Wakefield Work Update

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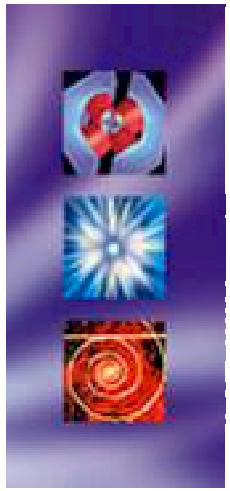
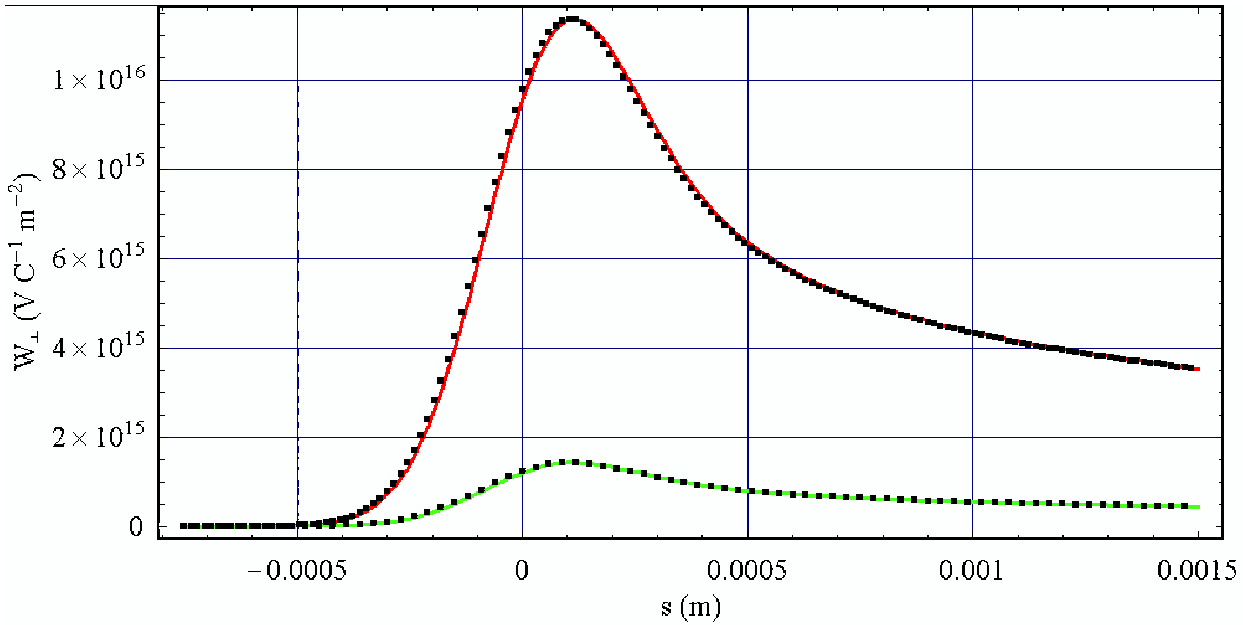


Transverse Wakefields

- From the resistive wall monopole order longitudinal wake potential the dipole order transverse wake potential can be calculated:

$$W_{\perp}^{1}(s) = \frac{2}{b^{2}} \int_{0}^{s} W_{\parallel}^{0}(s')\, ds'$$

- Check for DC wakes, 1mm & 2mm radius



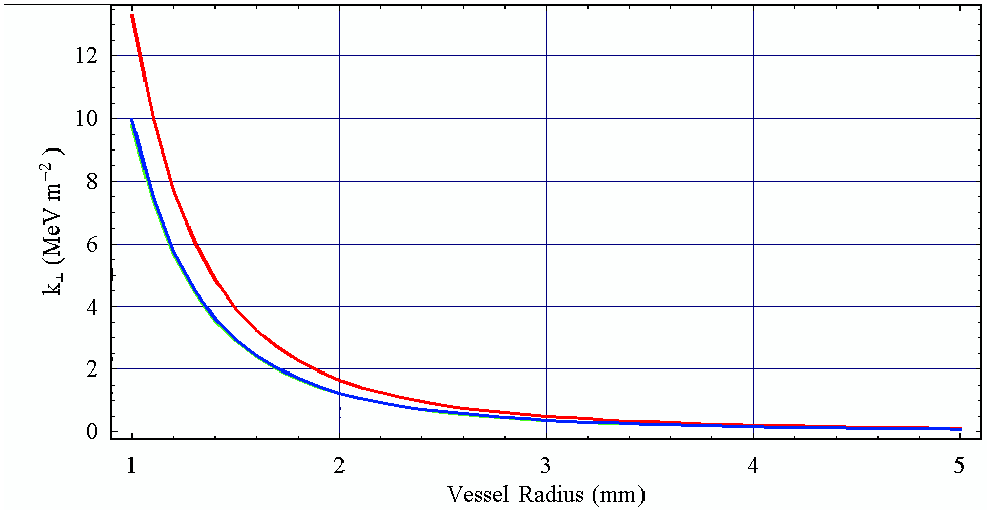
Points - Analytic lines – integration of long wakes

