

Omega

HARDROC2 Bandgap and T&H measurements

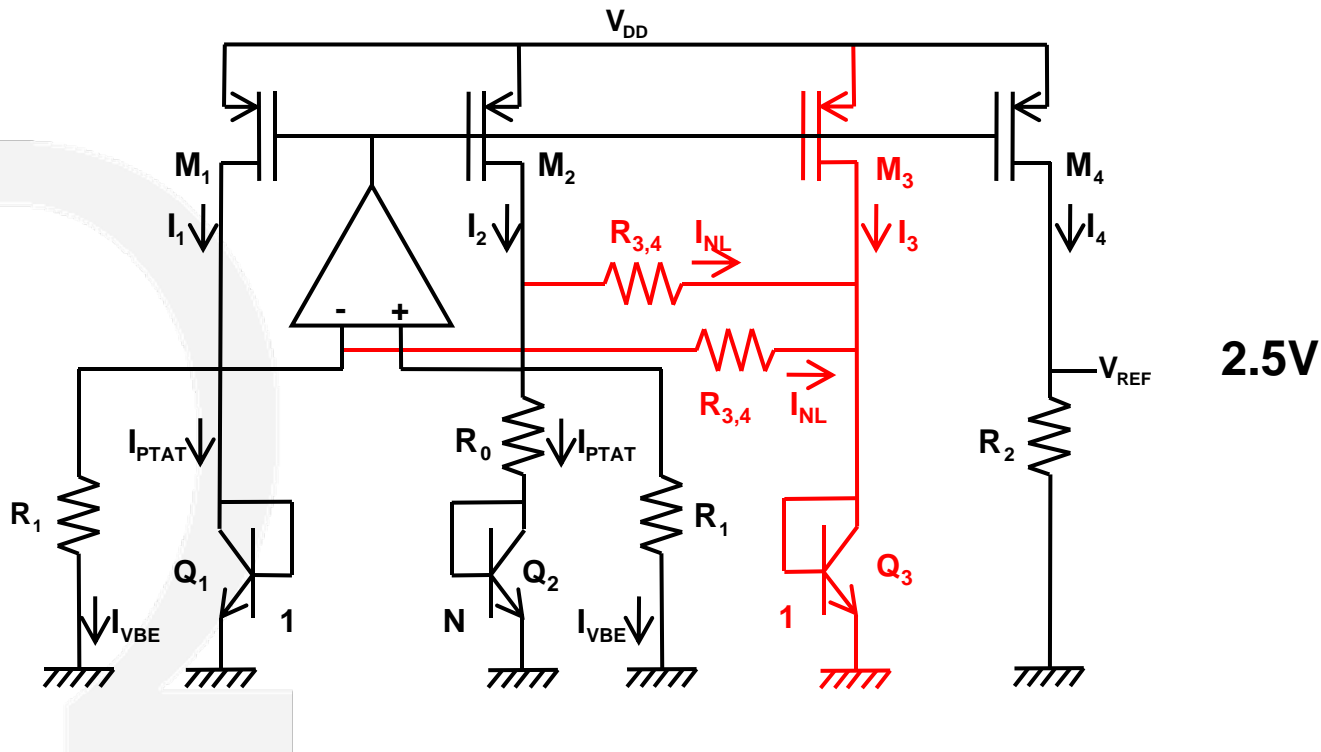
<http://omega.in2p3.fr/>

Nathalie Seguin-Moreau



BANDGAP

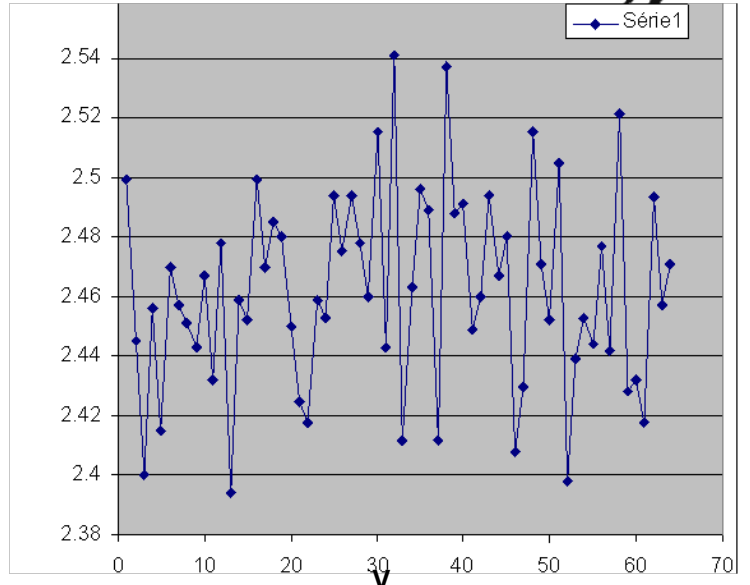
- ≈ 70 hardroc2 chips measured
- Bandgap common to the ROC chips
