

Combination of applied 3-D fields and snowflake divertor for impurity control

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Goals and Background

- Goal: apply 3-D fields to snowflake divertor discharges (Exploratory)
 - Are these two impurity control techniques compatible?

Background

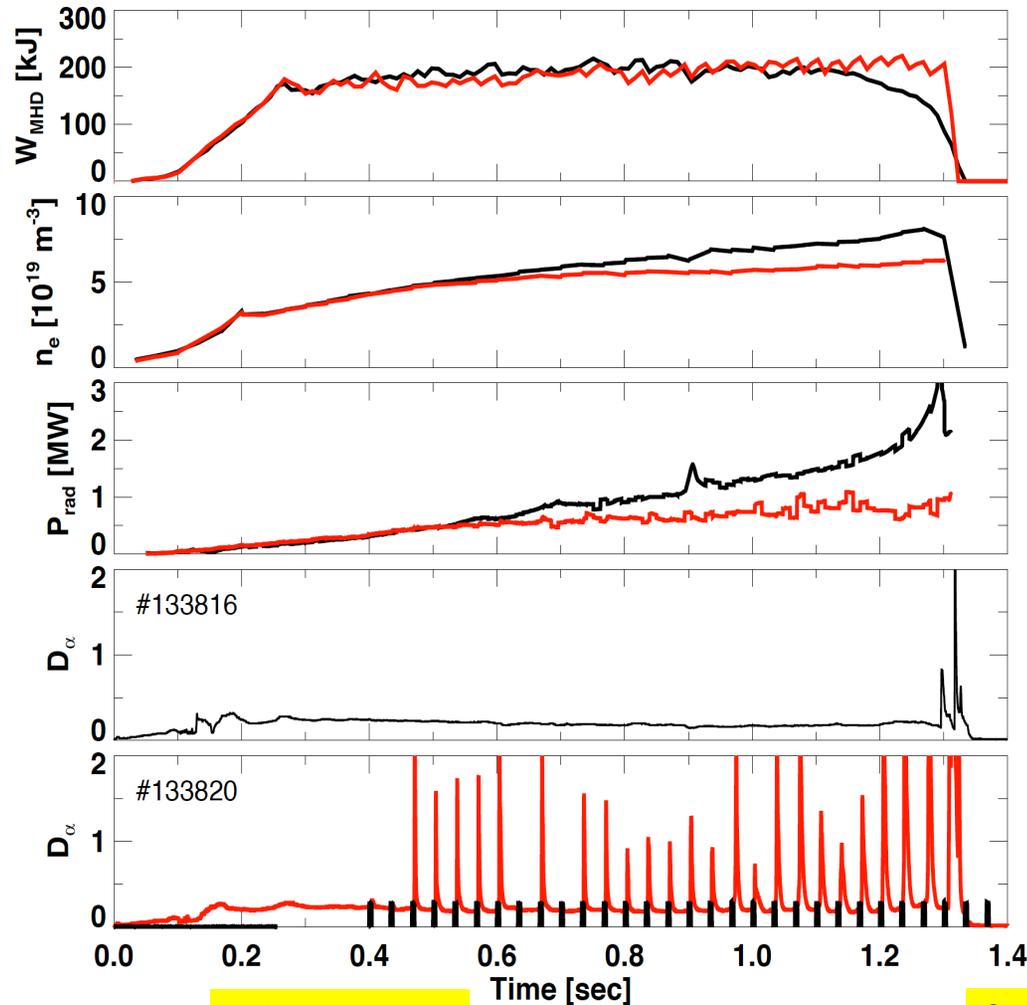
- Applied $n=3$ 3-D fields have changed the rotation profiles and edge stability, including triggering ELMs
 - Also created striations on the divertor target, consistent with separatrix splitting
 - No clear signature of enhanced particle transport
 - Edge impurities are reduced when ELMs are triggered, though
- The snowflake configuration in FY10 was maintained for long pulses, which reduced the carbon content in the plasma
 - Due to reduced physical sputtering because of easier access to partial detachment
 - ELMs also triggered in snowflake configuration
- The idea here is to combine the two techniques, to look for possible synergies in impurity control

