LIFE Overview

Tom Anklam, Lawrence Livermore
National Laboratory
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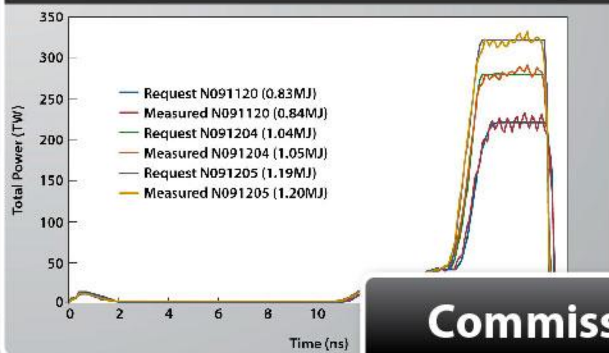
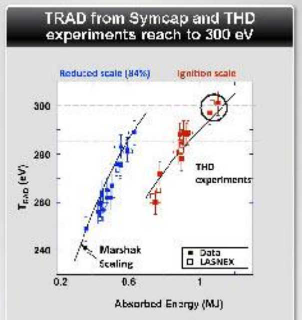
The National Ignition Facility is complete - and on track to demonstrate power-plant scale fusion energy

Ignition: Next steps: Work on velocity and shape!

