

SPIROC tests @ DESY

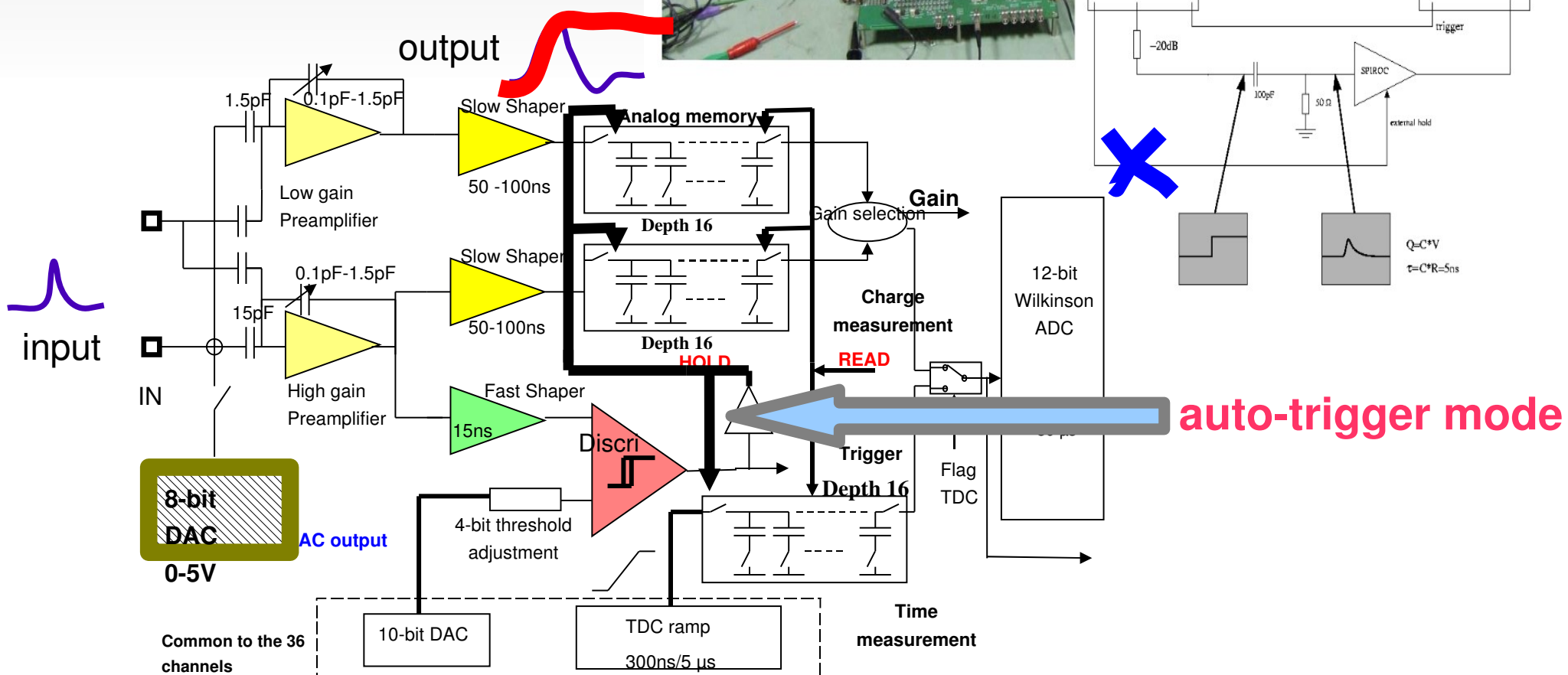
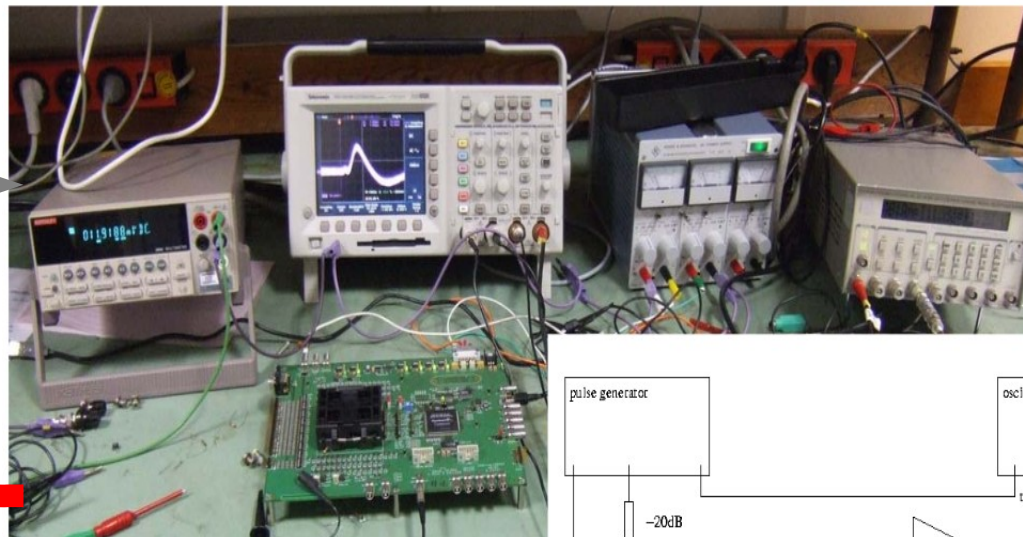
Wei Shen (University of Heidelberg)

Benjamin Lutz , Riccardo Fabbri (DESY)

status of measurements - analog path

Test setup:

Pulser + Coupling C + Oscilloscope

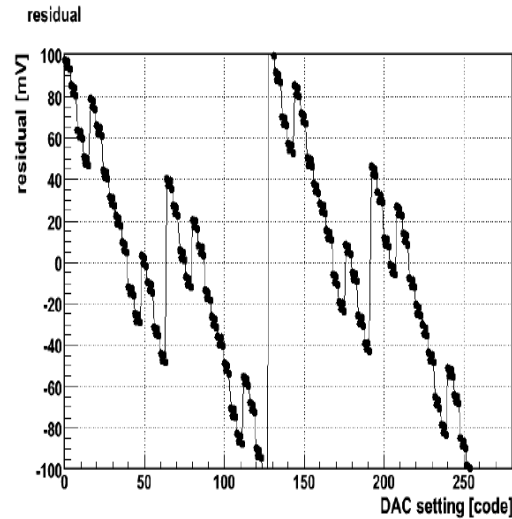
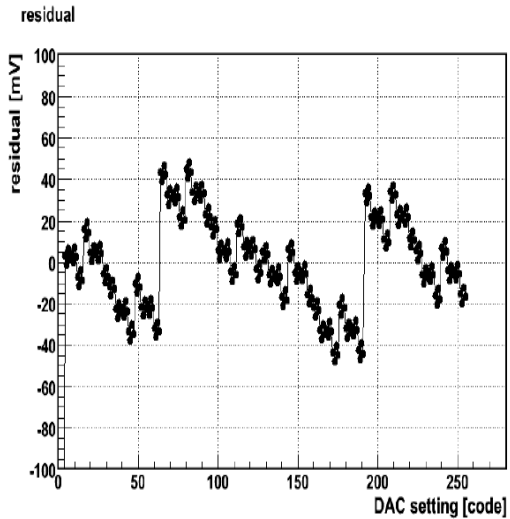
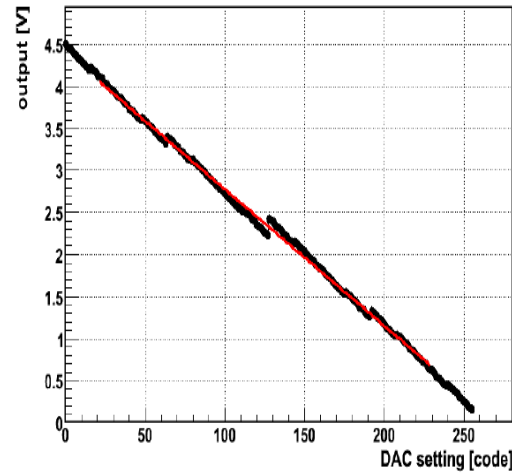
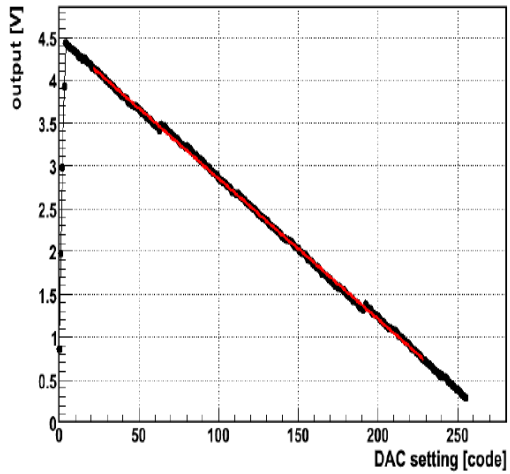
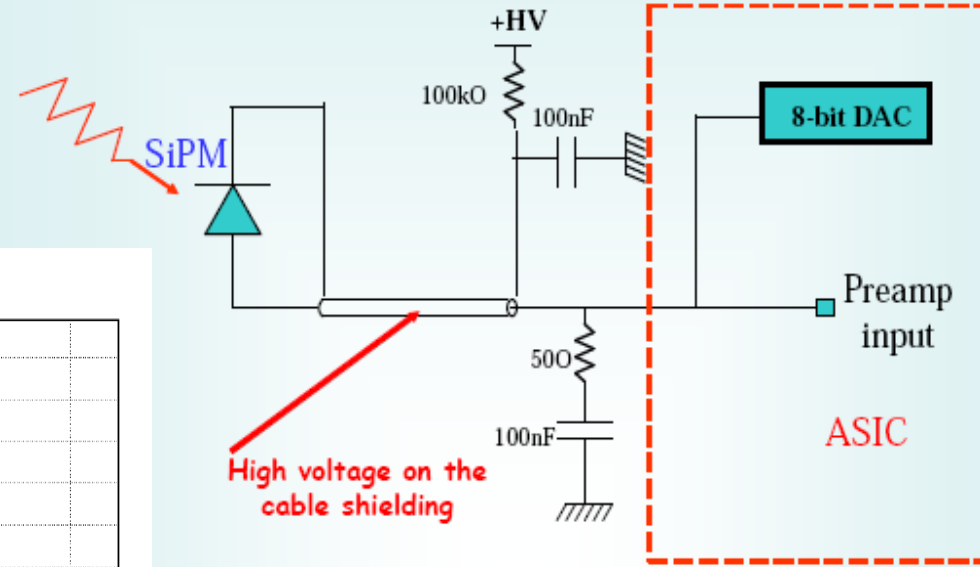


finished measurements

- input DAC
consistency check
- external hold mode
linearity
peaking time
noise
- auto-trigger mode
trigger time walk
trigger time jitter
thermal noise spectrum

input DAC

Input DAC



- swing 4.5V
- tune SiPM voltage
- residual $\pm 2\%$
- consistent with Orsay measurements

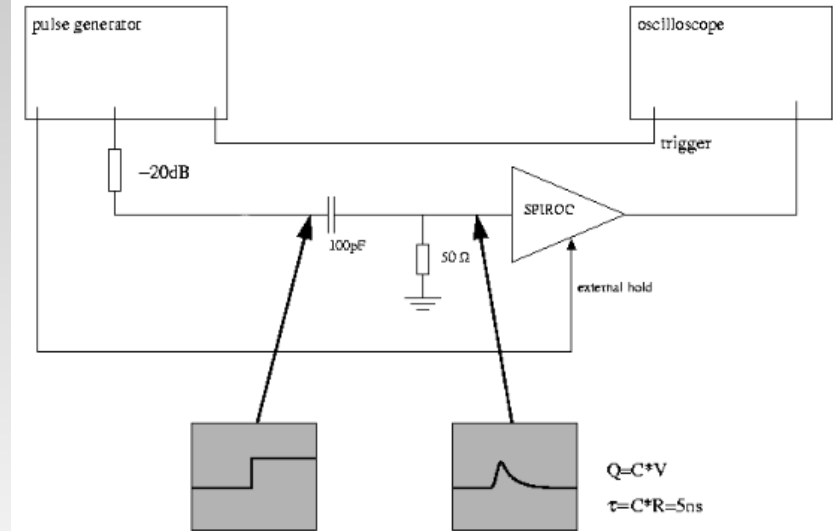
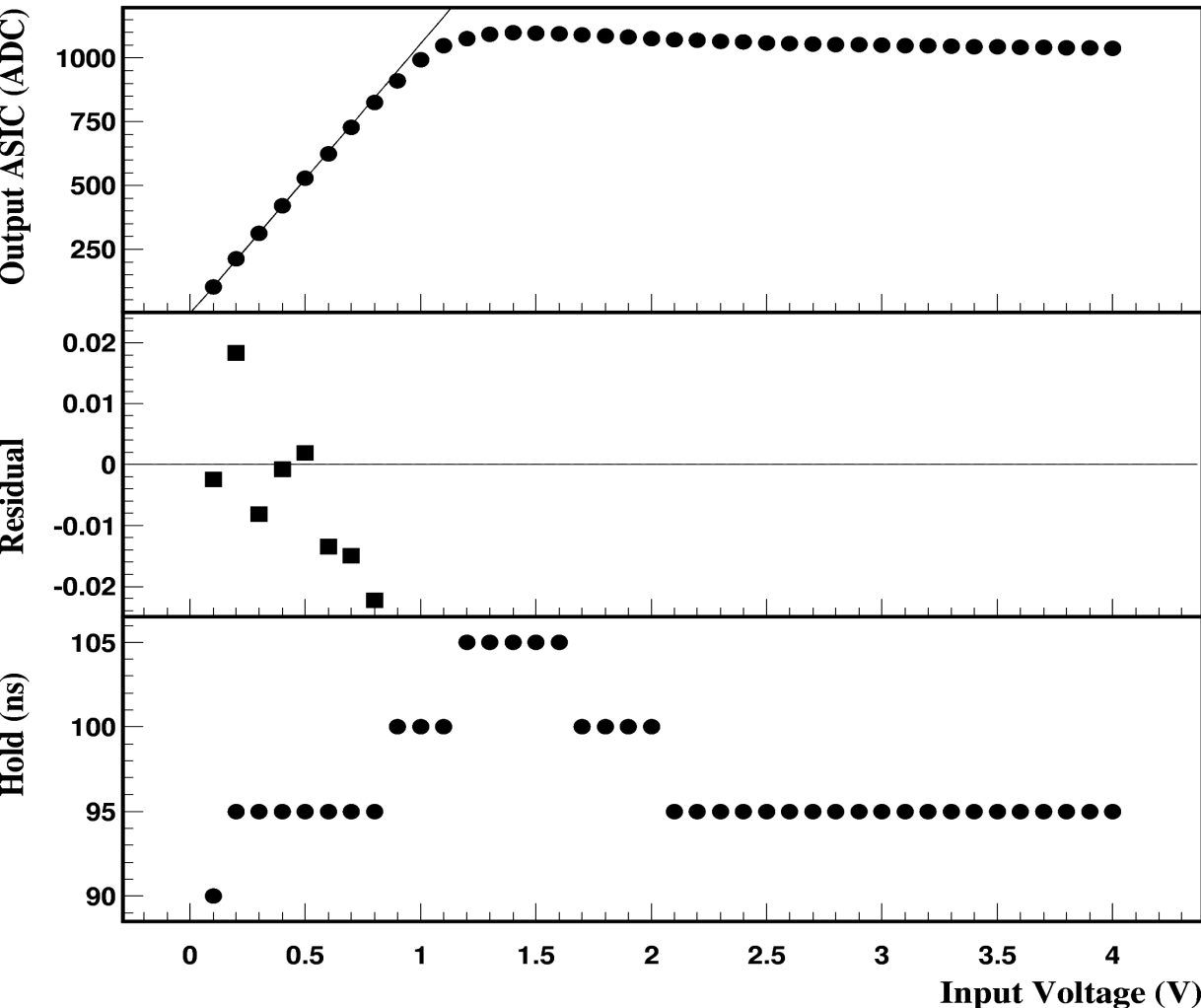
linearity and peaking time (external hold)

