

Analogue Pickup Amplifier/Shapers APICs

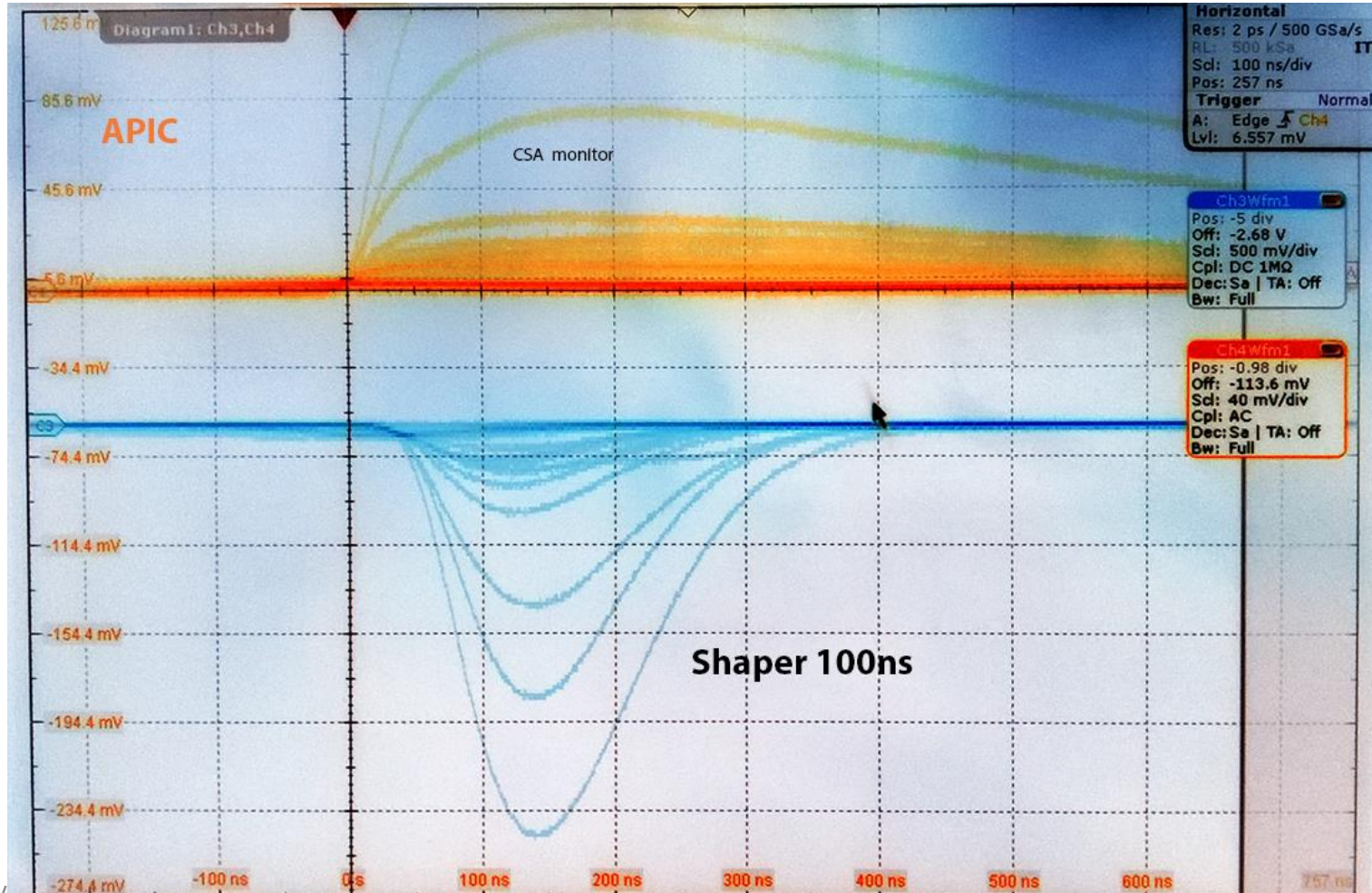


Portable, battery-operated preamplifier-shaper for charge-generating detectors

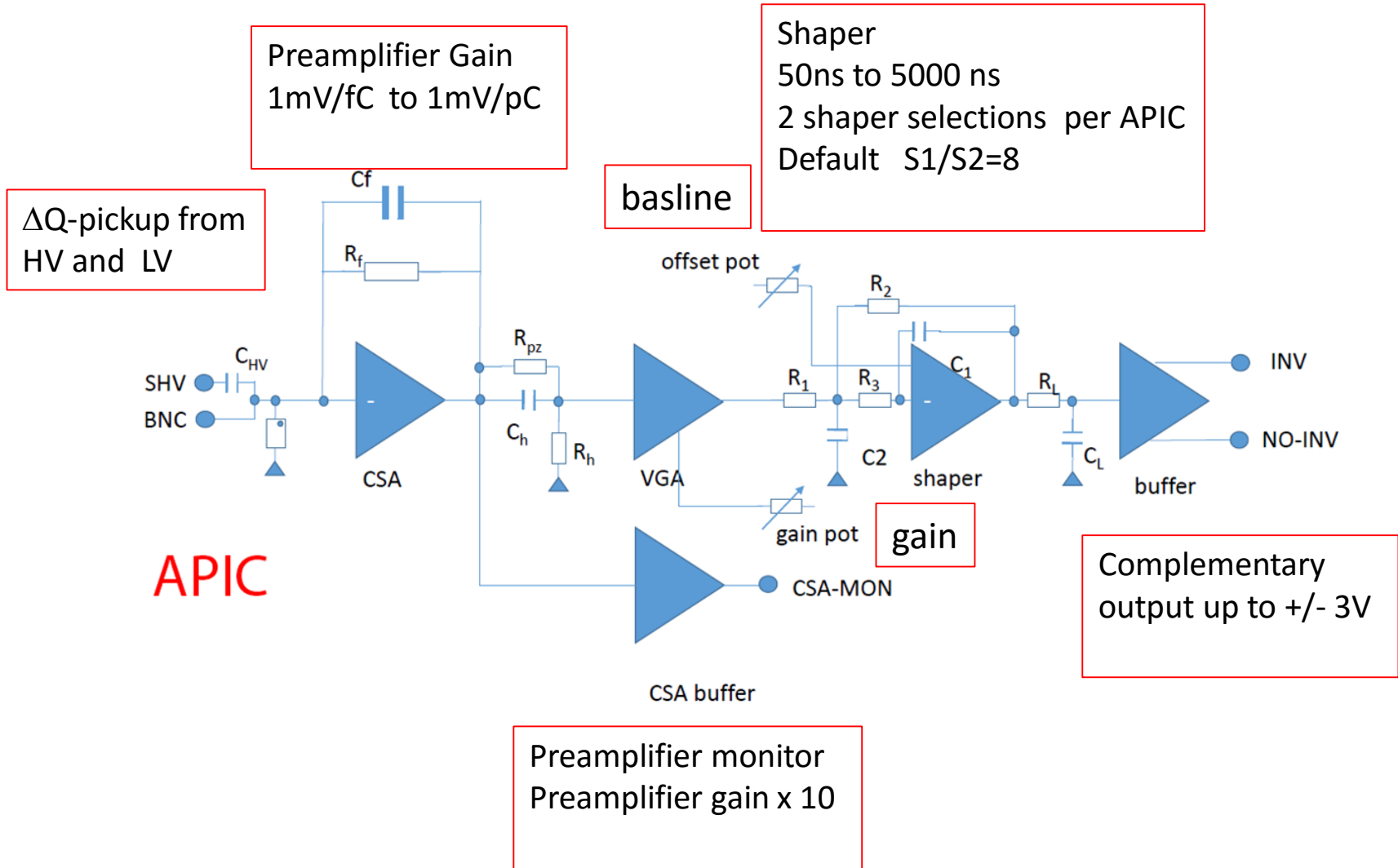
APIC Properties

- Dual-polarity CSA preamplifier, default gain -2mV/fC ($1\text{mV} / 3125$ electrons)
 - Triple spark input protection
 - SHV input capacitive (4nF) up 5kV to BNC input
 - CSA monitoring output: CSA signal $\times 10$
 - Variable amplifier gain = 1 ... 1000, via 20 turn potentiometer
 - 2nd order shaper with $\text{Gamma}_2(t)$ pulse-shape
 - Two selectable peaking times (ns) (Type 00= 50/200; Type 01= 100/400; Type 02=200/800, Type 03 = 500/2000)
 - Complementary 50 Ohm linear outputs up $\pm 0.3\text{V}$
 - Baseline potentiometer 20 turn, $\pm 2\text{V}$
 - Test pulse generator pushbutton (pos. charge injection @ 7 kHz to CSA input)
-
- Portable, metal box, 144 x 100 x 58 , $\frac{1}{2}$ kG
 - Autonomous operation via rechargeable Lithium battery 12 V / 2.5Ah
 - Power consumption 80 mA (Battery charge current not included)
 - Battery charge connector for solar panels 13-50V, 200 mA
 - Battery Autonomy min. 24 h (fully charged)
 - Battery charge-up indicator LED (green)
 - Power indicator LED (red)
 - Battery-low indicator (blinking yellow LED)
 - Stable baseline over Battery voltage range 12.5 (max)... 9.3V (min)
 - Direct power (+ charger) via R232 cable to NIM modules ($\pm 12\text{V}$)

