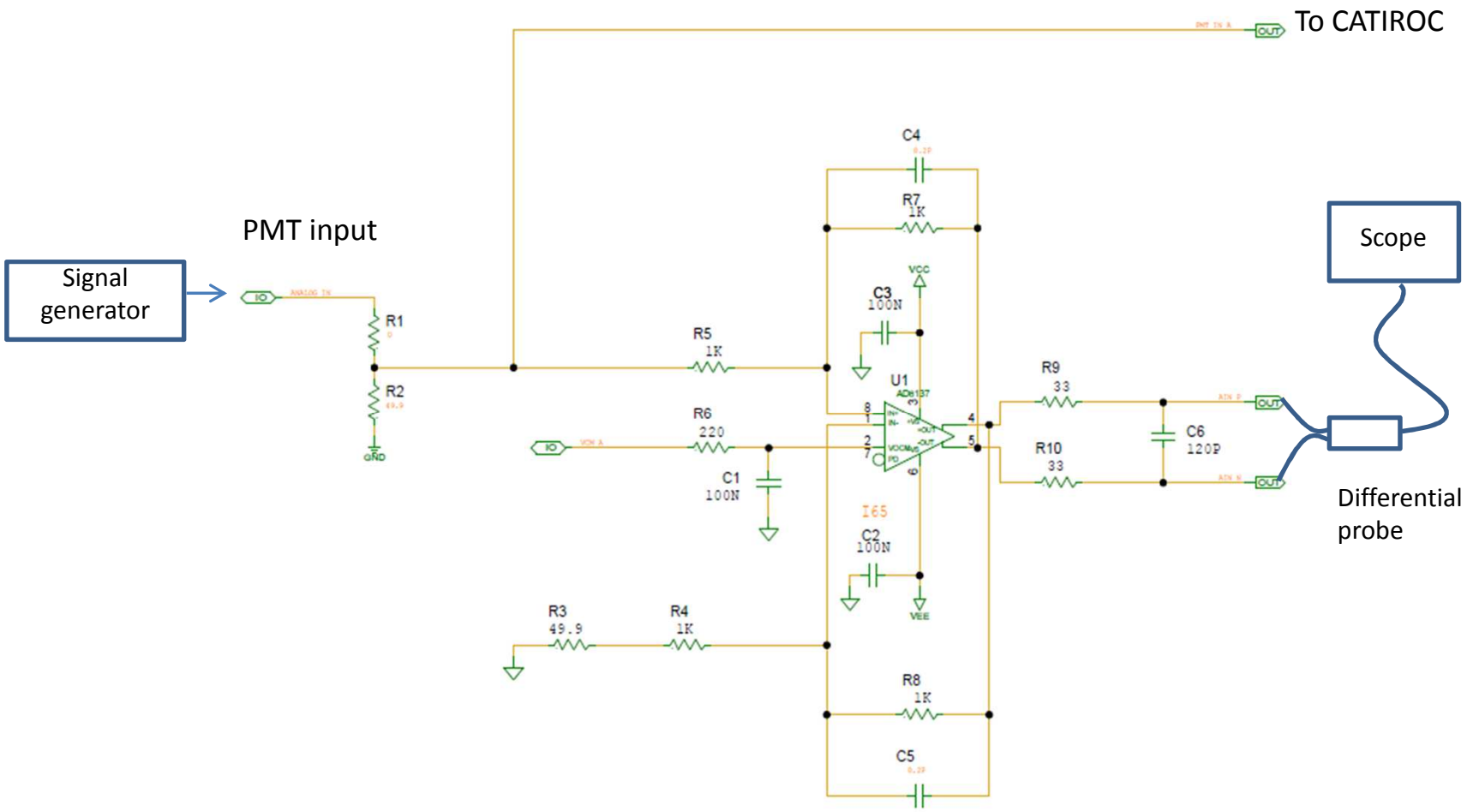
LRO FE Mezzanine tests

Antonio Verdugo de Osa CIEMAT

WA105 Light Detection System phone meeting

30/8/2018

Test setup

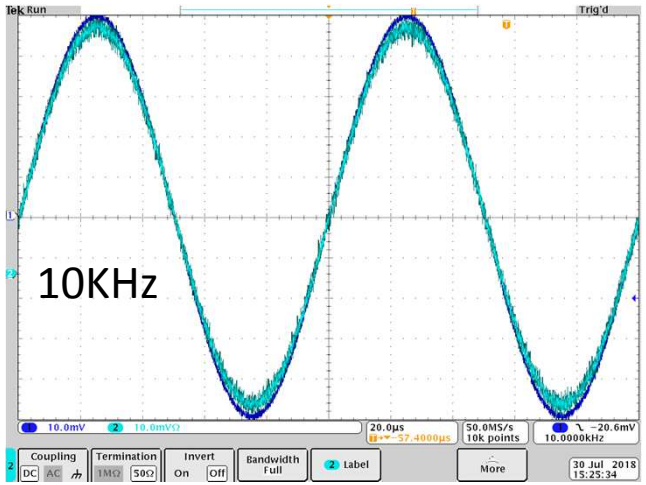


No DAC control available. Only possible tests of the analog input

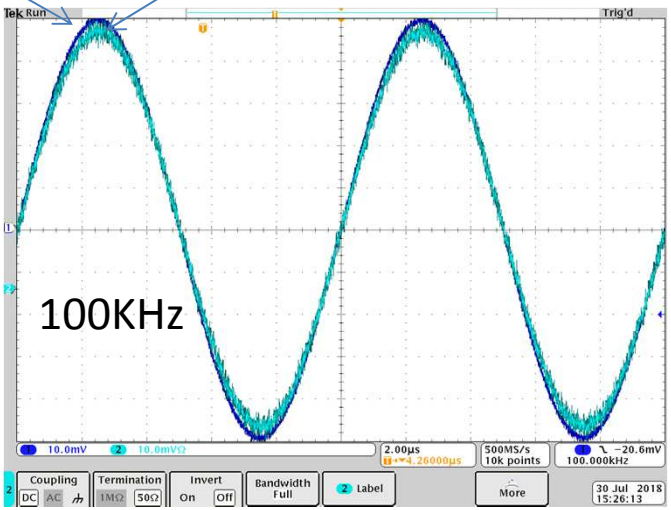
Banwidth tests

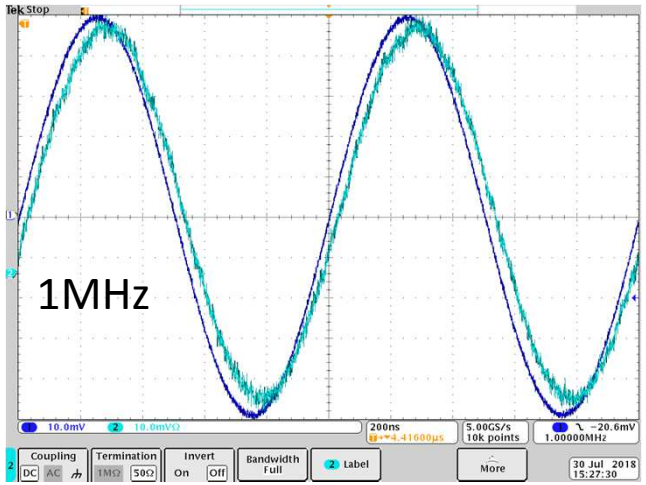
Input signal 100mVpp @ different frequencies

