Reduction of Tile Heating, Particle, and Carbon Sources with the New DIII–D Divertor 2000

by
C.J. Lasnier*
for C.B. Baxi, M.A. Mahdavi, G.D. Porter,*
D.G. Whyte,† W.P. West, N.S. Wolf,*
and the DIII–D Team

*Lawrence Livermore National Laboratory
†University of California, San Diego, California

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Overview

- Local tile heating was reduced by tile alignment and contouring.
- Modeling indicates that baffling plays a major role in reduced core carbon contamination.
- Pump and baffle are effective.

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Mis-aligned
tiles suffer
strong erosion
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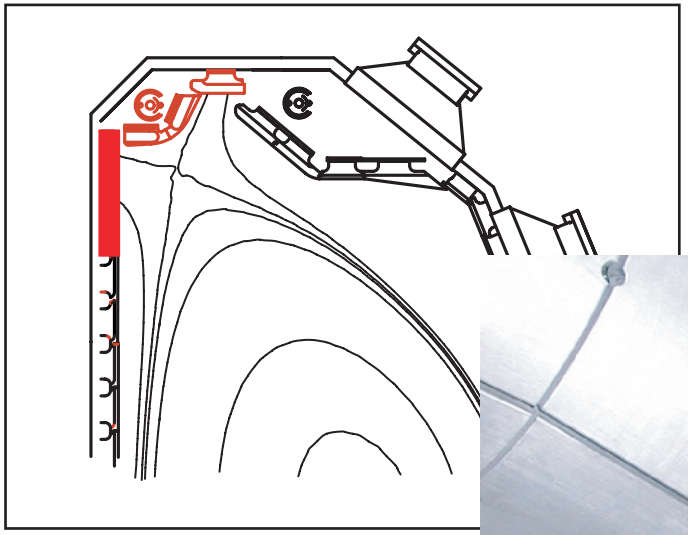
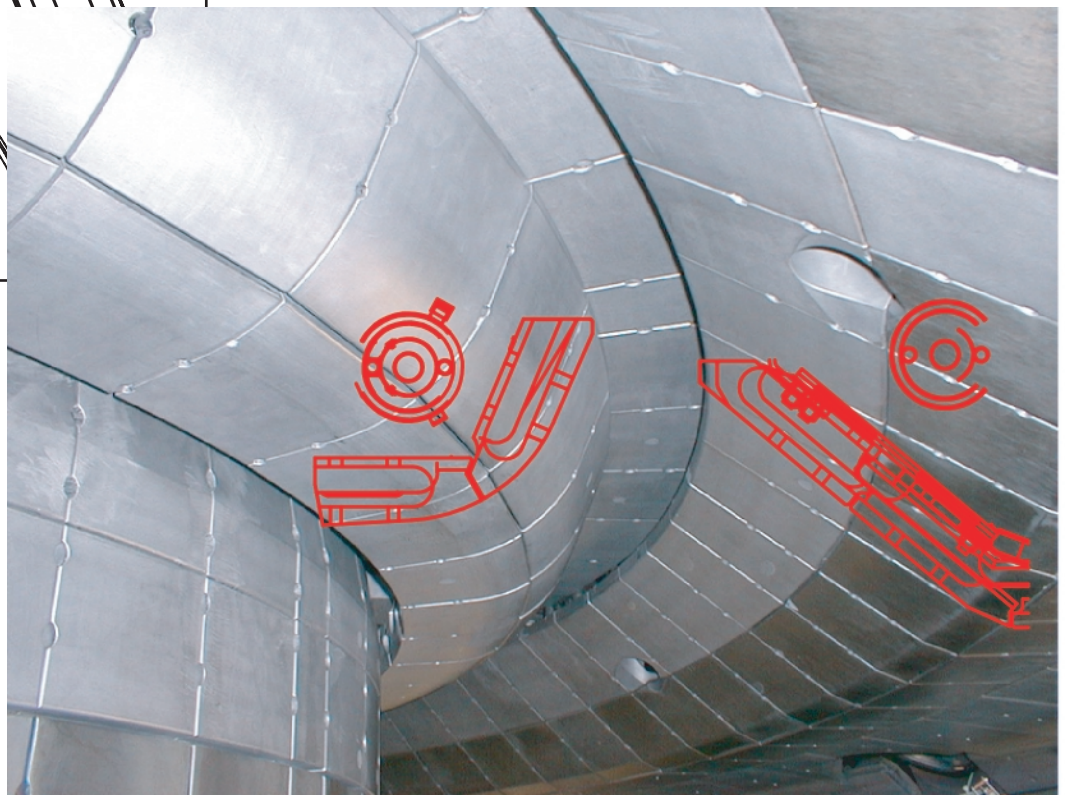
03 upperbaffleErosionMisalign