APIC signals



APIC electronic Diagram

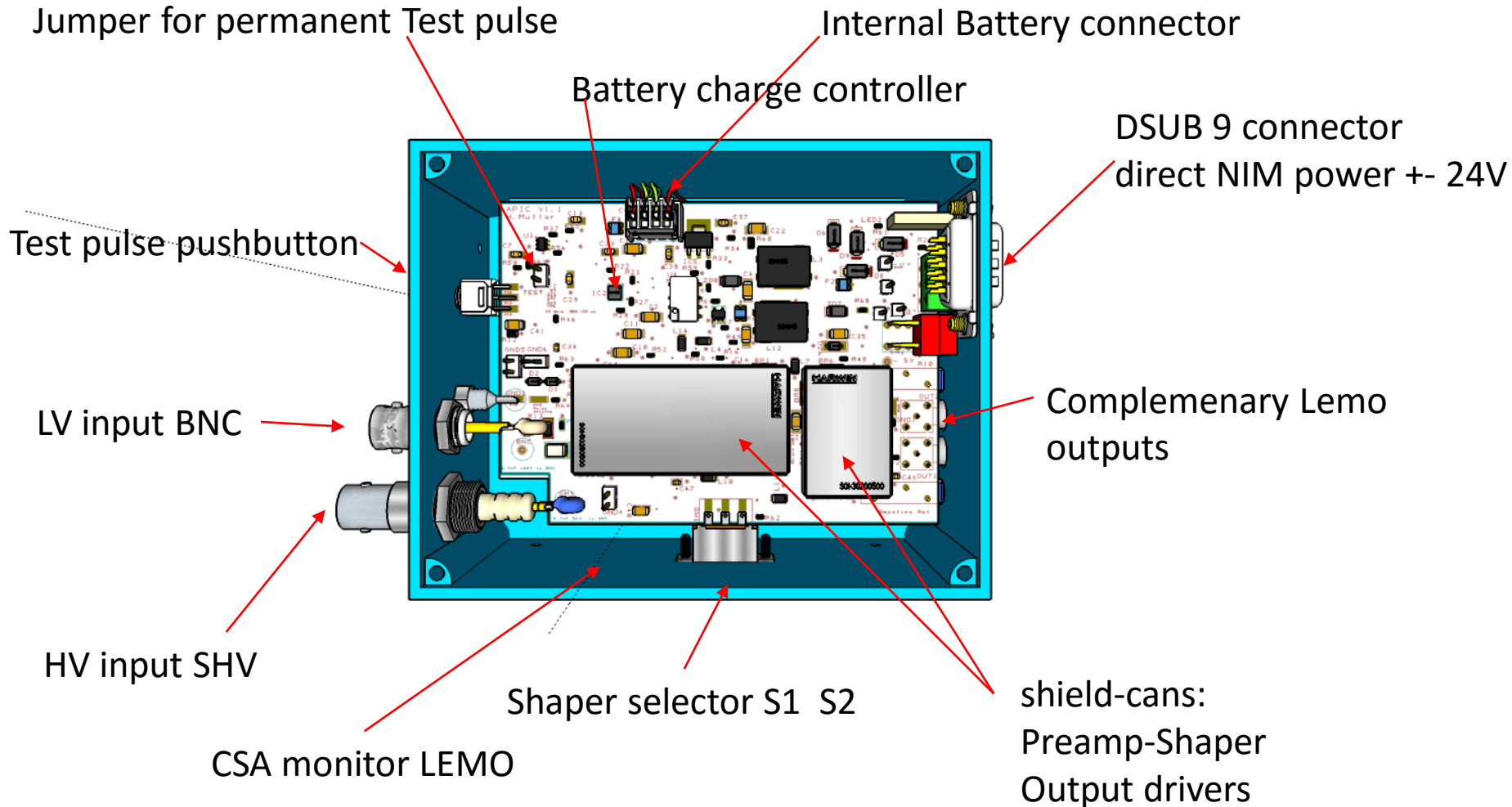


APIC electronics board

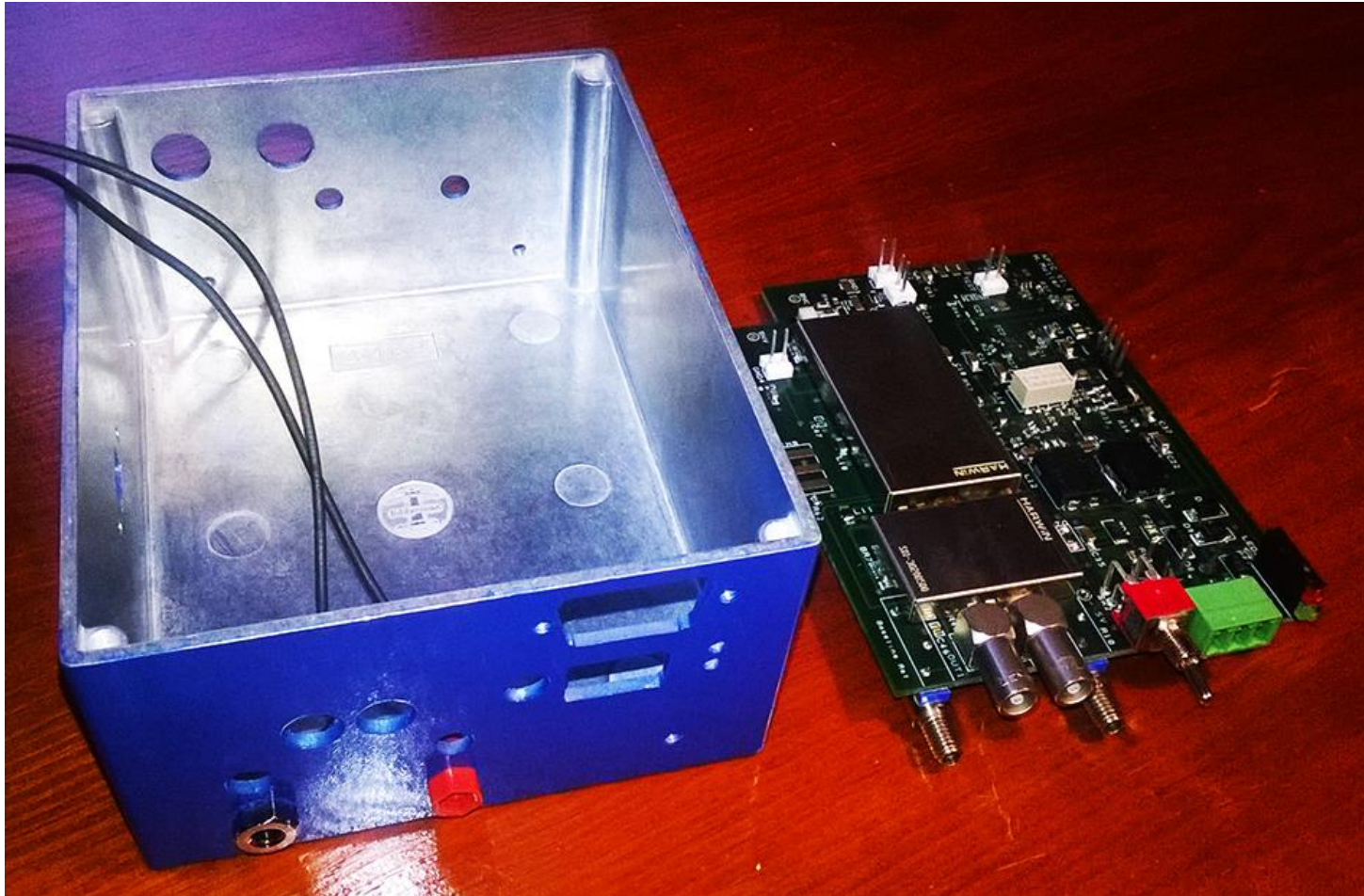


