

# Lithium Fluoride and Smart Microgels for Innovative Fluorescent Nuclear Track Detectors in Radiobiology

Nano Rome, 19-23 September 2022  
Innovation  
Conference & Exhibition

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Agenzia nazionale per le nuove tecnologie,  
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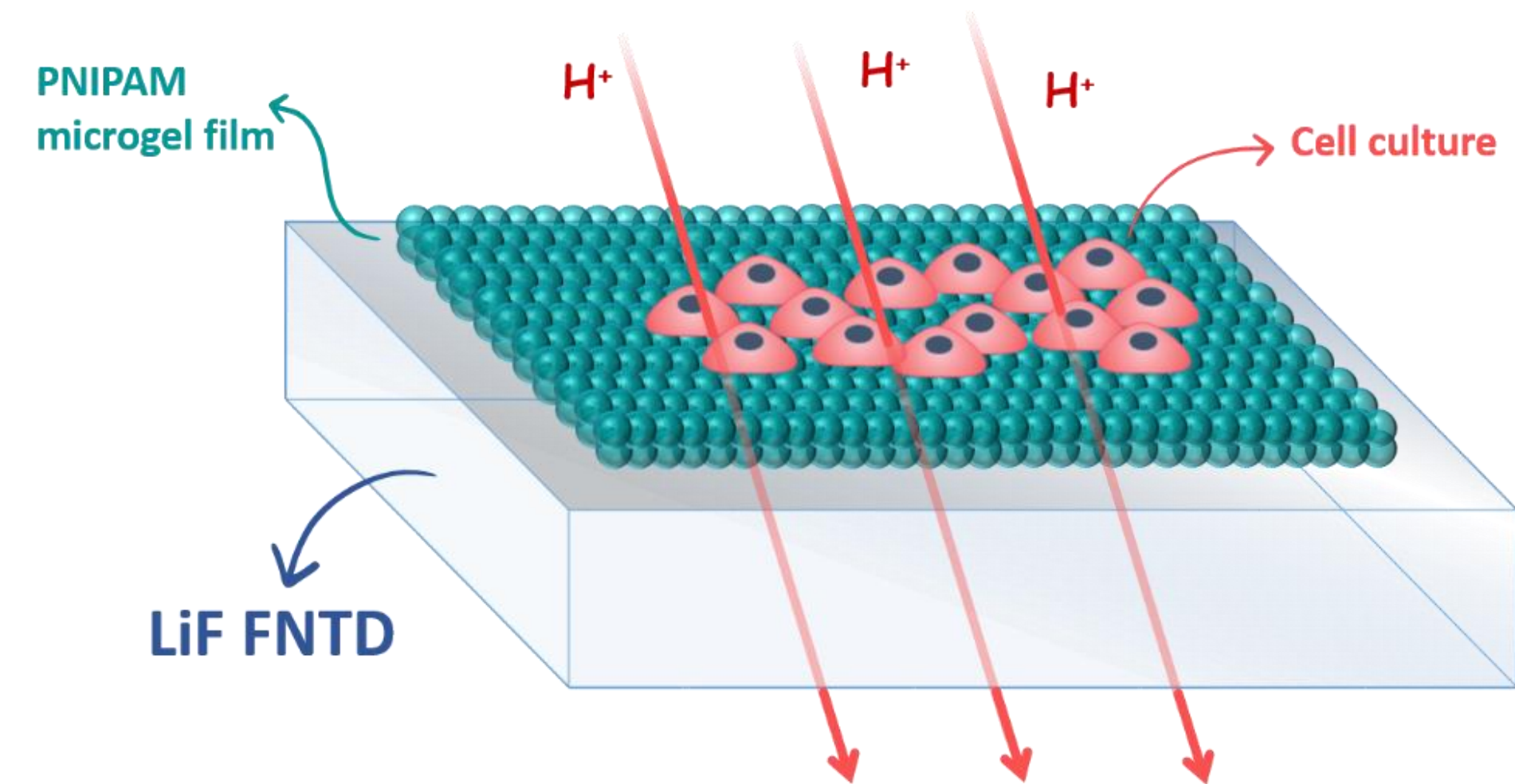
## BIOTRACK project



This work represents the study and research carried out in a wider context, the **BIOTRACK** project granted by Regione Lazio.

