Low Frequency Collimator Measurements
Preliminary Results - 14 Nov 2007

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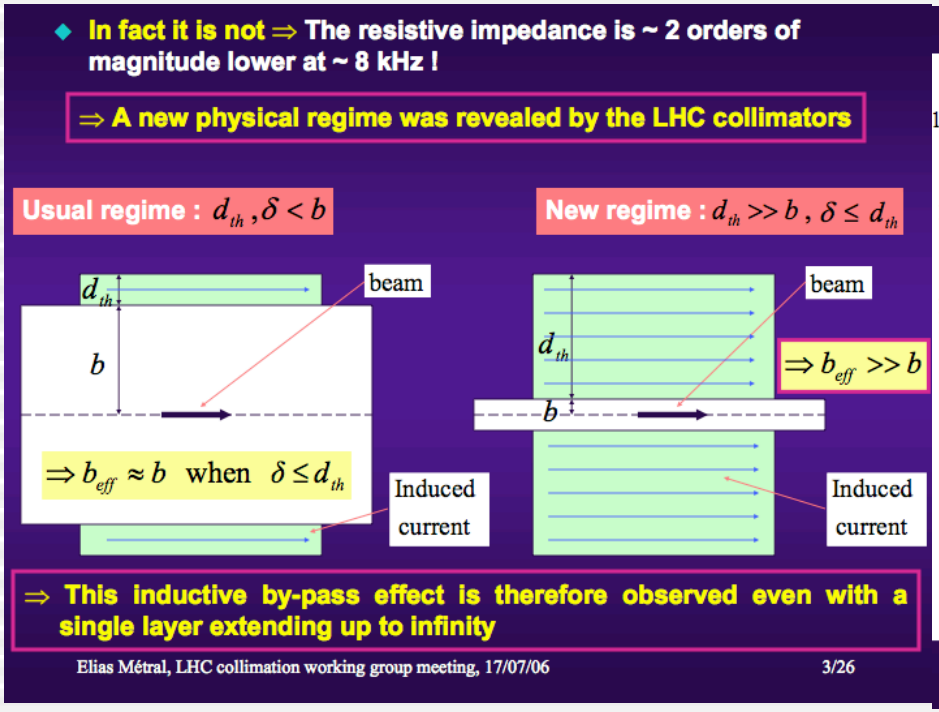
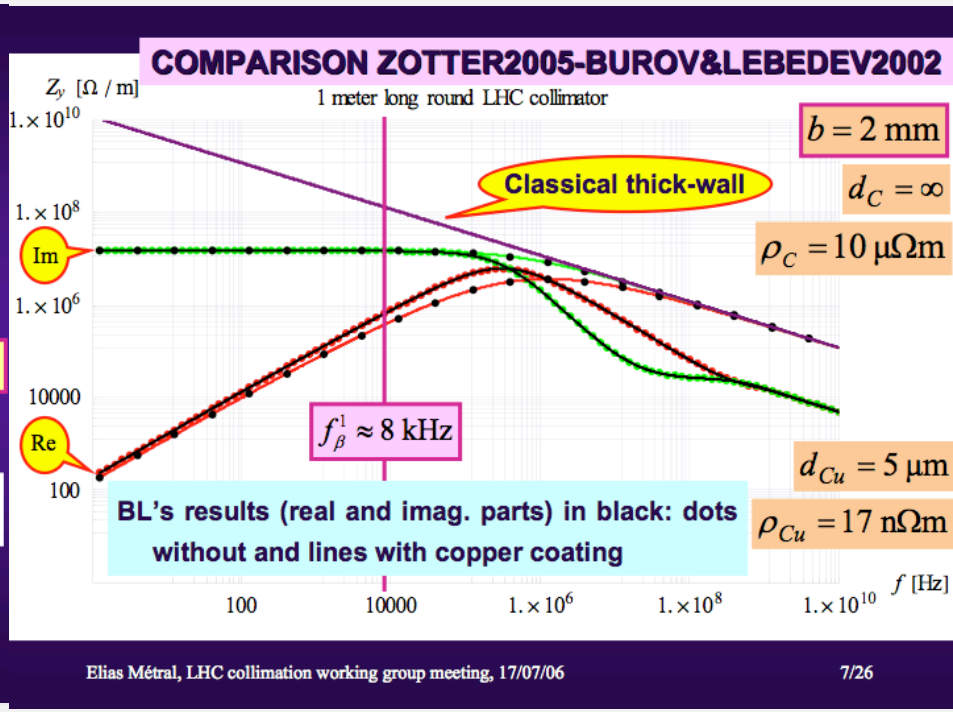
Theory

