

# **Final report about the examinations of the - System G -**

**according to Prof. Fran De Aquino**

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## **Contents**

- 1. System-G after Prof. Fran De Aquino**
  - 1.1. Theory
  - 1.2. Description of the System-G after Prof. Fran De Aquino
- 2. Experimental set up at the IGF**
  - 2.1. First construction, hexagon, steel sheet**
    - 2.1.1 Manufacturing the construction
    - 2.1.2 Operation / results
    - 2.1.3. Annealing of the shell casing
    - 2.1.4 Renewed operation
    - 2.1.5 Enquiry about suitable iron powder
    - 2.1.6. Determining the resonance behaviour
    - 2.1.7. Pressing the iron powder
  - 2.2. Second construction, torus (circular), steel tube**
    - 2.2.1. Manufacturing the construction
    - 2.2.2. Operation / results
  - 2.3. Third construction, torus (circular), steel tube, thinner insulation**
    - 2.3.1 Manufacturing the construction
    - 2.3.2 Operation / results
  - 2.4. Fourth construction, torus (circular), pvc tube**
    - 2.4.1. Manufacturing the construction

2.4.2. Operation / results

**2.5. Fifth construction, torus (circular), PU tube, 90 mm <sup>2</sup>cable**

2.5.1. Manufacturing the construction

2.5.2. Operation / results

**2.6. Sixth construction, torus (circular), steel tube, GG 150 powder**

2.6.1. Manufacturing the construction

2.6.2. Operation / results

**2.7 Seventh construction, cardboard box, ELF antenna 1.5 mm, round**

2.7.1. Manufacturing the construction

2.7.2. Operation / results

**2.8.. Eight construction, cardboard box, ELF antenna, 1.5 mm, round not bundled**

2.8.1. Manufacturing the construction

2.8.2. Operation / results

**2.9. Ninth construction, cardboard box, like construction 2.8, though strong Insulation**

2.9.1. Manufacturing the construction

2.9.2. Operation / results

**2.10. Tenth construction, steel sheet coat, core diameter 8 mm, varnish isolated**

2.10.1 Manufacturing the construction

2.10.2 Operation / results

**2.11. Eleventh construction, steel sheet coat, annealed, core 8 mm without insulation**

2.11.1. Manufacturing the construction

2.11.2. Operation / results

**2.12.. Examination of the conductivity of the iron powder**

2.12.1. Measuring arrangement

2.12.2. Operation / results

**2.13. Reduction of the resonant frequency by external components**

2.13.1. Measuring arrangement

2.13.2. Operation / results

**2.14 Examination of time delay distortion**

2.14.1. Measuring arrangement

2.14.2. Operation / results

**2.15. Examining the behaviour of the shielding of the shell casing**

2.15.1 Measuring arrangement

2.15.2. Operation / results

**2.16. Examining the behaviour of the shielding of different materials**

2.16.1. Measuring arrangement

2.16.2. results

**3. Summary**

**4. Error analysis**

4. 1. Used measuring instruments

**5. References**

**6. Note of thanks**

**7. Critical comments**

## 1. System G after Prof. Fran De Aquino

January 2000 Prof. Fran De Aquino, Maranhao State University, Brazil reported on one of his experiments, described as the System-G , to which he developed a corresponding theory. (see <http://jnlabs.imars.com/systemg/index.htm> ).

Prof. De Aquino claims that he has succeeded with the help of a so-called ELF antenna to reduce the weight of the experimental construction considerably.

### 1.1. Theory

Prof. De Aquino derives a formula in [16] for the connection between heavy mass  $m_g$  and inertial mass  $m_i$ , which must be regarded as a fundamental basis for the experiment.:

$$m_g = m_i - 2 \left\{ \sqrt{1 + \left\{ \frac{aD}{m_i c} \sqrt{\frac{\mu \sigma}{4\pi f^3}} \right\}^2} - 1 \right\} m_i$$

Included are.:

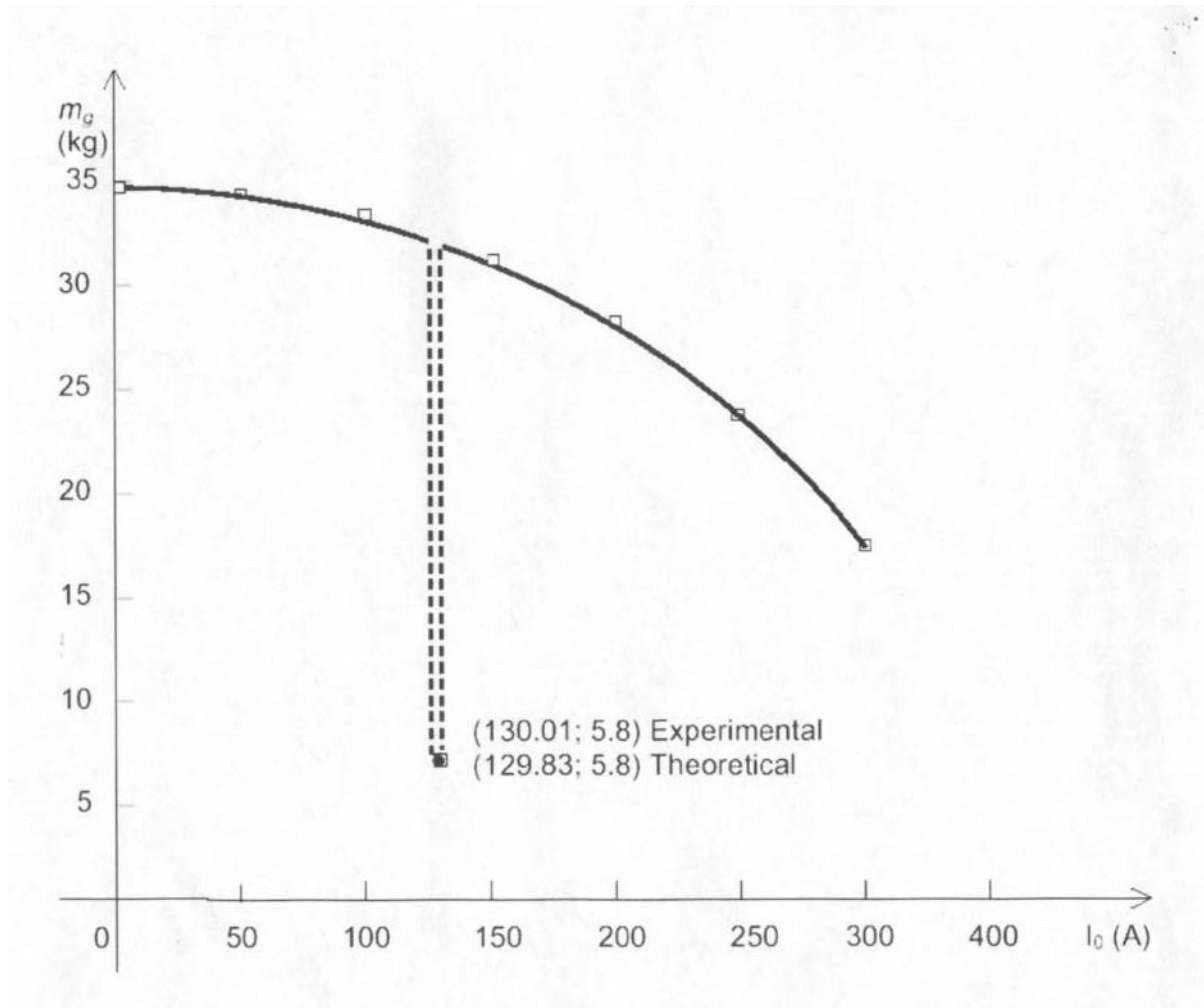
- D: Power density of the emitted radiation
- f: Frequency of the radiation
- a: Surface of the mass particles  $m_i$
- $\mu, \sigma$ : Permeability and conductivity of the medium *around* the mass particle  $m_i$   
( the steel shell casing)
- c: Light velocity

Mass becomes  $m_g = 0$  if valid:

$$D = \frac{m_e c}{a_e} \sqrt{\frac{5\pi f^3}{\mu \sigma}}$$

If D is very big opposite to this term, the mass gets even negative!

By using the theoretical values De Aquino receives the following diagram:



The heavy mass decreases with rising current. Noticeable is the singularity striking the at  $I =$  approx. 130 A, where the mass of the iron powder goes toward zero. Left. is only the weight of the iron coat .

This diagram is suggesting, that theoretical and experimental values well agree. However, De Aquino has published no actual measurement results nowhere.

After our enquiries there is worldwide no operating " replication" in existence. It was our intention to make the experiment according to the accessible information as exactly as possible.

## 1. 2. Description of the System G after Prof. Fran De Aquino

Description of the construction (see illus. 1)

Two copper spools coiled inversely arranged (each three meanders) are in a torus of annealed sheet iron. The diameter of the copper bars is 12 mm, the thickness of the sheet iron 0.6 mm.

The two copper spools are at their ends, not connected within the torus.

Around the sheet iron, a "steel jacket" can be attached, which, however, has merely a

protecting function and doesn't contribute to the function, according to the information of Prof. De Aquino

The tube diameter of the torus is indicated with 63.5 mm, the middle diameter of the ring with 640 mm

The length of each copper bar is 6 m (total of 12 m). The two copper spools are described as an "ELF antenna" and are varnish insulated.

This ELF antenna lies in iron powder with a permeability of  $75 \cdot \mu_0$

Connecting the construction through an alternating current transformer (translation relationship 6:1) to the energy net (in Brazil: 220V / 60 Hz).

a current flow up to 300A is possible. (at not connected line ends)

In addition, a weight reduction of more than 30%, shall be measured.

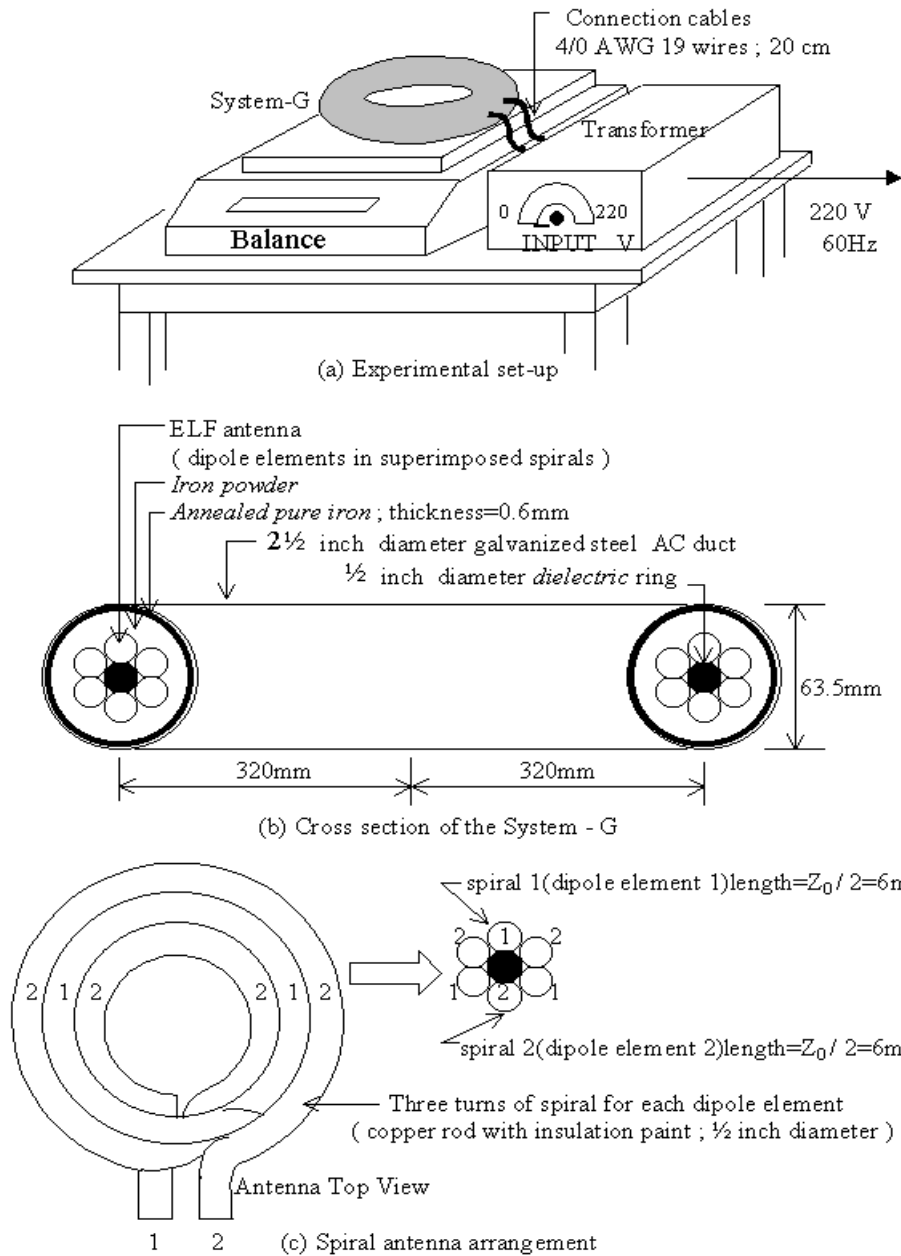


Fig. 1 – Schematic View of the Experimental Apparatus

## 2. . Experimental set up at the IGF

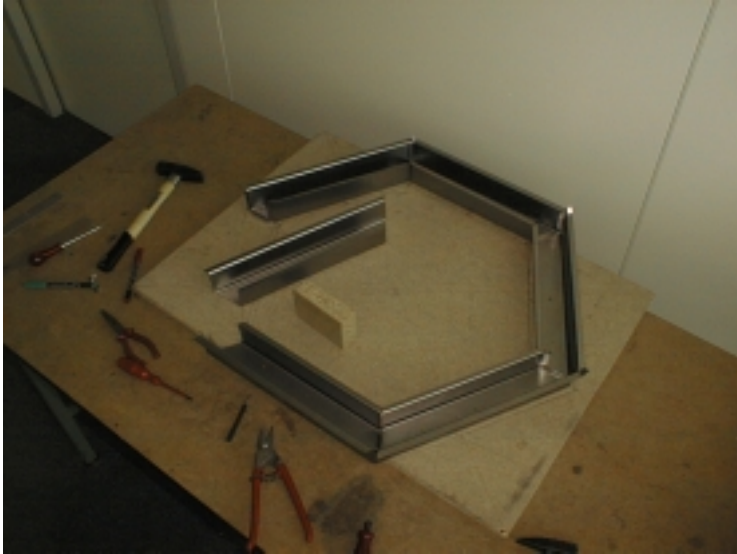
### 2.1. . First construction, hexagon, steel sheet

#### 2.1.1. Manufacturing the construction

For our first construction we decided to use a hexagon shaped arrangement (see illus. 2). due to economical reasons in the manufacturing method.

The metal of the shell casing was simply easier and faster to be built than in round shape. The same applied to the copper windings, were a "enormous" exertion had been necessary for the design. (illustr. 3)

Furthermore the individual elements of the hexagon shell casing fitted much better in the kiln. With this first construction we wanted to gain primarily experience and gradually optimise following arrangements.



Illus. 2



Illus. 3

The copper bars had a diameter of 12 mm. The middle diameter of the hexagon was 640 mm, the cross-sectional area for the shell casing  $56 \text{ mm} \times 56 \text{ mm} = 3136 \text{ mm}^2$

Inside of the bundled conductor, was a 12 mm PVC bar.

The copper bars were isolated (see illus. 4) with fabric tape or shrinkage tube (thickness approx. 0.08 mm) insulated. (see ill. 4).

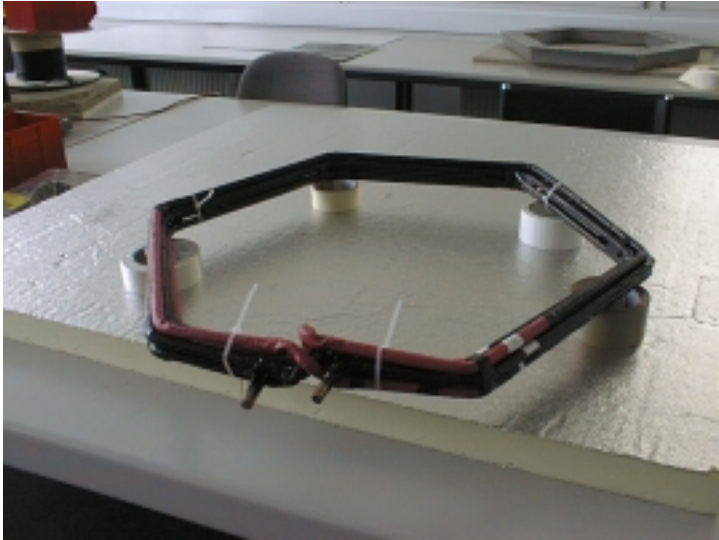
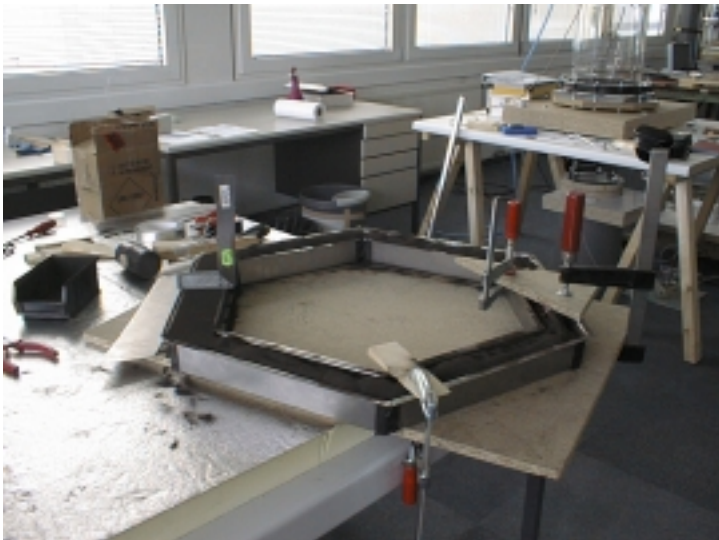


Abb. 4

The sheet metal shell casing (steel sheet, thickness 0.7 mm, purity 99.74%) was filled with the ELF antenna together with gray cast iron powder type GG 150 (grain size 0 to 150  $\mu$  m) (see illus. 5).



Illus. 5

To condense the grey cast iron powder with the iron shell casing evenly, (also between the individual meanders of the ELF-antenna) a rattling table was used . Two three-phase motors, fixed underneath the rattling table, caused vibrations by unbalance (see illus. 6). Between each individual rattling process powder had to be refilled.



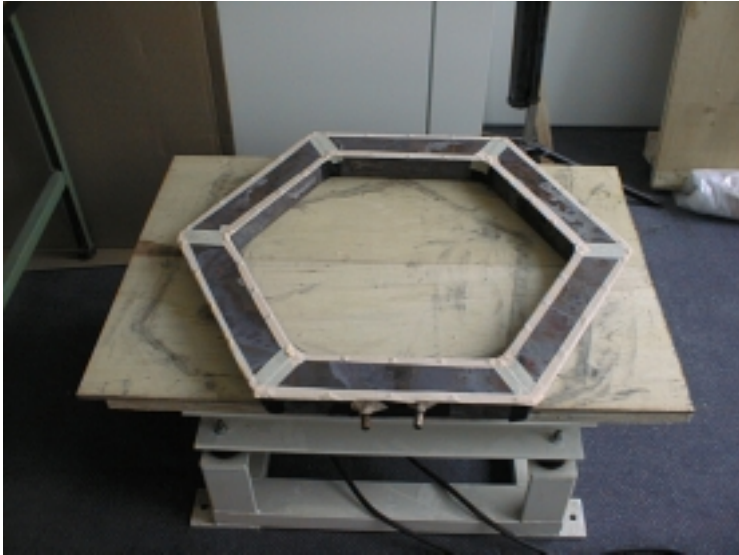


Abb. 6

### 2.1.2. Operation / results

Then the complete construction was put (see illus. 7) on a mechanical scale and attached to a customary welding transformer that can supply up to 300 A (for a short-time even more) (see illus. 8).



Illus. 7



Illus. 8

### **Measuring results:**

A current of 9.8 mA was measured, at the secondary voltage of 26.2 V of the welding transformer. In the insulation no possible leaks are yet taken into consideration. It is possible that the measurement of the current was possibly distorted by leaks and a too high current was measured. The mechanical scale showed no weight change.

### **Result:**

These results were still miles away from those indicated by Prof. De Aquino. However, we did not expect anything else, since the used materials weren't optimised yet. Next, we wanted to utilize (as already mentioned) a improved manufacturing method.

### **2.1.3. Annealing the shell casing**

The first step in optimising was annealing the sheet iron shell casing. The sheet iron has a purity degree of 99.74% and corresponded with the Prof. De Aquino specifications. The Curie temperature of iron is 770 degrees Celsius. The metal was glowing at 850 degrees Celsius for approx. 4 hours (see illus. 9). The cool down rate was 200 degrees Celsius per hour. The glowing process took place under argon atmosphere. The metal was taken out of the kiln only at "room temperature"



Illus. 9

#### **2.1.4. Renewed operation**

At the renewed operation there weren't any considerable differences to the values measured before. At a secondary voltage of the welding transformer of approx. 26 V a current of approx. 10 mA flowed. Possible leaks were not considered.

#### **2.1.5. Enquiry about suitable iron powder**

The next parameter which we wanted to improve was the iron powder. Prof. De Aquino indicates a permeability of  $75 \cdot \mu_0$  for the iron powder to be used.

While the manufacturer of the grey cast iron powder GG 150 couldn't make any statements on conductivity and permeability, Tridelta GmbH, Hermsdorf supplied us with a ferrite powder (type Mf 196) with a quality very interesting to us.

The manufacturer was able to supply us with three "basic data" for this powder:

1. In a compact firm condition the Mf 196 powder has a permeability of approx.  $2000 \cdot \mu_0$  (melted as a sintered ring core at 1350 degrees Celsius).
2. At a mixing ratio of 90% Mf 196 powder with 10% polyamide a permeability of approx.  $20 \cdot \mu_0$  known
3. A mixing ratio of a of 70% Mf 196 powder with 30% polyamide caused a permeability smaller than  $10 \cdot \mu_0$ .

Since we wanted to use the powder in pure form (100%) the permeability was. over  $20 \cdot \mu_0$

We checked this according to the following method (see illus. 10).

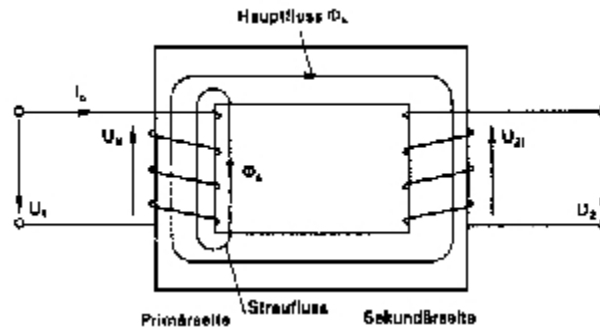


Abb. 10 Transformer in neutral

Validated transformer main equation:

$$U_{2i} = (B \cdot A \cdot 2 \cdot \pi \cdot f \cdot n_2) / 2^{(0,5)}$$

with:  $B = \mu_0 \cdot \mu_r \cdot H$

and:  $H = (I_{01} \cdot n_1) / l_e$

results in:  $\mu_r = (U_{2i} \cdot 2^{(0,5)}) / (2 \cdot \pi \cdot f \cdot n_2 \cdot A \cdot \mu_0 \cdot H)$

Notice:

- $\mu_r$  ... relative permeability [/]
- $U_{2i}$  ... Secondary voltage [V]
- $f$ .. Frequency [Hz]
- $n_2$  ... Windings of the secondary spool [/]
- $A$ . Cross-sectional area of the iron [m<sup>2</sup>]
- $\mu_0$ ... magnetic field constant  $\mu_0 = 1.25664 \text{ E-6 Vs/(Am)}$
- $H$  . Field strength [A/m]
- $B$ . magnetic induction [T]
- $I_{01}$  ... Primary current [A]
- $n_1$  . windings of the primary spool [/]
- $l_e$  ... Length of the magn. Lines of force into iron [m]

Practically we replaced the transformer, (illus. 10) with a thin synthetic tube, filled with MF 196 powder (see illus. 11)



Abb: 11

How many windings must be rolled up primary and secondary sided depends on the material or its saturation behaviour. The iron powder used by us, showed, that a saturation occurred very quickly, and the field strength therefore must be kept low. At very low  $\mu_r$  ( $< 500$ ) we worked with high frequencies, otherwise secondary sided nothing is induced.

