



Co-deposition of deuterium and impurity atoms on wall probes in the divertor of JET with ITER-like wall

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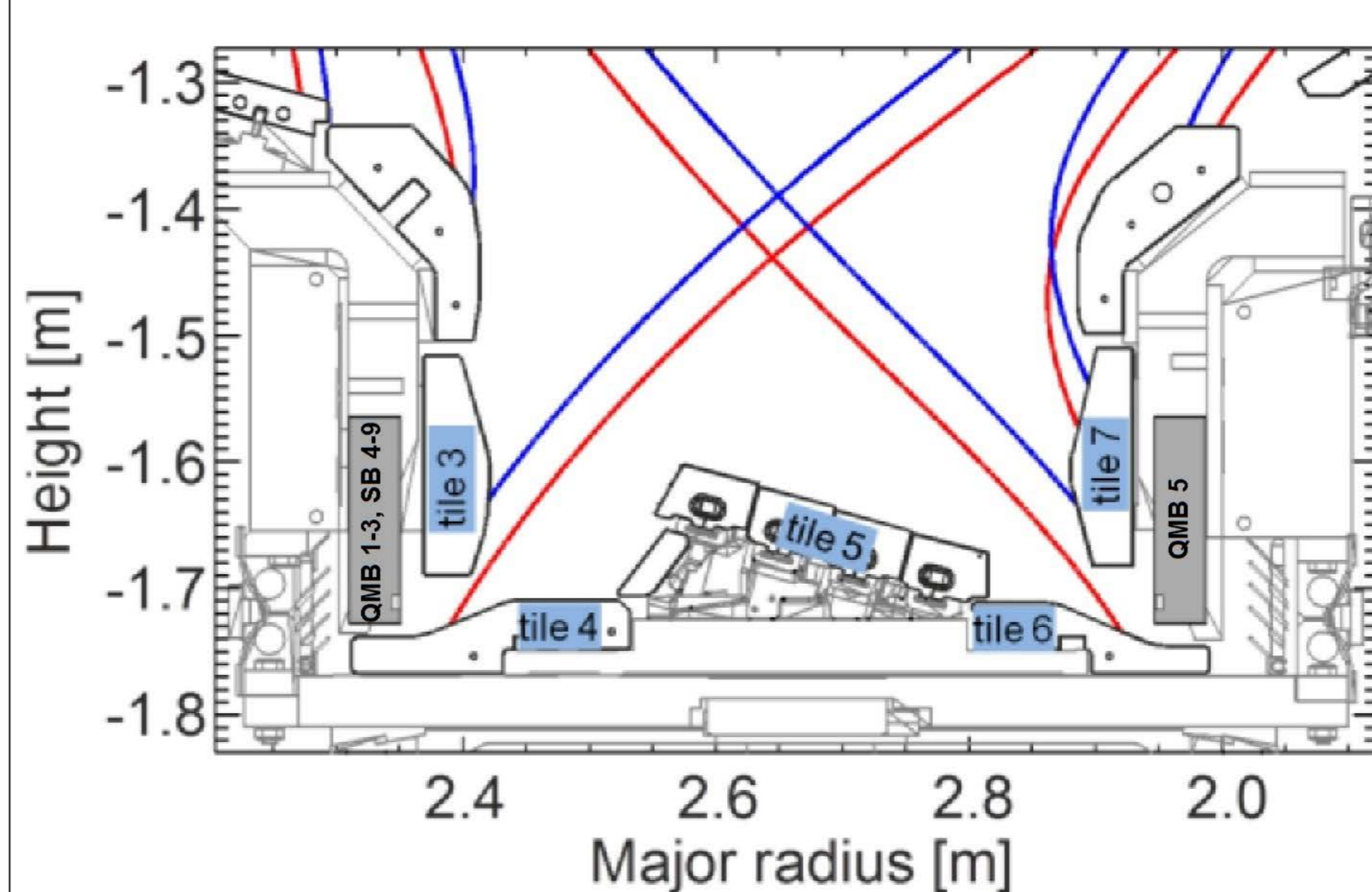
Summary

- Components from remote locations in divertor corners of JET-ILW studied with ion beam analysis and scanning electron microscopy.
- C/D co-deposition indicated on Inconel-600 blocks mounted on divertor carrier ribs ("spatial blocks").
- D also found in Be or BeO (almost C free) layers on stainless steel covers for quartz microbalances → C presence not essential for D retention.
- C found on spatial blocks but not on quartz microbalance covers. Source: divertor carrier ribs → C transport on cm scale in remote corners.
- ¹⁸O tracer introduced at the end of third ITER-like wall campaign found on surface of probes → indication of in-vessel oxidation.

