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## P2.002 W7-X NBI beam dump thermocouple measurements as safety interlock

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In the upcoming operational phase OP1.2b of the Wendelstein 7-X stellarator in 2018 it is planned to have the Neutral Beam Injection (NBI) Heating System operational. Any un-absorbed heating power is dumped on the NBI beam dump graphite tiles that are cooled using CuCrZr-cooling structures. The Heat Shield Thermography (HST) system is present to prevent damage and overheating of the graphite tiles on these beam dumps. In addition, other interlocks (plasma density and ECRH stray radiation interlocks among others) are present to prevent damage to in-vessel components in case of un-absorbed heating power. Since the HST as well as the other interlocks have a rather low safety integrity level (SIL) it was decided to use the available thermocouple measurements of the beam dumps as an additional interlock. Due to the relatively slow response of this type of measurement, the focus of this safety interlock lies on preventing major damage to the PV wall in case of a chain of malfunctions of HST, other heating interlocks and heating systems control. It is not implemented to fully prevent damage to the beam dump structure itself.

This paper describes the setup of the beam dump measurements, the upgrade of the electronics cabinets to SIL2-rated thermocouple measurement with alarm trip relays, the sequence for stopping the NBI beam and the analyses performed to determine the interlock alarm trip settings for operation in OP1.2b.

- [1] P. McNeely et al., "Current status of the neutral beam heating system of W7-X", Fusion Engineering and Design, Volume 88, October 2013
- [2] N. Rust et al., "W7-X neutral-beam-injection: Selection of the NBI source positions for experiment start-up", Fusion Engineering and Design, Volume 86, October 2011
- [3] B. Mendelevitch et al., "Water-cooling system of the W7-X plasma facing components", Fusion Engineering and Design, Volume 98-99, October 2015

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