We want to bench mark theory:





Measurement Method

Coaxial wire method to estimate transverse impedance

- single wire displaced
- two wires

has low sensitivity at low frequencies

Extension of two wires method:

Evaluation of the transverse impedance of a DUT by measuring the inductance variation of a probe coil

F.Caspers, A.Mostacci,L.Vos http://lhcp.web.cern.ch/lhcp/LCC/LCC_2002-01.htm#main3a

F.Caspers, A.Mostacci, U.Iriso

Bench Measurements of Low Frequency Transverse Impedance, CERN-AB-2003-051-RF

Measurements

Measured quantity: the complex impedance of the coil from the S11 (reflection) signal

- Z reference --> high conductivity material (copper)
- Z DUT --> low conductivity material (graphite)

From measurements:

$$\vec{Z}_T(\omega) = \frac{c}{\omega} \frac{\vec{Z}^{DUT}(\omega) - \vec{Z}^{REF}(\omega)}{N^2 \Delta^2}$$

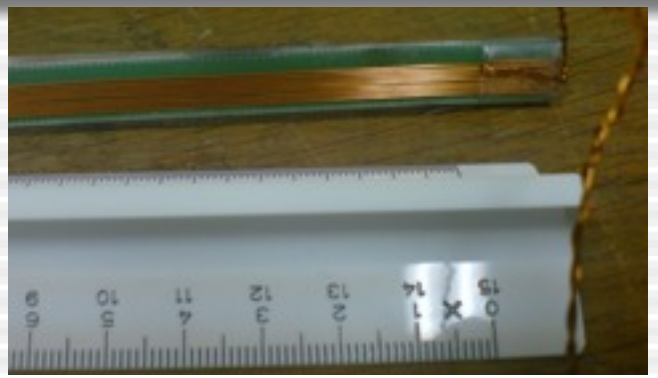
# of turns

Coil width

$$Z_{meas} = Z_{rw}^{graph} - Z_{rw}^{Cu} \Rightarrow \text{simple processing to plot } Z_{rw}^{graph} \text{ (next slide)}$$

Measurement set up

Best coil prototype used until now:

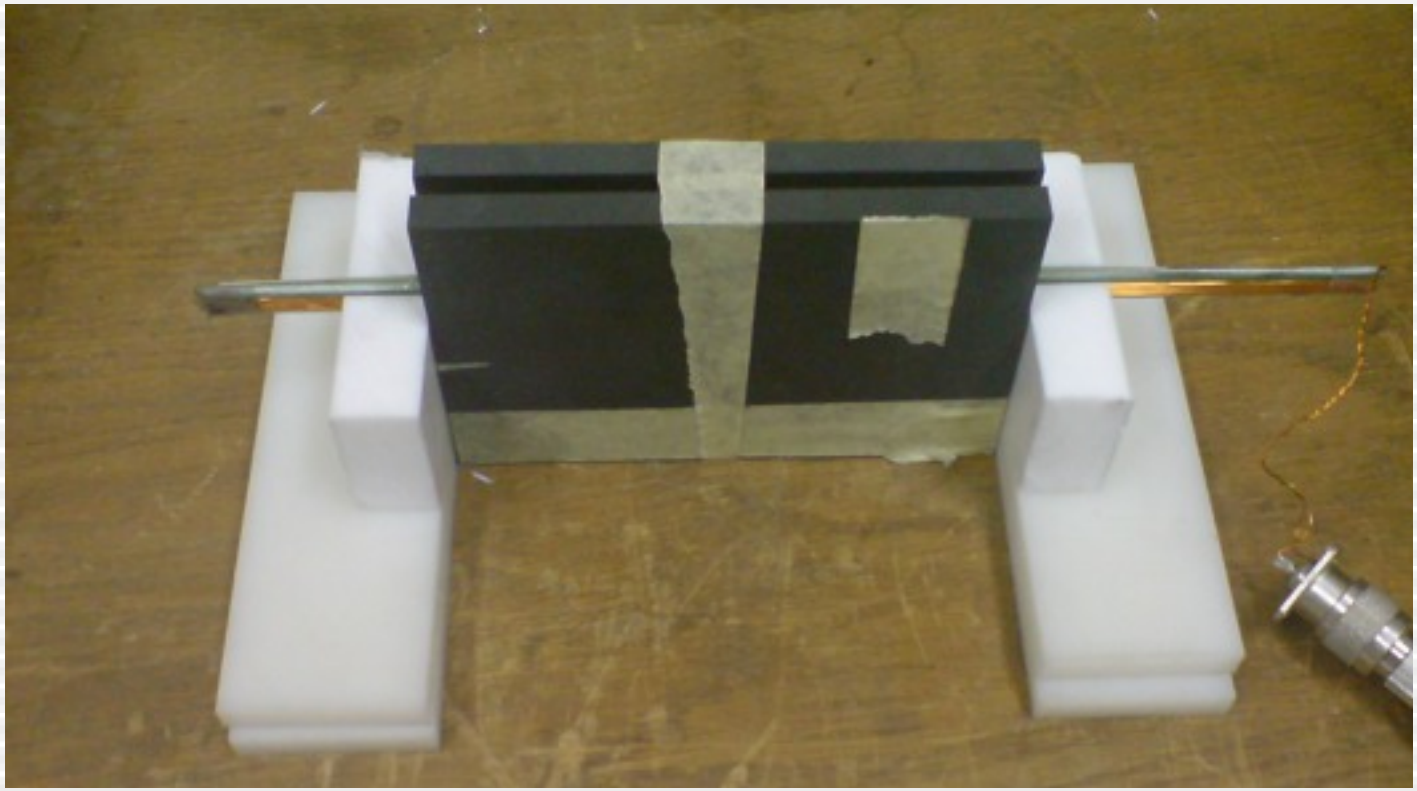


$$L = 30\,cm$$
$$\Delta = 2.5\,mm$$
$$Nturns = 9$$

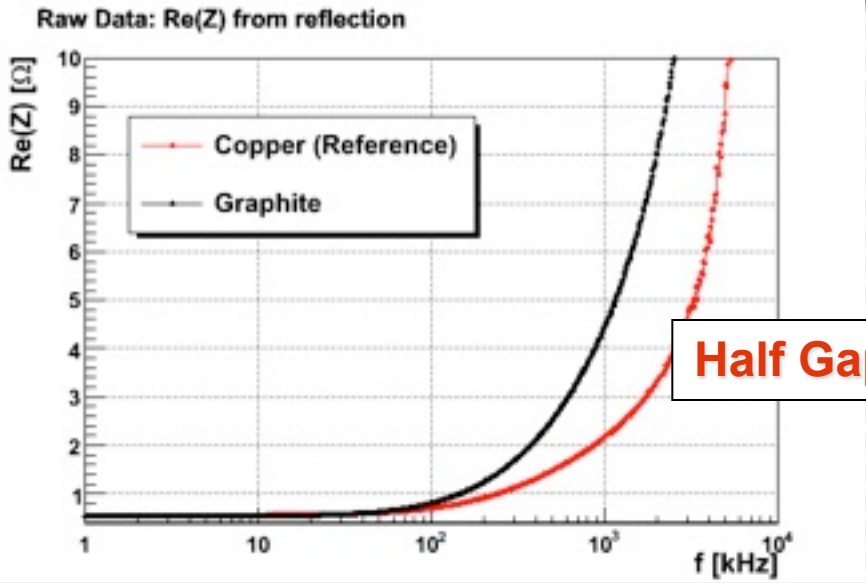
Used with Copper and Graphite blocks:

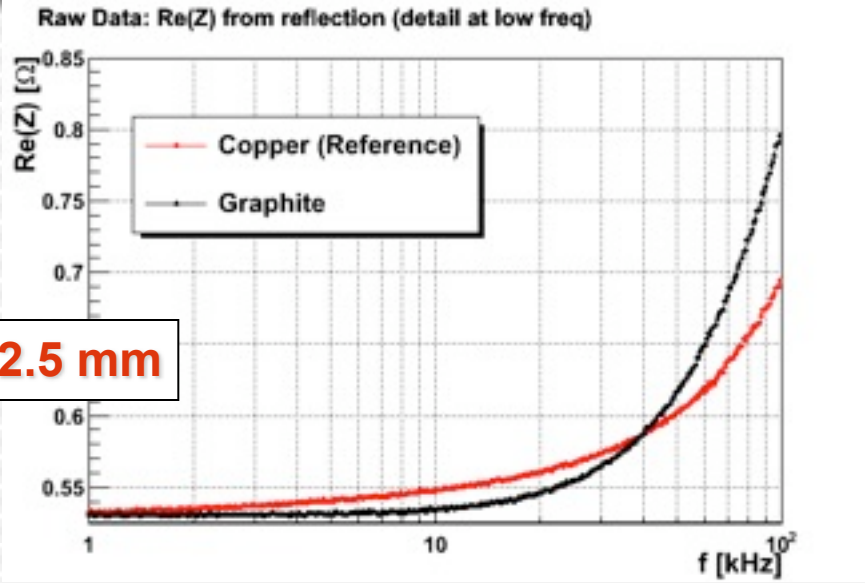
$$10cm \times 15cm$$
$$1cm \text{ thick}$$