Photo APIC 1.1, latest Version Aug 16 is APIC 1.3

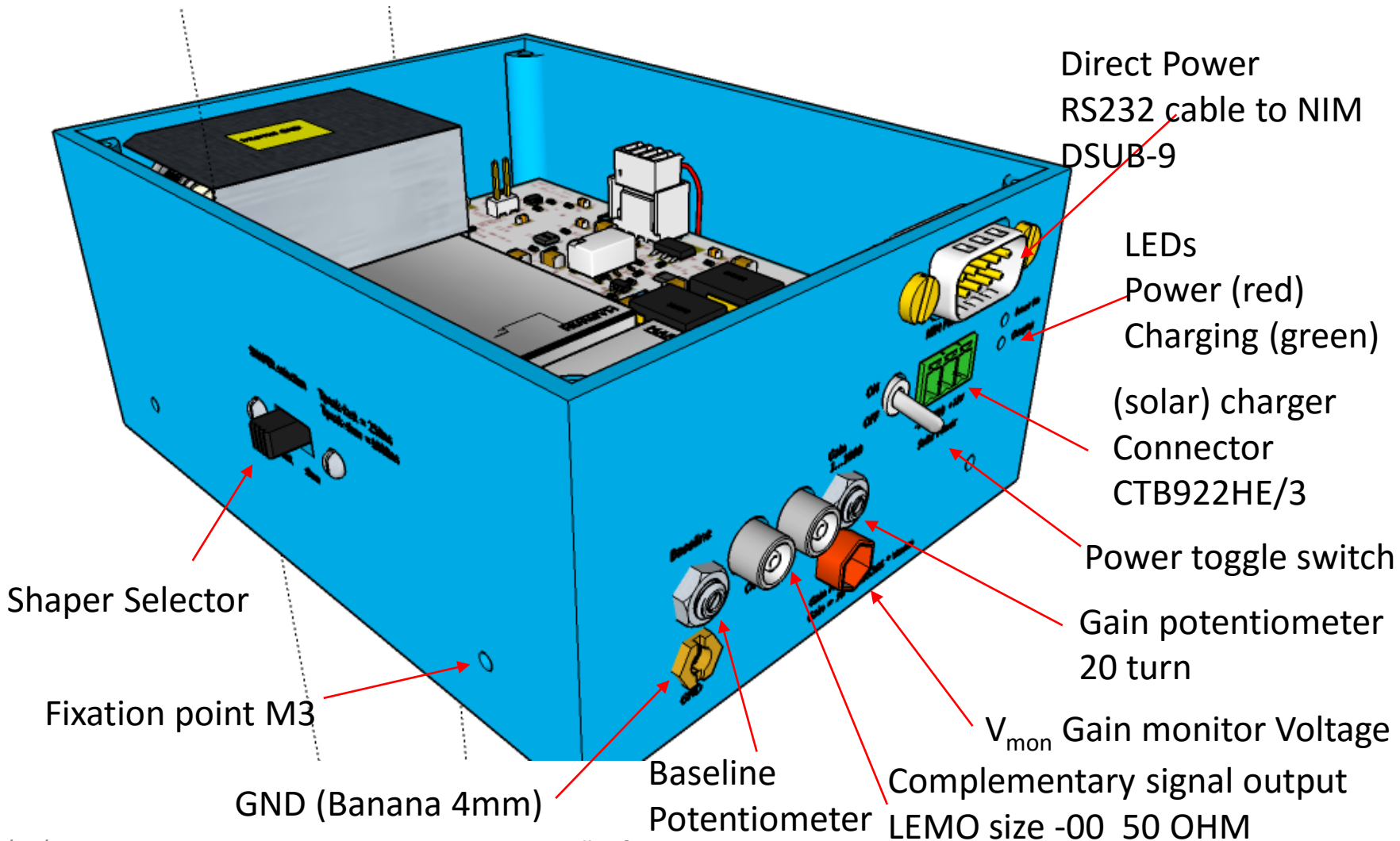
Top view on APIC open box



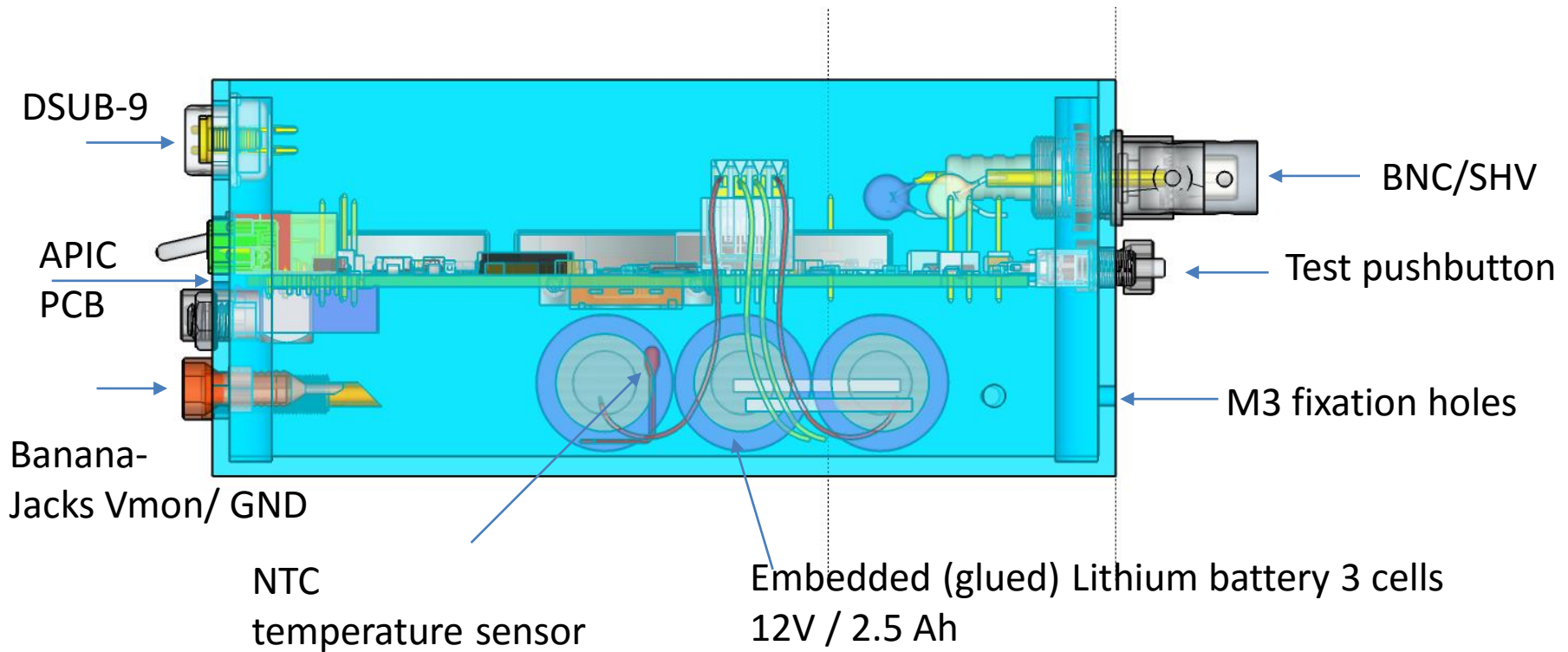
Electronics and Box



