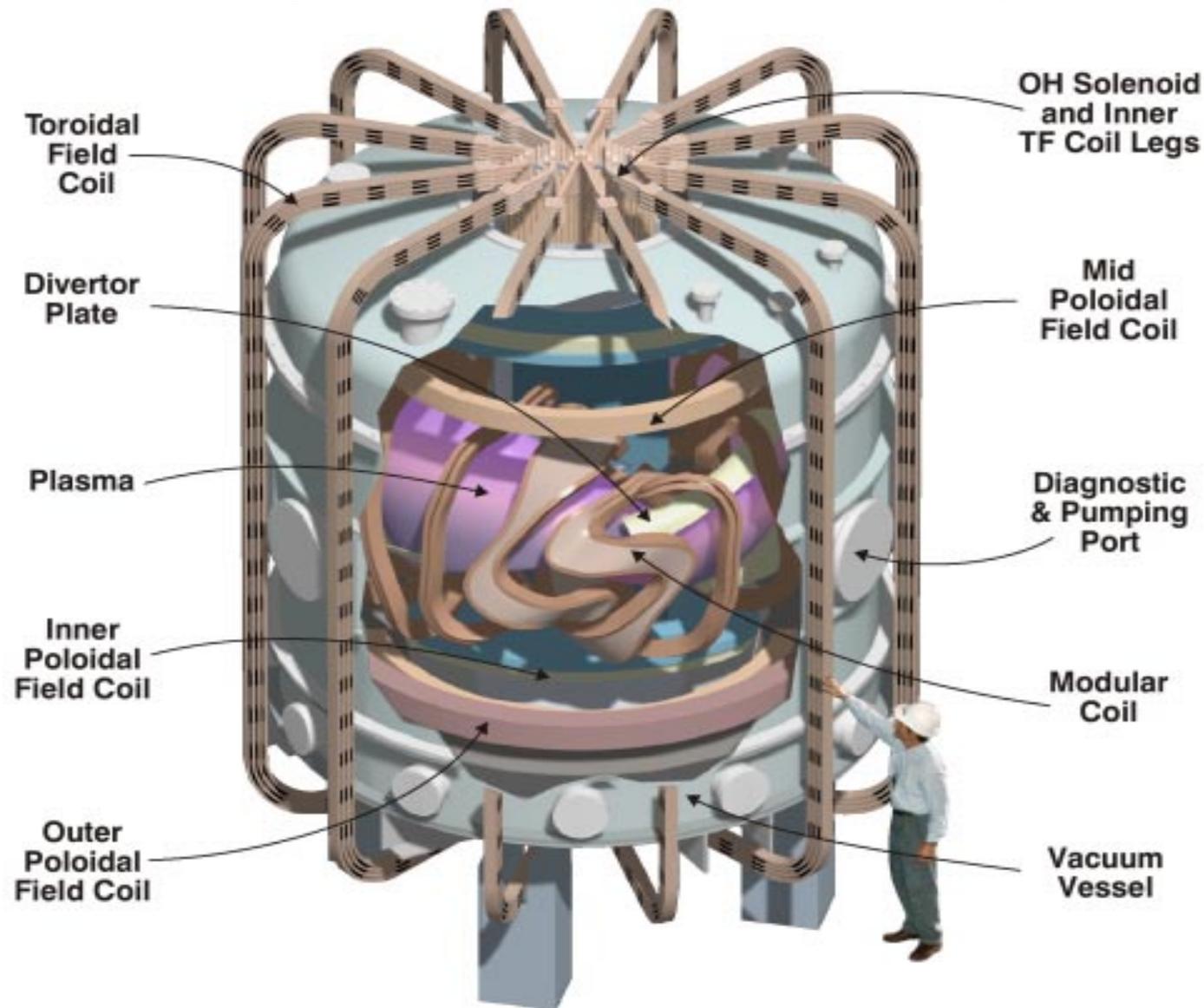


Design of the QPS Experiment

QPS: A Compact Quasi-Poloidal Stellarator Experiment

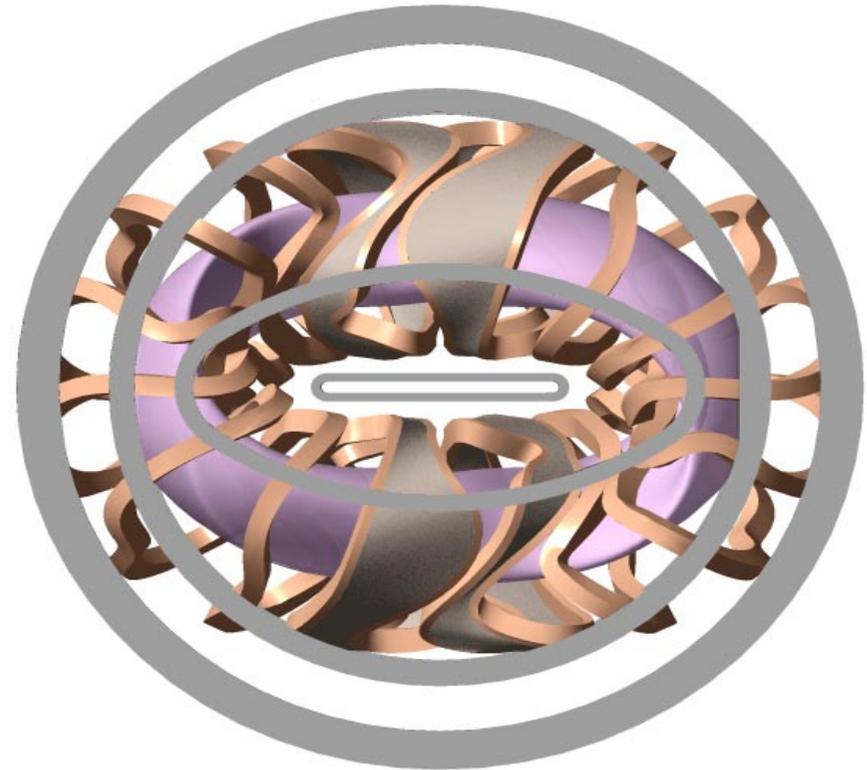


Features & Improvements

Feature	APS 2000	Recent Improvements
Base Magnetic Configuration	<ul style="list-style-type: none"> - Quasi-poloidal features - Reduced neoclassical transport - $R / a = 2.5$, $a = 36$ cm - Inadequate space in center for TF coil legs & ohmic current solenoid 	<ul style="list-style-type: none"> - Higher degree of quasi-poloidal symmetry - Improved neoclassical confinement - $R / a = 2.7$, $a = 33$ cm - Adequate space in center for coils
Modular Coils	<ul style="list-style-type: none"> - 22 coils, 6 coil types - Coil overlap problems 	<ul style="list-style-type: none"> - 16 coils, 4 coil types - Adequate coil spacing
VF Coils	2 pairs	3 pairs
Vacuum Vessel	Bell jar with aluminum spool pieces	Bell jar with stainless steel spool pieces
Diagnostic Ports	4 (56 cm), 18 (20 cm dia.)	12 (61 cm diameter)
Vacuum Approach	<ul style="list-style-type: none"> - Differentially pumped Viton o-rings - Rectangular access door with Viton Seals 	<ul style="list-style-type: none"> - Metal seals - Personnel access through one of the twelve diagnostic ports

