



# VMM3a for GEM readout status

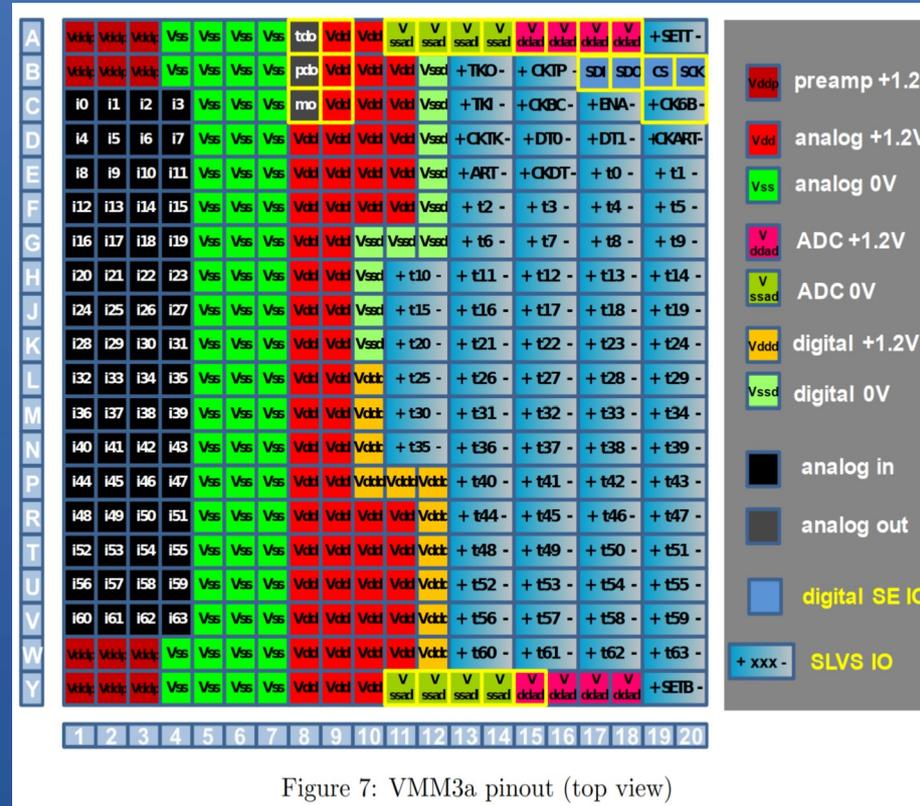
*Vitalii Burtsev on behalf of BM@N collaboration*

4th Collaboration Meeting

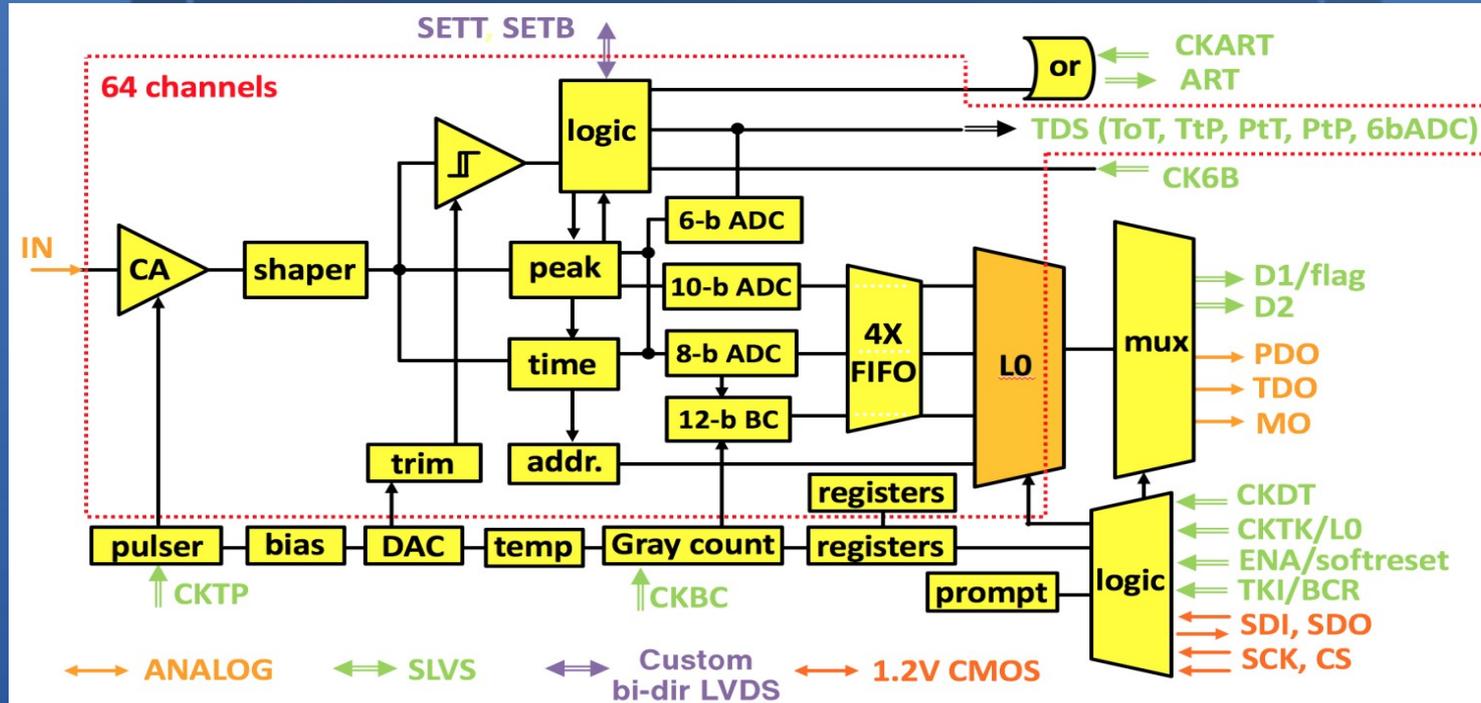
of the BM@N Experiment at the NICA Facility

