

CdS Torino: richieste servizi per il 2026 LUNA

Nuclear astrophysics

Observational
astronomy

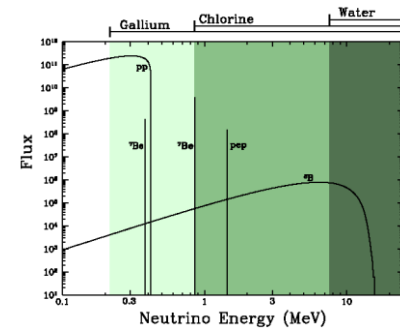
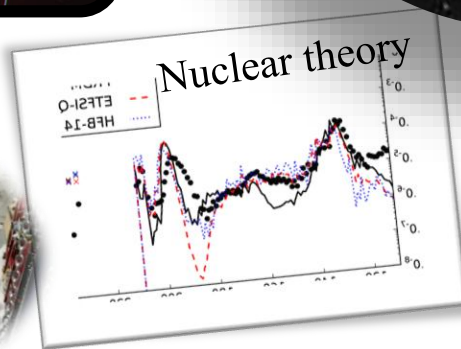
Cosmology

Nuclear
astrophysics

Nuclear
physics

Neutrino
physics

Stellar
models



Nuclear experiments

Laboratory for Underground Nuclear Astrophysics



Radiation

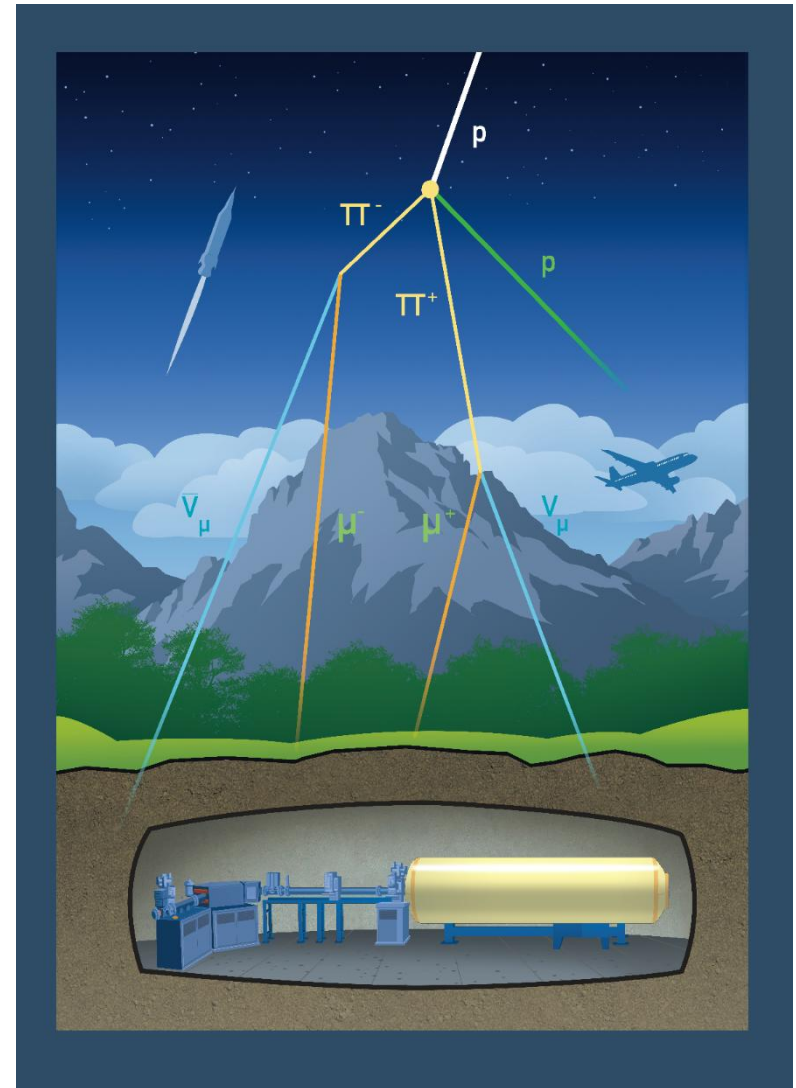
LNGS/surface

Muons

10^{-6}

Neutrons

10^{-3}



LNGS (1400 m rock shielding $\equiv$ 4000 m w.e.)

