Modelling of the impedance of the ESRF Storage Ring

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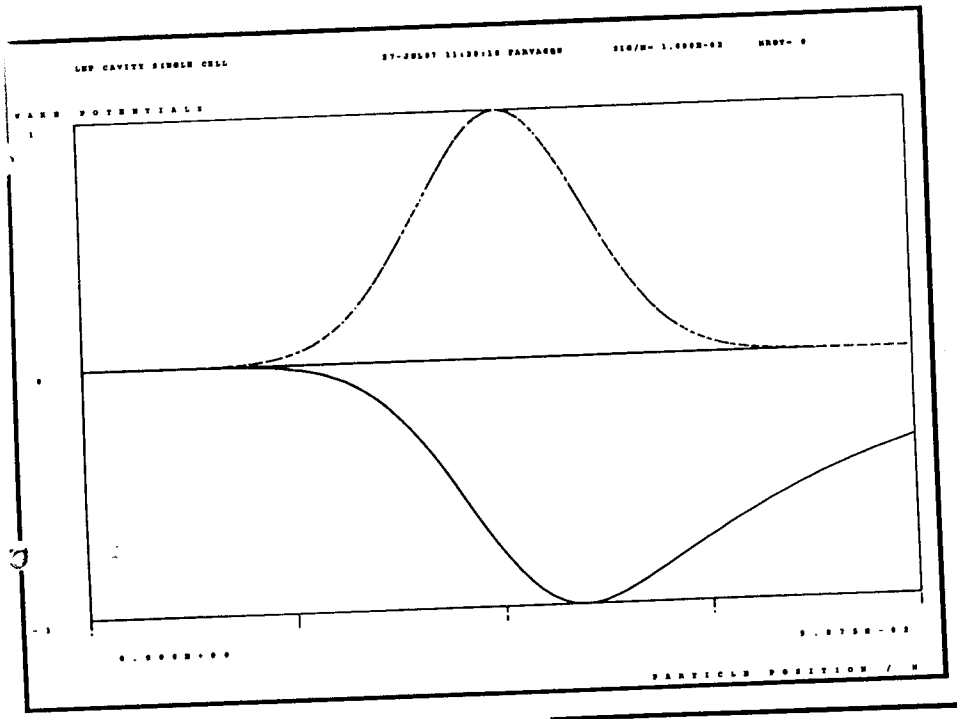
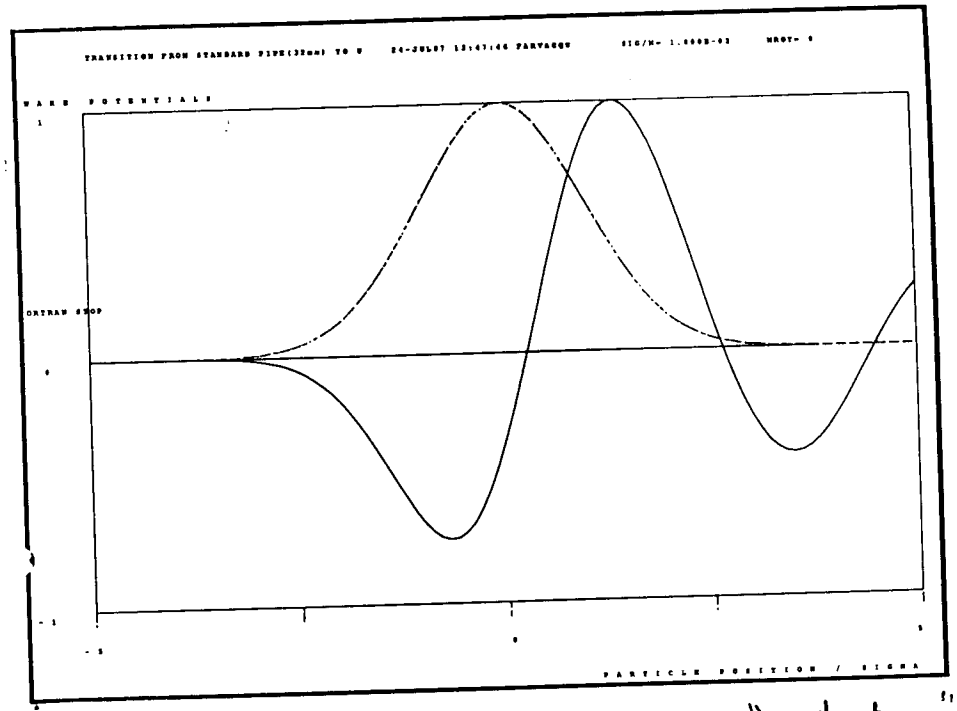
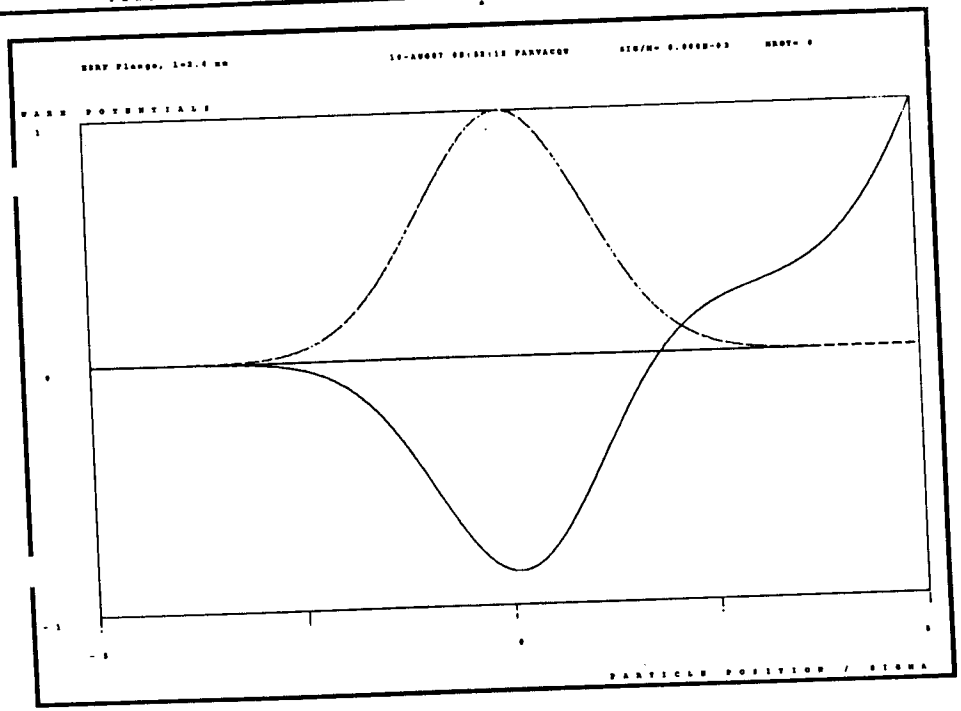
- 1987: Design report: impedance budget
- 1996 – 1999: Beam measurements
- 2000: New modelling of the real vacuum vessel