14 October 2019

# VMM3(a) pinout



# VMM Architecture and highlights

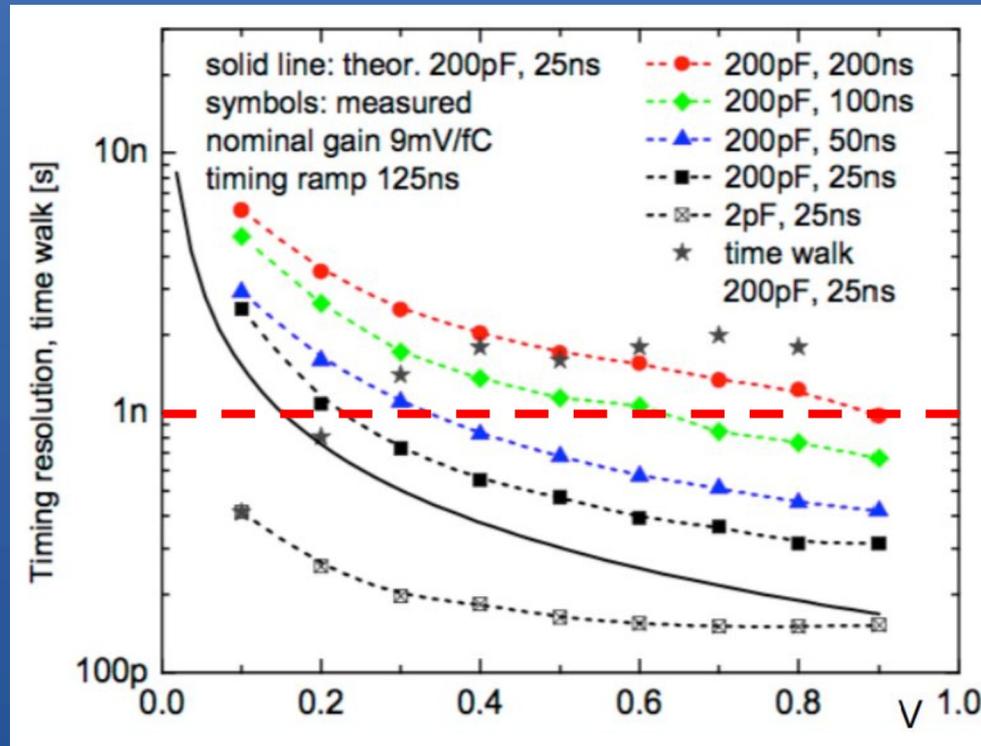


- Peakttime (200, 100, 50, 25 ns)
- Gain (0.5, 1, 3, 4.5, 6, 9, 12, 16 mV/fC)
- Neighbor logic
- Both input charge polarity
- TAC slope adjustment (60, 100, 350, 650 ns)
- Low power 10mW/ch
- 64 input ch/ASIC