Measurement Setup

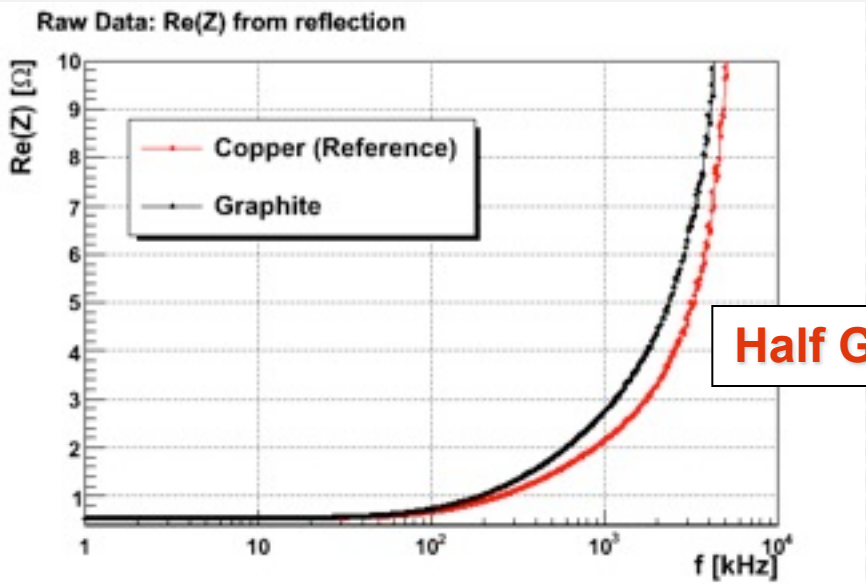


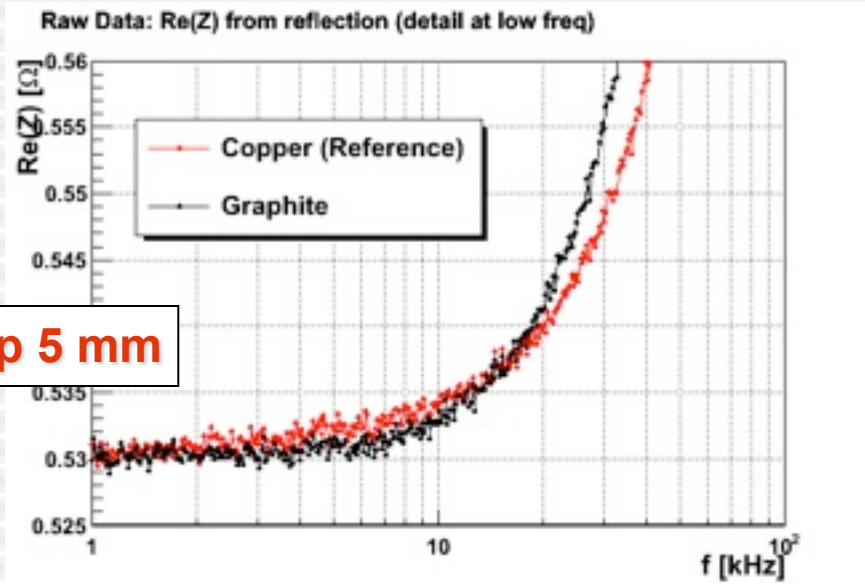
Raw data, as measured with VNA





Half Gap 2.5 mm

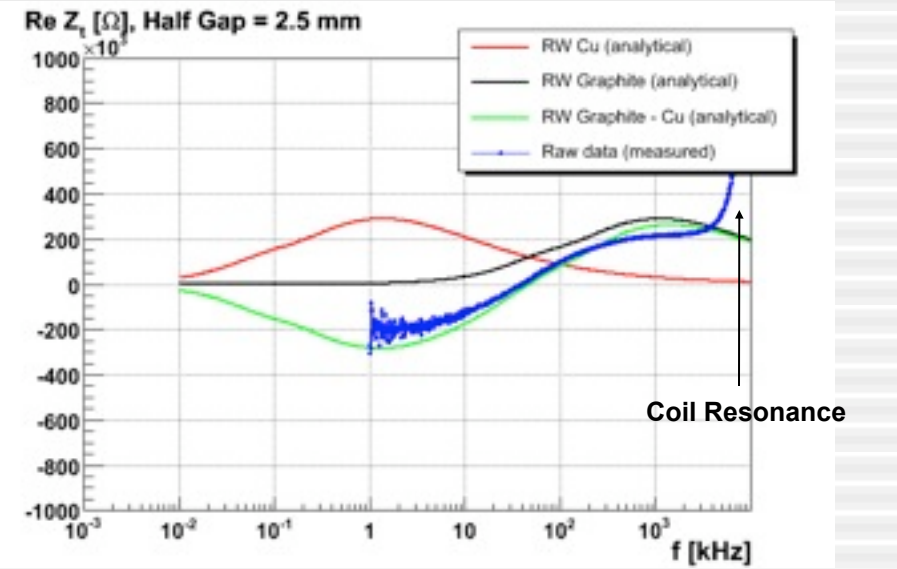


