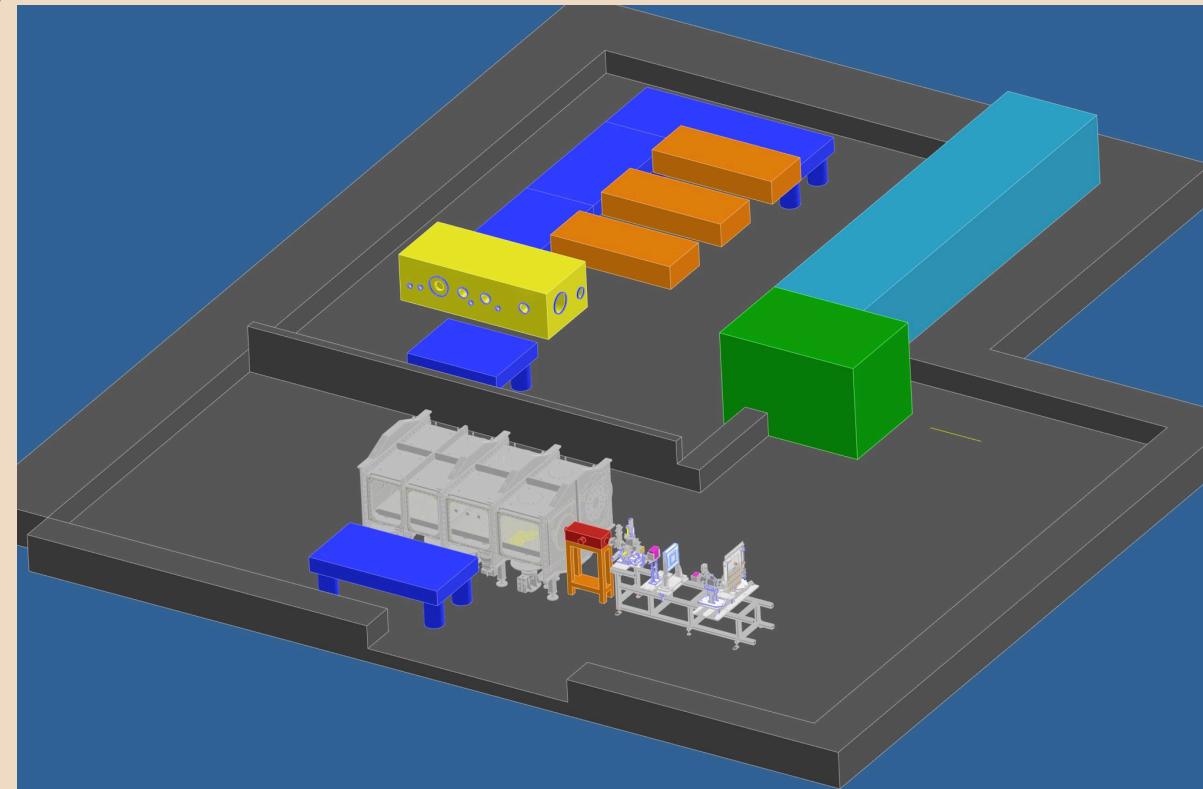


High power laser program at INFN- LNS

EuAPS kick-off meeting

GAP Cirrone, R Catalano, G Cuttone,
S Passarello, G Petringa, S Tudisco,





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WP3

HIGH POWER LASER BEAMLINE



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WPs Organisation

- T3.1 Clean room realization
- T3.2 Laser design and realization
- T3.3 Target system for high repetition rate (up to 10 Hz)
- T3.4 Plasma Diagnostics
- T3.5 Secondary beam diagnostic



