# Progress on Pulsed Multipole Injection for the MAX IV Storage Rings

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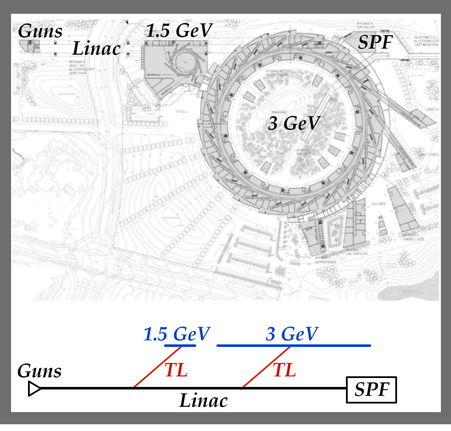
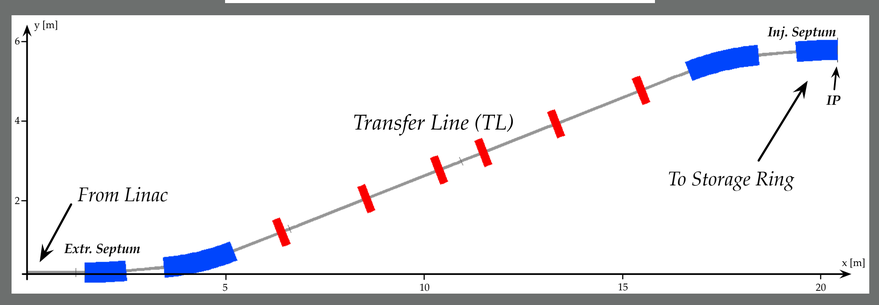
## In a Nutshell

- MAX IV facility employs a 3 GeV linac as a full-energy injector for two storage rings (via vertical transfer lines)

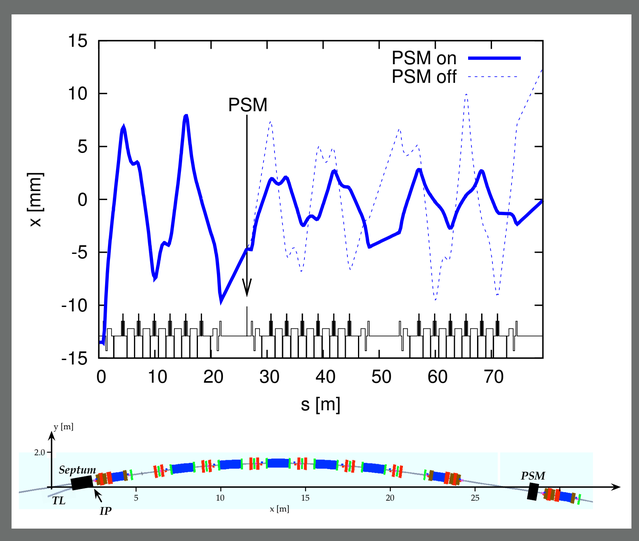


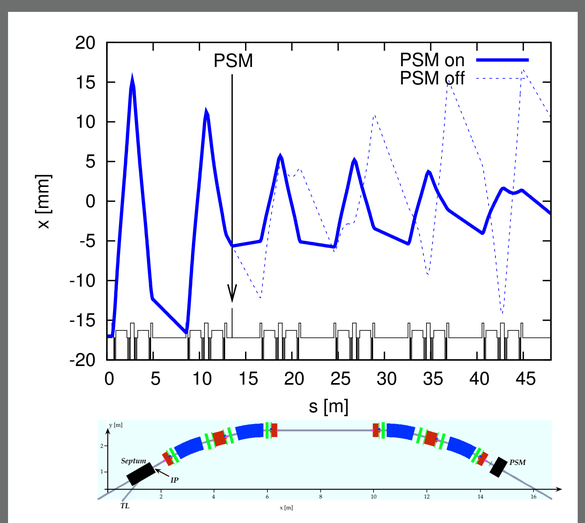

- Injection into MAX IV storage rings will make use of pulsed multipole injection (PMI)

PRST-AB **15**, 050705 (2012)

- Previously a single pulsed sextupole magnet (PSM) was foreseen in each ring




3 GeV Storage Ring

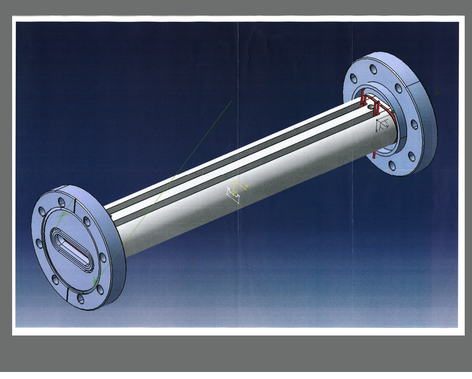



1.5 GeV Storage Ring

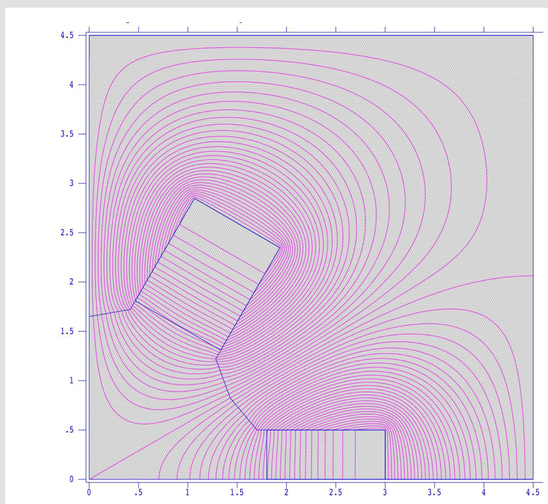
- Recently: nonlinear injection kicker (NLK) prototype developed for BESSY II