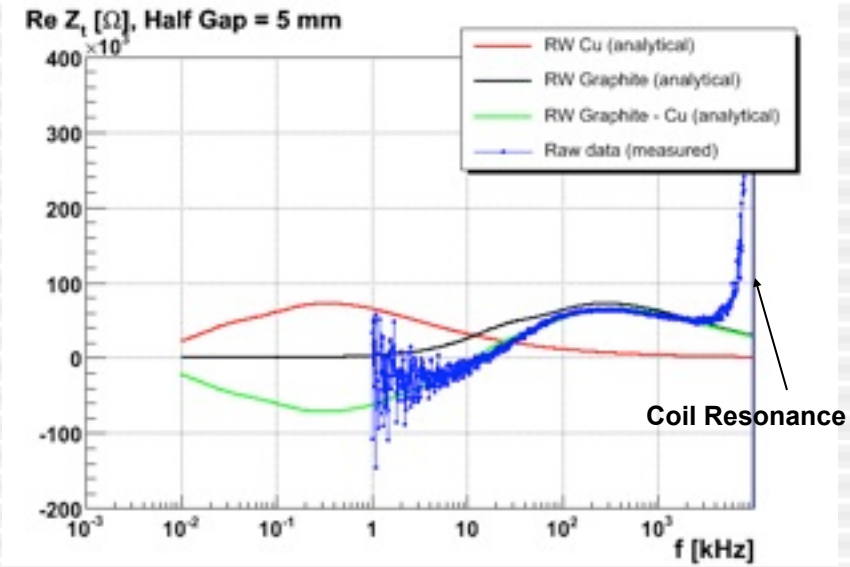


Half Gap 5 mm

Preliminary results

Apply formula : $$\vec{Z}_T(\omega) = \frac{c}{\omega}\frac{\vec{Z}^{DUT}(\omega) - \vec{Z}^{REF}(\omega)}{N^2\Delta^2}$$

