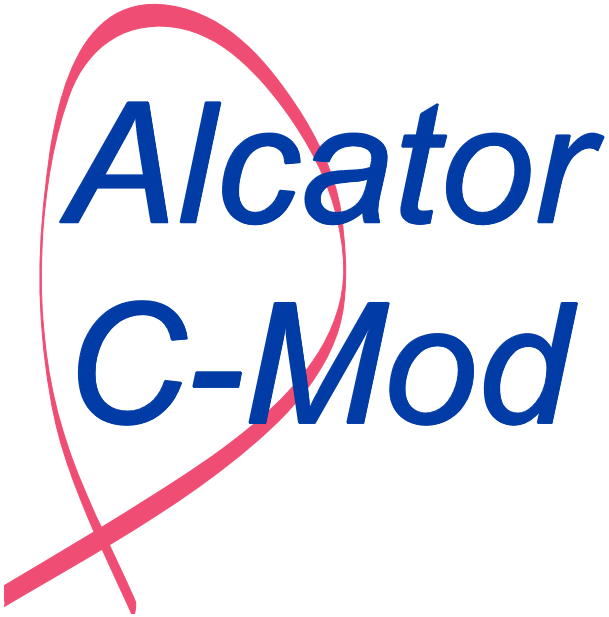
C-MOD PROGRESS AND PLANS RELATING TO H-MODE AND ADVANCED SCENARIOS

G. Wallace on behalf of the C-Mod team

7th meeting of the ITPA IOS Topical Group
Kyoto, Japan
October 18, 2011



Heating and current drive systems updated during up-to-air

No plasma operation since last meeting, pumping down for next campaign this week

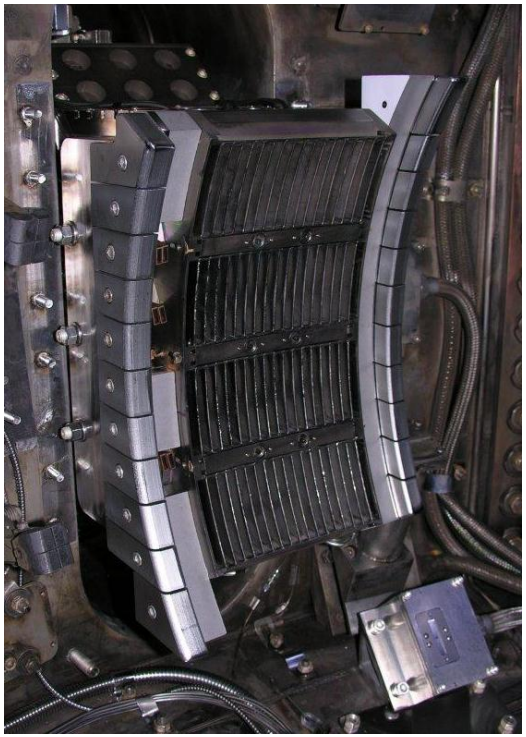
- New LH limiter installed
- Upgrade to protection system for longer LH pulses
- New rotated 4-strap ICRF antenna installed

Analysis of existing data covered in individual talks

- Further analysis of LH density limit data (see talk tomorrow on IOS-5.3)
- Further analysis of ramp-up experiments (see talk on Thursday by C. Kessel)

New LH limiter designed to reduce reflected power

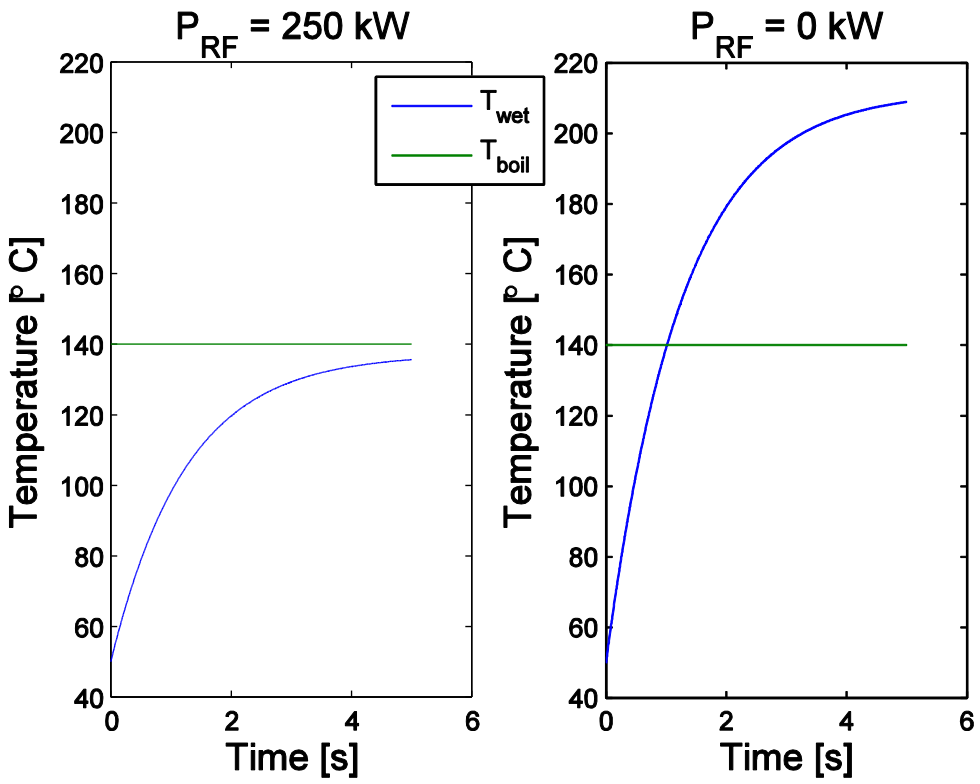
- Old limiter fixed to wall, launcher moved relative to limiter
  - Could only operate with launcher between .1 and .5 mm behind old limiter
- New limiter fixed to launcher (0.2 mm behind limiter), both move together
- Can be pushed proud of ICRF limiters to reduce deleterious effects on LH wave coupling (Tore Supra results show this helps)
- Will be able to move launcher to region with best density/density gradient for coupling



