Roman Pots
and
the AA Impact Parameter

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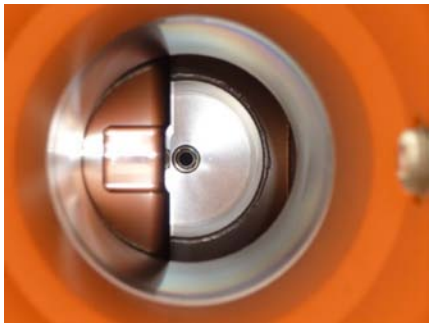
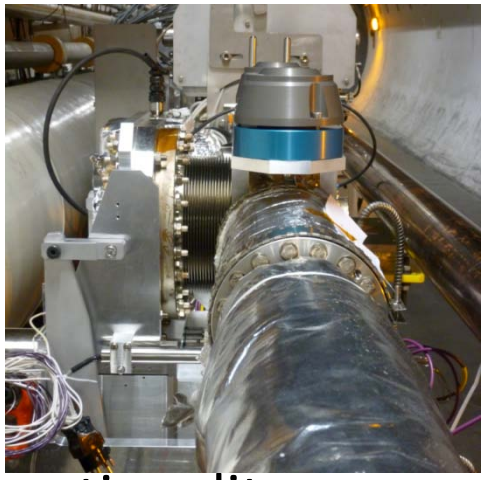
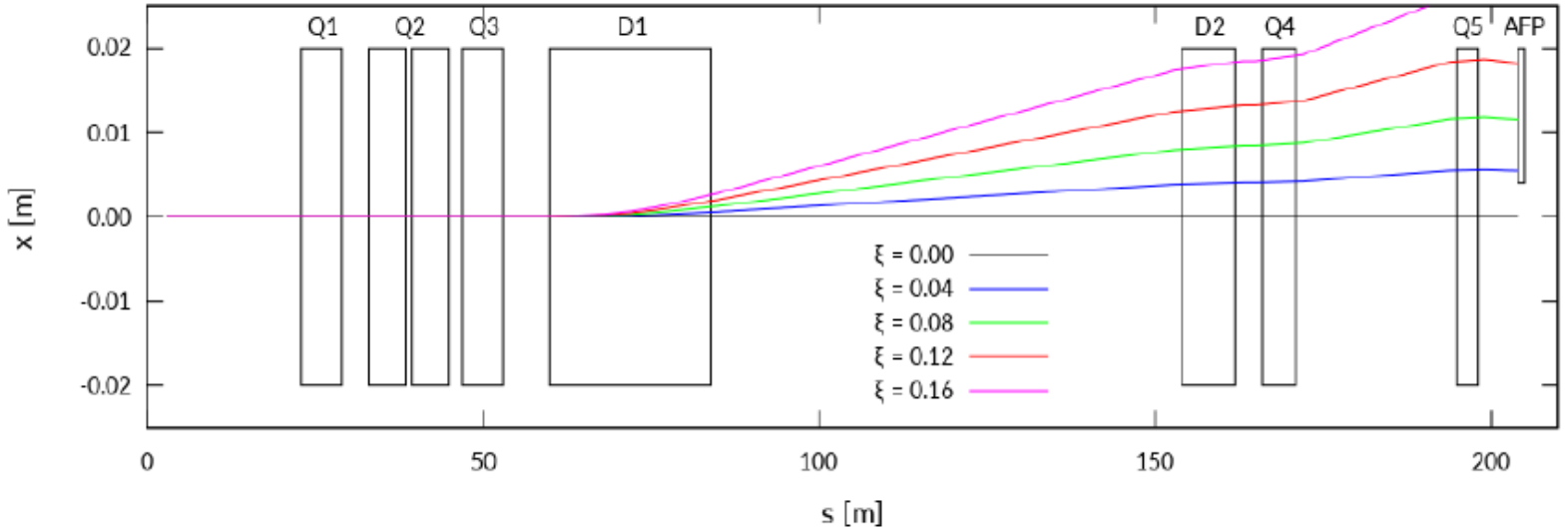


AFP Horizontal Pots



- Two stations per arm @211m
- Each station contains Si tracker (4 pixel planes)
- Outer station can be also equipped with ToF functionality
- Use the machine lattice as a magnetic spectrometer
- Accepts: $\xi = 1\text{-}E/E_{beam}$, $0.02 < \xi < 0.1$ for protons

