ARIES Systems Activities*

- ARIES-NS ('Non-Electric') Neutron Source
  - drafted "Interim Report" section (12/99)
  - additional amplification/explanation required

- ARIES-AT ($A = 4, \beta_N = 5.6, 6.0, 6.8$)
  - Physics Discussion cases posted (02/04)
  - Series A posted (02/29) $R_T = \text{var, } j_{PFC} = 40\text{MA/m}^2$
  - Series B posted (03/01) $Z_{eff}$ increased, core $f_{rad}$ increased
  - Series C posted (03/10) $R_T = 5.2m, j_{PFC} = 45\text{MA/m}^2$

- ARIES Systems Code (ASC)
  - largely back on the tracks
  - still limping w/o graphics
  - rfCD scalings $f(T_e, Z_{eff})$
  - radial/vertical builds are up to date
  - TFC(HTSC) and PFC options need attention
  - cost update† (in progress)

- Socio-economics of fusion
  - new Task 7 adopted by IEA ESE-ExComm
  - Workshop at UCSD

* since last Project Meeting (12/99).
## ARIES-AT Physics Basis*

<table>
<thead>
<tr>
<th>Case</th>
<th>A</th>
<th>B †</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normalized beta †, ( \beta_N )</td>
<td>5.59</td>
<td>6.04</td>
<td>6.81</td>
</tr>
<tr>
<td>Plasma vertical elongation, ( \kappa )</td>
<td>2.14</td>
<td>2.14</td>
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<tr>
<td>Plasma triangularity, ( \delta )</td>
<td>0.78</td>
<td>0.78</td>
<td>0.78</td>
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<tr>
<td>Toroidal beta †, ( \beta ) (%)</td>
<td>9.34</td>
<td>10.17</td>
<td>11.76</td>
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<tr>
<td>Toroidal beta ‡, ( \beta ) (%)</td>
<td>8.40</td>
<td>9.15</td>
<td>10.59</td>
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<tr>
<td>Poloidal beta, ( \beta_p )</td>
<td>2.10</td>
<td>1.90</td>
<td>2.47</td>
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<tr>
<td>Edge density ratio ‡, ( n_s/n )</td>
<td>0.28</td>
<td>0.27</td>
<td>0.24</td>
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<tr>
<td>Bootstrap-current fraction, ( f_{bc} )</td>
<td>0.941</td>
<td>0.945</td>
<td>0.908</td>
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<tr>
<td>Safety factor, ( q(0) )</td>
<td>3.69</td>
<td>3.56</td>
<td>3.56</td>
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<tr>
<td>Safety factor, ( q(a) )</td>
<td>3.97</td>
<td>4.05</td>
<td>3.94</td>
</tr>
</tbody>
</table>

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* C. Kessel (PPPL): Aspect ratio, \( A \equiv R_T/a_p = 4.0 \)
‡ Baseline Strawman selected 21 March 2000
† Not including disruption-avoidance margin (0.9)
○ Assumes \( n_s/n_0 = 0.20 \)
ARIES-AT Fusion Power Core*

- $A = 4.0, \kappa = 2.2, \beta_N = 5.6, 6.0, 6.8^*$
- rf CD per T. K. Mau, pending NBCD (for rotation)
- Underutilized TFC ($B_c \simeq 12T$), pending...
  - possible size reduction
  - possible higher net power output, $P_E$
- initial PFC cf. ARIES-RS may inhibit smaller FPC size

* MAPPER/DISSPLA figure-processing assistance of C. Bathke is acknowledged.
ARIES-AT Systems (Interim) Conclusions

- **ARIES-AT** \( (A = 4.0) \)
  - **Physics:**
    - Three E/S cases at \( \beta_N = 5.6, 6.0, 6.8 \)
    - Corresponding rf CD scaling, \( f(T_e, Z_{eff}) \)
    - Interim emphasis on \( \beta_N = 6.0, [Q_E, COE] \)
    - Need NBCD scaling
    - PFC interference affecting access to small FPC (?)
  - **Engineering:**
    - Is HTS needed/beneficial for TFC and/or PFC?
    - up-to-date radial/vertical builds
    - high efficiency power cycle [added cost?]
    - plant capacity factor, \( p_f \approx 0.76 \), pending RAM analysis (forced and scheduled outages)

- Low-cost fabrication cost credits
- Trade-offs and sensitivity parametrics
- ASC cost model update/upgrade (in progress)