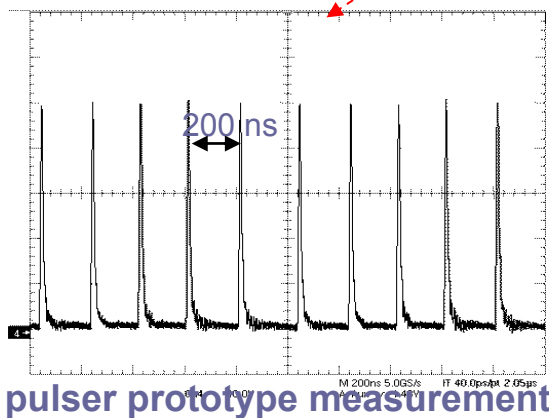
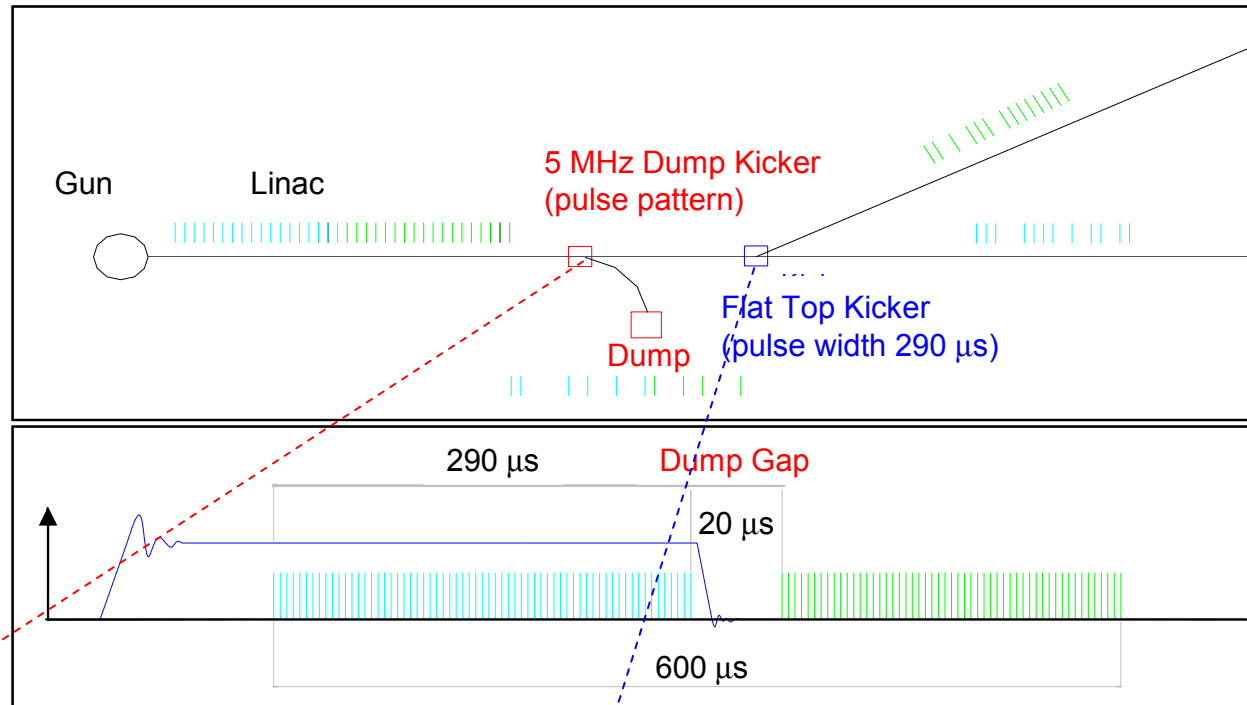
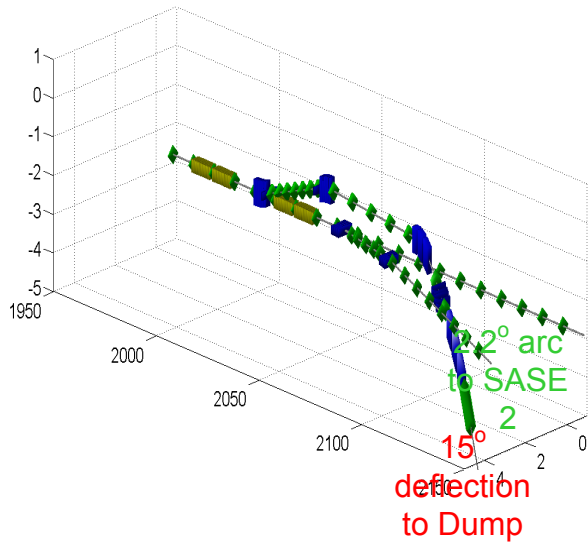
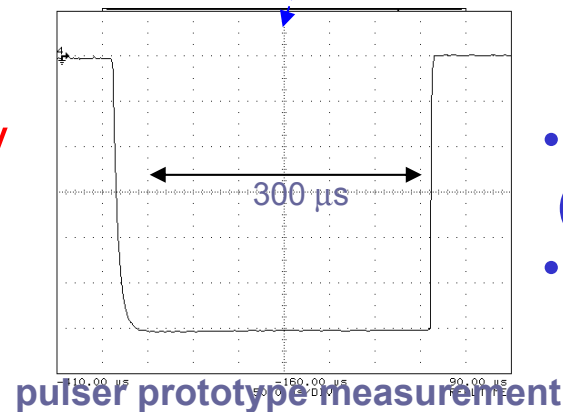


