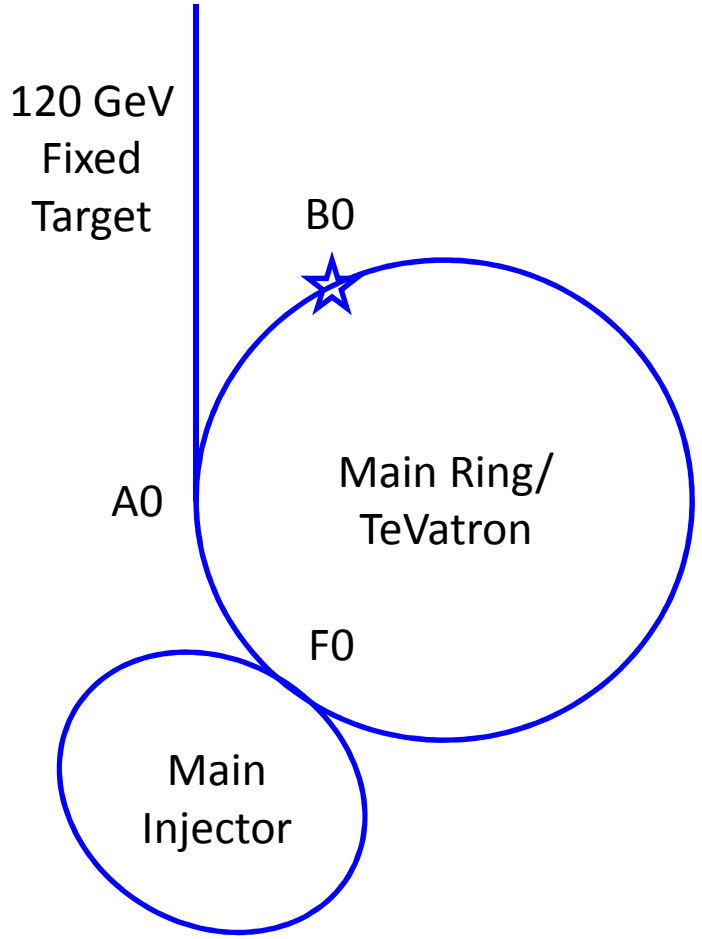
Conceptual Design of the ORKA Primary Beamline

ORKA Collaboration Meeting

July 27, 2012

Geography

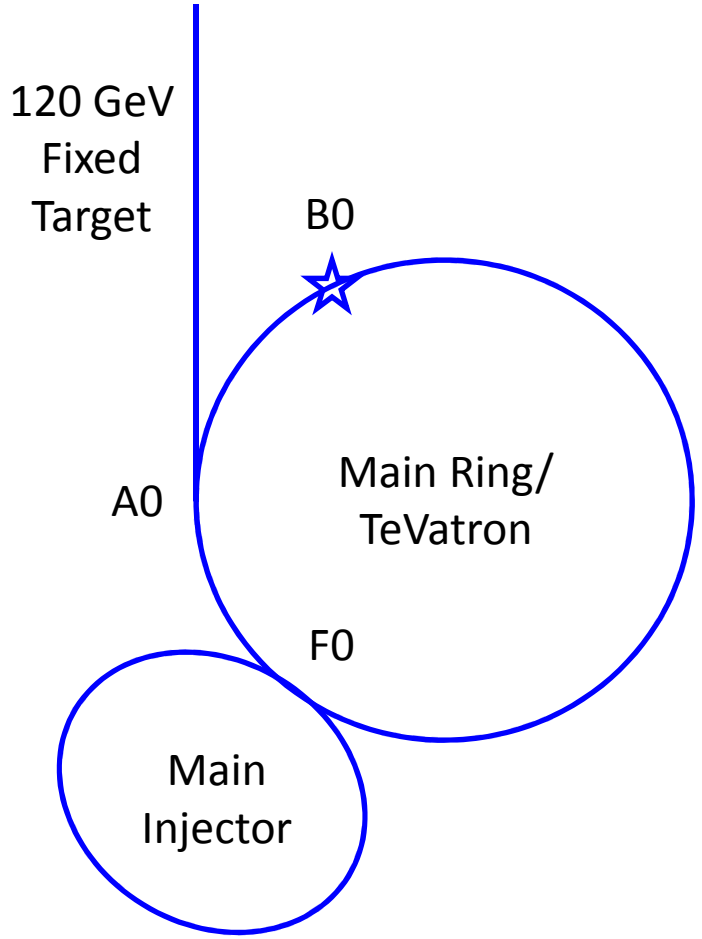
- Beam is transferred from Main Injector to F0 via P1 line.
- Beam then follows P2 line from F0 to F17.
- Finally, beam in transported from F17 to F49 via P3 line.
- At this point it is directed toward Switchyard (120 GeV Fixed Target area).
- The downstream end of P3 (F48 and F49) has been modified from the original design (the “design lattice”).