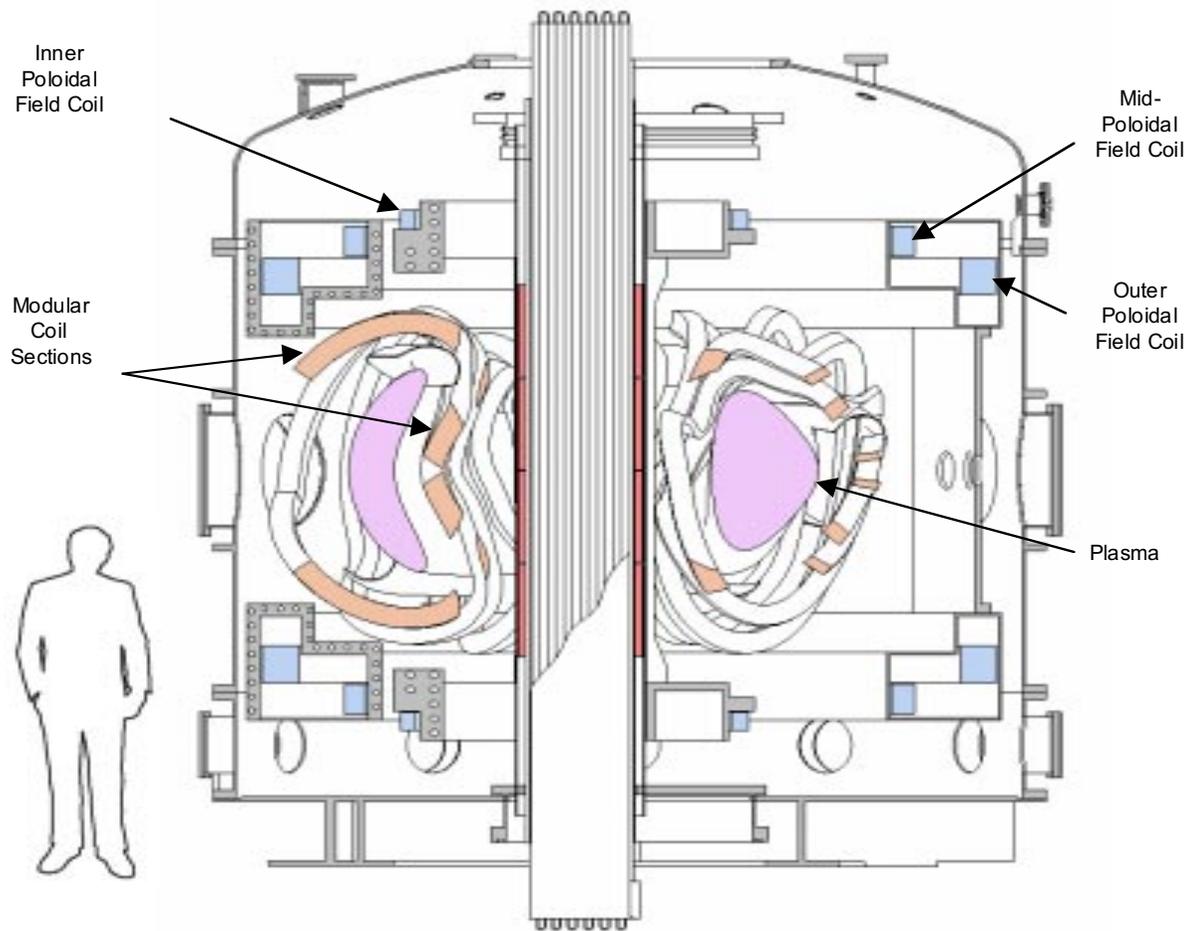
Machine Parameters

Major Radius	0.9 m
Minor Radius	0.33 m
Aspect Ratio	2.7
Toroidal Field on Axis	1 T
Number of Modular Coils	16
Plasma Current	<150 kA
Pulse Length	~1 s
Plasma Heating Power	1- 3 MW



