



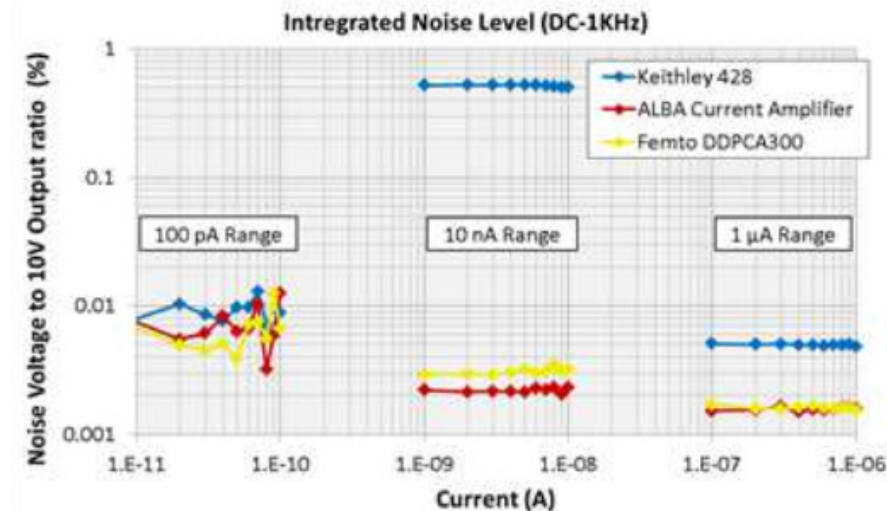
FRFMPLCO06

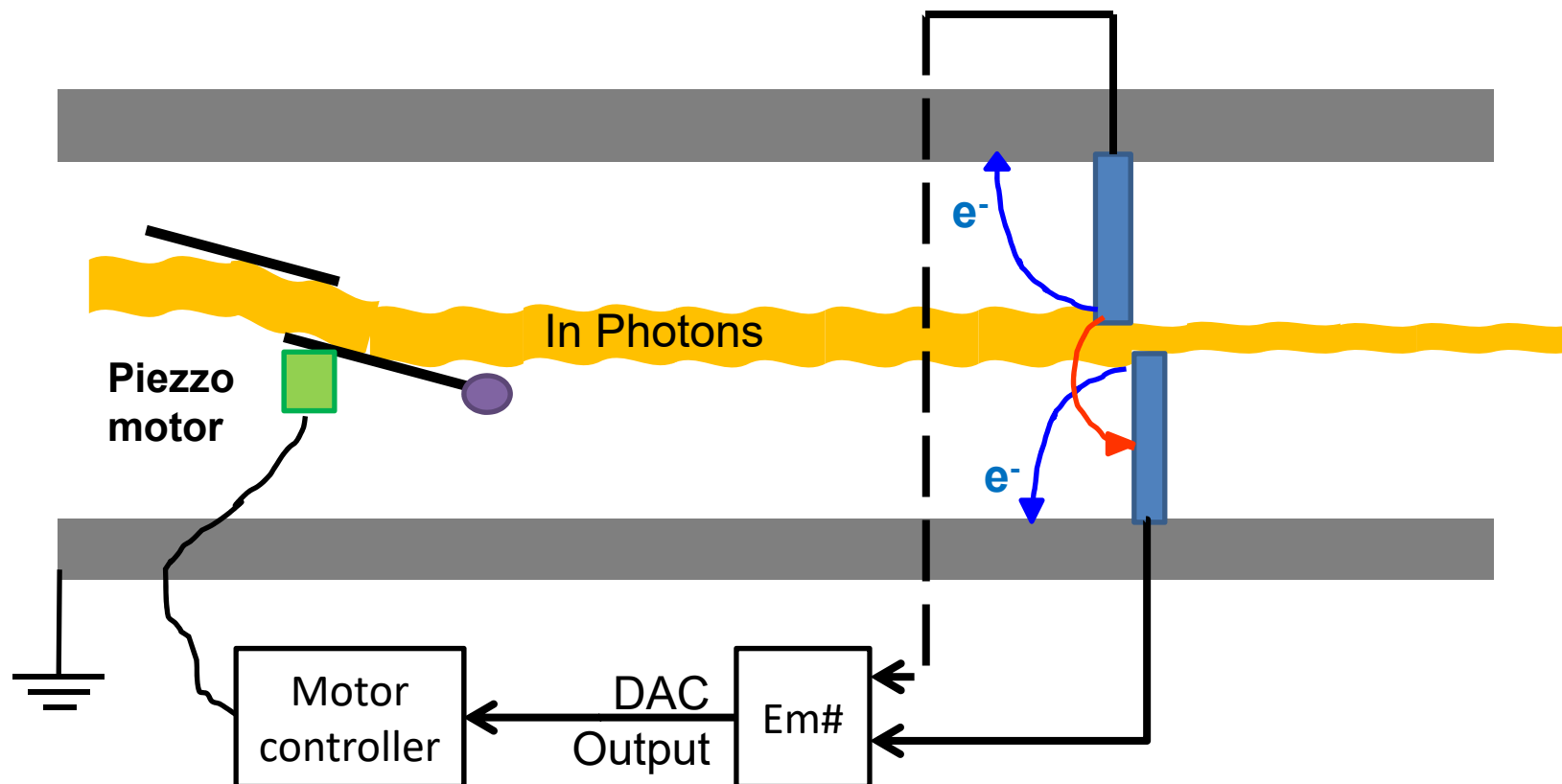
HARMONY: A GENERIC FPGA BASED