Signal output and control side

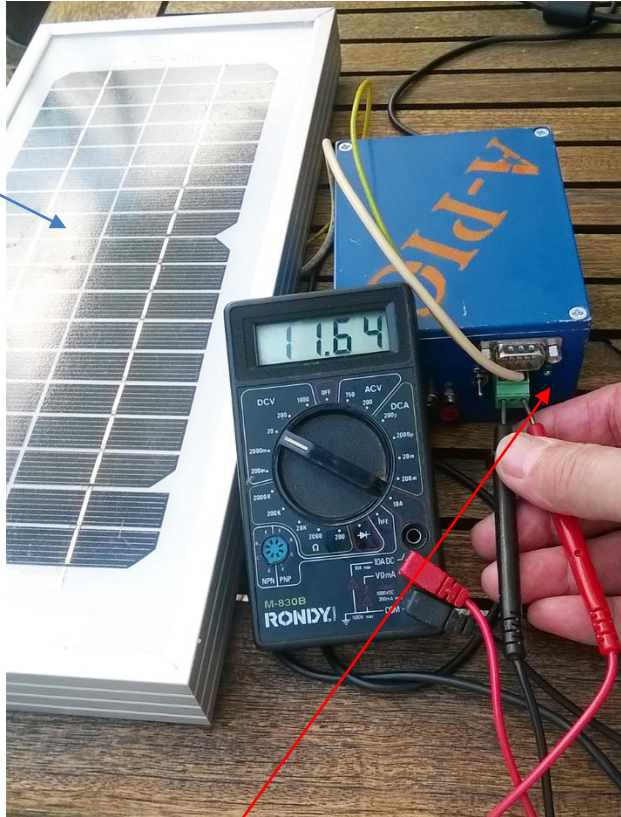


“Transparent” box



Solar panel APIC charging

Charging Voltage (11.64 Volt)



