

# WP3: Nuclear modeling and Monte Carlo simulations

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Istituto Nazionale di Fisica Nucleare

SPES\_MED CSN3 NUCSYS CSN4 CUPRUM-TTD CSN5

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## **WP3** activities

	WP3 - Models and simulations								
MS3.1	Report on cross-section, yields and purity modelling for Sc-47 production	$\rightarrow$		•					
MS3.2	Report on cross-section, yields and purity modelling for Tb radioisotopes				$\rightarrow$		•		
MS3.3	Report on cross-section, yield and purity modelling for Cu-67 (and possibly other theranostic nuclides)							$\rightarrow$	•
MS3.4	Report on models and simulations for target release	$\rightarrow$		•					
MS3.5	Report on models and simulations for photo-ionisation experiments	$\rightarrow$					•		
MS3.6	Report on Monte Carlo simulations of ISOL in-target production				$\rightarrow$				•
$\rightarrow$	Activity started								
•	Milestone reached	]							

Figure 28. SPES\_MED Gantt and MileStones (MS) for 2025 (Year 1), 2026 (Year 2) and 2027 (Year 3).

## M3.1 status

			Year 1		r 1		Year 2		Year 2			Year 3					
	WP3 - Models and simulations						· ///						47				
MS3.1	Report on cross-section, yields and purity modelling for Sc-47 production	$\rightarrow$			•					-			4/	S	C		
MS3.2	Report on cross-section, yields and purity modelling for Tb radioisotopes					+											
MS3.3	Report on cross-section, yield and purity modelling for Cu-67 (and possibly other theranostic nuclides)																

# ~80% completed

#### **PAPERS:**

- Bilayer target for efficient production of <sup>47</sup>Sc from proton-induced irradiation, L Canton, F Barbaro, Y Lashko, L De Dominicis, L Mou, G Pupillo, Applied Radiation and Isotopes – ACCEPTED
- Bilayer-Target Strategy for Efficient Proton-Induced <sup>47</sup>Sc Production, L Canton, F Barbaro, Y Lashko, L De Dominicis, L Mou, G Pupillo, The European Physical Journal Plus UNDER REVIEW
- <sup>47</sup>Sc production for medical applications: cross-section optimization with genetic algorithms, Y Lashko, L Canton, L Zangrando, F Barbaro, Journal of Physics G: Nuclear and Particle Physics - UNDER REVIEW

### TALK & POSTER:

- Smart Tuning of <sup>47</sup>Sc Production: Genetic Algorithms Meet Nuclear Data, F Barbaro, L Canton, Y Lashko, <u>L Zangrando</u>, Workshop sul Calcolo nell'INFN, La Biodola, 26<sup>th</sup>-30<sup>th</sup> May 2025
- Optimizing Nuclear Cross-Section Data for <sup>47</sup>Sc Production Using Genetic Algorithms, <u>L Canton</u>, F Barbaro, Y Lashko, L Zangrando, ND2025, Madrid, 22<sup>nd</sup> 27<sup>th</sup> June 2025
- Assessing the Viability of <sup>49</sup>Ti(p,x)<sup>47</sup>Sc for Medical Applications: A Genetic Algorithm Approach, <u>Y Lashko</u>, F Barbaro, L Canton, L Zangrando, IWNT42-2025, Rila, 29<sup>th</sup> June-5<sup>th</sup> July 2025



## M3.4 and M3.5 status

MS3.4	Report on models and simulations for target release	$\rightarrow$		•					
MS3.5	Report on models and simulations for photo-ionisation experiments	$\rightarrow$					•		
MS3.6	Report on Monte Carlo simulations of ISOL in-target production				Ť				•

#### • M3.4: Simulations of magnesium-28 release from the target are currently in progress.

- At this stage, they are running locally, to validate the correct implementation of silicon carbide (SiC) disks in the model.
- The work is being carried out by Sara Luise, a BSc Physics student, under the supervision of Sandra Moretto and Alberto Arzenton.

### • M3.5: Calculations for laser photo-ionization are also ongoing.

- A previous study on silver conducted by the laser group is currently under review.
- Similar studies on gallium and scandium will soon be performed by another BSc student, Roberto Gazzola, also supervised by Sandra Moretto and Alberto Arzenton.
- PAPER: Laser isotope separation and ion yield of 111Ag for medical use in the SPES-ISOLPHARM project., A. Arzenton, E. Mariotti, D. Scarpa, O. S. Khwairakpam, P. Nicolosi, D. Serafini, L. Mariotti, A. Andrighetto., Applied Radiation and Isotopes UNDER REVIEW

## **SPES-MED Computing Infrastructure status**

- Due to a communication gap with the INFN Gruppo 3 Computing Committee, we were only recently informed that our request for computing resources had been approved and allocated on CloudVeneto.
- The assigned resources 140 CPU cores, 512 GB RAM, and 10 TB of storage have now been successfully
  integrated into the production Kubernetes infrastructure of CloudVeneto. These resources will be made available
  to the LARAMED and ISOLPHARM groups starting next week.
- Despite the delayed access, we successfully met M3.1 by leveraging the legacy infrastructure from the REMIX project. Approximately 80% of the simulations related to 47Sc production have been completed; the remaining 20% will be executed on the newly available CloudVeneto resources.
- As for the other milestones:
  - M3.2 preliminary work Master Thesis Luca Grassi (supervisors L. Canton, F. Barbaro, L. De Nardo) and future simulations by CloudVeneto
  - M3.3 preliminary work Master Thesis Giovanni Frezzato (supervisors L. Canton, F. Barbaro) and future simulations by CloudVeneto
  - M3.4 is expected to begin using CloudVeneto in July.
  - M3.5 does not require CloudVeneto resources.
  - M3.6 is planned to begin using CloudVeneto starting from Year 2.

