8m long strip readout and safe gas mixture

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(1) Study on strip grouping

We have tested three different strip width: single strip, grouping three strips, grouping 5 strips.

In the following slides we'll show the pulse peak ADC spectra and screen captured triggered pulses.

Gas mixture used in these tests is Ar/R417A(50/50).

The transmission line is formed by strip band/honeycomb/ground aluminum sheet at the bottom and strip band/RPC+1/4" foam panel/ground aluminum sheet on the top:
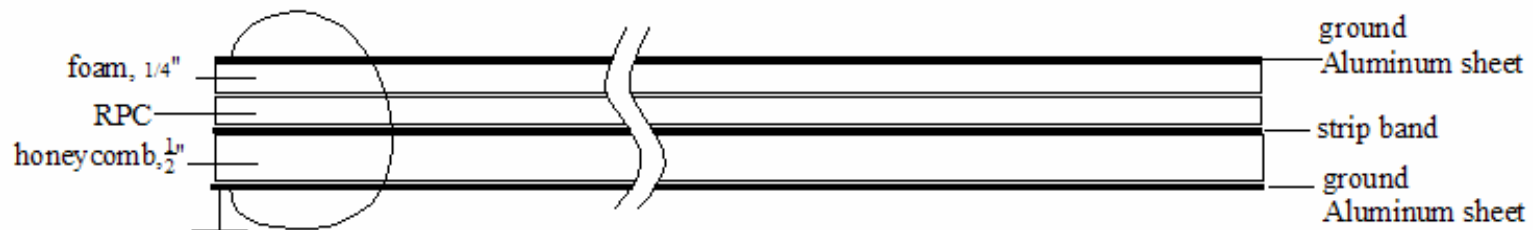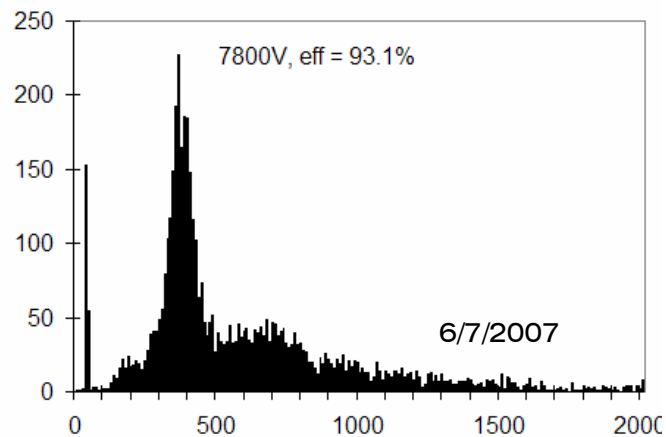

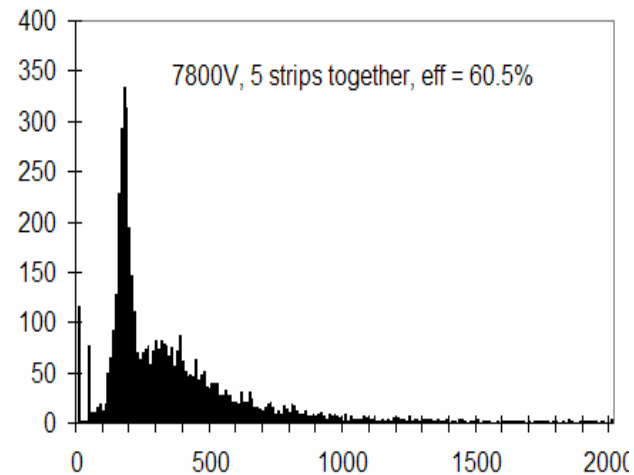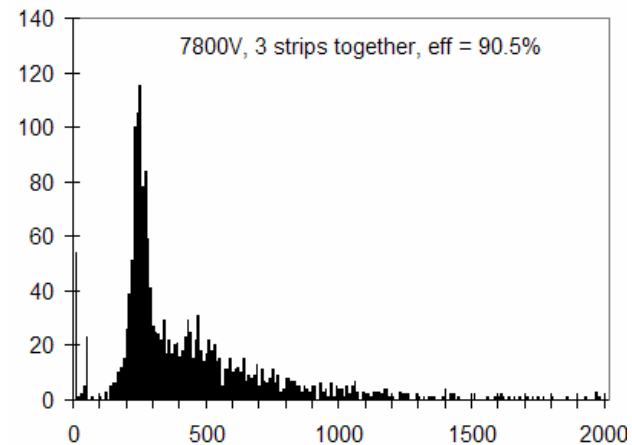The far end terminator 12Ω, near end terminator 180Ω.

