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Design, characterization, and validation of a pulsed RF burst source for in-situ cavity beam position monitor calibration

Monday 11 August 2025 16:00 (2 hours)

Beam Position Monitors are critical instruments in accelerator facilities, providing precise beam orbit measurements with tens of nanometers resolutions, essential for the operation of current linac-based FELs and future linear colliders. In this report, we introduce the development and successful testing of a pulsed RF burst source specifically designed for BPM calibration. The source was characterized and installed at the ATF2 facility in KEK, Japan. The system injects tailored RF pulses into the BPM cavity via one of the two output ports. With the capability to adjust frequency and pulse width, to emulate beam pulses, the system demonstrated nearly complete cancellation of beam-generated signals when the injected RF pulse overlapped with the beam pulse. This source has the potential for in-situ BPM calibration, mitigation of static signal contributions caused by cavity misalignments and capacity for wakefield compensation. Dedicated hardware development for further refinement of the source is underway at Royal Holloway, University of London, using two TI LMX2820 high-frequency synthesizers triggered by a shared external source to achieve precise phase synchronization between distinct frequencies at defined delays. Preliminary measurements indicate a phase jitter of about 1.2 degrees, currently limited by the trigger signal's slow rising edge (tens of ns), while system requirements demand sub-nanosecond (hundreds of ps) precision for robust, high-frequency phase locking.

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Yes

Would you like to submit this poster in student poster session on Sunday (August 10th)

No

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

Yes

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