XFEL Beam Collimation and Switchyard Review Beam Switchyard

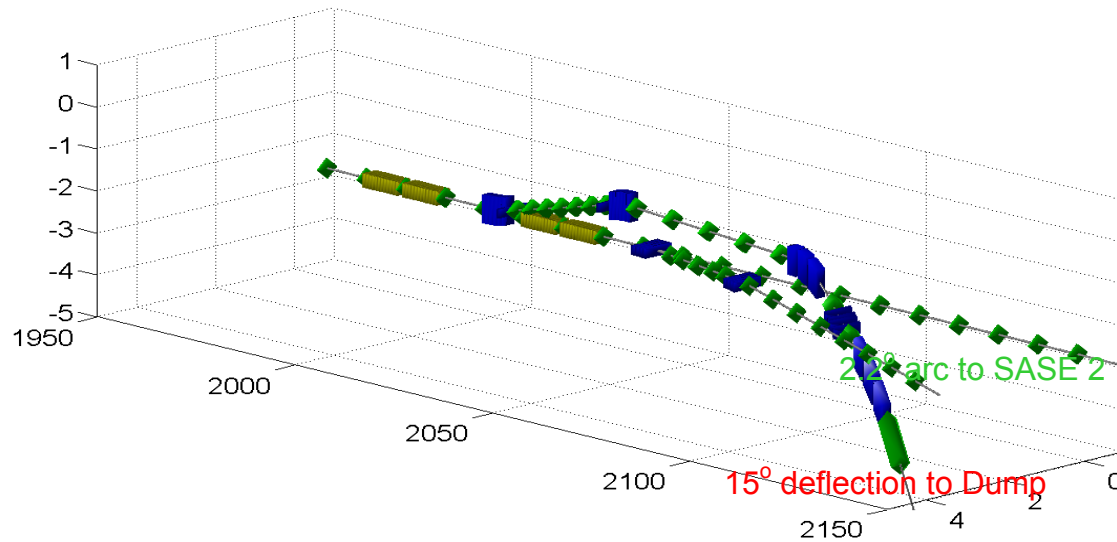
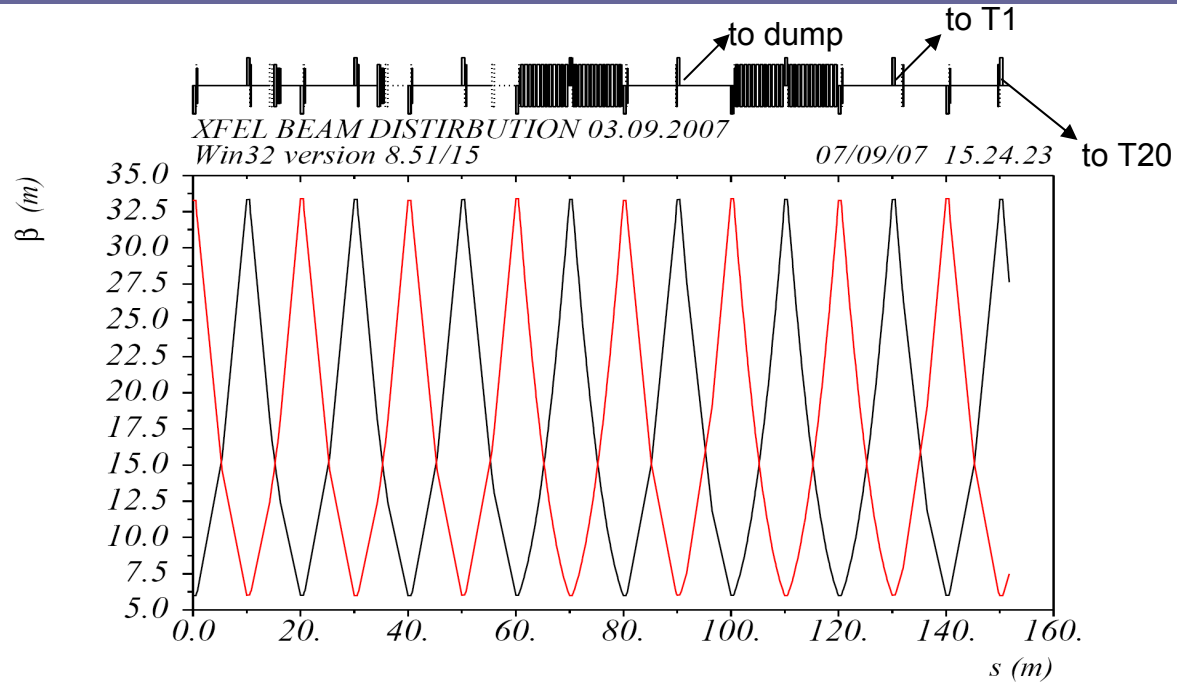
FEL-Beam-Dynamics Group
3.12.2007