SOLUTION FOR FLEXIBLE FEEDBACK SYSTEMS



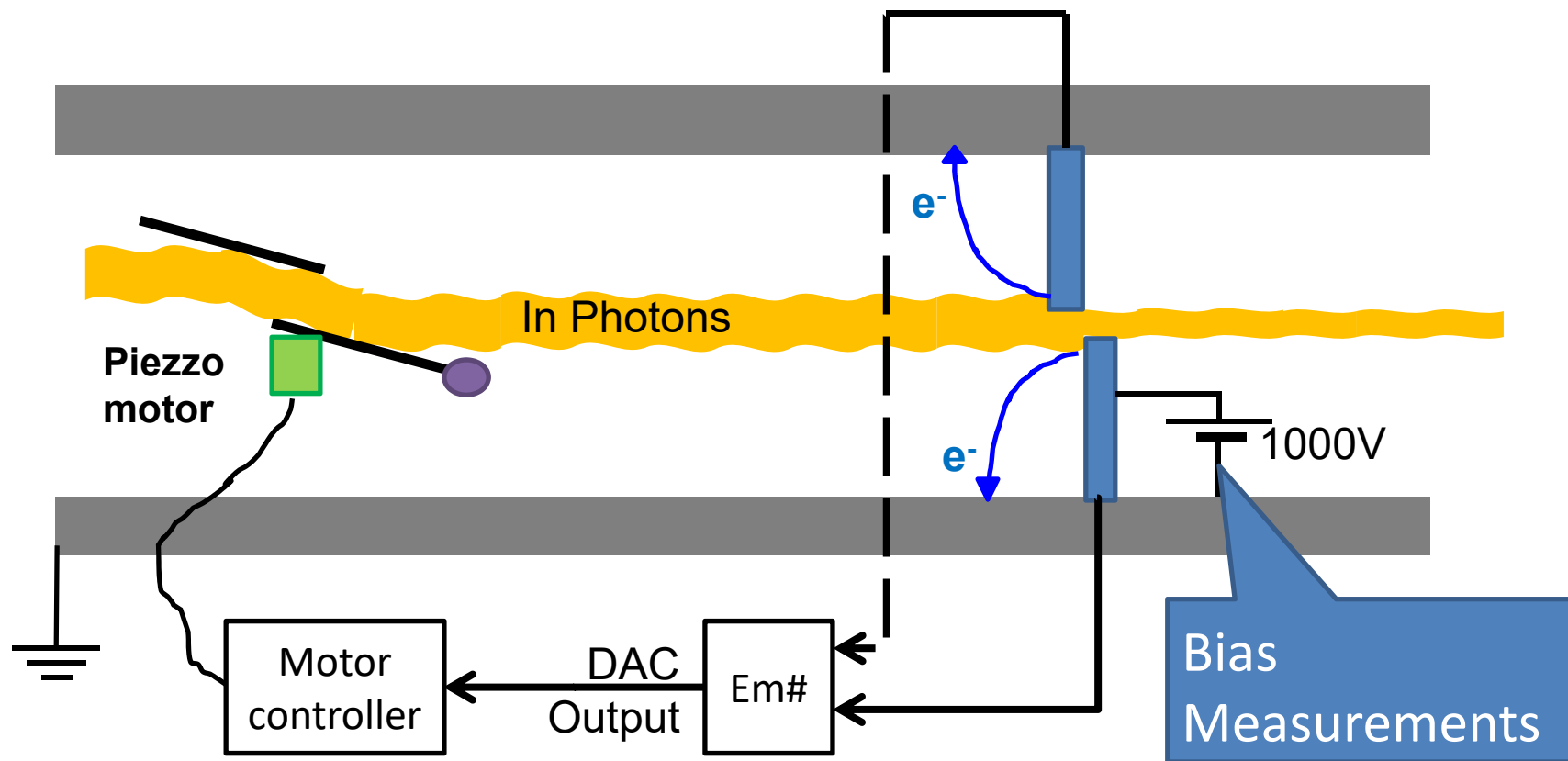
Previous Electrometer developments at ALBA

