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From RFX-mod to RFX-mod2: perspectives of the Reversed Field Pinch configuration

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In this contribution the main achievements of the RFX-mod Reversed Field Pinch (RFP) are summarized as the basis for a substantial upgrade of the device. The RFX-mod active MHD control system successfully controlled MHD instabilities such as Resistive Wall Modes and mitigated localized Plasma Wall Interaction by avoiding Tearing Modes wall-locking. This allowed producing the highest RFP plasma current in the world, up to 2MA. At high current the RFP plasma, as predicted by the theory, has been observed to self-organize in a global helical shape, where one Tearing Mode dominates the spectrum. In such regimes secondary Tearing Modes still play a role, influencing both internal transport and recycling, impurity content and density limit, through the non axi-symmetric distortion of the plasma edge. Passive and active boundary structures surrounding the plasma have a significant effect on Tearing Modes: the RFXLocking code has been developed to describe such an interaction in RFX-mod and to investigate RFX-mod limitations, thus indicating possible improvements of the device. A further reduction of secondary modes is only possible by reducing the plasma - stabilizing shell distance and lowering the resistivity of the first conducting wall surrounding the plasma. Both these requirements are met in the design of the upgraded device (dubbed RFX-mod2) by removing the present vacuum vessel and modifying the support structure to ensure vacuum tightness. This is expected to reduce the edge magnetic deformation, thus improving PWI and confinement. Non-linear visco-resistive MHD simulations with a boundary layout that mimics RFX-mod2 are reported, in order to better quantify the reduction of the non-linearly saturated amplitude of tearing modes. Some technological issues raised by the implementation of the new magnetic boundary are also discussed

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