DE LA RECHERCHE À L'INDUSTRIE

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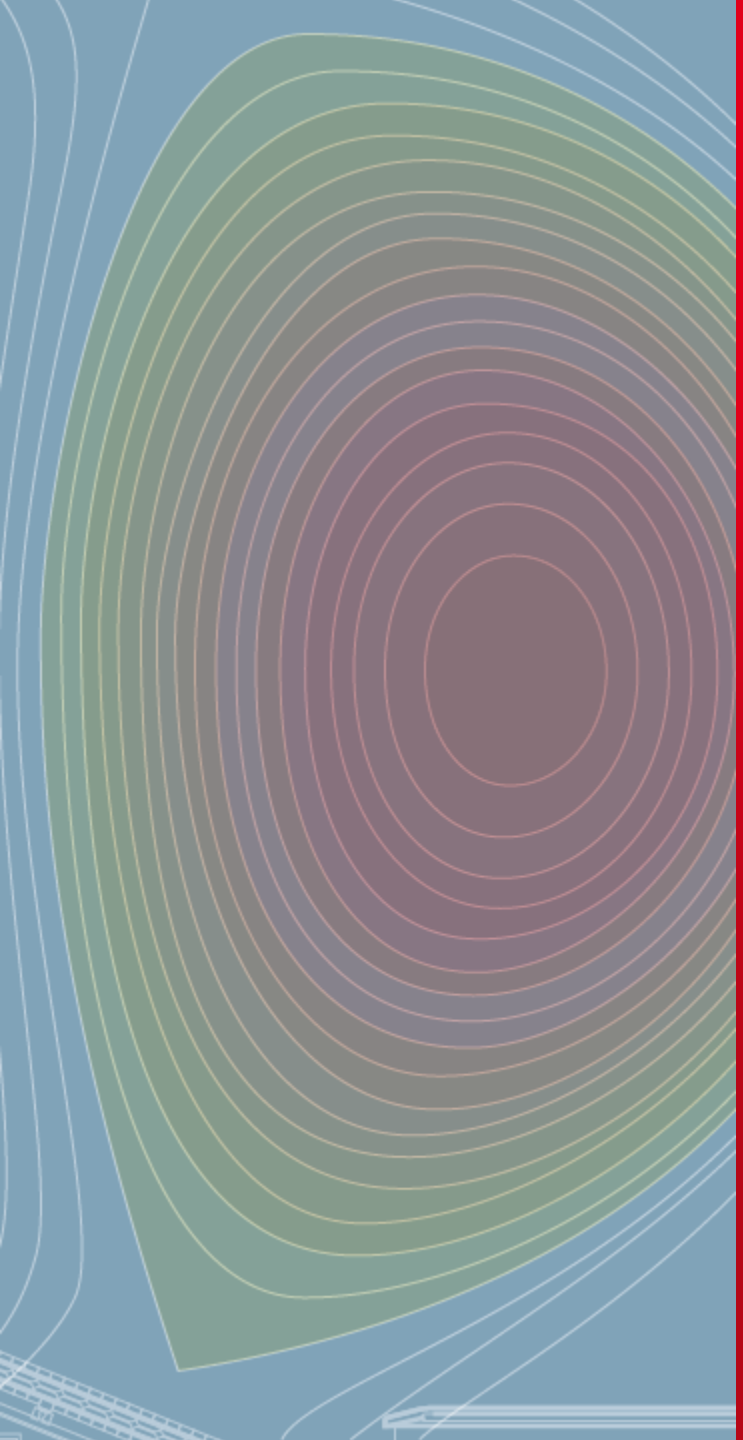
6th Meeting of the WEST Governing Board

