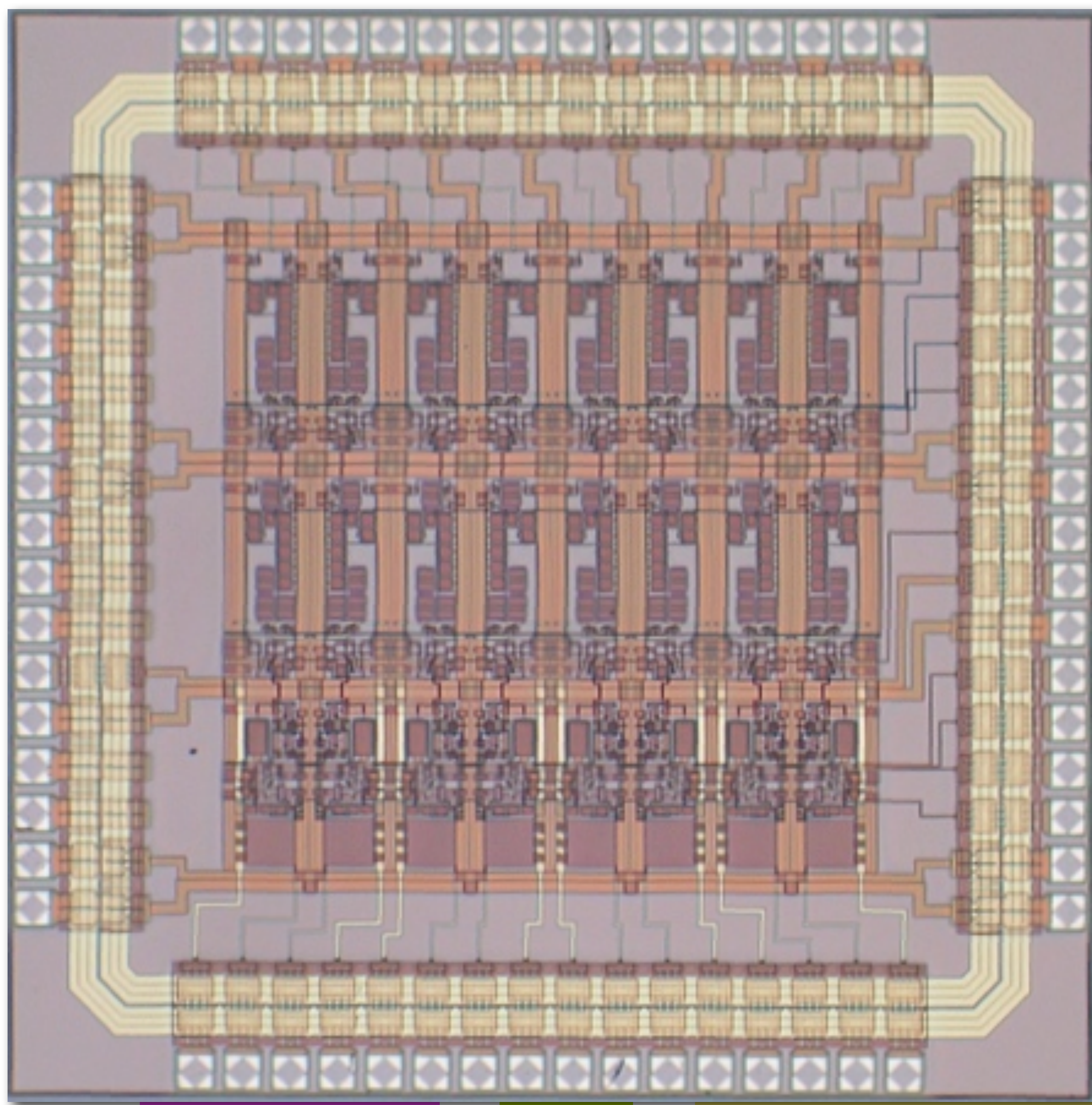# Brand-new

The ASIC for LXeTPC

ASIC for LXeTPC(FEXE08)

We have designed the first model of ASIC (Application Specific Integrated Circuit) for front end electronics of liquid xenon TPC (Time Projection Chamber). This ASIC has eight independent amp-shaper circuit for signal input and analog output.

