

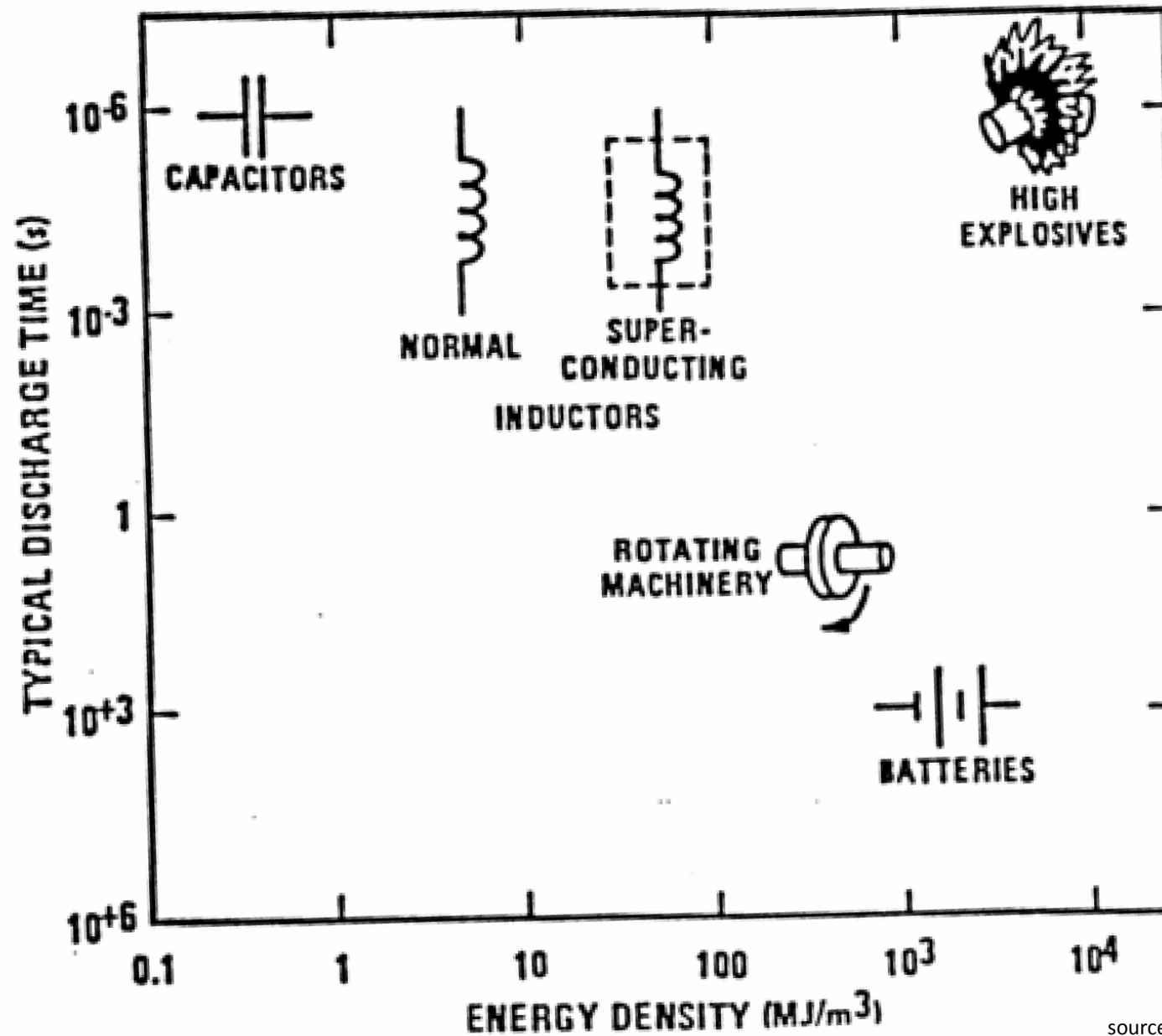


Construction of an Experimental Setup for Pulsed Wire Discharge Experiments

Presentation by Max Bigelmayr

Rostock 23.8.2018

stored energy – density and discharge time



Pulsed wire discharge (PWD) experiments & Exploding wire method (EWM)