Filter output amplitude around 8% below the expected 1:1 ratio in the pass band

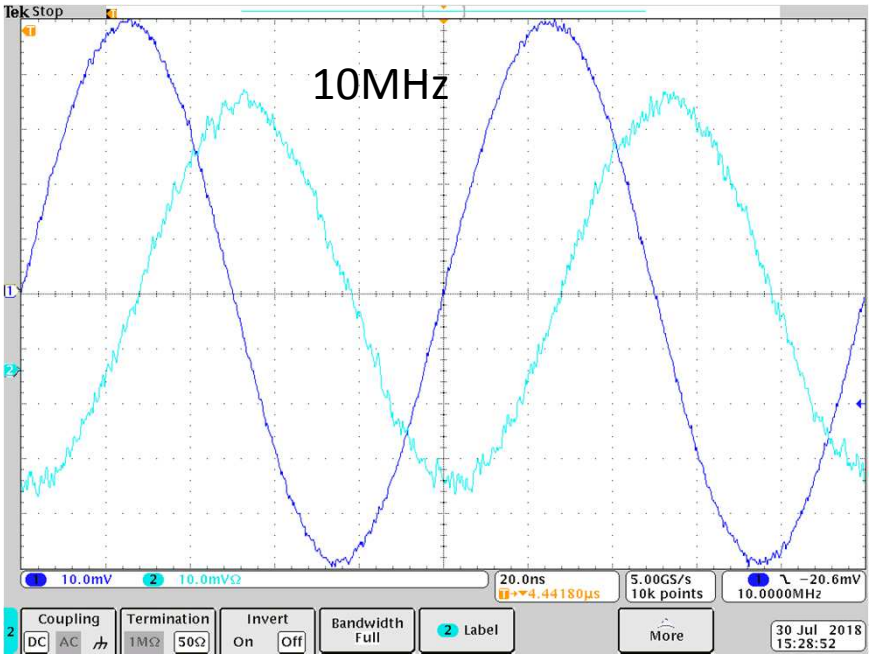


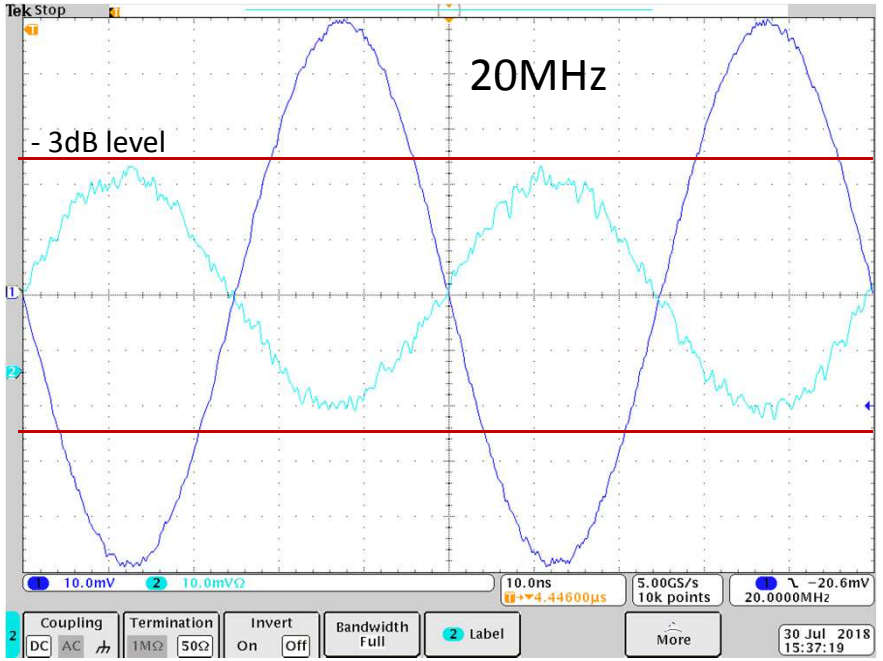
Signal input (generator) Filter output (ADC input)





Banwidth tests



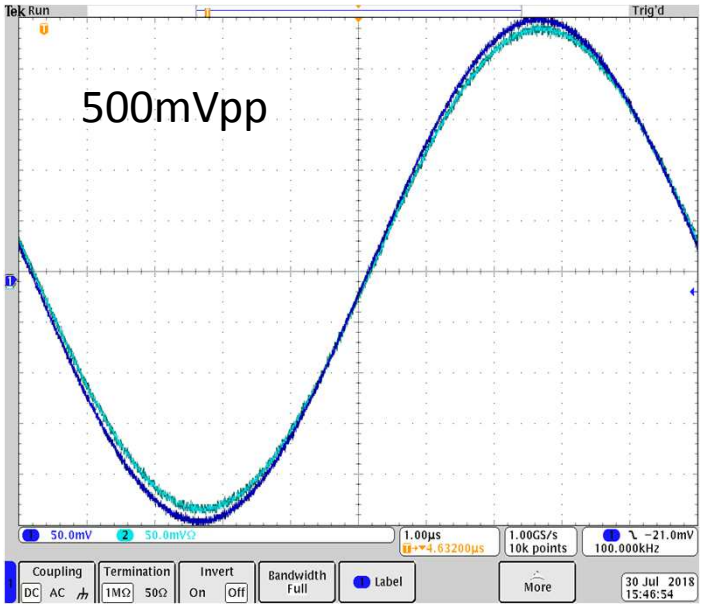


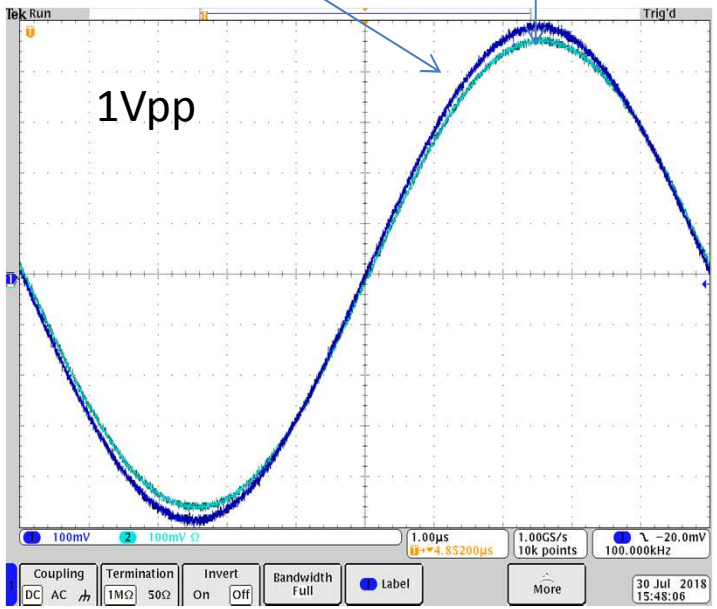
At the cutoff frequency (20MHz) the output signal is about 15% bellow the expected level (-3dB)

Dynamic range tests

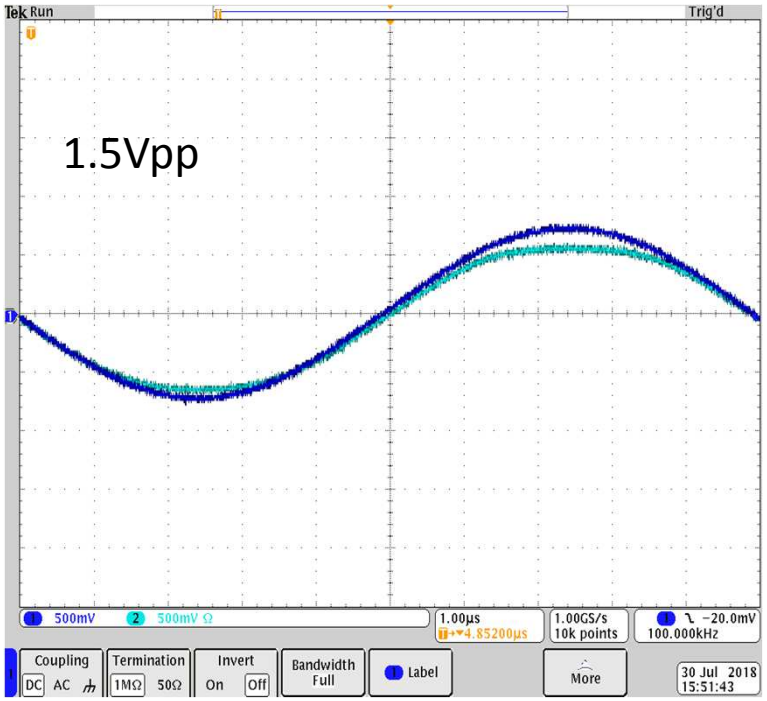
Input signal 100KHz @ different amplitudes