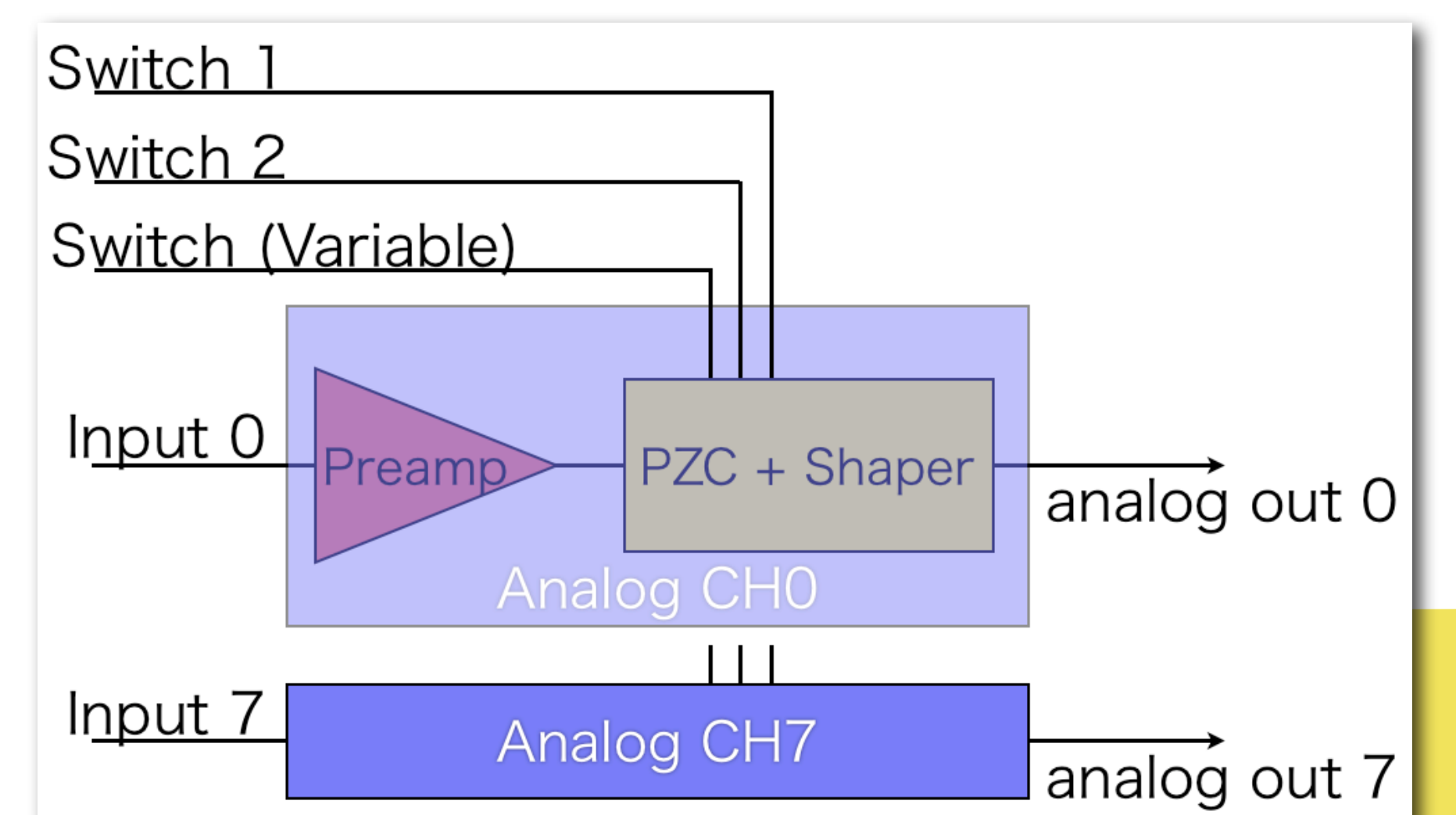|	FEXE08
Input charge	-25fC ~ +25fC
Conversion gain	5.6 V/pC
Die size	3 mm x 3 mm
Peaking time	1us (& variable)
Power dissipation	Less than 10 mW/ch

Specification (expected)

It concludes pre-amplifier, pole zero cancellation(PZC), shaper, and switches which control shaping time constant.