Transmitter protection system (TPS) upgrade allows for longer LH pulses

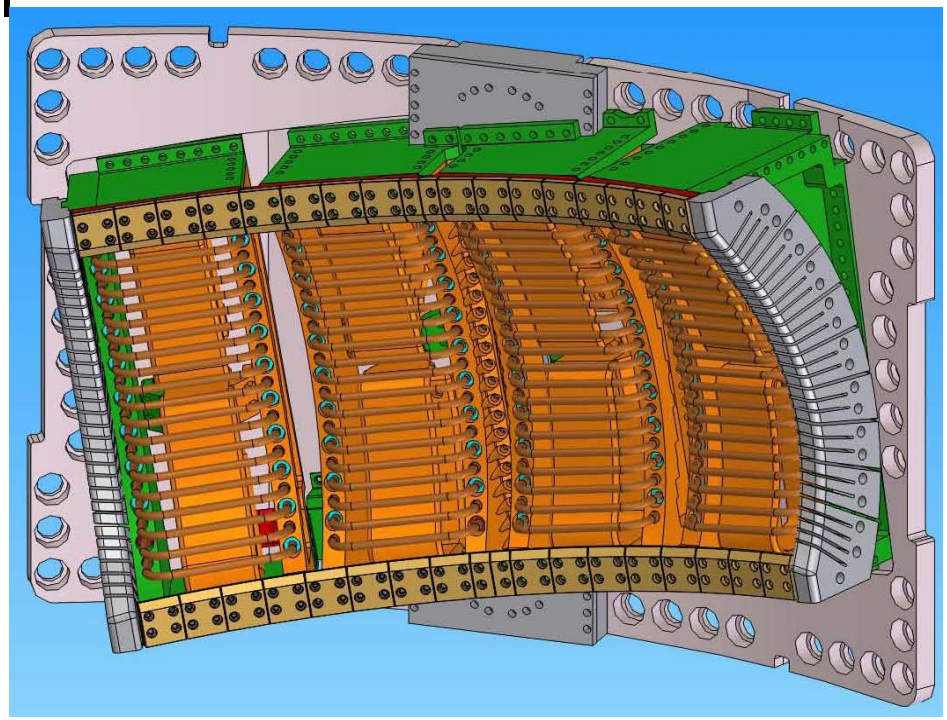
- LH pulse length administrative limit set at 0.5 s during previous campaigns
  - Need longer pulses for advanced scenarios
- New TPS calculates klystron collector temperature in real time
- TPS will shut off high voltage if temperature threshold is exceeded
- Shakedown of new TPS scheduled for December
- Will carefully increase pulse length during upcoming run campaign

