January 24, 2019

Gabriel’s thesis DRAFT outline

Suggested by Matt in April 2018:

Carlos’ color code:

LIKE

IN PROGRESS

NO LIKEY

1)      **200kV gun electrostatic design and beam based assessment of gun features, like Yan is doing now with 300kV gun.  i.e., compare predictions and measurements, emittance across the face of the photocathode, measurement of emittance, beam deflection (AND TRANSMISSION?).  Can happen at CEBAF or UITF.**

**In progress. T-shape electrode in UITF now. Reduced mushroom electrode to be characterized in UITF before going to CEBAF.**

Gabriel’s published paper #1:  "*Electrostatic design and conditioning of a triple point junction shield for a -200 kV DC high voltage photogun,*" Review of Scientific Instruments **89**, 104703 (2018)

* Another paper on beam characterization with each electrode

2)      **Design 200 and 350kV Wien filters.  Build the 200kV Wien filter, test it, measure beam properties of this new Wien filter.   CEBAF or UITF. How much of this will be on him to build it? Do we have already in the UITF the 200lV version?**

* Need to be brought up to speed by Joe on the relevance of this work, and on the design details.
* A paper on the design, construction, magnetic field mapping, and beam-based characterization?

3)      Particle tracking code estimates of CEBAF front end, beam through two-Wien spin flipper (energized).  Bunchlength and transmission vs current and gun voltage.  
  
4)      Assist Brock Roberts with design of RF cavity beam magnetometers.  MicroWave Studio, AC fields, optimize designs, pros and cons of each design.  We want cavity sensitive to magnetization at GTS and maybe UITF, and sensitive to polarization at UITF and CEBAF.  The tricky part here…we don’t know if an RF cavity can detect beam angular momentum.  
  
5)      Assist Reza Kazimi with design of new CEBAF chopper system, RF deflecting cavities that Fay and Mark could use as bunch length monitor for pulsed tgun project at GTS  
  
6)      **Electrostatic design of 500kV gun that uses giant insulator and plastic receptacle with intervening SF6 layer.  Larger photocathode than we use now, optimize the design to allow laser illumination with 1cm beams (no beam loss). I also would like him to work on modeling an insulator that can fit directly to an 350kV plug, hopefully collaborating with MPF through an SBIR. Let’s talk about prioritizing ideas/tasks, what would be important for a 500kV helping nuclear physics programs? How does this fit with Mamun’s Early Career Proposal?**

* Model a dummy electrode with triple junction shielding (3JS) to fit SCT’s ginormous inverted insulators inside the ginormous vacuum chamber.
* Develop concepts for 350kV plug fit to insulator (SF6 layer? Machined epoxy receptacle?
* Test chosen concept in chamber with dummy ball in SF6, does it blow up, or not?
* Then test under vacuum conditions.
* Based on outcomes, then the electrode front end could be designed to accommodate either large photocathodes, or keep the standard size for JLEIC polarized electron source, but this might be towards the end of Gabriel’s PhD program and he might not get to be a part that, which is ok.