Experiments on GOLEM tokamak

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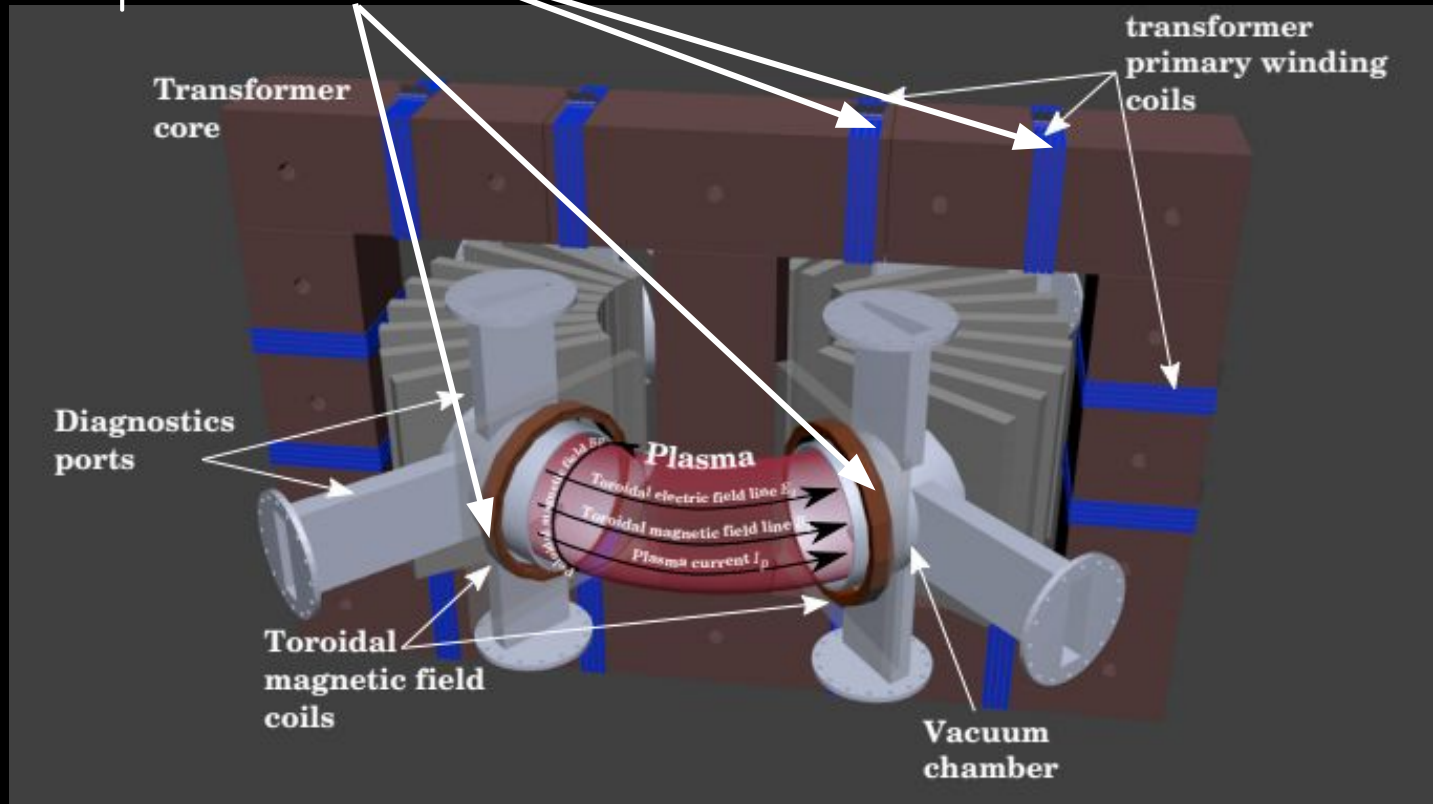
Parameters of experiment:

1. ρ_0 - pressure in chamber
2. U_{CD} - voltage in capacitor banks
3. U_B - voltage in capacitor banks
4. T_{CD} - delay



