IFIGENEIA

Innovative Facility for Isotope GENeration with Efficient Ion Accelerator

T4.2 Identify best radionuclides for production with LINAC

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Kick-off meeting
3-4 April 2025
Thessaloniki, Greece

This project has received funding from the European Union's Horizon Europe Framework Programme for Research and Innovation under grant agreement no 101186921.

T4.2 Description

T4.2 Identify best Isotopes for production with LINAC (M5-M42) [Leader: UL]

1. Analysing of precise nuclear data

2. …. for the selection of suitable radionuclides (target materials);

3. Investigating chemical forms and separation methods (high yields, activity scale, radiation stability), (+technical concept of the target materials)

4. Considering radiation safety and material recovery

T4.2 Description

T4.2 Identify best Isotopes for production with LINAC (M5-M42) [Leader: UL]

FOCUS:

A. Radiolanthanides as main candidates? Others?
B. Aim to support preclinical research and clinical uptake (the relevance and robustness of performed preclinical experiments) to **simplify their supply and utilization in the clinics**.
C. Expand reactor-based production (not cyclotrons – LINAC)
D. Identify both established and novel radionuclides

T4.2 Identify best Isotopes for production with LINAC

Start Date:	**M5**	**Task Leader:**	**UL**
End Date:	M15-42-48	**Task Contributors:**	UL, ?

Del.	Deliverable Title	Lead Partner	Diss. Level	Due On
D4.2	Report for the identification of the best candidate isotopes for each of the three application areas: theranostics, therapy and diagnostics	UL	SEN - Sensitive	15 (42)

Mx	Milestone Title	Lead Partner	Mean of verification	Due On
4	Pilot pre-clinical studies finalization	6 - GNP	D4.3	48

T4.2 Methodology

1. Stepwise Approach: Data Collection – Nuclear data (LINAC: cross-sections, half-life, emissions)
2. Feasibility Assessment – LINAC energy & target compatibility
3. Radionuclide Prioritization – Focus on:
   - Therapeutic radionuclides (e.g. Lu-177, Tb-161 etc.?)
   - Diagnostic emitters
   - Theranostic pairs (main focus in UL partners)
4. Process Optimization – Target design, chemical form, separation
5. Validation & Selection – Recommend radionuclides for pilot testing

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Context & Motivation

Why LINAC?*

Reactor production is declining, needs are increasing

LINACs are compact, tunable, and eco-friendly

Enable local production in hospital or R&D settings

Address the supply gap for *medium/long-lived* radionuclides

New radionuclides may open doors for next-gen radiopharmaceuticals

*Inspired by the NUSANO LINAC model (starting 2025)

Radionuclides Candidates

Targeted Radionuclides to Discuss:

Lu-177: well-established therapeutic, growing demand

Mo-99/Tc-99m: traditionally reactor-based generation

Tb-161: longer-lived promising alternative for therapy

(compared vs. cyclotron generated ones)

Y-86/Y-90, Sc-44/Sc-47: theranostic options

Potential new radionuclides (to be evaluated based on LINAC feasibility)

➡️ Focus on beta emitters, theranostic pairs, longer-lived radionuclides

(compared vs. cyclotron generated ones)

➡️ Limit selection to 1–2 new isotopes for feasibility

T.4.2 Timetable - Resources

- Task 4.2 Timeline: M5 – M42

Phase	Months	Description
Survey & selection	M5–M12	Literature, cross-sections, database
Feasibility study	M13–M24	LINAC compatibility
Separation strategy	M18–M30	Chemistry, recovery
Final selection	M30–M36	Candidate isotopes for pilot
Reporting	M36–M42	Deliverables, protocol input to WP4

Resources Involved:UL, WP3 coordination, inputs to/from T4.1–T4.5

Interactions with other Tasks

- **Collaboration is key:**
- **WP3**: LINAC design and target irradiation feasibility
- **T4.1**: Legal and regulatory harmonization – laboratory safety
- **T4.3–T4.5**: Radiochemistry, preclinical studies, clinical translation
- **WP5**: Strategic investment (scaling up production)
- **Deliverable contributions:**
- Protocols for Lu-177 and Mo-99
- Input for new radionuclides validation

Strategic Alignment

- From the **Slovenian team's standpoint**:

✔ LINAC **does not replace** cyclotron
✔ LINAC **can expand** reactor-based production of new radionuclides
✔ Aim to **introduce new radionuclides** – potential for theranostic use
✔ Must consider both **known radionuclides** (Lu-177, Mo-99) and **emerging ones**

- 🎯 **Goal**: Practical, feasible set of radionuclides for the lab (WP4)

Next Steps

- **1. Coordinate with WP3** to get technical LINAC parameters:
  - technical parameters that define LINAC-produced radionuclides
- **2. Define technical radionuclide shortlist** – focus on availability & impact
- **3. Cross-check with known medical demand** (interviews?)
- **4. Contribute to planning pilot production protocols (T4.3–T4.5)**
- **5. Align with regulatory & infrastructural planning (T4.1, WP5)**