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Single strip

For single strip case the pulse height is the maximum. Use linear fan-in to add three strips together.
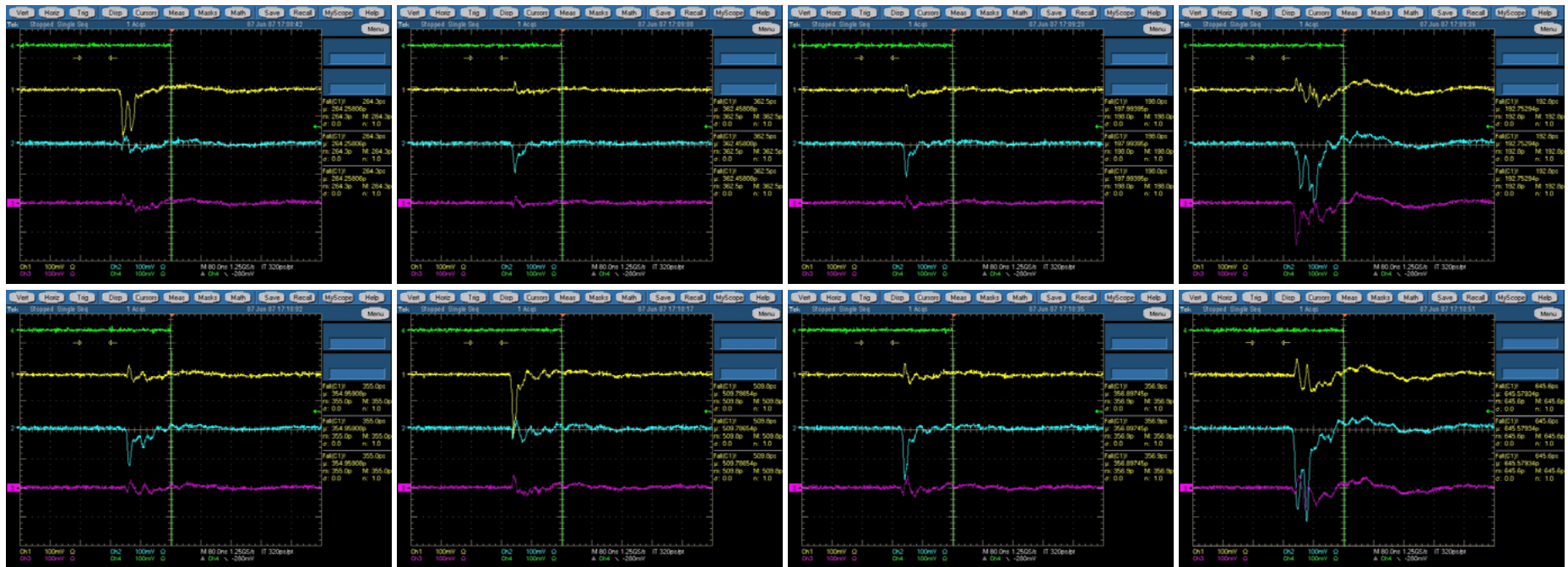

7800V, 3 strips together, eff = 90.5%

7800V, eff = 93.1%

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7800V, 5 strips together, eff = 60.5%

ADC calibration:

V(mV)=0.181*ch+9.88

Screen capture for single strip

100mV/div, 80ns/div

Grouping 3 strips

At the far and near ends connect 3 strips together.

7800V, 3 strips together, eff = 90.5%
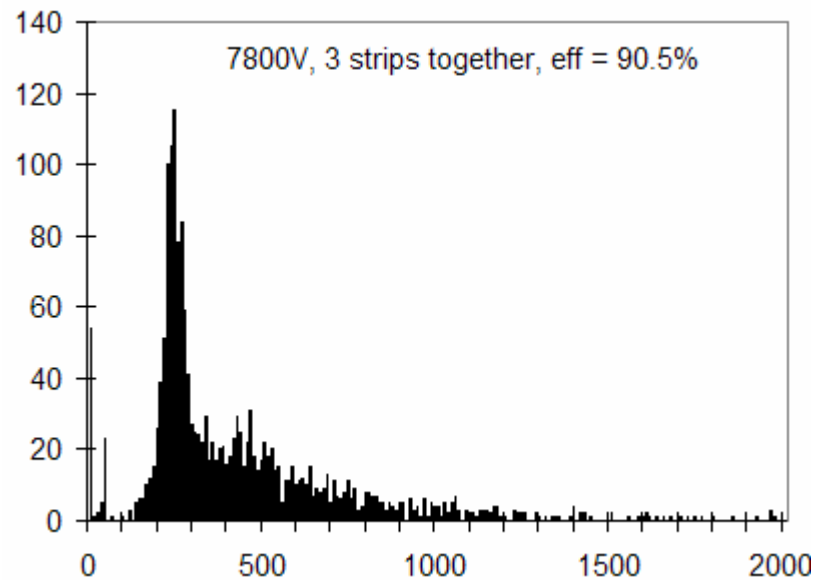
ADC calibration:

