SPA 2 Activities DIFFER 2023

T.W. Morgan[1,2], M. Balden[3]

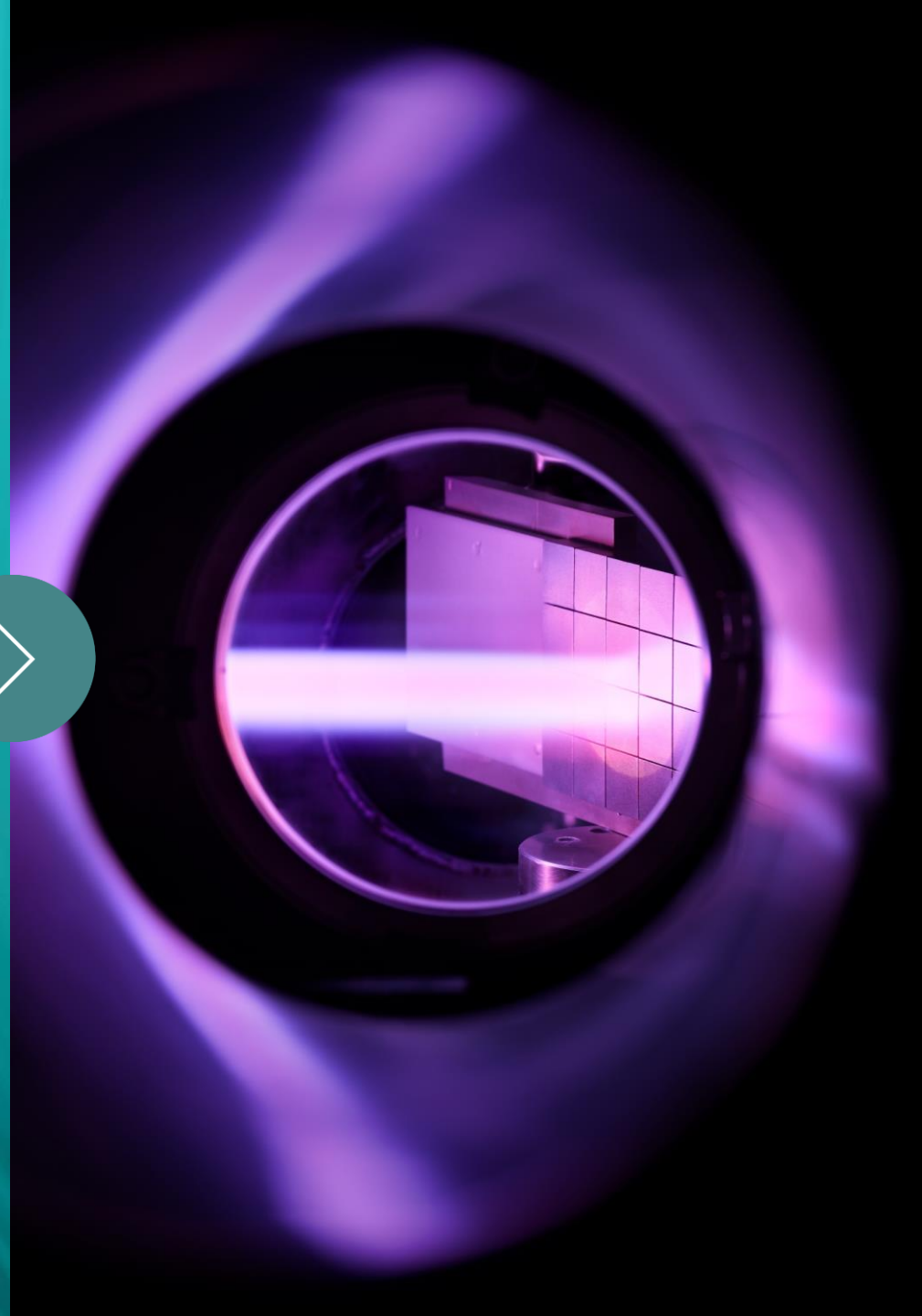
[1]*Dutch Institute for Fundamental Energy Research, Eindhoven, The Netherlands*

[2]*Eindhoven University of Technology, The Netherlands*

[3]*Max Planck Institute for Plasma Physics, Garching, Germany*

DIFFER

NWO

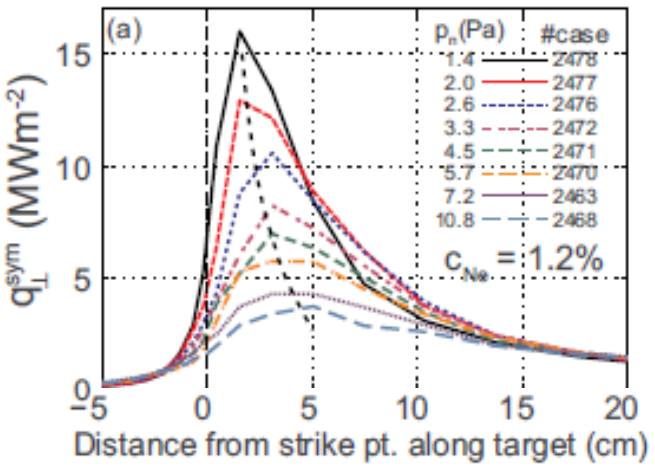


What is the effect of slow transients?

