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Introduction

Plasma-wall interaction (PWI) has benefits and drawbacks:

- + Extract helium "ash"
- + Breed tritium
- + Extract heat for power production
- Erosion, wall damage
- Fuel retention
- Impurity accumulation

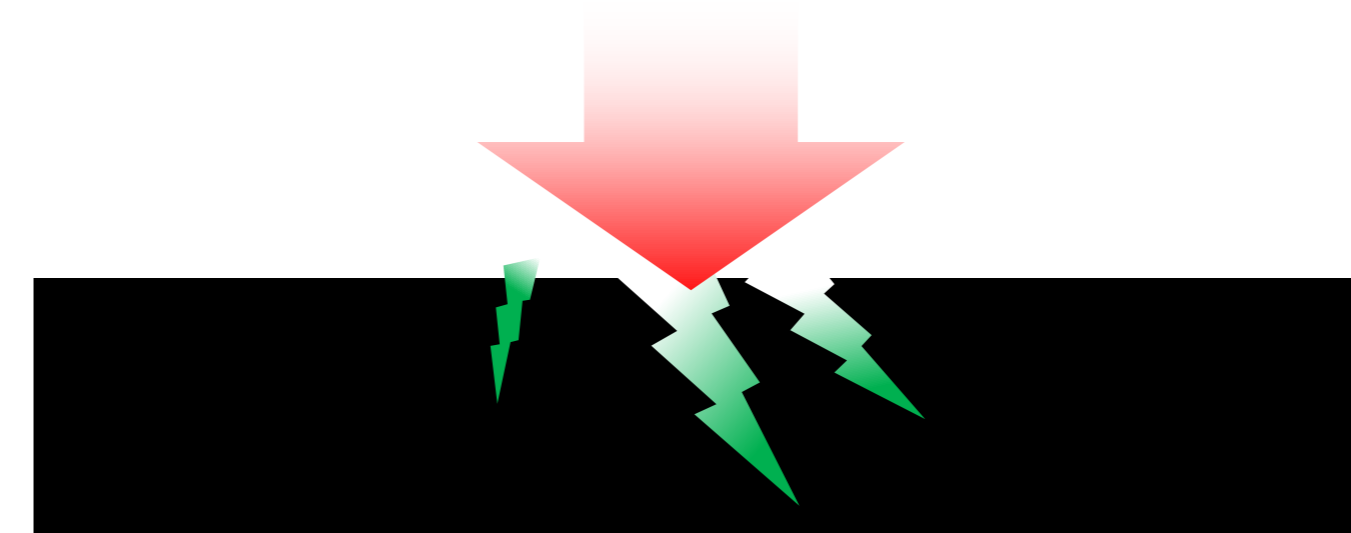
PWI studies are necessary to enhance benefits and diminish drawbacks. Diagnostics and techniques for this are presented.

