# WPPWIEE SPA.2: High Particle Fluence Exposures of Plasma-Facing Components for ITER

***Pre- and post-characterisation of***

***ENEA-58 mock-up for exposure in Magnum-PSI***

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MAX-PLANCK-INSTITUT
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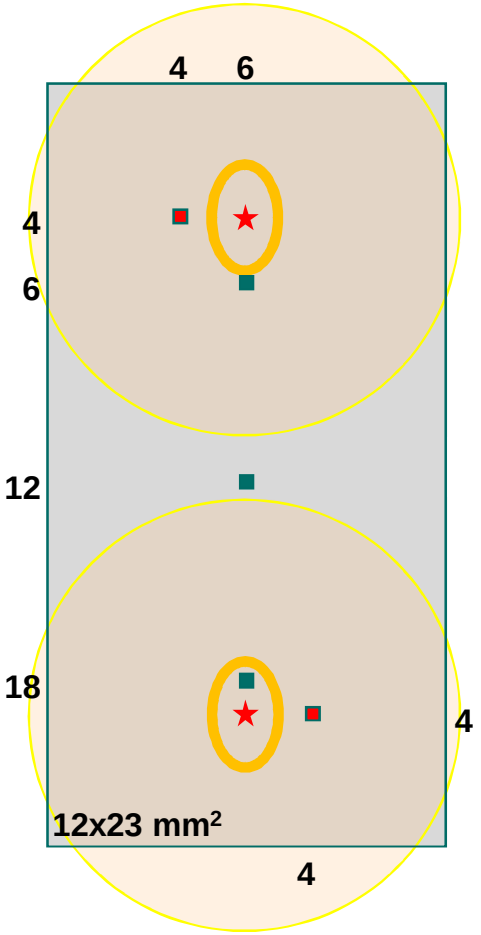
***Midterm meeting***

Pre- and post-characterisation of
ENEA-58 mock-up for exposure in Magnum-PSI

# Exposure of mockup ENEA-58 at Magnum-PSI

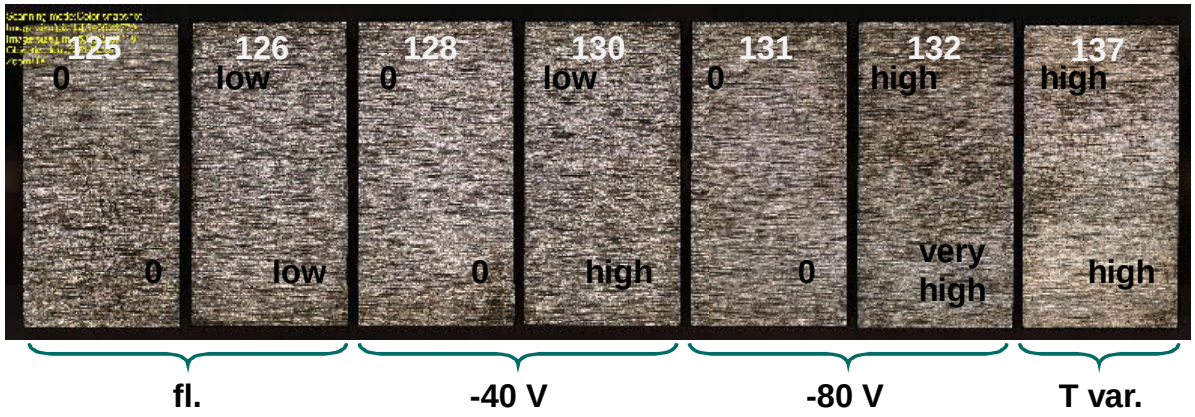

- **Aim 1: Determination of erosion by noble gas seeding → validation of assumption for calculation of impurity impact energy for high flux/fluence**
- **Aim 2: Progression of study of synergy of ELM-like events to plasma exposure**

