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## The CMS Enfourneur n.2: a Huge, Lean, and Safe Machine for LS3 ECAL Upgrade

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In preparation for the High Luminosity phase of the LHC at CERN, to start in 2029, a refurbishment of the electronics of the CMS electromagnetic calorimeter (ECAL) is planned. The ECAL barrel section is organized in 36 elements called Supermodules (SMs), 18 in each side. All SMs, weighing about 3 tons each, must be extracted, upgraded and inserted again during the Long Shutdown 3 (LS3) using two large machines, Enfourneur n.1 (E1) and n.2 (E2) operating one per each CMS side. E1 –used for the original SMs installation - has been heavily upgraded to be compliant with the current safety norms, but the demands from the logistics of the CMS cavern and the tight schedule require to produce a second machine. The new E2 machine must meet some major engineering challenges: maintaining or improving functionality and safety in compliance with European regulations in terms of safety (Eurocodes and the Machinery Directive in particular), as well as being installable in the CMS plus side, which is only accessible through narrow shafts and tunnels. E2 was therefore designed in a modular way, harmonizing functional and structural requirements with the space and tools available for transport and installation. Functionality and safety have also been improved by replacing hydraulic actuation with electrically driven controls and motors, resulting in refined positioning capabilities and simplified procedures for handling heavy, voluminous, and extremely delicate objects such as supermodules. The E2 design is currently complete and the construction has started in January 2023.

### Funding Agency

### Footnotes

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Yes

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