

Injector Test Cave “to-do” list:

February 13, 2014

Proposed Milestones:

- 1) Designer to layout region 1, from gun to $\frac{1}{4}$ CM (4 months, or 0.25 FTE, complete by June)
- 2) Adderley to begin building the beamline (gun to A4, under vacuum by October 2014)
- 3) Model the proposed beamline (2 months, complete by May)
- 4) Purchase insulators (receive by mid-June)
- 5) Finalize the gun chamber design (2 week designer time, working from Chris Wicker prints)
- 6) Purchase gun chamber, bake at 400C, add NEG, insulator, ball electrode, prep chamber, NEG tube and valve, etc. (under vacuum by end of August)
- 7) Purchase Glassman 450kV HV supply and SF6 tank (receive items, install at Cave, electricians to provide power, approval for SF6 by DA, ready to turn ON by August)
- 8) Successful high voltage tests of 350kV gun at GTS by end of August
- 9) HV testing of ITC gun beginning October 2014, with OSP and locked door
- 10) Top of cave cleared of stuff, HPA and klystrons positioned above Cave, electronics racks positioned above Cave (by September)
- 11) Electricity and water delivered to racks above Cave (early FY15)
- 12) Facilities remove knee wall
- 13) Complete the seismic analysis
- 14) Move the AC power panel
- 15) Provide AC power inside the Cave
- 16) Design the concrete shield doors
- 17) Kellner to move concrete blocks, build new cave
- 18) GN2 restored
- 19) SRF to perform vacuum check of $\frac{1}{4}$ CM
- 20) EES to wire up magnets, bpms, cups and dumps, harps, SCAM, etc.
- 21) Laser light to gun
- 22) Cryo group to connect $\frac{1}{4}$ CM to Test lab LHe, provide epics controls
- 23) EES to apply RF to $\frac{1}{4}$ CM
- 24) Beamline downstream of $\frac{1}{4}$ CM designed, layout in hand
- 25) Beamline to HDIce....

New 350kV Gun

- 1) Review chamber design, make modifications if necessary.
 - a. Add the neg pumps, modules or sheet? Ground screen?
 - b. Modify the puck design, and/or the way pucks are held inside ball electrode (Marchlick's design)? (save for later upgrade)
 - c. Moveable anode? (save for later upgrade)

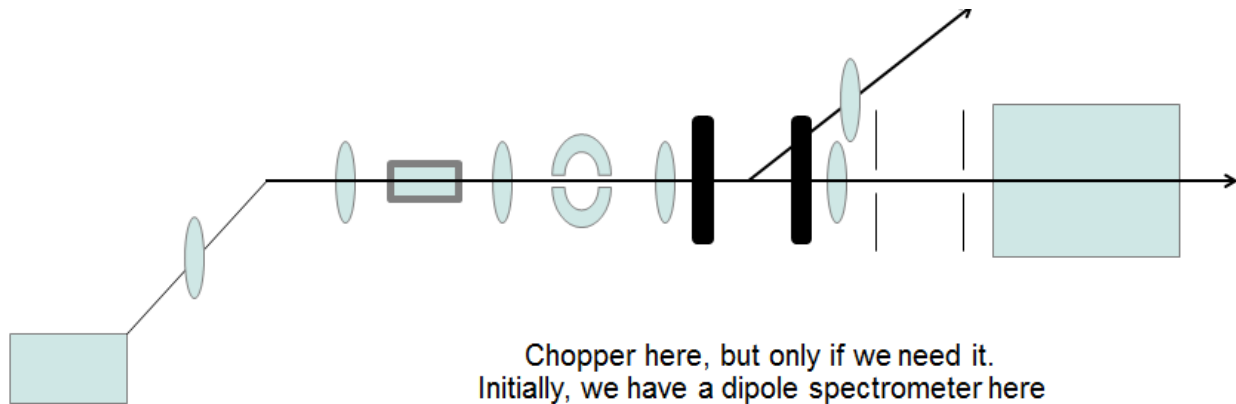
- 2) Order chamber and perform 400C bakeout, measure outgassing
- 3) Use the 200kV gun table, use the 200kV gun prep chamber
- 4) Order R30 black insulators
- 5) Niobium electrode, stainless steel electrode, TiN-coated electrode made of aluminum and /or copper?

Glassman 400kV high voltage power supply

- 1) Agree on specifications, purchase. PSS connection? Add this to specifications?
- 2) SF6 tank with receptacle(s). Have it arrive with pressure vessel stamp of approval
- 3) Conditioning resistor? Leave in place all the time?
- 4) Where to put the supply?
- 5) Electricians to provide power

Beamline Region 1: from gun to entrance to ¼ CM

- 1) Agree on the layout: Gun, solenoid1, 15degree bend, solenoid2, Wien filter, solenoid 3, buncher, solenoid 4, dipole to spectrometer, solenoid 5, A3/A4, 1/4CM
- 2) Have a designer lay things out....use 80/20 aluminum cage instead of girders
- 3) Someone to model this layout for us, determine beam specs (what if gun operates at 300kV, 500kV? How much bunching do we expect to need? Optimum laser pulsewidth?)
- 4) Solenoids for 350kV beam, can we use U of I magnets? If not, design and build new ones
- 5) 15 degree bend magnet design and build
- 6) Can we use existing Y chamber and laser chamber?
- 7) Modifications to our spare Wien?
- 8) Buncher
- 9) Buncher RF
- 10) How to set the buncher? Yao cavity upstream of 1/4CM?
- 11) Dipole magnet to spectrometer (do we have one?)
- 12) Spectrometer line: viewer, harp, dump, mott polarimeter
- 13) Identify all beamline components: valves, viewers, bpms, steering magnets, insertable cup, dumps, apertures,
- 14) Differential pumping, where and how many? Use newer thin design
- 15) Need many UHV ion pump supplies
- 16) Pick a suitable naming nomenclature: 0I, 1I, 0L ?



