US Contribution

The US is responsible for disruption mitigation technology development and deployment of prototypical shattered pellet injection (SPI) units on existing tokamaks (up to a capped value).

Overview

The system has three functions: 1) limiting electromagnetic impacts of current decay on components, 2) limiting the magnitude of heat and particle flux to the plasma facing components, and 3) suppressing the formation of, or dissipating (if formed), a runaway electron beam.

Shattered pellet injection involves cryogenically freezing pellets of the desired species (hydrogen, deuterium or neon) in a specially designed “pipe gun.” The pellet is injected into the plasma with a high pressure gas (hydrogen or deuterium) when a disruption is detected. The pellet is “shattered” upon entry to better assimilate the material into the plasma.

1st Plasma Scope

For first plasma, US ITER will develop and deploy shattered pellet injection technology and improve SPI capability and reliability.

Status

A shattered pellet injection prototype has been delivered to the JET tokamak in the UK where it supports the IO led effort to develop ITER relevant disruption mitigation methods and technology. Similar prototypes have been deployed for disruption mitigation experiments on DIII-D tokamak in the US and the KSTAR tokamak in Korea.
Disruption Mitigation

**Technical Description**

- **Material delivery for thermal mitigation event:**
  8-10 kPa*m$^3$ gas equivalent (nominally 2 kPa*m$^3$ per injector location)

- **Material delivery for runaway electron mitigation event:**
  up to 90 kPa*m$^3$ gas equivalent of material

- **Pellet types:**
  Hydrogen, Deuterium (D) and Neon (Ne)

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*Plastic model of a pellet illustrating the size that will be used in ITER’s disruption mitigation system. Photo: ORNL*

*The SPI testbed for disruption mitigation technology development. Photo: ORNL*