Proposed Changes

Reconstruct Main Ring design lattice[1] and add a final-focusing triplet at B0.

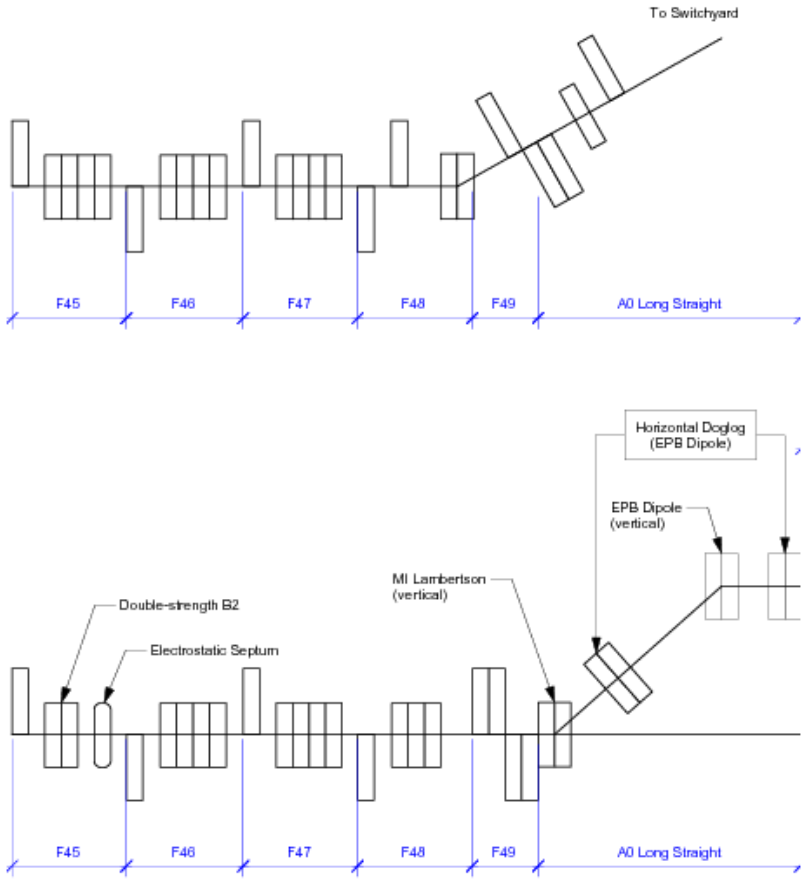
- Reinstall design lattice at F48, F49 and most of A-Sector.
- Add elements in A0 to allow running beam to Switchyard.
- Modify A43 – A47 to allow dogleg and final focusing optics.



