JET gets ready for α-particles in DT campaign

- Specific scenarios with elevated q-profile and internal transport barrier (ITB) were developed in D plasma for studying α–particle driven TAEs in the "beam afterglow" phase of future DT discharges. Low power ICRH was used to probe the instability of TAEs.
- TAEs with n=4,5,6 were most easily excited with ICRH. For JET discharge with highest DD neutron rate, the TRANSP extrapolation to D:T=50:50 shows βα ~ 0.08%-0.12%, which exceeds the TFTR plasmas with α–particle-driven TAEs (0.02%-0.07%).
- The HAGIS code study for TAEs with n=4, 5, 6 and isotropic α-particle population with computed with TRANSP, gives the TAE growth rates (γ/ω) ≈0.3%. These are close to the reference "afterglow" JET pulse # 41723 from DTE1 and very encouraging.
- In the hybrid scenario on JET, beam-driven fishbones expel 1 MeV tritons and 3 MeV protons (products of D-D fusion). These non-resonant losses are explained via fishbone fields affecting topology of the orbits near the trapped/passing boundary. Similar effect on α–particles in DT plasmas will give 1% losses.
- For the studies of alpha physics and TAEs, diagnostics relevant for burning plasmas were upgraded: neutron and γ-ray cameras and spectrometers, fast ion lost detectors, as well as active TAE antennae for probing stable TAE.