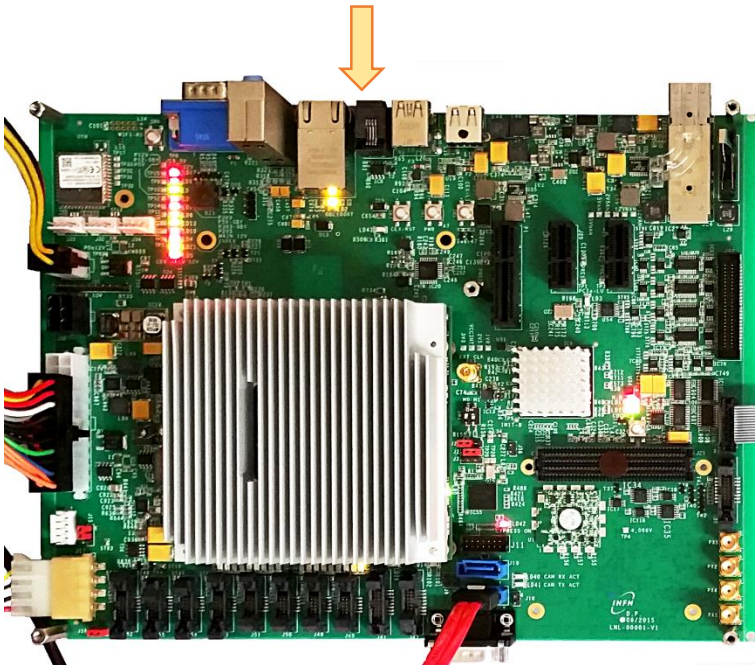


# An I/O Controller for Real Time Distributed Tasks in Particle Accelerators

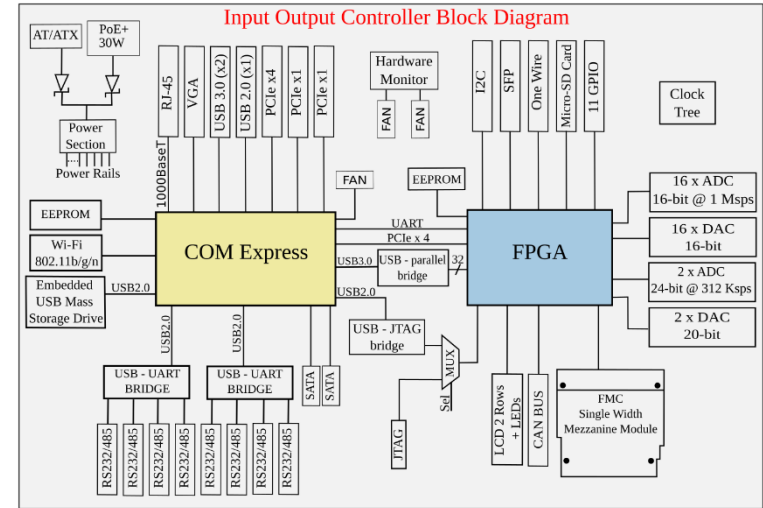
IOC aims to be an universal controller capable of addressing the needs of most the control subsystems of a particle accelerator. The custom mother board exploits the COM Express standard and a Xilinx Spartan-6 FPGA leaving the final user with the possibility to deal with a general purpose PC or to exploit the FPGA in terms of fast peripherals control and hard real-time processing.

IOC Status: advanced prototyping stage.

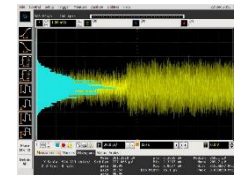


IOC Prototype Top View.

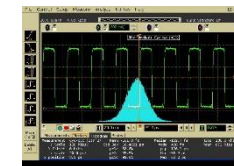
## Hardware architecture and main features.



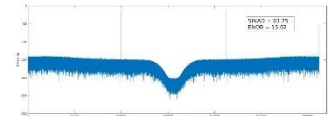
Some test outcomes.



Ripple Measurements



Cycle-to-Cycle Jitter



ENOB = 13.62

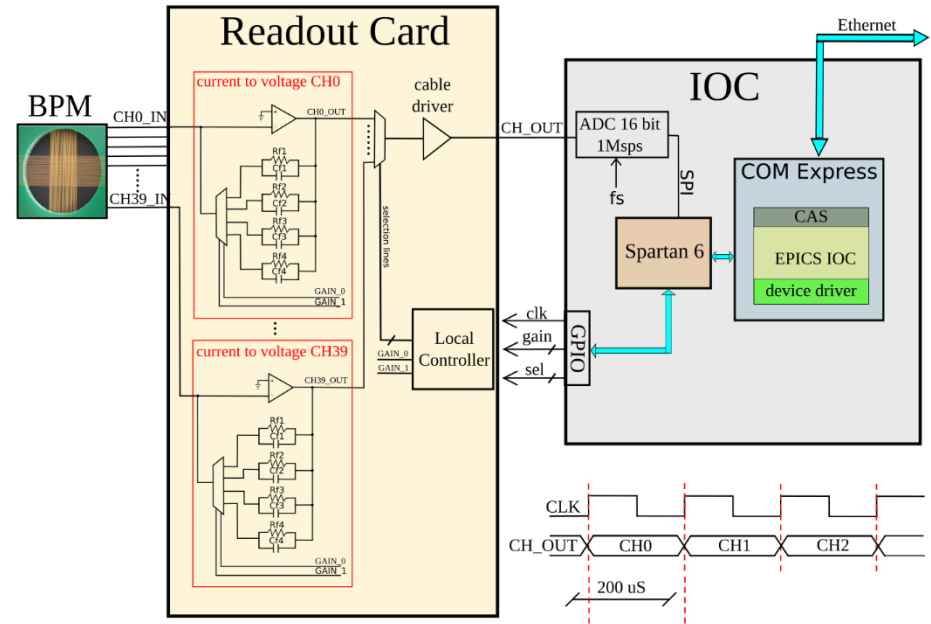
$$ENOB = \frac{SINAD - 1.76 + 20 \log \left( \frac{FullscaleAmplitude}{InputAmplitude} \right)}{6.02}$$



The context



The Beam Profiler Monitor (BPM) consists of a grid of thin wires (twenty horizontal and twenty vertical) made of gold plated tungsten.



The new BPM data acquisition architecture.

The diagnostic system provides information on the beam transverse profile. The new BPM data acquisition system architecture will be based on the IOC and the most time-critical tasks will be performed in the FPGA freeing the CPU from hard real-time operations. The COM Express, running a standard Linux distribution, implements an EPICS Channel Access Server making BPM data available to remote EPICS clients for beam profile visualization.

The IOC designed allows for hardware standardization and will replace, in many applications, legacy hardware with cutting-edge on-board technologies. IOC merges local hard real-time data processing as well as facility level EPICS based slow controls, in a single compact and low power (PoE+ compatible) board.