We worked with sinus signals with frequencies between 20 and 60 kHz.

$H = (I_01 * n) / l_e$  needs few windings to realize low field strengths. We used primary sided, 37 and secondary-sided 10 windings

We took up following sizes:

Current  $I_01$ , voltage at the secondary spool  $U_{2i}$ , frequency  $f$

We used the following construction (see illus. 12)



Illus.12

Within left picture, it shows the function generator HAMEG HM 8030-3 which generates

the sinus signal (here 50 kHz). After that the audio amplifier, still supplying enough power with this frequency, is switched in between, (see illus. 13).



Illus. 13

The amplitude and with that the field strength, produced primary sided, can be regulated on the amplifier

Once, the voltage  $U_1$  at the primary spool (Tektronix digital Oszi, channel 1) and on the other hand the voltage  $U_2$  is measured at the secondary spool (Tektronix digital Oszi, channel 2). In addition, the current must be measured, during the flow through the primary spool. This cannot be realized by switching the multi-meter in between. Corresponding multi-meters do not work, or are too inaccurately at this frequency range. The currents are comparatively low. Therefore the voltage should be measured with a Shunt resistance (here power resistor 0.1 ohms, max. 5 W). and a additional oscilloscope. This must galvanically be separated from the other Oszi otherwise all three channels have a common ground mass and the measurements results in falsification. To simplify, the Fluke 45 table multi-meter can also be used to measure the voltage over the Shunt instead of the analogous oscilloscope. It is suitable for frequencies of about 80 kHz.. The current should under no circumstances be measured directly, since the shunt of the gauge is too large,

During the measuring process, the amplitude should only be opened up as far as the saturation occurs. Otherwise with increasing field strength, the permeability decreases down to 1 again.

The construction used by us has a middle magnetic field line length (which corresponds also to the middle bulk of the synthetic material tube) of  $l_e = 0.38$  m and the cross-sectional area of the iron powder filling =  $A 2,54 \cdot 10^{-4} \text{ m}^2$ .

For example, at a frequency of  $f = 40$  kHz, a primary current  $I_0 = 2.7$  mA, a primary voltage  $U_1$  103 mV and a secondary voltage  $U_2 = 10$  mV, a permeability of the Mf 196 powder of  $\mu_r = 66,4$ .

Therefore the powder seemed suitable to us.

After the Mf 196 powder was filled into the hexagon shell casing instead of the GG 150 powder, (incl. ELF antenna and rattling), and the construction again was attached to the welding transformer, almost equal measurements were reached. (a. 26 V approx. approx. 10 mA ).

### Result:

The exchange of the iron powder had caused nothing decisive.

Because of these circumstances we decided to examine the resonance behaviour of the system.

### 2.1.6. Determining the resonance behaviour

We did build the measuring circuit outlined in the following circuit diagram (see illus. 14).

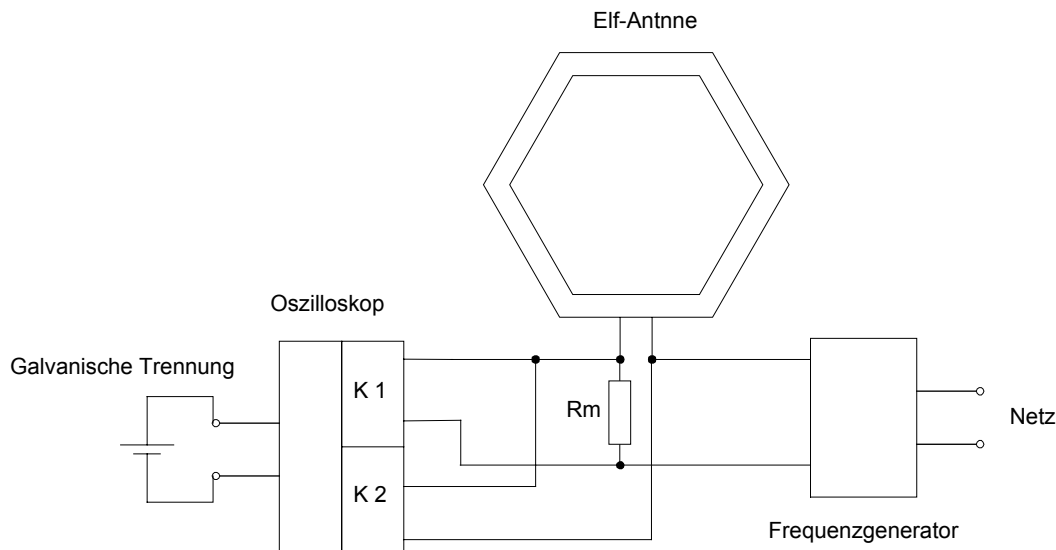


Abb. 14

The ELF construction was connected to a frequency generator.

For the frequency domain of 0 Hz to 100 kHz a function generator Hameg HM8030 3 was used. For the frequency range 100 kHz. and for some MHz to we used a signal source Fluke 6062A

The oscilloscope was a Tektronix TDS 3054.

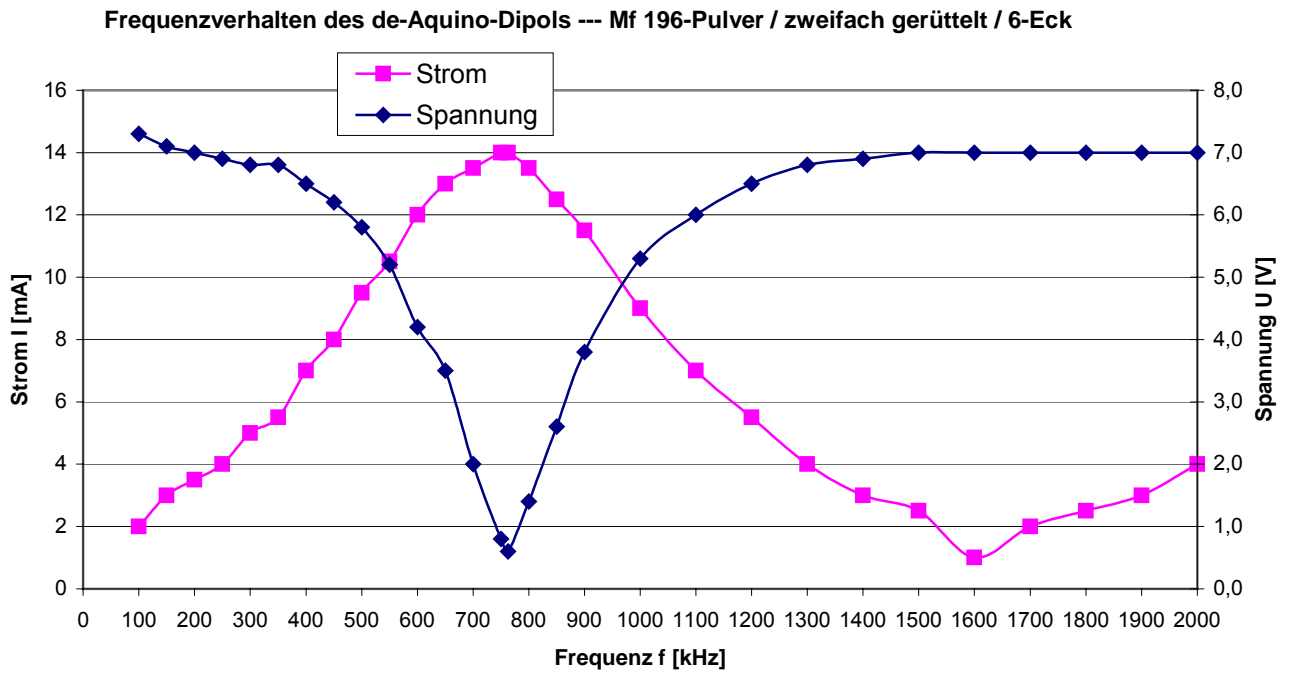
For the galvanic separation the oscilloscope was fed through a network-independent mobile energy supply.

The measuring resistance  $R_m$  was 10 Ohm and served recording the current

We worked with a sinusoidal Generator voltage, which had in "neutral" (no resonance), 7.2 V, peak-to-peak, and "disrupted." for example in resonance case, down to 0.6V peak-to-peak

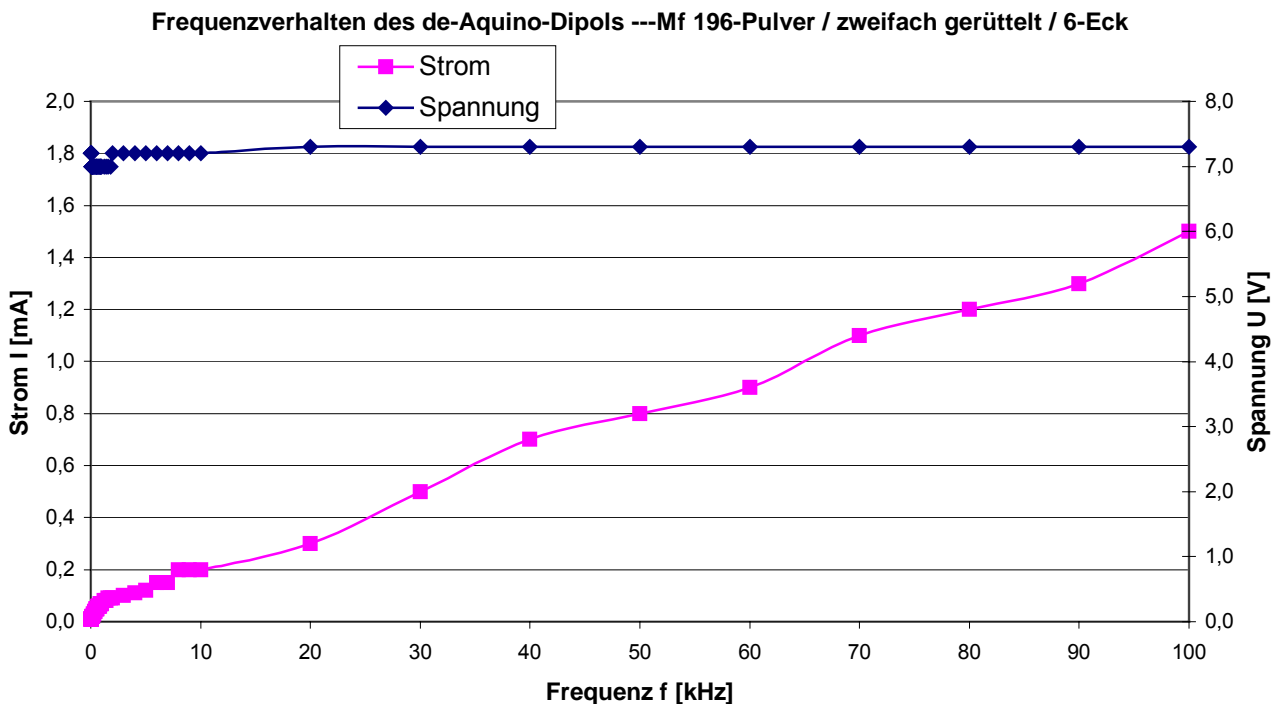
Our first measuring series in the area of 100 kHz to 2 MHz showed the following

behaviour of the current and voltage (see illus. 15). A clear resonance point can be recognized close to 760 kHz.



III. 15

Finally we examined the behaviour of 0 Hz to 100 kHz (see illus. 16).





### III.. 16

You can clearly recognize, that this construction has its lowest resonant frequency at approx. 760 kHz. Below that there is no resonance point .

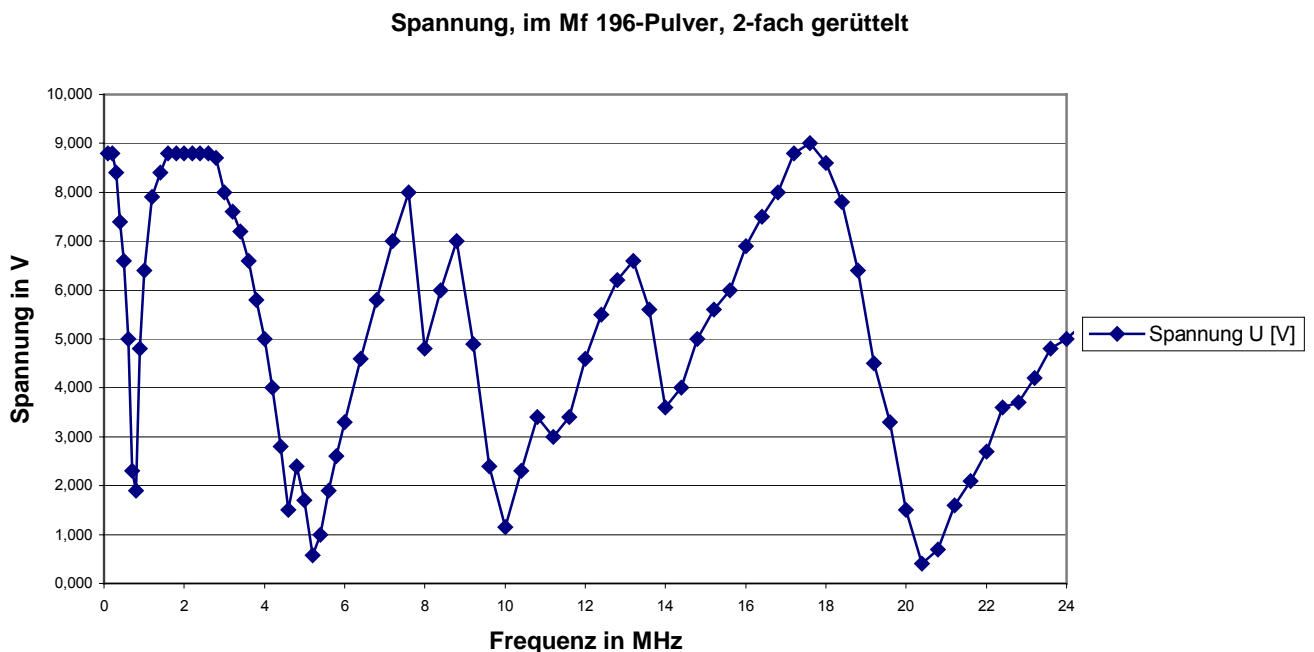
#### **Result:**

We are still far away from the resonance of 60 Hz , indicated by Prof. De Aquino

We noticed during additional measuring, that the System G construction has also resonance points in the higher frequency range. (see illus. 17.)

At these resonance points a current minimum occurs at the same time as the voltage maximum

To simplify the representation in this report , we will in the future declare the resonant frequencies as voltage minimum

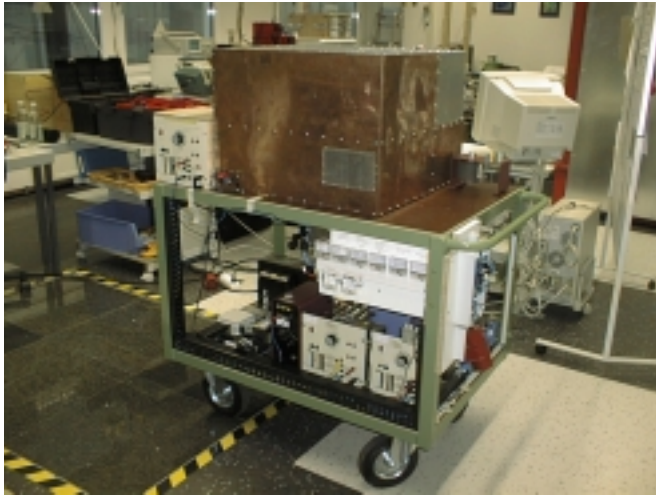


### III.. 17

Besides the resonance point at 760 kHz further resonance points at approx. 5 MHz, approx. 10 MHz and approx. 20 MHz can be recognized.

Until now only a few mA flowed at resonance. Because of this we tried to work with higher voltages. In our laboratory we had a short wave transmitter (Self constructed) capable of approx. frequency of 5 MHz, ( were another resonance point was ) supplying a maximum output voltage of 5000V ( possible output power for the transmitter 2000 W). (see illus. 18)

Unfortunately a high voltage supply flashover occurred during start up of the voltage. which damaged the insulation of the ELF antenna. The insulation wasn't designed for such high voltage. In addition, the copper bars were laying as bundles close to each other, which favoured the Flash over. We had to repair the insulation.



Illus. 18

We insulated the copper bars 2 mm thick, at first we started again with low voltage (as Prof. De Aquino). We noticed that alone by rising the insulation thickness, the resonance behaviour of the System G construction had changed considerably (see illus. 19).

Nach Reparatur der Isolation, Mf 196-Pulver, 2-fach gerüttelt

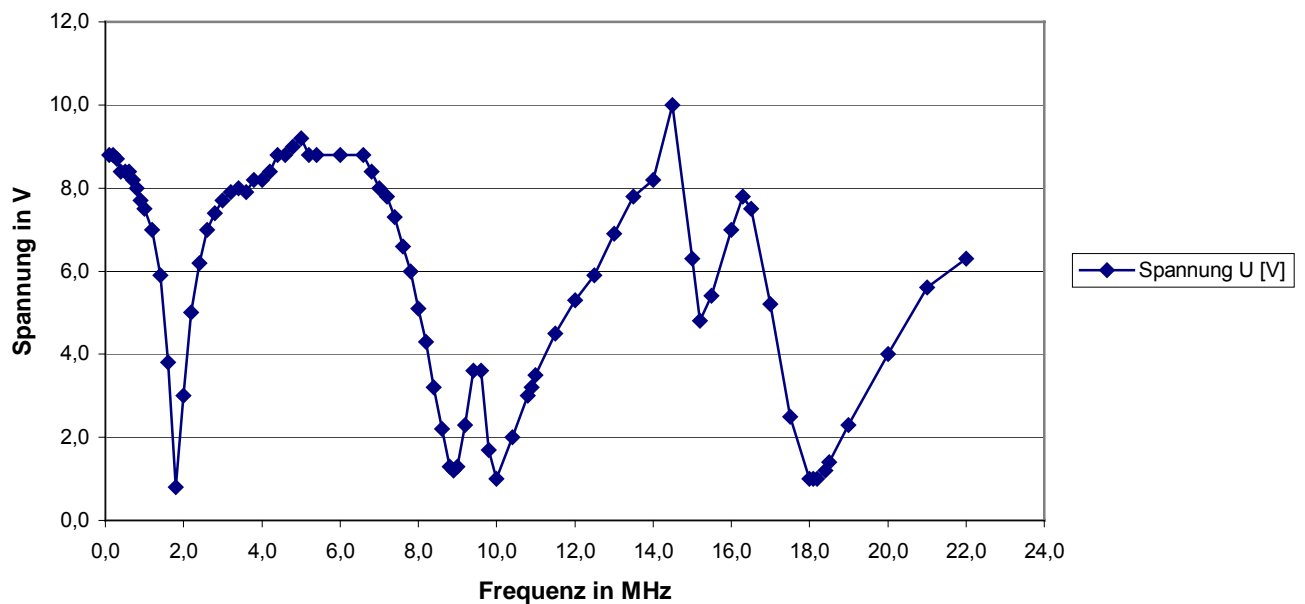


Abb. 19

The lowest resonance point was now at approx. 1.8 MHz (before 760 kHz), the next higher at approx. 9 MHz (before approx. 5 MHz) .

**Result:**

At this point, we decided to change our examination strategy. Each parameter of the system will specifically be examined.

**2.1.7. Pressing the iron powder**

We decided, using our RCL meter, Fluke PM6304 , (see Ill..20) to examine the impedances of our System G arrangements in the future.

The RCL meter has 4 measuring frequencies:

100 Hz, 1 kHz, 10 kHz, 100 kHz.

The most interesting measuring frequency for us is 100 Hz, it comes closest to the 60 Hz of Prof. De Aquino..



Illus. 20

First we examined the change of the resonance behaviour in which the System G assembly (including the iron powder) was being pressed with high pressure. We had the opportunity to put our construction on a hydraulic press, with a pressing-pressure of 30 tons (see illus. 21)



Abb. 21

Preventing that our experimental construction wouldn't, simply squashed, we built around the steel sheet shell casing (with the ELF antenna and the Mf 196 powder) an additional concrete shell, with additional stability.(see Ill..22). Pressure was only put on that area, under which the hexagon was located..



Illus. 22

Illus. 23 shows the concreted System G construction, while the press is closing.



Illus. 23

After the pressing process it was clearly seen, that the height of the area where the steel sheet shell was located was visibly smaller than before the pressing process. The width remained (inner and outer diameter) the same even by strengthening the concrete.

Resulting in following resonance and impedances (see illus. 24).

1 = before pressing

2 = after pressing

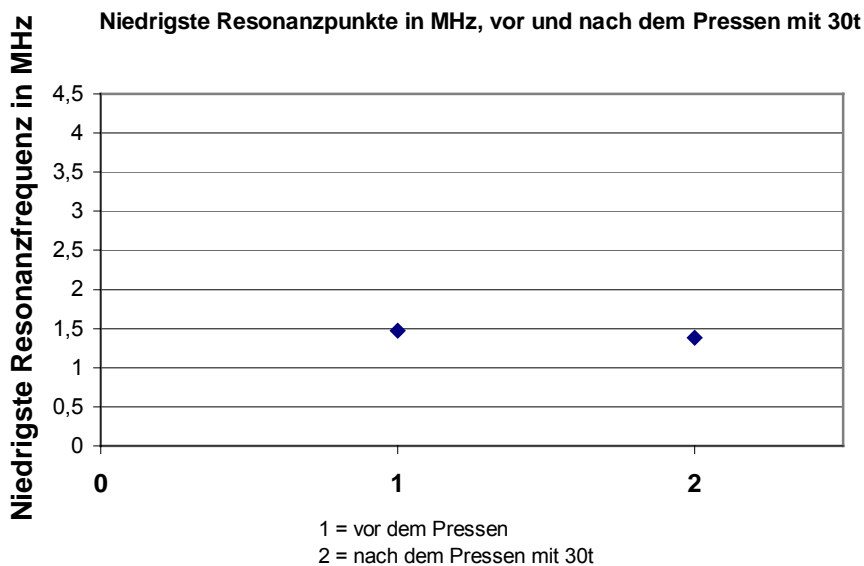
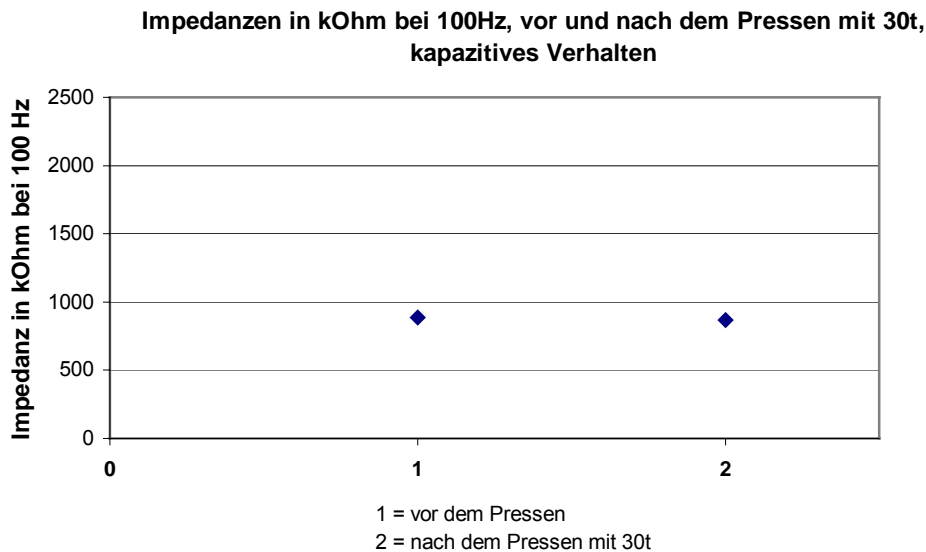


Abb. 24

Before we started pressing we had noticed that after concreting, the lowest resonance point, was at approx. 1.45 MHz. Prior to concreting it was approx. 1.8 MHz. Consequently the changing of the shell casing had also affected the resonant frequency. The pressing itself changed the resonant frequency only insignificantly.