The **BIOTRACK** project aims at developing a new generation of Fluorescent Nuclear Track Detectors (FNTD) based on a tissue-equivalent radiation-sensitive material, lithium fluoride (LiF), with a “smart” thin film of microgels based on poly(N-isopropylacrylamide) (PNIPAM) for cell culture, that are of interest for radiobiological experiments with ionising particles.

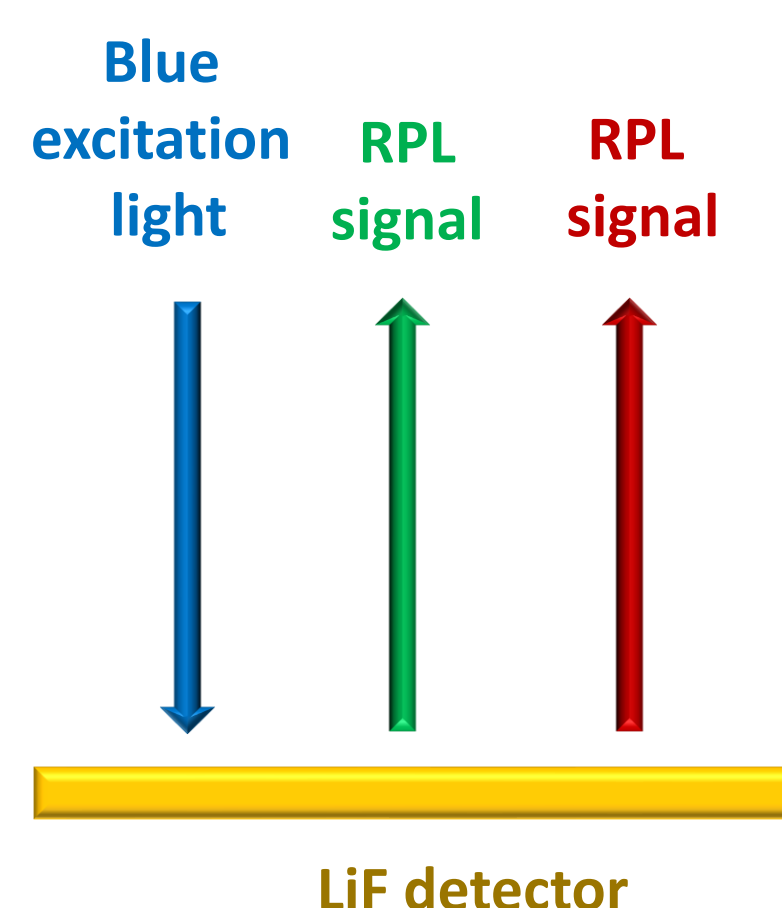
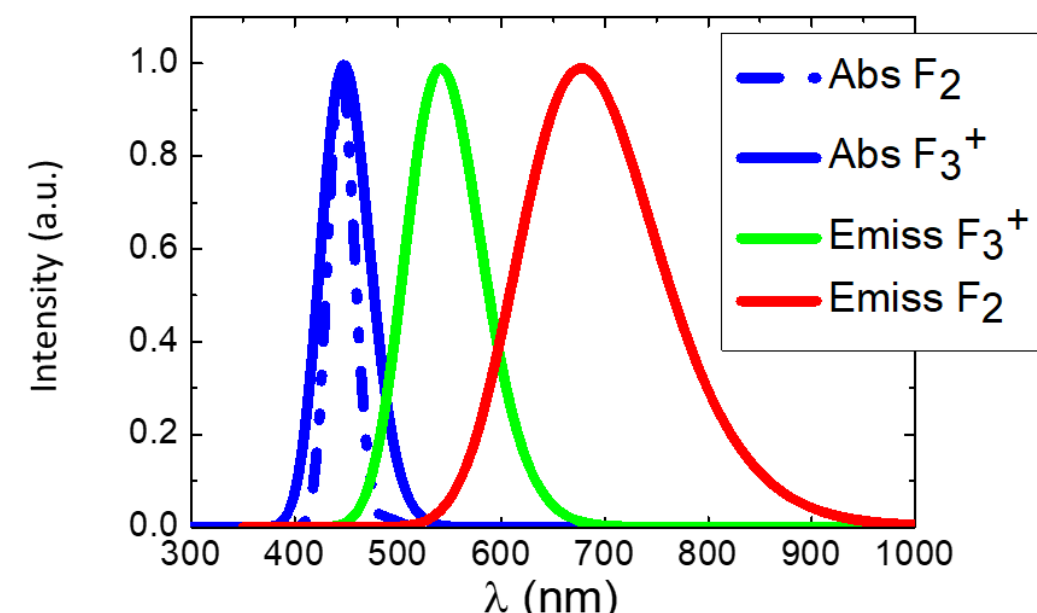