V(mV)=0.181*ch+9.88

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Screen capture for group of 3 strips

100mV/div, 80ns/div

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Grouping 5 strips

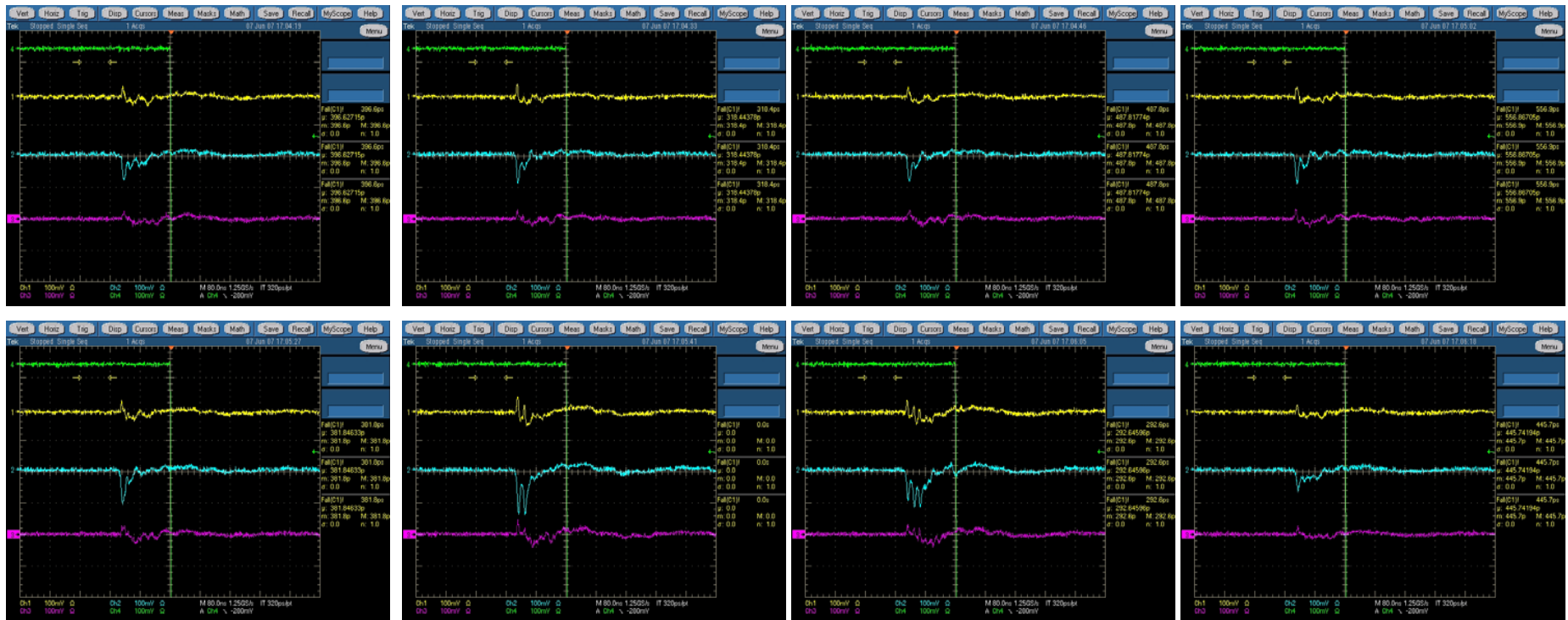At far and near ends connect 5 strips together.

