CSN5@CNAF
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RIPTIDE

RecoIl Proton Track Imaging DEtector

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Objective

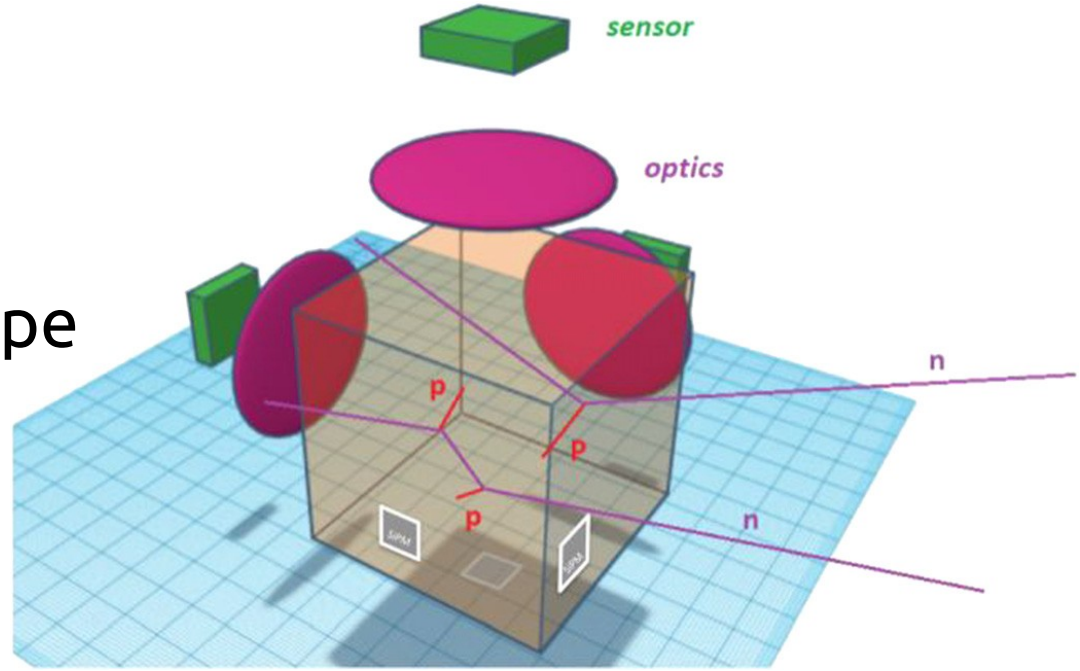
- **Build a novel recoil-proton track imaging detector in which the light output produced by a fast scintillator is used to perform a complete reconstruction in space and time of the interaction events**
- Neutron detectors are an essential tool for the development of many research fields, such as nuclear, particle and astroparticle physics (e.g. solar neutrons) as well as radiotherapy and radiation protection
- Fast neutron detection is often based on the neutron-proton elastic scattering reaction: the ionization caused by recoil protons in a hydrogenous material constitutes the basic information for the design and development of neutron detectors
- In two-body kinematics the neutron energy E_n is related to the proton recoil angle and energy (ϑ_p,E_p) by the formula

$$E_n = E_p / \cos^2(\vartheta_p)$$

- No neutron-tracker detector capable of reconstructing the momentum is in the data-taking phase right now, though several systems are under study or being developed

Detector

- The proposed prototype is a cubic plastic scintillator coupled to a system of lenses focusing the proton tracks into CMOS cameras
- The aim is to be able to detect fast neutrons, determine their energy and, most importantly, retrieve their trajectory (i.e. momentum reconstruction)
  - using single and double n-p elastic scattering
- The goal is to build and characterize a first prototype by the end of the project



People and Budget

- People mainly in Bologna
  - R. Spighi (RN) – 50%
  - C. Massimi – 50%
  - A. Mengarelli – 30%
  - R. Ridolfi – 20%
  - P. Console Camprini (ENEA) – 50%
  - F. Giacomini – 10%
    - Support to computing activities (sw development, simulation, maybe image analysis), mainly through student supervision

  + N. Terranova (ENEA, LNF) – 50%
- Estimated budget for a 3-year project
  - Instrumentation 25 – 80 k€
  - Computing 15 k€