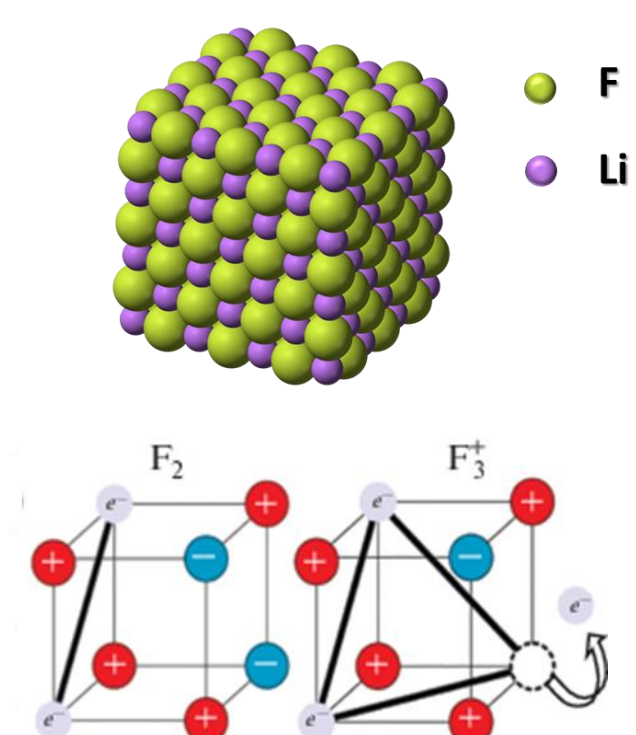
These innovative solid-state detectors – compact and with high spatial resolution – exploit photoluminescence (PL) optical readout of radiation-induced colour centres (CCs) in LiF by conventional optical and confocal laser microscopes, which are widely employed in life science laboratories. Their performances will be compared with those of conventional detectors and dosimeters.



