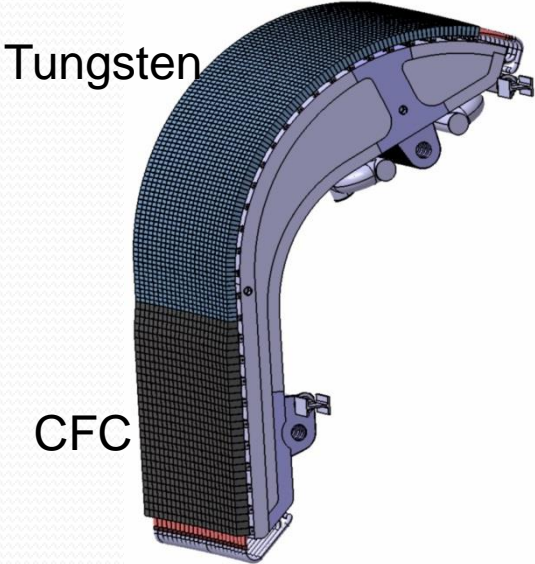
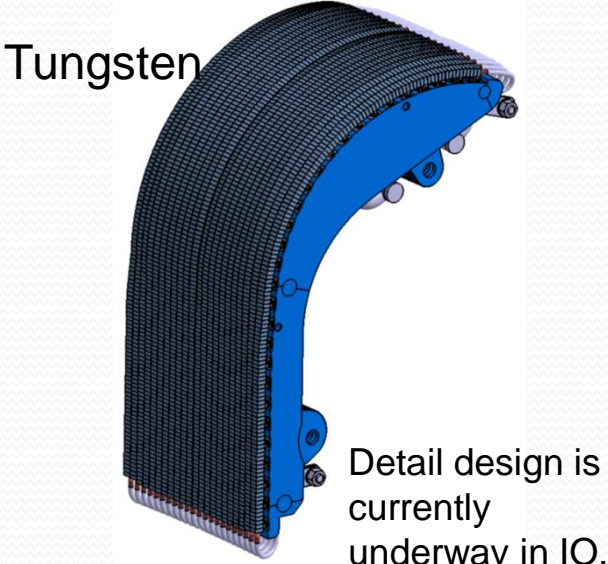


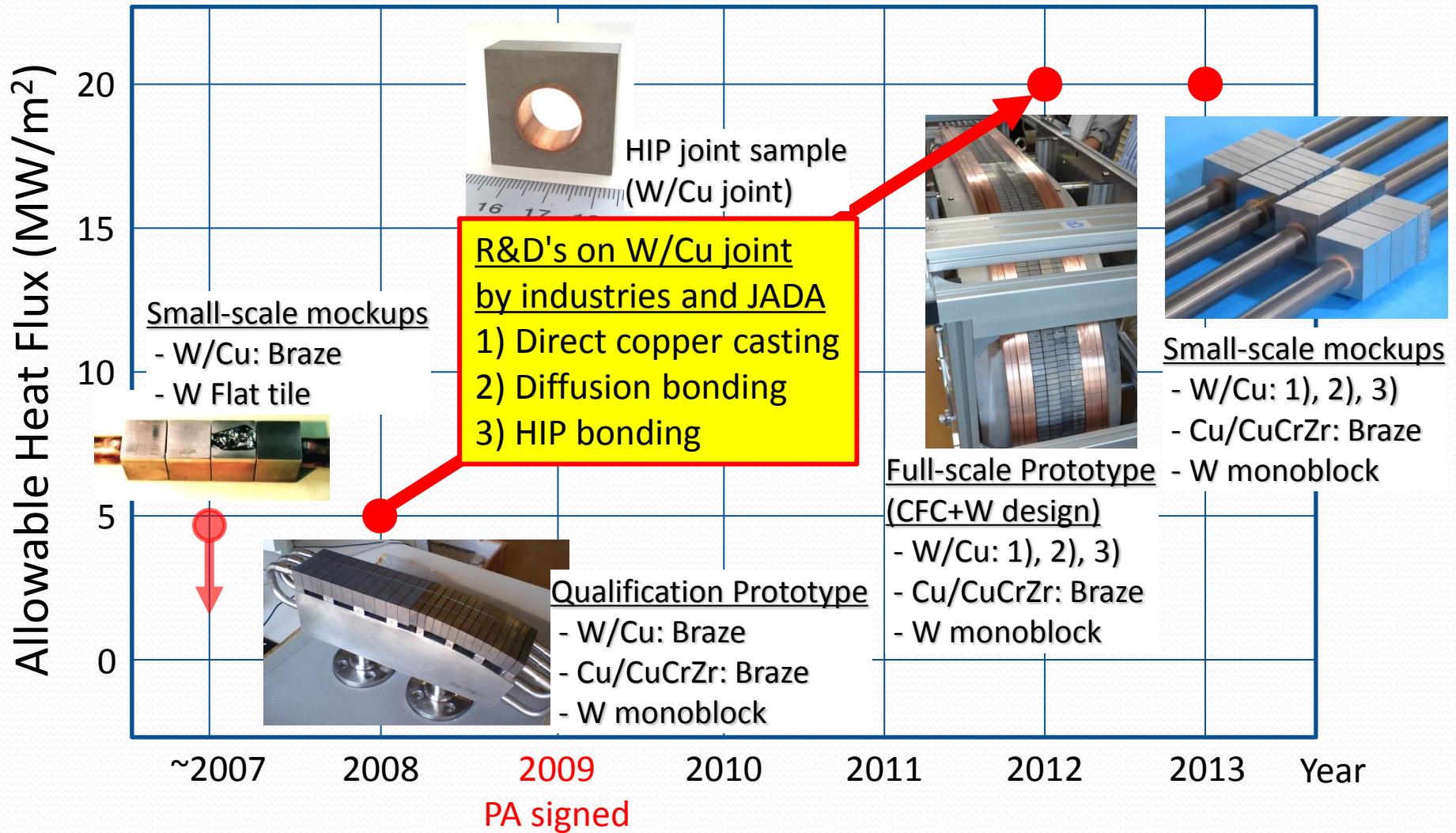
FORWARD DEVELOPMENTS OF FUSION -
Participant forum 3
The WEST project: a wide partnership
for the sake of the ITER tungsten
divertor