Top View of Plasma and Coils

Machine Elevation & Modular Coil Set



SIDE VIEWS

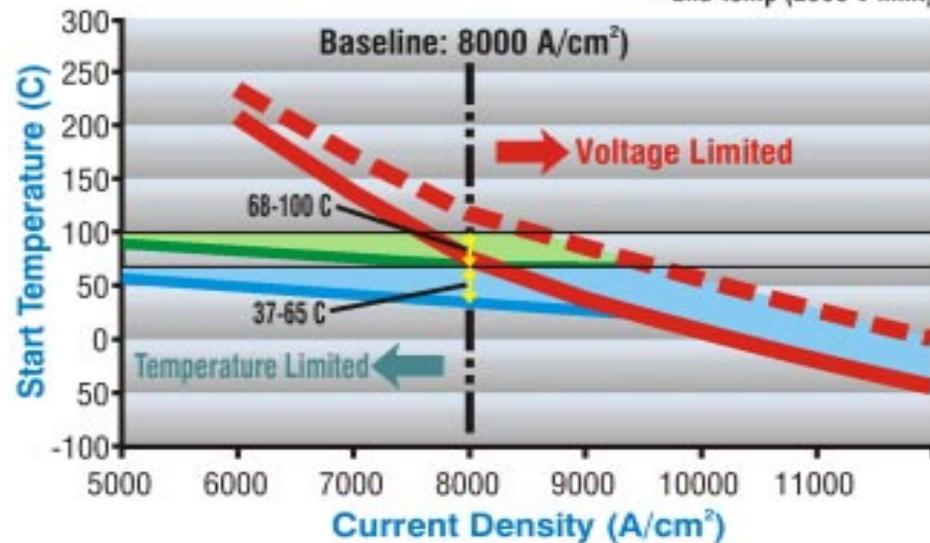


Modular Coil Current

QPS modular coil start temperature vs current density for 0.5 sec flat top

16 coils in series, 16 turns per coil,
2600 volts, $\langle B \rangle = 1$ Tesla,
variable cross section, $R_0 = 0.9$ m

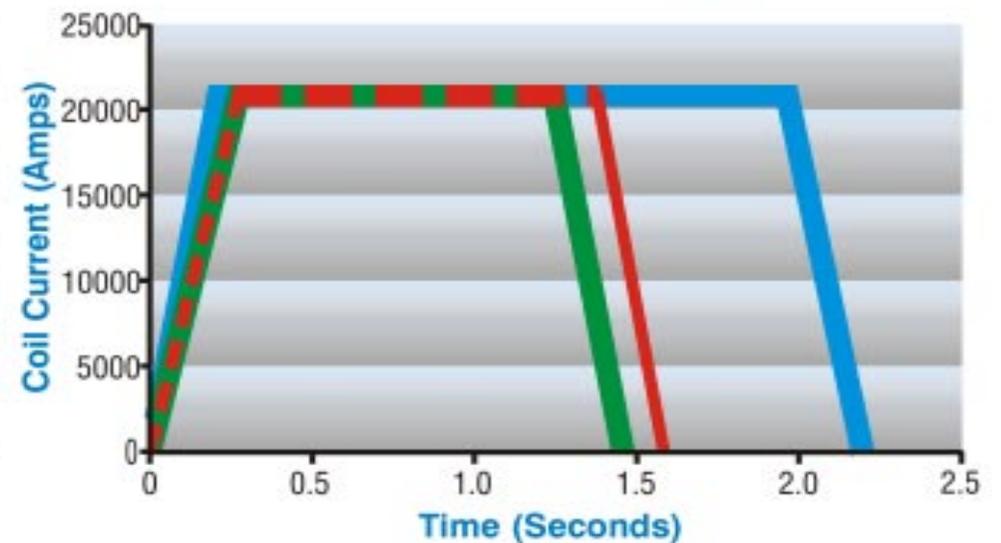
- Start Temp (2600 V limit)
- Start Temp (100 C peak)
- Start Temp (65 C peak)
- End Temp (2600 V limit)



QPS modular coil current vs time for various coolants

16 coils in series, 16 turns per coil,
2600 volts, 8.2 x 12 cm cross section,
0.43 copper fraction

- R.T., T=20-65 C
- Refrig., T=0-65 C
- Elev., T=45-100 C



Status & Proposed Schedule

- QPS is now in the conceptual design phase after a successful Physics Validation Review in April, and a Project Validation Review in May
- Conceptual design, cost and schedule review next step
- The design will continue to evolve through the Conceptual Design Review to account for improvements in the coil design and vendor input / participation
- 4-year design and construction period required after that
- Open issues
 - Reducing construction cost for modular coils
 - Optimum design for coil support structure
 - Maximum baking temperature & divertor plate geometry