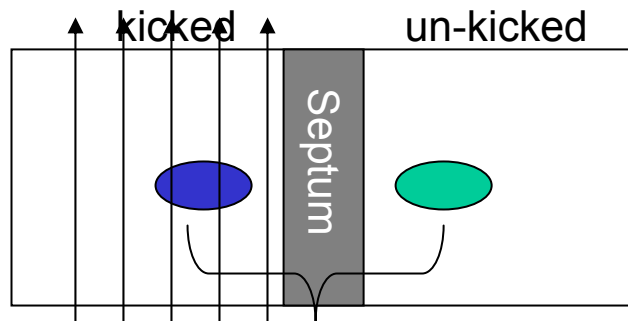


- low accuracy (>1 %)
- 5 MHz burst operation



- high accuracy (< 0.01 %)
- 10 Hz operation





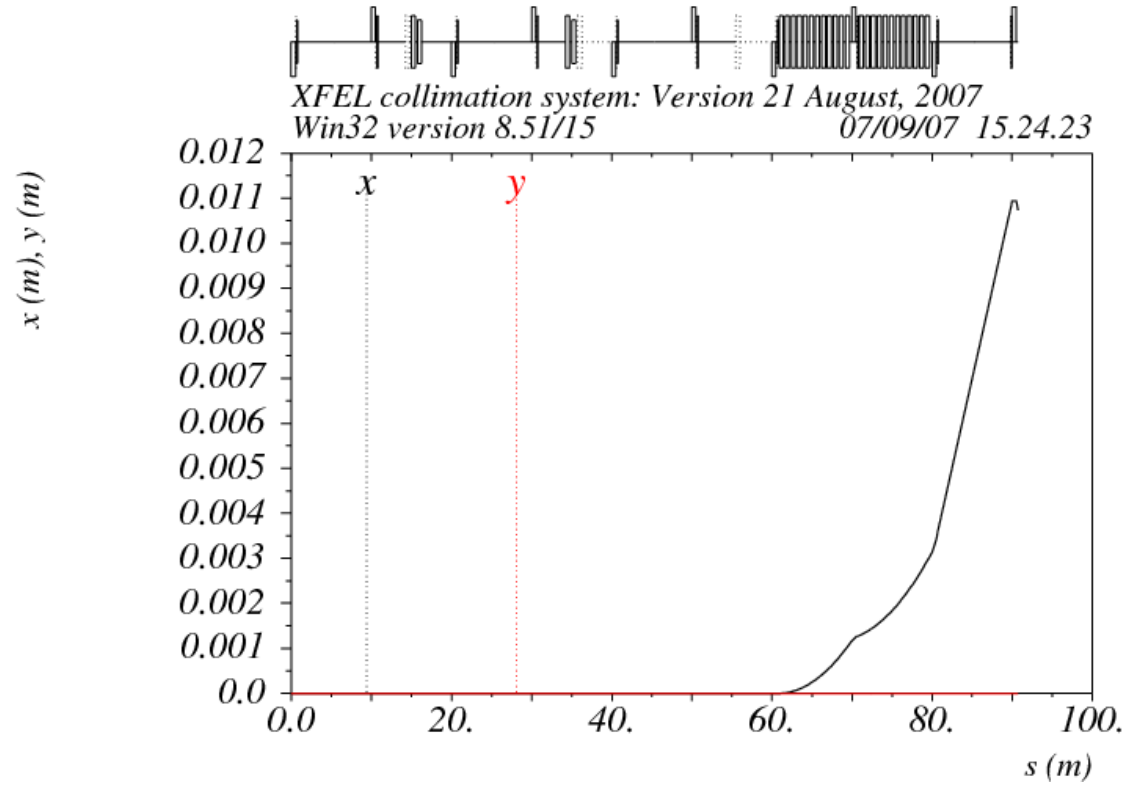
Septum thickness: $x_{\text{septum}} = 5 \text{ mm}$
 Tolerable jitter: $n_{\text{jitter}} = 0.1 \sigma$
 Collimation depth: $m_{\text{collimation}} = 85 \sigma$
 Beta at Septum: $\beta_{\text{septum}} = 30 \text{ m}$
 <Beta> at Kicker: $\beta_{\text{kicker}} = 25 \text{ m}$

$$\Delta = x_{\text{septum}} + 2m_{\text{collimation}} \sqrt{\epsilon \beta_{\text{septum}}} = \Theta_{\text{kick}} \sqrt{\beta_{\text{septum}} \beta_{\text{kicker}}}$$

$$\Theta_{\text{kick}} = 0.4 \text{ mrad} \quad (Bdl = 33.6 \text{ mTm (25 GeV)}, l_{\text{kick}} < 18 \text{ m})$$

$$\frac{\Delta \Theta}{\Theta} = n_{\text{jitter}} \left/ \left(2m_{\text{collimation}} + \frac{x_{\text{septum}}}{\sqrt{\epsilon \beta_{\text{septum}}}} \right) \right.$$

$$\frac{\Delta \Theta}{\Theta} \approx 3 \times 10^{-4} \quad (< 5 \times 10^{-3} \text{ measured at TTF})$$



