

MOPORI02

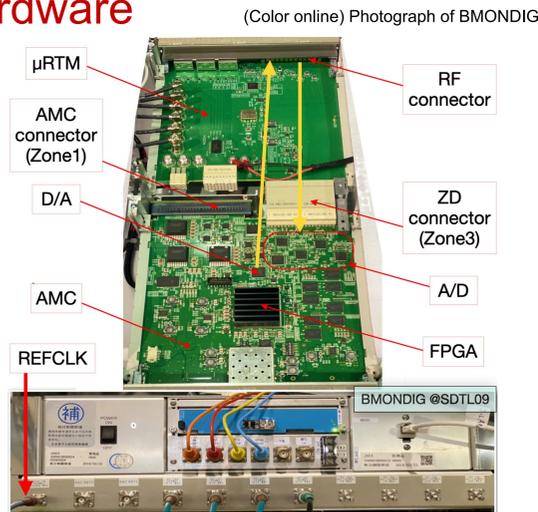
Introduction

- Several beam monitors at the linac;
 - Beam current monitor (slow current transformer, SCT),
 - Beam phase monitor (fast current transformer, FCT),
 - Beam position monitor (BPM).
 - Main objectives of beam monitoring system development;
 - Obsolescence,
 - Desire to monitor the entire macro pulse;
- Challenging to perform signal processing in an FPGA during beam operation, with a general-purpose of digitizer
→ a memory with ~50k points in FPGA.

	Extant system	Updated system
Device	• WE7000 station w/ WE7111 digitizer for SCTs/FCTs, WE7118 for BPMs	• Field-programmable gate array (FPGA)-based beam monitor digitizer (called "BMONDIG") for SCTs/FCTs, and BPMs
ADC	• General purpose DC-coupled ADC	• General purpose AC&DC-coupled ADCs
Key point	• Conventional	<ul style="list-style-type: none"> • FPGA-based including a digital signal processing (DSP) function • Sequentially measures comb-like beam w/ duty cycle and averaging calculation processes • MicroTCA.4 (Micro Telecommunications Computing Architecture.4) standards

The aim is to achieve stable operation with lower beam loss for all intensities at J-PARC.

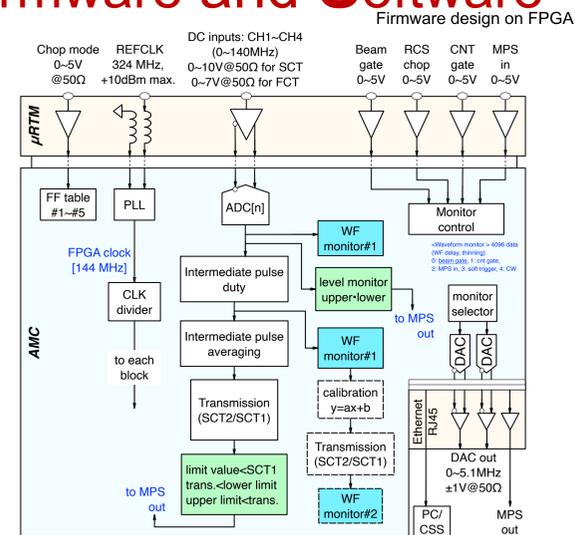
Hardware



- by Mitsubishi Electric TOKKI System Co., Ltd (MELOS);
- Evaluation using A/D-D/A signal processing board: advanced mezzanine card (AMC), rear transition module (μRTM).

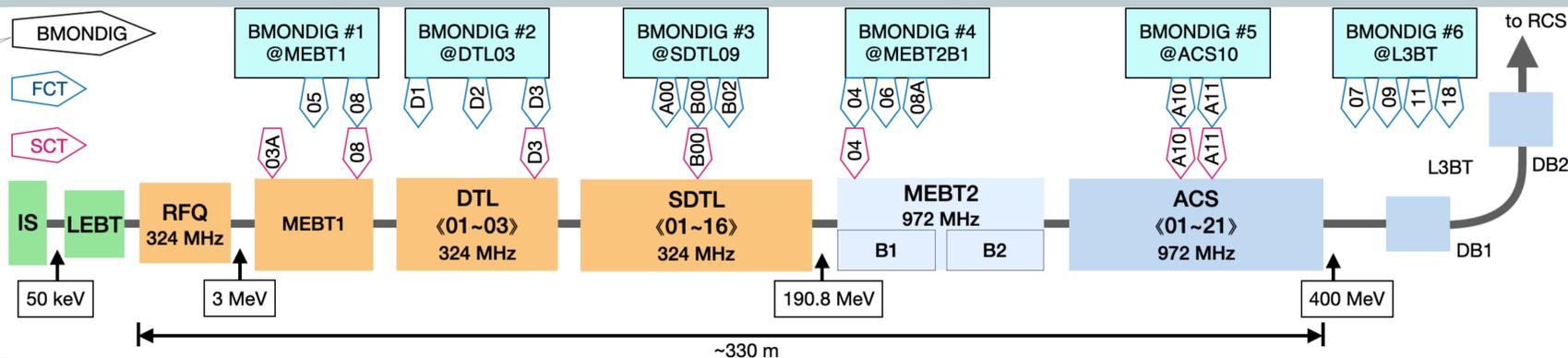
A/D • D/A signal processor AMC: specifications	
FPGA	XC7Z045-1FFG900C
OS	Xilinx Linux (EPICS-IOC)
ADC	8ch, 16-bits, 370 MSPS(max.), BW 800 MHz
DAC	2ch, 16-bits, 500 MSPS (max.)

