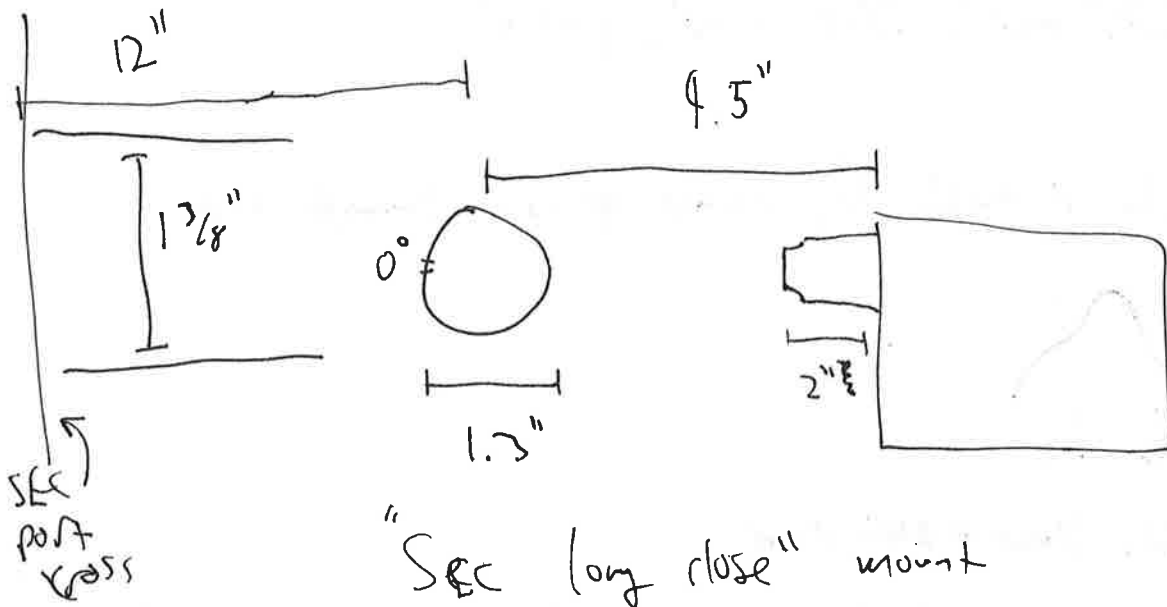


2020/09/29: Tuesday



SDD1, SN 27054, in SEC Radial Scan mount

SDD2, SN 16815, in SEC long close mount,  $0^\circ$

SDD3, SN 19777, in CC mid-point mount, Mylar filter, 9P3

10:35AM: (03,04) Seed plasma, back to  $H_2$ . Very <sup>obvious</sup> ~~prominent~~ lines.  
Clearer than krypton by a lot.

SDD3: 7.5% s, Lines at ch31, ch60 = 258eV, 517eV

SDD2: 340% s, Lines at ch38, ch46, C3 = 273eV, 374eV, 518eV  
+4 +18 +7

Recall my calibrations start at ch1, but DPMCA report starting at ch0.  
So add 1 to ch number, add 18 eV to energy values.

10:44AM (05,06) Ap & new. 21.2% s SDD3, 221% s SDD2. Drift occurred.

$\times 2.8 \quad \times 0.65 \quad 28/0.65 = 4.3$ , approx 5. good. Consistency.

10:48AM (07,08) Hyper B field. 336% s SDD3, 585% s SDD2

10:51 AM (09,10) No Mylar filter. SPD3: 124% SPD2: 256%  
Nitrogen line appears in SPD3.

10:58 AM (11,12) RMT seg. vs. SPD3 clearly piled up.

11:02 AM (15) Mylar re-usable. Very strange spectrum. Humped shape.



Noise. Must be RMT noise.

Persists even to Ap3. Yes, this is bad noise.

11:27 AM Got to the point that 200ns - 5.6ms peaky time noise don't extend beyond ch 25 at the end of the run. Good.

