

Detector Capacitance

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We did some measurements in the lab today in order to baseline for the new Amplifier of Mitch.

These confirm the original picture that motivated work on the new transimpedance preamp starting a year ago.

But it's been valuable to do direct comparisons to confirm that there is a significant effect on rise time and amplitude due apparently to the larger detector capacitance of the $8 \times 8 \text{ mm}^2$ vs. the $2 \times 2 \text{ mm}^2$ APDs (nominal capacitance is $\sim 0.9 \text{ pF/mm}^2$).

Cp. what we presented at ACES last year about the preamp:

<https://indico.cern.ch/event/287628/session/9/contribution/65/material/poster/1.pdf>

yellow trace is preamp output of Wenteq. Left figure is 2x2 mm APD and right is 8x8mm. Both from Vcsel, 1750 V.



Acquisition: Sampling Mode real time, Normal
Bandwidth Manual 500 MHz
Analog Memory Depth automatic 1.002 kpts, Digital 102 pts
Analog Sampling Rate automatic 20.0 GSa/s, Digital automatic 2.00 GSa/s
Analog Averaging on, Averages 1024, Interpolation Auto

Channel 1: Scale 100 mV/, Offset -270.6 mV, Skew 0.0 s
Coupling DC, Impedance 50 Ω , Bandwidth Limit 500.000 MHz

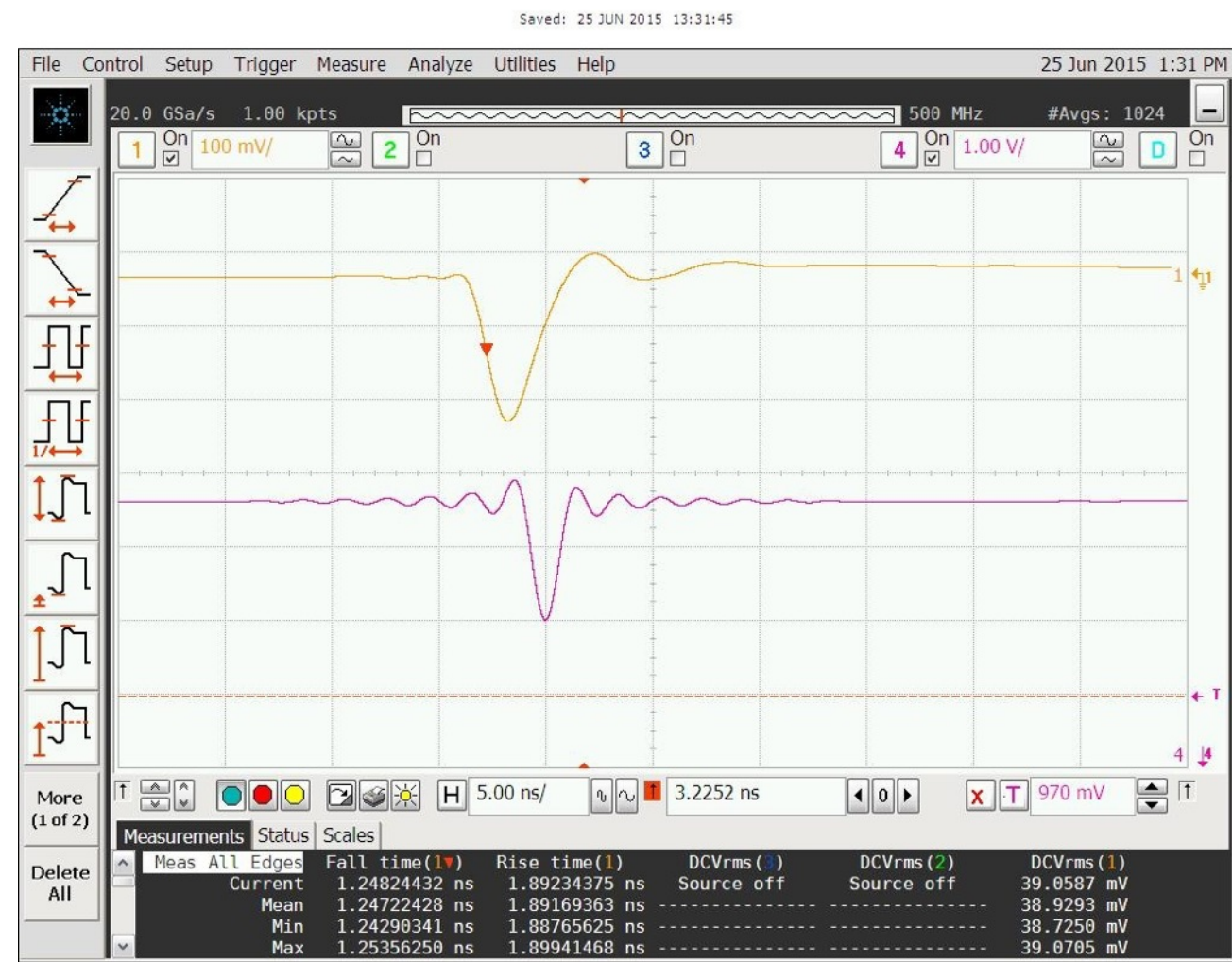
Channel 4: Scale 1.00 V/, Offset 4.00 V, Skew 0.0 s
Coupling DC, Impedance 50 Ω , Bandwidth Limit 500.000 MHz

Horizontal: Scale 5.00 ns/, Position 3.2252 ns, Reference center

Trigger: Mode edge, Source Channel 4, Level 970 mV, Slope falling
Sweep triggered, Sensitivity normal, Holdoff Time 100 ns