Divertor-2000 built for core density and impurity control



- New tiles were contoured and aligned to reduce local heating



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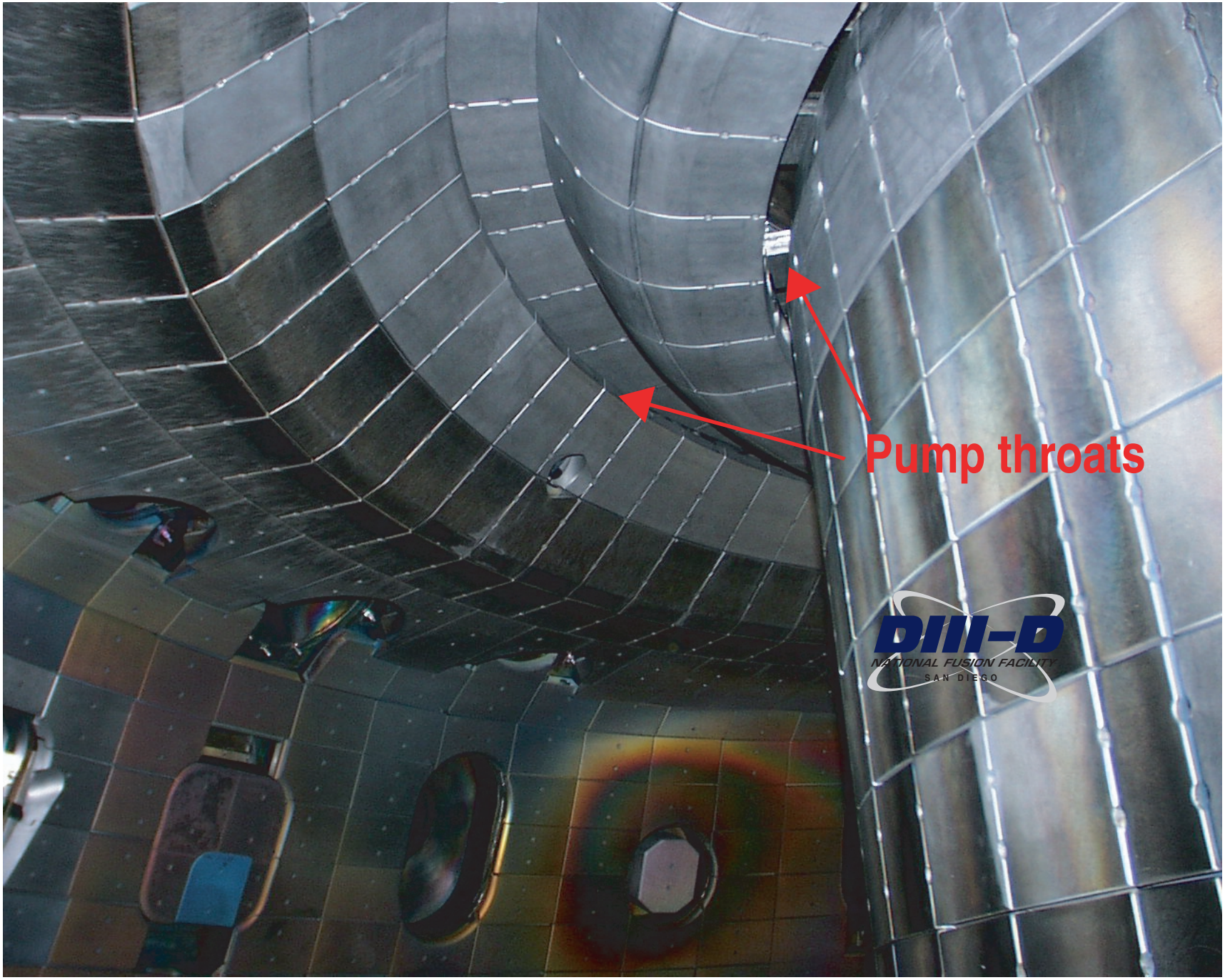
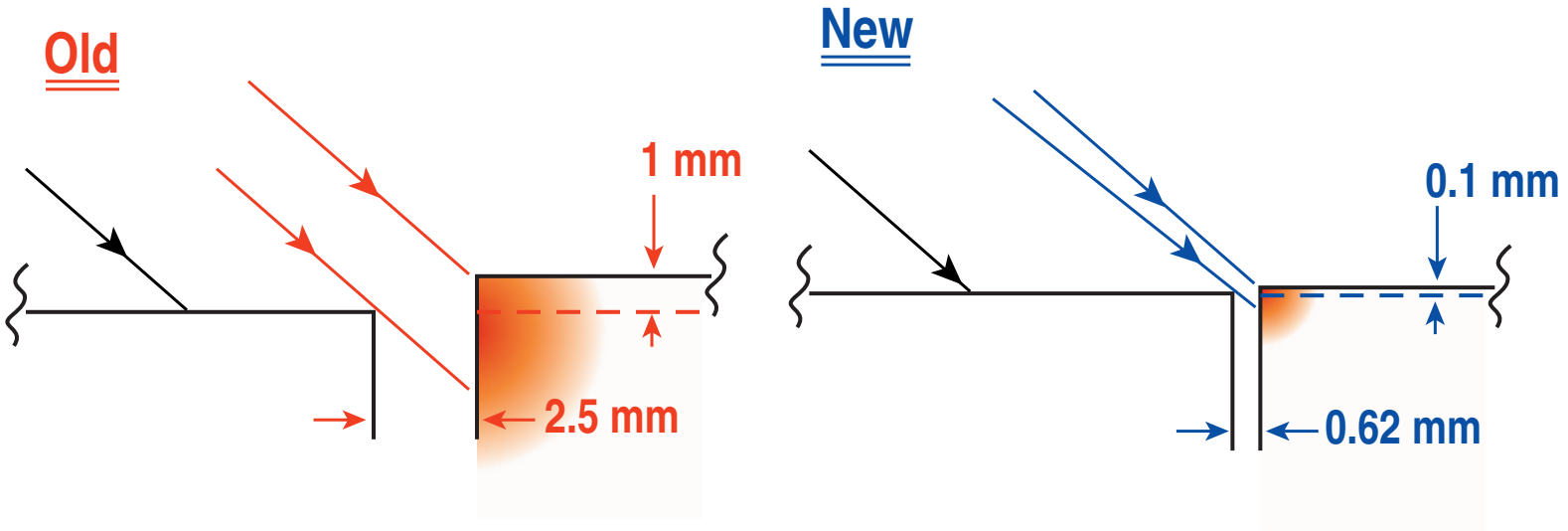
New system pumps the inner strike point, outer pump existing



Accurate alignment and smaller gaps reduce tile edge heating



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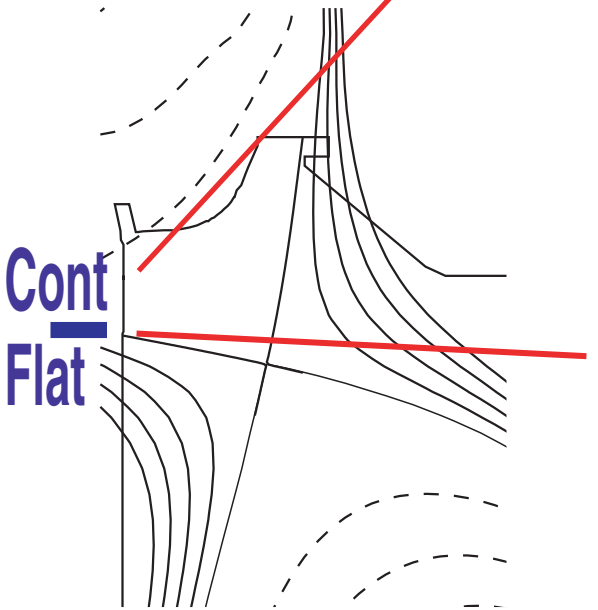
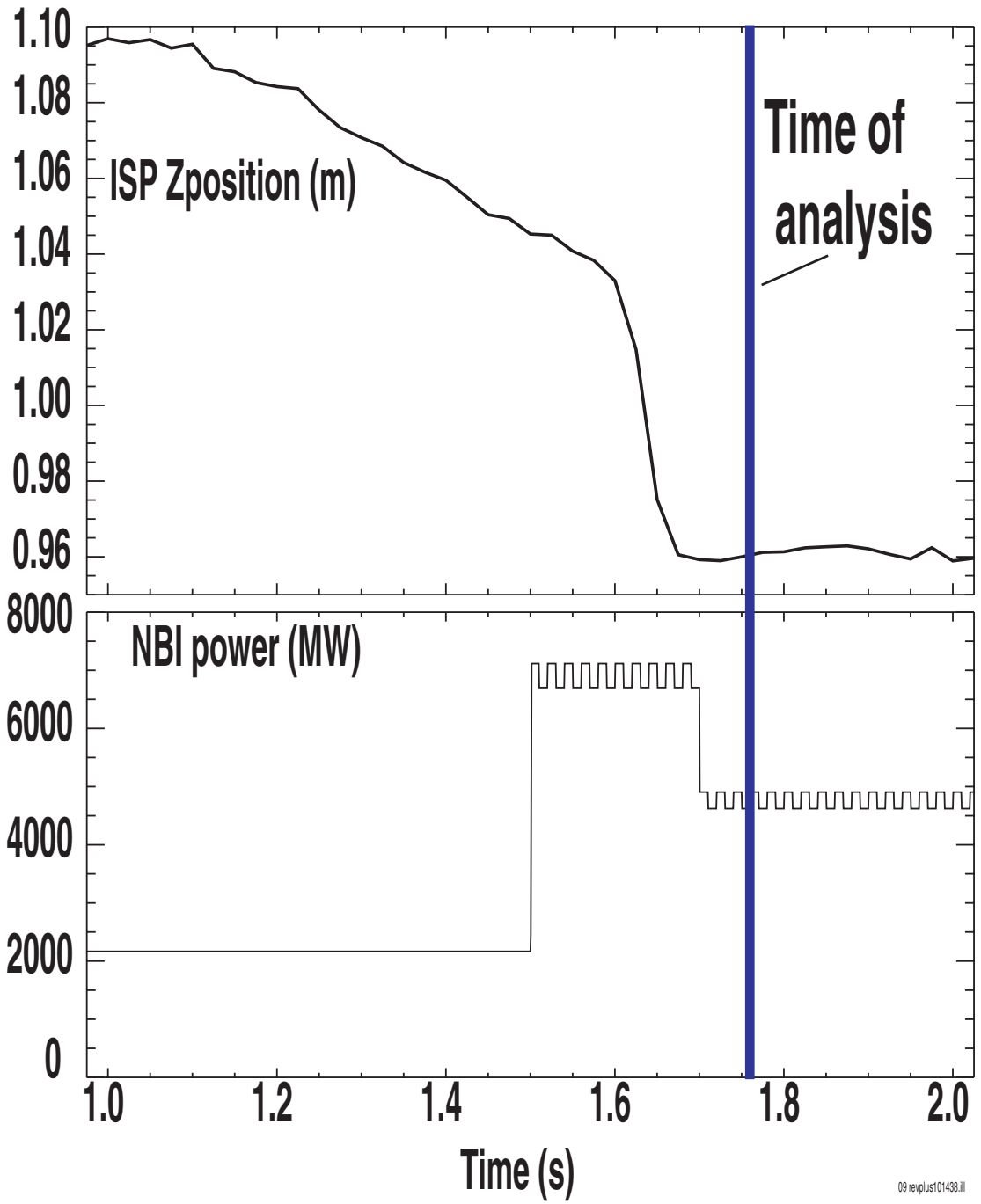
Inner Strike position moved from contoured to flat tiles