TIMELINE FOR THE C4 CAMPAIGN

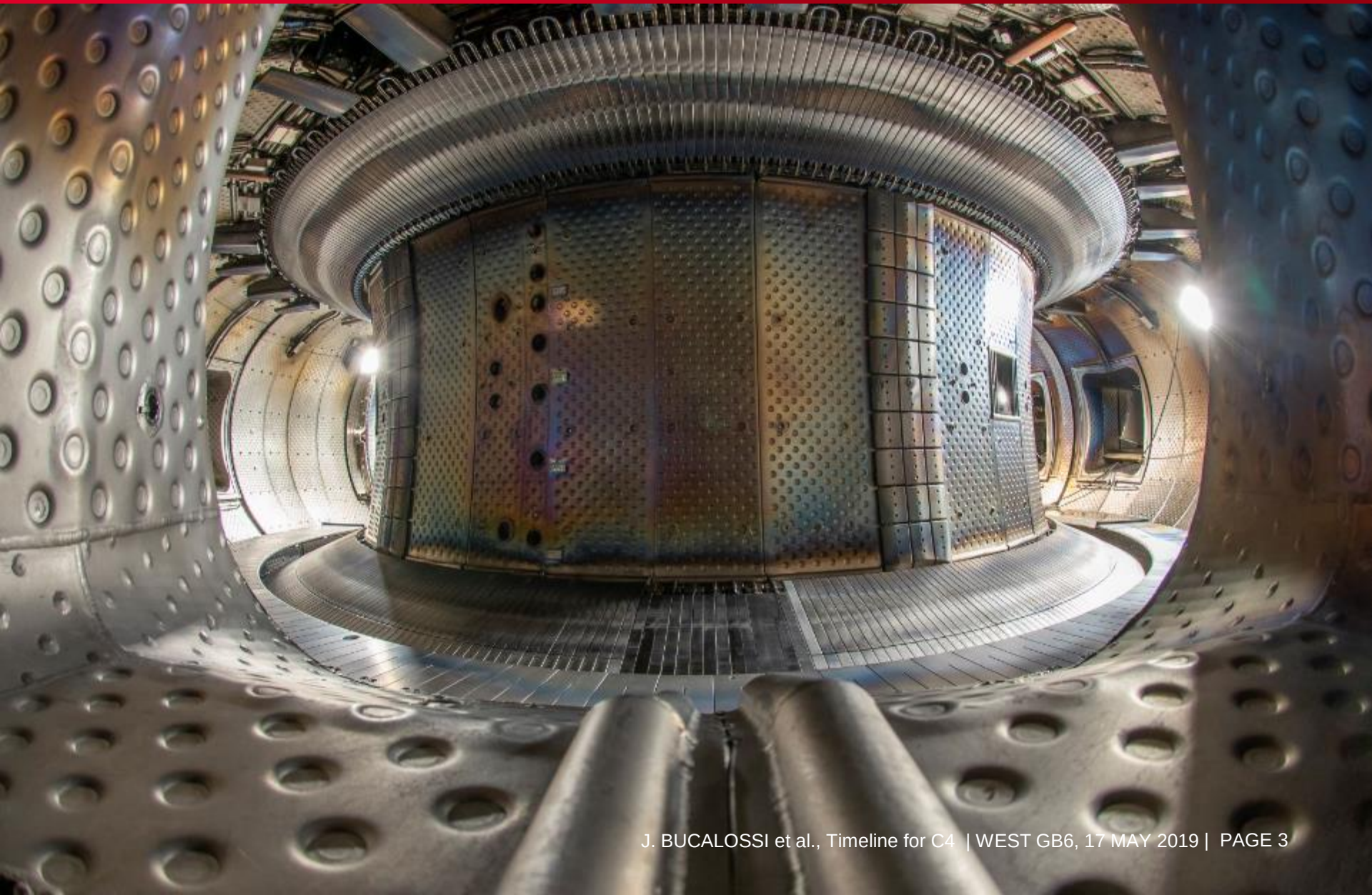
Jérôme BUCALOSSI, on behalf of the WEST team

