Contribution ID: **26** Type: **Invited Oral**

Pellet ELM Pacing and Disruption Mitigation Impacts on the Fusion Fuel Cycle

Wednesday, 12 October 2022 15:10 (35 minutes)

A future fusion reactor based on the tokamak concept in particular will need to employ methods to mitigate both edge localized modes (ELMs) and disruptions. Both of these unwanted plasma events can lead to high heat fluxes that can damage internal plasma facing components. The mitigation of these events in the plasma relies on the injection of material into the plasma to trigger a plasma response that will pre-empt otherwise naturally occurring events with more intensity that can lead to damage that will interrupt fusion energy output. The material injection for ELM mitigation is largely deuterium into the edge plasma in small pellets of sufficient size to trigger small ELMs on demand at a much higher rate than they would otherwise naturally occur. This will lead to extra plasma exhaust gas in the form of deuterium. Disruption mitigation is now envisioned to be accomplished with the deep injection of very large cryogenic pellets that are shattered upon entry into the plasma that contain hydrogenic species mixed with some higher Z impurity such as neon to efficiently radiate the plasma thermal energy.

In both of these mitigation techniques the injected material ends up as exhaust gas that must be pumped out of the reactor vessel and removed from the continuous fuel cycle. In the case of pellets for ELM pacing this would occur continuously during the plasma burn phase and require an enhanced pumping capacity and ability to remove the excess deuterium from the recirculating DT that ends up in the fueling subsystem. In the case of a disruption, the pre-emptive mitigation will result in significant amounts of gas that will cause the plasma pumping to be interrupted and switched over to a roughing pump system that can handle tritiated gas at a high pumping speed to quickly recover back to an operating reactor. In this presentation the implications of additional exhaust gases from both mitigation techniques on the fuel cycle are described and possible methods to efficiently handle the unwanted perturbations on the operation of the fuel cycle.

Speaker's Affiliation

ORNL

Member State or IGO

United States of America

Primary author: Dr BAYLOR, Larry (ORNL)

Presenter: Dr BAYLOR, Larry (ORNL)

Session Classification: Tritium Fuel Cycle Engineering System Design

Track Classification: Interface btw Plasma Physics & Fuel Cycle Technology