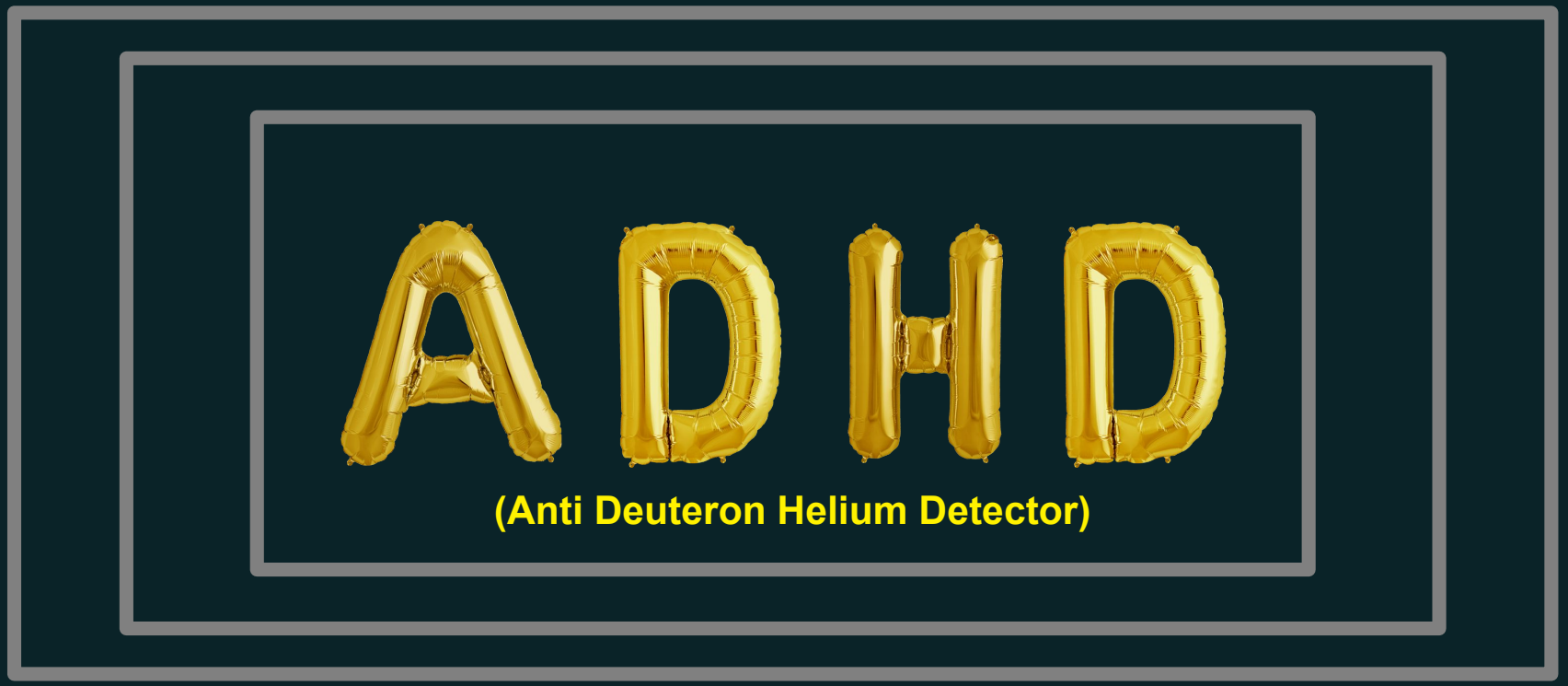
# Anti-Deuteron identification in Space with Helium calorimeter