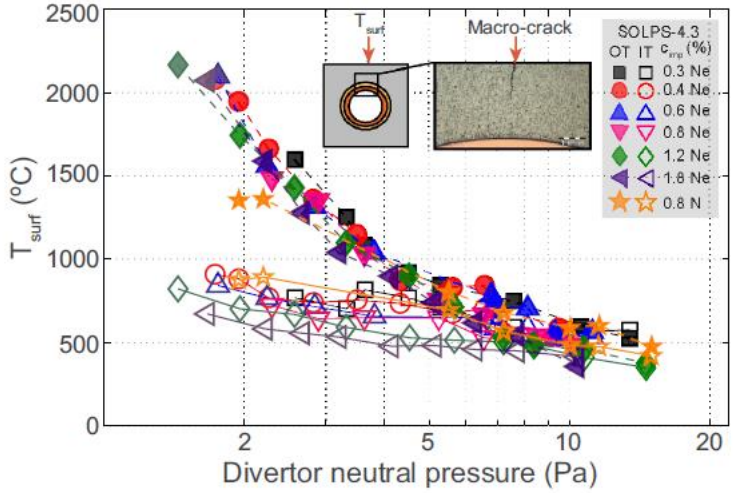
What happens during slow transients?

Slow transients: heat flux increase at divertor (10-20 MW m^{-2}) due to loss of detachment

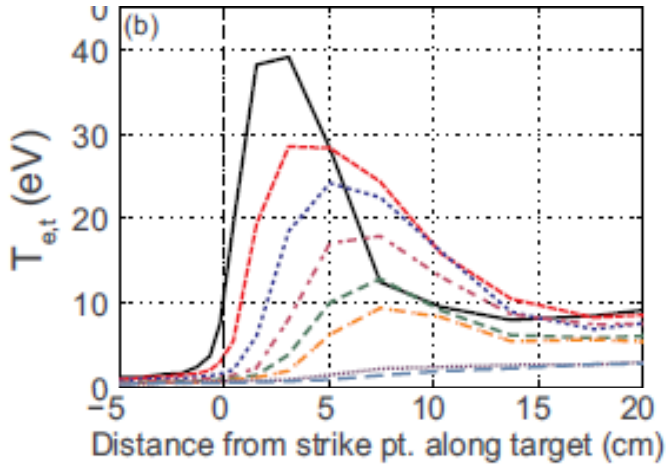
- T_{surf} > 2000 °C, R_x to 2mm deep in 1 hour, lose yield strength, cracking
- T_e increases, sputtering due to entrained impurities



$p_n \downarrow$ » $q_\perp \uparrow$



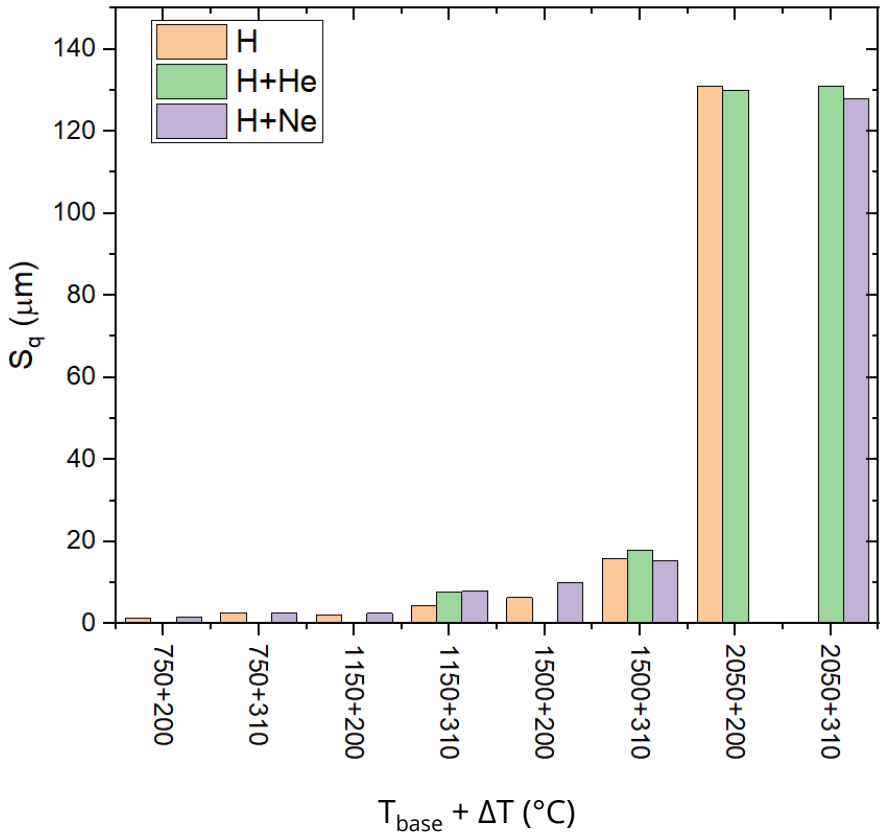
$q_\perp \uparrow$ » $T_{surf} \uparrow$