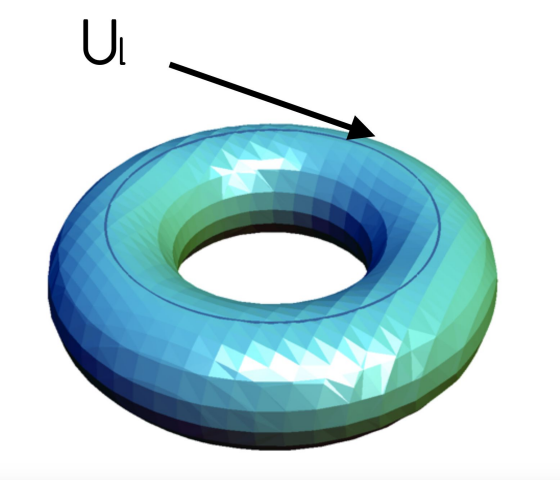
Plan of work

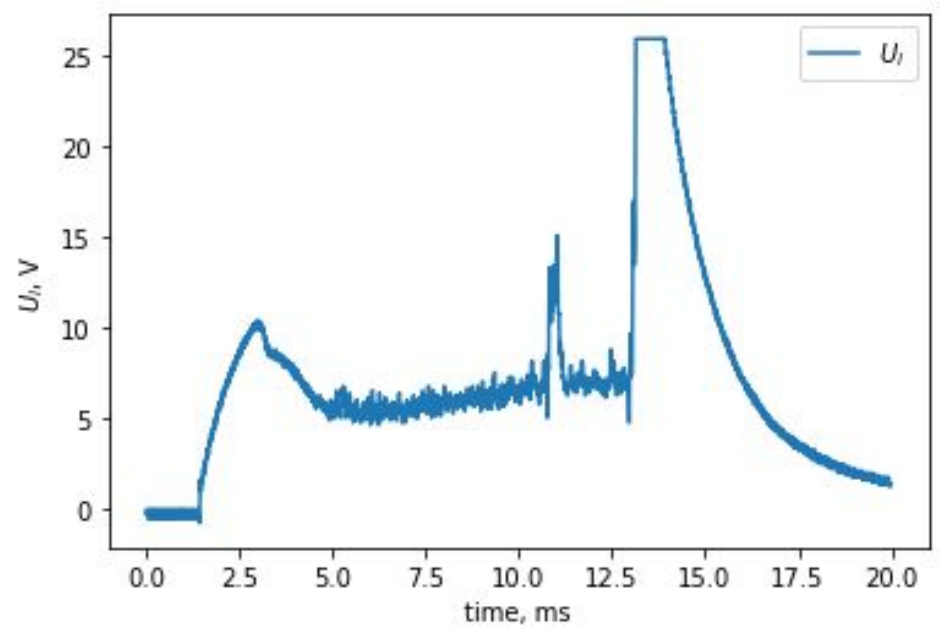
until mentioned, all data taken from discharge #34394

- Set parameters
- Make discharge
- Repeat
- Process the data

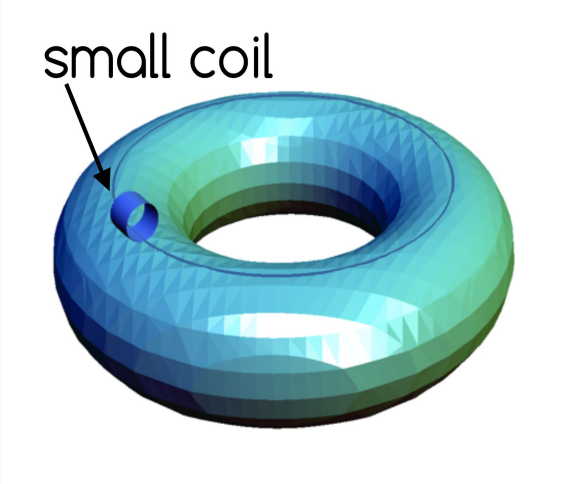
U_l - loop voltage that drives plasma current. Via this voltage plasma exists