This ASIC is required high gain, high density, and low noise. The dynamic range of input charges and gain are adjusted for the collected charges of the TPC (about 5 femto-Coulombs at 511 keV gamma ray).

It has pre-amplifier, pole zero cancellation(PZC), shaper, and switches which control shaping time constant (1 micro second, 500 nano seconds, or more over 1 micro second).

Switch 1
Switch 2
Switch (Variable)
Input 0 — Preamp — PZC + Shaper — analog out 0
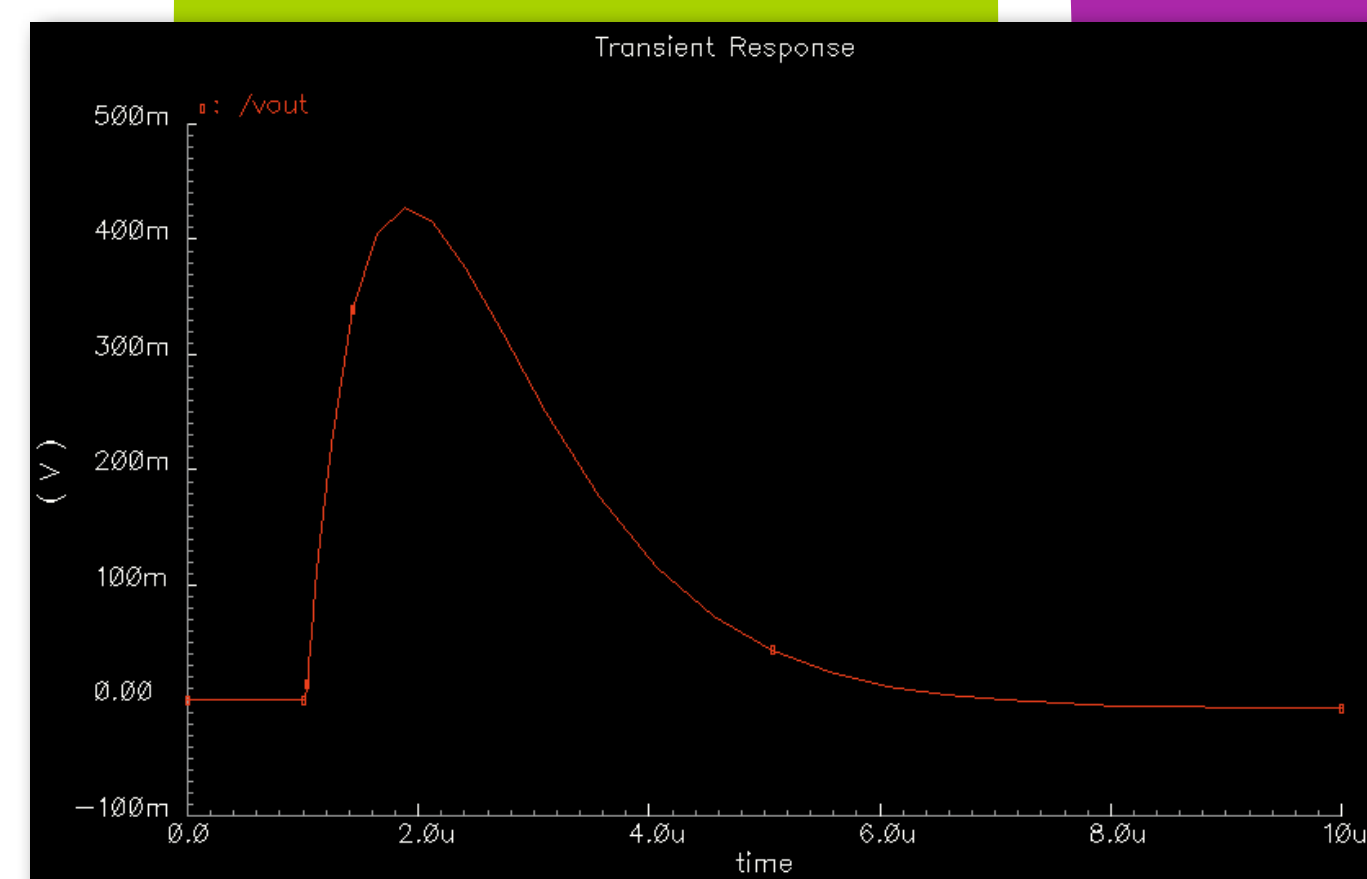Analog CH0
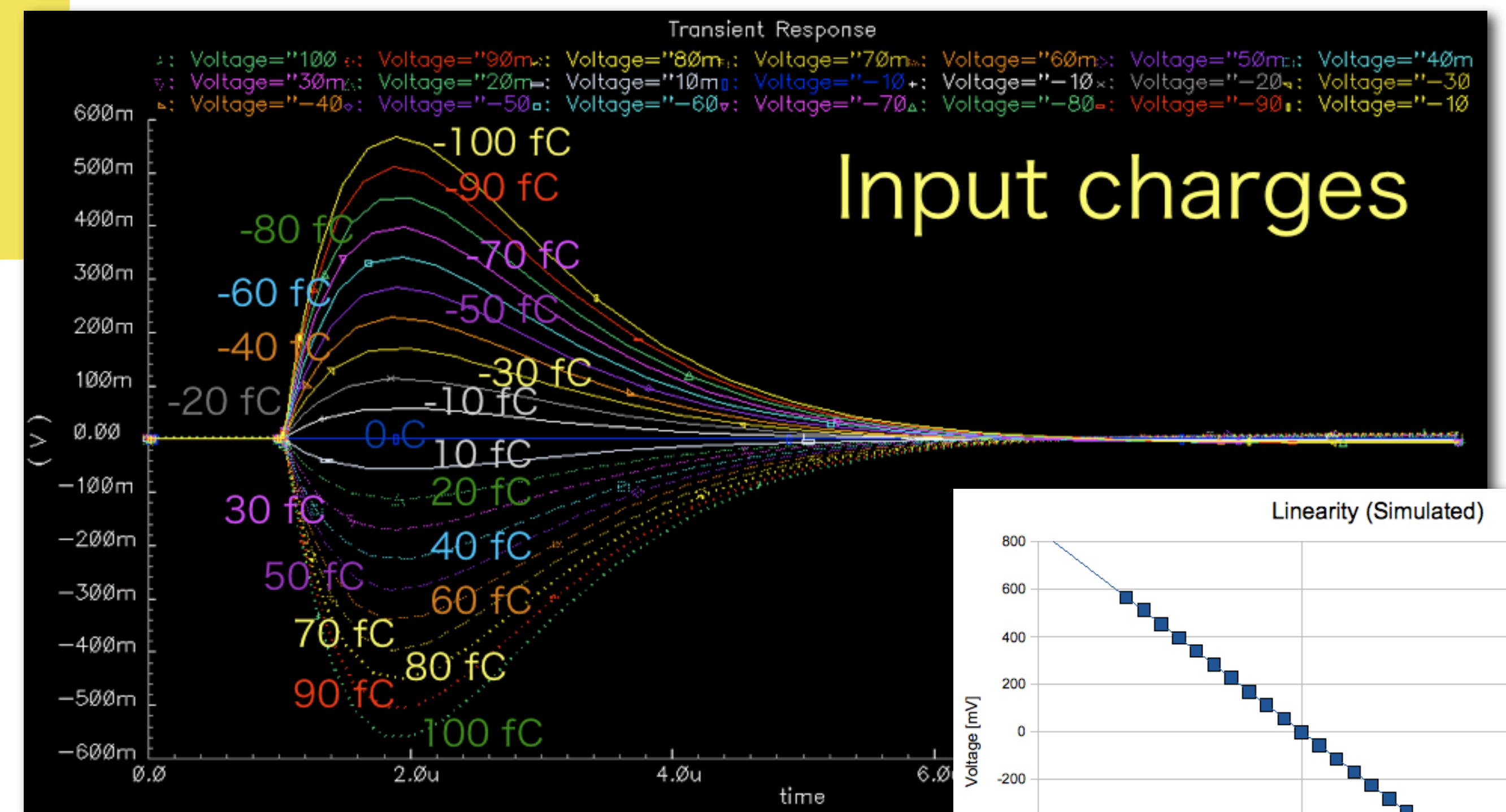Input 7 — Analog CH7 — analog out 7