Firmware and Software

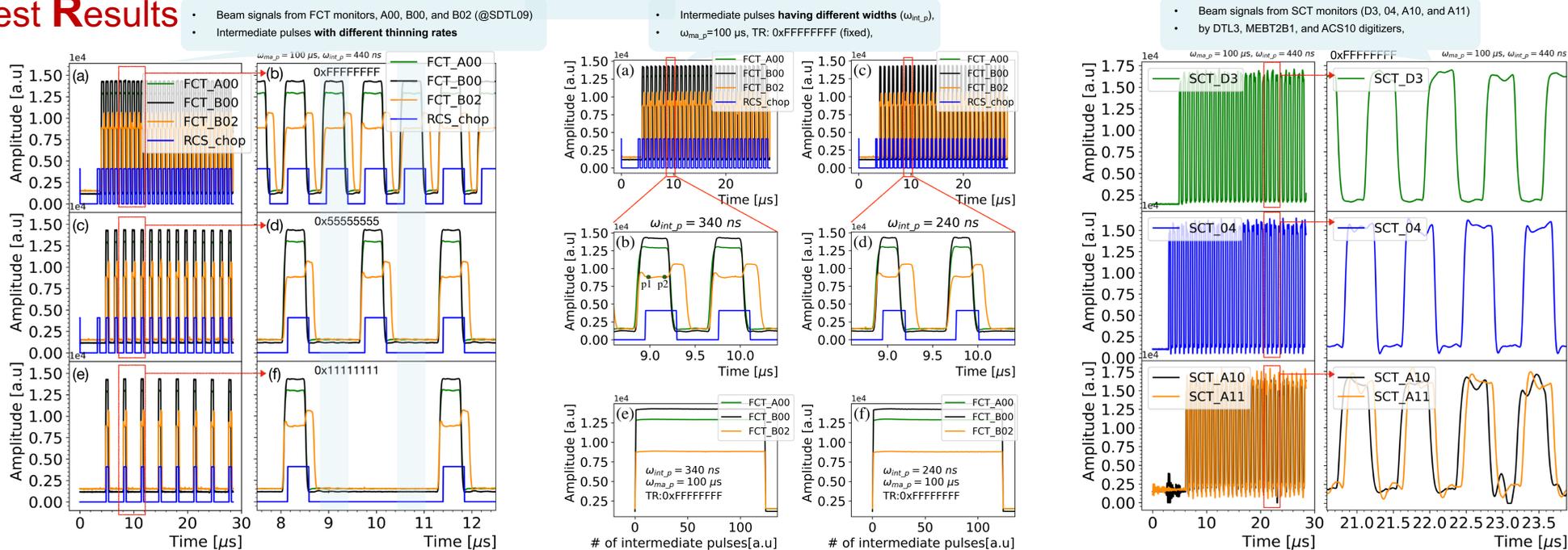


- Design implementation on Zynq XC7Z045-1FFG900C FPGA;
 - Raw data acquisition, duty, averaging of intermediate pulse amplitude, beam position and transmission calculations, interlock protection, point data and waveform monitoring.
- Embedded Linux OS. EPICS-IOC application and a control system studio (CSS)-based GUI to control the system.

Six new monitor digitizers were installed at MEBT1, DTL03, MEBT2B1, ACS10, and L3BT RF stations.



Test Results



Conclusion and Future work

- ☑ Six new beam monitor digitizers were installed at six RF stations in the linac klystron gallery.
- ☑ The new digitizers successfully measured and monitored linac beam pulse under different operating conditions.
- ☐ Meanwhile, BPM measurements, calculations, and FPGA design development are underway.

Acknowledgments

- We gratefully acknowledge MELOS for implementing a perfect monitor digitizer for the J-PARC linac.
- The authors also thank linac commissioning group members for providing different beam conditions during our study.