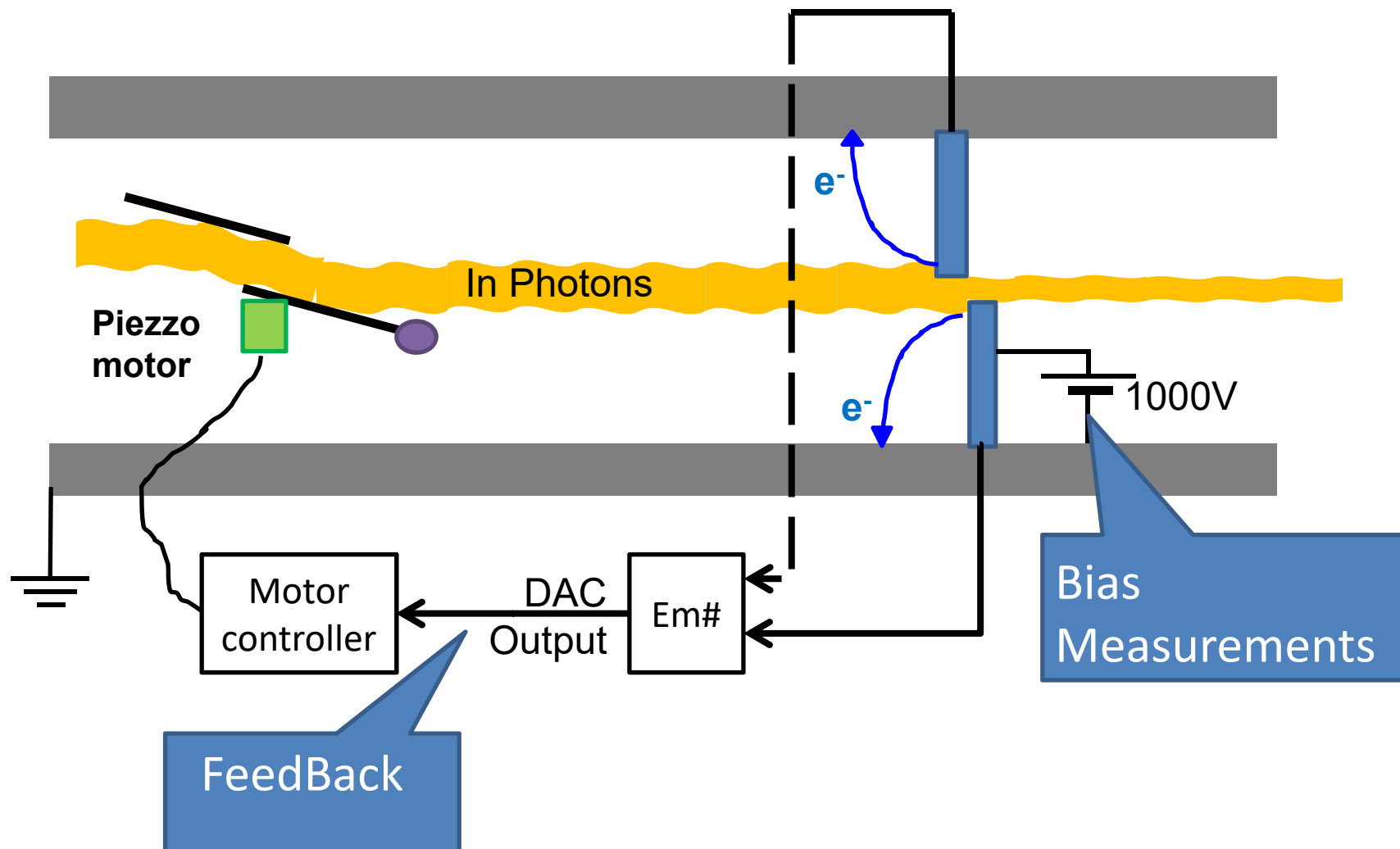
- 4 channel Em
- Mainly for diagnostics applications
- Very low noise current amplifier
 - 7 ranges 1mA - 100pA
- But some limitations
 - 12bits ADC
 - Microprocessor based
 - Interruptions, Memory,...
 - Cannot read encoders
 - No Feedback possibility



