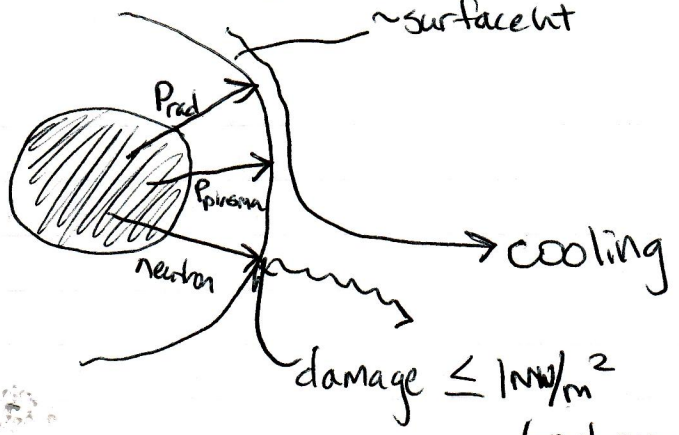
4/6

- Office hour disc Wed 4PM
  - ~ Exam review and HW review
- Open book in-class exam Tues 4/13
- HW #8 due at beginning of exam — worth 50%
- Take-home final exam Apr 27, due May 6

HW #8 (continued)

6) Wall loading: Plasma and radiation heating present wall loading challenge. Keep < a few MW/m^2
Neutron material damage sets limit on neutron "power" loading (actually power associated with neutrons passing through wall) of $\leq 1\ MW/m^2$
Assume ITER was 50/50 DT and operates at the $n\tau - kT$ intercept you found in 5) (or if not found, used main $n\tau - kT$ on energy balance curve of 3))
Calculate the corresponding "heating and neutron" wall loading in MW/m^2. Do they fall in allowed limits. If not, suggest how to change the design to adjust the loadings

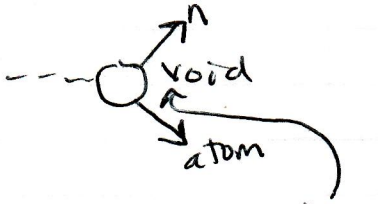
Wall loading



not amount deposited, amount it takes to go through

neutron damage

① displacement voids



n,d reactions → ^4He causes swelling

Wall loading (continued)

$D + T \rightarrow \alpha + n$

$\rightarrow 3.5\ MeV$ → heating ⟹ ignition

"ash" — ~10-15 keV

$n_T = n_D + n_T + n_\alpha$ ("ash")

$n_D + n_T$ → decrease

$\therefore P_{fusion} \downarrow$ assume $\tau_D = \tau_T = \tau_{He^4} = \tau_{part}$

7) "Ash" issue: The α-particles from fusion are generally contained in the plasma... Rest is posted on website

$$0 = \frac{dn_{He}}{dt} = S - \mathcal{L}$$

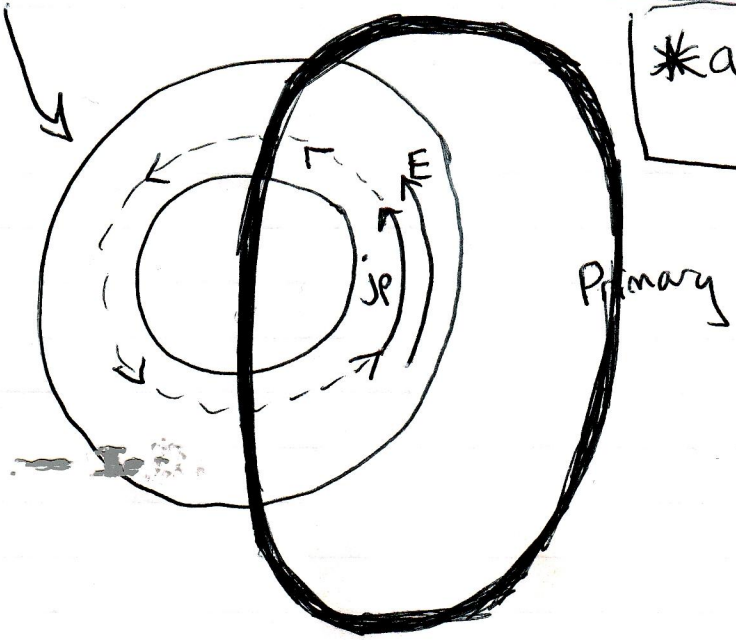
$$= \frac{P_f}{E_f} \cdot f_\alpha = \frac{n_\alpha}{\tau_\alpha}$$

