

Consideration of a target network for advanced laser light sources

Helmholtz–Zentrum Dresden–Rossendorf
e-mail: t.cowan@hzdr.de, i.prencepe@hzdr.de

April 18, 2016

In the next few years a number of paneuropean advanced laser light user facilities will become available for the scientific community. The HED instrument at the European XFEL is expected to start operating for users in 2018 with high power lasers provided by HIBEF User Consortium. The ELI infrastructure (Beamlines, NP and ALPS) is under development and will become available in the next few years. ESRF has plans for laser based high energy density activities, and high repetition rate national laser facilities are or will be soon in operation (e.g. Gemini, Apollon). These facilities promise major breakthroughs for high energy density physics, relativistic laser plasmas, high pressure science, planetary and astrophysics, advanced accelerators and study of materials under extreme conditions.

Most of these facilities will give the possibility of performing high repetition rate experiments, typically in the 1-10 Hz range. This operating regime corresponds to a requirement of thousands targets per day. Facilities would thus need to provide the users with supporting technologies for delivering different kinds of targets, such as gas jets, clusters, liquid crystals, cryogenic targets, and solid targets to be fabricated adopting state of the art material science techniques. The production and characterization of such a massive amount of targets would require resources and competencies not easily accessible to most research groups. Target availability could very likely become a limiting factor preventing to exploit the full potential of advanced laser and X-ray facilities. Moreover, a number of technological issues related to the adoption of solid targets in high repetition rate experiments should be considered: fast target refreshing, positioning and alignment; real time target characterization and sorting; target debris shielding; target cleaning. A joint effort for solving these issues would increase the impact of the scientific achievements obtainable at new user facilities and, eventually, be beneficial for the whole community.

In this frame, the development of a target network for advanced laser light sources would be a strategic asset to ensure the availability of state of the art targets and to promote the formulation of common strategies to address issues related to target delivery and irradiation at high repetition rate. The ideal partners of such a target network would be established laboratories specialized in target production, material science centers, currently operating and upcoming facilities, university research groups with specific competences. The synergy between partners could be developed along different strategic paths, depending on the commitment of the community. Possible frameworks include:

networking only - “know-how” sharing and target bartering. This option would

be most appropriate for specific experiments carried on in the frame of single collaborations between target laboratory institutes and experimental groups, with limited impact on the whole community.

consortium participation - institutes contributing their own resources (or obtaining funding from local governments) to provide specific kinds of targets for users' experiments as a "user consortium" contribution. This option would particularly benefit research groups involved in obtaining the local funding.

integrated network - EU proposal for a network of target fabrication laboratories with complementary specific expertise. Partners would be provided with resources for financially supporting dedicated positions and developing capabilities for target production and characterization. Partners would formulate a common strategy for target supply and planning future capabilities. The network would consist of several laboratories with basic production capabilities and different individual specialties and allow incorporating specific processes at different laboratories in integrated production chains. This third option would benefit both target production laboratories and experimental groups, and would have a significant impact on the whole community.

The first step towards the construction of a target network should include the assessment of:

- target demands (types, quantity, timescale);
- current and upcoming capabilities of the partner institutions;
- desired new capabilities;
- strategies planned at upcoming and existing paneuropean facilities for target fabrication, in situ characterization and supporting techniques (for target delivery and irradiation at high repetition rate);
- any additional requirement from the community (e.g. computational tools for target design and optimization).

In this frame, we propose a workshop to discuss the strategy for the development of a target network. The workshop will be held on August 29-30 at HZDR as a satellite of the EUCALL 2016 Meeting. The tentative program of the workshop includes:

- survey of state of the art experiments and targets in different fields (shock-compression, relativistic plasmas...) and/or presentation of prototypical high repetition rate experiments;
- presentation of the EUCALL HIREP working package;
- upcoming facilities: planned strategy for addressing target issues;
- capabilities and demands of the partners;
- discussion on network building strategy and funding concepts.