



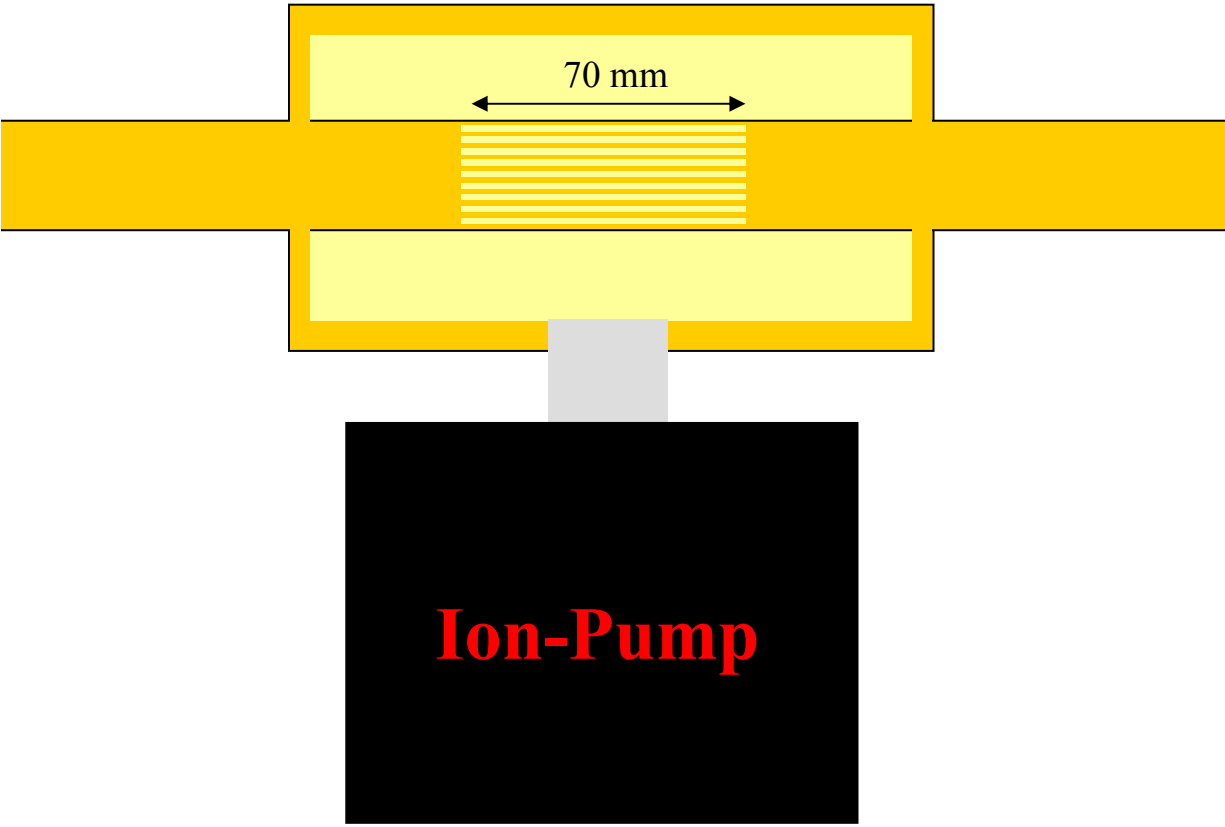
# Wakefields of the Pump

Igor Zagorodnov

22.09.2008

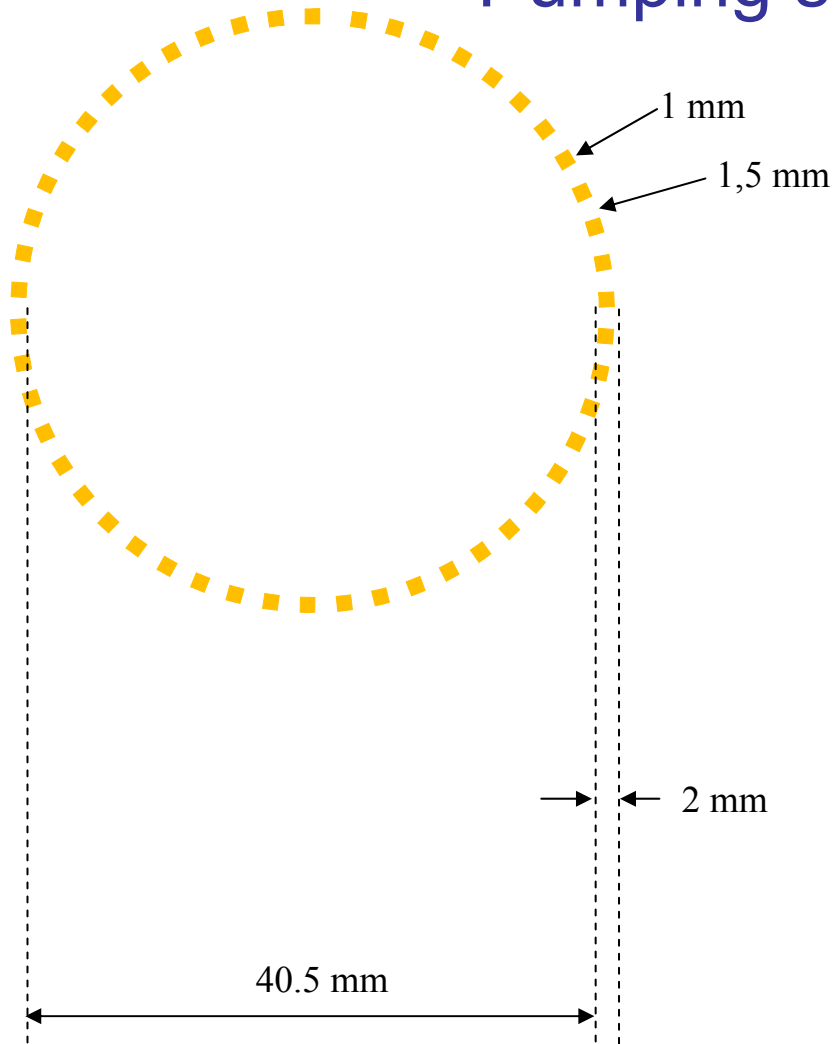
BD meeting, DESY

# Pumping slots



Boris Nagorny

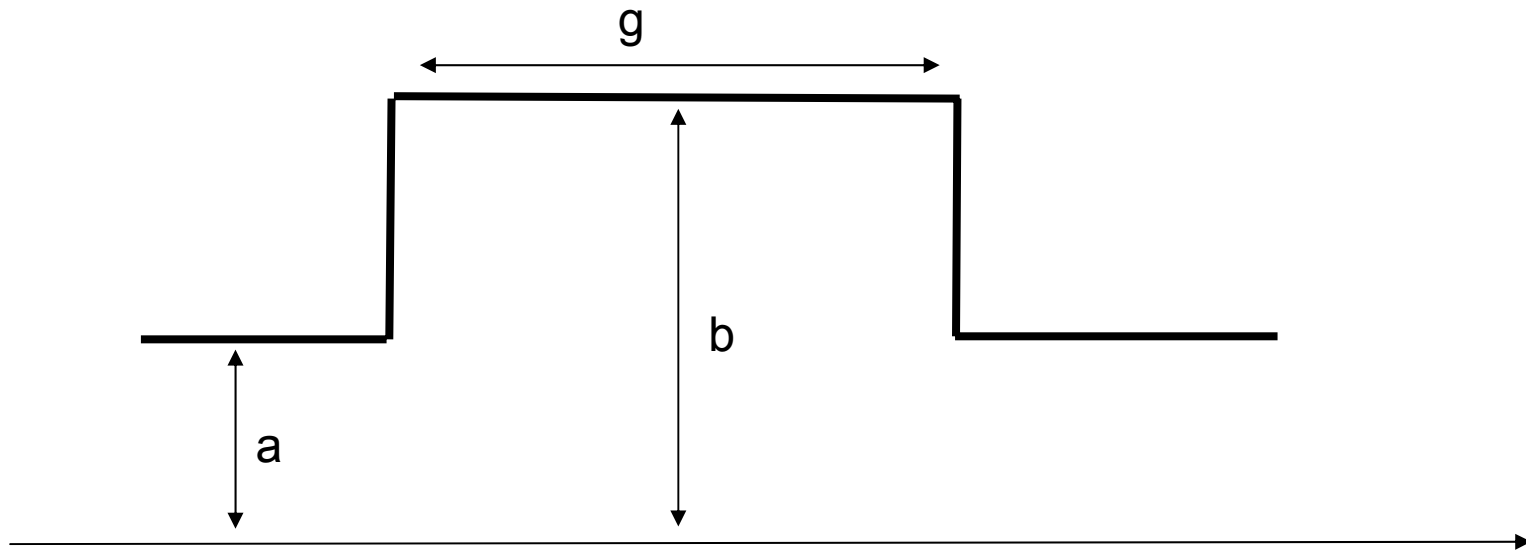
# Pumping slots



78 items after LINAC

Boris Nagorny

# Pumping slots: cavity model



# Pumping slots

$$a = 20 \text{ mm}$$

