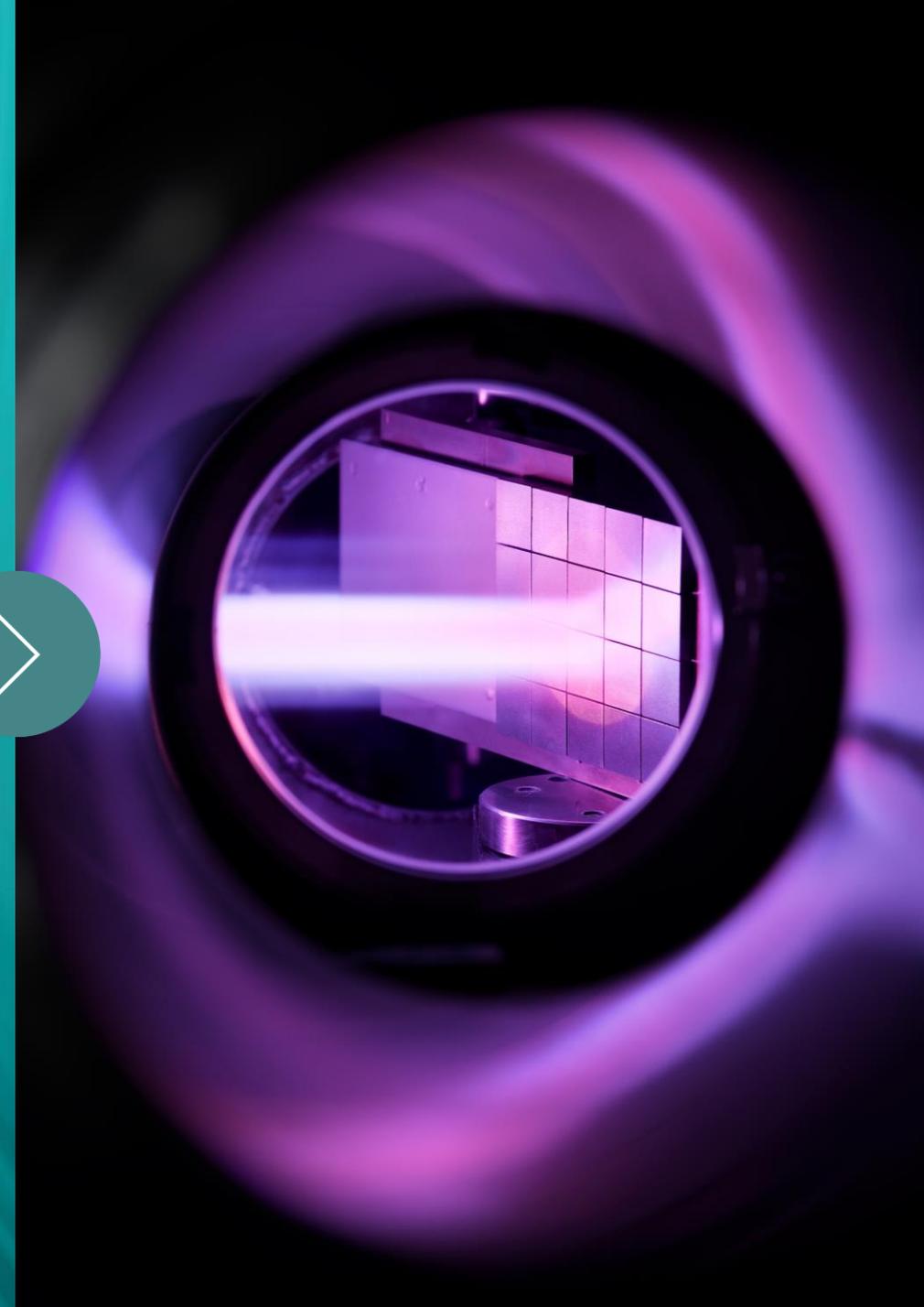


WP PWIE SP B.1

DIFFER activities in 2021: Erosion behaviour of W model systems in MAGNUM-PSI

T.W. Morgan

SP B.1 Kick-off meeting 09-06-2021



Task description

Determine the impact of plasma conditions on erosion of W model systems and formation of re-deposited layers: MAGNUM-PSI experiments and analyses (DIFFER)

Deliverable: Determine the impact of plasma conditions on erosion of W model systems and formation of re-deposited layers: MAGNUM-PSI experiments and analyses (DIFFER)



Questions to investigate for low T_e , high n_e plasma

In s.s. plasma know that impurities will dominate erosion in ITER

Are seeding impurities entrained in the plasma beam, leading to higher energies than expected?