7800V, 5 strips together, eff = 60.5%
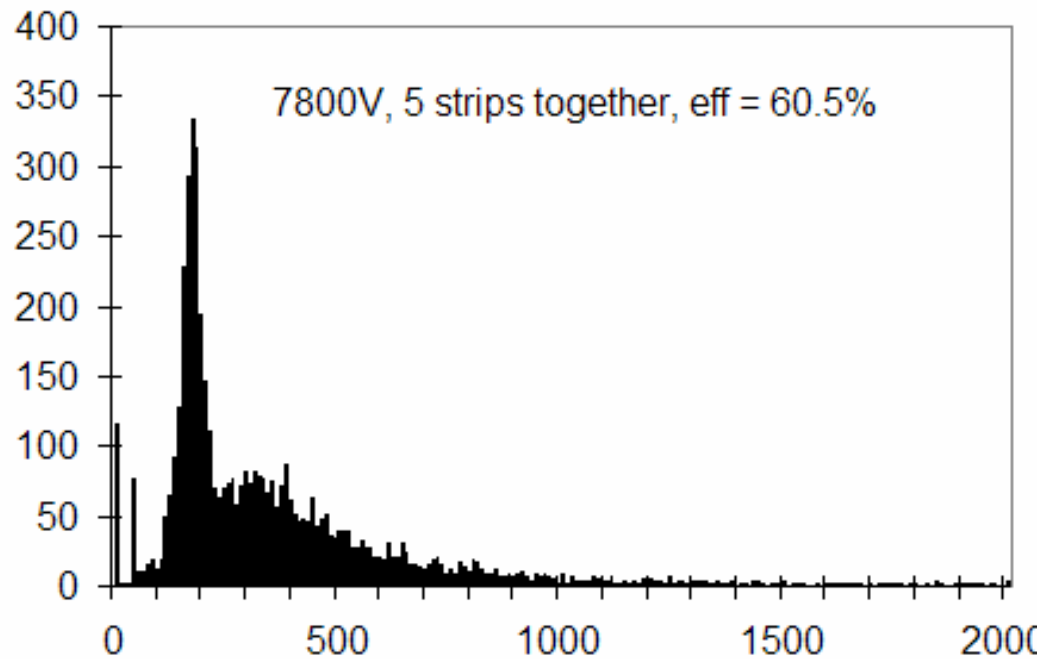
ADC calibration:

$V(mV) = 0.181 * ch + 9.88$

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Screen capture for group of 5 strips

