

OVERVIEW OF DIII-D OFF-AXIS NEUTRAL BEAM PROJECT

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DIII-D has four neutral beamlines. Each of these beamlines has two ion sources, each of which inject up to 2.5 MW for 3.5 seconds. These beamlines intersect the vacuum vessel at an angle of 19.5 degrees off from radial, enabling current drive in the same direction as the plasma current (co-injection). In 2004, one of these beamlines (210 degree) was rotated to provide counter-injection (opposite of plasma current). A different beamline (150 degree) is now being modified to have the capability to provide off-axis neutral beam current drive. The goal of the off-axis injection is to have the center of the ion source aimed at a position 40 cm below the geometric center of the vessel. To achieve this off-axis injection, the beamline requires a mechanical lifting system that can elevate the beamline up to 16.5 degrees from horizontal. The beamline also requires more strongly vertically focused ion sources (in order to pass the beam through a reduced effective aperture) as well as modified internal components. Additionally, the design of the new internal components incorporated modifications to allow for the doubling of ion source pulse lengths without the need for active cooling.

This paper discusses the various beamline system design requirements for off-axis injection, as well as the results from the actual commissioning of the beamline. The focus of this paper is the presentation of the actual data obtained during beamline commissioning and during normal physics operations. Overviews of the design and performance of mechanical lifting system (hydraulics and controls), focused ion sources, flexible beamline support systems (vacuum, cryogenic, power and water cooling), and internal beamline collimators are included. Additionally, the in-vessel monitoring and shine-through protection requirements are discussed.

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