What happens to eroded W in high-density, low temperature plasma?

Influence of different plasma parameters and gas species on W erosion and re-deposition

- Seeding impurity entrainment
- Ion-neutral friction vs ionization and prompt re-deposition

Fokker Plank model for trace impurities in H plasma ($n_e=1 \times 10^{20}$) [van Swaaij (2014)]

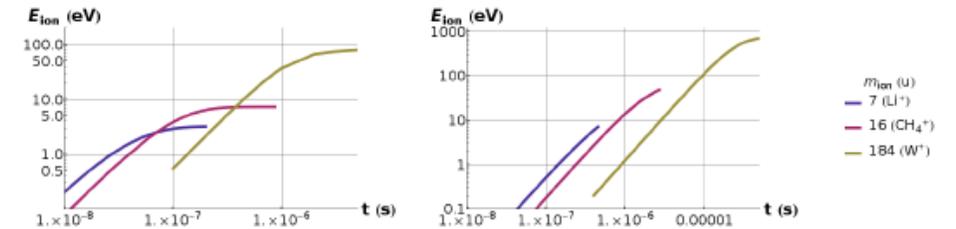


Figure 7.4: Evolution of the test particle kinetic energy in the lab frame, in a 1 eV plasma (left) and in a 10 eV plasma (right).

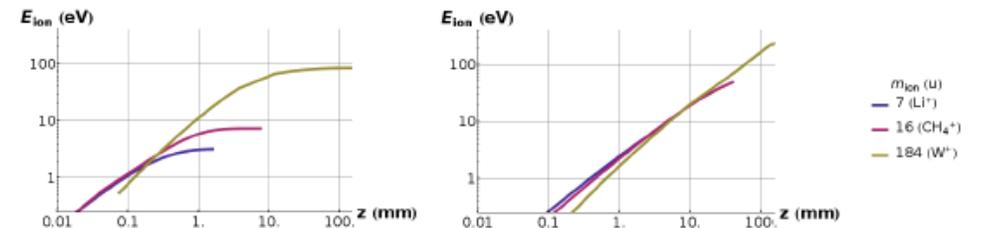
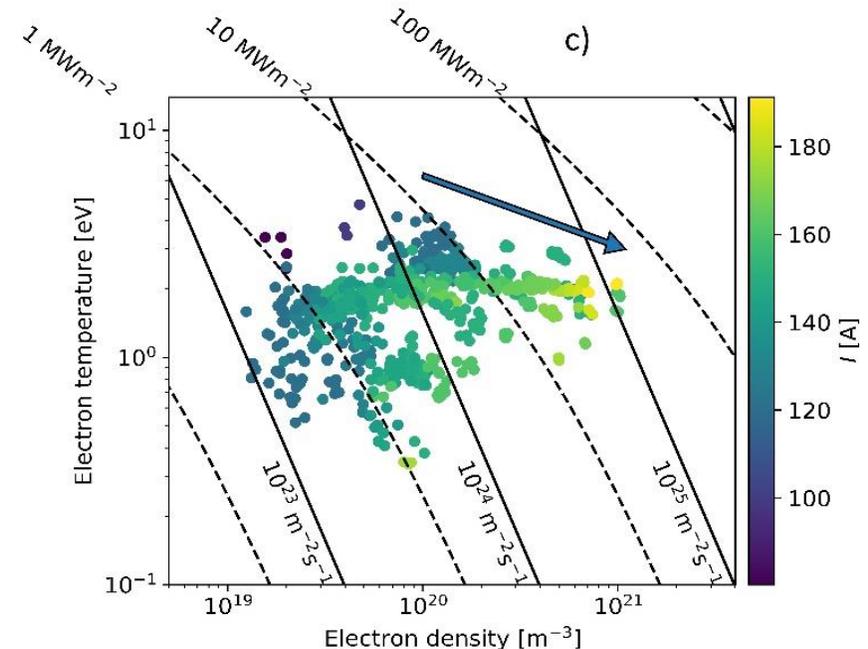
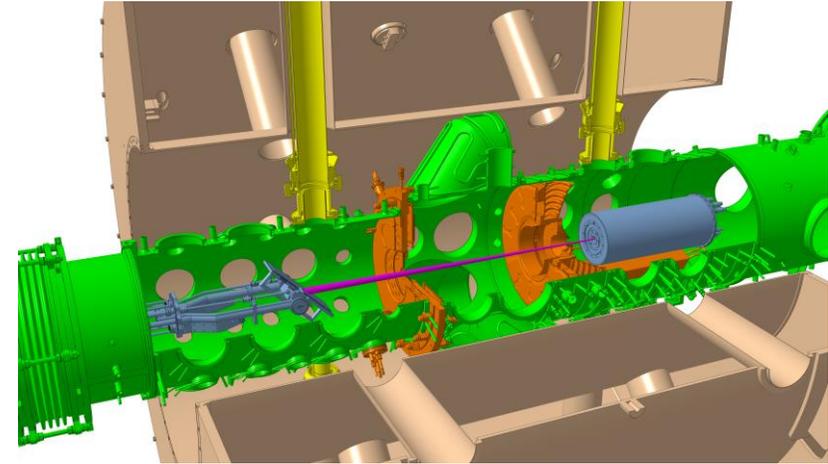


