Contribution ID: **507** Type: **Poster**

Experiments on Magneto-Hydrodynamics Instabilities with ECH/ECCD in FTU Using a Minimal Real-Time Control System

Tuesday 14 October 2014 14:00 (4h 45m)

Experiments of magneto-hydrodynamics (MHD) instabilities control using injection of Electron Cyclotron Waves (ECW) are being performed in the FTU tokamak at toroidal field of 5.3T, plasma current of 0.5MA, line averaged density of 0.6 10^20 m^-3. The control system is based on only three real time key items: an equilibrium estimator (EQUIFAST) based on a statistical regression, a MHD instability marker (SVDH) using a 3d array of pick-up coils and the fast ECW launcher. One beam of 0.33MW, 140GHz, max pulse duration of 0.5s has been used for heating in the Ordinary Mode polarization (OM1) with perpendicular toroidal injection and nearly on axis EC resonance. The EC absorption volume has been controlled by the poloidal steering of the launcher. The MHD activity (m,n=2,1 or 3,2 modes) has been deliberately induced either by Neon impurity injection or by a density ramp hitting the density limit. No diagnostics providing the radial localization of the instabilities have been used. This is given a-posteriori through the evaluation of the effectiveness of the stabilization. When the ECW power is switched on, the instability amplitude shows a marked sensitivity to the position of the absorption volume with an increase or decrease of its growth rate. A significant reduction of the MHD amplitude has been obtained during the ECW injection phase. However, the continued cooling by Neon recycling that originates the instabilities does not allow their complete suppression at least at this ECW power level. The MHD control loop has been modified for the density limit experiments. The automatic search of the steering angle producing the fastest instability reduction has been introduced, based on the evaluation of the time derivative of the MHD amplitude. Once such angle is reached the controller holds the position until the SVDH signal crosses the switching off threshold. This control criterion has led to the suppression of the instabilities, even if the ECW injection is in some cases accompanied by a density pump-out reducing the density below the onset threshold. These experiments are the first attempt of feedback control of the ECW launcher in FTU for MHD control purposes. The control tools used are essential and based on a minimal set of diagnostics. Such experimental condition mimics the situation of a fusion reactor where reduced diagnostics capabilities are expected.

Paper Number

EX/P2-47

Country or International Organisation

Italy

Author: Dr SOZZI, Carlo (Istituto di Fisica del Plasma CNR, Associazione EURATOM-ENEA)

Co-authors: Dr ROMANO, Afra (ENEA Unità Tecnica Fusione, C.R. Frascati); Dr BRUSCHI, Alessandro (Istituto di Fisica del Plasma CNR, Associazione EURATOM-ENEA); Dr MORO, Alessandro (Istituto di Fisica del

Plasma CNR, Associazione EURATOM-ENEA); Mr BOTRUGNO, Antonio (ENEA - Unità Tecnica Fusione); Mr ESPOSITO, Basilio (ENEA); Dr MARCHETTO, Chiara (Istituto di Fisica del Plasma CNR, Associazione EURATOM-ENEA); Dr GALPERTI, Cristian (Istituto di FIsica del Plasma CNR, Associazione EURATOM-ENEA); Mrs MAZZOTTA, Cristina (ENEA); Dr MAROCCO, Daniele (2ENEA Unità Tecnica Fusione, C.R. Frascati); Dr MINELLI, Daniele (Istituto di Fisica del Plasma CNR, Associazione EURATOM-ENEA); Dr ALESSI, Edoardo (Istituto di Fisica del Plasma CNR, Associazione EURATOM-ENEA); Dr BELLI, Francesco (ENEA Unità Tecnica Fusione, C.R. Frascati); Dr GRANUCCI, GUSTAVO (ISTITUTO DI FISICA DEL PLASMA - CNR); Dr APRUZZESE, Gerarda (ENEA Unità Tecnica Fusione, C.R. Frascati); Dr PUCELLA, Gianluca (ENEA); Dr CALABRO, Giuseppe (ENEA); Dr RAMOGIDA, Giuseppe (ENEA Unità Tecnica Fusione, C.R. Frascati); Dr FIGINI, Lorenzo (Istituto di Fisica del Plasma CNR, Associazione EURATOM-CNR); Dr BONCAGNI, Luca (ENEA Unità Tecnica Fusione, C.R. Frascati); Mr GROSSO, Luigi Andrea (ENEA Unità Tecnica Fusione, C.R. Frascati); Dr MOSCONI, Maia (Dipartimento di Energetica, Politecnico di Milano); Dr MARINUCCI, Massimo (ENEA Unità Tecnica Fusione, C.R. Frascati); Dr TUDISCO, Onofrio (ENEA Unità Tecnica Fusione, C.R. Frascati); Dr BURATTI, Paolo (ENEA); Dr GARAVAGLIA, Saul (Istituto di Fisica del Plasma CNR, Associazione EURATOM-ENEA); Dr NOWAK, Silvana (Istituto di Fisica del Plasma, IFP-CNR, Associazione EURATOM-ENEA-CNR sulla Fusione); Mr PIERGOTTI, Valerio (ENEA Unità Tecnica Fusione, C.R. Frascati); Mrs MELLERA, Vittoria (Istituto di Fisica del Plasma CNR, Associazione EURATOM-ENEA); Dr BIN, William (Istituto di Fisica del Plasma CNR, Associazione EURATOM-ENEA)

Presenter: Dr SOZZI, Carlo (Istituto di Fisica del Plasma CNR, Associazione EURATOM-ENEA)

Session Classification: Poster 2