

Tritium on graphene for Ptolemy

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Nijmegen - Ptolemy Coll meeting

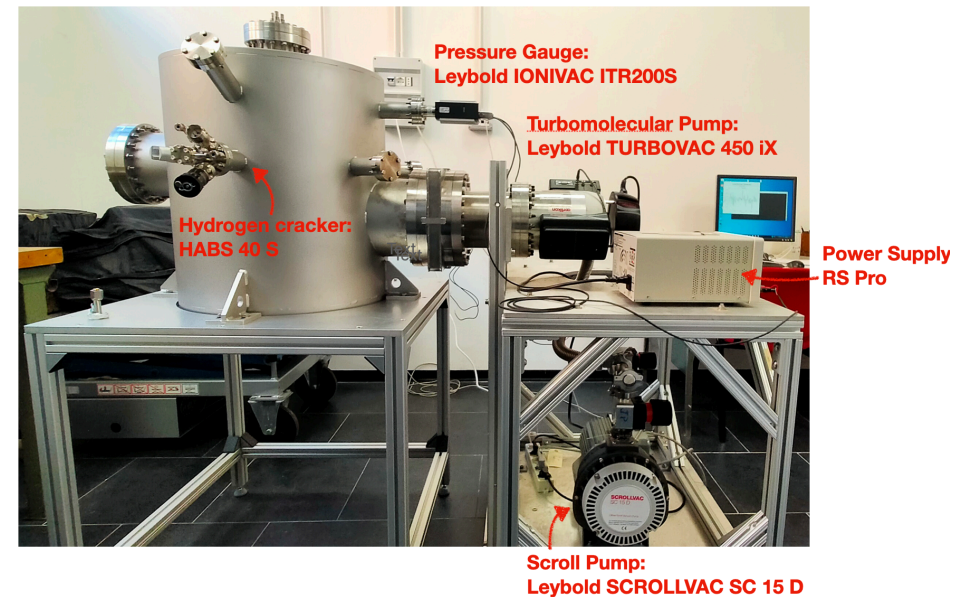
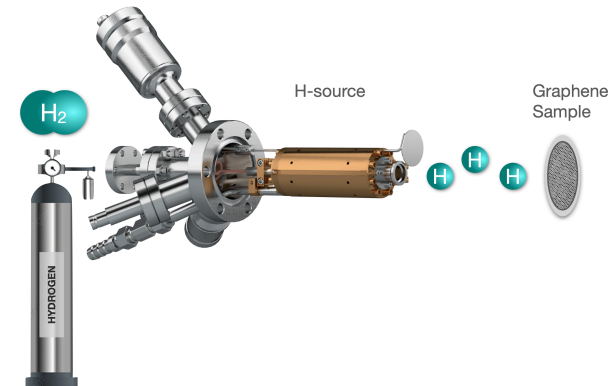
Goals

- ▶ Have a **<1 GBq solid atomic tritium** target
- ▶ Use **carbon nanostructure** as **substrate**
 - ▶ *Well defined **position** and well defined **potential** in the Ptolemy demonstrator*
- ▶ Demonstrate the solid target is **stable** (i.e. no tritium release) at **room temperature**
 - ▶ Already done with hydrogen (*paper submitted*)
 - ▶ To be certified according to radio-protection standards (in Italy)
- ▶ **Measure radioactivity**

Solid atomic tritium target

M.G.Betti et al. Nano Lett. 2022, 22, 7, 2971–2977

- ▶ Exploit expertise in graphene hydrogenation
 - ▶ *thermal H_2 cracking in vacuum*
- ▶ **Atomic tritium *chemisorbed* on graphene monolayer**
 - ▶ Well defined electric potential, stable at room T in vacuum.
- ▶ UKAEA's Active Gas Handling System (tritium for JET, EU Tokamak) : **feasibility study for reaction chamber project**
- ▶ **Ready to buy their service**



Current limitations

- ▶ **Tritium is a scarce resource**, we need to rely on expensive providers
- ▶ Requires a **lab equipped** for containment and monitoring
 - ▶ Existing labs in Italy : FNG at ENEA Frascati
 - ▶ LNGS not yet ready for that
- ▶ **Scaling** to 1 microgram to be studied
 - ▶ Which is the shape of the target that fits better into the demonstrator ?
 - ▶ Need simulations
 - ▶ Should be installed on a magnetic **support** ? (*Fridge permanent magnets?*)
 - ▶ To let the electron enter the filter
 - ▶ Is the monolayer graphene the best **substrate** ? Alternatives to make it more compact and scalable (also economic sustainable)

Tasks

- ▶ Tech. transfer to tritium + radio-protection issues
- ▶ New substrates
- ▶ Design of a 1 mug target
(need engineering of the support ?)
- ▶ Simulation (integrate a realistic target into the filter)
- ▶ Serial production

Tritium procurement

- ▶ **UK AEA facility**
 - ▶ Feasibility study *end of 2025*
 - ▶ Design chamber in *2026*
- ▶ ***At this point we need a financial support (Phase-1) to build the chamber***
- ▶ Production and shipping of the chamber to UK AEA *2027*
 - ▶ First tritium samples *by end of 2027 ?*
- ▶ *Then serial production? 2028 ?*
 - ▶ *Produce substrates, characterise them, ship to UK, add tritium on them, ship tritiated graphene to LNGS*