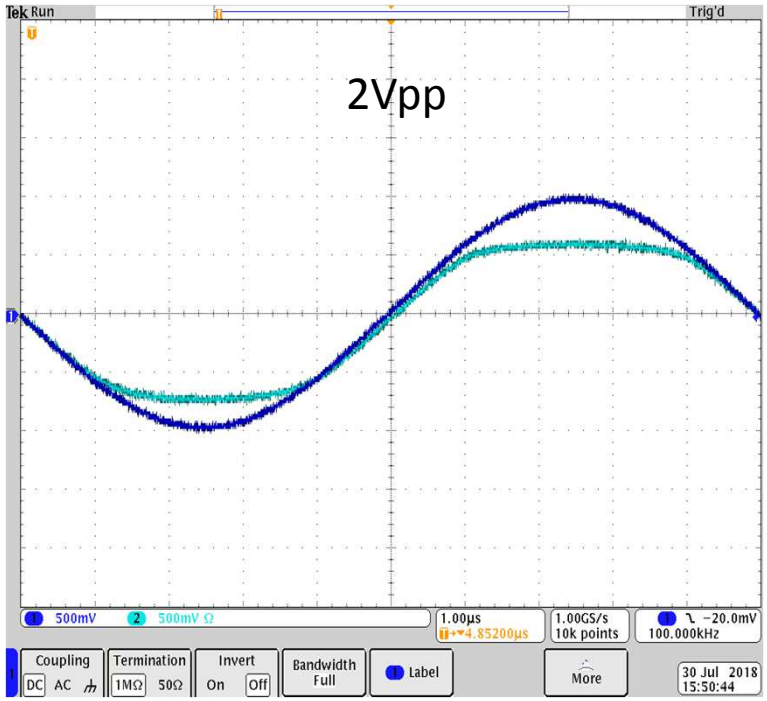
Signal input (generator) Filter output (ADC input)





Dynamic range tests





Saturation levels around +500mV and -700mV.
50% and 30% bellow the expected ±1V

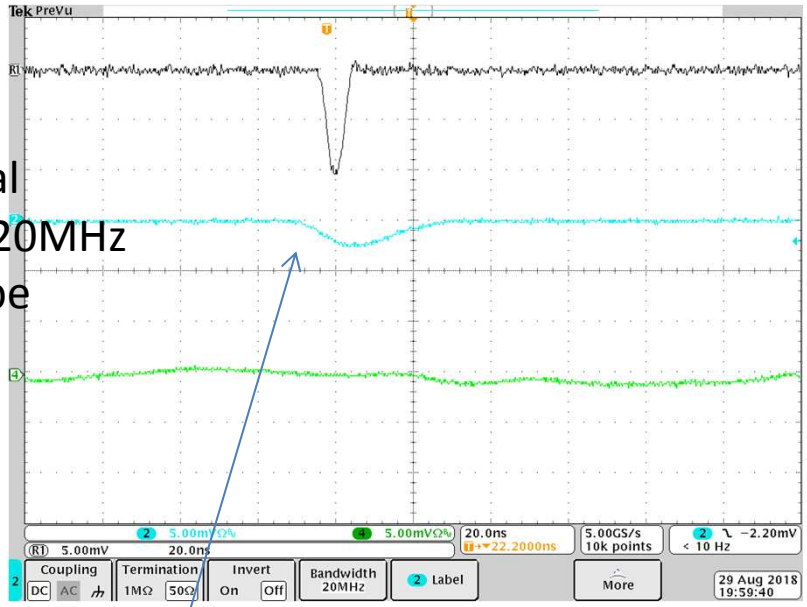
SPE like pulse response

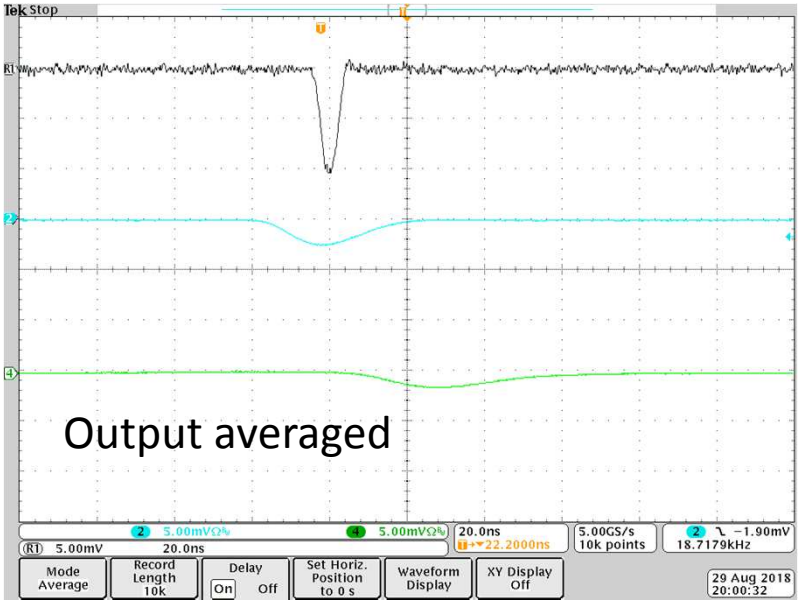
Input signal: 10mVpp pulse with 5ns width, 3ns raise and fall.
Similar shape to the SPE with a PMT gain of 10^7

Input

Input signal filtered @20MHz In the scope

Output

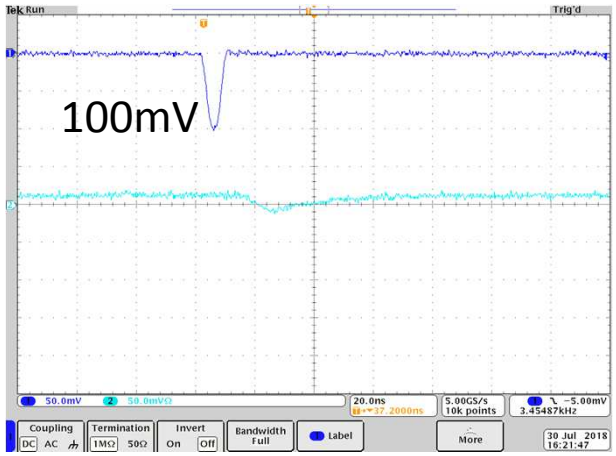


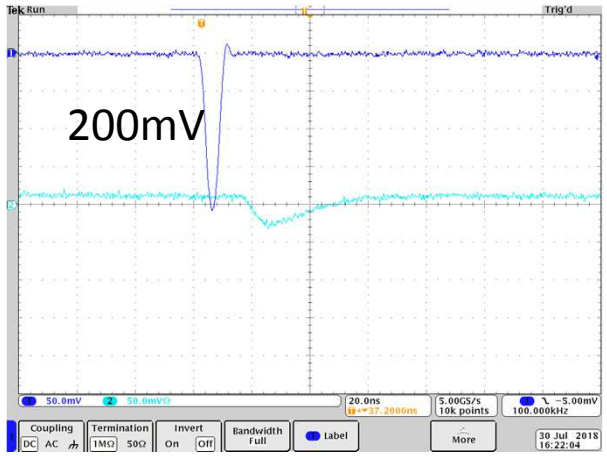


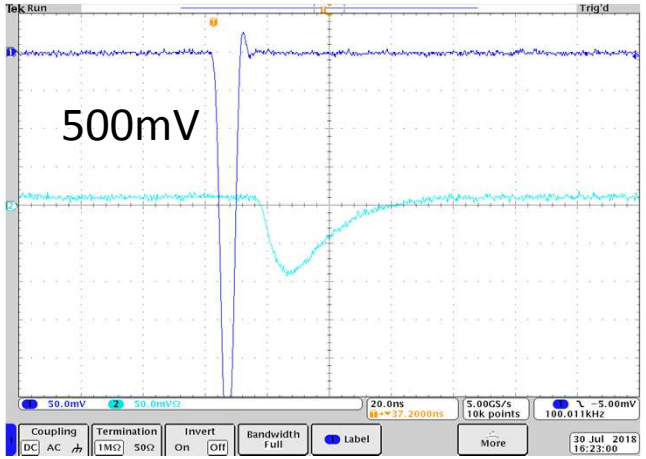
Signal fitered with the scope @20MHz
(what we should see at the FE filter output)