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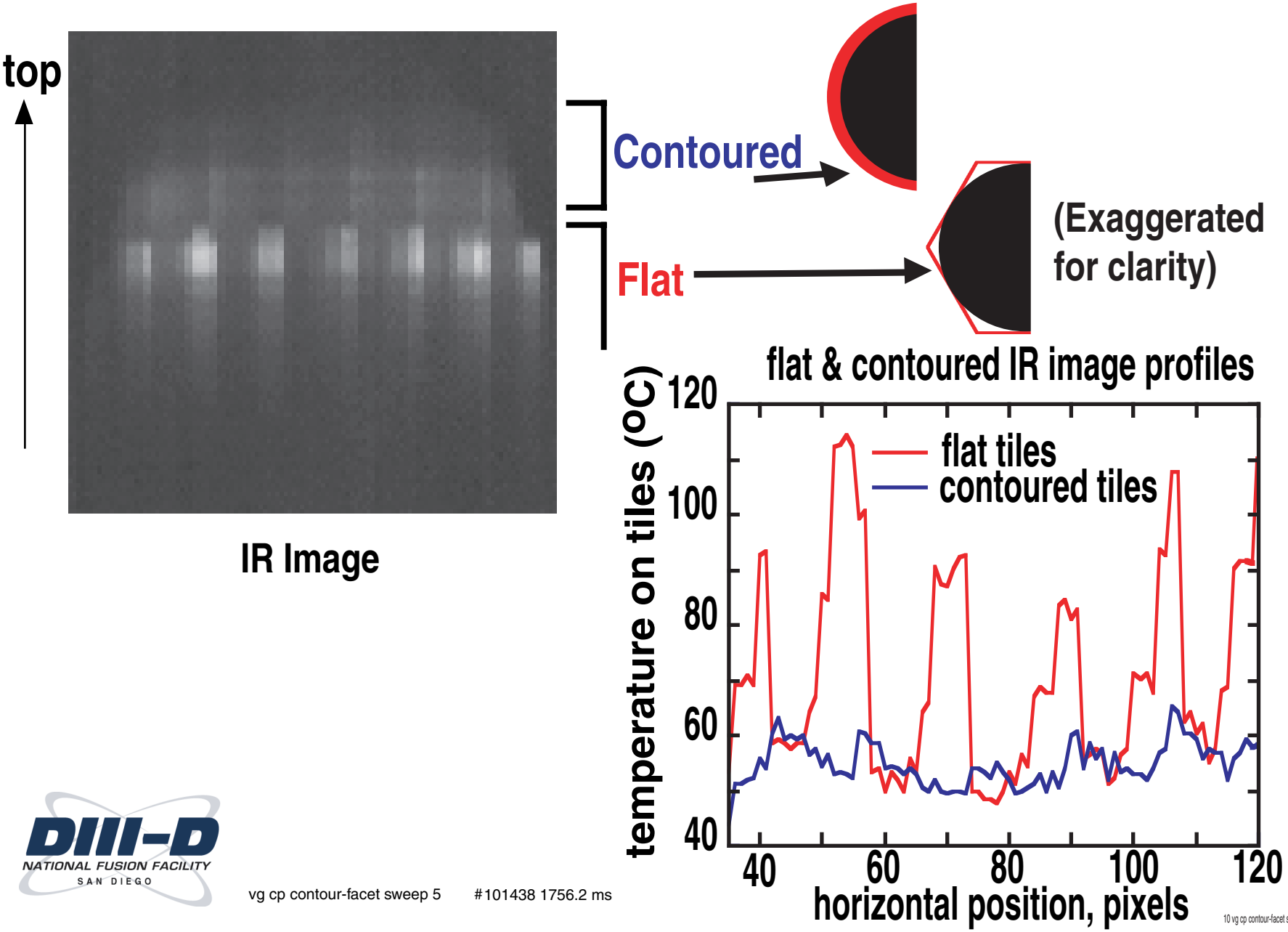
101438 1750.00

09 revplus101438.lll

Horizontal surface temperature profiles from IRTV image show much less peaking on the contoured tiles