$$\sigma_z = 25 \text{ } \mu\text{m}$$

$$g = 70 \text{ mm}$$

$$F = 0.5$$

$$k_{\parallel} = \frac{Z_0 c}{4a\pi^{2.5}} \Gamma\left(\frac{1}{4}\right) \sqrt{\frac{g}{\sigma_z}} \quad \text{Spread} = \frac{k_{\parallel}}{2.467}$$

$$k_{\parallel}^{\text{cavity}} = 15.5 \frac{\text{kV}}{\text{nC}} \quad \text{Spread}^{\text{cavity}} = 6.3 \frac{\text{V}}{\text{pC}}$$

$$k_{\parallel}^{\text{pump}} \approx k_{\parallel}^{\text{cavity}} F = 7.6 \frac{\text{kV}}{\text{nC}}$$

$$k_{rms}^{\text{pump}} \approx \text{Spread}^{\text{cavity}} F = 3.1 \frac{\text{kV}}{\text{nC}}$$

$$k_{\parallel}^{\text{pump,total}} = k_{\parallel}^{\text{pump}} * 78 = 593 \frac{\text{kV}}{\text{nC}}$$

$$k_{rms}^{\text{pump,total}} = k_{rms}^{\text{pump}} * 78 = 242 \frac{\text{kV}}{\text{nC}}$$