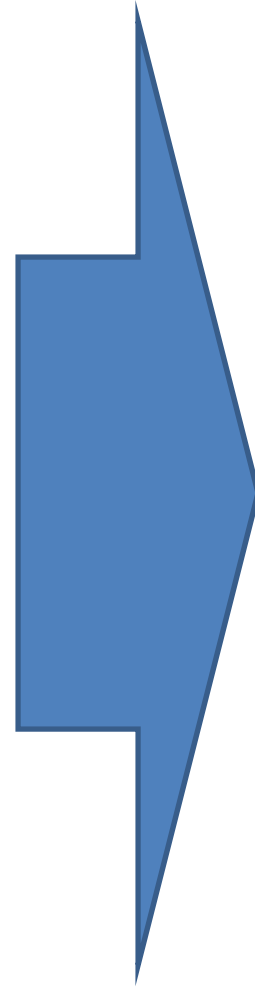








- Low current measures has low-pass filters around 3kHz
- Motors and actuators have slow reaction times
- Encoders clock frequencies can achieve few MHz



FPGA

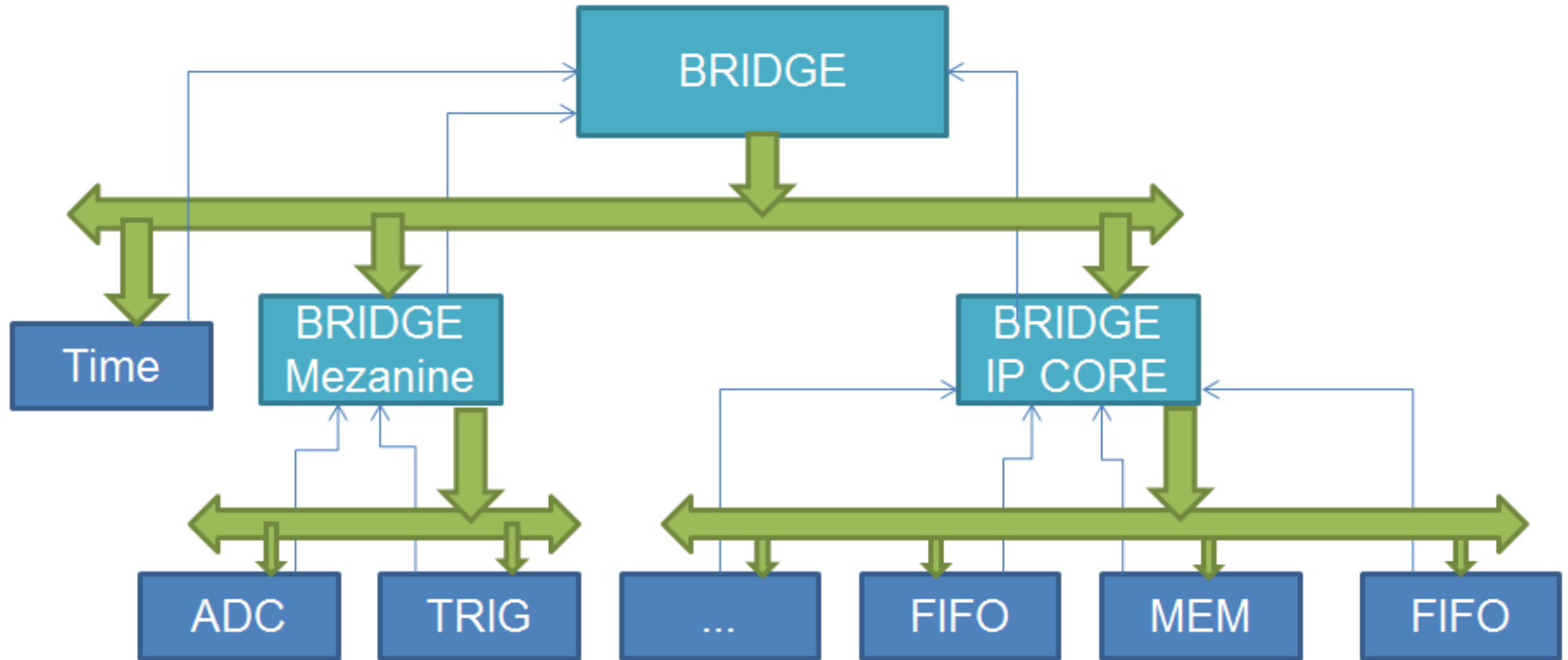
Self-Describing Bus (SDB) with Harmony Bus