"capacitive" RF cavity



"inductive" tapered transition

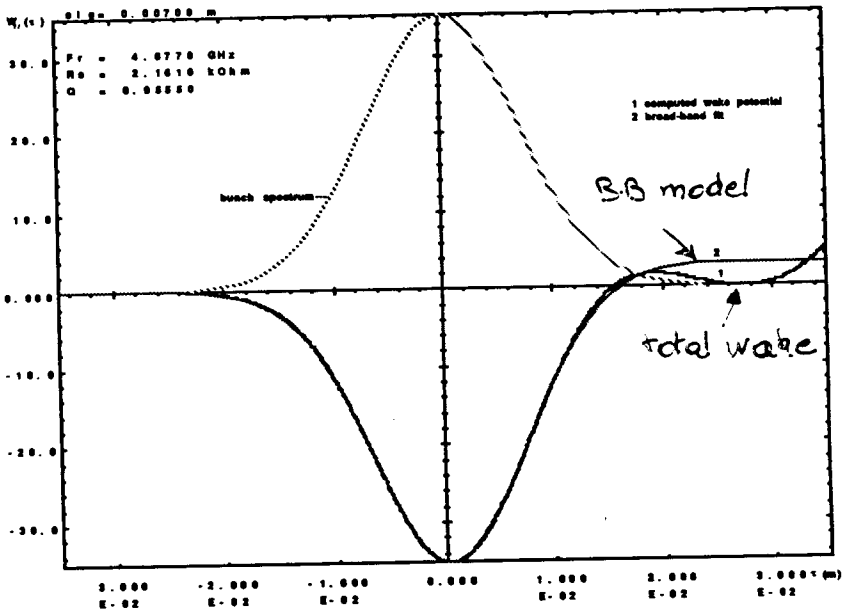


"resistive" gap in Flanges

Total impedance

All wake potentials (7 mm bunch) are added

The wake potential of a broadband resonator is fitted to the resulting curve



Main contributions:

- RF
- Flanges

Results

1987 Estimate

	f_r (GHz)	R_s (kΩ)	Q	Z/p (Ω)
7 mm bunch	4.68	2.16	0.056	3
20 mm bunch	4.12	2.91	0.254	1

1997 Measurements

f_r (GHz)	R_s (kΩ)	Q	Z/p (Ω)
30	42	1	0.5

The resonance frequency looks much higher than expected: no bunch shortening ever observed, though the bunch spectrum extends over 10 GHz

New modelling

Goals

- Take into account the real geometry
- Try 3D codes
- Try and get a better agreement with measurements

Preliminary controls

Comparison of codes:

- TBCI
- NOVO
- ABCI
- gdfidL

Check dependence on

- Mesh size
- Boundary conditions
- 2D/3D

New computations

In progress...

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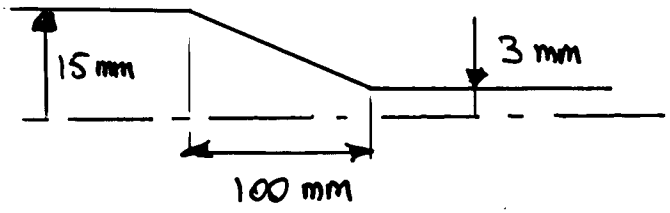
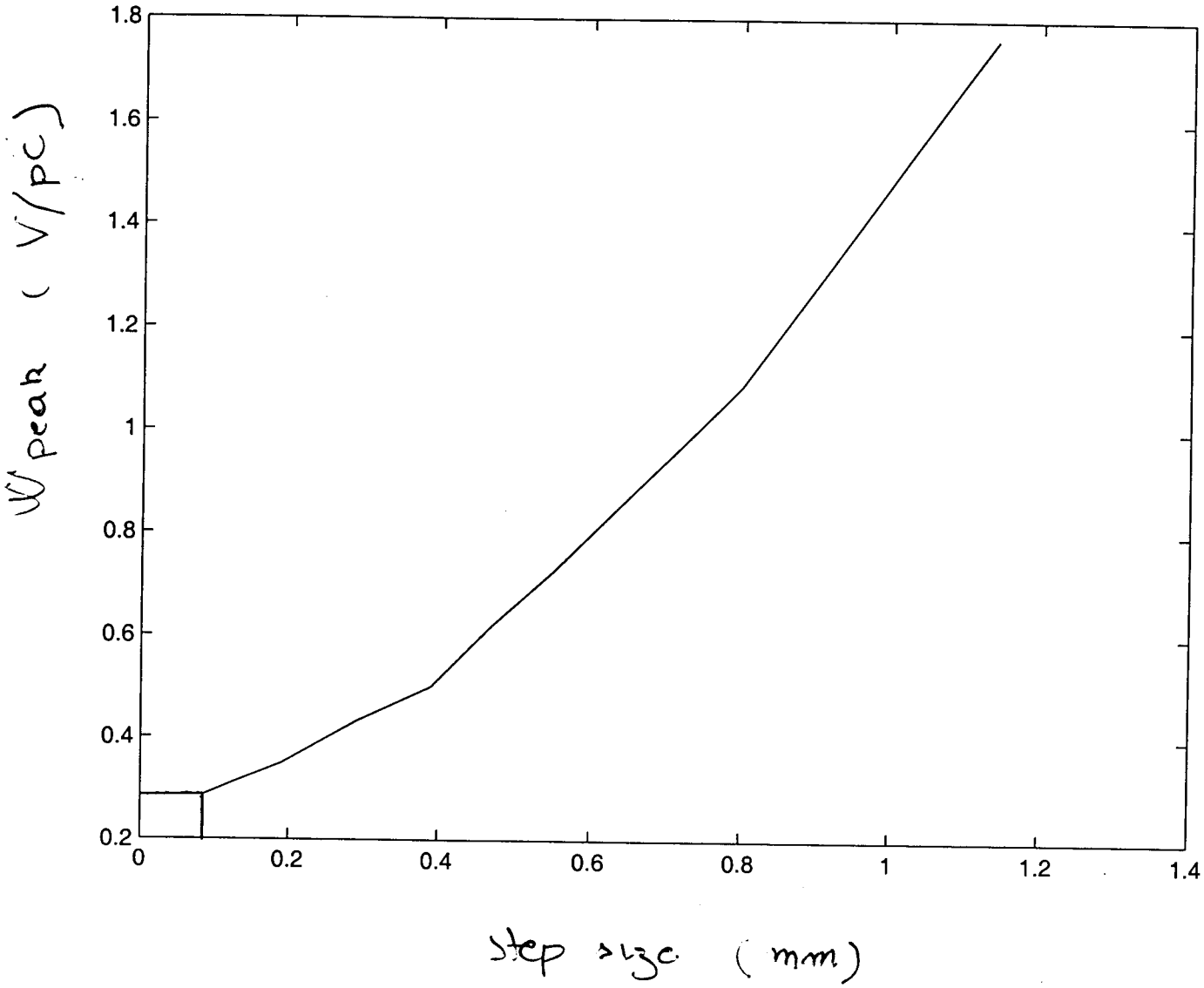