Château de Cadarache – May 17, 2019

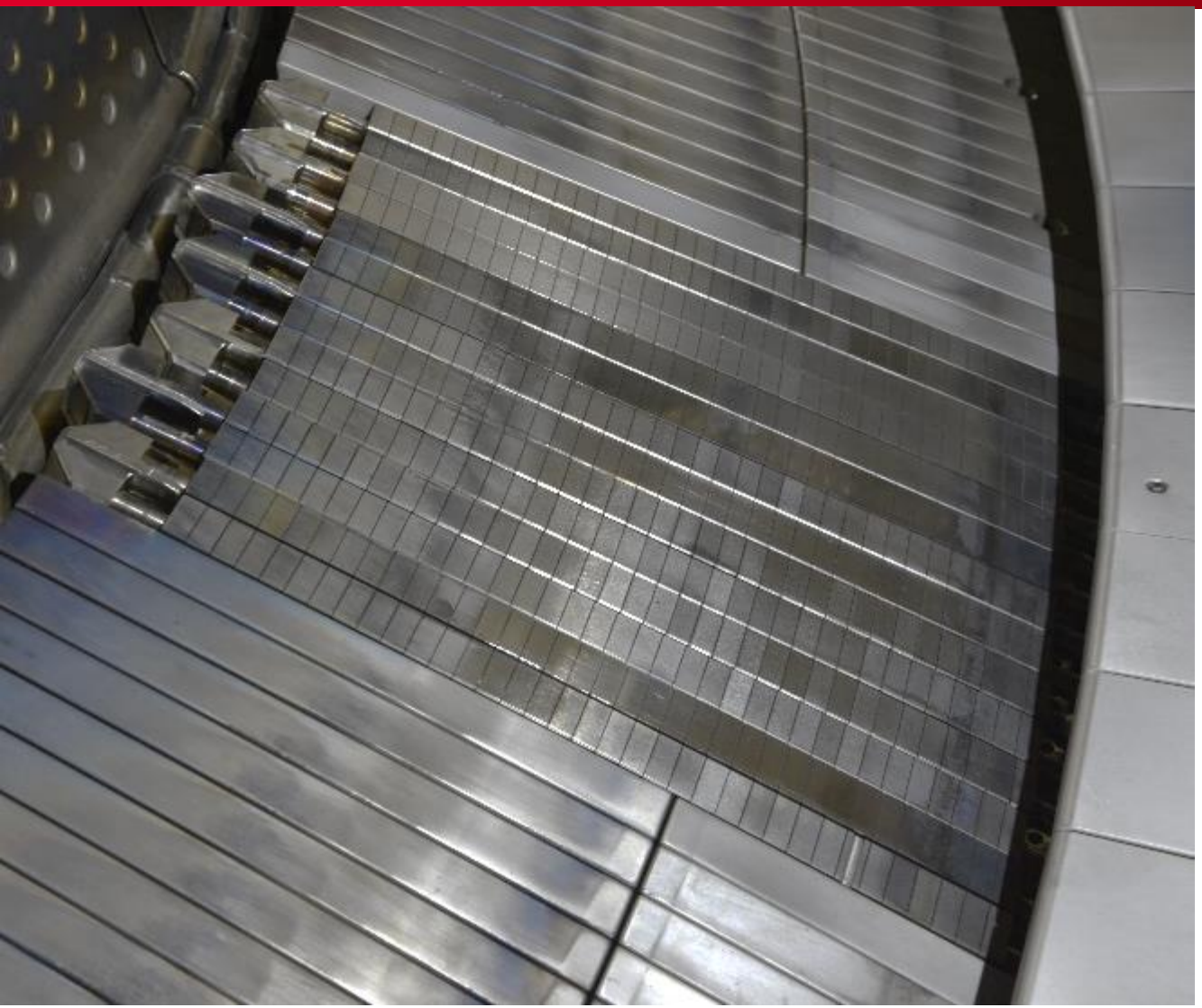


MACHINE CONFIGURATION FOR C4

APRIL 2019 BEFORE CLOSING THE VESSEL



ALL ITER-LIKE PFUS PROTOTYPES INSTALLED



- 14 prototypes from all potential suppliers of ITER divertor VT installed
- 4 with sharp edges
- Alignment within ITER tolerances (4 with max tolerance 0.3mm)
- One groove on an outer monoblock for melting studies (PFU7)