Measure:

Meas	All	Edges	Rise time(1)	DCVrms(3)	DCVrms(2)	DCVrms(1)	Rise time(2)
Current			1.09554438 ns	Source off	Source off	88.0193 mV	Source off
Mean			1.09427343 ns			88.0183 mV	
Min			1.02448438 ns			87.8962 mV	
Max			1.09672163 ns			89.0321 mV	
Range (Max-Min)			72.23726 ps			1.13595 mV	
Std Deviation			2.6540014 ps			74.0727 μ V	
Number of Meas			2.655 k			2.655 k	
Meas Window			All Data			All Data	
Drag&Drop Time							
Edge Direction			Rising			Rising	



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Analog Averaging on, Averages 1024, Interpolation Auto

Channel 1: Scale 100 mV/, Offset -270.6 mV, Skew 0.0 s
Coupling DC, Impedance 50 Ω , Bandwidth Limit 500.000 MHz

Channel 4: Scale 1.00 V/, Offset 4.00 V, Skew 0.0 s
Coupling DC, Impedance 50 Ω , Bandwidth Limit 500.000 MHz

Horizontal: Scale 5.00 ns/, Position 3.2252 ns, Reference center

Trigger: Mode edge, Source Channel 4, Level 970 mV, Slope falling
Sweep triggered, Sensitivity normal, Holdoff Time 100 ns

Measure:

Meas	All	Edges	Fall time(1)	Rise time(1)	DCVrms(3)	DCVrms(2)	DCVrms(1)
Current			1.24824432 ns	1.89234375 ns	Source off	Source off	39.0587 mV
Mean			1.24722428 ns	1.89169363 ns			38.9293 mV
Min			1.24290341 ns	1.88765625 ns			38.7250 mV
Max			1.25356250 ns	1.89941468 ns			39.0705 mV
Range (Max-Min)			10.65909 ps	11.75843 ps			345.575 μ V
Std Deviation			2.7030990 ps	3.1138574 ps			101.364 μ V
Number of Meas			2.856 k	2.856 k			2.856 k
Meas Window			All Data	All Data			All Data
Drag&Drop Time							
Edge Direction			Falling	Rising			

Same as previous slide using Cividec amplifier



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Bandwidth Manual 500 MHz
Analog Memory Depth automatic 1.002 kpts, Digital 102 pts
Analog Sampling Rate automatic 20.0 GSa/s, Digital automatic 2.00 GSa/s
Analog Averaging on, Averages 1024, Interpolation Auto

Channel 1: Scale 100 mV/, Offset 202.0 mV, Skew 0.0 s
Coupling DC, Impedance 50 Ω , Bandwidth Limit 500.000 MHz

Channel 4: Scale 1.00 V/, Offset 1.64 V, Skew 0.0 s
Coupling DC, Impedance 50 Ω , Bandwidth Limit 500.000 MHz

Horizontal: Scale 5.00 ns/, Position 3.2252 ns, Reference center

Trigger: Mode edge, Source Channel 4, Level 970 mV, Slope falling
Sweep triggered, Sensitivity normal, Holdoff Time 100 ns

Measure:

Meas	All	Edges	Rise time(1v)	DCVrms(3)	DCVrms(2)	DCVrms(1)	Rise time(2)
Current			857.46023 ps	Source off	Source off	46.9457 mV	Source off
Mean			858.749451 ps			46.9295 mV	
Min			840.85464 ps			46.8308 mV	
Max			878.88452 ps			49.3115 mV	
Range (Max-Min)			38.02988 ps			2.48067 mV	
Std Deviation			2.2100641 ps			209.871 μ V	
Number of Meas			5.112 k			5.112 k	
Meas Window			All Data			All Data	
Drag&Drop Time							
Edge Direction			Rising			Rising	



Acquisition: Sampling Mode real time, Normal
Bandwidth Manual 500 MHz
Analog Memory Depth automatic 1.002 kpts, Digital 102 pts
Analog Sampling Rate automatic 20.0 GSa/s, Digital automatic 2.00 GSa/s
Analog Averaging on, Averages 1024, Interpolation Auto

Channel 1: Scale 100 mV/, Offset -36.7 mV, Skew 0.0 s
Coupling DC, Impedance 50 Ω , Bandwidth Limit 500.000 MHz

Channel 4: Scale 1.00 V/, Offset 4.00 V, Skew 0.0 s
Coupling DC, Impedance 50 Ω , Bandwidth Limit 500.000 MHz

Horizontal: Scale 5.00 ns/, Position 3.2252 ns, Reference center

Trigger: Mode edge, Source Channel 4, Level 970 mV, Slope falling
Sweep triggered, Sensitivity normal, Holdoff Time 100 ns

Measure:

Meas	All	Edges	Fall time(1v)	Rise time(1)	DCVrms(3)	DCVrms(2)	DCVrms(1)
Current			2.26671875 ns	1.31678125 ns	Source off	Source off	20.1339 mV
Mean			2.26798790 ns	1.31579510 ns			20.1288 mV
Min			2.19546875 ns	1.21812500 ns			19.1656 mV
Max			2.38617188 ns	1.35325521 ns			20.1475 mV
Range (Max-Min)			190.70313 ps	135.13021 ps			981.931 μ V
Std Deviation			8.5897515 ps	4.3085381 ps			38.9330 μ V
Number of Meas			3.624 k				3.624 k
Meas Window			All Data				All Data
Drag&Drop Time							
Edge Direction			Falling	Rising			