## Pumping slots

$$a = 20 \text{ mm}$$

$$\sigma_z = 25 \text{ } \mu\text{m}$$

$$g = 70 \text{ mm}$$

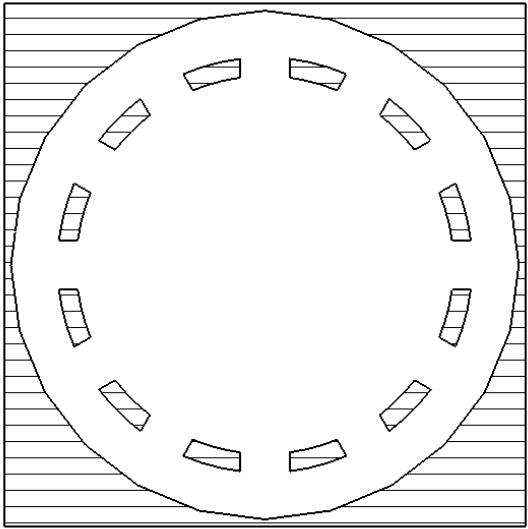
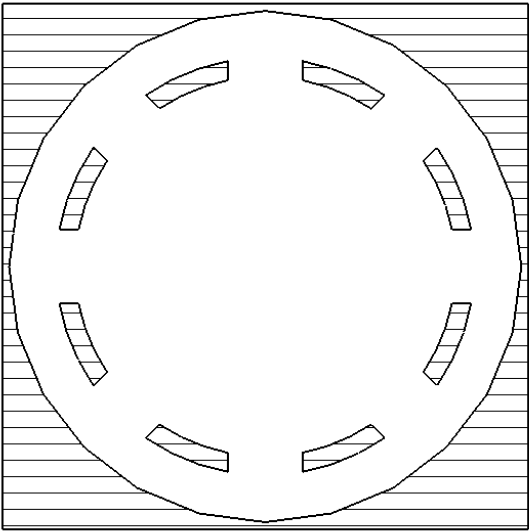
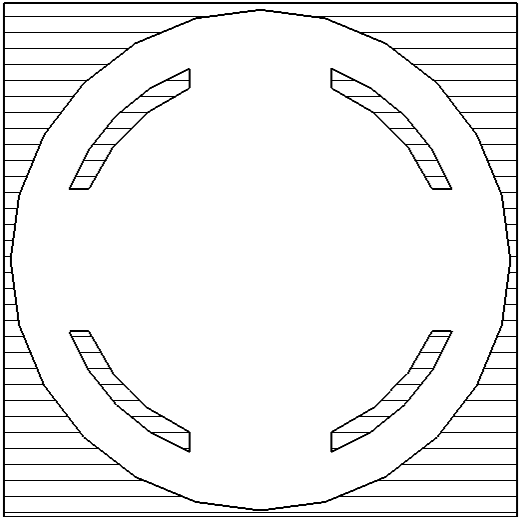
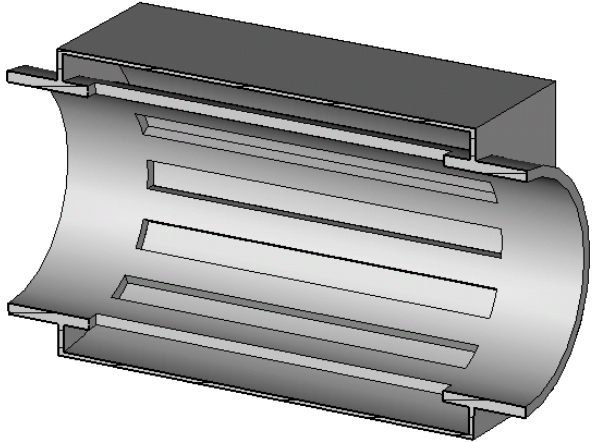
$$k_{\parallel}^{pump,total} = k_{\parallel}^{pump} * 78 = 593 \frac{\text{kV}}{\text{nC}}$$

$$k_{rms}^{pump,total} = k_{rms}^{pump} * 78 = 242 \frac{\text{kV}}{\text{nC}}$$

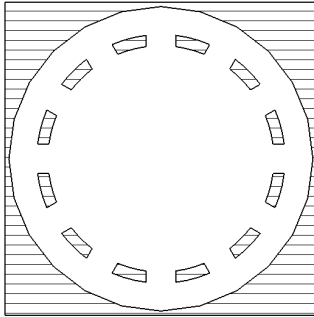
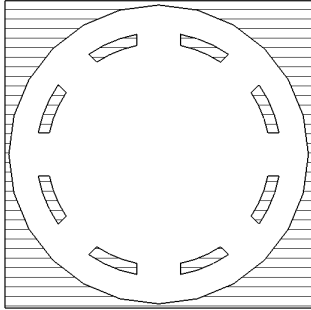
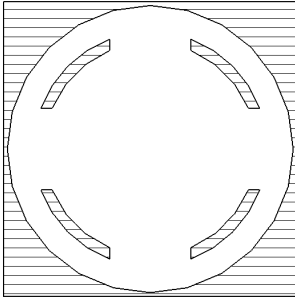
### TOTAL (LINAC to SASE2)

	Pipe (456m)	Collimators (4 items)	Kickers (3*10m)	Pumps (78 items)
Loss	3430	4343	2659	593 (5.4%)
<b>Spread</b>	<b>4332</b>	<b>3164</b>	<b>1557</b>	<b>242 (2.6%)</b>
Peak	-9048	-9088	-4633	