external hold - linearity

$$Q = C_c * V * 0.1, \quad C_c = 100 \text{ pF}$$

0.1 - 20dB attenuator

HG mode: Variable Capacitance: 100fF Shaping Time: 50ns



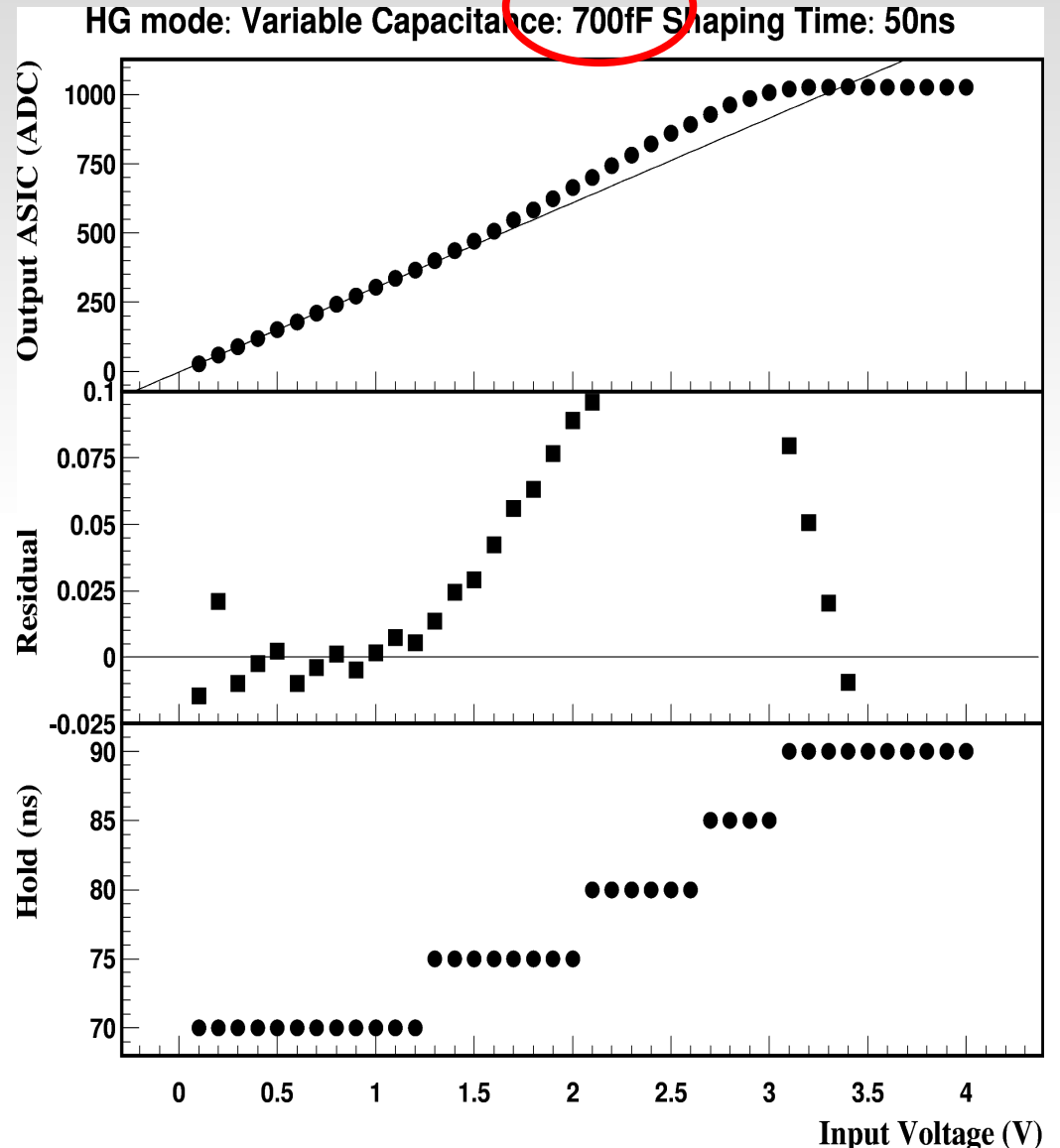
High Gain mode
voltage-scan @
50ns shaping time
different feedback cap.

peaking time not fixed
see slide 11

external hold - linearity

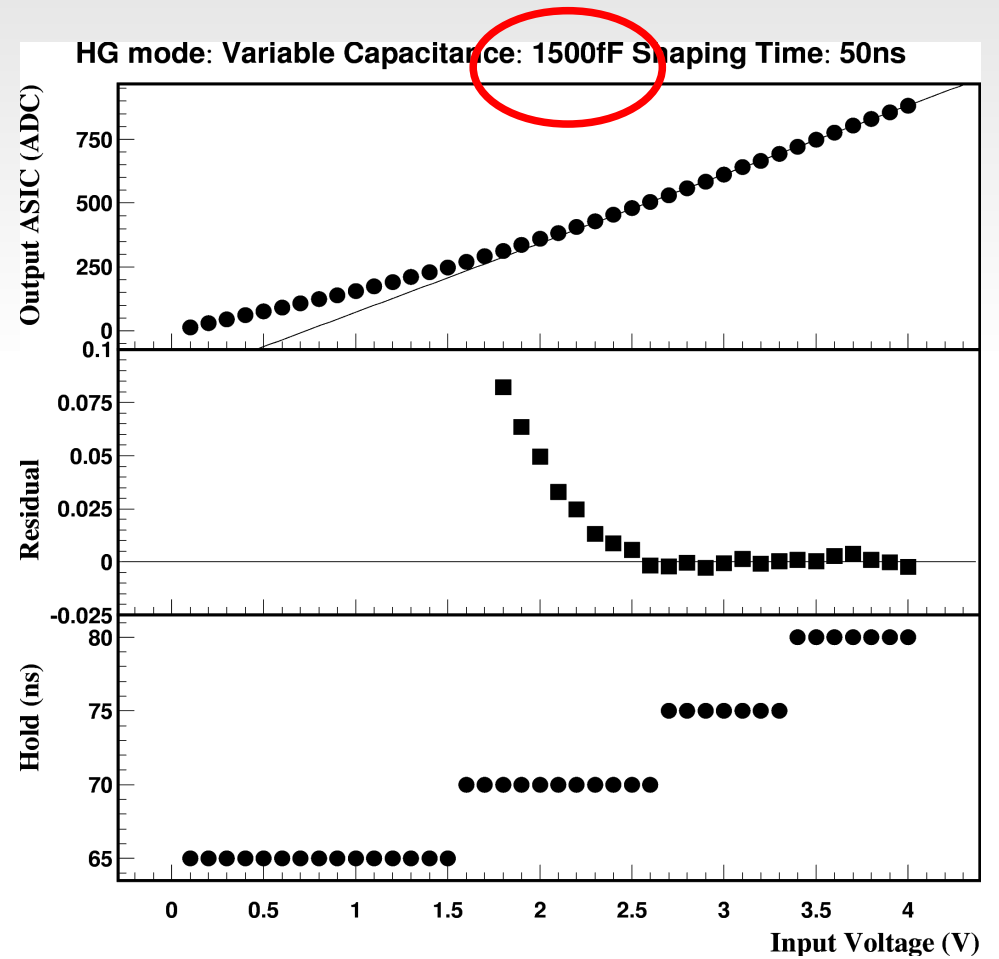
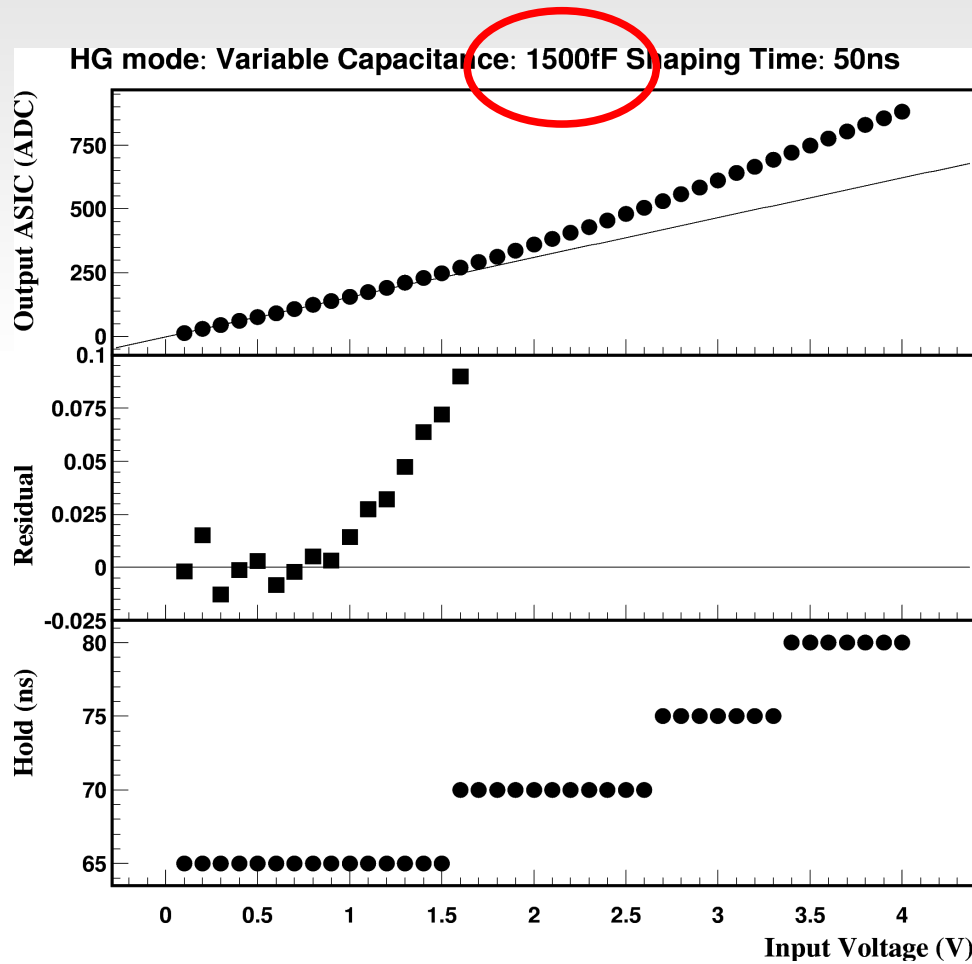
High Gain mode