$\sim \tau_D \sim \tau_T \sim \tau_{part}$

but chg/mass diff

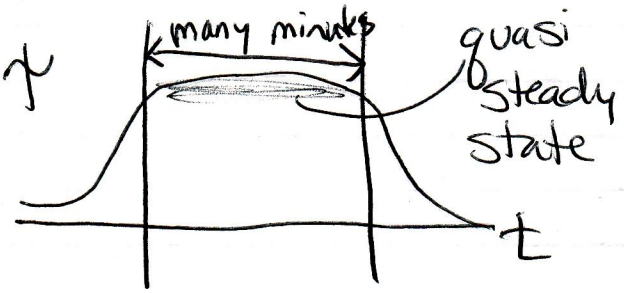
$\rightarrow \tau_\alpha$ maybe $> \tau_{part}$

This is a Tokamak

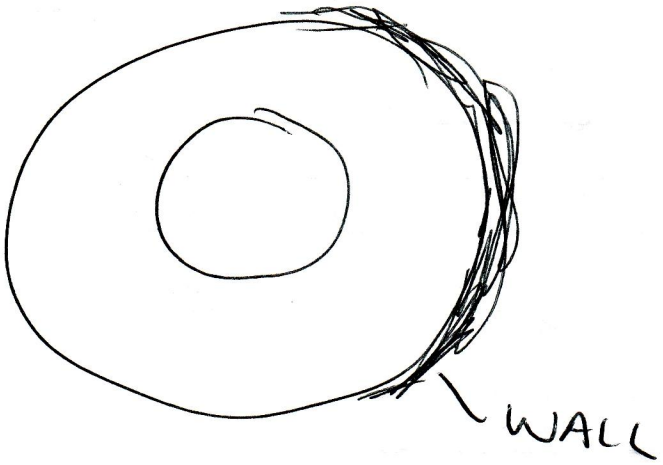


assume confinement time is 1 sec

$\frac{d\Psi}{dt} \rightarrow E$



δ) What do you do to the wall to prevent it shorting out the electric field?



ohmic heating

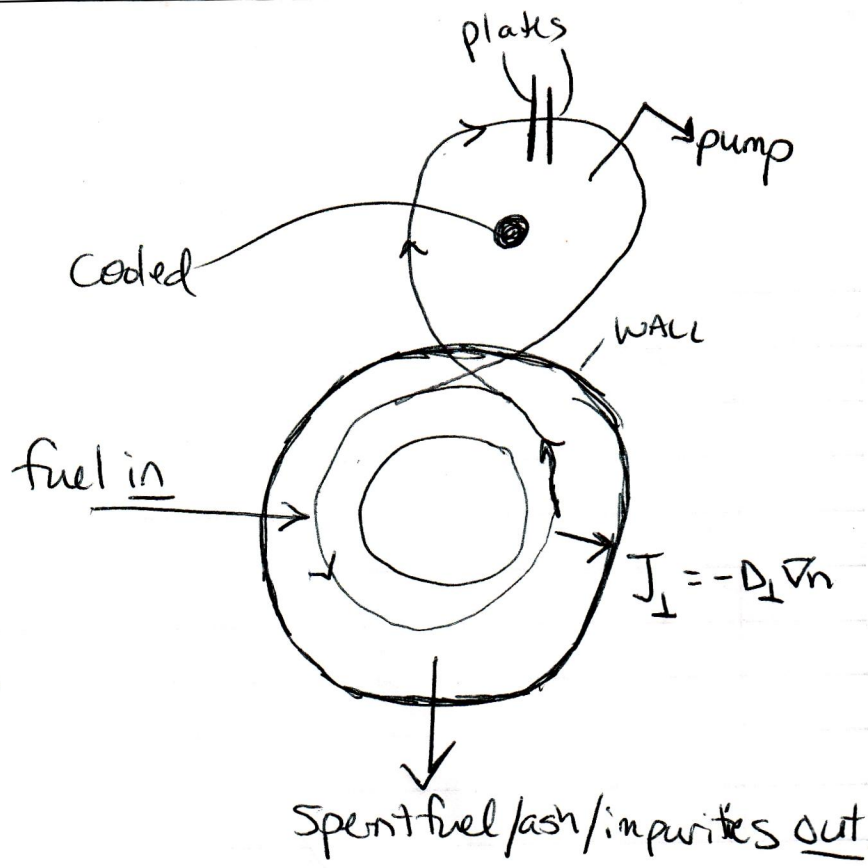
↓

auxillary heating

↓

α - heating

9) Divertor



It's an important part of all systems

should divert B_θ not B_T
see pg 169

on plate surface: $2D^+ \rightarrow D_2$ (gas) surface

what does adding this accomplish:

① heat to divertor plate

② scrapes off impurities