

High-Efficiency WLS Plastic for a Compact Cherenkov Detector

Luigi Ernesto Ghezzer^{1,2}, Francesco Nozzoli^{1,2}, Francesco Meinardi³, L.Ricci^{2,1}, P. Spinnato^{1,2}, E.Verroi^{1,2}, Paolo Zucon^{2,1}

¹TIFPA-INFN, Trento Italia, ² Università di Trento, Trento Italia, ³ Dipartimento Scienza dei Materiali, Università di Milano Bicocca, Milano Italia

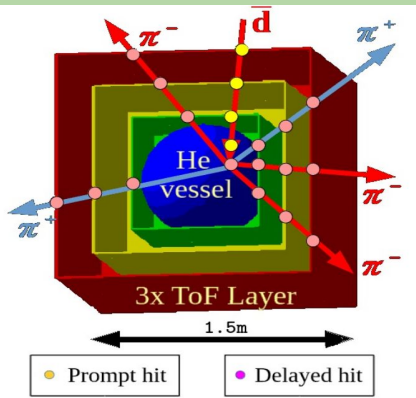
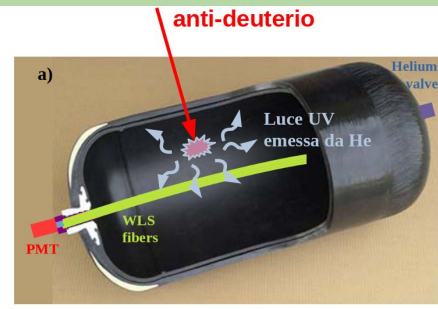


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Scientific context: The search for low-energy cosmic antideuteron probes primordial antimatter and Dark Matter nature

PHeSCAMI “Pressurized Helium Scintillating Calorimeter for AntiMatter Identification” PRIN2022

- Pressurized He calorimeter
- Exploits delayed decay of He metastable states
- Provides unique antimatter identification signature



<https://doi.org/10.3390/instruments8010003>

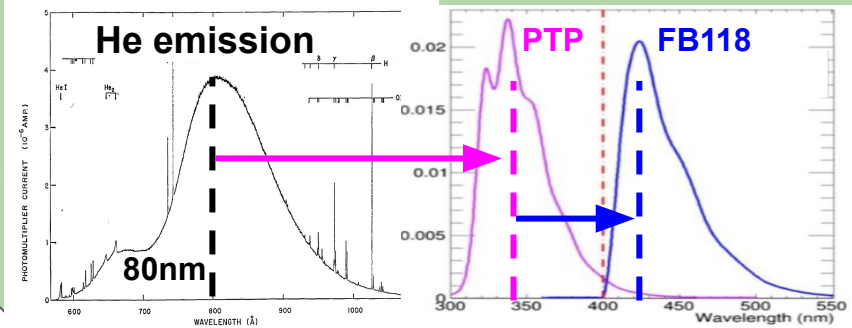
PHeSCAMI: Two-Stage WLS System

Gaseous helium scintillation emits VUV photons (80 nm).
Difficult to extract (strongly absorbed by most materials).

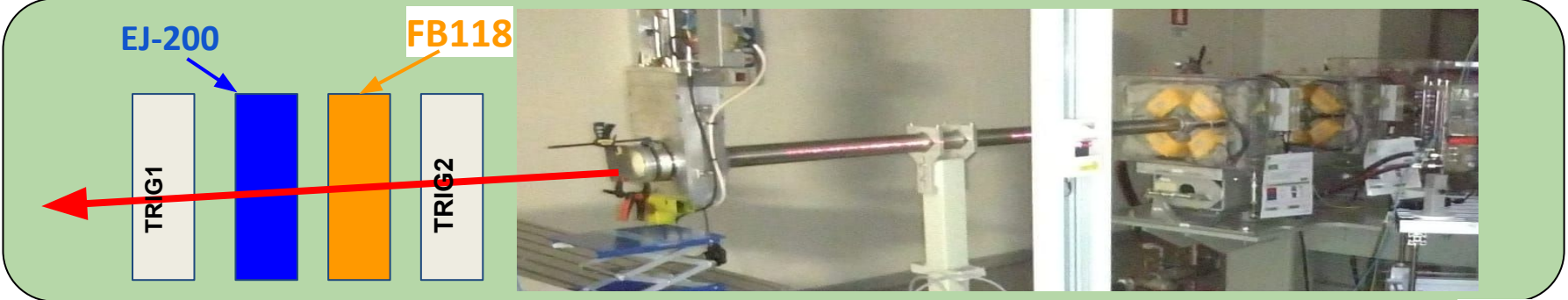
Two-stage WLS approach (similar to LAr/DUNE):

1. PTP layer converts VUV (80 nm) → UV (330 nm)
2. FB118-doped PMMA fiber (by G2P Rovereto) converts 330 nm → 430 nm (visible).

