***PROCEDURE FOR PHASING THE LINAC***

***Screens:***

BURT, RF Combo for each Zone, BPM rels, BPM global controls, Viewers, MPATH.

A phasing worksheet (embedded Excel workbook) is provided below for your convenience. Double click on the table to get access

1. ***Perform an all-save***
2. ***Insert beam dump IDC5F08***
3. ***For each of zones 2, 3, and 4 (in that order) go through the following loop (one zone at a time)***
   1. Zero BPMs
   2. Set Zone gang phase to 0o
   3. Record vernier cavity (3-3) GSET: GSET3\_3=\_\_\_\_\_\_\_\_\_\_
   4. Adjust (reduce) GSET3\_3 to make <x2F08>~5 mm GSET3\_3=\_\_\_\_\_\_\_\_\_\_

***NOTE: steps 3.a-d set the beam position so it stays in the linear range of the BPMs while you’re moving the phases around***

* 1. ***For each cavity N=8, 7, 6,… 2, 1 (in that order – phase low to high energy) go through the following loop (one cavity at a time)***

***NOTE: this procedure moves the beam well off crest (onto the falling part of the waveform) and calibrates the position as zero at this initial “*test*” phase. It then steps it up across crest, and then on to the rising part of the waveform. When the position gets back to zero, it is as far ahead of crest as it was behind crest at the first zero. Crest is then established as the midpoint of the two test phases.***

* + 1. Record cavity PSET
    2. Decrease PSET by 30o; record this as test1

***NOTE: if (PSET-30o) < -180o, set test1 = (PSET – 30o + 360o) so as to stay in range of slider***

* + 1. Zero BPMs
    2. Using phase slider, *increase* phase set point in 1o steps – making <x2F08> increase and then decrease – until <x2F08> = 0 again

***NOTE: if set point exceeds 180o as you increase slider value, jump PSET to -180o so as to stay in the range of the slider and continue to increase phase set point to -179o, -178o, -177o, …***

* + 1. Record test2 at which <x2F08> = 0 is recovered.
    2. Evaluate PSETNEW=(test1 + test2)/2

***NOTE: if you jumped phase over -180o for test1 or +180o for test2 be sure to “wrap” the phase properly to get the midpoint phase. This can be evaluated as follows:***

***IF*** -180o < test1 < test2 < 180o ***(no jumps)***

PSETNEW=(test1 + test2)/2

***IF*** -180o < test2 < 150o < test1 ***(i.e., if you wrappedtest1)***

PSETNEW=((test1 -360o)+ test2)/2***;***

***If in addition*** PSETNEW<-180o, add 360o

***IF*** test2 < test1 < 150o ***(i.e., if you wrappedtest2)***

PSETNEW=(test1 + (test2+360o))/2***;***

***If in addition*** PSETNEW>180o, subtract 360o

***Any other case? Call for help…***

* + 1. Reset original PSET to PSETNEW
    2. Proceed to next cavity; at N=1 (last cavity) go to Step 4.

1. ***With all cavities individually phased, reset vernier cavity GSET3-3 to initially recorded value***
2. ***Gang-Phase Zone***

***NOTE: this step moves the beam well off crest (onto the rising part of the zone waveform) and sets the position to zero at this initial test phase. It then steps it up across crest, and thence on to the falling part of the waveform. When the position gets back to zero, it is as far behind ahead as it was behind at the first zero. Crest is then*** ***established as the midpoint.***

* 1. Set gang =gangtest 1 = 10o
  2. Zero BPMs
  3. Reduce gang in 0.1o steps – increasing and decreasing <x2F08> – until <x2F08> = 0 is recovered at gangtest 2
  4. Record gangtest 2
  5. Zone crest gang phase is gangcrest =(gangtest 1+gangtest 2)/2; if |gangcrest|>1o, call for help.
  6. Set zone operating phase to gangcrest+10o .
  7. Zero BPMs
  8. Extract dump IDC5F08 and return to Step 2 and repeat for next zone; all zones completed, proceed to Step 6.

1. ***With all cavities and zones phased, set recirculator path length to phase energy recovery pass.*** 
   1. Insert ITV1G01
   2. Adjust MPATH in 0.1 A steps to center beam on viewer.

***NOTE: Moving MPATH current in the positive direction lengthens the orbit, moves the phase toward trough (assuming a “near normal” setup), the beam to lower energy at the dump, and upward on the viewer.***

***If you can’t find the beam on the viewer with a 2 A change in MPATH or if beam width exceeds the viewer field, call for help established as the midpoint.***

* 1. Withdraw ITV1G01; allsave. Procedure complete.

Workbook for phasing: enter data in blue fields; new values in peach fields; double click to access Excel