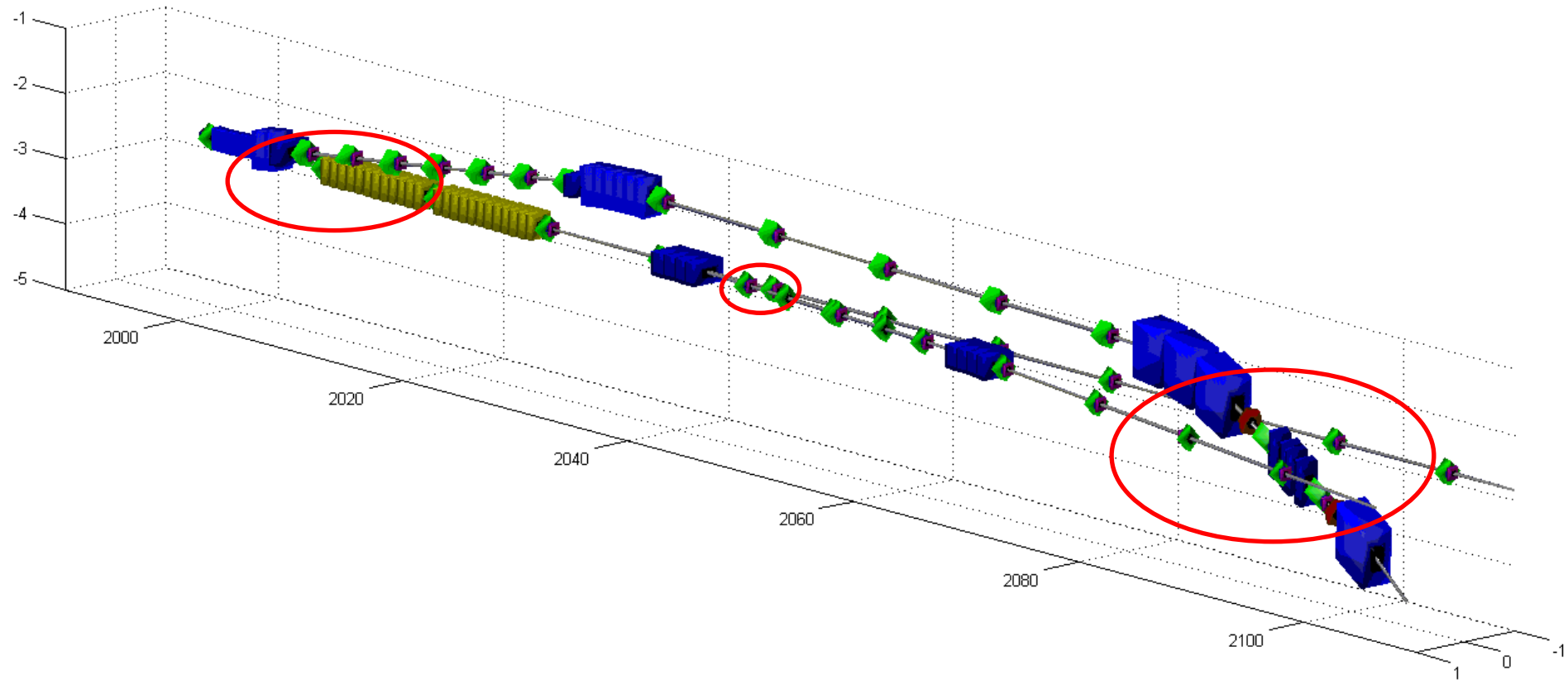
0.5 mrad kick required

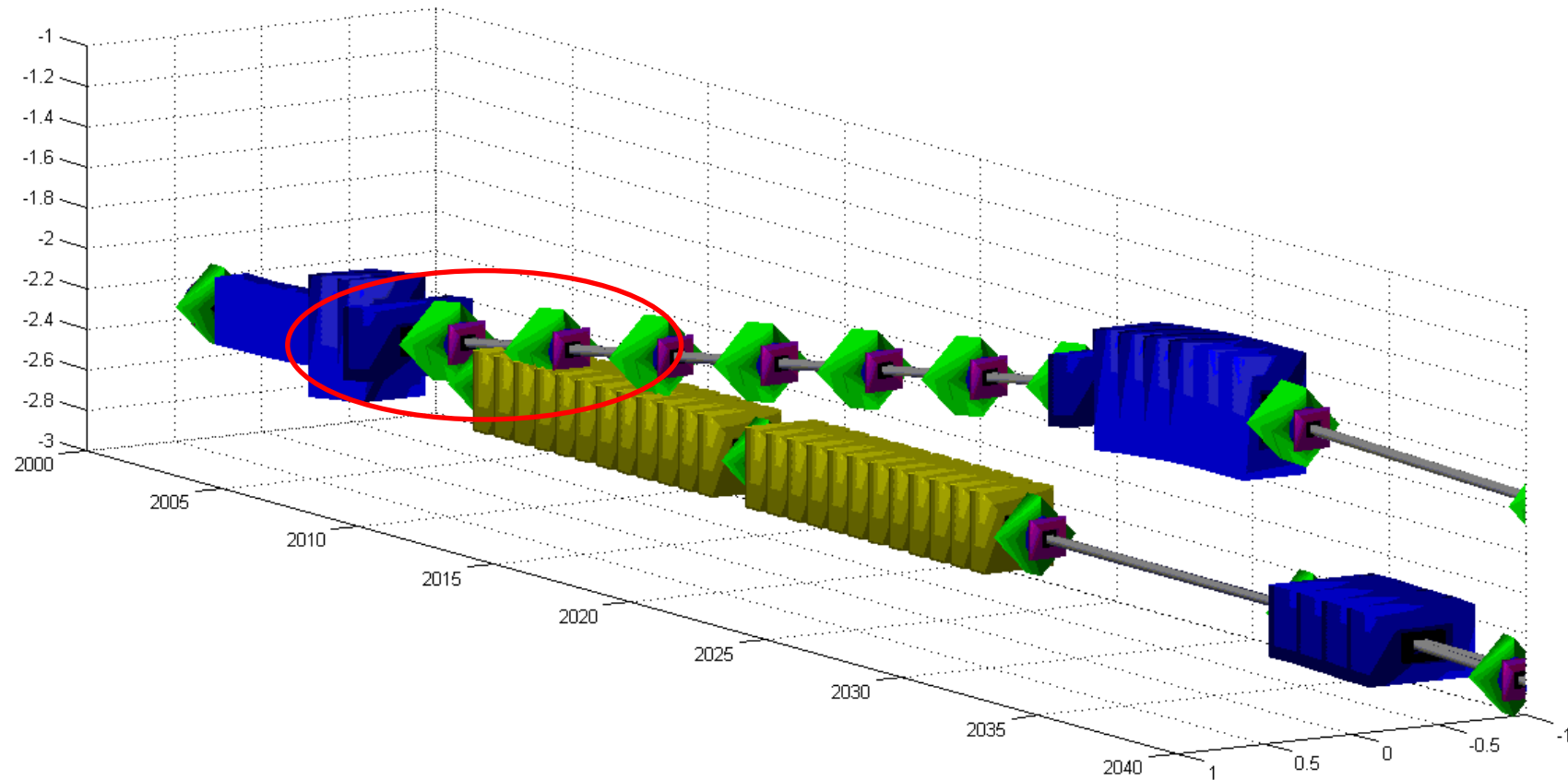
		Fast single bunch kicker (for beam dump)	Flat top kicker (for beam distribution)
Pulse Form		Burst	Flat top
Repetition Rate	Hz	5×10^6	10
Max. Pulse Width	s	200×10^{-9}	300×10^{-6}
Rise/Fall Time	s	$< 100 \times 10^{-9}$	$\approx 20 \times 10^{-6}$
Rel. Amplitude Stability		0.01	3×10^{-4}
Relative Residual Ripple		3×10^{-4}	3×10^{-4}
Kick angle	mrad	0.5	0.5
Max. int. Field Strength	mT×m	42	42
Min. full aperture	mm	30	30
Max. system length	m	18	18

