Contribution ID: **6** Type: **not specified**

Hydrodynamics of ISOLDE liquid metal targets

Wednesday, 19 December 2007 11:45 (20 minutes)

The proton beam from the CERN Proton-Synchrotron Booster (PSB) is highly pulsed. A typical 1.4 GeV PSB pulse consists of four bunches, with a maximum bunch power of 12 GW. This is more than six orders of magnitude higher than the often quoted average beam power of ˜2.7 kW. The lifetimes of early liquid metal targets exposed to the PSB beam were severely compromised through broken welds, corroded proton beam windows and flow of liquid metal into the ion source. To reduce the energy densities for liquid metal target units, the current practice is to spatially defocus the beam and to apply a time-staggered extraction mode to the PSB bunches. Hydrodynamic simulations of proton-induced transient effects such as splashing were carried out and showed that the 10 us bunch spacing which matches the target relaxation time leads to constructive interference of proton-induced pressure waves. Measurements of the release of 84Kr from a Pb target and 111Cd from a Sn target confirm the dependence of release on bunch spacing. Small changes in the PSB bunch spacing can significantly reduce pressure amplitudes and may be a solution to further improve ISOLDE liquid metal target release and yield properties by increasing the practical limit of 8e12 protons per pulse whilst ensuring target lifetimes remain unaffected. With the ongoing design phase and planned construction of the CERN accelerator complex upgrade, this study introduces some of the engineering tools which will be required in the development of the new target and ion source units compatible with the proton beam characteristics.

Summary

Acknowledgements: We acknowledge the financial support of the EC under FP6 “Research Infrastructure Action –Structuring the European Research Area”EURISOL DS Project; Contract No. 515768 RIDS. The EC is not liable for any use that can be made on the information contained herein.

Primary author: Dr NOAH MESSOMO, Etam (CERN)

Co-authors: Dr LETTRY, Jacques (CERN); Mr BRUNO, Luca (CERN); Mr CATHERALL, Richard (CERN); Dr STORA, Thierry (CERN)

Presenter: Dr NOAH MESSOMO, Etam (CERN)

Session Classification: Technical Developments