UNM Update 8/30/17
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We started looking at low pressure SF6 + other gas mixtures.
Motivation: low-mass WIMPs (hence low pressure) directional searches will require low pressures.

- We worry about issues that impact the z-length of tracks such as capture distance in NI gases.
- In addition, we worry about diffusion getting large when there is only a few Torr of SF6 + 50-100 Torr of OTHER gases.
- We also wanted to see what happens when we have very low pressure SF6 + OTHER gases (could be few Torr SF6 + helium, for example).

We decided to look at a few Torr SF6 + CF4. Wanted to see the turn on of NI behavior, and we stumbled on some very interesting results:

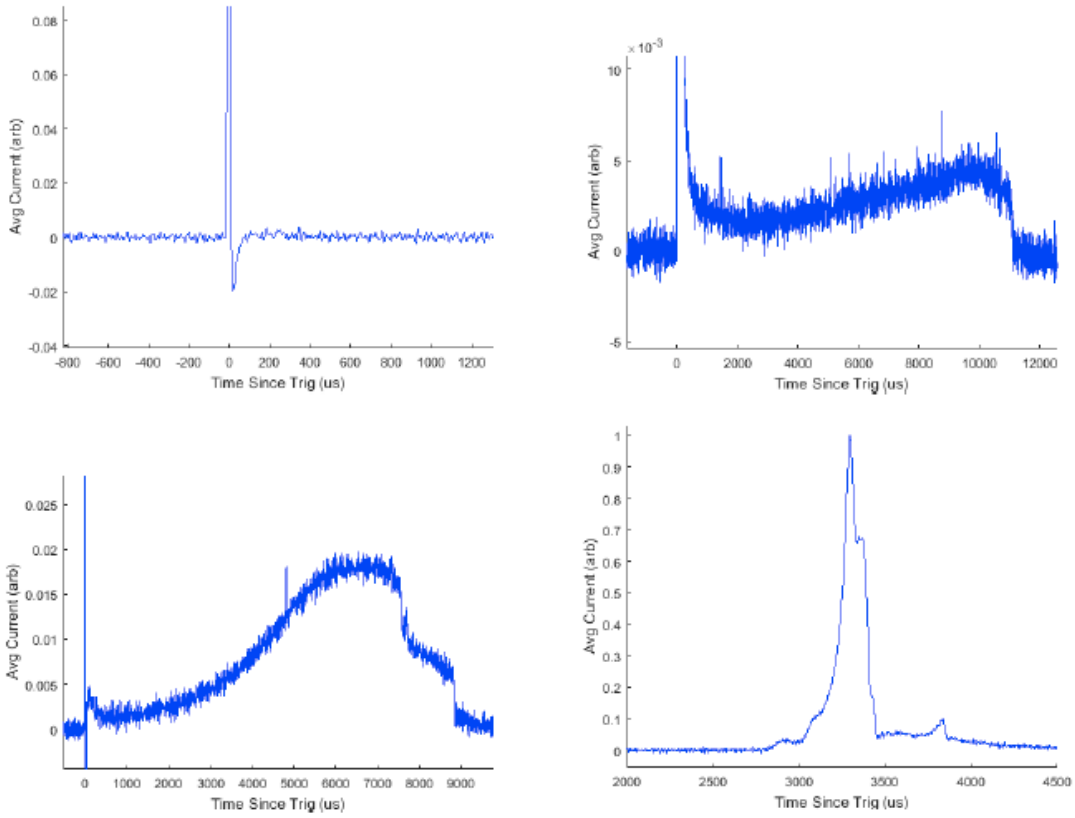

Figure 1

Figure 1 shows what happens to PURE CF4 at 40 Torr as you raise the drift field: it switches from e- drift to NI ion drift! This is well known though. From TOP LEFT panel, clockwise: 200 V/cm, 300 V/cm, 375 V/cm, 800 V/cm.

