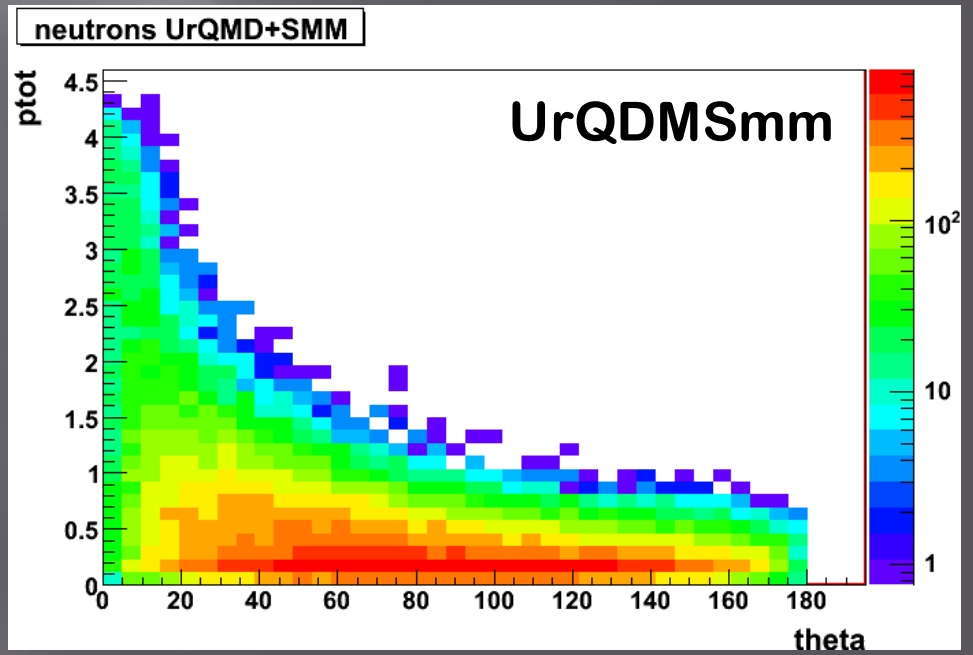


neutron phase space

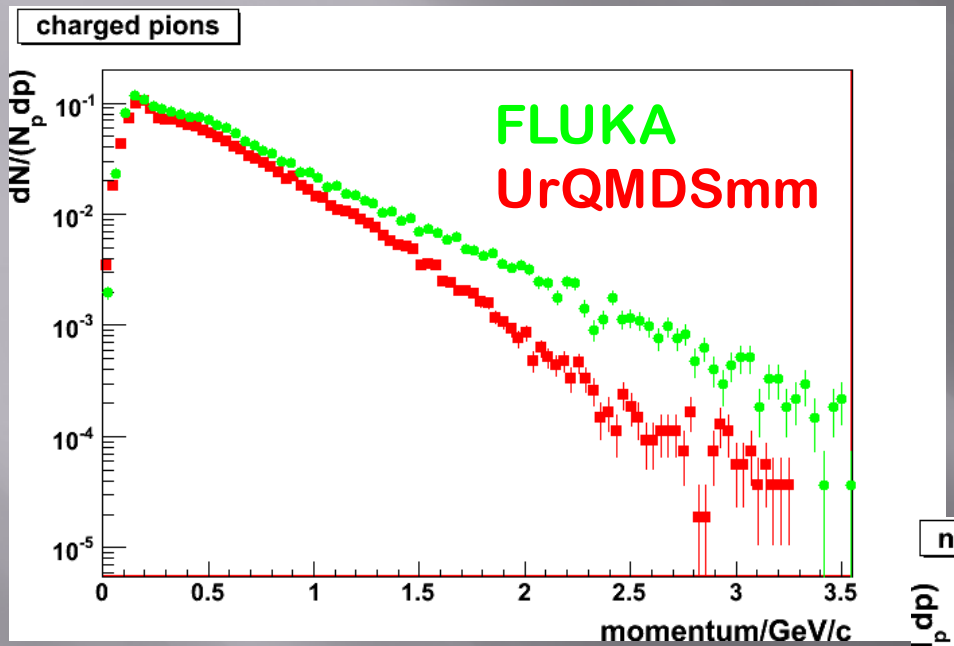


in both cases maximum yield around 70°

