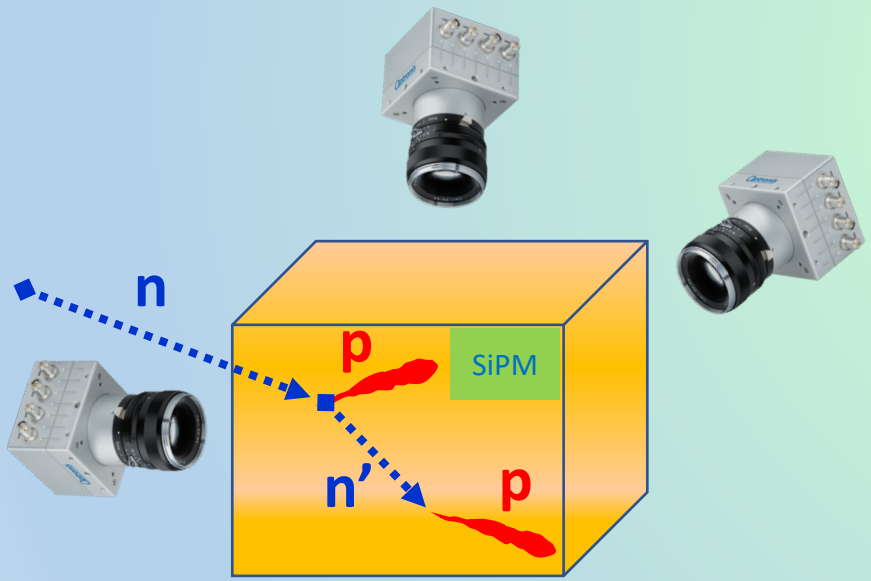
RIPTIDE
Recoil ProTon Imaging DEtector

Neutron detection:

- **Energy and direction**



PROPONENTS:

Console Camprini Patrizio

Giacomini Francesco

Massimi Cristian

Mengarelli Alberto

Musumarra Agatino

Pellegriti Maria Grazia

Ridolfi Riccardo

Spighi Roberto

Terranova Nicholas

Villa Mauro

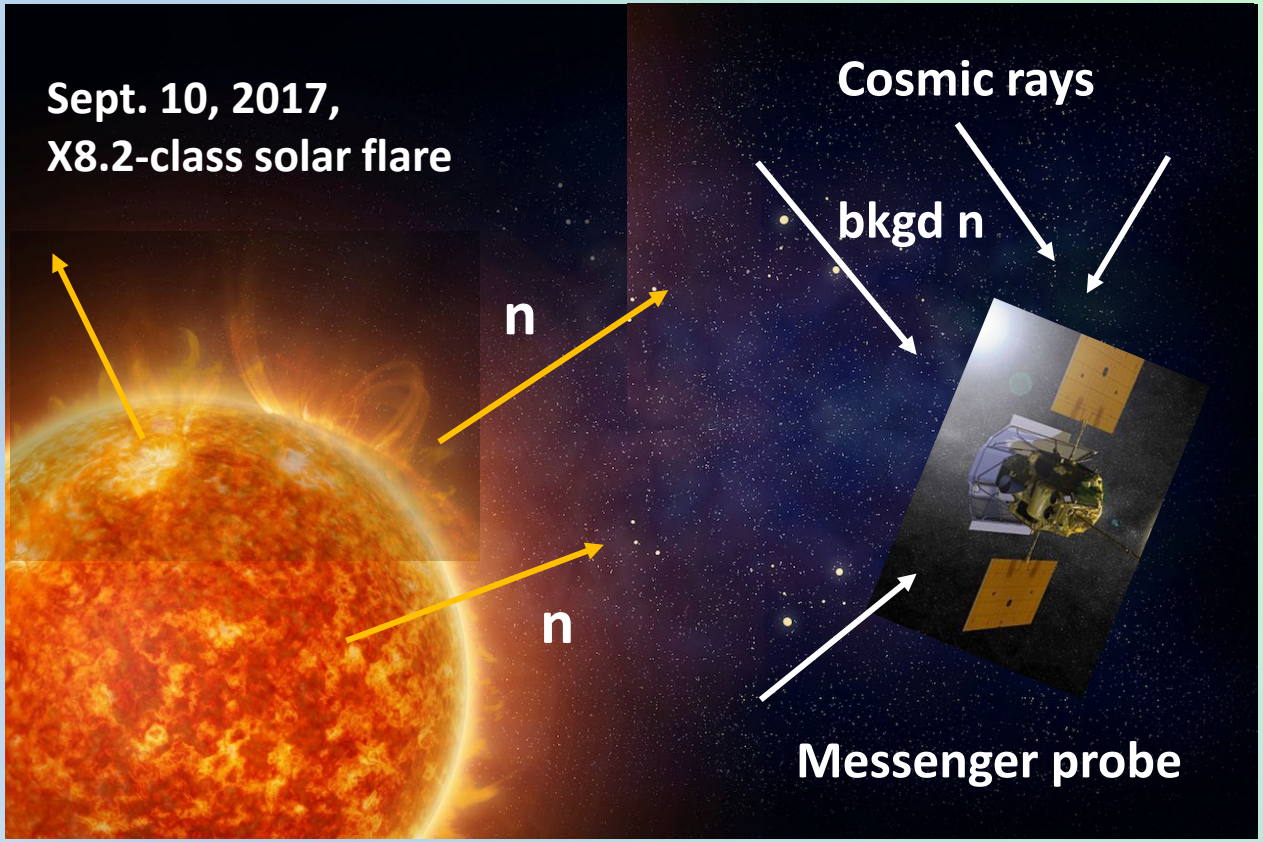
Can't put FTE, but contribute to the project:

Introduction

Research field of n-TOF and FOOT experiments

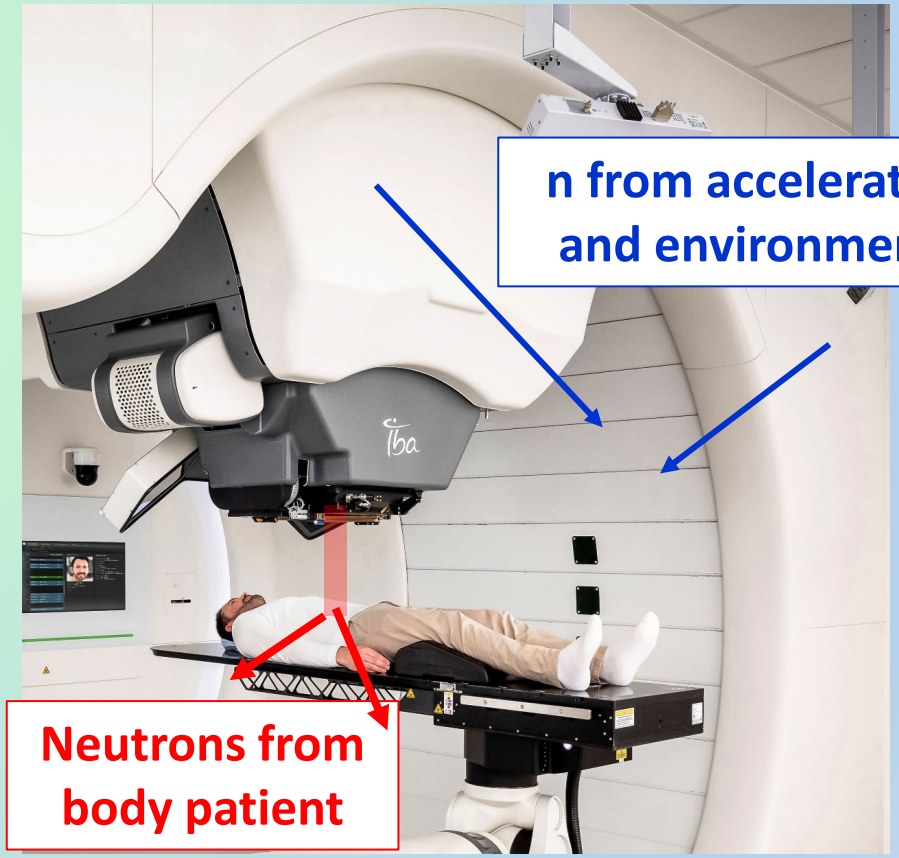
Astrophysics:

- neutron flux from sun



Hadrontherapy:

- neutron flux from human body



The measurement of the neutron direction is crucial to select signal from background

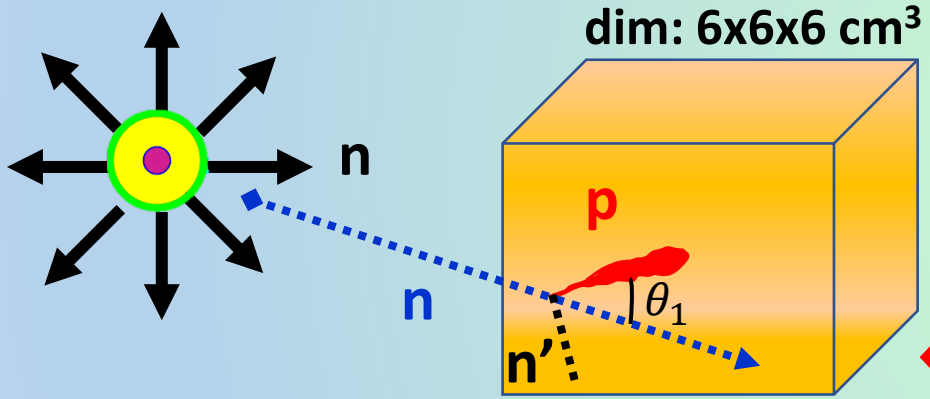
Objective

Proof of principle of a fast [5-50 MeV] neutron detector:

- **Determine their Energy and trajectory (→ momentum reconstruction)**

Known neutron source (no background)

Single scattering technique



dim: 6x6x6 cm³

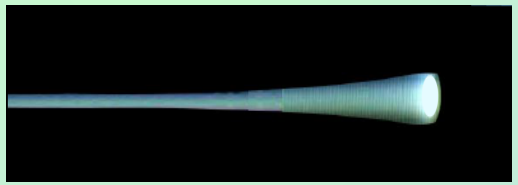
neutron direction is known

Measure neutron kinetic energy

$$E_{kin}(n) = E_{kin}(p)/\cos^2\theta_1$$

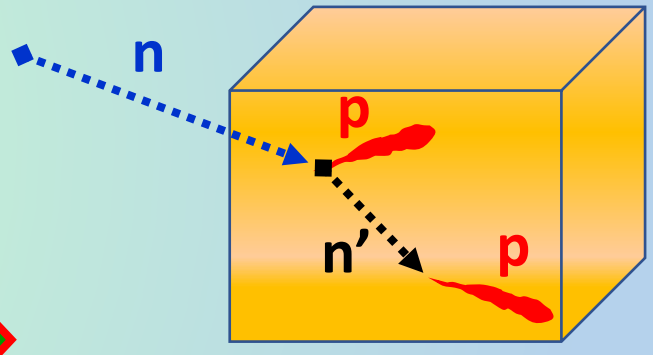
neutron momentum

In both cases, the crucial point is to determine the Bragg peak in the proton track



