Status and Results of the TFS for SIS18/SIS100

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In this short report, we show the current status of the project Transverse Feedback System (TFS) for the SIS 18, which can be commissioned later at the SIS 100 of FAIR project, upon its completion.

The TFS features and parameters are designed to have a large dynamic range such that it can be installed at the SIS 18 as well as the SIS 100. Testing the functionality of the System on a real beam at the SIS 18 is planned in the next few monthes.

A new concept for using multiple pickups in estimating the feedback correction signal in order to minimize noise power has been adressed. Furthermore, a distributed system design and synchronization scheme considering the current BPM Liberas of the existing SIS 18 facility has been developed.

System Design

We apply a new approach for mitigating noise at the PUs using more than two PUs at different positions to estimate the feedback correction signal for the Kicker position.

Data acquisition for the TFS takes place at distinct devices – namely, the Liberas. Therefore, the system has to be realized in a distributed manner. The main subsystems of the distributed TFS are the Libera devices for data acquisition, and the central unit for calculation, intensive operations and synchronization.

In order to achieve the synchronization between the TFS central unit and the distributed Liberas, time stamps are transfered in addition to the position data from the Liberas to the central unit. These time stamps are calculated in terms of shared reference wavefronts among all the TFS nodes. Specifically, we use the RF signal as a shared reference in our design. A time stamp is composed of wave front number, and time shift from this wavefront. In addition to the reference signal, a trigger signal is needed to indicate the start of counting the wave fronts. Figure 1 shows the form of the synchronization signals.

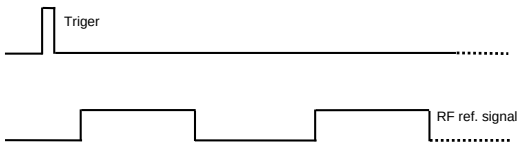

Figure 1: TFS synchronization signals.

In order to stabilize head-tail oscillations and higher order modes, which become dangerous for high beam intensities, many position measurements and kicks must be achieved for every bunch. Therefore, a bunch-by-bunch system would not be enough here, and we implement a wide-band feedback system.

Feedback parameters, e.g., revolution frequency and linear combination factors, are privided via the GSI interface cards FG 380.221. System configuration is done by an external computer via Ethernet connection.

Implementation

The TFS central unit electronics are shown in Figure 2. The System is implemented on a Virtex 6 FPGA ML605 kit from the company Xilinx. Several daughter cards has been deployed in order to connect this kit to the Kicker, the FG 380.221 cards, and the Liberas.

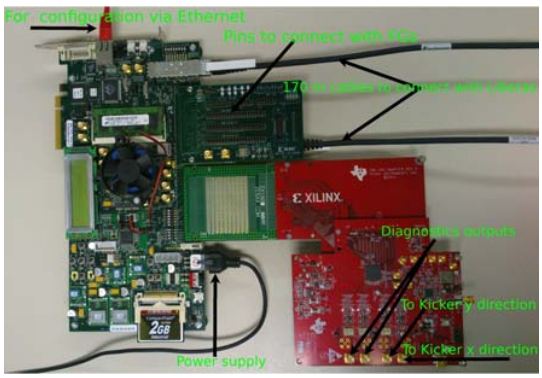

Figure 2: TFS board.

The beam position data from the PUs are sampled and preprocessed at the Libera kits from the company Intrumentation Technology. The data as well as the time stamps are then sent from the Liberas to the TFS central unit via two long fiber optical cables using Aurora multi-Gigabit communication. Clusters of Libers are considered to connect to multiple BPMs.

References

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 doi:10.15120/GR-2014-1-FG-SIS18-04