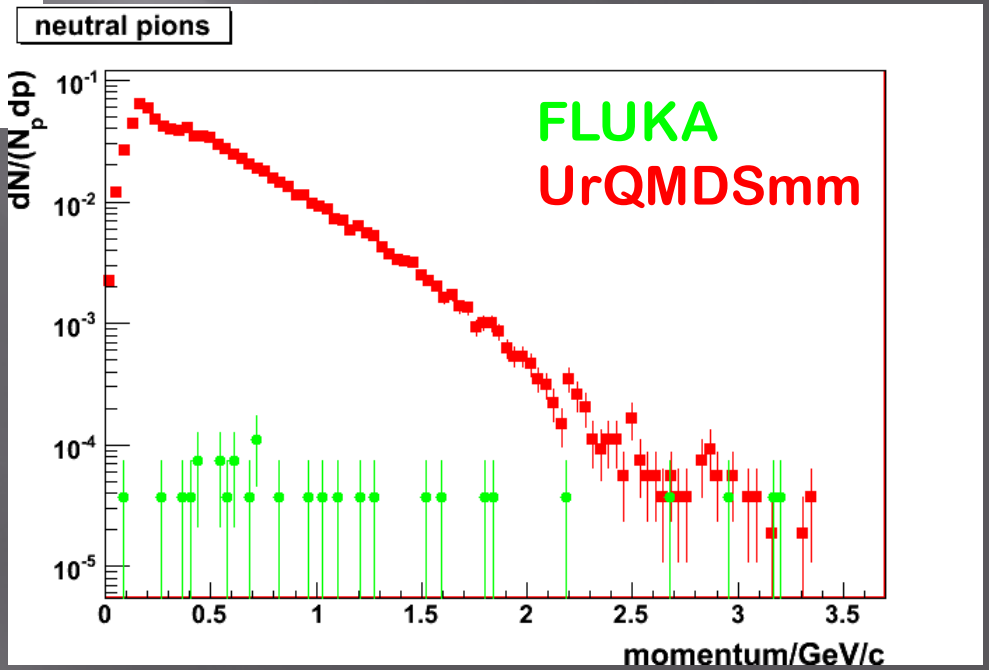
FLUKA: backward yield suppressed



pions

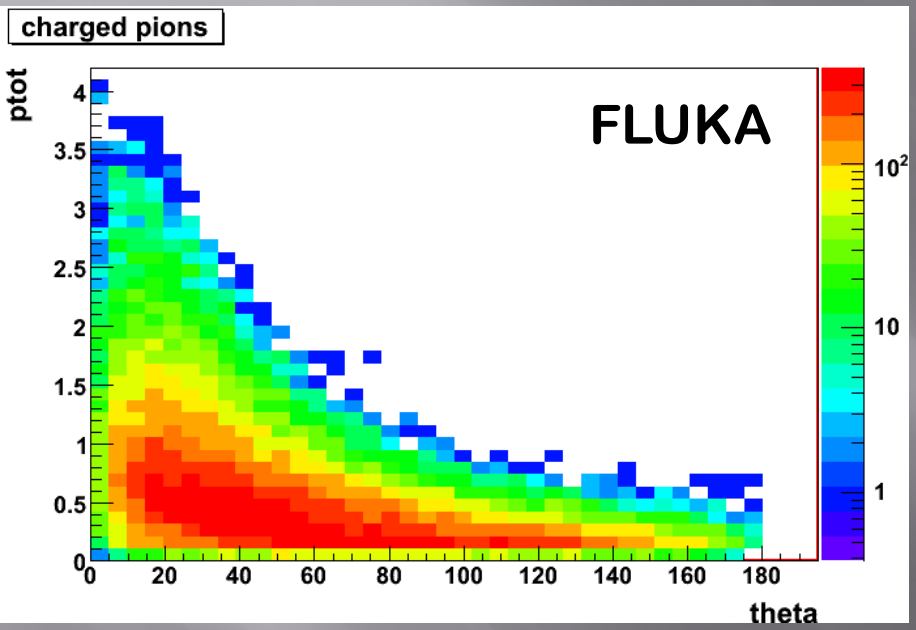


qualitatively similar
FLUKA gives more momentum