Klystron coolant temperature simulation



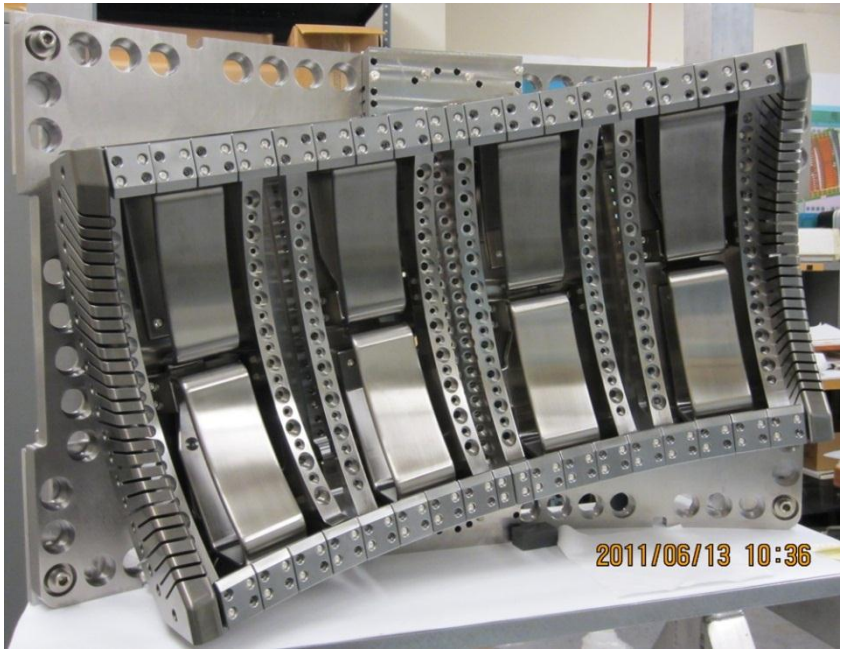
New rotated 4-strap ICRF antenna designed to reduce impurity production

- Rotated design results in total cancellation of parallel electric field
- Lower parallel E-field should result in reduced sheaths, hopefully leading to fewer high-Z impurities
- Integrated SOL reflectometer for density profiles (contribute to IOS-5.2)
- Ready to start assessment with first plasmas



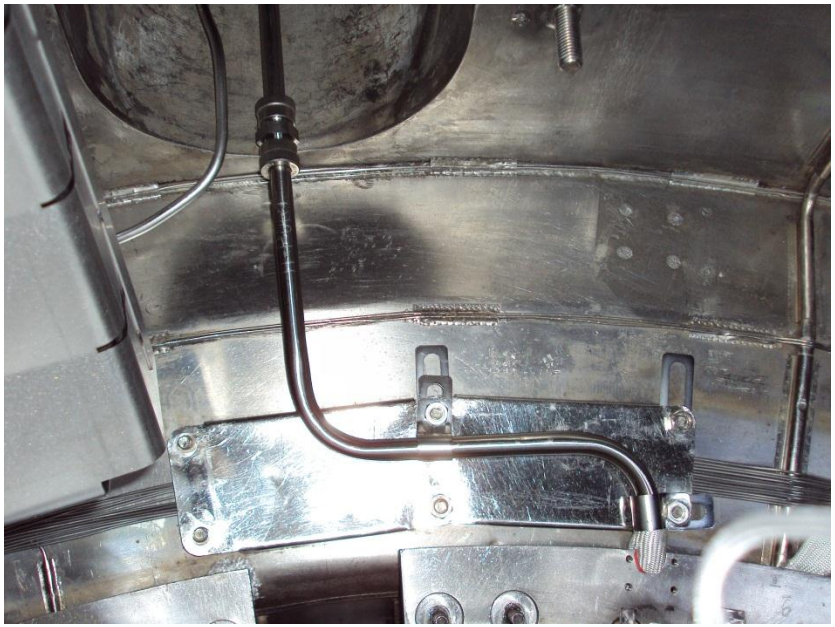
Fewer high Z impurities will make ICRF more effective per MW

- If new antenna achieves ~10 MW/m^2 (present limit), the injected power will be limited to 2 MW from rotated antenna due to smaller area
  - For present J antenna, 3 MW is typical maximum injected power
  - Will need to achieve ~15 MW/m^2 to achieve 3 MW
- To reduce impurities, present non-field aligned antennas are operated in dipole [0, π] phasing rather than monopole phasing [0,0]
- For [0, π, 0, π], estimated sheath field is reduced ~3-10
- For [0,0,0,0], sheath field is negligible – a surprising prediction and one we can test



New impurity seeding gas lines installed in divertor

- Existing gas lines at midplane and vertical ports
- Two new gas lines located in divertor 140° apart toroidally
- Plan to compare efficacy of puff locations with respect to core impurity levels



Alcator C-Mod FY 2012 run campaign begins soon

Planned experiments related to IOS:

- Evaluate rotated ICRF antenna including coupling (IOS-5.2), impurity production
- Continue impurity seeding studies at ITER q_{95} and shape with new gas lines including feedback control (IOS-1.2)
- Assess new LH limiter configuration
- Extend LH pulse length
- Examine LHCD density limit at higher temperature (IOS-5.3)
- Combine LHCD with ICRF for higher performance non-inductive scenarios, and assessment of potential hybrid scenarios
- Expand power and density range for I-mode
- Continued exploitation of the 2.7T, 2nd harmonic proton heating regime, at target $beta_N$ and n/n_G with possible extension to He majority plasma (IOS-1.1)