

# PCR Requests 2026-2027

**WP STEL**

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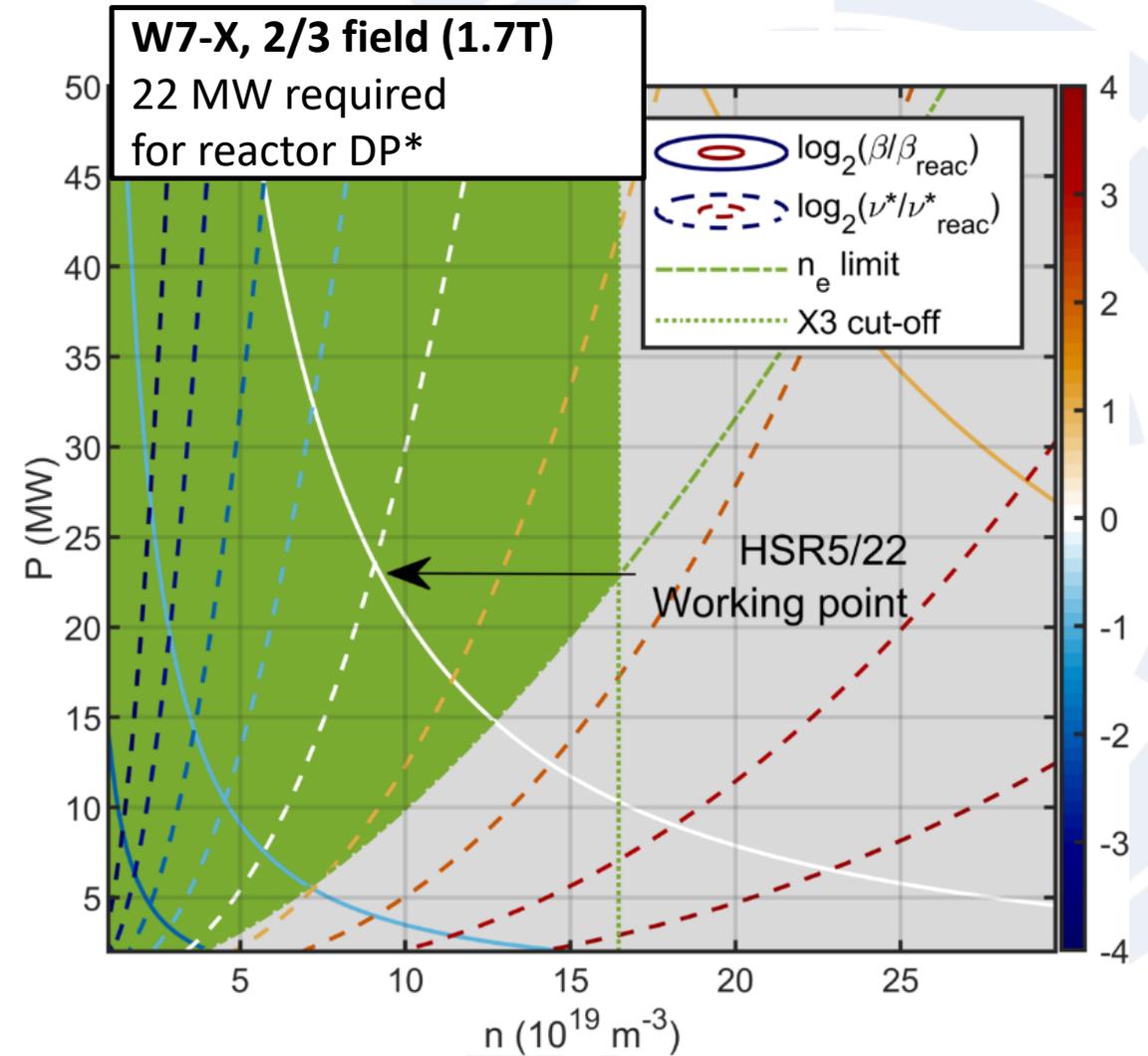
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## PCR: Extension of NBI from 8 MW to 12 MW Prio: high)

- In order to achieve  $\langle\beta\rangle$  of 4% W7-X needs to achieve  $W_{\text{dia}}$  of ca. 2 MJ.
- This can be achieved at lower magnetic field with heating power of ca. 20-30 MW.
- NBI enables direct ion heating, whereas ECRH heats ions only indirectly via electrons.
- Presently, the available input power is:
  - PECRH up to 8.5 MW  $\rightarrow$  will be increased to 12 MW
  - PNBI up to 8 MW  $\rightarrow$  may be increased to 12 MW
  - PICRH up to 1 MW  $\rightarrow$  still in exploratory phase
- Enhancement of PNBI essential for achieving the goals of W7-X, possible at the beginning of FP10.



