



Cosmic Antiproton Sensitivity of the GAPS Experiment

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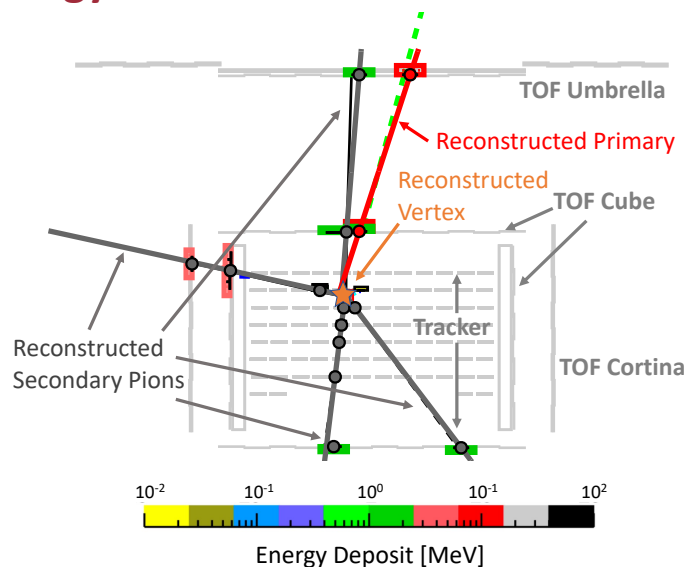
on behalf of the GAPS Collaboration

Cosmic Antiproton Sensitivity of the GAPS Experiment

- GAPS (General AntiParticle Spectrometer) Experiment optimized to detect low-energy antinuclei from a NASA Antarctic long-duration balloon
- **Antideuteron** and **Antihelium-3** are smoking-gun signatures of dark matter annihilation/decay with negligible astrophysical background
GAPS Science: Xiao+, ICRC 2021 No. [101560](#), Antihelium-3 sensitivity: Stoessl+, No. [101701](#)
- Precision **Antiproton** spectrum (~ 0.1 to 0.35 GeV/ n at the top of the atmosphere) sensitive to light dark matter, evaporating primordial black holes, and Galactic propagation models

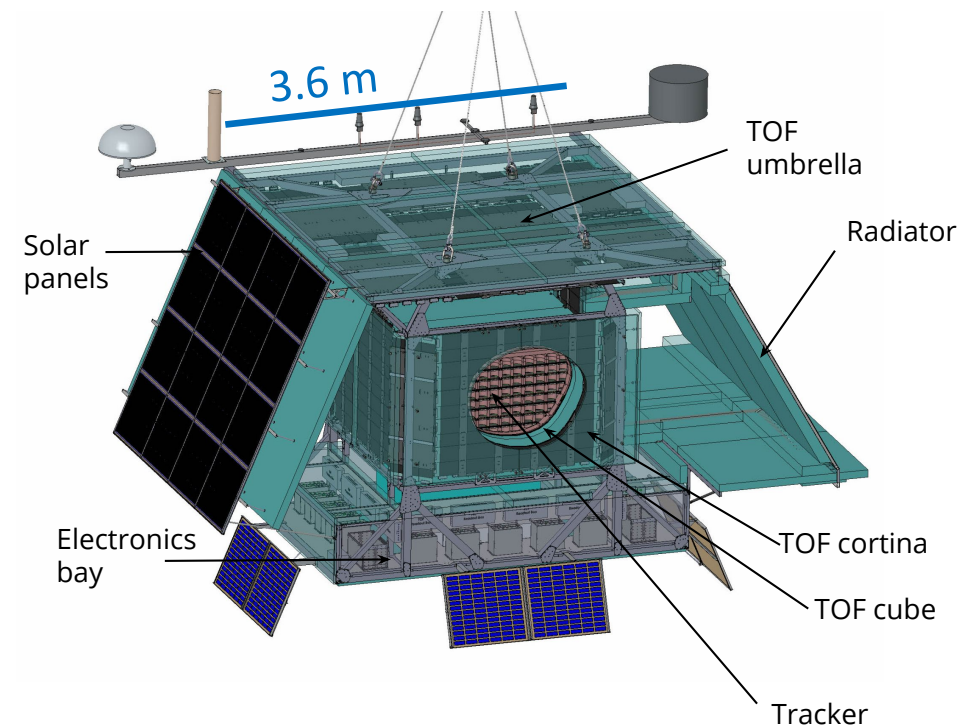
GAPS Annihilation-star Topology for Antinucleus Identification

- Simulated, reconstructed event (right) shows antinucleus event topology
- Annihilation star topology results from exotic atom formation and annihilation
- Energy deposition patterns depend on primary charge



Reconstruction: Tiberio+, ICRC 2021 No. [191853](#), with machine learning: Marcelli+, No. [101754](#)

The GAPS Instrument:



- **TOF** measures β with $\sigma_\beta / \beta \sim 5 - 10\%$ and provides the trigger
- 10-layer silicon **tracker** is the tracker, target material, and X-ray spectrometer (< 4 keV energy resolution for 20 – 100 keV)
- Novel integrated oscillating head pipe **thermal system**
- No magnet, cryostat, or pressure vessel required!

Instrument Design and Performance : Quinn+, ICRC 2021 No. [101811](#)

Cosmic Antiproton Sensitivity of the GAPS Experiment

➤ Relative rejection $>10^6$ required due to large nuclei nuclei relative to antiprotons

➤ Distributions for sample event variables used to reject nuclei

➤ Acceptance after likelihood analysis yields relative proton suppression $>10^6$ and preserves large signal acceptance