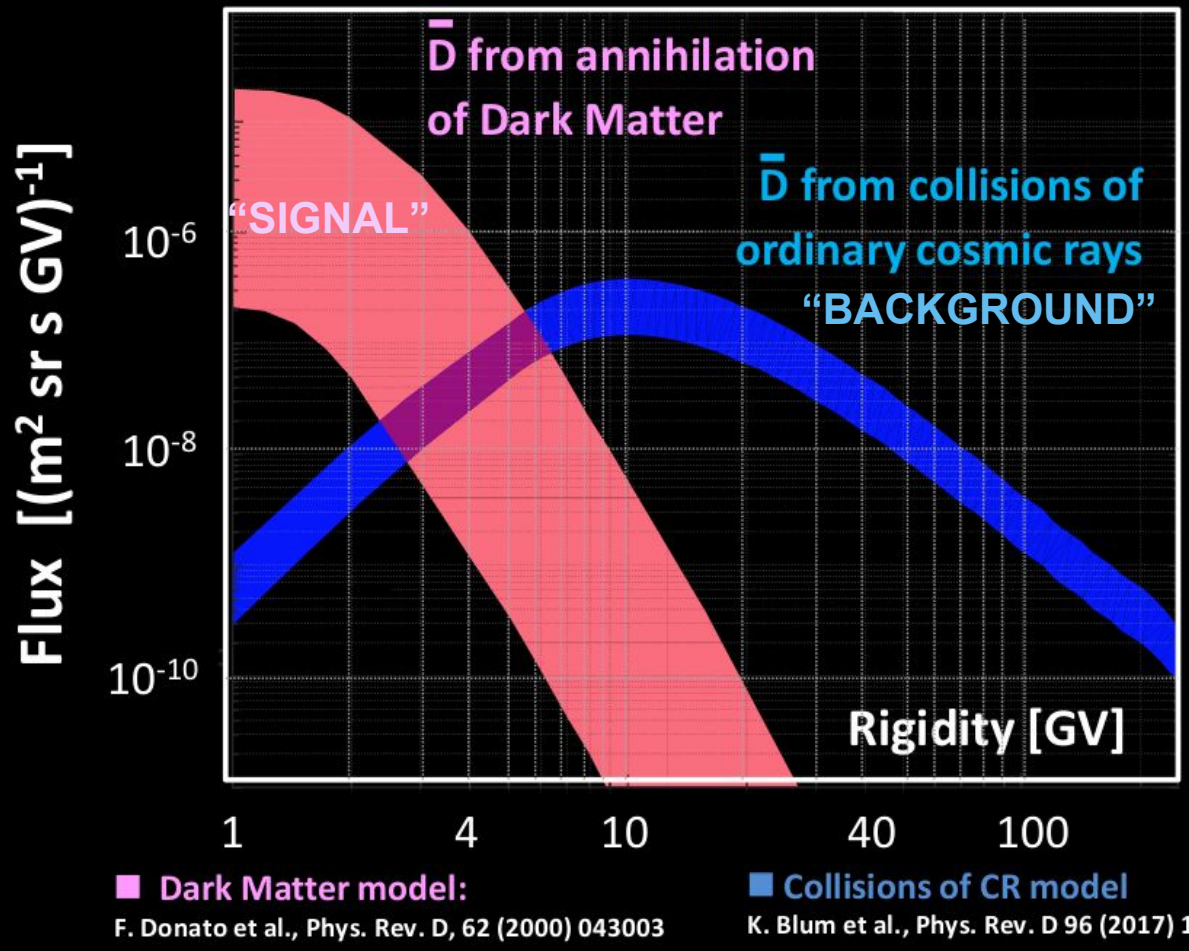



Preventivi INFN-TIFPA 2023

Francesco Nozzoli

# Anti Deuterons in Cosmic rays

**Anti Deuterons have been proposed as an almost background free channel for Dark Matter indirect detection**




**The Anti Deuterons Flux is $< 10^{-4}$ of the Antiproton Flux.**

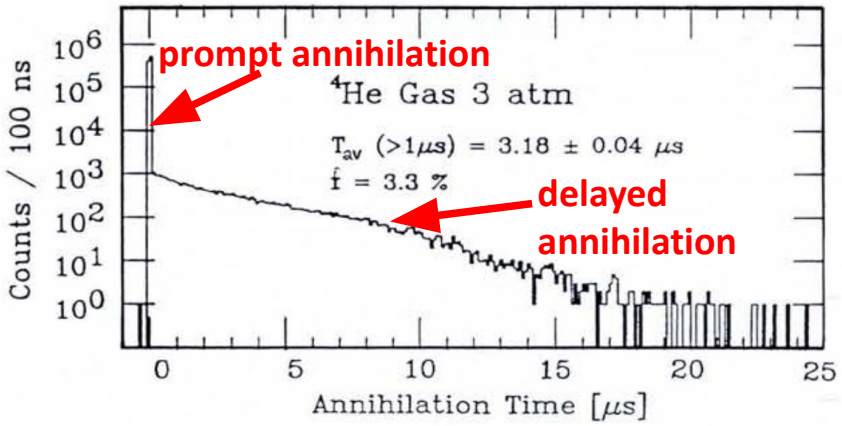
**Additional background rejection needed**