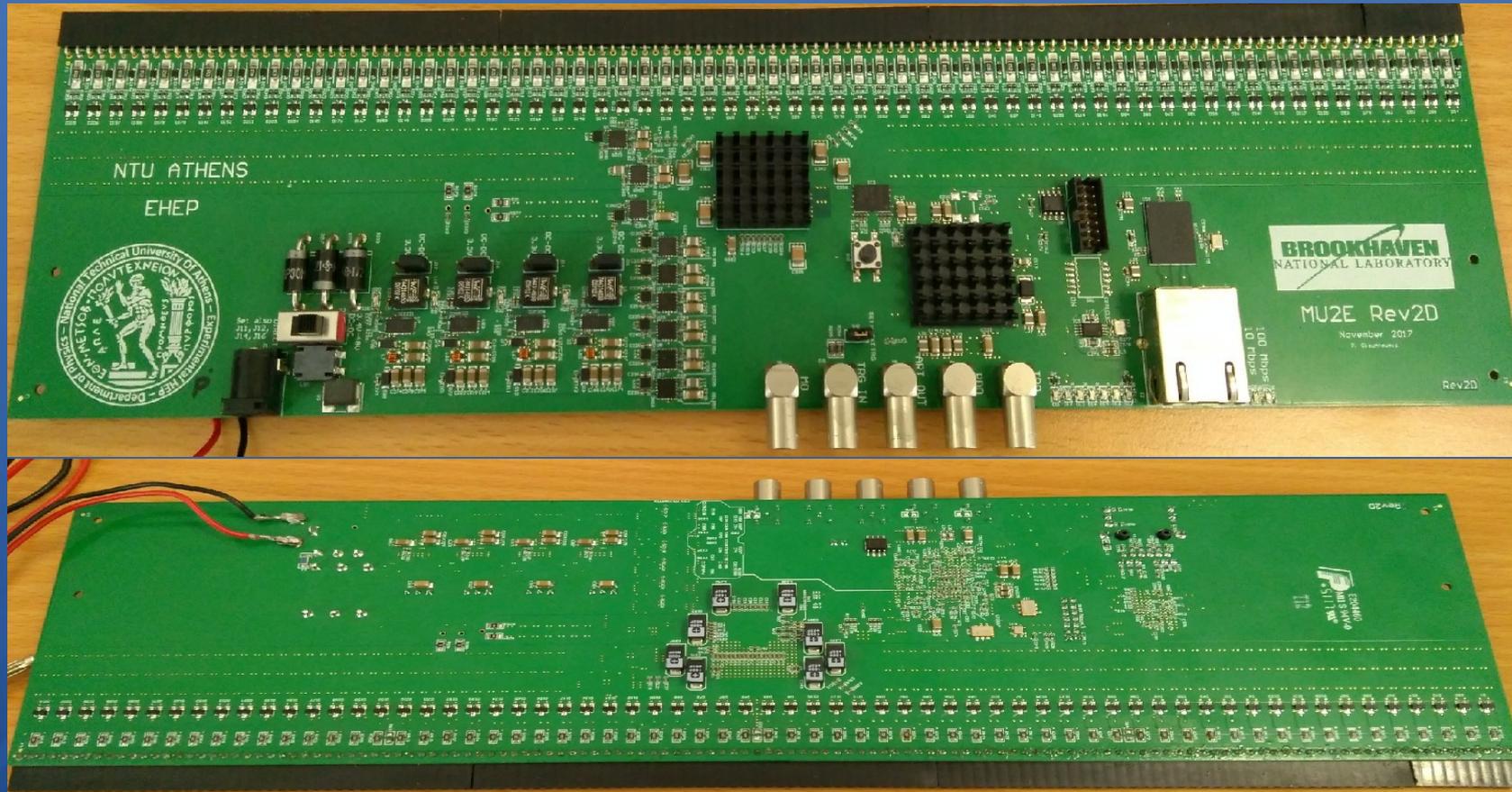
# Viking and VMM3a chip comparison

	VMM3a	VA162	VA163
Input channels	64	32	32
Input charge	-2 to 2 pC	-1.5 pC to +1.5 pC	-750fC to +750 fC
Shaping time	25 to 200 ns	2 to 2.5 us	500 us
Noise	500e ENC at 25pF	2000e ENC at 50 pF	1797e ENC at 120pF
Gain	0.5 to 16 mv/fC	0.5 uA/fC	0.88 uA/fC
Total power max	640mW	66mW	77mW

# VMM3a time resolution



# VMM3 based CSC readout



# VERSO GUI

The screenshot displays the VERSO v4.4.0 GUI interface. The window title is "VERSO - v4.4.0".

**Run Status:** Includes buttons for "Start Run", "Stop Run", "Calibration", "Monitor", and "DataFlow". It also shows "Run # 0", "Write Ntuple" (checked), "Write Raw", and "VMM2", "VMM3", "LO R/O" options.

**Setup:** Shows the configuration file path: `/home/azzz/Downloads/20180723_testConfig_board103_cosmic_tailCancellation.xml` and the output directory: `/home/azzz`.

**Counters:** Displays "Triggers 0", "Hits 0", "Event Stop -1", and "Tree Flush -1".

**Communication:** Shows "Open Communicati" with "All Boards Alive" and "IPv4: 192.168.0.2 # FEBs 1".

**Configure:** Includes "FEB Select" (All) and "VMM Select" (1-8).

**Trigger:** Shows "Latency 128 x6.25ns", "Lat. Extra CKBC 88 x6.25ns", "Dead Time 65535 x8ns", and "# CKBC ART T/O 6 x24".