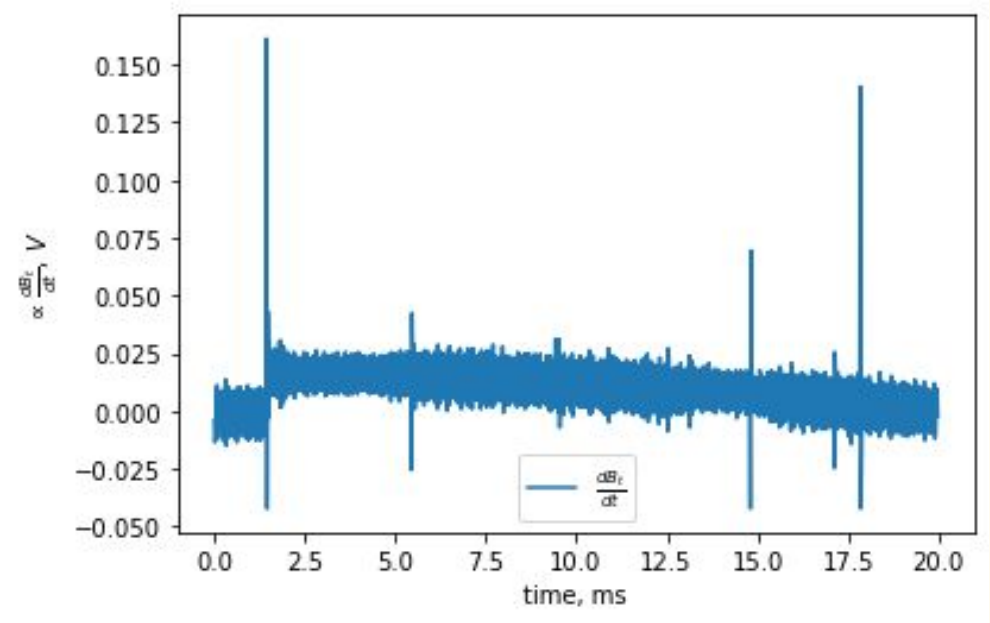
this slice seems strange



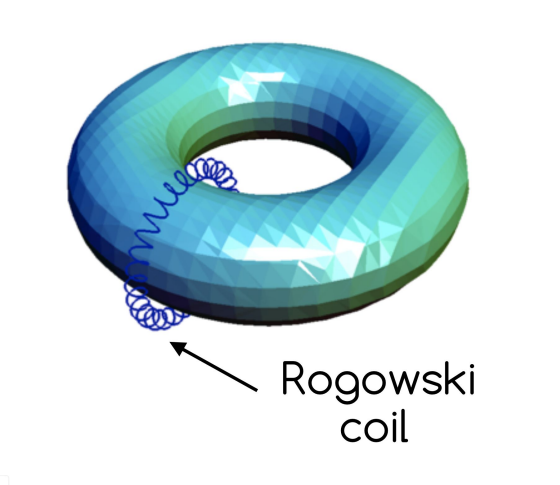


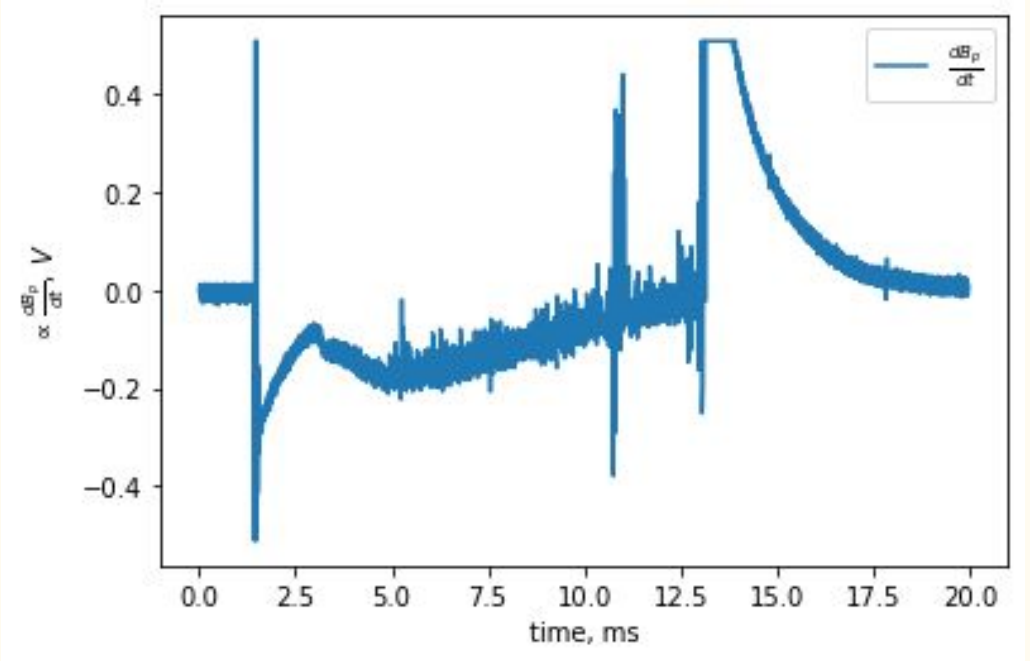
B_t - toroidal magnetic field. Its time derivative is proportional to voltage on small coil.