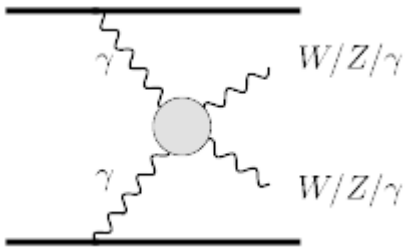


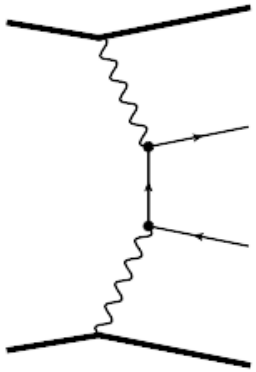
AFP Physics Goals

Physics programme: everything with a single or double proton tag

- Diffraction: soft, hard, single, central

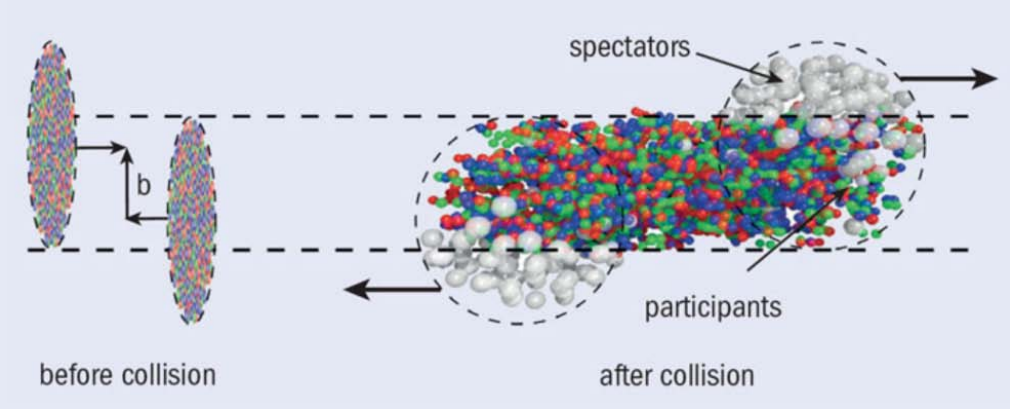
- Two photon physics:
  - SM tests: γγWW and γWW couplings
  - Searches for new physics
  - Exclusive processes (e.g. γγ→ll)
  - QCD tests: absoptive corrections
- …
- There were ideas to use AFP in pA and AA runs …





AFP for AA collisions

- Can we use them to estimate b?
- Spectators move forward
- Larger b results more spectators
- The traverse the machine lattice as the forward protons do



- First proposal (RHIC):

S. Tarafdar, Z. Citron, A. Milov

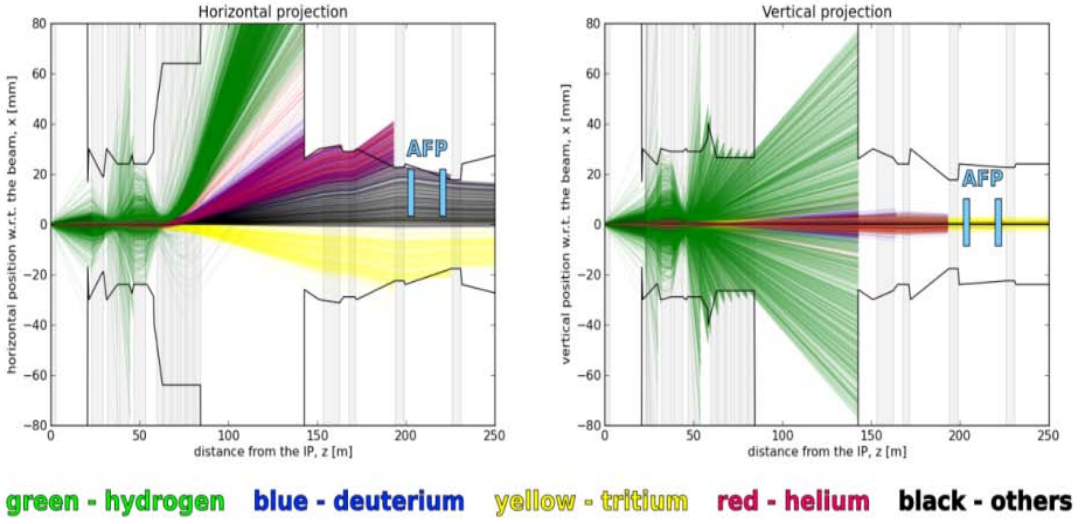
[arXiv:1405.4555]