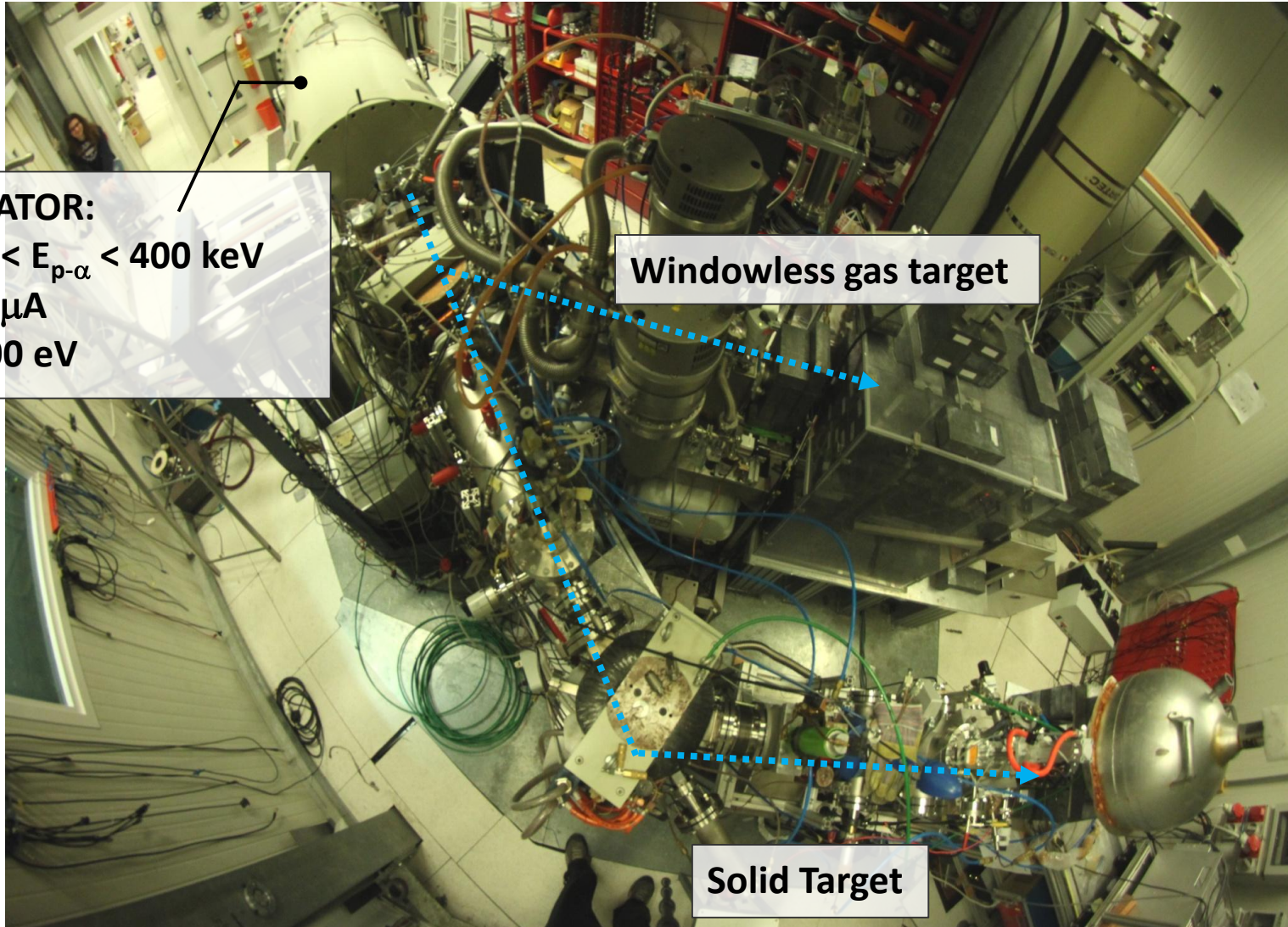
LUNA experimental setup

ACCELERATOR:

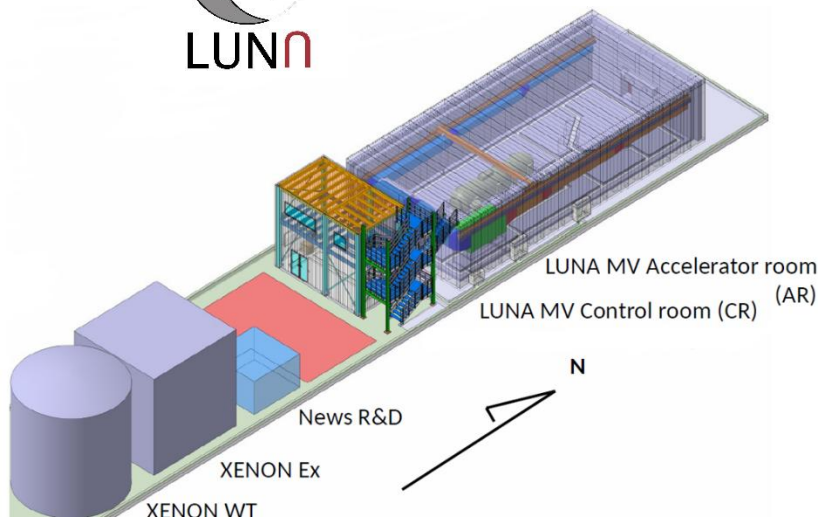
- $50 \text{ keV} < E_{p-\alpha} < 400 \text{ keV}$
- $I \sim 300 \mu\text{A}$
- $\Delta E = 100 \text{ eV}$