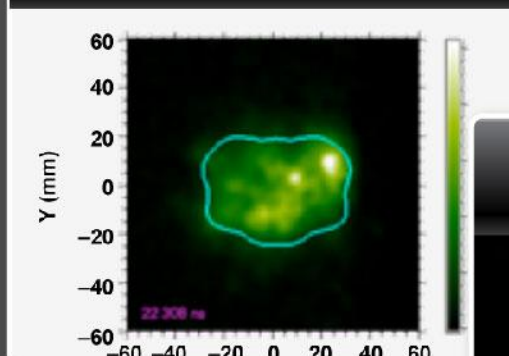
Commission NIF



Commission hohlraum

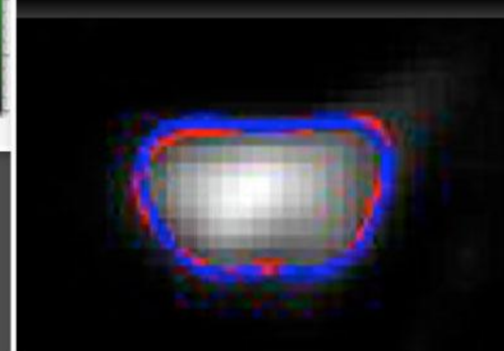


X-ray image

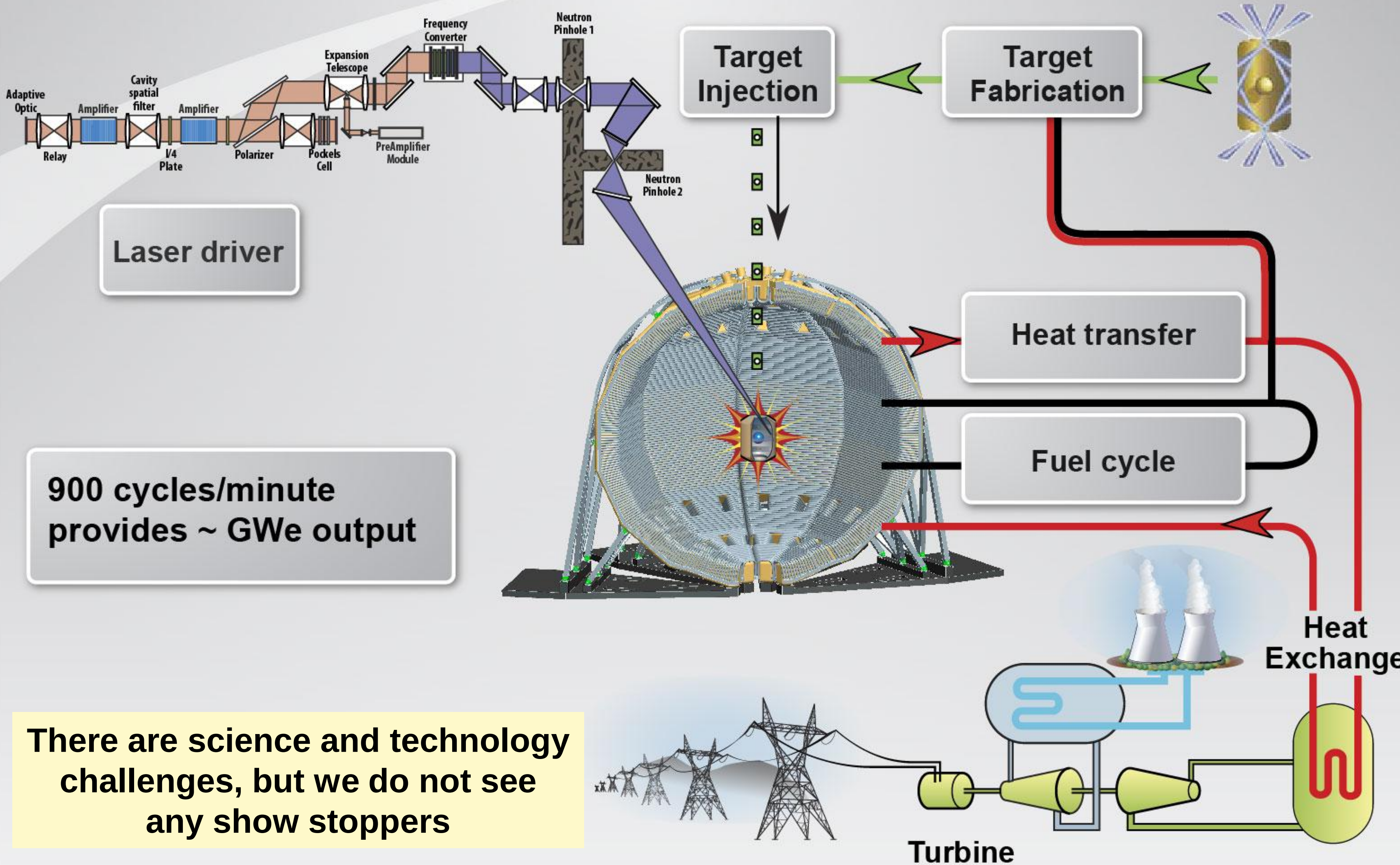


Underway

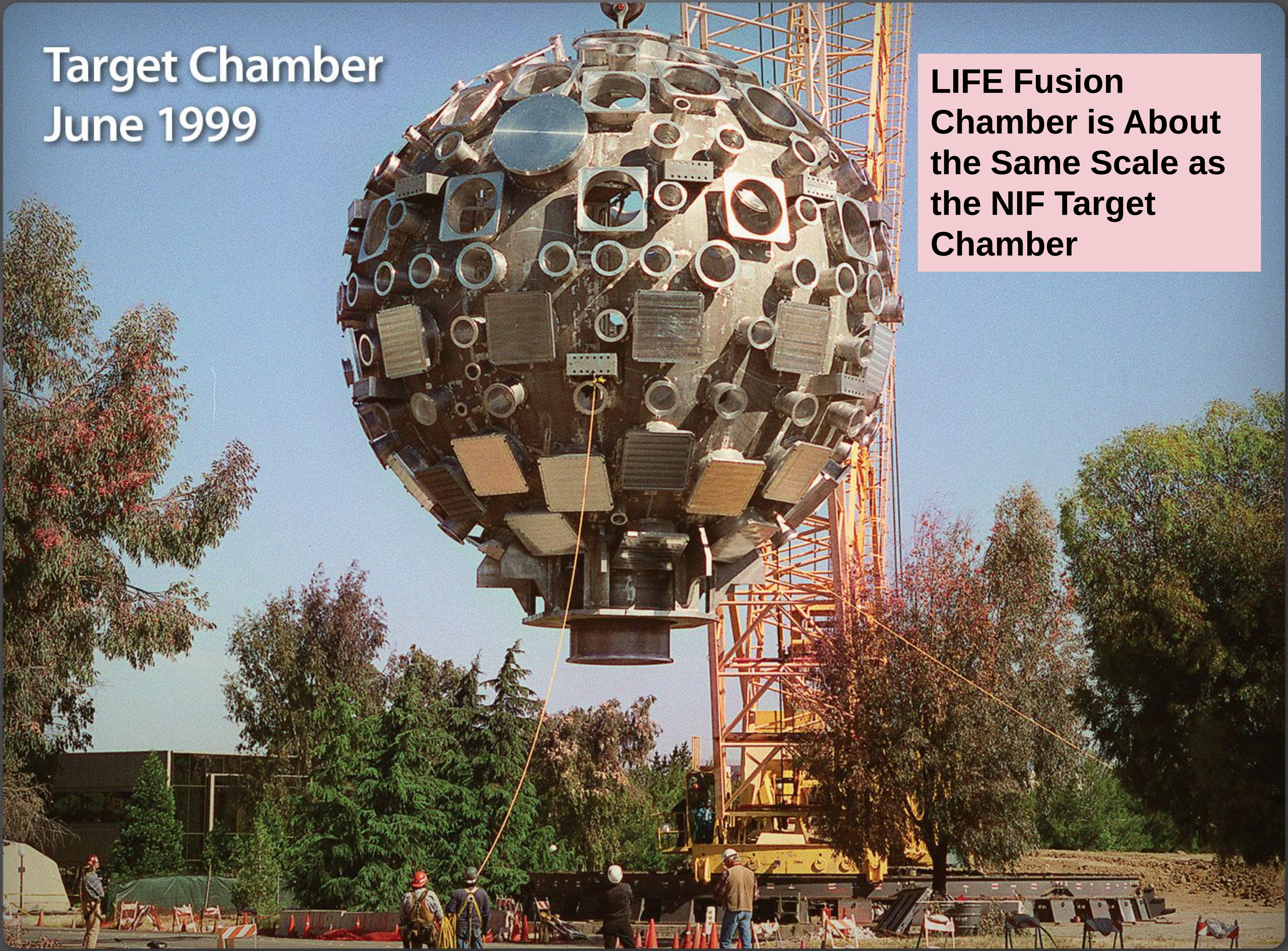
Neutron image

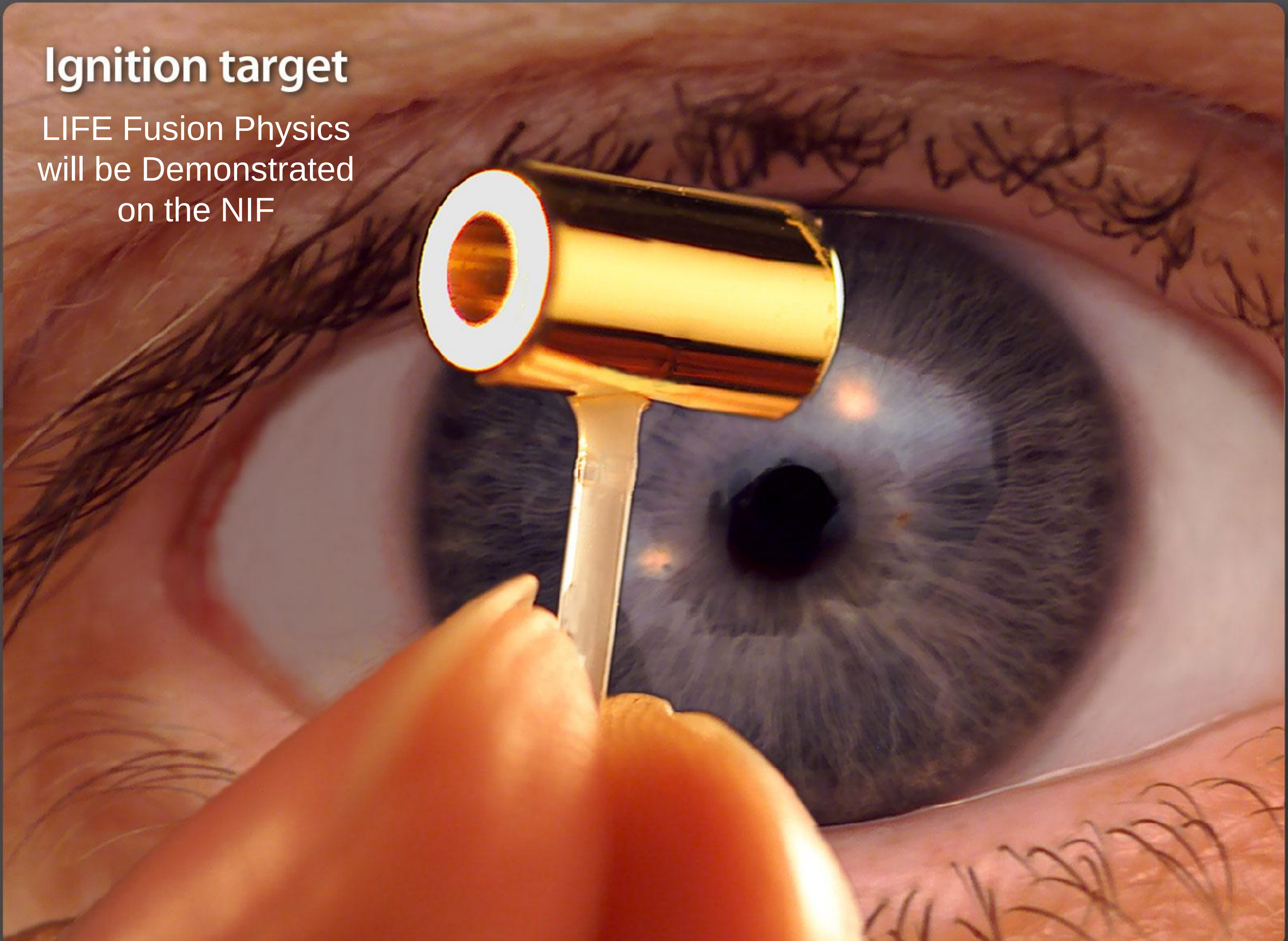