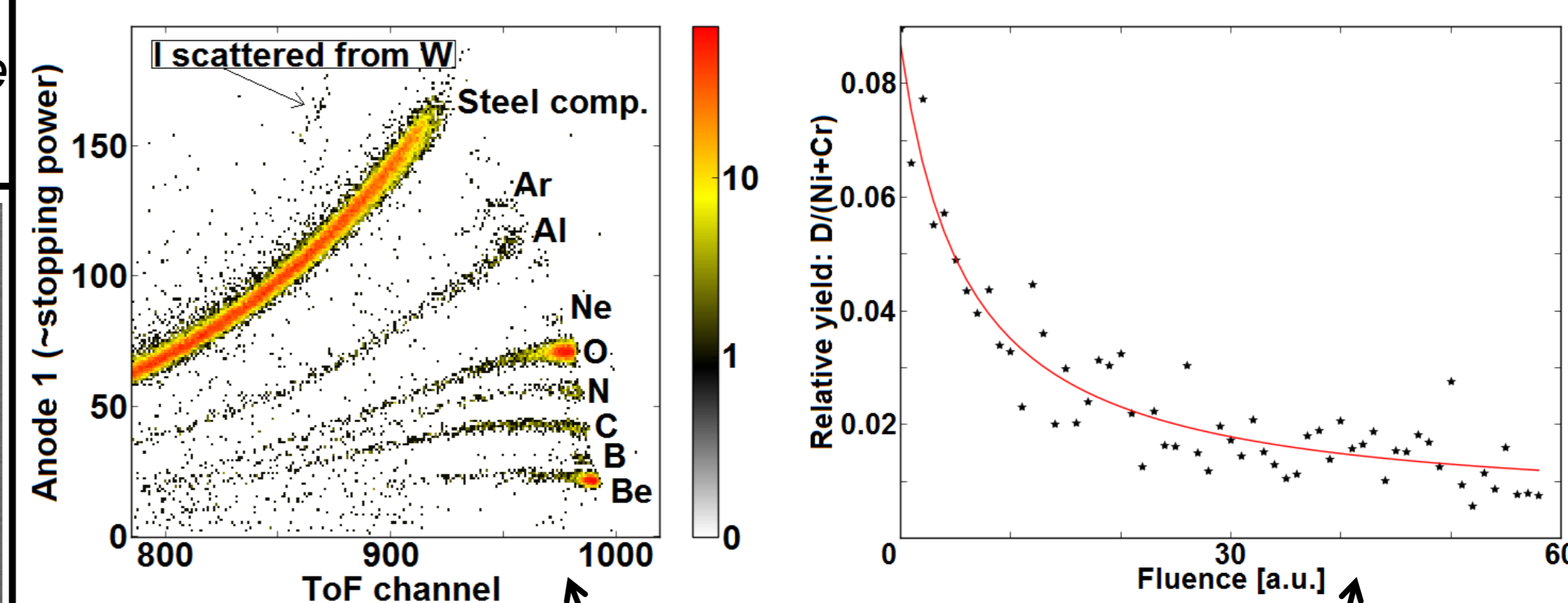
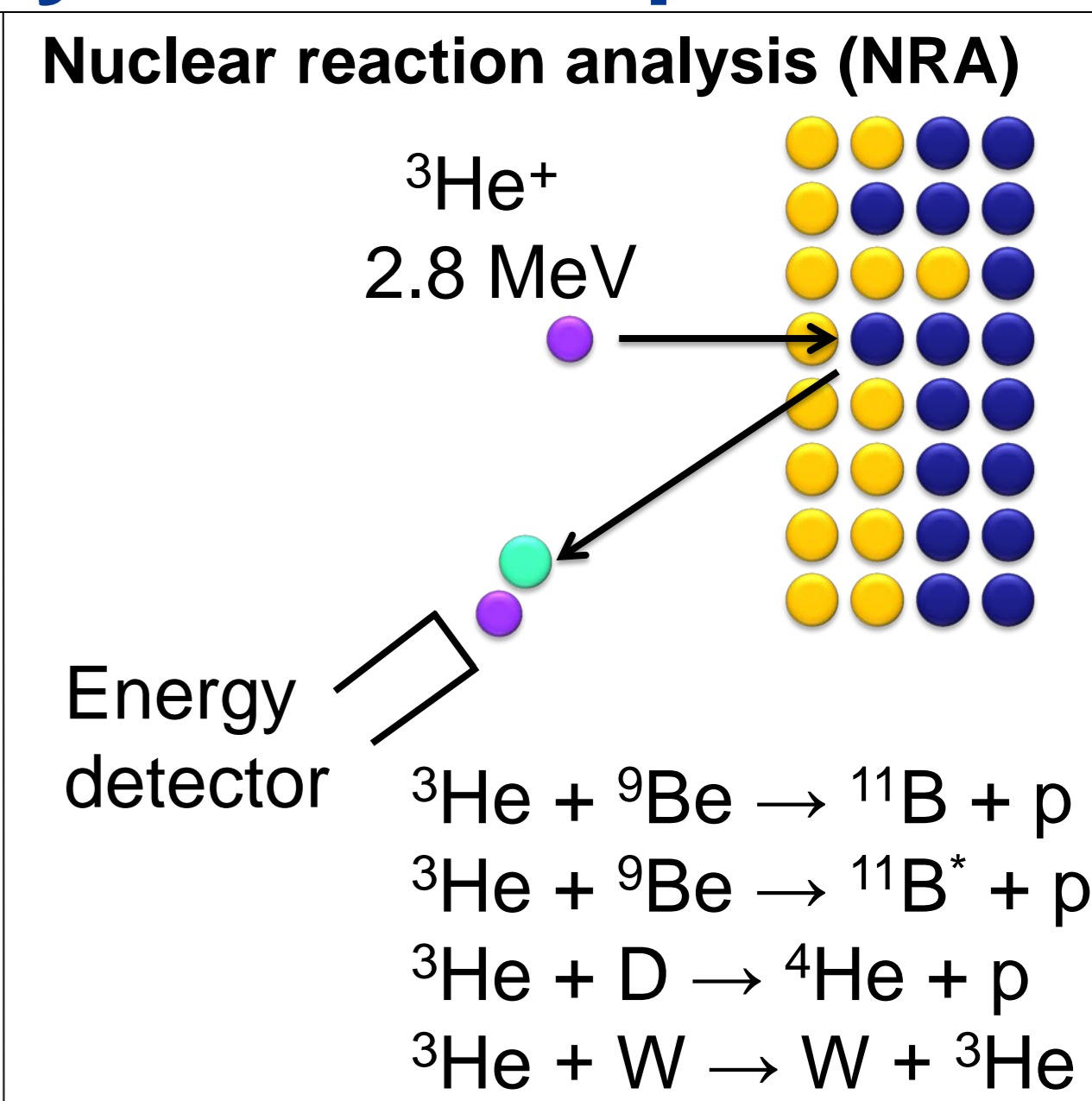
