

FIRST DEDICATED EXPERIMENTS ON THE AZIMUTHAL FIELD AS A NEW RESEARCH TOOL FOR THE DENSE PLASMA FOCUS

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Recent experiments using 15 frame interferometry on PF-1000 facility in Warsaw confirm axial magnetic field, which can allow magnetic flux lines to densely cover closed surfaces creating "magnetic flux surfaces". Evolution of such 3-dimensional (3-D) magnetic field structures is necessarily accompanied the association between neutron emission and spontaneously self-organized, relatively long lasting, finite plasma structures. A crucial aspect of this association is the simultaneous observation of an induced electric field that can provide a very long (theoretically infinite) acceleration path length along a trajectory enclosed within the magnetic structure leading to high ion kinetic energy, resulting in a high reaction rate. Associated charge and current densities can be related to electric scalar potential and magnetic vector potential measured outside the plasma. We report our first observations of these fields outside the plasma focus and discuss their general features.

The reported technique is capable of unambiguous first-principles interpretation of signals in terms of quantities related to distributions of charge density and rate of change of azimuthal current density ("electromagnetic structure") in the plasma focus. It is non-intrusive and completely insensitive to non-axisymmetric aspects of plasma. Our first results show that axial magnetic field generated by azimuthal current density distribution symmetric about the axis exists before, during and after the pinch phase.

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