- The mockup "ENEA-58" is composted of 7 monoblocks
- On each monoblock two experiments with Magnum-PSI can be performed → 14 experiments
- The laser spot will be laid over the plasma beam to simulated ELM events
- Conditions for each experiment have been chosen
- To determine erosion, trenches with a µm-ruler on its cross-section plane are prepared on the labelled location, as well as a grid of CLSM measurements (not labelled)
- Microstructural change on the surface can be identified by comparison of pre- and post-exposure analysis
- For determination of surface roughness changes, CLSM will be done pre- and post-exposure analysis




red = SEM, squares = CLSM

# Exposure of mockup ENEA-58 at Magnum-PSI

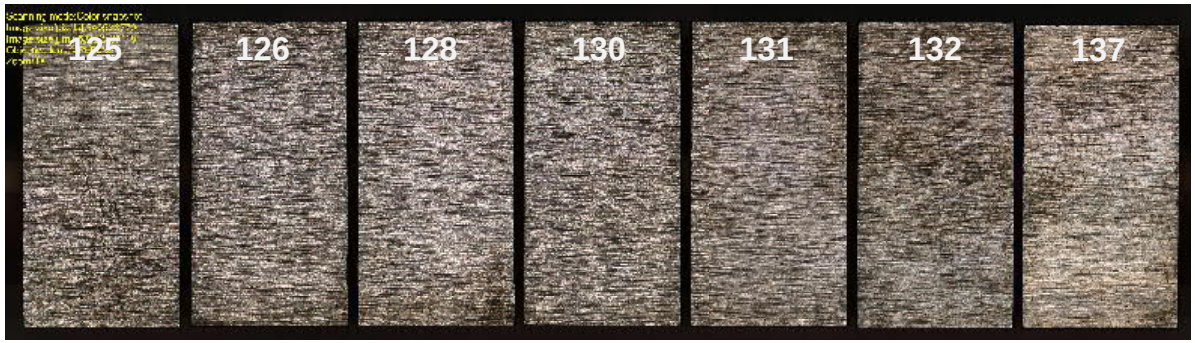


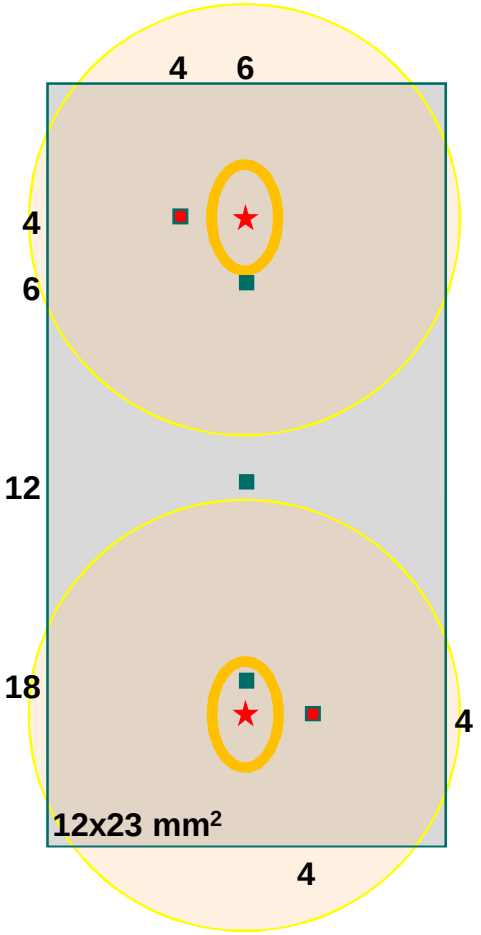

| Monoblock | Position | Gas mix | Biasing / V | Surface T / K | ΔT / K | $N_{pulses}$ | Erosion |
|---|---|---|---|---|---|---|---|
| 1 – 125 | Top | H | Fl | 2000 | 310 | 4e5 | 0 |
| 1 – 125 | Bottom | H + He | Fl | 2000 | 310 | 4e5 | 0 |
| 2 – 126 | Top | H + Ne | Fl | 2000 | 310 | 4e5 | Low |
| 2 – 126 | Bottom | H + Ar | Fl | 2000 | 310 | 4e5 | Low |
| 3 – 128 | Top | H | -40 | 2000 | 310 | 4e5 | 0 |
| 3 – 128 | Bottom | H + He | -40 | 2000 | 310 | 4e5 | 0 |
| 4 – 130 | Top | H + Ne | -40 | 2000 | 310 | 4e5 | Low |
| 4 – 130 | Bottom | H + Ar | -40 | 2000 | 310 | 4e5 | High |
| 5 – 131 | Top | H | -80 | 2000 | 310 | 4e5 | 0 |
| 5 – 131 | Bottom | H + He | -80 | 2000 | 310 | 4e5 | 0 |
| 6 – 132 | Top | H + Ne | -80 | 2000 | 310 | 4e5 | High |
| 6 – 132 | Bottom | H + Ar | -80 | 2000 | 310 | 4e5 | Very high |
| 7 – 137 | Top | H+Ne | -80 | 1150 | 310 | 4e5 | High |
| 7 – 137 | Bottom | H+Ne | -80 | 1500 | 310 | 4e5 | High |