convergence TBCI



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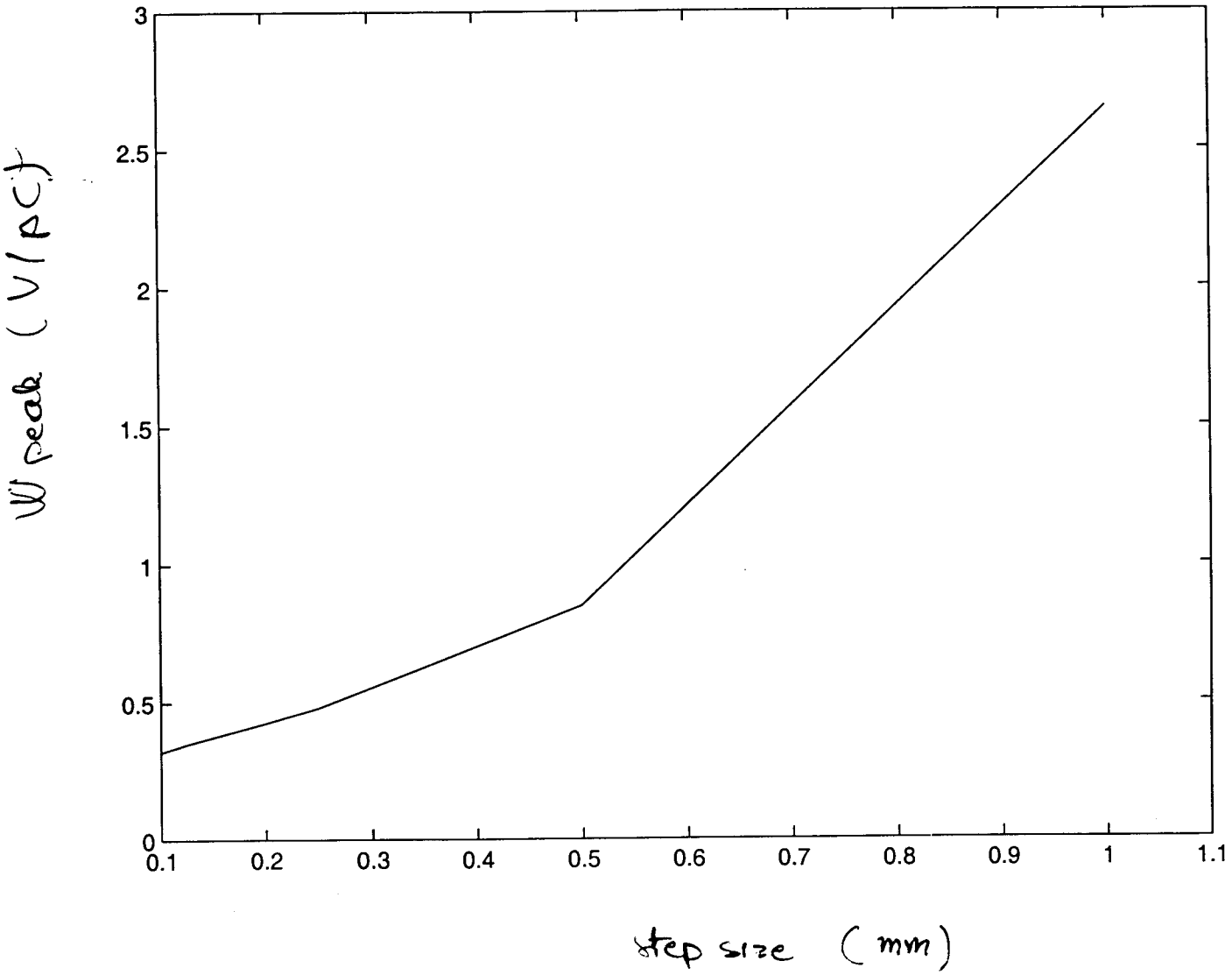
convergence GDFidL