- Flexibility & FPGA
 - It not needed all FPGA performance
- SDB to setup the cores
 - But not to share data
- Harmony Bus to share data between cores of FPGA
 - SDB setups the data to share



THDAPLCO01. M.Broseta et al., “Embedded Control System for Programmable Multi-Purpose Instruments”

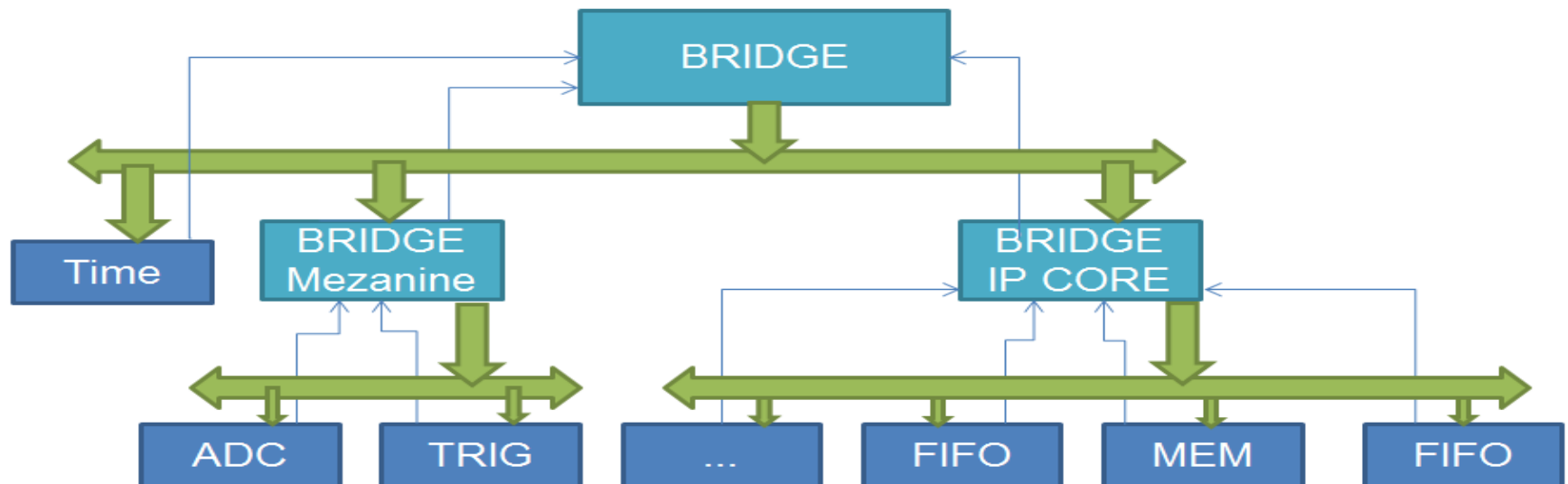
Harmony Bus block diagram



- 2x 64 bits (+ 3 Control lines)
 - Upstream
 - Downstream

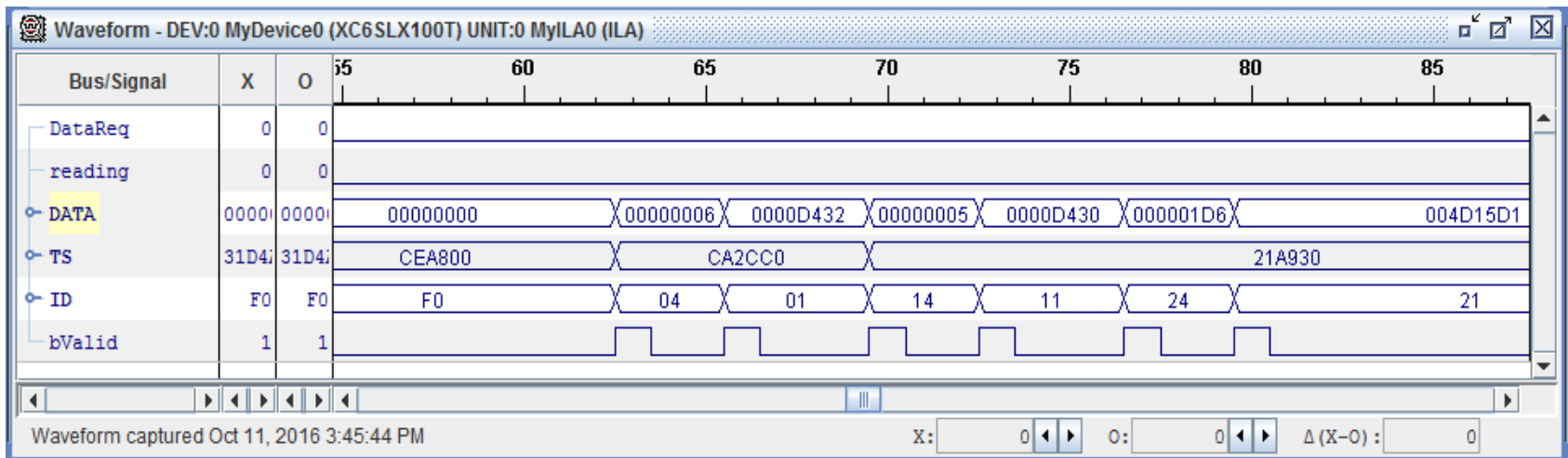
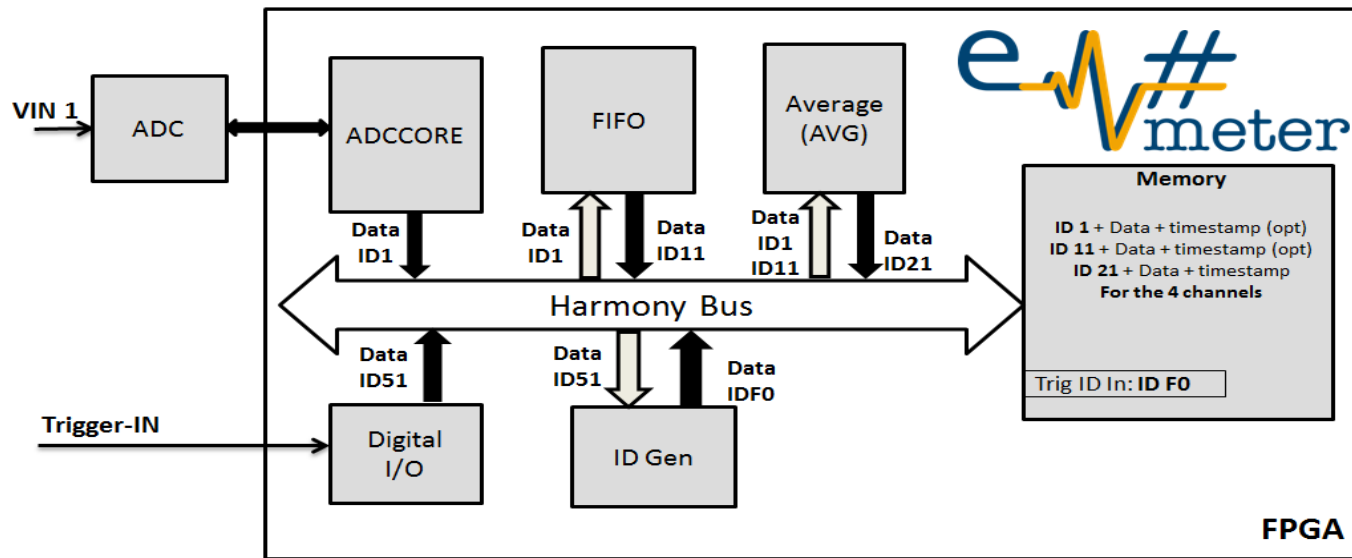
- 32 bits DATA
- 24 bits TimeStamp(in ns)
- 8 bits Identification (ID)

