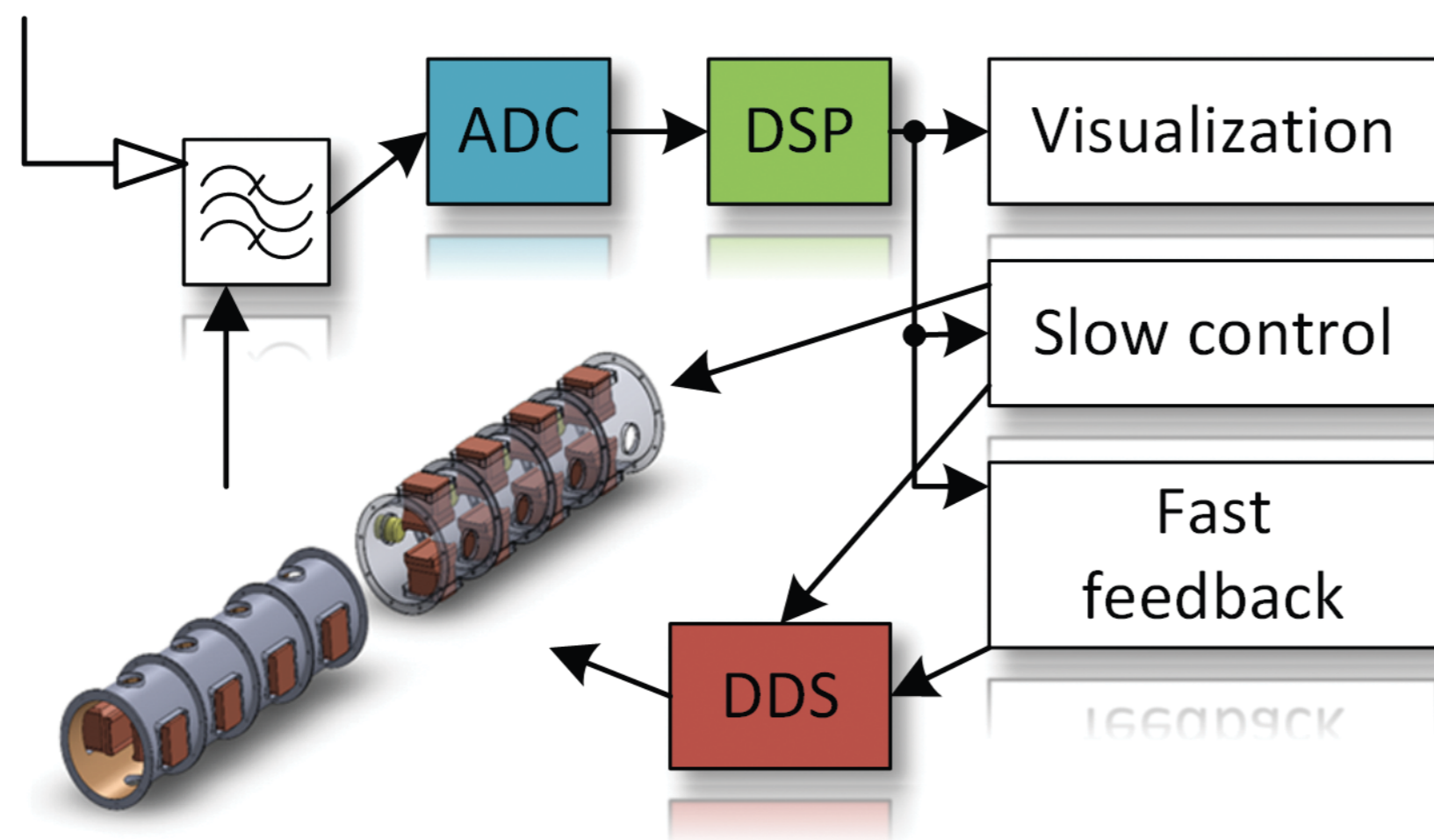# DIGITAL SIGNAL PROCESSING
ALGORITHMS FOR LINAC LOW-LEVEL RF SYSTEMS

D.Liakin, S.Barabin,A.Orlov, ФГБУ 'ГНЦ РФ ИТЭФ' НИЦ 'КИ'
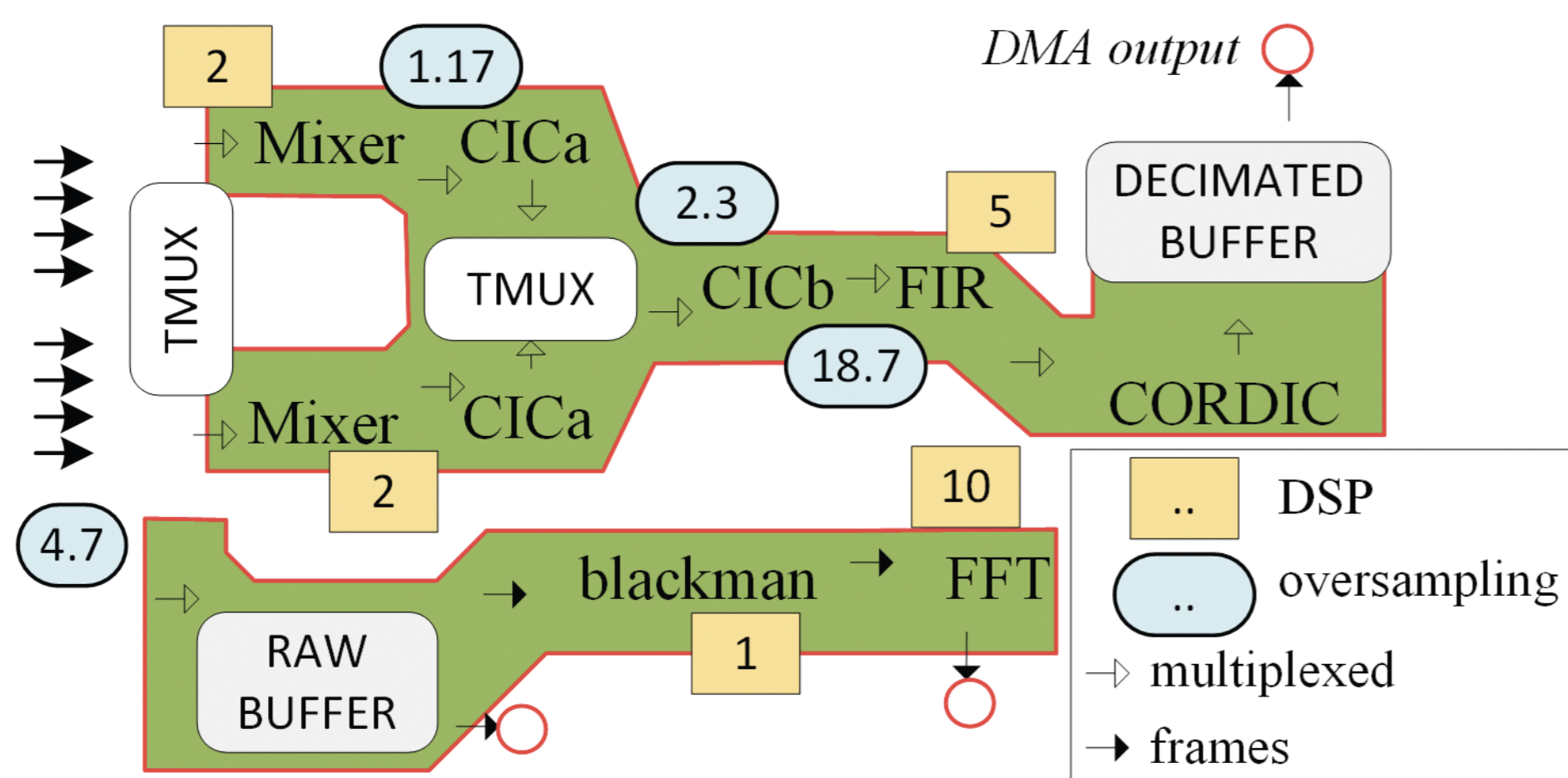