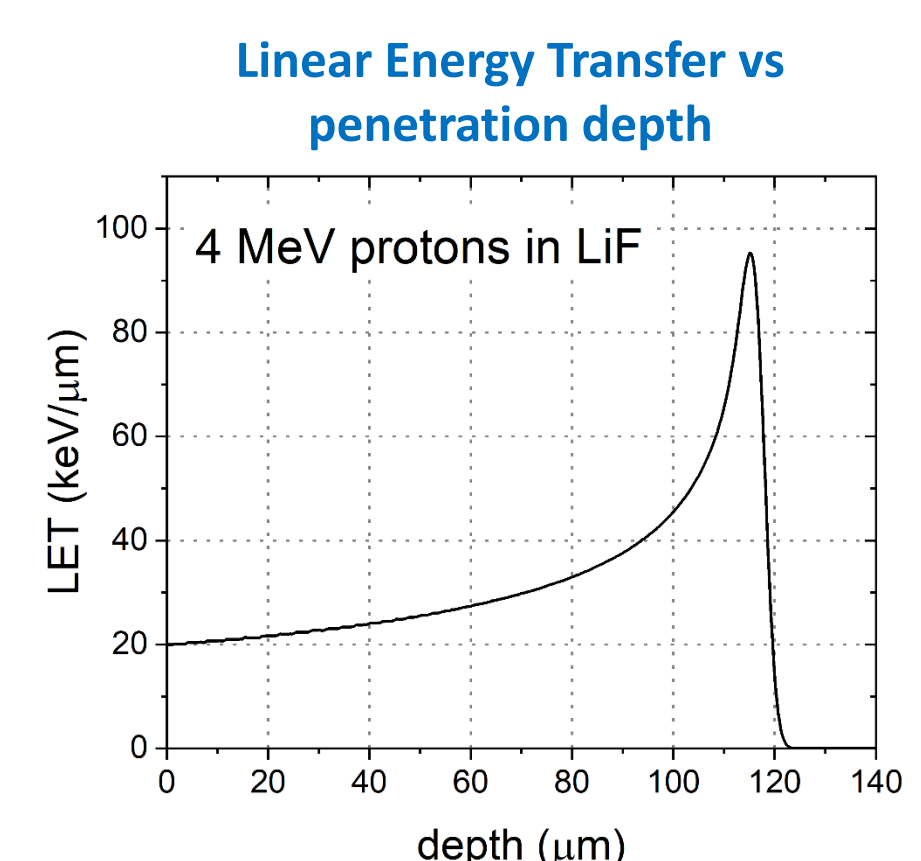
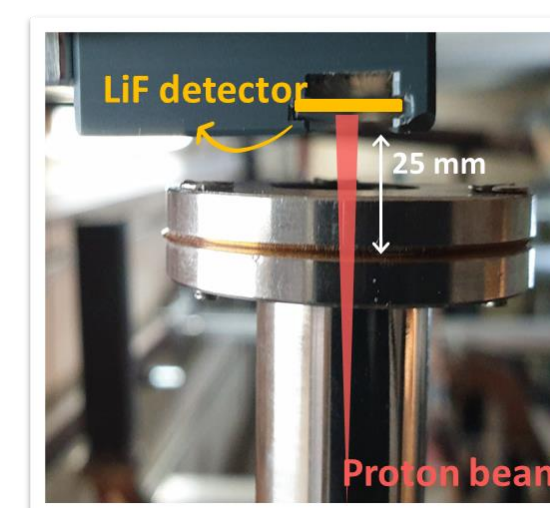
## Study and characterization of FNTDs