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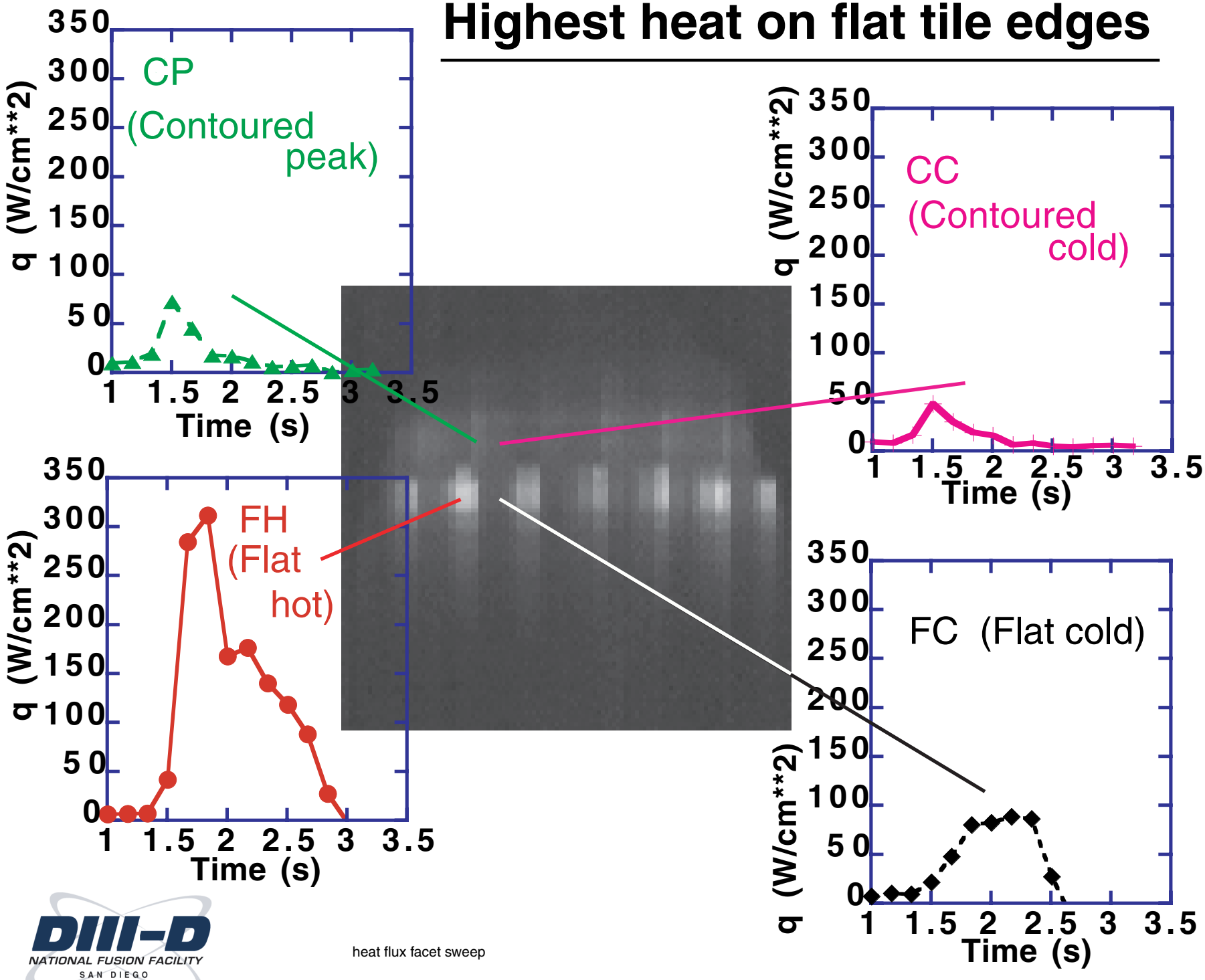
vg cp contour-facet sweep 5 #101438 1756.2 ms

Highest heat on flat tile edges



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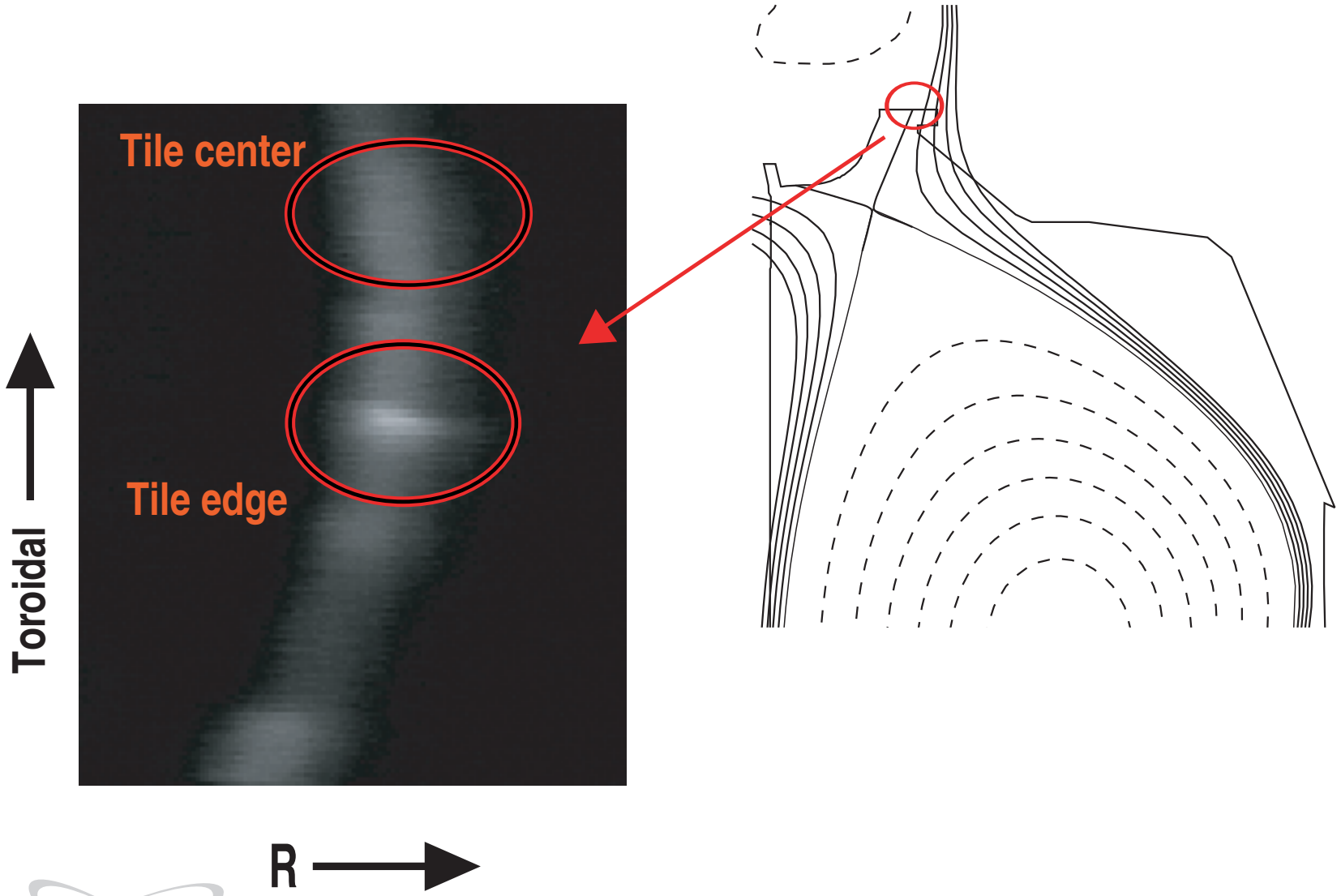
heat flux facet sweep