- Harmony is working at 125 MHz Clock
- Bridges raises messages with a Round-Robin algorithm.
- With 1 bridge, and 2 ID; it is possible to send data at 62MS/s. More IDs and Bridges reduces bandwidth and increase Jitter





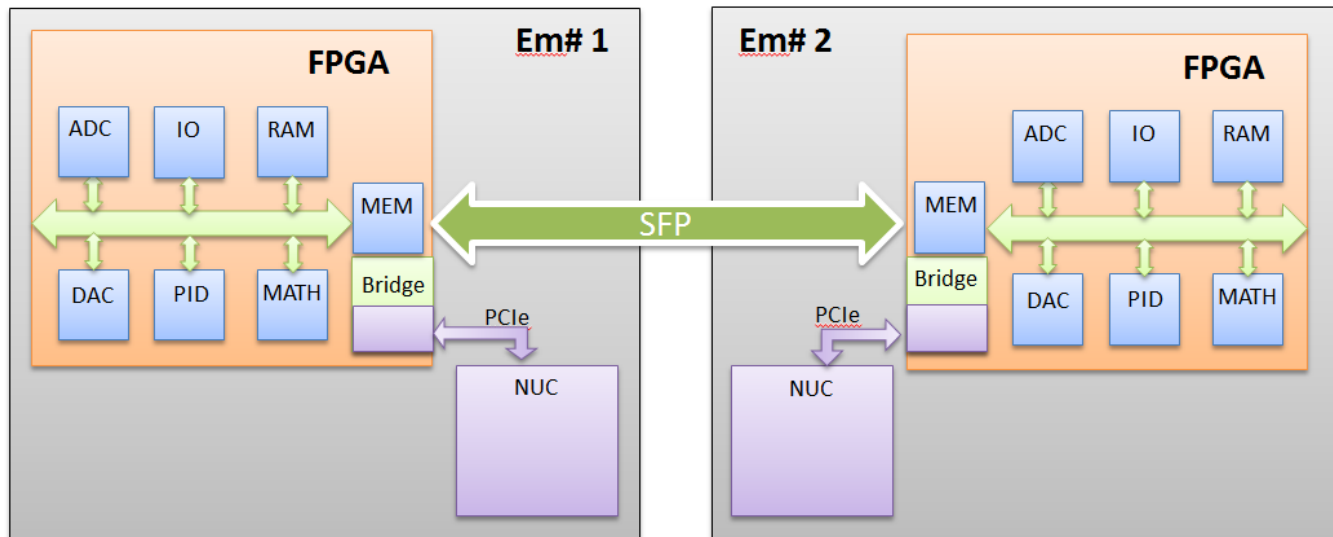
- Framework for new instrumentation
- Flexible instrumentation adaptable to changes
- Allows interconnection among instruments
- Simultaneous Work (Software and Gateware)
 - Cores can be tested individually
 - Harmony Messages generated to simulate a core
- Ready for continuous scans
- Continuous Harmony Bus Diagnostics at Bridges plus specific error flags at cores





- Project collaboration agreement with MaxIV
- On production
 - 12 units at ALBA
 - 50 units at MaxIV
- Flexible framework for new projects
- Scientists waiting for measurements with bias up to 1kV

- New Harmony devices
 - Multiple Digital In/Out, to read encoders, and generate trigger sequences
- Develop a inter-device communication with Harmony





**Many people are
involved in the project
THANKS TO ALL**

Jose Avila, Manuel Broseta, Guifré Cuní, David Fernandez, Julio Lidon, Antonio Milan, Oscar Matilla, Marc Rodríguez, Alberto Ruz, Jordi Salabert, Peter Sjöblom, Darren Spruce and many others



QUESTIONS?