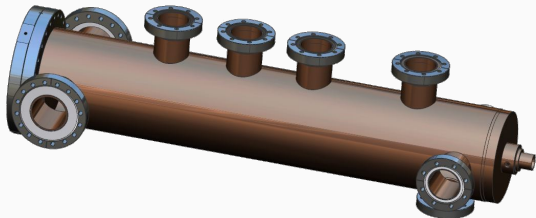


Optics measurements for the Harmonic Kicker Diagnostic Line (HKDL) at UITF

M. Bruker

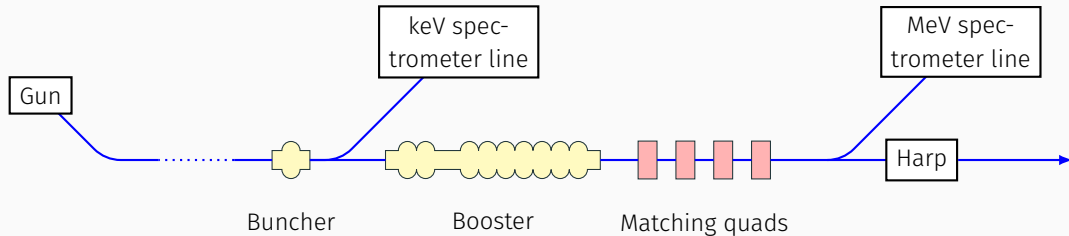
September 30, 2021



stolen from:

2021_0220 Kicker Fab Progress Sarah Solomon.pptx

Matching at UITF—Let us talk about what matching is



- Setting matching quads requires well-known Twiss parameters upstream
- Need accurate prediction of β_x in MeV spectrometer, cannot measure it there
- Ellipse at booster exit is energy-dependent and not well-known
 - ELEGANT model starting at gun probably unreliable
 - GPT model could be OK

Objective

- Be able to set booster/buncher to anything ($p, \frac{\Delta p}{p}$) and match Twiss to HKDL and MeV spectrometer w/o big empirical tweaks

Measurement

- With any MeV beam:
 - Use as many lenses as possible to measure Twiss in MeV region
 - Current backpropagation appears inconsistent: find reason and eliminate it
- Once backpropagation works correctly, obtain beam ellipse at booster exit for different MeV energies and compare with GPT; refine model as appropriate
- Demonstrate ability to predict spot size downstream

- Spectrometer: $\sigma_x = \sqrt{\beta_x \epsilon_x + \left(\mu_x \frac{\delta p}{p}\right)^2}$
 - Given reliable prediction of β_x , measure momentum spread
 - Effective $\frac{\delta p}{p}$ as measured by harp contains intrinsic and low-frequency components (“jitter”)
 - Use viewer framegrab to tell them apart and quantify them individually
- Ultimately: Perform small variations in $\sigma_{x,y}$ and $\frac{\Delta p}{p}$ and ensure consistency with model

Summary of resource allocation

Measurements

- Set booster to one energy, perform different quad scans
- Set booster to ≈ 5 different energies, verify beam ellipse vs. GPT
- Measure momentum spread with both 703 viewer and harp; vary it

Modeling

- Precursory: Use ELEGANT to quantify systematic error budget
- Precursory: Use GPT to predict Twiss at booster exit for all energies
- Interleaved: Feed back measured data into ELEGANT to match model to reality

Shifts

- ≈ 3 beam shifts per week over the course of 4 weeks