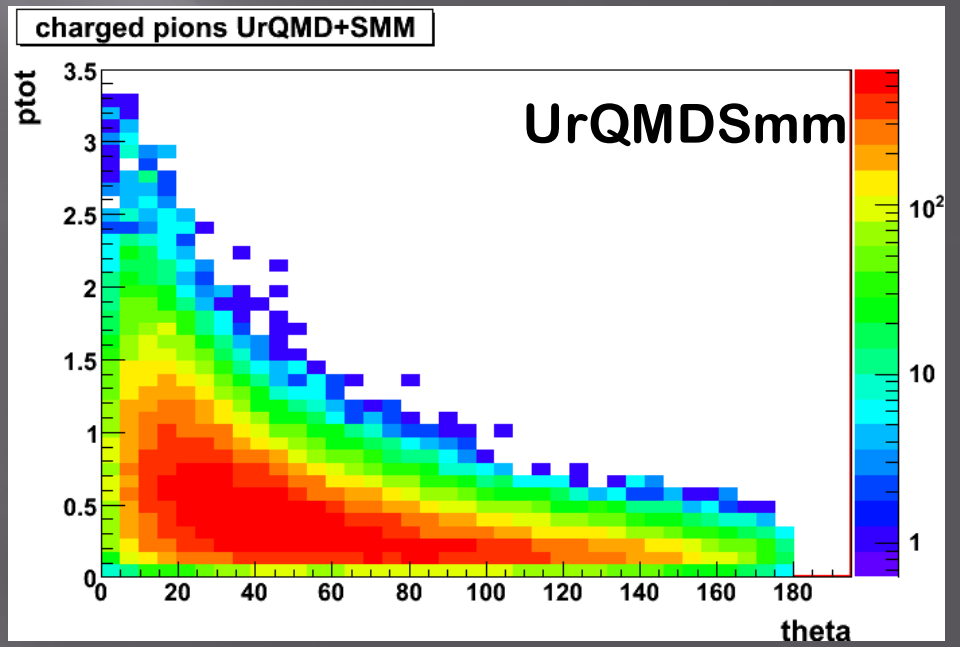


FLUKA: short-lived
π^0 rarely survive

pion phase space



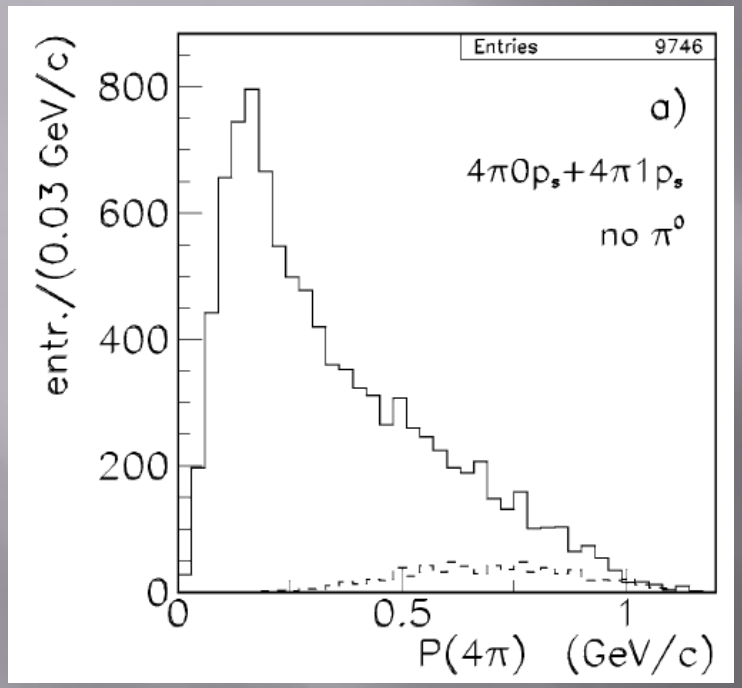
distributions quite similar.