- first discharge of capacitors through metal wires by Edward Nairne 1774

Practical Application:

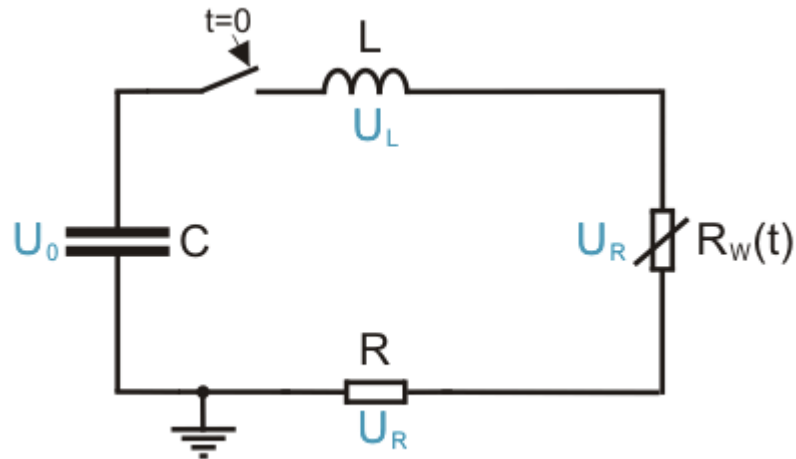
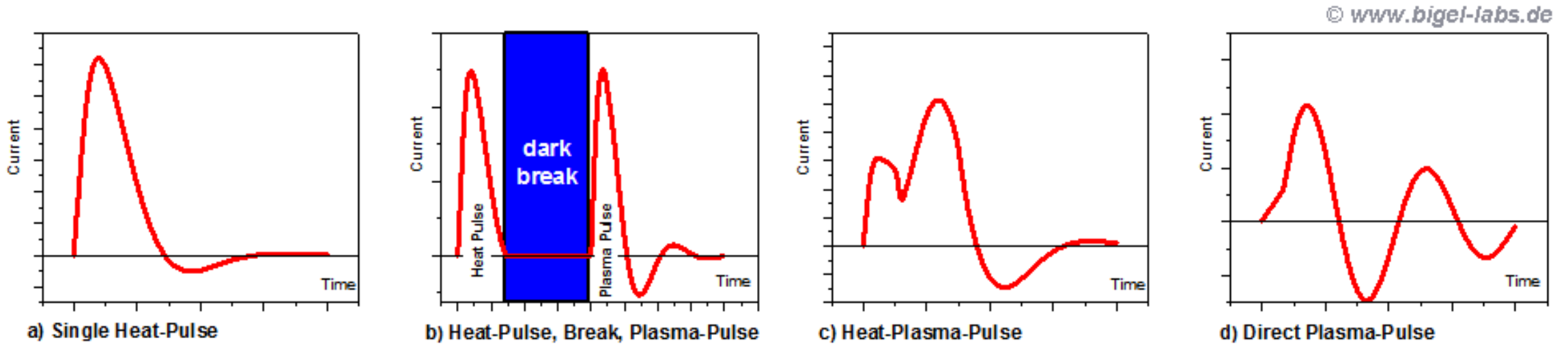
- high intensity light source
- production method for metal nanoparticles
- method for sheet metal forming (using shock waves)

advantage:

- energy may be adjusted very accurately
- no legal restraints
- new capacitor technology allows small setups