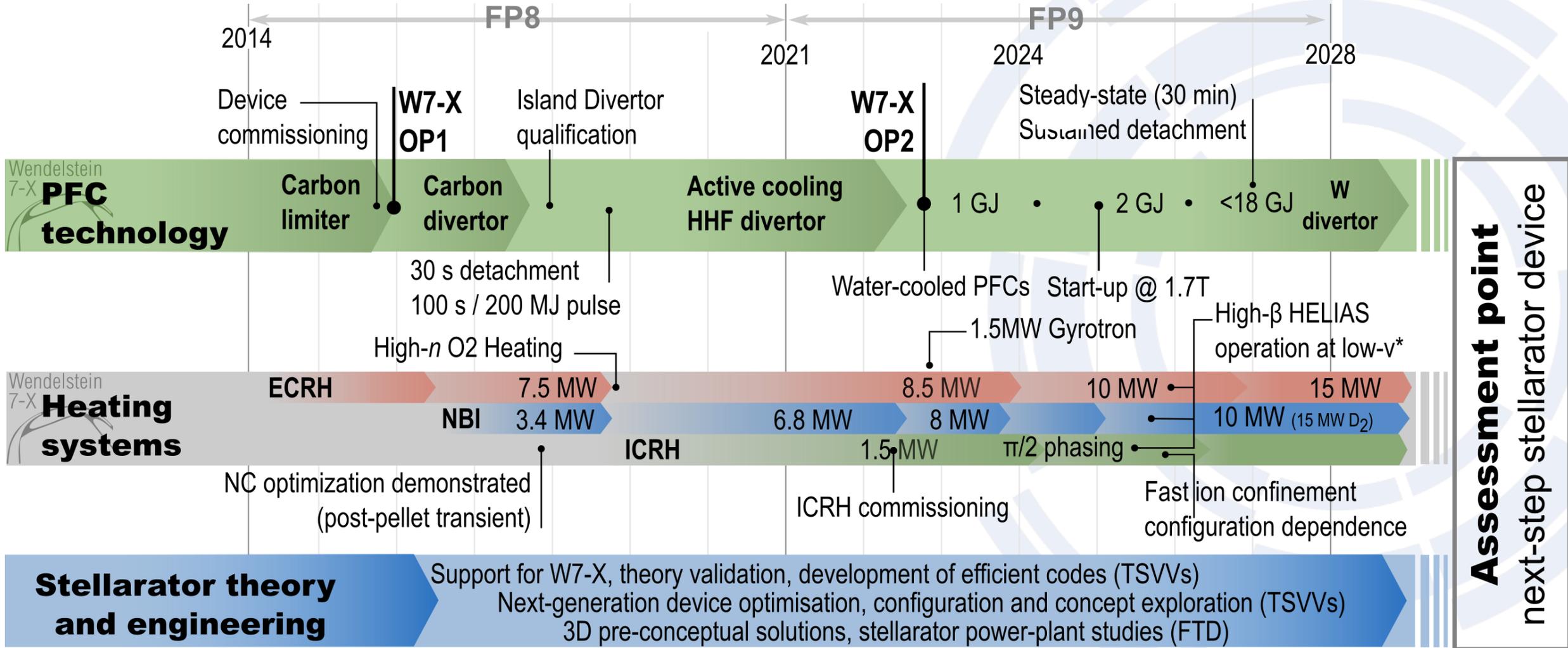


## PCR: Extension of NBI from 8 MW to 12 MW (prio: high)

- **Upgrade Plan:** Use 2 PINIS neutral beam sources from Jülich's TEXTOR tokamak to expand the W7-X system from 4 to 6 sources, increasing total NBI power from 8 MW to 12 MW (especially in deuterium operation).
- **Total Costs**
  - Labor: 0.5 M€
  - Hardware: 2.5 M€
- **Resources required for electrical and mechanical installation works**
  - 2026: 1 person-year
  - 2027: 3 person-years
- PCR request: 24 PM for 2027
- Beneficiary: MPG
- Fast-ion confinement at high- $\beta$  remains a critical unresolved physics gap on the road to a stellarator reactor. Without additional heating resources, this question cannot be addressed at W7-X before 2030, leaving a key uncertainty in the FoAK physics basis unresolved during FP10.



# Reaching goals of W7-X within FP9





# Present resources in stellarator reactor area – 2026 (62 PM)

Tag	Beneficiary	ppm @ 50%
6-Stellarator DEMO reactor - Expert on development of stellarator reactor: Coordinator	CIEMAT	2,00
6-Stellarator DEMO reactor - Expert on development of stellarator reactor: Coordinator	MPG	2,00
6-Stellarator DEMO reactor - Remote maintenance engineer	UKAEA	4,00
6-Stellarator DEMO reactor - Blanket system expert:	ENEA	3,00
6-Stellarator DEMO reactor - Blanket system expert: DEMO blanket solutions	KIT	3,00
6-Stellarator DEMO reactor - Blanket system expert: Blanket Remote handling, Neutronics	CIEMAT	19,00
6-Stellarator DEMO reactor - Expert on neutron modelling: Monte Carlo simulations	KIT	3,00
6-Stellarator DEMO reactor - Expert on neutron modelling: blanket and reactor geometries; Monte Carlo	VTT	5,00
6-Stellarator DEMO reactor - Expert on neutron modelling: computational neutronics	CIEMAT	6,00
6-Stellarator DEMO reactor - Expert on neutron modelling:neutronics modelling	DIFPER	6,00
6-Stellarator DEMO reactor - Expert on neutron modelling:Neutron modelling	UKAEA	3,00
6-Stellarator DEMO reactor - plasma physicist	OEAW	2,00
6-Stellarator DEMO reactor - Thermo-mechanical engineer/physicist	EPFL	4,00