Principle of LIFE plant operation

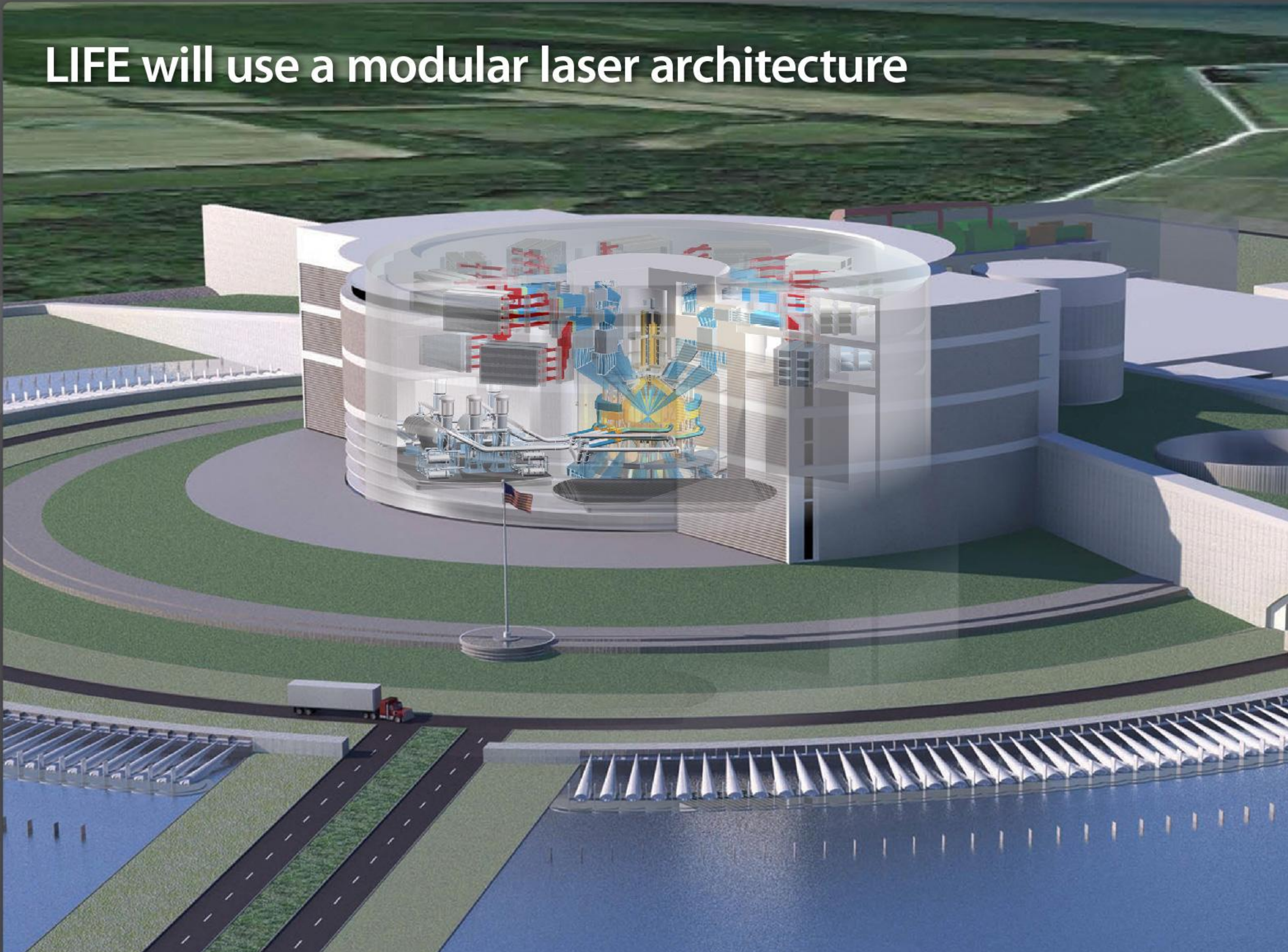


There are science and technology challenges, but we do not see any show stoppers