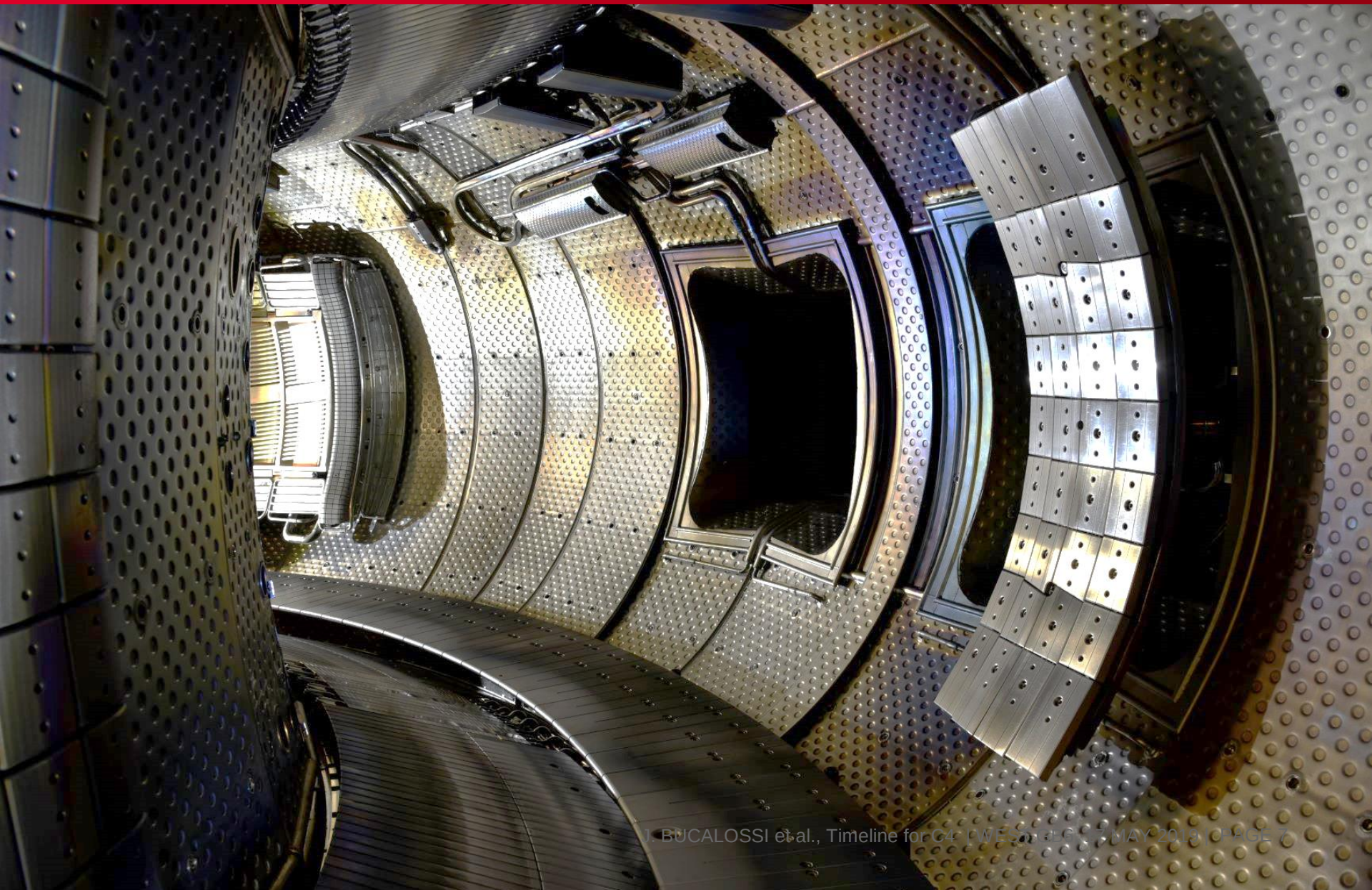
TEST SECTOR CONFIGURATION FOR C4

NOMINAL HEATING POWER INSTALLED

Commissioning

IC2-Q1B	IC1-Q2B	IC3-Q4A	LH1-Q6A	LH2-Q6B
				
1MW CW 3MW 30s	1MW CW 3MW 30s	1MW CW 3MW 30s	4MW CW	3MW CW

NEW MASSIVE TUNGSTEN MOVABLE OUTBOARD LIMITER



NEW SYSTEMS OPERATIONAL FOR C4

IR system

- Full coverage of the 5 RF antennas
- 66% coverage of the lower divertor

Optical heads of the vertical IR endoscopes

Bolometry

- 8 vertical lines towards divertor baffle (upper Q5B)

ECE imaging

- Mirrors have been installed in the vacuum vessel
- **Air leak** on the window seal ➔ repair ongoing (may not be available for C4)