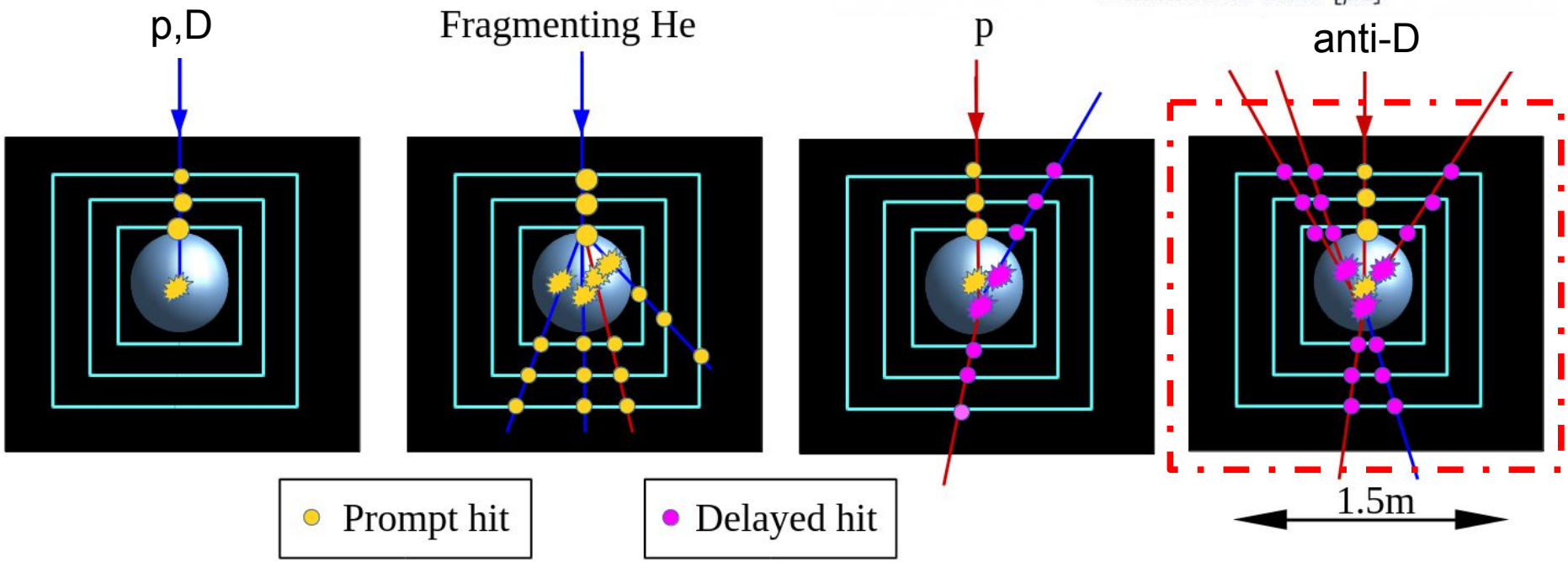
# Signature for Z=-1 antimatter: ~μs delayed captures in He

-In matter lifetime of stopped anti-p is ~ps
-In liquid/gas He delayed annihilation: few μs
(~3.3% of the p)(discovered @ KEK in 1991)

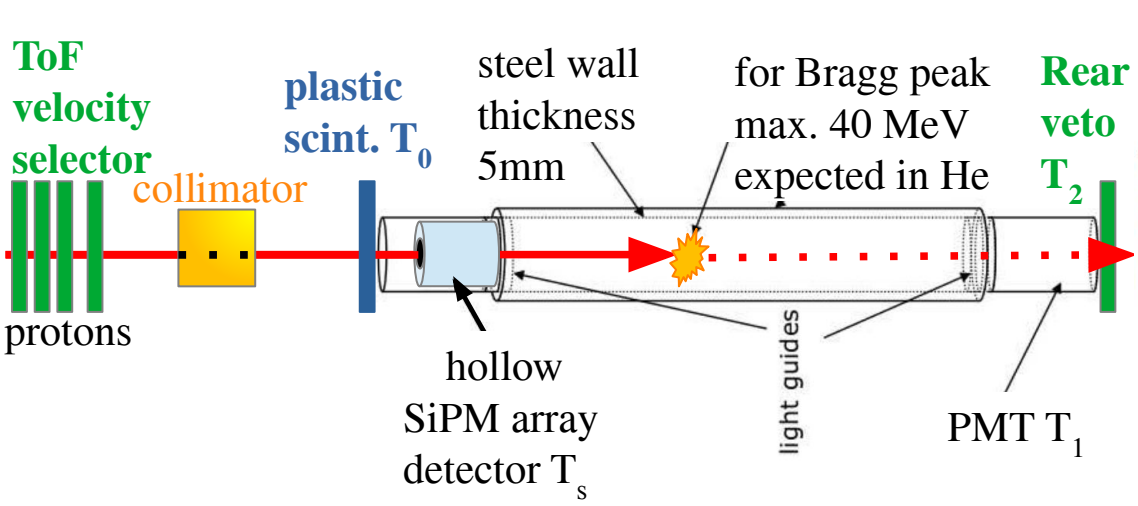
Observed also for $K^-$, $\pi^-$ and expected for anti-D

