Three-ion ICRH scenarios: a new technique for heating mixture plasmas with promising applications for JET DTE2 and ITER operations

JET | ASDEX Upgrade | Alcator C-Mod

EX/8-1

Two possible realizations of the three-ion ICRH technique were demonstrated in H-D plasmas

- **Use ^{3}He ions at low concentrations, ~0.2-1.5%**

→ $(Z/A)_2 < (Z/A)_3 < (Z/A)_1$: e.g., ICRH heating of ^{3}He ions in H-D plasmas, demonstrated on Alcator C-Mod, AUG and JET

→ Scenarios relevant for ITER non-active plasmas

^{3}He minority heating in H-^{4}He plasmas, ^{4}He-(^{3}He)-H
^{4}He minority heating in H-^{9}Be-Ar plasmas, ^{9}Be/Ar-(^{4}He)-H

→ Scenario relevant for D-T plasmas, T-(^{9}Be)-D:
ICRH heating of intrinsic ^{9}Be impurities as a minority

- **Use fast NBI ions as resonant 'third' species**

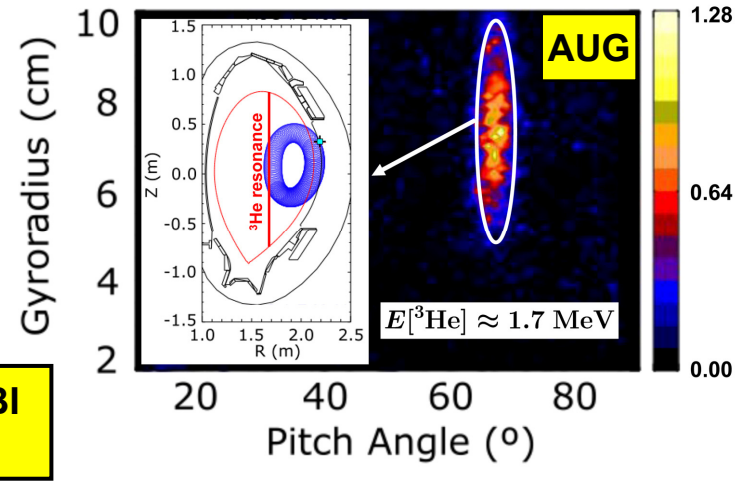
→ D-(D_{NBI})-H scenario demonstrated on JET:

D-NBI ions accelerated from 100keV to ~2MeV with ICRH, a factor of 10-15 increase in the neutron rate

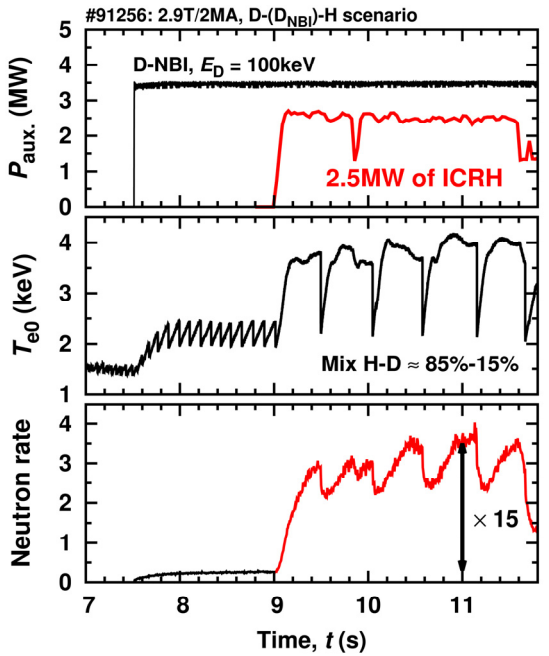
→ Scenarios for D-T plasmas: T-(T_{NBI})-D and T-(D_{NBI})-D

apply moderate acceleration of T-NBI or D-NBI ions to the energies, at which D-T reactivity is maximized

E_T = 70keV vs. E_T = 180keV: a factor of 5 increase in σv_{DT}



JET: ICRH heating of D-NBI ions in H-D plasmas



Application for D-T plasmas