- Variation with temperature
- Non uniformity



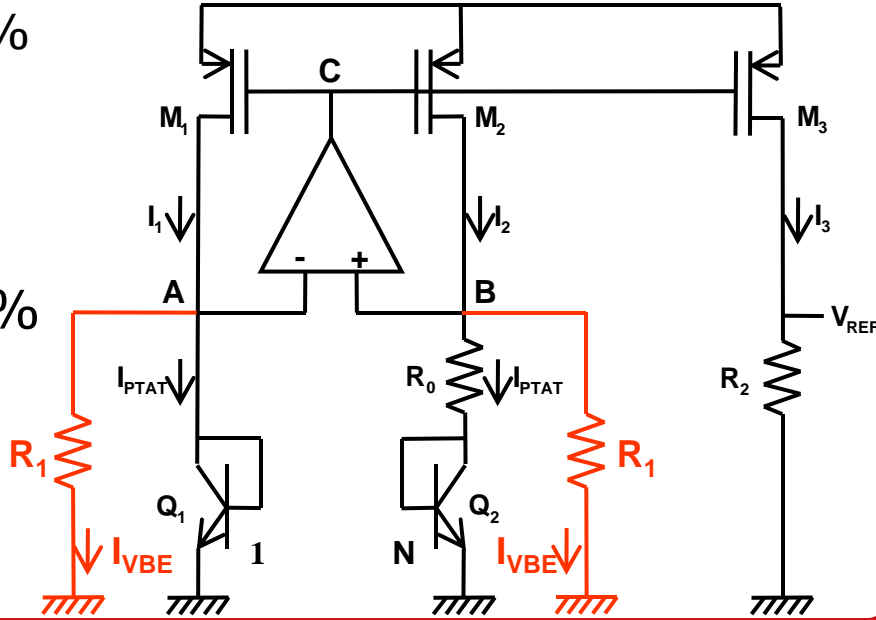
Non uniformity of the absolute value



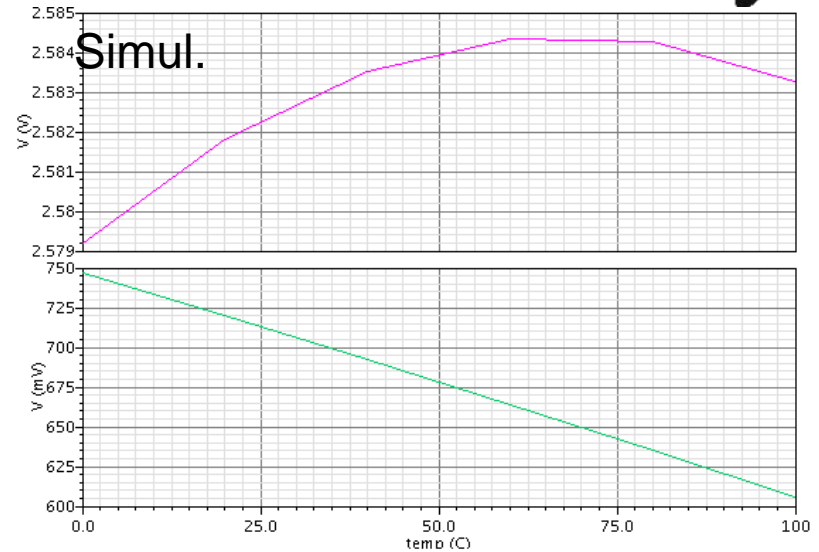
- ~70 hardroc2 chips measured
- Non uniformity: 2.46V \pm 30mV