Solar module
ET-M53605
5 Watt max.
17.8 V @ 0.215 A

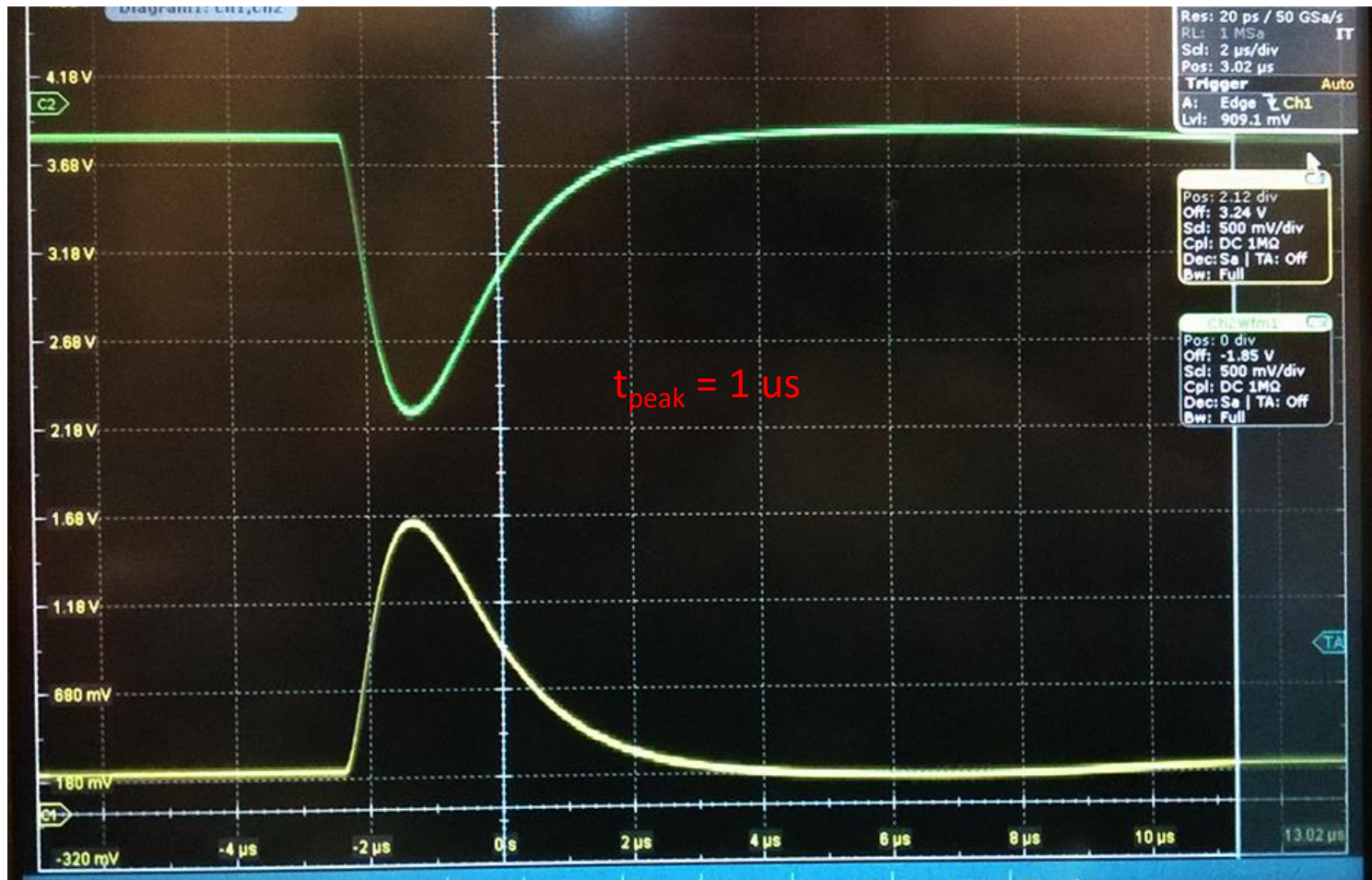
Sun charge current (186 mA)*



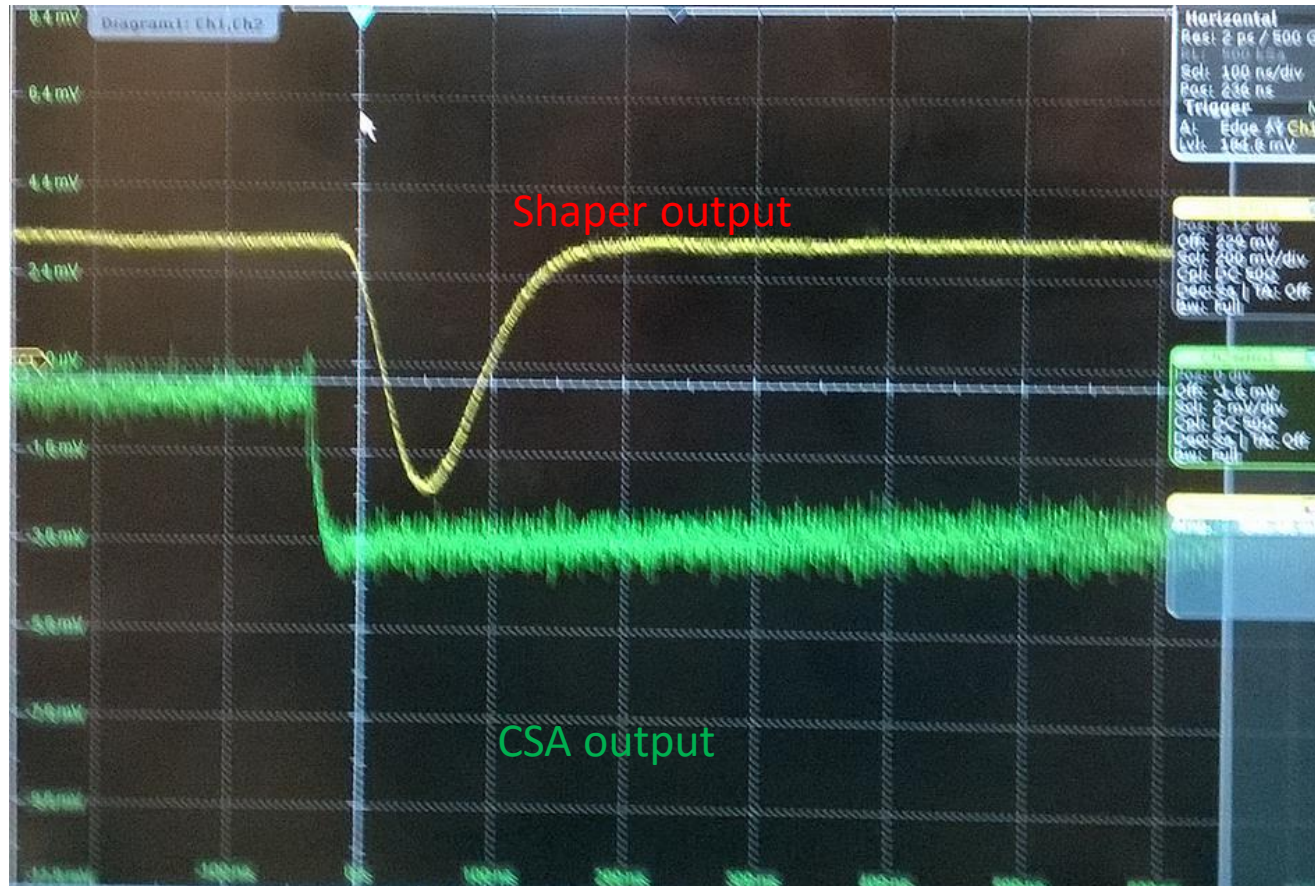
*Shadow charge current (30 mA)