Possible Run Plan (1/2 day)

- Reproduce best snowflake discharges, e.g. 141240, or more recent version
- Add DC $n=3$ fields to look for evidence of density pumpout
 - Are there striations in the divertor heat and particle fluxes?
- Vary the field spectrum ($n=2$, and maybe even $n=1$?), to look for an enhancement of particle transport
 - Benefit from experience in Jong-Kyu Park's XP
- Option: use square wave pulses of DC fields to trigger ELMs and augment the natural ELMs in the snowflake
- *Consideration: Attempt experiments in as low of q_{95} as possible, where the 3D fields should have the biggest effect*

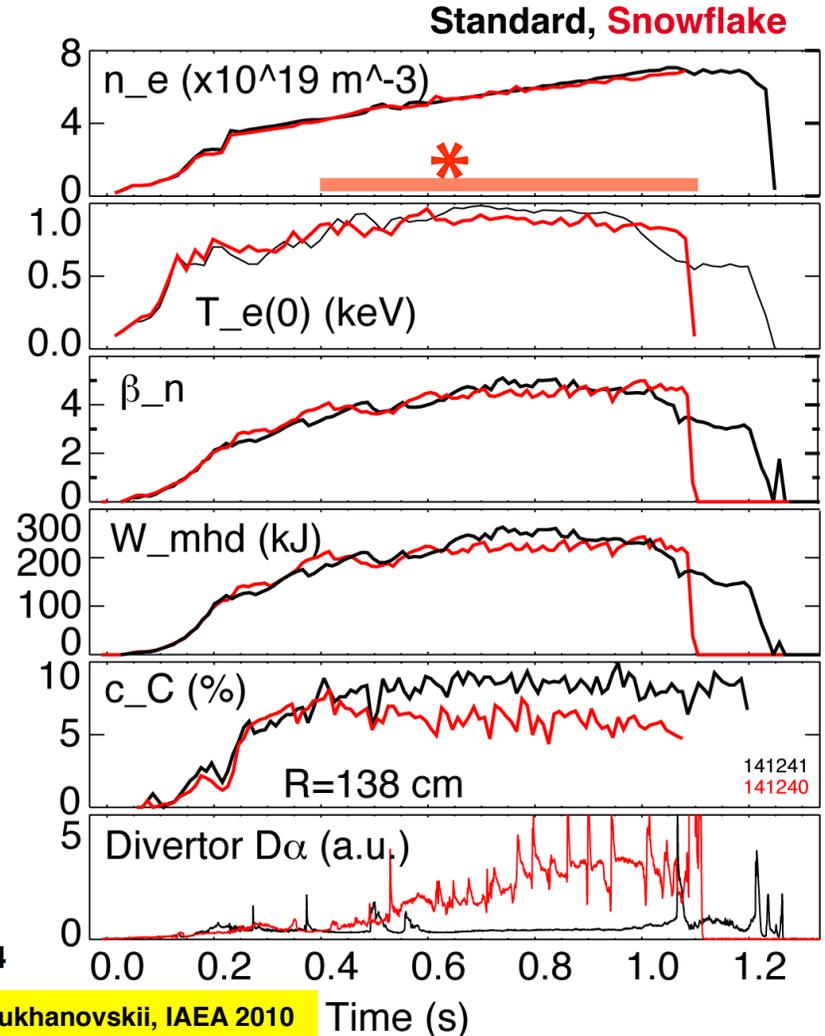
Triggered ELMs with $n=3$ fields and Snowflake divertor each succeeded in reducing edge impurities

Type I ELMs triggered for impurity control (post-lithium, $n=3$)



J. Canik, NF 2010

“Snowflake” divertor reduced impurities



Soukhanovskii, IAEA 2010