- **SIMULATIONS:**
 - M2: 390/4 instead of 400/4 (2.5% variation):
 $\Rightarrow \Delta V = +100\text{mV}!$
- 3% difference in trans size \Rightarrow 3% change of $I = 20\mu\text{A}$.
Offset: $0.6\mu\text{A} \times 123\text{k} = 73\text{mV}$

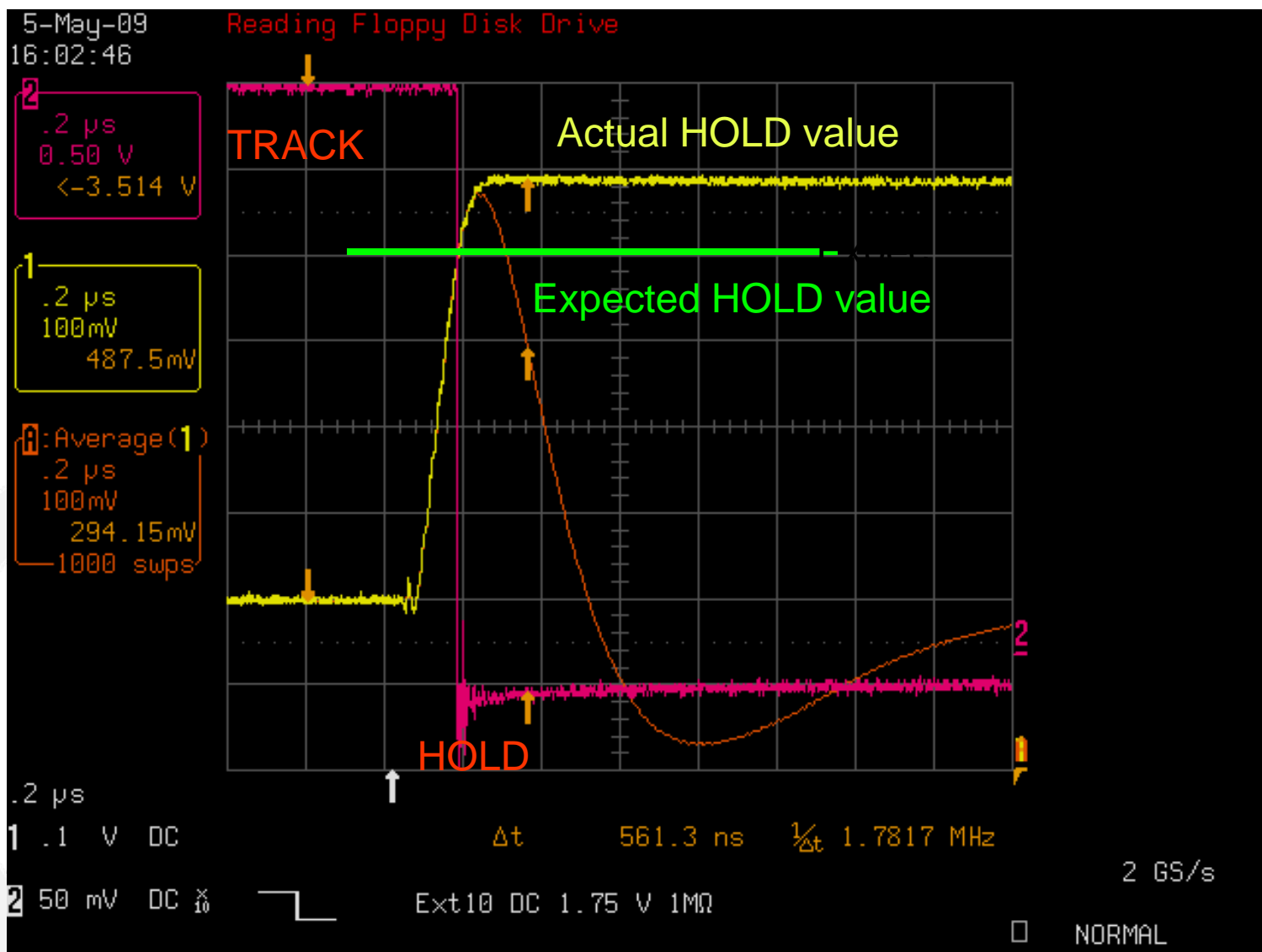


- SIMULATIONS
 - Vbg : Variations around 100uV/degree
 - ΔV_{be} : -1.4mV/°K
- Measurements:
 - ΔV_{be} = -1.5mV/°K



	Vbe	Vbg	$\Delta V_{bg}/\Delta T$
Chip 50	735 mV	2.4737	-165 $\mu\text{V}/^\circ$
Chip 53	739 mV	2.4816	-151 $\mu\text{V}/^\circ$
Chip 69	740 mV	2.5053	9 $\mu\text{V}/^\circ$
Chip 73	735 mV	2.482	-25 $\mu\text{V}/^\circ$
Chip 74	735 mV	2.447	-38 $\mu\text{V}/^\circ$

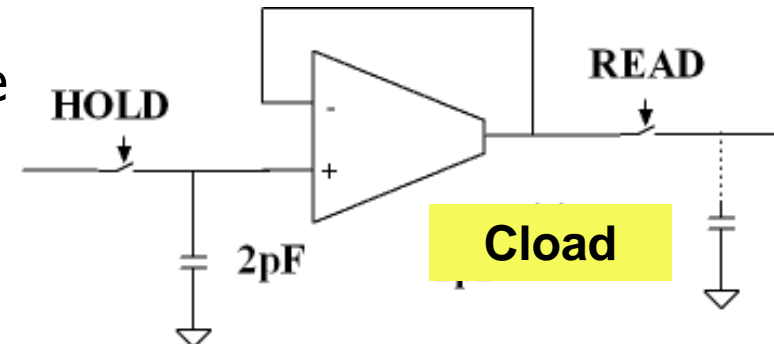
HR2: TH measurement



- $C_{\text{storage}}=2\text{pF}$, Q stored during 1ms.
- $I_{\text{leakage}}=1\text{pA} \Rightarrow dQ=idt=1\text{e-}15\text{C}$ in 1 ms