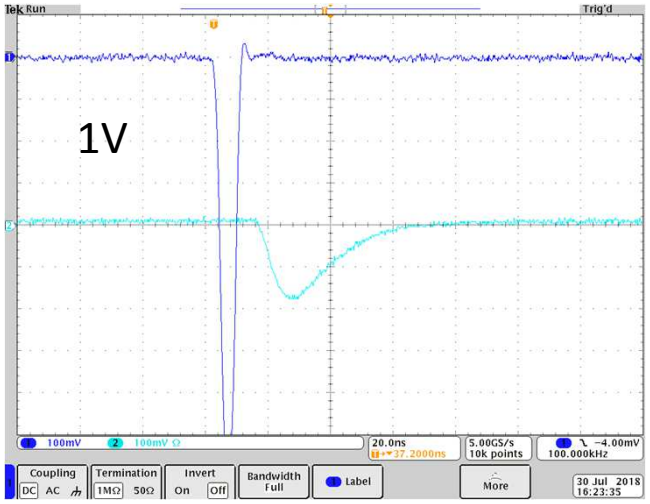
The filter output for input signals bellow 10mV are difficult to distinguish due to the filtering and the noise. It's not possible to trigger on them. Only visible triggering on the input averaging the output signal.

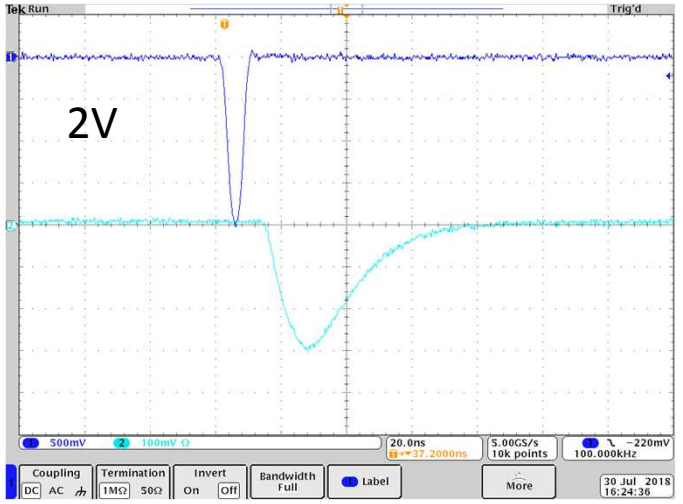
PMT like pulse response











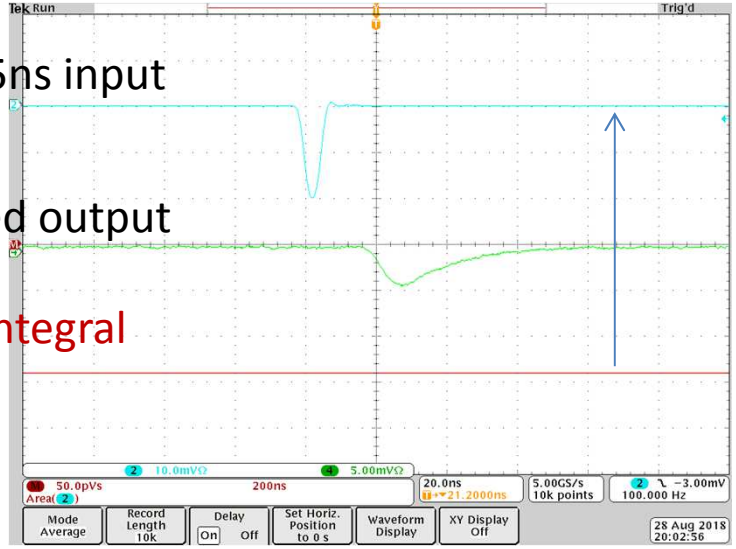
PMT like pulse response

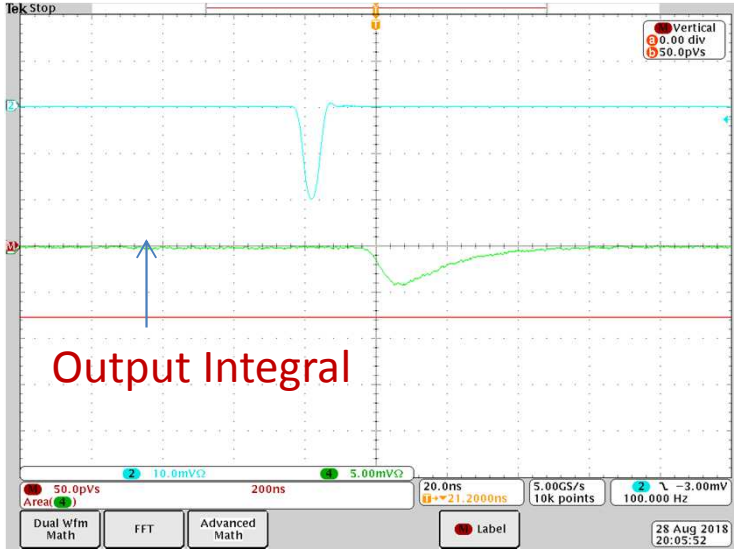
Charge conservation

20mV, 5ns input

Averaged output

Input Integral

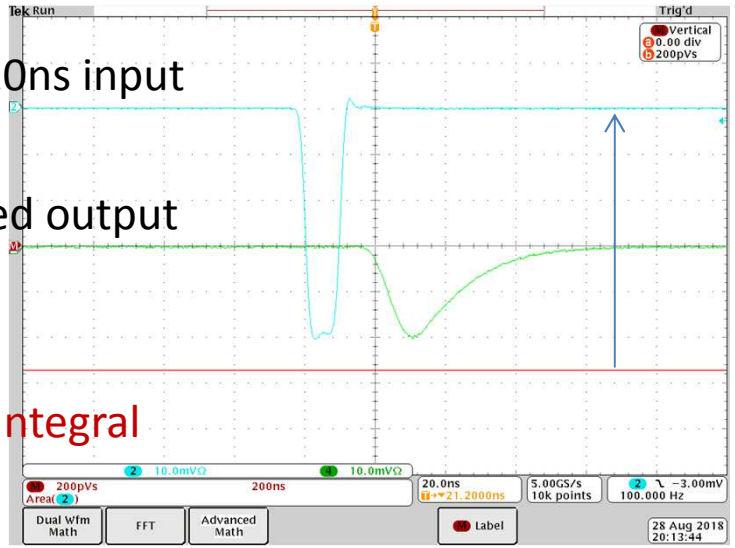




50mV, 10ns input

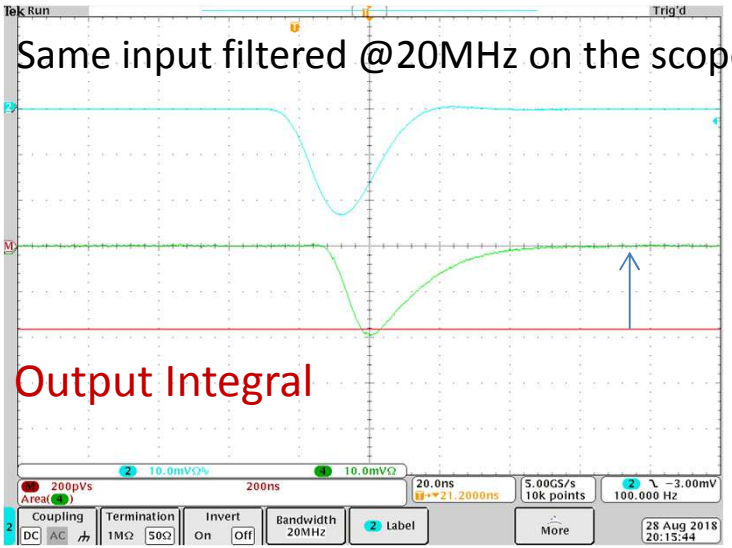
Averaged output

Input Integral

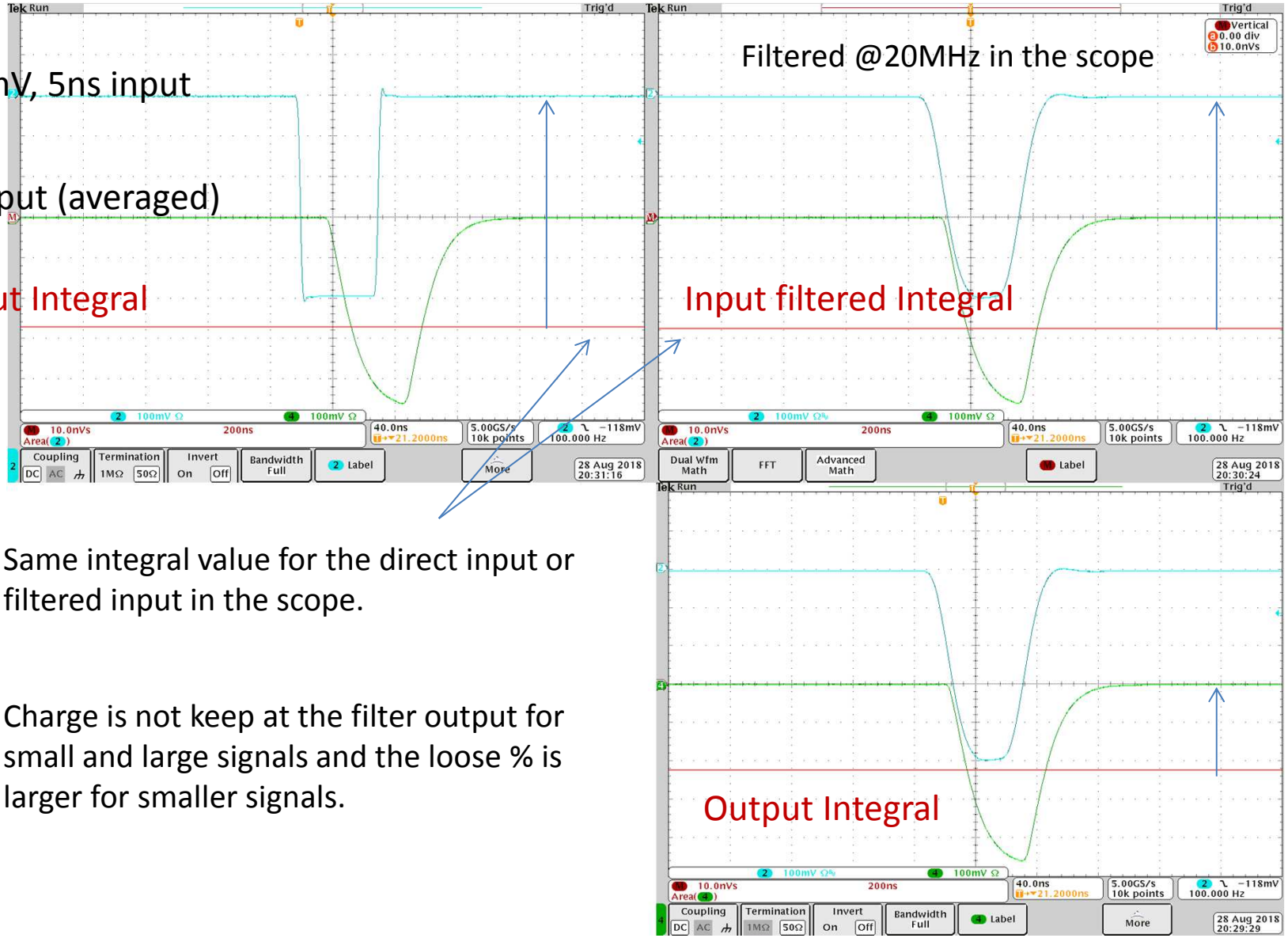


Same input filtered @20MHz on the scope

