Development of a High-Bandwidth Waveform Processing System using RFSoC for RI Beam Experiments

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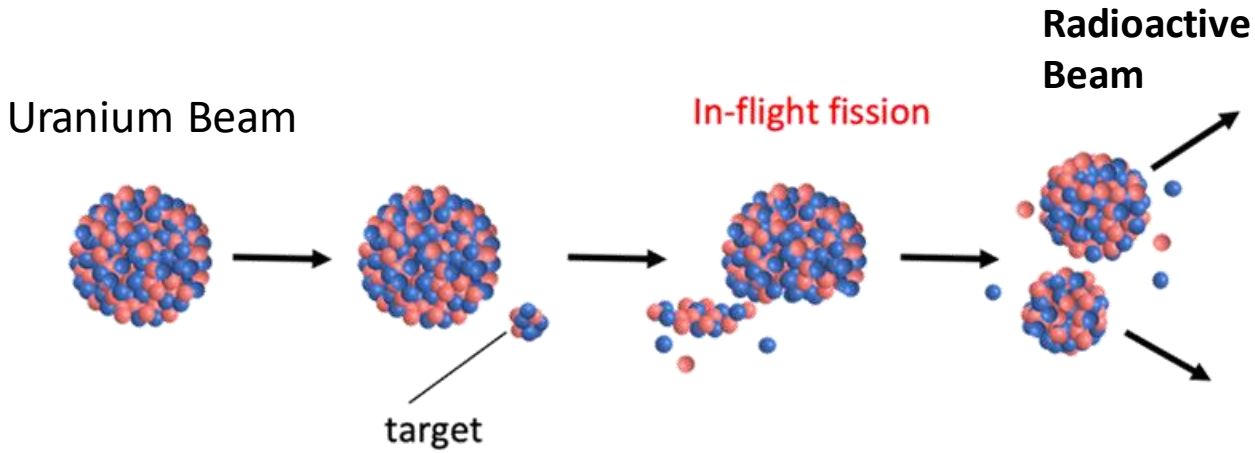
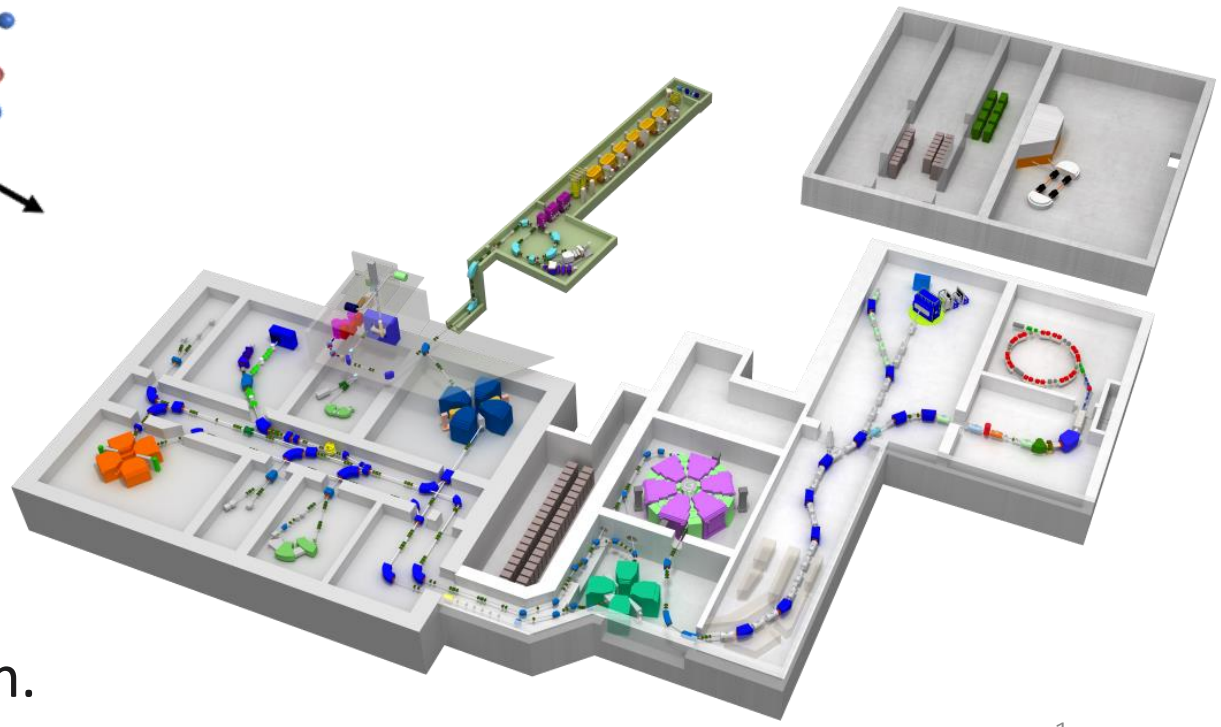
RIKEN RI Beam Factory(RIBF)



We are working on a data acquisition system for RIKEN RIBF that is an RI-beam facility in Japan.

Experiments performed at RIBF require TOF measurements with high-rate and high-resolution.

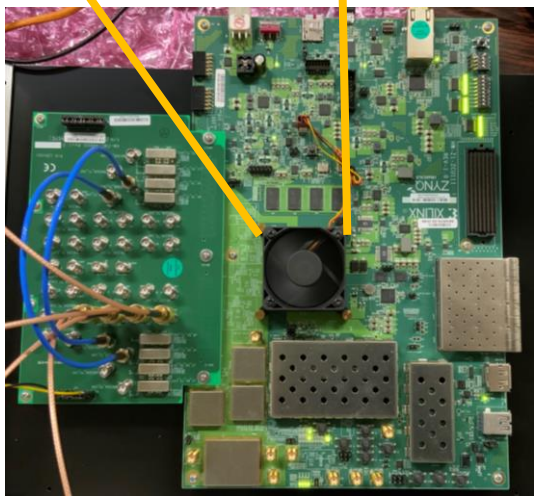


RIKEN RIBF

AMD RFSoC

RFSoC

- 4GHz ADC x8
- FPGA
- ARM CPU (Linux OS)

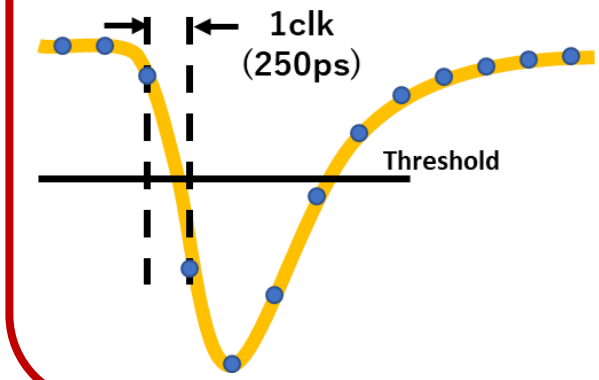

ZCU111 Evaluation kit

To perform the TOF measurement with real-time waveform processing, we have been developing a new system based on AMD RFSoC.

The RFSoC device includes 4GHz ADC, FPGA, and CPU, so it includes all necessary functions for the measurement.

Timing Resolution

- In case of FADC, apply waveform processing



⇨**Centroid Calculation**

$$G = \frac{\sum_i^n v_i \times i}{\sum_i^n v_i}$$

We chose centroid calculation, as a result, 9 ps timing resolution in sigma was achieved.

In this contribution, we report the algorithm for the extraction of timing information from a waveform, and the implementation of FPGA firmware.