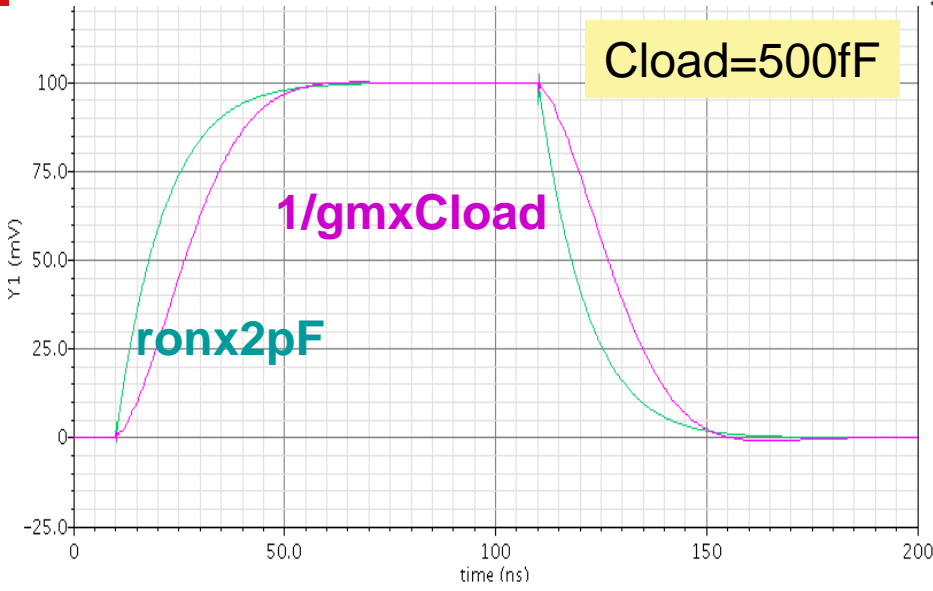
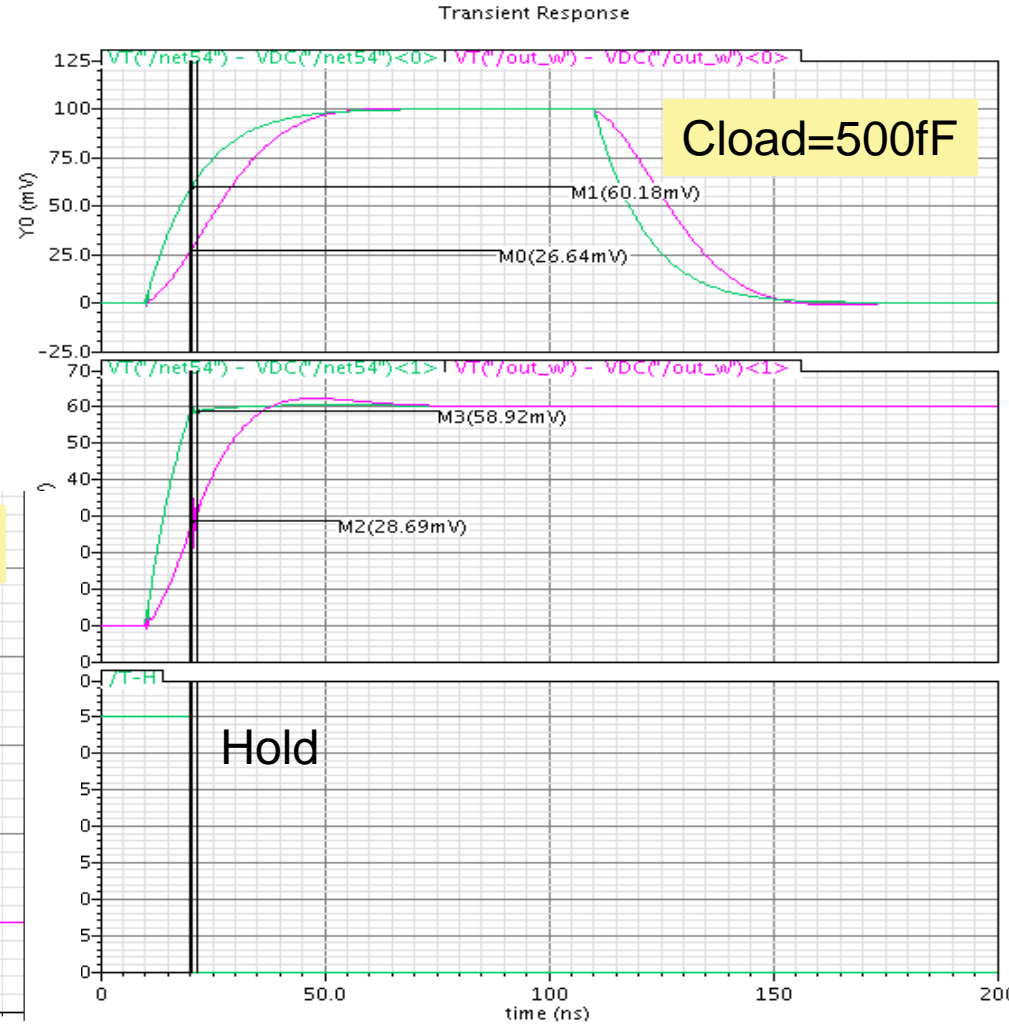
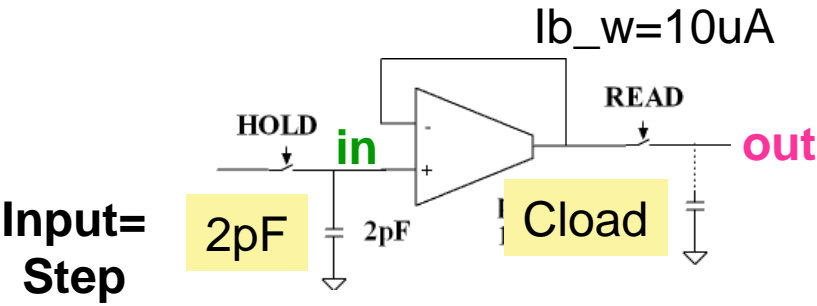
$\Rightarrow dV/dt=1/C$. $dq/dt=1\text{ mV/ms}=1\text{LSB}$