Output Integral



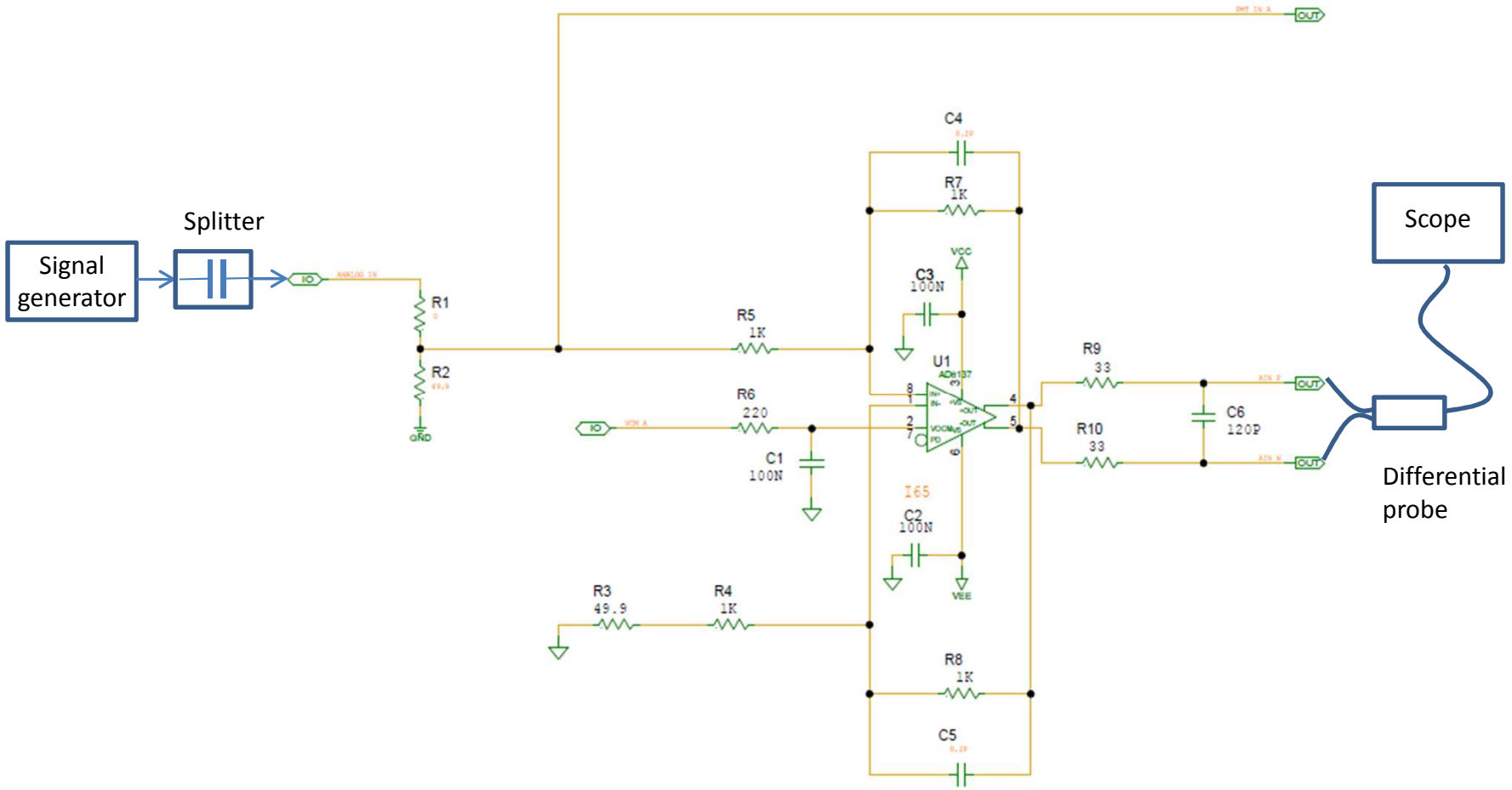
Large (500mV & 50ns) pulse response



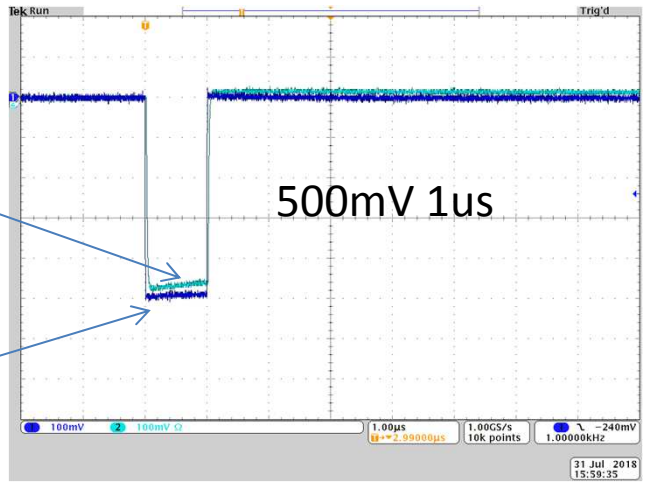
Same integral value for the direct input or filtered input in the scope.

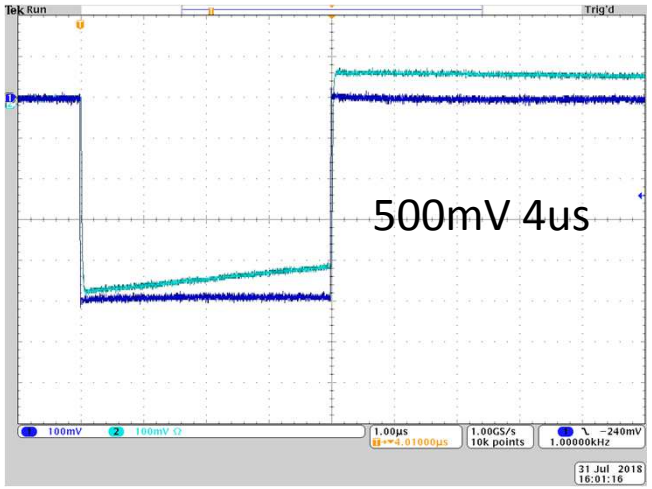
Charge is not keep at the filter output for small and large signals and the loose % is larger for smaller signals.

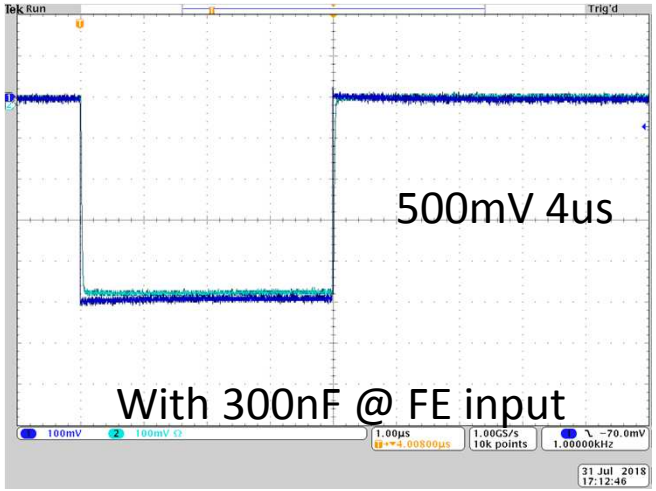
Tests with the splitter



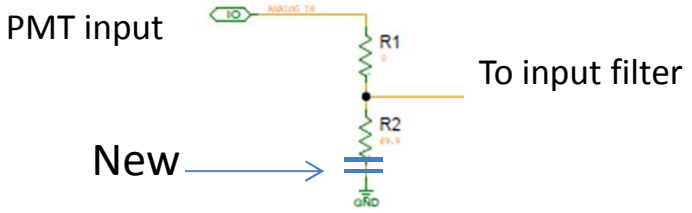
300nF Splitter + FE long pulse response







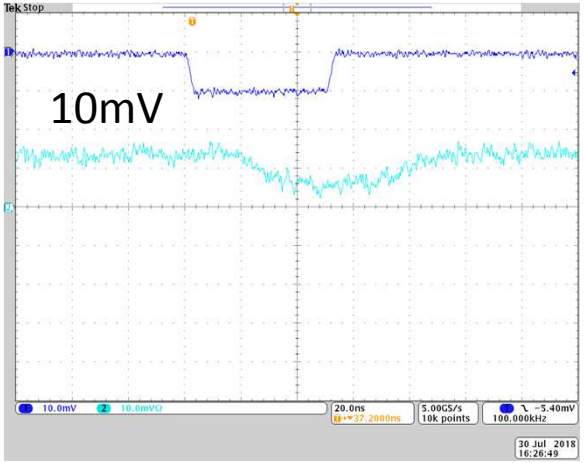
The overshoot is compensated adding a capacitor (of the same value than the splitter capacitor) in series with the 50Ω input resistor of the FE.