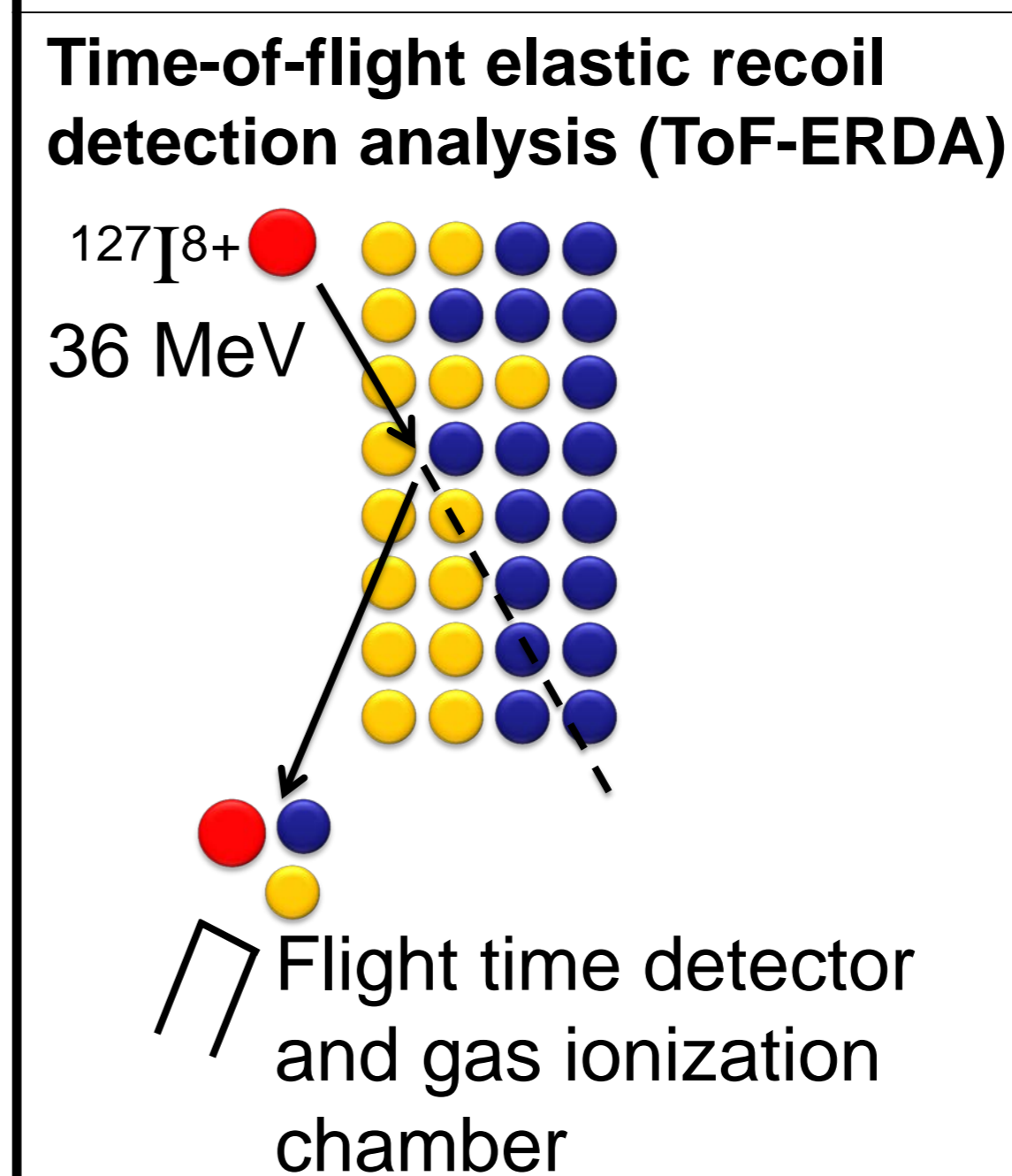
Background