- Nwell connected to in- to reduce the leakage I effect.
 - Measurement
 - $\Rightarrow 10\text{mV}/50\text{s}$ or $200\mu\text{V}/\text{s}$
 - when nwell connected to vdd, $10\text{mV}/\text{s}$
- Nwell connected to in-,
 \Rightarrow equ. to $C_{\text{load}}\approx 1\text{pF}$ on the output of the widlar

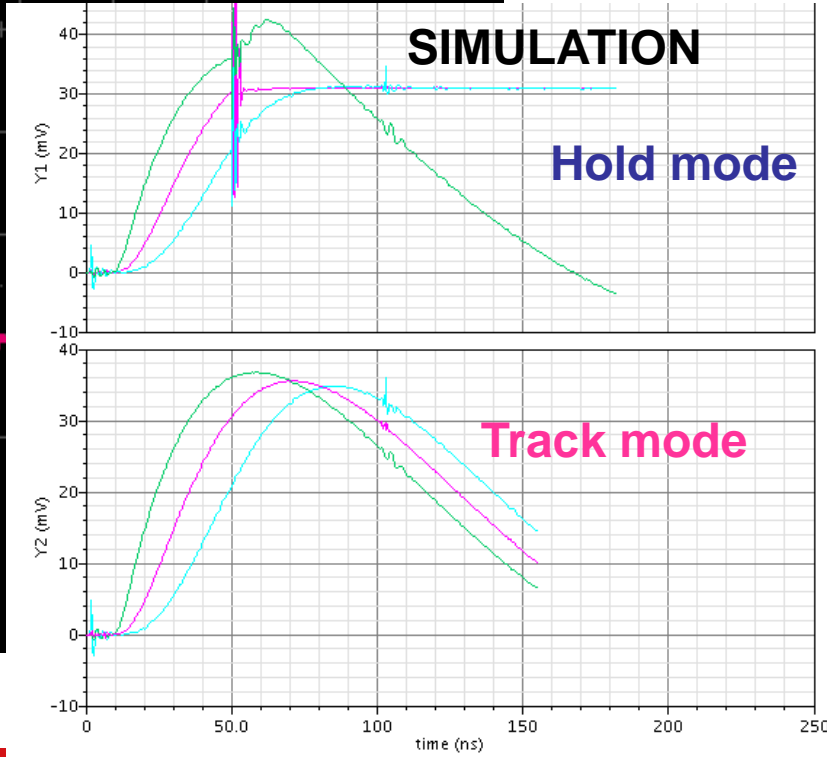
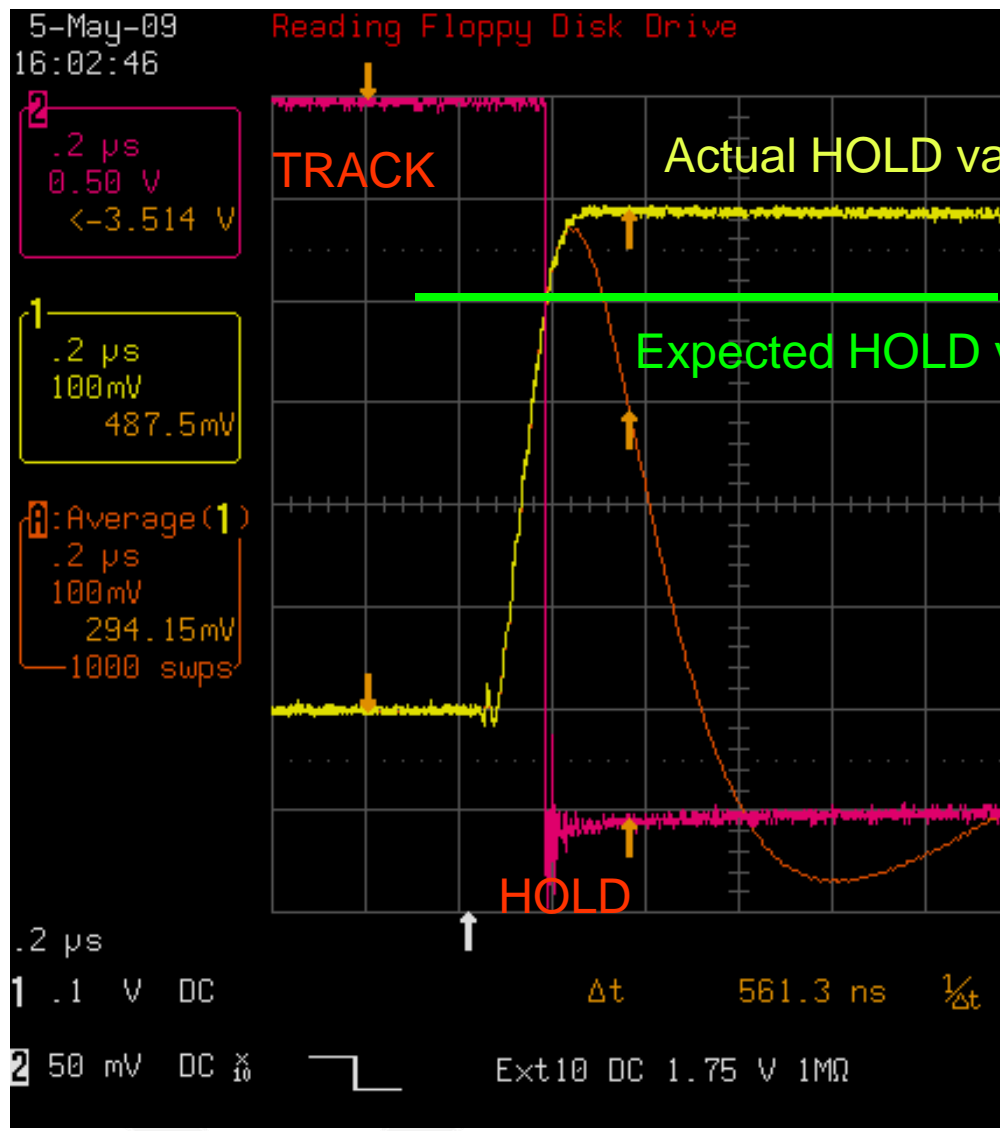


HR2: Effect of Load (simulation)