Green charging LED indicates charging status

Slow shaper complementary output

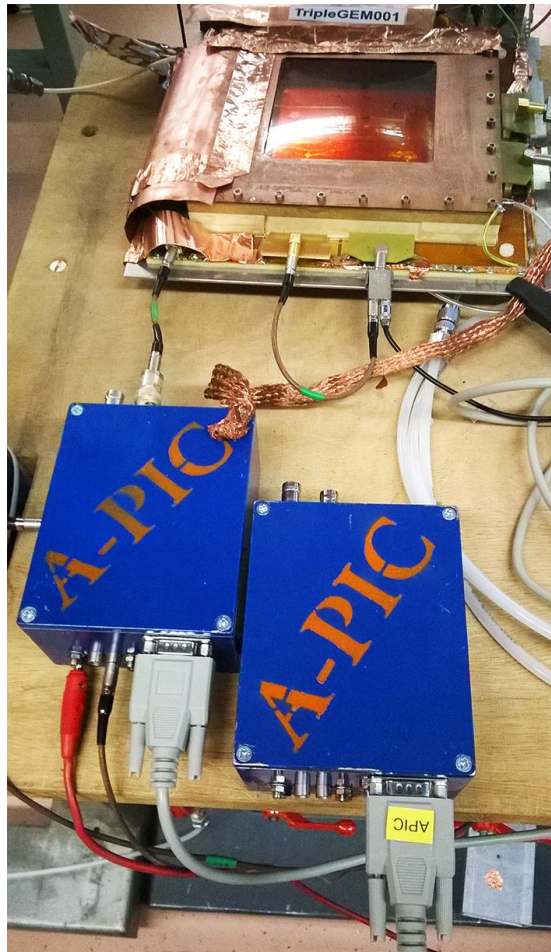


CSA monitor



The CSA monitor is more noisy than Shaper, the CSA voltage step is a direct measure of the Pickup charge ΔQ . The shaper peak is also proportional to ΔQ but amplified by a gain amplifier, the gain can be determined on a test pin.

APIC on GEM



APIC input connected to:

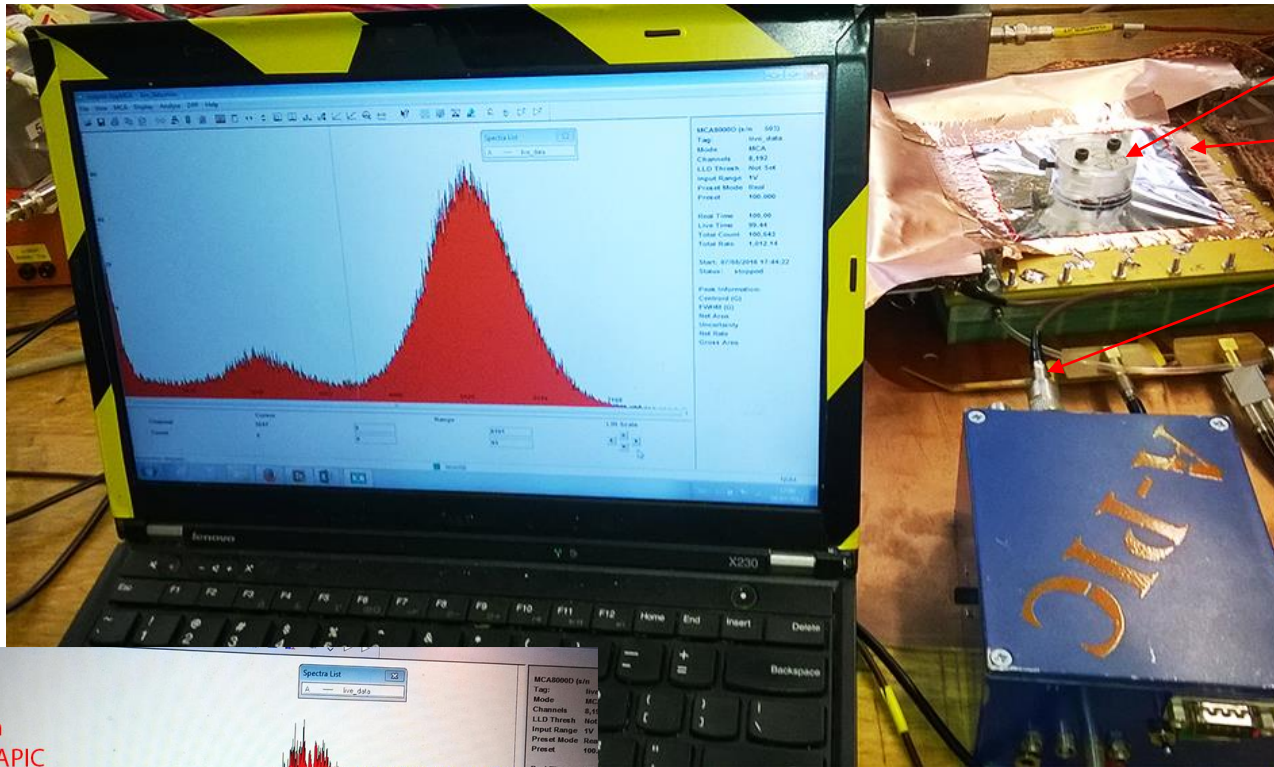
- bottom of GEM (BNC)
- GEM Electrodes (SHV)

Strong common Ground recommended

APIC Inputs are triple spark protected
(no damage observed so far)