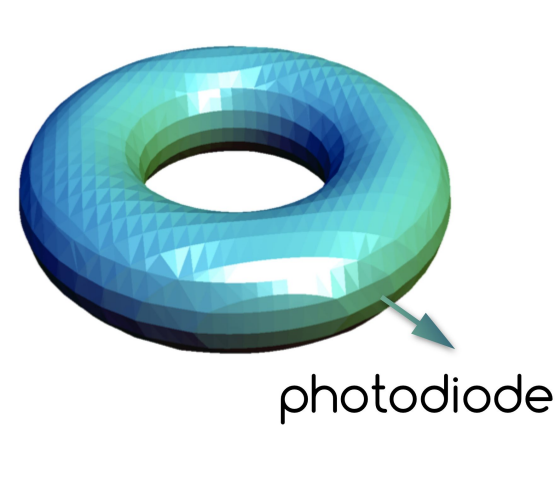


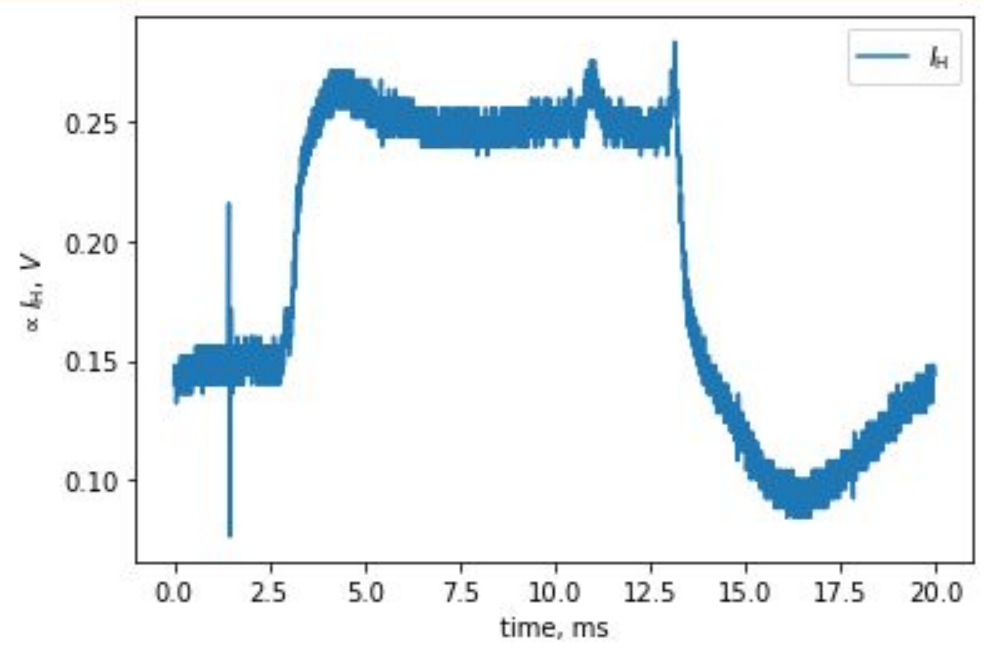
B_ρ - poloidal magnetic field. Its time derivative is proportional to voltage on Rogowski coil





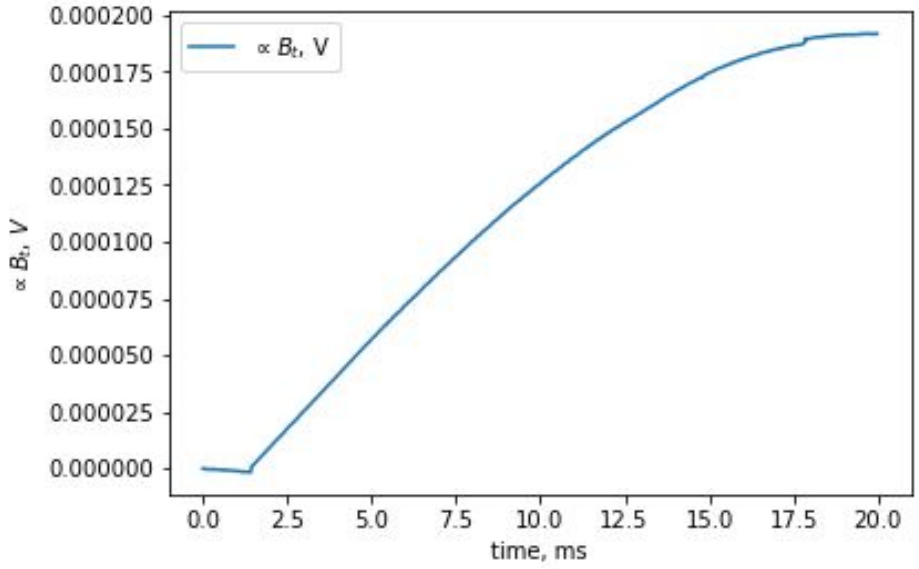
H_α - intensity of hydrogen radiation. It is proportional to voltage in photodiode

