Run-Time Allocation and Comments on Particle Control Options

R. Kaita and J. Boedo

NSTX Research Forum

September 23, 2004

Machine time expected to be *very* tight for next run

- Fourteen weeks in FY05 vs. twenty-one in FY04
  - Each experimental task (ET) group gets 8 days
  - Fourteen "scientific contingency" days available

- New ET technologies can help make case for using part of 8 days allocated to develop "cross-cutting" capabilities
  - Supersonic gas injection
  - Pellet injection
  - Surface coating and conditioning techniques
  - Diagnostics

- José Boedo to lead discussion for setting priorities at end of session and present recommendations on Friday

Need to include preparation for FY06 decision point on particle control options in FY05 run planning

NSTX Issue	Cryopump Assessment Status	Cryo Assessment Basis or Schedule for Achievement	Liquid Lithium Module Assessment Status	Liquid Lithium Module Assessment Basis or Schedule for Achievement
Capability for Particle Control	Ability established with operational caveats (see comments under "Operation" in next table)	DIII-D (GA) results on edge plasma modification available - although *predictive* capability for "first principles" NSTX design needs more work	Ability established	UCSD (PISCES) and UIUC results on hydrogen retention and PPPL (CDX-U) results on recycling reduction
Capability for Power Handling	Not applicable (must be protected from high heat flux)	Not applicable	Required flow rate is 7-12 m/s from analysis	PISCES results on temperature dependence of lithium evaporation confirm temperature limits; power handling tests at LIMITS facility (Sandia) planned but not started
Safety	Cryogens handled routinely	Experience on DIII-D, NSTX, and elsewhere	1) Static "pools" of liquid lithium handled safely 2) Circulating Li system assessment required	1) CDX-U has safe handling experience with static fully-toroidal liquid lithium limiter 2) Tests of flowing lithium hardware in progress at LIMITS facility; assessment to be completed in mid-FY05

NSTX experiments in FY05 can investigate operational issues that need to be addressed for FY06 decision point

NSTX Issue	Cryopump Assessment Status	Cryo Assessment Basis or Schedule for Achievement	Liquid Lithium Module Assessment Status	Liquid Lithium Module Assessment Basis or Schedule for Achievement
Installation	In-vessel modifications substantial but potentially straightforward: • Close passive plate gaps and redesign secondary passive plate supports	Preliminary assessment completed – Menon (ORNL - ret.)	In-vessel modifications could be limited but have special requirements: • Permit lithium flow into, through, and out of NSTX • Accommodate CHI "gap" and diagnostic penetrations	Preliminary assessment completed – Nelson (ORNL); prototype flowing liquid metal systems being tested at MTOR (UCLA) and LIMITS; conceptual design for NSTX flow configuration requires experimental data and MHD modeling results for NSTX divertor geometry (UCLA/Hypercomp)
Operation	Pumping dependence of separatrix distance to plenum limits achievable plasma geometries	Preliminary assessment completed – Menon (ORNL - ret.)	MHD effects on liquid lithium may limit permissible magnetic field ramp rate; ***assess ELM, thermoelectric current, and plasma wind effects; control external current loops***	Experimental and computational assessment of MHD effects on liquid lithium flow in NSTX fields in progress at SNL and UCLA; ***ELM effects and other issues related to NSTX plasmas require further investigation on large MFE facilities***