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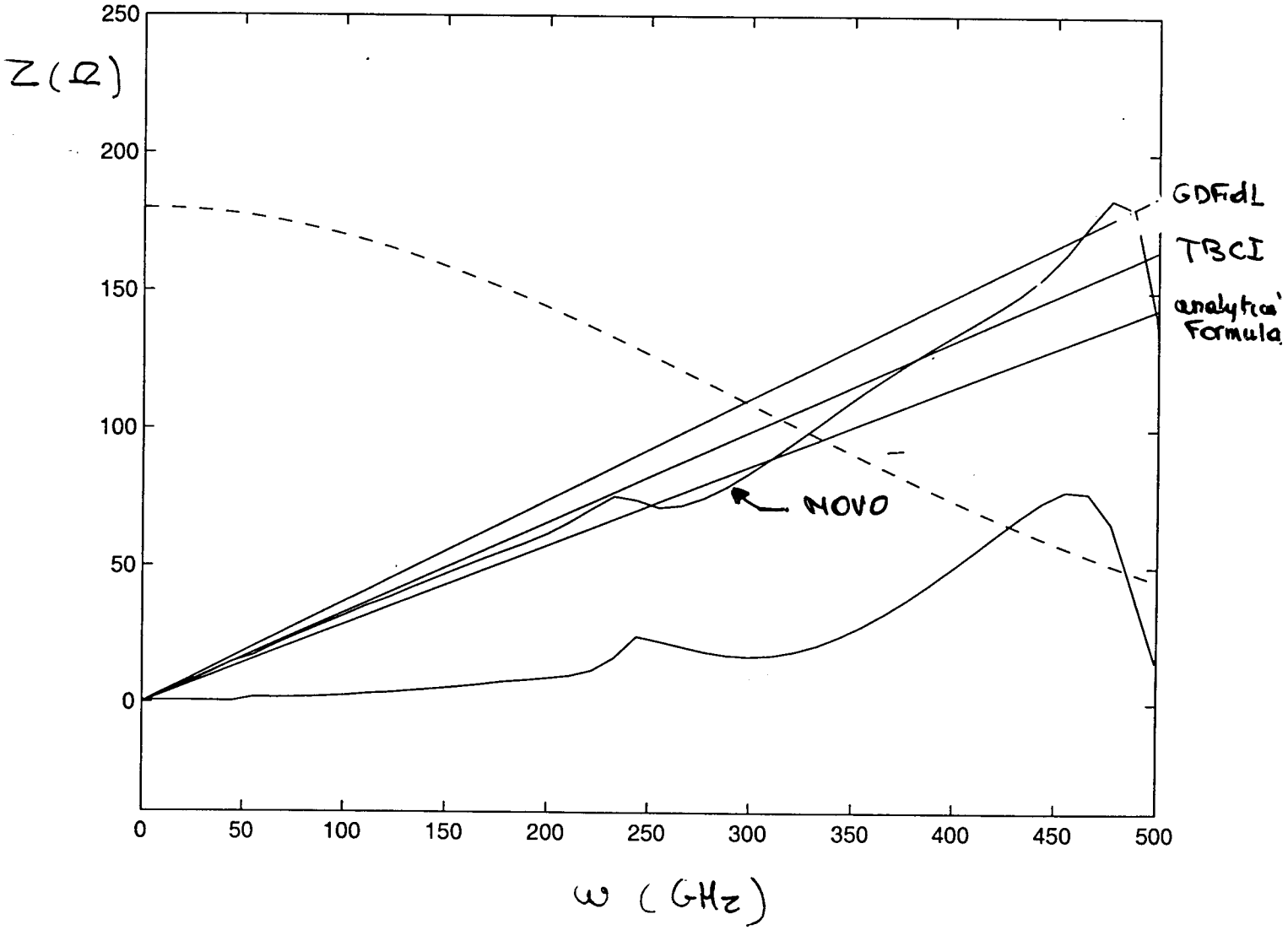