Figure 7.5: The test particle kinetic energy plotted against the covered distance x , in a 1 eV plasma (left) and in a 10 eV plasma (right).



Approach

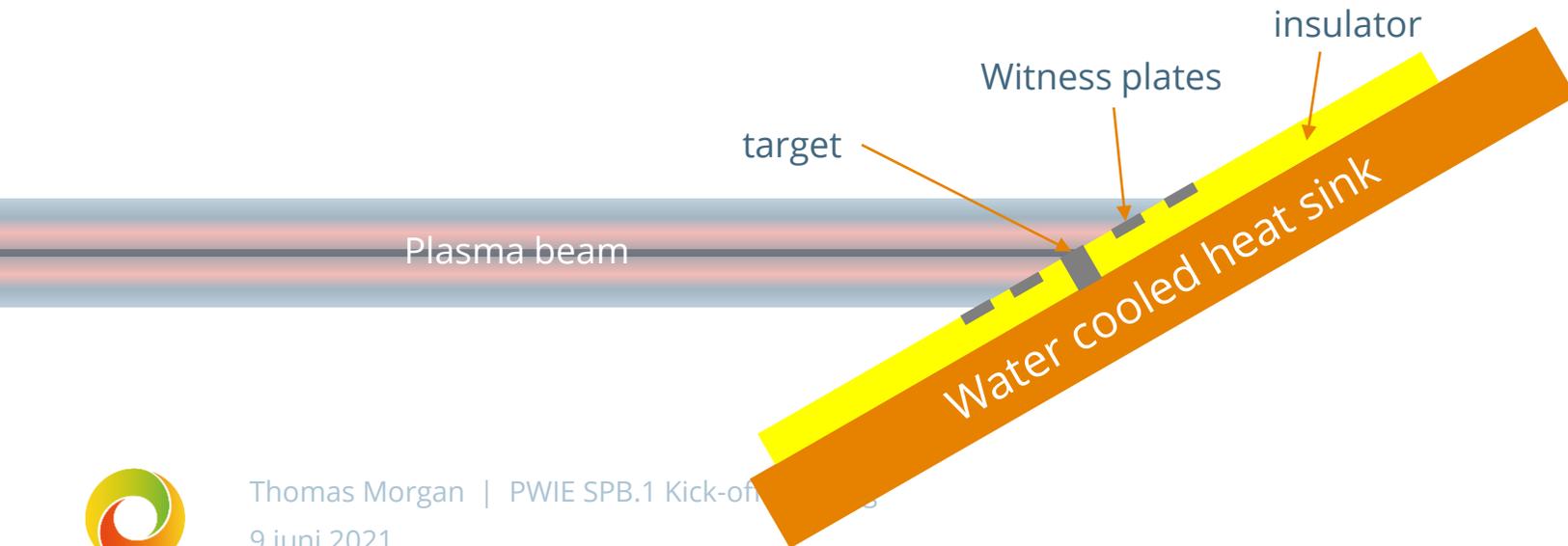
- Use Magnum-PSI with large target holder, tilting to low angle (reduce heat load and closer to reality)
- Use either impurity species or seeded impurity in H plasma
 - By changing bias can determine erosion threshold for impurity and influence of entrainment
- By changing settings can go from high T_e , lower n_e to low T_e , high n_e
 - more dominated by prompt re-deposition vs more dominated by ion-neutral friction
- Track what happens to eroded products in terms of migration, redeposition and layer properties



Experimental approach



- Use small target surrounded by high thermal conductivity insulator (BN/AlN): can vary biasing only on target surface
- Use QCM and spectroscopy to monitor gross erosion
- Measure film properties from deposition on witness plates (RBS, XRF)
- Can modify incidence angle by rotating target holder





Thanks, questions?

