ILC Cavity Gradient Regulation Error Budget for Longitudinal and Transverse Requirements

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Transverse Requirements

for each cavity- not V.S.

- Gradient regulated to 1% and 1 degree (peak to peak?)
  - Regulated to a stable value for some TBD time period
  - Errors may be common across flattop
    - Correctable by quads if slow variation
  - Errors may be from distortions or tilts in flattop
    - Only correctable by fast kickers
- Longitudinal requirements stay the same

Sources of Errors

No feedback

- Lorentz Force Detuning (20%, 20deg)
  - A function of gradient and various cavity parameters
- Cavity P_k, Q_l and beam loading (2%, 2deg)
  - Test with simulator
- Microphonics (2%, 5 deg)
- Static detuning (1%, 2deg)
- Beam loading variation
- Vector sum calibration errors and drifts (1%, 1deg)
- Receiver linearity
- Noise
- Residual loop error (.2%, .2deg)
- Reference line drifts (0%, .3deg)

Error Budget

- Lorentz Force Detuning (.2%, .2deg)
  - A function of gradient and various cavity parameters
- Cavity P_k, Q_l and beam loading (.2%, .2deg)
  - Test with simulator
- Microphonics (.2%, .2 deg)
- Static detuning (.1%, .1deg)
- Beam loading variation (.1%, .1deg)
- Vector sum calibration errors and drifts (.1%, .1deg)
- Receiver linearity (.1%, .1deg)
- Noise (.02%, .02deg)
- Residual loop error (.1%, .1deg)
- Reference line drifts (.1%, .1deg)

First Pass

- All cavities should be at the same gradient, P_k, and Q_l (bin cavities)
  - Less sensitivity to beam variations
  - Reduced tilt
- Microphonic compensation
  - Stiff cavities or to be developed PZT systems
- One PA per cavity would be a better technical solution to this issue