Design Status of the ITER Upper Port Launcher

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The purpose of the ITER electron cyclotron resonance heating (ECRH) upper port antenna (or launcher) will be to drive current locally to either stabilise the NTMs (depositing ECCD inside of the island which forms on the q=3/2 or 2 rational magnetic flux surfaces) and control the sawtooth instability (deposit ECCD near the q=1 surface). The launcher should be capable of steering the focused beam deposition location across the resonant flux surface over the range in which the q=1, 3/2 and 2 surfaces are found, for the various plasma equilibria susceptible to the onset of NTMs. And sawteeth. ITER's present reference design uses a front steering (FS) concept, with the moveable mirror close to the plasma. Two separate mirrors are used to decouple the focussing and steering aspects resulting in an optimized optical configuration providing a well focused beam over a large steering range. The launcher is capable of steering eight 2MW beams via two sets of steering mirrors out of each of the four allocated upper port plugs. A brief description of the mm-wave design and physics performance will be given.

The critical component of the FS launcher is the steering mechanism, which will be a frictionless and backlash free mechanical system based on the compliant deformation of structural components to avoid the invessel tribological difficulties. An inert gas pressure controlled bellows system provides accurate angular positioning of the steering mirror. The entire launcher (mm-wave components) can be designed fail-safe in that if a given subsystem fails, it can be isolated and ITER can continue operation. In addition, in-situ leak testing of critical components (steering mechanism, cooling, diamond window, etc.) is envisioned to insure proper functioning and avoidance of disrupting ITER operation. Details of the FS launcher design relating to physics performance, mm-wave, thermohydraulic, electromagnetic and integration of launcher components into the port plug will be discussed.