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# The ESS Fast Beam Interlock System –design, deployment and commissioning till the beam on dump

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The European Spallation Source (ESS), is a linear accelerator located in Lund, Sweden. It is currently under completion and will be the most powerful neutron source. A key system ensuring the safe operation of the machine is the Fast Beam Interlock System (FBIS), which is the brain of the Machine Protection System (MPS) at the ESS. FBIS is both modular and distributed, designed to react to approximately 250 input signals from critical accelerator and target subsystems at the time of this commissioning. The commissioning phase is until beam on dump in 2025. Its role is to assess the beam clearance conditions in real time, ensuring a fast beam stop when necessary to prevent unsafe operation. To meet the requirements of the protection integrity level, FBIS operates at a high data throughput and ultra-low latency. This paper provides an overview of the FBIS control system and the most significant challenges faced during the last commissioning phase. The focus was on integrating several new systems and automating integration tests across the site. The strategies used to validate and deploy over 20 newly installed crates, as well as the important role automation plays in ensuring reliable and efficient commissioning under increasingly complex system conditions.

## Footnotes

## Funding Agency

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