Beamline Region 2: 5 MeV within the cave

- 1) Locate the position $\frac{1}{4}$ CM
- 2) SRF to install the $\frac{1}{4}$ CM for us
- 3) Locate good positions for the RF waveguide penetrations in Cave ceiling
- 4) Cyrolines
- 5) Identify the components of this region, from $\frac{1}{4}$ CM to hole in wall.....
- 6) Dipole to bubble chamber zone...
- 7) Yao cavity here?

Beamline region3: beam outside the cave, to HDIce

- 1) Chicane
- 2) Bpms
- 3) Cavity bpms
- 4) Quads
- 5) Harps
- 6) Faraday Cup 2

Personnel Safety System and Machine Protection:

- 1) Door interlocks to what? Gun HV supply, Laser shutters, valve to gun?
- 2) A two region design, for beam that stays within the cave, and then for when beam leaves the cave to "physics hall"
- 3) Lots of local shielding, CARMS and BLMs
- 4) Doors and labyrinth

Work for EES:

- 1) New and improved ItoV current monitors
- 2) SCAM
- 3) Video monitor system

- 4) RF control modules, at 1497 MHz for laser, buncher, 1/4CM
- 5) Need a master oscillator
- 6) nA cavity BPMs
- 7) tune mode BPMs
- 8) HARP control
- 9) Picoammeters at dumps, cups and apertures. Picoammeter switcher?
- 10) Buncher RF amplifier
- 11) HPA and two klystrons

Infrastructure work inside/outside the Cave:

- 1) Remove concrete blocks at gun-end of cave? Why?
- 2) Pull old un-used electrical
- 3) Install new electric where we want it
- 4) Continue to remove old un-used stuff from walls....like FEL light box stands...
- 5) Add a cable tray above the beamline
- 6) Racks near the gun
- 7) Excess or dump old un-used equipment
- 8) A good workspace Jim's old office
- 9) Cabinets and shelves, organize our equipment
- 10) Paint the floor of cave again?
- 11) Need electronic folder that contains our pressure vessel approvals
- 12) Get a ladder with platform

Above the Cave:

- 1) When to clear out space, how much space is needed?
- 2) HPA and klystrons: find them and install, electricians to provide power
- 3) Waveguides and penetrations
- 4) How many racks for magnets, I&C, cryo, RF, etc.,?
- 5) Jackhammer more penetrations?

Control Room:

- 1) When to get tables and chairs
- 2) New ceiling tiles
- 3) Network and phone connections
- 4) Racks inside control room for network, PSS?
- 5) PSS console
- 6) Wall? Desktop monitors
- 7) Space for HDIce controls?

Software:

- 1) What computers do we need?
- 2) When to load software?

Laser Room and laser table near gun:

- 1) Fully functional laser table with CW and macropulse modes
- 2) 780nm doubler system
- 3) Light at 780nm delivered to cave via fiber
- 4) Pockels cell near beamline
- 5) Stepper motors, insertables,
- 6) IOC and RF control module?

Facilities Work:

- 1) Remove the triangular shaped concrete piece that limits access to cave
- 2) Build new cave for HDIc
- 3) Electric supply moved
- 4) Electricity delivered where needed
- 5) Need a labyrinth and door(s)

Ongoing relevant R&D, needed to ensure success at Test Cave

GTS work with 500kV inverted gun#1

- 1) R28 black insulator + dummy ball electrode, happy at 360kV with krypton and 350kV under vacuum
- 2) R30 white insulator with shed: in progress
- 3) R30 white insulator with zirconium coating
- 4) Need clean SF₆
- 5) Add long receptacle to SF₆ tank, modify the resistor
- 6) Need to test TiN-coated aluminum ball

Field emission tests: aluminum and copper electrode coated with TiN

- 1) Finishing tests with aluminum polished to 1200 grit, then TiN coated
- 2) Can begin TiN coated copper tests soon.....

CsK₂Sb photocathodes:

- 1) Develop reliable recipe
- 2) Modify the depo chamber to accommodate pucks and white light heater
- 3) Test crucible sources of CsOH and KOH
- 4) Attach to gun at GTS

Beamline at GTS: 350kV gun, CsK2Sb lifetime tests, Brock cavity development for pulse kicking:

- 1) Remove old crap from GTS
- 2) Build simple beamline with two or three solenoids, viewers, valves, and dump
- 3) Brock cavities
- 4) Need a laser chamber or 15 degree dipole chamber....
- 5) Simple green laser system (find our 5W 1064 amp, Gaskell)

Components Region 1:

Gun (with ion pump, floating anode to ammeter)

Bpm +Steering magnet pair

Solenoid1

BPM +Steering magnet pair

4.5" valve, electropneumatic

Y chamber with one viewer+camera, NEG pump array, ion pump

15 degree magnet

Laser Chamber with one viewer, ion pump

Bpm + Steering magnet pair

Solenoid 2

Bpm + Steering magnet pair

Cross with viewer and small ion pump

Wien filter

Cross with viewer and small ion pump

Bpm + Steering magnet pair

Solenoid 3

Bpm + Steering magnet pair

Differential pump

Buncher

Viewer and small ion pump

Solenoid 4

Bpm + Steering magnet pair

Dipole magnet

Solenoid 5

Viewer

Bpm + Steering magnet pair

Insertable faraday cup

A3

Differential pump

Valve