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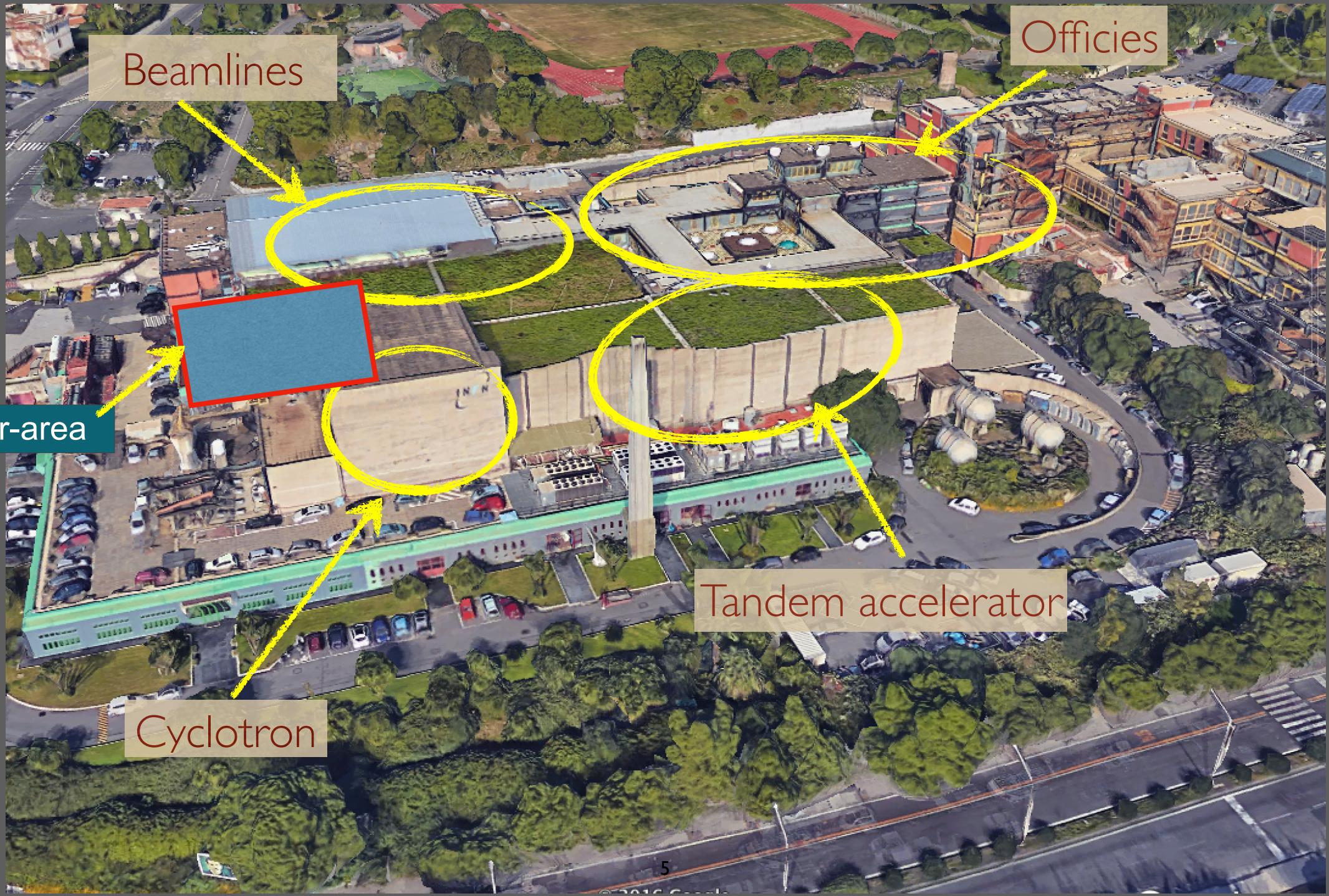


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WP 3	High Power Laser beam line (INFN-LNS)					
Task		Deliverables			Milestones	
3.1	Clear room realisation	D3.1.1	Infrastructure realisation	M24	M3.1.1	Clean room design
					M3.1.2	Procurement and first payment
					M3.1.3	Second payment
					M3.1.4	Third payment
					M3.1.5	Assembling, commissioning and fourth payment
3.2	Laser design and realisation (PW scale/10 Hz)	D3.2.1	Laser design procurement and installation	M30	M3.2.1	Laser Design
					M3.2.2	Procurement and first payment
					M3.2.3	Second payment
					M3.2.4	Third payment
					M3.2.5	Assembling, commissioning and fourth payment
3.3	Target system for high repetition rate (up to 10 Hz)	D3.3.1	Design and realisation of the target system	M30	M3.3.1	Design and procurement
					M3.3.2	Realization and test
3.4	Plasma diagnostic	D3.4.1	Plasma diagnostic: acquisition and installation	M10	M3.4.1	Design and procurement
3.5	Secondary beam diagnostic	D3.5.1	Secondary beam diagnostic: acquisition and installation	M30	M3.5.1	Design, procurement and mechanical realisations of diagnostic
					M3.5.2	Calibration under conventional beams