Similar to the impedances, measured at 100 Hz (see illus. 25).



Illus. 25

### **Result:**

Even through pressing, it wasn't possible to come close to the target range. (according to Prof. De Aquino statement resonant frequency 60 Hz at an impedance of 116 milli Ohm [14]).

No further changes could be carried out on the hexagon construction (it is concreted in ), therefore a second construction was build.

## **2.2. Second construction, torus circular, tubular steel**

### **2.2 1. Manufacturing of the construction**

We used a steel tube with a pipe diameter of 60 mm, bent to a ring with a middle diameter of 640 mm. The wall thickness of the pipe was 3 mm (see illus. 26).

These are almost exactly the measures which Prof. De Aquino provides.



Illus. 26

Furthermore we manufactured an ELF antenna from a customary flexible line, cross-sectional diameter of line  $25 \text{ mm}^2$ , insulation thickness  $1.5 \text{ mm}$ .

The line was wrapped according to the information from Prof. De Aquino.

The respective length of the two dipole elements was  $6 \text{ m}$  (together  $12 \text{ m}$ ).

The two elements aren't connected with each other (electrically) (see illus. 27).

Inside of the conductor bundle was a PVC pipe with the thickness of the cable.



Illus. 27

### 2.2.2. Operation/results

The resonance and impedances were examined as follows:

1. Measuring of the ELF antenna in air (without iron powder outside the torus).
2. Measuring of the ELF antenna without iron powder however within the torus.
3. Measuring of the ELF antenna, surround by MF 196-powders in the torus.
4. Measuring of the ELF antenna, surround by MF 196 powders in the torus, shaken.

With following results (see illus. 28 and illus. 29)

Niedrigste Resonanzpunkte in MHz, runder Stahltorus

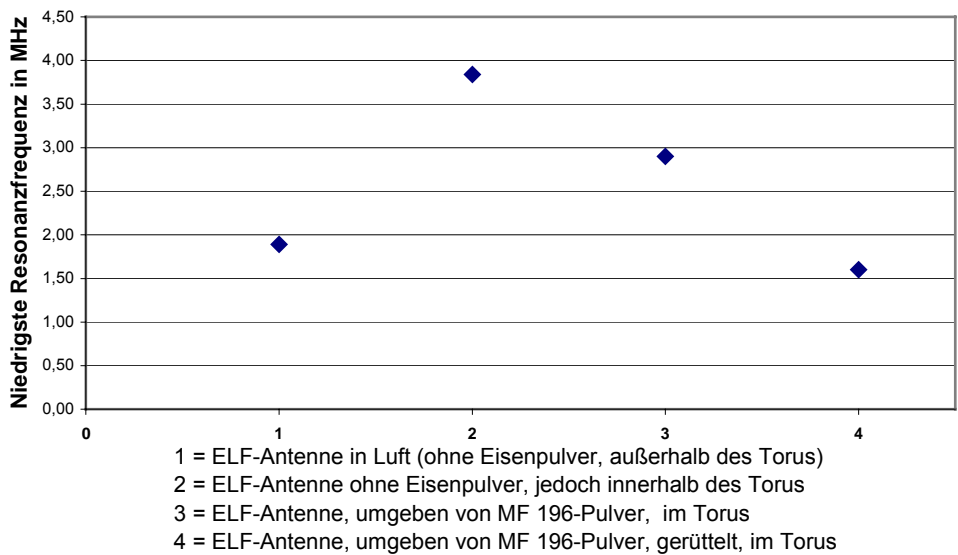


Abb. 28

Impedanzen in kOhm bei 100Hz, runder Stahltorus,  
kapazitives Verhalten  
Achtung! Bei Messung 3 kam uns der Meßwert abhanden!

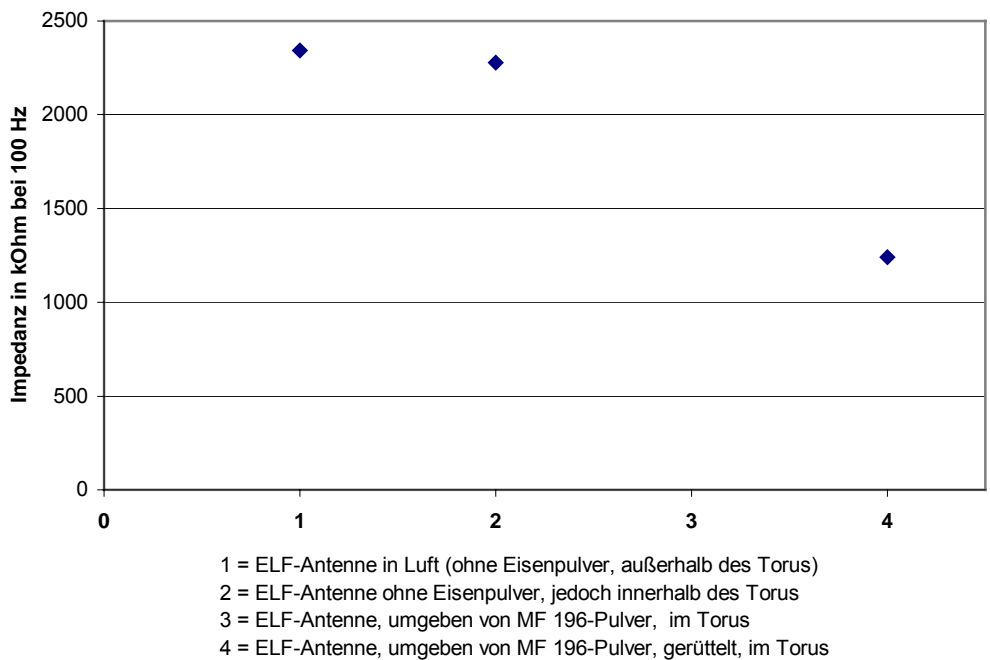


Abb. 29

**Result:**

The measures we received showed that the resonant frequency rises as soon as the



ELF antenna is put in the empty steel torus without iron powder.

Filling it with Mf 196 powder the resonant frequency goes back again. The shaking in of the Mf 196 powder causes another fall back to approx. 1.6 Mhz.

The impedance of the system, which by the way has a capacitive character, falls back to reading 1 to 4 continually. We have lost the reading for measuring 3. The lowest impedance lies by approx. 1. 25 mega-ohms.

With this construction we also didn't even roughly reach the values of Prof. De Aquino

## **Enter 2.3.**

### **2.3....Third construction, torus (circular), steel tube, thinner insulation**

#### **2.3.1. Manufacturing the construction**

Next we wanted to examine the effect of a thinner insulation on the impedance and resonance behaviour of the system, with the same conditions as shown at 2.2.

Another ELF antenna was manufactured. We removed the original insulation (1.5 mm) Of a flexible line with 25 mm<sup>2</sup> of cross-sectional and replaced it by a heat shrinkable tube with 0.1 mm strength (see illus. 30 and illus. 31).

The same measures as 2.2.1. applied.



Illus. 30



Illus. 31

We noticed, that by removing the thick insulation and overlaying the thinner heat shrinkable tube, the cable lost a little of its stability  
Meaning when wrapping the ELF antenna coils, the individual cable-bows did not cling on to each other evenly.  
Due to the series of experiments, we also wanted to examine the influence of cables laying loose and narrow to each other.

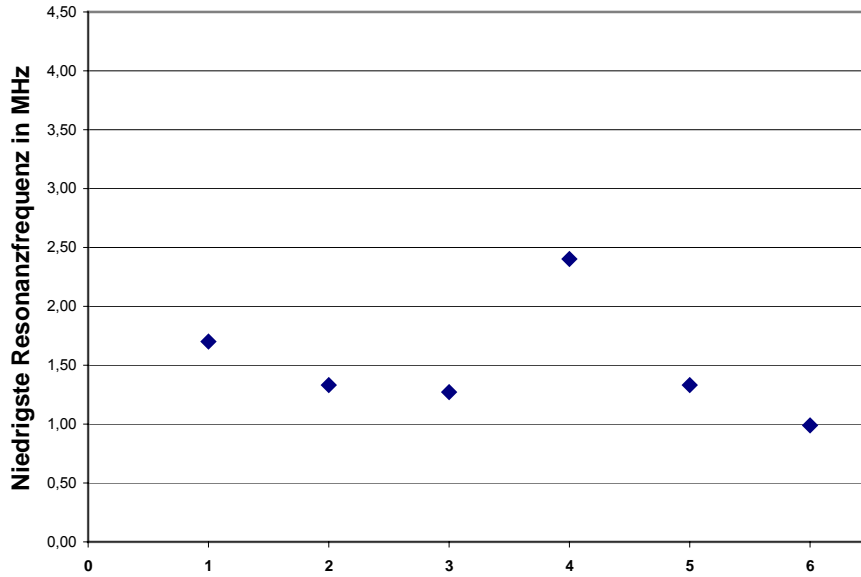
### **2.3.2. Operation / results**

The resonance and impedances were examined as follows:

1. Measuring of the ELF antenna in air outside the torus.
2. Measuring of the ELF antenna in air, outside the torus, with 50 cable fasteners fixed.
3. Measuring of the ELF antenna in air outside the torus, with 100 cable fasteners fixed.
4. Measuring of the ELF antenna without iron powder, however inside the torus, with 100 cable fasteners fixed.
5. Measuring of the ELF antenna in Mf 196 powder inside the torus fixed with 100 cable fasteners
6. Measuring of the ELF antenna shaken in Mf 196 powder, inside the torus, fixed with 100 cable ties.

Following results revealed (see illus. 32 and illus. 33.)

### Niedrigste Resonanzpunkte in MHz, runder Stahltorus, Isolation 0,1mm



- 1 = ELF-Antenne in Luft (ohne Eisenpulver, außerhalb des Torus)
- 2 = ELF-Antenne in Luft (ohne Eisenpulver, außerhalb des Torus), mit 50 Kabelbindern fixiert
- 3 = ELF-Antenne in Luft (ohne Eisenpulver, außerhalb des Torus), mit 100 Kabelbindern fixiert
- 4 = ELF-Antenne ohne Eisenpulver, jedoch innerhalb des Torus, mit 100 Kabelbindern fixiert
- 5 = ELF-Antenne, umgeben von MF 196-Pulver, im Torus, mit 100 Kabelbindern fixiert
- 6 = ELF-Antenne, umgeben von Eisenpulver, gerüttelt, im Torus, mit 100 Kabelbindern fixiert

Abb. 32

**Impedanzen in kOhm bei 100Hz, runder Stahltorus, Isolation 0,1mm  
kapazitives Verhalten**

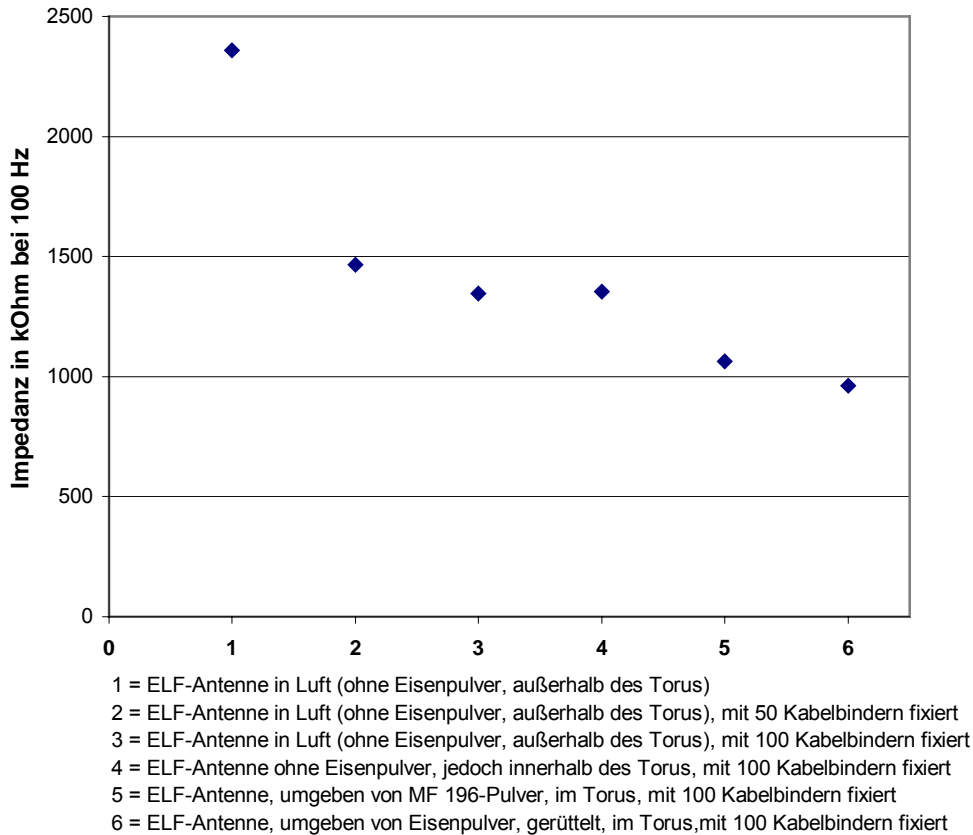


Abb. 33

The influence of the insulation strength is considerable. As already mentioned, the hexagon construction under point 2.1.6, causes a thicker insulation and a higher resonance frequency.

The same applies for the impedance.

The loose or narrow laying cable-bows considerably affect impedance and resonance.

The tighter they are laying, the smaller are both values.

Similar as in point 2.2.2, the resonant frequency rises as soon as the ELF antenna is put into the torus without iron powder. The "loosely" filled iron powder pushes the resonant frequency down below. Rattling (with refilling) provides another reduction of the resonance (and impedance).

**Result:**

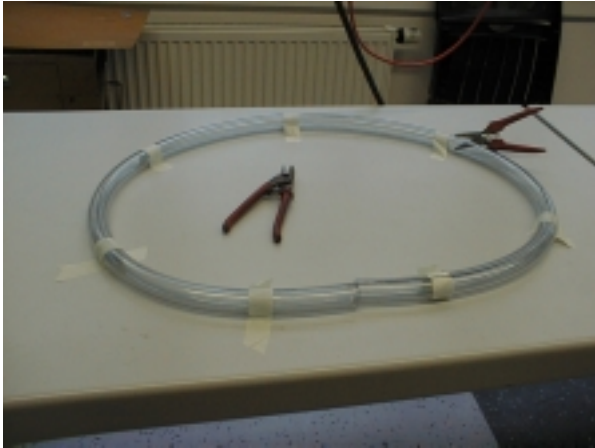
These values are "more favourable" than the values shown in item 2.2.2.

But they by far, do not come close to the ranges of Prof. De Aquino.

**2.4. Furth construction, torus (circular), PVC tube**

**2.4.1. Manufacturing the construction**

To record the influence of an iron or steel shell coat regarding e.g. not magnetic materials, we replaced the steel torus of item 2.2 and 2.3 by a shell coating made of a PVC tube, with unchanged conditions as item 2.3 (see illus. 34 and illus. 35.)



Illus. 34

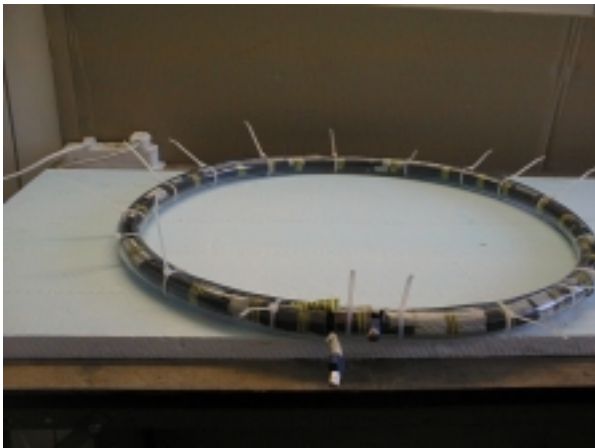


Abb. 35

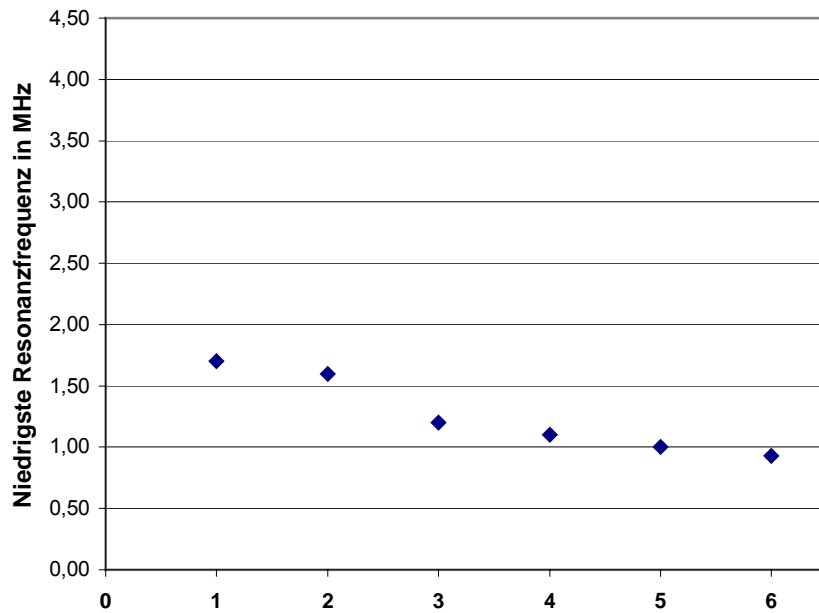
#### 2.4.2. Operation/results

The resonance and impedances were examined as follows:

1. Measuring of the ELF antenna into air outside of the PVC tube.
2. Measuring of the ELF antenna within the PVC tube without iron powder.
3. Measuring of the ELF antenna within the PVC tube with Mf 196 powder.
4. Measuring of the ELF antenna in the PVC tube in Mf 196 powder, shaken
5. Measuring of the ELF antenna in the PVC tube in Mf 196 powder, shaken fixed with package cord
6. Measuring of the ELF antenna in the PVC tube in Mf 196 powder shaken, fixed with package cord and approx. 1.5 t of pressing pressure

The following results were recorded (see illus. 36 and illus. 37).

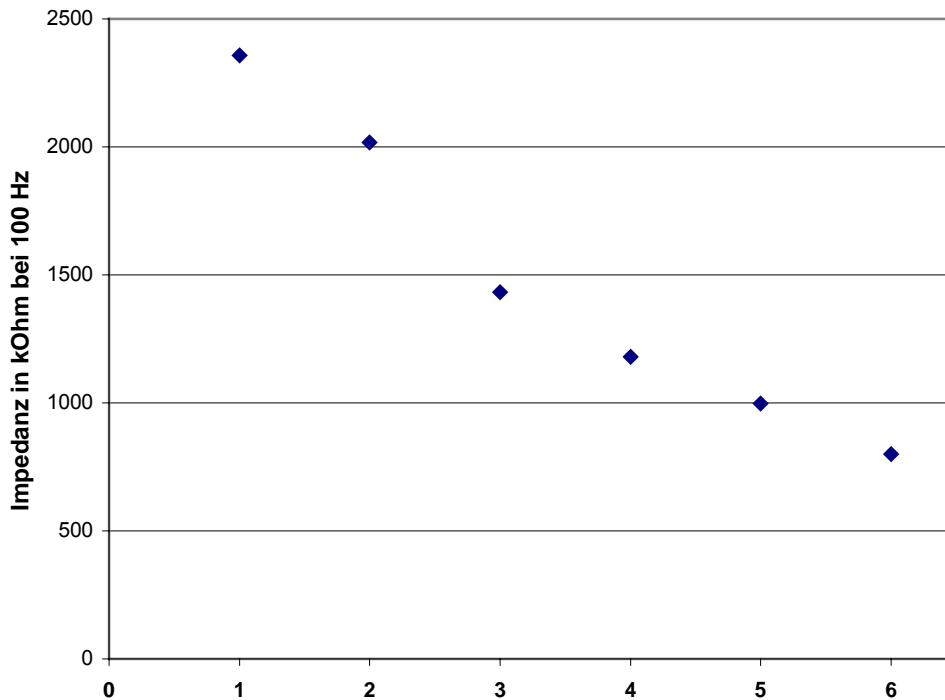
**Niedrigste Resonanzpunkte in MHz, PVC-Schlauch, Isolation 0,1mm**



- 1 = ELF-Antenne in Luft, außerhalb des PVC-Schlauches
- 2 = ELF-Antenne innerhalb des PVC-Schlauches, ohne Eisenpulver
- 3 = ELF-Antenne innerhalb des PVC-Schlauches, mit Mf 196-Pulver
- 4 = ELF-Antenne, im PVC-Schlauch, in Mf 196-Pulver, gerüttelt
- 5 = ELF-Antenne, im PVC-Schlauch, in Mf 196-Pulver, gerüttelt mit Paketschnur fixiert
- 6 = ELF-Antenne, im PVC-Schlauch, in Mf 196-Pulver, gerüttelt mit Paketschnur fixiert plus, ca 1,5t Pressdruck

Abb.36

**Impedanzen in kOhm bei 100Hz, PVC-Schlauch, Isolation 0,1mm  
kapazitives Verhalten**



- 1 = ELF-Antenne in Luft, außerhalb des PVC-Schlauches
- 2 = ELF-Antenne innerhalb des PVC-Schlauches, ohne Eisenpulver
- 3 = ELF-Antenne innerhalb des PVC-Schlauches, mit Mf 196-Pulver
- 4 = ELF-Antenne, im PVC-Schlauch, in Mf 196-Pulver, gerüttelt
- 5 = ELF-Antenne, im PVC-Schlauch, in Mf 196-Pulver, gerüttelt mit Paketschnur fixiert
- 6 = ELF-Antenne, im PVC-Schlauch, in Mf 196-Pulver, gerüttelt mit Paketschnur fixiert plus, ca 1,5t Pressdruck

Abb. 37

We would like to mention, that measuring 1 to 4 the individual cable bows had **not** been fixed with cable fasteners or similar items.

The pressing pressure was generated by a hydraulic jack. The measuring 6 was carried out "under pressure".

The PVC tube (without iron powder) did not increase the resonant frequency (unlike the items 2.2.2 and 2.3.2).

The influence of loose and shaken Mf 196 powder is already known and recognized here.

**Result:**

A clear (one or more decades) effect, that we had hoped for, at impedances and resonance in favour of an iron shell coat, by exchanging the iron-/ steel shell coat in a plastic shell coat, did absolutely not appear

It doesn't seem to make any greater difference, whether to uses synthetic material instead of iron.

## 2.5 Fifth construction, torus (circular), PU tube, 90 mm<sup>2</sup> cable

### 2.5.1. Manufacturing the construction

The aim of this construction was, to find out the behaviour of a system, if a considerably stronger copper cable was being used.

We used a customary, flexible copper cable with 90 mm of 2 cable diameter.

The insulation thickness was 1.6 mm.

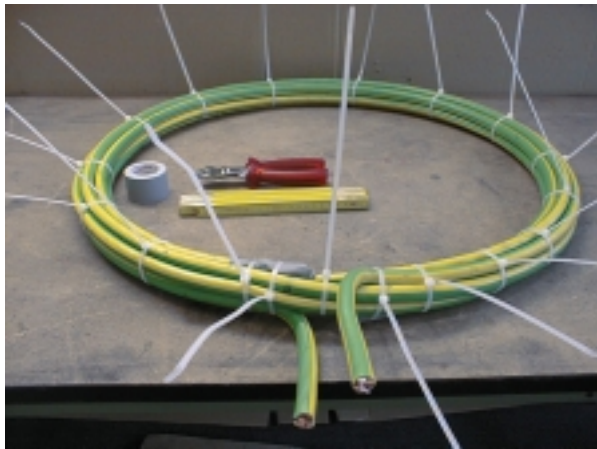
The diameter of the middle ring was 640 mm. The length of a dipole 6 m (together 12 m).

Inside of the cable bundle was a PVC stick, same thickness as the cable.

The pipe diameter of the coat had to be extended.

We manufactured a torus made out of a Polyurethane tube with a tube diameter of 75 mm (illus. 38, illus. 39 and illus. 40).

