Cryogenic target development for high-repetition rate solid H2 and D2 targets

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With the development of new petawatt in many countries, new needs for targets appear. In this context the development of a proper target system reliable for operating at 1-10 Hz repetition rate is needed. Furthermore, there is a high scientific interest in investigating the possibility to use “solid hydrogen” thin foils since they can allow producing well defined, high current proton beams, reducing the shot-to-shot fluctuations which are typical for laser-accelerated proton beams (typically the H content comes from target impurities). Thus, the main goal of this scientific and technological topic is to design, develop and test (in various operating high power laser facilities) a system for “solid H” target delivery. The applicability of laser driven proton beams in various fields (Medicine, Biology, Material Science, Chemistry, etc.) being the eye tumor a “demonstration case”.A research program based on “Particle Acceleration by Laser” is born at CEA/INAC/SBT (Low Temperatures Laboratory)

Cryogenic engineering has for a long time been identified as a key technology in the missions of CEA for fundamental or applied research activities. Particle Physics, Astrophysics, Magnetic and Inertial Fusion and Laser are fields of Physics which need complex equipment or large infrastructures where cryogenics is one of the key issues. In this context, SBT (with 60 persons, half engineers and technicians) targets to serve the national and international research community by providing expertise, unique prototypes and specifically designed devices building upon the know-how derived from 50 years of cryogenic engineering.

SBT was in charge since 1994 to develop the “cold chain” for cryogenic targets for inertial fusion, or simulation of thermonuclear weapons (LMJ or NIF programs), or power production (IFE program, HiPER project). The SBT is able to provide:

Very complex systems working at 15 K (or less) with of 1 mK stability for Hydrogen solidification,

Robotics able to work in a cryogenic environment (loading, targets transfer),

Targets positioning with an accuracy of 15 microns in an experimental chamber of 10 meters diameter.

SBT wants to value its technical and scientific experience in the field of particles acceleration, and to obtain high energy protons is a new topic and challenge in which we are now involved since last year. This talk will presents the capabilities of CEA/INAC/SBT and the technical program for the period 2014-2017.

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