**GTS and UITF 350kV guns**

Over ~ 13 days, Bubba reached 229kV on the UITF “350kV gun”. Whereas the little gun reached 216kV in only a few days.

Bubba encountered some field emission but mostly he was dealing with voltage induced gas desorption (electrostatic force pulls gas from walls) which started at 121kV

Puncture (?) at 229kV accompanied by HVPS trip on over current. Material blown from insulator on the cable/atmosphere side. The vacuum side – no obvious damage, no visible path to atmosphere. Cable with carbon mark but might still be useable

UITF voltmeter was not setup in software to read HVPS current with enough accuracy, the current trip setpoint was at 300uA

Mostly identical geometries:

* gun chamber dimensions,
* cathode and shed electrodes,
* anode gap 9cm

GTS anode is large with 5 holes to support off axis illumination at angle, whereas the UITF gun anode is small, identical to CEBAF anodes, normal incidence illumination.

Damaged UITF insulator is from the same batch as one used at GTS gun, black mildly conductive. There should be two more left. (Purchased 5 total: Yan and I damaged the first one, one still functional at GTS, one damaged at UITF)

UITF gun used NEG wire screen instead of perforated sheet. The wire screen held in place with buttons affixed to threaded posts. The buttons are all present and accounted for, none pulled off due to electrostatic force.

GTS gun was krypton gas conditioned from the start, reached 365kV in 70 hours.

The NEG coating looks good, no obvious particulate in bottom of gun. The electrode looks good, no obvious damage.

Dummy mirror puck looks damaged

Extractor gauge might not have been grounded. NEGs grounded at one end, the anode was grounded through picoameter.

We heated the electrode, thinking the gas was coming from the electrode. Heating over the weekend to ~200 C did not help.

Vacuum in the gun degraded from -12 to -9 Torr during HV processing. It did not appear we would restore good vacuum post HV conditioning. It seemed clear we were going to have to re-bake the gun once we reached our desired voltage, and then repeat conditioning hoping we had removed the argon and neon from the gun.

Marcy reminded us that the CEBAF gun is NEG coated too. But we only took it to 150kV and we operate it at 130kV.

Questions:

Typically voltage induced gas desorption starts at ~ 180+kV. Why was voltage induced gas present at such lower voltage? Visible at 121kV. Could similar behavior have been masked at the GTS because we started with gas conditioning right away?

Why was neon so prominent (argon too, but maybe NEG coating made with argon)? We don’t think mass 20 = doubly ionized argon. We can probably assume the ion pump is fine and not the source of neon, because we did achieve the best vacuum of any gun ever made. Does neon originate from prep chamber?

Does Gas Conditioning protect the gun? Should we always gas condition the gun first, never condition under vacuum at first try?

Why is mirror puck scratched? Pockmarked? Do the springs push the puck into place properly?

The gun sat under baked vacuum for a long time (a year?). Did this have anything to do with gas desorption behavior?

Why didn’t the black mildly conductive insulator protect us from this accident? Does the conductive insulator do anything useful for us? Previous tests with R30 insulators – white and black – reached higher voltages, ~ 300kV. This is the first R30 to die at 220kV.

Plan:

* Remove NEG coating? how?
* Obtain perforated sheet with ~ 60% open space
* Add threaded posts, to secure the perforated ground sheet?
* Install a puck with dummy GaAs wafer next time, no mirror puck
* Verify puck sits flush with electrode face
* Align, install, bake, gas condition, bake again, make beam.

More Questions:

Test prep chamber first? Does it need to be fixed before baking?

What gun do we put on the table? Note, we don’t have the high voltage cable for little gun….available at end of August. Rebuild big gun and re-install it, or put little gun in its place and commission it with beam, then move it to CEBAF?

Do the two guns have same length? Can little gun drop in place today, with NEG tube available, and table located where it’s at now.

M20 BPMs on the NEG tube at UITF?