neutron source not known

Double scattering technique

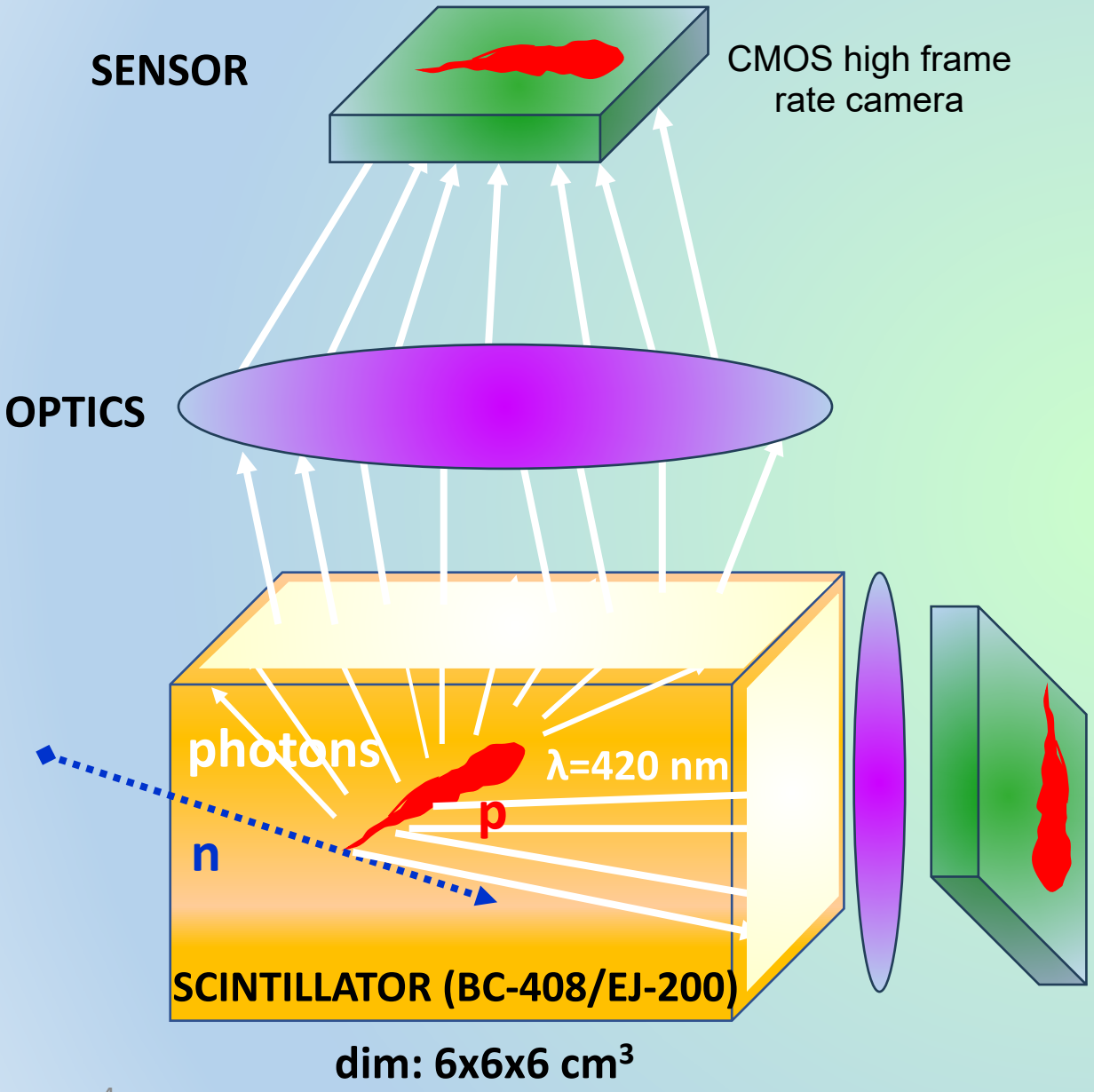


Measure neutron direction

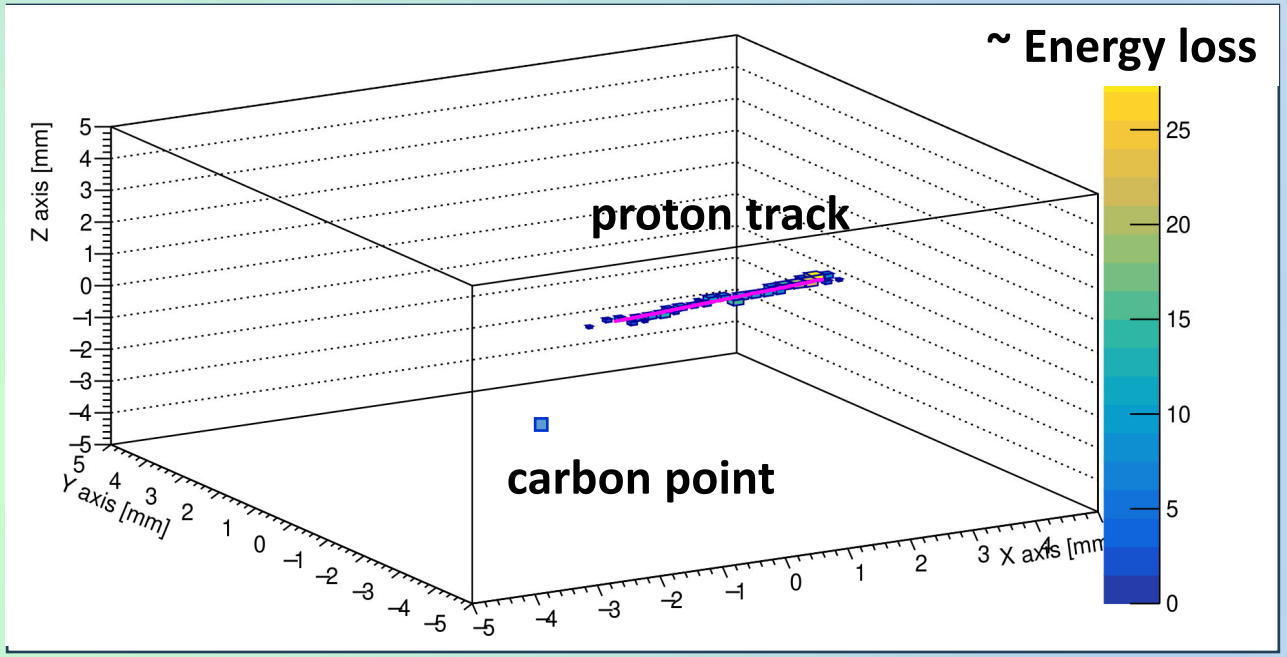
Measure neutron kinetic energy

neutron momentum

Methodology



3D RECONSTRUCTION OF THE PROTON TRACK



Different methodologies:

- Linear fit
- Principal component analysis
- Artificial Intelligence (future development)

Nome	Ruolo	FTE 2024
Console Camprini Patrizio	Ricercatore ENEA Bologna	0.5
Giacomini Francesco	Primo Tecn. CNAF Bologna	0.1
Massimi Cristian	Professore associato UNIBO	0.5
Mengarelli Alberto	Tecnologo INFN Bologna	0.2
Ridolfi Riccardo	Ass di Ricerca Bologna	0.5
Spighi Roberto	Dirig Ricerca INFN Bologna	0.5
Terranova Nicholas	Ricercatore ENEA Frascati	0.5
Musumarra Agatino	Professore Associato UNICT	0
Pellegriti Maria Grazia	Ricercatore INFN	0
Villa Mauro	Professore Ordinario	0
TOTALE FTE		2.8

Numbers

ANAGRAPHIC

Duration: 3 years

- 2024: define the detector structure
- 2025-6: detector realization and data taking

REQUESTS (keuro)

CAPITOLO	DESCRIZIONE	2024	2025	2026
Apparati	CMOS high frame rate camera (~CYCLONE 2000)	7.5	2ND CMOS: 7.5	
Inventario	2 Canon RF 35mm F1.8 IS MACRO ST	1.5	MCP if necessary) [0 -30]	
Consumo	cables, connectors, supports	1.0	Laboratory metabolism: 2	Laboratory metabolism: 2
	black box to characterize light sensors	1.0		
	lens and mirrors	1.0		
Missioni	2 in-person meetings in Bologna	1.0	In person meetings: 1	data takings: 5
Totale		13	[3-33]	7