- In or out of vacuum stripline kicker with d = stripline distance

$$B[\text{T}] = \mu_0 I / d$$

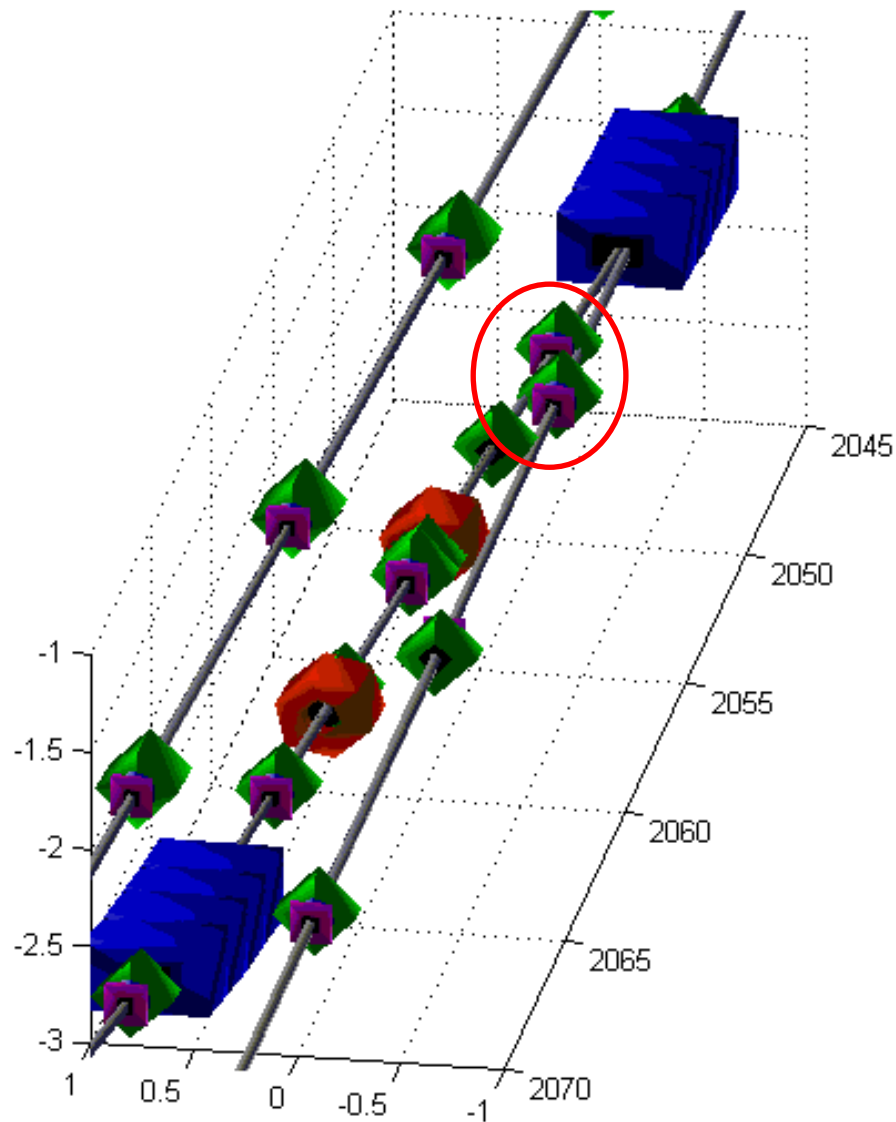
- Decrease of vacuum chamber size helpful
 - Test on ongoing for sputtering of $d < 20$ mm ceramics
 - 100σ at kicker location approx 3.5 mm





