

# **Fusion Reactor Technology II**

**(459.761, 3 Credits)**

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**Fusion Plasma Technology**  
**Reactor Technology**  
**Blanket and Material Technology**  
**Safety Technology**  
**Operation and Maintenance**  
**Technology**

# **Fusion Plasma Technology**

Reactor Technology

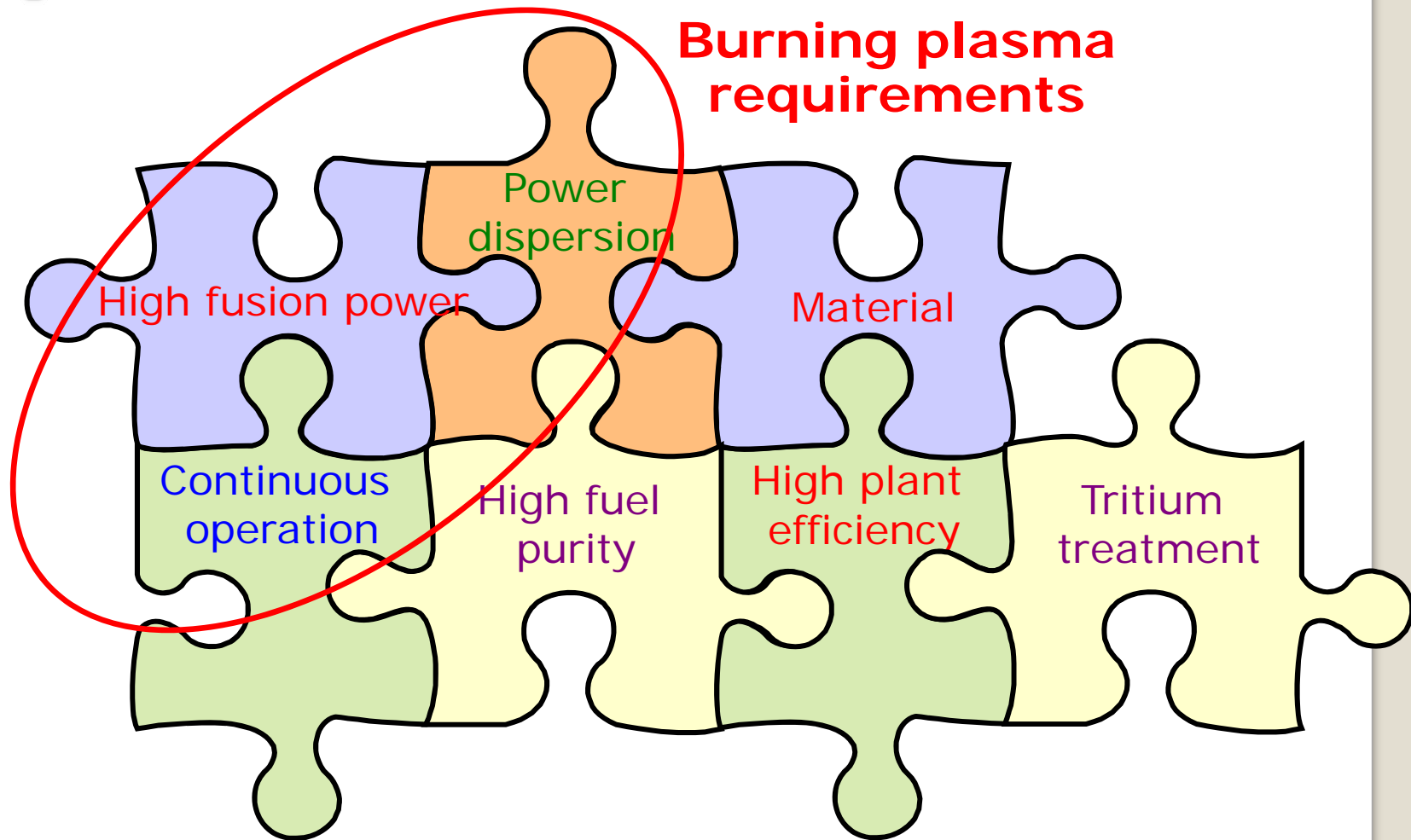
Blanket and Material Technology

Safety Technology

Operation and Maintenance

Technology

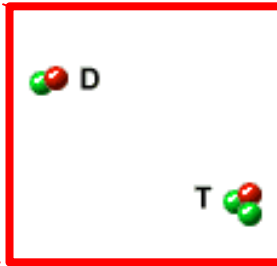
# Requirements for FPP



# Fusion Reactor Energetics



What is required to light a fire in a stove?



