



PWIE SP D “*PSI & SOL Modelling*” - KOM 2021

Task under SP D.3: ERO modelling & morphology studies

A. Kirschner, D. Reiser, H. Xie, ...





1. Dynamic morphology studies, comparison with ion beam experiments
 2. ERO modelling for $^{13}\text{CH}_4$ injection in W7-X
 3. Tungsten and beryllium, erosion, migration, deposition modelling
- Manpower for 2021: in total 16 PM
 - For all three tasks: no bottlenecks expected ...



Task 1: Dynamic morphology studies



- 2D AFM profiles to investigate surface morphology as result of ion beam irradiation
- Data driven model discovery to find continuum models to describe temporal evolution

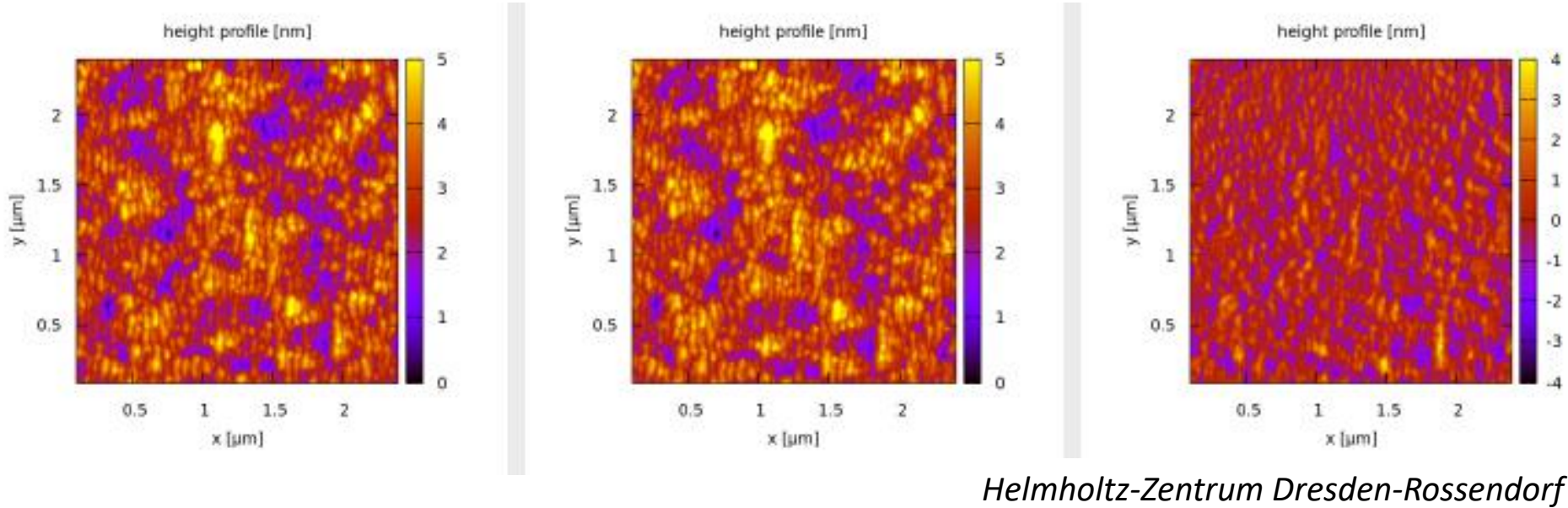
Continuum models describe the evolution of surface height h :

$$\frac{\partial h}{\partial t} = -\nu \nabla^2 h + \frac{\lambda}{2} (\nabla h)^2 - b \bar{h} - K \nabla^2 \nabla^2 h + \dots = \sum_{i=1}^N \alpha_i f_i(h)$$

Snapshots of 2D profiles can be analysed to extract model parameters ν , λ , μ , etc.