To receive a better "contact" of the iron powder with the insulation, we filled at the last measuring, 1.5 Liter of spirit into the torus. During all measuring the ELF antenna is fixed with approx. 50 cable fasteners.



Illus. 38



Abb. 39





Abb. 40

### **2.5.2. Operation / results**

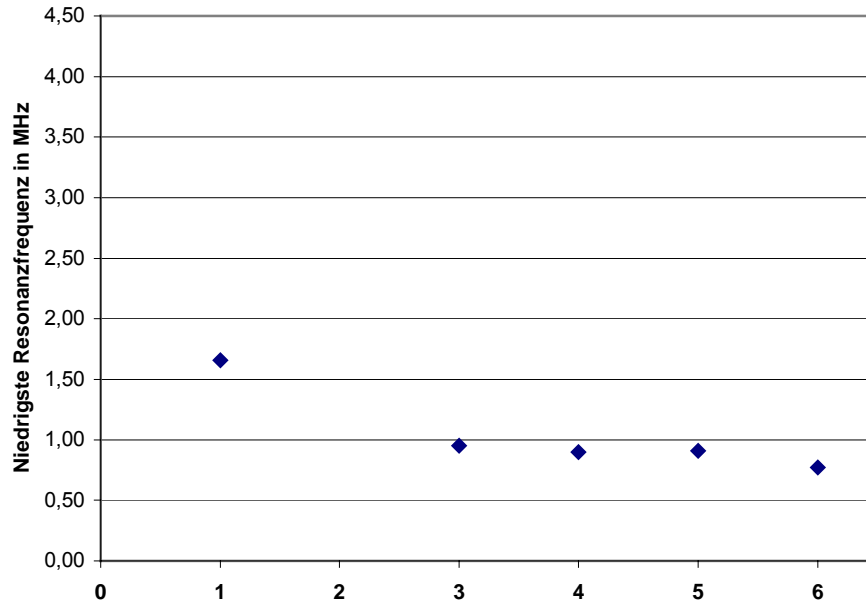
The impedances and resonance were examined as follows:

1. Measuring of the ELF antenna in air outside the PU tube
2. Measuring of the ELF antenna within the PU tube without iron powder
3. Measuring of the ELF antenna within the PU tube with Mf 196 powder
4. Measuring of the ELF antenna in the PU tube in Mf 196 powder shaken
5. Measuring of the ELF antenna in the PU tube in Mf 196 powder shaken, in addition, approx. 1.5 t of pressing pressure
6. Measuring of the ELF antenna in the PU tube in Mf 196 powder, shaken, 1 day after additional filling 1.5 l of spirit

Following results were received. (see illus. 41 and illus. 42).

We have lost the reading for measuring 2.

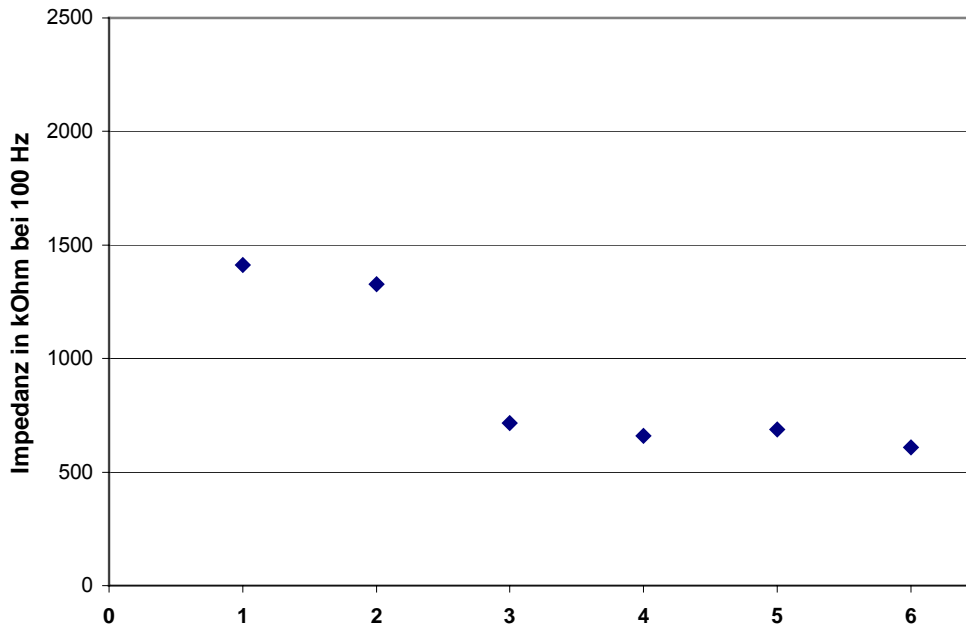
Niedrigste Resonanzpunkte in MHz, PU-Schlauch, Isolation 1,6mm  
(bei Messung 2 kam uns der Messwert abhanden)



1. Messung der ELF-Antenne in Luft, außerhalb des PU-Schlauches
2. Messung der ELF-Antenne innerhalb des PU-Schlauches, ohne Eisenpulver
3. Messung der ELF-Antenne innerhalb des PU-Schlauches, mit Mf 196-Pulver
4. Messung der ELF-Antenne, im PU-Schlauch, in Mf 196-Pulver, gerüttelt
5. Messung der ELF-Antenne, im PU-Schlauch, in Mf 196-Pulver, gerüttelt, plus ca. 1,5t Pressdruck
6. Messung der ELF-Antenne, im PU-Schlauch, in Mf 196-Pulver, gerüttelt, 1 Tag nach dem Zufüllen von 1,5 l Spiritus

Illus. 41

**Impedanzen in kOhm bei 100Hz, PU-Schlauch, Isolation 1,6mm  
kapazitives Verhalten**



1. Messung der ELF-Antenne in Luft, außerhalb des PU-Schlauches
2. Messung der ELF-Antenne innerhalb des PU-Schlauches, ohne Eisenpulver
3. Messung der ELF-Antenne innerhalb des PU-Schlauches, mit Mf 196-Pulver
4. Messung der ELF-Antenne, im PU-Schlauch, in Mf 196-Pulver, gerüttelt
5. Messung der ELF-Antenne, im PU-Schlauch, in Mf 196-Pulver, gerüttelt, plus ca. 1,5t Pressdruck
6. Messung der ELF-Antenne, im PU-Schlauch, in Mf 196-Pulver, gerüttelt, 1 Tag nach dem Zufüllen von 1,5 l Spiritus

Illus. 42

The pressing pressure was also caused by a hydraulic jack.

Measuring 5 was carried out "under pressure".

**Result:**

The PU torus (without iron powder) doesn't increase the resonant frequency (opposite to the iron-/ steel torus).

Mf 196 powder, in loose and shaken condition behaved as expected.

The pressing pressure did also causes nothing worth mentioning.

Similar applies to moistening the Mf 196 powder with spirit

In regards to the results of Prof. De Aquino, we didn't make in progress so far.

**2.6. Sixth construction, torus (circular), steel tube, GG 150 powder**

**2.6.1. Manufacturing the construction**

This test was quasi a "repetition" of test 2.3, using different iron powder. We filled in the grey cast iron powder GG 150, we already mentioned.

Pointed out under 2.3, a flexible copper line, 25 mm<sup>2</sup> was used, thickness of the insulation 0.1 mm, brought into the steel torus together with the GG 150 powder.

The leader bundle of the ELF antenna was always fixed with 100 cable fasteners.

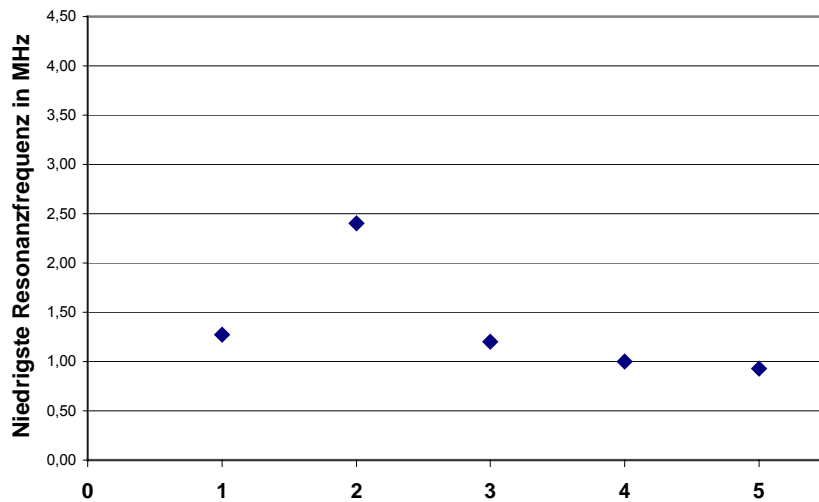
## 2.6.2. Operation / results

The impedances and resonances were examined as follows:

1. Measuring of the ELF antenna in air (outside the torus)
2. Measuring of the ELF antenna in the torus without iron powder.
3. Measuring of the ELF antenna in the torus with GG 150 powder.
4. Measuring of the ELF antenna in the torus with GG 150 powder, shaken.
5. Measuring of the ELF antenna in the torus with GG 150 powder, shaken. Then filled with 0.3 l of water.

Following results were received (see illus. 43 and illus. 44.)

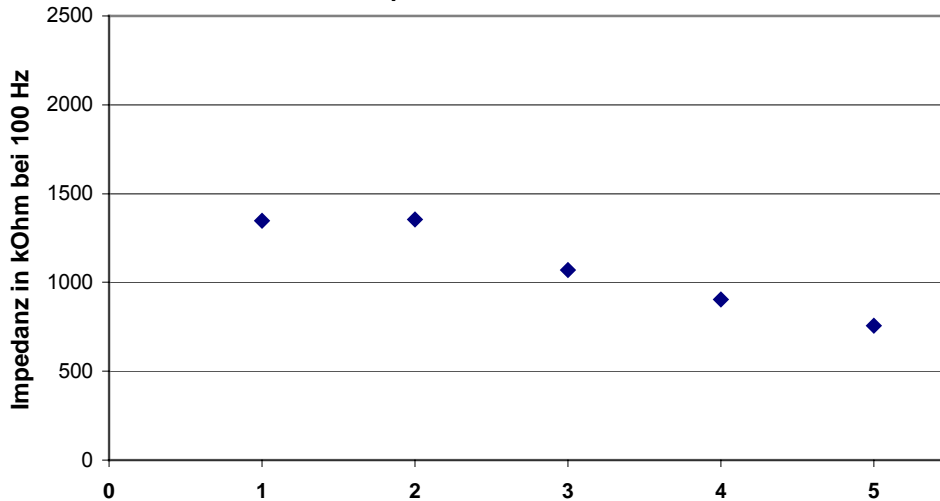
**Niedrigste Resonanzpunkte in MHz, runder Stahltorus, Isolation 0,1mm, GG-150-Pulver**



- 1 = ELF-Antenne in Luft (ohne Eisenpulver, außerhalb des Torus)  
2 = ELF-Antenne ohne Eisenpulver, jedoch innerhalb des Torus  
3 = ELF-Antenne, umgeben von GG-150-Pulver, im Torus  
4 = ELF-Antenne, umgeben von GG-150-Pulver, gerüttelt, im Torus  
5 = ELF-Antenne, umgeben von GG-150-Pulver, gerüttelt, im Torus, nach Einfüllen von 0,3l Wasser

Illus. 43

**Impedanzen in kOhm bei 100Hz, runder Stahltorus, Isolation 0,1mm, GG-150-Pulver  
kapazitives Verhalten**



- 1 = ELF-Antenne in Luft (ohne Eisenpulver, außerhalb des Torus)
- 2 = ELF-Antenne ohne Eisenpulver, jedoch innerhalb des Torus
- 3 = ELF-Antenne, umgeben von GG-150-Pulver, im Torus
- 4 = ELF-Antenne, umgeben von GG-150-Pulver, gerüttelt, im Torus
- 5 = ELF-Antenne, umgeben von GG-150-Pulver, gerüttelt, im Torus, nach Einfüllen von 0,3l Wasser

**Illus. 44**

In direct comparison with item 2.3. (the same construction in MF 196 powder) no clear change can be recognized regarding the lowest resonant frequencies.

The moistening brought also very little.

Please notice, that the GG 150 powder is far less absorbent than the MF 196 Powder. The impedances at 100 Hz are a little more favourable " compared with the GG 150 powder, but still "infinitely far" from 116 milli Ohm.

**Result:**

The exchange of the iron powder showed nothing new.

**2.7. Seventh construction, open cardboard box shell casing, 1.5 mm varnish isolated, scale 1: 2**

**2.7.1. Manufacturing the construction**

We noticed that all our previous systems, had at the impedances and at the resonances always the same order of magnitude. We decided to shorten the time consuming manufacturing method.

Since the material of the shell coat had no considerable influence, the following shell coat's were made of cardboard box material.

The models were fabricated in a 1: 2 scale. At this point, a greater change of impedances and resonances can be diagnosed and if required a copy of the original

system could be replicated.

We used also thin cable diameter and customary copper varnish wire, cable diameter 1.5, mm middle diameter of the hexagon 320 mm, length of a dipole bow 3 m, total length 6 m (see illus. 45.)

Totally placed into Mf 196 powder. (see illus. 46) .



Illus. 45

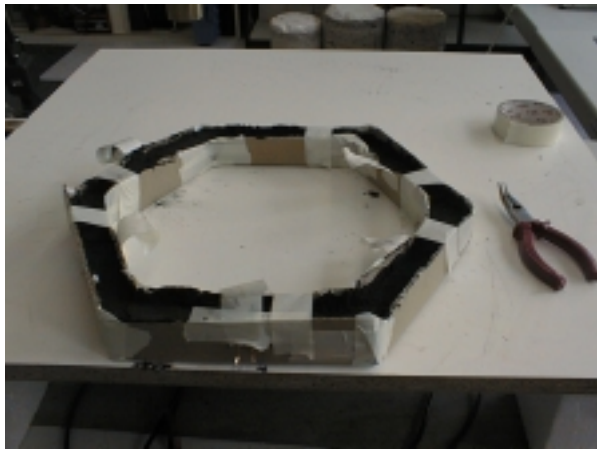


Abb. 46

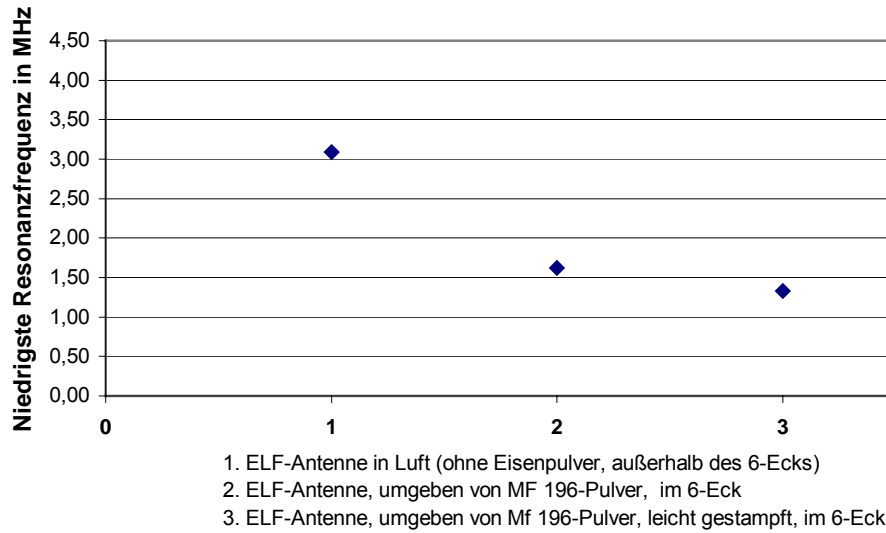
### 2.7.2. Operation / results

The impedances and resonances were examined as follows.

1. ELF antenna in air (without iron powder outside of the hexagon)
2. ELF antenna, surround by MF 196 powder within the hexagon
3. ELF antenna, surround by MF 196 powder, easily stamped, within the hexagon,

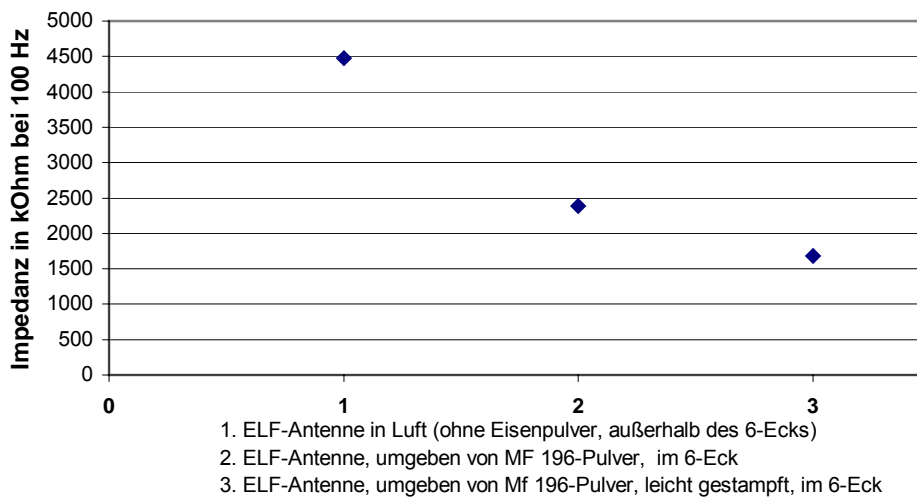
Following results were received. (see illus. 47 and illus. 48):

**Niedrigste Resonanzpunkte in MHz, 6-Eck, Maßstab 1:2, lackisoliert, Mf 196-Pulver, Leiterdurchmesser 1,5mm**



Illus. 47

**Impedanzen in kOhm bei 100Hz, 6-Eck, Maßstab 1:2, lackisoliert, Mf 196-Pulver, Leiterdurchmesser 1,5mm  
kapazitives Verhalten**



Illus. 48

At first we were astonished, that despite of serious change of three parameter (insulation, scale, cable crosscut) we were still laying within the order of magnitude of the previous systems

The lowest resonant frequencies had only been insignificantly higher as previous arrangements.

The higher impedances can be explained due to the very low cable diameter (cf. 2.2 and 5.2).

### **Result:**

Our objective (ca.116 milli Ohm at an approx. 60 Hz) still far away.

## **2.8 Eight construction, open cardboard box shell casing as hexagon, ELF antenna, cable diameter 1.5 mm, varnished , cable no longer bundled, scale 1:2**

### **2.8.1. Manufacturing the construction**

We discovered in an illustration published in the internet by Prof. De Aquino, in which the cable bows were **not** bundled, but with distance evenly distributed over the tube cross-section of the torus

If and how this version would have an effect on our target was examined with the following model:

Construction:

Copper varnish wire, cable diameter 1.5 mm, distance of the cables to each other 8 mm, middle diameter of the ELF antenna 320 mm, length of a dipole bow 3 m, total length 6 m (see illus. 49 and illus. 50).

This ELF antenna was also put into Mf 196 powder.

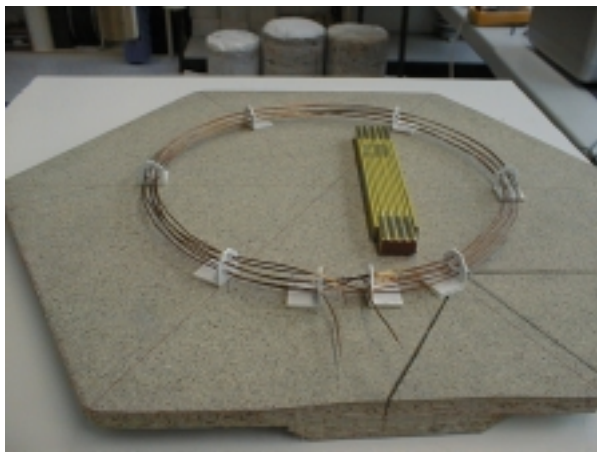
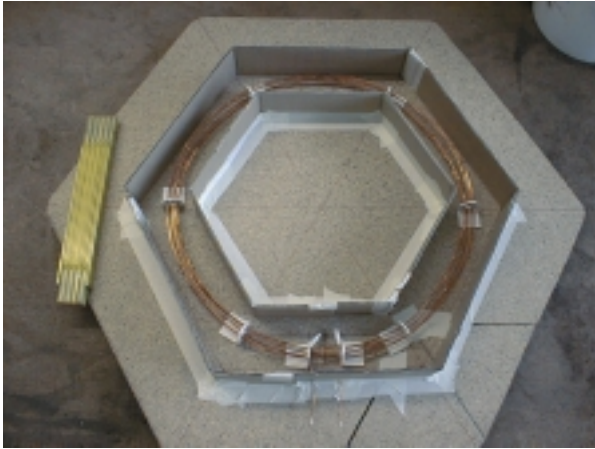


Abb. 49





Illus. 50

## 2.8.2. Operation / results

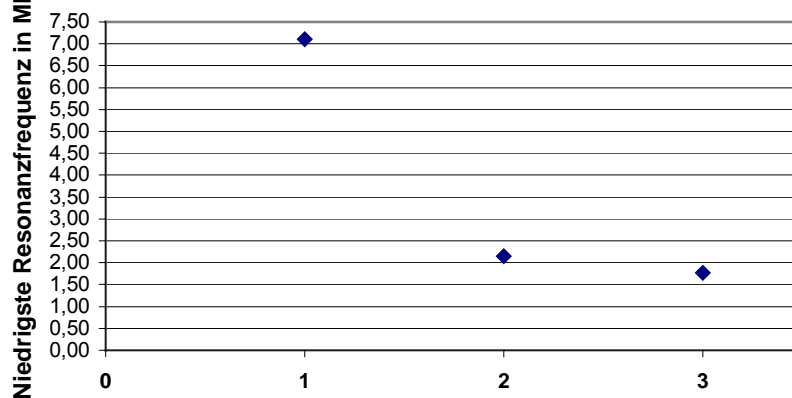
The impedances and resonances were examined as follows:

1. ELF antenna in air (without iron powder, outside of the hexagon)
2. ELF antenna, surround of MF 196 powders, within the hexagon
3. ELF antenna, surround of Mf 196 powders, easily stamped, within the hexagon,

The following results had been recorded (see illus. 51, illus. 52 and illus. 53).

**Attention !!! Scale changed !!!**

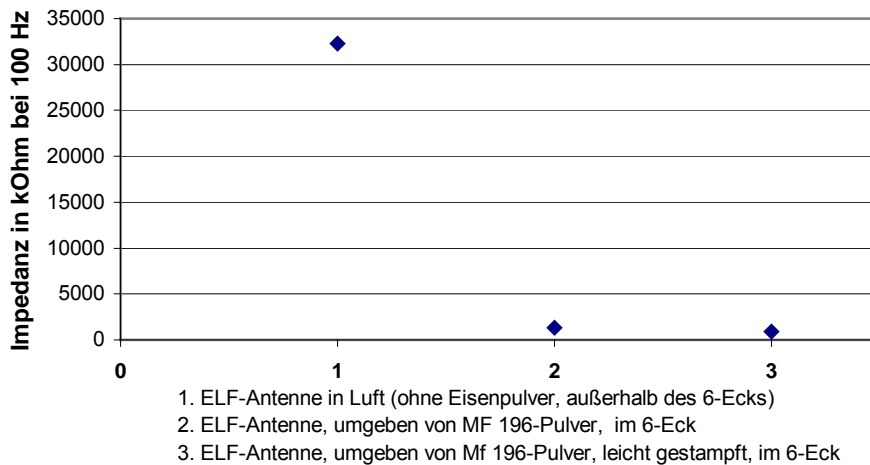
**Niedrigste Resonanzpunkte in MHz, Mantel als 6-Eck, Elf-Antenne rund,  
Maßstab 1:2, lackisoliert, Mf 196-Pulver, Leiterdurchmesser 1,5mm**



1. ELF-Antenne in Luft (ohne Eisenpulver, außerhalb des 6-Ecks)
2. ELF-Antenne, umgeben von MF 196-Pulver, im 6-Eck
3. ELF-Antenne, umgeben von Mf 196-Pulver, leicht gestampft, im 6-Eck

Abb. 51

**Impedanzen in kOhm bei 100Hz, Mantel als 6-Eck, Elf-Antenne rund,  
Maßstab 1:2, lackisoliert, Mf 196-Pulver, Leiterdurchmesser 1,5mm,  
kapazitives Verhalten**



Illus. 52

The following illus. 53 shows the impedances again in "original" scale. Measurement 1 is located outside of the diagram.

