Contribution ID: **173** Type: **Oral Presentation**

EX/6-2: Experimental Demonstration of High Frequency ELM Pacing by Pellet Injection on DIII-D and Extrapolation to ITER

Thursday, 11 October 2012 15:00 (20 minutes)

Pellet pacing of edge localized modes (ELMs), which is the triggering of rapid small ELMs by pellet injection, has been proposed as a method to prevent large ELMs that can erode the ITER plasma facing components [1]. D_2 pellet injection has been used on the DIII-D tokamak to successfully demonstrate for the first time the pacing of ELMs at a 10x higher rate than natural ELMs. The demonstration of ELM pacing on DIII-D was made by injecting slow (<200 m/s) 1.3 mm D_2 pellets at 60 Hz from the low field side in an ITER shaped plasma with a low natural ELM frequency of 5 Hz, q_95 of 3.5, beta_N of 1.8, and normalized energy confinement factor H_98 of 1.1, with the input power only slightly above the H-mode threshold. The non-pellet similar discharges have ELM energy losses up to 50 kJ (˜8% of total stored energy), while the case with pellets was able to demonstrate 60 Hz ELMs with an average ELM energy loss less than 5 kJ (<1% of the total). Total divertor heat flux from the ELMs is reduced by more than a factor of 10 as measured by a fast framing IR camera. Central impurity accumulation of Ni is significantly reduced by the application of the 60 Hz pellets. No significant increase in density or decrease in energy confinement with the pellets was observed.
Experimental details have shown that the ELMs are triggered before the pellets reach the top of the H-mode pressure pedestal, implying that very small shallow penetrating pellets would be sufficient to trigger ELMs. Fast camera images of the pellets entering the plasma from the low field side show a local triggering phenomenon. A single plasma filament becomes visible near the pellet cloud and strikes the outer vessel wall within 200 μs followed by additional ejected filaments. The implications of these results for possible pellet ELM pacing on ITER will be discussed.

[1] P.T. Lang et al., Nucl. Fusion 44 (2004) 665.

Work supported by the US Department of Energy under DE-AC05-00OR22725, DE-FC02-04ER54698, DE-AC52-07NA27344, and DE-FG02-07ER54917.

Country or International Organization of Primary Author

USA

Primary author: Mr BAYLOR, Larry R. (USA)

Co-authors: Dr LOARTE, Alberto (ITER Organization); Mr LASNIER, Charles J. (Lawrence Livermore National Laboratory); Dr STRAIT, Edward J. (General Atomics); Dr UNTERBERG, Ezekial A. (Oak Ridge National Laboratory); Dr FENSTERMACHER, Max E. (Lawrence Livermore National Laboratory); Mr BROOKS, Neil H. (General Atomics); Mr COMMAUX, Nicolas (Oak Ridge National Laboratory); Mr PARKS, Paul B. (General Atomics); Dr MOYER, Rick A. (University of California San Diego); Mr COMBS, Stephen K. (Oak Ridge National Laboratory); Mr MEITNER, Steven J. (Oak Ridge National Laboratory); Dr EVANS, Todd E. (General Atomics); Mr JERNIGAN, Tom C. (Oak Ridge National Laboratory); Dr OSBORNE, Tom H. (General Atomics)

Presenter: Mr BAYLOR, Larry R. (USA)

Session Classification: Pedestal Stability and Control II

Track Classification: EXC - Magnetic Confinement Experiments: Confinement