APIC power via RS232 cable to NIM
can be disconnected due to APIC battery

Charge histogramming on a GEM detector



Fe⁵⁵

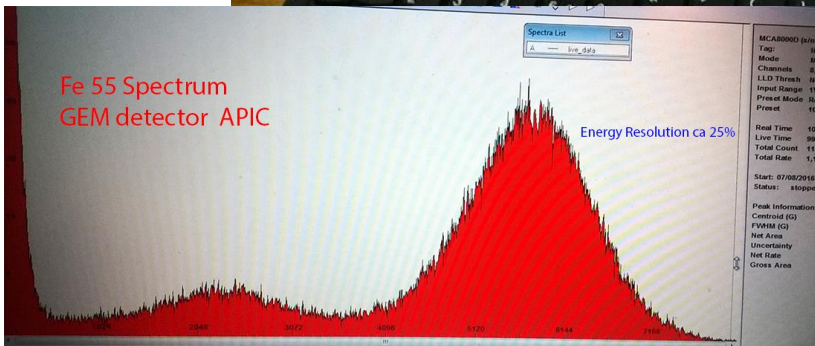
GEM detector

APIC input cable
from bottom
of GEM to BNC
input

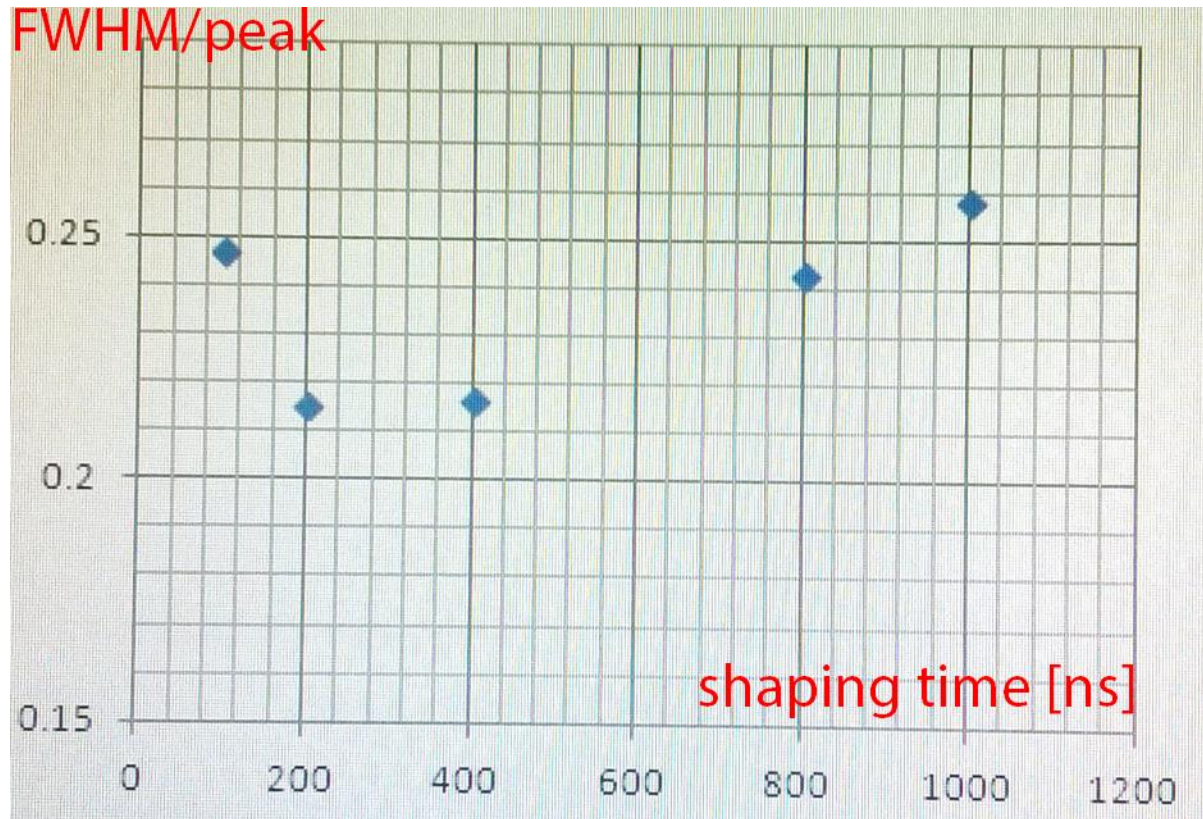
APIC



APIC output connected to MCA



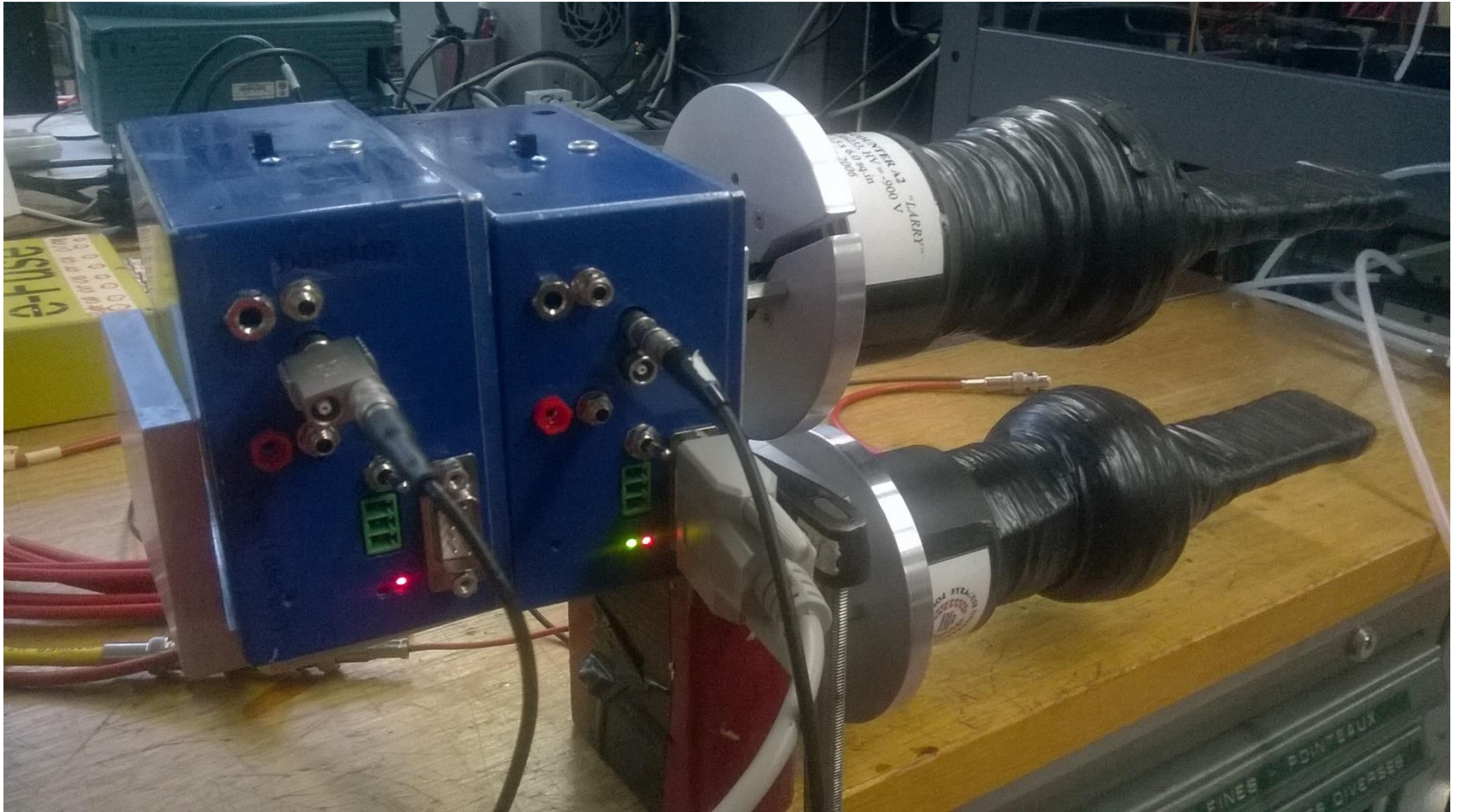
GEM S/N as function of APIC shaping time*