**Impedanzen in kOhm bei 100Hz, Mantel als 6-Eck, Elf-Antenne rund,  
Maßstab 1:2, lackisoliert, Mf 196-Pulver, Leiterdurchmesser 1,5mm,  
kapazitives Verhalten**

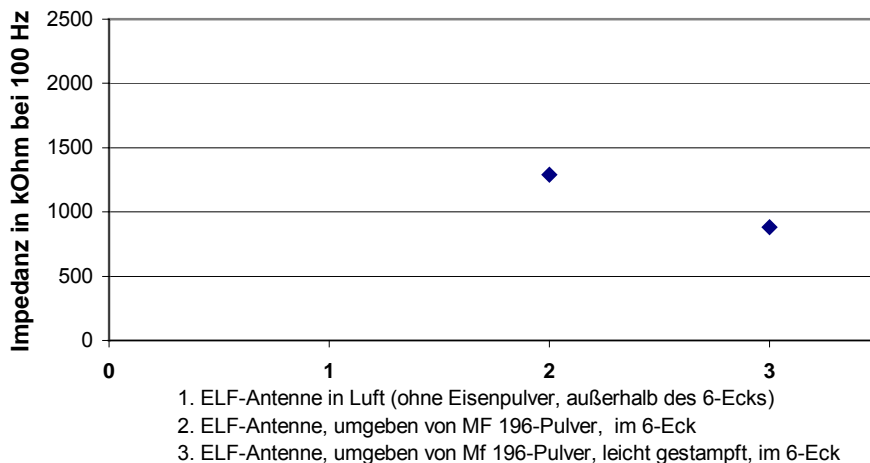


Abb. 53

**Result:**

While the resonant frequencies of this system increased toward item 2.7 only slightly (as

soon as the ELF antenna was in the iron powder), a very clear reduction of the impedances (up to 50%) were recognized in comparison to 2.7  
The construction of an ELF antenna in which the cables are arranged within distance seemed to be a more favourable solution regarding the impedances.

**2.9. Ninth construction, open cardboard box shell casing as a hexagon, ELF antenna round, cable diameter 1.5 mm, NO longer bundled.  
Scale 1:2, insulating thickness 1.5 mm**

**2.9.1. Manufacturing the construction**

To examine the difference between "thick" synthetic insulation and varnish insulation, we changed in our construction 2.8 only one parameter, the insulation thickness. Now to 1.5 mm (Pvc) (see illus. 54.)

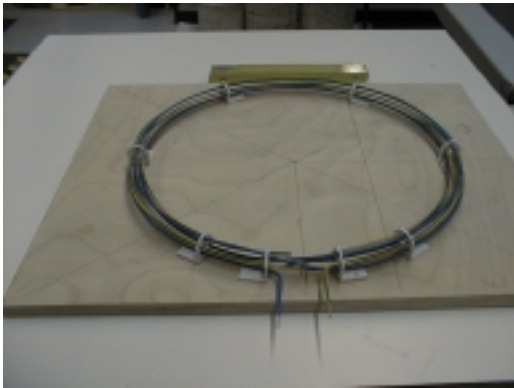


Abb. 54

**2.9.2. Operation / results**

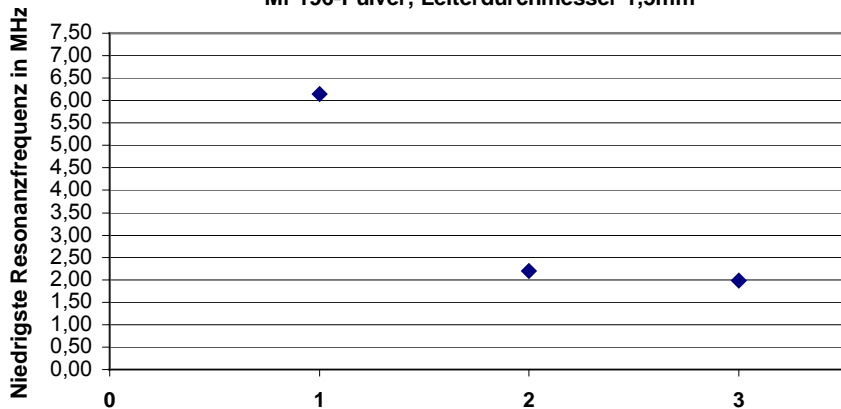
The impedances and resonances were examined as follows:

1. ELF antenna in air (without iron powder, outside of the hexagon)
2. ELF antenna, surround of MF 196 powders, within the hexagon
3. ELF antenna, surround of Mf 196 powders, within the hexagon, easily stamped

The following were recorded. (see illus. 55, illus. 56 and illus. 57).

**Attention !!! Scale changed !!!**

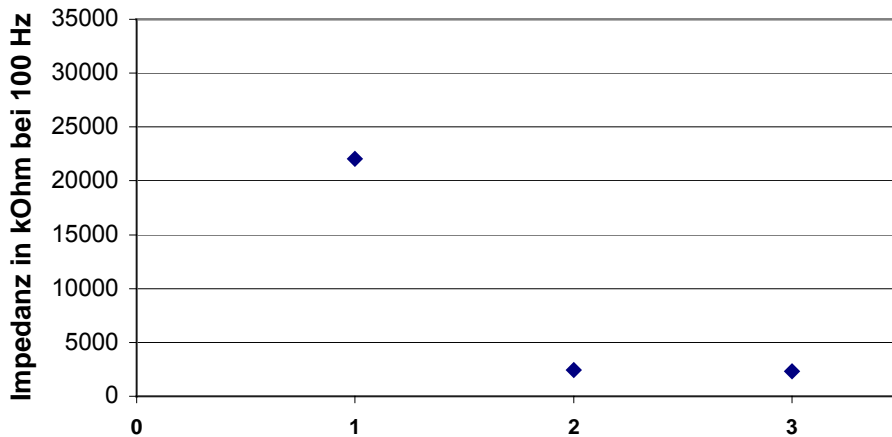
Niedrigste Resonanzpunkte in MHz, Mantel als 6-Eck, Elf-Antenne rund, Maßstab 1:2,  
Isolation 1,5 mm,  
Mf 196-Pulver, Leiterdurchmesser 1,5mm



1. ELF-Antenne in Luft (ohne Eisenpulver, außerhalb des 6-Ecks)
2. ELF-Antenne, umgeben von MF 196-Pulver, im 6-Eck
3. ELF-Antenne, umgeben von Mf 196-Pulver, leicht gestampft, im 6-Eck

Abb. 55

Impedanzen in kOhm bei 100Hz, Mantel als 6-Eck, Elf-Antenne rund,  
Maßstab 1:2, Isolation 1,5mm,  
Mf 196-Pulver, Leiterdurchmesser 1,5mm, kapazitives Verhalten



1. ELF-Antenne in Luft (ohne Eisenpulver, außerhalb des 6-Ecks)
2. ELF-Antenne, umgeben von MF 196-Pulver, im 6-Eck
3. ELF-Antenne, umgeben von Mf 196-Pulver, leicht gestampft, im 6-Eck

Illus. 56

The following illus. 57 again shows the impedances in the "original" scale. Measurement 1 is outside of the diagram.

Impedanzen in kOhm bei 100Hz, Mantel als 6-Eck, Elf-Antenne rund, Maßstab  
1:2, Isolation 1,5mm,  
Mf 196-Pulver, Leiterdurchmesser 1,5mm, kapazitives Verhalten

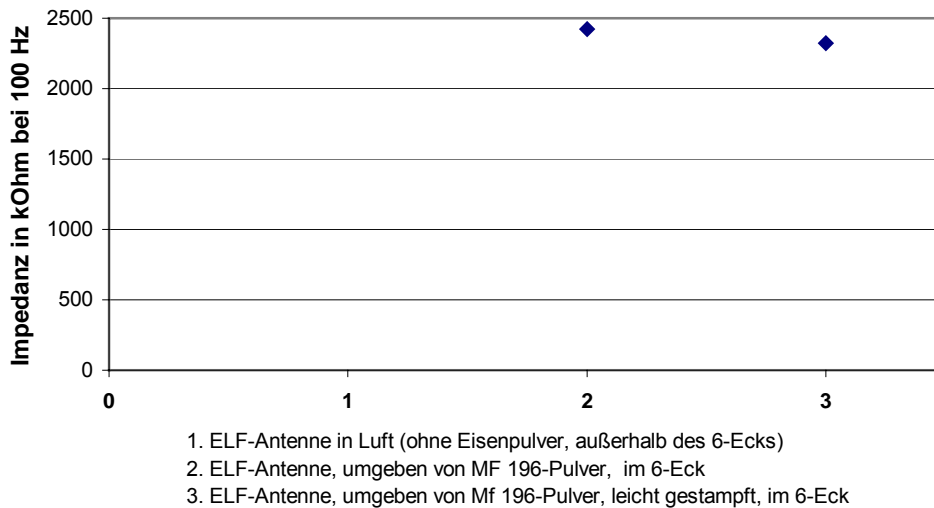


Abb. 57

While the resonance points showed only insignificant changes toward item 2.8., the impedances however increased considerably, partially more than 100%, each capacitive behaviour.

### Result:

This construction showed the expected behaviour.

A thicker insulation caused higher (and with this disadvantageous) impedances.

## 2.10. Tenth construction, steel sheet shell coat as a octagon, ELF antenna round, cable diameter 8 mm, varnish insulated, cable NOT bundled any longer, original scale 1:1

### 2.10.1 Manufacturing the construction

Due to the experiences made with the previous nine arrangements ( actually some more, but only nine meaning full arrangements are described here ) we wanted to optimise the tenth construction with the knowledge we had won so far.

We manufactured an ELF antenna out of thick copper bars 8 mm (diameter). Each dipole half was 6 m long, together 12 m.

The cable bows were **not** bundled and had a distance of each 16 mm to each other. Middle diameter of the ELF antenna: 640 mm (see illus. 58).

The shell casing was built in an octagon steel sheet shell casing, strength 0.7mm with a purity of 99.74% (see illus. 59 and illus. 60).

Varnish spray (Kontakt Chemie, Plastic 70, Schutzlack) was used for the insulation of the copper bars.

Iron powder Mf 196 powder (Tridelta) was used.

During this tenth series of experiments, the steel sheet shell casing was annealed (similar to item 2.1.3.).

We started the series of experiments on construction number ten with a not annealed shell casing.

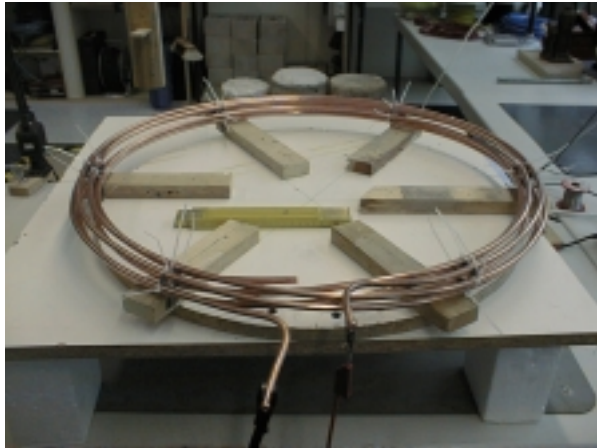
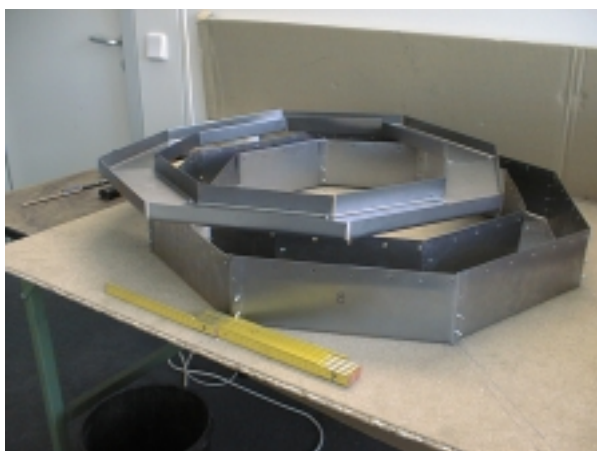
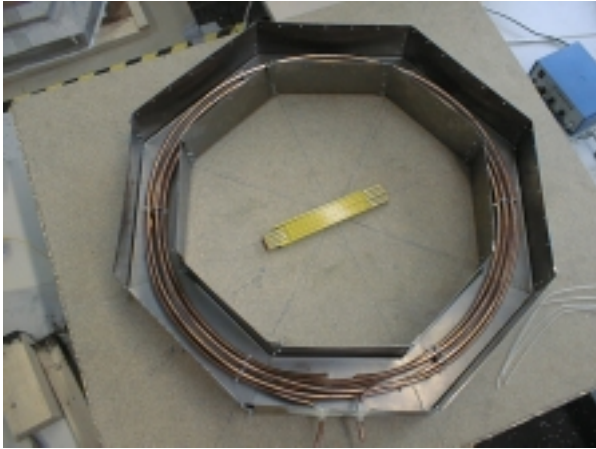


Abb. 58



Illus. 59



Illus. 60

### 2.10.2. Operation / results

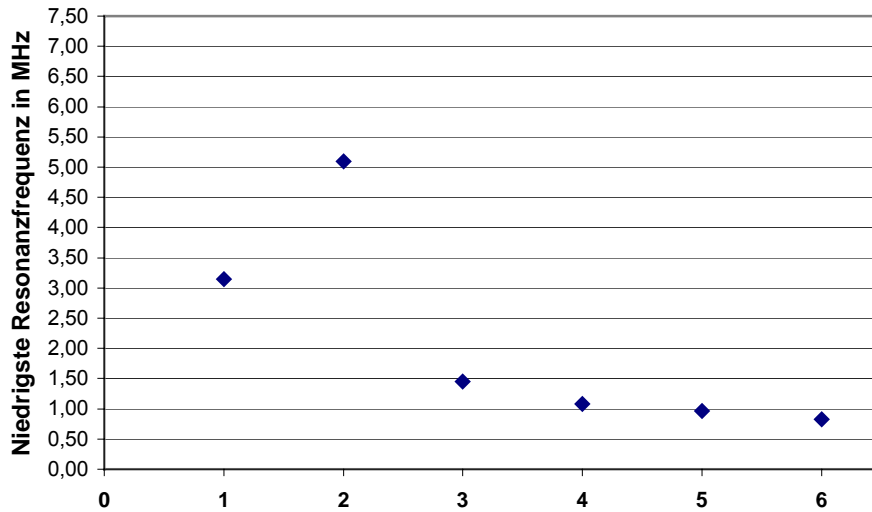
The impedances and resonance were examined as follows:

1. ELF antenna, varnished, in air (without iron powder, outside the octagon).
2. ELF antenna, varnished, within the octagon (without iron powder) lid open
3. ELF antenna, varnished, in loose Mf 196 powder, lid open.
4. ELF antenna, varnished, easily stamped into Mf 196 powder, lid open.
5. ELF antenna, varnished, easily stamped into Mf 196 powder lid closed
6. ELF antenna, varnished, shell casing, **annealed**, into easily stamped Mf 196 powder, lid closed.

Following results were recorded (see illus. 61 and illus. 62:)

**Attention !!! Scale changed !!!**

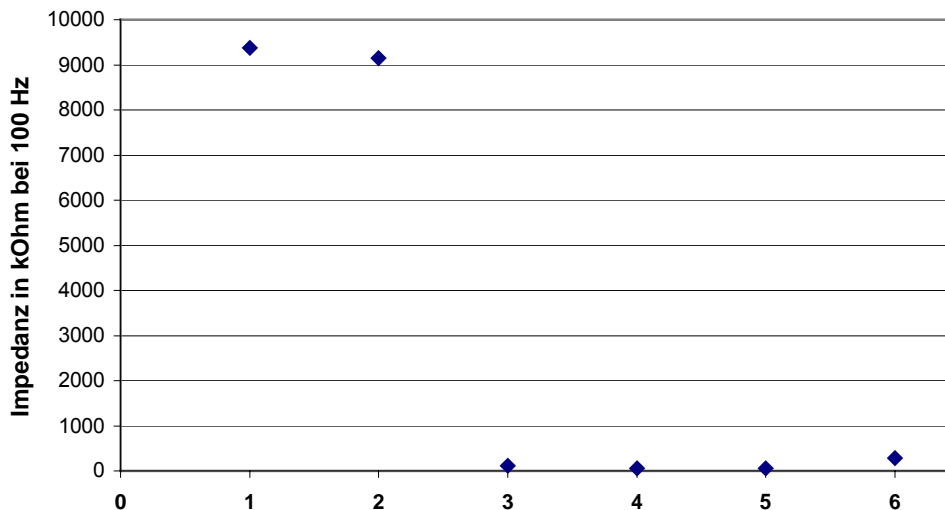
**Niedrigste Resonanzpunkte in MHz, Stahlblechmantel als 8-Eck, Antenne rund,  
Leiterdurchmesser 8mm, lackisoliert, Leiter NICHT mehr gebündelt,  
Originalmaßstab 1:1**



1. ELF-Antenne, lackiert, in Luft (ohne Eisenpulver, außerhalb des 8-Ecks).
2. ELF-Antenne, lackiert, im 8-Eck (ohne Eisenpulver), Deckel offen
3. ELF-Antenne, lackiert, in lockerem Mf 196-Pulver, Deckel offen.
4. ELF-Antenne, lackiert, in leicht gestampften Mf 196-Pulver, Deckel offen.
5. ELF-Antenne, lackiert, in leicht gestampften Mf 196-Pulver, Deckel geschlossen.
6. ELF-Antenne, lackiert, Mantel gealüht, in leicht gestampften Mf 196-Pulver, Deckel geschlossen.

Illus. 61

**Impedanzen in kOhm bei 100Hz, Stahlblechmantel als 8-Eck, ELF-Antenne rund,  
Leiterdurchmesser 8mm, lackisoliert, Leiter NICHT mehr gebündelt,  
Originalmaßstab 1:1, kapazitives Verhalten**



1. ELF-Antenne, lackiert, in Luft (ohne Eisenpulver, außerhalb des 8-Ecks).
2. ELF-Antenne, lackiert, im 8-Eck (ohne Eisenpulver), Deckel offen
3. ELF-Antenne, lackiert, in lockerem Mf 196-Pulver, Deckel offen.
4. ELF-Antenne, lackiert, in leicht gestampften Mf 196-Pulver, Deckel offen.
5. ELF-Antenne, lackiert, in leicht gestampften Mf 196-Pulver, Deckel geschlossen.
6. ELF-Antenne, lackiert, Mantel gealüht, in leicht gestampften Mf 196-Pulver, Deckel geschlossen.



Illus. 62

Following illus. 63 shows the resonance points again in the "original scale " Measurement 2 is outside of the display diagram.

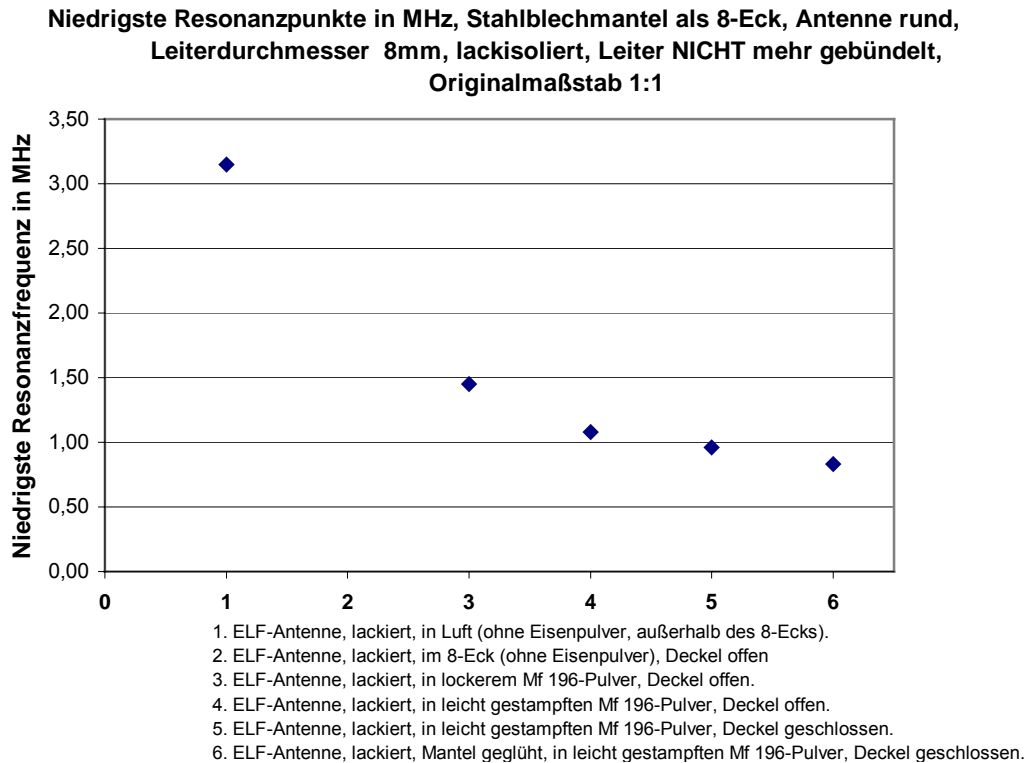
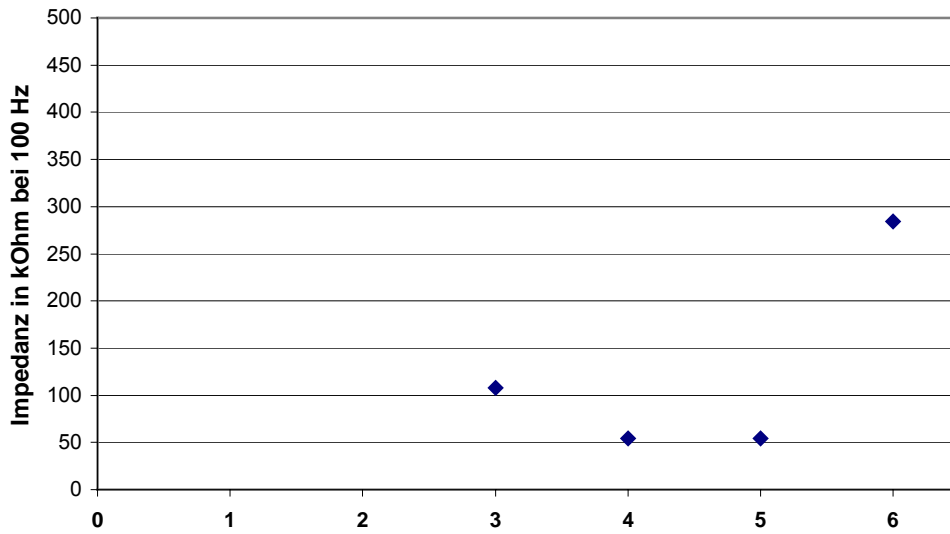


Abb. 63

Following illus. 64 shows the impedances in a more significant scale. Measurements 1 and 2 are outside of the displayed diagram.

Impedanzen in kOhm bei 100Hz, Stahlblechmantel als 8-Eck, ELF-Antenne rund,  
 Leiterdurchmesser 8mm, lackisoliert, Leiter NICHT mehr gebündelt,  
 Originalmaßstab 1:1, kapazitives Verhalten



1. ELF-Antenne, lackiert, in Luft (ohne Eisenpulver, außerhalb des 8-Ecks).
2. ELF-Antenne, lackiert, im 8-Eck (ohne Eisenpulver), Deckel offen
3. ELF-Antenne, lackiert, in lockerem Mf 196-Pulver, Deckel offen.
4. ELF-Antenne, lackiert, in leicht gestampften Mf 196-Pulver, Deckel offen.
5. ELF-Antenne, lackiert, in leicht gestampften Mf 196-Pulver, Deckel geschlossen.
6. ELF-Antenne, lackiert, Mantel gegläht, in leicht gestampften Mf 196-Pulver, Deckel geschlossen.

Illus. 64

### Result:

While the lowest resonance points, relative little moved down below, with impedances we reached the lowest (favourable) values so far. With 50 kilo Ohm still several decades away from 116 milli Ohm .

