**Theme 1 – 500 keV CW beams to 1D**

Beam Pre-requisites

Prior to beam commissioning…

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

ATLis 22180: Gun to Chopper Commissioning up to Pcup/FC1 (130/200kV) – 3 shifts, per gun HV?

**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 solenoid wiring with beam
4. Check correctors maximize current in pcup/FC1/1D TM
5. Check correctors maximize current on A1 (3 holes) and A2 (PSS hole) TM
6. Check harp scans beam TM
7. Check Decarad sensitivity vs. VL beam loss (<50 nA)

ATLis 22181: Early Injector Orbit Data Collections – ½ shift, 130kV only?

ATLis 22182: Setup beam from Pcup→FC1 – 9 shifts,

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

Perform PSS kicker certification (uses 130 keV kicker)

1. Perform functional kicker test

ATLis 22061: PSS Kicker Test (130/200kV) – ½ shift each

**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

ATLis 22184: Efficacy of Knobs chosen for spot move – 3 shifts, 130kV only?

ATLis 22182: Setup beam from Pcup→FC1 – 9 shifts, 130kV only?

 How many of nine shifts here? 4?

**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

ATLis 22182: Setup beam from Pcup→FC1 – 9 shifts

 How many of nine shifts here? 3?

ATLis 22080: HVPS vs Pcup Current Cal (130/200kV) – 1/8 shift at each Gun HV

ATLis 22082: Photocathode Lifetime (130/200kV) – 1 shift at each Gun HV

**Deliverable = Restore CW capability**

Test new 200 kV PSS kicker (for 130 keV)

1. Perform functional kicker test

ATLis 22061: PSS Kicker Test (130/200kV) – ½ shift each

**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
6. Measure bunchlength vs gradient

\*\*\*EES-RF to support, especially when trying 200kV setup\*\*\*

ATLis 22190: RF Element Setup for AIPINJ, 130kV – 3 shifts, tune-mode only

 need another ATLis for CW or revise 22190?

 ...for prebuncher gradient measurement?

 ...for transmission vs gradient?

 … chopper amplifier commissioning?

**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

ATLis 22182: Setup beam from Pcup→FC1 – 9 shifts

 How many of nine shifts here? 2?

ATLis 22183: Beam steer from FC1 to FC2 – 3 shifts

 How many of three shifts here? One?

 need another ATLis for buncher gradient measurement?

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

**Theme 2 – 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)

ATLis 22183: Beam steer from FC1 to FC2 – 3 shifts

 How many of three shifts here? 2?

Mott HCO

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

CW Beam setup to FC2

1. 0L02 setup 6.3 MeV CW

Regular 0L02 setup. No ATLis? 22183

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

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

Optics Tools Ready

1. Test qsUtility harp scan method (sole-A1-harp) ATLis 21923
2. Measure emittance/Twiss of ABCD beams for refined setup to FC1 ATLis 21923
3. Test qsUtility YAG screen method (sole-A1-YAG)
	1. Brian Freeman tools
4. Measure emittance/Twiss vs. harp method (agreement?)

ATLis 21923 for 130keV, 22072 for 200keV, qsUtility – 2 shifts for each gun HV

**Deliverable = Ready to quickly measure emittance/Twiss (w/qsUtility)**

Dipole Optics

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

Before Wien setup, nail down dipole optics.

ATLis 22160: MDF1I02 Optics vs Coil Fixture Rotation

**Deliverable = Define 15 deg dipole setting (mechanical shims, current 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 – 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**

**Repeat Themes 1-4 for 200 kV (as needed)**