03-01-04 Fritz Gap vs TCBOR Comparison Analysis experiment by Brett Miller

Fritz Gap Specs : 20 0.5" cu tubes 2" long
19 gaps spaced at : 0.014" per gap
Total spacing : 0.266"
Base/Dielectric : Lexan

TCBOR Specs* : 7 1.5" cu tubes 2" long
Housing : 6" green drain flume PVC 5" length
Gap Measurements: gap #1: 0.065"
gap #2: 0.040"
gap #3: 0.053"
gap #4: 0.024"
gap #5: 0.043"

Total Spacing : 0.225"

Above is a picture of both gaps used in the test, side by side.

The experiment will consist of several short coil runs alternating with the use of each static gap running a number of gaps which will result in the same (or as close as I can get in this case) total gap spacing:

1st 3 TCBOR gaps: 0.158"
11 Fritz gaps : 0.154"

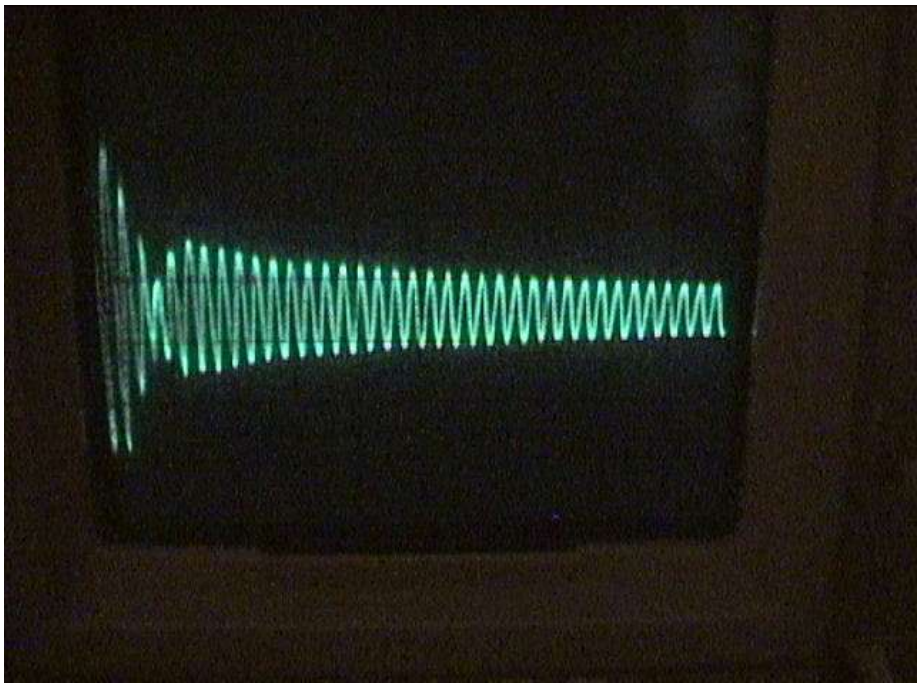
Notice the 4 thousandths of an inch difference, favoring the TCBOR for a higher firing voltage**.

Observations will consist of visually noting the difference in quantity and intensity of power arcs to a grounded target. Also, a Tektronix 922R will be used to observe the e-field of the running coil in an attempt to derive the quenching characteristics of each gap.

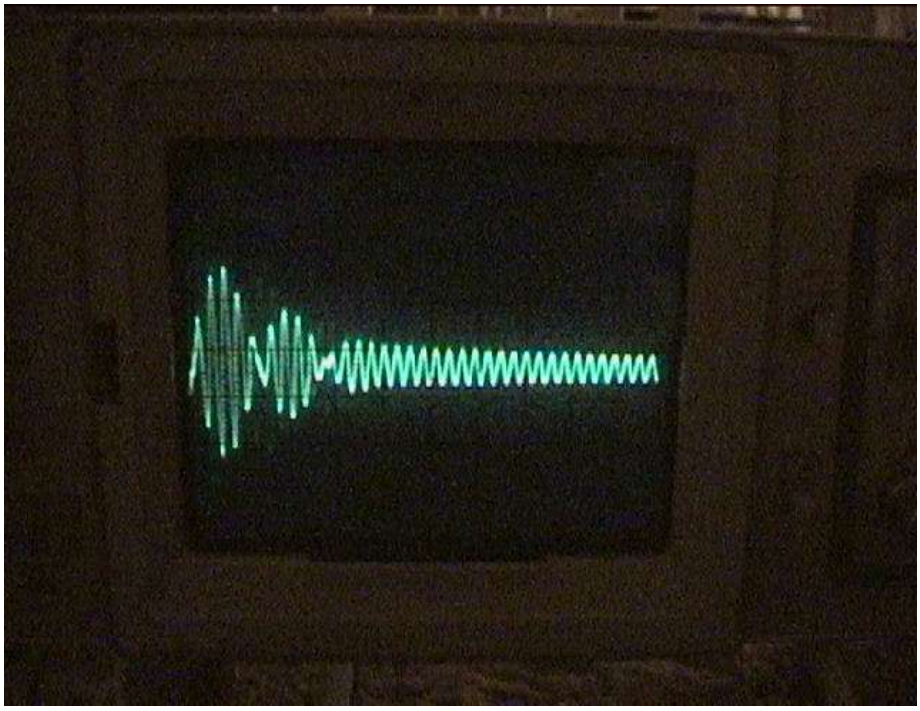
*This gap was constructed by myself, strictly according to the old Richard Quick document about 5 years ago. The only exception is that I didn't have a feeler gauge at the time so I just "eyeballed" it, and then adjusted it later according to best spark output from the coil. Later heat expansion caused the screws to loosen, so I expoxied everything in place. The gap also has slits cut into the pvc (between each gap) to facilitate cooling/quenching through the actual gaps using a fan. I believe I first saw this method used by Ross Overstreet on his TC website. No external cooling was used on either of the gaps during testing.

**Also it should be noted that the 3x larger diameter of the TCBOR electrodes would result in a greater theoretical standoff voltage.

- This is not intended to be a professional peer reviewed paper, but simply notes of an amateur published for entertainment of the amateur coiling community.



Above Fritz Gap appears to exhibit first notch quenching…Tek922R set to 20us per div, although scale illumination would have been advantageous. Looks as though there may have been some jitter here.



Above TCBOR gap exhibits a 3rd notch quench. 20us per div.

Results and Conclusions:

The scope Traces were gather via a 12" antenna on a BNC to clip lead connected to a Tektronix 922R 15MHz oscilloscope, placed 8 feet from the running coil. Specs for the 6" dia TC system are found at:

http://hot-streamer.com/brett/6inchcoil/6inch.txt

The coil was kept at a point just beyond where breakout first begins to occur. Around 60V on my 140V 20A variac:

The Fritz gap got noticeably hotter to the touch during the short runs (30 seconds or less) than the TCBOR, however this did not adversely affect performance (in terms of spark length and ferocity). I did not do any actual spark measurement since the difference between the performance of the gaps at this spacing (~.154-.158) was so drastic it did not matter what the actual lengths were.

At this distance both the static gap units began to fire at around the 55-60V mark on my 140V 20A 60hz variac.

As you can see from the waveforms above, the Fritz gap is the clear winner on the issue of quenching. Arcs made while using the Fritz gap were also longer more ferocious and numerous with both the gaps set for the same overall spacing. However, it is important to understand that not all coilers are after a first notch quench for their systems. Many coilers have provided reasons for **not** wanting a first notch quench and there are examples in the TCML archives.

The spark gap design, like that of the secondary and most (if not all) of the other components tends to be a compromise, based on the coiler's specific goals for output.