Conclusions

Agreement between codes

	Step size (mm)	Inductance (pH)
Analytical		288
GdfidL	0.1	370
TBCI	0.085	330
Novo	0.1	340
ABCI	1	340

3D effect

	Step size (mm)	Inductance (pH)
Circular approx.	0.125	259
Real geometry	0.125	456

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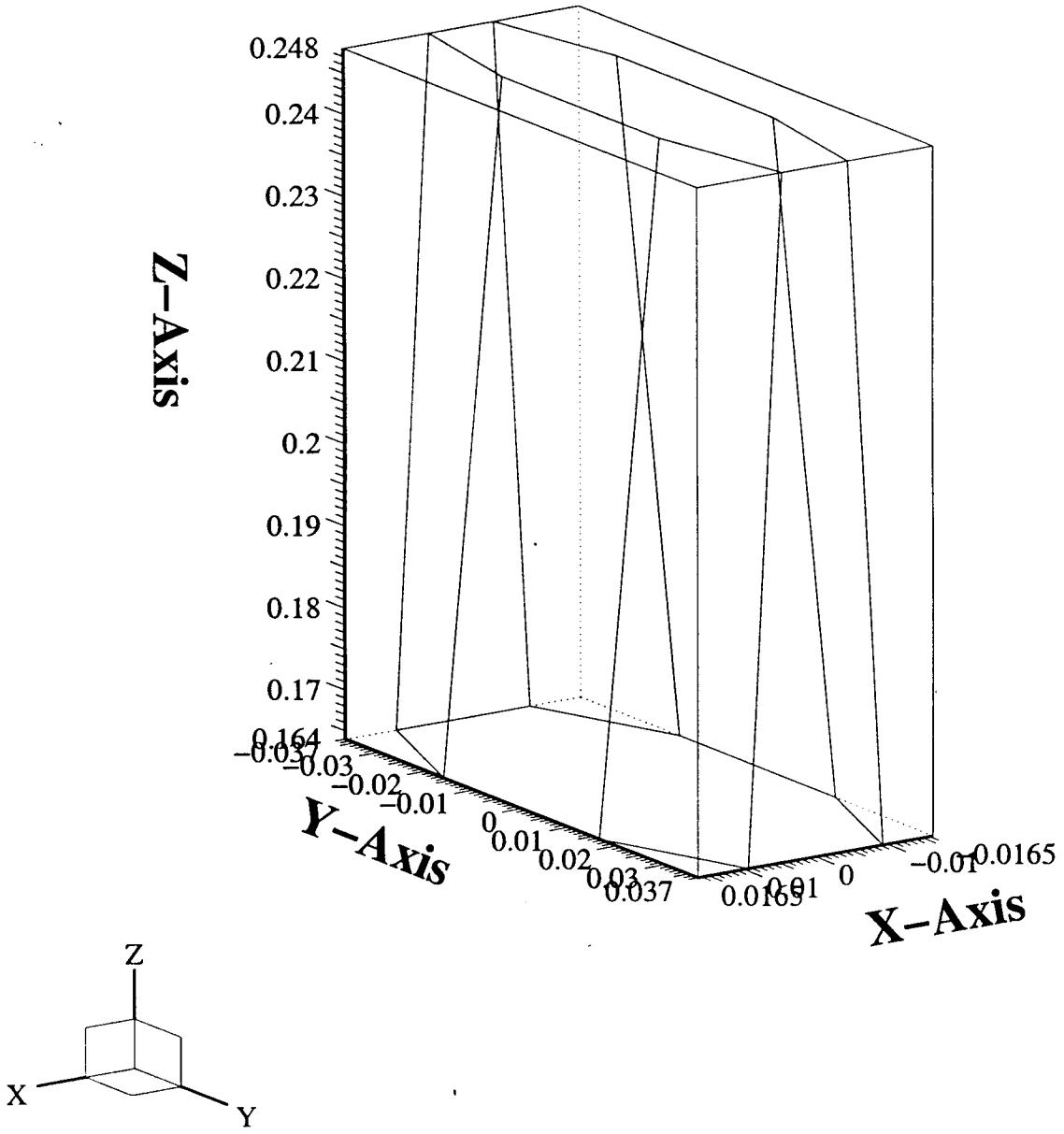
Fri Feb 4 16:06:17 2000