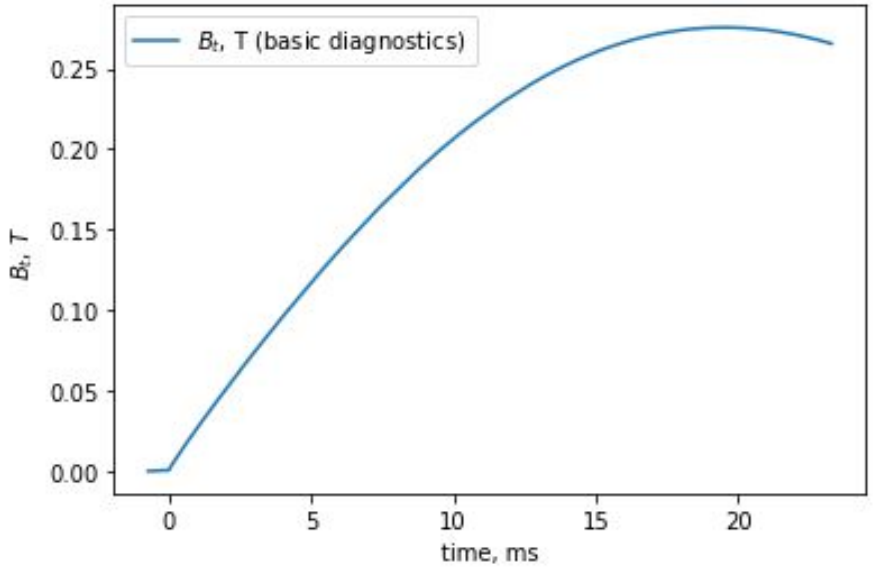




Wake up scientist, we have a data to explore

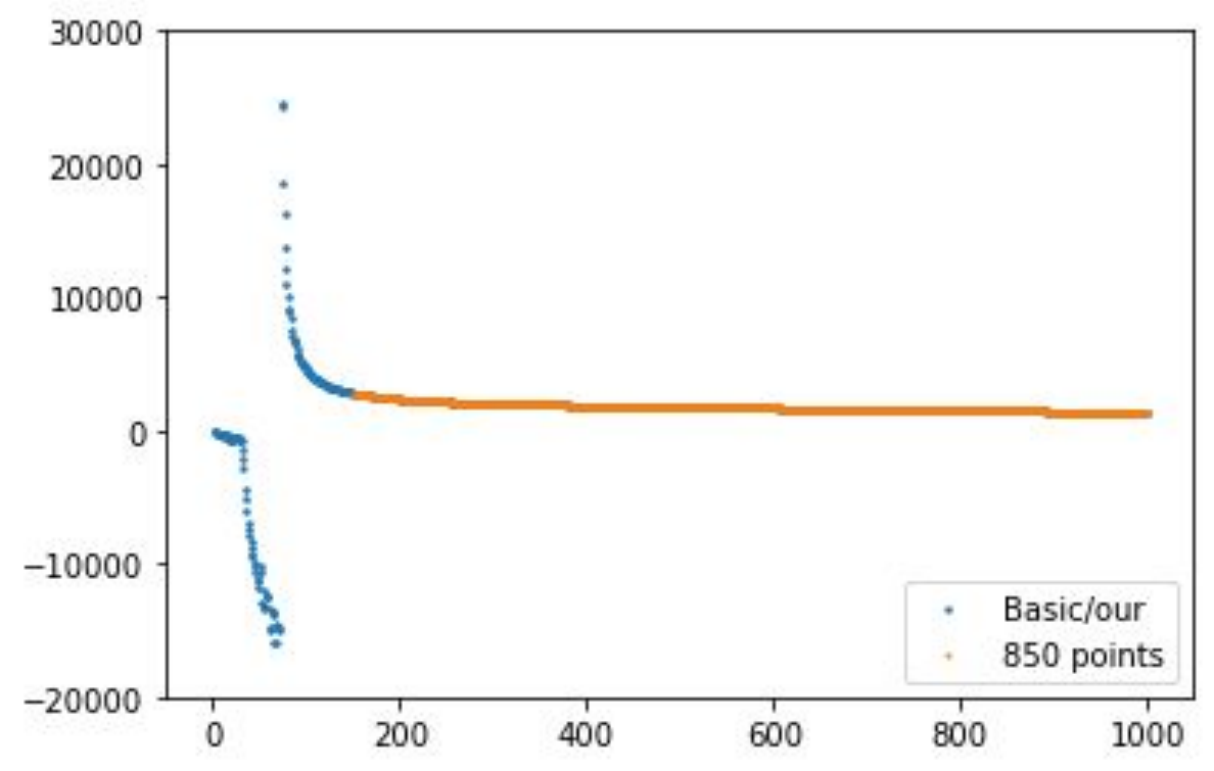
Determination of calibration constants





$$B_t(t) = C_{Bt} \int_0^t U_{Bt}(\tau) d\tau$$

1st calculation - 1st problem

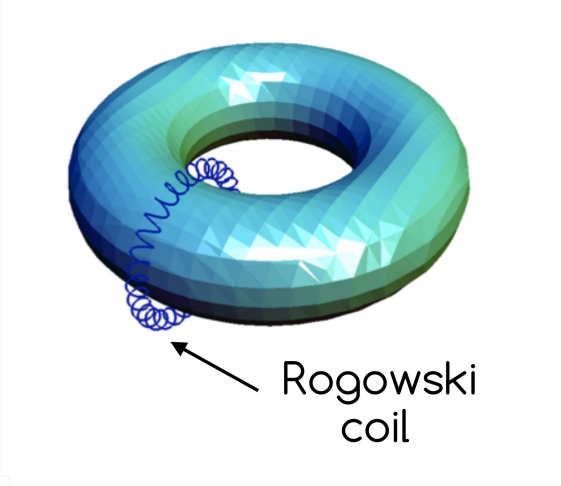