Function diagram

Main Chip (photograph)

In the ASIC design, the parameters of circuit by the request from TPC's design of readout are optimized by CADENCE CAD. By using analog simulation(SPICE), each parameter are tested.
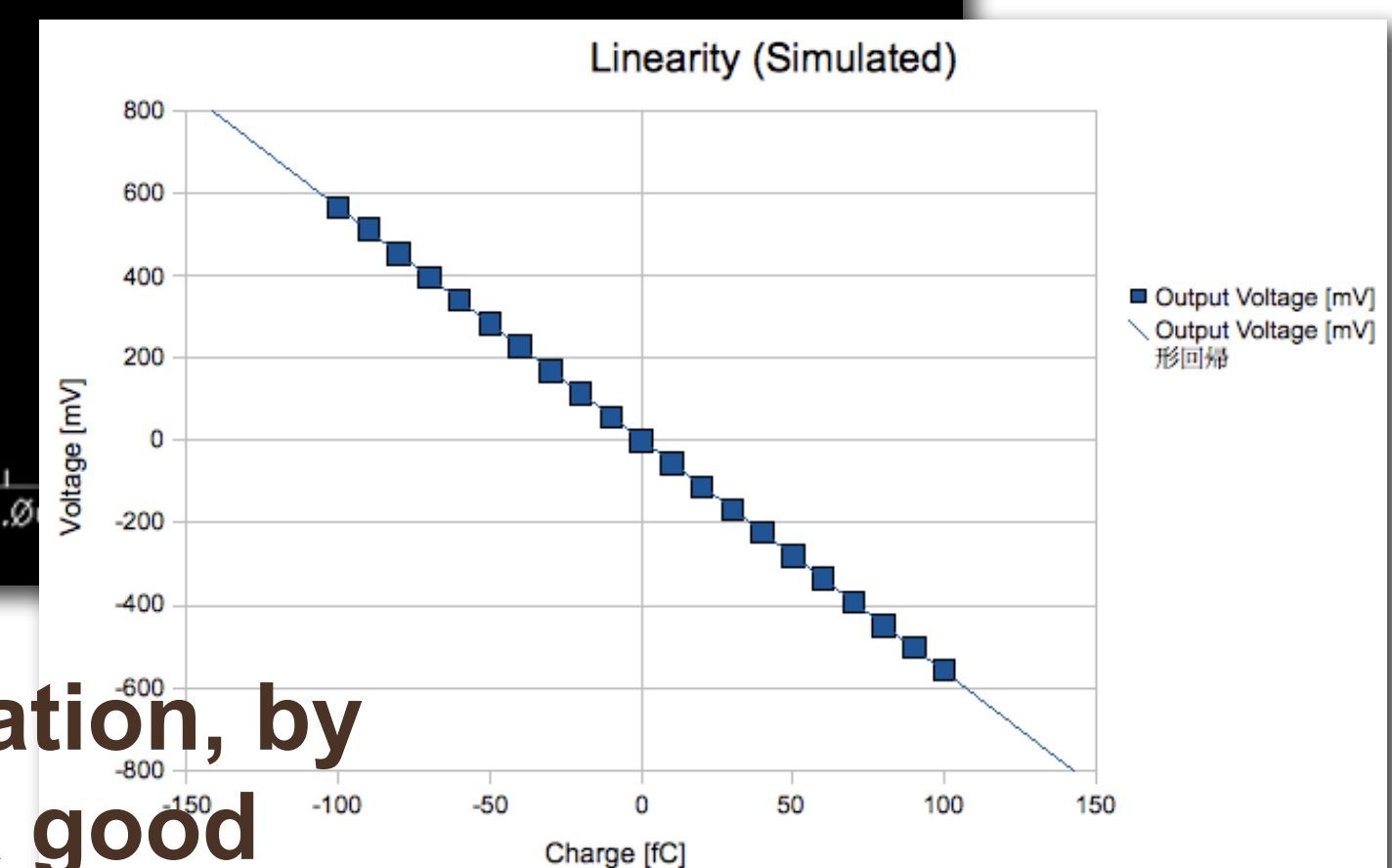
Simulation