- For ep in different context:

J.J.C., M.W. Krasny:

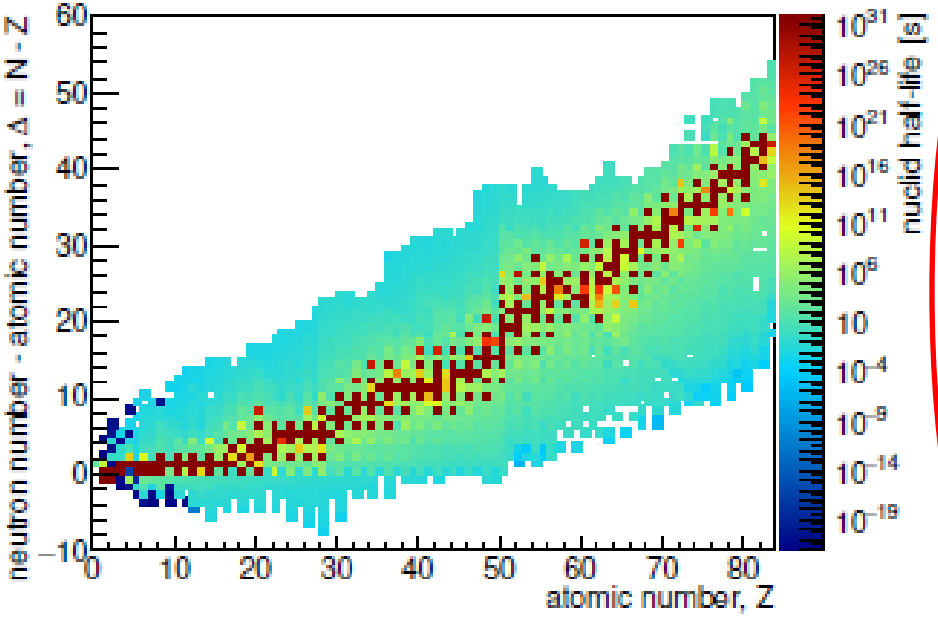
Future physics at HERA, 1996, v. 2 p. 991