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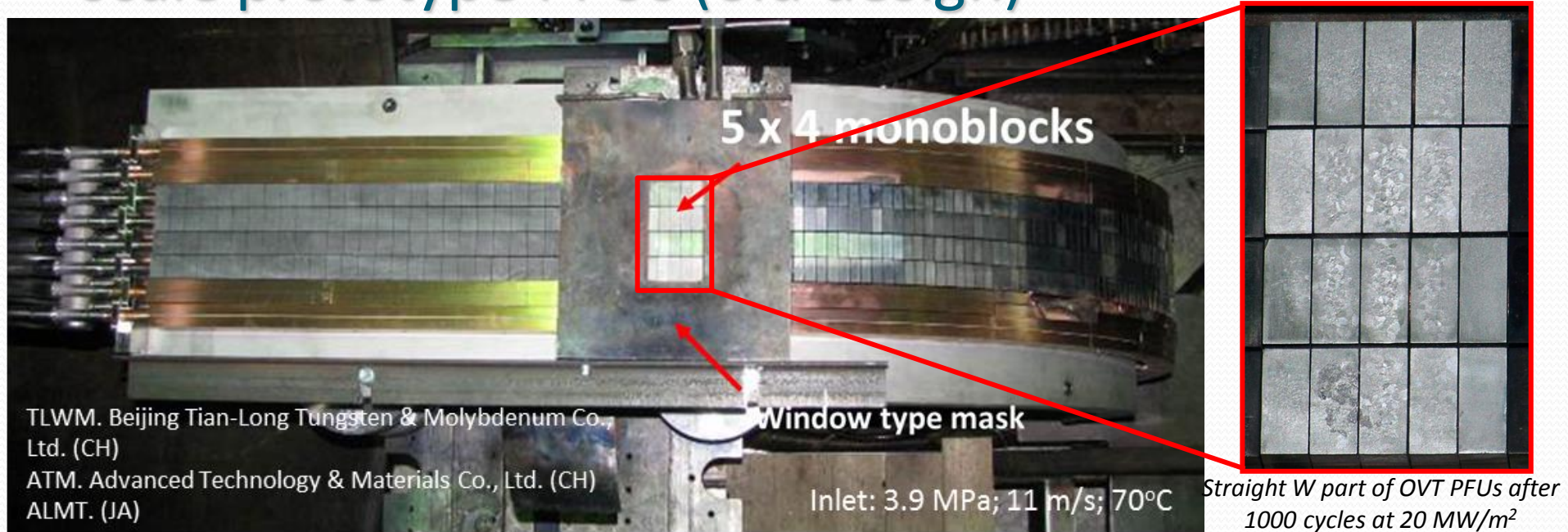
ITER divertor operation challenges

	CFC+W Outer Vertical Target (old)	Full-tungsten OVT (<u>new baseline</u>)
	 <p>Tungsten</p> <p>CFC</p>	 <p>Tungsten</p> <p>Detail design is currently underway in IO.</p>
Operation phase	H/He	H/He/DD/DT
Materials	Target: CFC Baffle: tungsten Cooling tube: CuCrZr Support Structure: SS	Target: Tungsten Baffle: Tungsten Cooling tube: CuCrZr Support Structure: SS
Heat Load	<u>Target: 10-20MW/m²</u> , Baffle: 5-10MW/m ²	
Coolant	Water, 70°C, 4MPa	