 Deuterium

 Tritium

■ Fuel: D, T

■ Amount/density:  $n$

■ Heat insulation:  $\tau$

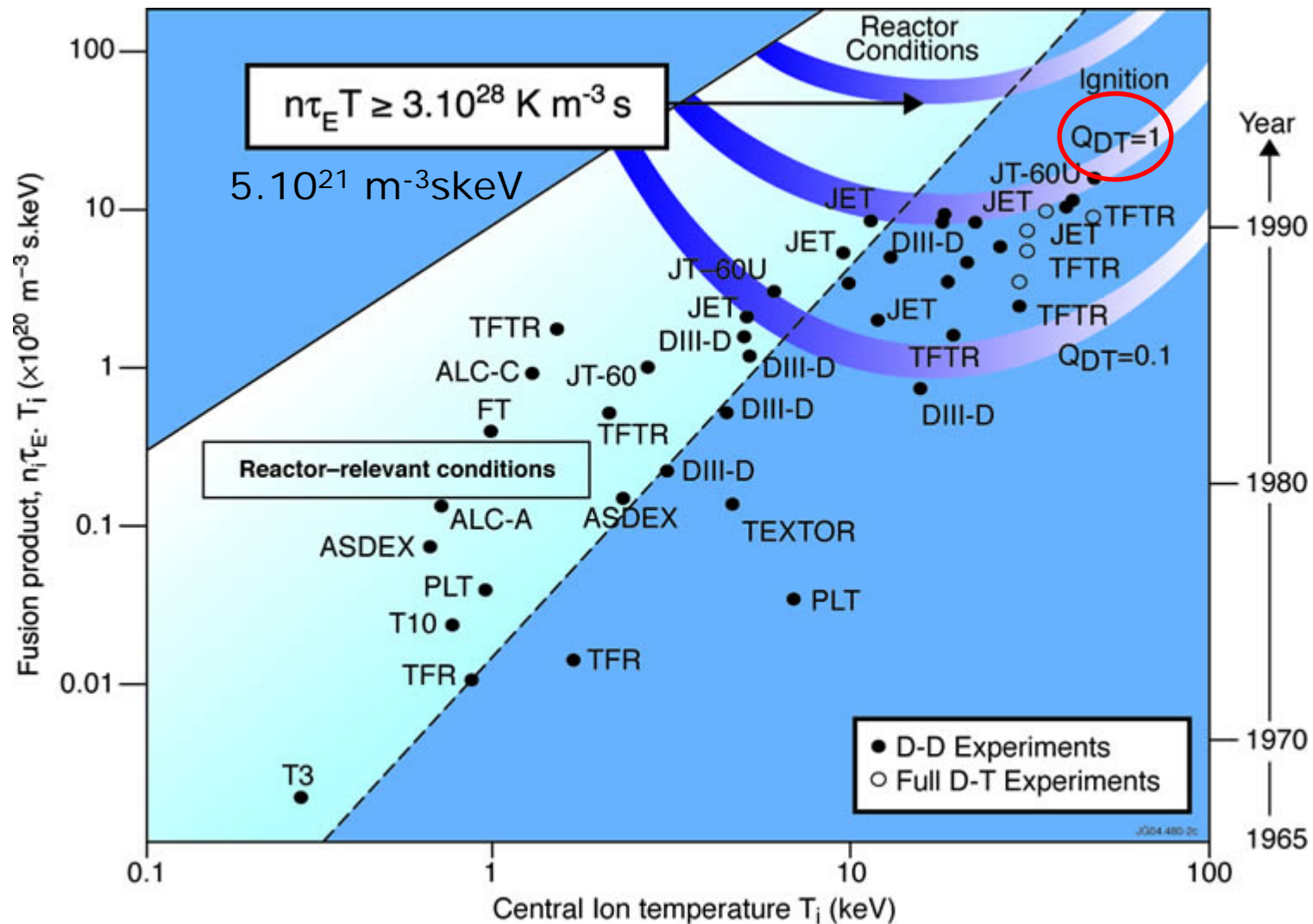
■ Ignition temperature:  $T$



$\geq ?$

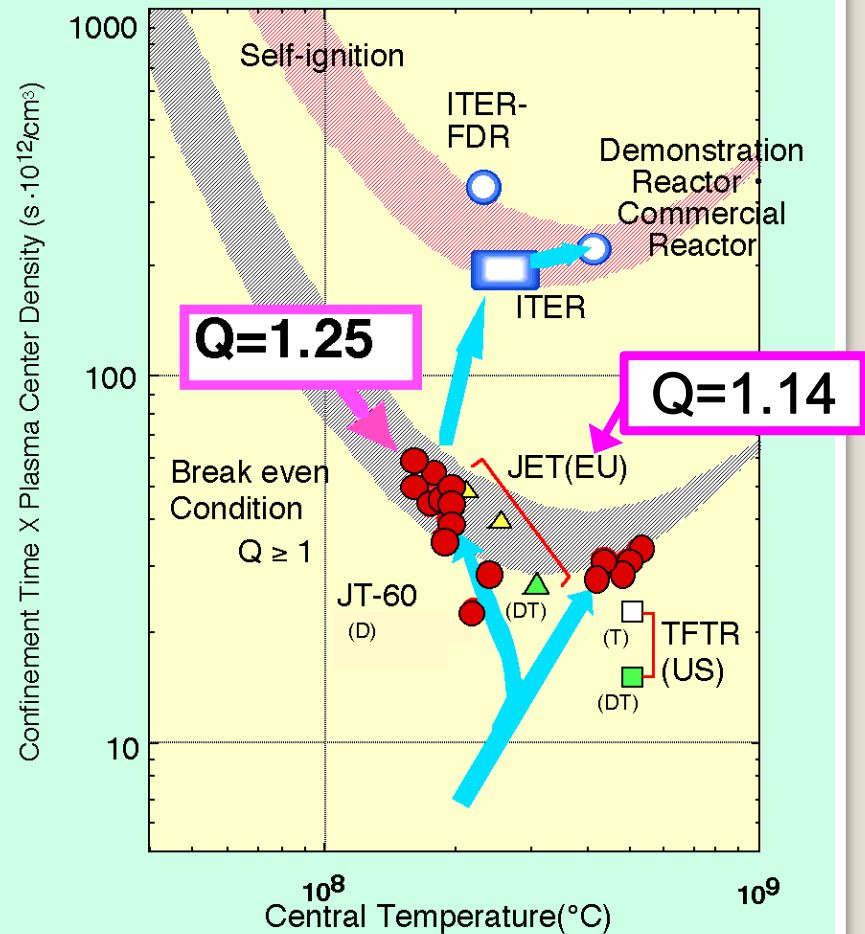
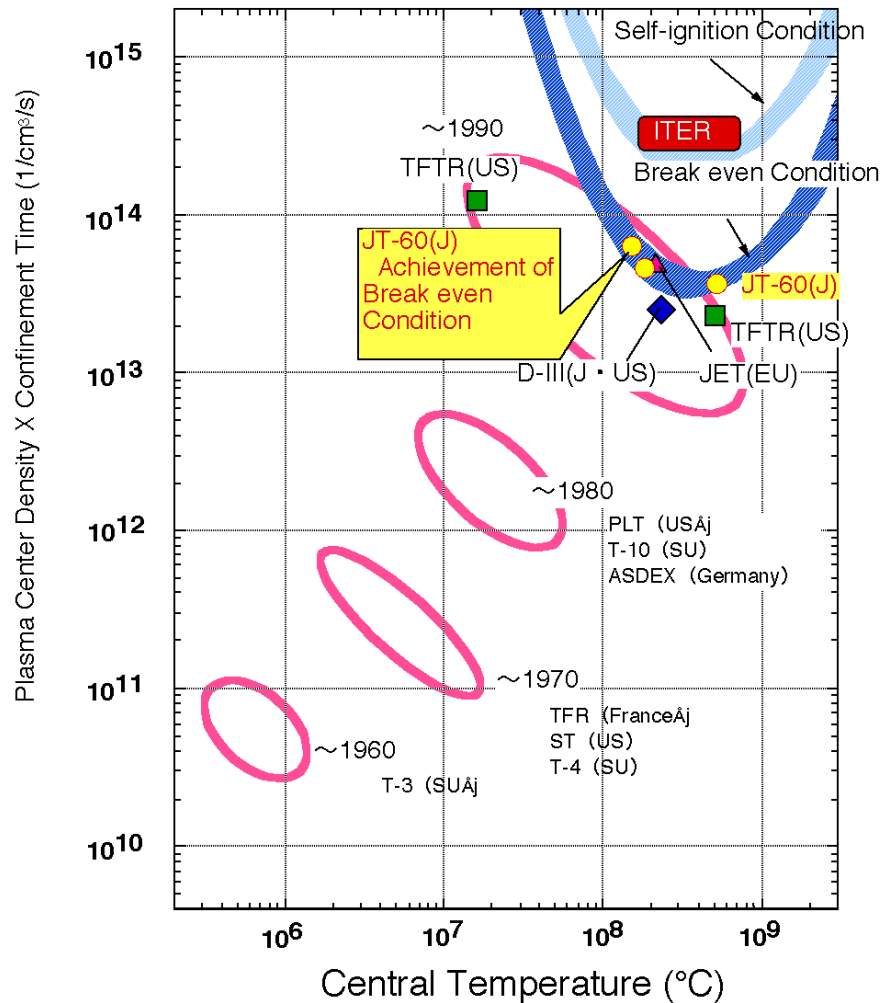
required  
**Lawson  
Criterion**