50mV/div, 80ns/div
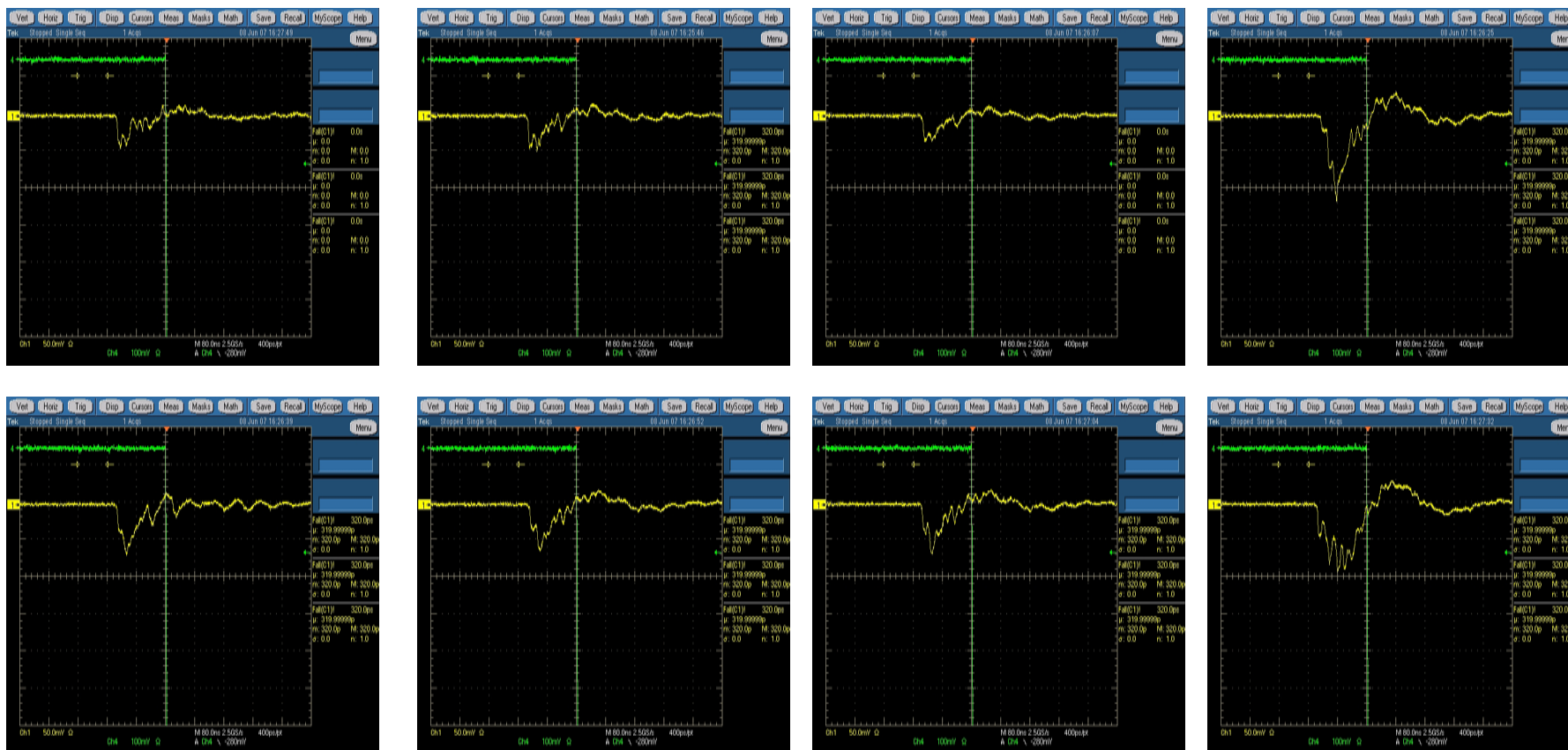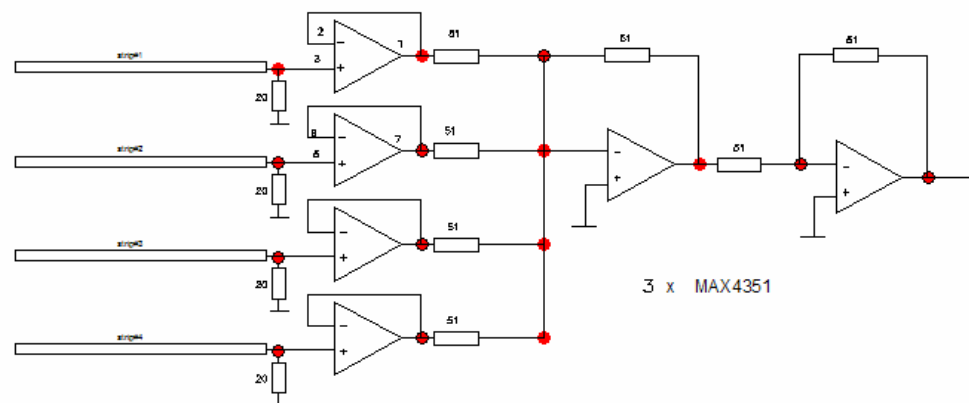