Abstract
Set of LLRF systems had been designed for various applications of resonant RF devices such as accelerators or beam deflectors. Paper presents a compact signal detection algorithms, used in most of developed systems. Application specific extension of the algorithm allows the system to be synchronized to external self-excited oscillator.
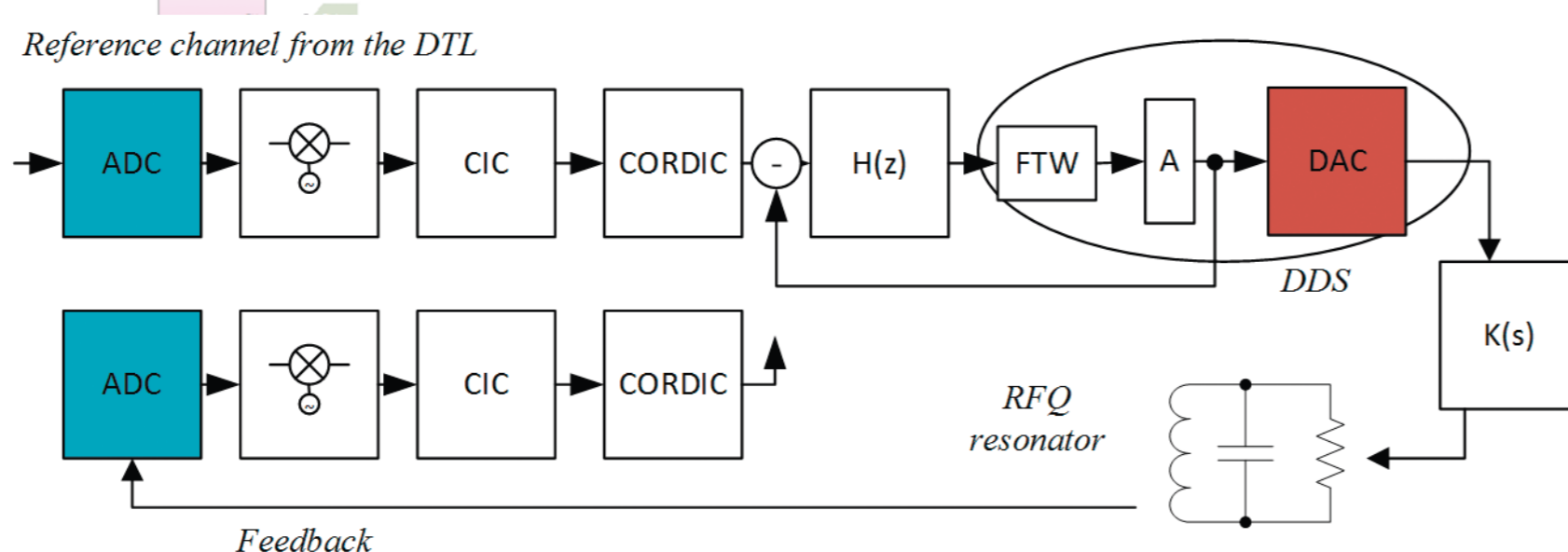
External ref., feedback, feedforward

