

ANALYSIS OF DIII-D NEUTRAL BEAM POWER SYSTEMS FOR 10 SECOND OPERATIONS

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The neutral beam injector systems on the DIII-D tokamak are currently limited to 3 seconds duration at full power (81 kV, 2.5 MW) of total beam on time with the existing beam line components. To achieve high performance discharges with a high fraction of noninductive neutral beam current drive for pulse lengths longer than the resistive time, long pulse upgrades are planned for both the neutral beam line and the power supplies which drive it. The beam on time will be extended to 10 seconds to provide full drive throughout the tokamak shot.

This paper discusses the evaluation, simulations and measurements of the neutral beam power systems to identify component modifications required for the longer pulse operations. The power supplies examined are the high power beam voltage supply (up to 84 kV at 80 Amperes) as well as the ion source arc and filament power supplies and the downstream grid control supplies. The beams may be modulated through the entire length of the 10-second shot to provide a control on total neutral beam power into the plasma. This will cause additional power dissipation and insulation stresses in the power system well above what occurs in the un-modulated pulse.

Initial analysis of design data has shown that most of the major components of the power supplies are completely capable of providing the increased pulse length. Many of the power supplies have been in operation for over 20 years, so the emphasis of the effort on the power supplies is to evaluate modifications that will ensure reliability with the longer pulses into the foreseeable future.

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