Transverse Wakes

- The convolution of the transverse wake with the bunch gives the transverse kick factor:

$$k_\perp = \int_{-\infty}^{\infty} \rho(s) W_\perp(s)\, ds$$

- The kick factor represents a transverse momentum kick per distance off axis per distance longitudinally
- Calculated for all combinations:

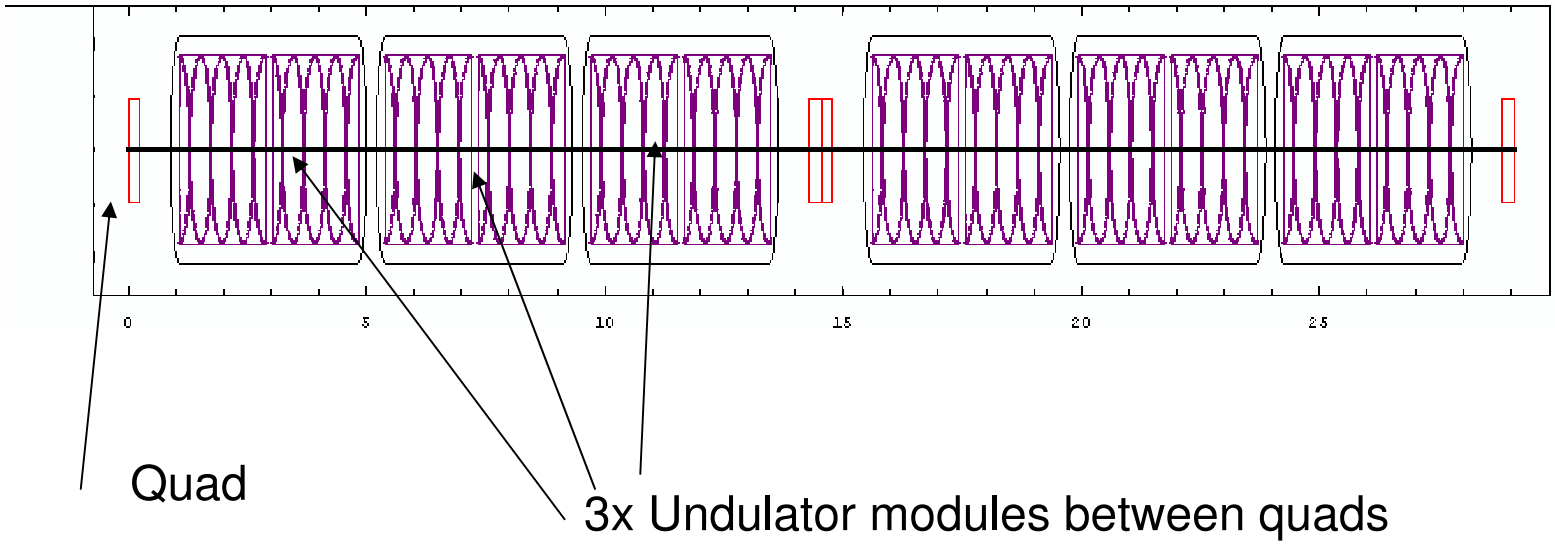


Copper, 150 micron bunches

$$\propto \frac{1}{b^3}$$

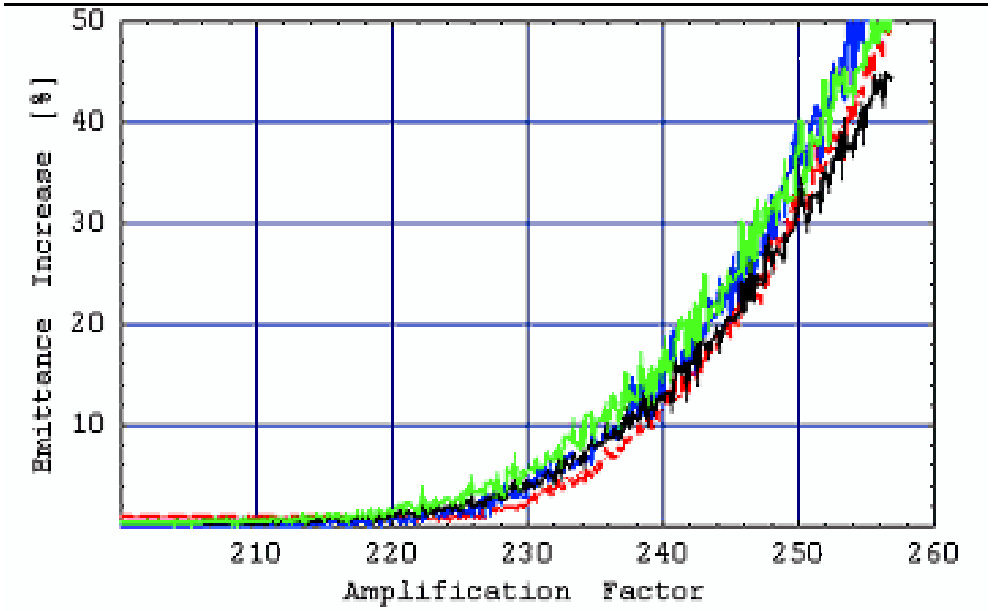
Transverse Wakes

- For a copper pipe rad~5.6mm the transverse kick factor at 77K is 0.22eV/micron/m