non-linearity appears when
operating at higher
Feedback Capacitance



external hold

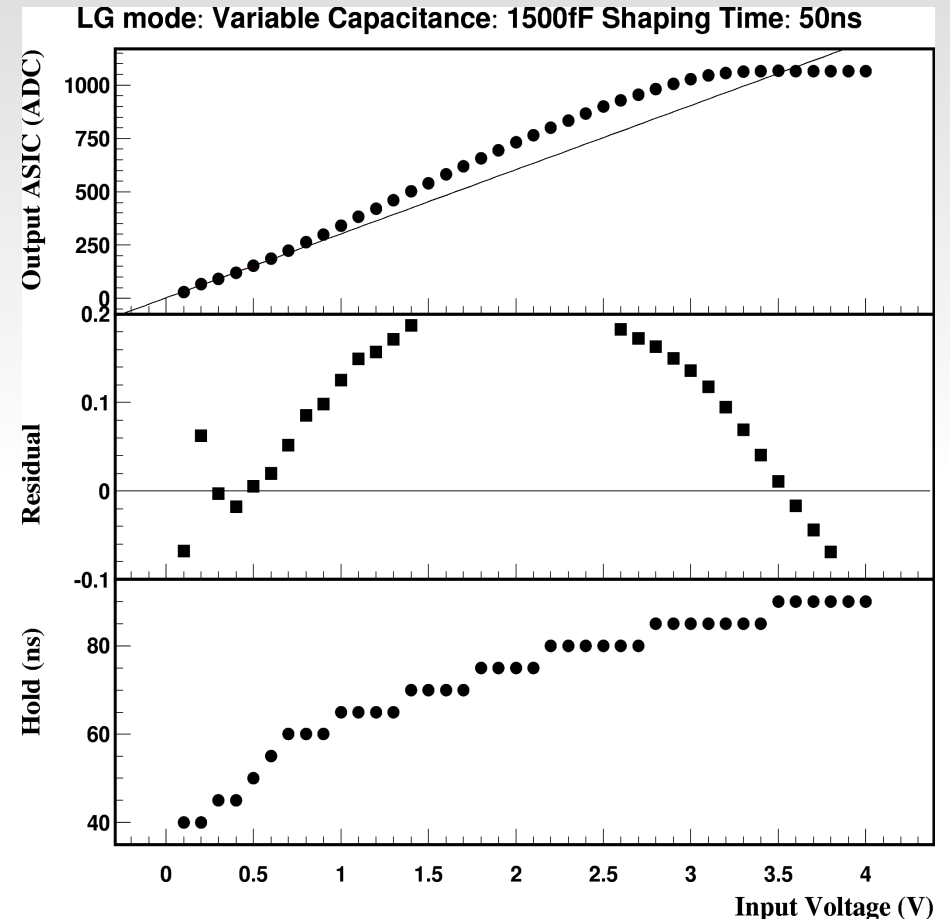
HG mode : non-linearity more evident @ large feedback



Analog output with external hold

Low Gain Mode

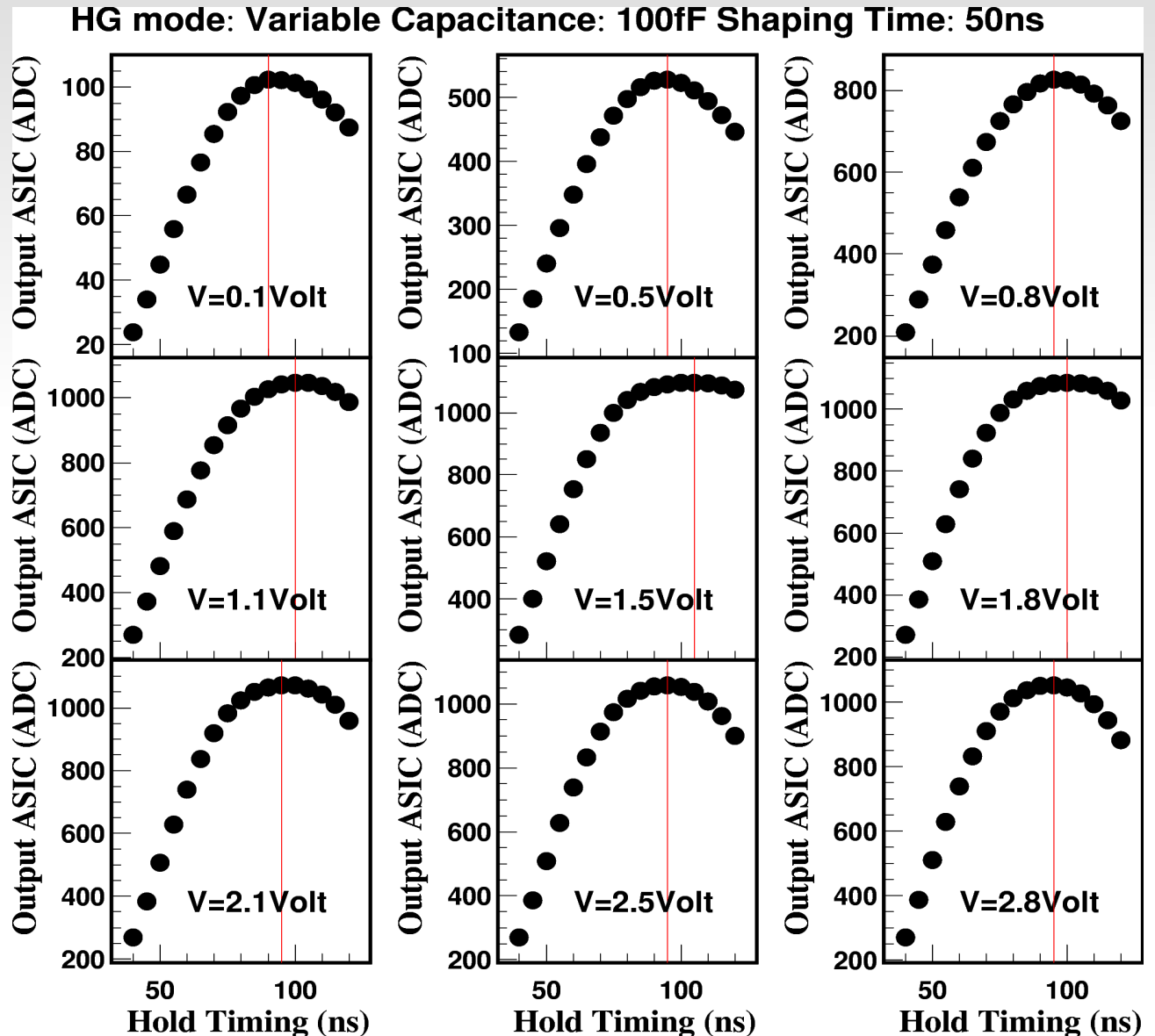
same feature @ low gain mode
large feedback capacitance



