The WaveCatcher systems: a Family of Powerful and Low-Cost Digitizers

Dominique Breton, C. Cheikali, Jihane Maalimi, Pascal Rusquart - CNRS/IN2P3/LAL (Orsay)
Eric Delagnes – CEALRIFU (Saclay)

The WaveCatcher systems: 2 to 64-channel 12-bit 3.2 GS/s oscilloscope-like digitizers, close to the picosecond level in timing precision

- Based on the SAMLONG Analog Memory ASIC
- Sampling rate ranging between 400 MS/s and 3.2 GS/s.
- 1024 samples/channel
- 12 bits of dynamic range, working on 14 bits
- Small signal bandwidth: 500 MHz
- Systolic jitter: < 5 ps rms at the system level
- Up to 64×8-channel synchronous system
- Advanced Oscilloscope-Like Software (Plug and Play)
- Embedded feature extraction: Baseline, Peak, Charge, CFD (TDC-like mode) ...

Why Analog Memories
Modern high-end ADCs have broken the GS/s frontier but their implementation becomes difficult. Their companion FPAGAs have to be high end and the cost per channel explodes. The use of analog memories like SAMLONG makes it possible to perform high quality digitizing at low cost and with a low power consumption.

The Sampling MATRIX
Our sampler chip is made of a matrix of L lines and C Columns of analog memory cells. Its main clock doesn’t exceed 200 MHz. It is virtually multiplexed by 16 inside the chip thanks to the 64 vertical servo controlled delay line loops (DLL). The input signal is split in 16 branches, each housing a voltage buffer. The chip behaves like an analog circular buffer

System Features
- Possibility to add an individual DC offset to each channel
- Individual trigger discrimination for each channel
- Integrated raw trigger rate counter on each channel
- External or internal trigger + different modes for synchronization/triggering
- 2 extra memory channels for + digital + signals on 16-channel board (M) can be used as additional analog inputs
- One pulse generator on each input
- External clock input for multi-board applications (8, 16, 64-channels)
- Embedded USB, UDP and Gigabit optical interfaces (8, 16 & 64-channel)
- Possibility to upgrade the firmware via NIM/TTL or/and USB
- Embedded charge extraction
- Embedded signal amplitudes and baselines extraction
- Embedded digital CFD for time measurement

Application Examples
These acquisition systems are used in test benches or experiments in a multitude of fields:
- particle beam monitoring
- calorimetry
- R&D of detectors
- study of rare fast photo-detectors (SiPM, MCP-PMT, MicroMegas)
- new generation of detectors (GEM, zero-straggler Micromegas, diamonds) for high-energy physics
- research on TOF-PMTs for medical imaging
- particle physics detectors...

Dedicated software and C-libraries
- A dedicated software, compatible with all WaveCatcher modules (from the 2-channel module to the 64-channel crate) has been developed under LabWindows CVE. It permits configuring all the available parameters on the modules, visualising and saving data (ASCII or Binary) but also making different online histograms of Differential Time Jitter, Amplitude, Charge, Baseline, XY plots...
- A dedicated C-library, compatible with Windows and Linux allows the users to build their own DAQ software (via USB or UDP). It permits initialising, configuring and reading out the WaveCatcher Modules
- Documentation is available for Software, Library and Modules.
- A dedicated website houses all information and updates for Software, Firmware and Library.

Summary

Contact: breton@lal.in2p3.fr, eric.delagnes@cea.fr, jmaalimi@lal.in2p3.fr
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