Windowless gas target

Solid Target



Bellotti Ion Beam Facility



A Sen. et al, NIM B 450 (2019) 390-395



$^1\text{H}^+$ (TV: 0.3 – 3.5 MV): 500-1000 μA



$^4\text{He}^+$ (TV: 0.3 – 3.5 MV): 300-500 μA



$^{12}\text{C}^+$ (TV: 0.3 – 3.5 MV): 150 μA

$^{12}\text{C}^{++}$ (TV: 0.5 – 3.5 MV): 100 μA

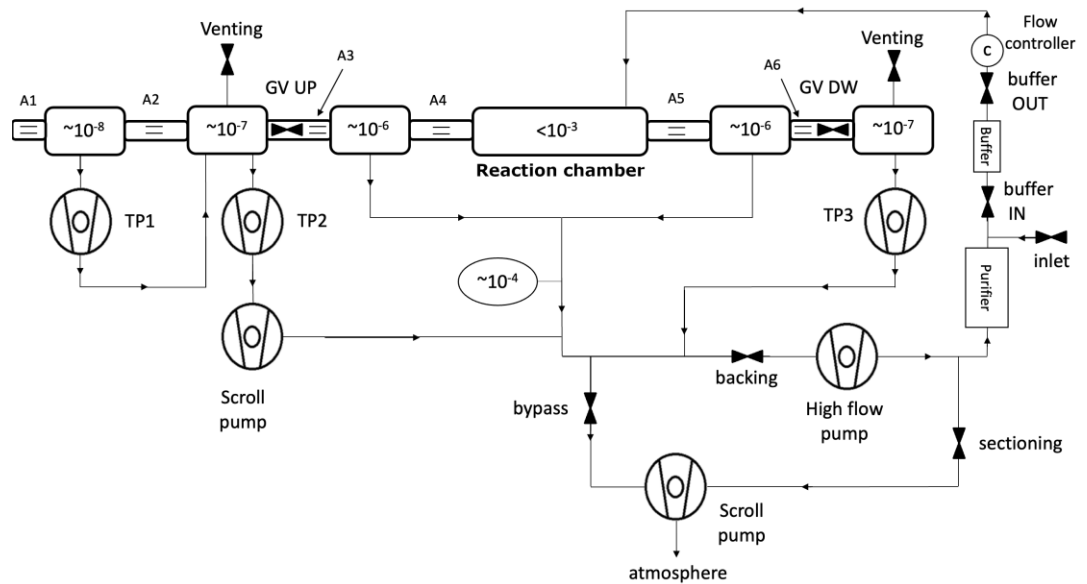
- ✓ 3.1 FTE @ INFN-To (Francesca Cavanna, Paolo Colombetti, Gianpiero Gervino, Ranjan Sariyal, Claudia Travaglio)
- ✓ Responsibilities:
 - ❖ Part of the collaboration board
 - ❖ Coordination of the PRIN2022 project (measurement of the $^{14}\text{N}(p,\gamma)^{15}\text{O}$ at LUNA-400)
 - ❖ Responsibility on the detectors design for the measurement of the $^{22}\text{Ne}(\alpha,\gamma)^{26}\text{Mg}$ at Bellotti Ion beam facility

$^{22}\text{Ne}(\alpha, \gamma)^{26}\text{Mg}$

- ✓ The $^{22}\text{Ne}(\alpha, \gamma)^{26}\text{Mg}$ reaction is the main competitor of the $^{22}\text{Ne}(\alpha, n)^{25}\text{Mg}$
- ✓ Both reactions are active in Asymptotic Giant Branch (AGB) stars ($2 M_{\text{Sun}} < M < 10 M_{\text{Sun}}$) and in massive stars ($M > 10 M_{\text{Sun}}$)
- ✓ The neutron budget available for the nucleosynthesis of the elements beyond Fe strongly depends upon the availability of ^{22}Ne and the rate of the two competing open channels of $^{22}\text{Ne} + \alpha$ reactions
- ✓ Measurement $\rightarrow E_{\alpha} = 600\text{-}900 \text{ keV}$ (Gamow window)

Experimental setup:

- ❖ Alpha beam from IBF (currents up to 500 μA)
- ❖ ^{22}Ne windowless gas target in recirculation mode
- ❖ Array of 6 NaI(Tl) detectors ($102 \times 102 \times 203 \text{ mm}^3$)



Richieste servizi: progettazione e officina meccanica

- ✓ Progettazione e realizzazione dei supporti per i 6 rivelatori NaI (20 cm e 10 kg)
- ✓ Minimizzare il materiale di supporto per evitare fondo indotto dal fascio
- ✓ Compatibile con schermatura di Pb di circa 15 cm di spessore