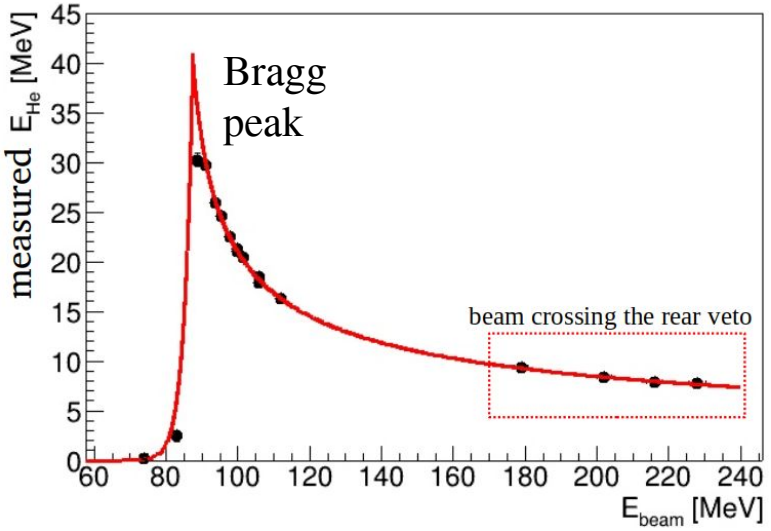
**ASACUSA experiment at CERN use these metastable states to measure anti-P mass**



# 2019-2021 “Grant-73 INFN” measurements on a 200bar Helium Calorimeter prototype @ INFN-TIFPA



# PREVENTIVI: 2024 - 2025 - (2026)

Finanziato dall'Unione europea
NextGenerationEU


Ministero dell'Università e della Ricerca

Segretariato Generale

Direzione Generale della Ricerca

PRIN: PROGETTI DI RICERCA DI RILEVANTE INTERESSE NAZIONALE – Bando 2022
Prot. 2022LLCPMH

**Project accepted: Pressurized Helium Scintillating Calorimeter for AntiMatter Identification**

**Requirements for INFN-TIFPA**

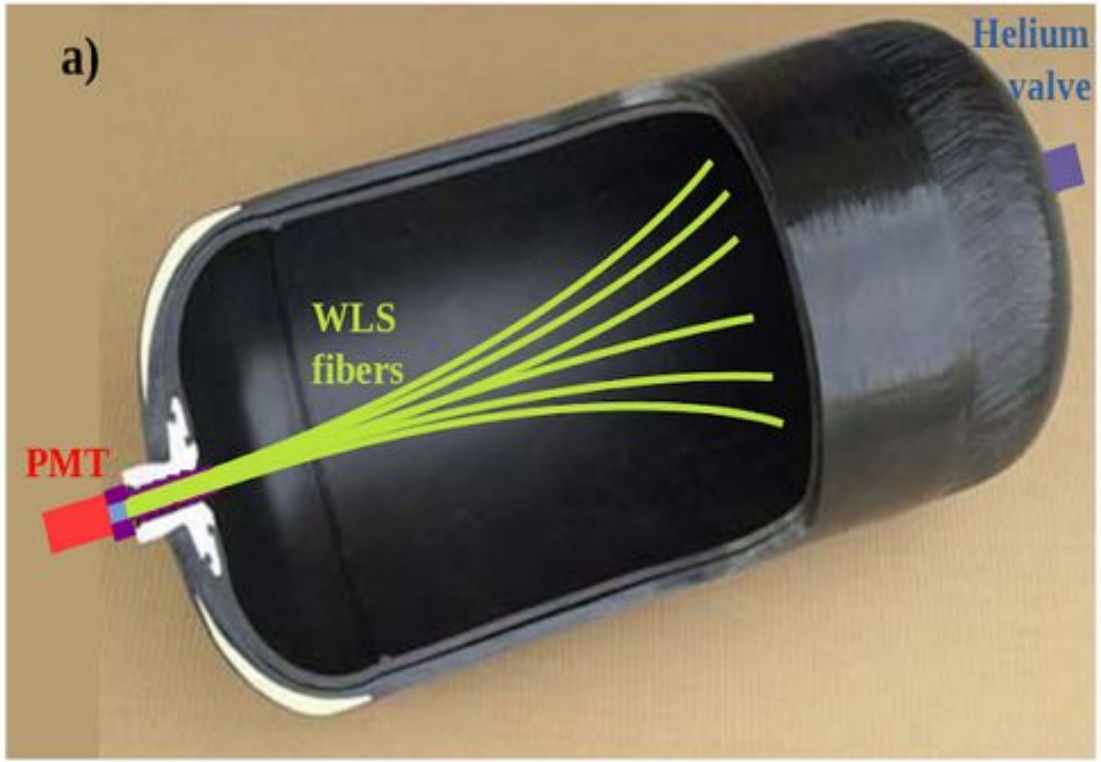
- **4mesi/anno da rendicontare sul progetto per Spinnato, Rashevskaya, Verroi**
- **laboratory space + Proton beam time**
- **technical support (Mechanics & Electronics) sempre più urgente un tecnico TIFPA**
- **amministation support (ordini per 93keuro da spendere in 2 anni)**

