ARIES Systems Activities

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ARIES Project Meeting

UCSD

March 20–21, 2000

UCSD

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) $R_T = var$, $j_{PFC} = 40 MA/m^2$
  - Series B posted (03/01) Z_{eff} increased, core f_{rad} increased
  - Series C posted (03/10) $R_T = 5.2m$, $j_{PFC} = 45 MA/m^2$
- 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

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* since last Project Meeting (12/99).

† *cf.*, J. Delene, *et al.*, ORNL/TM-1999/243/R1 (Feb. 2000).

ARIES-AT Physics Basis*

Case	A	B‡	C
Normalized beta†, β_N	5.59	6.04	6.81
Plasma vertical elongation, κ	2.14	2.14	2.14
Plasma triangularity, δ	0.78	0.78	0.78
Toroidal beta†, β (%)	9.34	10.17	11.76
Toroidal beta , β (%)	8.40	9.15	10.59
Poloidal beta, β_p	2.10	1.90	2.47
Edge density ratio°, n_s/n	0.28	0.27	0.24
Bootstrap-current fraction, f_{bc}	0.941	0.945	0.908
Safety factor, $q(0)$	3.69	3.56	3.56
Safety factor, $q(a)$	3.97	4.05	3.94

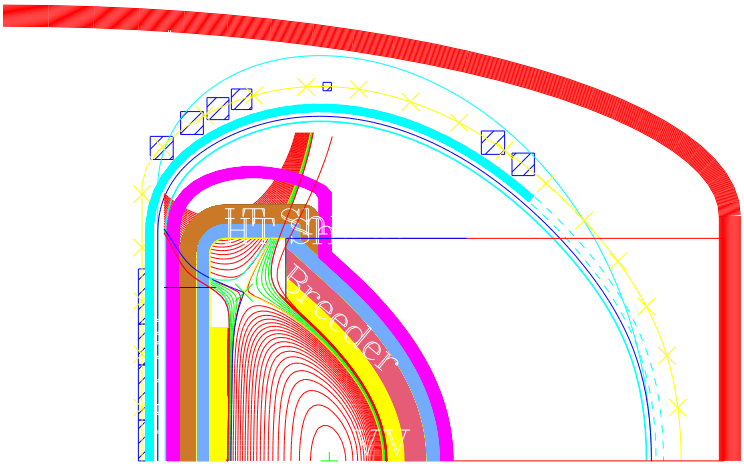
* C. Kessel (PPPL): Aspect ratio, $A \equiv R_T/a_p = 4.0$

‡ 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, $p_f = \simeq 0.76$, pending RAM analysis (forced and scheduled outages)
- Low-cost fabrication cost credits
- Trade-offs and sensitivity parametrics
- ASC cost model update/upgrade (in progress)