$p_n \downarrow$ » $T_{e,t} \uparrow$

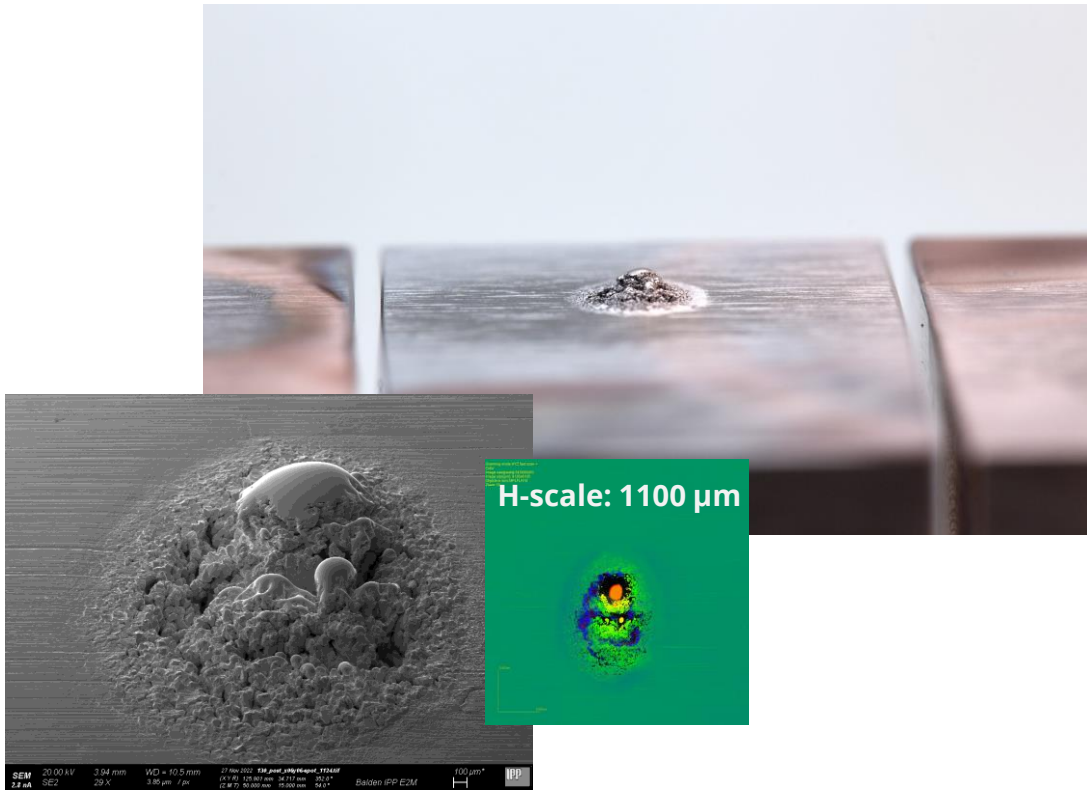
Pitts *Nucl. Mat. Energy* 20 (2019)

Previous results show extreme roughening at Tsurf = 2000 °C



Severe deformation for very small ELM-like loads (Npulse = 10^5; F_{HF}~4 MW m^{-2} $^{0.5}$)

Strikepoint protrusion = erosion risk?



Approach

Questions:

- To what extent is large-scale deformation due to localized nature of laser?
- Does this damage saturate or continue over time?
- Does it pose an increased erosion/melting risk?

Approach:

- Magnum-PSI exposures with Tsurf>2000 C, ELM pulses from LASAG
- Use different sized W blocks with size < laser spot or > laser spot
- Evaluate evolution over time (up to 10^6 N_{pulses})
- Investigate loading under oblique incidence (leading edge effects)