We were astonished, because after annealing the steel shell casing a (unfavourable) rise of the impedance at almost 500% arose, while the resonant frequency of the system was going insignificantly down to approx. 900 kHz, here also several decades above the aimed 60 Hz.

**Now it was clear to us:**

**The System G, described by Prof. De Aquino, can't work !!!!?**

However, we weren't satisfied with this determination.

We decided to carry out further examinations which perhaps could bring us closer to our target.

**The order of our intended further procedure:**

1. Repetition of the test as point 2.10, all though with an ELF antenna, **not** isolated

2. Examination of the conductivity of the iron powder.  
Prof. De Aquino states in his documentation the use of iron powder,  $\text{Cond} = 10 \text{ S/m}$ .
3. Testing to push the resonance point of the ELF antenna downward by using external components.
4. Determining possible time delay distortion.
5. Examination of the behaviour of (electric-) magnetic shielding with different materials. (such as MU metal). Prof. De Aquino claimed, the magnetic field, would be almost 100% protected, by the sheet iron of the shell casing. Hardly nothing would reach the outside.

### **2.11. Eleventh construction, steel sheet shell casing, annealed as octagon, ELF antenna round, cable diameter 8 mm, NO insulation, cable NOT bundled, original scale 1:1**

#### **2.11.1. Manufacturing the construction**

The construction corresponded with item 2.10. Different, the used ELF antenna wasn't insulated, had however all data like 2.10.

Of course we couldn't carry out any tests with the un annealed shell casing now, it was already annealed..

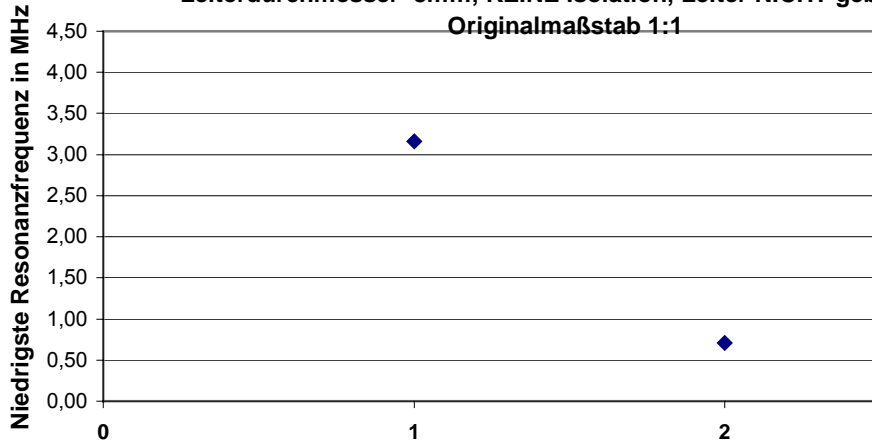
#### **2.11.2. Operation /results**

The impedances and resonances were examined as follows:

1. ELF antenna, **not** varnished, in air (without iron powder, outside of the octagon).
2. ELF antenna, varnished, shell casing **not annealed**, easily stamped into Mf 196 powder, lid closed.

Following results were recorded. (see illus. 65 and illus. 66:)

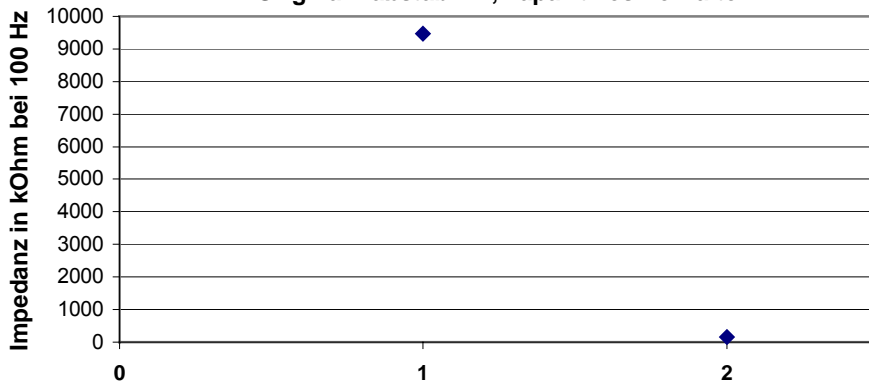
**Niedrigste Resonanzpunkte in MHz, Stahlblechmantel gegläht als 8-Eck, ELF-Antenne rund,  
Leiterdurchmesser 8mm, KEINE Isolation, Leiter NICHT gebündelt,  
Originalmaßstab 1:1**



1. ELF-Antenne, NICHT lackiert, in Luft (ohne Eisenpulver, außerhalb des 8-Ecks).
2. ELF-Antenne, NICHT lackiert, Mantel gegläht, in leicht gestampften Mf 196-Pulver, Deckel geschlossen.

Illus. 65

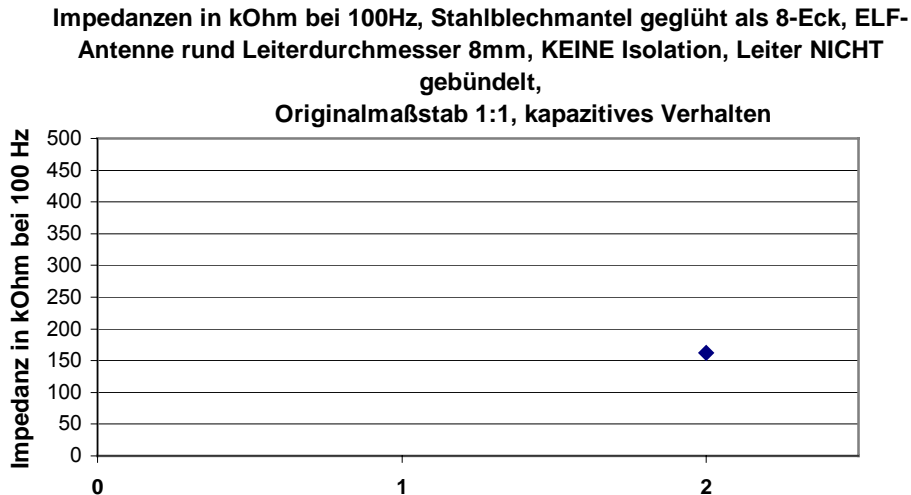
**Impedanzen in kOhm bei 100Hz, Stahlblechmantel gegläht als 8-Eck, ELF-Antenne rund,  
Leiterdurchmesser 8mm, KEINE Isolation, Leiter NICHT gebündelt,  
Originalmaßstab 1:1, kapazitives Verhalten**



1. ELF-Antenne, NICHT lackiert, in Luft (ohne Eisenpulver, außerhalb des 8-Ecks).
2. ELF-Antenne, NICHT lackiert, Mantel gegläht, in leicht gestampften Mf 196-Pulver, Deckel geschlossen.

Abb.66

Following illus. 67 shows the impedances in a more meaningful scale. Measurement 1 is outside of the display diagram.



1. ELF-Antenne, NICHT lackiert, in Luft (ohne Eisenpulver, außerhalb des 8-Ecks).
2. ELF-Antenne, NICHT lackiert, Mantel geglüht, in leicht gestampften Mf 196-Pulver, Deckel geschlossen.

Illus. 67

### Result:

Not insulating the copper cables, reduces resonance and impedance. With approx. 700 kHz and approx. 160 kOhm still in the range area of the system with insulation, herewith very, very far off to Prof. De Aquino values

## 2.12. Examination of the conductivity of the iron powder

Prof. De Aquino indicates in his documents: "iron powder, Cond = 10 Sm for [14] , meaning that this powder has a very high-impedance, which means, it has a bad electric conductivity.

This isn't the specific electric conductivity of pure solid iron with  $\kappa = 10 \text{ m}/(\Omega \cdot \text{mm}^2)$  [ 8]. (For comparison purposes, E copper:  $\kappa = 56 \text{ m}/(\Omega \cdot \text{mm}^2)$ ).

See the different units of S/m or  $\text{m}/(\Omega \cdot \text{mm}^2)$ , which have in completely different dimensions.

### 2.12.1. Measuring construction

Our laboratory isn't designed to examine metallic material. However, to get an idea of the range of the electrical conductivity of iron powder (Mf 196 and GG 150), we used following measuring construction (see illus. 68).



Abb. 68

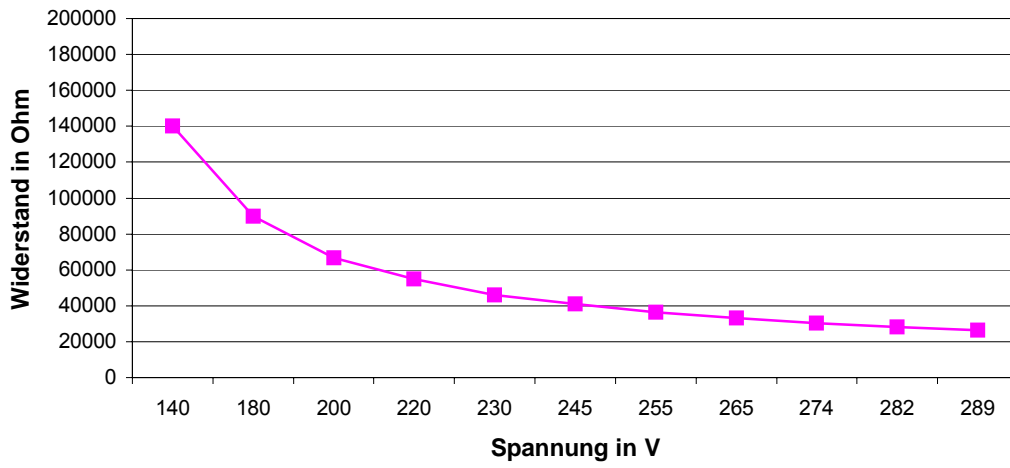
Illus. 68. shows two iron powder "hills". On the left side Mf196 on the right GG 150. The powder was easily stamped. The pad is non conducting carton. Two not insulated copper cables (each approx. 80 mm ) lead into each of these "hills". The distance of the copper cables within the hill amounts to approx. 30 mm.

### 2.12.2. Operation / results

Following test was carried out on each hill. Attached to the copper cables, a variable alternating voltage (0 to 280 V) with a frequency of 50 Hz . Simultaneously the current was measured and herewith a resistance  $R = U/I$  calculated.

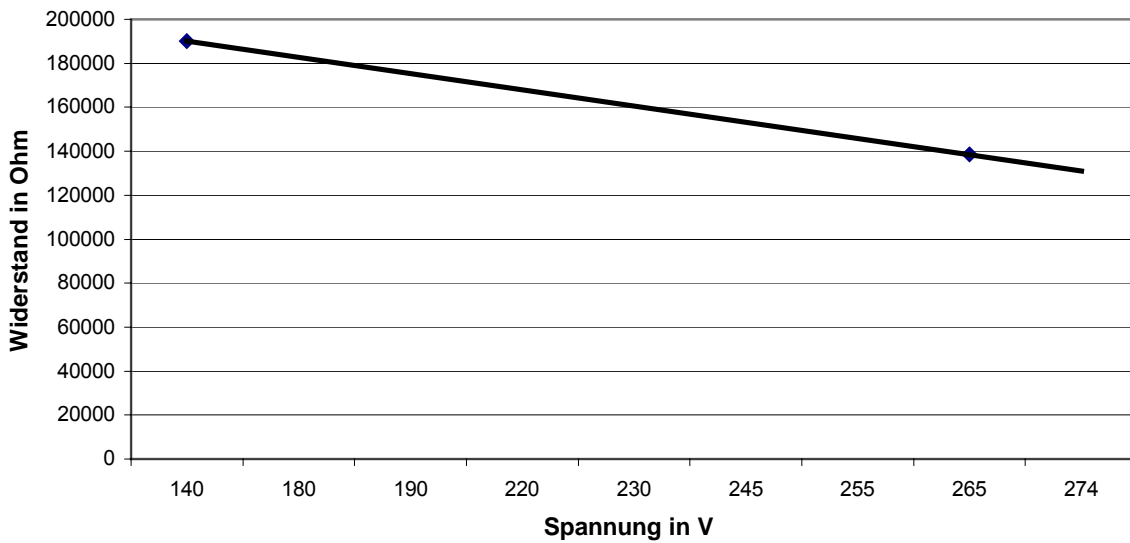
Following results were recorded. (see illus. 69 and illus. 70).

**Abhängigkeit des Wechselstromwiderstandes von GG 150-Pulver von der Spannungshöhe (bei 50 Hz)**



Illus. 69

**Abhängigkeit des Wechselstromwiderstandes von Mf 196-Pulver von der Spannungshöhe (bei 50 Hz)**



Illus. 70

**Result:**

Very low currents were flowing. Meaningful current sensing below 140 V wasn't possible, because of being out of the smallest measurement range of our current equipment.

While a current curve could be measured with the GG 150 powder, merely two usable measurements ( $1 \mu\text{A}$  at 190 V or  $2 \mu\text{A}$  at 277 V) resulted with the Mf 196 powder.

Even if this may be a big estimation, the two measuring rows show, that both the Mf 196 as well as the GG 150 powder has very high-impedance, meaning they have a very unfavourable conductivity (in consideration to solid iron). Reason being, that primarily the single grains oxidize.

**2.13. Reduction of the resonant frequency by external components.****2.13.1. Measuring construction**

We used the construction shown in item 2.11. (steel sheet shell casing, annealed, as a octagon. ELF antenna, round, cable diameter 8 mm, no insulation, cable not bundled, within the Mf 196 powder, original scale 1:1).

We switched different coils or coil combinations in series (see illus. 71 and illus. 72)

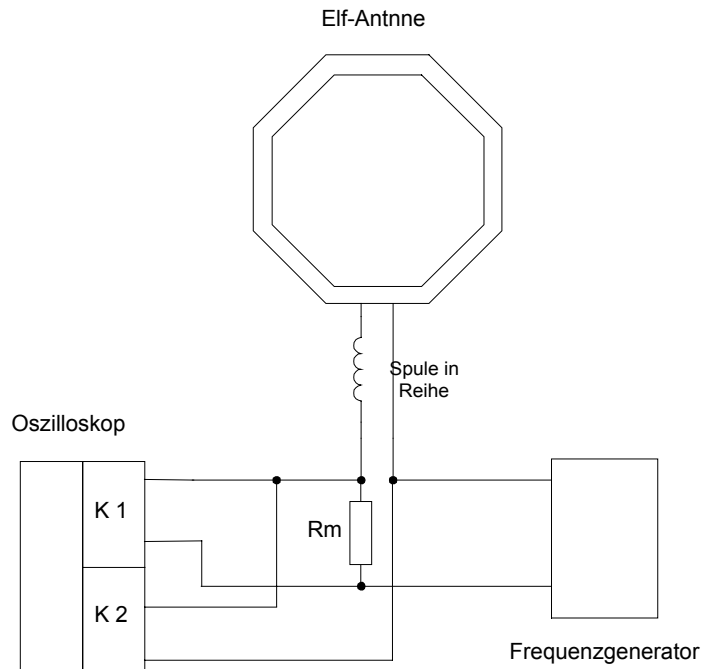
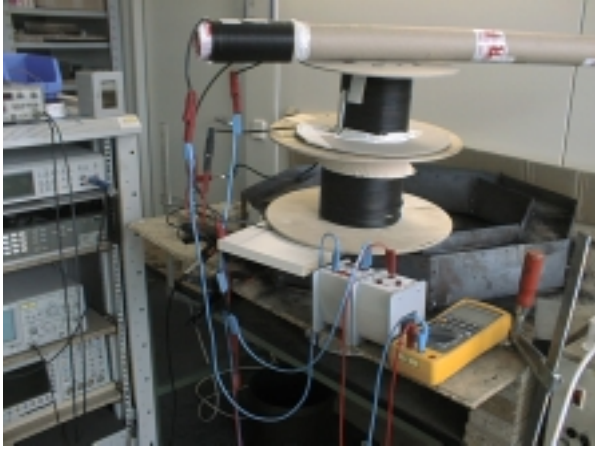




Abb. 71



Illus. 72

### 2.13.2. Operation / results

The inductivities of the individual coils were measured at 50 Hz.

1. Resonance without coil in series
2. Resonance with  $192\mu\text{H}$  in series
3. Resonance with  $198\mu\text{H}$  in series
4. Resonance with  $338\mu\text{H}$  in series
5. Resonance with  $497\mu\text{H}$  in series

Following results were recorded. (see illus. 73).

### Verminderung der Resonanzfrequenzen durch Reihenschaltung von Spulen

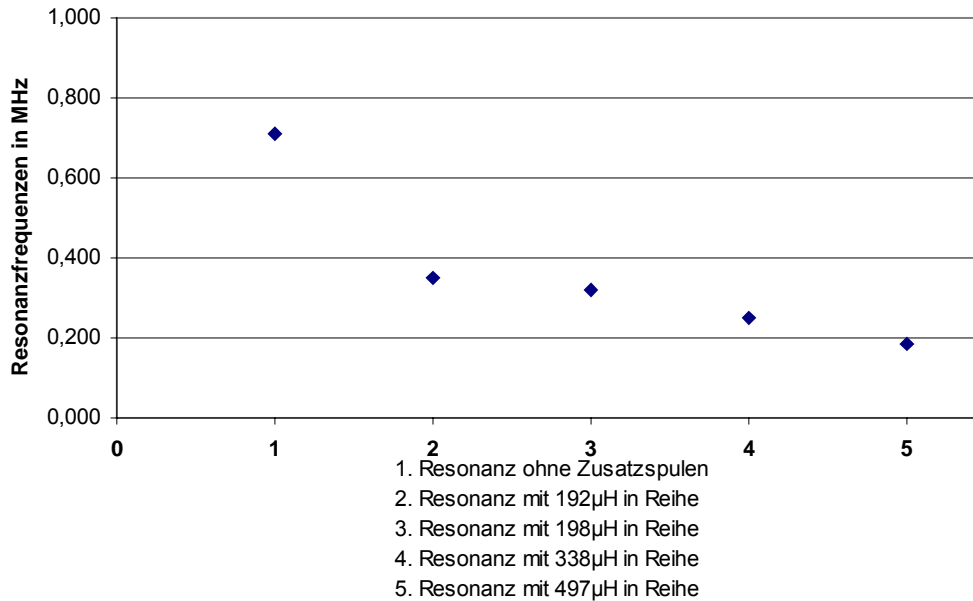


Abb. 73

#### Result:

The lowest – meaningful - resonance was measured at approx. 180 kHz. Below that the current rises were so low, that you couldn't talk about "resonance" any more.

With this method we didn't come close to the range of a resonant frequency of 60 Hz.

#### 2.14. Examination, whether between "the beginning and the end" of a dipole half time delay distortion appears.

##### 2.14.1. Measuring construction

With this examination we wanted to find out, if possibly time delay difference can be measured (signal), which fed at the beginning of a dipole half (oscilloscope channel K1) and at the end of this dipole half (that is in the iron powder) is worn off again (channel K2).

We used a model, scale 1:2, shell casing fabricated with cardboard, Mf 196 powder, varnished wire, no cable bundle, wire diameter 0.56 mm, hexagon construction (see illus. 74 and illus. 75).

The lowest resonant frequency of this construction was detected at 2.6 MHz .

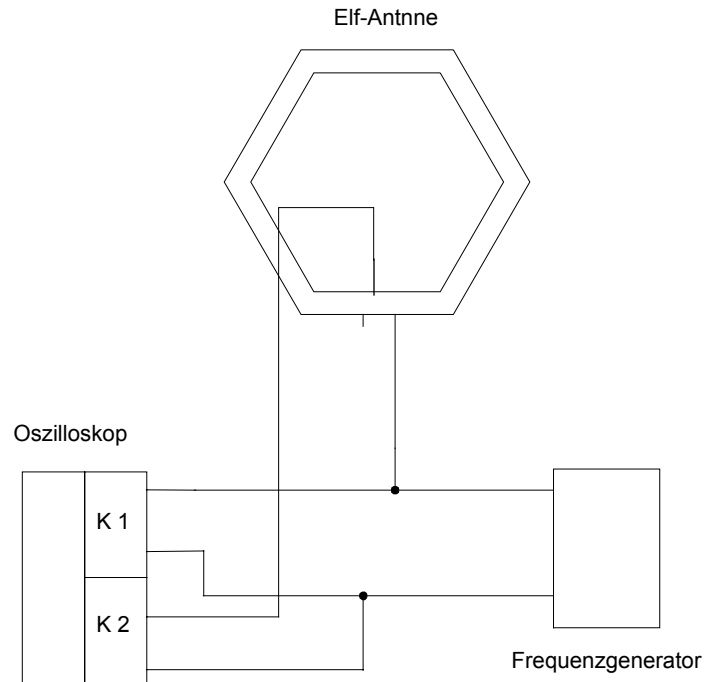


Abb. 74



Abb. 75

### 2.14.2. Operation / results

A rectangle signal,  $U = 10 \text{ V}$ ,  $f$  approx.  $150 \text{ kHz}$ , was supplied (see illus. 76 and illus. 77).

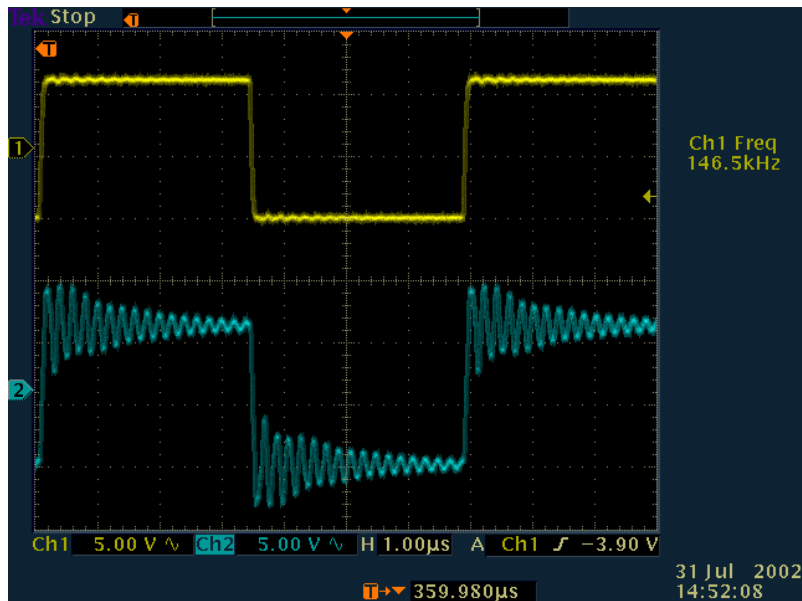


Abb. 76

The upper signal was at the beginning of the dipole half. The lower signal was measured at the "inner end" of the dipole half.

The fundamental frequency of the lower signal didn't show any phase shift toward the upper one. The interference vibrations of the lower signal, caused by the respective voltage jump at the entrance, showed a frequency of almost 5 MHz..

This being exactly double the size of the resonance of the system (approx. 2.6 MHz) we measured. Since we merely measured only one dipole half, the results are correct. Splitting a dipole, consequently is doubling the resonant frequency .

Next we **connected** the two ends of the two dipole halves. We measured like before, at the beginning of a dipole half and at the end ( in the middle of the ELF antenna).

Following are the measurements (see illus. 77):

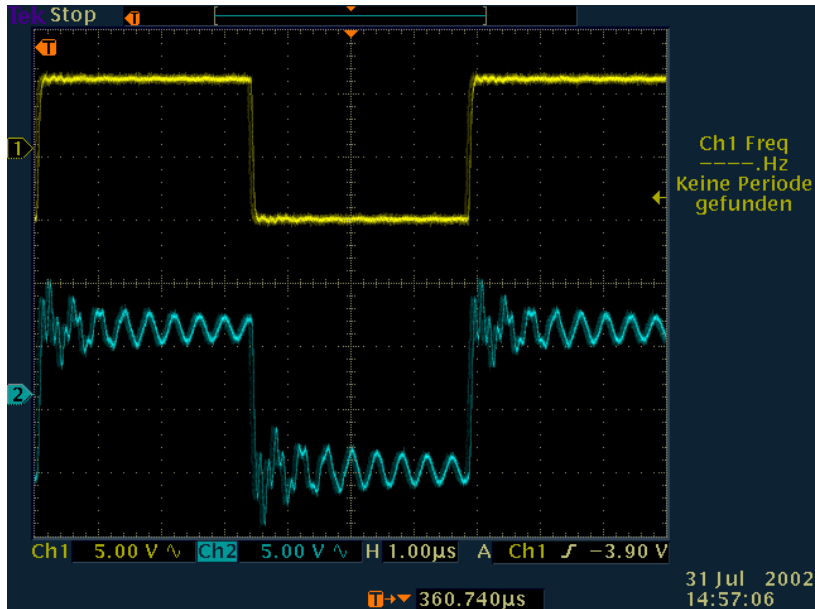


Abb. 77

The frequency of the superimposed vibration was now only halve, approx. 2.5 MHz. This wasn't surprising either, because double dipole length means halve of the frequency.