**Mode:** Includes "Pulser", "External", and "Fixed Window" buttons.

**Acquisition:** Includes "ACQ On" and "ACQ Off" buttons.

**CKTK & CKBC:** Shows "CKTK Max 7" and "CKBC Freq. (M) 40".

**CKTP:** Shows "Number of Pulses to S-Skew (steps) 0 x1ns", "Period 30000 x200ns", and "Width 4 x500ns".

**Monitor Sampling:** Set to 50.

**Incidence Angle:** Set to 0.

**Buttons:** "FPGA Reset" and "VMM Hard Reset".

**Messages:** The "Message Reportin" section shows the following log output:

```
VERSO Info      Waiting for open communication with FEB...
VERSO Info      Setting configuration file to:
VERSO Info      /home/azzz/Downloads/20180723_testConfig_board103_cosmic_tailCancellation.xml
VERSO Info      Configuration loaded successfully
SocketHandler::loadIPList Loaded 1 IP address(es):
SocketHandler::loadIPList > 192.168.0.2
VERSO Info      Ping successful
SocketHandler::addSocket VMMSocket added:
VMMSocket::Print      Name      : FEC
VMMSocket::Print      Bound to port : 6007
VMMSocket::Print      Status    : 4
```

The "Messages" tab also includes sub-tabs for "Global Registers 1", "Global Registers 2", "Channel Registers", "Calibration", and "Set IP".

# Global registers

VERS0 - v4.4.0

Run Status: Start Run, Stop Run, Calibration, Monitor, DataFlow

Run #: 0

Write Ntuple:  Write Raw:  VMM2:  VMM3:  LO R/O:

Counters: Triggers: 0, Hits: 0, Event Stop: -1, Tree Flush: -1

Communication: All Boards Alive

Configure: FEB Select: All, VMM Select: 1

Trigger: Latency: 128, Lat. Extra CKBC: 88, Dead Time: 65535, # CKBC ART T/O: 6

Mode: Pulser, External, Fixed Window

Acquisition: ACQ On, ACQ Off

CKTK & CKBC: CKTK Max: 7, CKBC Freq. (M): 40

CKTP: Number of Pulses to Skew (steps): 0, Width: 4

Monitor Sampling: 50, Incidence Angle: 0

FPGA Reset, VMM Hard Reset

Setup: /home/azzz/Downloads/20180723\_testConfig\_board103\_cosmic\_tailCancellation.xml

Output: /home/azzz

Messages: Global Registers 1, Global Registers 2, Channel Registers, Calibration, Set IP

Global Configuration Registers

Test Pulse DAC [sdp10]: 0, Ch. Polarity [sp]: Positive, Ch. Gain [sg]: 3.0 mV/fC, Peak Time [st]: 200 ns

Threshold DAC [sdt10]: 380, Neighbor Logic [sng]: Enabled, TAC Slope Adj. [stc]: 60 ns, Sub-hysteresis [ssh]: Disabled

Leakage Curr. [slg]: Enabled, An. Tristates [sdrv]: Disabled, Dyn. Discharge [sfm]: Enabled, Dis. at Peak [sdp]: Disabled

Monitor Multiplexing: Ch. Monitor [sm5-sm0]: 0, Monitor Mode [scmx]: Enabled (Channel), Route to PDO Output [sbmx]: Disabled

Analog Buffer: TDO analog output [sbft]: Disabled, PDO analog output [sbfp]: Disabled, MO analog output [sbfm]: Disabled

ADC Enable: 6-bit mode [s6b]: Disabled, 8-bit mode [s8b]: Disabled, Hi. Res. (10-bit/8-bit) [s10b]: Enabled

Direct Timing Output: Enable [sttt]: Disabled, Mode: TtP (Thresh-to-P), [stpp]: 0, [stot]: 0

Address in Real Time (ART): Enable ART [sfa]: Enabled, Detect Mode [sfam]: Timing at Threshold

ADC Conversion: 10-bit time [sc10b]: 200 ns, 8-bit time [sc8b]: 100 ns, 6-bit time [sc6b]: Low

Dual Clocks Enable: Data [sdcks]: Disabled, ART [sdcka]: Disabled, 6-bit [sdck6b]: Disabled

# Global registers

VERSO - v4.4.0

Run Status: Run # 0, Start Run, Stop Run, Calibration, Monitor, DataFlow, Write Ntuple, Write Raw, VMM2, VMM3, LO R/O

Setup: /home/azzz/Downloads/20180723\_testConfig\_board103\_cosmic\_tailCancellation.xml, Output: /home/azzz

Messages: Global Registers 1, Global Registers 2, Channel Registers, Calibration, Set IP

Global Configuration Registers

Direct Out I/Os [slvs] Disabled, ART flag sync. [ssart] Disabled, Skip Channels 16-47 [s32] Disabled, Tail cancellation [stlc] Enabled, Fast recovery [srec] Disabled, Bipolar shape [sbip] Disabled, Auto-reset [stcr] Disabled, Reset at 6b compl. [sfrst] Disabled, Time ramp at thresh. [srat] Disabled

