Welcome

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DIII–D Advanced Tokamak Workshop
General Atomics
San Diego, California

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DIII-D NATIONAL FUSION FACILITY

GENERAL ATOMICS

Advanced Tokamak is the Focus of DIII–D Long Range Program

- **DIII–D Mission: to establish the scientific basis for the optimization of the tokamak approach to fusion energy production**
  - Tokamak concept optimization
  - Discovering the ultimate potential of the tokamak
  - Make the tokamak all it can be

Advanced Tokamak: Our Vision of Attractive Fusion Energy Production

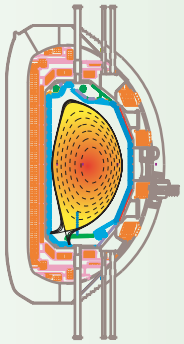
— Key Elements —

- **Steady state**
  - High bootstrap
  - Current drive
- **High fusion power (density)**
  - High β, β_N
  - $Q_{SS} \propto \beta_N^4$
- **High energy gain**
  - High confinement
- **Effective heat and particle control**
  - Heat flux reduction
- **Plasma control**
  - Reliable, stable, disruption-free operation

Long-Range Vision for Steady-State Scenario Development in DIII–D Points to DEMO with Advanced Scenario

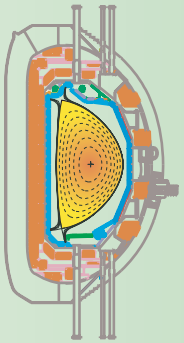
Steady-State Scenario for ITER

f_{BS} ~55%
β_N ~ 3.5
f_{NI} = 100%,
t_{DUR} ~5s



Steady-State Scenario for FDF

f_{BS} ~ 70%
β_N ~ 4
t_{DUR} ~ 10 s

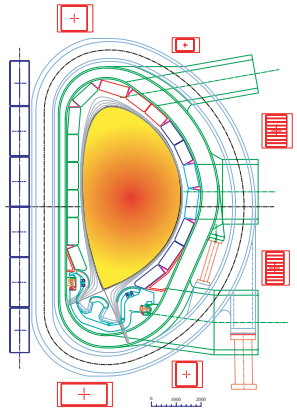


Establish Physics Basis for Steady-State Powerplant Optimization

$f_{BS} \rightarrow 90\%$
$\beta_N \rightarrow 5$
$t_{DUR} \rightarrow 10$ s

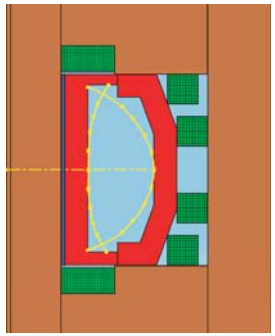
ITER

Q≥5
t_{DUR} ~1000s



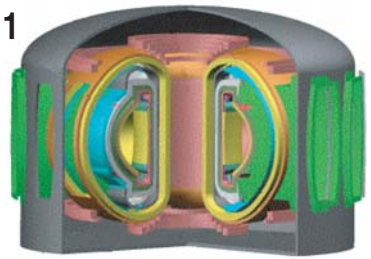
FDF

Net tritium
(1 kg/yr)
Blanket testing
($\rightarrow$ 1 MW yr/m^2)



DEMO-AT

Plant Q > 1



High Performance Steady-State Fusion Plasmas are Being Pursued in Support of ITER Objectives

ITER Objectives

1. **"To achieve extended burn in inductively-driven deuterium-tritium plasma operation with Q ≥ 10 (Q is the ratio of fusion power to auxiliary power injected into the plasma), not precluding ignition, with an inductive burn duration 300 and 500 s"**

2. **"To aim at demonstrating steady-state operation using non-inductive current drive with Q ≥ 5"**

   - **Goal: Maintain DIII–D as is a world leader in establishing the scientific basis for steady-state operation**

Purpose

- Forum for long-range planning
- Understanding optimization of existing scenarios
- Integration of core and boundary
- Exploration for higher beta
- Control needs