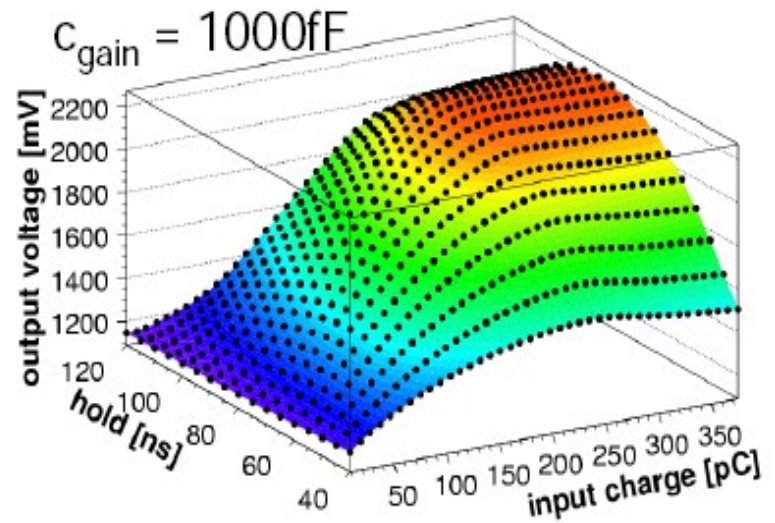
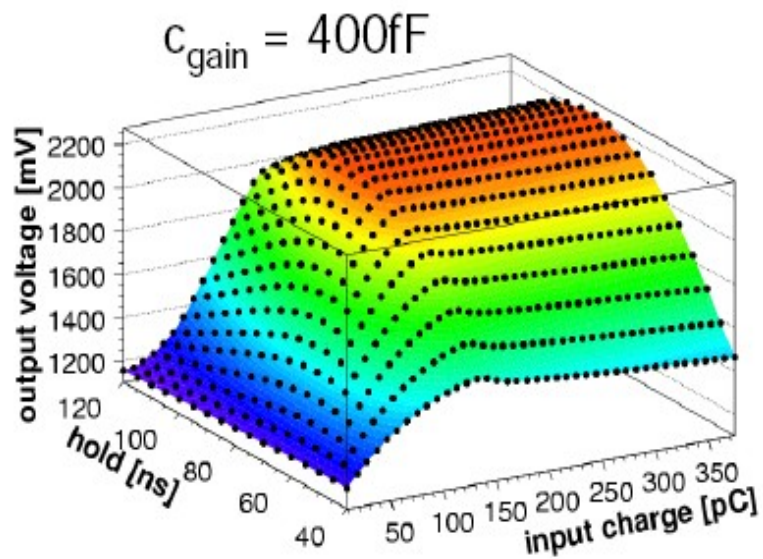
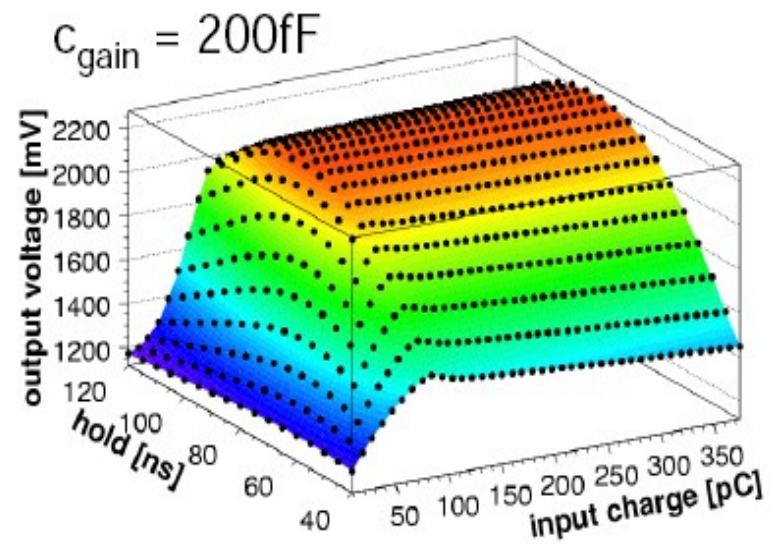
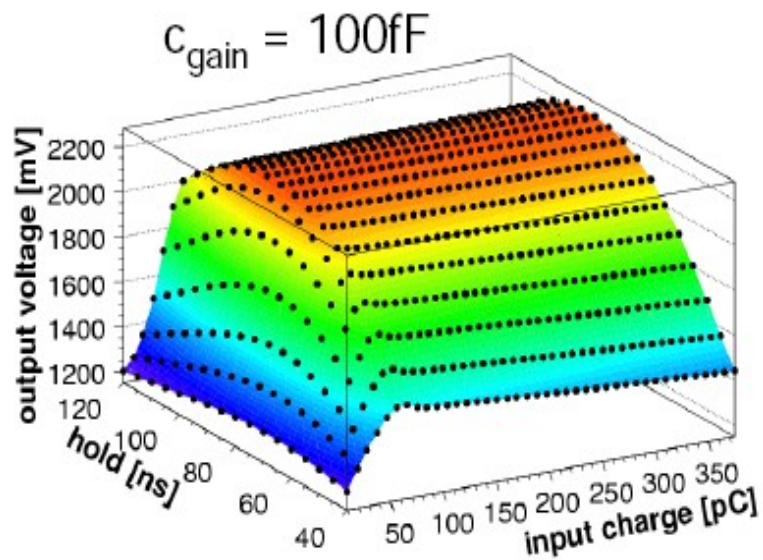
Analog output with external hold

