

# First experience with the W7-X Fast Interlock System

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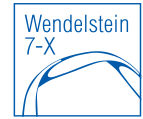
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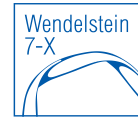
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## Motivation

- The first practical experiences with the central Fast Interlock system (cFIS) have been gained during the operation phase 1.2b in summer 2018
  - initial cooled divertor, max. 200 MJ heating input, max. pulse length 100 s
- proof of
  - a satisfactory reaction, scalability, operability
- assessment of
  - the response times resulting from various safety-relevant plasma diagnostics.
- definition of
  - improvement and upgrade of the FIS to protect components in the plasma vessel in the future (active cooled divertor, max. heating power up to 14 MW)

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## Main results

- The response time of the cFIS is sufficient.
- The fast shut-off of the heating systems within 5  $\mu$ s worked reliably.
- All interventions by the cFIS were justified. False alarms were not observed.
- Diagnostics for ECRH stray radiation, diamagnetic energy, and plasma density worked very reliable.

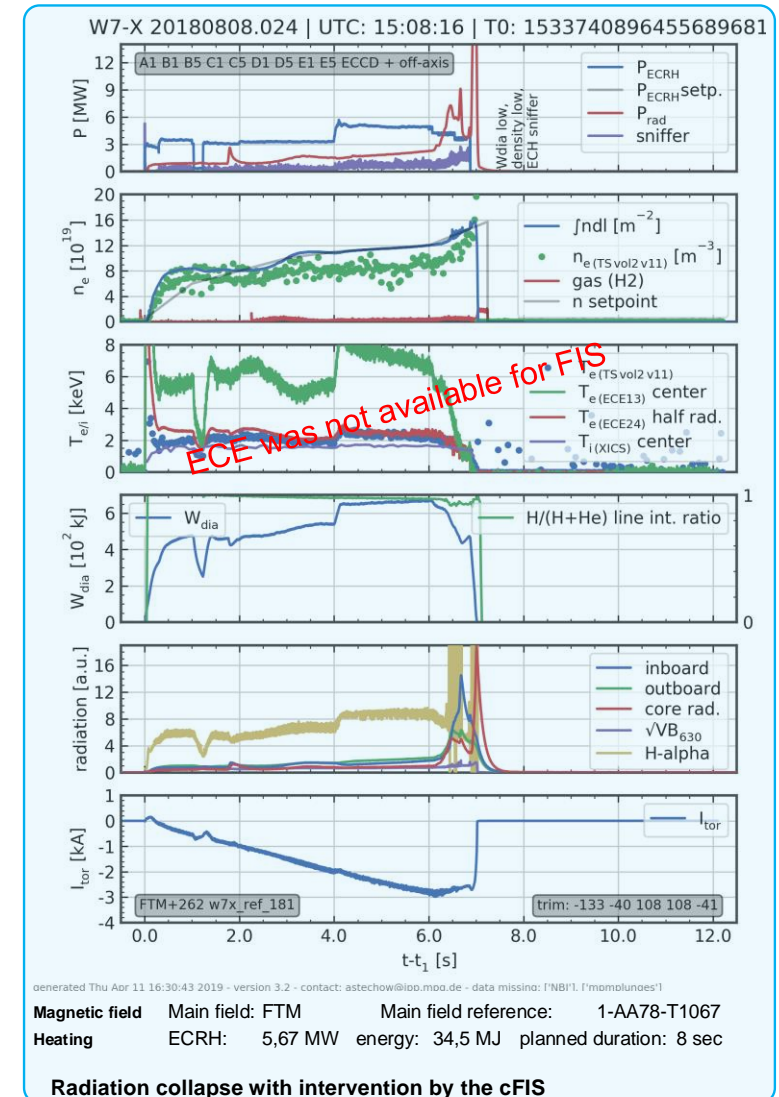
## example

radiation from the plasma gets too high at 6 sec.