(19) ~10%, low count rate. Mostly at the end of the pulse.

Updell gets as low as -230V at the very end.

Compare to ~-310V on 2/5 at 1:20 PM

11:34 AM, After run 4. We'll see how things go. (20)

Yes, does appear to be ~5x higher count rate. Mostly at end of pulse again.

45% SPD3.

11:40 AM (21) After run 5. Mylar. ~230% Yes, ~5x higher again. Real X-rays.

Let's wait here. Oh, yes! See an oxygen line probably.

So... if this were good, threshold ~100eV,  $e^{-\frac{230}{30}}$  vs  $e^{-\frac{100}{30}}$   $e^{-\frac{230}{50}}$   $e^{-\frac{300}{50}}$   $e^{-\frac{300}{30}}$

Difference between 70eV & 50eV would be 20x to 50x

12:16PM (22,23) 55kW, up from previous.

SD2: ~20%

SD3: 700%

Shorter pulse, too. It was  
dying at the end and so  
here for X-rays.

X-rays don't come when the plasma dies.  
Pulse setting is ~290V

Yes, clear O line is visible.

12:31PM (24,25) 60kW now. SD2: 10%

SD3: 1,000%, half again higher.

We're losing it at around 2ms now.

O-line is visible. Looking good, plasma!

12:34PM Shortening pulse for safety. (26,27)

~~550%~~ SD3

12% SD2

12:41PM: Magnetic field up. Knobs vs blue: 304A

Magn-Power: 322A

SD3: 603%

SD2: ~12%

Basically same

12:48PM: 2.5 ms now, cause it can take it. (30,31)

SD3: 1075%

SD2: 10%

May just be my imagination... but spectrum  
looks stiffer. than at lower field

12:55PM: 70kW RMF power. (32,33) 2,500% SD3. O-line indistinct.

What if it were 5 cm radius, 15 cm long,  $1 \cdot 10^{12}/\text{cc}$ , 10 eV?

$$5 \cdot 10^{13} \text{ eV/cc} \cdot \frac{1.6 \cdot 10^{-19} \text{ C}}{1 \text{ e}} \cdot \left( \frac{100 \text{ cm}}{1 \text{ m}} \right)^3 = 8 \text{ J/m}^3 = 8 \text{ Pa}$$

$$8 \cdot 10^{-6} \text{ J/cc} \quad E = 7 \text{ mJ} \quad P_{\text{abs}} \sim 15 \text{ kW} = \frac{E}{t}$$

$$\frac{3}{4} \pi r^2 l = 880 \text{ cm}^3$$

$$t = 0.7 \mu\text{s} \quad \text{How could that be?}$$

$$\frac{B^2}{2\mu_0} = p \quad \mu_0 = 4\pi \cdot 10^{-7} \text{ H/m} \quad B^2 \cdot 10^{-5} \text{ T}^2 \quad B = \frac{32}{\sqrt{5}} \text{ G only. Not FRC if so}$$

w'd at max like 200 G

On 2/5, spectrum II get 30% into Ap1, 10 mJ/s.

$$\frac{30\%}{\text{ap1}} \rightarrow \frac{150\%}{\text{ap2}} \rightarrow \frac{750\%}{\text{ap3}} \rightarrow \frac{3750\%}{\text{ap4}} \rightarrow \frac{19,000\%}{\text{ap5}}$$

Currently I'm at 3,000% into ap5, 6.5x lower. But I had that Mylar filter in place which was been knocking it down by ~5x. So actually pretty similar.

Currently, CR into max channel is 379%

2/5 spectrum II get 5% into max channel. Equiv 625 into ap5.

Again fairly consistent.

CR above ch50 is currently 545%

2/5:11 above ch50 was 3.6% → 2,246%, 4.1x higher.

1:31 PM (58) Aperture 4. 419% total, 121% above ch50.

5.9x lower. 4.5x down Plausible!! (Count rate agreement.

