

Applications of digital signal processing to beam instrumentation

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Abstract

Most beam measurements are based on the electro-magnetic interaction of the fields induced by the beam with their environment. Beam current transformers as well as beam position monitors are based on this principle. The signals induced in the sensors must be amplified and shaped before they are converted into numerical values. These values are further treated numerically in order to extract meaningful machine parameter measurements.

The lecture will first introduce the architecture of an instrument and show, where in the treatment chain digital signal analysis can be introduced. Then the usage of digital signal processing will be presented using multi-turn intensity measurements, tune measurements and orbit and trajectory measurements as well as longitudinal phase space tomography as examples.

The hardware as well as the treatment algorithms and their implementation on Digital Signal Processors (DSPs) or in Field Programmable Gate Arrays (FPGAs) will be presented.