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ALICE 3: A next-generation heavy-ion experiment at the LHC

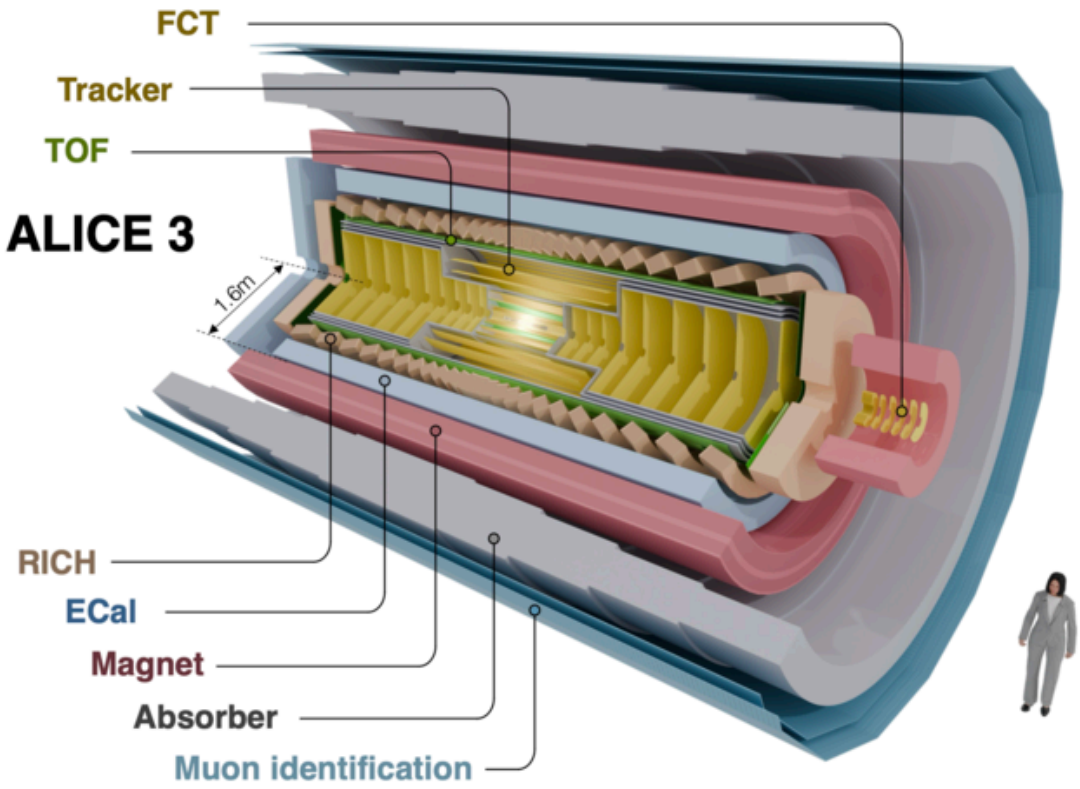

Figure 1: ALICE 3

The ALICE experiment at CERN focuses on the properties of strongly interacting matter and how they arise from the underlying interactions as described by quantum chromodynamics. Collisions of heavy nuclei at the LHC provide unique experimental access to the hottest and longest-lived quark–gluon plasma available in the laboratory, with abundant production of heavy-flavor probes. To deliver the measurements needed to pursue its physics program, ALICE is developing and planning several upgrades to its detectors for the remaining LHC Runs.

For Runs 5 and 6, a compact all-silicon tracker is in the planning stage, under the name ALICE 3. It includes a vertexing detector housed in vacuum within the beam pipe for ultimate pointing resolution, for measurements on heavy-flavor mesons, baryons, and multi-charm (yields, flow, correlations) and rejection of heavy-flavor background in dielectron and dimuon measurements; a large-acceptance silicon pixel tracker for correlation measurements and rapidity-dependent measurements; a time-of-flight layer and a ring-imaging Cherenkov

detector for hadron and electron identification; a steel absorber and two layers of muon detectors for muon identification down to $p_T = 1.5$ GeV; a forward conversion tracker for ultra-soft photons; an electromagnetic calorimeter for photon detection.

The proposed detector is conceived for studies of pp, pA and AA collisions at luminosities a factor of 20 to 50 times higher than possible with the upgraded ALICE detector, enabling a rich physics program ranging from measurements with electromagnetic probes at ultra-low transverse momenta to precision physics in the charm and beauty sector. This contribution provides a comprehensive overview of the upgrade and how it would enable ALICE and its extensive physics program to fully exploit the LHC to explore the properties of the quark–gluon plasma.

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