Major tasks

Assess **material migration**



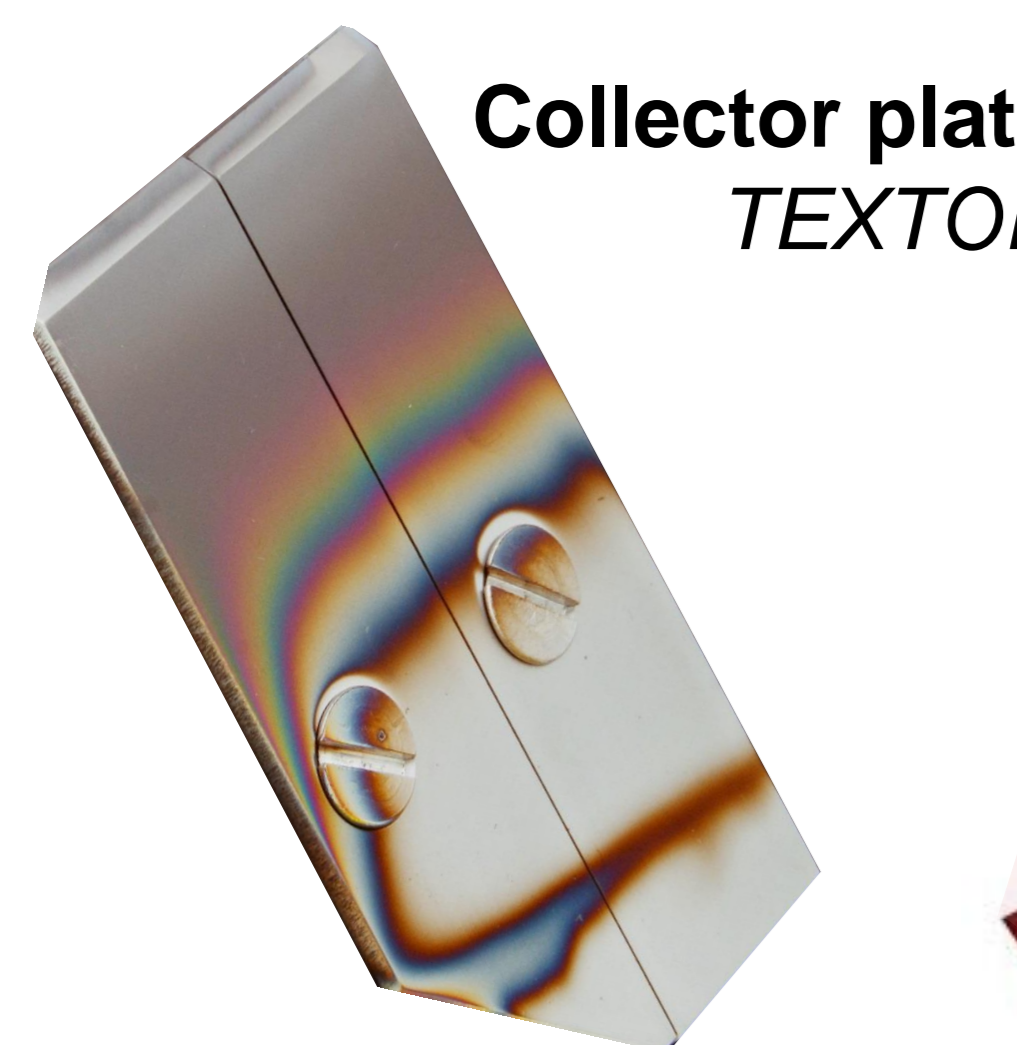
Assess **consequences**



- Heat flux
- Erosion
- Deposition
- Fuel retention
- Damage, melting
- Dust creation
- Material deterioration
- Hazards, safety

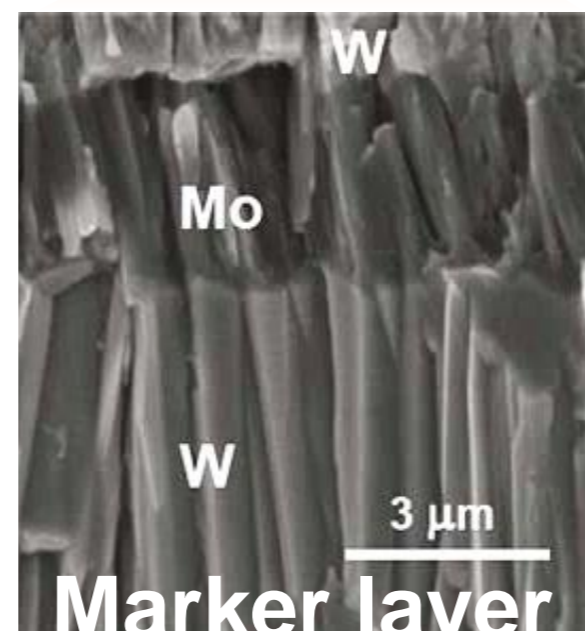
Measurement techniques

Test plasma-facing materials and geometries with retractable and interchangeable test limiters.



Monitor deposition with collector plates (on limiters or wall)

Study melting, erosion, transport and deposition with clips, inserts and marker PFCs



Estimate erosion and deposition rates with the aid of marker layers for reference.