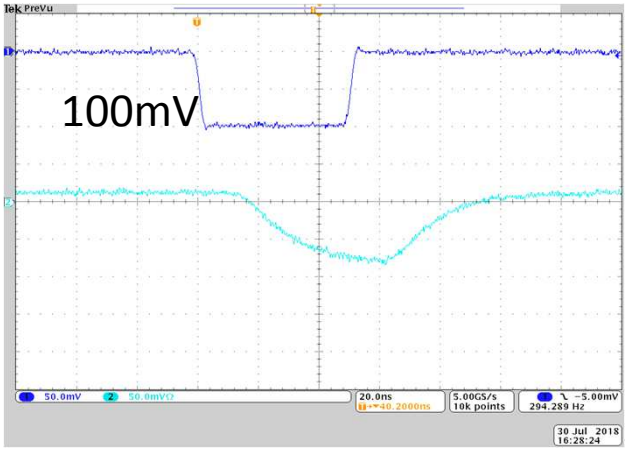


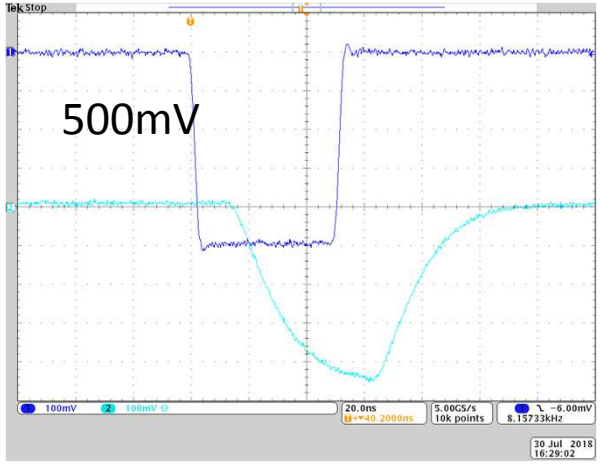
Conclusions

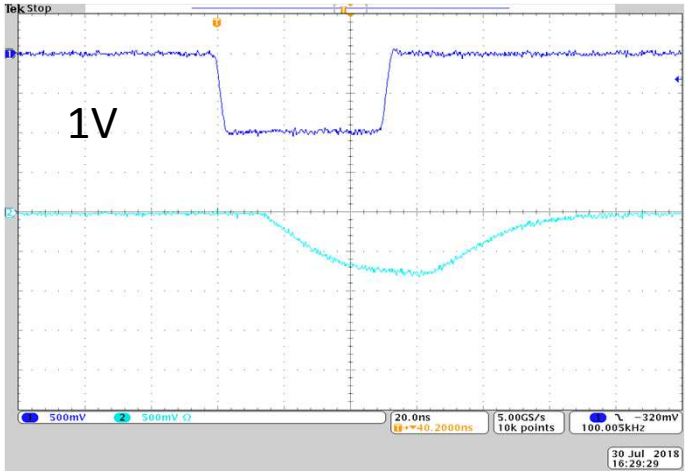
- Slight attenuation of the input signals.
- Bandwidth below the expected 20MHz.
- Dynamic range bellow the expected ±1V.
- Charge of the input signal is not conserved and the loose depends on the size of the input signal.
- Input signals bellow 10mV difficult to distinguish from the noise. The PMT must operate at gains > 10^7 to be able to distinguish the SPE signal.
- For next versions of the FE a capacitor in series with the input resistor should be placed to compensate the overshoot at the splitter.
- Tests of the board on other institute is convenient to verify the results.