### ✓ FNTDs based on PL of LiF colour centres induced by ionising radiation:

- Irradiation of LiF gives rise to stable formation of CCs
- $F_2$  and  $F_3^+$  are CCs consisting in two electrons bound to two and three close anion vacancies, respectively, with overlapping broad absorption bands peaked at **450 nm**
- PL spectrum from  $F_2$  and  $F_3^+$  defects, excited with blue light, consists in two partially-overlapped broad bands peaked at **678 nm** and **541 nm**, respectively



### ✓ Proton Irradiation @ TOP-IMPLART (Vertical beamline $E_{nom} = 3 \div 7$ MeV)



$E_{nom} = 3$  MeV Dose= 1.5 Gy



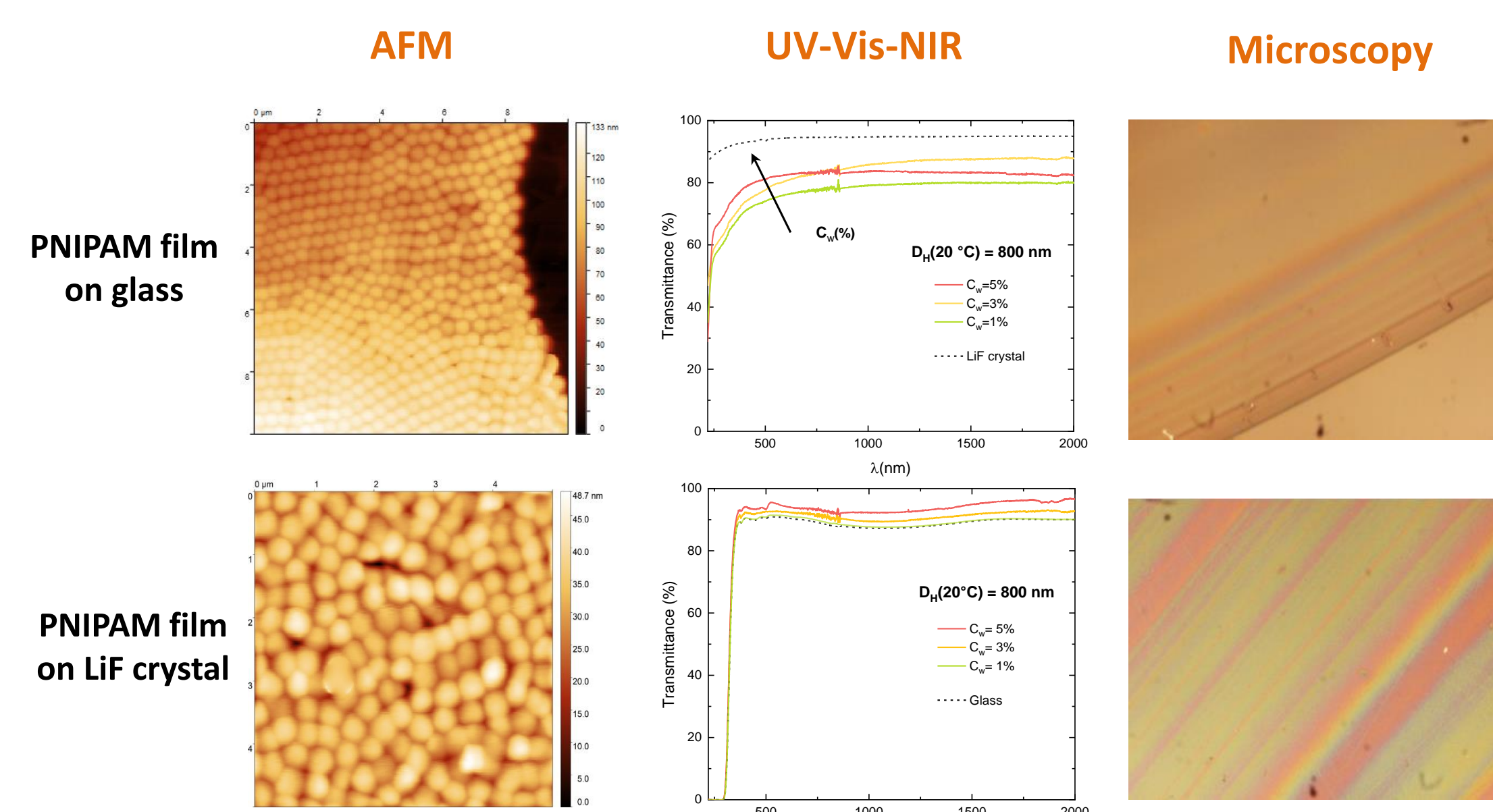
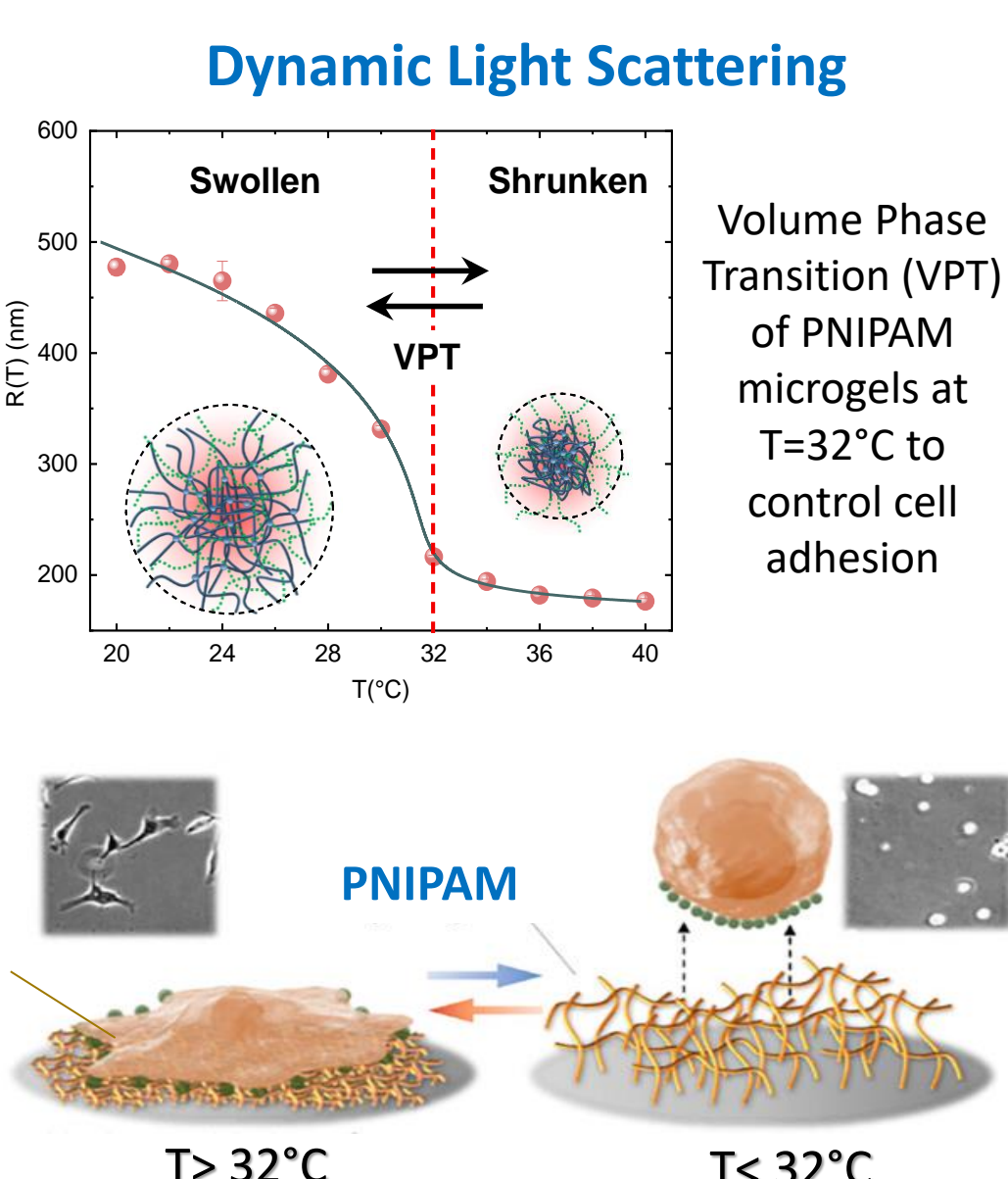
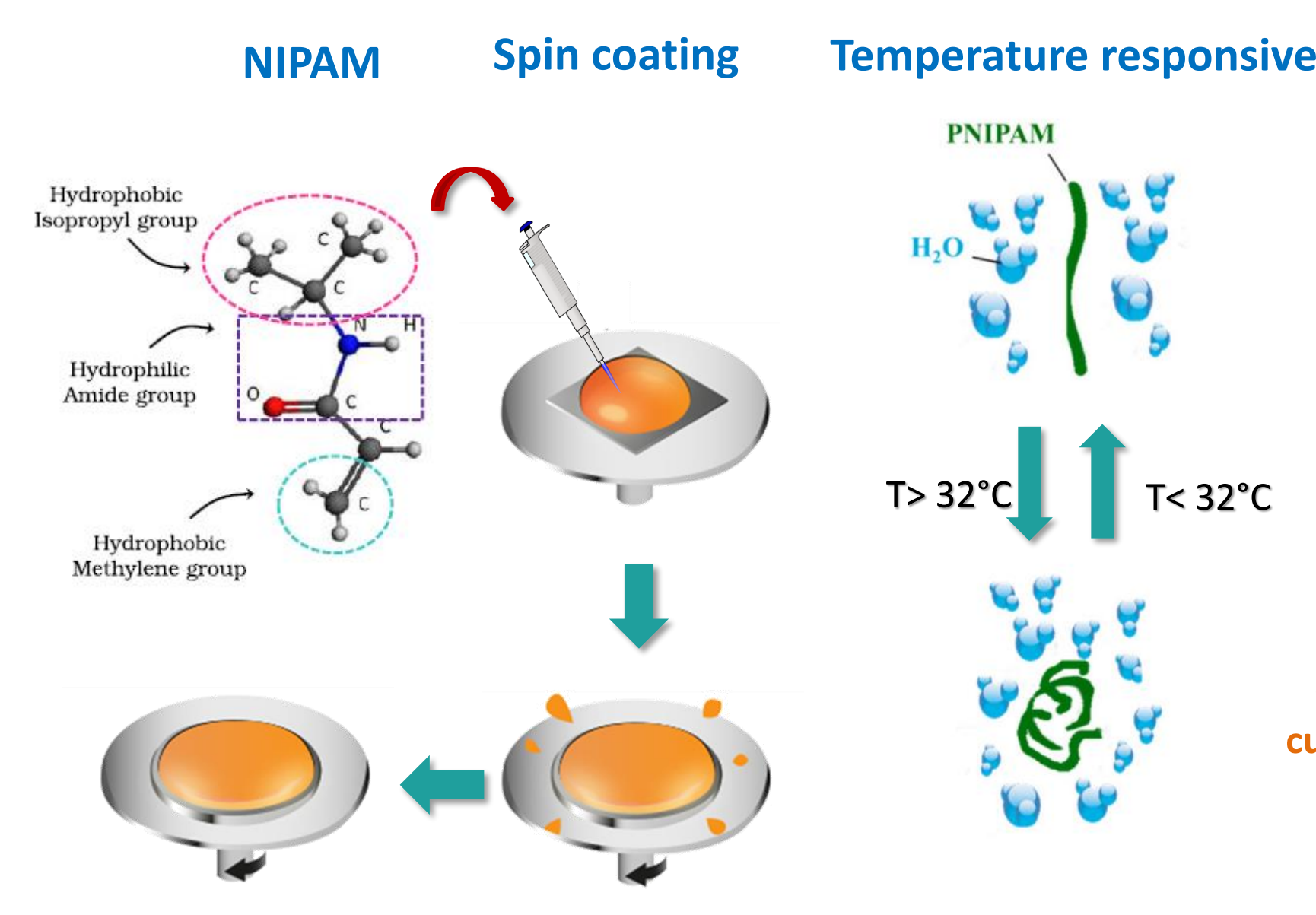
Irradiation of LiF crystals with proton beams at 3 and 7 MeV nominal energy

Local formation of CCs in LiF crystal to visualize tracks of single charged particles by fluorescence microscopy at high magnification (100x)

## Study and characterization of PNIPAM film for biocompatible FNTDs

- Functionalization through spin coating technique of LiF-based detectors with thin films of PNIPAM as **temperature-responsive cell culture surfaces**

- Investigation of morphology, thickness, roughness and optical properties of PNIPAM thin films grown on glass and LiF crystals



## Acknowledgements

This work is supported by Regione Lazio, through L.R. 13/2008, Progetto Gruppi di Ricerca BIOTRACK (Fluorescent Nuclear Track Detectors for Radiobiology) N.Prot. A0375-2020-36509.



<https://www.biotrack.enea.it>

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