Recent Progress on the MAX IV 1.5 GeV Storage Ring Lattice and Optics

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1.5 GeV Storage Ring

12-fold DBA lattice
96 m circumference
10 ID straights (3.5 m)
Bare lattice $\varepsilon = 5.982$ mm rad
Betatron tunes $\nu_1 = 11.22$, $\nu_2 = 3.15$

Max. chromaticity $\xi = -22.96$, $\xi = -15.15$

Momentum compaction $\alpha = 3.06 \times 10^{-3}$

Max. energy spread $\sigma = 7.45 \times 10^{-4}$

Bare lattice losses 114.1 keV/turn

Hor. damping partition $J_x = 1.46$

MAX IV Facility Overview

User operation expected to commence 2015.

Linear Optics

Combined-function magnets described in lattice by array of slices
Model includes fringe fields, crosstalk, and multipoles.

Nonlinear Optics

Nonlinear optics optimization strategy: correct chromaticity, minimize RDT’s, tailor tune shifts to minimize tune footprint → large DA and MA.

Dynamic Aperture

Large on-energy DA for high injection efficiency.
Off-energy DA ensures large momentum acceptance.

Momentum Acceptance & Touschek Lifetime

Lattice momentum acceptance (incl. vacuum apertures) matches RF acceptance throughout most of the cell.

Total lifetime beyond 10 hours expected at 500 mA.
(Touschek 22 h, elastic gas scattering 30 h, bremsstrahlung 53 h)

Frequency Map Analysis

Large continuous area of low diffusion around the design orbit.
Low diffusion at beam core over wide range of energies.

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MAX IV Project → http://www.maxlab.lu.se/maxlab/max4