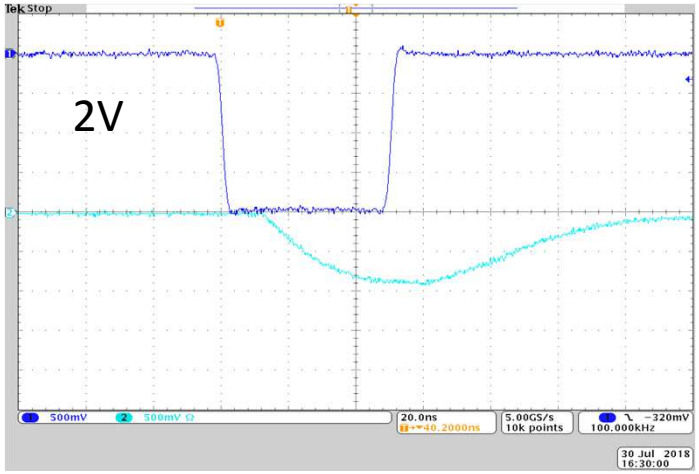
50ns Pulse response



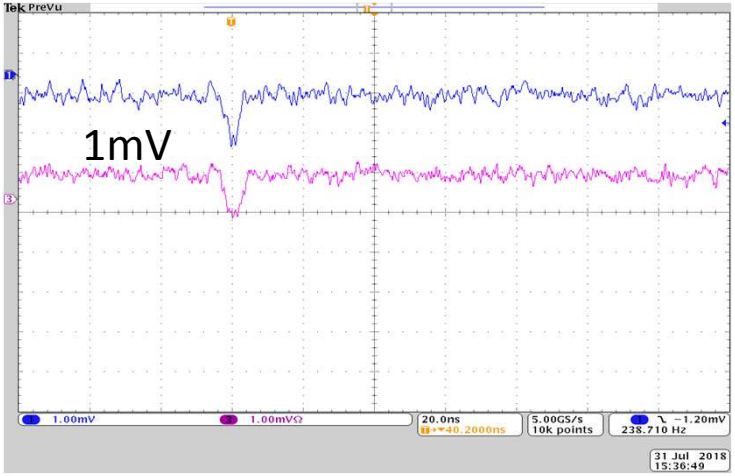


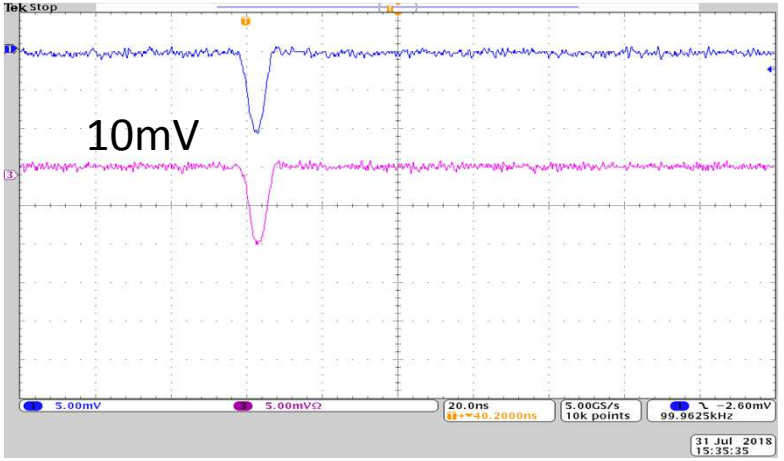


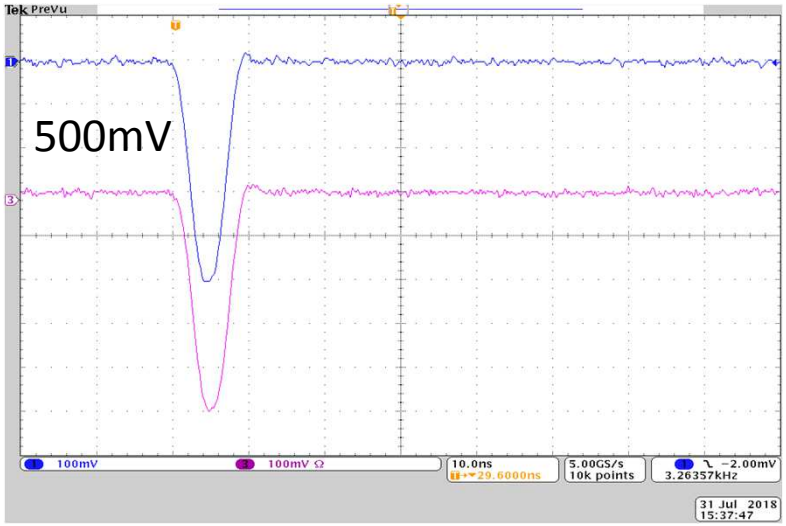


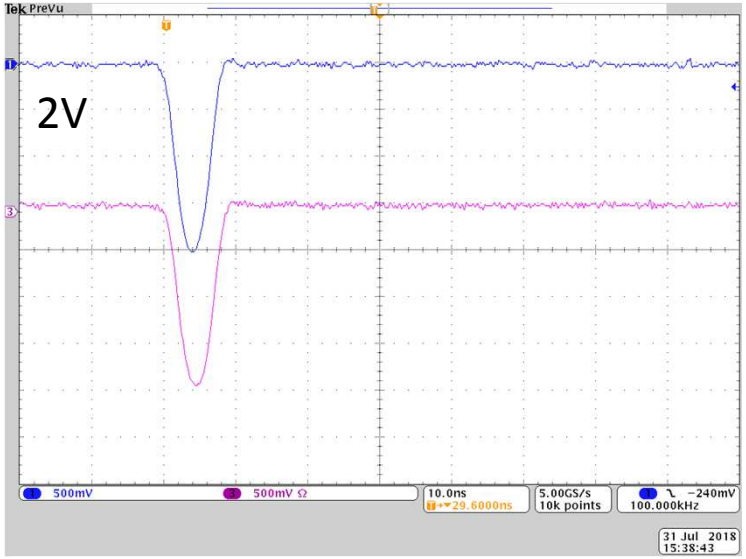


300nF Splitter (alone) SPE like pulse response

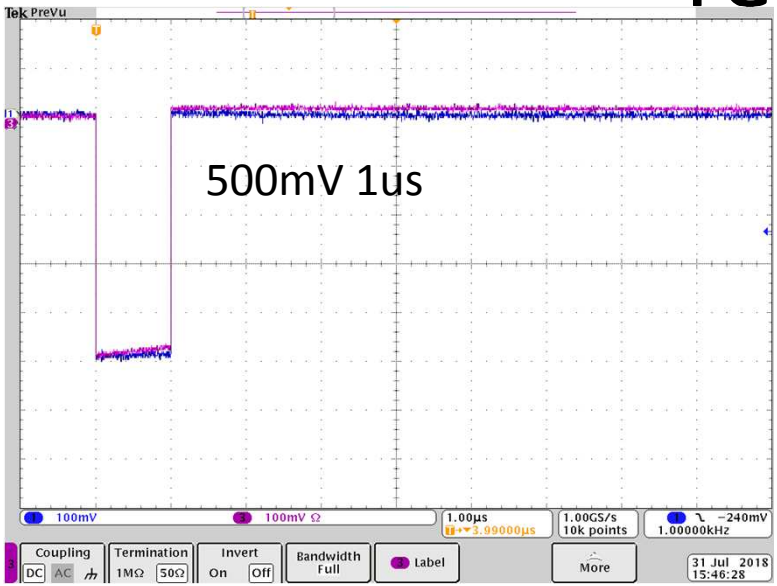


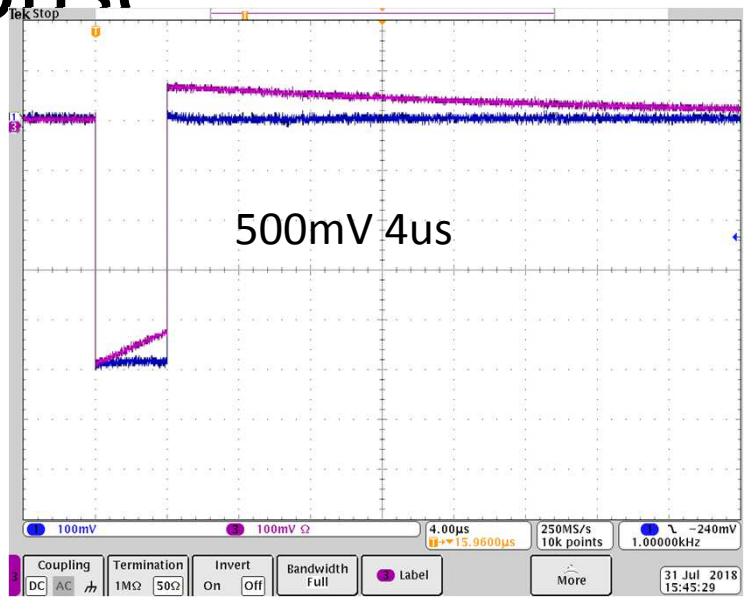


