Next Steps for the Systems Code

J. F. Lyon, ORNL

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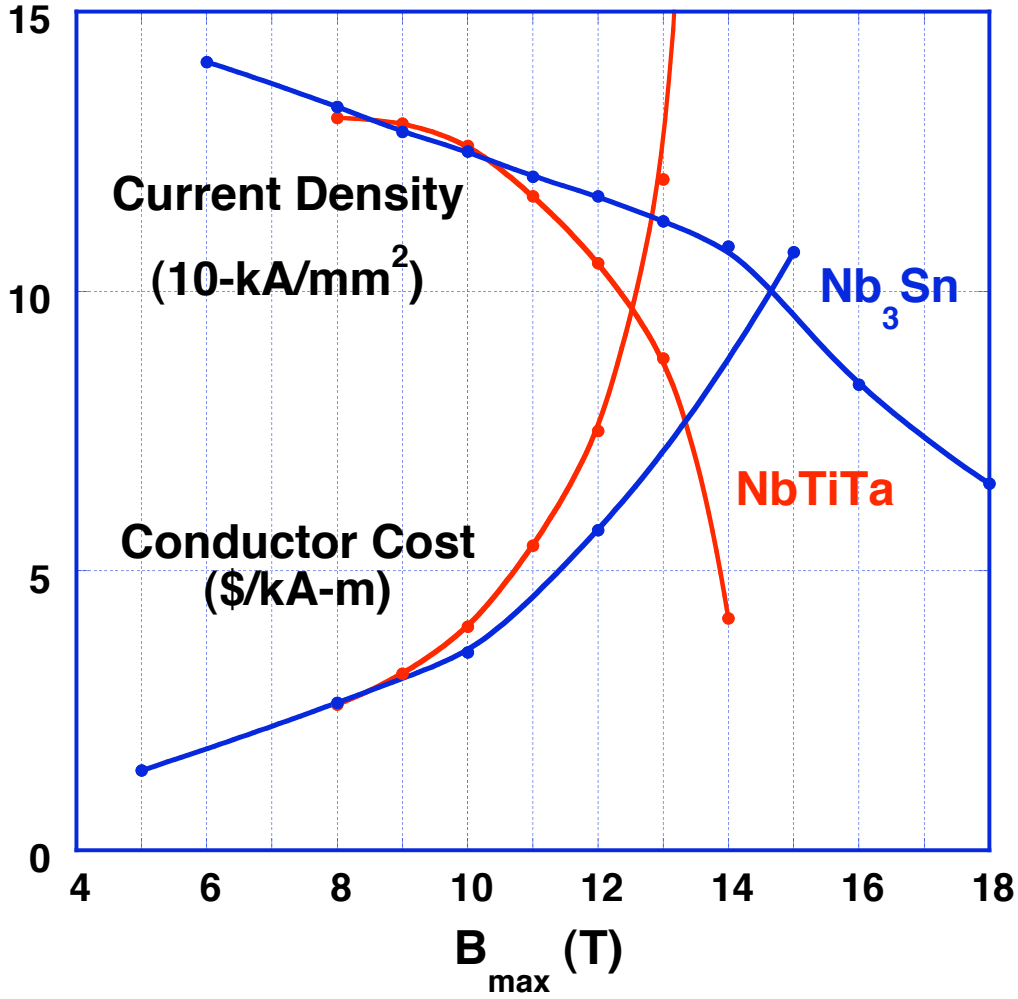
UT-BATTELLE

System Code Convergence

- **Until Sunday morning, the only topic for this talk was the problems I was having in obtaining a solution that satisfied all the constraints!**
- There had been no problem in obtaining parameters that satisfied all the constraints (incorrectly, it turned out) for the NKZD coils
- However, there was no solution for the other coil configurations or ridiculous results (negative costs)
- An incorrect B_{max}/B_{axis}(k) caused B_{max} to exceed limits or even go negative, which had many consequences -- found by adding diagnostics
- **There is the inherent problem of fine structure (local minima, ridges, bifurcations, no solution) in the topology of the 6-D variable space and in over-constrained cases typical in non-linear codes**
  - **nearby starting points end up at different final points**

Conductor *j* and Cost Varies with B_{max}

- **Conductor cost =** const $B_{axis}\langle R\rangle^2[f(B_{max})]$
- **Cost of winding coil =** conductor mass x \$80/kg
  const $B_{axis}\langle R\rangle^2 / j(B_{max})$
- **Coil structure =** volume x 7800 kg/m^3 x \$56/kg = $k_3\langle R\rangle^2$



Remaining Systems Work

- Recheck volume algorithms
- Better calculation of coil support structure
  - algorithm for shell structure, bucking cylinder
- Run NbTi(Ta) cases
- Divertor treatment
  - calculate areas, thicknesses, costs
- Improve vacuum systems (22.1.6) cost
  - only includes vacuum vessel cost; need to include other systems (pumping, gas useage/day)
- Incorporate ln(p_{wall}/2) correction in shield thickness

Remaining Systems Work

- **Add P_{alpha}*$\eta_{thermal}$ to thermal power**
- **Complete comparisons for all plasma & coil configurations**
- **Use ARIES-AT $\eta_{thermal}$ for comparison**
- Add ν^* correction to α-loss when available
- **Analyze changes since SPPS**
- Startup and commissioning operating points
  - P_{input} required
- **Determine what impurity fractions to use**

Remaining Systems Work

- **Cryostat, vacuum vessel & port values for port maintenance approach**
- **Shield/vacuum vessel geometry for field period maintenance approach**
- **External vacuum vessel**
- Add vertical field/control coils when required
- Calculate $T_e(r)$ and $T_i(r)$ self consistently at some point