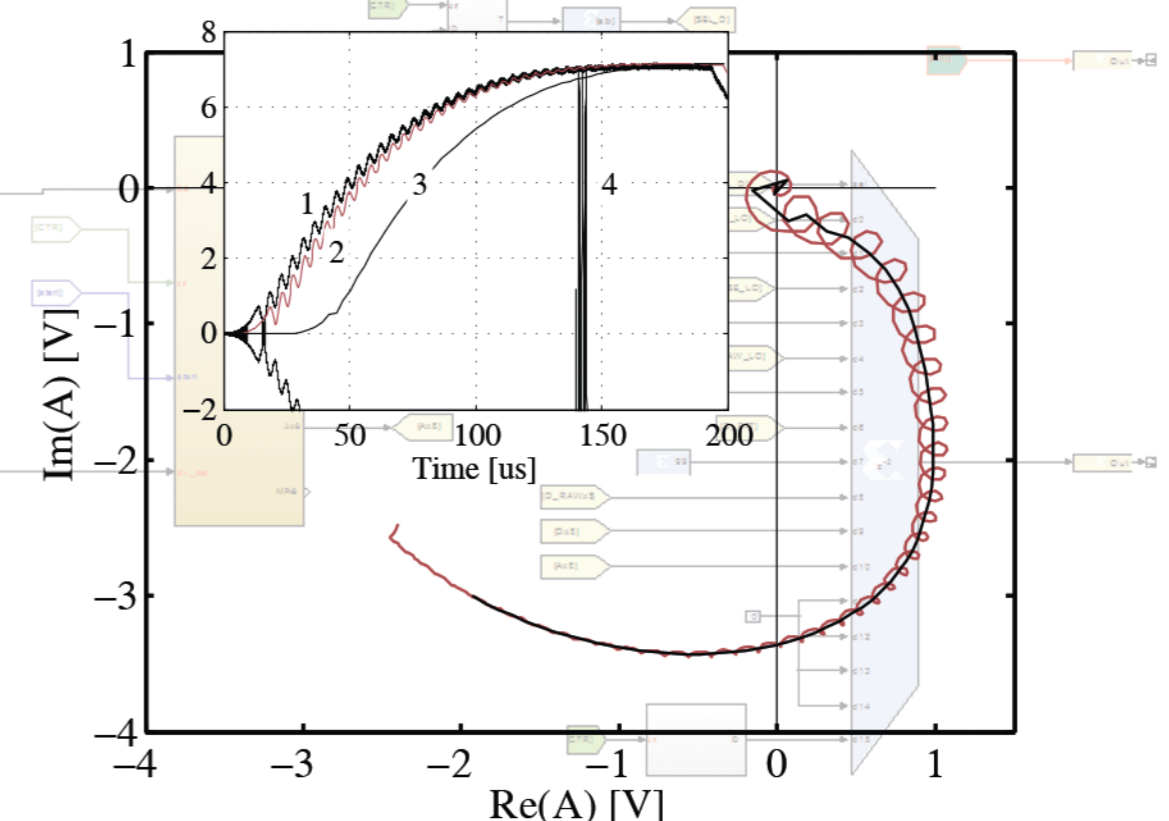General structure of LLRF system includes generator part, measurement part and signal processor.

