

# **STEFF PREAMPLIFIER & SUMMING AMPLIFIER TEST REPORT**

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**Project:** STEFF

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## 1. Scope

The aim of this report is to summarise the tests done on the STEFF preamps and summing amplifier, in order to establish that the configuration meets the required bandwidth (<4ns) and gain (100-200).

## 2. Equipment used

Equipment used	Manufacturer/Model
PSU	TTi, QL355T
Oscilloscope	Tektronix, DPO7054
Pulse generator	Phillips, PM5786B
Sine wave generator	R&S, SML01
Attenuators	LRS, A101 and A102
Boards	Texas Instruments, THS3202EVM UoM, summing amplifier

### 1. Set-up:

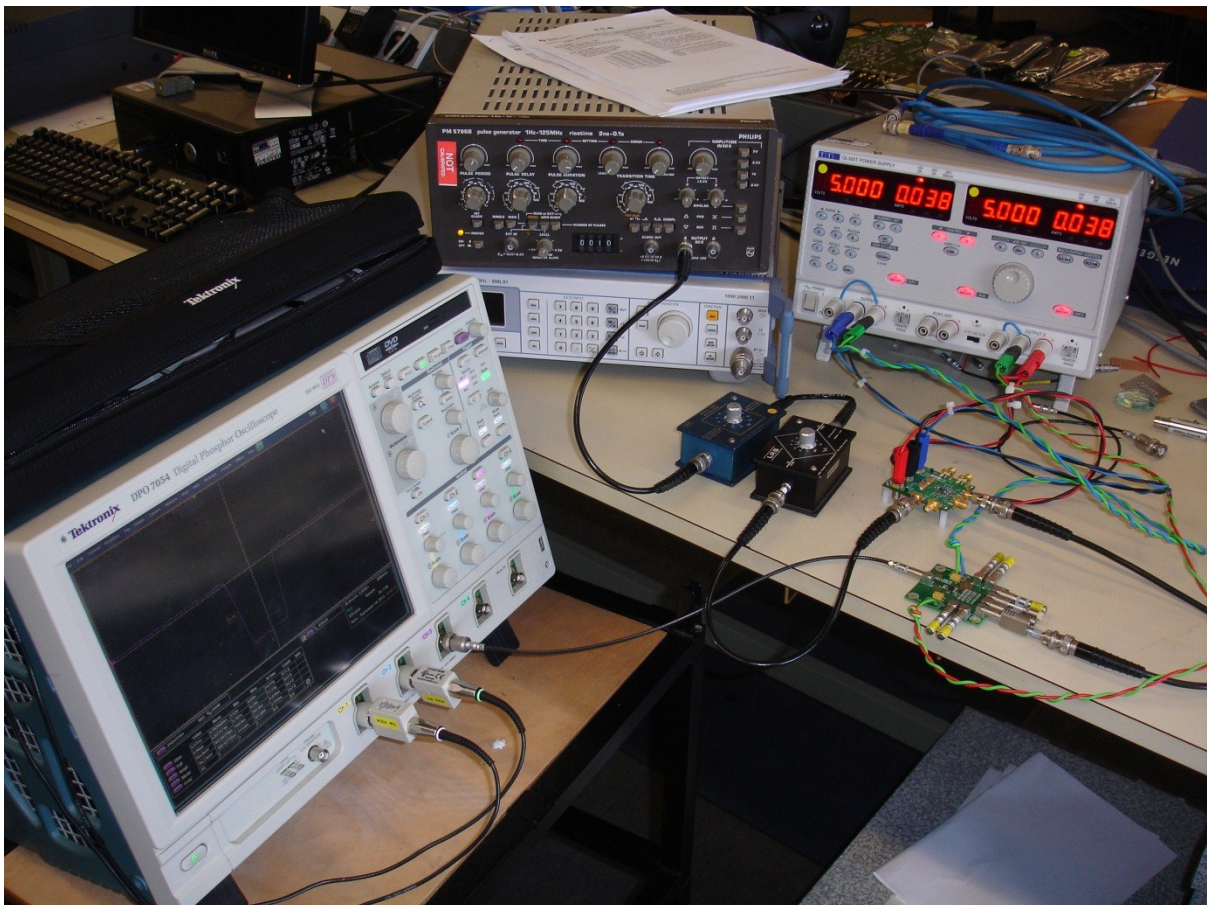


Figure 1 Set-up

## 2. Board modifications

### THS3202EVM

The op-amp used as the preamp is the Texas Instruments, THS3202. This is a dual current feedback op-amp in a single package that provides a compact solution. The evaluation board for the above chip was acquired (please see slou148.pdf) and the following modifications were made:

	Ref Des	Original value	New value
Preamp1	U1B, R8	Not populated	10R
	U1B, R7	619R	300R
	U1B, R9	Not populated	0R
	U1B, R12	453R	removed
Preamp2	U1A, R1	536R	10R
	U1A, R2	54R9	0R
	U1A, R4	453R	removed
	U1A, R6	536R	200R

Both preamps are configured as non-inverting. The output of preamp1 is fed to the input of preamp2 with a short wire. Each stage has a gain that is half of the preamp gain due to the series/parallel termination. The modifications in the above table result in a stage1 gain of 15.5 (preamp1 gain = 31) and a stage2 gain of 10.5 (preamp2 gain = 21). So, the overall stage gain is 163.

### UoM summing amplifier

Stage3 is the summing amplifier. The stage gain is 1 or 2 depending on the way that the detector is terminated at the input of the preamp1 (i.e. stage1). Below are the modifications done to the summing amplifier. R1 and R9 are the values on the top channel as seen on the schematic. The corresponding resistor values on the rest of the channels were also changed accordingly.

Ref Des	Original value (stage gain 2)	New (stage gain 1)	New (stage gain 2)
R1	100R	100R	removed
R9	100R	100R	50R
R17	390R	200R	200R

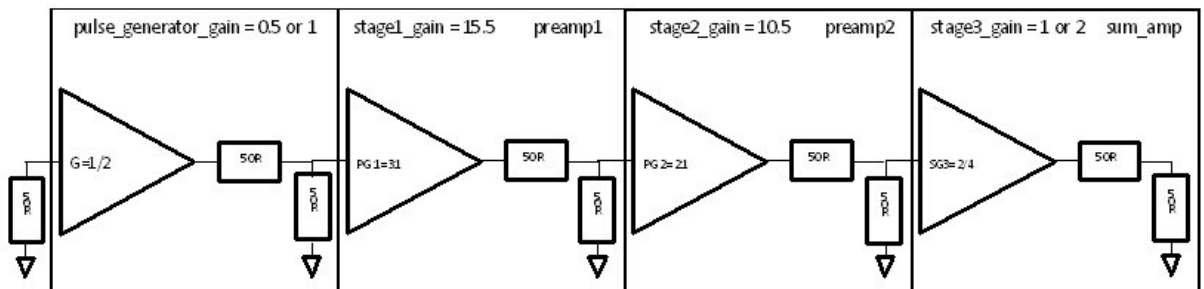


Figure 2 block diagram

### 3. Rise, fall times, amplitude and noise measurements

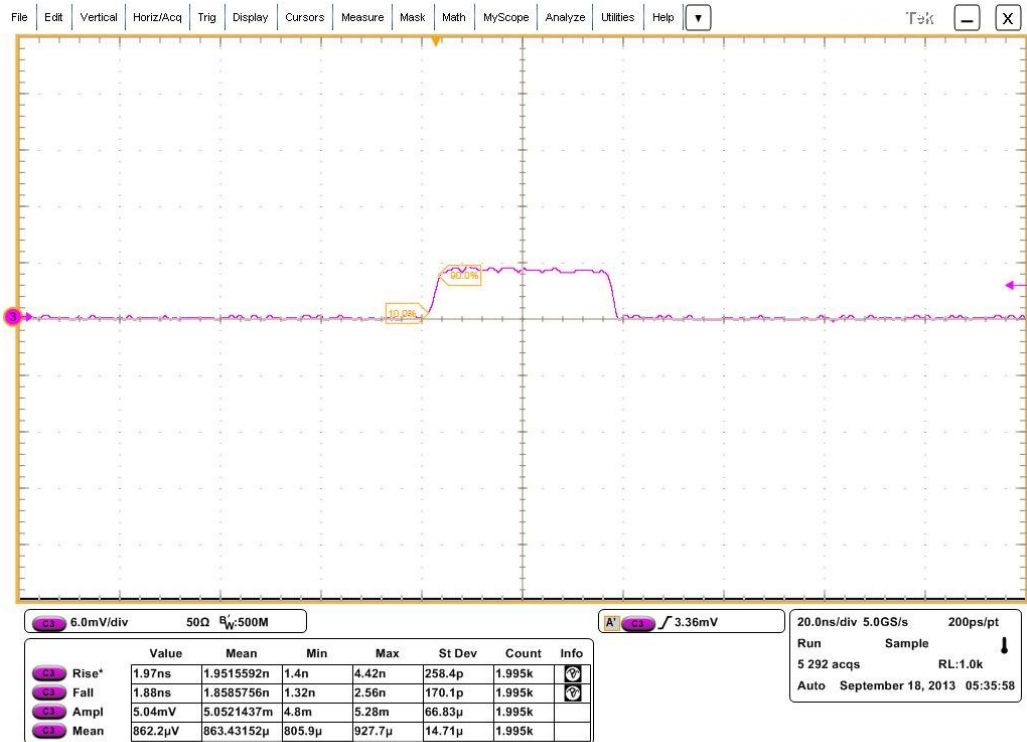


Figure 3 Pulse/scope rise, fall times and amplitude

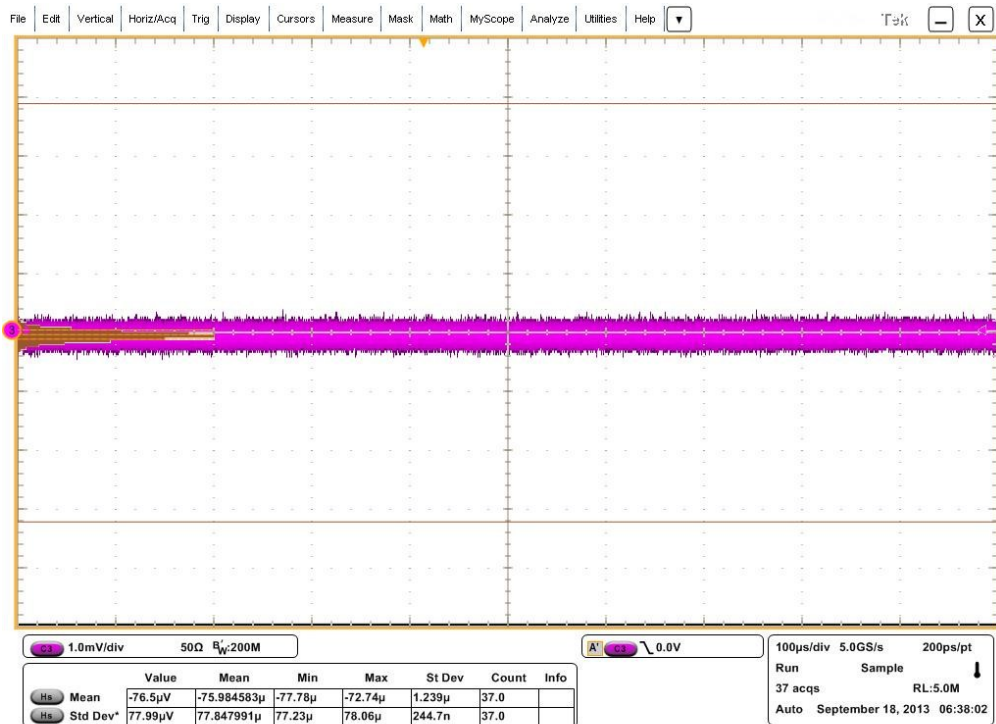


Figure 4 pulse input noise

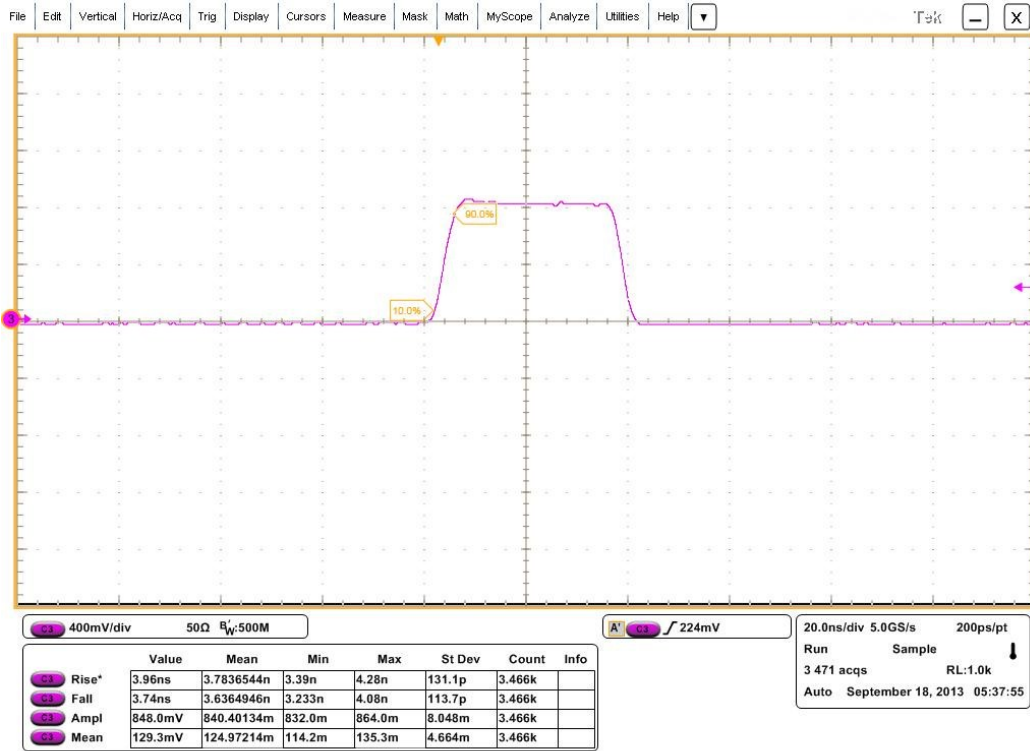


Figure 5 Preamp (2 stages) rise, fall times and amplitude

