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STEP Liquid Metal Armour Overview

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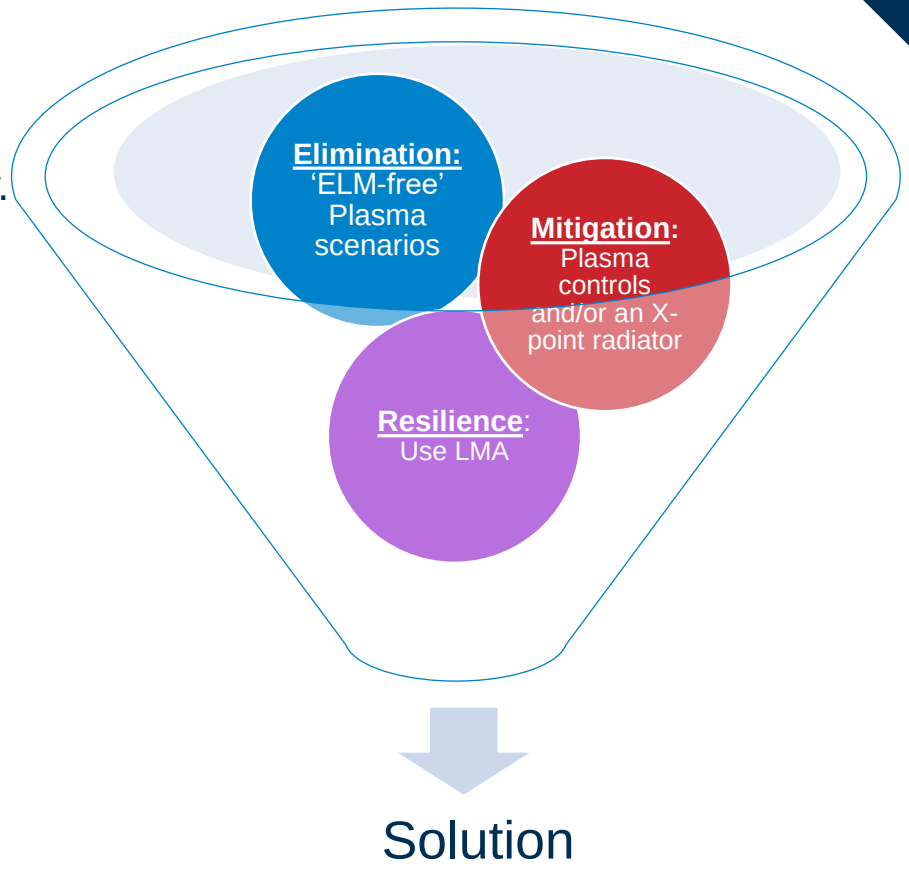
Background to STEP programme's interest in Liquid Metal Armours

- The main goal is to deliver the STEP Prototype Powerplant (SPP) by 2040.
- Long term powerplant operations are key to demonstrate commercial feasibility.
- Large power transients, in particular Edge Localized Modes (ELMs) pose risk to long term divertor operations, thus power plant operations.
- Sn Liquid metal armours (LMA) along with other approaches gives us the best chance to achieve long term divertor operations for the SPP.
- There are other areas in which LMA could be applied such in Limiters.
- Development of LMA needs to be accelerated in order to be feasible for STEP.