[C. Brizzolari et al. 2021 JINST 16 P09027](#)



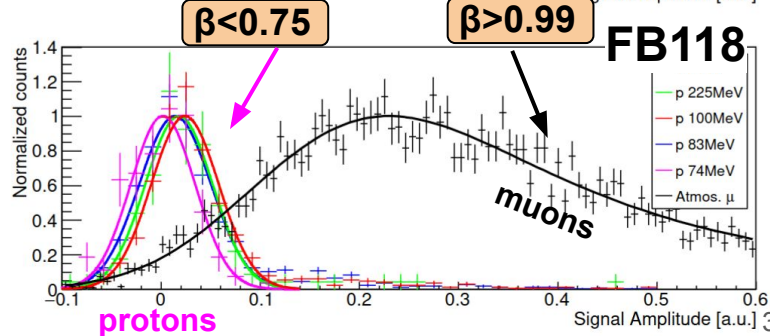
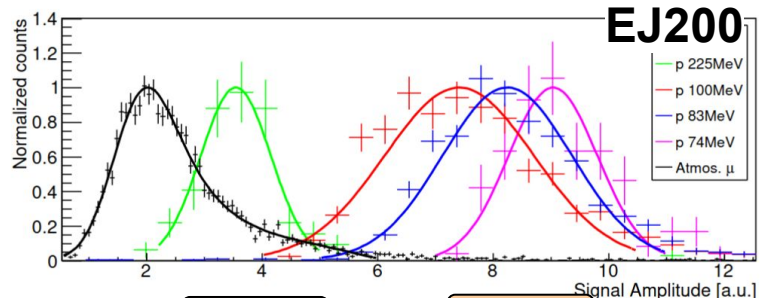
Test of FB118 with proton beam @ Trento



FB118/EJ-200 proton-beam test @Trento

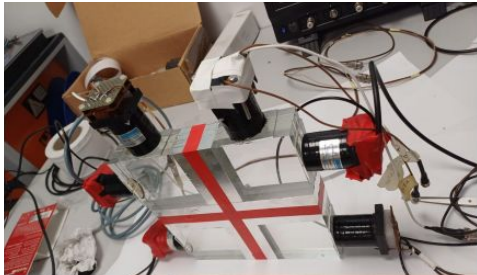
- Proton energies: 74–225 MeV $\Rightarrow \beta_{\text{prot}} < 0.6$
- Atm. muons energy: 4 GeV $\Rightarrow \beta_{\mu} > 0.99$
- Refr. index of FB118 is $\eta = 1.5 \Rightarrow \beta_{\text{trash}} = 0.75$
(Cherenkov threshold)

Result: FB118 do not emits light due passage of non relativistic protons ($\beta < 0.6$) while there is a strong Cherenkov emission for atmospheric muons ($\beta > 0.99$)



Test of FB118 with TOF muon telescope

- TOF setup to measure β of atmospheric muon (arm of 5m)
- FB118 Cherenkov layer (25x25x5cm)



FB118 Cherenkov layer

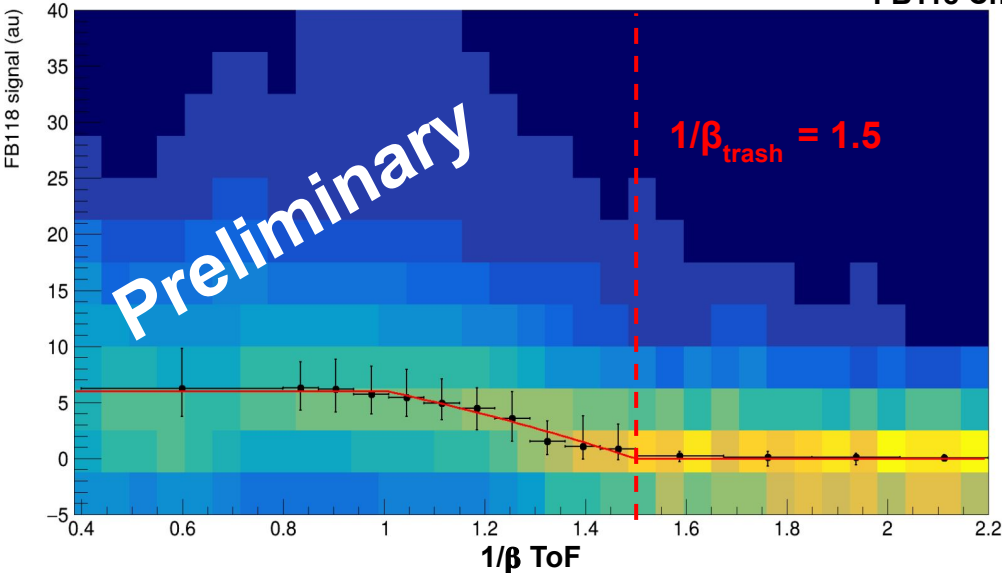
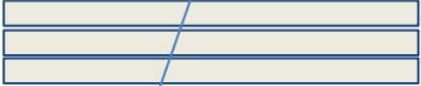
EJ200
upper ToF



5m

μ

EJ200
lower ToF



Result: FB118 light emission start for $\beta > 0.75$ and follow CRK emission.

FB118 is a promising Cherenkov radiator for velocity measurements in β 0.7-0.9 range for cubesats