Antineutrons Produced from Antiprotons in Charge-Exchange Collisions

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Overview

Idea

- Antiprotons where already known
- Are there also Antineutrons?
- What happens if C conjugation is applied on neutral particles?
- If they can be produced from Antiprotons, a large flux (300-600) is required

Experimental Set-Up

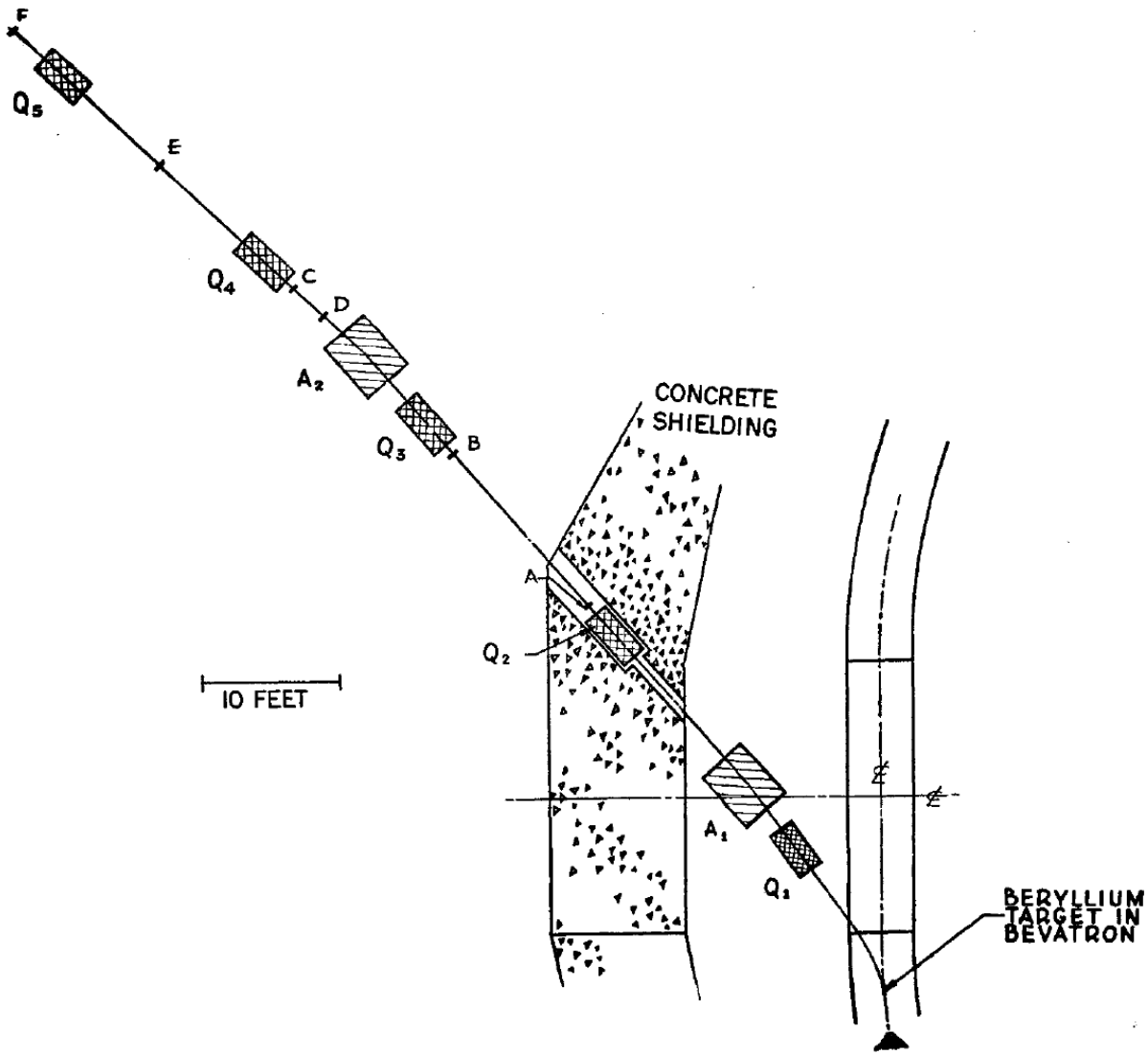
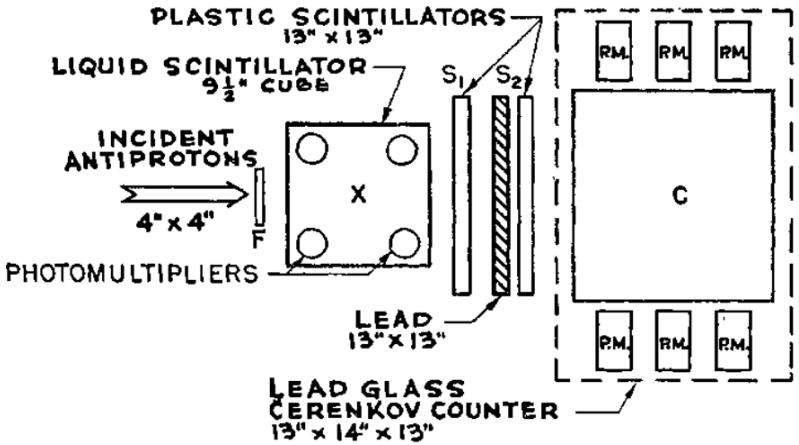


FIG. 1. Antiproton-selecting system. Q_1 through Q_5 are focusing quadrupoles. A_1 and A_2 are analyzing magnets. A through F are 4-by-4-by-$\frac{1}{4}$-inch scintillators.

