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Commissioning of ESS normal-conducting linac instrumentation and implications for future hadron linacs

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To support commissioning and early operation of the ESS normal-conducting linac, a variety of beam instrumentation systems have been deployed. These include beam chopping systems, Faraday cups, beam current monitors, and beam position and phase monitors as well as specialised systems such as wire scanners, emittance measurement units and neutron beam loss monitors. Commissioning has proceeded in three campaigns: proton beam through the Radio-Frequency Quadrupole to 3.6 MeV in 2021, through the first Drift Tube Linac (DTL) tank to 21 MeV in 2022 and through the first four DTL tanks to 74 MeV in 2023. In preparation for each campaign, the diagnostics team verified the measurement and protection functions of this instrumentation suite without beam. These functions were then verified with a low duty factor beam before finally declaring the systems operational. Throughout these verification activities and the succeeding commissioning stages, a rich data set was archived and analyzed. This paper describes the early experience with the ESS NCL instrumentation and, with a focus on lessons for future facilities, summarizes the data analysis techniques and results.

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Footnotes

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