C_{Bt} = 1600 ± 10 T/Vs

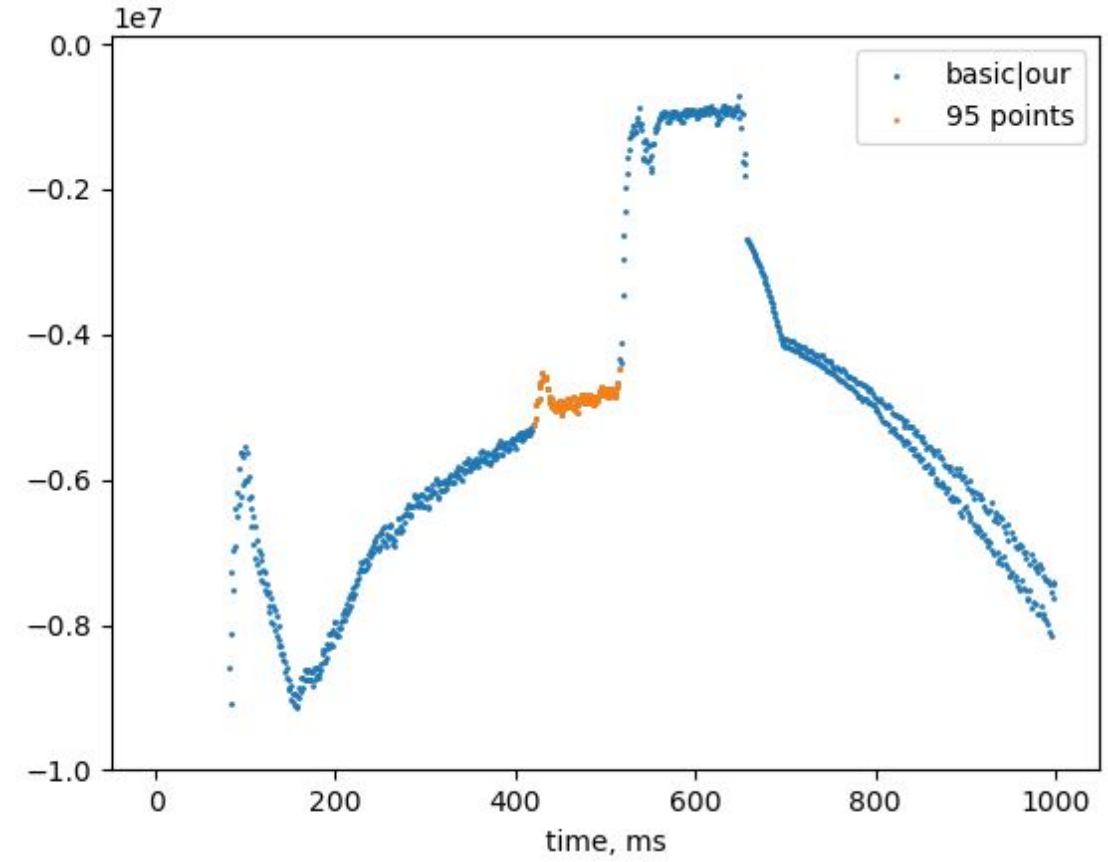
Determination of calibration constants

$$I_p + \frac{U_l}{R_{ch}} = C_{RC} \int_0^{\tau} U_{RC}(\tau) d\tau$$

We can calculate C_{RC} from datasets of U_{RC}, U_l and basic diagnostics of plasma current I_p