35% into max channel, 10.8x down. Ok, max channel catches some noise.

But ch50 above is good. Max channel: 34.

CR above ch40: 184%, compare to 1084%, 5.8x. Better, but not perfect.  
ch5: 156% compare to 733%, 5.3% again, better.

I should set SCA8 to ch50+ only. That's frayed.

2:05PM (35) Back to Ap5. Drift. Let's see what changed.

2,573  $\mu$ s tot. (comparable).

545  $\mu$ s, above ch50. Same. OK, no drift.

2:07PM: Scope channels

C1: RMF pulse

C2: Aux 2, SDD3 : SCA8, ch0  $\rightarrow$  ch 8/91

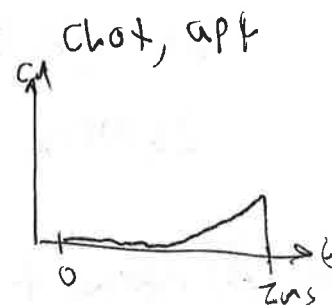
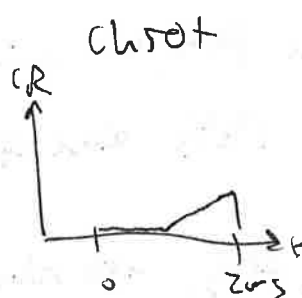
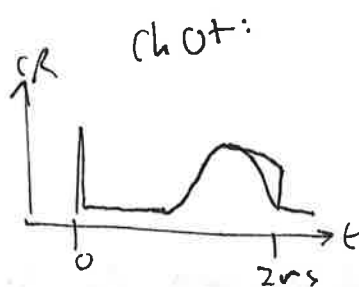
C2: Aux 2, SDD2 : SCA8, ch0  $\rightarrow$  ch 8/91

C4: Gate signal

Last Screenshot with this config will be at 2:10PM

After that, changing SDD SCA8 to be ch50  $\rightarrow$  on.

We'll see if this is anything like Ap4 scope trace



ch50t on apt5 matches apt. The initial burst & final fall must be due to the noise turn's getting in

Ok, I should gate the SDD to the beginning/end of the discharge.  
See what's up. Looks like 1.2ms might be a good dividing line.

0-1ms & 1.5-2.5ms

2:22PM: (36,37) Gated, 1.5ms  $\rightarrow$  2.5ms, the bright region.

8,000  $\mu$ s SDD3 How can that be?

OX750n K-d looks indistinct. Where does 0 go?

2:41 PM (38,39) Now it's gated between 0 and 1 ms.

Oxygen line appears strong!

<sup>650%</sup>  
w/ ~~350%~~ SAD? That noise isn't there.

Maybe it's still pickup. Wouldn't that be something?  
Getting through the Mylar.

2:52 PM: Something happened! Now we're at thousands of c/s and

(40) the input <sup>fast channel</sup> counts has similarly rocketed up

What happened? Did it get hotter? Noiser?

It's all noise / pickup. All low freq. chf.

2/5/11 didn't have an O K-d line. All intr in pulse?

It looks like a peak, but is it?

24,000 c/s, huh? 196% above ch50

3:05 PM (42) Aperture 4. Now: 45% <sup>max</sup> reduced from CR above ch50. Real X-ray?

3:09 PM (43) Aperture 1, gated to 1.5-2.5 ms. 615%

It's looking good! Similar to Ap5, without all that noise/pileup.

Compare to spectrum 36, 1177% above ch50. Huh... that's not great.  
What changed?

Aha. Current spectrum is 160% above ch50. Huh, factor of 7, not 5.

But yeah, let's compare to 34 & 36, and do Maxwellian fits of 50%.

3:24pm (44) Full pulse nos, 0-2.5ms. Slow threshold go. Ap5  
560%<sub>s</sub>

3:27pm (45) Lower pulse, lower B. 600%<sub>s</sub>, very similar.  
Max life 780%<sub>s</sub>, higher.