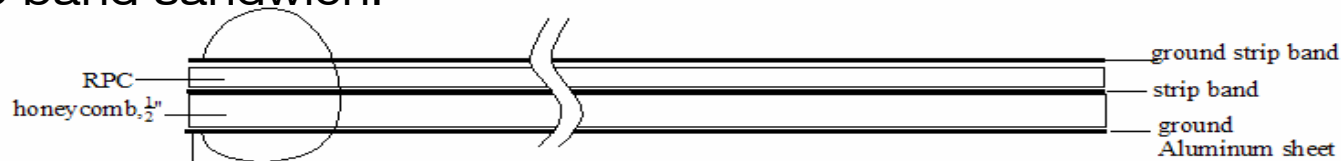
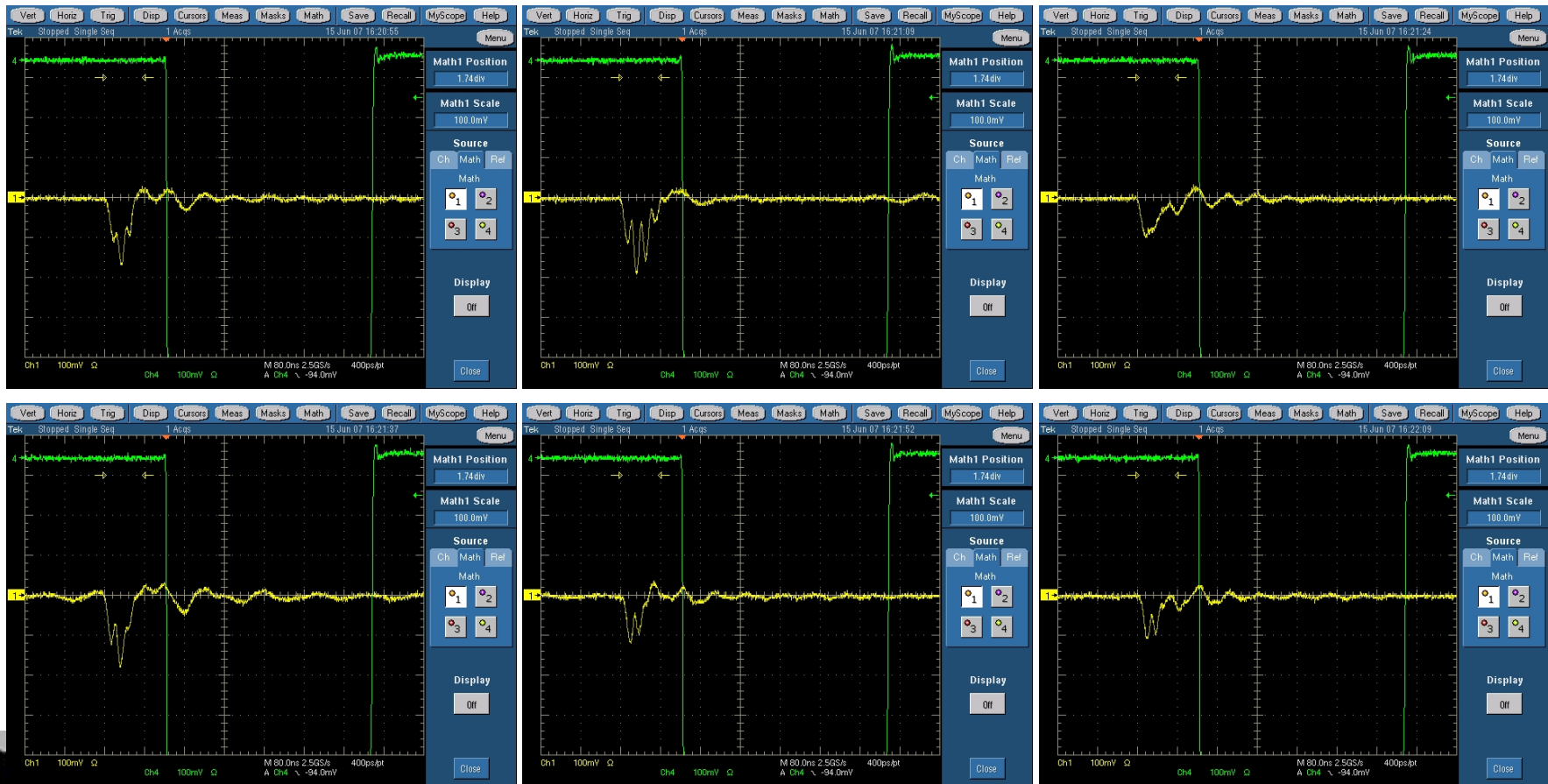June 19, 2007