# Status of the Tokamak Research

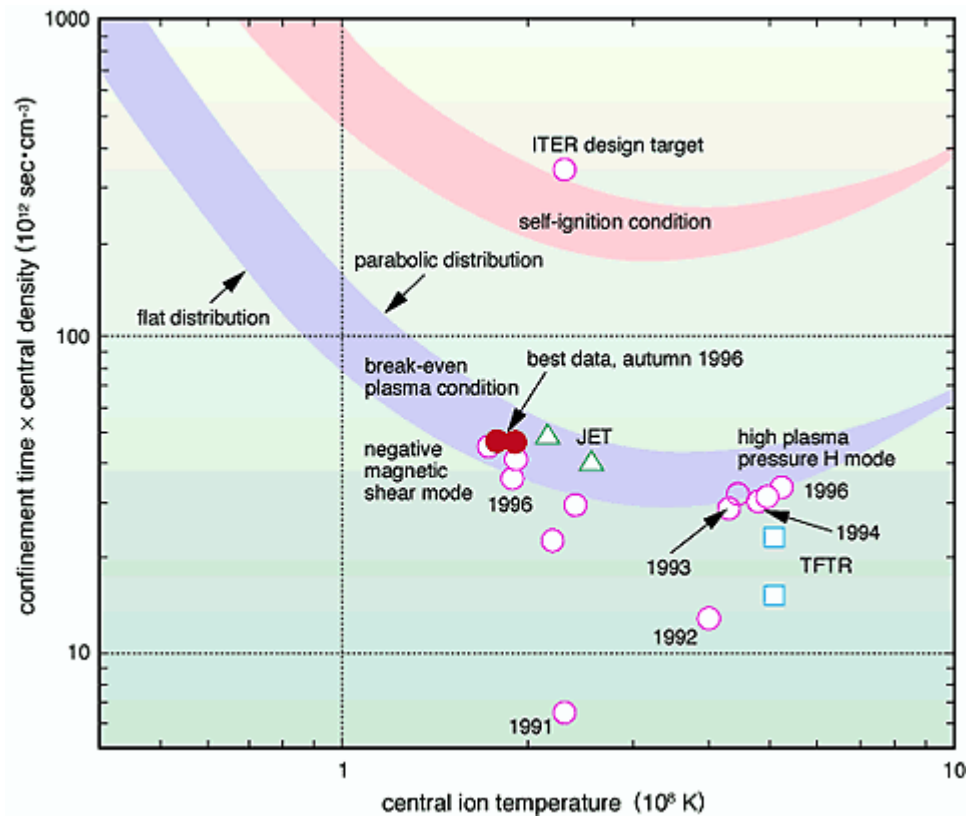




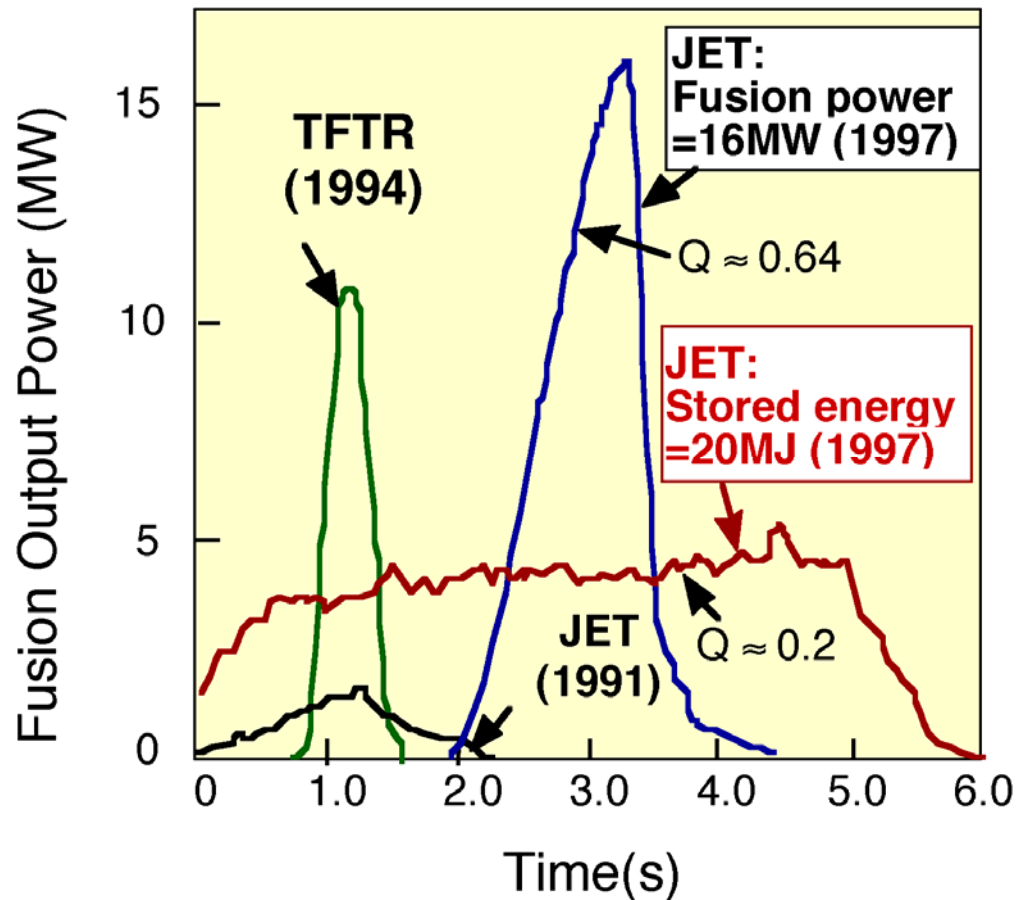
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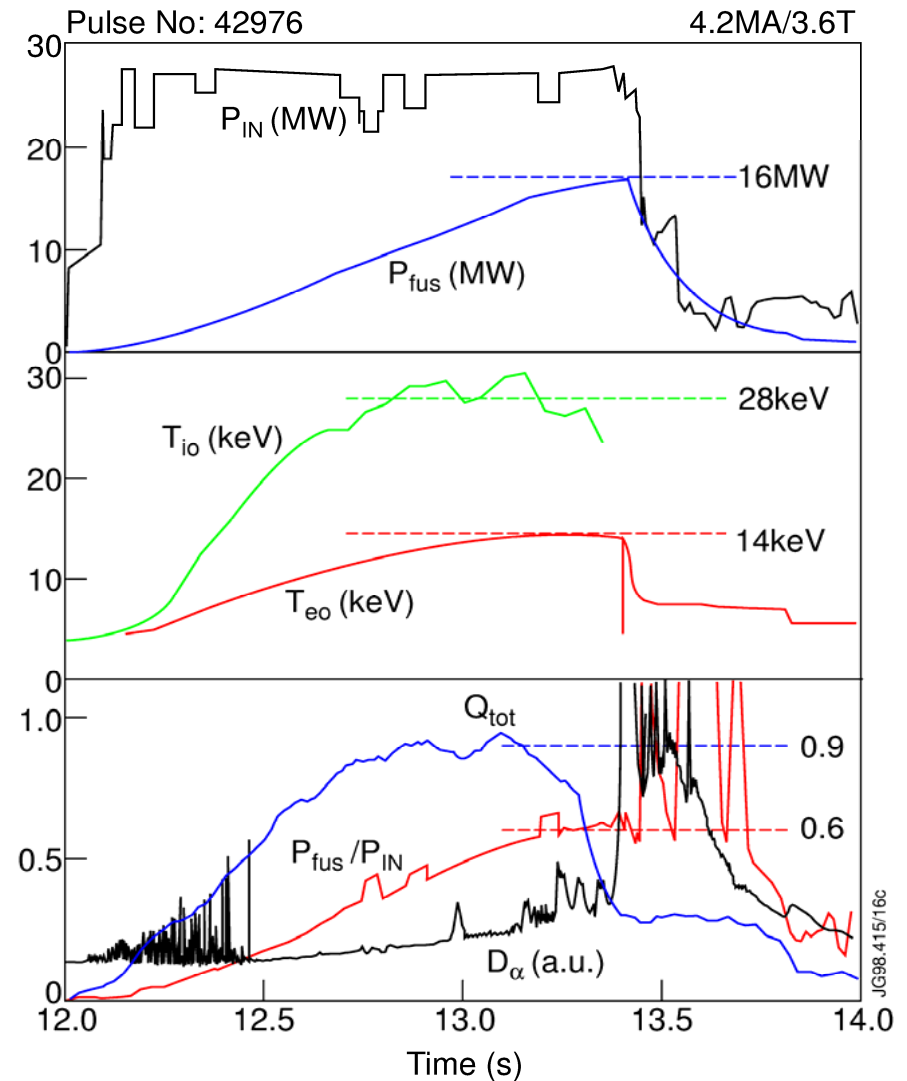
