Ring Injection
Parameter
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Lets use the “old” parameters for the moment

Compact storage ring to search for the muon electric dipole moment

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- PSI μE1 beamline
- up to $2 \times 10^8$ s$^{-1}$ μ+
- $p_\mu = 125$ MeV/c ($\beta = 0.77$, $\gamma = 1.57$) from backward decaying pions with $p_\pi = 220$ MeV/c.
- The muons arrive in bunches every 19.75 ns with a burst width slightly below 4 ns [23].
- The muon polarisation is $P = 0.9$; for the decay asymmetry we use $A = 0.3$
- $B = 1$ T and $E = 0.64$ MV m$^{-1}$
- Ring radius of $R = 0.42$ m.

The idea for the operation of the experiment at the μE1 beamline is to use one muon at a time in the storage ring and observe its decay before the next muon is injected. This way, the high beam intensity is traded off for beam quality and muons suitable for the injection can be selected. Assuming an injection latency of 1 μs and an average observation time of $\gamma \tau_\mu = 3.4$ μs results in more than $2 \times 10^5$ muon decays per second and allows for $N \sim 4 \times 10^{12}$ detected events per year.
Between crazy & super crazy
Pertubator air coil technological question
- Pertubator breaks symmetry
- Massless septum

Version A (28 MeV/c) feasible

Trigger: 50 MHz from Cyclotron (easy) or dedicated trigger

Minimising number of turns at injection

Gas degrader
- SF6
- Gas curtain

New magnet configuration
- Betatron yoke
- Classical cyclotron configuration with straights
The best of 2 words?

**PSI world**

![Artist's impression (A. Streun)](image)

**J-PARC world**

Technical difficulties for compact 2-D injection:
- 3T is too high to cancel fringe field by inflector,
- Required kick angle is too fast and big.

![Slide by H. Iinuma](image)
Spiral injection à la J-PARC?

- no symmetry break due to inflector
- ~ 20 turns for injection
- easier to realise $\gamma = 1.57$
Discussion w.r.t. Simulations

- Ultimate goal full S2E (where is the start ?)
- UQ and sensitivity analysis
- Fix code base now: Geant, Zgoubi, MADX-PTC
- Put together a code/model interest group
Concepts

- Pertubator (study on: symmetry, pulsing)
- Injection à la J-PARC
- SC Magnet (fields, access reversibility)
- used MRI magnets
- High voltage
- low weight, foils/wires
- Simulations

Action Items

- Phase space acceptance (1)
- Additional focussing
- Study magnets .3 ... 1.5 T
- Additional coils
- Study material budget
- Setup of a number of relevant input decks (1)
- USPAS
- Staged approach (1)
- Next steps, follow up workshop?
Used MRI magnets
Synergies

- Codes: BMAD-PTC, Zgoubi
- MRI experience (ANL, J-PARC)
- High voltage (MSc Univ. Aachen)
- Magnet for low field options