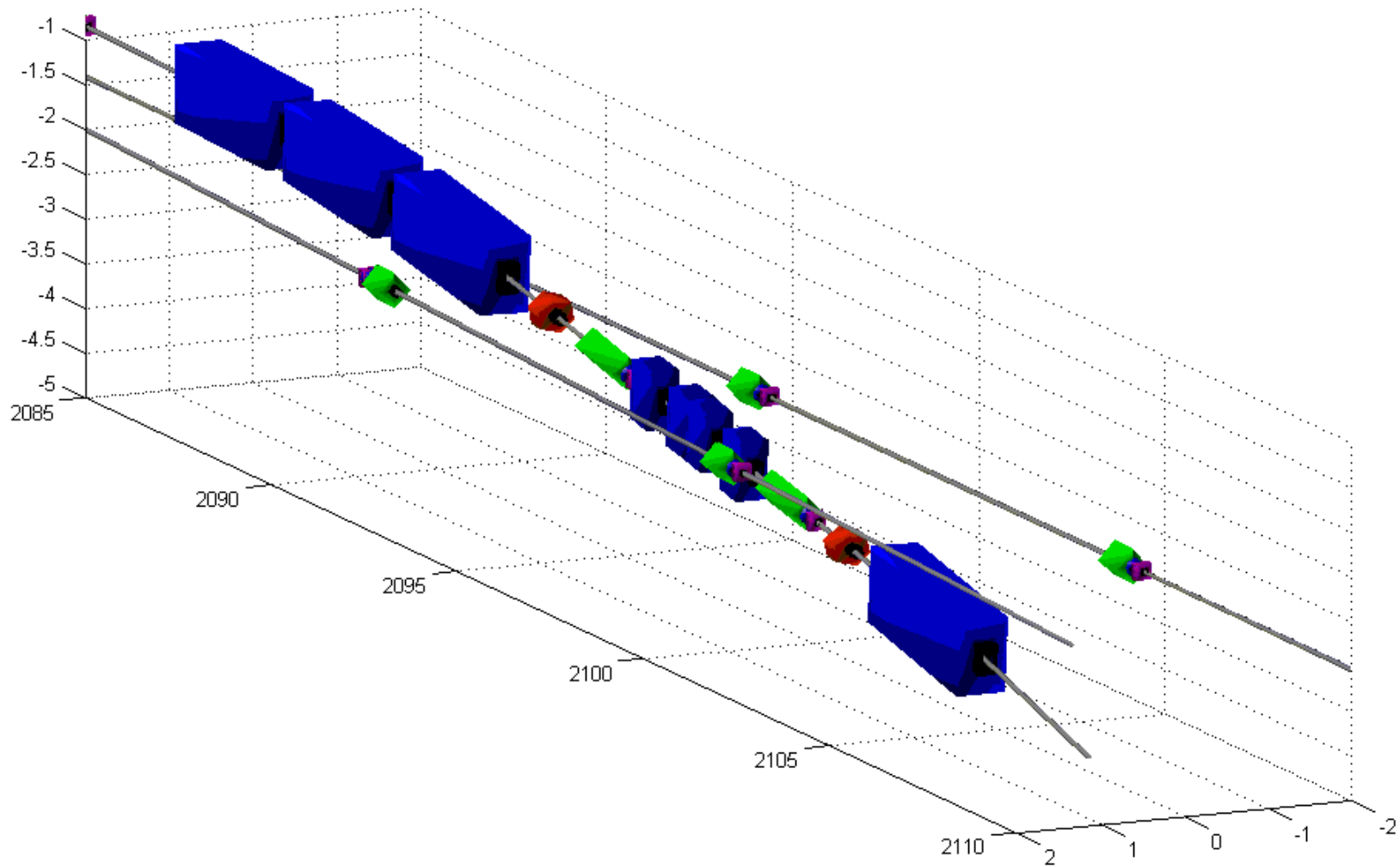
Severe Collisions, requires re-design of dump line

