

Update on slice momentum spread measurement with TDS and HEDA2

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Betatron contribution to slice momentum measurement

- The minimum momentum spread is

$$\delta p \geq \frac{\sqrt{\beta_x \varepsilon_x}}{D}$$

D: dispersion function
 β_x : beta function
 ε_x : geometric emittance

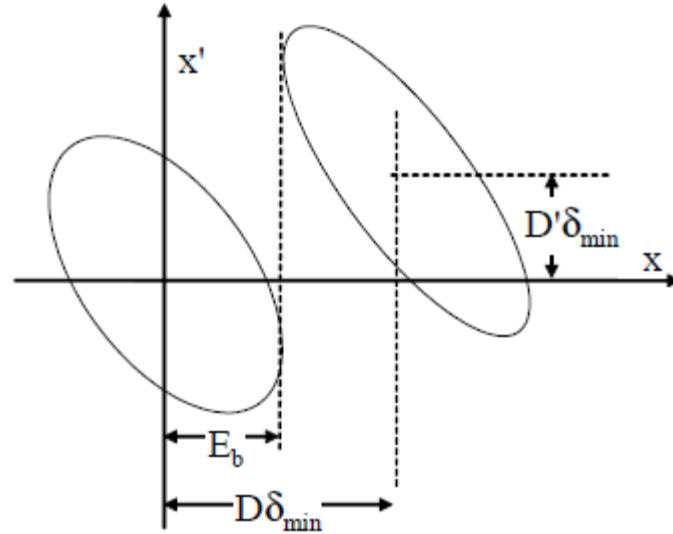


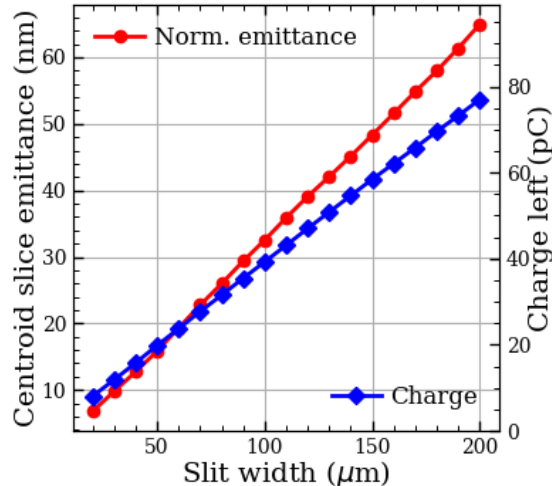
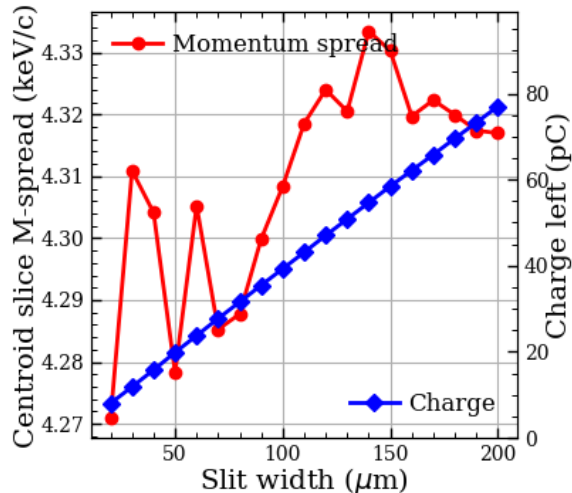
Fig. 5.14. Energy resolution in phase space

- to optimize it, the beam size (affected by space charge and emittance) should be small and the dispersion should be large

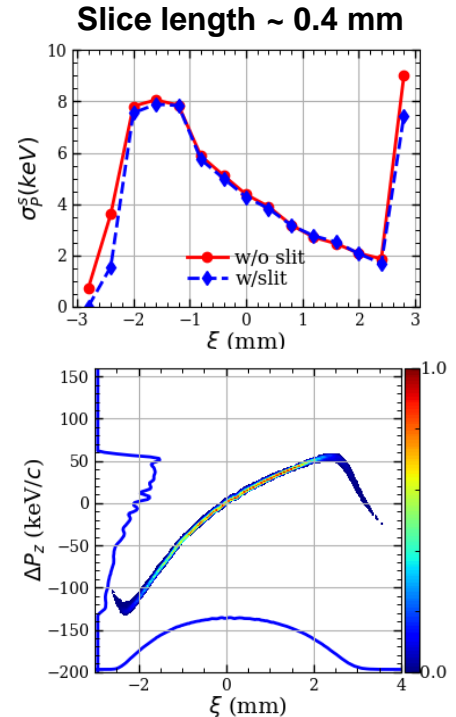
H. Wiedmann, Particle accelerator physics, third edition. 2007

Cut the beam with EMSY1 50 μm slit

- By cutting the beam, only the very center part with a small emittance and charge is left; meanwhile the longitudinal phase space is kept



After the slit, bunch charge reduced to ~ 15 pC,
x-emittance reduced from 0.6 μm to ~ 0.02 μm