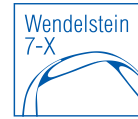
→ the electron temperature drops (but ECE was not available)

→ fast drop of diamagnetic energy

→ ECRH shut-off by cFIS



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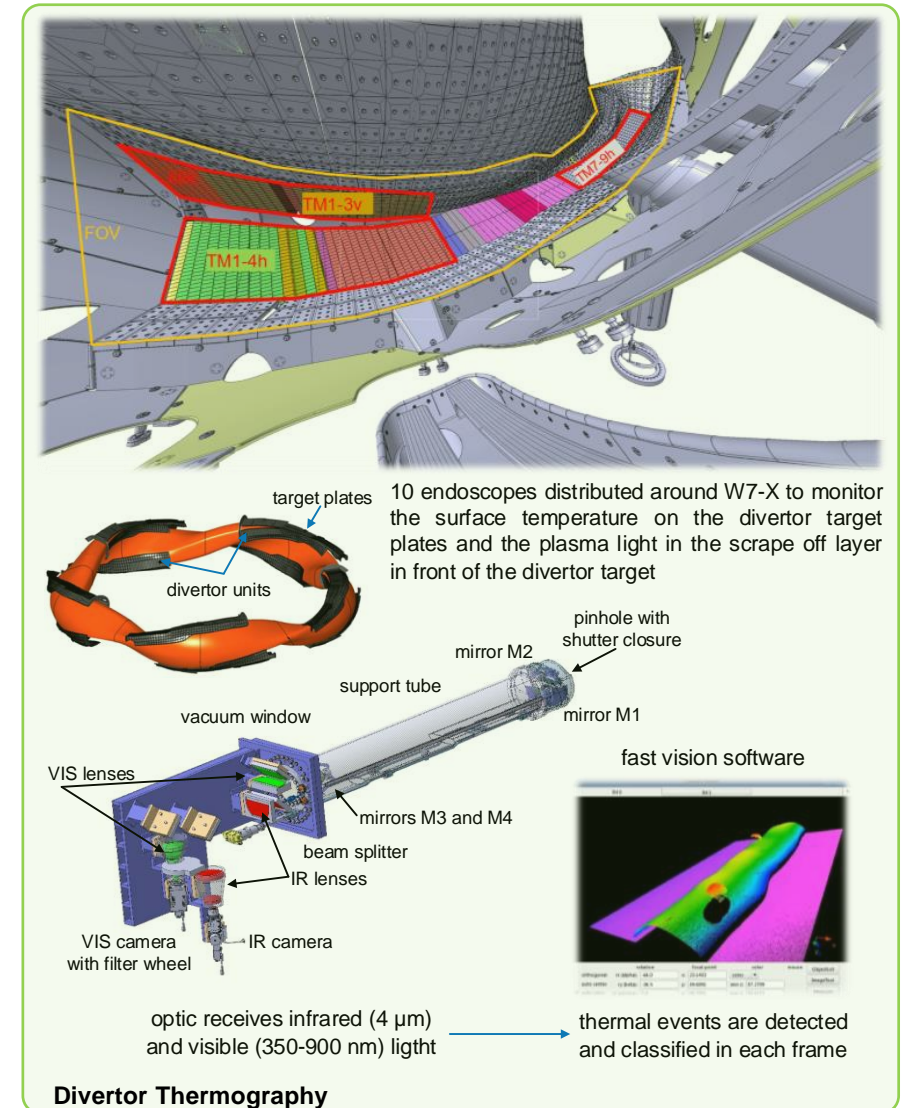
## Improvements

- Implementation of the ECE-diagnostic to the cFIS.  
(worked stand-alone properly)
- Elimination of some temperature drift and signal artefacts of the diamagnetic loops.
- Add real-time recording of data and events in the cFIS for analysis purposes. (e. g. to detect jitters in signal generation)
- Removal of some timing constraints in the cFIS  
(implemented as a precaution into the first version)  
→ aiming at a strict focus on safety-relevant parameters

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## Upgrade

- Implementation of Divertor Thermography to avoid overload of plasma facing components.
- Implementation of the new Ion Cyclotron Resonance Heating (ICRH) system into the cFIS.
- The increasing number of heating systems and safety-relevant diagnostics demands enhancement of the high speed core-system and communication.



Thank you for your attention

Poster - Board P/3-4 / 486