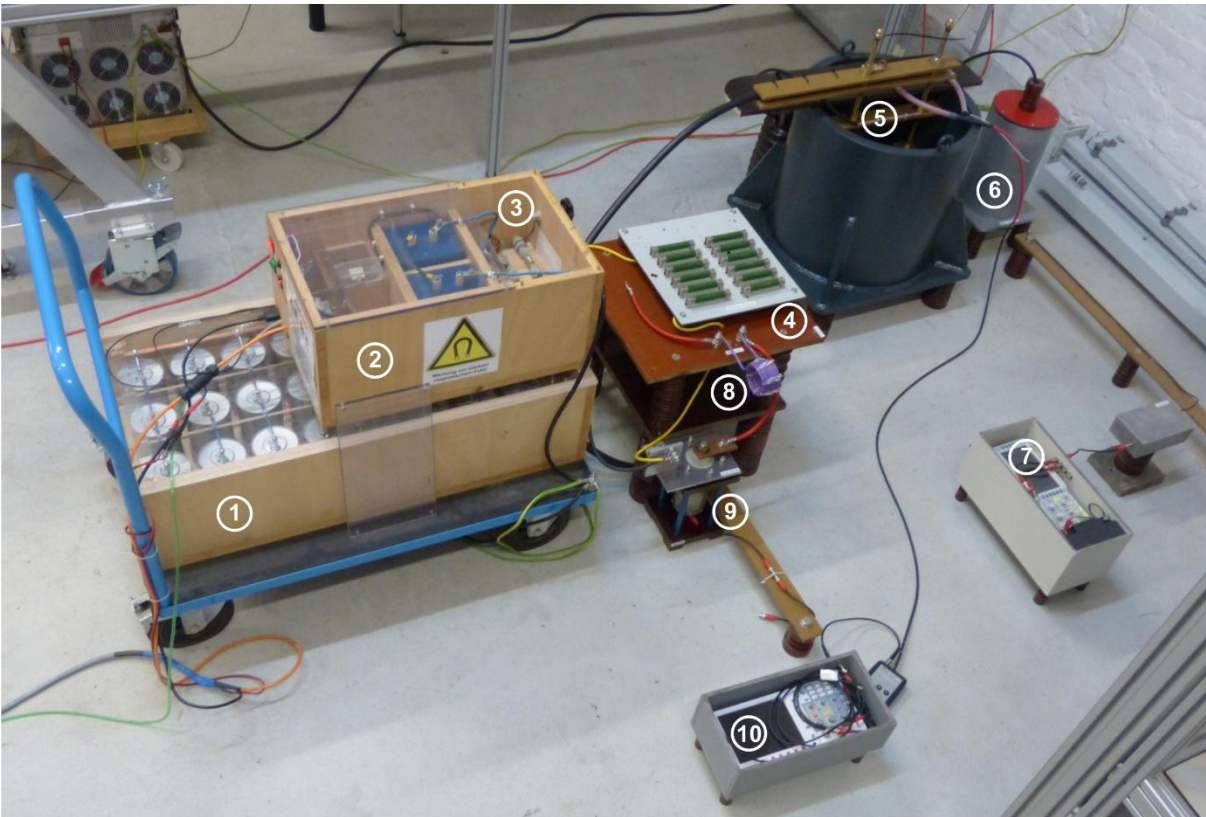
pulsed wire discharge (PWD) experiments



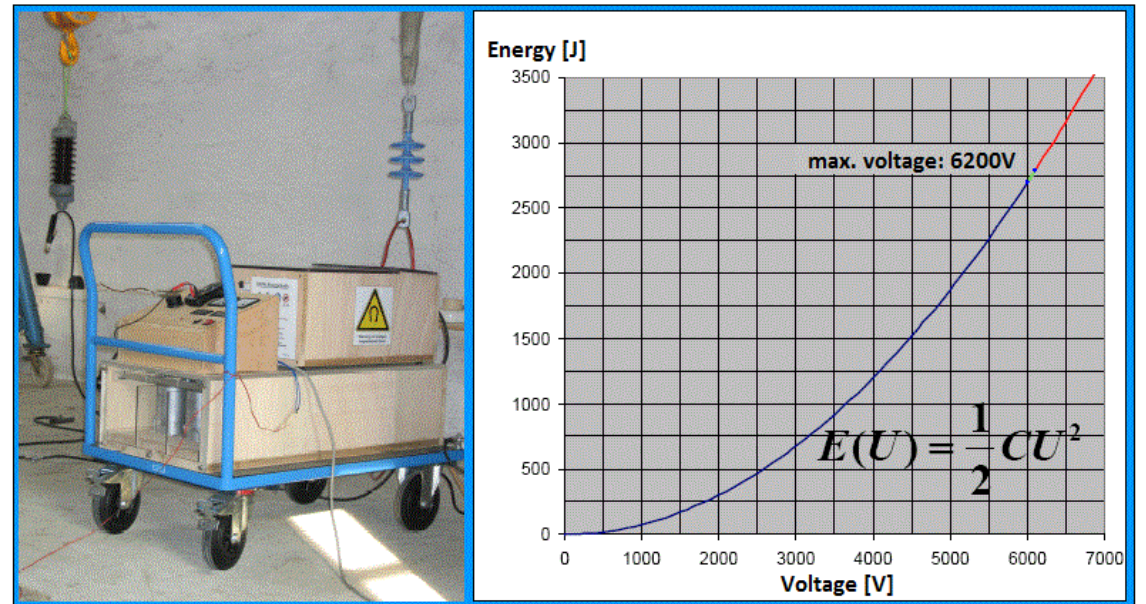
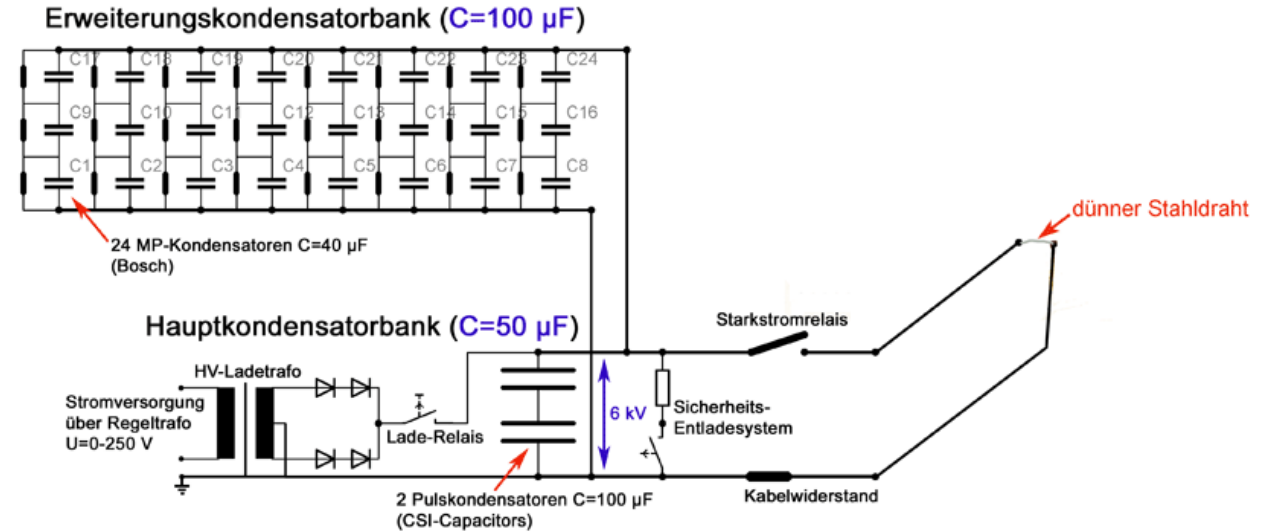
$$U_C(t) + U_L(t) + U_R(t) + U_W(t) = 0$$

$$\frac{1}{C} I(t) + L \frac{d^2 I(t)}{dt^2} + \frac{dI(t)}{dt} (R + R_W(t)) + I(t) \frac{dR_W(t)}{dt} = 0$$

