PEP-II Tune Feedback

Lock-in amp drives beam in x (or y) with $A \cos \nu_x \omega_{\mathrm{rev}} t$.

Downconverter forms Δx from sums, difference of pick-ups.

Downconvert from $2\omega_{\mathrm{RF}} \pm \nu_x \omega_{\mathrm{rev}}$ to $\omega = \nu_x \omega_{\mathrm{rev}}$

Lock-in finds magnitude R and phase θ of signal at f.

Get difference $\Delta\theta = \theta - \theta_0$ from center of tune resonance.

$+$ Σ $+$

Kicker

Transverse feedback

Pick-up buttons on beampipe

Tune-setting quadrupole magnets

Set drive to starting level. Run auto-gain, wait, then run auto-reserve.

No — Drive on? — No — Beam current < minimum?

Drive Level

Sensitivity Range

Tune Feedback

Tune Tracking

Yes

Low or No Beam

Yes

Find standard deviation of $\Delta\theta$ over N readings.

Compare mean of R over N readings to sensitivity range.

Adjust tune multiknob by $\Delta\nu_x$.

Move drive frequency to reduce $\Delta\theta$, using slope $d\theta/df$ near θ_0.

When beam is lost, set:

Tune to zero-current value;
Drive starting level 3 dB below present;
Drive = minimum;
Sensitivity = maximum;
Dynamic reserve = normal.

St dev > 2°? Drive < high limit? Raise drive 1 dB.

R > 75% of full scale? Go up one range.

$\Delta\nu_x$ Σ $-$ $+$

Desired Tune

Compute tune: $\nu_x = f/f_{\mathrm{rev}}$.

St dev < 1°? Drive > low limit? Lower drive 1 dB.

R < 25% of full scale? Go down one range.

Take N readings. Apply smoothing to tune data.

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