# Large Acceptance 50-GeV Muon Storage Ring for Neutrino Production: Lattice Design, CJ2.0 *

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Table 1: Muon Storage Ring Design Parameters and Constraints

| | | |
|---|---|---|
| Storage Ring Geometry | | racetrack |
| Storage Ring Energy | GeV | 50 |
| Vertical Descent Limit | m | ≈183 |
| Declination Angle | deg | ≈13 |
| Cross-sectional profile | m | 813 |
| $\epsilon_{rms}$ (normalized) | mm-rad | $3.2\pi$ |
| dp/p (rms) | % | 1 |
| maximum poletip field | T | 6.0 |
| arc cell phase advance | deg | 90 |

Table 2: Parameters of the large-momentum acceptance arc cells for a 50-GeV muon storage ring

| | | |
|---|---|---|
| General: tungsten shield thickness | cm | 1.0 |
| beam-stay clear | cm | 1.0 |
| intermagnet spacing | m | 0.75 |
| Dipoles: | | |
| dipole length | m | 2.4 |
| dipole bend | rad | 0.0859 |
| dipole field | T | 6.0 |
| beam size ($6\sigma$, max), WxH | cm | 8.0x5.3 |
| dipole full aperture**, WxH | cm | 12x9.3 |
| sagitta | cm | 2.67 |
| Quadrupoles: | | |
| quadrupole length | m | 1 |
| arc quadrupole strength | $m^{-2}$ | .31 |
| arc quadrupole poletip field | T | 3.6 |
| beam size ($6\sigma$), WxH | | |
| F quad | cm | 9.2x2.6 |
| D quad | cm | 4.2x6.2 |
| arc quadrupole bore** | cm | 14 |
| Sextupoles (overlay on quad field) | | |
| horiz. sextupole strength | $m^{-2}$ | 0.64 |
| vert. sextupole strength | $m^{-2}$ | 1.26 |
| horiz. sextupole poletip field | T | .52 |
| vert. sextupole poletip field | T | 1.03 |
| Arc FODO cell parameters: | | |
| cell length | m | 9.8 |
| cell phase advance | deg | 90 |
| $\beta_{max}$ | m | 16.2 |
| $D_x(max)$ | m | 1.3 |
| total number arc cells | | 31 |

**aperture = beam size + liner thickness + beam-stay-clear

Table 3: Parameters of the high-beta cells for neutrino production in a 50-GeV muon storage ring

| | | |
|---|---|---|
| drift length | m | 65.8 |
| quadrupole length | m | 3 |
| quadrupole strength | $m^{-2}$ | 0.0019 |
| quadrupole poletip field | T | 0.05 |
| quadrupole bore | cm | 33 |
| total cell length | m | 137.6 |
| cell phase advance | deg | ≈ 22 |
| $\beta_{max}$ | m | 436.0 |
| rms divergence | mr | 0.20 |
| number of high-beta cells | | 5 |

Table 4: Parameters of cells in return straight of 50-GeV muon storage ring

| | | |
|---|---|---|
| cell length | m | 50.78 |
| quadrupole length | m | 1 |
| quadrupole strength | $m^{-2}$ | 0.056 |
| quadrupole poletip field | T | 0.84 |
| quadrupole bore | cm | 18 |
| cell phase advance | deg | 90 |
| $\beta_{max}$ | m | 86.3 |
| rms divergence | mr | 0.73 |
| number of cells | | 12 |

Table 5: Storage Ring Parameters at 50-GeV

| | | |
|---|---|---|
| Circumference | m | 1752.8 |
| Neutrino decay fraction | | 39.2% |
| Production region: | | |
| matching and dispersion suppression | m | 44.1 |
| High-$\beta$ FODO straight | m | 688 |
| $\beta_{xmax}/\beta_{ymax}$ | m | 435/484 |
| $\nu_x/\nu y$ | | 13.63/13.31 |
| natural chromaticity | | -23.9/-23.9 |

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