100 Ohm SLVS Termination

On CKBC [slvsbc] Disabled, On CKTP [slvstp] Disabled, On CKTK [slvstk] Disabled, On CKDT [slvsdt] Disabled, On CKART [slvsart] Disabled, On CKTKI [slvstki] Disabled, On CKENA [slvsena] Disabled, On CK6b [slvs6b] Disabled

L0

L0 core [sL0ena] Disabled (Reset), Mixed signals in L0 [sL0enaV] Disabled, L0 BC offset [l0offset] (0-4095) 4060, Ch. tagging BC offset [offset] (0-4095) 0, Ch. tagging BC rollover [roll] (0-4095) 4095, Trig. window size [window] (0-7) 7, Max hits per L0 [truncate] (0-63) 63, # L0 to skip on overflow [nskip] (0-127) 0, Clocks w/ L0 disabled [sL0cktest] Disabled, Invert BCCLK [sL0ckinv] Disabled, Invert DCK [sL0dckinv] Disabled, BCID skip [nskipm] Disabled

Configuration Reset

Hard Reset [reset] Disabled

Counters: Triggers 0, Hits 0, Event Stop -1, Tree Flush -1

Communication: Open Communication All Boards Alive, IPv: 192.168.0.2 # FEBs 1

Configure: FEB Select All, VMM Select 1-8

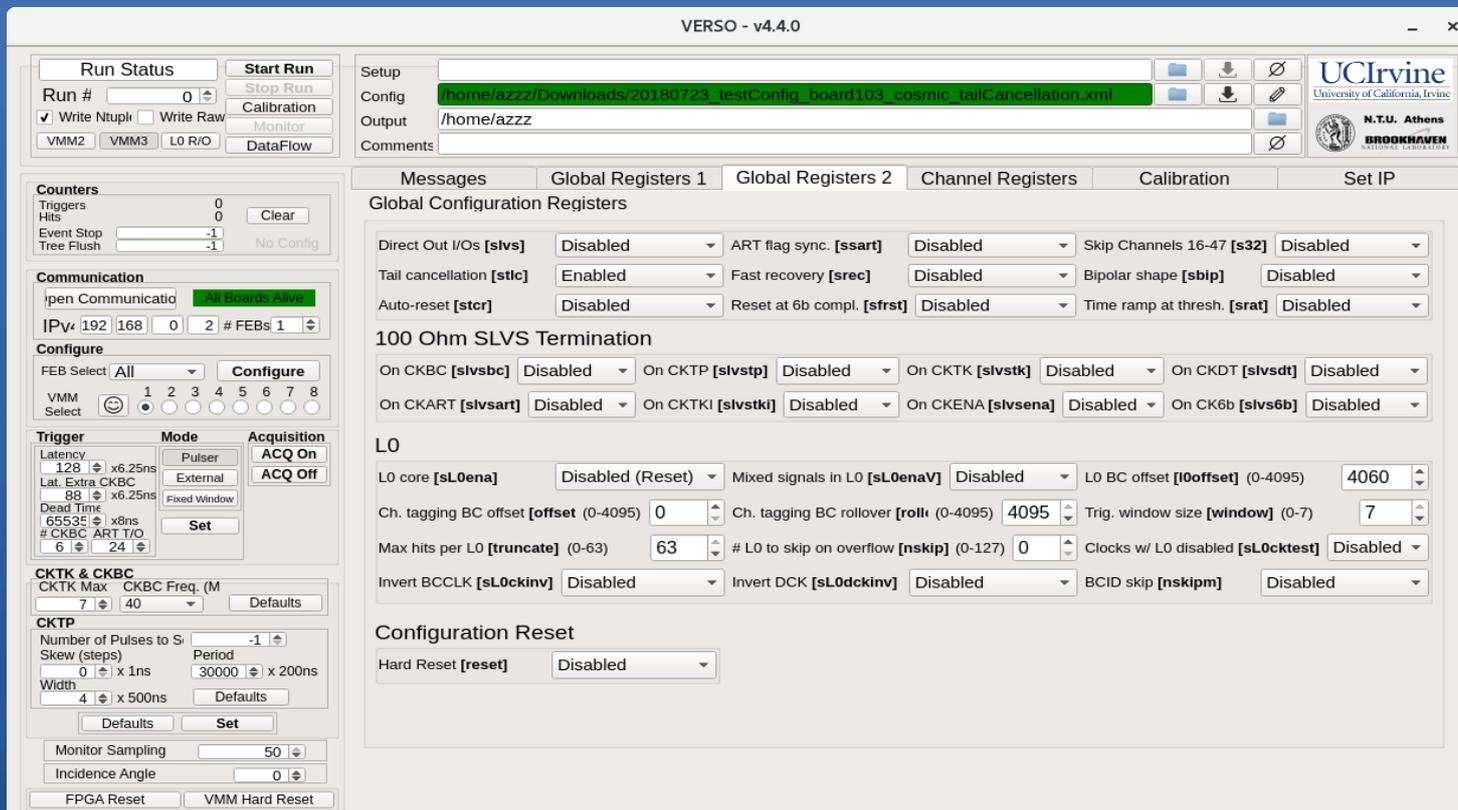
Trigger: Latency 128 x6.25ns, Lat. Extra CKBC 83 x6.25ns, Dead Time 65535 x8ns, # CKBC ART T/O 6 x24

