



Tune measurement and control system

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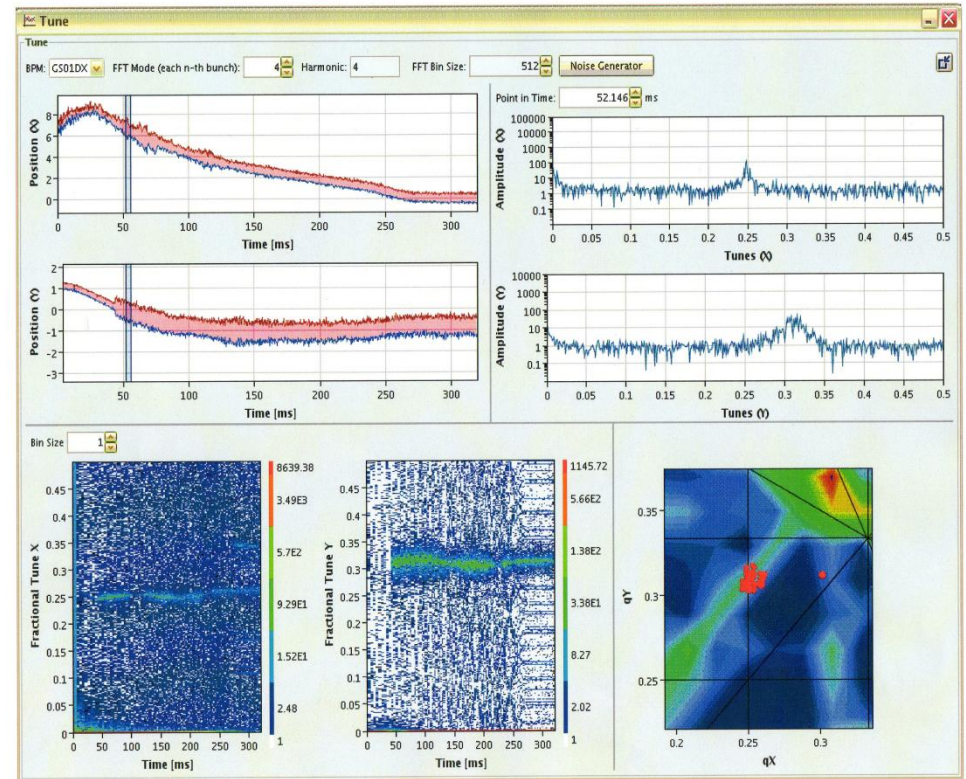
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Why control of tune?

- Precise setting of the tune is crucial for high current operation of GSI SIS 18 synchrotron especially for the storage of low energy ion beams which has a large tune spread.
- It becomes further more important in the FAIR project, where the currents would be much higher, and thus the tune accuracy due to space charge effects is much rigid.

Results achieved

- Remote controlled tunable noise generator to excite the beam
- A Tune measurement system based bunch to bunch position measurement
- Benchmarking of maximum exciter output without significant emittance blow-up at various beam currents and ion types