- Modification of plasma-facing components identified as key issue for fusion devices.
- **Aim:** Measure modification of surface composition and morphology on covers for quartz microbalances (QMB) and spatial blocks (SB)
- Samples retrieved after 3 ITER-like wall (ILW) campaigns at JET.

Campaign	Divertor time [s]	Total energy input [GJ]	QMB #	ILW-3 open shutter [s]
ILW-1	45 000	150	1	19 500
ILW-2	50 000	201	2	25 700
ILW-3	67 000	245	3	≤ 67 000



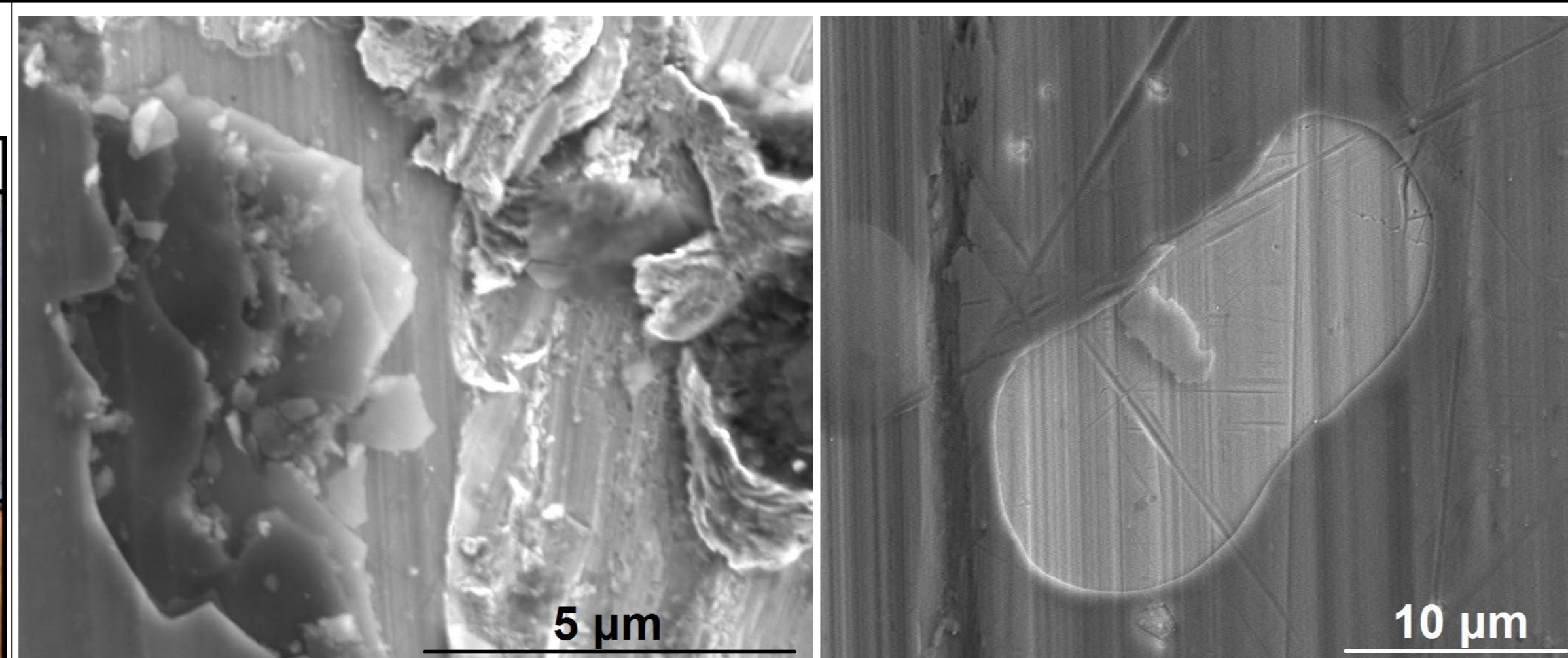
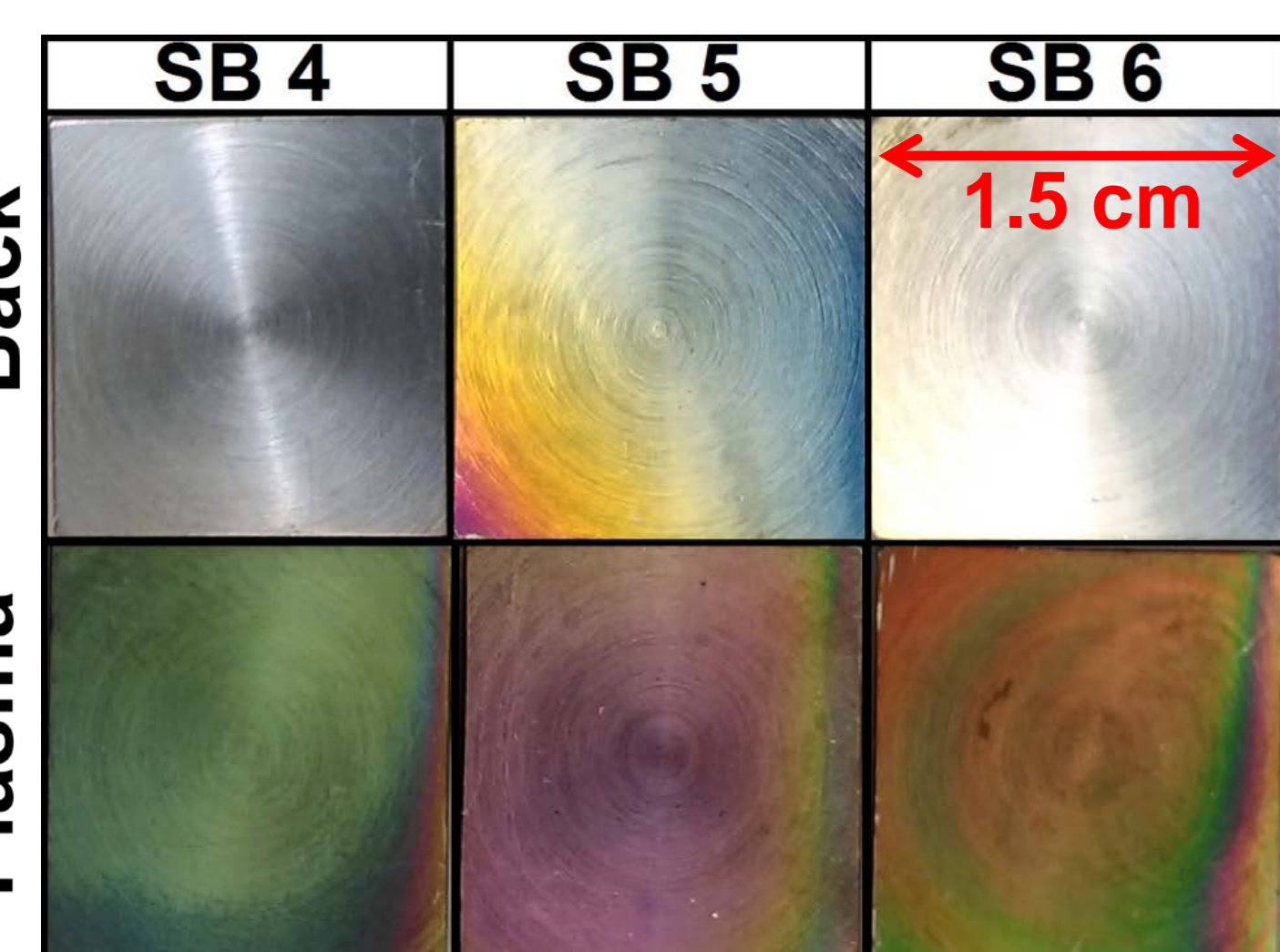
Ion beam analysis techniques