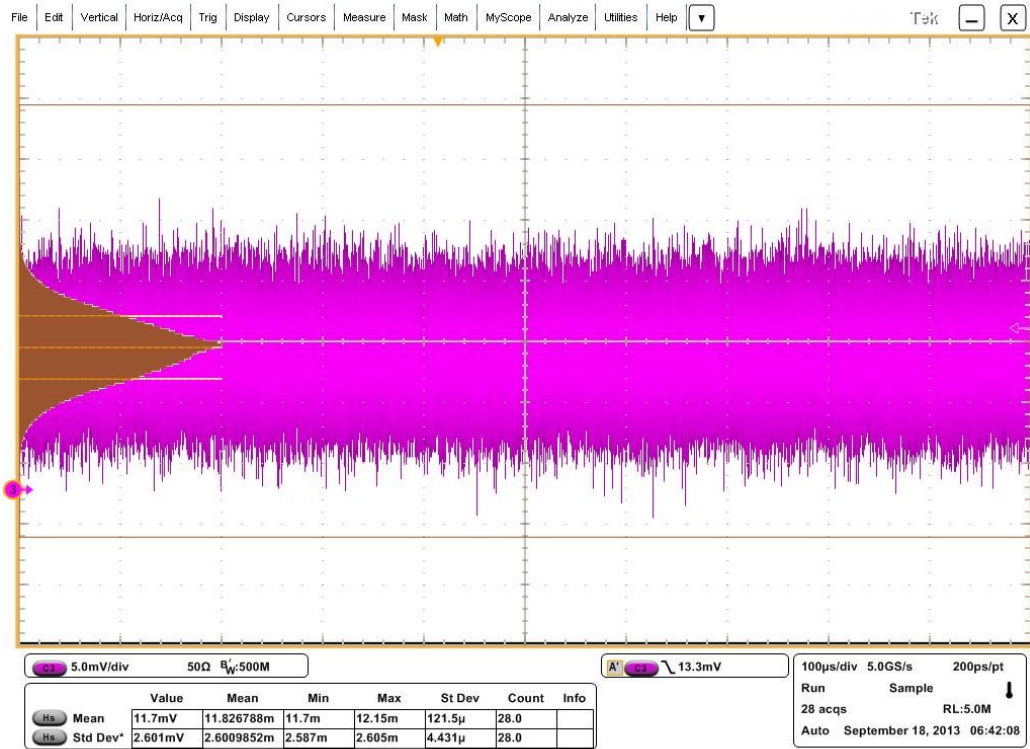


Figure 6 Preamp (2 stages) noise

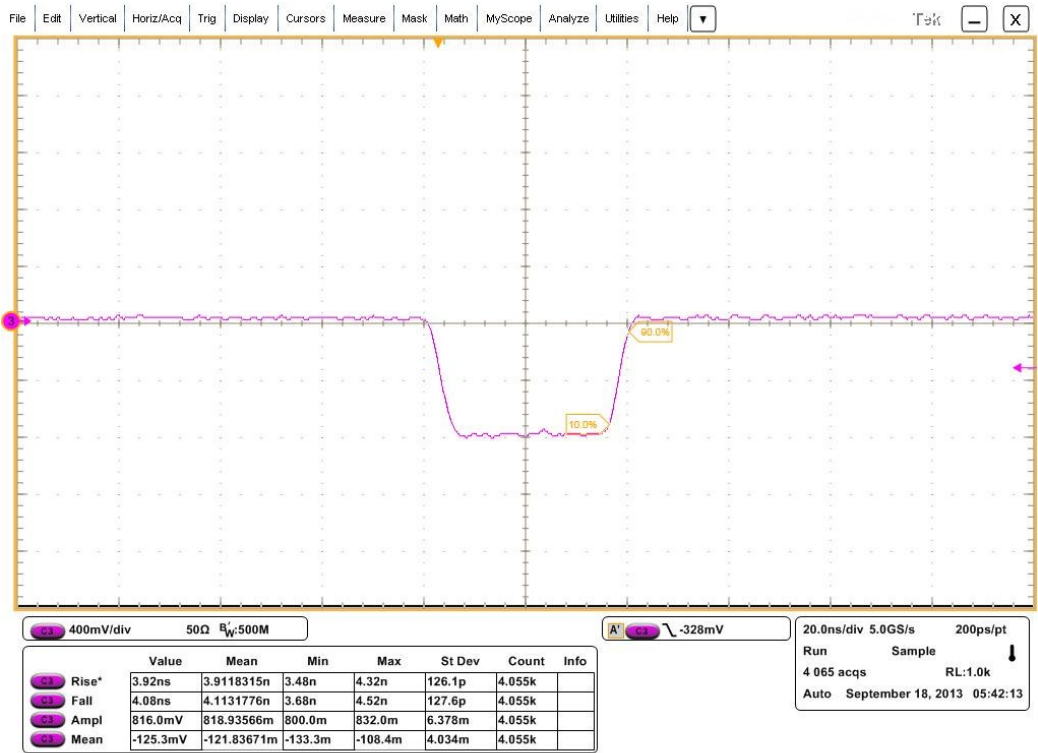


Figure 7 preamp + summing (gain 1, channels 8) rise, fall times and amplitude

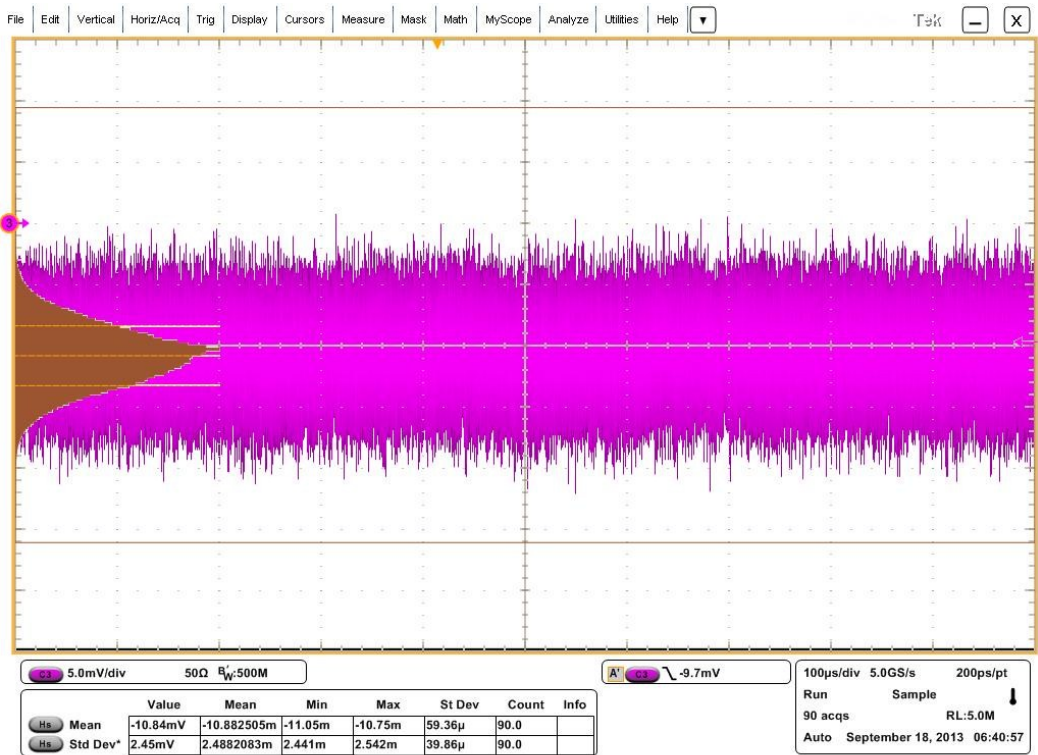


Figure 8 preamp + summing (gain 1, channels 8) noise

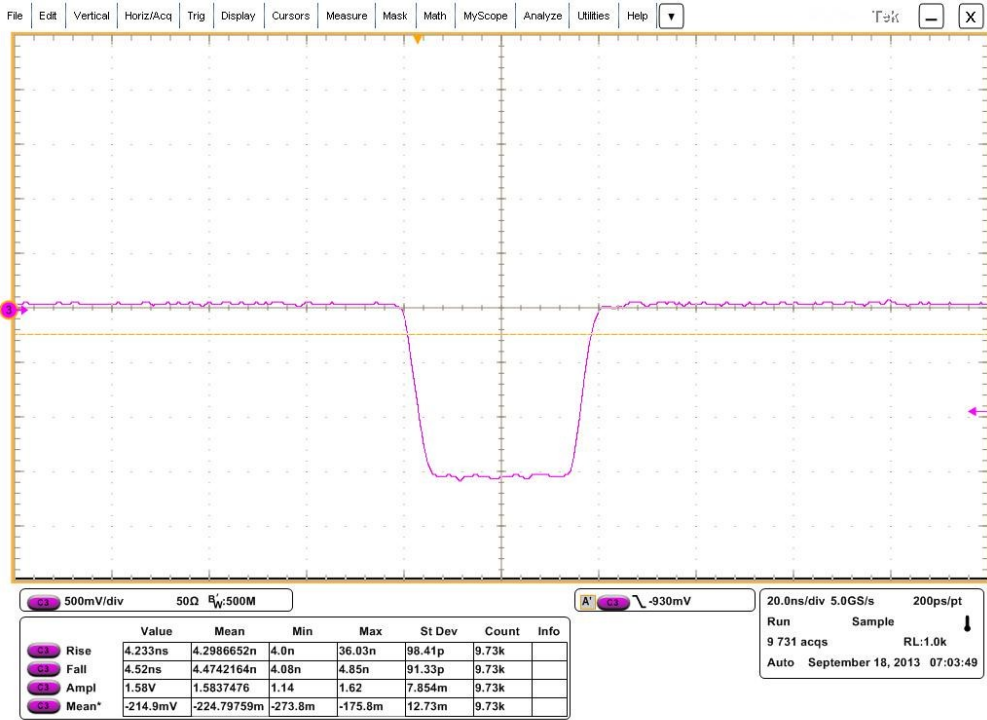


Figure 9 preamp + summing (gain 2, channels 8) rise, fall times and amplitude

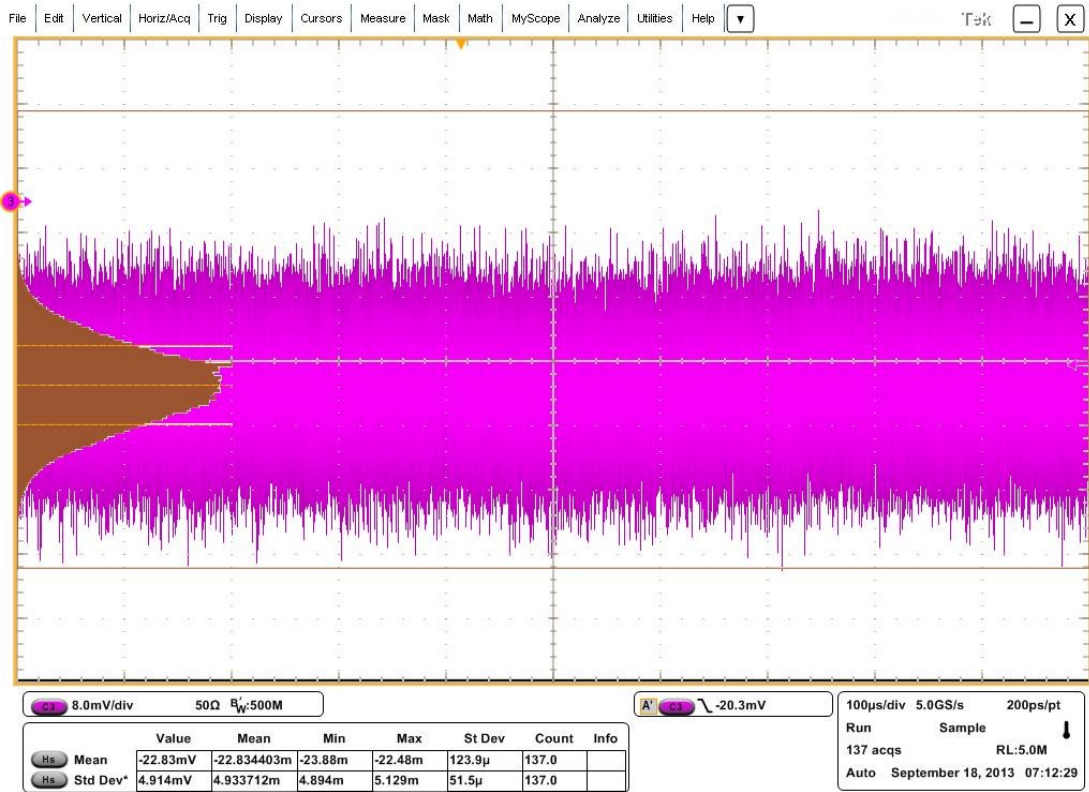