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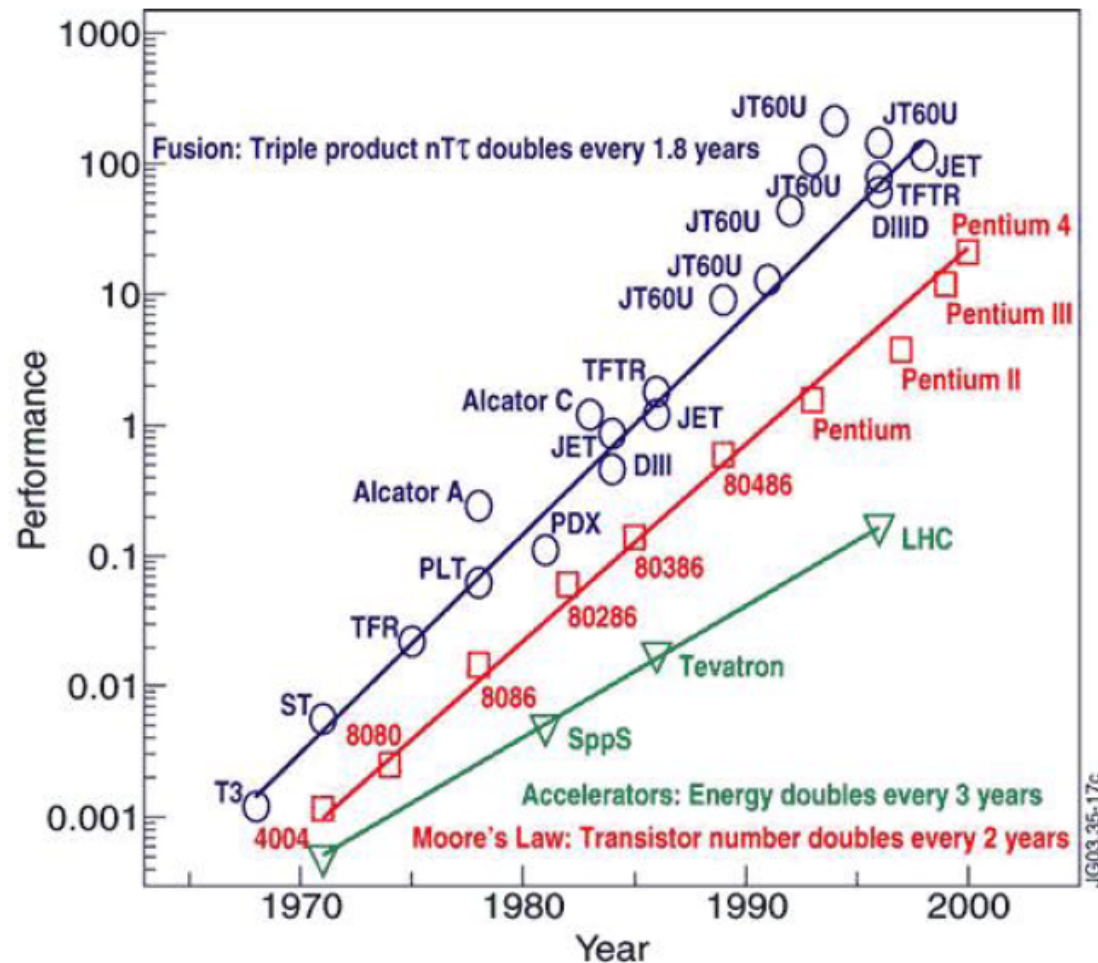
- Present machines produce significant fusion power:
  - TFTR (USA) ~10 MW in 1994
  - JET (EU) 16 MW ( $Q=0.64$ ) in 1997

