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Elise 1&2: supply of continuous thin solid hydrogen ribbons for high repetition rate lasers

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The recent emergence of commercial, high repetition rate, intense lasers opens up new prospects for applications. Of particular interest is the production of energetic proton beams through the interaction of an intense laser with a hydrogen target: this beam can then be used e.g. for protontherapy (cancer treatment), or for neutron production through interaction of the proton or deuteron beam with a secondary target. If physical processes involved in the production of protons have started to receive satisfactory explanations, the reliable production of protons at high repetition rate without any debris is still an issue [1]. In this context, SBT has developed different cryostats to generate thin ribbons of hydrogen through extrusion of solid hydrogen. In this article, we describe two devices, dedicated to the generation of solid hydrogen ribbons. The Elise cryostat [2] has already been tested and provided intense beams of energetic protons [3,4]. The stability of the ribbon will be presented; and it will be shown, how this stability can be improved thanks to rollers which serve as guides of the cryogenic ribbon. On the other hand, the new Elise 2 cryostat has recently been commissioned (Fig 1): like the Elise (1) cryostat, it provides thin ribbons of cryogenic hydrogen thanks to the extrusion of solid hydrogen from a tank through a thin nozzle. However, the cold source is no longer provided by low temperature helium gas flow: indeed, the nozzle is cooled thanks to a low vibration level (pulse tube) cryo-cooler. This makes the handling of this device much easier than the Elise cryostat, as cryogenic fluid is no longer necessary to operate it. We plan to test this device in a near future on different ultra high intensity laser facilities.

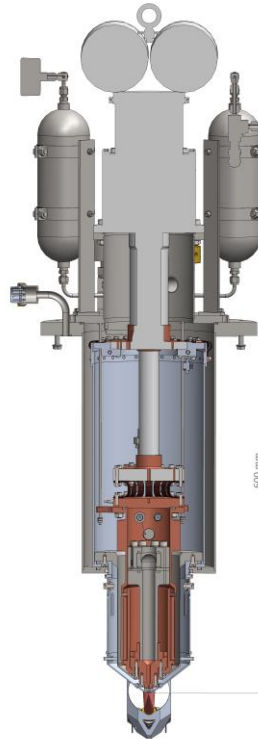


Fig. 1. Sketch of the ELISE 2 cryostat.

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