Use buffer to accept the strip signal

We use buffers to accept each individual strip signals, which are isolated by the buffers, thus preserve the pulse shape as single strip's. The second stage will add all inputs together. Each MAX4351 has 2 Op-amps, thus 4 strips need 3 MAX4351 chips. The transmission line is formed by a strip band/RPC/grounded strip band sandwich:
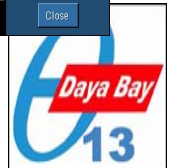
Screen capture for 4 strips

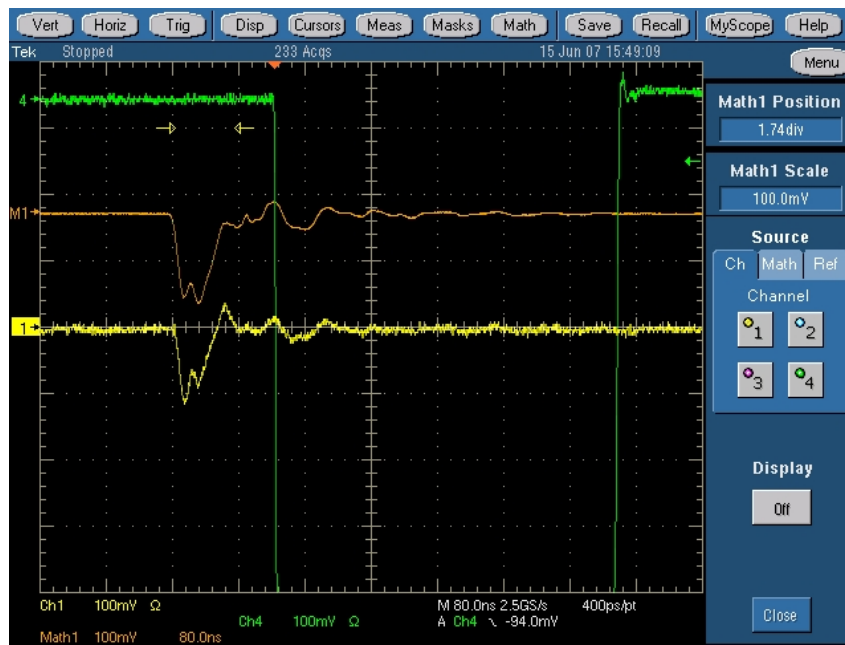Connect 4 strips to the buffer, 6 consecutive screen captures:
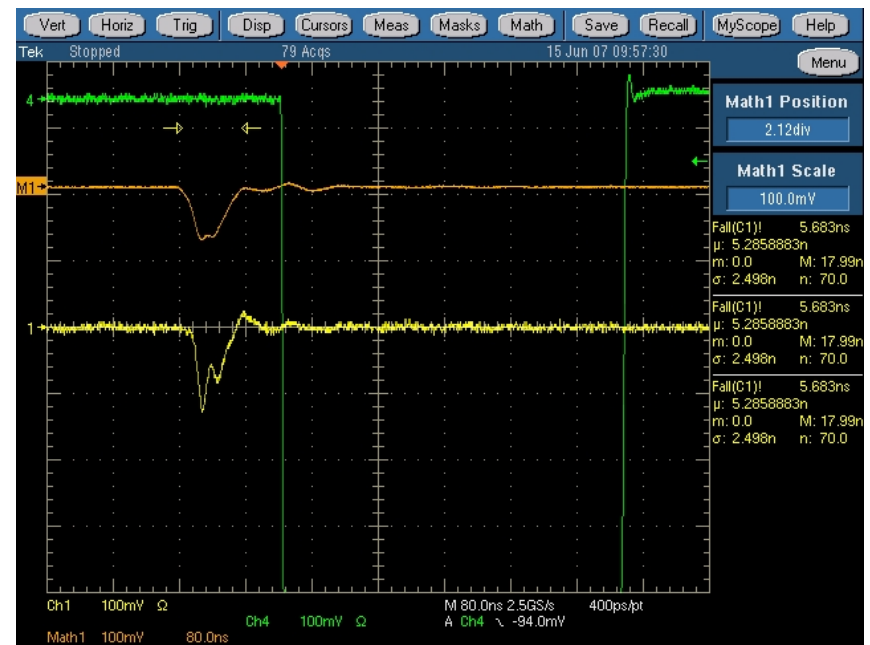

100mV/div, 80ns/div

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3 strips and single strip

3 strips connected, top trace
is the averaged pulse.
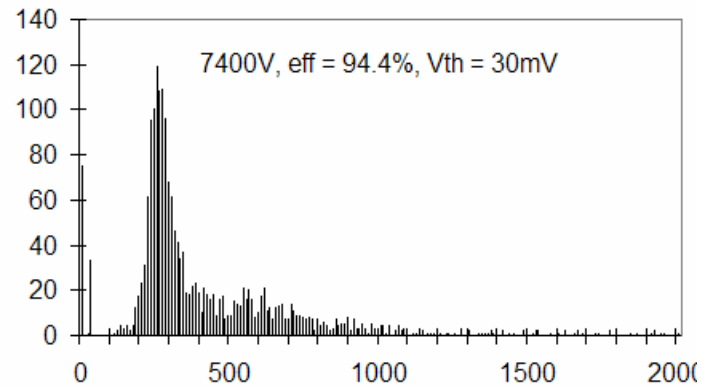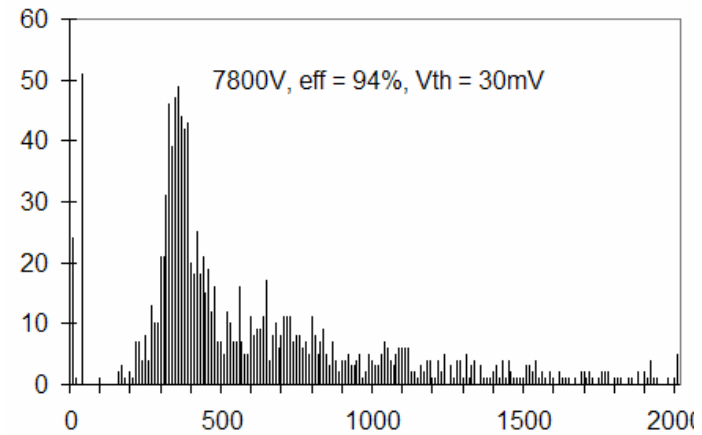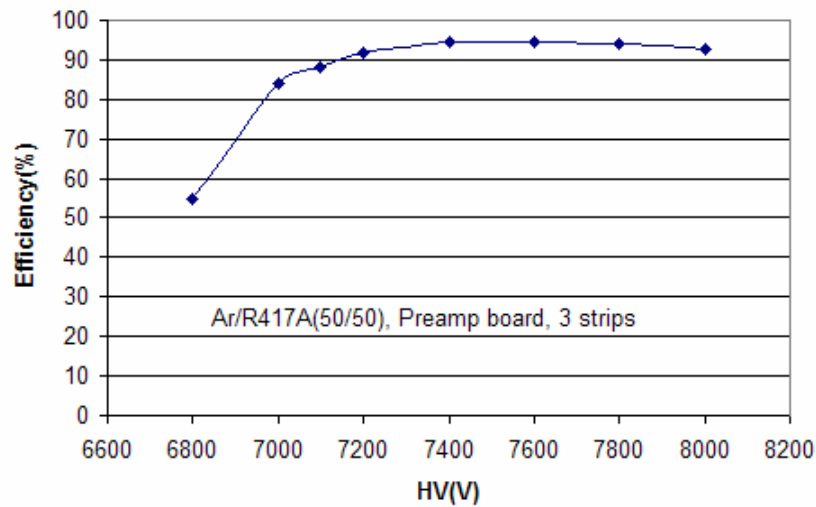
single strip connected, top
trace is the averaged pulse.