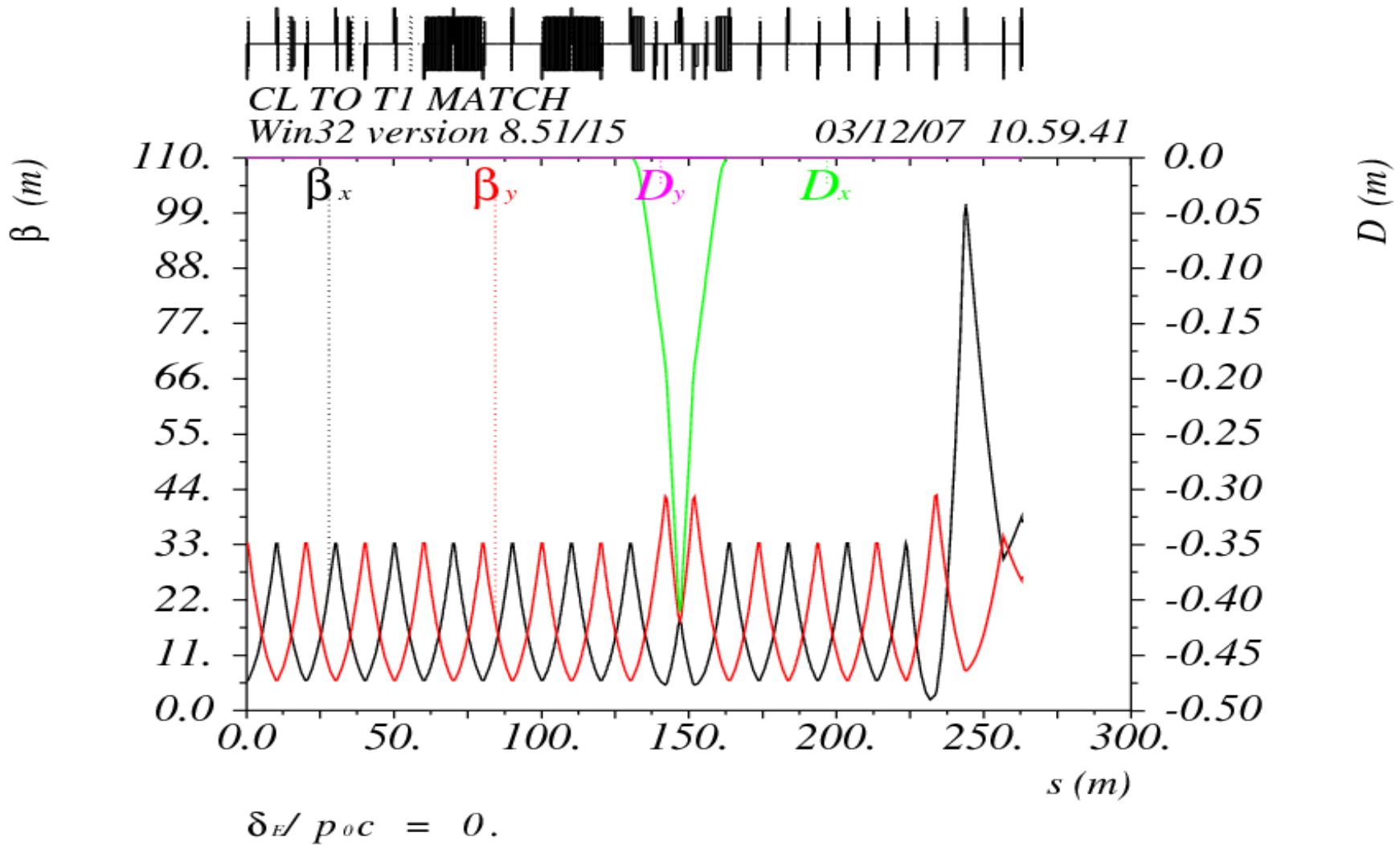
- stronger septum planned
- give up achromat vertical dogleg and horizontal bend

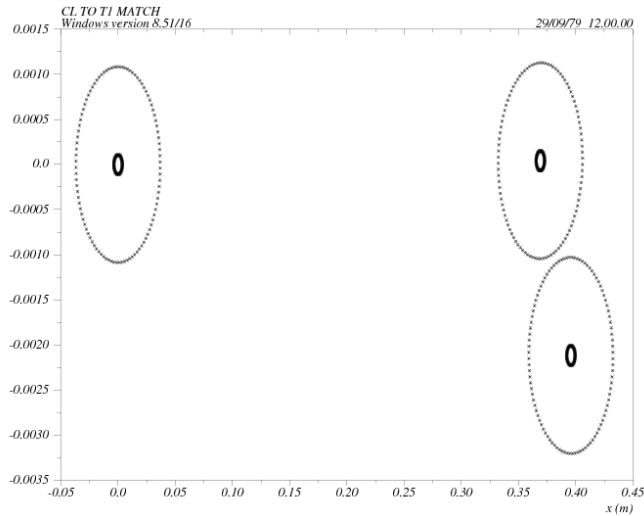


collision of 2 quadrupoles

- remove straight line quad – easy
- remove bend quad – maybe not possible => mirror plate quad