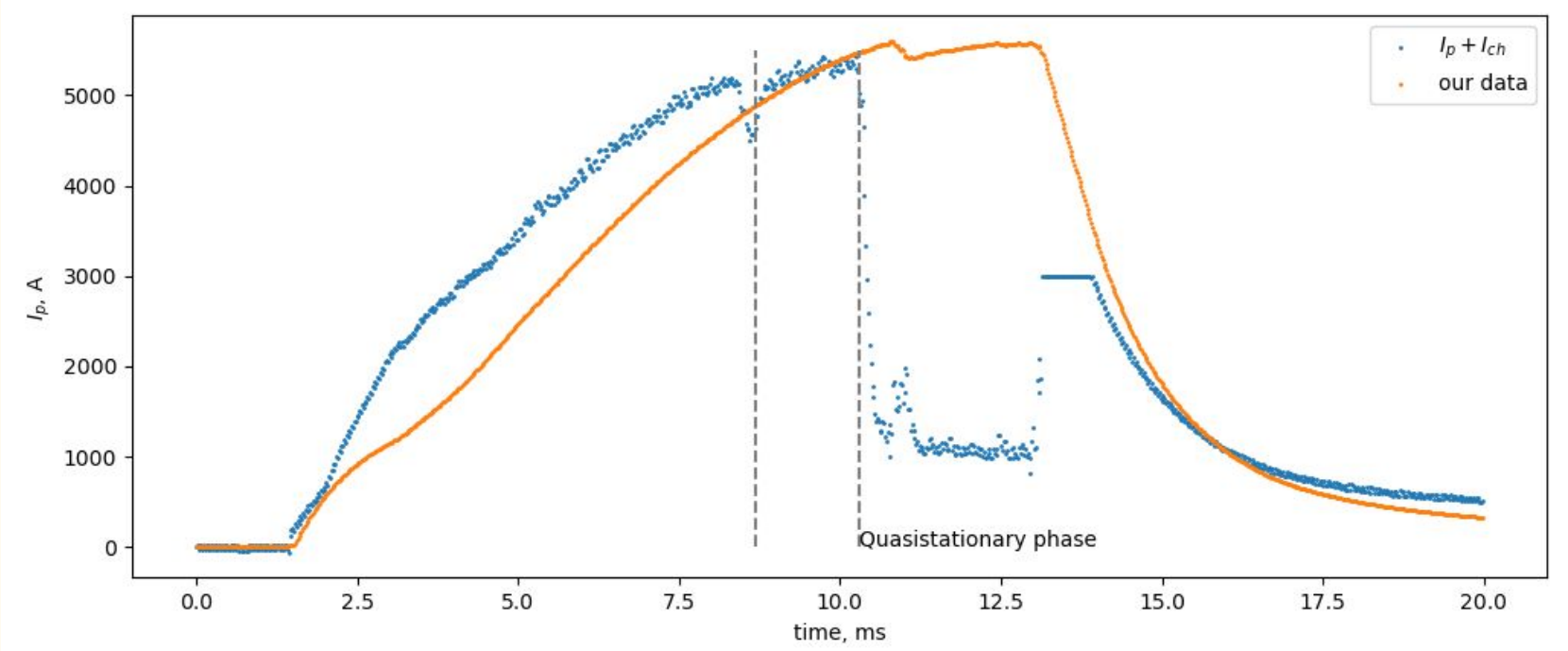
Deviation of C_{RC} (second problem)



$C_{RC} = -487 \pm 1 * 10^4$ A/Vs

Plasma current: $I_p = C_{RC} \int_0^\tau U_{RC}(\tau) d\tau - \frac{U_l}{R_{ch}}$

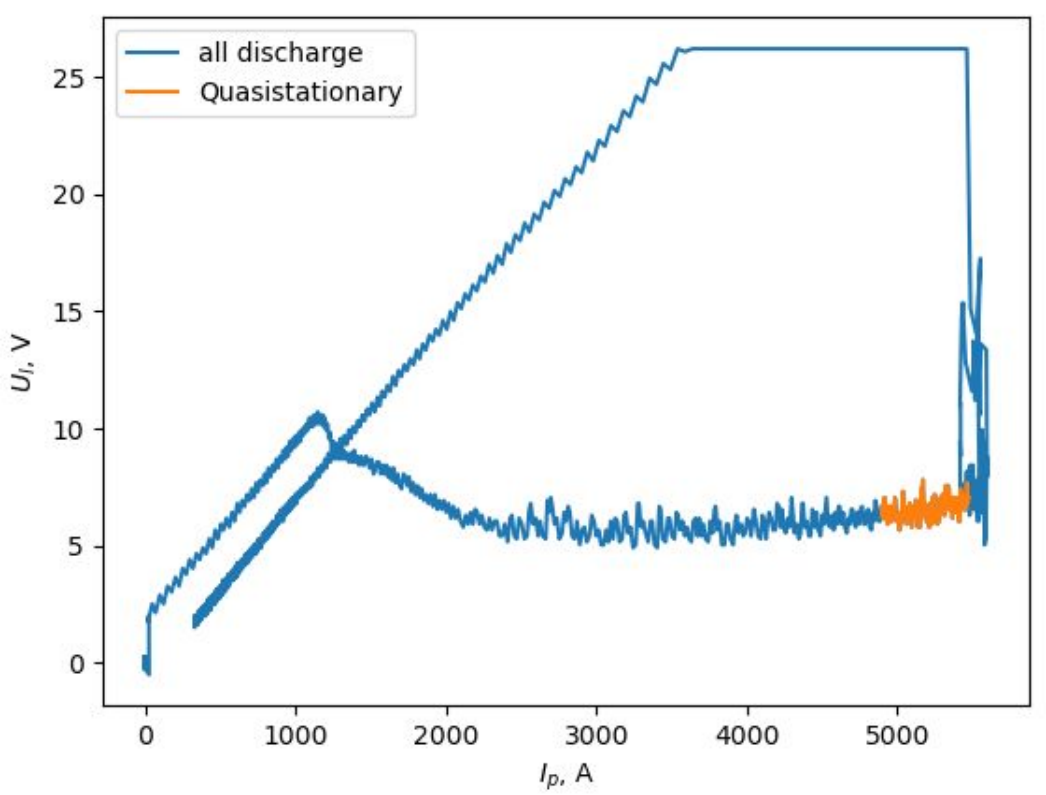
(yep, third problem)