100mV/div, 80ns/div

Efficiency plateau for 3 strips

Buffer connects 3 strips, set Vth = 30mV, efficiency plateau:

(2) Safe gas mixture R417A

Kwong mentioned an interesting gas mixture R422B, which is a new type of refrigerant and consists of three components: R134A/R125/R600(42/55/3 Wt. %, 41.1/52.8/6.1 Vol. %)

I obtained a similar refrigerant R417A, which is also a common refrigerant that belongs to non-flammable category. It consists of three components: $R134A(C_2H_2F_4)/R125(C_2HF_5)/R600 (C_4H_{10})$ (50/46.6/3.4 Wt. %; 52.3/41.4/6.3 Vol. %). As we can find from above report that the gas mixture Ar/R417A(50/50) performs very well. If we can use this gas mixture, we won't have flammable gas safety issue, that will make safety system simpler and cheap.

The remaining issue needs to be studied is how to use the R417A/R422B gas bottle? Is the gas mixing ration keeps constant from a full bottle to almost empty bottle? After talked to the technical support of Icor a possible solution is suggested by them:

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... Safe gas mixture R417A
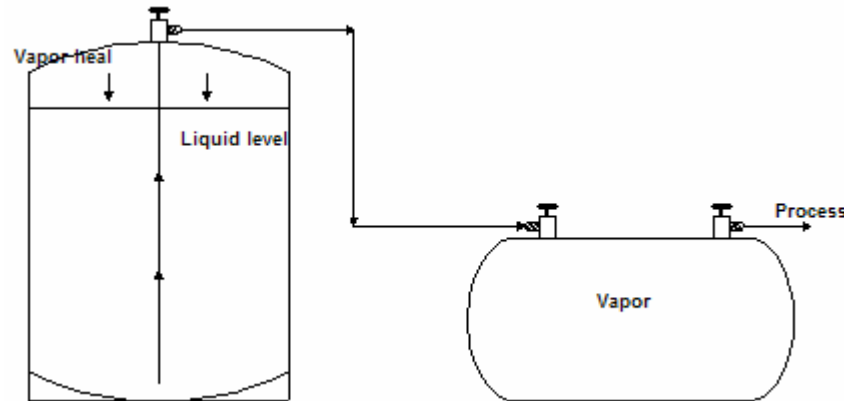
Initially the buffer tank will need a vacuum pulled to eliminate any air and moisture. The buffer cylinder must not drop in temp and re-condense the vapor. The liquid entering rate to the buffer cylinder may have to be 'calibrated' to match the amount of gas mix the RPC system requires.

Summary

- After we insert the buffer circuit in, the single strip's pulse shape (large, sharp) is well preserved even connect 4 strips to the buffer's inputs.

- The pulse height ADC spectrum looks good, efficiency plateau curve behaviors nicely.

- The "safe" gas mixture, refrigerant R417A with same amount of Ar, works very nicely. If we want to pursue this way, more R&D needs to be done, also the gas system needs to be modified.