additional

**Very high and high: probably already in macroscopic length scale**

# CLSM



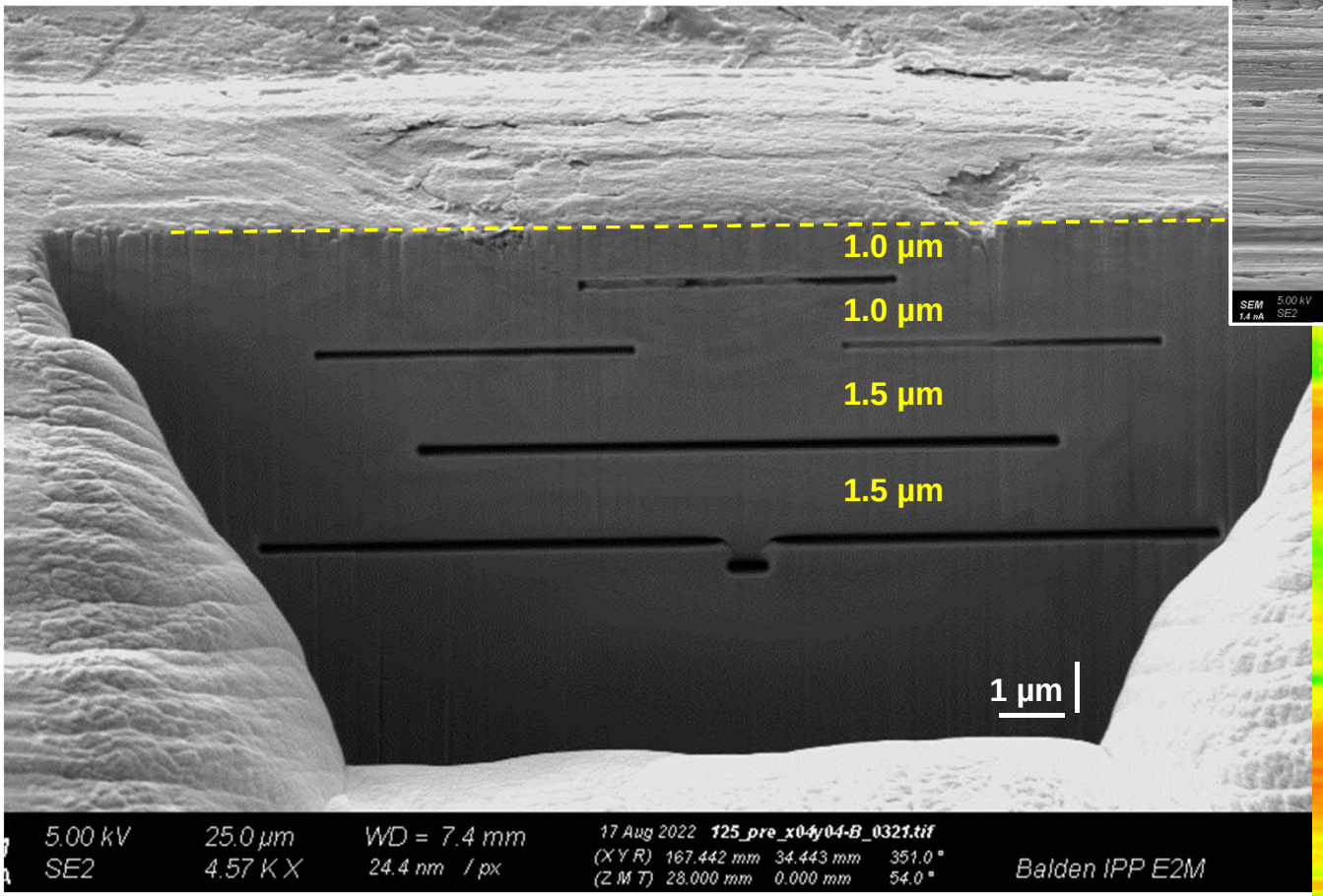

red = SEM, squares = CLSM

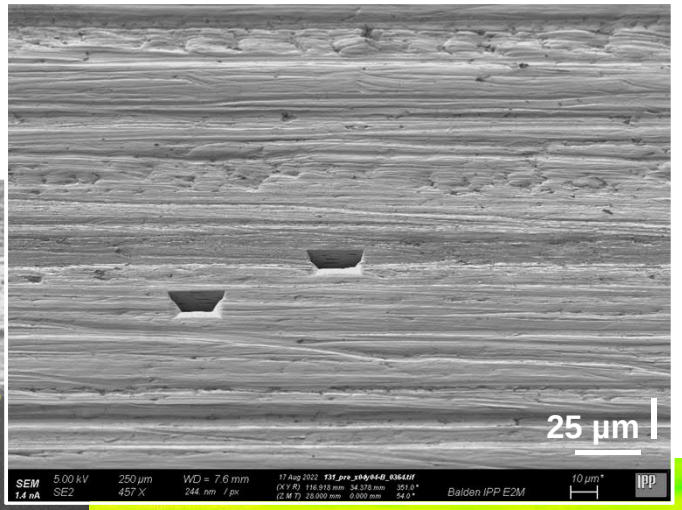
1) CSLM: x100, x50, x20, x5 of all 14 positions with FIB trenches with rules

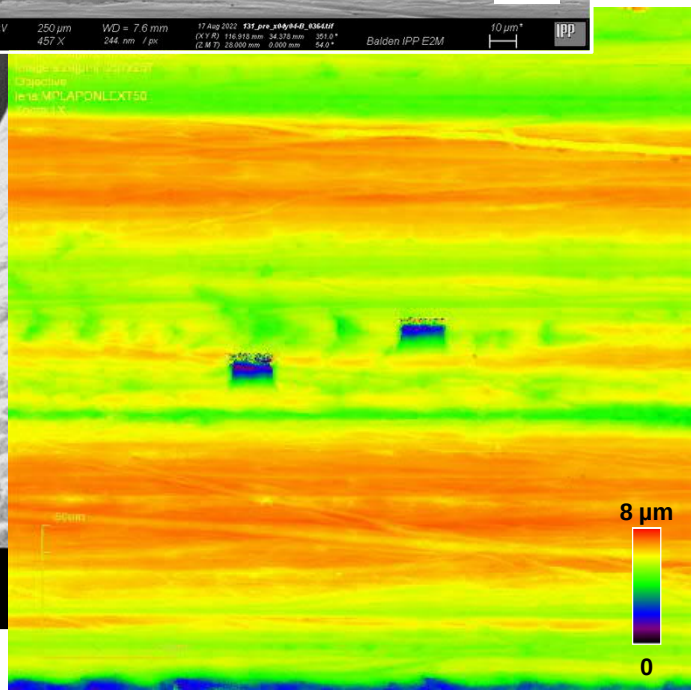
2) CSLM: x50 & x20 of 3 further position on each of the 7 monoblocks (for roughness assessment)

3) CSLM relative height values between points of a grid across full mockup (not labelled)

# Example: µm-ruler on cross-section plane



# Progression of pre-characterisation

**Task performed / to be performed**

- **Auriga: µm-ruler preparation at coordinates x04y04 and x08y19** → **Done** ✓
- **Auriga: SEM imaging of all µm-ruler and magnification series of surface at x04y04 and x08y19** → **Ongoing (✓)**
- **Auriga: SEM magnification series of surface at x06y06 and x06y17** → **Pending**
- **CLSM: Profile measurements of µ-ruler areas** → **Done** ✓
- **CLSM: Surface roughness measurement on three positions of each monoblock** → **Done** ✓
- **CLSM: relative height values between points of a grid across full mockup** → **Pending**

→ **Pre-characterisation will be finished in time**

**Further progression:**

- Sending for specimens to DIFFER planed for end of September
- Magnum-PSI exposure scheduled starting 15th November
- Post-characterisation will be / extend in 2023