JADA's achievements on the tungsten divertor



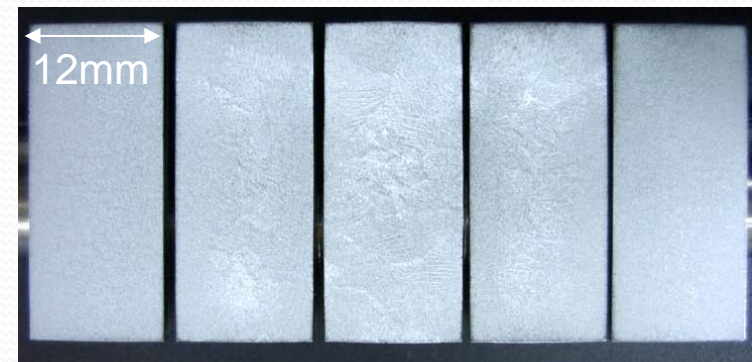
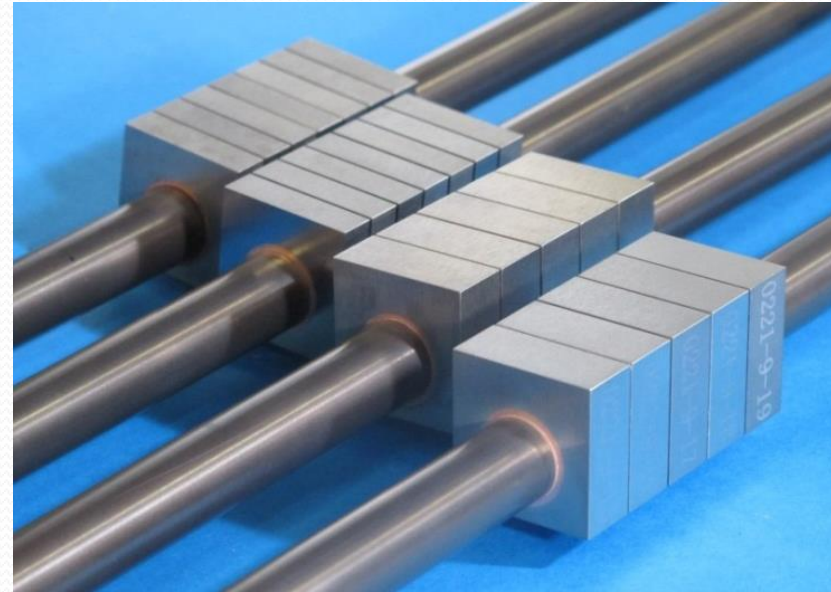
High heat flux test of tungsten part of the full-scale prototype PFUs (old design)



- First HHF test of the prototype PFUs (old design, PFU#1) was performed in Efremov Institute. No degradation of the heat removal capability of the tungsten armored part of all PFUs was found through 1000 cycles at 20MW/m².
- These results fulfill the IO acceptance criteria for "target" part, and indicate that the current tungsten monoblock technology is acceptable for the requirements of the full-tungsten vertical target.
- Second HHF test of the prototype PFUs (PFU#2) is being performed this week in Efremov Institute.

Latest R&D status in JADA

- JADA has started R&D on full-tungsten divertor target since 2012 under the task agreement with IO, in parallel to the OVT procurement based on the old design (CFC+W).
- Six small-scale divertor mock-ups have been developed and high heat flux tested at IDTF in Efremov Institute along the way.
- All the mock-ups showed sufficient heat removal capability and durability under the cyclic thermal loading up to 20 MW/m^2 for 1,000 cycles.
- As the next step, 1/1-scale prototype testing will be conducted.



Heated surface of the mock-ups (@ 20 MW/m^2)

Future Plan & Role of WEST

- Based on the technological achievement by now, full-W divertor has been adopted to the ITER baseline.
- However,
 - The maturity of technology is not sufficient enough for manufacturing full-W divertor so as to meet all technical requirements of ITER. It is essential to promote extensive R&D, including in-situ characterization under plasma environment (WEST), in addition to continuous high heat flux testing.
 - There are also remaining issues on interaction with plasma, such as exploring operational regime for high plasma performance with W-divertor and developing optimized plasma control to prevent excessive damage to W-divertor from VDE and disruption.
 - These should be extensively addressed by WEST long pulse operation.

Future Plan & Role of WEST

- Considering the remaining issues and uniqueness of WEST, JAEA appreciates CEA for promoting WEST program which ensures the full-W divertor characteristics under the ITER relevant conditions.
- JAEA will become a partner of WEST program, which derives further cooperation in the field of nuclear research and development by CEA and JAEA.
- JAEA will provide some of full-W divertor elements for testing in WEST and also more wider collaboration will be explored for extensive fusion research and development:
 - WEST and JT-60SA will be the core of the collaboration activities.
 - CEA and JAEA will promote the training of young scientists and engineers through the collaboration activities.