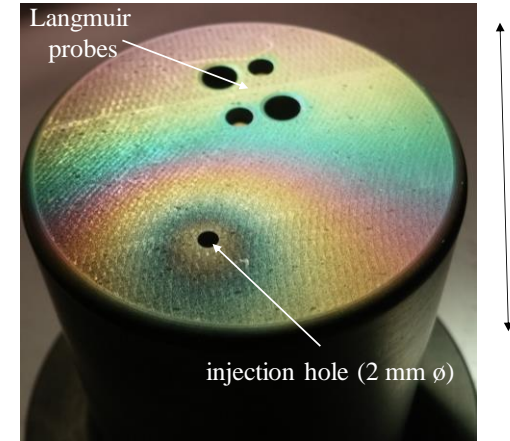
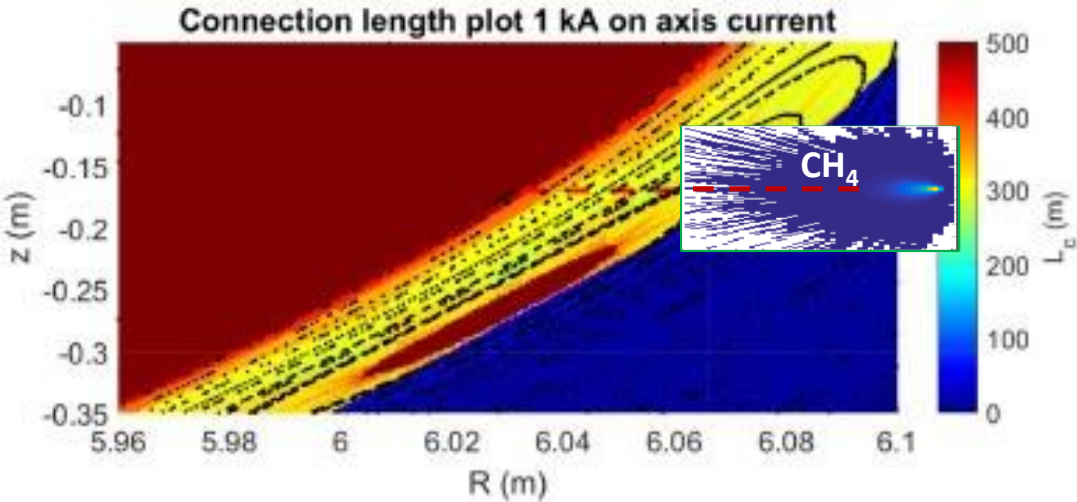
Task 1: Dynamic morphology studies



- Problem: misalignment between irradiation phases
- Numerical correction needed: several methods under investigation; ongoing task
- First results presented at PFMC 2021



Task 2: $^{13}\text{CH}_4$ injection through W7-X MPM



Manipulator head after exposure
(2 discharges with $^{13}\text{CH}_4$)

- ERO simulations are ongoing
- First results indicate the need of enhanced re-erosion of redeposited ^{13}C

- From colorimetry: ~1% local deposition efficiency
- IBA to be done

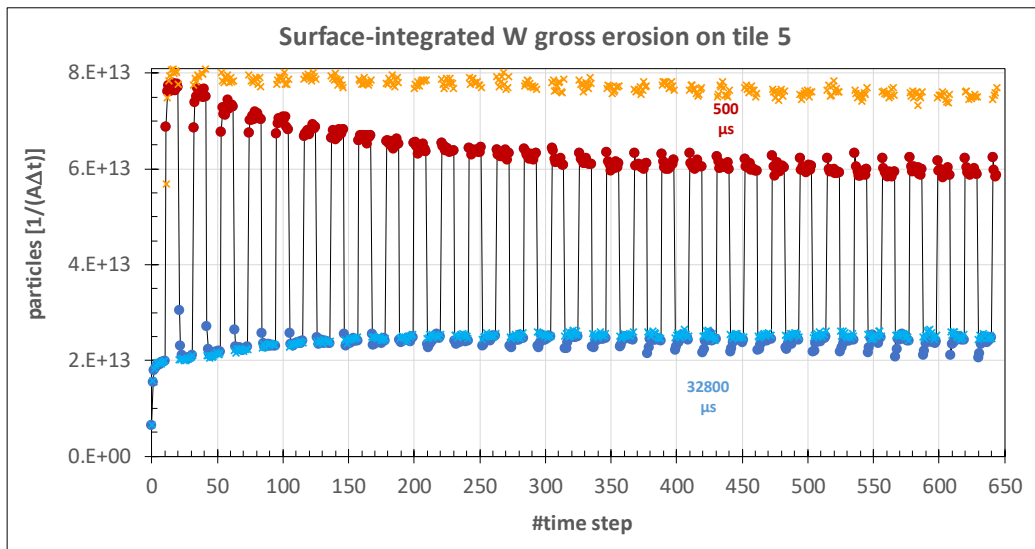


Task 3: W and Be migration

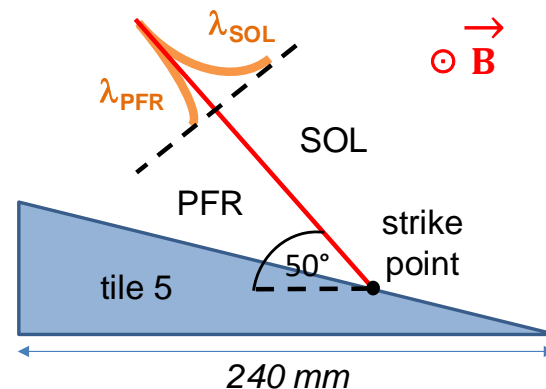


- Focus on divertor of JET-ILW
- Currently simplified plasma background
- Parameter studies: isotope effect
- ELM vs. intra-ELM phases, dynamic evolution

Surface-integrated W gross erosion on tile 5



Set-up for the modelling:



B field: 2 T, $\alpha_B = 2^\circ$

Plasma parameter:

- constant within separatrix
- inter-ELM: exponential decay λ according to Langmuir probe data