101438 1756.2 ms

Long pulse fixed strike locally heats the ceiling

Upper divertor IRTV



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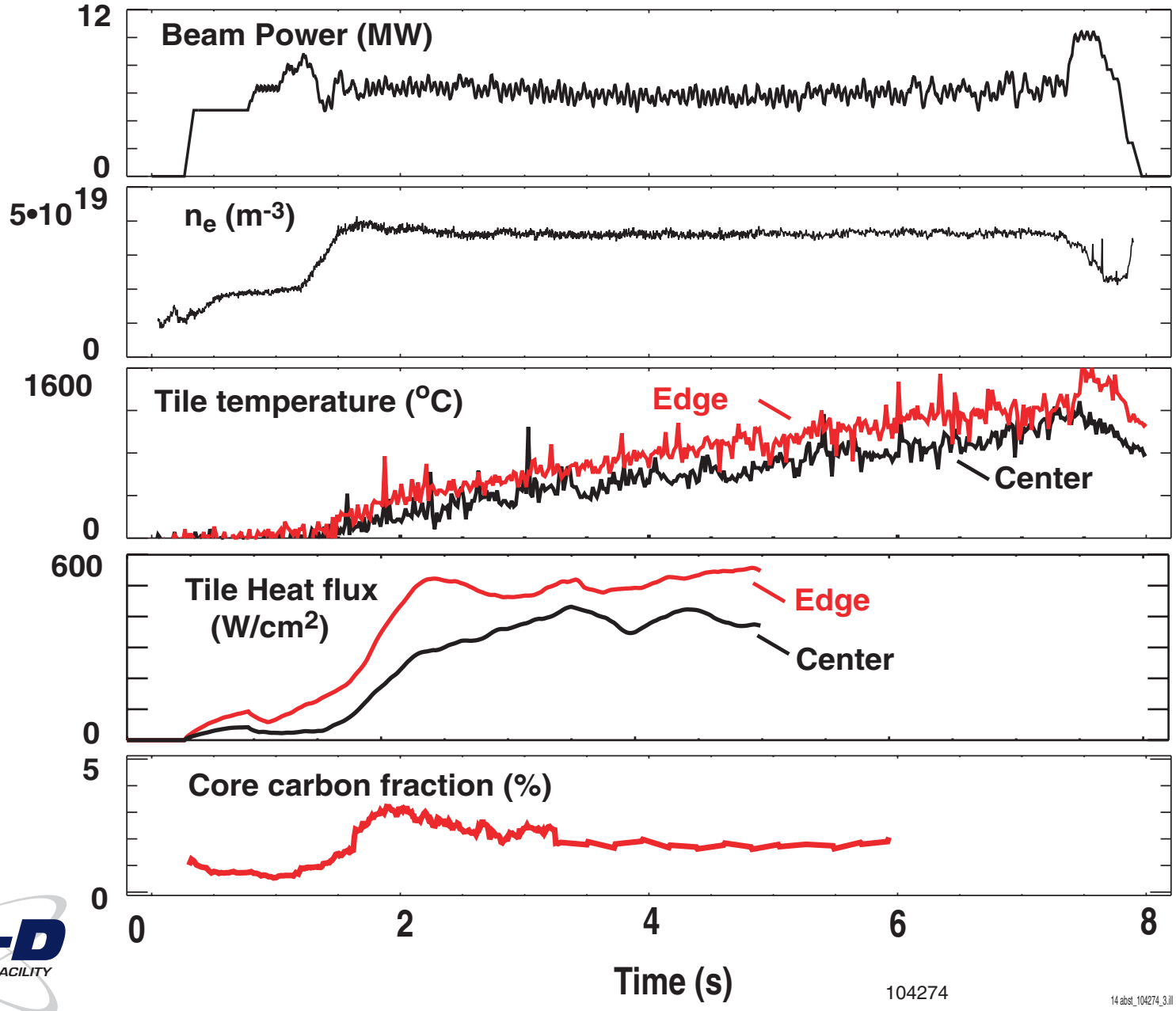
104274 7.7750

13 updive long pulse image+efit

No increase in core carbon seen with high tile temperature



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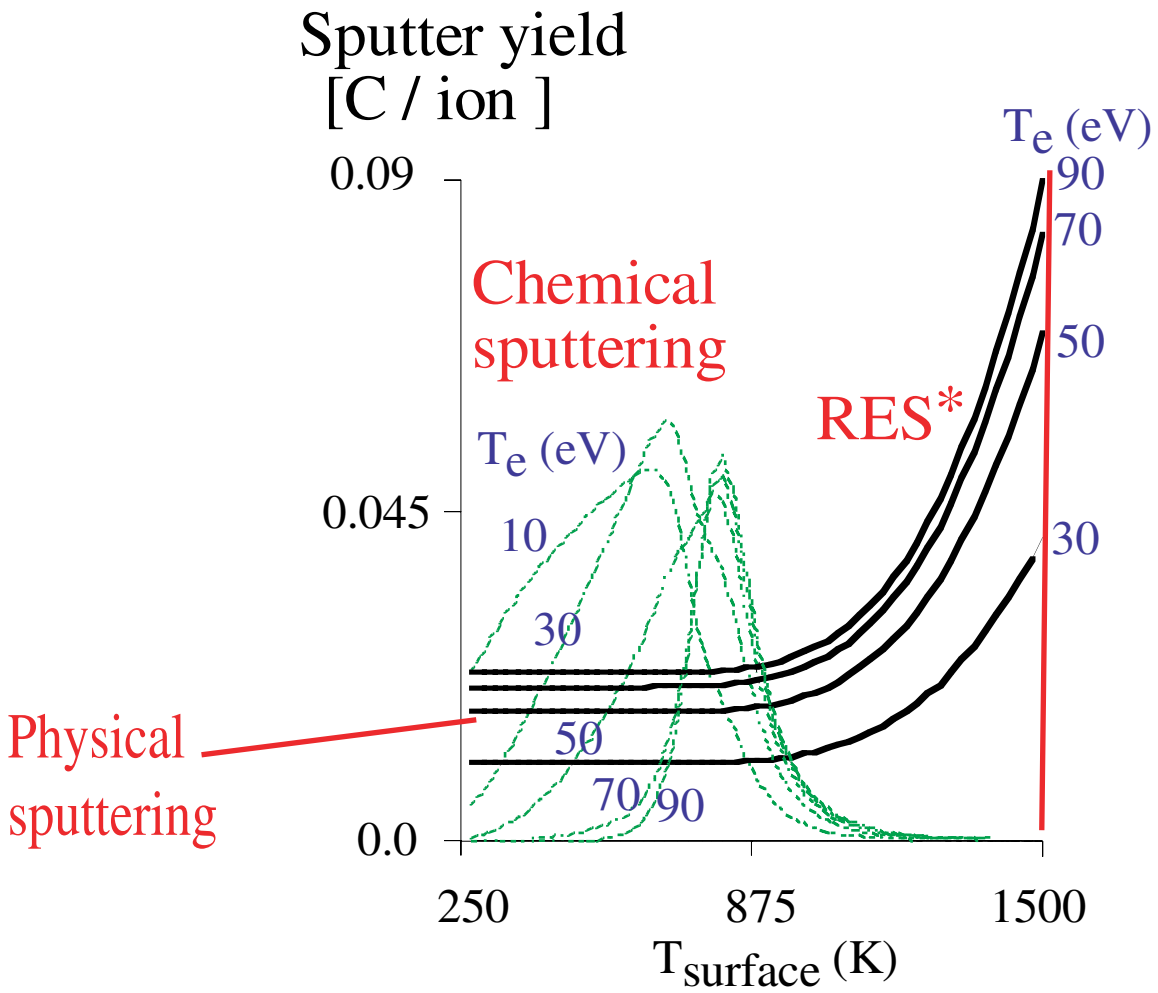
At 1500 K, Carbon yield ~ 4x physical sputtering