# Pumping slots

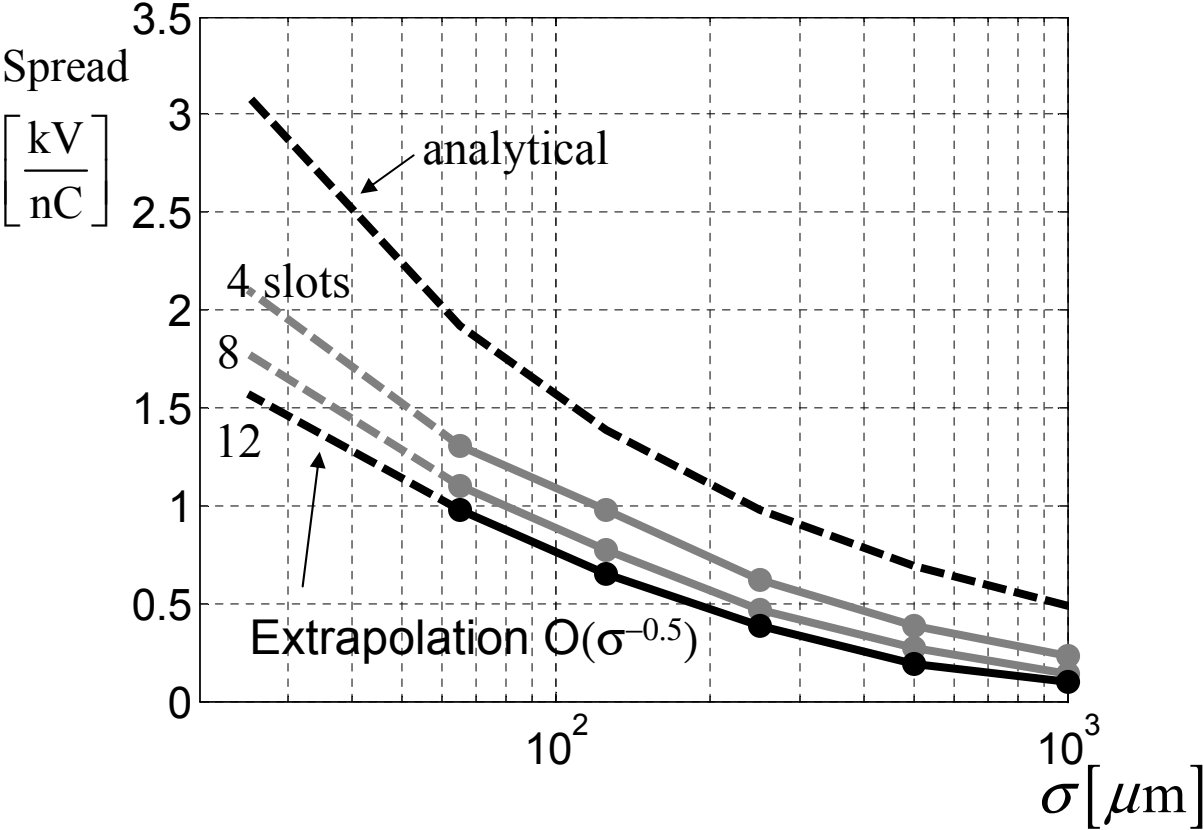


# Pumping slots



$$k_{\parallel} = 0.5 \frac{Z_0 c}{4a\pi^{2.5}} \Gamma\left(\frac{1}{4}\right) \sqrt{\frac{g}{\sigma_z}}$$