STEP Divertor – LMA placement

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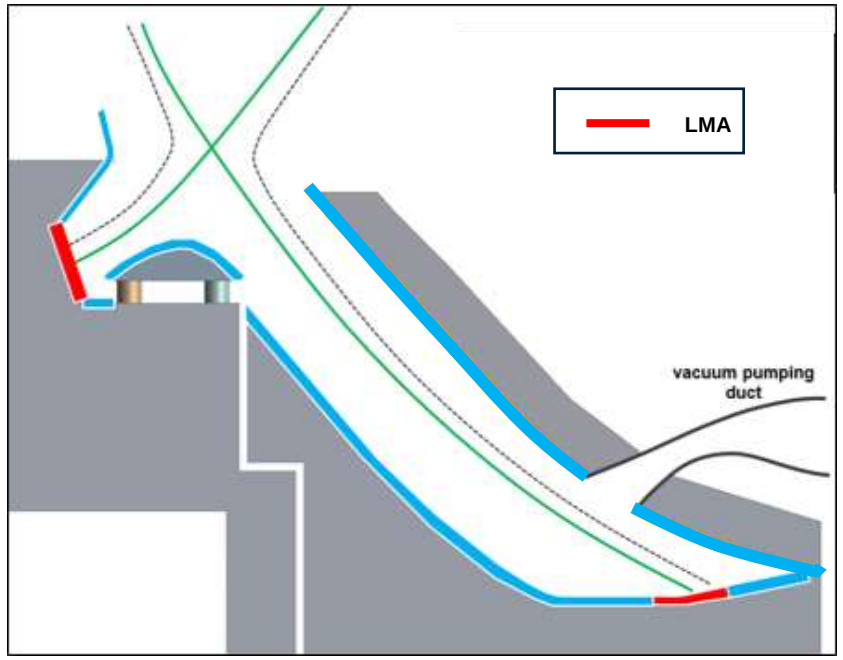
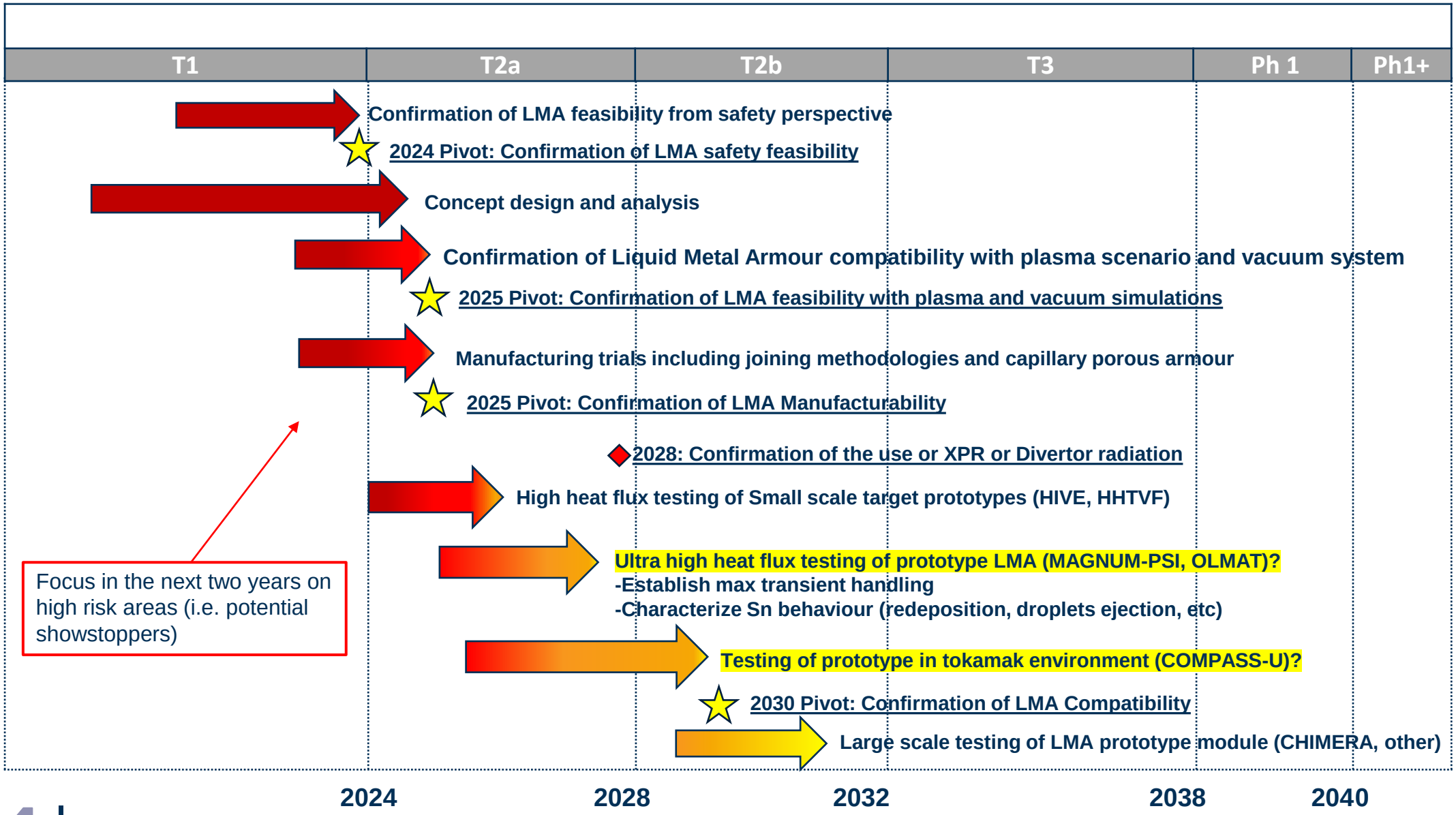
The STEP Divertor will use LMA at the strike points:

- Balance to be found between maximising coverage to ‘catch’ all transient loads, but minimising coverage to reduce evaporation/contamination concerns
- Further refinement required



Indicative LMA placement for STEP

STEP Liquid Metal Armour Preliminary Roadmap



Areas of common interest with EU DEMO

- CPS manufacturing
- CPS Joining to heat sinks
- PFC design
- Capillary flow, particularly MHD/TEMHD effects
- Sn handling and safety
- Sn effect on plasma (e.g. transport to the core, droplet ejection)
- Sn effect on vacuum systems
- Plasma – surface interactions (e.g. droplet ejection, hydrogen retention etc)
- LMA placement
- LMA integration
- Simulation of LMA performance and experimental benchmarking (e.g. vapour shielding, transport to plasma core)
- Testing of LMA in a Tokamak environment

Potential ways to work together

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- **Resources** to accelerate development (e.g. design, manufacturing, simulation).
- **System Integration work** (e.g. LMA tin supply)
- **System Lifecycle assessment** (operations, maintenance and waste in powerplant)
- **Safety assessments** – (e.g. Tin handling, tin/water (steam) interactions)
- **Testing facilities** (e.g. CHIMERA and HIVE)
- Development of **supply chain**
- **Raise profile** of LMA

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- Advanced **LMA target development**
- **Manufacturing** of CPS
- **Plasma transport simulations**
- **Testing facilities** (e.g. OLMAT, COMPASS-U, GLADIS)