Contribution ID: **456** Type: **Poster**

High density and high performance operation with pellet injection in W7-X

Friday, October 26, 2018 2:00 PM (20 minutes)

In this contribution we present details of recent W7-X pellet injection experiments and discuss properties of the achieved plasmas. Hydrogen pellet injections allowed to raise the electron density above $1.2 \cdot 10^{20}$ m^{-3} and to establish: (i) operation above the cut-off for the X2 polarization of the 140 GHz electron cyclotron resonance heating (ECRH); (ii) stable divertor heat flux detachment; (iii) plasmas with the diamagnetic energy above 1 MJ. In the latter case, a series of pellets raised the electron density to almost 10^{20} m^{-3} in a hydrogen discharge heated by X2 ECRH with the total power stepped from 2.7 MW to 5 MW. These electron densities are sufficiently high for electron and ion temperatures to equilibrate and to cause a change in the radial electric field. In the reheat phase after the pellet injection, ion temperatures above 3.5 keV could be reached with the ECRH only and a significant plasma pressure is achieved. The volume averaged $\langle\beta\rangle$ is about 1%, whereas the peak value β_0 is about 3.5%. The diamagnetic energy of about 1.1 MJ corresponds to confinement times above 0.2 s. In the middle of the
high energy phase, a sudden crash by about 150 kJ is observed by a number of diagnostics, with an inversion radius present in the ECE and soft X-ray signals. These β values allow for the first
time the analysis of the MHD stability and the validation of the Shafranov shift optimization. High central β values are also required for the improved confinement of fast ions.

A further improvement of the plasma performance can be achieved by a further increase of the electron density, which requires ECRH heating in the O2 polarization, as the electron densities
are already close to the X2 cut-off. To use the full available ECRH power of 7 MW in the O2 polarization a scenario with a switch of the polarization during the discharge has to be implemented. Such a scenario was successfully tested with initially helium target plasma, because of an easier density control. The hydrogen pellet injection was used to raise the density above the X2 cut-off and to maintain it at this high level for more than half a second. In the second half
of the campaign such a scenario will be attempted for hydrogen target plasmas.

Country or International Organization

Germany

Paper Number

EX/P8-8

Primary author: Mr BOZHENKOV, Sergey (Max-Planck-Institut für Plasmaphysik, Greifswald, Germany)

Co-authors: Dr LANGENBERG, Andreas (Max-Planck-Institut für Plasmaphysik,17491 Greifswald, Germany); Dr BRANDT, Christian (Max-Planck-Institut für Plasmaphysik, Greifswald, Germany); Dr ZHANG, Daihong (Max--Planck-Institut für Plasmaphysik, Greifswald, Germany); Dr PASCH, Ekkehard (Max-Planck-Institut für Plasmaphysik, Greifswald, Germany); Dr KOCSIS, Gabor (Wigner Research Center, Association EURATOM, Budapest, Hungary); Dr WURDEN, Glen (LANL); Dr FUCHERT, Golo (Max-Planck-Institut für Plasmaphysik, Greifswald, Germany); Mr DAMM, Hannes (Max-Planck-Institut für Plasmaphysik, Greifswald, Germany); Dr LAQUA, Heinrich (Max-Planck-Institute for Plasma Physics, Greifswald, Germany); Dr THOMSEN, Henning (Max-Planck-Institut für Plasmaphysik, Greifswald, Germany); Dr KNAUER, Jens (Max-Planck-Institut für Plasmaphysik, Greifswald, Germany); Dr SCHMITT, John (Auburn University, Auburn, AL 36849, USA); Dr BALDZUHN, Juergen (Max-Planck-Institut für Plasmaphysik, Greifswald, Germany); Dr BRUNNER, Kai Jakob (Max-Planck-Institut für Plasmaphysik, Greifswald, Germany); Dr RAHBARNIA, Kian (Max-Planck-Institut für Plasmaphysik, Greifswald, Germany); Dr MCCARTHY, Kieran Joseph (Ciemat); Dr JAKUBOWSKI, Marcin (Max-Planck-Institut für Plasmaphysik); Dr HIRSCH, Matthias (Max-Planck-Institut für Plasmaphysik); Dr PANADERO ALVAREZ, Nerea (Cen-

tro de Investigaciones Energéticas, Medioambientales y Tecnológicas (CIEMAT), Madrid, Spain); Dr PABLANT, Novimir (Princeton Plasma Physics Laboratory); Dr KOENIG, Ralf (Max-Planck-Institut für Plasmaphysik, Greifswald, Germany); Prof. WOLF, Robert (Max-Planck-Institute for Plasma Physics); Dr LAZERSON, Samuel (Princeton Plasma Physics Laboratory); Prof. PEDERSEN, Thomas Sunn (Max Planck Institute for Plasma Physics); Mr HOEFEL, Udo (Max-Planck-Institut für Plasmaphysik, Greifswald, Germany); Dr KAZAKOV, Yevgen (Laboratory for Plasma Physics, LPP-ERM/KMS)

Presenter: Mr BOZHENKOV, Sergey (Max-Planck-Institut für Plasmaphysik, Greifswald, Germany)

Session Classification: P8 Posters