- 150GeV forward momentum
- Looked at emittance dilation due to this kick
- Created an 'Undulator Cell' & tracked particles



Transverse Wakes

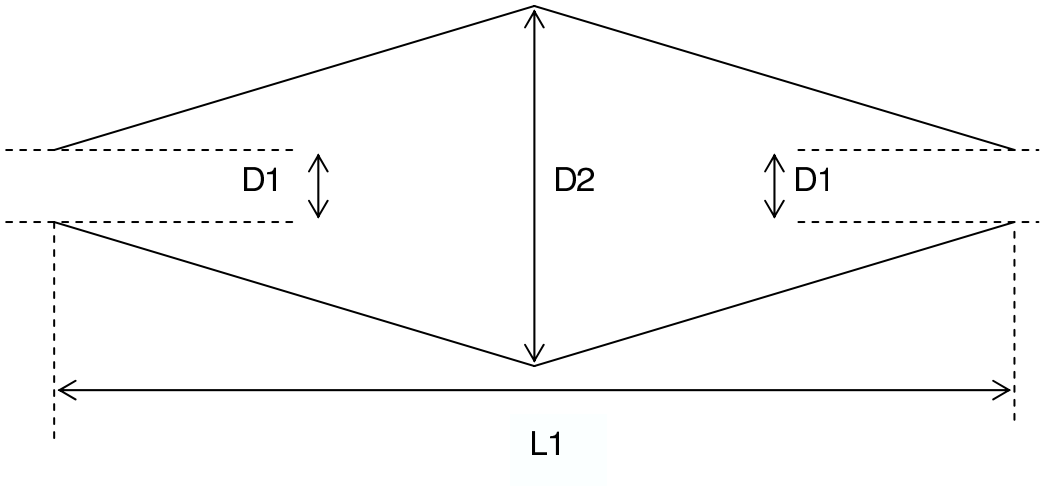
- To see any effect due to the wakefield kicks of the entire undulator the strength of kick must be increased by a factor >200



- Emittance increase in the horizonal (red, blue) and vertical (black green) planes, giving the r.m.s. (red, black) and 95% confidence limits (blue, green)