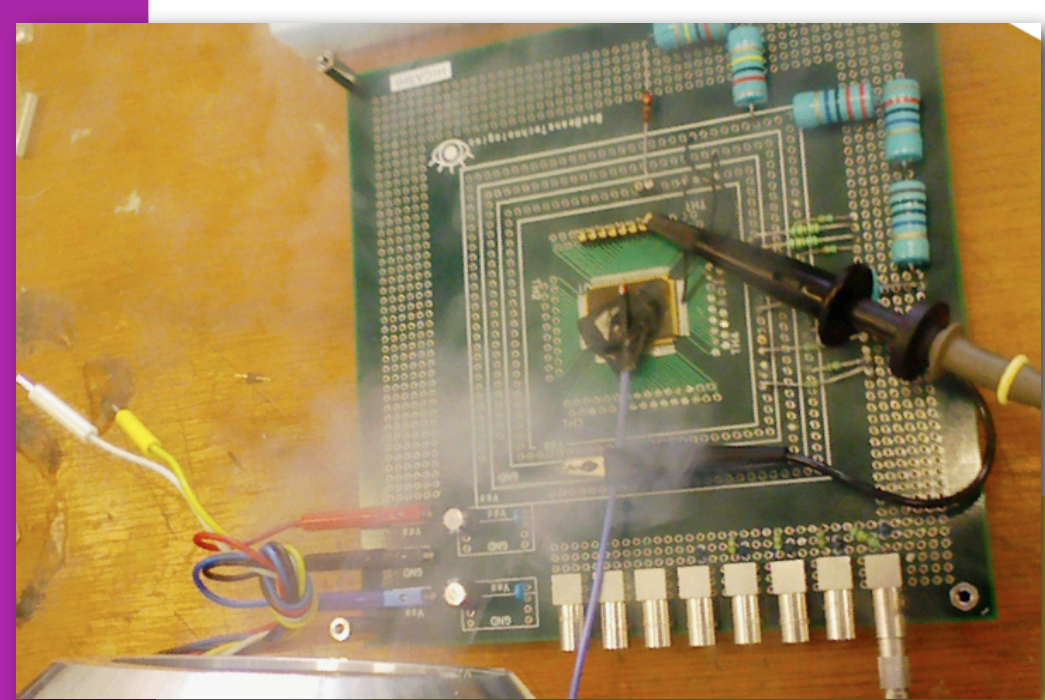**Input charges**

This is a analog out signal of simulation, by several input charges. It indicates a good linearity.