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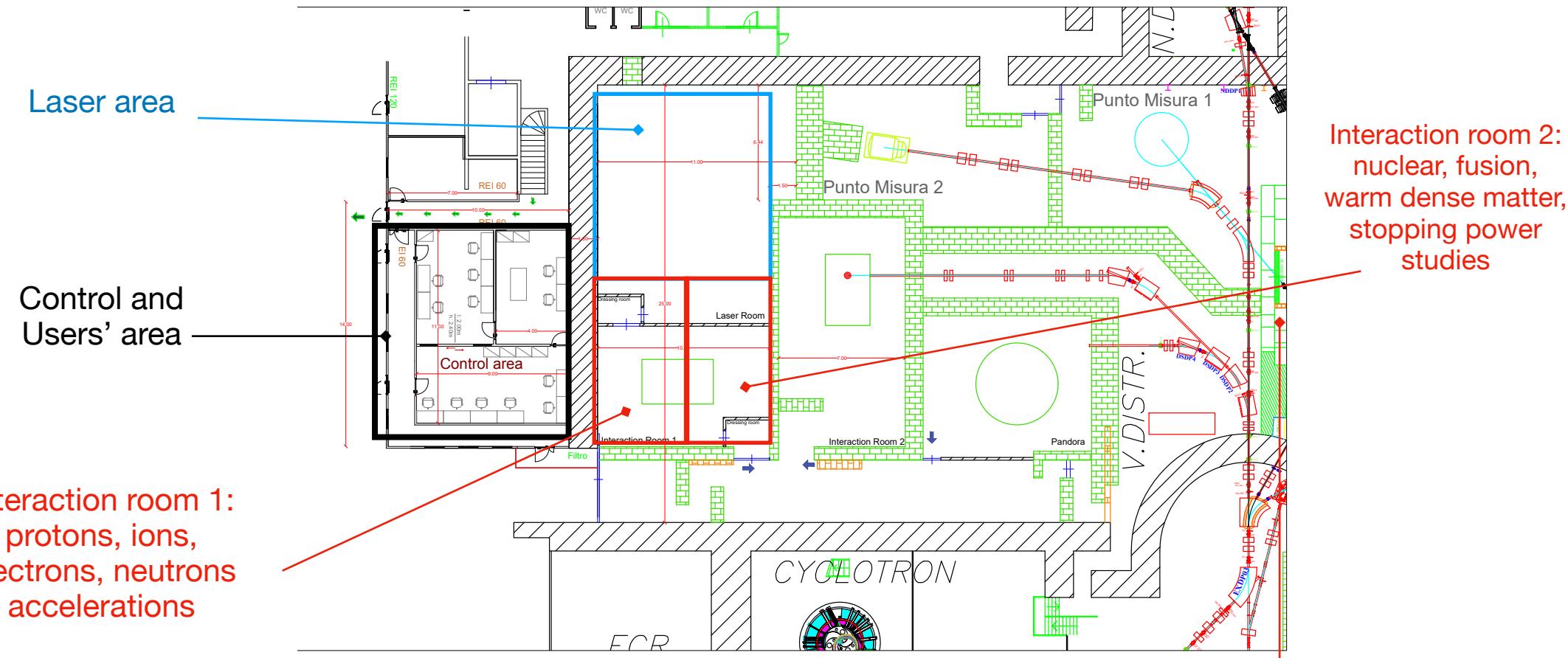