Experimantal Set-Up

- Protons + Beryllium = Antiprotons + ...
- scintillators detect them and other charge particles (A-F)
- heart of the experiment: A lead glas Cherenkov detector (C)
- in a second run the Cherenkov detector was replaced by a large Scintillator

lead glas Cherenkov detecor



- Antiprotons collide with the lead plate $\Rightarrow$ Antineutrons are created
- Antineutrons annihilate in the lead glas
- Light from annihilation gets deteced

results with Cherenkov detector

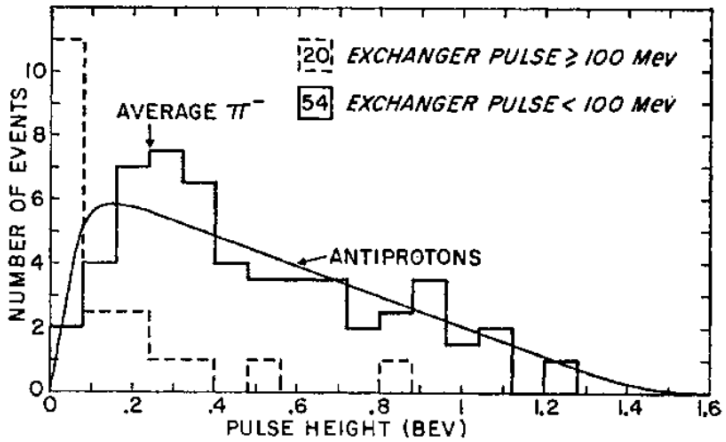


FIG. 4. Pulse-height spectrum in lead glass counter for neutral events. The solid histogram is for 54 antineutron events (energy loss in charge-exchange scintillator less than 100 Mev). Dashed histogram is for 20 other neutral events. Smooth solid curve is for antiprotons and is normalized to the solid histogram.

- Energy scale comes from relating puls height and shape to π-mesons
- Smooth curve provides the annihilation pulse-height distribution of antiprotons
- Histogram is the measured data
- since it is similar to the one of antiprotons, antineutrons exist

results with large scintillator

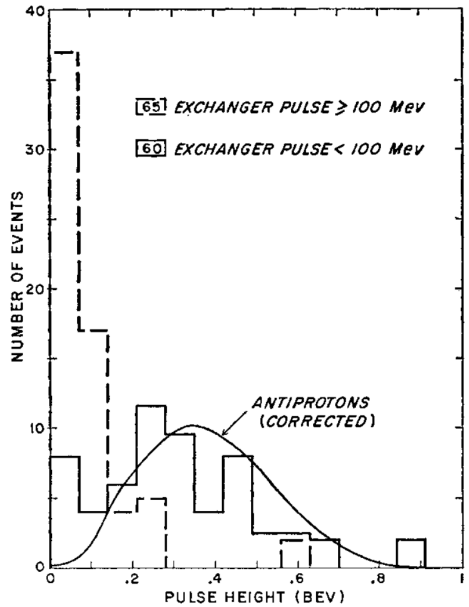


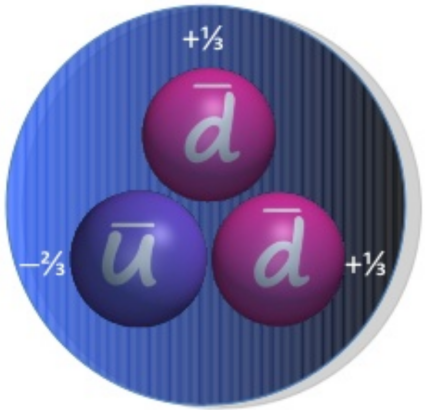
FIG. 7. Pulse-height spectrum in large scintillation counter for neutral events. Solid histogram is for 60 antineutrons (energy loss in charge-exchange scintillator less than 100 Mev). Dashed histogram is for 65 other neutral events. The smooth solid curve is the corrected antiproton curve from Fig. 6.

- large scintillator provides a similar pulse height distribution
- it also confirms the existance of antineutrons

Comparison of results

- In the lead glas detector 0.0030 ± 0.0005 antineutrons per antiproton had been detected.
- For the large scintilator 0.0028 ± 0.0005 antineutrons per antiproton had been detected.
- $\Rightarrow$ The efficiency is nearly equal.

today



- the antineutron is a Bayron wich consits of 3 quarks.
- gets deteced in hadronic Calorimeters where the annihilation energy gets collected

Questions?