CAES VUV spectroscope

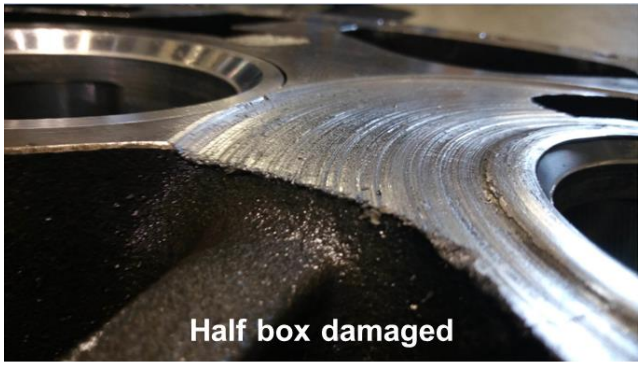
- Ready for commissioning

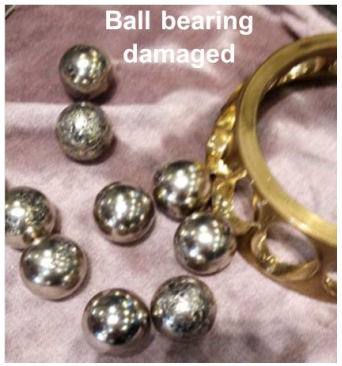
Pellet injector

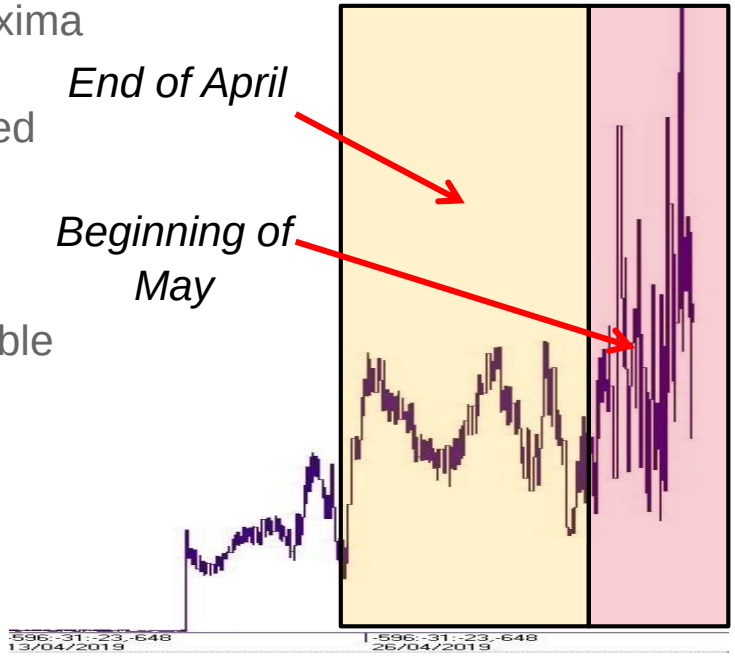
- All the tracks connected and operational: LFS mid plane, vertical, HFS mid plane, HFS lower X-point

A MAJOR INCIDENT ON A CRYOGENIC COMPRESSOR DELAYS C4 CAMPAIGN

- Last week, just before the start of the baking of the vessel, abnormal vibrations were recorded on the C4 compressor (4 compressors required for normal operation)
- **Compressor removed on May 10** and sent to Axima premises for failure analysis:
  - Ball bearing of main screw deeply damaged
  - "Half box" damaged with multiple rifts
  - Metallic chips spread in the compressor
- "Half box" not repairable → no spare available
- **Refurbished used compressor found** → available under a couple of weeks