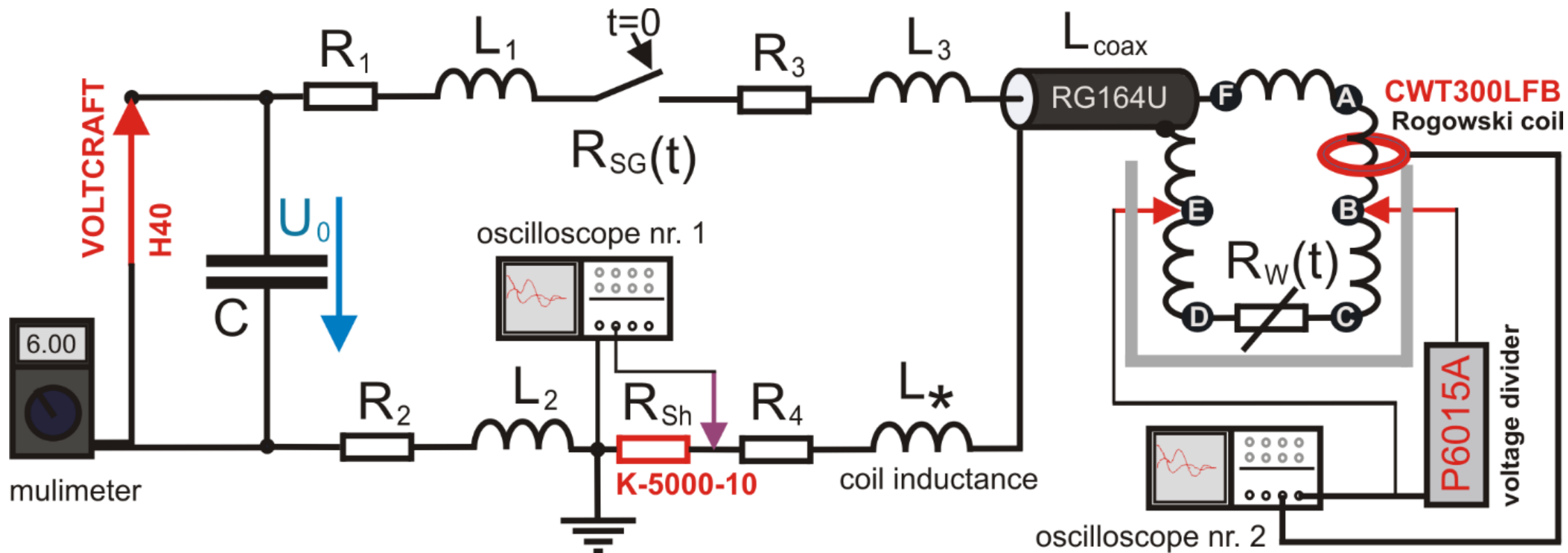
experimental setup



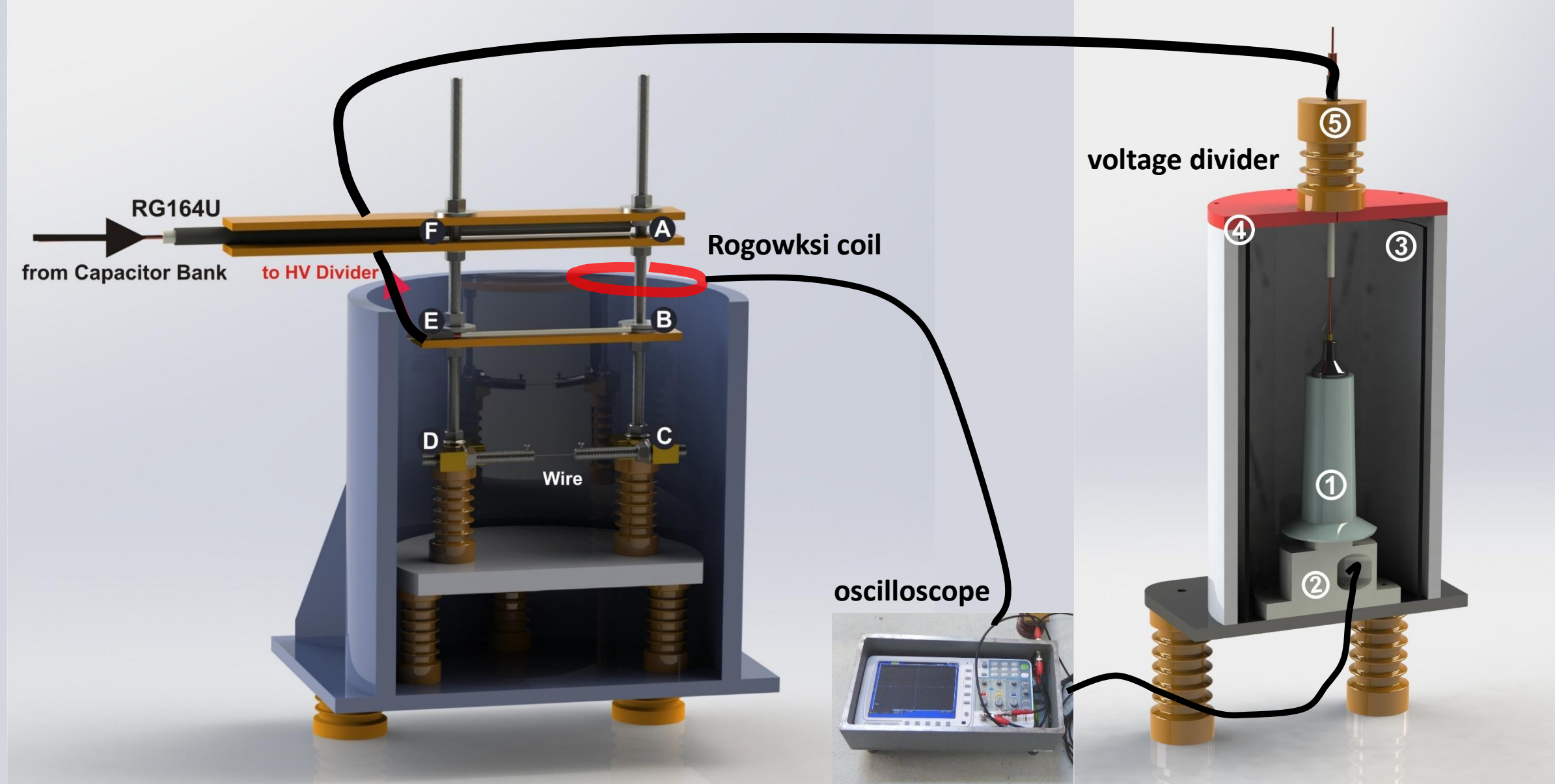
- ① capacitor bank KB2, ② capacitor Bank KB1, ③ high current switch,
 ④ safety dischargesystem 1, ⑤ discharge chamber with metal wire,
 ⑥ high voltage divider, ⑦ digital storage oscillosope nr. 2, ⑧ variable
 inductance L^* , ⑨ coaxial shunt resistor, ⑩ digital storage oscillosope nr. 1