J. Hogan et al. GP1.143
this meeting

*Radiation-Enhanced Sublimation

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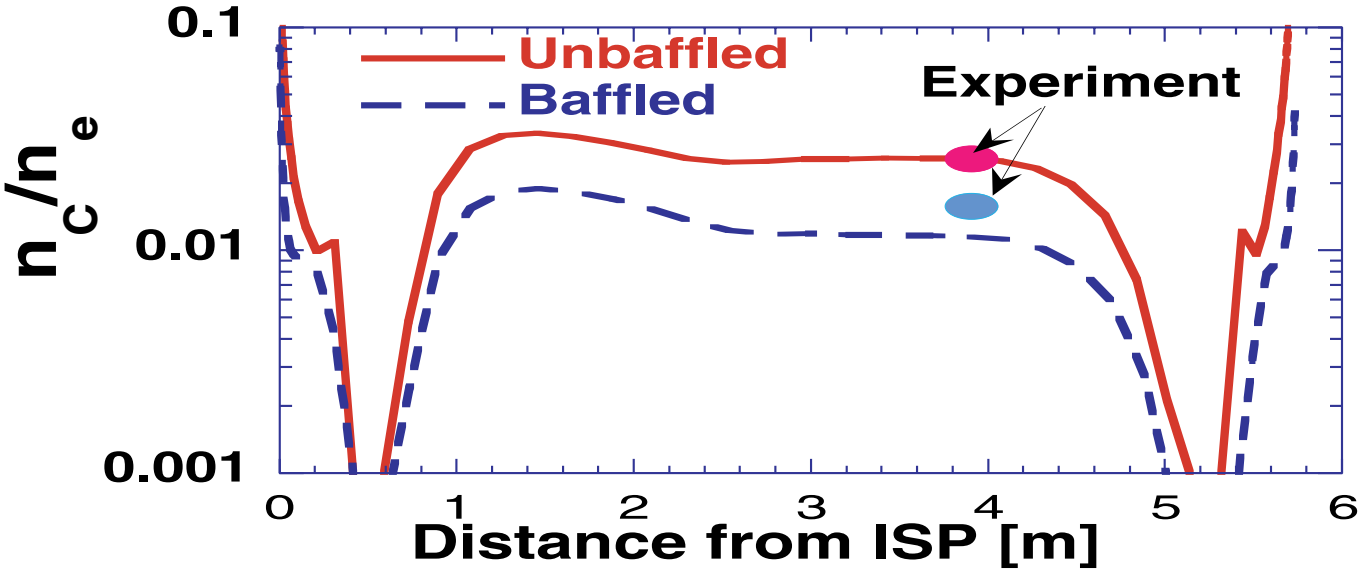
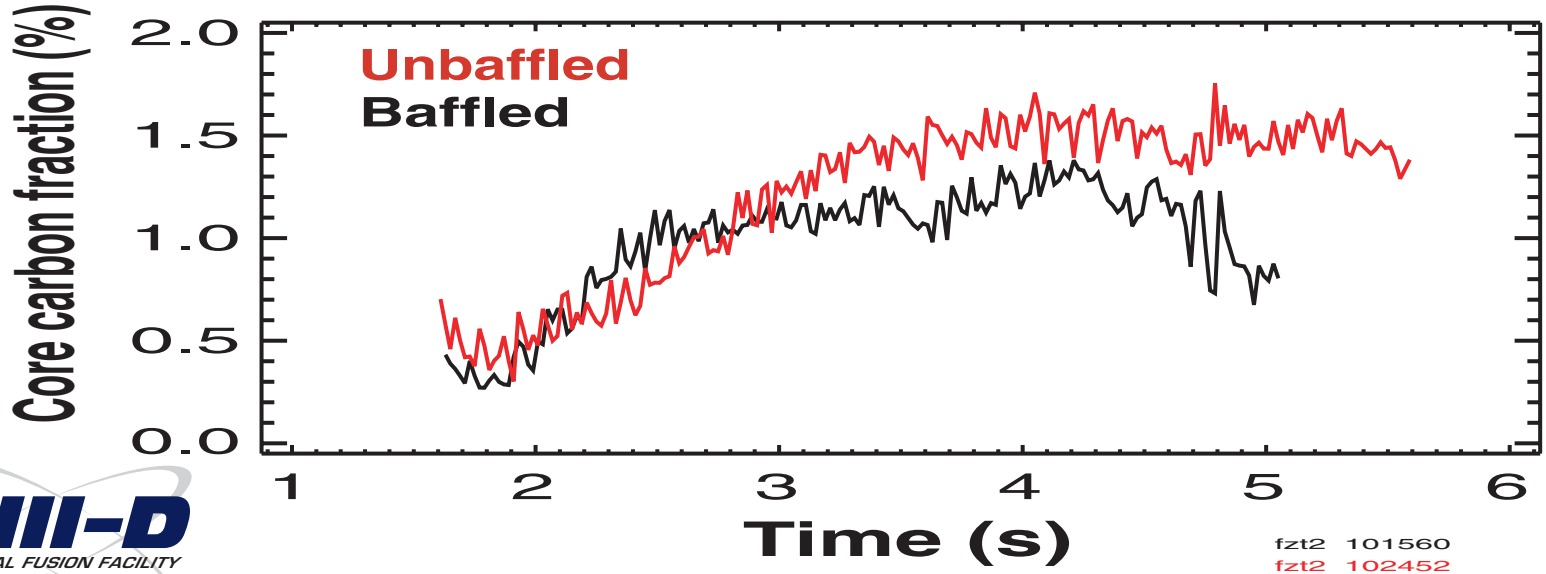
UEDGE modeling indicates that baffling plays a major role in lower core carbon with divertor 2000

- lower core carbon in USN





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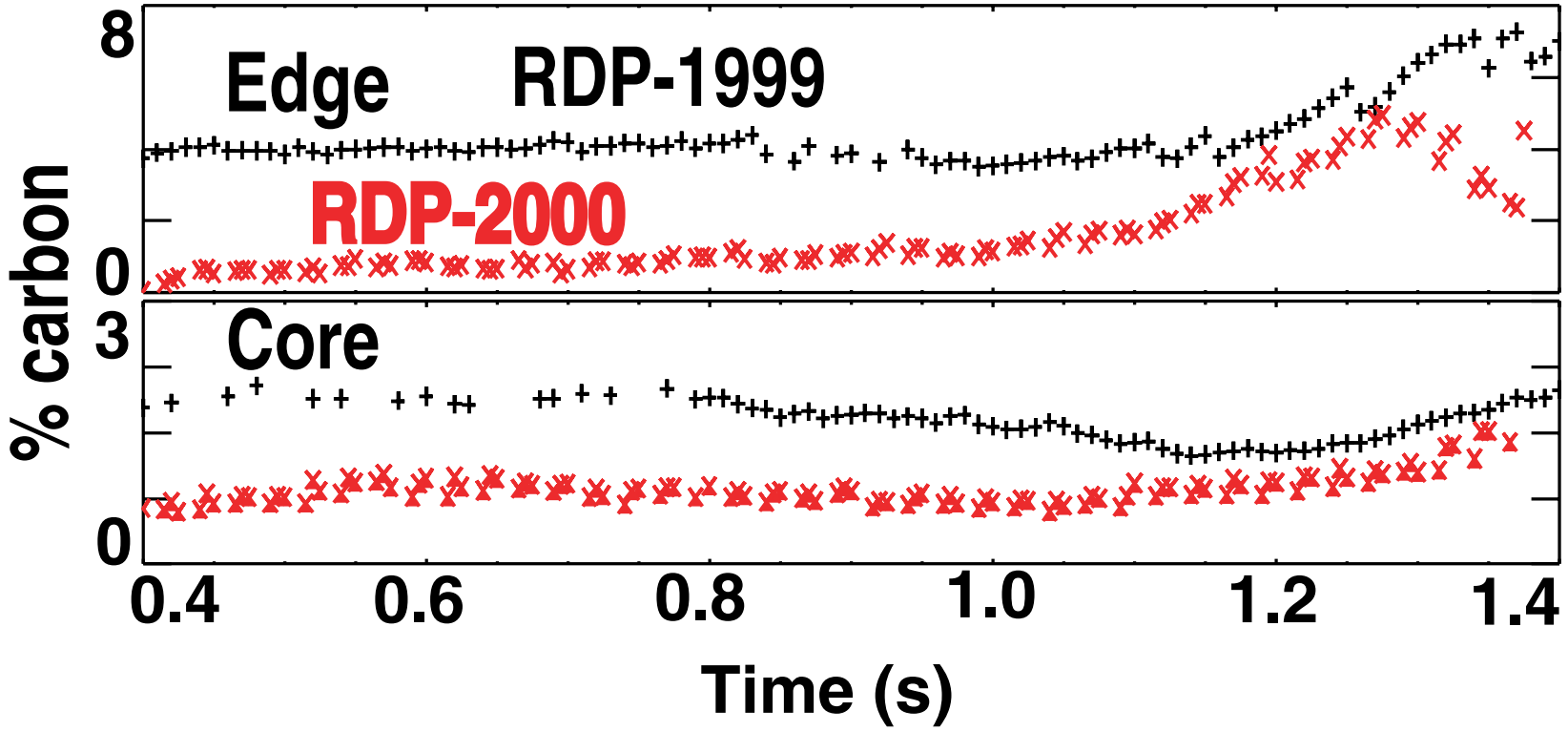
16 west_23 UEDGE carbon predic