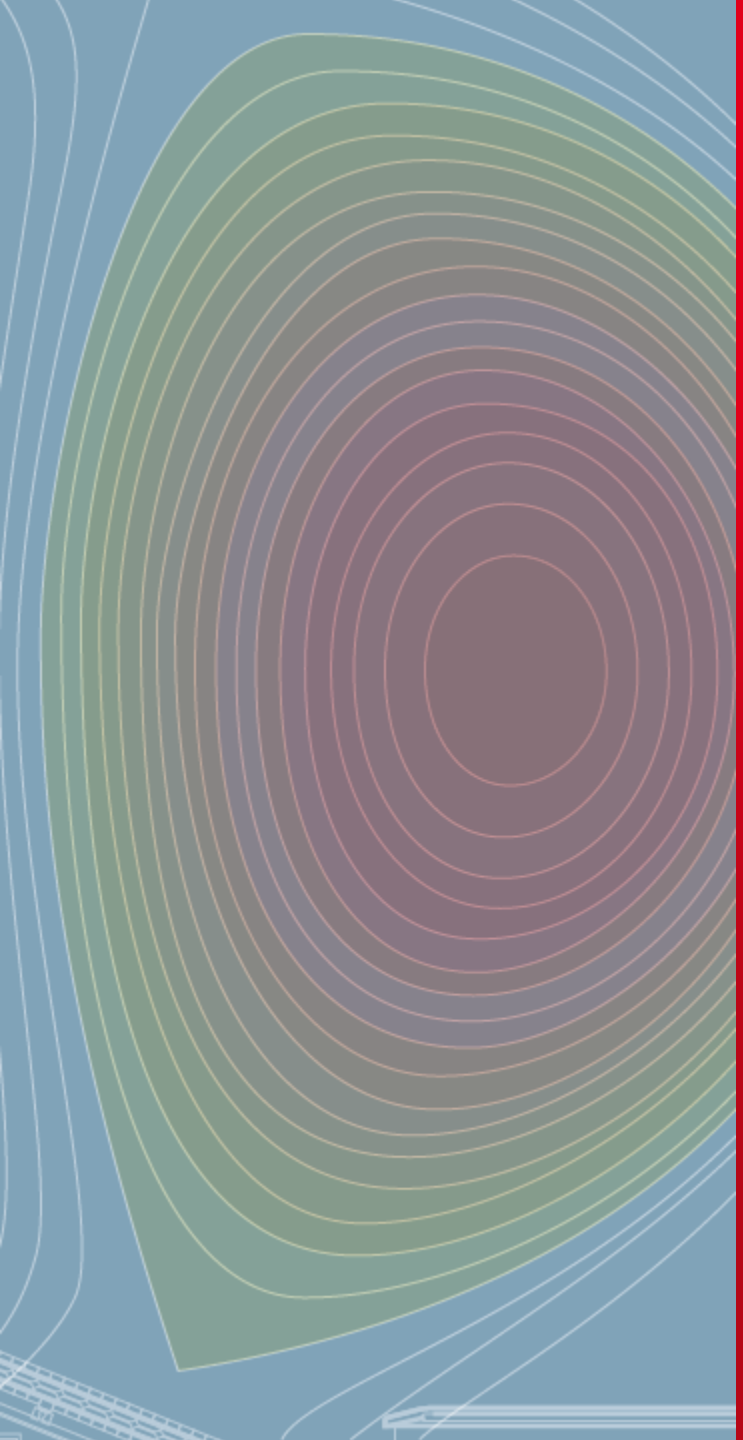






Vibration monitoring

Plasma restart for C4 can be expected for mid-July instead of mid-May as initially planned (in EUROfusion call for participation)



OBJECTIVES AND TIMELINE OF C4

OBJECTIVES OF C4

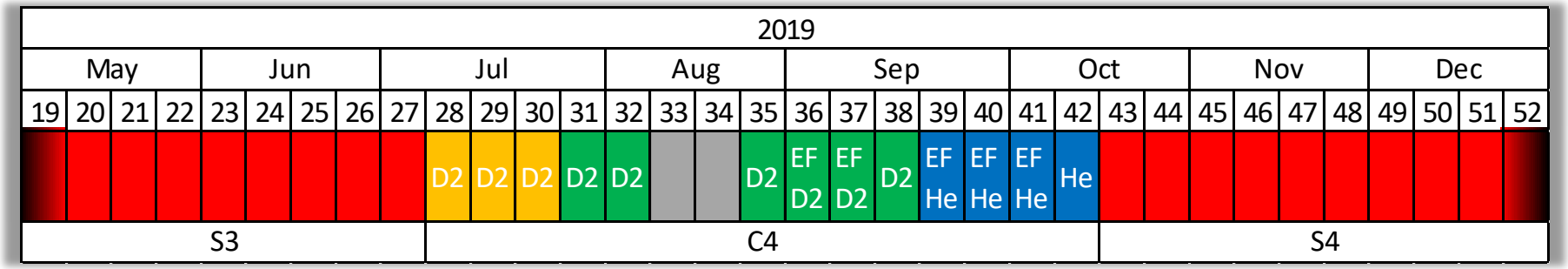
- **10 MW of injected RF power** (~6 MW of LHCD / ~4 MW of ICRH)
  → H-mode operation (EUROfusion KPI)