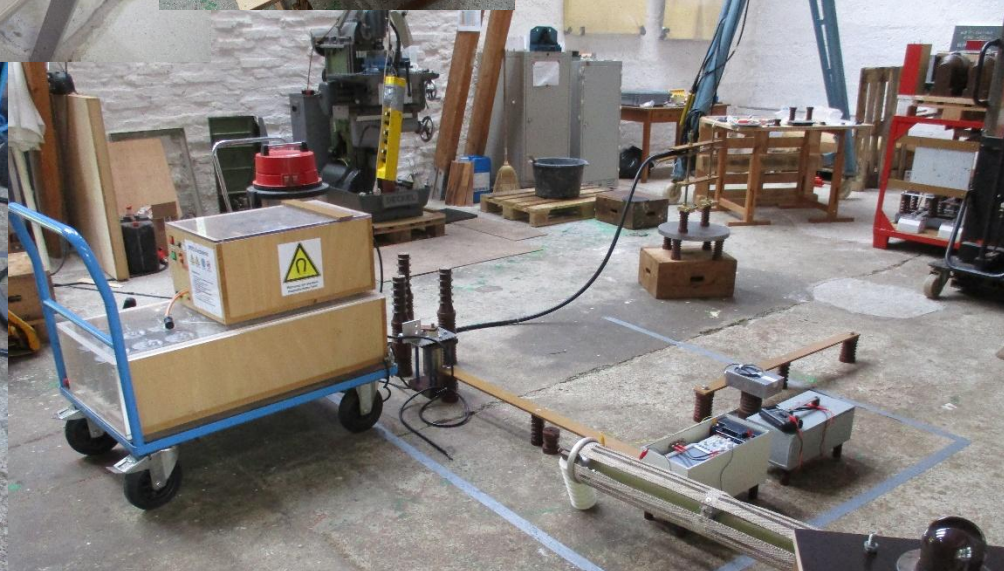
measurement setup



model idea of the discharge chamber and measurement



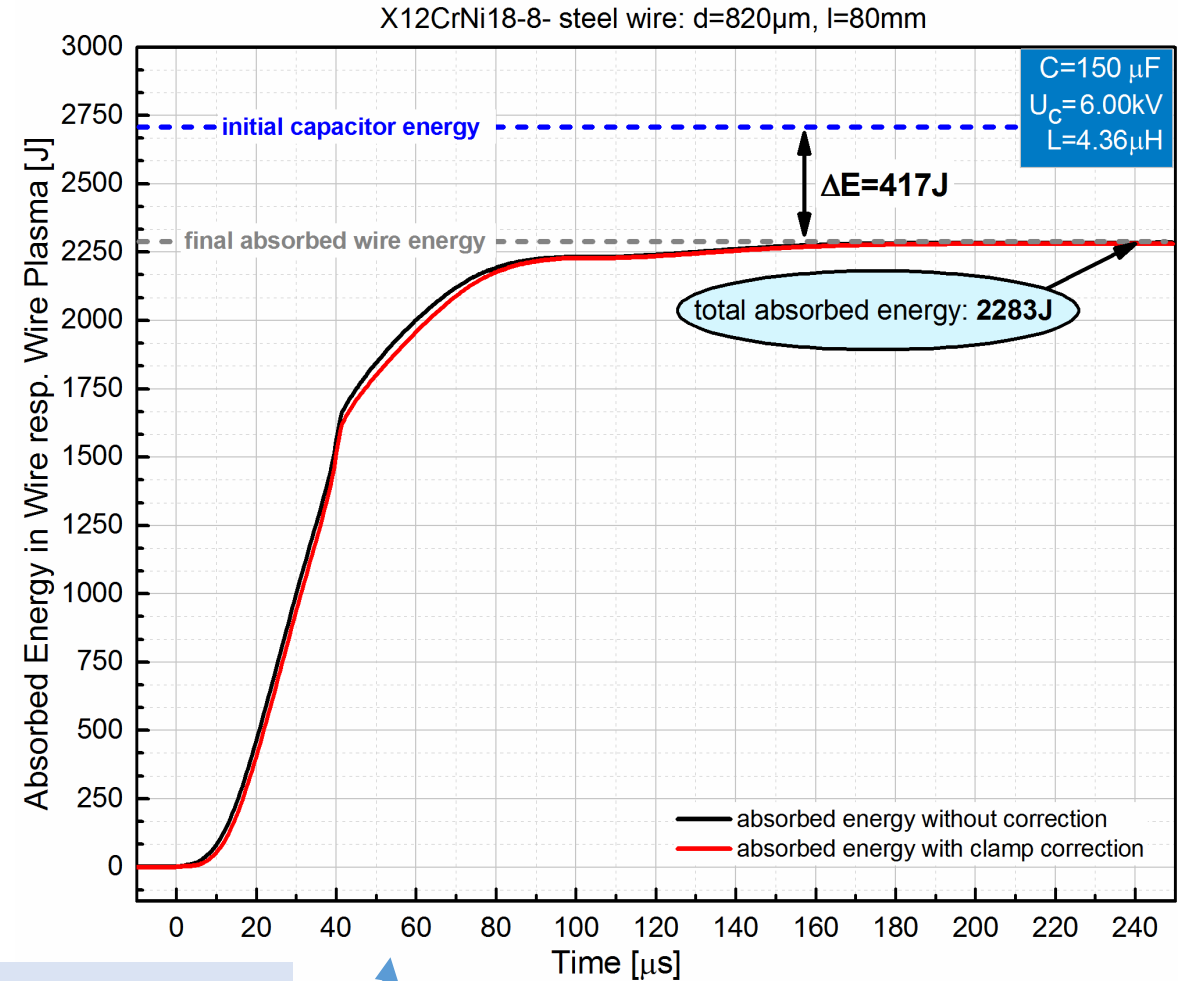
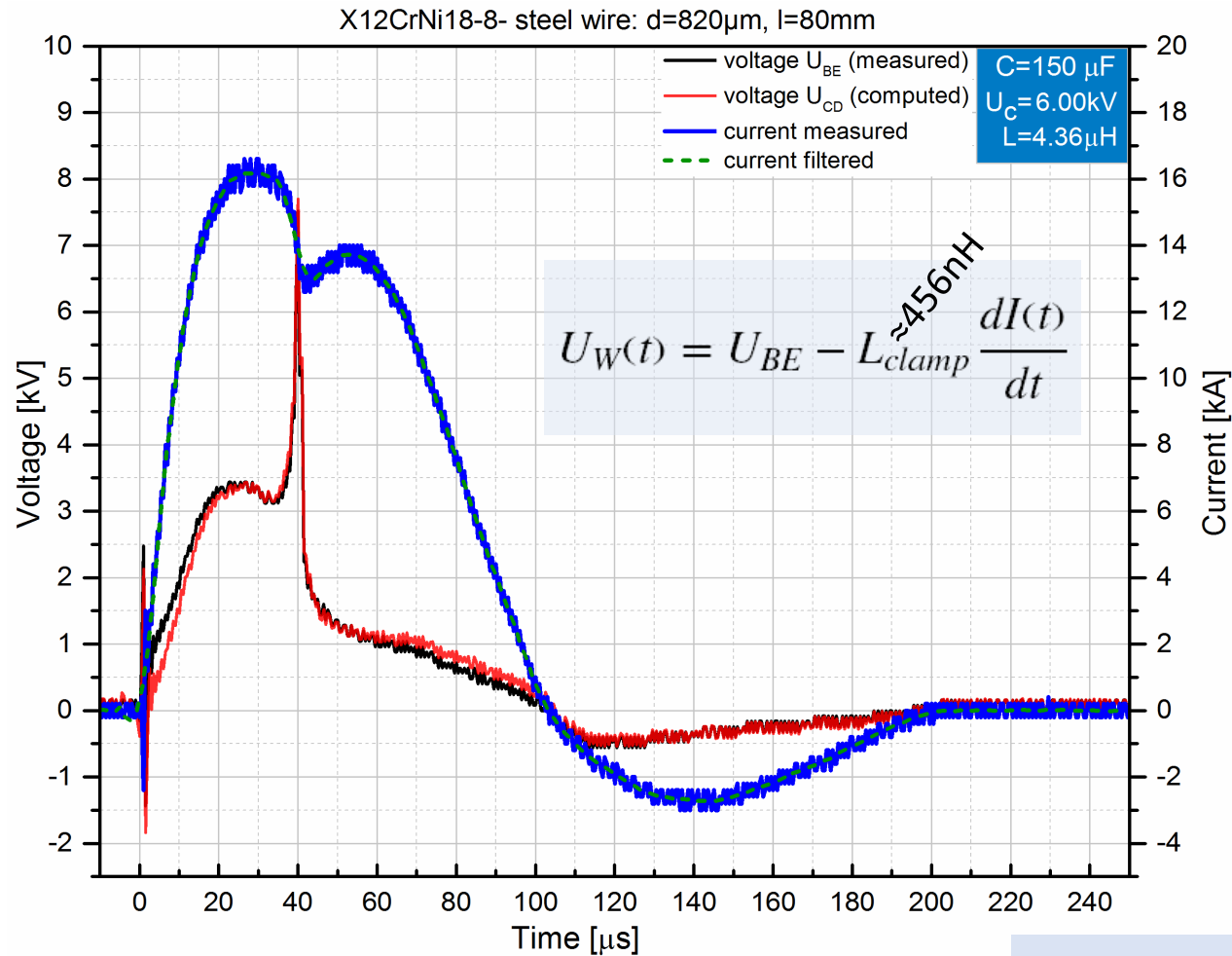
construction time...



final construction ready for transport to Rostock



first experiment: The discharge of a steel wire mid air



$$E_W(t) = \int_0^t U_W(t) I(t) dt$$

outlook and future plans (master thesis)

- experiments with arbitrary wire dimensions (steel, copper, aluminium)
- pulsed wire discharges underwater
- pressure wave measurements with turmalin sensors
- semi-physical modeling with extracted fit parameters



Thanks for your attention!