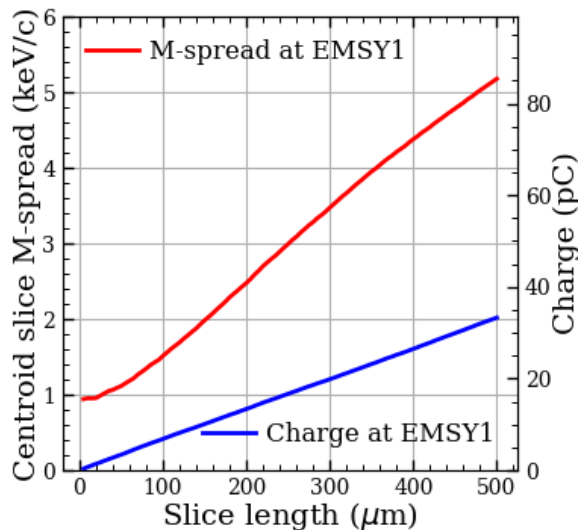


LPS at EMSY1

Effect of energy chirp and others

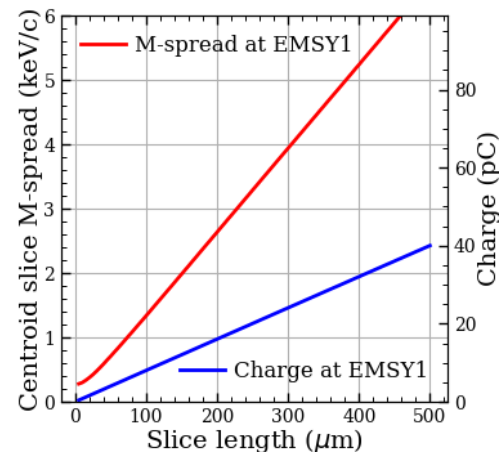
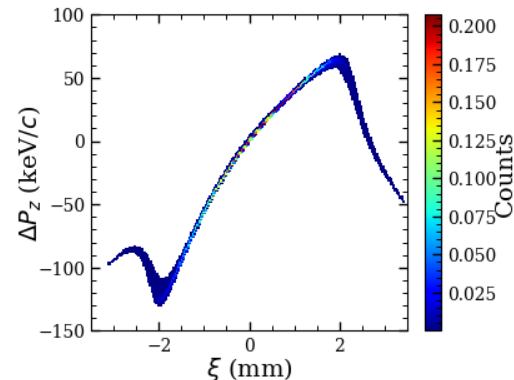
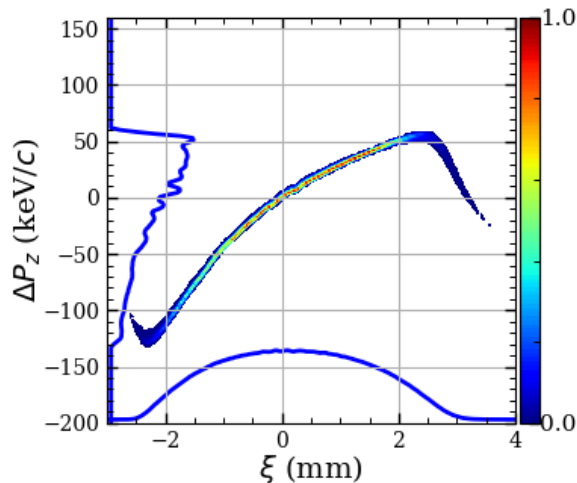
Input beam: BSA 1.3 mm, 250 pC, I_{main} 366 A, 19.3 MeV/c with **2 M** macroparticles (from Raffael's simulation)

$\sigma_{p,s}$ vs slice length



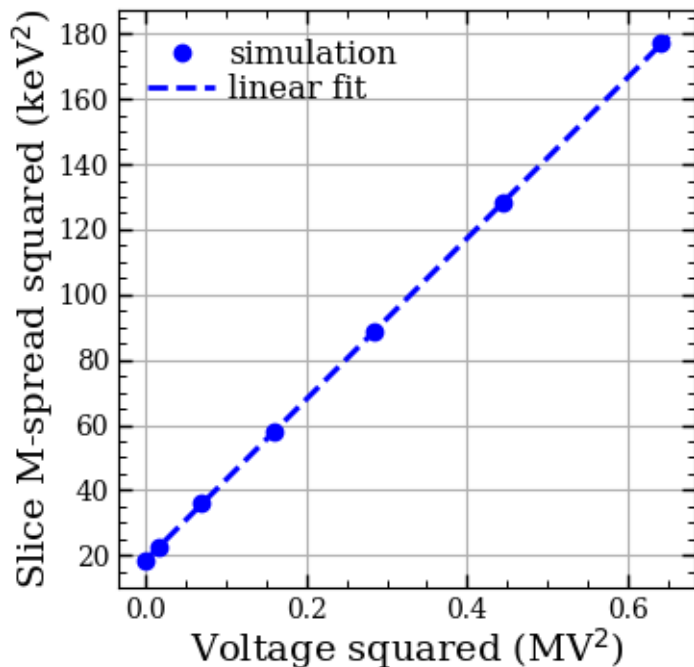
Input beam: BSA 1.0 mm, 250 pC, 200 k

LPS at EMSY1



TDS voltage scan results

$\sigma_{p,s}^2$ vs TDS voltage squared for 250 pC cut by slit



$\sigma_{p,s}$ vs TDS voltage for three scenarios

