

ID de Contribution: **170**

Type: **Non spécifié**

AI for the Design and Operation of Particle Accelerators

jeudi 27 novembre 2025 13:30 (25 minutes)

Artificial intelligence (AI) is emerging today as a major driver of innovation for research infrastructures. In the field of particle accelerators, it opens up unprecedented opportunities for real-time control, predictive diagnostics, beam optimization, and the design of new devices. This presentation will provide an overview of current AI approaches and applications in accelerator science, with a focus on projects and initiatives led by IN2P3 laboratories (GANIL, IJCLab, LPSC, etc.), while situating them within a broader European dynamic (TwinRISE, ARTIFACT, MLAcc).

The talk will highlight the technical and organizational challenges of this transformation: integration with control systems (EPICS, TANGO), data management and annotation, model reproducibility and explainability, and alignment with regulatory and ethical frameworks (AI Act, safety, traceability).

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Classification de Session: ML in Experimental Design and Control

Classification de thématique: Accelerator control