

# Startup Plan

- AGS pp setup: 3 weeks before RHIC
- AGS extraction and AtR setup
- AGS to RHIC synchro setup with RHIC new LLRF, target frequency 28.128770MHz, 1.5 shift: RF group
- Blue power supply work including snake training
- Blue Injection setup:
  - Circulating beam in Blue with snakes off : EVE+OWL shift
    - Preparation for the injection
      - Set beam sync clock to reference if it is at synthetic
      - Set main dipole trim and dipole correctors from RUN08 value. But zero the snake bumps
      - Restore the RHIC configuration to RUN08 setting. This includes
        - Injection kicker timing and voltage
        - RF parameters in RF DSP page. But set the path length offset to zero for snake off case
        - Instrumentation timing. We do expect timing adjustment once beam is captured with the new LLRF system
      - Get beam in for 1<sup>st</sup> turn at injection with corrector at bo6-tv9 set to 1.3mrad to optimize the AtR injection setup
    - preliminary bpm timing: Todd
    - Injection kicker timing: Wolfram
    - Orbit correction and tune adjustment based on RhicInjection to achieve circulating beam
    - Exam the average orbit. If the average orbit is considerably off-center
      - Check the total sum of all correctors' strength. Minimize the contribution of correctors to the path length first. And then scale the dipole trims to bring beam to center

- minimize the beam loss
  - orbit correction and optics adjustment including de-coupling based on the tune measurements as well as coupling measurements by RhicInjection application
- RF capture in Blue ring(RF group): DAY+EVE shift
  - Start setup with the new low level RF and 28 MHz cavity.
  - Goal is to have bunched beam and establish RF timing
  - Re-evaluate the commissioning plan if the RF injection setup with new LLRF fails. The contingency plan is to redo the RF injection setup with the old LLRF system which also takes 1.5shift.
- Re-establish circulating beam with snakes on: EVE+OWL shift
  - This task can be done without RF capture. Power supply group continues on their work on the Yellow power supplies in parallel
  - Re-exam the timing of the BPMs with the new LLRF
  - Restore the path length offset for the RUN08 operation to the RF parameter on DSP page
  - Turn on snake bumps. Check RHIC recipe book for the snake bump settings
    - S=1150m, -9 mm
    - S=1180m, -10mm
    - S=3050m, 11mm
    - S=3080m, 7mm
  - Optics correction and orbit correction to improve beam lifetime
  - Unmask snake blms
  - Turn on snakes with LOW intensity bunch ONLY. Check RHIC recipe book for the snake current setting
    - Outer Snk7.1-4: 100A
    - Inner Snk2.3-3: 323A
  - Optics correction and orbit correction to improve beam lifetime
  - Inject bunch with normal intensity to check the beam lifetime.

- Instrumentation setup: DAY+EVE shift
  - BPM, IPM, Artus(make sure the FFT is between 0.5 and 1.0)...
  - Critical systems: BBQ and Blue CNI polarimeter
  - Injection tuning: 1 shift
    - Orbit optimizing
      - Double check the correctors with large strength
      - Global rms and local orbit at snakes
    - Optics tuning
      - Working point: (0.695, 0.685)
    - Decoupling to  $dQ_{min} \sim 0.001$
    - Chromaticity  $\sim +2$  with good beam lifetime
  - This will be yield to re-setup RF at injection with old LLRF if the new LLRF fails. If so, we will take this opportunity for DX training if Yellow ring cryo allows
- Yellow injection setup, DAY 3.5 ~ DAY 7
  - Power supply work including DX and Yellow snake training
  - Establish circulating beam with snakes off: 1.5 shift
    - Similar steps as in Blue injection setup: establish circulating beam with snakes off
  - RF capture with new LLRF and 28 MHz: 1.5 shift
    - This will be done with new LLRF only if Blue new LLRF is successful.
  - Establish circulating beam with snakes on: 2 shift
    - In parallel, Blue injection working including continuing Blue instrumentation setup
    - Spin rotator training can also be parallel
  - Instrumentation setup: 2 shift
    - BPM, IPM, Artus, etc.
    - Critical system: BBQ and CNI polarimeter(Haixin, Anatoli, Mike, ...)

- Injection optimization in parallel
  - In parallel, Blue RF setup for ramp development
- DX training and Yellow snake training when Yellow ring is cold
- RF new LLRF ramp setup and 9 MHz cavity commissioning: DAY 7 - DAY 9
  - Commission the new low level RF system for ramp with 6 blue bunch ramp with 28MHz cavity.
    - Set up the RF loops for the ramp
  - re-establish RF-capture with 9 MHz cavity. Exam instrumentation timing with the new RF setup:
  - re-establish RF setup for ramp with 9 MHz cavity
  - establish longitudinal matching:
  - contingency plan is to switch back to 28 MHz cavity which requires
    - 2 hours ring access
    - 1~2 shifts to install short
  - In parallel:
    - Tune/coupling feedback setup for ramp development, 1 shift per ring: Yun, Al, Joanne, BBQ experts, ...
      - This can be taken place in between the RF setup with 9MHz
    - Polarization setup
      - Scan H orbital angle between snakes and measure polarization
      - Minimize H orbital angle between snakes and snake current scan
- Ramp development: DAY 10 – DAY 21
  - ramp both beams to store: DAY 10 –DAY 12
    - 6x6(or 12x12) bunch with nominal bunch intensity
    - tune/coupling feedback loop on
    - orbit correction and optics adjustment including chromaticity correction

- improve ramp efficiency: DAY 13 – DAY 15
  - orbit correction and optics correction including chromaticity
  - non-linear correction: 1 shift for both rings
  - RF setup at store with new LLRF
  - Polarimeter setup at store
  - increase the number of bunches. Goal is 111x111
- store setup: DAY 16 – DAY 19
  - Steering for collision
  - orbit correction and optics correction
    - optimize the H orbit angle between snakes
  - storage cavity (28MHz) setup
  - polarization setup
    - polarization ramp measurement
    - optimize H orbital angle between snakes, measure beam polarization as function of snake orbit angle scan at store
- Ramp/Store optimization: DAY 20 – DAY 21
  - Collimation setup: DAY 20
    - possibility of providing collision overnight
  - Optimize ramp to increase bunch intensity
  - Polarization optimization
    - Polarization ramp measurement
    - Snake orbital angle scan
    - Spin tune measurement
- Deliver collisions
- Rotator ramp development: 2 DAY
  - Ramp development
  - Store setup including vernier scan