Figure 10 preamp + summing (gain 2, channels 8) noise

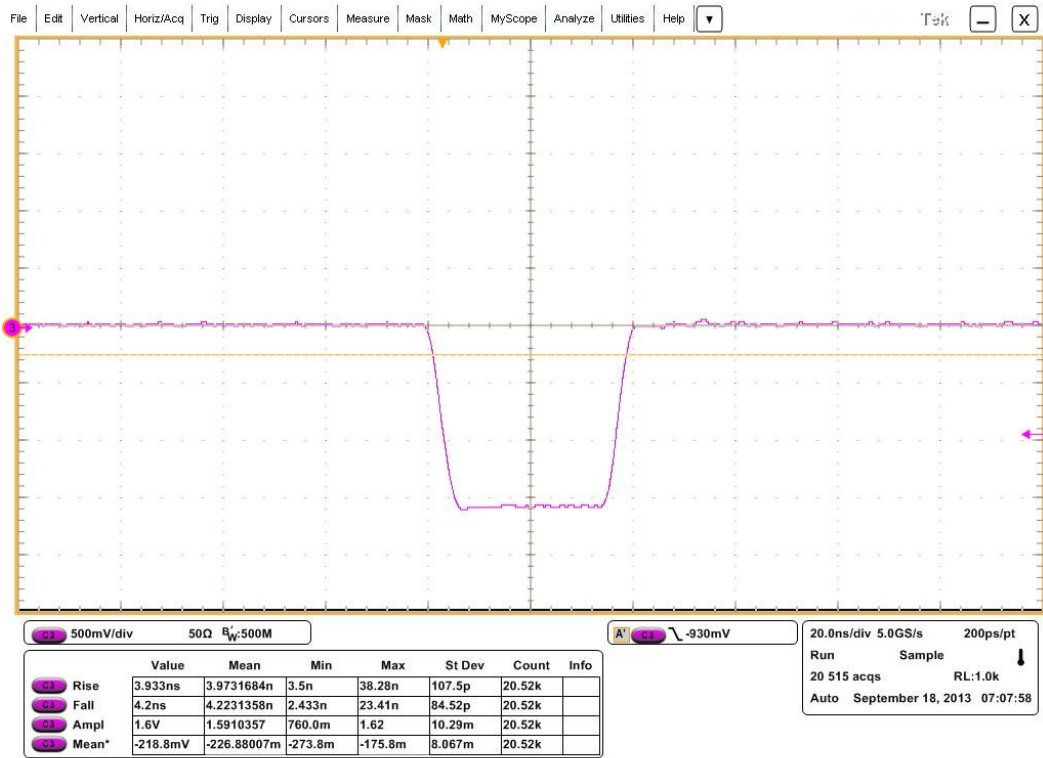


Figure 11 preamp + summing (gain 2, channels 6) rise, fall times and amplitude

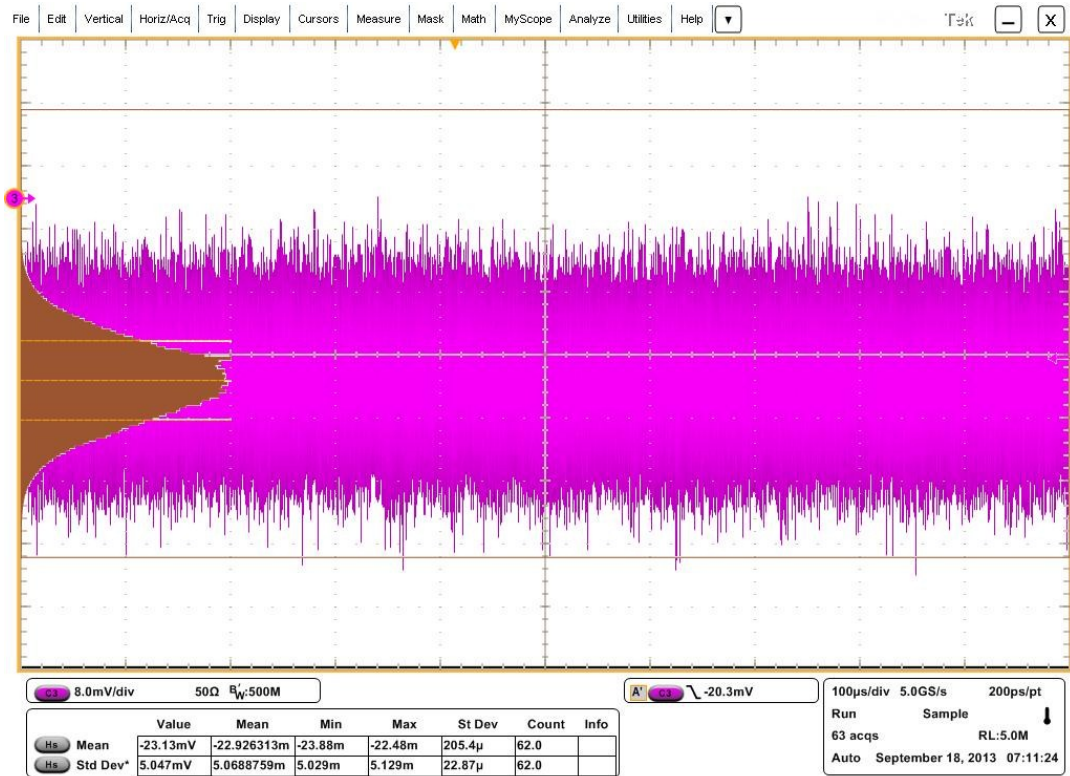


Figure 12 preamp + summing (gain 2, channels 6) noise



#### 4. Results summary

	Rise (ns)	Fall (ns)	Ampl(mV)	Noise(mV, sigma)
Pulse out	1.95	1.85	5	0.078
preamp out	3.78	3.63	840	2.6
Summing out (gain 1, channels 8)	3.91	4.11	818	2.48
Summing out (gain 2, channels 8)	4.29	4.47	1583	4.93
Summing out (gain 2, channels 6)	3.97	4.22	1591	5.06

Table 1 Measured rise, fall times and amplitude summary

	Rise (ns)	Fall (ns)	Gain
preamp	3.2	3.12	168
Summing out (gain 1, channels 8)	3.39	3.67	164
Summing out (gain 2, channels 8)	3.82	4.06	317
Summing out (gain 2, channels 6)	3.45	3.79	318

Table 2 Calculated gain, rise and fall times summary

#### 5. Conclusions

The preamp gain, rise and fall times are within spec (gain 100 – 200, rise/fall times 4ns or less).

With regards to the summing amp, dropping the feedback resistor from 390R to 200R has increased the bandwidth, such that all 8 inputs can be used when the signal gain of that stage is 1 and it is border-line when the signal gain is increased to 2. Using 6 of the 8 inputs with a signal gain of 2 provides similar bandwidth to using all 8 inputs but with a signal gain of 1.

Whether we use a gain of 1 or 2 depends on how the matching of the detector is done to the input of the preamp (i.e. are we going to lose half the signal or not).