Gas ionization chamber with multiple anodes → atomic number based separation of elements with ToF-ERDA. Complements regular mass based separation

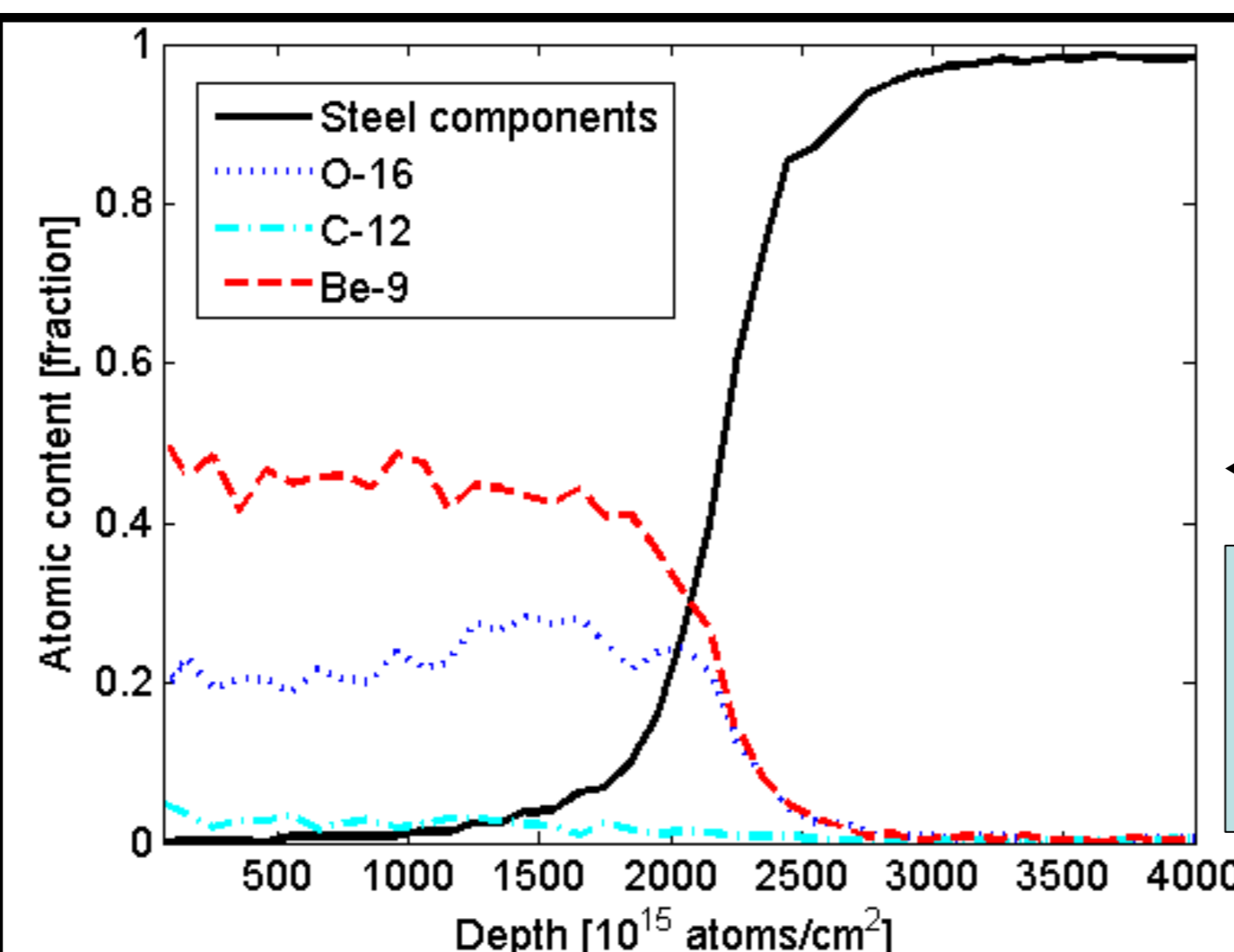
Compensation for ion induced release of diatomic gases → quantitative agreement between methods

