EDM-like Signals from Slow Effects like Beam Motion, losses, etc.

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- Order of Magnitude Estimation of Effect. based on Experience from the g-2 experiment.

  M.C. studies needed for more accuracy.

g-2 Experiment:

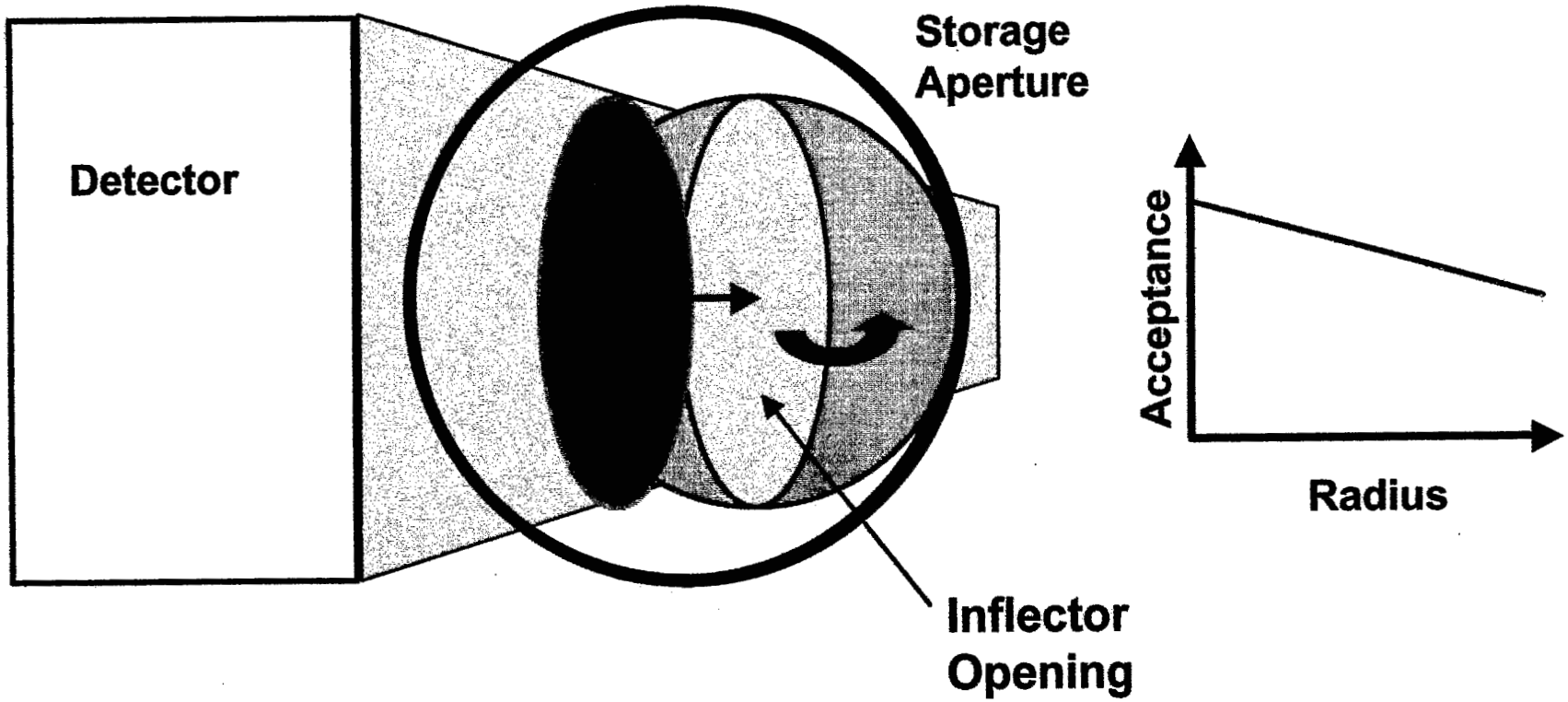
Muon injection + Small Inflector Aperture

↳ Coherent Betatron Oscillation

Beam moves as a <u>whole</u> with ~5 mm Amplitude.

Due to in/outwards muon decays the detector acceptance plays a role in defining the muon Polarization Phase.
In/out differential acceptance ⟶ g-2 phase modulation: 5 mm ⟶ ~ 1.5 mrad

Coherent Betatron Oscillations



- Beam center "swims"
- Beam width "breathes"
- Detector acceptance "notices" this

Muon EDM signal for 10^{-24} e·cm

~30 nrad vertically early to late.

If background same as in g-2

⇒ Beam should stay in Place to

$\boxed{\sim 200\,nm}$ in ~50 μs

Reasons for the Beam to "move":

1) Scraping
2) Kicker Eddy currents
3) Muon losses
4) Non-linearities of B, E-fields

⋮

e.g. Scraping (it could be in one directi
as in g-2, or both ...)

One direction: (CW - CCW does [redacted] help!)

- scrape w/ 2mm beam motion
- requiring ~5 μs transition time after which the beam moves less than ~0.2 μm

$\Rightarrow \tau_{RC} \sim 0.5\,\mu s$ or 2.5 turns.

Check the systematic error by moving the beam slowly by ~1 mm [redacted] vertically, horizontally.

Need to study

- Kicker eddy currents
- Muon losses
- Field non-linearities
- E-field stability