Impedance of Different Kicker Options

Olga Zagorodnova
BDGM, DESY
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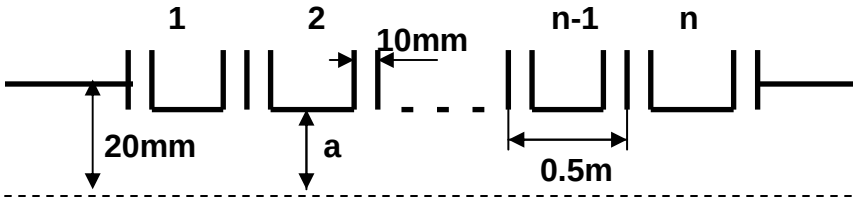
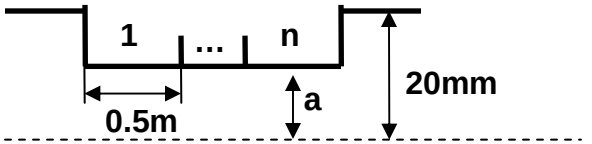
Geometries of the kickers for TD1 separation and kickers for TLD separation

In vacuum

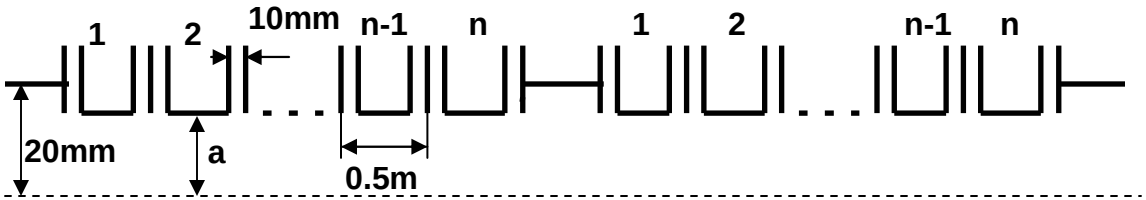


Out vacuum

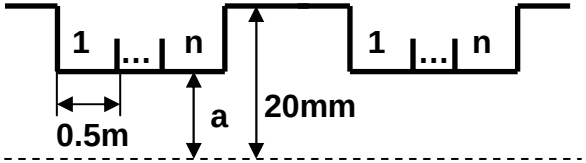


Geometries of the feedback kickers

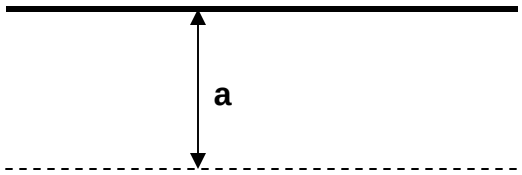
In vacuum



Out vacuum



(1) Analytical estimation of resistive wake for round pipe



Material: Stainless Steel 1,4435 X2 CrNi MO 18-14-3

$$Z(\omega) = \frac{Z_s(\omega)}{2\pi R}\left[1 + i\frac{\omega}{c}\frac{R}{2}\frac{Z_s(\omega)}{Z_0}\right]^{-1}$$

$$\Delta_{rough} = 300[\mathrm{nm}]$$

$$\Delta_{oxid} = 5[\mathrm{nm}]$$

$$Z_s(\omega) = Z_s^{\sigma}(\omega) + Z_s^{L}(\omega)$$

$$Z_s^{\sigma}(\omega) \approx \sqrt{\frac{i\omega\mu}{\sigma(\omega)}} \qquad \sigma(\omega) \approx \frac{\sigma_0}{1 + i\omega\tau}$$

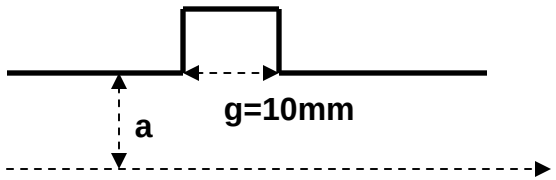
$$Z_s^{L}(\omega) \approx i\omega L \qquad L \approx 0.5\mu(\Delta_{oxid} + 0.02\Delta_{rough})$$