The slow decay of the superimposed vibrations is a good indicator, that there is almost no energy loss in the iron powder. Contrary to the statement made by Prof. De Aquino. If it would be true, that the ELF antenna is a good 60 Hz transmitter, you would expect, that a phase shift of  $\pi/2$  (or  $90^\circ$ ) occurs, because these values apply to a  $\lambda/4$  antenna.

**Our measurement results are far away from it.  
This ELF antenna cannot be a good transmitter.**

The connection at the dipole ends were removed again  
The frequency of the supplied signal was at 50 Hz. The signal was also measured at the end of the corresponding dipole half.

Following are the measurements see illus. 78):

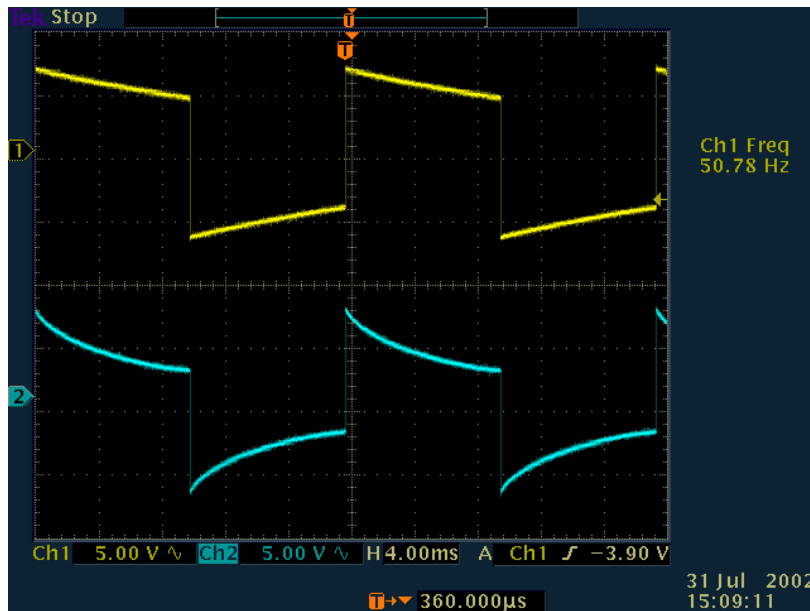


Abb. 78

In this case also was the upper signal the supplied one  
The lower one was measured at the "inner" end of the dipole half.

The "slope" of the input signal, (i.e. the deviation of the ideal rectangle) was caused by the sensing head of the oscilloscope.

No phase shift was recognized between the in and output signal.

### Result:

This confirms our suspicion, that the theory of Prof. De Aquino bears a fundamental error.

## 2.15. Examining the shielding behaviour of the shell casing

Prof. De Aquino points out in his publications, that the material of the shell casing (the shielding) absorbs the ELF waves "totally", especially if annealed iron is used [14].

We tried this out.

### 2.15.1. Measuring construction

We used the ELF antenna from test 2.2. (Cable cross-section of 25 mm<sup>2</sup>, insulation thickness 1.5 mm, round).

High magnetic field strengths are produced by high currents, therefore we connected the ends of the two dipole halves for this experiment. The two input clamps were connected to the welding transformer described at item 2.1.. To measure the current we used a current probe "Fluke i410".

To detect the 50 Hz magnetic field near the ELF antenna, a Gauss-meter, respectively

a Tesla meter "FW Bell 9950" with a measuring probe "STA99 0404" (frequency area: DC to 50 kHz) was used. The probe was placed within a defined distance and angle, in different places near the ELF antenna, to measure the maximum of the magnetic field strength (see illus. 79).

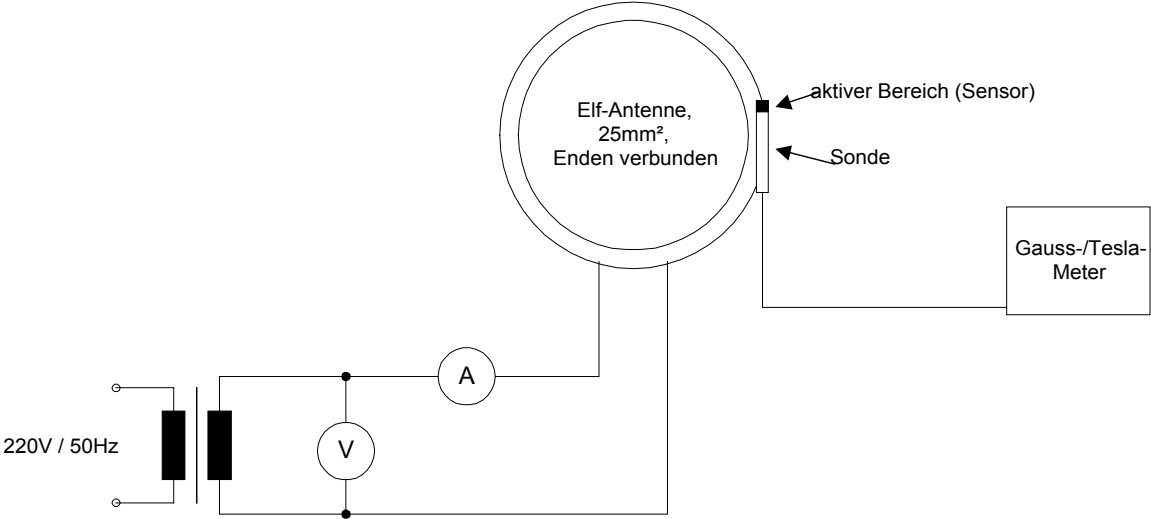


Abb. 79

We carried out measurements at the ELF antenna in air (see illus. 80 and illus. 81).

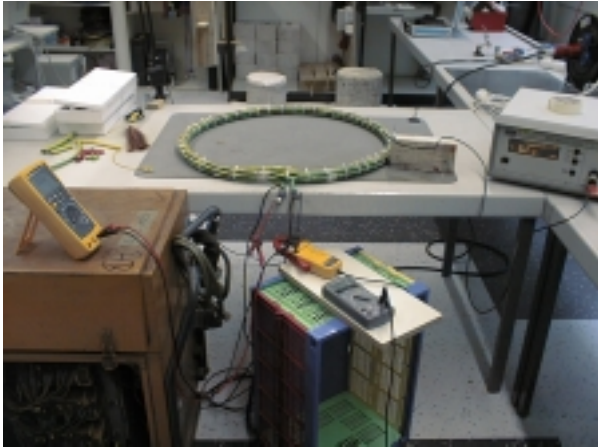


Abb. 80

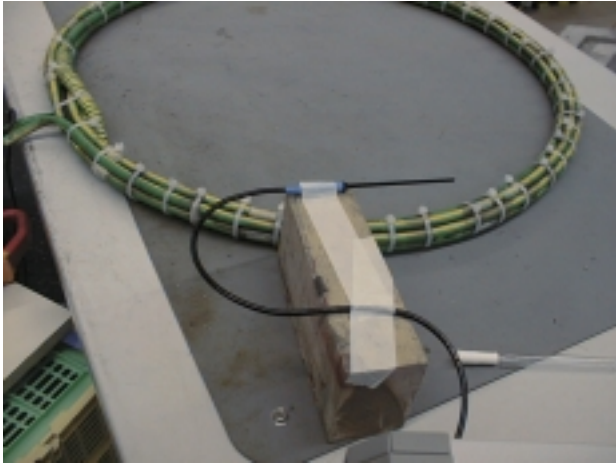


Abb. 81

The ELF antenna was then "packed" together with MF 196 powder into the annealed steel sheet shell casing , we repeated the magnetic field measurements. Close attention was paid, that distance and angle of the probe to the ELF antenna (not to the metal shell casing) exactly corresponded to previous measuring in air.

### **2.15.2. Results**

Through the short circuited ELF antenna with connected ends (in air) a current of 365A ran through, with secondary voltage of the welding transformer of 6.1 V. We measured with the magnetic field probe (in several places with a same, relative distance and angle to the ELF antenna) a magnetic 50 Hz alternating field with an average of 5.3 mT (milli-Tesla)

If the ELF antenna was, however, in the annealed steel sheet shell casing with MF 196 powder, a considerably lower current of approx. 250 A at 15.9 V ran through. The construction, laying on a mechanical scales (like illus. 7) kept its weight of 52.5 kg without any change. The magnetic field measurements had an average value of 4.6 mT.

### **Result:**

According to the Prof. De Aquino the magnetic field should "completely "absorbed in the torus.[14]." As the tests revealed, this isn't the case.

We decided to examine the "shielding " behaviour of different materials closer

## **2.16. Examination of the shielding behaviour of different materials**

### **2.16.1. Measuring construction**



We utilized:

- Cardboard of 8 mm strong
- MU metal sheet 0.5 mm strong
- Iron square pipe 1.5 mm strong, inside crosscut 22 mm x 22 mm
- Iron pipe (round) 2.8 mm strong, inside diameter 14.4 mm

The cardboard as well as the MU sheet metal were tilted so that the inside crosscut corresponded with the square tube (see illus. 82).

The length of all parts was 170 mm.

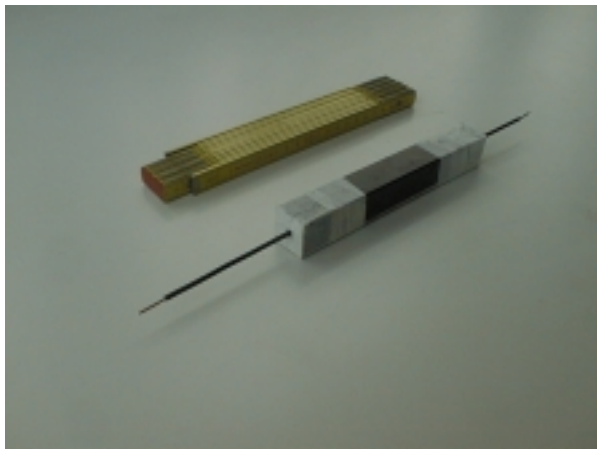


Abb. 82

In the middle was an insulated copper cable each ( $1.5 \text{ mm}^2$ ).

The measuring were carried out with and without Mf 196 powder, as well as with direct and alternating current (at different frequencies).

The probe was so placed, that the active part (the real sensor) was always positioned in the same distance to the copper cable, at the "outer skin" of the examined material placed in half length.

The magnetic field lines hit the sensor with an angle of  $90^\circ$  (see illus. 83 and illus. 84).

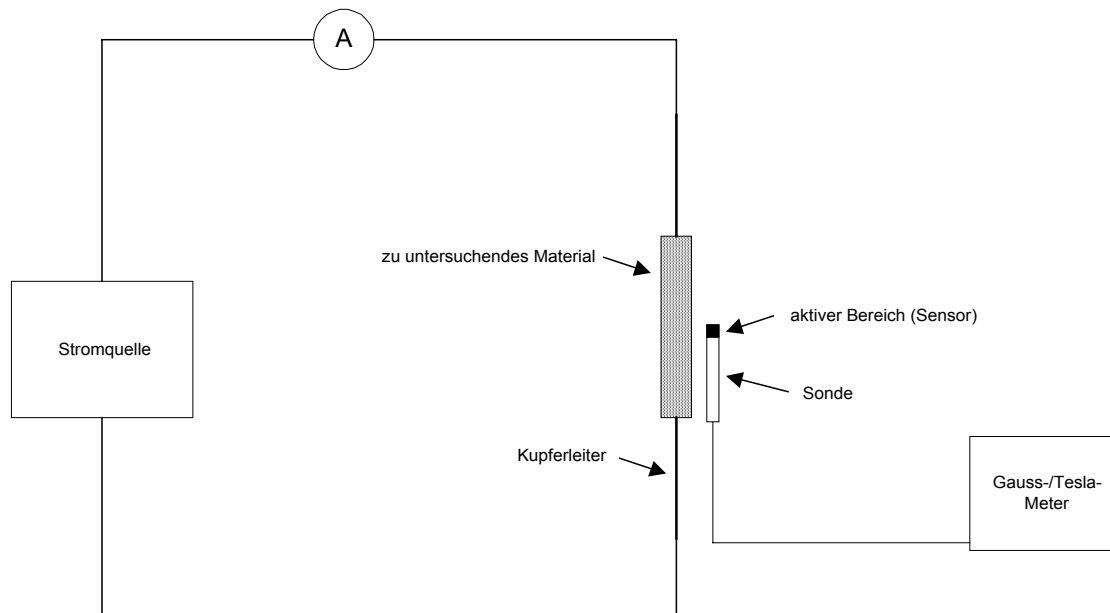


Abb. 83



Abb. 84

## 2.15.2.Results

Following results were recorded.(see illus. 85 to 90).

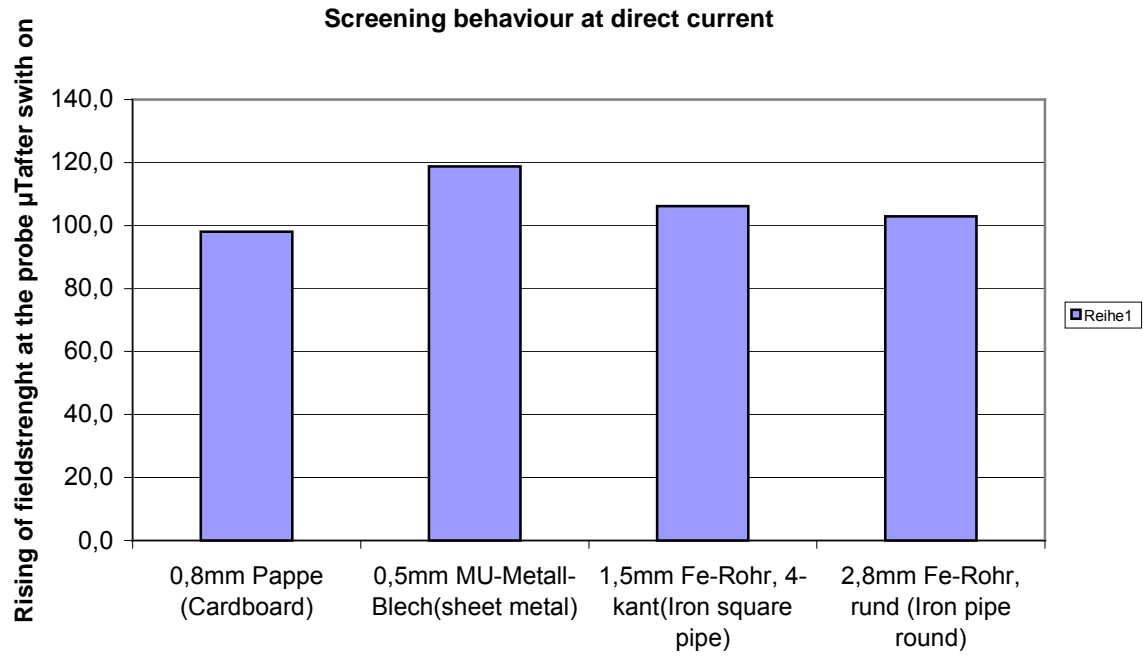


Abb. 85

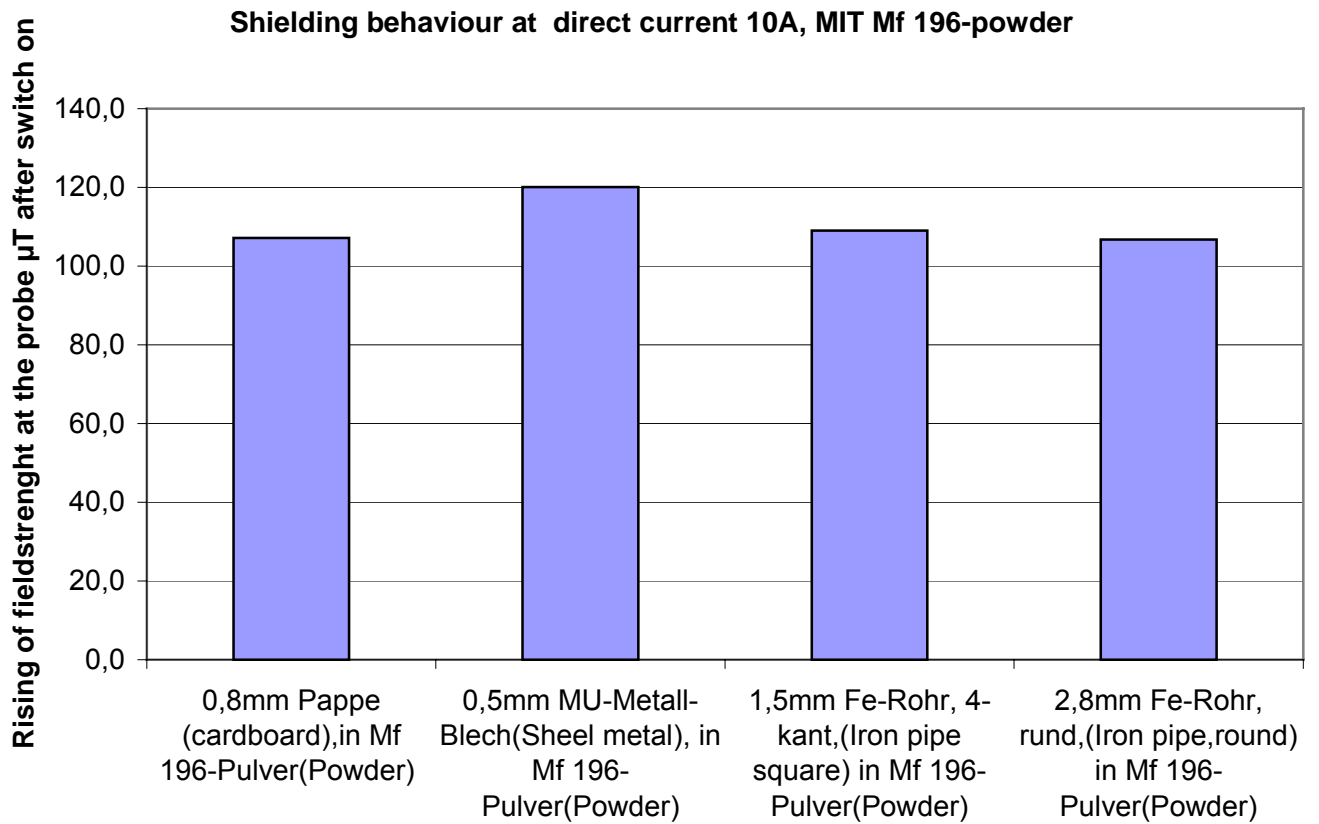


Abb. 86

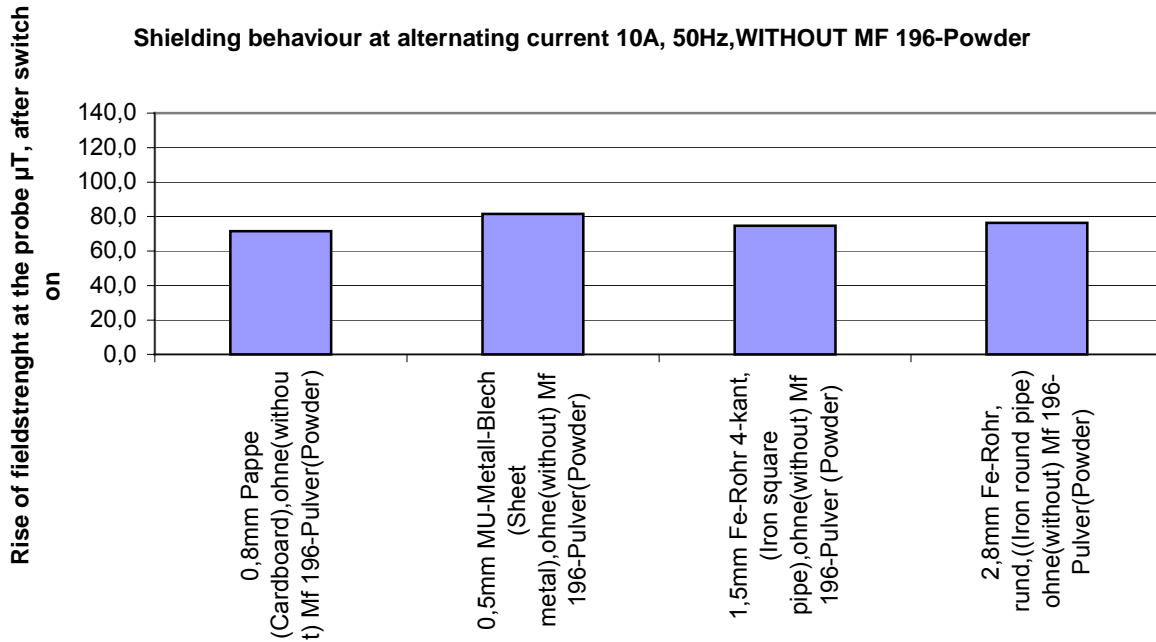


Abb. 87

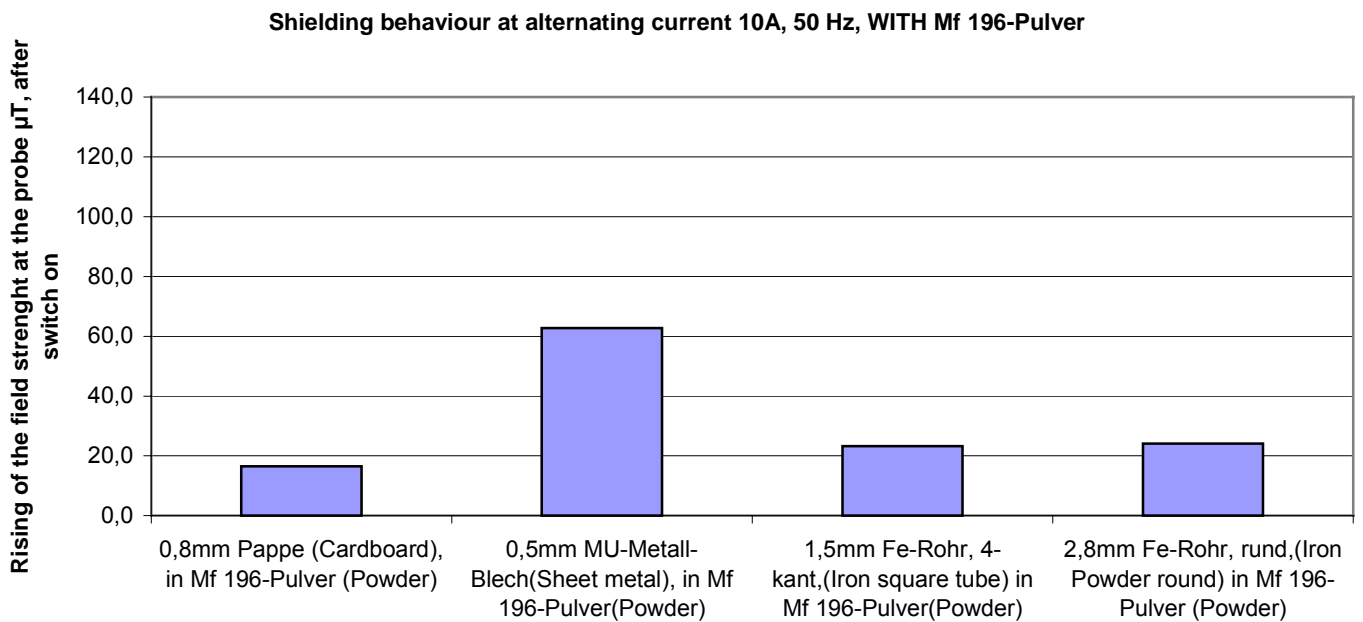


Abb. 88

Striking at this point the behaviour of the MU sheet metal filled with Mf 196 powder.