Spatial blocks

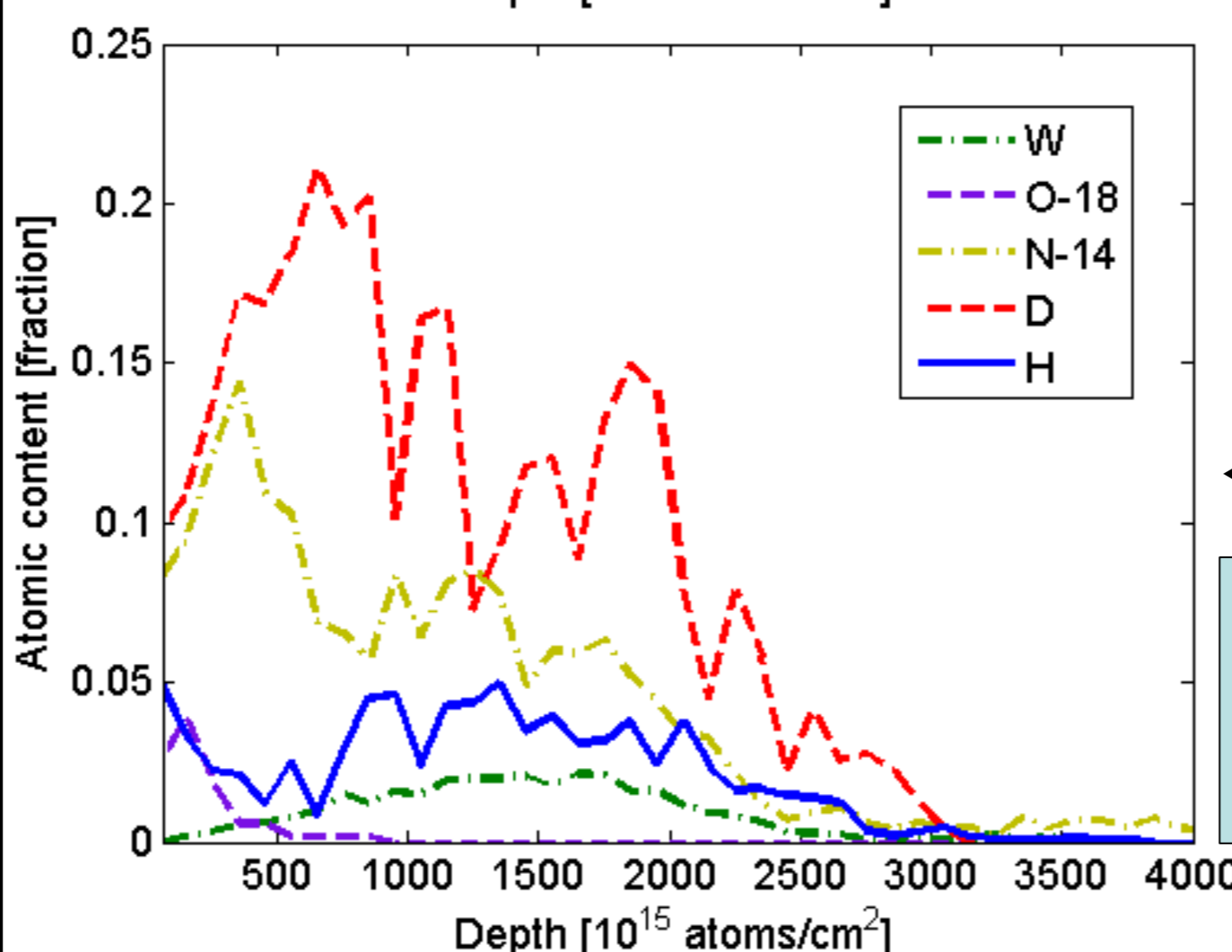


Scanning electron microscopy, secondary electron images. Multilayer structure and detached blister