The basic algorithm uses complex amplitudes for signal representation.

1- reference signal, 2,3-data filtered by wide/narrow band filter, 4-collecting the data for limited time extra-wideband analysis.

Parametric and non-parametric methods use a buffered raw data for most delicate data processing.

Example of an eight-channel signal processing module: the real-time branch continiously converts the ADC data stream to decimated complex amplitudes. A short-time raw data is available for postprocessing, for better performance the FFT may be executed in FPGA.
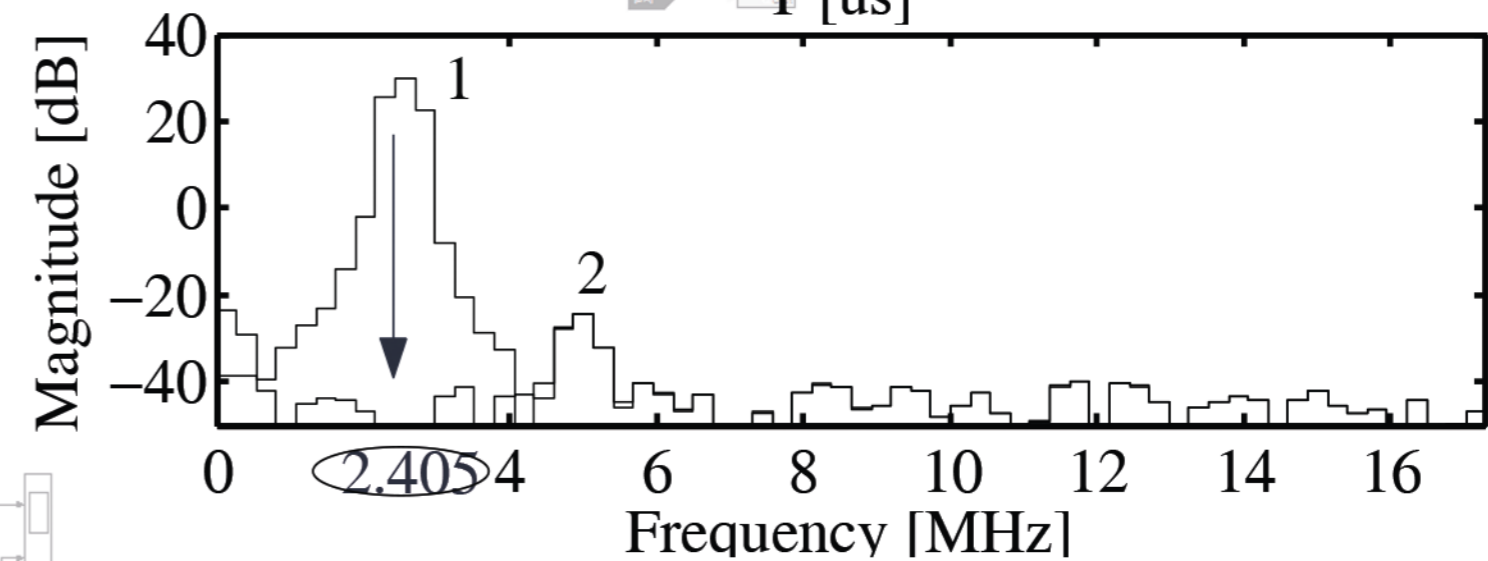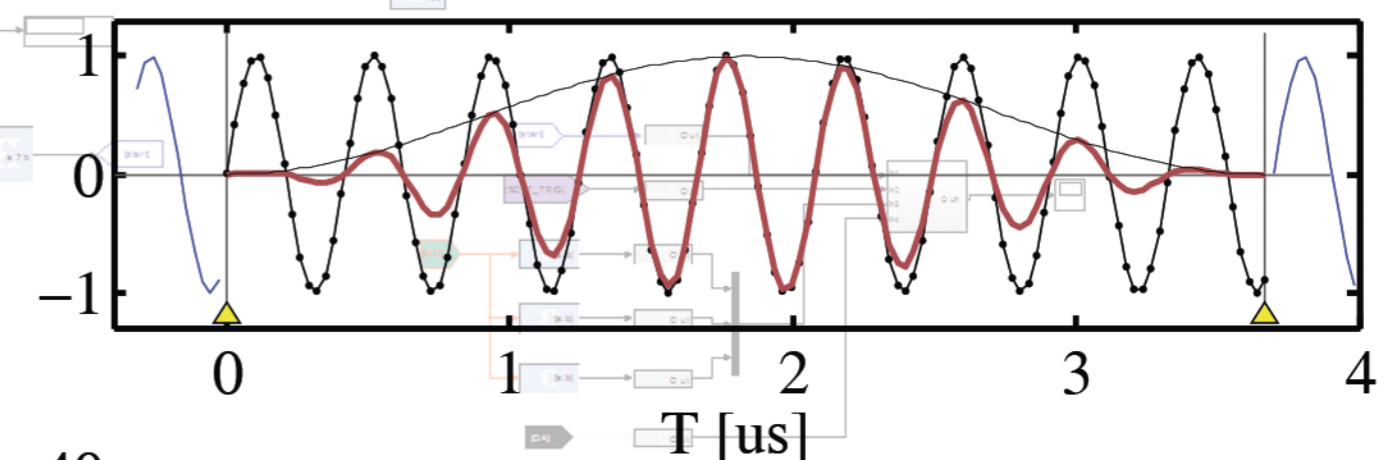

Assembled LLRF module for RF beam deflector includes two-channel signal generator, two multichannel RF vector detector modules and plunger position control electronics.

Synchronization of the novel RFQ to the existing self-exited RF system of mature drift tube linac.

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