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2016 CIGRE-IEC Colloquium
May 9-11, 2016
Montréal, QC, Canada

The development of large potential shields for UHVDC application

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From HVDC to UHVDC:

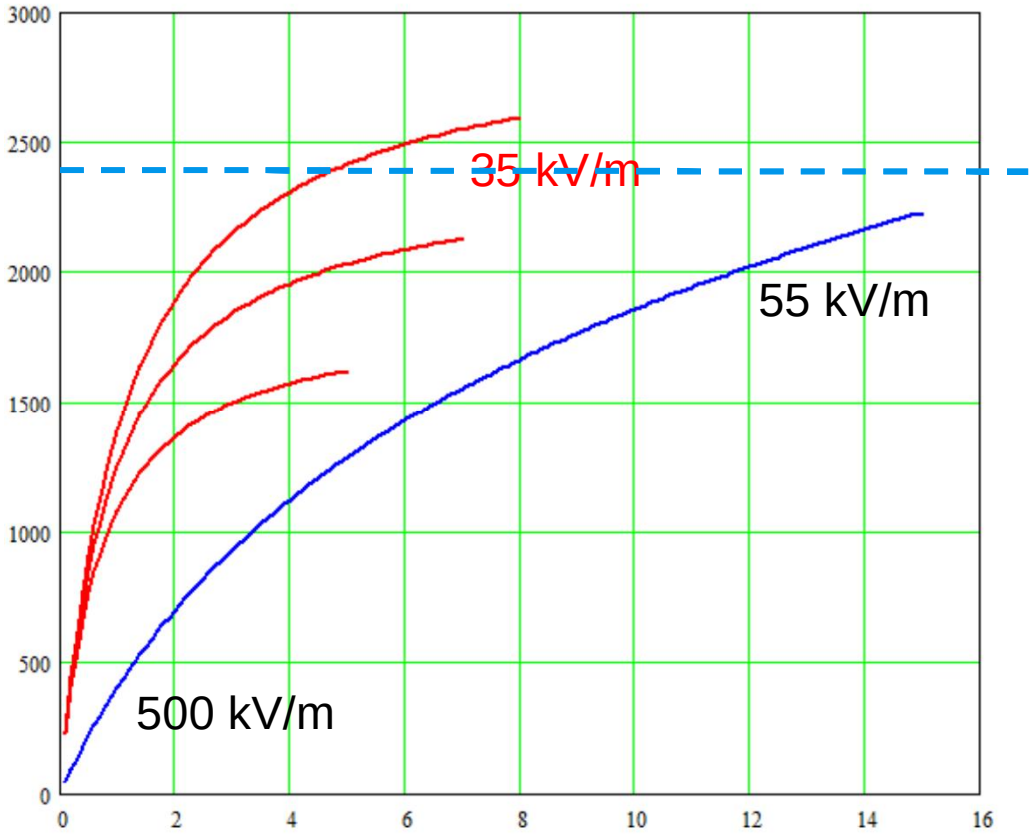
A significant increase of stress level and test voltage:

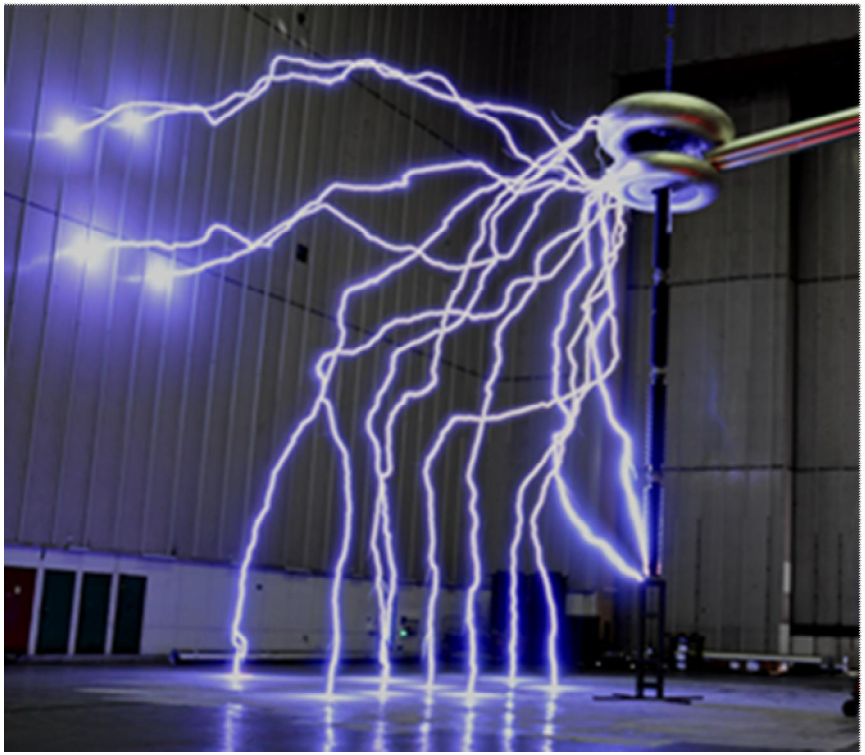
DC pole voltage (kV)	500	800 (+60%)	1100 (+37.5%)
SIWV (kV)	1100	1600 (+45%)	2100 (+31%)
U_{50} for SI (kV)	1250	1820	2390
Max. test SI, ca (kV)	1400	2038	2677

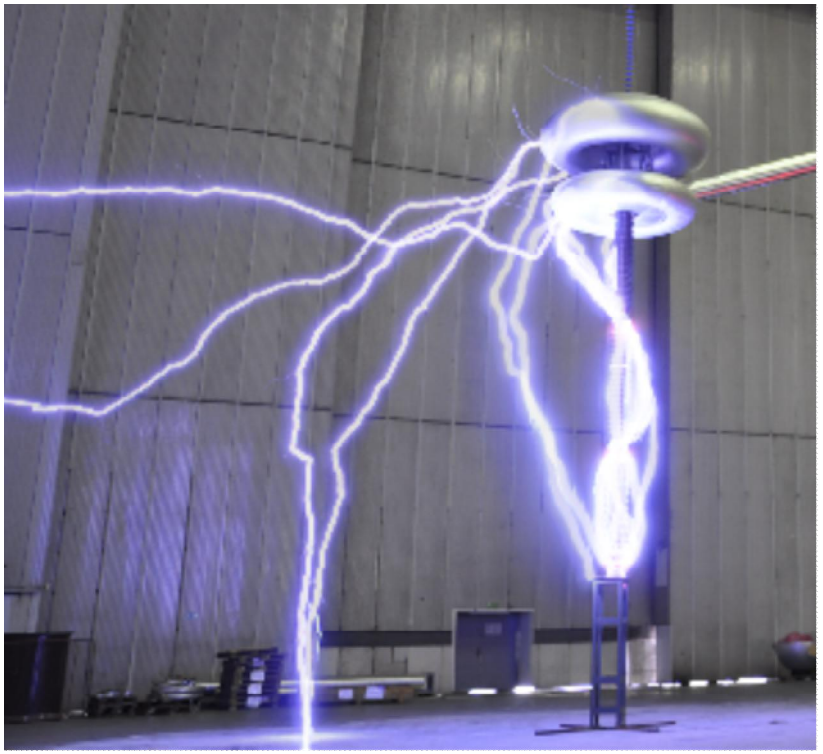
For U_{50} ~ 2400 & U_{test} ~ 2700 kV:

Difficulties caused by the saturation effect

- Availability of the voltage source
- Availability of the free space in the lab
- Uncertainties in the tests
- Need 18 meters for rod plane
- Should increase shield diameter



