**Theme 1 – 130 keV CW setup CW to 1D**

**~~Beam Pre-requisites~~**

1. ~~Hardware/software HCO completed~~
2. ~~Cathode=130 kV, Anode=0 kV w/o FE~~
3. ~~Photocathode activated~~
4. ~~Laser aligned (laser spot sizes measured)~~
5. ~~QE scan~~
6. ~~Solenoid and dipole values for 130 keV beam calculated and posted~~

**Deliverable => Can run beam**

**~~Restore beam to 1D~~**

1. ~~Warm RF off~~
2. ~~Wiens and quads off~~
3. ~~Steer VL beam to FC#1 viewer, save setup~~

**Deliverable => Dipole, steering coils, solenoids are approximately well set**

**HCO with Beam to 1D**

1. Check correctors move beam left-right-up-down on viewers VL
2. Check correctors move beam left-right-up-down on bpms TM
3. Check correctors maximize current in pcup/FC1/1D TM
4. Check correctors maximize current on A1 (3 holes) and A2 (PSS hole) TM
5. Check harp scans beam TM
6. Check Decarad sensitivity vs. VL beam loss (<50 nA)

**Deliverable => Basic diagnostics for viewer, bpm, harp, aperture, cups**

**Perform PSS kicker certification (uses 130 keV kicker)**

1. Perform functional kicker test

**Deliverable => PSS certification of kicker**

**Refine dipole and lens centered orbit to FC1**

1. Correct gun kick
2. Center on 15 deg dipole
3. Center on lenses
4. Center on Wien filters (apertures, quads) w/ Wiens off/on/etc

**Deliverable => good orbit to FC#1**

**First CW beam**

1. Compare TM vs. CW @ PC, A1, A2, MS, FC1, 1D <20 uA
2. Monitor vacuum when increasing current <100 uA
3. Calibrate PCUP to HVPS <100 uA
4. (opportunity) Answer if lifetime is notably ‘bad’ or ‘ok’ at 100 uA

**Deliverable = Restore CW capability**

**Test new 200 kV PSS kicker (for 130 keV)**

1. Perform functional kicker test

**Deliverable => PSS certification with new 200 kV capable kicker**

 **Warm RF CW setup to FC1 – Part 1**

1. Setup chopper RF amplitudes/phases and lenses for chopping/dechopping
2. Setup phase ABCD lasers through slits to FC1
3. Setup pre-buncher RF phase for bunching
4. Measure bunching gradient (how – on chopper screen?)
5. Measure transmission vs. gradient <100 uA to FC1

**Deliverable = High current bunched & chopped CW beam to FC1**

**Warm RF CW setup to 1D – Part 2**

1. Setup buncher RF phase for bunching
2. Measure bunching gradient (how – on keV dump?)
3. Setup capture RF amplitudes/phases for 500 keV
4. Setup 500 keV CW beam to 1D <100 uA

**Deliverable= High current bunched 500 keV beam to 1D**

**Theme 2 – 130 keV setup to FC#2 (requires SRF)**

**Hot Checkout with Beam to FC2**

1. Restore beam to FC#2
2. Standard HCO with beam to FC2 (RF, magnets, diagnostics)
3. Restore beam to 2D spectrometer – HCO (magnets, diagnostics)
4. Restore beam to 3D Mott – HCO (magnets, diagnostics, target, detectors)

**Deliverable => HCO with beam to FC2**

**CW Beam setup to FC2**

1. 0L02 setup 6.3 MeV CW

**Deliverable => Restore high current 6.3 MeV CW beam ABCD to FC2**

**Theme 3 – 130 keV Optics (Dipole, Wiens, Quads)**

**Optics Tools Ready**

1. Test qsUtility harp scan method (sole-A1-harp)
2. Measure emittance/Twiss of ABCD beams for refined setup to FC1
3. Test qsUtility YAG screen method (sole-A1-YAG)
4. Measure emittance/Twiss vs. harp method (agreement?)

**Deliverable = Ready to quickly measure emittance/Twiss**

**Dipole Optics**

1. Measure emittance/Twiss vs. dipole gap setting
2. Choose optimum dipole setting (alphax = alphay ?)

**Deliverable = Define 15 deg dipole setting**

**Wien Filter Operation**

1. Calibrate E/B settings for un-deflected beams both Wiens
2. Measure Wien ToF delay using chopper
3. Calibrate quads with qsUtility
4. Measure emittance/Twiss vs. Wien filter spin angle (measure dp/p?)
5. Match Wien optics, compared transmission matched vs. unmatched optics
6. (to FC2) Calibrate spin precession vs. E/B settings

**Deliverable = Demonstrate Wien filter operation and performance**

**3D Wien Flipper Operation**

1. Calibrate solenoids with qsUtility
2. Match cases Flip-Left, Flip-Right, Vertical-Up, Vertical-Down
3. (to FC2) Calibrate spin precession of FG solenoids
4. (to FC2) Test FG co-cycling vs. standard cycling (> 1 deg)

**Deliverable = Demonstrate capability to deliver polarized beams**

**High Current Fall Setup – An Example**

1. Demonstrate ABCD high current setup for Fall 2021 run

**Deliverable => Ready for beam ops**

**Theme 4 – 130 keV Parity Quality Beam Assessment**

**Parity Quality Beam Assessment**

1. Beam based cathode rotation
2. Initial PQB checkout to 1D (Q asy, Pos Diff)
3. Chopper Scan
4. RTP pos diff feedback convergence (FC1 checkout, then FC2 study)

**Deliverable = PQB assessment of new injector beam line @ 130 kV**

**Theme 5 - 200 kV**