

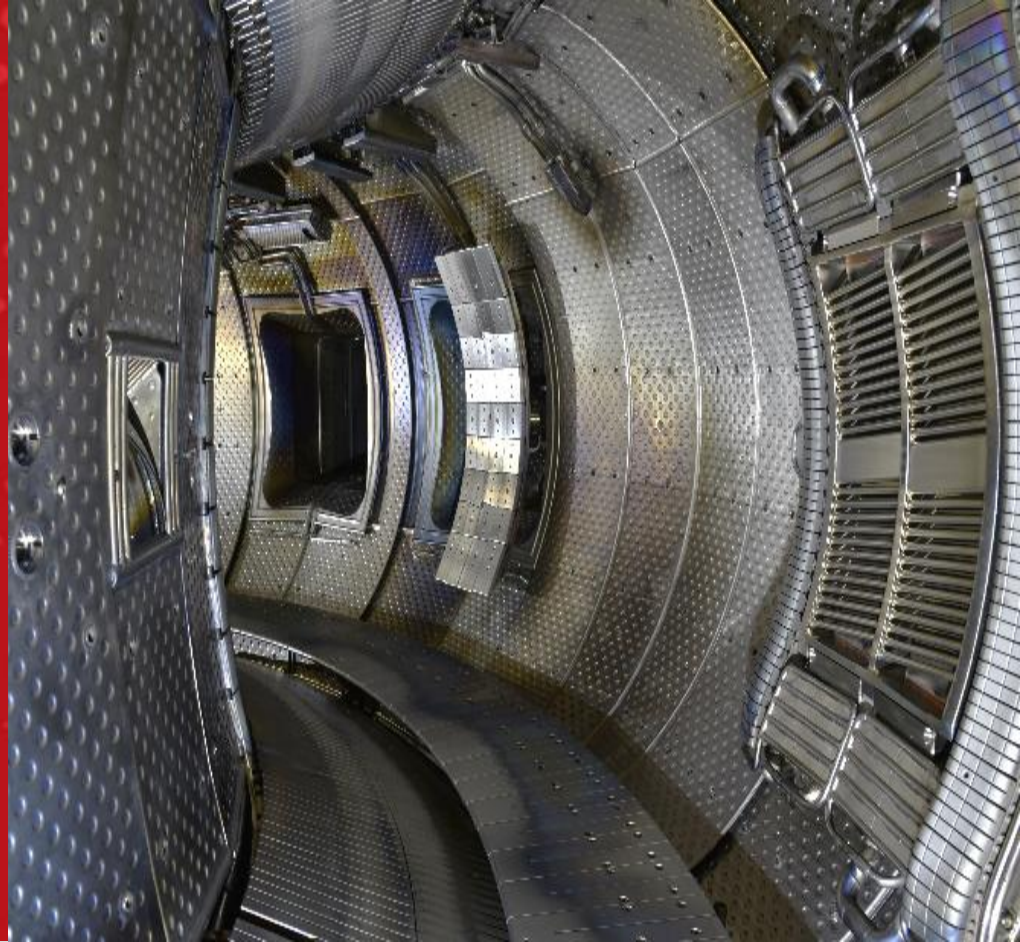


WP PWIE, KoM, June 11, 2021

# CEA activities in 2021: analysis of WEST PFUs – plans and capabilities

(SP B.2 and SP B.3)

M.Diez



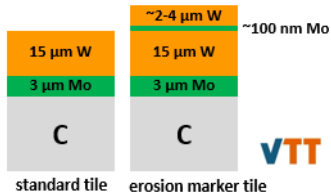
## ■ Task description

- Determine erosion, re-deposition, and fuel-retention patterns on WEST PFUs after C3, C4, and C5 campaigns: project coordination and surface analyses (CEA)
- Determine influence of surface morphology on erosion and re-deposition patterns of marker samples and coatings (AUG, WEST)
- Determine gross and net erosion of marker samples and coatings (AUG, WEST) and migration of impurities in edge plasmas (AUG, WEST, W7-X)
- Perform surface analyses for erosion/deposition, fuel-retention, and surface-modification patterns on samples from AUG, WEST, and W7-X (FZJ)