Mode: Pulsar, External, Fixed Window, ACQ On, ACQ Off, Set

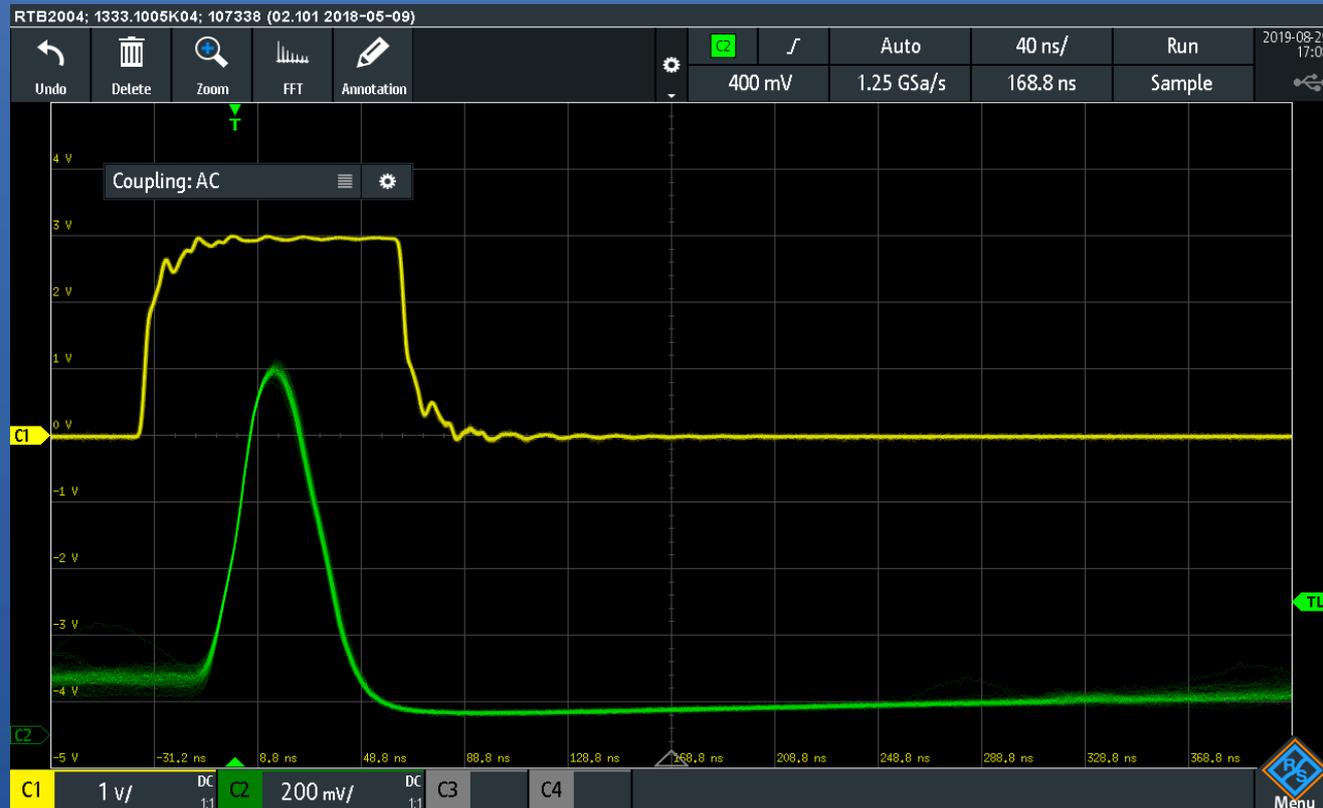
CKTK & CKBC: CKTK Max 7, CKBC Freq. (M) 40

CKTP: Number of Pulses to S -1, Skew (steps) 0 x 1ns, Period 30000 x 200ns, Width 4 x 500ns