Carbon concentration is reduced compared to previous operation



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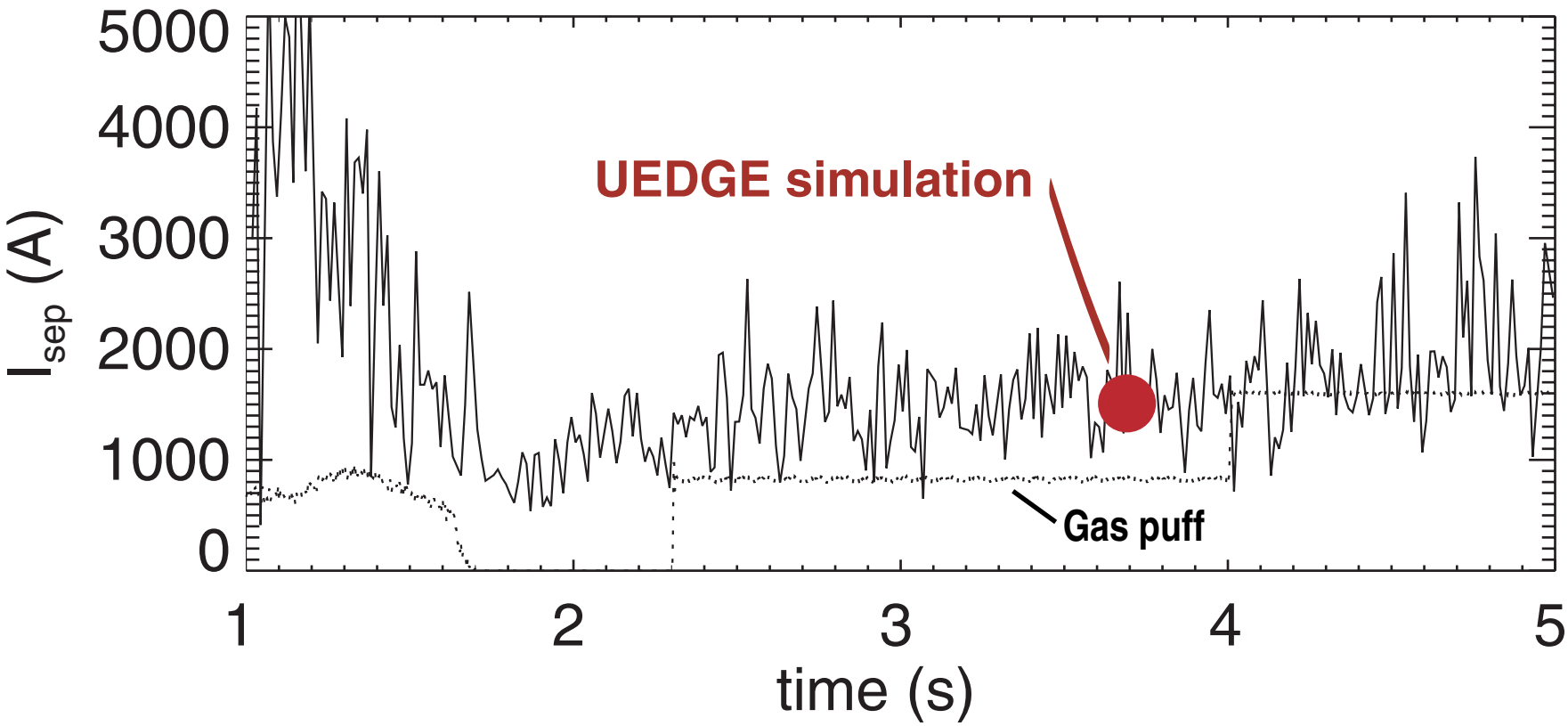
16b carbon conc red.ill

UEDGE matches measurement of core ionization



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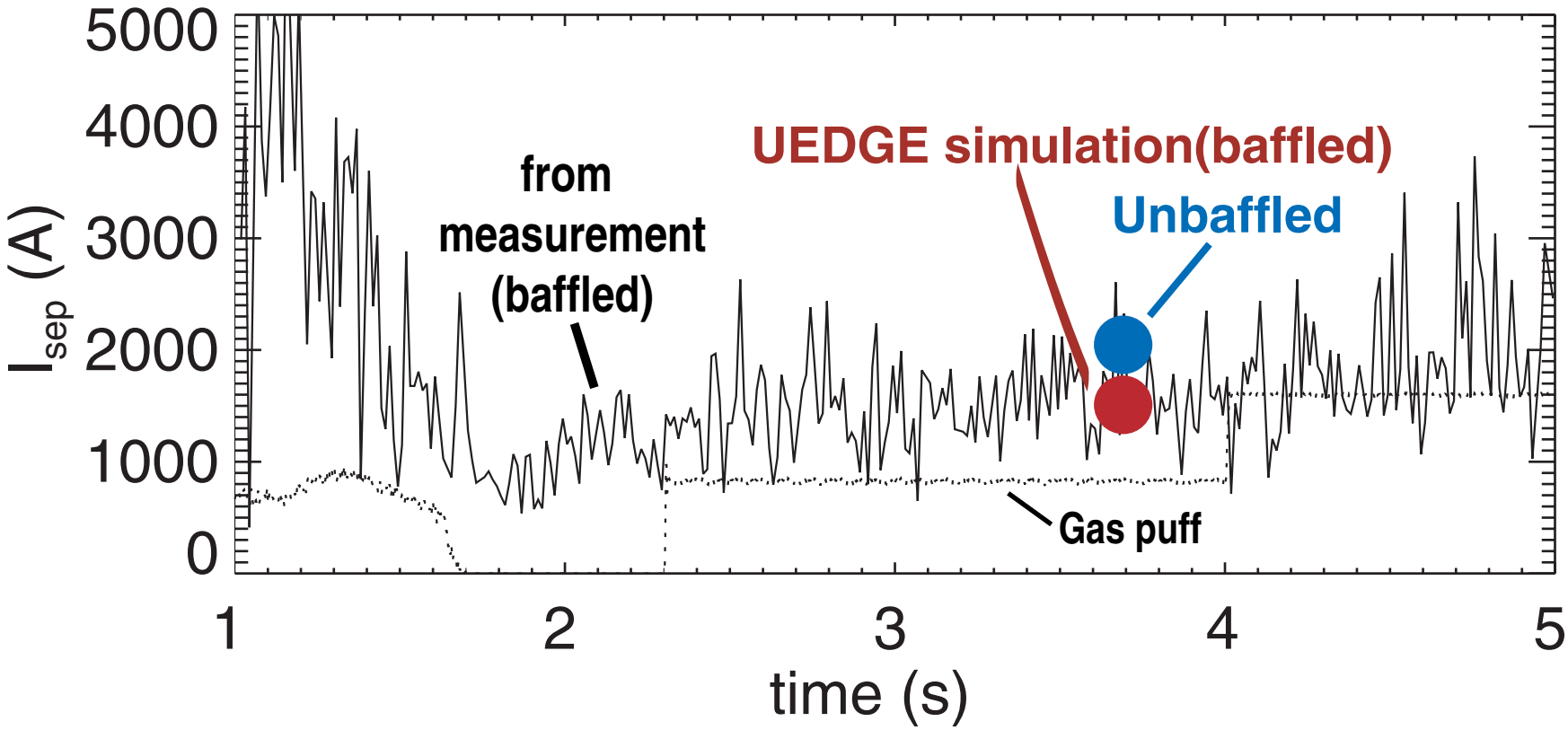
DIII-D shot #101560 and UEDGE simulation tpd30

