

**E16-10 PHYSICS ISSUES AND TRADE-OFFS IN MAGNETIC FUSION POWER PLANT** FARROKH NAJMABADI, *UC San Diego*, STEVE JARDIN, *Princeton Plasma Physics Laboratory*:

During the past ten years, the ARIES Team, a national US team involving universities, national laboratories, and industry, has studied a variety of magnetic fusion power plants (tokamaks, stellarators, spherical torus, and RFP) with different degrees of extrapolation in plasma physics and technology from present database. Continuation of research has allowed us to apply lessons learned from each ARIES design to the next. The results of ARIES studies provide a large body of data that highlight the contribution, tradeoffs, and relative leverage of advanced plasma physics and fusion technology directions. For example, for tokamaks, our results indicate that for the same plasma physics (e.g., first-stability) and technology extrapolation, steady state operation is more attractive than pulsed-tokamak operation. Dramatic improvement over first-stability operation can be obtained through either utilization of high-field magnets (e.g., high-temperature superconductors) or operation in advanced-tokamak modes (e.g., reversed-shear). In particular, if full benefits of reversed-shear operation are realized, as is assumed in ARIES-AT, tokamak power plants will have a cost of electricity competitive with other sources of electricity. We will discuss physics trade-offs in a MFE power plant, will compare physics needs of a MFE power plant with present-day achievements and will summarize physics regime of operation with highest leverage in achieving attractive MFE power plants.