Working on Wakefield of Undulator Joining Sections

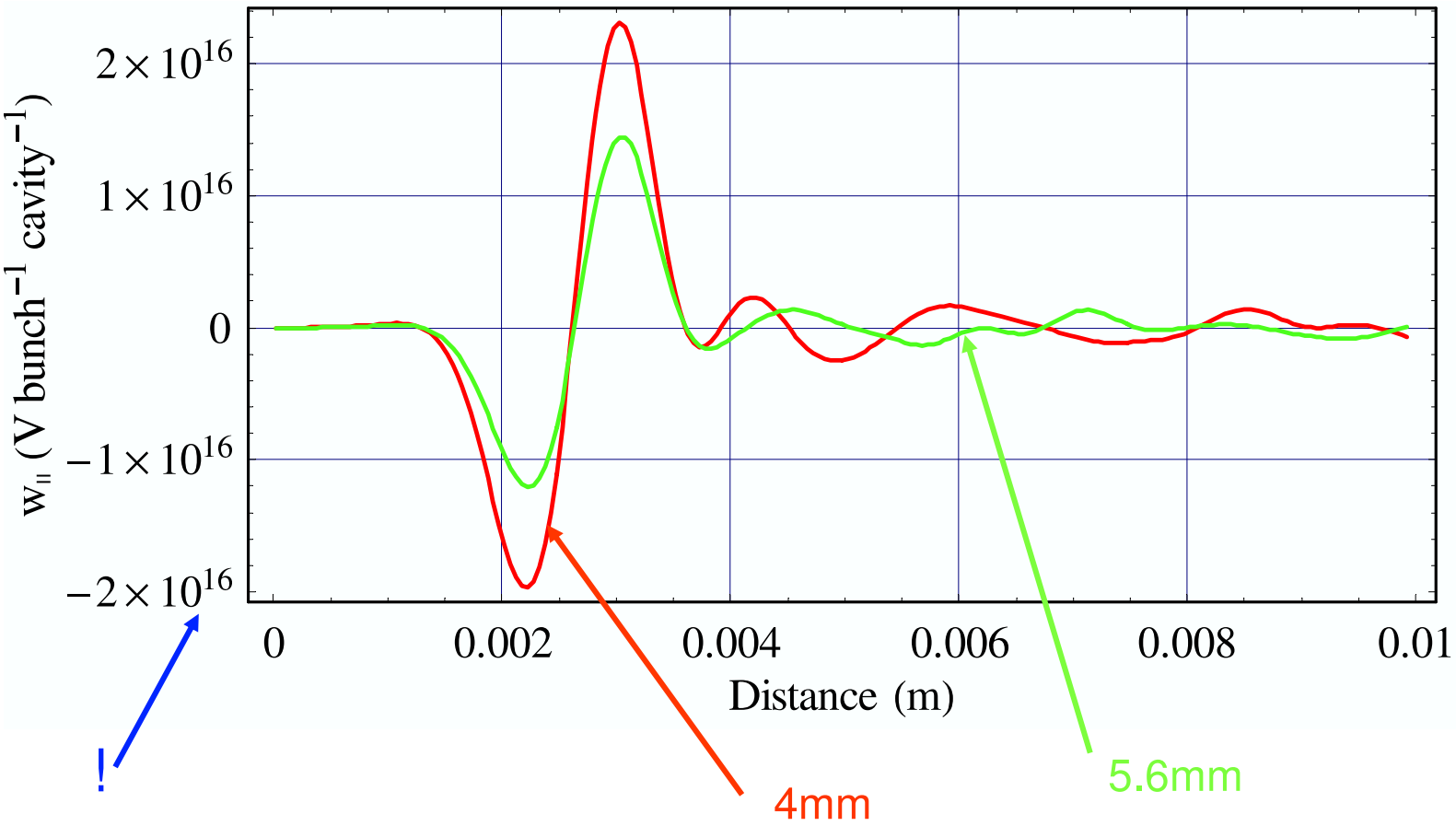
- Cylindrically symmetric “cavity”