## Present resources in stellarator reactor area – 2027 (58 PM)

Tag	Beneficiary	ppm @ 50%
6-Stellarator DEMO reactor - Expert on development of stellarator reactor: Coordinator	CIEMAT	2,00
6-Stellarator DEMO reactor - Expert on development of stellarator reactor: Coordinator	MPG	2,00
6-Stellarator DEMO reactor - Remote maintenance engineer: UKAEA	UKAEA	4,00
6-Stellarator DEMO reactor - Blanket system expert: Blanket	ENEA	3,00
6-Stellarator DEMO reactor - Blanket system expert: DEMO blanket solutions	KIT	3,00
6-Stellarator DEMO reactor - Blanket system expert: Blanket Remote handling, Neutronics	CIEMAT	19,00
6-Stellarator DEMO reactor - Expert on neutron modelling: Monte Carlo simulations	KIT	3,00
6-Stellarator DEMO reactor - Expert on neutron modelling: blanket and reactor geometries; Monte Carlo	VTT	5,00
6-Stellarator DEMO reactor - Expert on neutron modelling: computational neutronics	CIEMAT	6,00
6-Stellarator DEMO reactor - Expert on neutron modelling:neutronics modelling	DIFFER	6,00
6-Stellarator DEMO reactor - Expert on neutron modelling:Neutron modelling	UKAEA	3,00
6-Stellarator DEMO reactor - plasma physicist	OEAW	2,00
6-Stellarator DEMO reactor - Thermo-mechanical engineer/physicist	EPFL	0,00



# PCR: Increase efforts in stellarator reactor area towards FOAK

PRIO	PCR proposal description	PCR justification	Resources requested	Possible beneficiary	Rationale
high	Increase activities related to novel remote handling strategies	Advance in defining the reactor architecture and all the interphases between components in order to understand the viability and cost of some solutions and the impact on coils, VV, buildings, operations etc...	12 PM	VTT, UKAEA, EPFL	Very little resources in WPSTEL. Remote handling has essential difference when compared to tokamaks, needs a separate program.
Medium	Increase activities related to first wall or innovative solutions taken from WPDIV and applied to BB for stellarators	Advance in defining the reactor architecture and all the interphases between components and their impact on integration, RH, auxiliaries systems, BB performance, etc.	6 PM	DIFFER	Check if we can transfer novel technologies of first wall assembly to complex 3D shape of the stellarator first wall and divertor. Check with WPDIV!!
High	Preparation of FOAK design space using Systems Studies	The Systems code PROCESS has recently finished refactoring allowing after a longer break new, modernised systems studies of Stellarators, important to define the design space for a FOAK Stellarator.	6 PM	MPG	At the moment no resources foreseen in WPSTEL. Preparation for FP10
medium	Mechanical Stress Analysis of 3D Stellarator inter-coil support structure	The maximum field that can be achieved by a FOAK Stellarator depends on how well the forces can be absorbed by a complex 3D support structure, which requires detailed mechanical stress simulations.	12 PM	EFPL, IPP, CIEMAT	At the moment no resources foreseen in WPSTEL. EUROfusion resources are for the development of the tools.
Medium	Initial assessment of a FOAK Stellarator particle exhaust and fuel cycle	In order to make progress with the dimensions of a FOAK Stellarator fuel cycle, the expected particle fluxes in the exhaust need to be estimated based on the plasma scenario and the particle balance	6 PM	KIT	This activity resolves important questions concerning particle exhaust. Preparation for FP10. Low fidelity to get dimensions



# WPSTEL - 2027 budget requests and priorities

Topic	Required resources (PM, hardware, facilities, ...)	Associated CC budget* [k€]	Associated EC budget* [k€]	WP priority (Low, Medium, High)	PSD priority TBD
Extension of PNBI from 4 to 6 sources to reach Ptotal > 20 MW	24 PM	102	113	high	
Stellarator reactor: Remote handling in 3D environment of FOAK (part would be UKAEA, which will lower the cost)	12 PM	51	56	high	
Stellarator reactor: Preparation of design space using system studies for FOAK stellarator	6 PM	26	28	high	
Stellarator reactor: Tools for mechanical stress analysis of 3D inter-coil support towards FOAK	12 PM	51	56	high	
Stellarator reactor: Initial assessment of a FOAK particle exhaust and fuel cycle	6 PM	26	28	medium	
Stellarator reactor: Transfer of novel technologies towards 3D first wall and blanket	6 PM	26	28	medium	