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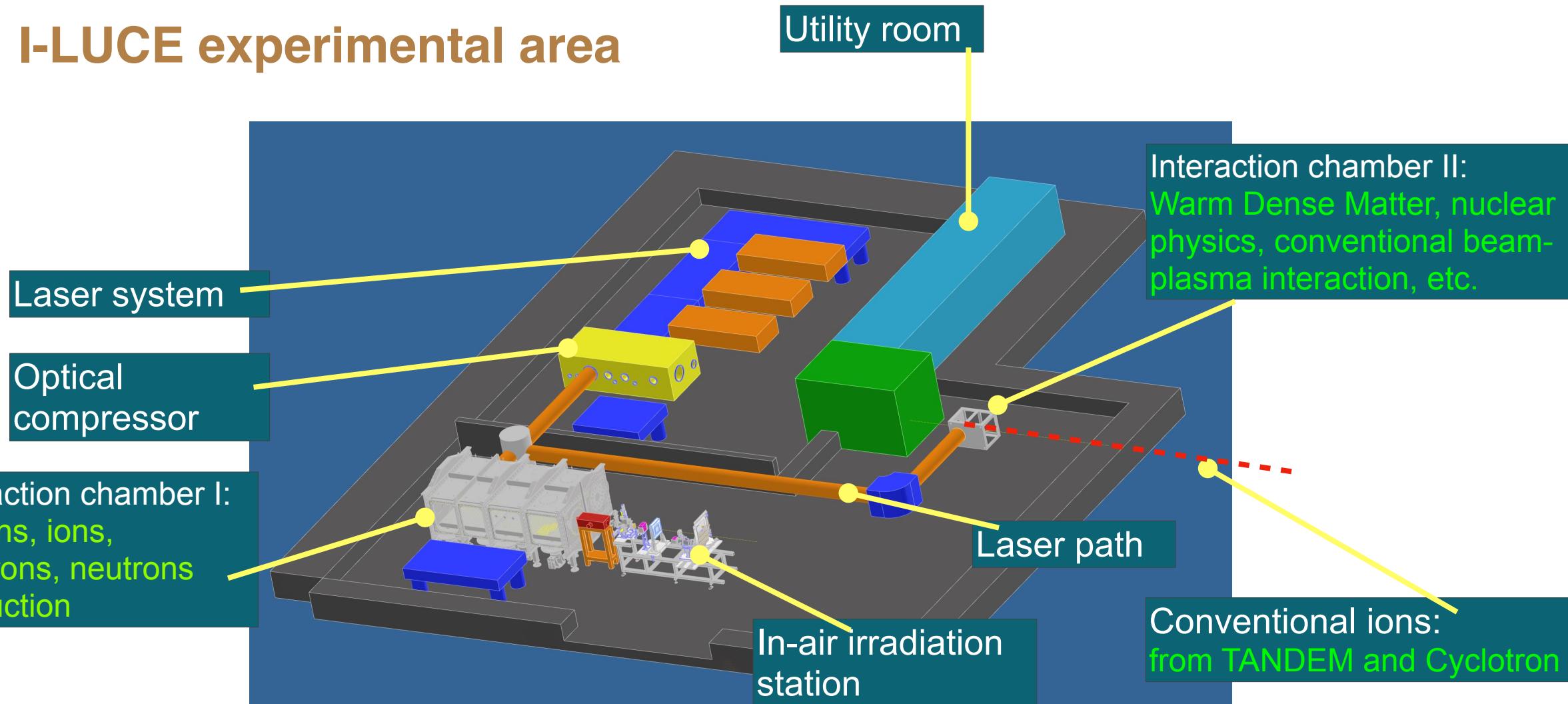
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I-LUCE area



I-LUCE experimental area



First implementation phase

8

- **Two laser beamlines:** pulse duration < 23 fs
- **Low repetition rate high-power:** 1 Hz up to 350 TW
 - ▷ Power density at the target: $> 1.25 \cdot 10^{21} \text{ W/cm}^2$
 - ▷ $I^* \lambda^2: > 8 \cdot 10^{20} \text{ W} \cdot \mu\text{m}^2/\text{cm}^2$
 - ▷ Proton beams: max energy 50 MeV;
 - ▷ Proton fluence: $5 \cdot 10^{11} \text{ MeV}^{-1} \text{ Sr}^{-1}$
 - ▷ Electron beams up to 3 GeV
 - ▷ X-Rays, neutrons
- **Higher repetition rate, lower power:** >10 Hz, > 50TW
 - ▷ Specific power at the target: $> 2.9 \cdot 10^{20} \text{ W/cm}^2$
 - ▷ $I^* \lambda^2: > 1.33 \cdot 10^{20} \text{ W} \cdot \mu\text{m}^2/\text{cm}^2$
 - ▷ Proton beams: max energy 6 MeV;
 - ▷ Proton fluence: $5 \cdot 10^{11} \text{ MeV}^{-1} \text{ Sr}^{-1}$
 - ▷ Electron beams up to 500 MeV
 - ▷ X-Rays, neutrons