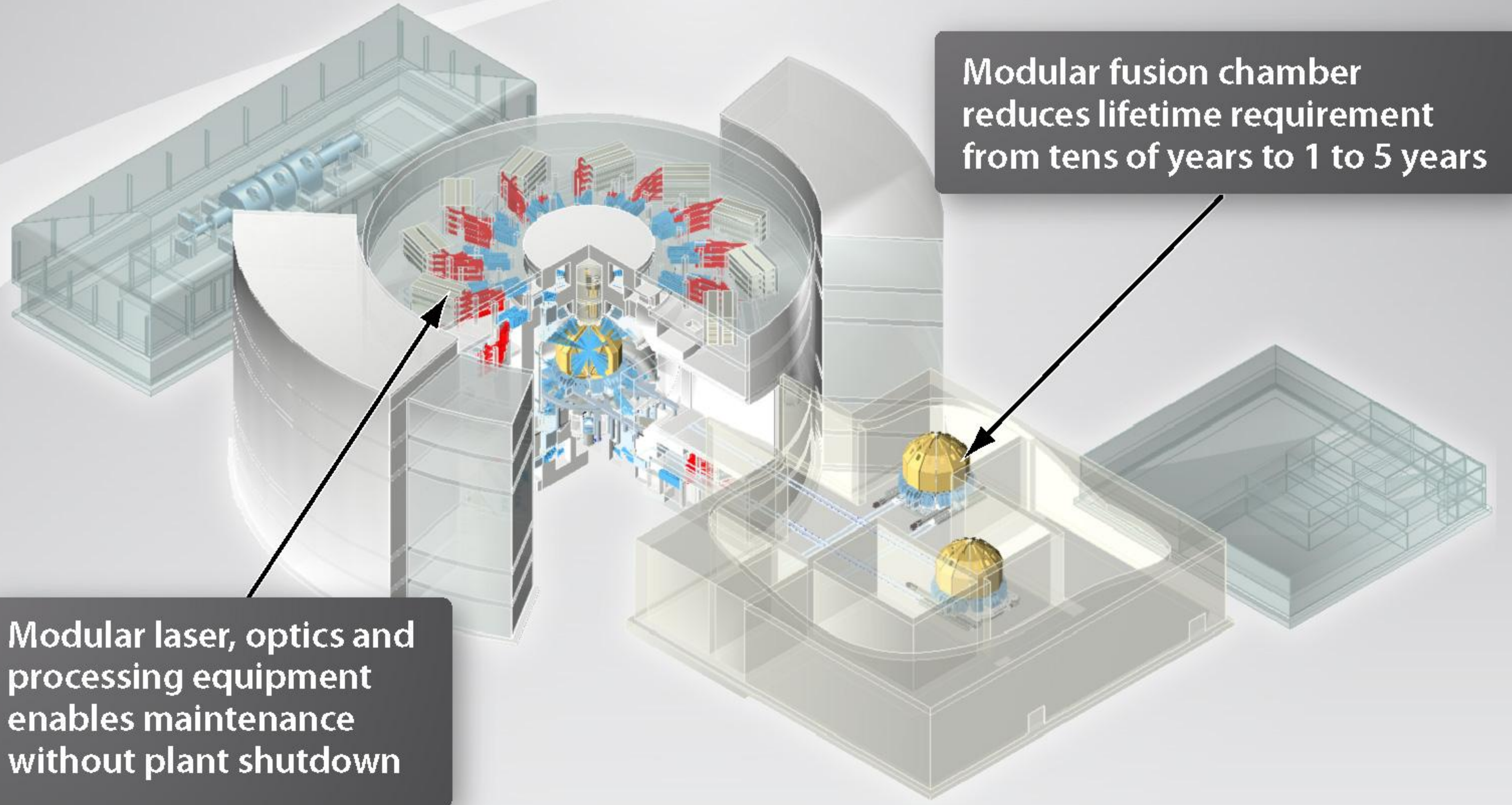

Target Chamber
June 1999
LIFE Fusion Chamber is About the Same Scale as the NIF Target Chamber


