Answers to PAC questions and recommendations, specific to ramp-up

The PAC cautions that sufficient experimental time will need to be made available to develop the current ramp. Early experiments will need to determine the limits of CHI plasma formation, and in particular determine the maximum achievable current without use of the solenoid. Although separate experiments can and should be done to develop a FWCD/NBCD current ramp starting at 400 kA (presumably using the solenoid to get there), a full demonstration of non solenoidal startup will have to wait for availability of the 28 GHz gyrotron.

- Agree and will make most use from predictive simulations that address ramp-up scenarios from a range of CHI initial conditions to assess actuators need. We plan to combine TSC simulations of the CHI phase with new experiments to further study the range of conditions expected for an optimal use of the EC gyrotron and for the optimization of the RF/NB phase.

Answers to PAC questions and recommendations, related to ramp-up/1

Validation of NBCD should be given high priority in the first two years of operation, starting at 600-800 kA using (initially) inductive ramp-up of the plasma.

- Agree. Validation of NBCD is in fact high priority in the development of credible scenario simulations for non-inductive current ramp-up and sustainment. We plan to prepare simulations for variations of the input parameters (like pressure amplitude and peaking factor) of about 30% and use NBCD experiments to validate simulations and to design new, optimized discharges.
  This also addresses the PAC recommendation:

NSTX-U should (1) develop the basis for integrated, steady-state operation and axisymmetric control for next-step STs and (2) establish stationary, 100% non-inductive operation, and partial inductive operation up to 2 MA, for 5s over a wide range of Greenwald fractions, collisionality, and β values

Answers to PAC questions and recommendations, related to ramp-up/1

The NSTX-U team did not provide details on the study, optimization, and control of NBCD at NSTX-U in collaboration with DIII-D. This area is well coordinated; DIII-D has announced a second national campaign that includes a joint experiment with PPPL for "testing the prospects of neutral beam current drive to produce fully non-inductive and current overdrive in preparation for follow-up experiments on NSTX-U". Sufficient priority should be given to this collaboration during the first 2 years of operation.

- Although detailed plans have not been articulated but only a mention was given, the NSTX-U team is actively participating in the National Campaign, designing discharges that use the DIII-D actuators to reproduce conditions that are expected in NSTX-U at lower magnetic field. The team is committed to benefit at the most from this collaboration for future research operation and we anticipate this coordination to be productive and fruitful for all parties.