Efield/Pitch correction overview

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E-field and pitch corrections

E-field correction

First order estimate depends on:

1. Momentum (radial) distribution
2. Quad voltage

$$C_E = -2\beta^2 n(1-n)\frac{\left\langle x_e^2 \right\rangle}{r_0^2}$$

Momentum distribution is extracted from FR analysis (FFT and CERN)

- Consistency of FFT and CERN methods ?

Do the FR analyses give the right answer?

FR analysis is dominated by early time data − (before debunching)

- First order correction in FFT method increases with delay of start time
- The early time distribution may be biased
- − what is the effect of scraping and the shifting of the closed orbit?
- Is the momentum distribution correlated with time into the fill?
- Are we looking at the right muons?

E-field and pitch corrections

E-field correction

Are there higher order contributions that would lead to modifications to the base correction? Due to

1. Quad multipoles
2. Quad misalignment/field errors
3. Betatron amplitude
4. Non uniformity of the dispersion function

$$C_E = -2\beta^2 n(1-n)\frac{\left\langle x_e^2 \right\rangle}{r_0^2}$$

Detector effects

- What is the effect of pile-up (especially at early time)
- Does calorimeter gain bias the FR measurement

Efield checks

How to test the FR analysis ?

- Explore analytically dependence on betatron amplitude, quad offsets
- Simulation
  - Generate a fast rotation signal in simulation with known momentum (radial) distribution and check that the FR analyses give the right answer
  - Generate distributions with/without scraping and determine if the momentum distribution is different and/or the FR analysis is consistent?
  - Explore dependence on quad misalignment, betatron amplitude
  - Our correction assumes that $\langle \beta \times \mathbf{E} \rangle$ is a reliable proxy for E-field shift
    - Compare with simulation with spin-tracking
  - Muon losses − gm2ringsim − distribution of evolution of distribution including muon losses
- Trackers
  - Measure radial distribution early to late to establish its stability.
- Pile up ? Gain?

Pitch correction

Lowest order estimate depends on:

1. Measure of vertical distribution
2. Quad voltage

Vertical distribution is extracted from tracker and calo data

- Consistency of tracker angular distribution with offset distribution (vertical)?
- Tracker/calo consistency?
- Consistency with simulation?

Higher order contributions from?

1. Radial B-field
2. Quad misalignment/field errors
3. Path length
4. Is the vertical distribution the whole story?

Quantify these dependencies (analytically and with simulation)

We determine pitch correction by estimating $\langle(\tilde{\beta}\cdot\mathbf{B})\tilde{\beta}\rangle$ along the muon's trajectory

We can compute the pitch correction directly by spin-tracking.

Are the results consistent? (Check with simulation)

Global checks

Simulate conditions of the different runs in as much detail as possible

- Generate and track distribution and compute E-field and pitch corrections for that distribution

Not a substitute for measurement but a valuable cross check