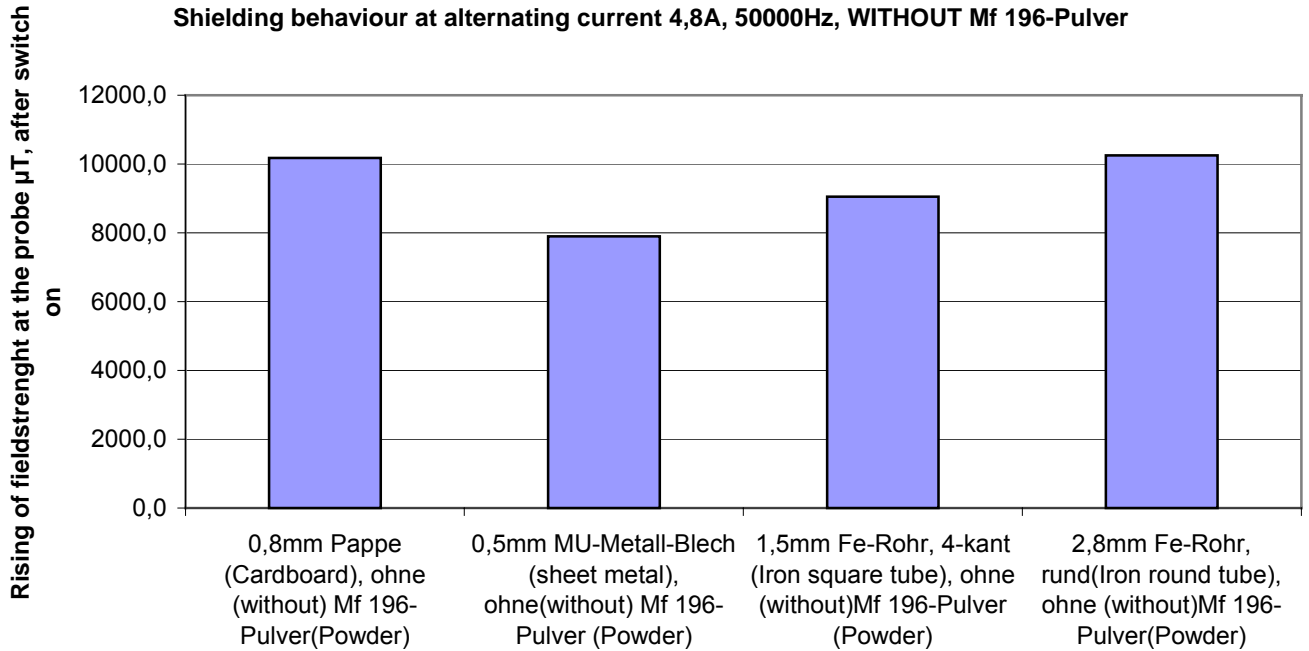


Abb. 89

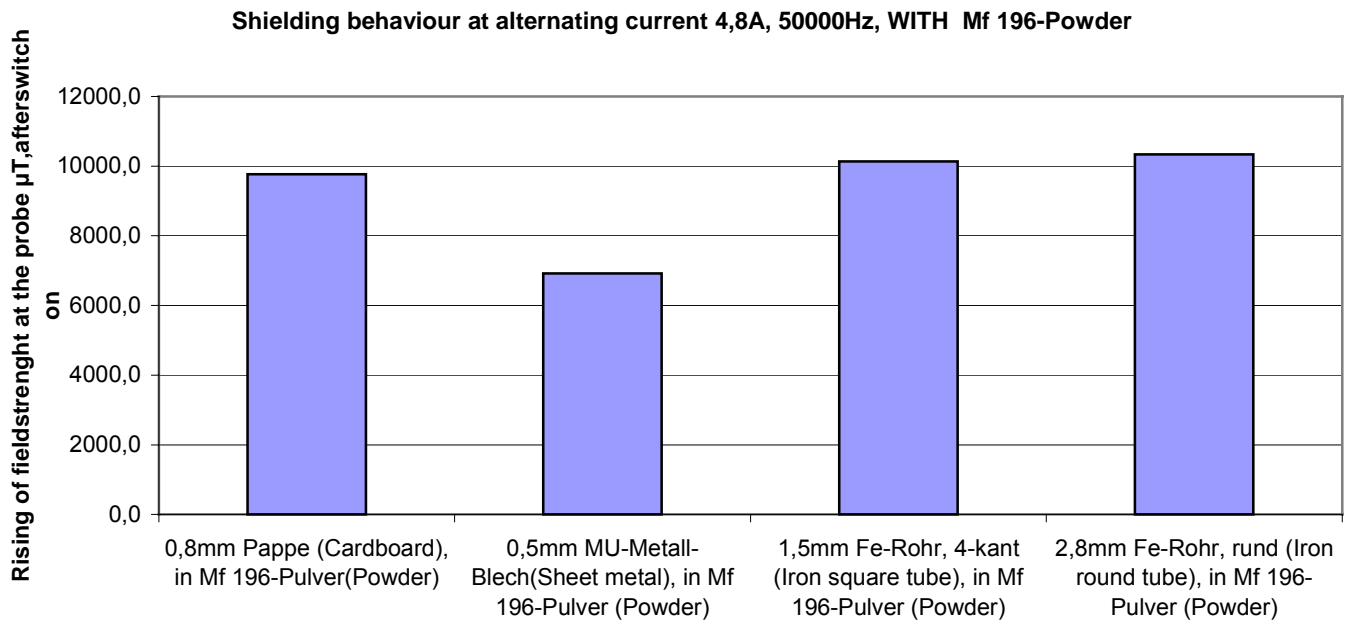


Abb. 90

### **Result:**

No considerable shielding behaviour can be diagnosed during the shielding with iron. No matter if, with direct current , 50 Hz alternating current or 50000 Hz alternating current, the readings of the iron are very close to those of the cardboard,(sometimes even slightly above)

The shielding behaviour of MU metal only works (in this case at 50000 Hz clearly recognizable) at higher frequencies.

At direct current and 50 Hz alternating current, the MU sheel metal seems to be even "amplifying".

### **3 Summary**

Unfortunately, do we have to say, the System G, as describes by Prof. De Aquino, can **not** operate.

We have examined many parameters and constantly optimised the parameters.

Primarily we worked with:

- the thickness of the copper cable
- the thickness of the insulation of the copper cable
- copper cable without insulation
- the type of the iron powder
- the pouring density of the iron powder (shaken loosely, pressed)
- transfer of the copper cables as bundle (loose/firm) or with distance
- the material of the shielding (of the shell casing)
- the annealing of the shielding (iron)
- the scale of the models
- the form of the construction (circular or hexagonal)

The lowest resonant frequency however, still lies 4 (in words four ) decades above the 60 Hz , stated by Prof..De Aquino. Also **no weight reduction** was measurable.

The following table and chart give a general view of the most significant experiments and the resonant frequencies reached:

Test no. 46 (point 2.11) shows the lowest resonance frequency (710 kHz). Test no. 46 (point. 2.11) corresponds "almost exact" to those specifications given by Prof. De Aquino.

All though with bare, not insulated copper cable. Test No. 44 (point 2.10) has the same construction, all though with varnish isolated copper cable. The measured resonant frequency (830 kHz) is slightly higher.

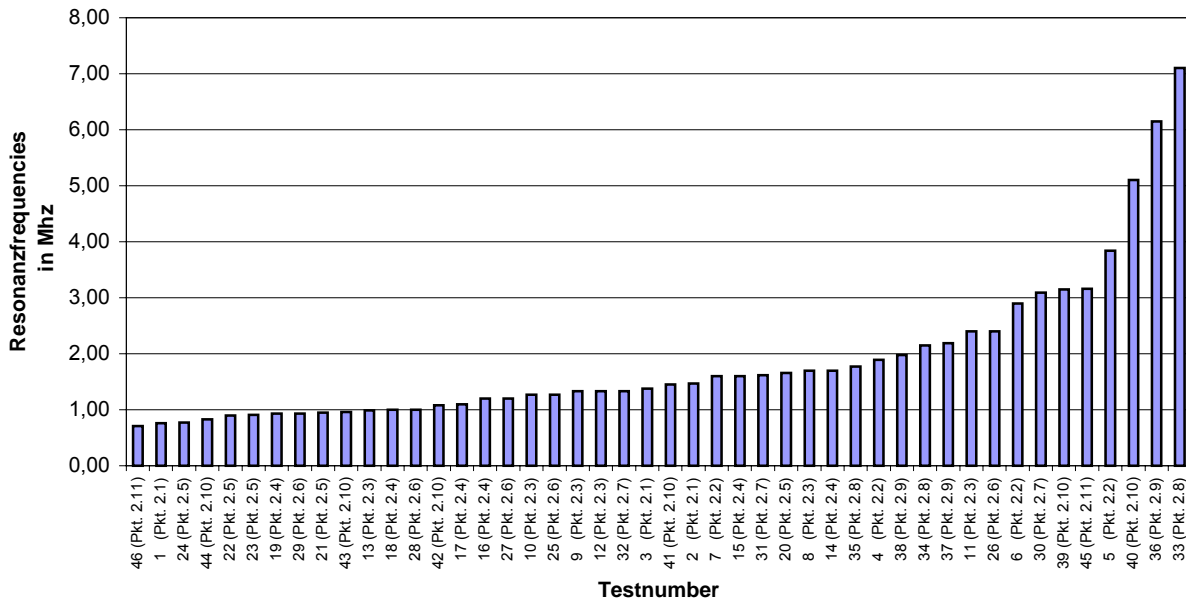
<b>Test No.</b>	<b>The construction</b>	<b>lowest Res.Freq ./MHz</b>
1 ( pnt. 2.1)	Sheet iron torus, hexagon, shaken, annealed in Mf 196 powder, cable diameter 12 mm, scale 1:1, insulation thickness 0.08 mm, bundled	0.76
2 ( pnt. 2.1)	Sheet iron torus, hexagon, shaken, annealed in Mf 196 powder, cable diameter 12 mm, scale 1:1, insulation thickness 2 mm, bundled before pressing	1.47
3 ( pnt. 2.1)	Sheet iron torus, hexagon, shaken, annealed in Mf 196 powder, cable diameter 12 mm, scale 1:1, insulation. 2 mm after pressing with 30 t, bundled	1.38
4 ( pnt. 2.2)	Steel torus, round, in air, outside the torus, cable cross-sectional area of 25 mm <sup>2</sup> , scale 1:1, insulation thickness 1.5 mm, bundled	1.89
5 ( pnt. 2.2)	Steel torus, round, in air, within the torus, cable cross-sectional area of 25 mm <sup>2</sup> , scale 1:1, insulation thickness 1.5 mm, bundled	3.84
6 ( pnt. 2.2)	Steel torus around in Mf 196 powder, cable cross-sectional area of 25 mm <sup>2</sup> , scale 1:1, insulating thickness 1.5 mm, bundled	2.90
7 ( pnt. 2.2)	Steel torus round, rattled in Mf 196 powder, cable cross-sectional area of 25 mm <sup>2</sup> , scale 1:1, insulation 1.5 mm, bundled	1.60
8 ( pnt. 2.3)	Steel torus, round, in air, outside the torus, cable cross-sectional area of 25 mm <sup>2</sup> , scale 1:1, insulation 0.1 mm, bundled	1.70
9 ( pnt. 2.3)	Steel torus, round, in air, outside the torus, cable cross-sectional area of 25 mm <sup>2</sup> , scale 1:1, insulation 0.1 mm, bundled, with 50 cable fasteners fixed,	1.33
10 ( pnt. 2.3)	Steel torus, round, in air, outside the torus, cable cross-sectional area of 25 mm <sup>2</sup> , scale 1:1, insulation 0.1 mm, bundled, with 100 cable fasteners fixed,	1.27
11 ( pnt. 2.3)	Steel torus around, in air, in the torus, cable cross-sectional area of 25 mm <sup>2</sup> , scale 1:1, insulation 0.1 mm, bundled, with 100 cable fasteners fixed,	2.40
12 ( pnt. 2.3)	Steel torus around in Mf 196 powder, cable cross-sectional area of 25 mm <sup>2</sup> , scale 1:1, insulation 0.1 mm, bundled, with 100 cable fasteners fixed,	1.33
13 ( pnt. 2.3)	Steel torus round, rattled in Mf 196 powder, cable cross-sectional area of 25 mm <sup>2</sup> , scale 1:1, insulation 0.1 mm, bundled, with 100 cable fasteners fixed,	0.99
14 ( pnt. 2.4)	Pvc torus, round, in air, outside the torus, cable cross-sectional	1.70



	area of 25 mm <sup>2</sup> , scale 1:1, bundled, insulating thickness 0.1 mm, d	
15 ( pnt. 2.4)	Pvc torus, round, in air, in the torus, cable cross-sectional area of 25 mm <sup>2</sup> , scale 1:1, insulation 0.1 mm, bundled	1.60
16 ( pnt. 2.4)	Pvc torus around in Mf 196 powder, cable cross-sectional area of 25 mm <sup>2</sup> , scale 1:1, insulation 0.1 mm, bundled	1.20
17 ( pnt. 2.4)	Pvc torus around in Mf 196 powder shaken, cable cross-sectional area of 25 mm <sup>2</sup> , scale 1:1, insulation 0.1 mm, bundled	1.10
18 ( pnt. 2.4)	Pvc torus round, rattled in Mf 196 powder, cable cross-sectional area of 25 mm <sup>2</sup> , scale 1:1, insulation 0.1 mm, with package cord fixed, bundled	1.00
19 ( pnt. 2.4)	Pvc torus around in Mf 196 powder shaken, cable diameter. 25 mm <sup>2</sup> , scale 1:1, insulation 0.1 mm with package cord fixed, bundled, 1.5 t pressing pressure	0.93
20 ( pnt. 2.5)	PU torus around, in air outside the torus, cable cross-sectional area of 90 mm <sup>2</sup> , scale 1:1, insulation 1.6 mm, bundled	1.66
21 ( pnt. 2.5)	PU torus around in Mf 196 powder, cable cross-sectional area of 90 mm <sup>2</sup> , scale 1:1, insulation 1.6 mm, bundled	0.95
22 ( pnt. 2.5)	PU torus around in Mf 196 powder shaken, cable cross-sectional area of 90 mm <sup>2</sup> , scale 1:1, insulation 1.6 mm, bundled	0.90
23 ( pnt. 2.5)	PU torus around in Mf 196 powder shaken, cable cross-sectional area of 90 mm <sup>2</sup> , scale 1:1, insulation 1.6 mm, bundled, 1.5 t pressing pressure	0.91
24 (Pkt. 2.5)	PU torus around in Mf 196 powder shaken, cable diameter. 90 mm <sup>2</sup> , scale 1:1, insulation 1.6 mm, bundled, 1 day after filling of 1.5 l with spirit	0.77
25 ( pnt. 2.6)	Steel torus, round, in air, outside the torus, cable cross-sectional area of 25 mm <sup>2</sup> , scale 1:1, insulation 0.1 mm, with 100 cable fasteners fixed, bundled	1.27
26 ( pnt. 2.6)	Steel torus, round, in air, in the torus, cable cross-sectional area of 25 mm <sup>2</sup> , scale 1:1, insulation 0.1 mm, with 100 cable fasteners fixed, bundled	2.40
27 ( pnt. 2.6)	Steel torus around in GG 150 powder, cable cross-sectional area of 25 mm <sup>2</sup> , scale 1:1, insulation 0.1 mm, with 100 cable fasteners fixed, bundled	1.20
28 ( pnt. 2.6)	Steel torus round, rattled in GG 150 powder, cable cross-sectional area of 25 mm <sup>2</sup> , scale 1:1, insulation 0.1 mm, with 100 cable fasteners fixed, bundled	1.00
29 ( pnt. 2.6)	Steel torus around in GG 150 powder shaken, cable diameter 25 mm <sup>2</sup> , scale 1:1, insulation 0.1 mm joint, with 100 cable fastened, fixed with 0.3 l of water	0.93
30 ( pnt. 2.7)	Cardboard torus, 6th corner, into air outside the torus, leader diameter 1.5 mm, scale 1:2, bundled, varnish insulated	3.09
31 ( pnt. 2.7)	Cardboard torus, hexagon in Mf 196 powder, cable diameter 1.5 mm, scale 1:2 varnish insulation, bundled	1.62
32 ( pnt. 2.7)	Cardboard torus, 6th corner, in Mf 196 powder easily stamped,	1.33

	cable diameter 1.5 mm, scale 1:2, bundled, varnish insulation .	
33 ( pnt. 2.8)	Cardboard torus , round , in air outside the torus, cable diameter 1.5 mm, scale 1:2, not bundled, varnish insulated	7.10
34 ( pnt. 2.8)	Cardboard torus around in Mf 196 powder, cable diameter 1.5 mm, scale 1:2, not bundled, varnish insulated	2.15
35 ( pnt. 2.8)	Cardboard torus around in Mf 196 powder, easily stamped, diameter 1.5 mm, scale 1:2, not bundled, varnish insulated	1.77
36 ( pnt. 2.9)	Cardboard torus around into air outside the torus, cable diameter 1.5 mm, scale 1:2, insulation 1.5 mm, not bundled	6.15
37 ( pnt. 2.9)	Cardboard torus around in Mf 196 powder, cable diameter 1.5 mm, scale 1:2, insulation 1.5 mm, not bundled	5.2.19
38 ( pnt. 2.9)	Cardboard torus around in Mf 196 powder, easily stamped, cable diameter 1.5 mm, scale 1:2, insulation 1.5 mm, not bundled	1.98
39 ( pnt 2.10)	Sheet iron torus in air, outside the torus, cable diameter 8 mm, scale 1:1, not bundled, varnish insulation	3.15
40 (pnt. 2.10)	Sheet iron torus, insulation varnish ,in air, in the torus, cable diameter 8 mm, scale 1:1, , not bundled, lid open	5.10
41 (pnt. 2.10)	Sheet iron torus insulation varnish in loose Mf 196 powder, leader diameter 8 mm, scale 1:1, open, not bundled, lid	1.45
42 (pnt. 2.10)	Sheet iron torus insulation varnish, in Mf 196 powder easily stamped, cable diameter 8 mm, scale 1:1, not bundled, lid open	1.08
43 (pnt. 2.10)	Sheet iron torus stamped easily into Mf 196 powder, cable diameter 8 mm, scale 1:1 varnish insulation, not bundled lid open	0.96
44 (pnt. 2.10)	Sheet iron torus, annealed, stamped easily into Mf 196 powder, cable diameter 8 mm, scale 1:1 varnish insulation, not bundled, lid closed	0.83
45 (pnt. 2.11)	Sheet iron torus outside the torus, cable diameter 8 mm, scale 1:1, annealed in air, no insulation, not bundled	3.16
46 (pnt. 2.11)	Sheet iron torus, annealed, stamped easily into Mf 196 powder, cable diameter 8 mm, scale 1:1, not insulated, not bundled, lid closed.	0.71

Test sorted by raising resonanzfrequencies



Parallel to our examinations, we did further enquiries and built up contacts to persons, that deal with this topic (e.g. J. L. Naudin, [for http://members.aol.com/jnaudin509/](http://members.aol.com/jnaudin509/) ).

We have contacted a person who knows Prof. De Aquino for quite some time, we exchanged with him our knowledge of Prof. De Aquino System G. (Name and contact mail address are known by us).

We were informed by him, that Prof. De Aquino has developed the System G theory, but a physically working System -G was probably never built.

This being the reason that no photos or videos of the System G exist.

He also takes into considerations that the theoretical view of Prof. De Aquinos System G bears errors. He claims that the atomic mass of the iron must be indicated in kg instead of g. This error has been corrected in the later developed theory of the System H.

We have also discovered **further** inconsistencies in his theory.

For example, there is a commonly known “formula” for “loss – free transmission wires”. in existence for many years

$$R(\text{start}) = [R(\text{end}) \cdot \cos(k) + j \cdot Z \cdot \sin(k)] / [\cos(k) + j \cdot R(\text{end}) \cdot \sin(k) / Z] = Z \cdot [R(\text{end}) / Z + j \cdot \tan(k)] / [1 + j \cdot R(\text{end}) \cdot \tan(k) / Z]$$

where  $k = 2 \cdot \pi \cdot \text{length} / \lambda$  and  $Z$  = a characteristic impedance of the cable  
 Typical values for  $Z$  are / in the area of 10 Ohms to 800 Ohms. Values outside this area

are hard to reach. R (end) is the terminating resistor of the transmission cable and R (start) the transformed value of the transmitter of the other end of the cable.

In free space,  $\lambda$  bei 60 Hz, 5000 km.

According to Prof. De Aquinos formula it results in a value of approx. 15 m.

This indicates a factor of 336 000. **Absolutely "gigantic"!**

Related to the actual permeability of approx.  $75 * \mu_0$ , a wavelength of  $\lambda(\text{real}) = \lambda / \sqrt{75} = 577 \text{ km}$  would be expected.

Way to long for the short cable in the System G.

With the above-mentioned formula you receive  $k = 2 * \pi * 12\text{m} / 577\ 000 \text{ m} = 1.3 * 10^{-4}$

You can assess that  $\cos(k) = 1,0000$  and  $\sin(k) = 1.310^{-4}$ .

With a typical value of  $Z = \text{approx. } 30 \Omega$  and a insulation resistance of  $300\ 000 \Omega$  at the end, you receive:

$$R(\text{start}) = [30 * 10.000 + j * \tan(1.3 * 10^{-4})] / [1 + j * 10.000 * \tan(1.3 * 10^{-4})] \text{ Ohm} = (3700 - 4800 j) \text{ Ohm.}$$

It can be realised on 60 Hz with a resistance of  $3700 \Omega$ , in series with a  $550 \text{ nF}$  condenser. If a voltage source of approx.  $24 \text{ V}$  is used, it is impossible that more than a few milli amps flow through this arrangement.

If a higher value of the insulation resistance is assumed, the R (end) transformed is even higher.

**It remains to be a puzzle, how such currents can take place within the range of 100 A to 200A!**

#### 4. Error analysis

To minimize the influence of changing environmental conditions to the measuring results, we pay close attention, that measurements on the measuring arrangements were performed at the same place, as well as with the same equipment and measuring cables.

We differed from it only in few exceptional cases, e.g. the concreted torus which was simply to heavy for the measuring table.

All measurements were carried out at room temperature (20 degrees Celsius to 23 degrees

Celsius) with a humidity in the area of 60% to 70%.

We paid close attention, that no falsifications of the measurement, resulting in missing galvanic separation, or faulty shielding of the measuring cables appeared (see 2.1.6.). Measuring equipment and sensors that we used (see 4.1.) comply with high and highest industrial standards.

You can request information relating to precision classes or tolerances at the IGF.

#### 4.1. Used equipment

- Function generator	Hameg HM 8030
- RCL meter	Fluke PM6304
- Synthesized signal generator/signal source	Fluke 6062 ares
- Oscilloscope (4 channel)	Tektronix TDS 3054
- Oscilloscope (2 channel)	Voltcraft 630
- Adjustable direct current source	Delta ElectroniK SM 35-45
- Gauss-/ Tesla meter	F. W. Bell series 9950
- RMS multi-meter	Fluke 89 IV
- Multi-meter	Voltcraft 2010
- Multi-meter	Voltcraft ME 42
- ampere-meter	Fluke i410
- Multi-meter	Green Multimeter VC 200
- NF power amplifier	Accusound pro 100
- Sweat transformer	Röwag KGL 200
- Digitalcamera	Epson Photo PC 600
- Process control computer	Kinzinger Hydra
- Laboratory PC	Dell OptiPlex GX1

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## **6. Note of thanks**

We would like to thank Fa. Wagon Automotive GmbH in Waldaschaff , particularly Robert Schreck, Kurt Englert, Dieter Fersch and Helmut Zentgraf for providing us, free of charge, the hydraulic press including the operation of the press.

Our special thanks go to Mr. Steve Burns who willingly answered our questions.

## **7. Critical comments**

Unfortunately, do we also have to address some critical words to Prof. De Aquino. He received a complete copy of this final report. We asked for his statement and indications of possible mistakes that could have taken place during the series of our experimental work.

Till now no statement has been made on his part.

Waldaschaff, November 27th, 2002

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