Ignition target
LIFE Fusion Physics will be Demonstrated on the NIF

LIFE will use a modular laser architecture

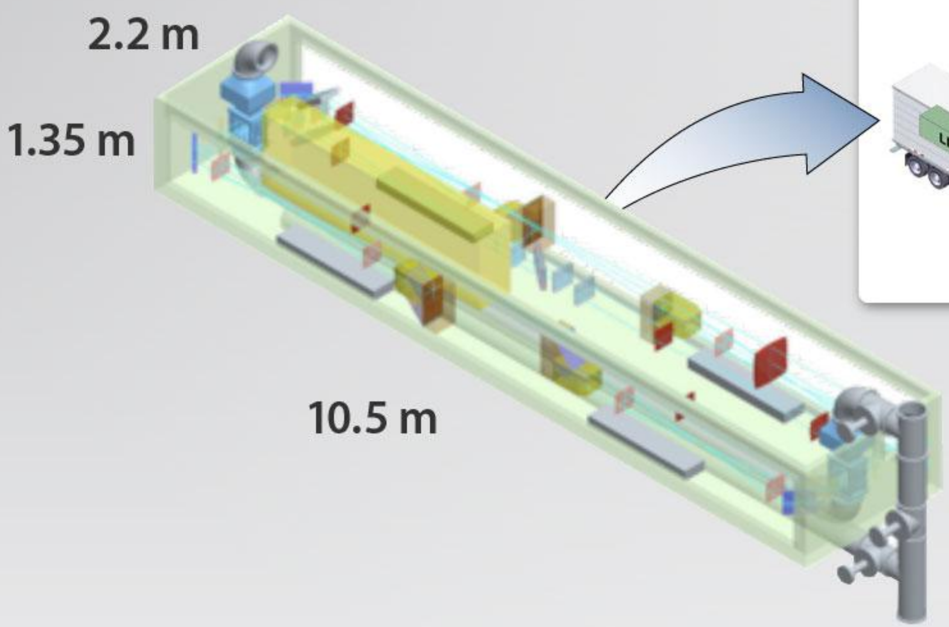


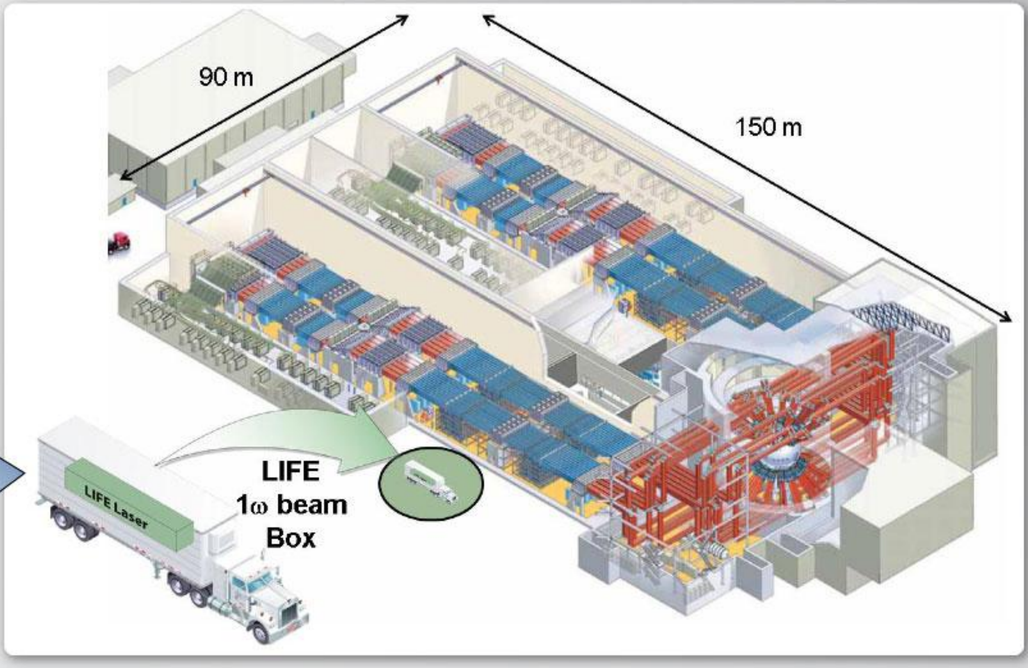
LIFE's modular architecture is what enables commercialization in a relevant timeframe



Pilot plant fusion chamber can use conventional steel rather than wait for new radiation-resistant alloys to be developed

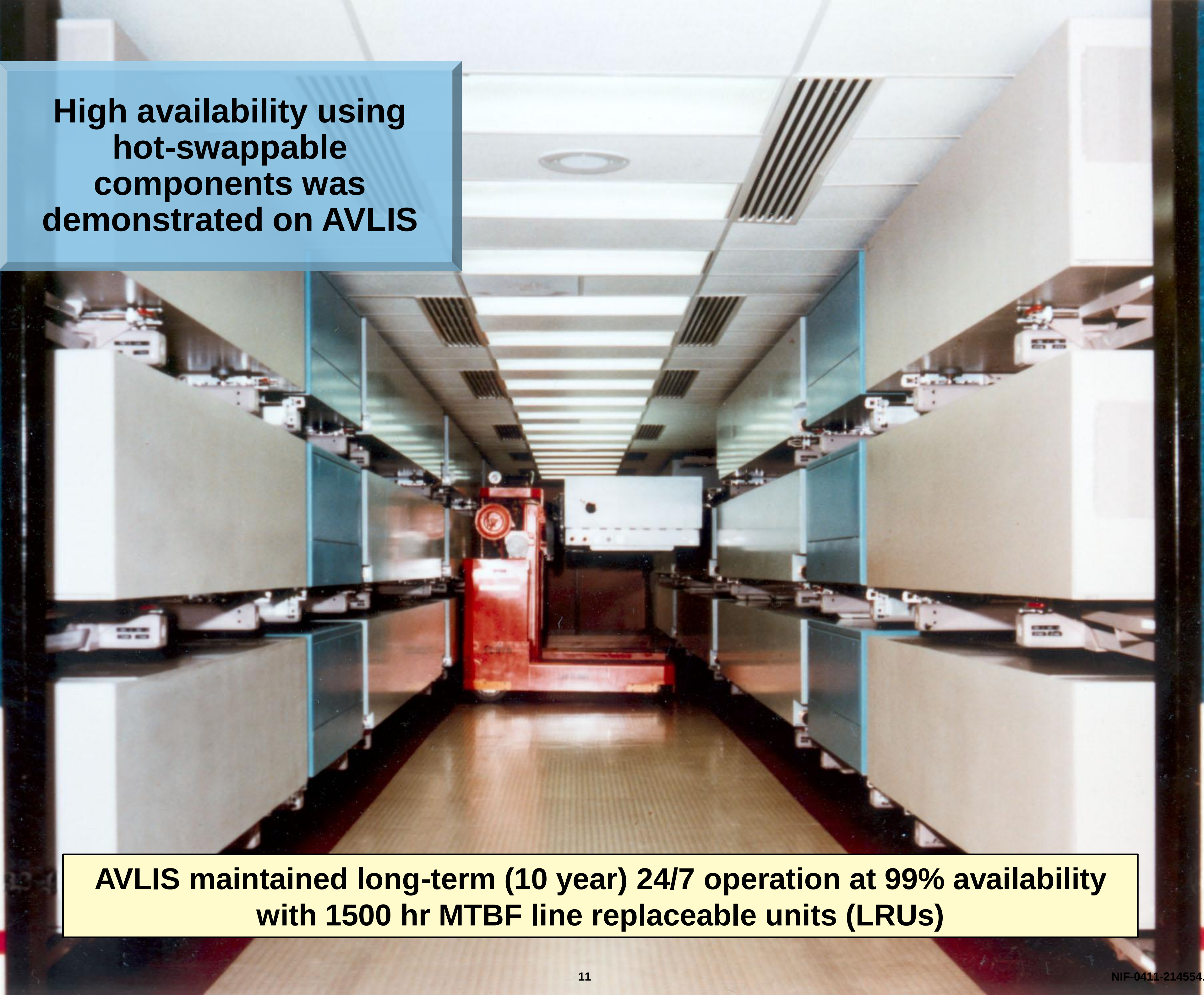
Each beamline folds into a transportable box, enabling an efficient & cost-effective supply chain