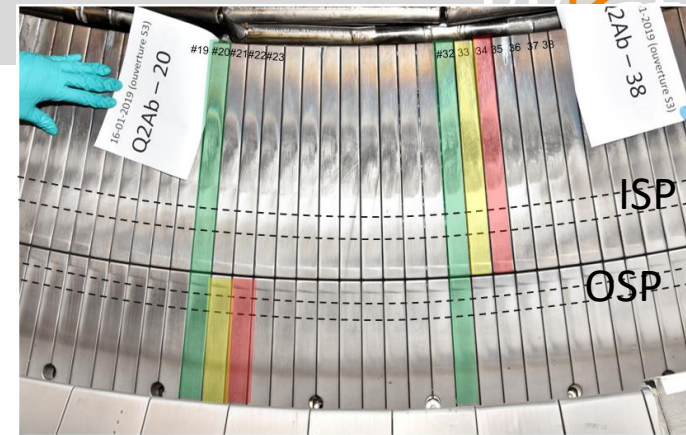
## ■ Deliverable SP B.2

D1 : erosion, re-deposition and fuel retention patterns on selected WEST PFUs after C3, C4 and C5 campaigns (2 PM)

## 8 W-coated graphite tiles with marker layers :



2 tiles exposed to C1-C3 (red)  
 4 tiles exposed to C1-C4 ( green)  
 2 tiles exposed to C1-C5 (yellow)



FP.8 → analysis of post-C3 tiles (done)

FP.9 → [project coordination of multi-analysis lab](#). Post-mortem characterization in 4 specific areas of the tiles : baffle shadowing, ISP, OSP, inner end of the tiles (far from SOL)

analysis of post-C4 tiles : on going / post-C5 tiles : available

[Step 1](#): impurities content, surface morphology, height profile (IPP) on full tiles – done

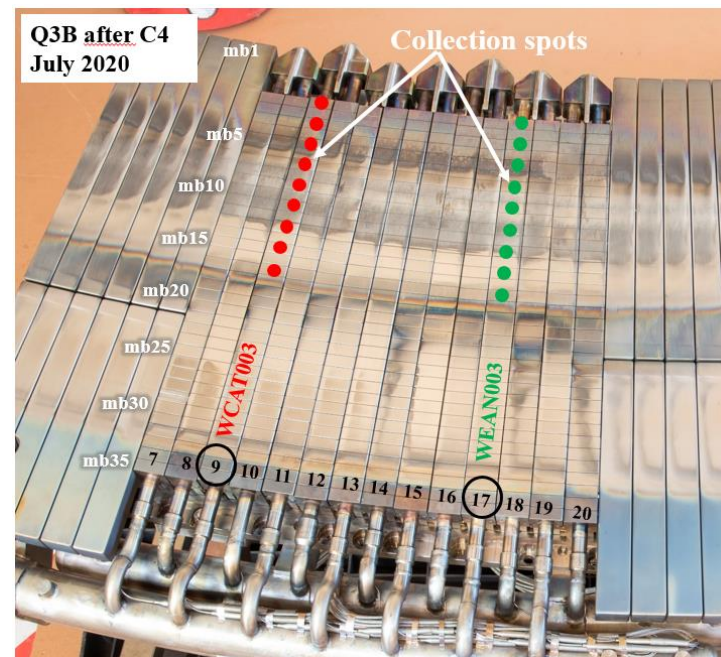
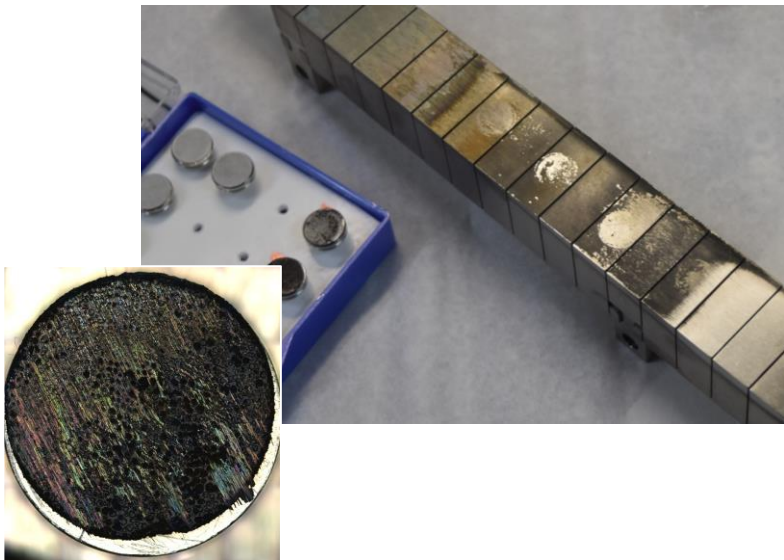
[Step 2](#): tiles cutting (VTT) - done

[Step 3](#): sample sequential analysis in various labs - (Aix Marseille university, IAP, IPP, JSI, RBI)  
 – on going

