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P2.043 The timing system of the ITER full size neutral beam injector prototype

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The ITER Neutral Beam Test Facility (NBTF) is currently under construction at Consorzio RFX, Padova, Italy. The NBTF includes two experimental devices: SPIDER for the study of the ion source and MITICA for the development of the full-size HNB prototype. Even if the two experiments share many architectural aspects in their Control and Data Acquisition System (CODAS), there are nevertheless some significant differences because MITICA must adhere to ITER's directives for plant control design. This paper describes the architecture of the MITICA timing system that represents one of the first examples of integration of IEEE1588 timing functions in fusion research medium-scale experiments.
Timing functions are required in MITICA CODAS to:
1) Synchronize data acquisition and assign a timestamp to each data sample;
2) Supervise the generation of events, trigger a reaction of the control system and/or provide enhanced data acquisition in a time window centered on the event occurrence time.
The IEEE1588 time synchronization protocol ensures sub-microsecond clock alignment among devices connected via a LAN. Therefore, it has the potential advantage of avoiding direct cabling among the involved actors, being all the synchronization messages exchanged over the LAN. A feature that IEEE1588 does not cover is the management of asynchronous events that may trigger some actions. Asynchronous events may trigger:
1) Enhanced data acquisition (e.g. with a higher sampling speed) during a time window centered on the trigger occurrence time;
2) Real-time response from the control system.
While the management of events triggering control actions is under the responsibility of the real-time control system, for events triggering enhanced data acquisition, the "lazy triggers" solution is adopted in MITICA. This solution allows events to be communicated via LAN, compensating the delay in network communication will be compensated by means of circular buffers at the ADC side.

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