HG & LG mode

Peaking time increases with increasing input charge



LG scan

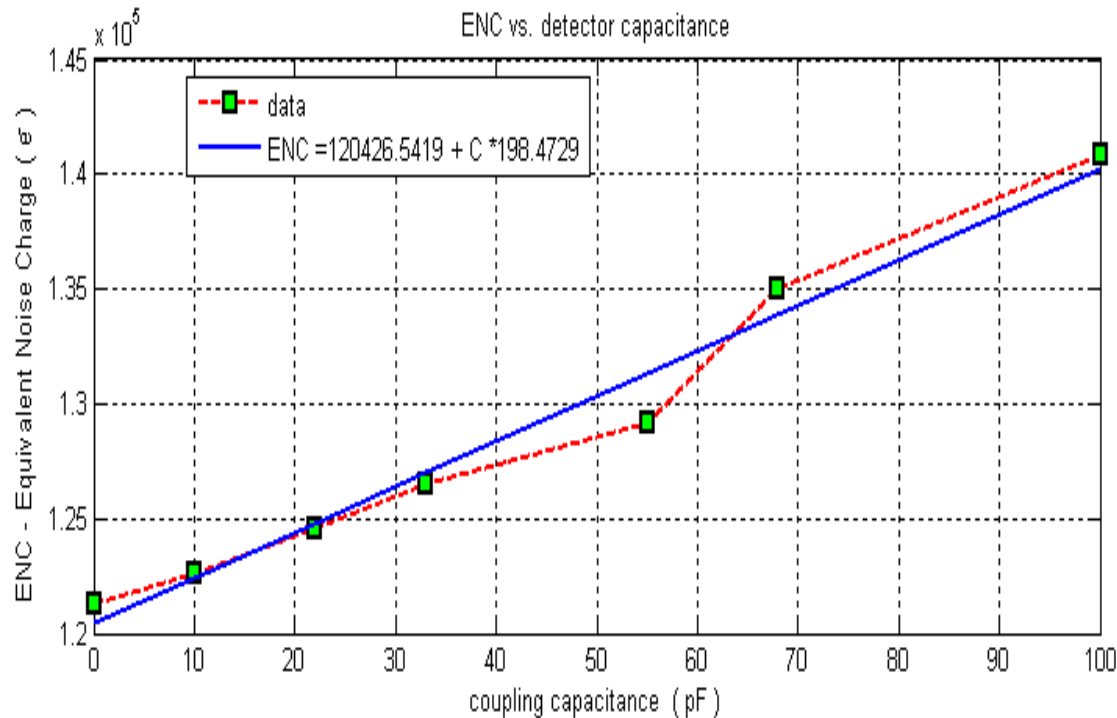
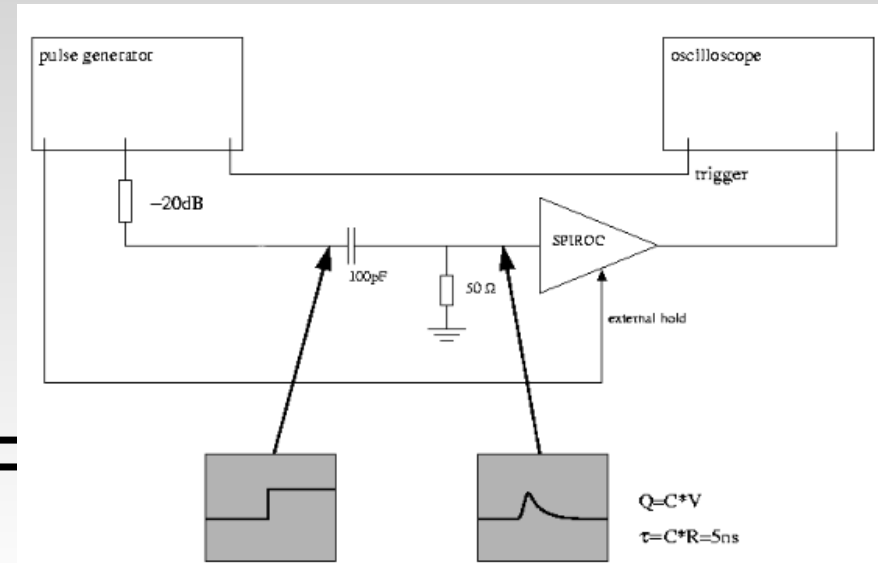


noise (external hold)

output noise referred to input terminal

equivalent noise charge
vs. detector capacitance

15% change in range 0-100 pF



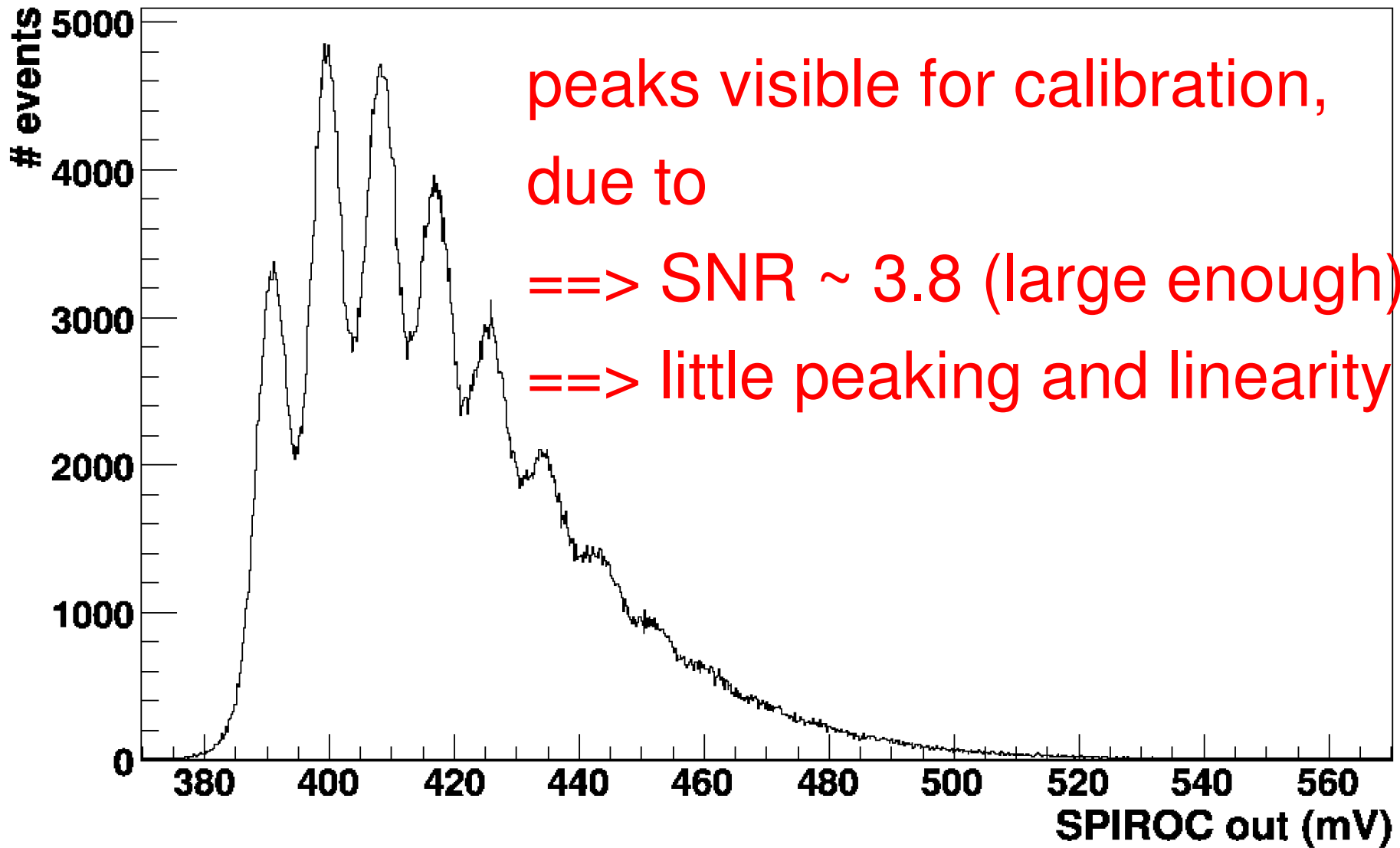
$1.3 \cdot 10^5$ electrons @
SiPM cap. ~ 50 pF

$S_g/N \sim 3.8$ @SiPM

Gain $0.5 \cdot 10^6$, enough
for calibration !