Summary

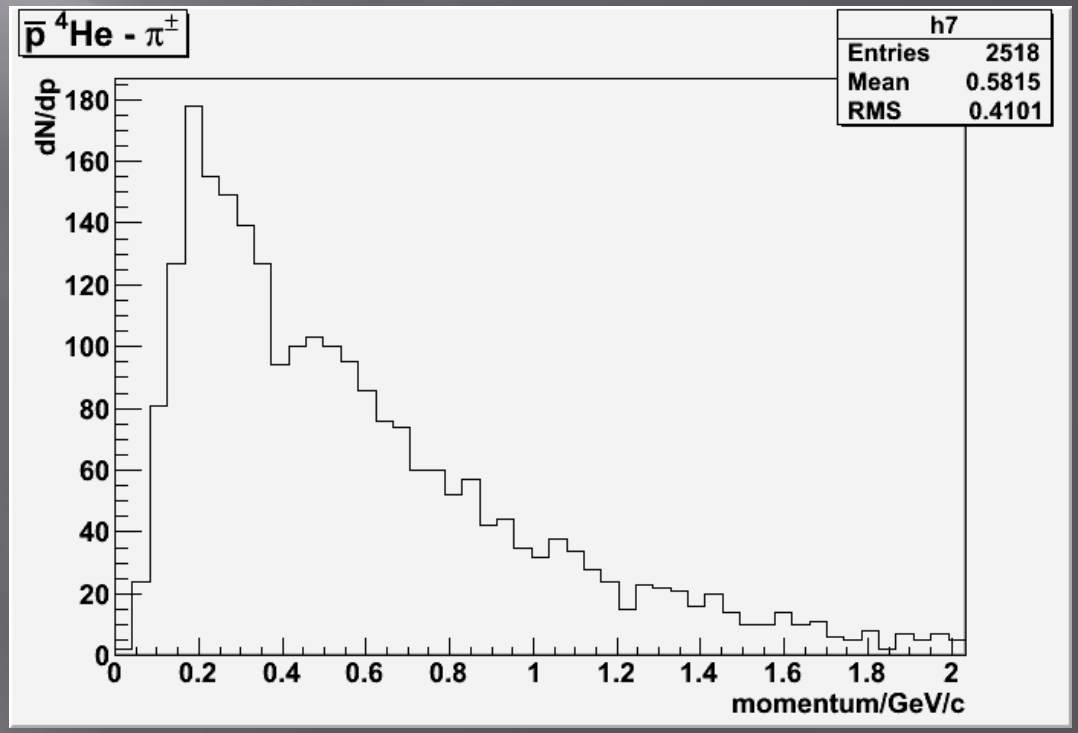
- Antiproton induced reactions calculable with FLUKA
  - update of cross sections with available data?
  - valuable for background channels
- Comparison to UrQMDSmm t.b.d. also with ^4He, H_2 (and data!)
  - FLUKA: finite target volume
- FLUKA output available in ROOT tree and as ASCII file
- Permission for use in PANDARoot to be negotiated (if there's interest)