# Status of the Tokamak Research

- DT-Experiments only in
  - JET
  - TFTR
- with world records in JET:
  - $P_{\text{fusion}} = 16 \text{ MW}$
  - $Q = 0.64$



# Status of the Tokamak Research

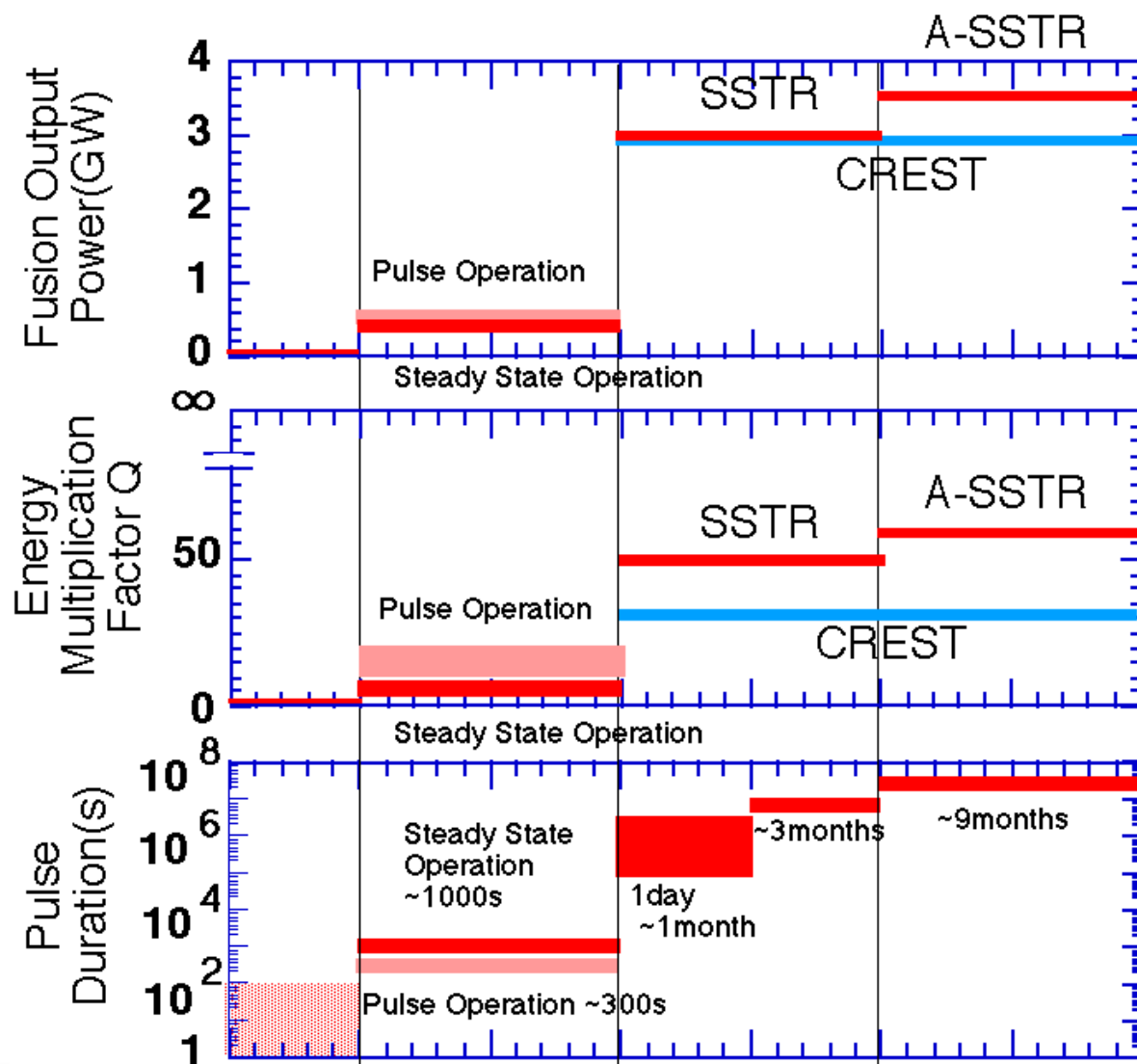


- Progress in fusion can be compared with the computing power and particle physics accelerator energy.