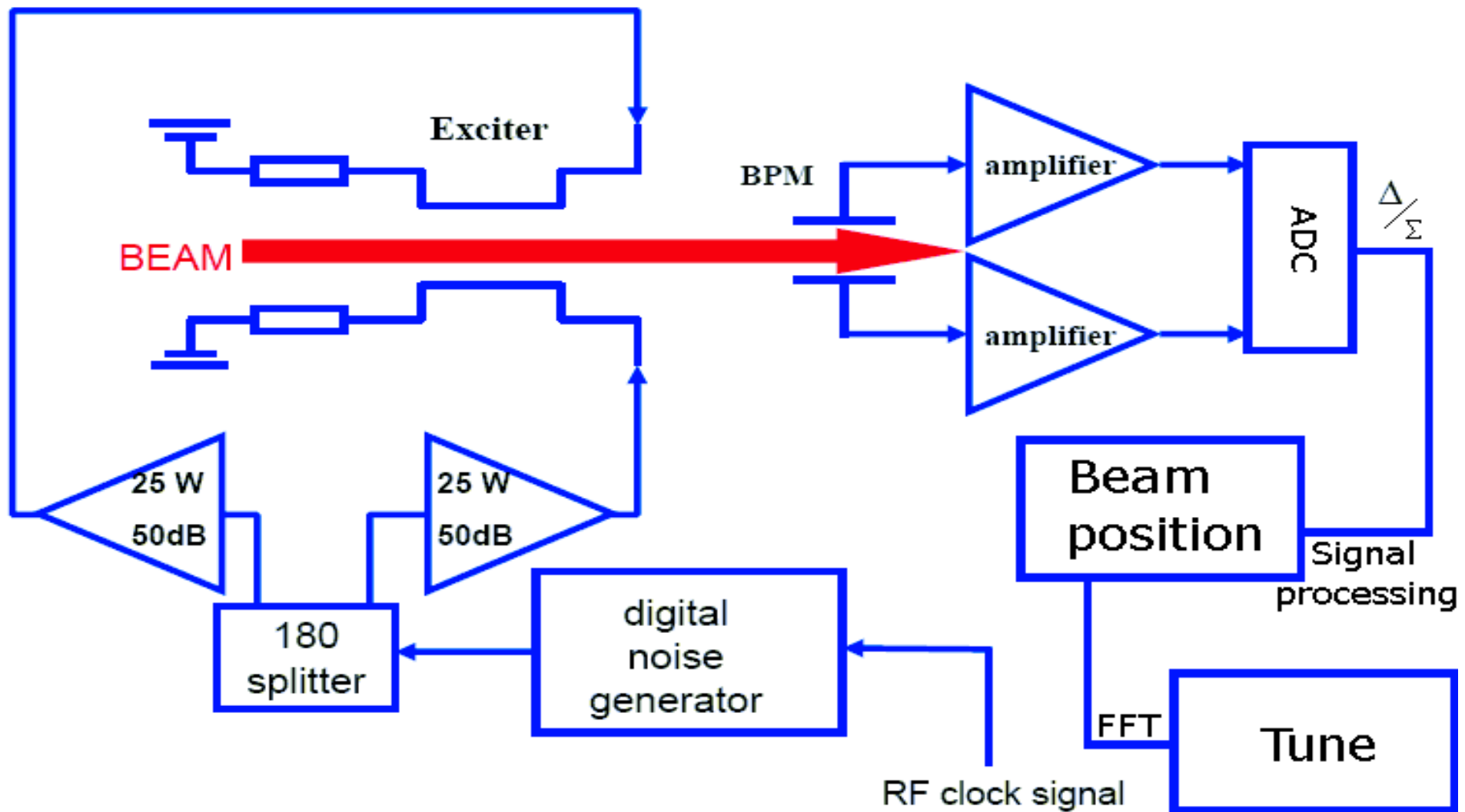


Cosy-Posi system showing tune on excitation of beam. Measurements done at $2 \cdot 10^8$ U^{73+} ions per bunch

Foreseen work

- Improvement in tune measurement algorithm, trying to achieve better SNR while maintaining stable values over the whole ramp of acceleration with minimum noise excitation.
- Further evaluation is needed, whether a feedback or a feed-forward system is needed based on the user requirements, and the understanding of accelerator lattice response time for SIS-18(existing) or SIS-100(FAIR).
- To design the working prototype of the control system!

How is tune measurement done?



How is tune measurement done?

- The broadband signals of a Beam Position Monitor are digitized by a fast 125 MSa/s ADC and digitally integrated over the actual bunch length to find position data.
- The tune is then determined by Fourier-Transformation of the position data of individual bunches. This very sensitive 'baseband' processing delivers the tune value without any additional input parameters.
- Since transverse emittance blow-up has to be avoided, the excitation power required for the excitation of coherent betatron oscillations, must be as low as possible.

References

- 1) U.Rauch et al, Proc. of DIPAC 2009, Basel, Switzerland, Baseband tune measurements at GSI SIS-18 using digitized BPM signals.
- 2) K.Lang et al, Proc. Of PCaPAC'08, Ljubljana, 2008