

JET: an Opportunity
for the U.S. in the
Coming Decade

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Introduction

-- Premise: JET represents the only opportunity for the U.S. to experimentally study $Q \geq 1$ DT plasmas in the coming decade

-- Counterpoint to Question #2:
 \Rightarrow are some burning plasma issues accessible in JET in the near term

-- Also feeds into Question #4:
 \Rightarrow JET DT experiments should improve our ability to predict performance of future burning plasma device

Current JET plans (JET-EP)

- Upgrades recently approved for "research in support of ITER" (E. Solano, APS-DPP 2000)
- Auxiliary heating (NBI, ICRH, ECRH) steadily increased to 50 MW total in 2005 (higher β , confinement scaling...)
- New divertor, higher triangularity (higher n_e , longer ELM-free H-mode)
- DT plasmas in 2006
- Could attain $Q \sim 1$ with core transport barrier

Increased plasma volume could
allow $Q \leq 2$

-- Part of JET-Upgrade proposal at Snowmass (C. Gormezano et al.)

-- $Q \sim B^3(a^3/R)^{5/4}$ (assuming gyro-Bohm scaling): increase "a" by 15%

-- Transient $P_{\text{fusion}} \sim 72$ MW, $P_{\text{alpha}} \sim 14$ MW

-- **Not** part of JET-EP

Scientific issues accessible, at least in part, in JET DT experiments

- Alpha-particle transport
- Effect of alphas on, e.g., sawteeth
- Stability of Alfvén eigenmodes
- Formation and control of core and edge transport barriers with alpha heating, alpha-driven instabilities
- Alpha-particle diagnostic development?

Political impact of JET collaboration

-- Importance of BP physics long recognized by U.S. fusion community

-- Attempts at new devices and/or major collaborations have failed (\$)

-- "...no scientist has been able to tell me that we will reach [$Q \geq 1$] in less than 40 more years" (Rep. Dana Rohrabacher, APS News, 1995)

-- U.S. program should benefit from collaboration in first $Q \geq 1$ expts.

⇒ Improve our chances for a new U.S. BP device

⇒ Alternatively, or in addition, might help our case for rejoining ITER

Conclusions

- JET DT will allow near-term study of some burning plasma issues
- JET DT should improve our future-device-performance predictions
- U.S. already has small JET collaboration... should increase it
- Instead of waiting for 2006, start ramping collaboration now to:
 - (1) ensure that DT occurs
 - (2) push for maximum possible Q
- Increased U.S. participation in JET now and later is welcomed

Conclusions continued

- Necessary increase (\$5-10 M??) in U.S. fusion budget for ramped JET collaboration probably feasible
- JET DT provides the U.S a **near-term** achievable goal in BP science
- Help attract students, stimulate external interest...?
- If no collaboration, Workshop issues will not be addressed by the U.S. until (well?) after 2010