



Contribution ID: 68

Type: **not specified**

Identification of the horizontal instability mechanism at the CERN Proton Synchrotron Booster

Wednesday, 25 September 2019 10:40 (20 minutes)

A horizontal head-tail instability has been observed in the CERN Proton Synchrotron Booster (PSB) since the '70s. Beam-based measurements of losses versus the horizontal working point reveal a dependence of the instability on the horizontal tune. Macro-particle simulations and the Sacherer formalism suggest that the unmatched kicker termination is responsible for the observed beam losses and exponential growth. The extraction kicker was finally unambiguously confirmed to be the source of the instability. This was achieved with beam-based measurements with a temporarily modified termination, adjacent to the thyatron switch of the extraction kicker system, from a high impedance termination, required for operation, to a matched termination using a 6.25Ω resistor. With this configuration, no sign of the instability was any longer observed.

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Session Classification: Session 6