- **He campaign**
  → He-W Plasma-wall interactions studies (EUROfusion experiments)

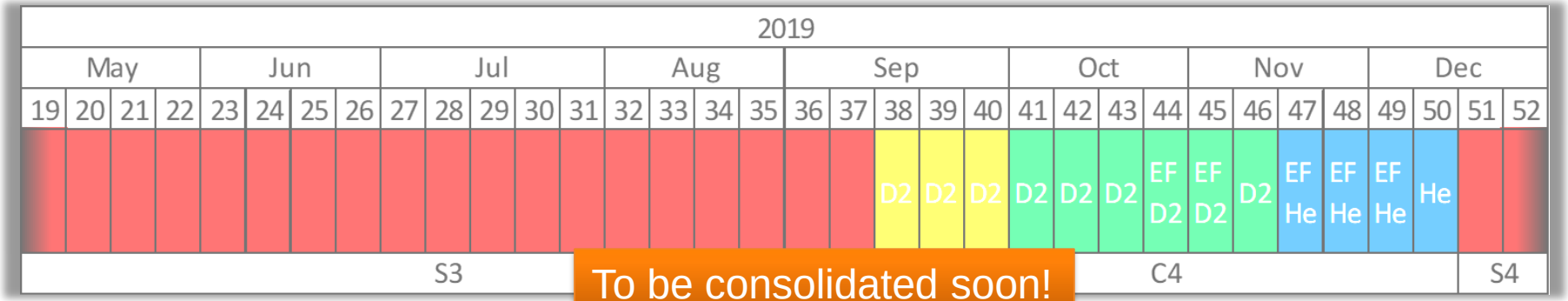
- **1 minute long pulses** (upper divertor)
  → Plasma scenario for high fluence campaigns (phase 2)

TENTATIVE TIMELINE FOR 2019

- Assuming compressor replacement in 6 weeks
- **13 weeks for C4 campaign** → ~60 experimental sessions
- End mid-October for phase 2 shutdown



- **Backup solution** in case of delays for the compressor replacement
- **13 weeks for C4 campaign** → ~60 experimental sessions
- Shift of C5 campaign (Phase 2) in Sept 2020



Vessel venting
Plasma commissioning
D2 experiment
He experiment

WEEKLY PROGRAMME

Wk	Main TF	Gas	Main experiment	Objective
1	C	D2	Ohmic / LH+IC vacuum cond.	40kA pre-magnetization
2	C	D2	LH + IC ramp up	2.5MW LH, 1 MW IC / 2T Ohm
3	C	D2	LH + IC ramp up	5MW LH, 1.5 MW IC / 2T Ohm
4	W2	D2	High Conf. 3.7T	4 MW IC (+LH)
5	W2	D2	High Conf. 3.7T	6 MW LH + 4 MW IC
6	W2	D2	High Fluence. 3.7T / 2T	6 MW LH + 4 MW IC / 6 LH
7	W1	D2	Lq (1) / LPO N2 (1)	EUROfusion D2 expt
8	W1	D2	Pre-damaged (5)	EUROfusion D2 expt
9	W	D2	Contingency	Contingency
10	W1	He	Changeover (3) / Sources (2)	EUROfusion He expt
11	W1	He	Lq (3) / Sources (2)	EUROfusion He expt
12	W1	He	He PWI (5)	EUROfusion He expt
13	W	He	Contingency	Contingency

If H-mode not reached @ 3.7T

OTHER EXPERIMENTS PLANNED IN C4

W1 in addition to EUROfusion sessions (22)

- W source: divertor vs main chamber (1 session)
- Divertor regimes (1 session in D2 and 1 session in He)
- “High Heat Flux” scenario development (2 session)
- Shaping / tolerance to PFU misalignement (3 sessions)
- PFU melting experiments (2 session)

W2 in addition to scenario development sessions (15)

- Ohmic and L mode confinement (1 session)
- L-H power threshold (1 session)
- ELM regime (1 session)
- H mode confinement (1 session)
- I mode access on USN at 3.7T (1 session)

~10 contingency sessions

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