Overview of ASDEX Upgrade results - DTU Orbit (09/11/2017)

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The ASDEX Upgrade (AUG) programme is directed towards physics input to critical elements of the ITER design and the preparation of ITER operation, as well as addressing physics issues for a future DEMO design. Since 2015, AUG is equipped with a new pair of 3-strap ICRF antennas, which were designed for a reduction of tungsten release during ICRF operation. As predicted, a factor two reduction on the ICRF-induced W plasma content could be achieved by the reduction of the sheath voltage at the antenna limiters via the compensation of the image currents of the central and side straps in the antenna frame. There are two main operational scenario lines in AUG. Experiments with low collisionality, which comprise current drive, ELM mitigation/suppression and fast ion physics, are mainly done with freshly boronized walls to reduce the tungsten influx at these high edge temperature conditions. Full ELM suppression and non-inductive operation up to a plasma current of $I_p = 0.8$ MA could be obtained at low plasma density. Plasma exhaust is studied under conditions of high neutral divertor pressure and separatrix electron density, where a fresh boronization is not required. Substantial progress could be achieved for the understanding of the confinement degradation by strong D puffing and the improvement with nitrogen or carbon seeding. Inward/outward shifts of the electron density profile relative to the temperature profile effect the edge stability via the pressure profile changes and lead to improved/decreased pedestal performance. Seeding and D gas puffing are found to effect the core fueling via changes in a region of high density on the high field side (HFSHD).The integration of all above mentioned operational scenarios will be feasible and naturally obtained in a large device where the edge is more opaque for neutrals and higher plasma temperatures provide a lower collisionality. The combination of exhaust control with pellet fueling has been successfully demonstrated. High divertor enrichment values of nitrogen $E_N \geq 10$ have been obtained during pellet injection, which is a prerequisite for the simultaneous achievement of good core plasma purity and high divertor radiation levels. Impurity accumulation observed in the all-metal AUG device caused by the strong neoclassical inward transport of tungsten in the pedestal is expected to be relieved by the higher neoclassical temperature screening in larger devices.

General information

State: Published
Organisations: Department of Physics, Plasma Physics and Fusion Energy
Authors: Kallenbach, A. (Ekstern), Aguiam, D. (Ekstern), Aho-Mantila, L. (Ekstern), Angioni, C. (Ekstern), Arden, N. (Ekstern), Arredondo Parra, R. (Ekstern), Asunta, O. (Ekstern), de Baar, M. (Ekstern), Balden, M. (Ekstern), Behler, K. (Ekstern), Bergmann, A. (Ekstern), Holm, J. H. (Intern), Jensen, T. (Intern), Madsen, J. (Intern), Nielsen, A. H. (Intern), Nielsen, S. K. (Intern), Olsen, J. M. B. (Intern), Rasmussen, J. (Intern), Salewski, M. (Intern), Pedersen, M. S. (Intern)
Number of pages: 12
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information

Journal: Nuclear Fusion
Volume: 57
Issue number: 10
Article number: 102015
ISSN (Print): 0029-5515
Ratings:

BFI (2017): BFI-level 1

Web of Science (2017): Indexed yes

BFI (2016): BFI-level 1

Scopus rating (2016): CiteScore 1.62 SJR 1.01 SNIP 0.942

Web of Science (2016): Indexed yes

BFI (2015): BFI-level 1

Scopus rating (2015): SJR 1.288 SNIP 1.43 CiteScore 1.88

Web of Science (2015): Indexed yes

BFI (2014): BFI-level 1

Scopus rating (2014): SJR 1.705 SNIP 1.476 CiteScore 2.2

Web of Science (2014): Indexed yes

BFI (2013): BFI-level 1

Scopus rating (2013): SJR 1.128 SNIP 1.129 CiteScore 1.83

ISI indexed (2013): ISI indexed yes

Web of Science (2013): Indexed yes

BFI (2012): BFI-level 1

Scopus rating (2012): SJR 1.397 SNIP 1.216 CiteScore 1.81

ISI indexed (2012): ISI indexed yes

Web of Science (2012): Indexed yes

BFI (2011): BFI-level 1
Scopus rating (2011): SJR 2.056 SNIP 2.366 CiteScore 3.78
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 2.307 SNIP 1.923
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 2.021 SNIP 2.457
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 2.076 SNIP 1.754
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 2.059 SNIP 2.02
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 2.068 SNIP 1.855
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 1.858 SNIP 1.949
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 2.633 SNIP 1.659
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 2.1 SNIP 1.665
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 2.836 SNIP 1.401
Scopus rating (2001): SJR 1.992 SNIP 2.174
Web of Science (2001): Indexed yes
Scopus rating (2000): SJR 1.589 SNIP 1.122
Scopus rating (1999): SJR 2.14 SNIP 1.559
Original language: English
Nuclear fusion, Tokamak physics, ITER, DEMO
DOIs:
10.1088/1741-4326/aa64f6
Source: FindIt
Source-ID: 2371780470
Publication: Research - peer-review › Journal article – Annual report year: 2017