pbar ^{4}He – data comparison



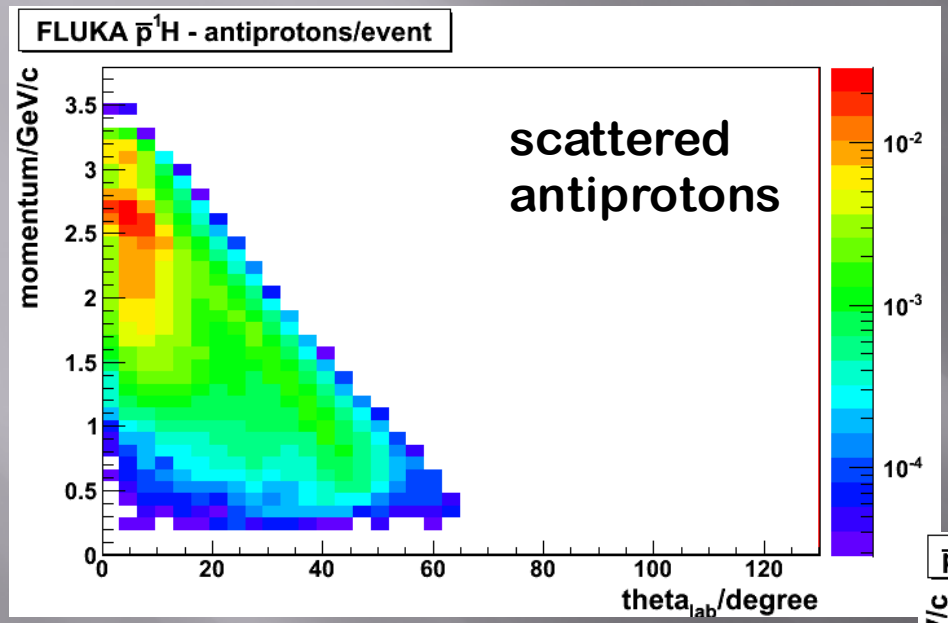
P. Montagna (OBELIX coll.)
NPA700(2002)159
pbar ^{4}He at rest

FLUKA – charged pions (inclusive)
(not at rest)