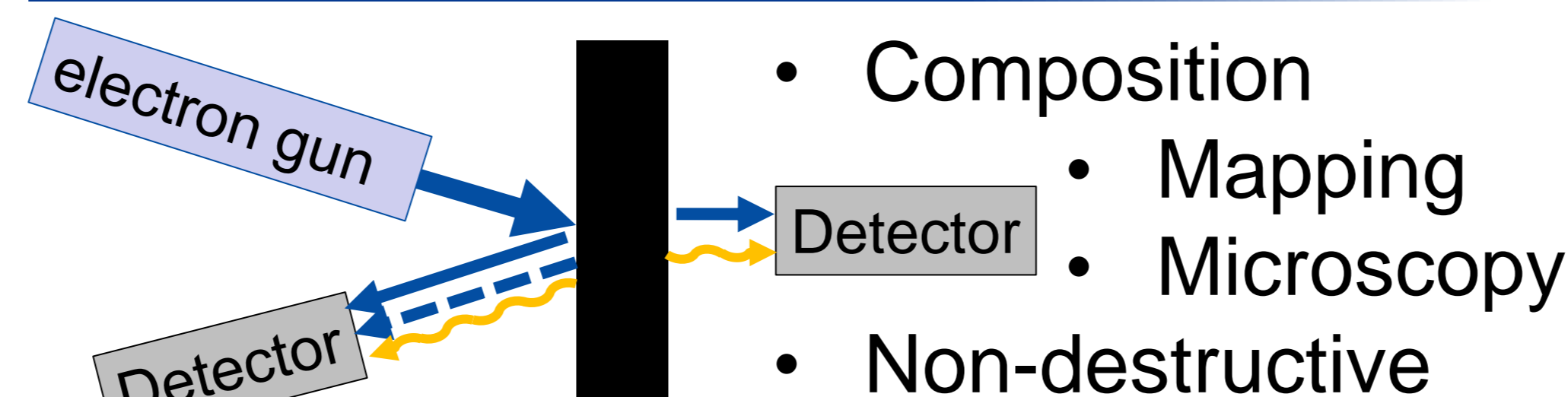
Ion beam analysis



- Composition
- Depth profiles
- Isotope sensitive
- Non-destructive

RBS, ERDA, NRA, PIXE

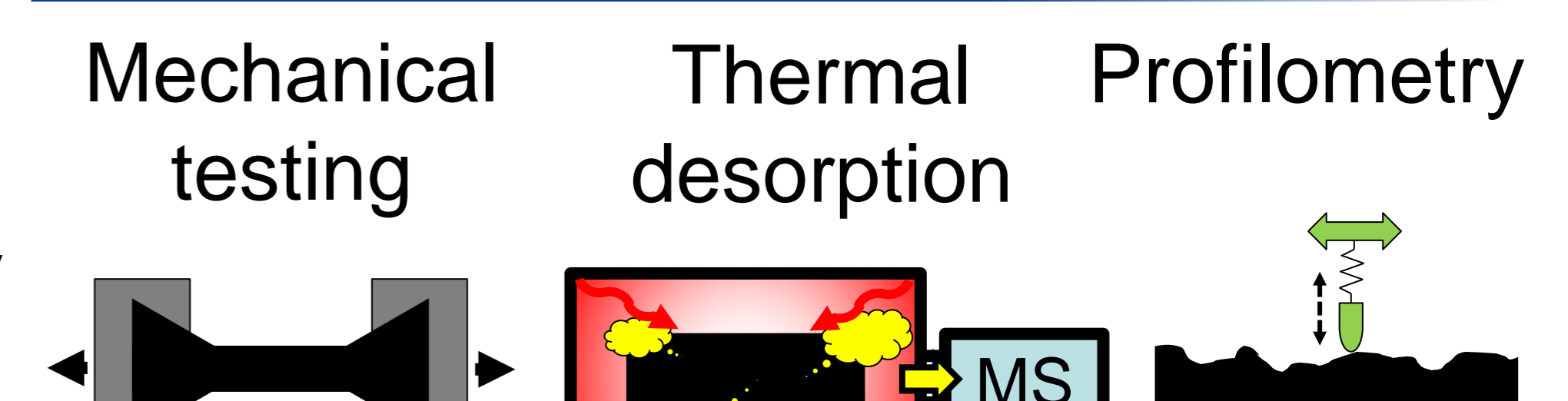
Electron microscopy



- Composition
- Mapping
- Microscopy
- Non-destructive

BSE, SEM, EDX TEM, EDX

Other treatment



Mechanical testing Thermal desorption Profilometry

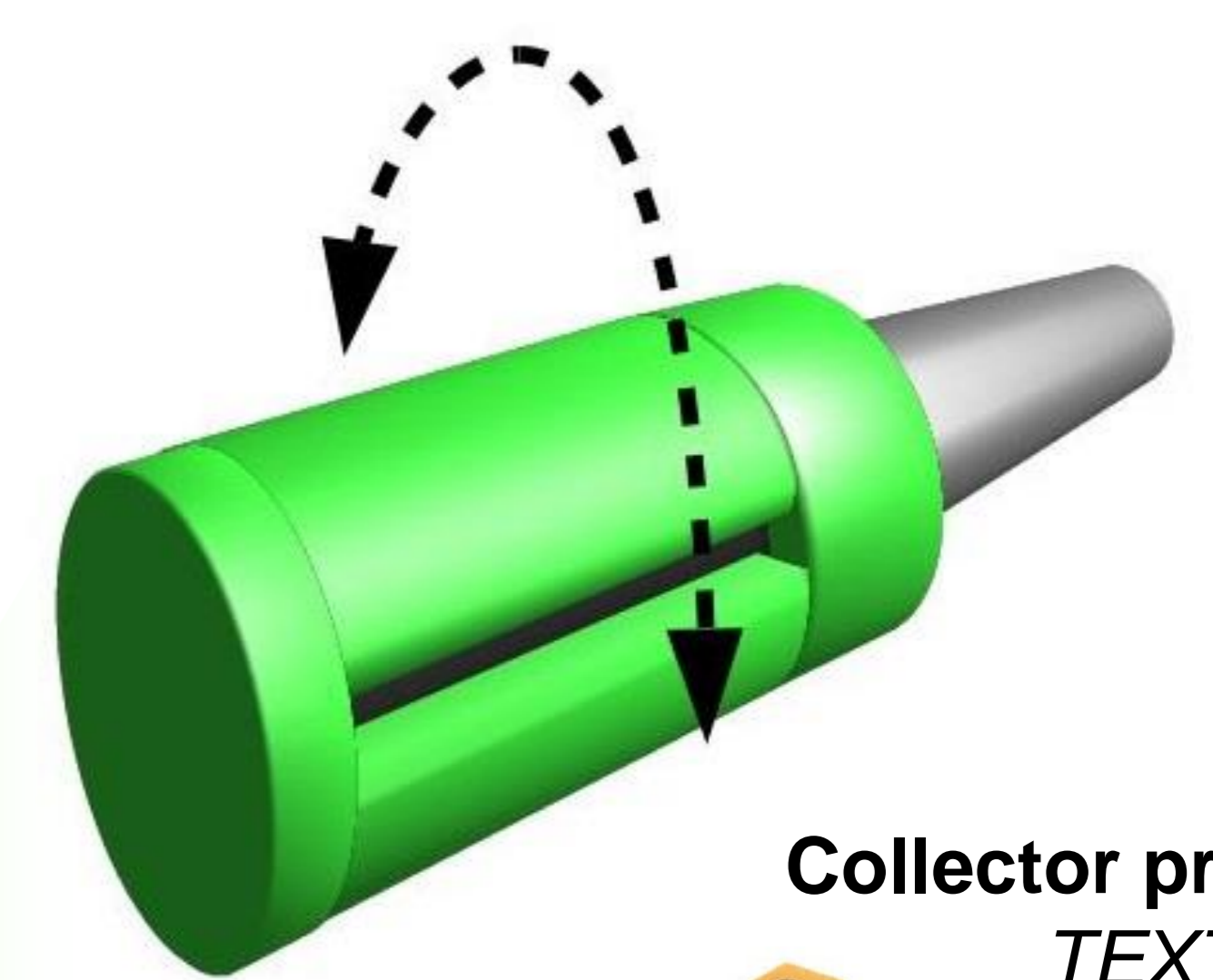
Measure edge plasma parameters with plunging probes.



Watch PFC heating and impurity transport in real time with line-filtered diagnostics

Future: *in-situ* deposition measuring with laser induced breakdown spectroscopy

Collect impurities from plasma edge within seconds with (rotating) collector probes.



Assess outgassing or gettering with mass spectrometry at pump ducts

Resolve local deposition on a shot-to-shot basis with Quartz microbalances or rotating collectors

Test performance of optical mirrors for future diagnostics with flat metallic surfaces