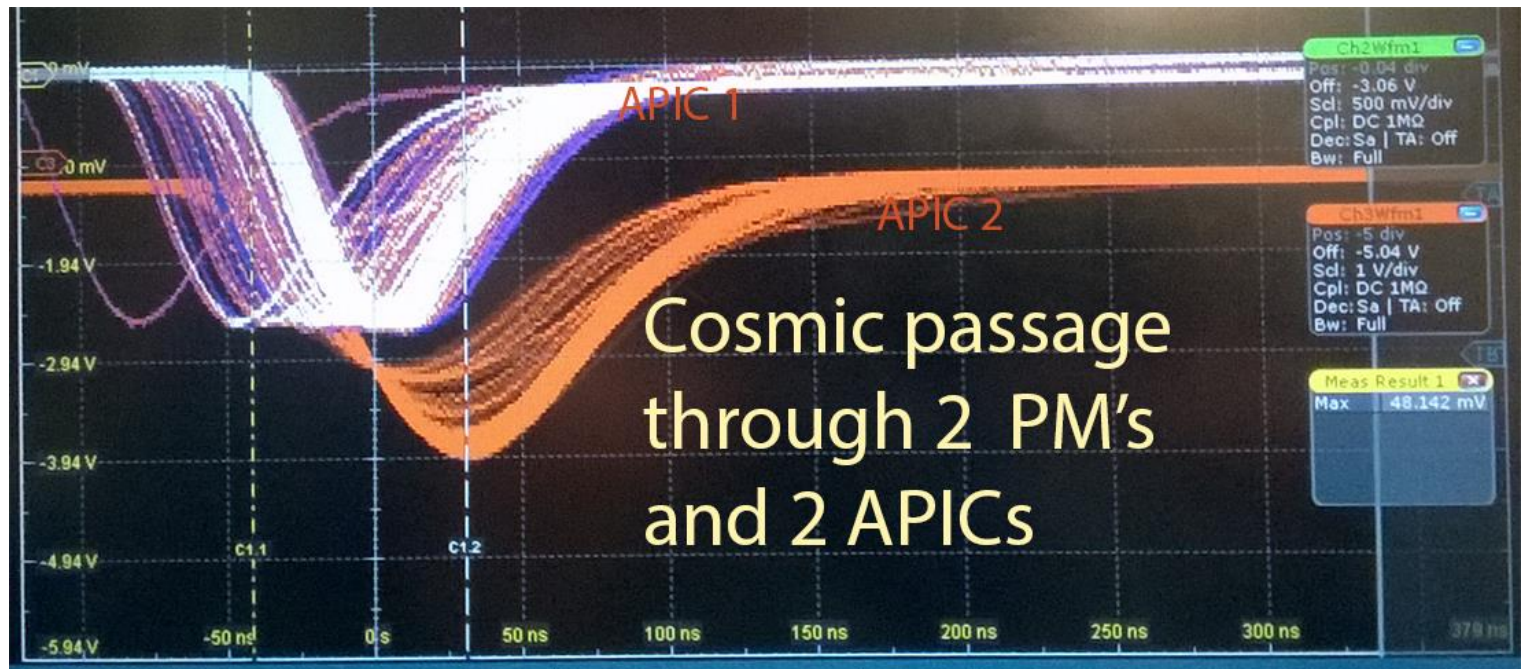
Energy resolution for a triple GEM, as a function of shaping time. The minimum in this example (21%) is for a peaking time of $\sim t_p = 300\text{ns}$ (shaping time 150 ns).

*measurements by Cosmin Jalba, trainee CERN July 2016

APICs on Photomultiplier telescope

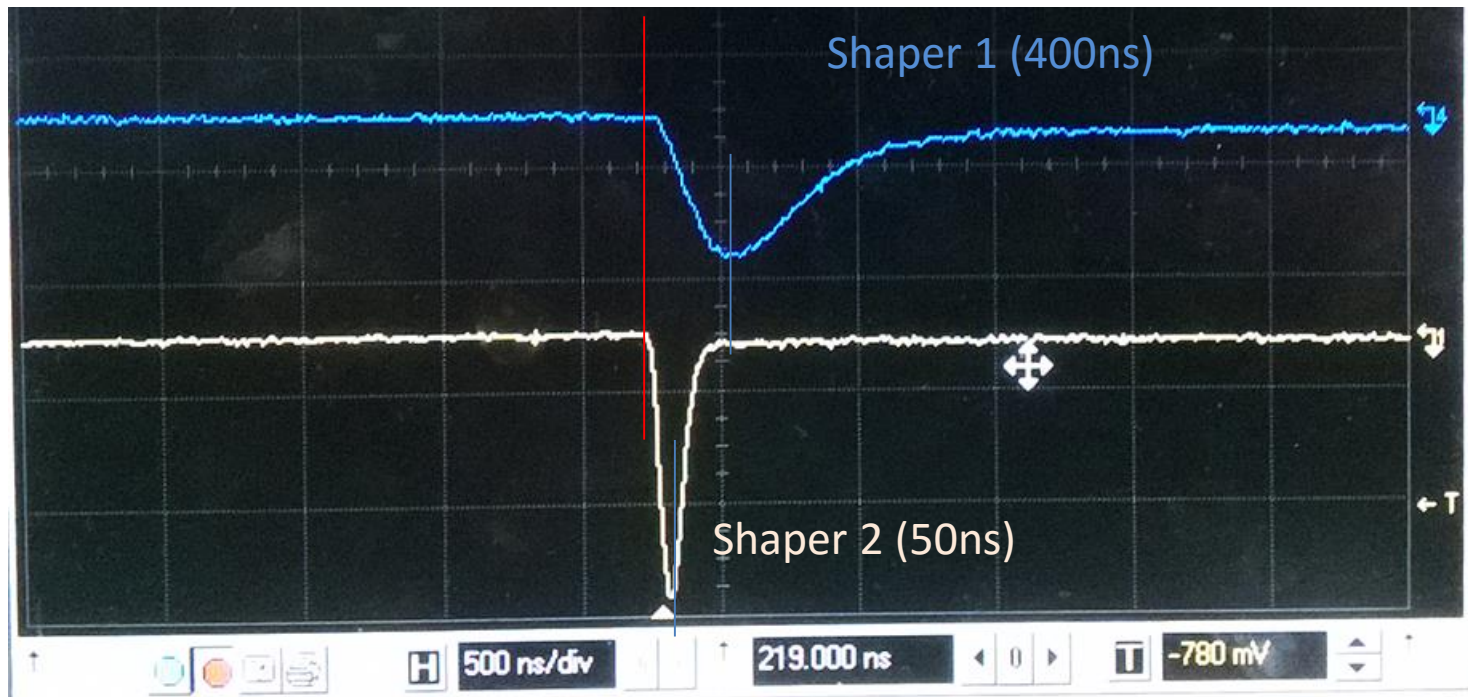


Cosmics monitoring



APIC timing

Particle passage t_0



APIC shapers have constant peak position relative to passage of particle

APIC status/ availability

Final APIC version 2.0 , available 1Q 2017

- Blinking LED added when battery goes low
- Baseline stabilized against battery charge status
- CSA monitoring output revised
- 4 standard shaping time pair versions Type 00, 01, 02, 03
- MPGD standard versions CSA gain 1mV/fC
- PMT, SiPM versions lower CSA gains 0.1mV/pC
- Enquiries via email to : info@srstechnology.ch
- User manual in preparation, contact Hans.Muller@cern.ch