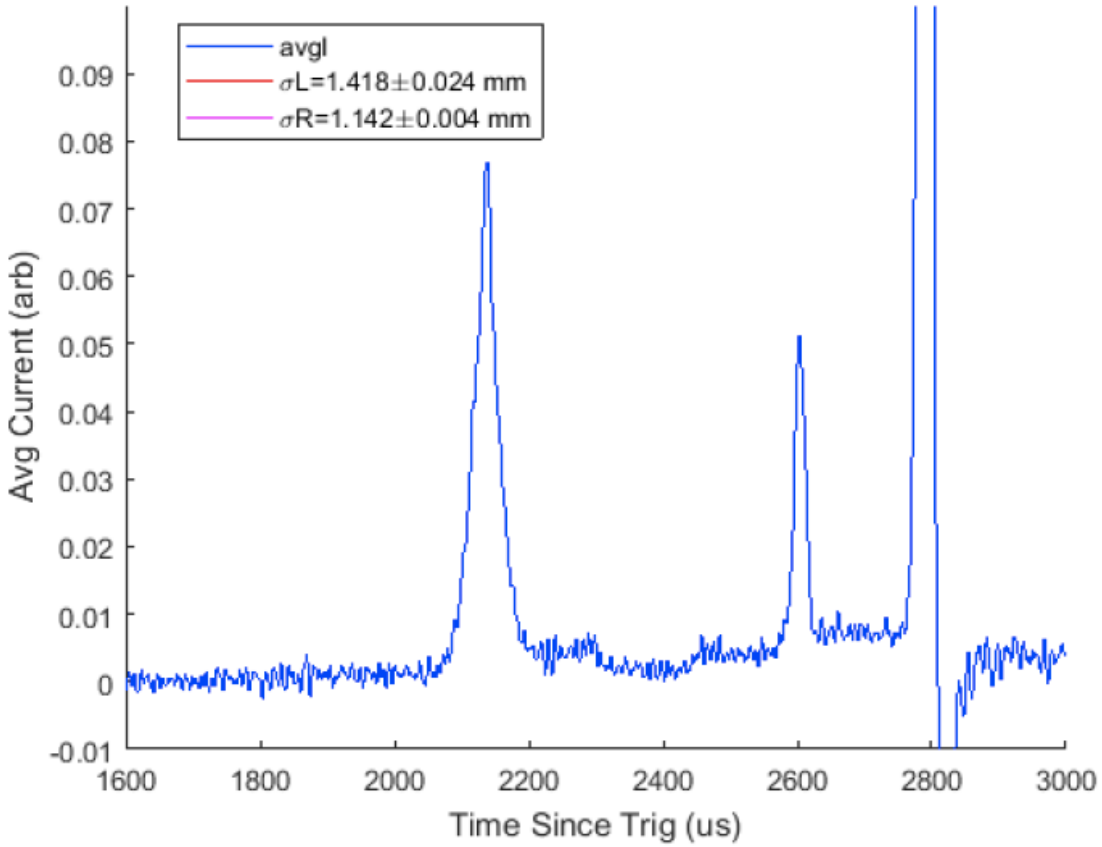

Figure 2

Figure 2: 20 Torr CF4 + a few Torr SF6 at 675 V/cm. This is the key result from this work. We clearly get NI behavior with just a tiny amount of SF6 but, besides the usual SF6- and SF5- peaks, we see an additional peak on the left. This is a new MINORITY carrier, whose amplitude can be 'tuned' as we find. In addition, its drift speed/mobility is quite a bit faster than the SFX peaks, which will allow for better fiducialization.

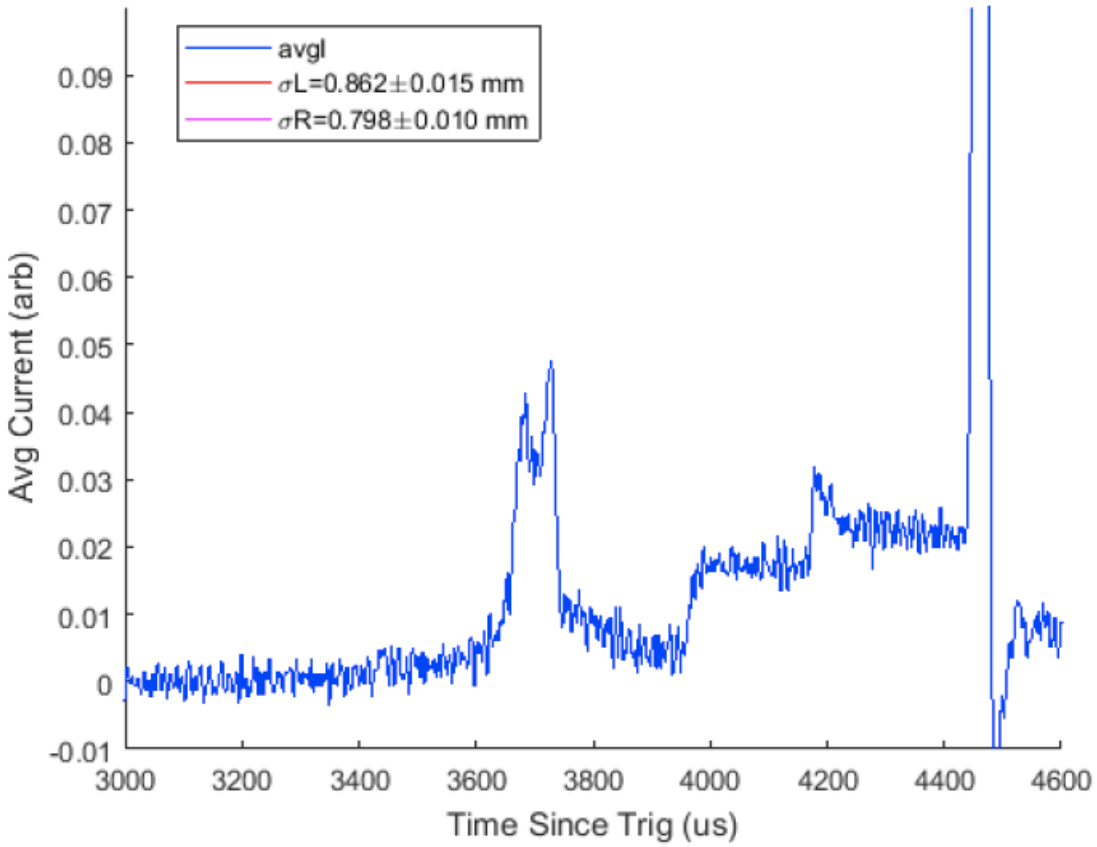

Figure 3

Figure 3: 50 Torr CF4 + a few Torr SF6 at 1000 V/cm. We now see that there are TWO new minority carriers, but we're not sure. Important thing here is that we're able to get good gas gain even at high pressure.

The advantage of this new gas mixture is that the dominant CF4 gives us spin-dependence, better fiducialization and, potentially, better gas gain at high pressures. The tiny amount of SF6 gives us the NI behavior, i.e., good diffusion.