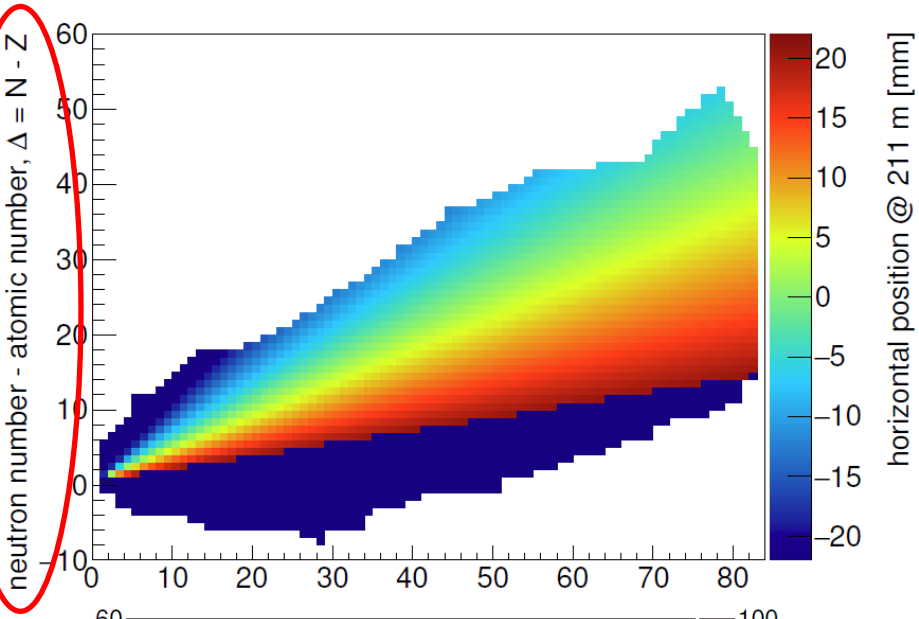
http://inspirehep.net/record/409130

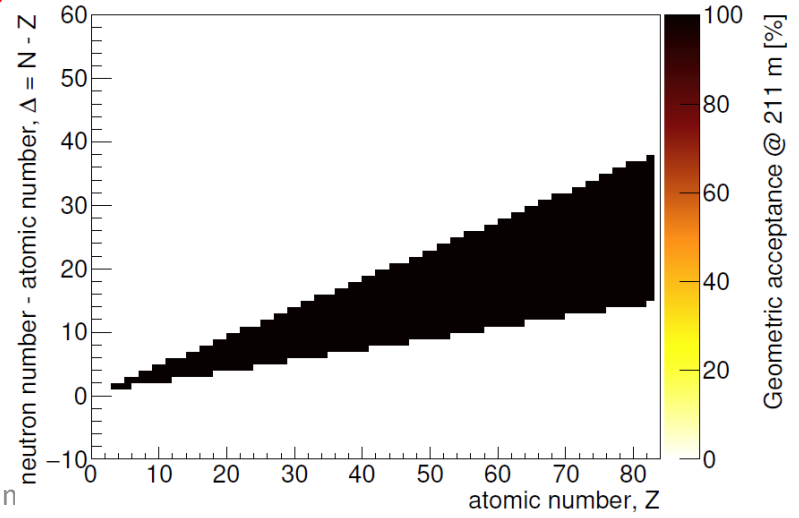


AFP for AA collisions

Idea: take all know nuclides and run through the LHC – **model independent**



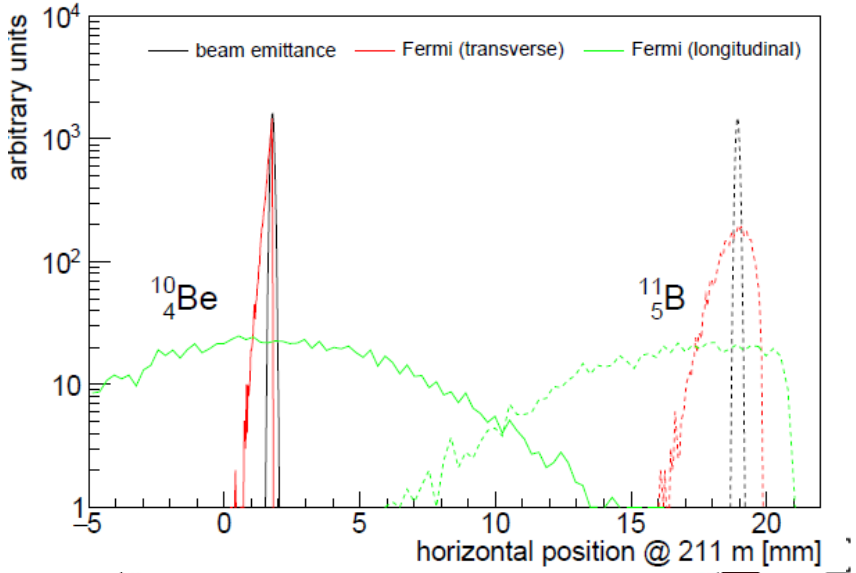


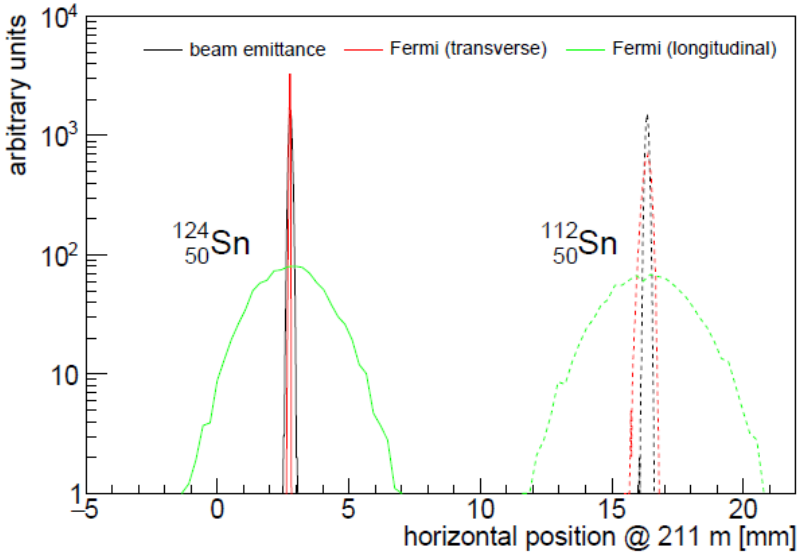