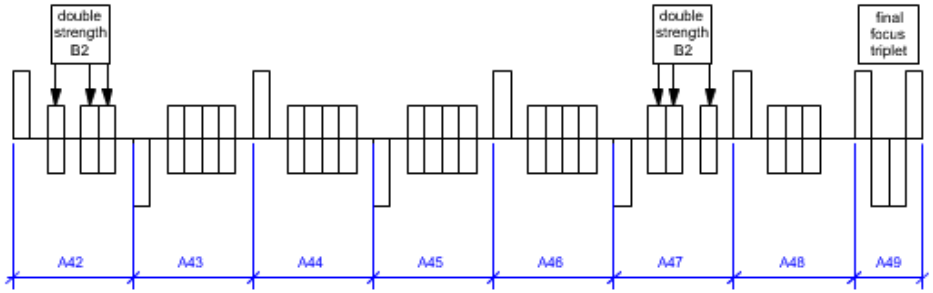
1) A. Garren, "Lattice of the NAL Proton Synchrotron", 1969 (Fermlab-FN-182-0130)

Modifications to F-Sector and A0

- An electrostatic septum is added in F45 to allow simultaneous ORKA/SY120 running. If simultaneous running is not desired the septum may be replaced with a kicker.
- Two pair of orthogonal dipoles are added to the A0 long straight to redirect beam to Switchyard. No rolled dipoles.
- The Main Ring lattice is extended into Switchyard. This improves stability.



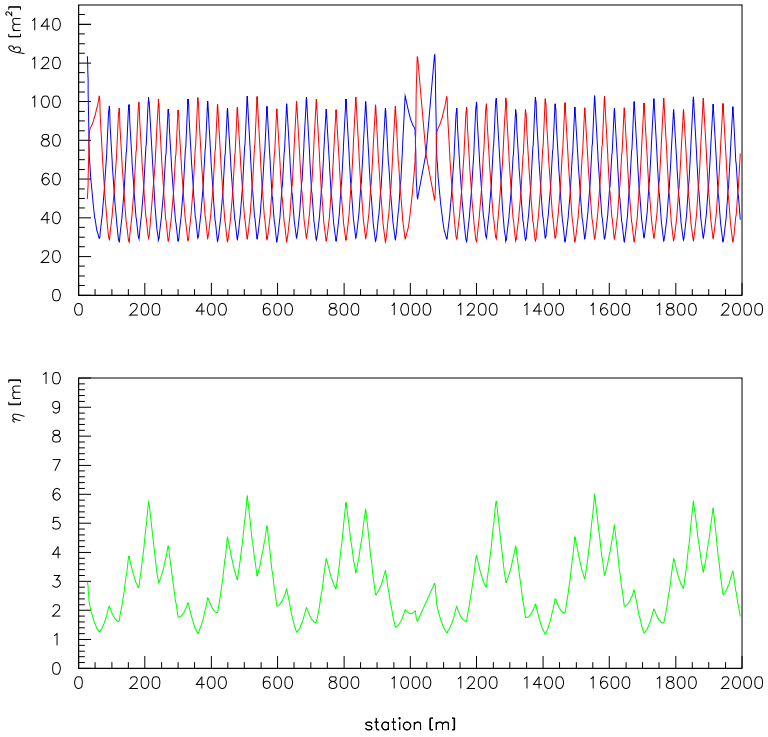
Modifications to A-Sector Design Lattice