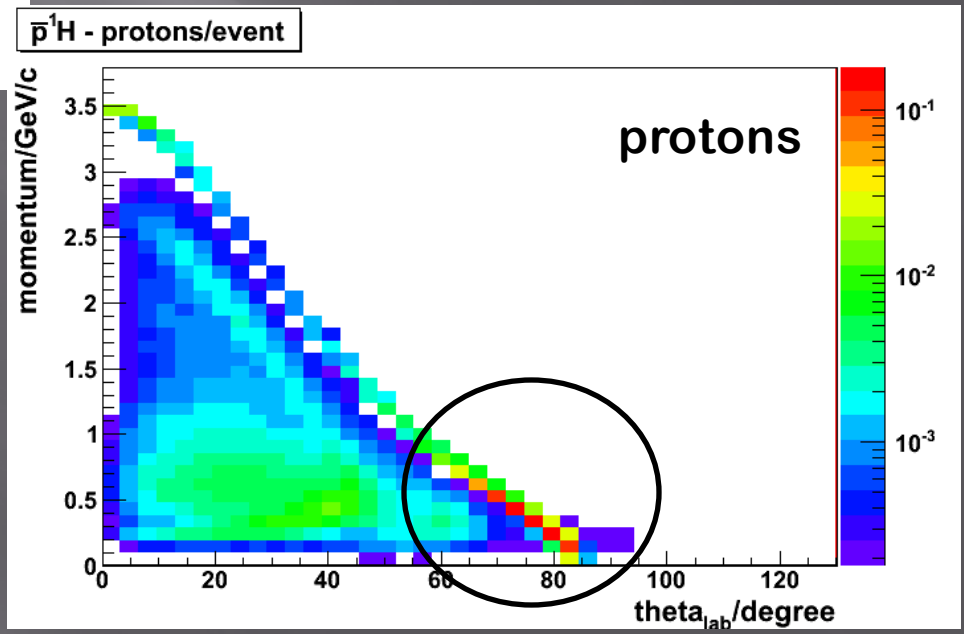
more detailed analysis to come …

FLUKA Antiproton–Proton

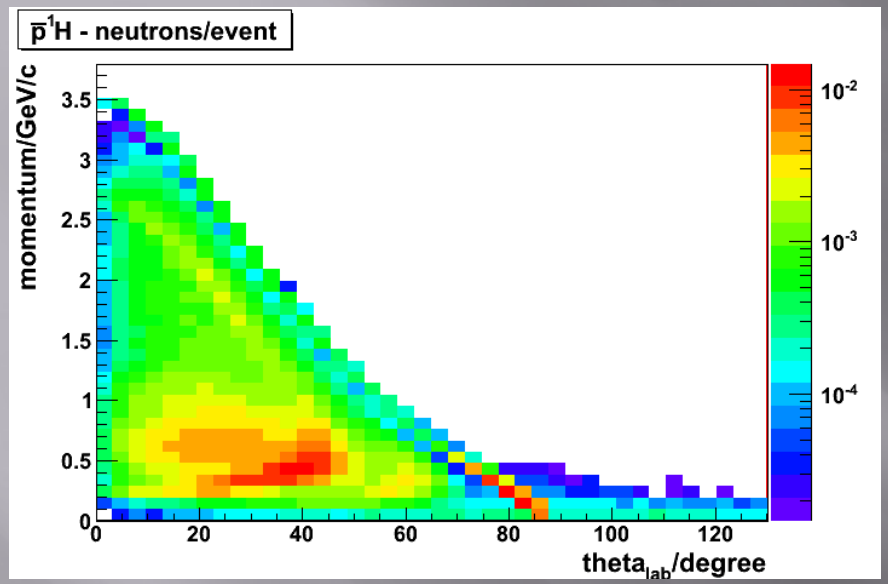


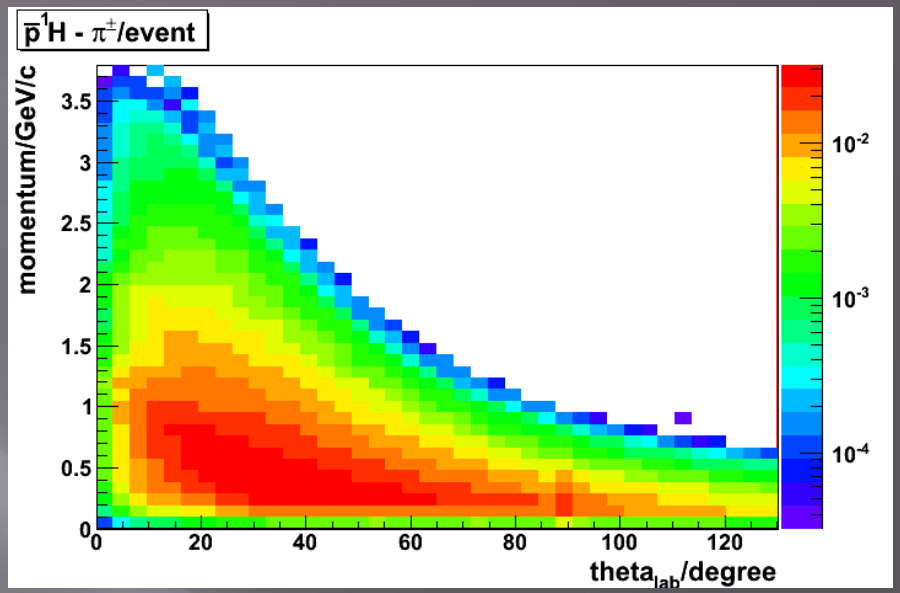
elementary reaction also calculable