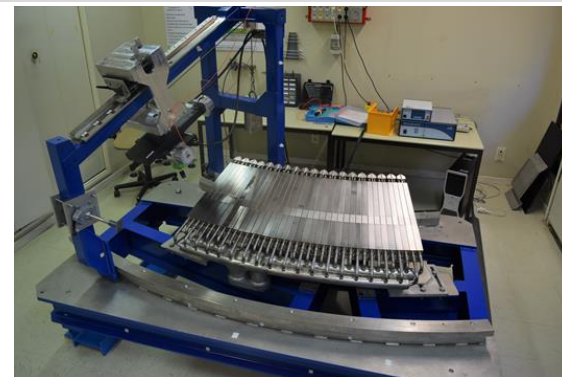
## ■ Deposits collected on ITER-like PFUs surface (post C3, post C4)

Impurities content (SEM, EDX, FIB) and redeposited layers thickness (CLSM, TEM) –  
CEA, Aix Marseille University – **done**

### Erosion/Redeposition patterns on the lower divertor sector



- No marker layers available for PFUs phase II to evaluate erosion
- Proposal (CEA) : **4 PFUs dedicated to the erosion estimate** using confocal microscopy



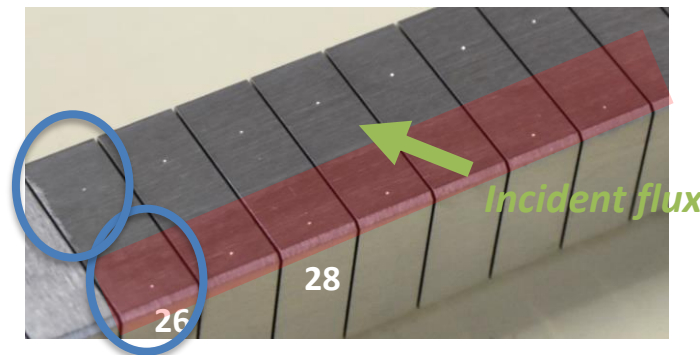
Step 1: 2 Vickers indentations on the monoblock surface: 1 indentation in the shadowed area, 1 indentation in the plasma exposed area - **done**

Step 2: pre-exposure characterization using confocal microscopy (depth of the indentations + roughness) - **done**

Step 3: exposure to WEST - **2022**

Step 4: the erosion will be evaluated by measuring the depth of Vickers indentations in the plasma-exposed area - **2022**

Shadowed area  
= no erosion expected  
= reference



## ■ Task description

Carry out post-exposure analyses of selected PFUs from WEST Phase 1 and pre-characterize selected PFUs for Phase 2: project coordination and surface analyses

## ■ Deliverable SP B.3

D1 : database on ageing, erosion and fuel retention behavior of selected WEST PFUs (2 PM)

- **Project coordination of multi-analysis lab.** Post-mortem characterization of a large variety of plasma-exposed components (15 ITER-like PFUs, >100 W-coated CFPs)

Step 1: non destructive tests on full components at CEA – **done**

*microscopic observations (cracks, melting, OHS, etc), emissivity measurement, roughness evolution, heat exhaust capability (SATIR)*

Step 2: radiation control procedures for shipping PFC outside CEA – **on going**

Step 3: full component analysis

Step 4: strategy for PFU cutting and discussion for sample distribution – **planned for 2021**

Step 5: PFU cutting (EDM machine) at CEA - **planned for 2021 for at least 1 PFU**

Step 6: post-mortem characterization program with lab. involved - **2021 and beyond**



Thank you for your  
attention





PFU	C1/C2 (PFU#)	C3 (PFU#)	C4 (D+He) (PFU#)	C5
<b>JA</b>				
WJMI002	8	8	12	out
WJKA003	7	7	out	out
WJKA004	10	10	10	out
<b>CN</b>				
WCAT001	13	out	20	out
WCAT002	14	14	14	out
WCAT003	9	9	9	out
WCAT004		20 (pre damaged)	7 (pre damaged + groove)	out
<b>EU</b>				
WEAT001		19	19	out
WEAT002		11	11	out
WECN001		13	13	out
WECN002		16	16	out
WERI001 (unchamfered)		15	15	out
WERI002 (unchamfered)		12	8 (melting experiment)	out
WEAN003			17	out
WEAN004			18	8 (melting experiment)

	tile id	position on the sector			
		C1/C2	C3	C4 (D+He)	C5
	<b>Q2A</b>				
Erosion Marker	941G142	outer#22	outer#22	out	out
Erosion Marker	940G193	inner#34	inner#34	out	out
Erosion Marker	940G336	inner#20	inner#20	inner#20	out
Erosion Marker	941G193	outer#20	outer#20	outer#20	out
Erosion Marker	940G227	inner#32	inner#32	inner#32	out
Erosion Marker	941G018	outer#32	outer#32	outer#32	out
Erosion Marker	941G028	outer#21	outer#21	outer#21	outer#21
Erosion Marker	940G177	inner#33	inner#33	inner#33	inner#33