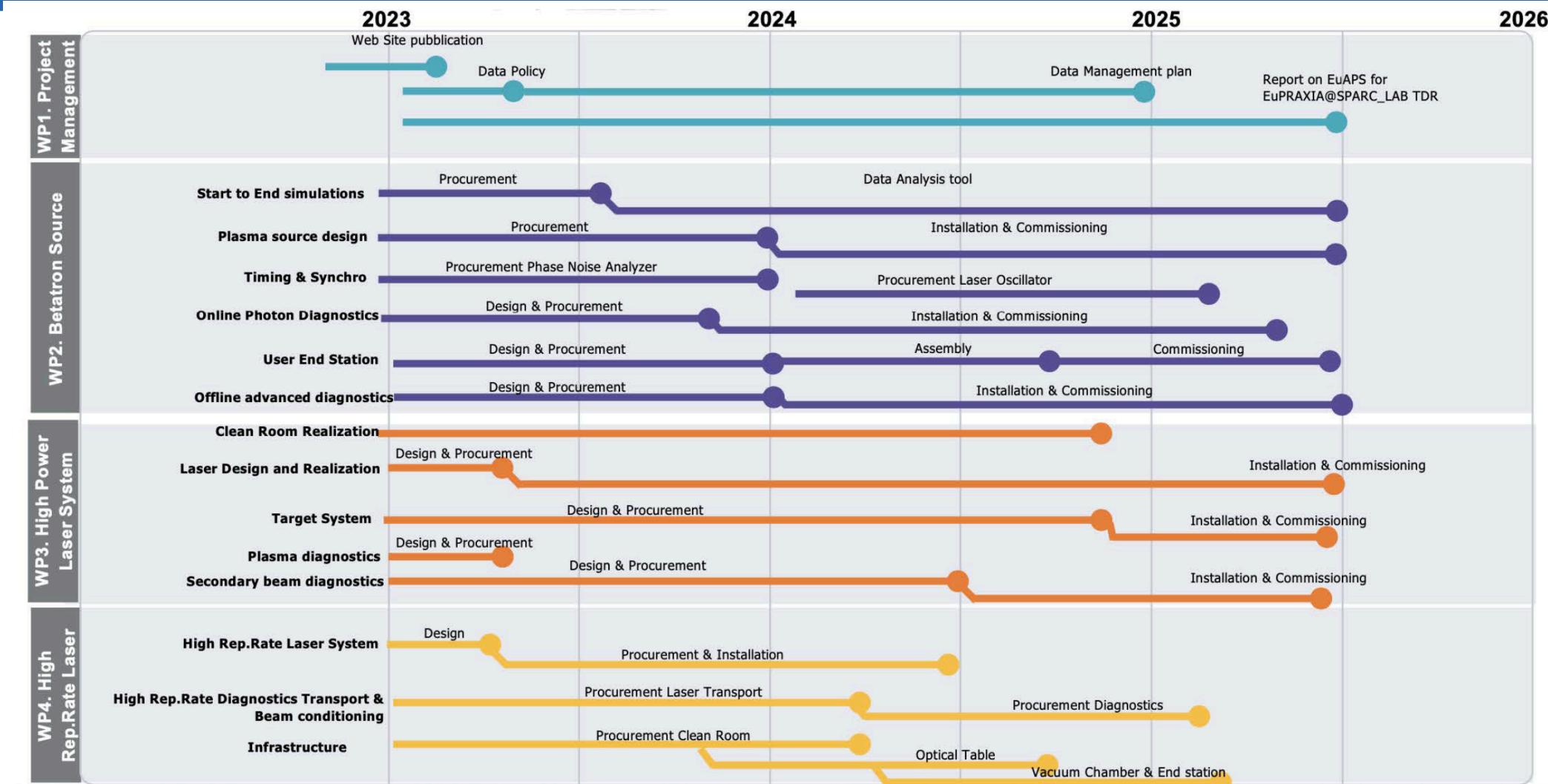
We are discussing the possibility to increase the duration of the laser pulse to the **ps level**



- Nuclear reactions in plasma
- Stopping power in plasma
- Nuclear decay
- Inertial fusion
-

