

Proposal Code : PDF – FusionTech -0002	
<b>Title</b>	Development of a Microwave Cavity diagnostic for Solid Hydrogen Pellet Mass Measurement
<b>Abstract</b>	<p>Development of SPINS-IND at IPR has given confidence in developing and operation of pneumatic pellet injector system which can deliver 3 to 5 mm hydrogen pellets and accelerates it up to 1000 m/s. The primary objective of this development is the estimation of injected pellet mass before being injected in the plasmas. This necessitates the knowledge of the pellet mass precisely just before entering into the plasma.</p> <p>The pellet mass estimation is based on the principle of perturbation in resonant frequency of microwave cavity due to the insertion of a dielectric (hydrogen pellet in the present scope of work) inside it. A cylindrical microwave cavity placed in the pellet path is excited with its resonance frequency. A dielectric placed inside it shifts the resonance frequency of the cavity. In this method, the pellet volume is calculated using the frequency shift and the volume of the cavity. Then, the pellet/dielectric mass is estimated using the cavity and the dielectric parameters.</p> <p>This project proposal involve activities to be carried out in the following two phases:</p> <p>Phase I: - Development of prototype microwave cavity and testing the mechanism by injecting dummy pellets of different materials.</p> <p>Phase II: - Upgrading the prototype for measuring the mass of hydrogen and Deuterium pellets and also synchronising it with control system of pellet injector. Following are the specific scope of the works:</p> <ol style="list-style-type: none"> <li>1. Understanding the requirements, Literature survey on the cavity perturbations systems</li> <li>2. System conceptualization, design and analysis.</li> <li>3. Development of prototype microwave cavity and associated instrumentation.</li> <li>4. System setup for the plastic / any other dielectric</li> </ol>

	<p>mass measurement.</p> <ol style="list-style-type: none"> <li>5. 5. Study of the moving plastic pellet mass measurement using the developed system</li> <li>6. 6. Design modification and instrumentation for application in cryo and vacuum environment for measuring mass of hydrogen/Deuterium pellets.</li> <li>7. 7. Experiment with the solid hydrogen pellet mass or any other similar dielectric material</li> <li>8. Further optimization of the system to synchronise with the control system of pellet Injector. Testing the cavity for its reliability, repeatability, maintainability.</li> <li>9. Development of multiple microwave cavities to measure pellet mass for different locations along the guide tube.</li> </ol>
<b>Research Focus Areas</b>	A non-destructive method for measuring the mass of high-speed pellets of solid hydrogen by utilizing a microwave cavity.
<b>Qualifications</b>	PhD in Physics or Engineering
<b>Desired Experience</b>	Expertise in microwave circuitry and related instrumentation is desirable. Preference will be given to candidates with prior experience in designing, analyzing, and optimizing RF and electromagnetic (EM) components and systems using standard software packages.
<b>Other remarks</b>	-