2012 Day 2 Question 1A (Diagnostics)

a. To measure $P_{inst} = \frac{W_{stored}}{\tau_E} = P_{heating}$ (for power balance)

$\tau_E = \frac{W}{P_H}$, $W = \int p^* + \frac{B^2}{8\pi} \approx \int p^{kinetic}$ at low $\beta$.

$p \approx \sum_s \frac{3}{2} n_s T_s \approx 3 n_e T_e$ (assume $n_e \approx n_i$, $T_e \approx T_i$)

→ $W = 3 \bar{n}_e \bar{T}_e V$ ($V$ total volume)

measure $\bar{n}_e$ measure with interferometer

$\bar{T}_e$, thomson scattering (~ width of measured spectrum)

$V$ should be known a priori

~~$P_H$ should also be known (maybe not how much is deposited though?)~~

$P_{ohmic} = \eta I^2$, $\eta \sim T_e^{-3/2}$ (Thomson scattering)

$I$ → Rogowski coil (measures $\dot{I}$ → integrate to $I$)

→ $I V_{loop}$

b. NBI power $< 1$ MeV deposits on ions