QMB covers

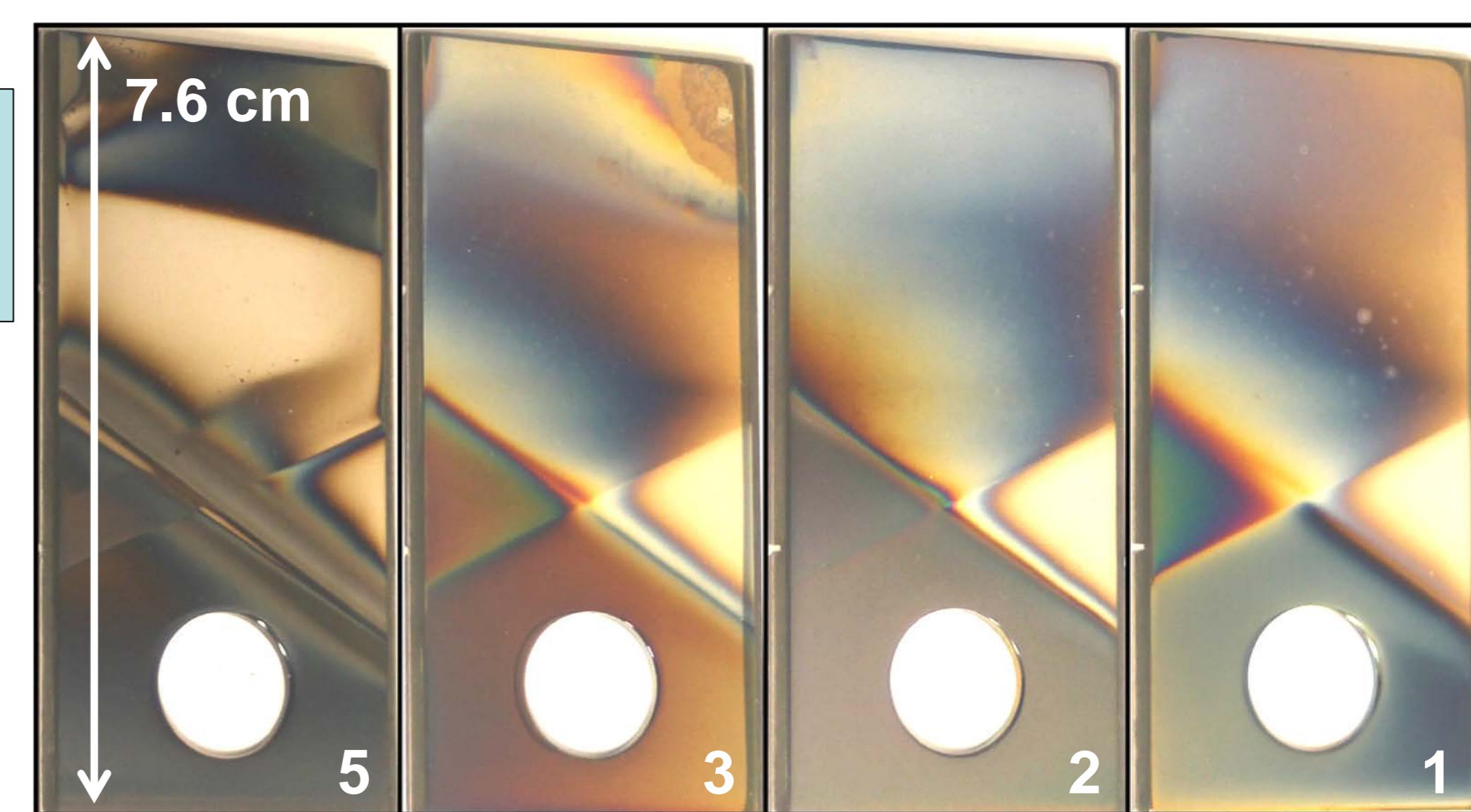


QMB3 (ILW-3) Be and O-rich layer, almost no C present!



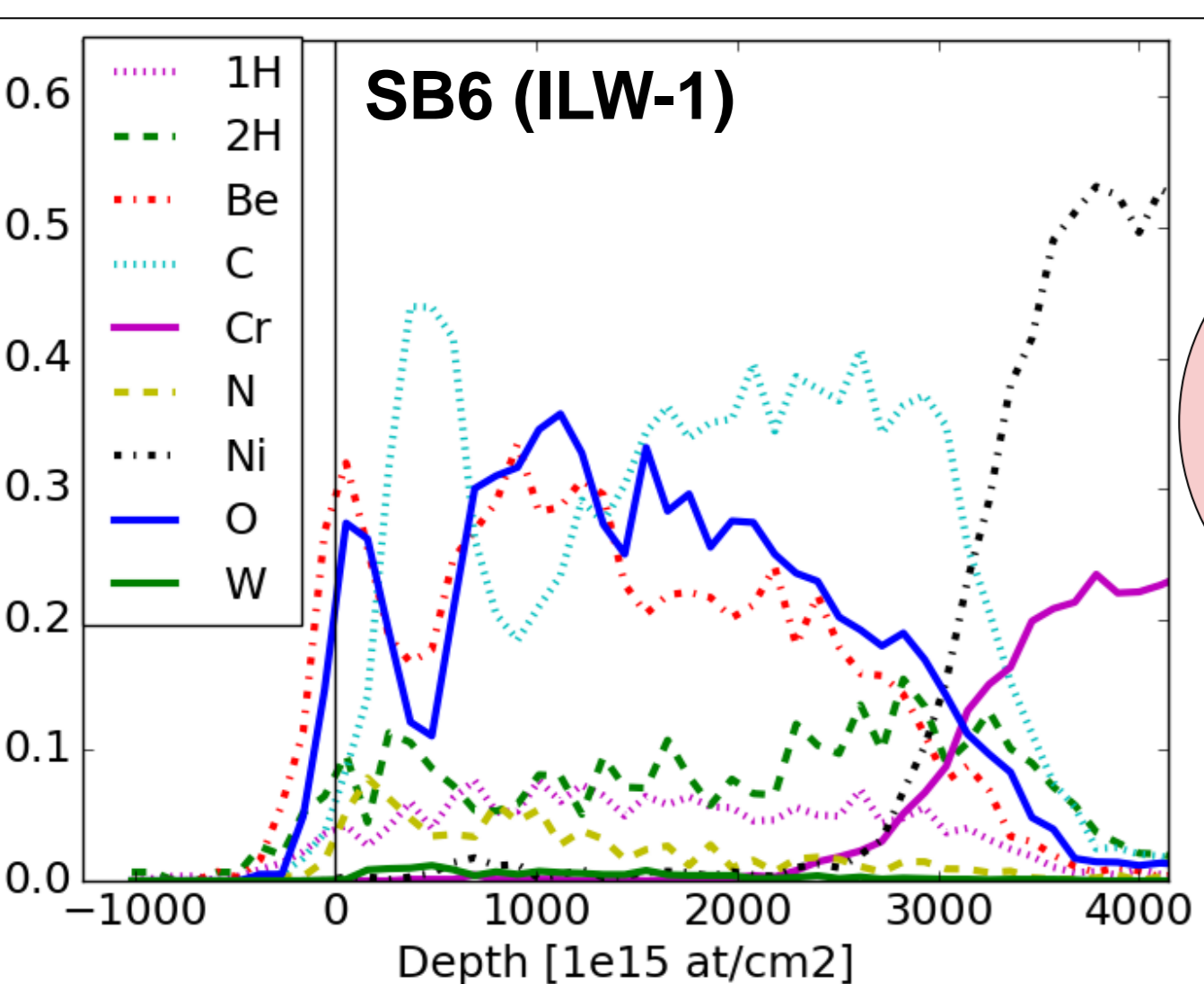
H, D and impurities, same measurement point as above. Large atomic fraction of D!