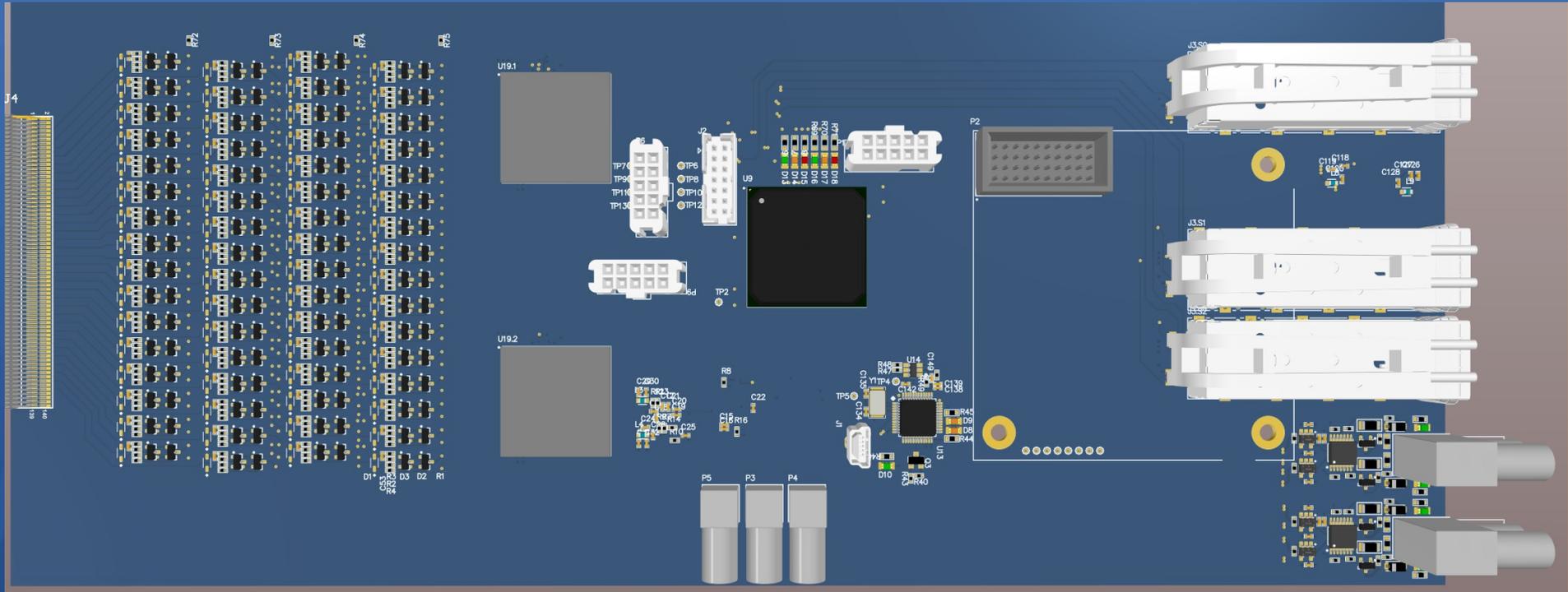
Monitor Sampling 50, Incidence Angle 0, FPGA Reset, VMM Hard Reset



# Trigger and MO signal



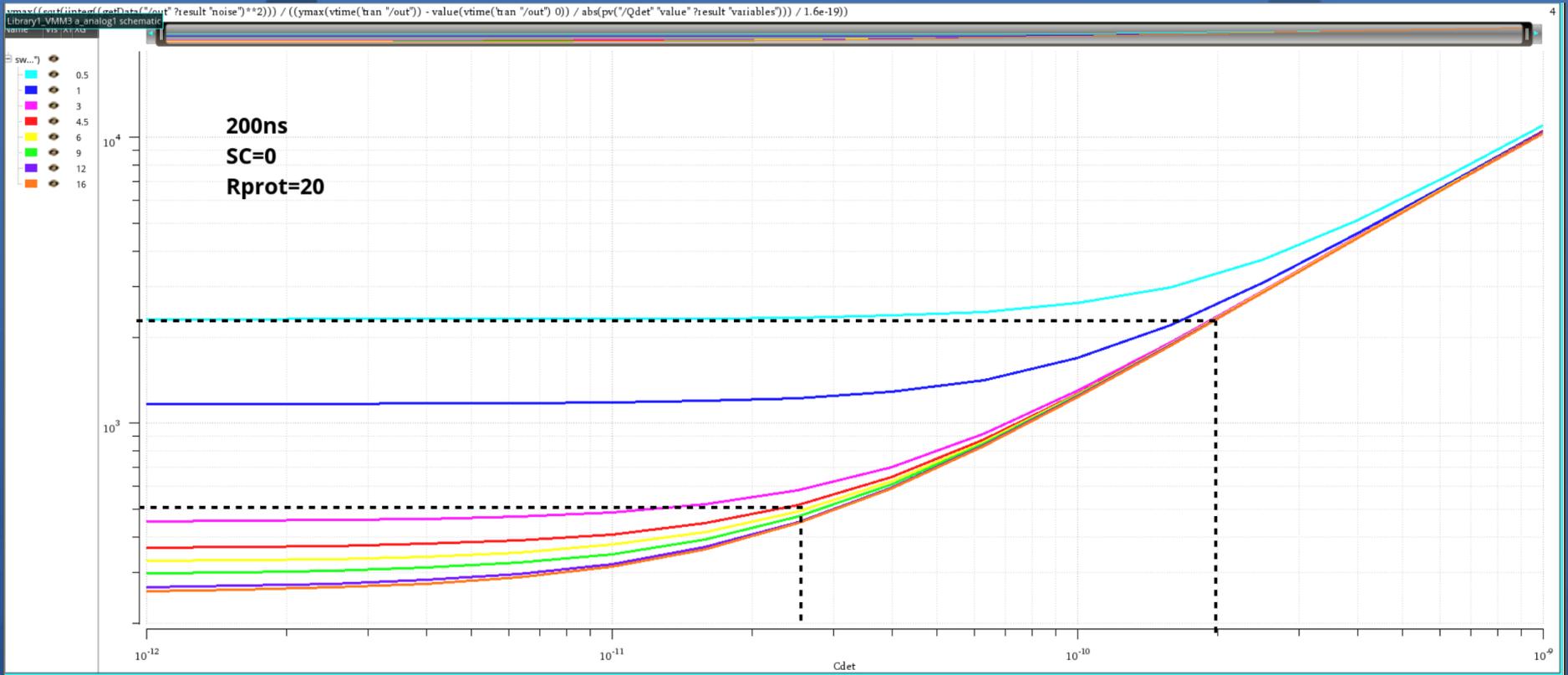
# Kintex7 based 128ch GEM evaluation board