Linearity (Simulated)

This is a analog out signal by simulation, while we input charges about 80 fC. Pulse height is about 420 mV.
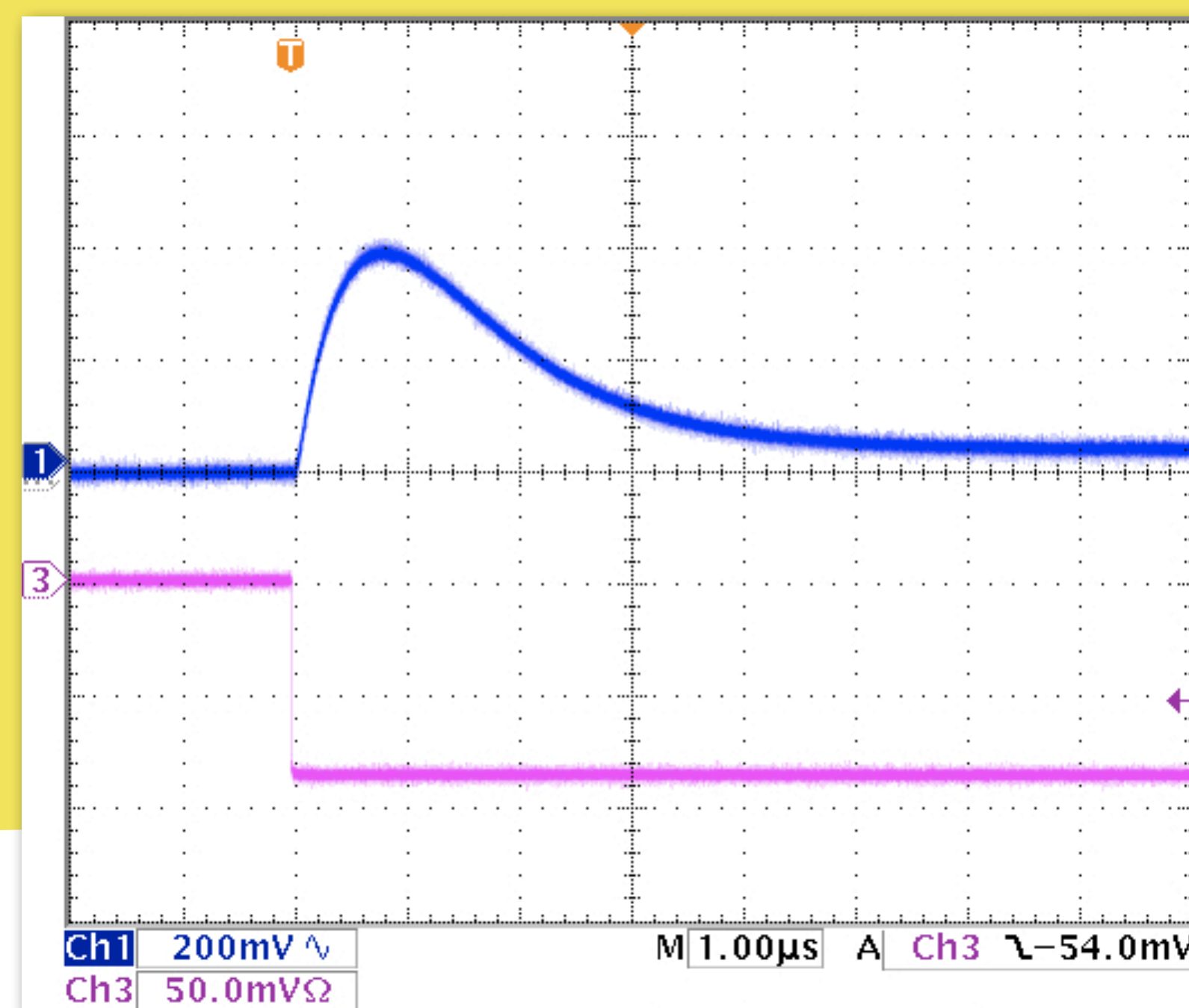
Now investigating

Cooling test

The ASIC need to have a low temperature tolerance, since TPC operates in liquid xenon (-100 degree). This kind of ASIC has been checked well in normal temperature, but it hasn't well in low temperature.

We've got a main chip's pulse!!

Ch1 200mV
Ch3 50.0mVΩ
M 1.00μs A Ch3 ⌐-54.0mV

This is a analog out signal of main chip, by inputing charge about 80 fC.

Pulse height is 400mV, that is a nearly equal to the result of simulation, but a little small.

We will check it and that of another channels, also linearity.