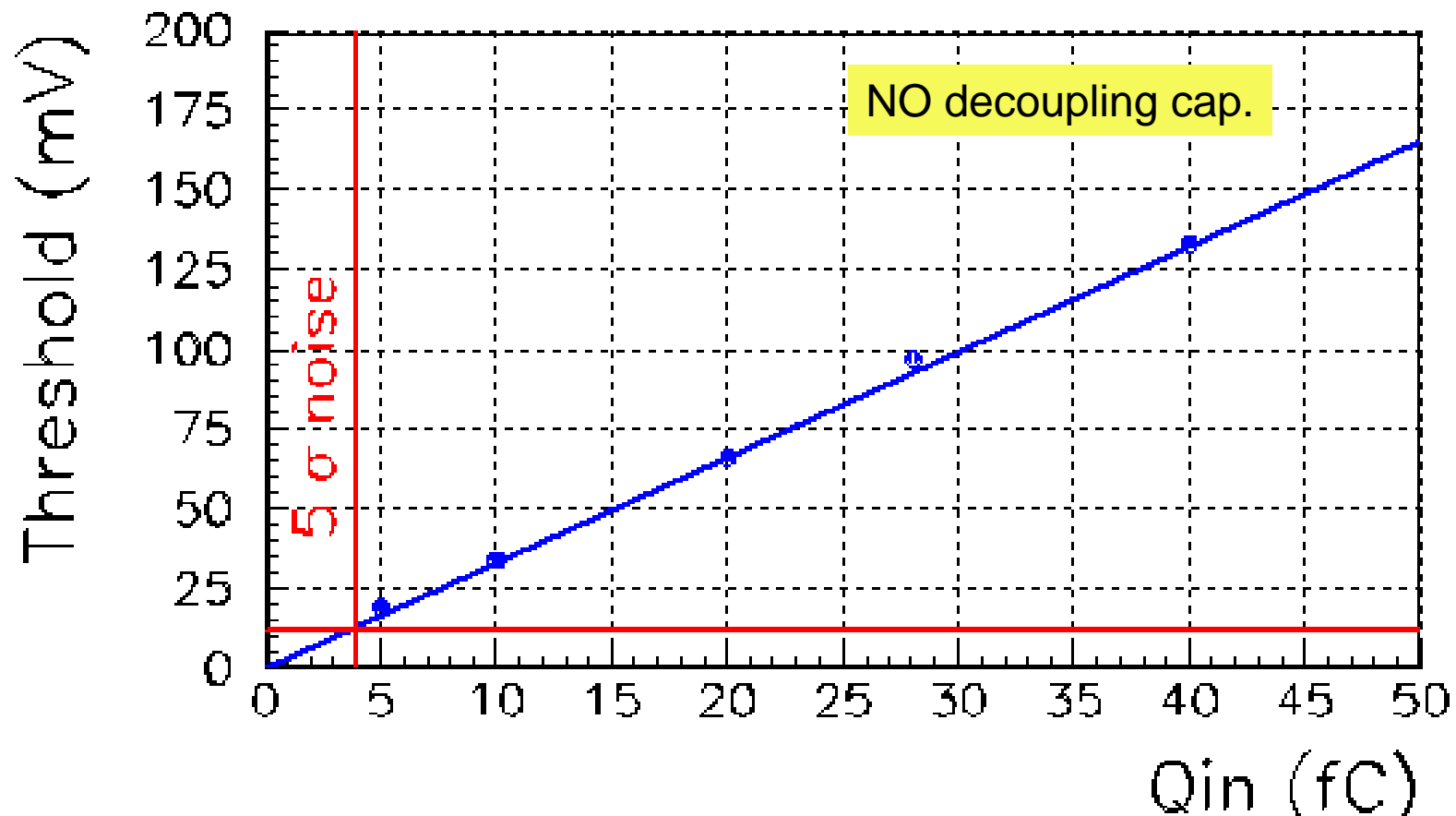
SW= 0.4 and 0.8/0.35 => Ron=5k



HR2: good agreement between sim/meas.



Trigger down to 5fC



- Hardroc2b submitted mid June for a medical application, minor modifications
 - Pinout UNCHANGED
 - Bandgap: offset minimised
 - Read/SC selection bug corrected
 - SC control register: buffers added on the Clk
- Reception: mid september => measurements before production submission
- Production foreseen end 2009 for technological prototypes

- 400 Hardroc2 packaged in plastic TQFP160 at LAL
- Testboard (LAL) + software (Rodolf de La Negra, IPN Lyon) ready
- HR2 chips will equip 24 chips ASU designed for Micromegas and GRPC detectors, to be tested on testbeam (summer 09 and Autumn 09) at CERN