Note: Small amounts of B, Ne and Ar found on QMBs after ILW-2 in addition to impurities shown here. The latter two come from disruption mitigation and plasma edge cooling.

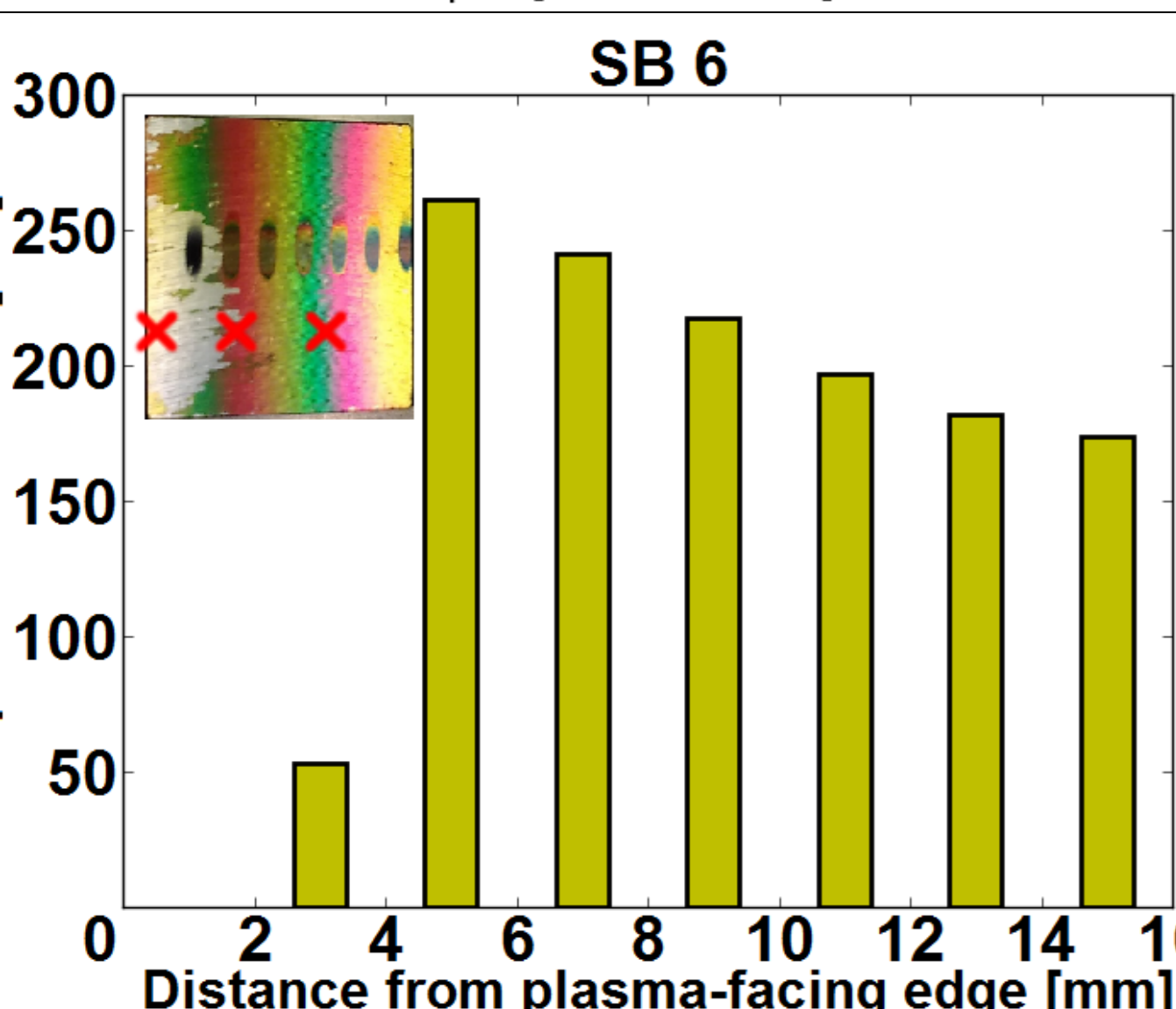


QMB covers from ILW-3. Triangle pattern due to coverage by shutter in open/closed position.

Elemental depth profiles



Deposit thickness



[1] G. Sergienko et al., Quartz micro-balance results of pulse-resolved erosion/deposition in the JET-ILW divertor, Nucl. Mater. Energy 12 (2017) 478-482.