

# Discussion on Cross Sections for Cosmic Ray Physics (at AMBER)

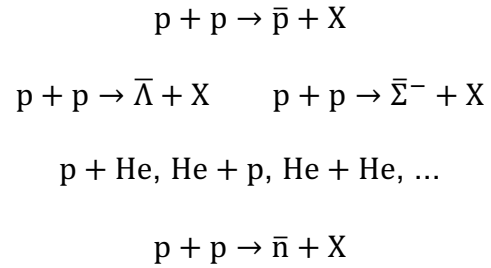


Apparatus for Meson and Baryon  
Experimental Research

# Antiproton-production measurements

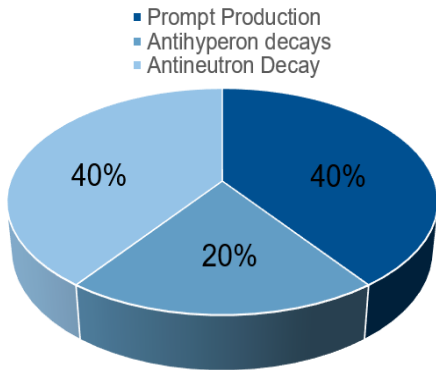
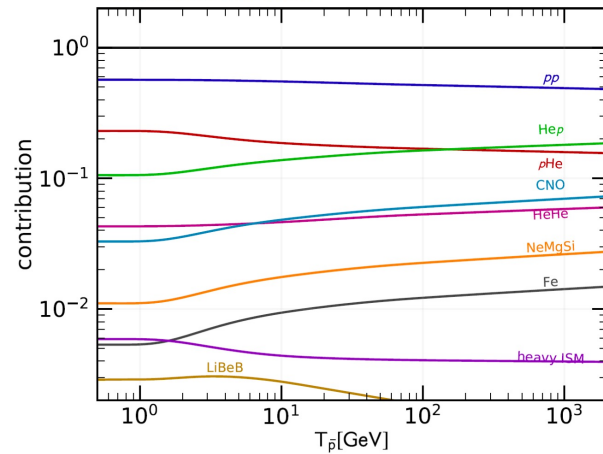
*What is required to reach a sufficient accuracy of antiproton production modeling?*

## Production Reactions

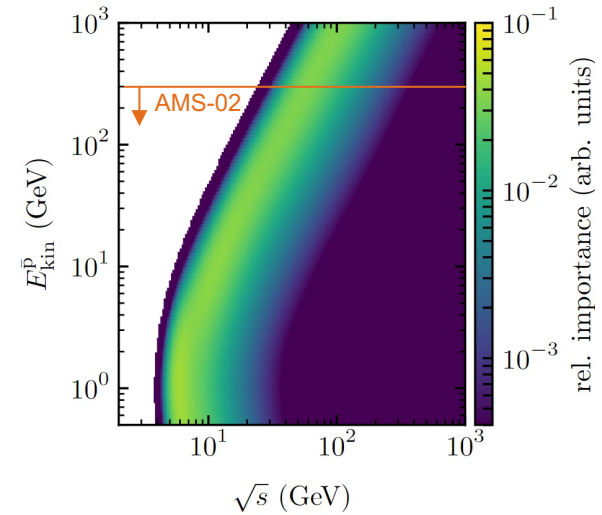


decreasing  
availability of  
data

Figure taken from Di Mauro et al., Phys. Rev. D, Vol. 97, 103019 (2018)



