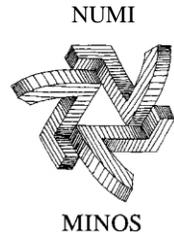




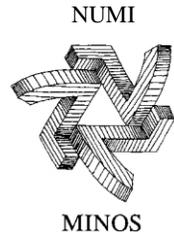
Review of Specifications for the NuMI Primary Proton Beamline

- Requirements from physics of the experiment and parameters of the Main Injector
- Specifications as determined from construction constraints, radiation control requirements, instrumentation requirements
- Requirements imposed by groundwater protection
- Brief description of line as designed
- Test program at P150



Energy

- 120 GeV proton energy
 - Originally wanted ν 's from high energy pions
 - Now want to maximize the number of low energy forward pions
 - Sharing cycles with antiproton production suggests 120 GeV



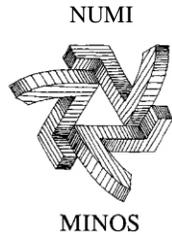
Intensity

- Hypothetical ‘year’ of $3.7E20$ protons leads to 1350 events in oscillation energy range in far detector (4.5 kton fiducial region)
- Clearly need as many protons per actual year as possible
 - 5 Booster batches when cycle sharing, 6 Booster batches when only user of cycle
 - Maximal number of protons per batch and cycles per year
 - Incompatible with much slow spill activity
- Near detector would prefer lower intensity



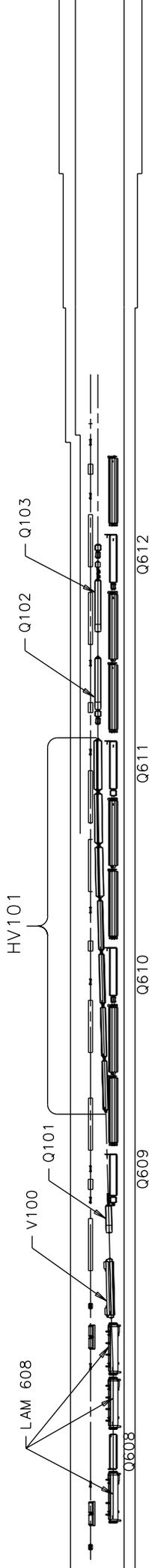
Beam Entering NuMI Line

- NuMI trajectory must start on MI closed orbit
- Must have appropriate Twiss functions at kicker
- Have acceptable separation in Lambertsons
- Match old resonant extraction orbit, since that was used for construction drawings
- Transverse emittance
 - Have used 40π 95% no tails
 - Maybe normal operating will be 15π with tails
- Momentum spread
 - Have made studies with $1E-4$, $2E-4$ and $4E-4$

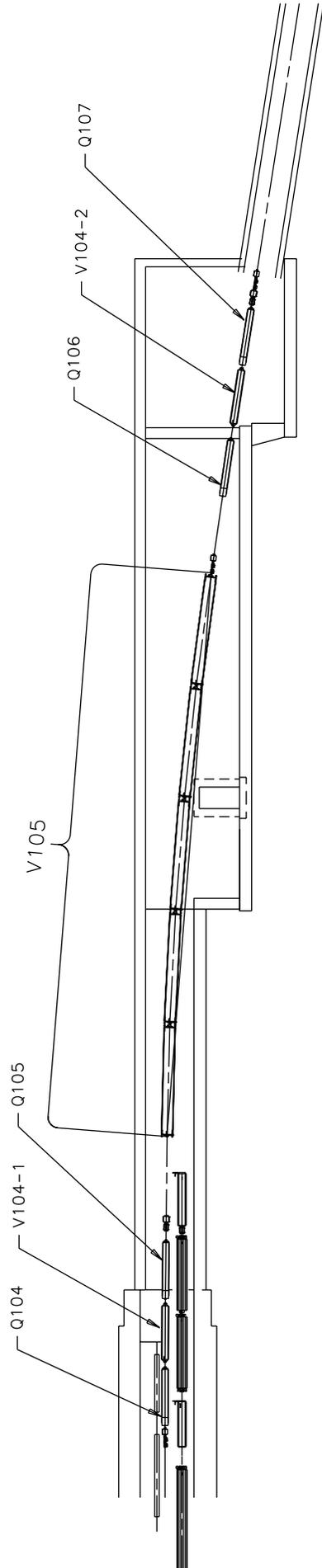


Targeting Conditions

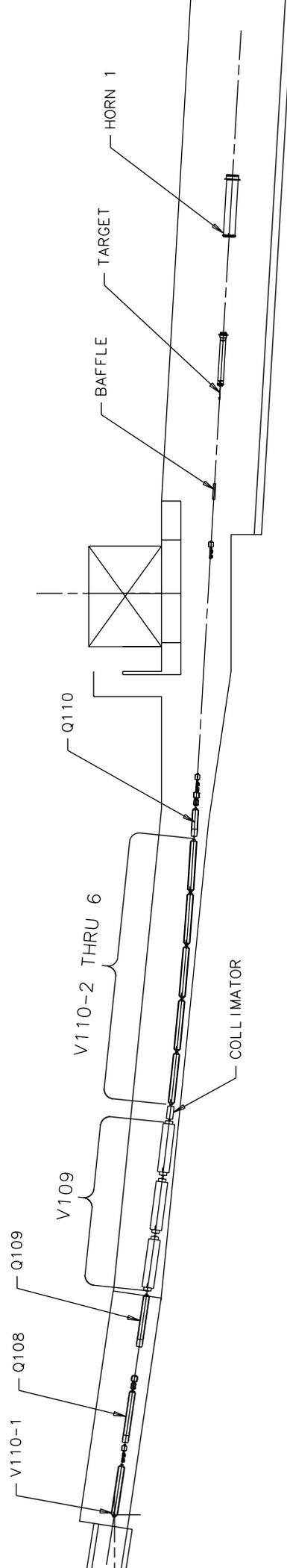
- Production of pions at 0° assumed in simulations and so must be true in practice
 - Primary beam must point toward Soudan, within $60 \mu\text{rad}$ (10% of error budget allowed by physics)
- Beam size sigma of 1.4 mm(vert) x .7 mm(horiz)
 - No smaller, due to target heating, but intensity dependent
 - If gets too much larger (~50%), begin to miss target with tails
- Present proposed tune has horizontal β' and vertical dispersion functions equal zero



MI 60 REGION AT THE MAIN INJECTOR (ELEVATION VIEW)



NuMI STUB (ELEVATION VIEW)



PRETARGET TUNNEL (ELEVATION VIEW)



Beam Sizes and Apertures

95/100% Beam Sizes and Apertures