General cylinder

outline of the specified polygon



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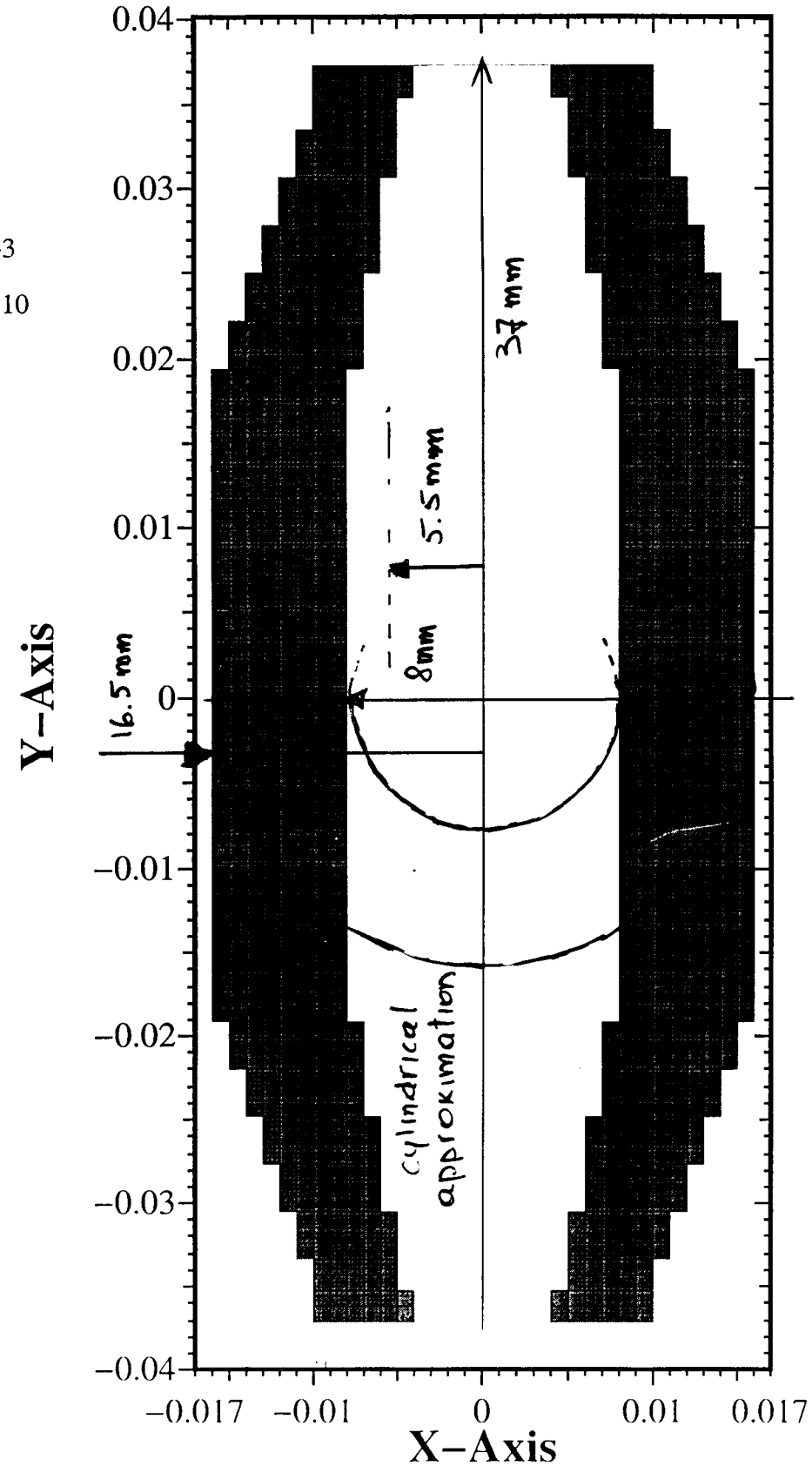
GdfidL

Material boundaries

sigma= 5e−3

sigma/dz = 10



Impedance budget

Restrict to 2D computations

Take only main elements (no detail drawing)

Modelled:

- Taper for ID chambers
- Flanges
- RF cavities
- Transitions to RF cavities

Ignored:

- Shielding of bellows
- Pumping grids
- BPM buttons
- "Exotic" elements