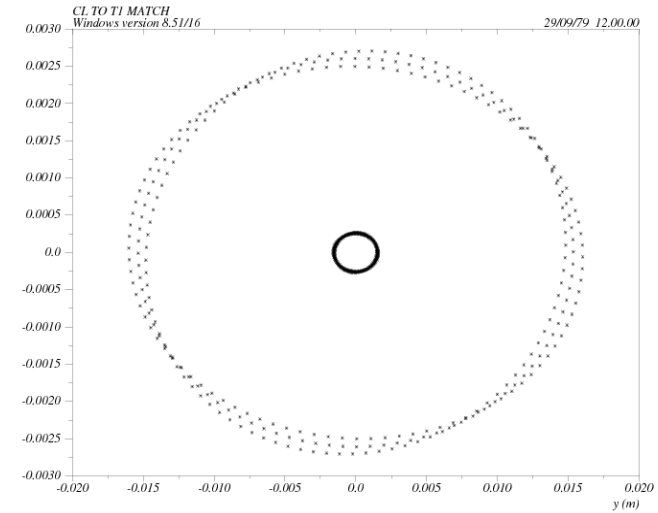


horizontal

$\delta = 0\%, \pm 1.5\%$
1 σ ellipses

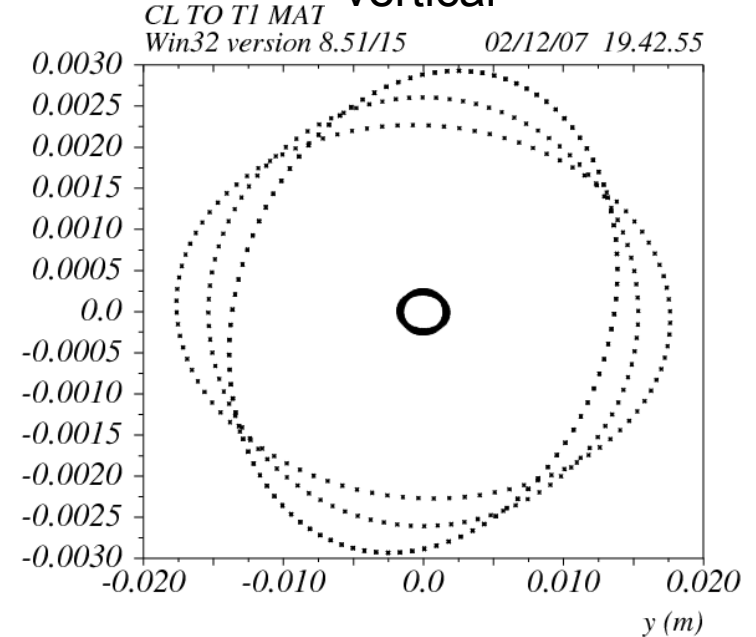
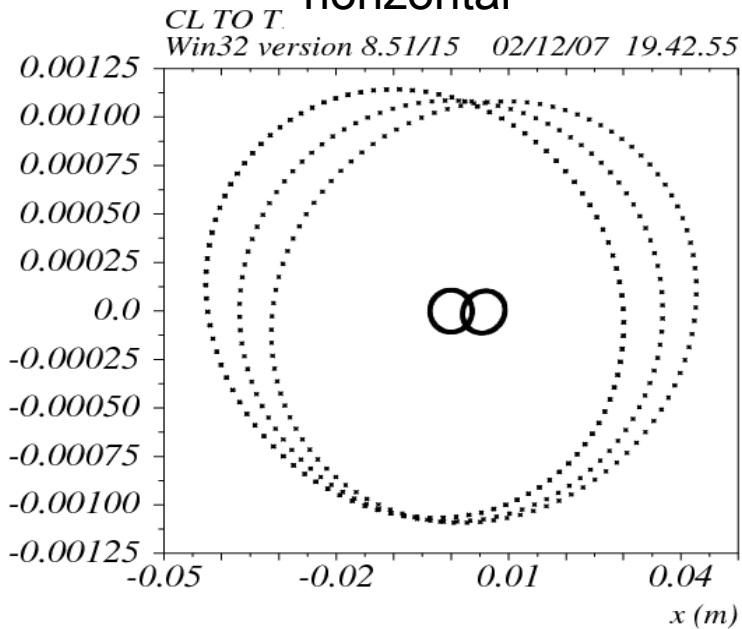


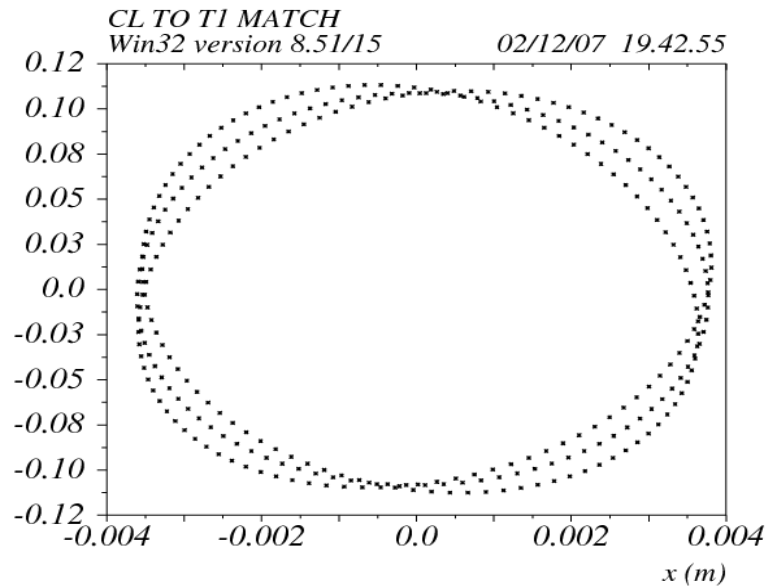
2 sextupoles



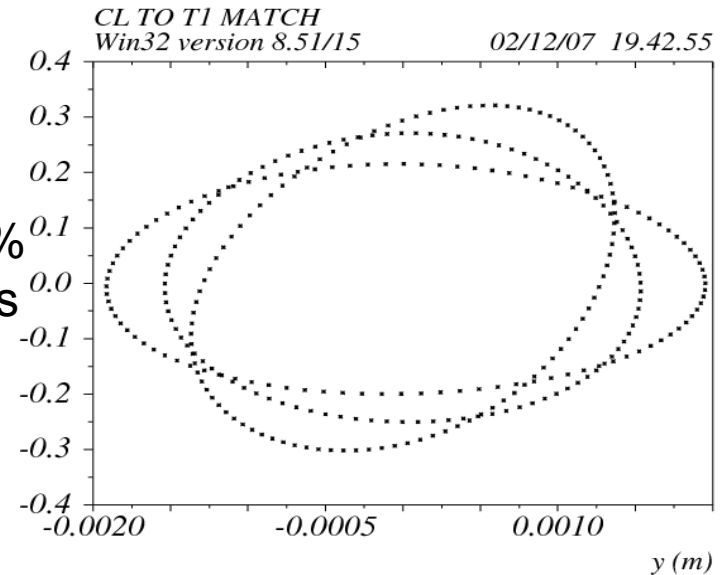
vertical

$\delta = 0\%, \pm 1.5\%$
1 σ ellipses





$\delta = 0\%, \pm 2.5\%$
100 σ ellipses



Missing: Influence of kicker

Influence of septum stray fields has been calculated by Bagrat Grigoryan