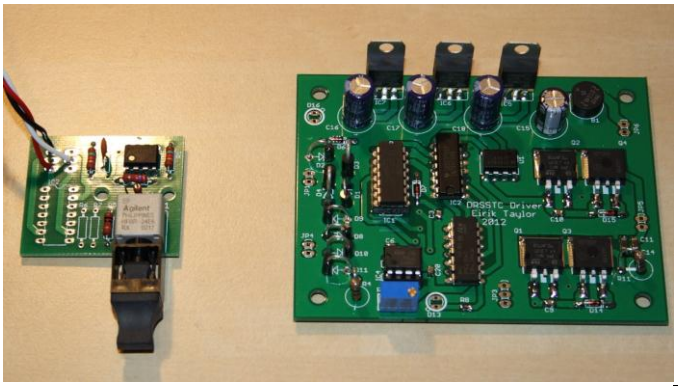
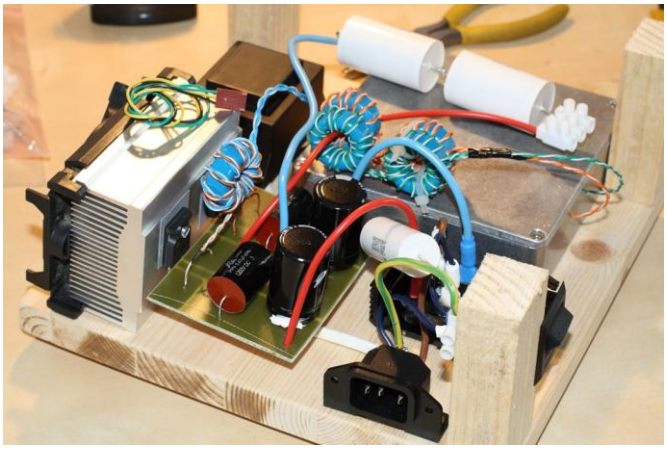
DUAL RESONANT SOLID STATE TESLA COIL 1

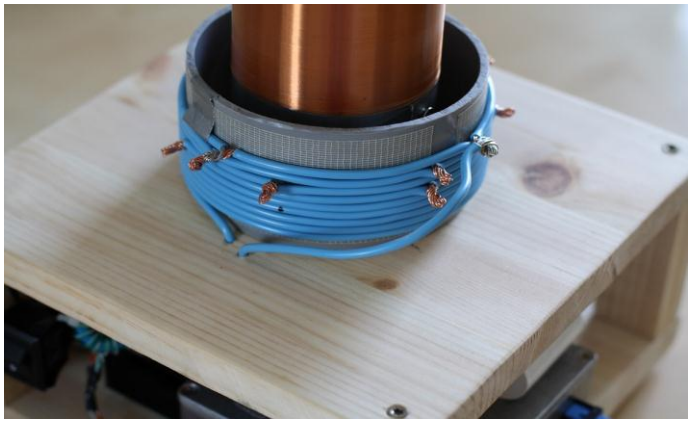
For someone who dabbles in solid state Tesla coils, it was high time I built a DRSSTC. The difference between a conventional SSTC and the DR-SSTC is the use of "dual resonance". What this means is both the secondary circuit (the topload and secondary coil) AND the primary circuit (now consisting of both a primary winding and a tank capacitor) are tuned to form a coupled resonant circuit. Just like the old spark-gap Tesla coils, which were popular before solid state coiling gained steam. The use of a rather high-Q resonant primary circuit results in massive tank currents, often in the range of 200-500A, which requires a low average duty cycle to keep power dissipation down. Typically a DRSSTC is run at 1-5% duty cycle using an interrupter, and yet is able to produce impressive streamers despite low average power.

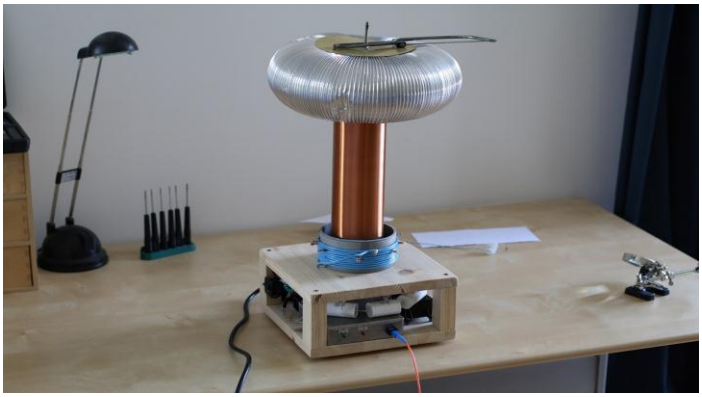
There is a wealth of information on DRSSTCs freely available on the internet, which I advise you to read. Check the provided links further down for starters. The driver design I used for this coil is one of Steve Ward's designs. I designed my own PCB based on his schematic, and had a bunch of PCBs fabricated by Seeedstudio. Gerber files and a mouser order list for the driver can be downloaded here.

