Development of a Fast Valve Assisted Mechanical Launcher for Cryogenic Pellets

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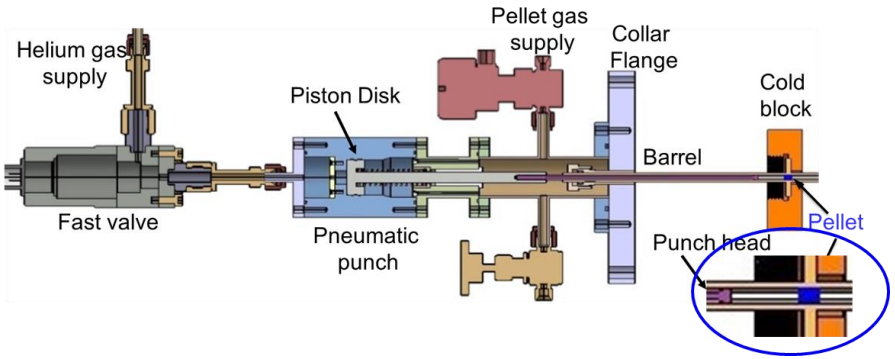


Fig-1 Working principle of the MPL along with its sub-parts: the fast valve, pneumatic punch head, and the pellet freezing barrel.

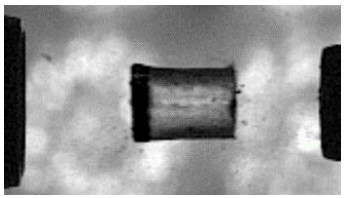
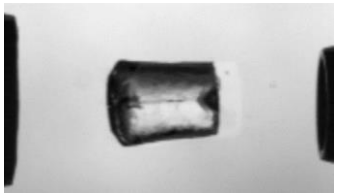


Fig-2: Image of two different hydrogen pellets



Tokomak-based fusion reactor is a promising method of clean and unlimited energy; where the matter exists in the plasma state (e.g. condition in the sun) helps in achieving the fusion reaction. However, fueling the high-temperature plasma and disruption mitigation are a few of the major challenges in these machines. In a disruptive event, a sudden loss of a large amount of energy can damage the reactor wall significantly.

While hydrogen isotopes are used for fueling, Argon and Neon, etc. are used for disruption mitigation. In either case, injection of frozen solid pellets of these gases is an efficient way of supplying material to the reactor core. This work presents the development of a pneumatic driven fast actuator called mechanical pellet launcher (MPL) that can inject pellets into plasma at very high speed. The MPL is successfully tested on cylindrical hydrogen pellets of 6.2 mm (length) x 4.2 mm (diameter), and a pellet speed ranging from 80 to 140 m/s has been achieved.

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