calibration mode with external hold

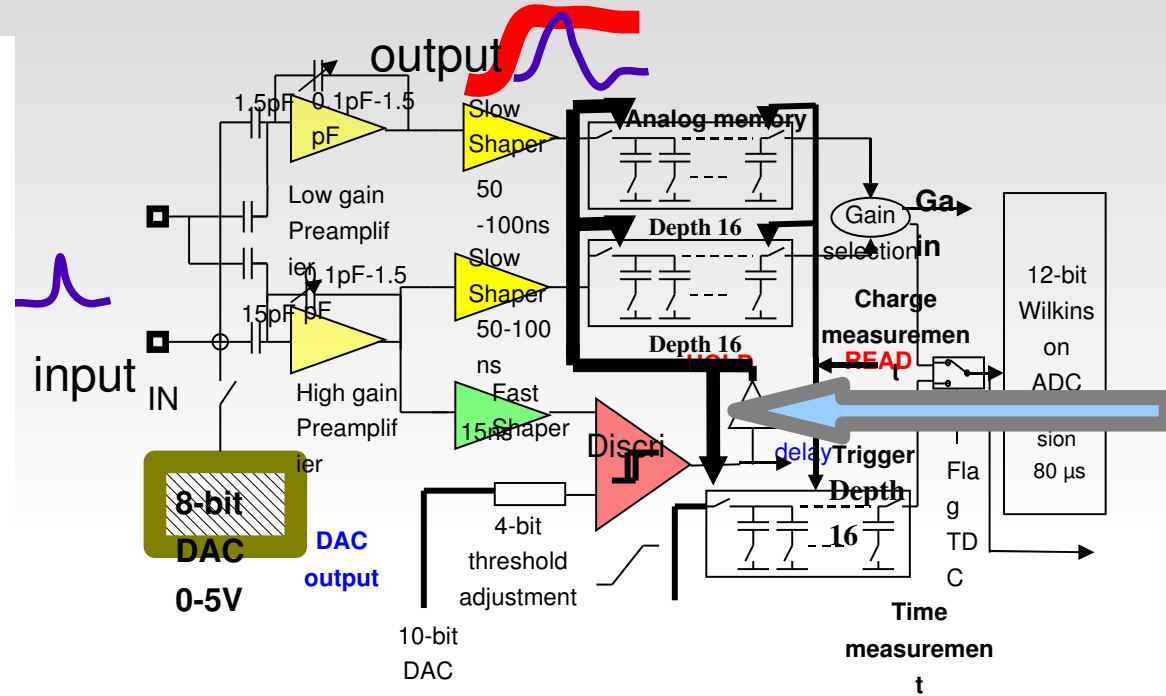
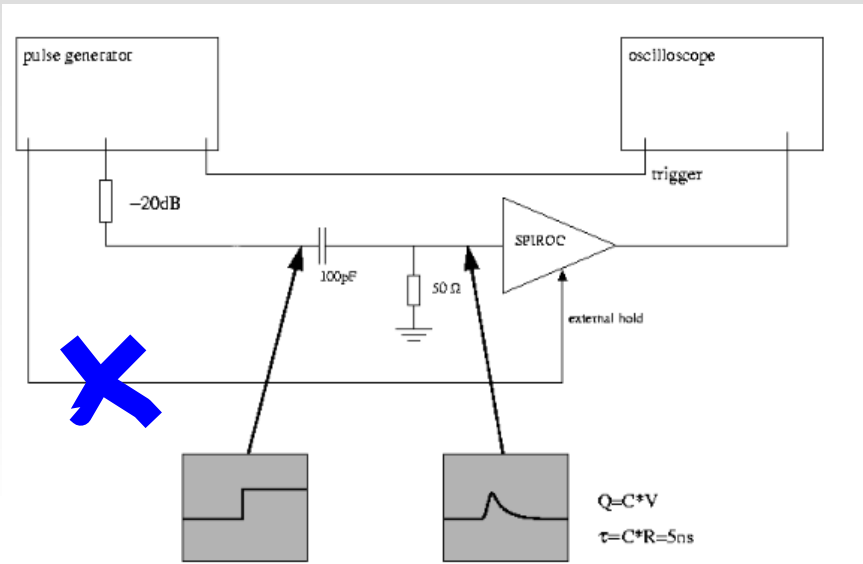
SiPM 753 SPIROC HG 100fF 50ns external hold



peaks visible for calibration,
due to
==> SNR ~ 3.8 (large enough)
==> little peaking and linearity effect

auto-trigger mode

Auto-trigger mode



* Different threshold DAC values are set at the discriminator in the fast shaping line

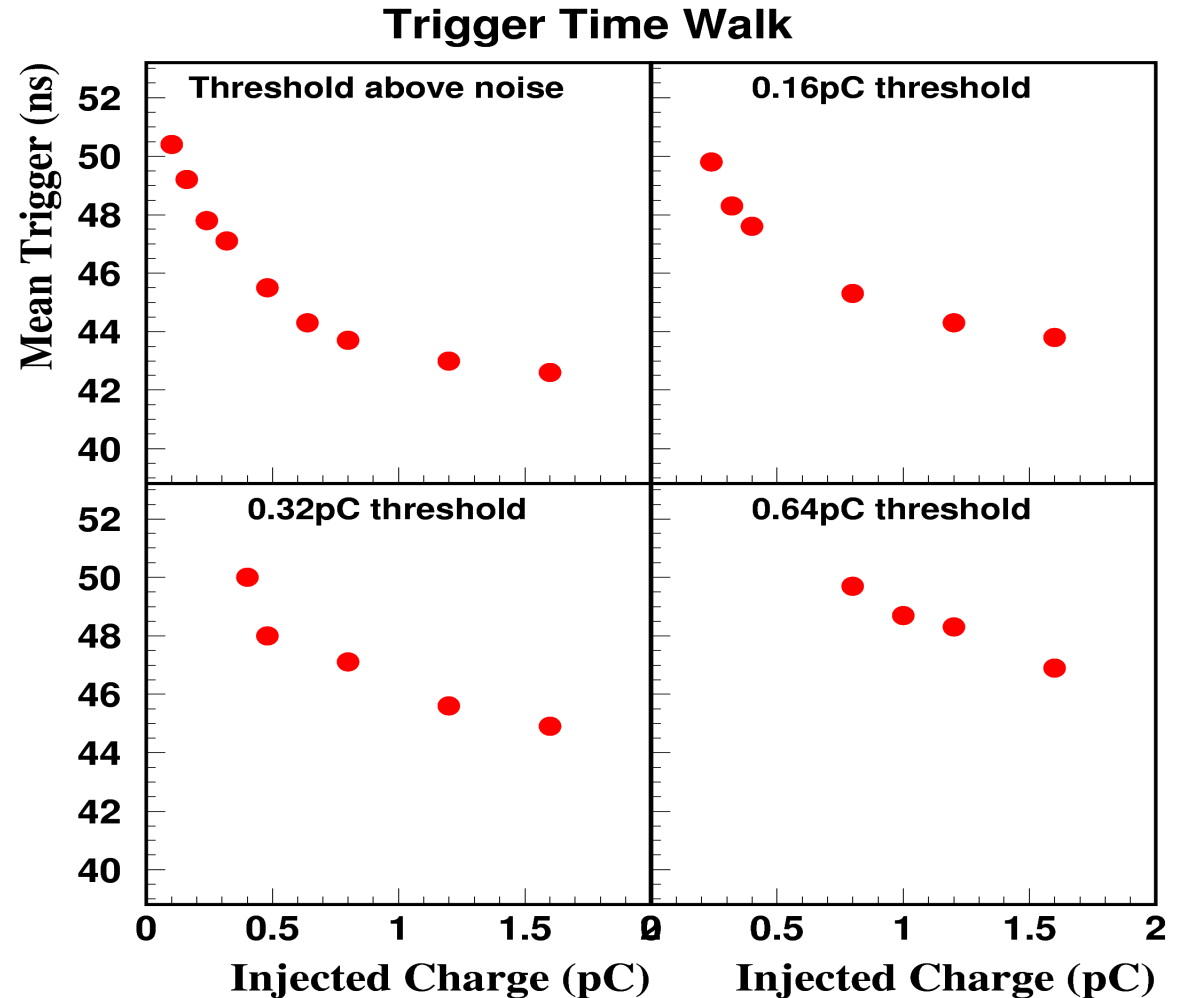
==> trigger time-walk(threshold) ==> trigger jitter(noise)