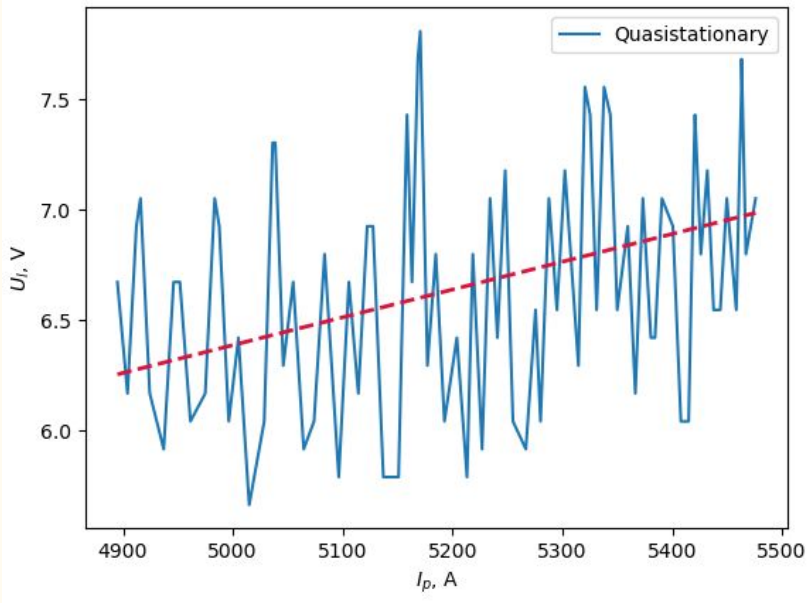
Quasistationary phase: 8.7-10.3 ms

Next conclusions

Plasma resistance



$R_\rho = 1.26 \pm 0.01$ mΩ



Electron temperature T_e

$$T_e = 0.9 R_p^{-\frac{2}{3}}$$

77 ± 0.4eV

8.95 ± 0.5 * 10^5K

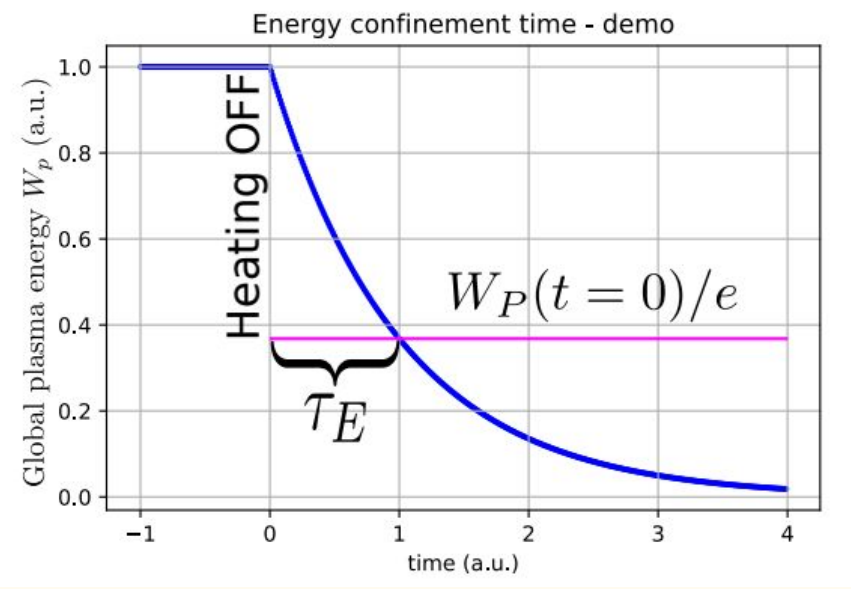
Electron density n_e

$$n_e = \frac{2 p_0 V_{ch}}{k T_0 V_p}$$

1.45 * 10^{19} m^{-3}

Confinement time

1.6 * 10^-19 *
1.45*10^19 *
77 * 80 * 10^-3
3/ 6.65 / 5210



$$\tau_e = \frac{e n_e T_e V_p}{3 U_l I_p} = 120 \pm 20 mks$$