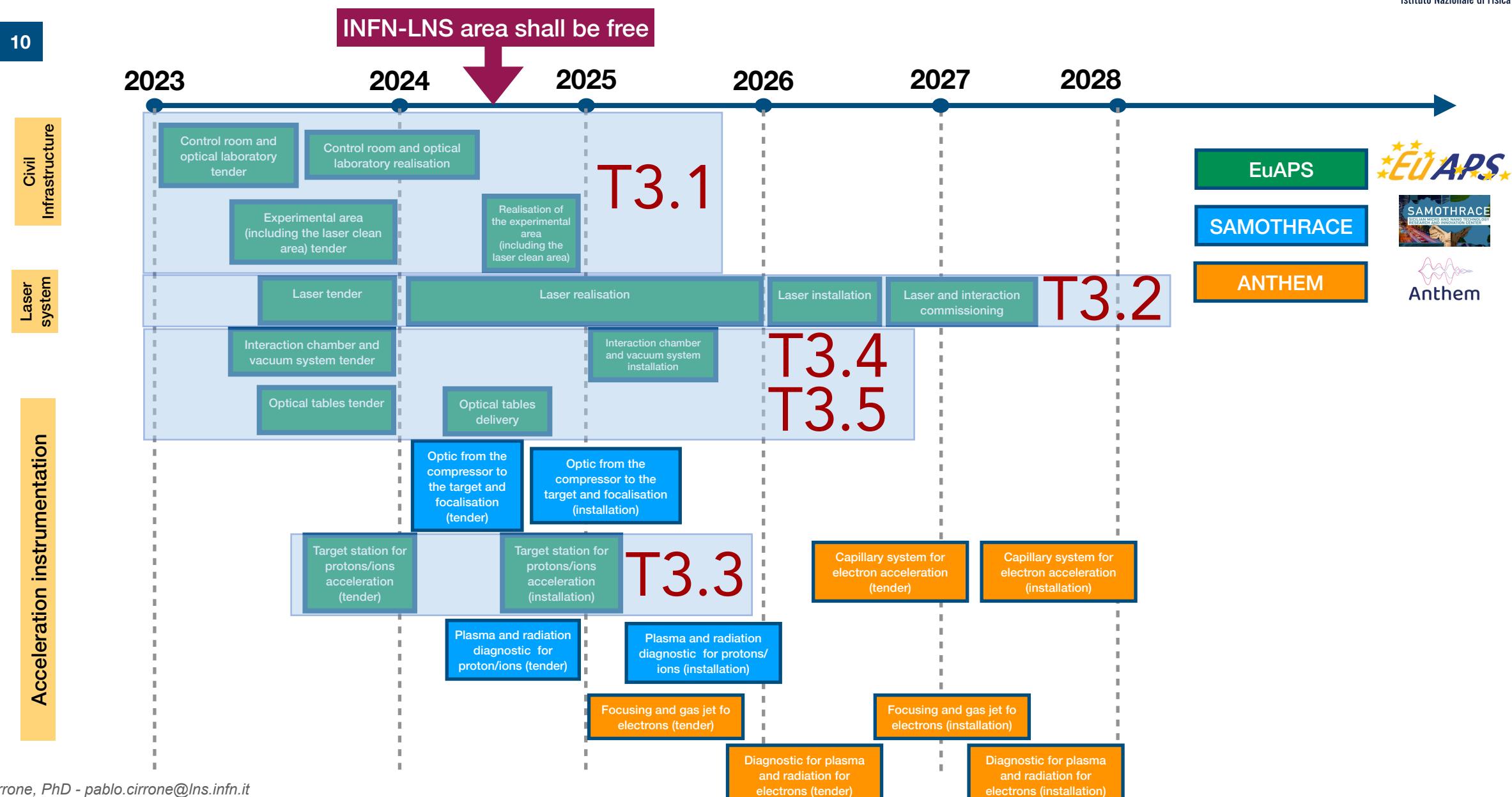
Second phase

The laser system will be ready (oscillators, optics, compressor chamber, etc.) for an upgrade to 500 TW at the cost of 2.0 M€



I-LUCE time scale

10





Risks

- Tender procedures and **time scale**
 - In particular for EuAPS
- **Clearance and availability of the LNS areas** in June 2024
 - In June 2024 we expect to start the clean-area and experimental area installation
 - Shielding for radio-protections and facilities
- **Optical laboratory** shall be ready before the shipment of the laser front-end
- **Additional funds** for the experimental area perhaps needed (150 K€) as control area cost was underestimated

Tenders status

Tender	Status	Task
Control area	Waiting for Intellera	T3.1
Clean and experimental area	In discussion with the technical division	T3.1
Laser system	Administrative steps concluded; Technical proposal almost completed;	T3.2
Interaction chambers	Administrative steps concluded; Technical proposal ongoing;	T3.3 T3.4 T3.5