UEDGE predicts core ionization reduced by baffle without pumping

- UEDGE matches measurement of core ionization in baffled discharge



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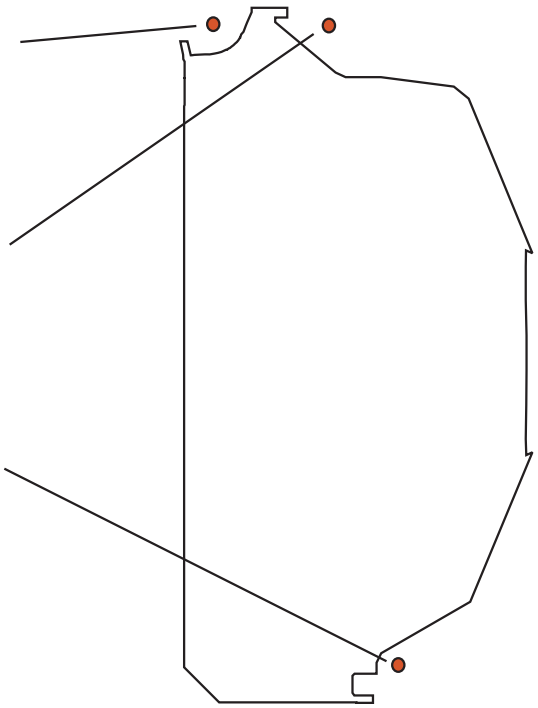
DIII-D shot #101560 and UEDGE simulation tpd30

New pumps

Pump	R (m)	pumping speed at the pump at 1 mT (L/s)
upper inner (1999)	1.12	30,000
upper outer (1998)	1.59	43,000
lower outer (existing)	1.86	50,000



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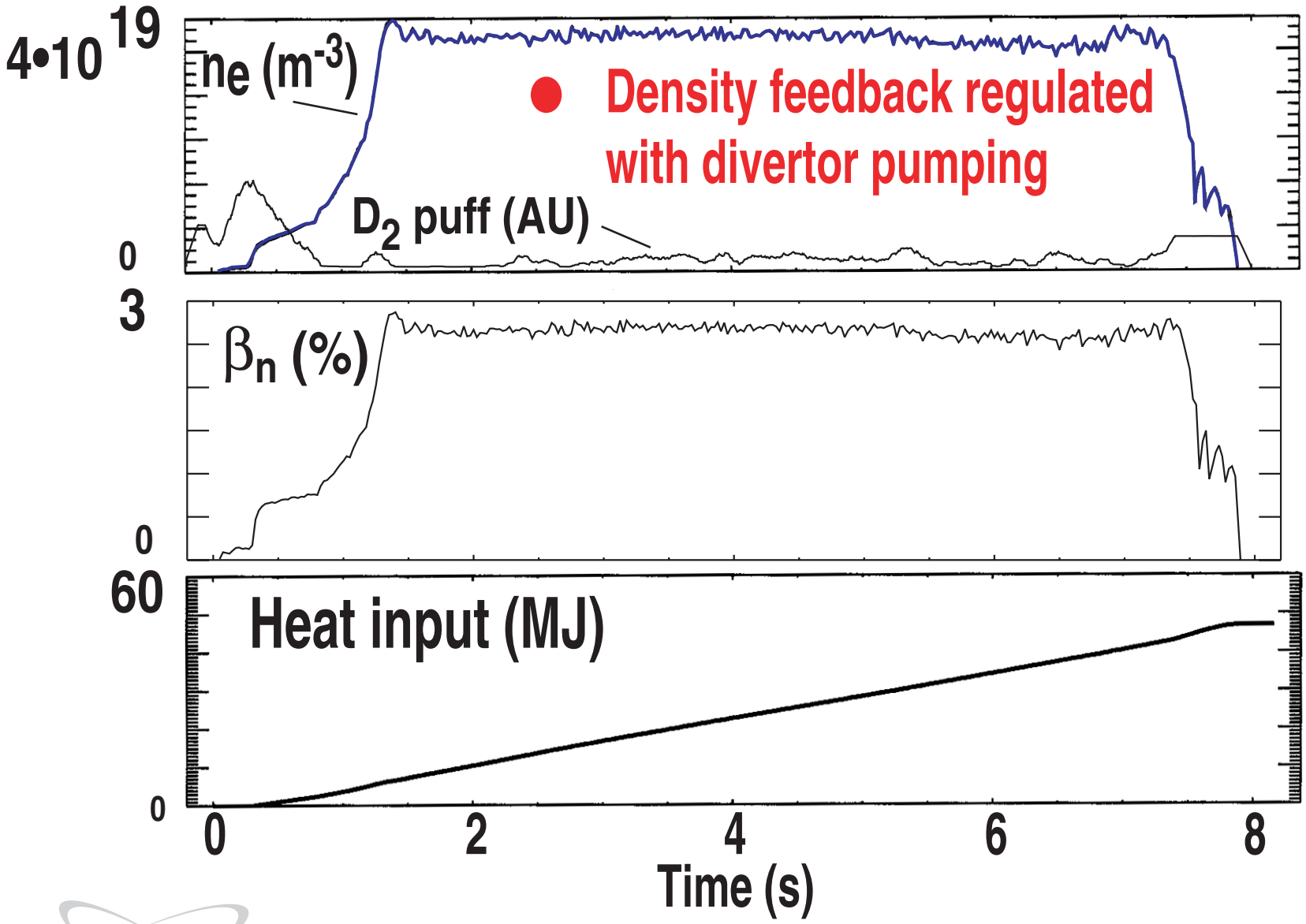
Density control achieved with the new Divertor 2000



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19Div2000LongPulsePumped.eps

Summary

- Local tile heating was reduced on the new inner wall tiles by alignment and contouring.
- Modeling indicates that baffling plays a major role in reduced core carbon contamination.
- Many discharges show reduced carbon content.
- The new upper inner pump and baffle are installed and working. Pumping is effective as predicted.

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