The interrupter I used was something I had completed a long time ago, the universal Timer/interrupter module. With that done, I measured the resonance frequency of the coil with topload, which was used to determine the tank capacitor/ primary winding dimensions. In order to made tuning of the primary circuit easy, many turns were desired on the primary winding. This would lessen the inductive contribution of a single turn to the entire circuit, meaning I could set tap points at larger intervals. It also lessens the effect of undesired inductance in leads and internal wiring.









Construction details.

Specs:

IGBTs: FGH60N60SMD

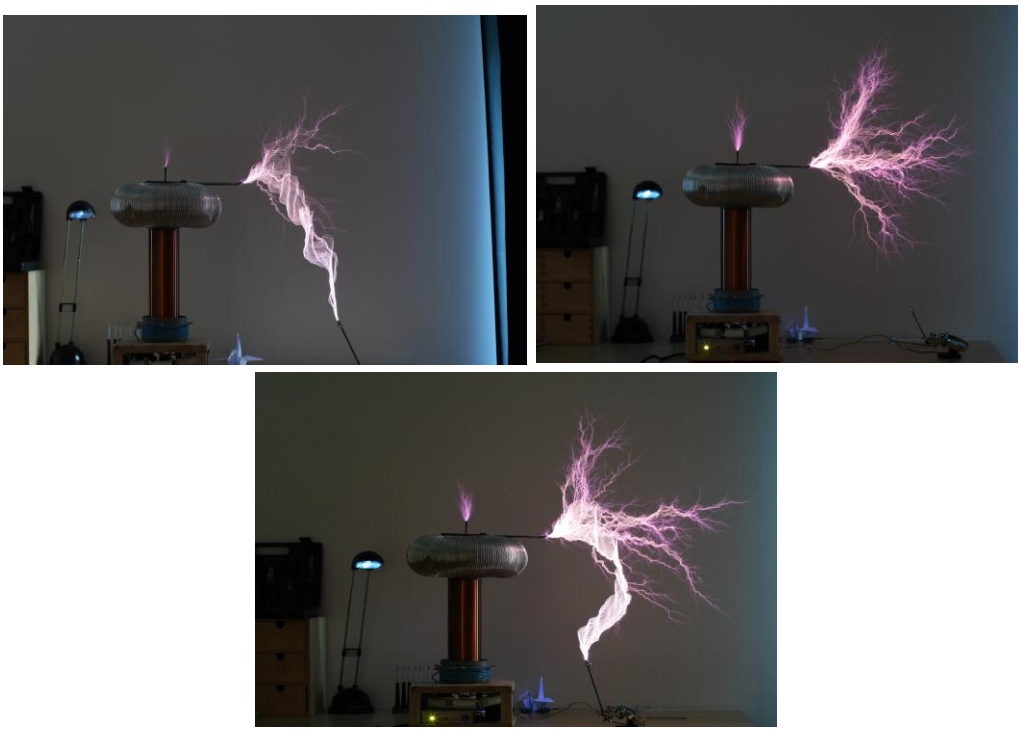
Tank Capacitor: 3x 942C20P15K in series for 50nF

Resonant Frequency: 200kHz

Primary Diameter: 11cm

Secondary Diameter: 8cm

Interrupter Settings: 250µs on time, 150Hz repetition rate. Have taken up to 360µs, 170Hz, although this doesn't increase streamer length, only arc power.



Streamers! Exposure time is 1/2 second, f2.8.

Some minor gotchas I encountered were phasing of the CT transformer used for feedback, in relation to the primary winding and GDT. Also, coupling needs to be fairly low to avoid racing sparks. It's not immediately clear in the images above, but the secondary is raised enough that the bottom turn is roughly level with the top turn of the primary. The primary tank capacitors had to be separated from the driver box due to corona forming at their contact point. 3mm of plexiglas placed between the capacitors and the box was enough to prevent this.

Source: http://uzzors2k.4hv.org/index.php?page=drsstc1