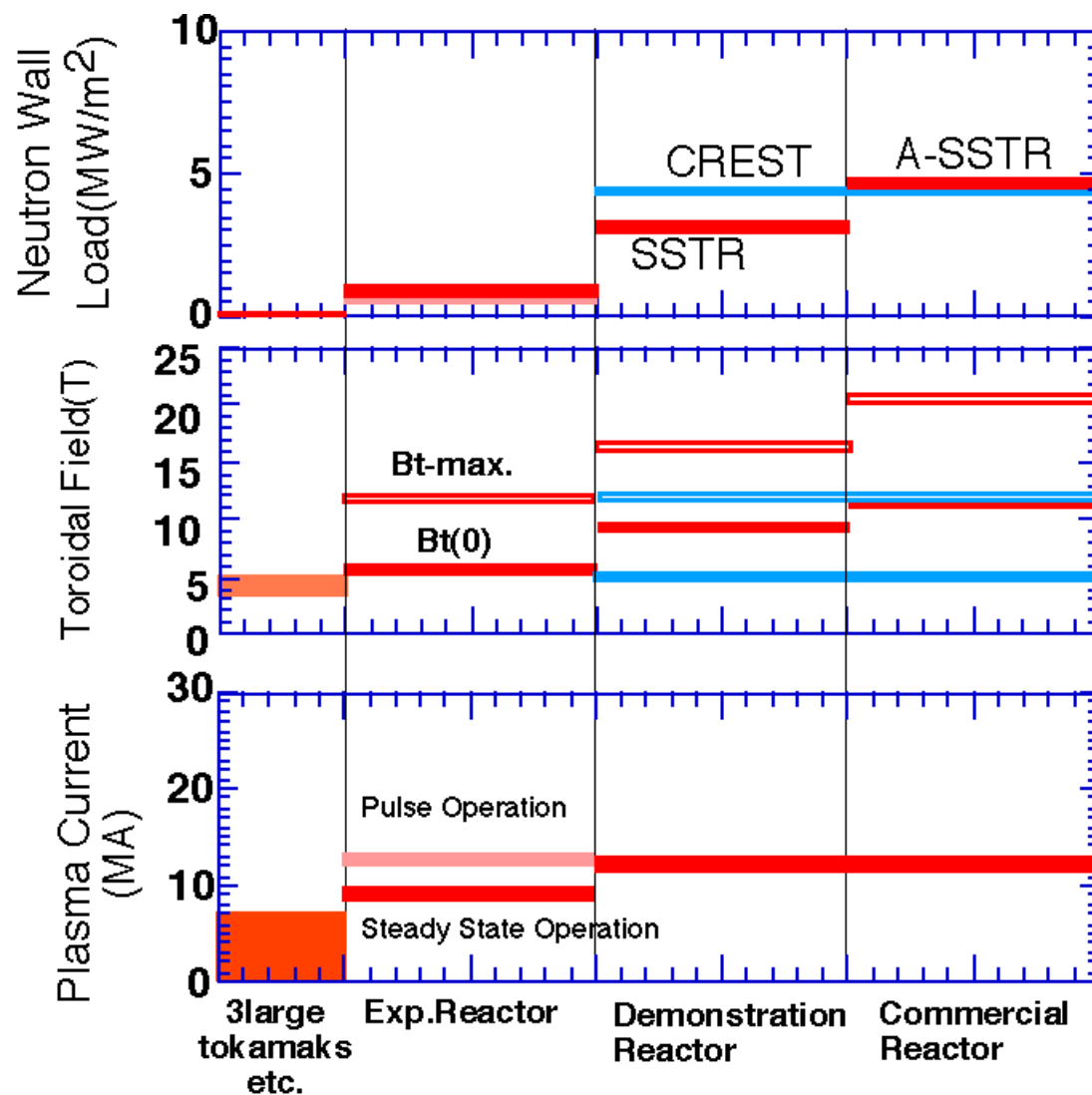
# Required Advancement

1. Fusion output power
2. Energy multiplication factor
3. Pulse duration
4. Neutron wall load
5. Toroidal magnetic field
6. Plasma current
7. Normalized beta
8. Operation density
9. Heat exhaust and radiative cooling
10. Helium exhaust
11. Self-heating fraction and heating control
12. Current drive efficiency
13. Simultaneous attainment

# Required Advancement

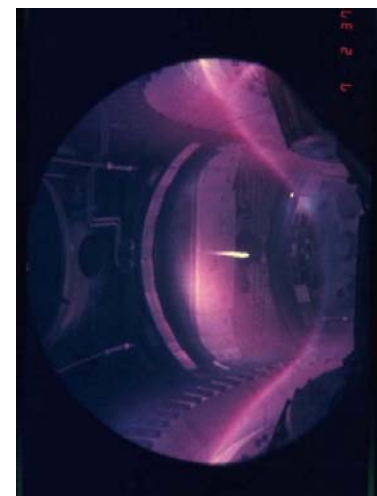
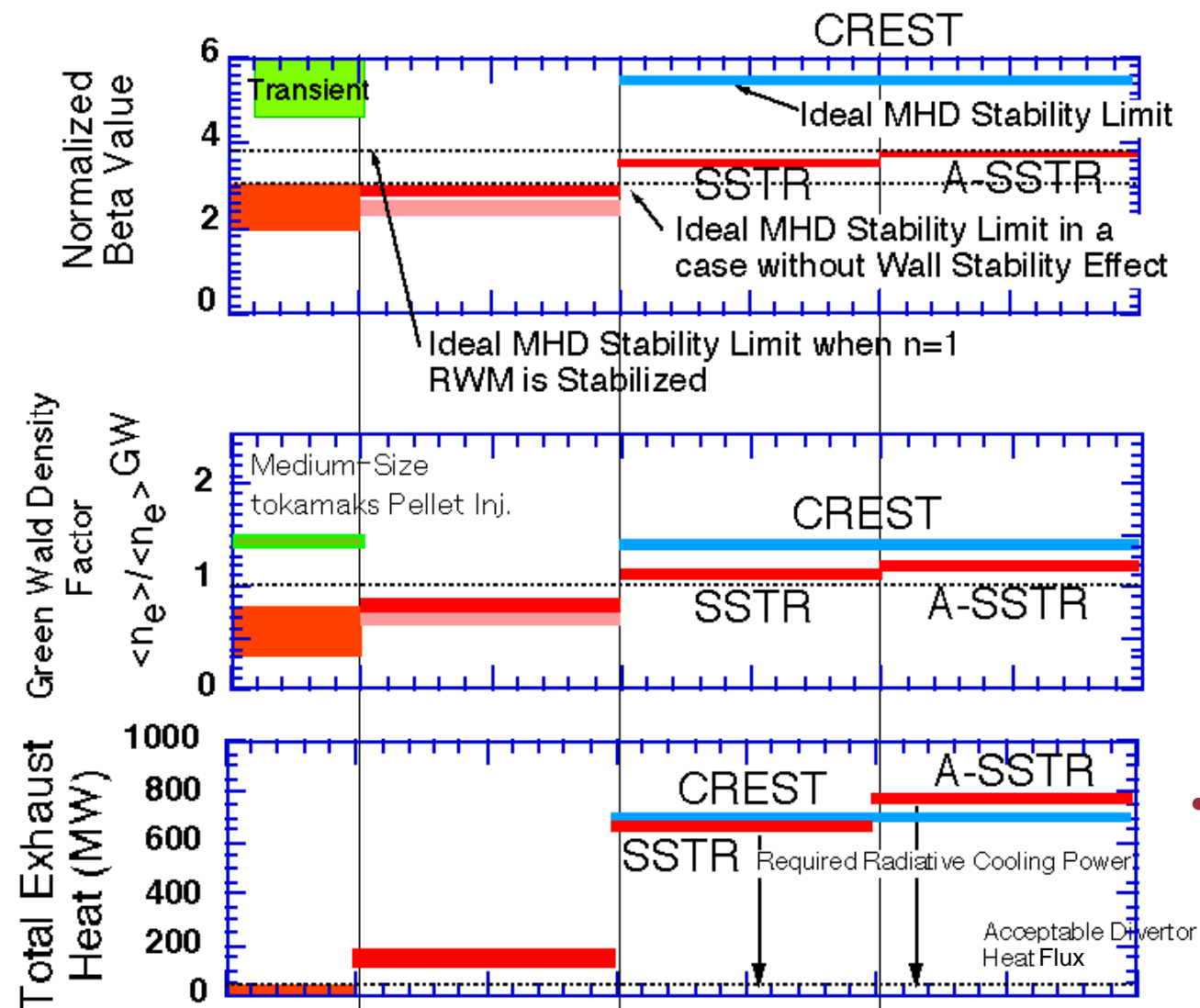