- D1 = 4mm, 5.6mm
- D2 = 10mm
- L1 = 156mm

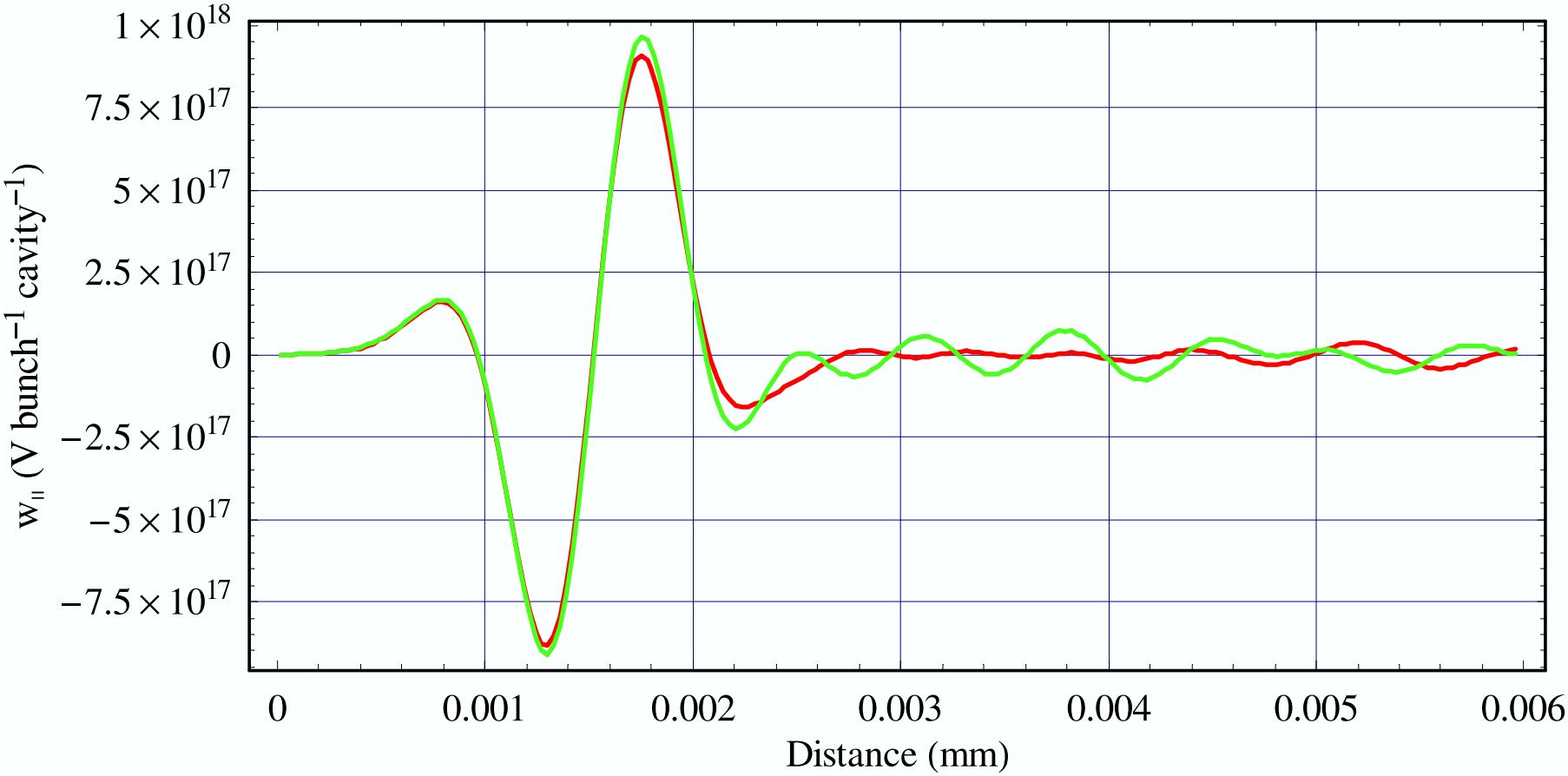
Wake Potentials Calculated in Mafia

- Current numbers look wrong – 500 micron Gaussian Bunch



Wake Potentials Calculated in Mafia

- Especially 300 micron bunch – no difference between 5.6mm and 4mm and numbers bigger than 150 and 500 micron (?)



Induced Energy Spread

- If we assume that there is a factor of 10^{-12} missing (reasonable as units often expressed in V pC^{-1}) then the induced energy spread for 50 such cavities is:

$$\frac{\sigma_E}{E}(150\mu m) \approx 10^{-5}\%$$

$$\frac{\sigma_E}{E}(500\mu m) \approx 10^{-6}\%$$

$$\frac{\sigma_E}{E}(300\mu m) \approx 0.1\%$$