## Relevant Collision Energies



### required future measurements?

- collision energy, collision system, reactions, ...
- covered phase space

*Provocation: What do we gain if the uncertainty of the propagation is dominant*

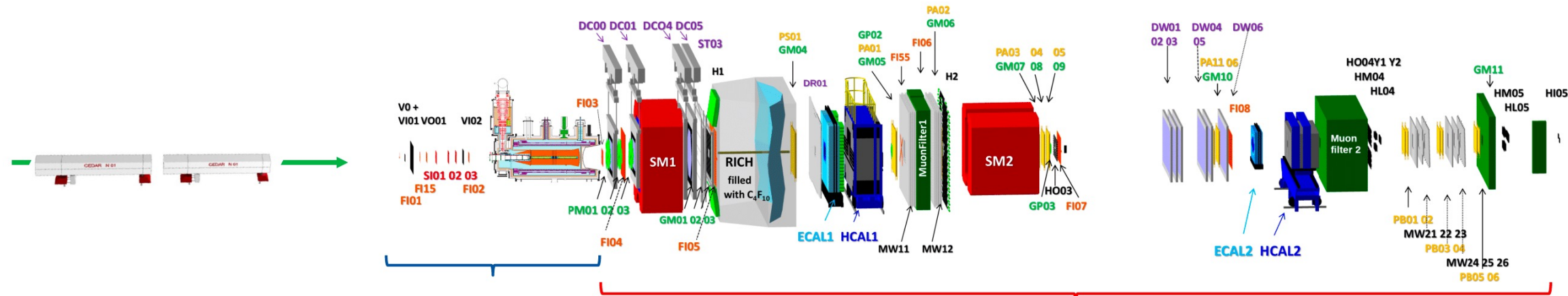
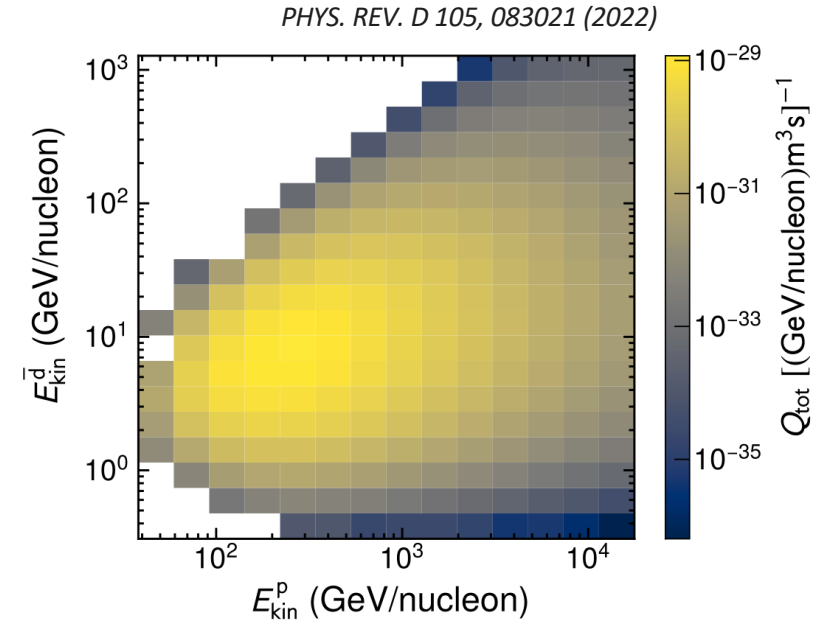
# Antinuclei measurements

## How relevant are antinuclei measurements at low collision energies?

- most data of antinuclei production from high-energy collisions (mainly LHC)  
→ relevance of low-energy data?
- what would be the relevant phase-space of antinuclei to be covered at low collision energies?
- complementary particle correlation studies valuable?

How relevant would be antinuclei measurements at AMBER?

What PID detectors would be necessary to cover the relevant phase space?