(2) Analytical estimation for cavity (g - finite)

$$w_{\parallel}^{\delta}(s) = \frac{Z_0 c}{\sqrt{2}\pi^2 a}\sqrt{\frac{g}{s}} \qquad k_{\parallel} = \frac{Z_0 c}{4a\pi^{2.5}}\Gamma\left(\frac{1}{4}\right)\sqrt{\frac{g}{\sigma_z}}$$

$$w_{\perp}^{\delta}(s) = \frac{2}{a^2}\frac{\sqrt{2}Z_0 c}{\pi^2 a}\sqrt{gs} \qquad k_{\perp} = \frac{2}{a^3}\frac{Z_0 c}{\pi^{2.5}}\Gamma\left(\frac{3}{4}\right)\sqrt{g\sigma_z}$$

$$\mathrm{k_{rms}} = \frac{k_{\parallel}}{2.467}$$



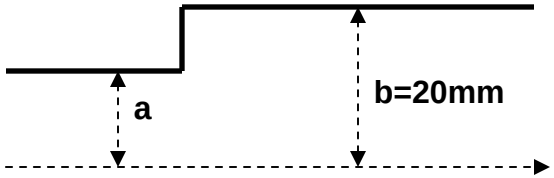
a=20, 15, 10mm

(3) Analytical estimation for step-out transition (g - infinite)

$$Z_{\parallel} = \frac{Z_0}{\pi}\ln\left(\frac{b}{a}\right) \qquad k_{\parallel} = \frac{Z_{\parallel} c}{2\sqrt{\pi}\sigma_z} \qquad \mathrm{k_{rms}} = k_{\parallel}\sqrt{\frac{2}{\sqrt{3}} - 1} \approx 0.4\,k_{\parallel}$$

$$w_{\parallel}^{\delta}(s) = Z_{\parallel} c\,\delta(s)$$

$$w_{\perp}^{\delta}(s) = 2 * k_{\perp} * \theta(s) \qquad k_{\perp} = \frac{Z_0 c}{2\pi}\left(\frac{1}{a^2} - \frac{1}{b^2}\right)$$



a=20, 15, 10mm

The table shows different combinations of kickers with different apertures in vacuum and out of vacuum

		TD1	TDL	Feedback
A	a (mm)	20		
	n (in vacuum)	20	5	4
	n (out vacuum)	22	6	4
B	a (mm)	15		
	n (in vacuum)	15	4	2
	n (out vacuum)	17	5	4
C	a (mm)	10		
	n (in vacuum)	10	3	2
	n (out vacuum)	12	3	2

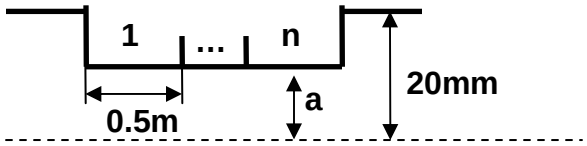
Energy Spreads in kV/nC, calculated for the gaussian bunch 25mkm

	In Vacuum				Out vacuum			
	TD1	**TDL**	**Feedback**	**Total**	**TD1**	**TDL**	**Feedback**	**Total**
A a=20mm	257	64	103	**423**	180	49	65	**294**
B a=15mm	309	105	142	**556**	240	93	163	**496**
C a=10mm	401	185	315	**901**	361	163	287	**811**

Impedance budget for the collimation section without kickers

Section	El. type	Num.	Loss (kV/nC)	%	Spread(kV/nC)	%	Peak(kV/nC)	%
CL								
	PUMCL	78	5.96E+02	4	2.41E+02	3	8.43E+02	4
	PIP20	1	5.40E+03	41	3.95E+03	56	9.25E+03	45
	FLANG	500	1.42E+03	11	5.73E+02	8	2.00E+03	10
	COLL	4	5.72E+03	43	2.77E+03	39	8.59E+03	42
	BPMCL	12	1.86E+02	1	8.30E+01	1	2.78E+02	1
			1.33E+04	100	7.06E+03	100	2.06E+04	100

			1.33E+04	100	7.06E+03	100	2.06E+04	100



Contributions of the kickers with different apertures to impedance budget of collimation section

	a, mm	In Vacuum	Out Vacuum
A	20	5.7%	4%
B	15	7.3%	6.6%
C	10	11.3%	10.3%