- MAX IV and SOLEIL have recently launched a collaboration to design and build a new nonlinear kicker magnet based on the BESSY II design: "multipole injection kicker" (MIK)

P. Lebasque, SOLEIL



## Previously: Pulsed Sextupole Magnet



*PSM reference design for the MAX IV 3 GeV storage ring. Magnet bore: 32 mm.*

- Pulsed sextupole magnet (PSM) in each MAX IV storage ring was foreseen for top-up injection (as demonstrated at KEK PF)

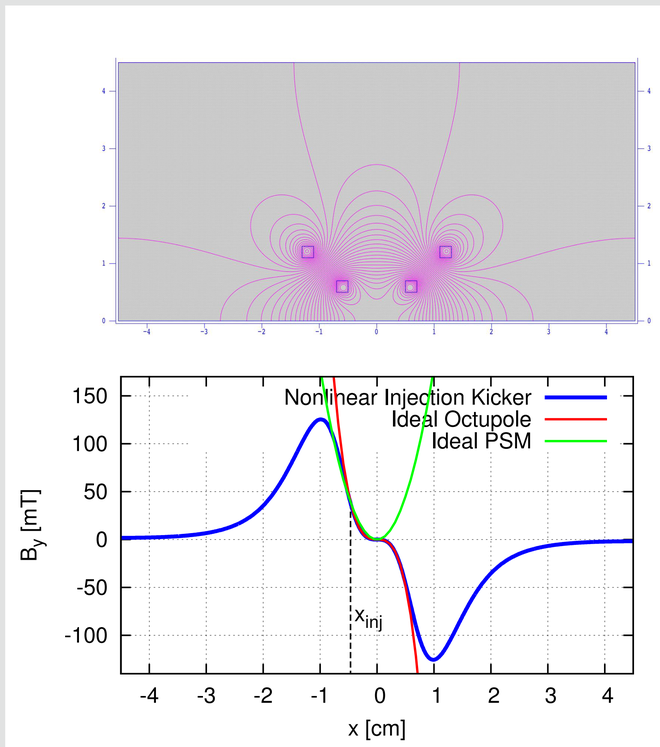
PRST-AB **13**, 020705 (2010)

- PSM reference design called for 32 mm magnet bore leading to ~ 21 J stored energy, 2125 A required current

- Combined with 640 ns pulse duration in MAX IV 1.5 GeV storage ring this leads to ~ 93 kV required pulser voltage

- Need lower-inductance design to reduce required voltage

## New: Nonlinear Injection Kicker




*NLK reference design for the MAX IV 3 GeV storage ring. Upper half geometry (top) and resulting field profile in the midplane (bottom).*

- Prototype nonlinear injection kicker (NLK) recently developed for BESSY II

- Stripline-like design: flat zero-field area for stored beam, high-field area for injected beam

IPAC'11, THPO024, p.3394

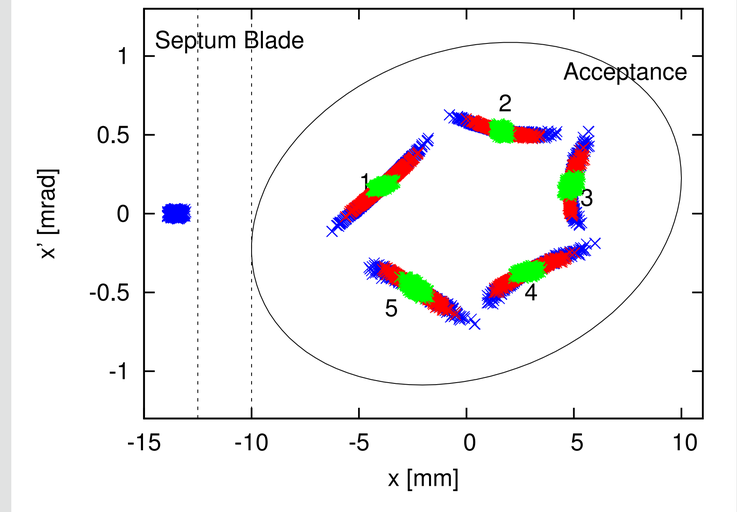
- Much lower inductance than a solid-iron PSM: drastically reduces required pulser voltage

- Perturbation of the stored beam further reduced compared to PSM

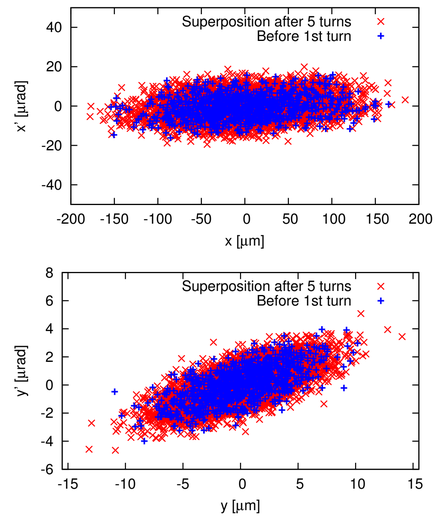
- In MAX IV cannot inject at field maximum (inner rods would limit vertical acceptance); instead inject on slope (tracking shows negligible degradation of capture)

- Reference design calls for < 2855 A current and < 19.5 kV pulser voltage

## Injection and Capture Process




*Tracking of capture and first five turns in the MAX IV 3 GeV storage ring. Injection with NLK (blue) compared to PSM (red) as well as pure dipole kick (green).*




*Tracking of the stored beam in the MAX IV 3 GeV storage ring through the SOLEIL MIK in single-turn injection mode.*

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

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