

2004-8 Goals

Phase I:

- 1 MW EBW heating/CD earliest availability in late 2005
- Demonstrate on-axis EBW heating and startup in 2006 with 1 MW
- Provide power supplies and cooling sufficient to support phase II

Phase II:

- If phase I tests successful, install ~5MW in 2007 for EBW heating, sustained CD and NTM stabilization in 2008-9

Supporting EBW Emission Experiments

- Obtain ~ 100% X-B conversion with local limiter in early 2003
(could also look at reflected power with same antenna)

- Obtain ~100% O-X-B conversion with (or perhaps without) local limiter in late 2003.
[Is this too late to provide input to antenna design for phase I?]

Antenna Design

- Antenna conceptual design is not defined
- Should antenna be designed for both X-B (normal incidence) and O-X-B (oblique incidence launch)?
- Can only use local limiter for fundamental EBW
- If O-X-B only should it still incorporate a local limiter to widen transmission window?
- Should antenna be adjustable poloidally to vary $n_{//}$ and EBW damping location.

Modeling & Theory

- Need modeling to include realistic antenna pattern and refraction at mode conversion layer near plasma edge (a la GLOSI).
- Need to better define typical target equilibria, kinetic profiles and NSTX needs for heating, startup, long pulse sustained CD and NTM suppression.
- Need to complete GENRAY/CQL3D scoping study to explore sensitivity of CD efficiency to RF launch parameters (eg. poloidal launch angle, $n_{//}$, frequency) by early 2003
[Parallelize GENRAY, late 2002]
- Need to model modification of current drive efficiency by transport and interaction with bootstrap current
- Need to model edge parametric instabilities that may occur with high RF power
- Model non-thermal EBW emission
- Determine the need to incorporate relativistic effects in propagation and damping of EBWs

RF Sources

- Fundamental EBW Heating/CD has better radial access especially at high beta
- ORNL have four 28 GHz tubes could generate 1.4 MW cw, mod-regs and sockets available at ORNL (use PPPL NBI power supply)
- Maybe modify ORNL 28 GHz tubes to 15.3 GHz operation (fundamental at 0.6T), need to attempt this with one tube ASAP.
- Could use 28 GHz tubes as is for fundamental EBW heating/CD at 1T, but needs CS upgrade
- Use 28 GHz tubes as is for second harmonic EBW heating/CD at 0.5T (O-X-B, with no local limiter)
- Development program with Thales (or CPI) to modify 8 GHz, 1 MW Gyrotron for ~ 15 GHz (expensive, but should we consider this for phase II?)