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A technical overview of industry-science R&D projects for the High Luminosity LHC under CERN openlab

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CERN openlab is a unique resource within CERN that works to establish strategic collaborations with industry, fuel technological innovation and expose novel technologies to the scientific community.
ICT innovation is needed to deal with the unprecedented levels of data volume and complexity generated by the High Luminosity LHC. The current CERN openlab Phase VIII is designed to tackle these challenges on a number of fronts, including, but not limited to: heterogeneous computing, platforms, and infrastructures; novel storage, compression, and data management solutions; emerging low-latency interconnect and link protocols; and the exploitation of artificial intelligence algorithms across a multitude of domains, including edge devices for real-time event selection and triggering. The evaluation and adoption of these technologies are being accelerated by ongoing collaborations between industrial leaders in the relevant fields and the scientific community at CERN. The work of ongoing focussed projects in these areas will be summarised, and results demonstrating their impact will be shown. Incubator projects on emerging technologies such as digital twins and generative AI will be presented, as well as the next steps in these R&D efforts.

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