Subsystem Tabulation of the Single Pass RF Driver

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This paper presents a subsystem-by-subsystem description of the Single Pass RF Driver (SPRFD). The purposes are to show SPRFD's relationships to RF driver features assessed from 1976, to isolate the differences that affect prior conclusions about workability of RF drivers including confidence in pellet ignition, and to highlight the key associated technical issues to help prompt experts in the various areas to appreciate the specific challenges and perhaps become interested in their assessment. For important context and to show the excellent prospects for the complete HIF power plant, the pellet and chamber subsystems are likewise described and assessed.

The SPRFD has been described in various ways, at HIF2010, AHIF in 2011, and HIF2012. The most useful attention was by the working group for RF drivers at AHIF, which reported out a set of recommendations with the first being: "A more detailed examination of the Single-Pass HIF Driver concept may be a good starting point" pursuant to the objective that: "Now is the time for developing detailed conceptual designs for economical energy production that take advantage of decades of progress in accelerator physics and RF accelerator technology." [1] Examination of detailed conceptual designs was the essence of the format

of the first several HIF Workshops, and the features of the SPRFD, the matching pellet design,and the chamber with a "hat trick" of advances needs that kind of focus and intensity.

This paper continues the effort to disseminate information about the SPRFD to facilitate the progress on its design recommended at AHIF. To that end, the paper is organized as a set of tables presenting descriptions and assessments of its subsystems: front ends comprising multiple HVDC, initial RF stages each accelerating

16 different isotopes for a total of 1024 separate ion sources, and alignment of the 16 isotopes into single beamlines for a total of 64 parallel beams; main RF linac with zippers that reduce the number of beams to four; the linac section that outputs isotopes at equal magnetic rigidity to telescope at the pellet; delay lines that rearrange the macropulses and then remove the preponderance of empty space between them; drift lines that maintain the phase spacesof individual microbunches while the distances between the isotopic macropulses decrease in a prelude to telescoping; chirping the individual microbunches in each isotopic macropulse to drive a final compaction of each macropulse; spiral wobbling the different isotopic pulses by different amounts according to their role in driving pellet implosion and ignition; and focusing the equal stiffness beams to build the power profile for the sequence of pre-pulse, compression, and ignition. The pellet subsystem table covers the results of the most recent simulations of implosion and fuel burn for cylindrical targets with fast ignition [2]. Description of the chamber subsystem focuses on the multiple ways lithium is deployed to combat the fusion neutrons, deliver very high temperature Li to the primary heat exchangers, and keep structural materials at temperatures like an automobile engine.

In setting forth this description of the SPRFDin accessible pieces, we hope to prompt appropriate action according to AHIF's clear recommendation, and restore HIF dedication to push this highly recommended, "best bet" for fusion power to the energy market.

References

[1] RF Accelerator Working Group Summary, Workshop on Accelerators for Heavy Ion Fusion, LBNL, **May 23-26**, 2011

[2] R. Ramis and J. Meyer-ter-Vehn, *Laser and Particle Beams* (2014), **32**, 41–47.