Title: Investigating Jet Structure in Hadronic Heavy Ion Collisions

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Abstract: This thesis presents a detailed study of jet structure in hadronic heavy-ion (Pb+Pb) collisions at center-of-mass energy at 5.36 TeV recorded by the ATLAS detector during 2023–2024. We utilize a jet-reconstruction framework—including anti-k_T clustering, Cambridge/Aachen re-clustering, Soft-Drop grooming, and Lund-plane mapping—to isolate medium-modified splittings. Later chapters apply these techniques to data: we quantify the influence of jet p_{T} and track-p_{T} thresholds, jet radius, and event centrality on jet structure. In the last part of the thesis, Monte Carlo studies and response–matrix corrections are performed to study detector effects. We report the first measurement of Lund-plane density ratios in Pb+Pb vs. pp at the ATLAS experiment, demonstrating possible enhanced soft large-angle radiation consistent with quark–gluon-plasma induced broadening. Further analysis is needed to mitigate detector effects.

Keywords: Jet, Jet Structure, Lund Jet Plane, Heavy Ions, Quark–gluon plasma