**Requirements for UniTN (additional 93keuro resp. prof. P. Zuccon)**

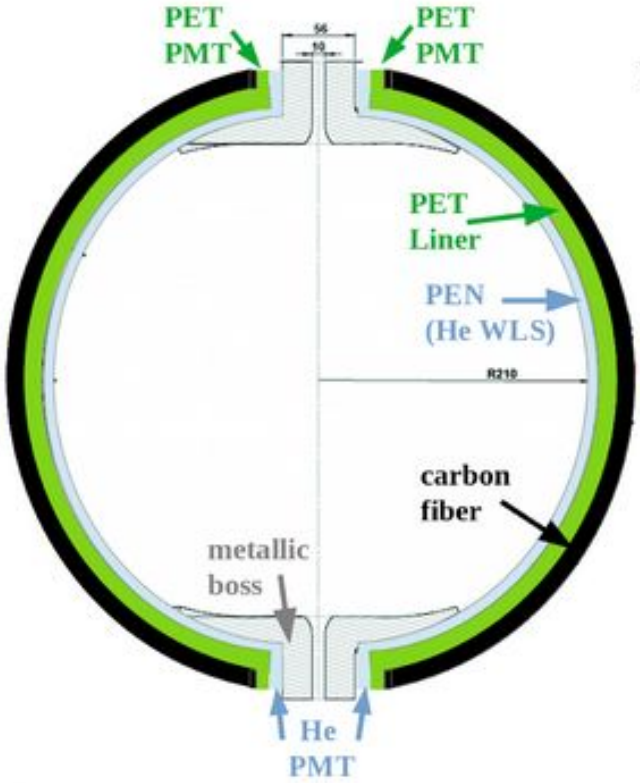
- **supervisor of PhD scholarship starting from Nov. 2023 (Short deadline HELP!)**

# expected outcomes: 2024 - 2025

**Development and test of HeCal prototype Based on commercial (automotive) COPV**

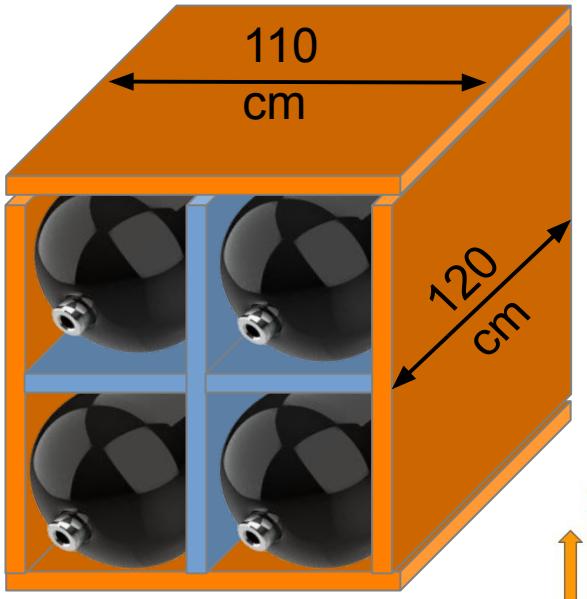



**Development and test of a COPV including a “fast” scintillating layer in the vessel**




PET and PEN are stronger than Copper and fast scintillating ( 6.8ns and 35 ns )
( https://doi.org/10.3906/fiz-1912-9 )

# 2026: ADHD demonstrator for a balloon launch
# 2x2x2 ⌀ = 50cm He modules




https://www.tifpa.infn.it/projects/adhd/

… pathfinder for the "ADHD-Science" circumanctartic balloon (3m x 3m x 3m)