

HOM Based Beam Diagnostics in TESLA Superconducting Cavities at FLASH

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FLASH is a free-electron laser driven by a superconducting linac at DESY in Hamburg. It is able to generate high-brilliance XUV and soft X-ray pulses. Many accelerating cavities are equipped with HOMBPMs (Higher Order Mode based Beam Position Monitors) to align the beam and monitor the transverse beam position. We applied an efficient measurement and signal analysis with various data process methods to determine the transverse beam position. By fitting the HOM signals with a genetic algorithm, we implemented a new HOMBPM calibration procedure and obtained reliable beam prediction positions over a long time. A stable RMS error of about 0.2 mm by using the spectra of signals and 0.15 mm by using this new method over two months has been observed. For a FEL facility, the accelerating RF fields in SC cavities must be controlled precisely. A new type of beam phase determination technique based on beam-excited HOMs in cavities has been implemented. We measured the long term beam phase in cavity 1, module 1. Besides, some preliminary results of cavity tilt measurement will be presented.

Primary author: Mr WEI, Junhao (DESY)

Co-authors: Mrs NICOLETA, Baboi (DESY); Mr SHI, Liangliang (PSI)

Presenter: Mr WEI, Junhao (DESY)

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