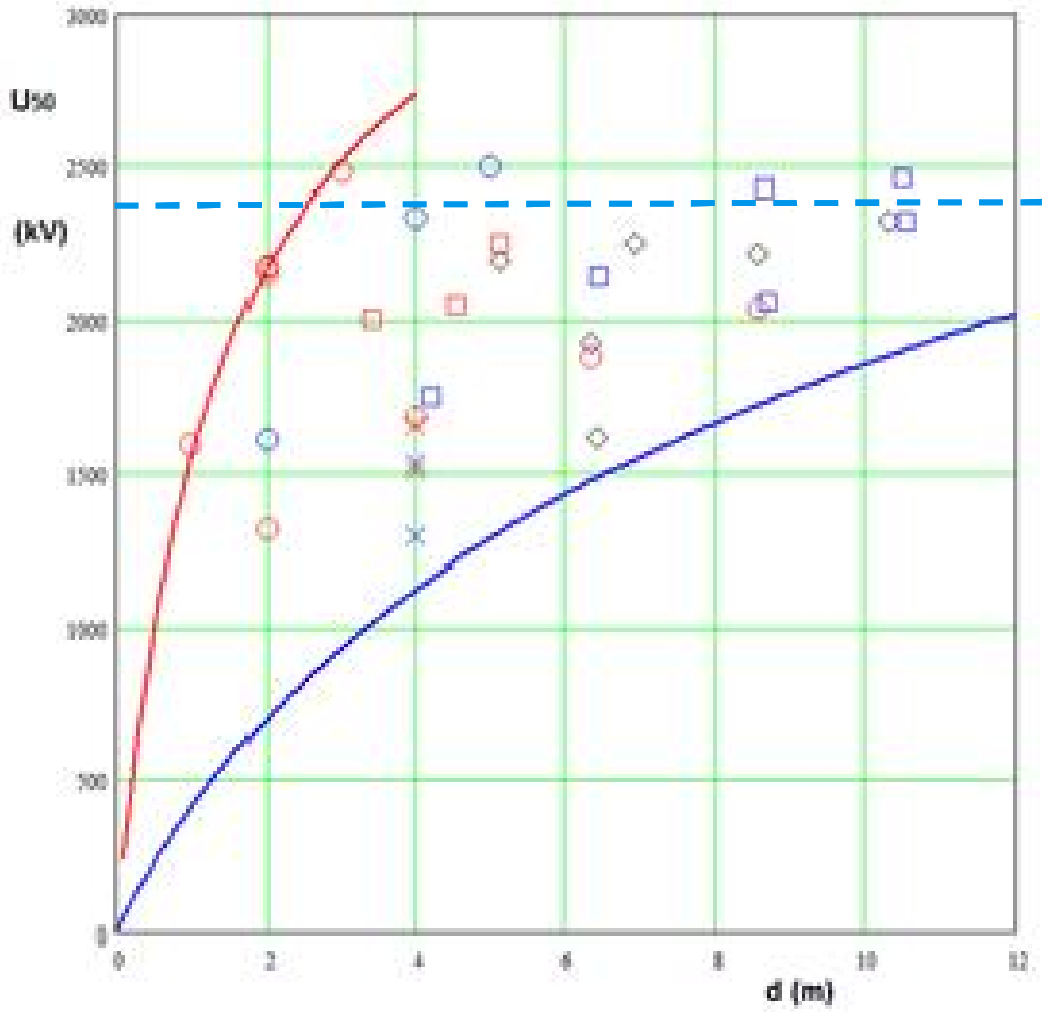




“Damaged” sphere:

For the real design,

- With screws, clamps, insulators, U_{50} reduced
- 2 meter sphere is not big enough
- The same principle applies to all large shields
  - Valves
  - Capacitors
  - Smoothing reactor
  - disconnector
  - Bus-bar terminals
  - …



Summary

Because of the ultra-high voltage level and the saturation of air insulation:

- It is a challenging task to obtain reliable test results.
- Larger potential shields are necessary.
- Small “damages” have significant effect on the dielectric strength.
- Effect of walls need to be included.
- Computer simulation, benchmarked by test results, becomes necessary tool for the design.