wake / impedance calculation

the usual approximations
\( v = c \)
linear motion
rigid beam
integrated kick
no space charge
thin beam
semi infinite beam pipes

the usual methods
short range: window
long range: full field calculation
sometimes modal

the problems
numerical dispersion
field-particle interaction far after
structure: "indirect" wake integration
not always available
FD methods: geometry approximation

improvements in the last years
short range: rz: nearly all problems solved
3d: dispersion, geo. approx. (echo3d)
no general solution for wake integration
long range & full field: parallel computing
(not available for everybody)
not only beam dynamics

heating / losses
  online monitors:
    peak fields
    peak power
    time integrals of losses, fluxes

diagnostics
  wakes interfere with diagnostics (e.g. BPMs)
  wakes are used for diagnostics (e.g. EOS)

design of components
  coupler \( f < f_c \)
  absorber \( f < f_c \ldots f >> f_c \)

full field calculation required !!
difficult

long structures ... multiple structures coupled by long waveguides & long range wake & $\tau \approx T_b$

\[ \text{e.g. interaction regions} \]

non linear motion $\rightarrow$ CSR codes

non linear motion & strong shielding

\[ \text{e.g. bc-chambers at "low" frequencies} \]