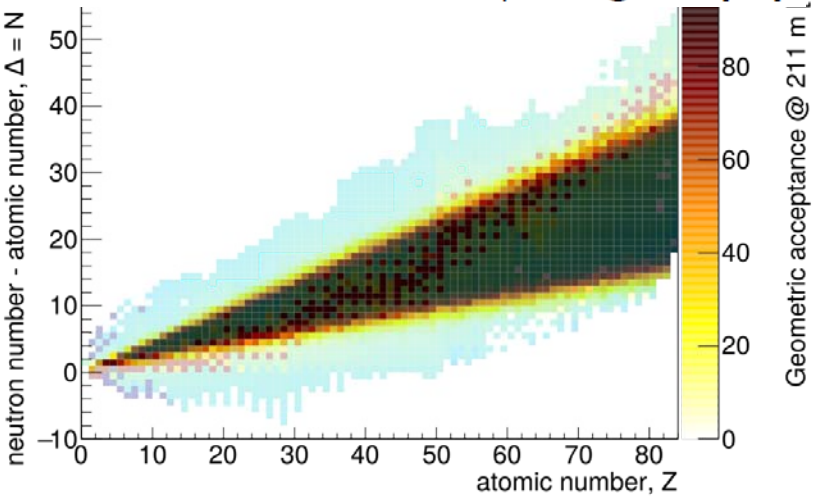
- Detectors @ (>) 3mm (19σ+0.5mm)
- Significant part of nuclides can be registered

Smearing effects

Influence of the beam emittance and Fermi motion







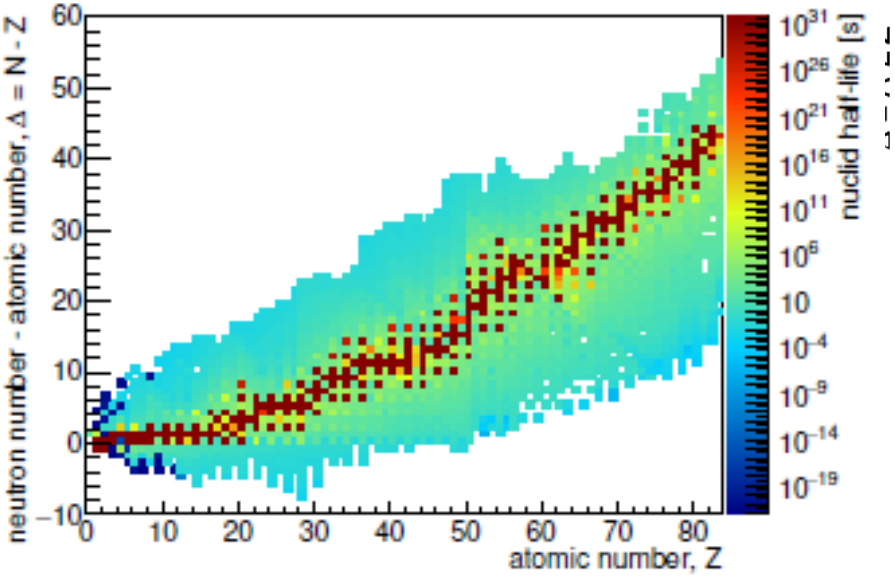
Large Lorentz γ (~2600 for $\sqrt{s_{NN}}$= 5 TeV) results large spread (~2 γp_F)

