Despite the galvanic termination, the energy of the electromagnetic waves demands consideration, too. Conventional oil stable EM absorbers and ferrite plates are suited for attenuating EM waves in the GHz range and are attached at the cell's termination wall, see Fig. 7.

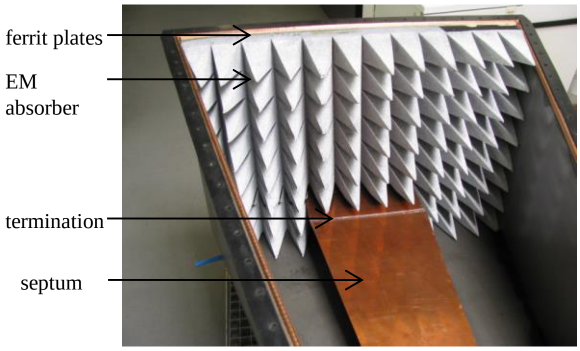

Fig. 7. Oil-filled GTEM cell (interior view)

H. Manufacturing of GTEM Cell

With the design shown in this contribution an oil-filled GTEM cell (Fig. 8) has been manufactured and can now be used for AF determination of UHF sensors for UHF PD measurement at power transformers.

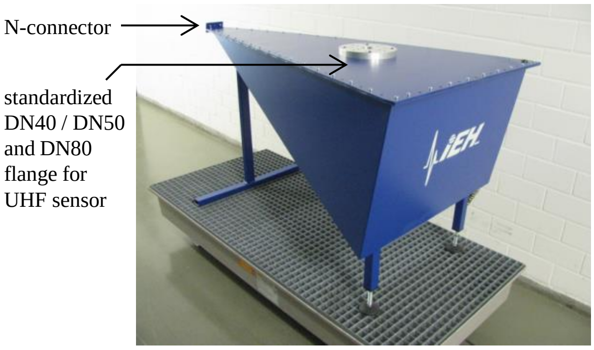

Fig. 8. Oil-filled GTEM cell

IV. CONCLUSION

Electrical and UHF measurement are influenced by the actual level of the PD source, the signal attenuation in the coupling path, the sensor sensitivity and the sensitivity of the measurement device. Because electric measurement equipment (coupling capacitors and quadrupole) can be calibrated it is suited for routine tests. To become a comparable method, UHF needs standardization of its measurement equipment: UHF antennas require calibration or at least a validation of their sensitivity. Therefore, the antenna factor needs to be determined under reproducible conditions which also meet inside-transformer conditions in the UHF frequency range (300 MHz – 3 GHz). To consider the radio frequency properties of the insulation inside transformers an oil-filled GTEM cell is designed to meet 50 Ohm conditions for measurement purposes. The cell provides a test volume with known electric and magnetic field strength and far-field conditions using the TEM mode. The test volume must be chosen according existing typical antenna sizes and geometries. Using this setup, the antenna factor of any UHF sensor can be determined in oil to characterize the sensor. Hence, an evaluation of the sensor quality and its performance in comparison can be made. The test setup has to be compatible for various systems like drain valve mounted sensors and plate sensors which are integrated directly into transformer tank walls. A standard setup like the presented approach provides comparability and can therefore be valuable for the UHF measurement to become an accepted method for transformer diagnostics and monitoring.

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