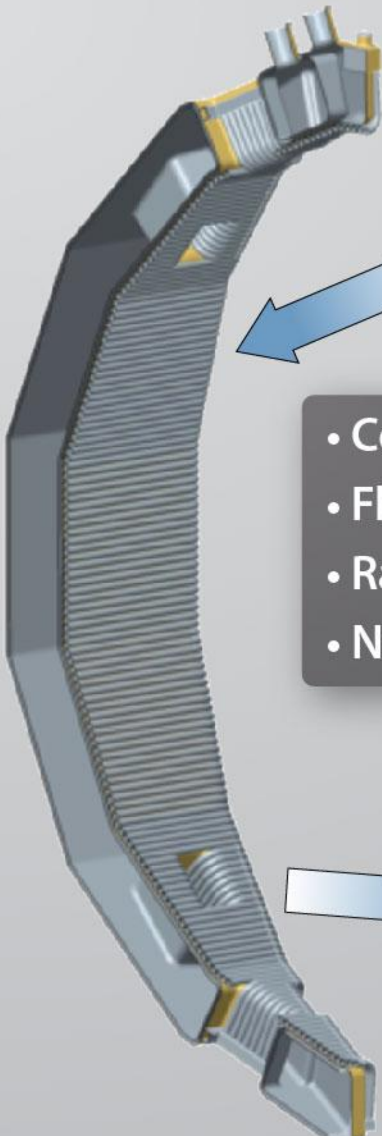
- **Offsite beamline factory**
- **Truck-shippable 1w beamline**
- **Low-overhead installation**
  - — **Kinematic placement**
  - — **Few interfaces**

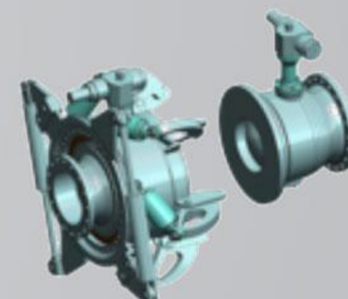
High availability using hot-swappable components was demonstrated on AVLIS



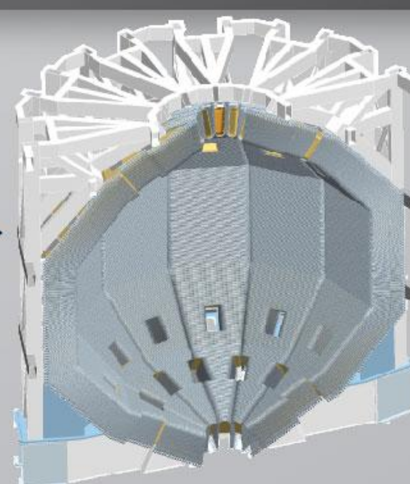
AVLIS maintained long-term (10 year) 24/7 operation at 99% availability with 1500 hr MTBF line replaceable units (LRUs)