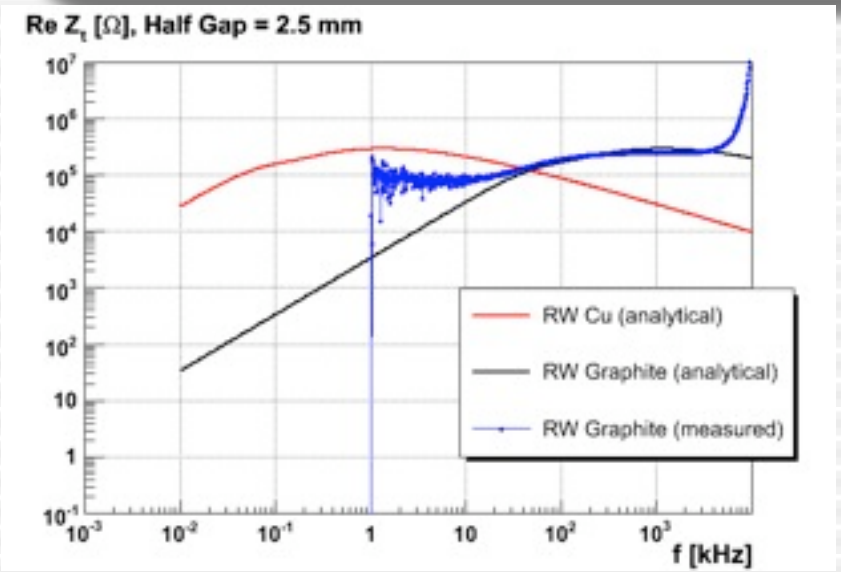


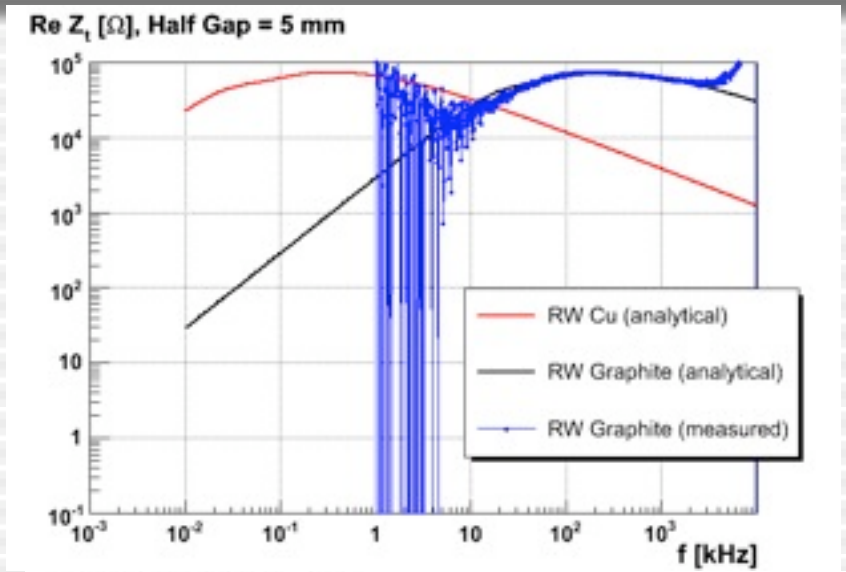


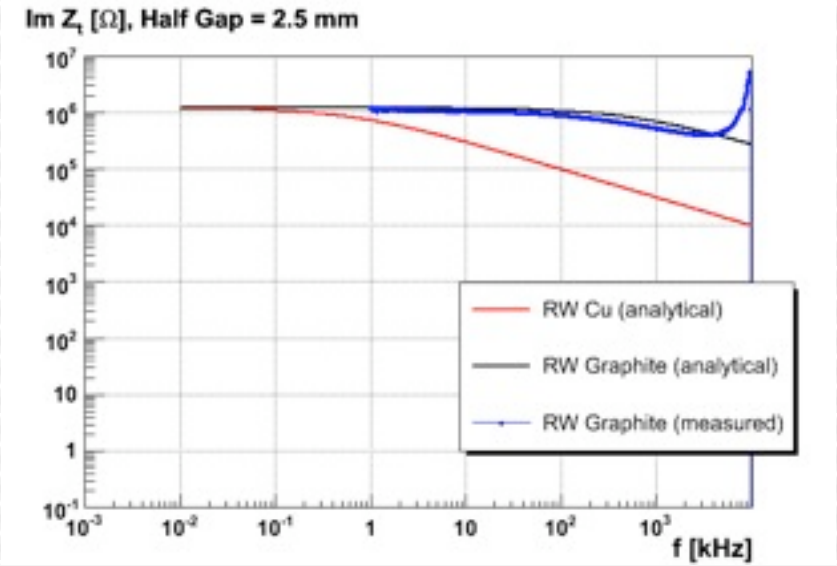
But:

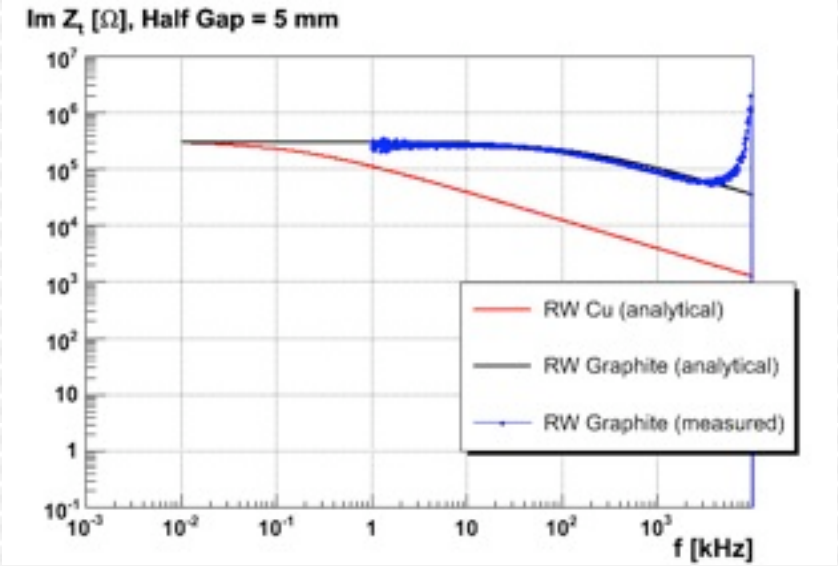
$$Z_{meas} = Z_{rw}^{graph} - Z_{rw}^{Cu} \Rightarrow \text{simple processing to plot } Z_{rw}^{graph} \text{ (next slide)}$$

Preliminary results - processed data









Next steps I

Check/Improve:

- coil and plate positioning and alignment
- data processing/averaging
- other gap configuraitons

Test

- more coil prototypes produced by us
  - with more turns
  - different lengths
- coils from AT department
  - much more turns but thinner wires

Next steps II

Collimator Jaws

Collimator assembly