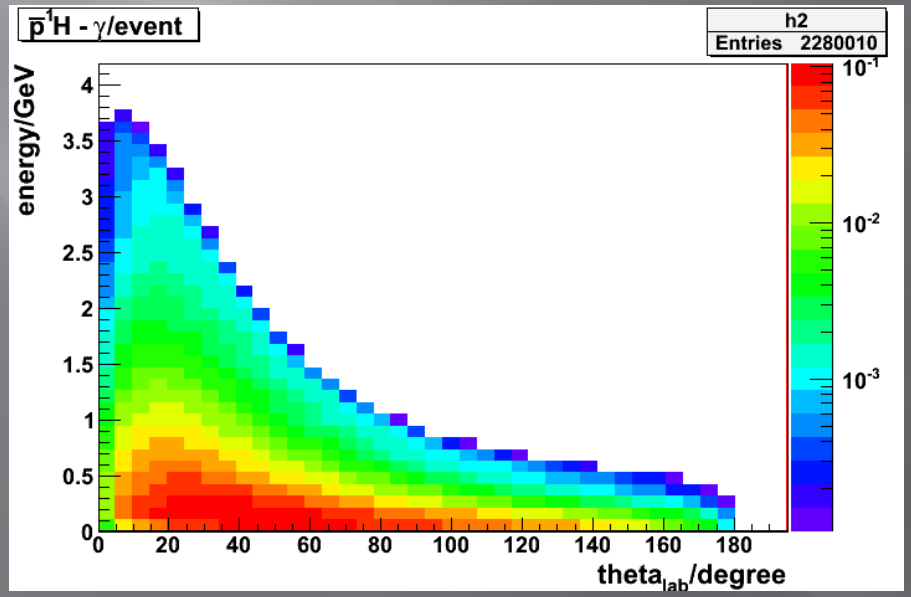
so far no comparison with DPMGen done

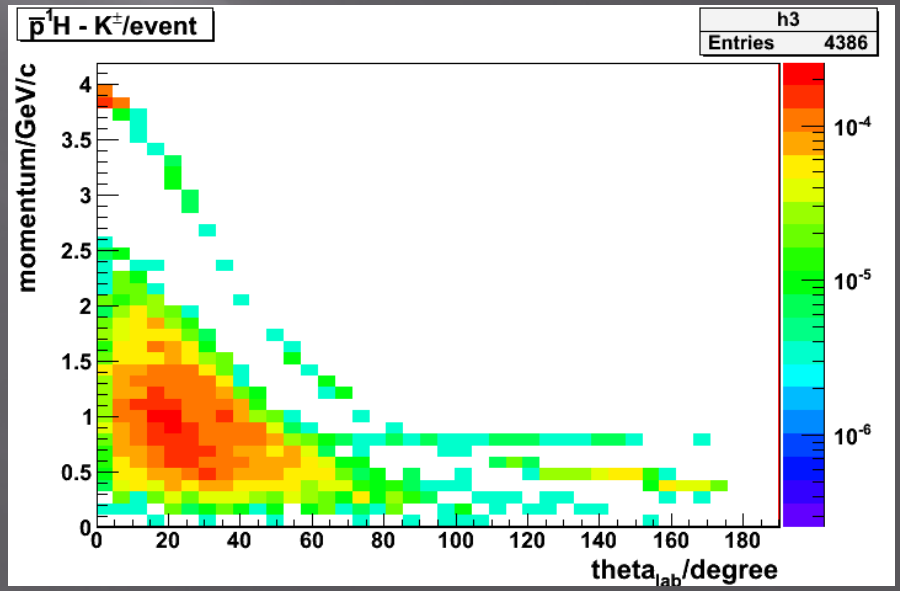


Antiproton–Proton

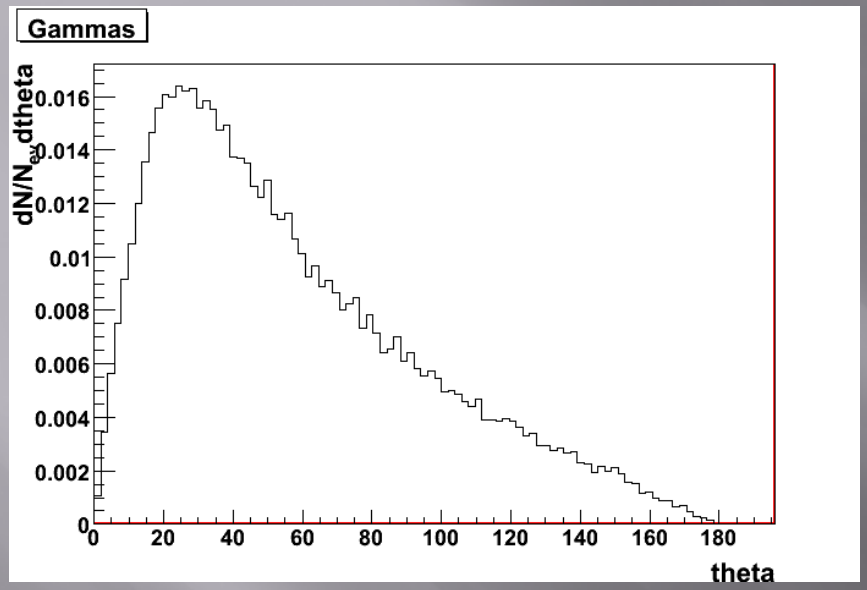




