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[Invited] Successes & Failures in Design Solutions During the 30 Year Life of ITER (and how we could have improved)

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Over 30 years ITER has been through many design iterations and multiple novel solutions for the magnets have been tried, in some cases being carried through to successful manufacturing and in other cases being abandoned. Now that ITER operation is approaching, the fusion community is considering possible next steps, to a power producing fusion plant. If we consider the long road ITER has followed, what lessons can be learned for these next steps?

Looking back at the design iteration history of the ITER magnets, there are several key factors driving magnet design, such as superconductors, structural support, voltage and thermal protection, power supply arrangement and feeders. We can see the new availability of advanced materials and design techniques including high T_c superconductor at low temperature, cable-in-conduit (CICC) development and analytical magnet design. The presentation will look at what ITER did in the early stages in this direction and how a future reactor design could utilise these concepts in the magnets.

Perhaps the most basic lesson is that if a tokamak reactor tries to satisfy the research priorities of many, it can end up as a machine being designed by a committee. This is really the political environment but it can be decisive (as in the case of ITER) in determining the nature of the project. Beyond this, we can look at the many novel technical solutions (those that made it into the final ITER magnets and those that did not) and consider whether we could have been more efficient...and whether we can see any signs of the same mistakes being repeated.

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