

"Fill the gap" strategy: implementing low-Z materials in antenna vicinity

### Tungsten coated antenna limiters

 Antenna limiters have previously been confirmed [4] as main contributors to W production during ICRF





Boron-coated antenna limiters (>=2012)

Upgrade, because of boronizations

· Boron is not additional material in ASDEX

• 50 μm coating of boron on graphite only on side limiters of antennas a1 and a2 replaced



08 F

• Side limiters are responsible for at least half of rise of c<sub>W</sub> in plasma (wide parameter range)

· Accounting the upper and the lower rows (previous local measurements), and the improvement of broad limiter antenna, antenna limiters are responsible for more than 2/3 of cw rise

· Boron-coated antenna side limiters allowed easier ICRF operation and confirmed the dominant role of antenna limiters on W source during ICRF

## Summarv

the W compatibility.

Boron-coated antenna side limiters: - confirmed dominant role of antenna limiters as W sources in ASDEX Upgrade; - along with broad-limiter antenna allowed multiple ITER-relevant experiments with ICRF power and W wall.

# References

[1] Bobkov V. et al, Nuclear Fusion, 50, (2010), 035004. [2] HFSS (High Frequency Structure Simulator), http://www.ansys.com [3] Maggiora R. et al., AIP Conference Proceedings, 1406 (2011), 73-80. [4] Bobkov V. et al. Journal of Nuclear Materials. 415, 1 (2011), S1005-S1008. [5] Jaquet P. et al., Nuclear Fusion, 62, (2012), 042002. [6] Polozhiy K. et al., Europhysics Conference Abstracts 35G (2011), P4.071.





## Strap phasing affects loading: use of 3dB hybrid scheme with 2 three-strap antennas is crucial

Modified two-strap ICRF antenna with broad-limiters and narrow straps:

- more stable operation at low deuterium rate;

- smaller rise of W concentration in the plasma during ICRF;

- smaller rise of sputtering yield measured at the antenna limiters.

ASDEX Upgrade progress with ICRF system shows that antenna design development is the way to make ICRF compatible with a full-W wall. Two antennas with a new three-strap design are planned for 2013 to minimize antenna near fields to further improve