**Beam:**  $p, \mu, \pi, K, (e)$

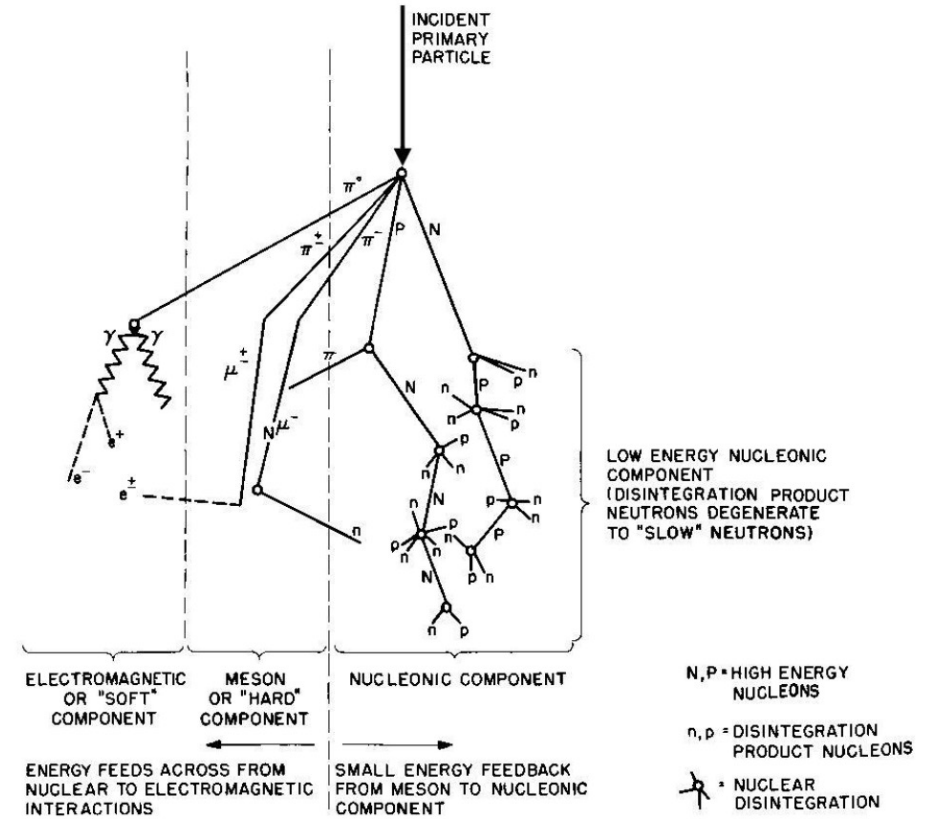
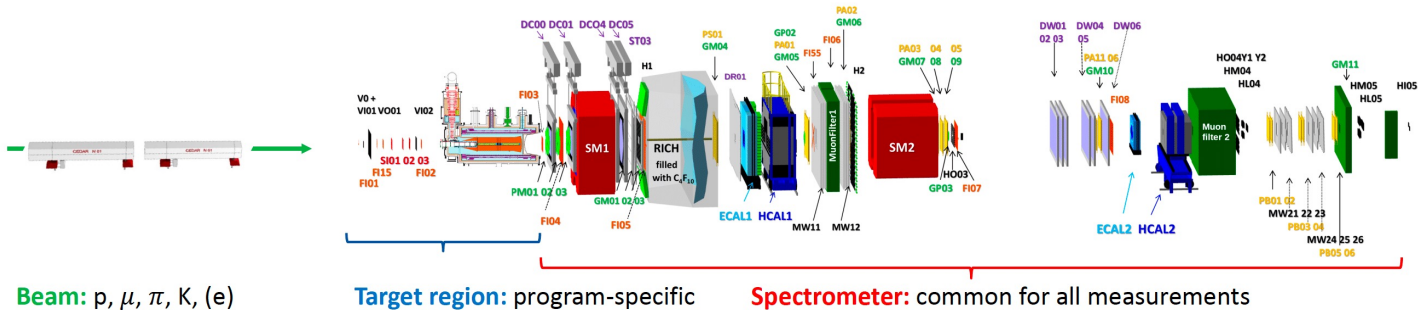
**Target region:** program-specific

**Spectrometer:** common for all measurements

# Further measurements as input for Astrophysics

## What further measurements would be of interest for the astrophysics community?

- measurements of neutral pion production for studies of galactic gamma ray spectra
- production of mesons and successive production of muons (muon excess in air shower measurements)
- measurements with meson or muon beams
- measurements of rare processes with high-intensity beams
- ...



Schematic Diagram of Cosmic Ray Shower

Thank you very much for your contribution and discussion



Apparatus for Meson and Baryon  
Experimental Research