$$\text{Spread} = \frac{k_{\parallel}}{2.467}$$





# Pumping slots

$\sigma = 1 \text{ mm}$

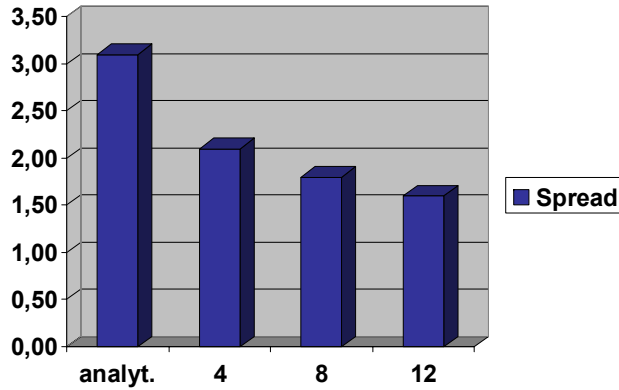
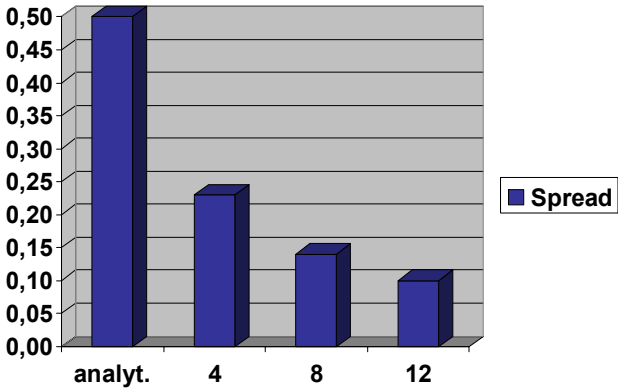
	Loss, kV/nC	Spread, kV/nC
analytical	1.2	0.5
4 slots	0.5	0.23
8 slots	0.21	0.14
12 slots	0.1	0.1

+130%

$\sigma = 25 \mu\text{m}$

	Loss, kV/nC	Spread, kV/nC
analytical	7.6	3.1
4 slots	6.5	2.1
8 slots	5.6	1.8
12 slots	4.8	1.6

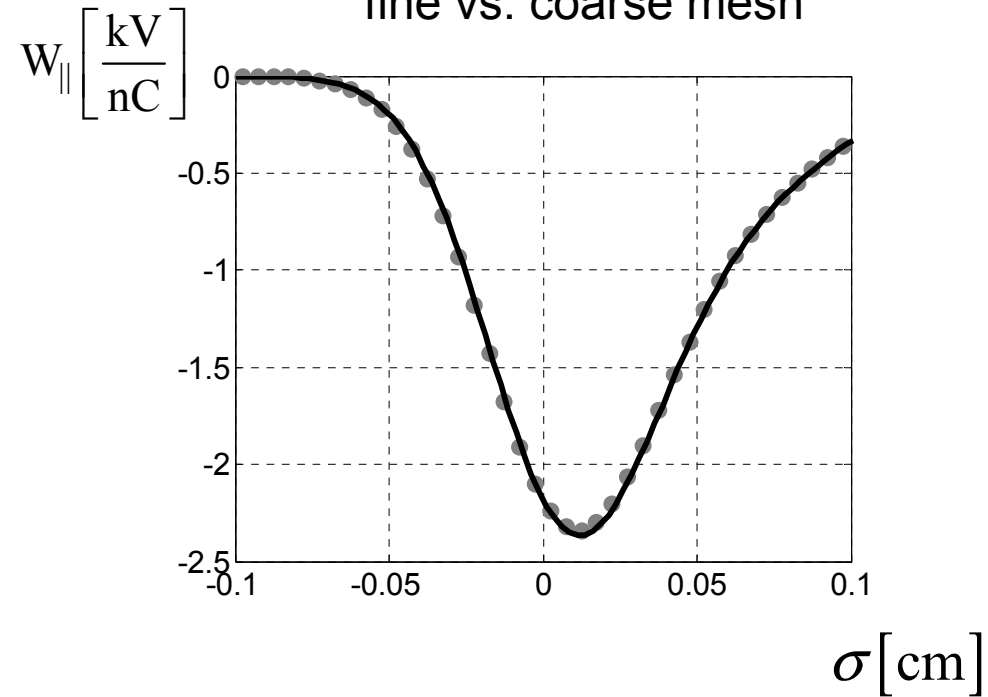
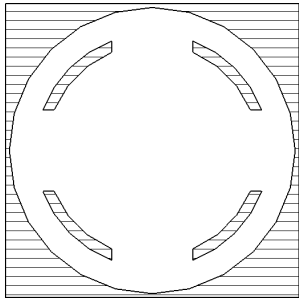
+30%



# 4 slots. Accuracy check

$$\sigma = 250 \mu\text{m}$$

fine vs. coarse mesh



~ 3% error  
in the spread parameter