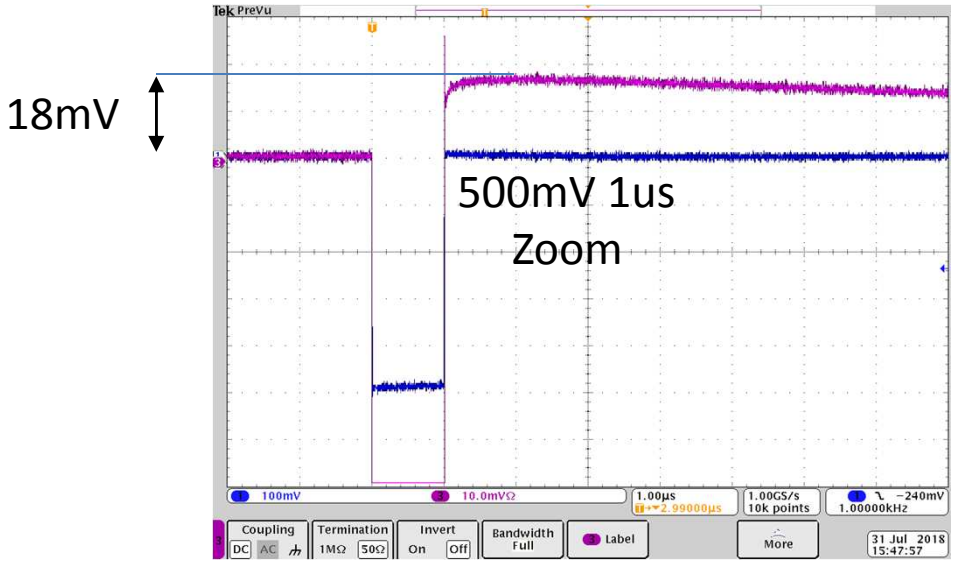




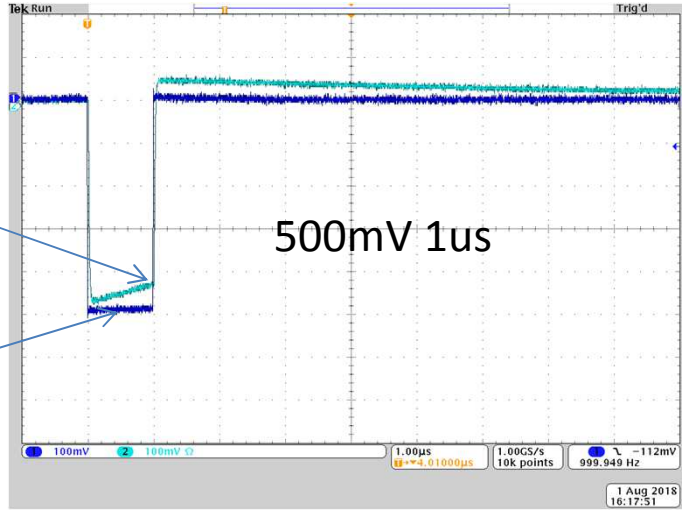
300nF Splitter (alone) long pulse response

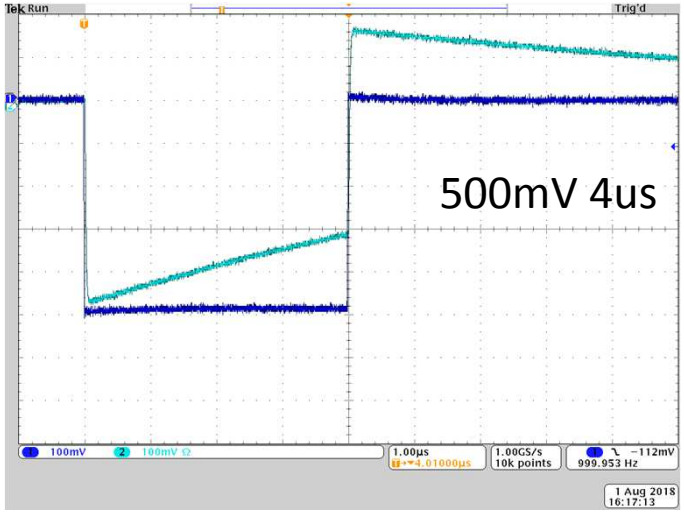


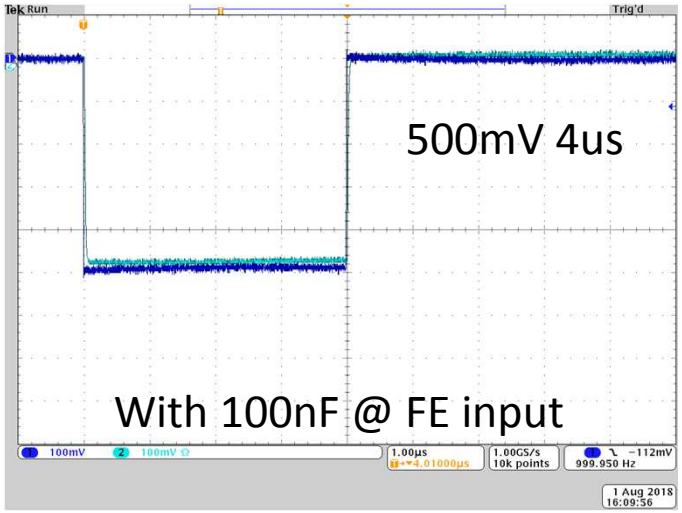




100nF Splitter + FE long pulse response







The overshoot is compensated adding a capacitor (100nF on this case) in series with the 50Ω input resistor of the FE.