Emittance influence negligible

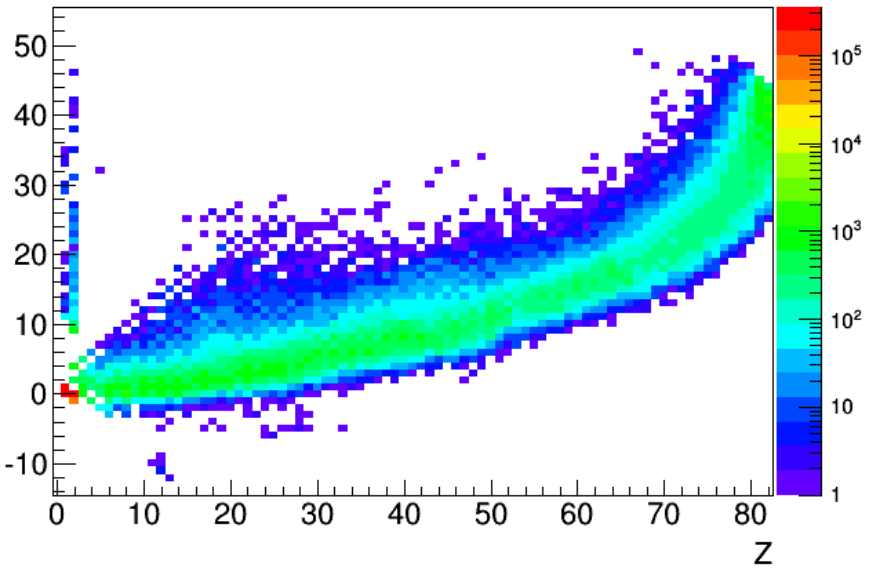
Fermi motion more important for lighter debris – wider smearing in momentum → ξ → position

Results with DPMJET

Reality



DPMJET

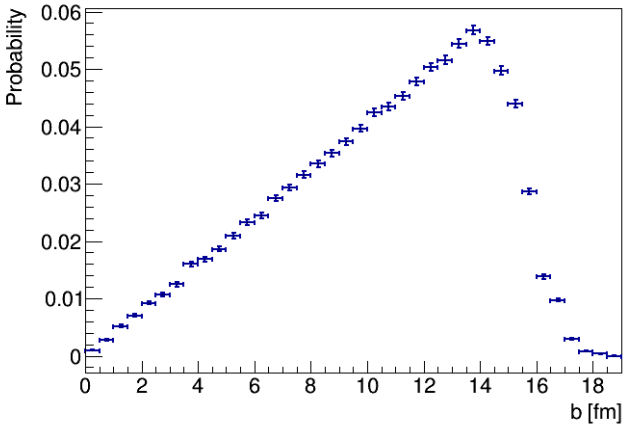


DPMJET:

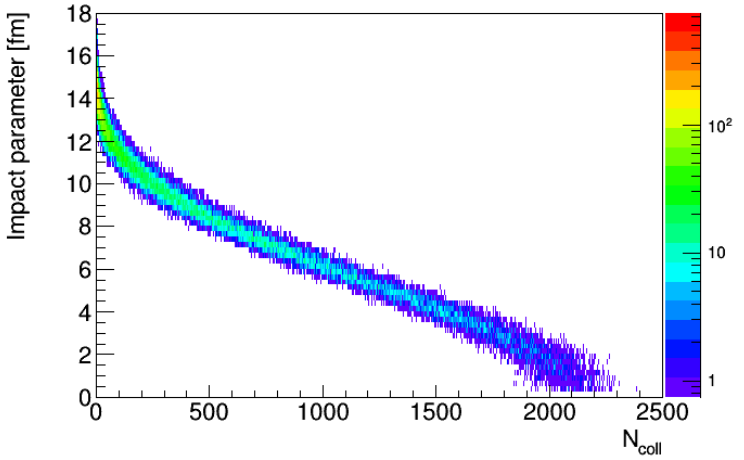
no very short-lived states are produced

some differences with dbs?!