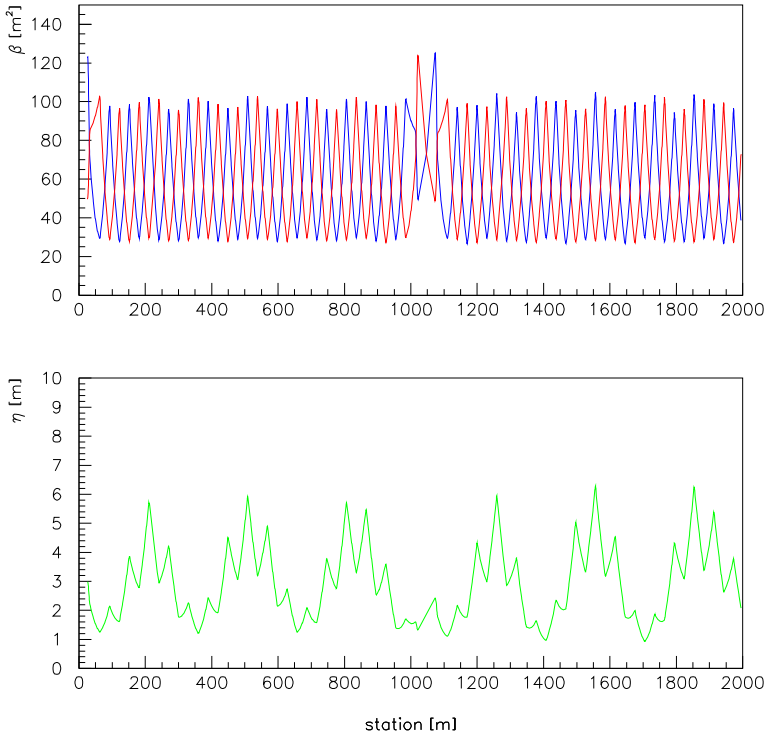
- At A42 and A47, replace four Main Ring dipoles with two double-strength dipoles.
- At A42 and A47, install an additional double-strength dipole. Dipoles will have opposite polarity, forming a dogleg. NOTE: This dogleg blocks the aisle, which may be problematic.
- Install symmetric triplet (4Q120 quadrupoles) at A49. Assume waist is ~10m downstream of final quadrupole, and located 14m upstream and 6 ft. inside B0 location.
- Use AQ49 to match into triplet.

Lattice Functions

Design Lattice

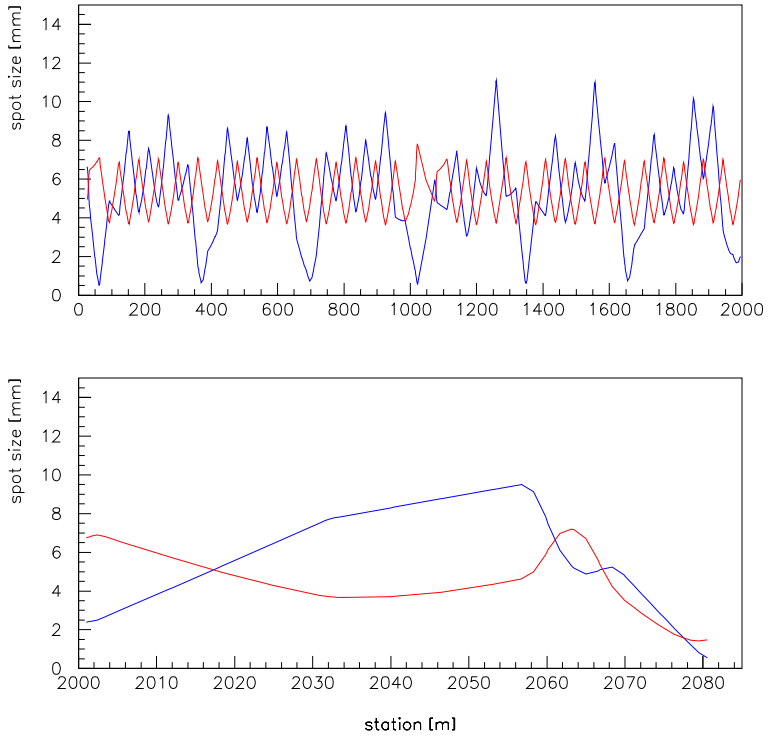


Modified Lattice



Beam Envelope

Envelope Through Beamline and at Final Focus



Assumed Parameters

- Beam is matched to lattice at F0.
- 20π mm·mr (95%) normalized emittance.
- 0.1% momentum bite.

Summary

- A conceptual design has been presented which allows simultaneous running of the Switchyard 120 program and the ORKA experiment.
- The design utilizes a well-understood lattice.
- A single bend buss and a single quadrupole buss is used, simplifying operations.
- A symmetric triplet is used for the final focus; the upstream quadrupole and drift space is used to match into the FF optics.
- The achieved spot size is 0.5×1.5 mm (half-width), located 14m upstream and 6 ft. inside from B0. This is based on a 20π mm·mr 95% emittance, 0.1% momentum bite, matched beam.
- Additional information is presented in “Integration of ORKA and SY120”, T. Kobilarcik, Beams-doc-4146.