# Required Advancement



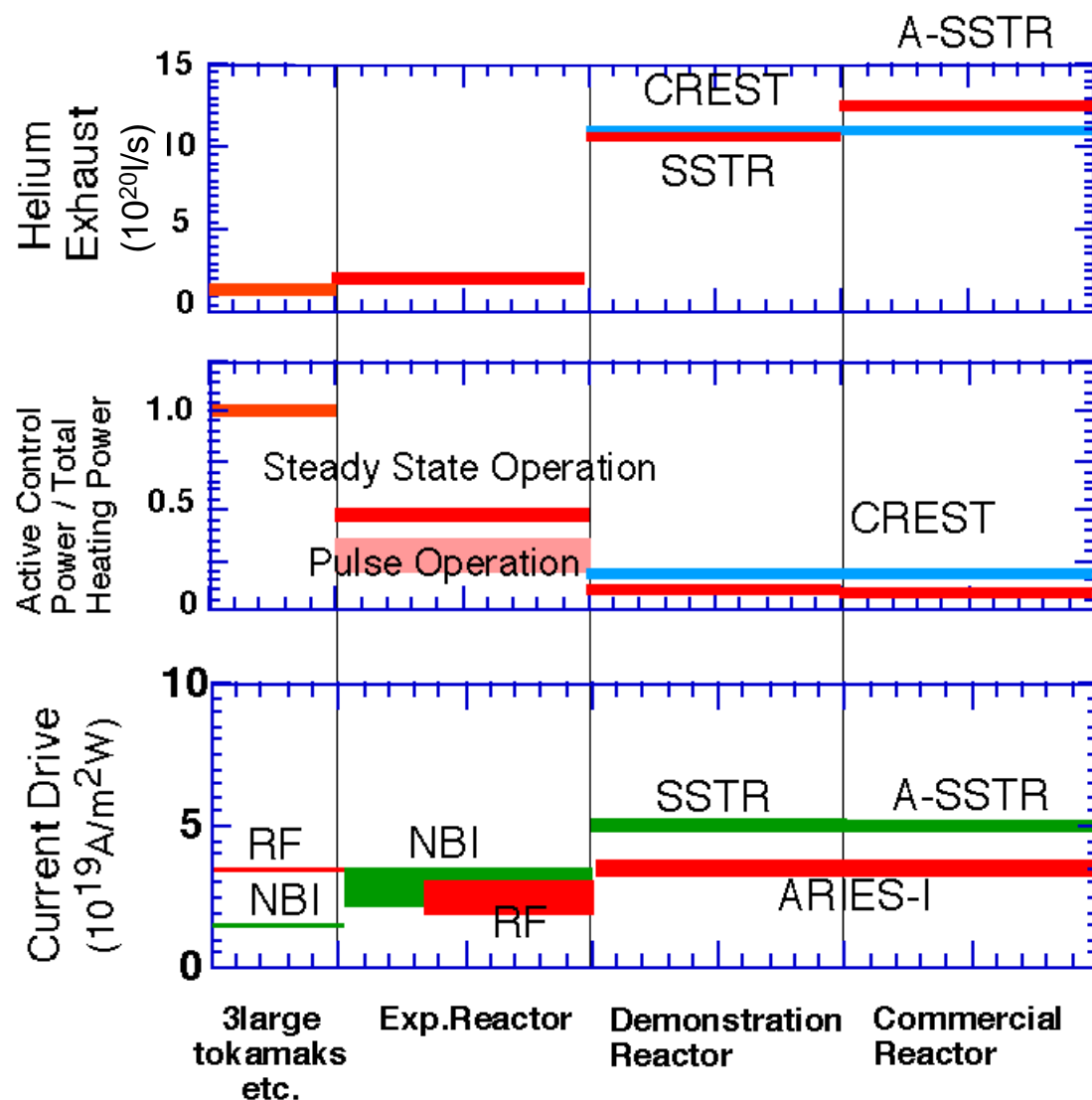


# Required Advancement

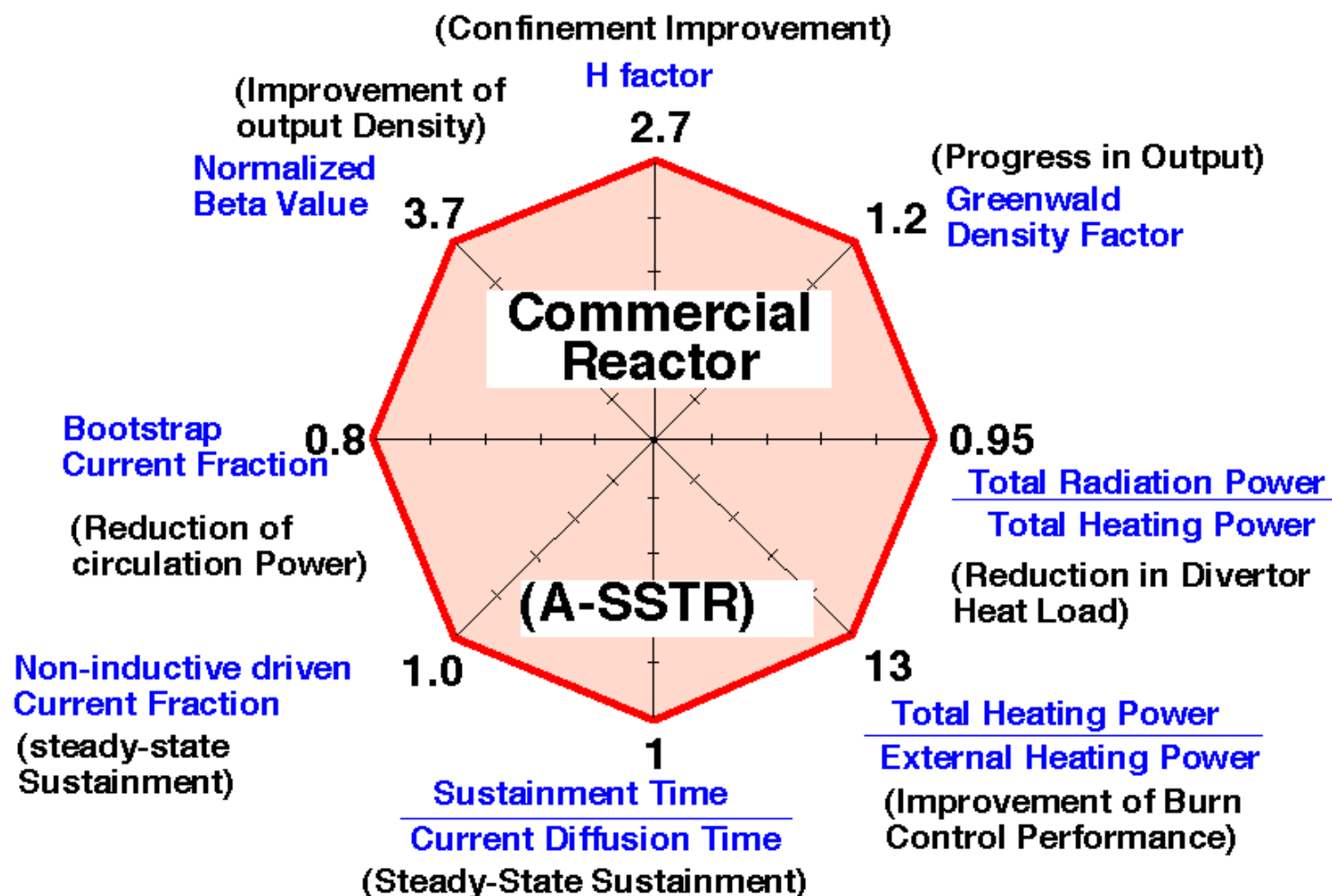


