Incremental improvements which should be considered for the injector IMO. The list below is roughly in beam order. The gun and quarter are not IMO sufficient - there are too many issues between the two that Qweak noticed that need to be addressed.

1. HV source capable of 275 keV
2. PSS and MPS faults do NOT turn off gun HV, only tunnel entry does
3. improved solenoids to reduce optics effects of 0.1 mm steering so match doesn't drift
4. rotate 15 degree bend magnet 7.5 degrees to cut multipoles a factor of 2-3. Since we're going to have only one gun, there's no need for 15 degree entrance and normal exit. Consider scaling it up in ID to cut multipoles another factor of two. If my visual memory is correct, it will have to be scaled in ID to accommodate even a modified beam pipe junction when rotated.
5. aluminum beam pipe replacing straight sections of stainless in low energy (under 300 keV) region to damp 60 Hz a factor of fourteen and higher harmonics more. Diagnostics, bellows, etc. remain as is, to minimize cost of change. Perhaps half the path length?
6. upgrade Wien filters and other warm components not listed above to 275 keV capability.
7. relocate pre-buncher after both Wien filters
8. check whether FG solenoids at 275 keV need water cooling added to bore as originally designed. FGs are used for Wien flip. Consider enlarging bore of end plates to original 70 mm to improve homogeneity but increasing longitudinal stray field.
9. determine whether existing air core QU and QW quads after 15 degree bend and around Wiens should be replaced with iron return units with higher focusing strength or more degrees of freedom (e.g. Mainz triplets)
10. replace apertures which clip beam with BPMs with at least 15 mm clear diameter to reduce helicity correlated charge asymmetry due to subtle steering on cathode by electro-optic elements. Examine other diagnostics for upgrades, e.g. stripline BPMs. PSS kickers could direct beam into aluminum beam pipe with external cooling jacket instead of A1.
11. smaller chopping circle at 499 MHz? New chopper cavities at different frequencies?
12. a conceptual design Yuhong and I did circa 2000 shortened the low energy region about 3m. With the Wien flip, about 2m might be recoverable, but more diagnostics could eat some of it. When I mentioned this at the first AI meeting, Henry Robertson suggested moving the entire injector, including quarter, upstream a meter or two. This would allow a shield wall to be built where the fence is now, completely divorcing injector and NL PSS segments re beam ops.
13. magnetic shielding of 21' wide by 12' high region of injector enclosure. Divert all the transverse flux around the low energy beam, leaving only Bz. Measure that and compensate for precession with solenoids or Wiens. Make provision for supplemental shielding of beam line with 16" or 24" square sheet enclosures. Replace all steel stands with aluminum to eliminate multipoles the stands generate
14. build a capture cavity with 200 keV nominal input KE, TBD output KE, as backup if new QM fails. Haipeng Wang says the design was completed before the idea of incorporating a SC capture in new quarter came up.
15. cryo mods may be needed to handle new quarter with only 60 liters LHe. Buffer dewar?
16. solenoid focusing in 6 MeV region to reduce envelope and halo creation via scraping
17. determine whether helicity magnets are in best locations optically. Can their power supplies handle 2 kHz flip rate? 960 Hz was OK for Qweak, 1.5 μs transitions.
18. two stripline BPMs with ~70 cm gap just before MDL (5 MeV spectrometer dipole) so normal incidence can be set precisely
19. replace all DP cans with 16 mm ID beam pipes with NEG coating. Conductance comparable. Wien filter ID 15 mm, so these wouldn't be limiting apertures. Fewer particulates.
20. add a Ta-181 annulus and neutron detectors to 2D dump copper puck so absolute injector

energy may be measured via (gamma,n) reaction at 7576.75+- 1.35 keV. This will pin down energy at one point so any remaining environmental fields can be taken into account in setting the sprectrometer dipole at all energies. If the quarter allows yet higher energies, copper's isotopes have neutron thresholds at 9910.7 keV and 10863.7 keV. The Ta-181 annulus should have ID such that the copper can be hit without touching the tantalum with beam.

21. consider installing a permanent, well shielded dump on the 5D line.

If instead of upgrading the existing line Joe's paradigm of a new line parallel to the existing one, to be used for the highest precision experiment running at any time, is adopted, perhaps the only upgrade to the existing line that should still be considered is the use of the new 9" solenoid design in the old chopper in lieu of existing MFD. The 8.5" design would be used throughout the new line. Cryo would almost certainly have to install a buffer dewar for the second cryo-unit so it could have independent JT control, but as mentioned above this may be necessary even with just the one new unit - question has been submitted to Cryo. The parallel line has a great benefit due to redundancy: if the new gun or quarter fail, we can revert to present scheme for running beam to four halls.