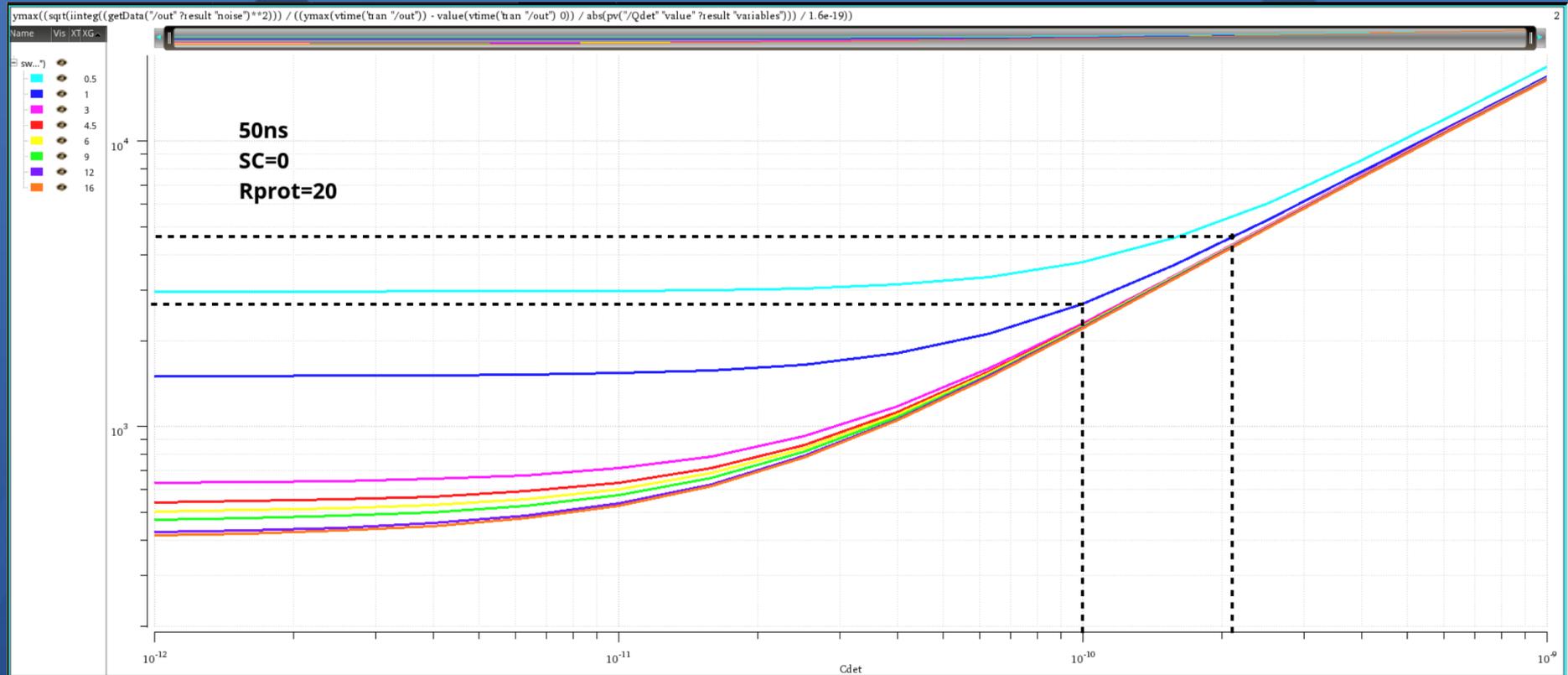
THANK YOU FOR YOUR  
ATTENTION

# ENC at 200ns



ENC with 200pF is  $\sim 2.1\text{ke}$ , 25pF is  $\sim 500\text{e}$

# ENC at 50ns



ENC with 220pF and 50ns is ~4.5ke and for 100pF is 2.8ke

# The analog pedestal distribution versus the channel