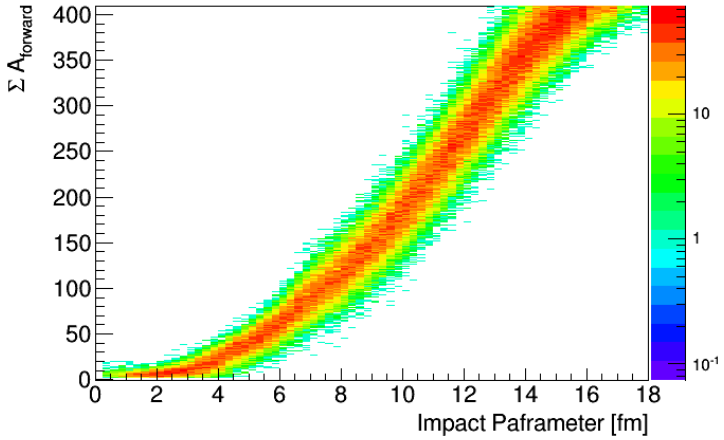
Results with DPMJET

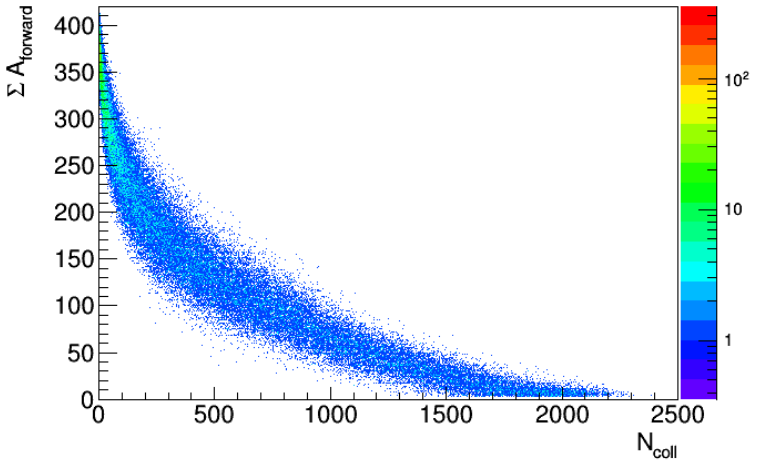


Shape of b distribution as anticipated



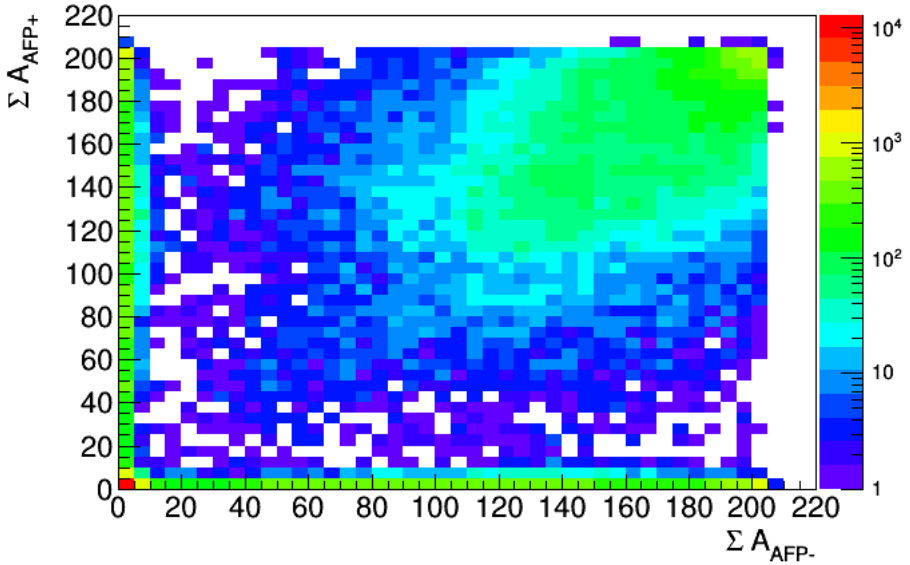
Low N_{coll} → peripheral collisions





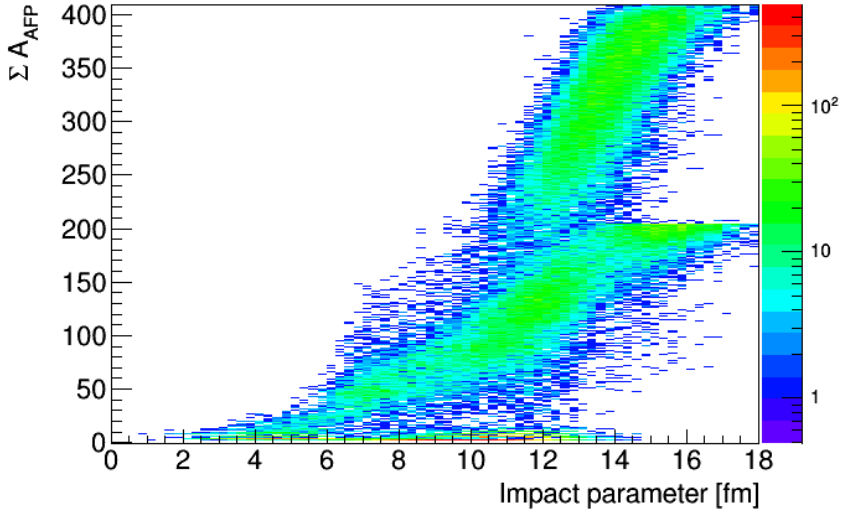
Total number of nucleons in forward well correlates with b value or N_{coll}

Results with DPMJET



Two configurations dominate:

1. ``heavy" debri on one side
2. ``heavy' debri on each side

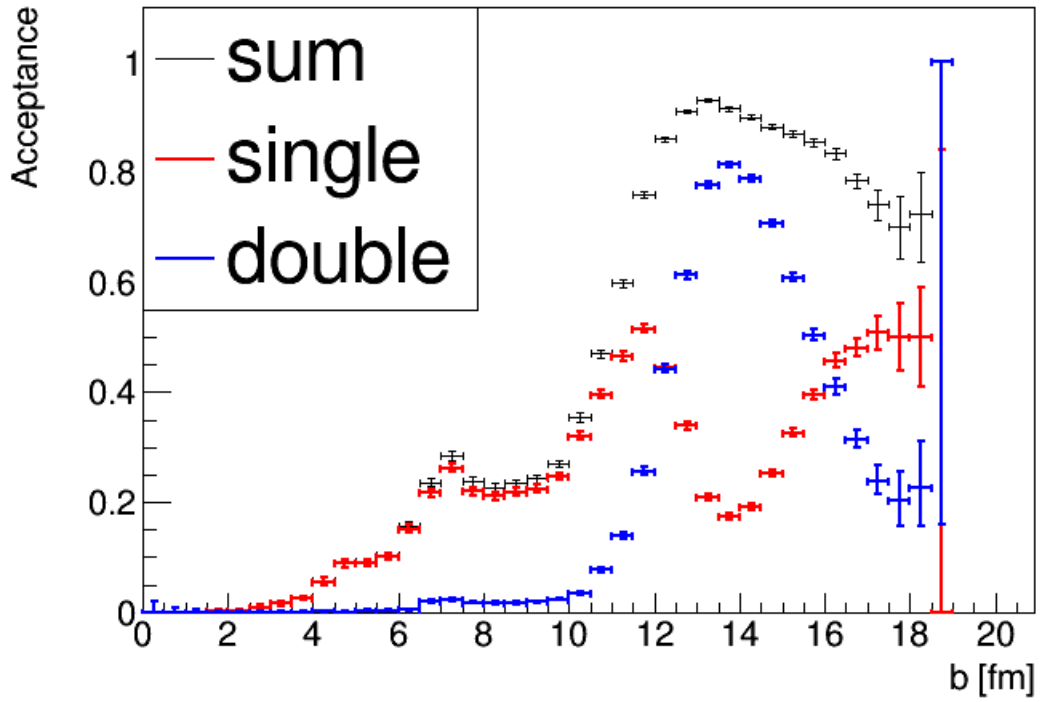


This is reflected in the (b, $\sum A_{AFP}$)

Two components

Lack of signal for central collisions

Results with DPMJET



Performance of the method depends on the b value

May help in peripheral AA collisions

Summary

- Existing AFP can register a wide spectrum of existing nuclides
- Fermi motion of nucleons leads to the relative energy loss, and hence, the registered position smearing; Impact of the beam emittance is very small
- Some debris resulting from ``fragmentation'' of spectator systems produced in AA can be registered by the AFP - partial acceptance
- Debris deliver impact parameter dependent information
- Preliminary results are encouraging → complementary determination of b @ high-b values
- How detailed data on the initial state can be extracted?
- How well we can reconstruct A seen by the AFP?
- How reliable is the model of the spectator system fragmentation at the LHC energies?