- Pellet injection in ASDEX Upgrade

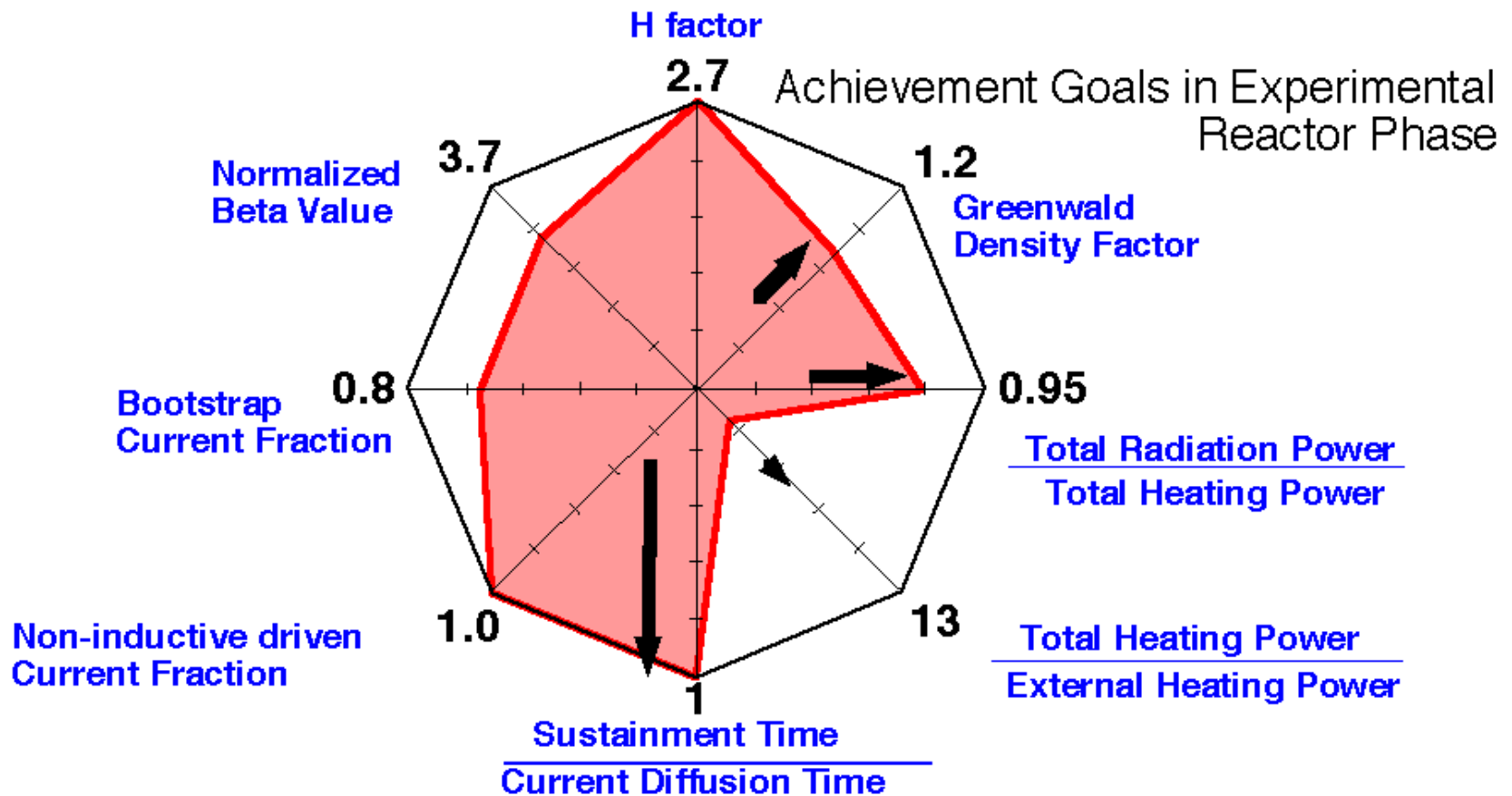
# Required Advancement



# Required Integrated Plasma Performance



# Status



# Status

