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Tracking Frequency Reference Phase Changes at Point of use based on BPM Measurements.

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Multibunch Feedback systems in Diamond use the RF reference signal to sample the BPM signals. Uncertain reference phase variations due to upstream adjustments to the RF system previously necessitated regular manual realignment of the sampling phase. Locking the sampling phase to the measured beam phase has been investigated to improve the stability and robustness of the system and remove the dependence on absolute RF phase. Significant improvements have been achieved using a Beam Locked Loop architecture based on an IQ modulator and cartesian feedback to phase align the local 500MHz reference signal to the BPM RF frequency component under closed loop digital control with remote management via EPICS. The system has been successfully deployed on the storage ring at Diamond and has been operating live since October 2019. Live data captured from the operational storage ring demonstrates the ability to tolerate a wide variation in beam phase whilst maintaining accurate beam sampling and robust acquisition of the reference phase over the operating range of beam currents and fill patterns.

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