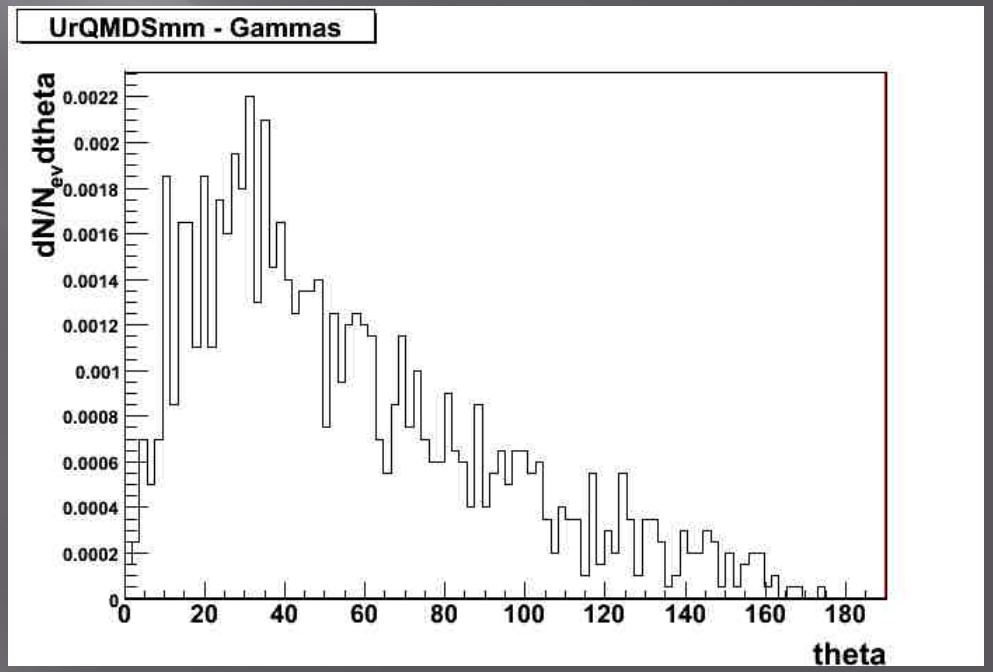




Addendum: Gammas from ^{12}C



FLUKA: 10times more gammas
Caveat: in UrQMDSmm
π^0 not decayed ($\langle\pi^0\rangle$/ev = 2.3)



Addendum: Gammas from ^{12}C