Auto-trigger mode

SiPM Gain – $0.5 \cdot 10^6$

0.08pC = one pixel

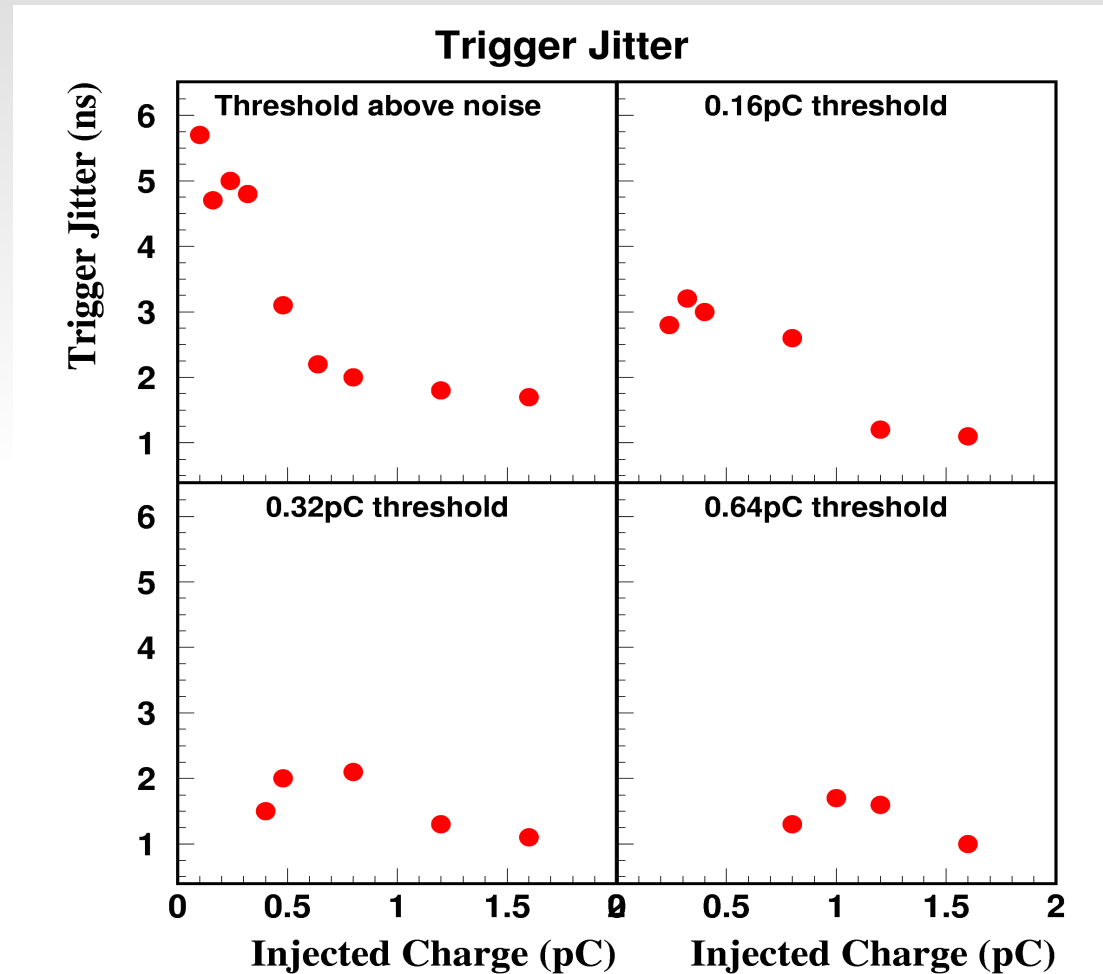
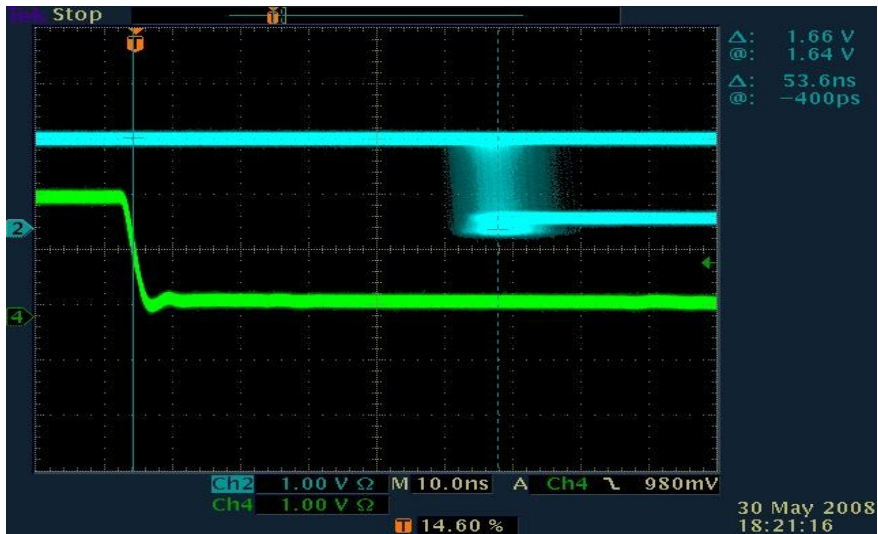
Time walk small @
threshold half a MIP



Auto-trigger mode

standard dev. value

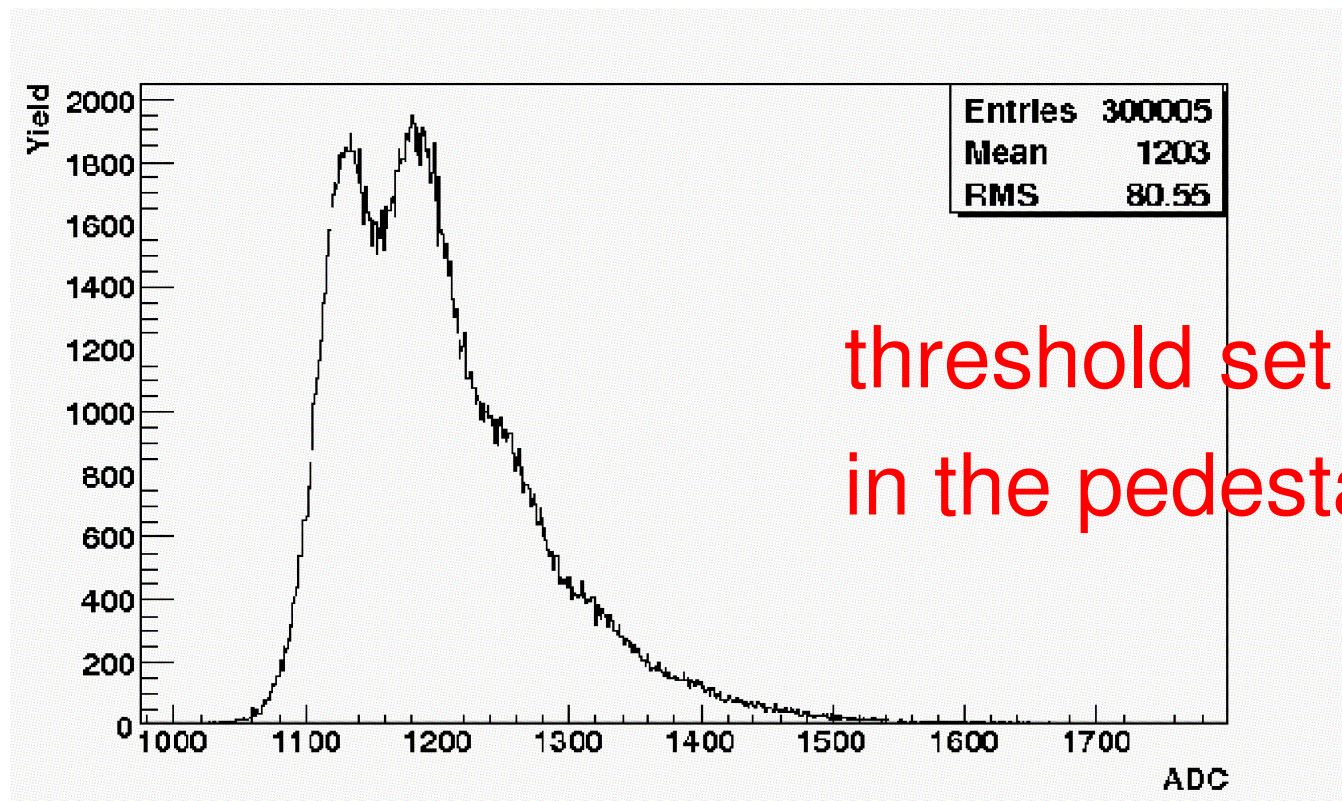
large at low threshold



thermal noise

Auto-trigger mode

thermal noise spectrum with auto-trigger



threshold set
in the pedestal peak

conclusion

- good for calibration with LED light
- LG mode (real experiment mode) , auto-trigger time walk and time jitter very small

outlook

- test physics mode with auto-trigger
- auto-trigger & external trigger inter-calibration
- looking forward to SPIROC2