Operating point control of high f_bs plasmas – how much external H&CD is needed?

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- A goal of AT development for DEMO & reactors is to maximize the bootstrap current fraction;
  $\Rightarrow$ in order to minimize the external CD needed and thus maximize the overall plant Q, reducing the COE.

- But another goal is to have a very high performance operating point (high β_N, H; near operational limits);
  $\Rightarrow$ in order to maximize power output or minimize engineering constraints & reduce the capital cost.

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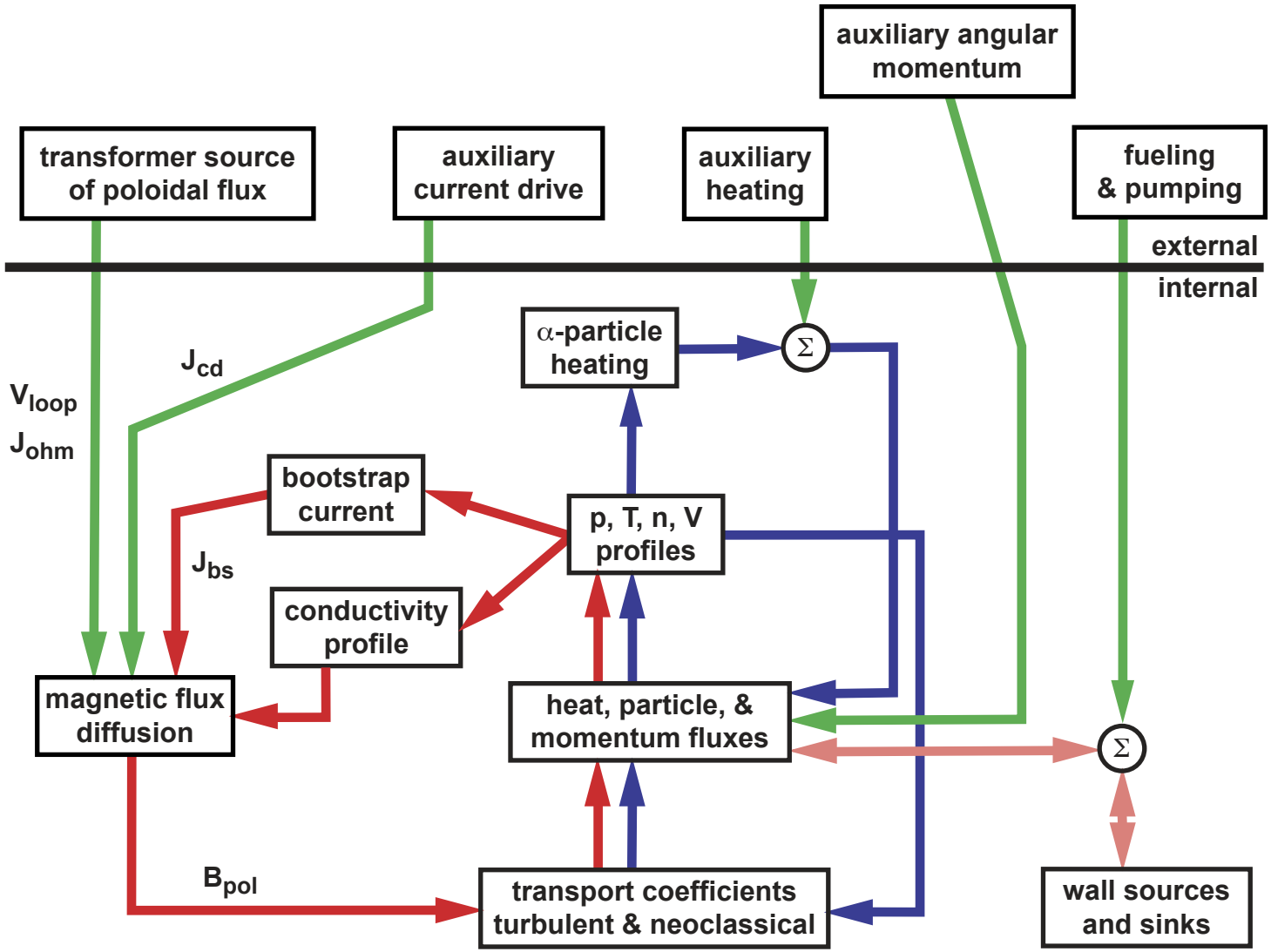
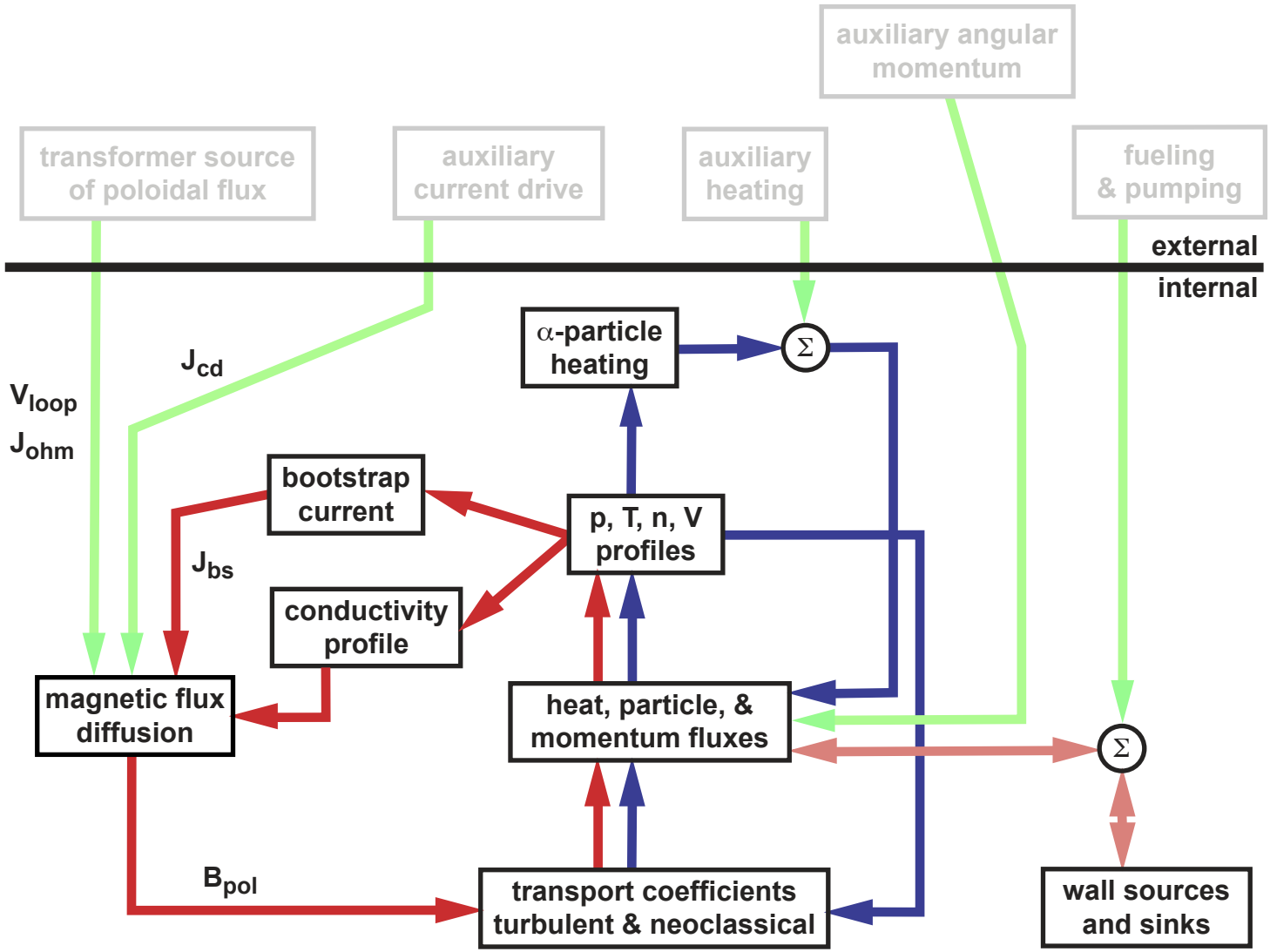
- Because in order to operate near the limits, control of the operating parameters is needed – the closer you get to the limits, the better (faster, more effective) the control has to be.
- But less power for control actuators is available.
- Thus the question is:
  Just how much (and what sort of) external H&CD is needed?
  (Bearing in mind that increasing H&CD power reduces the COE.)


auxiliary angular momentum
transformer source of poloidal flux
auxiliary current drive
auxiliary heating
fueling & pumping
external
internal
α-particle heating
Σ
J_{cd}
V_{loop}
J_{ohm}
bootstrap current
p, T, n, V profiles
J_{bs}
conductivity profile
magnetic flux diffusion
heat, particle, & momentum fluxes
Σ
B_{pol}
transport coefficients turbulent & neoclassical
wall sources and sinks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