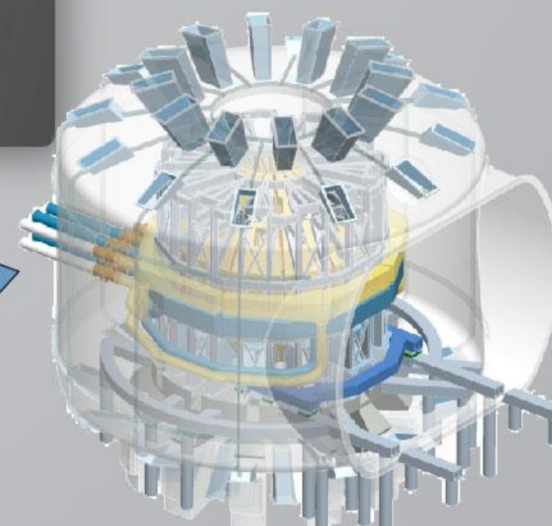
Modular fusion "chamber" provides boiler-like heat extraction as well as tritium breeding



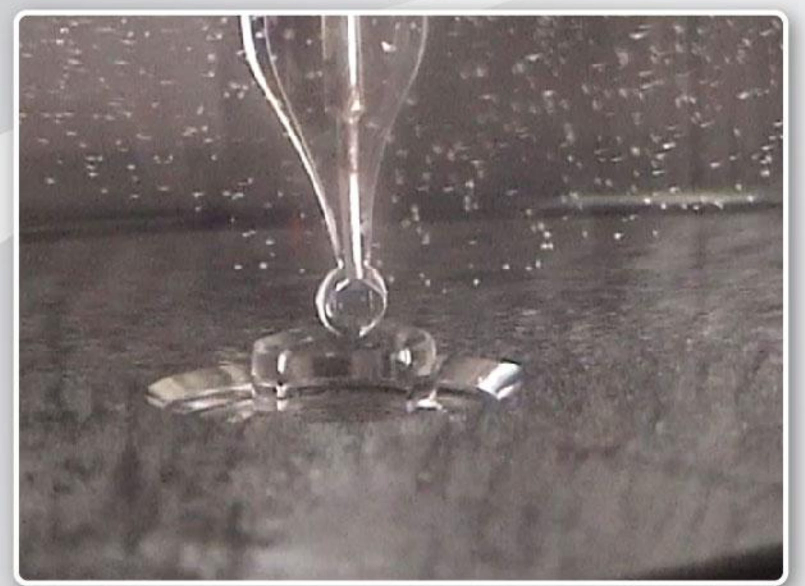


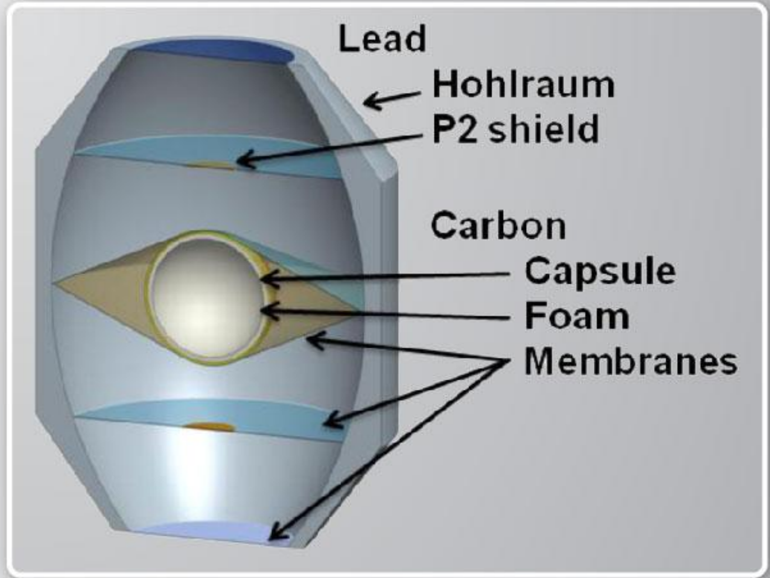
- Conventional steel manufacturing
- Flow connectors from the oil industry
- Radiation-tested optics solution
- No need for chamber clearing



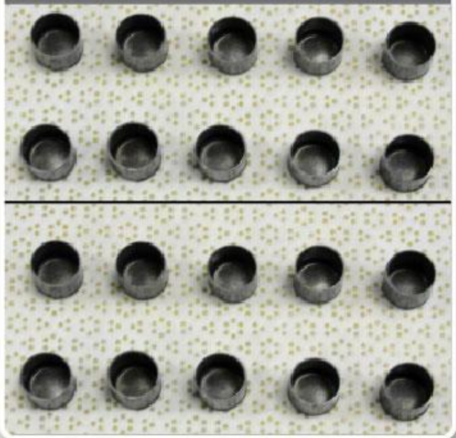


Fusion fuel is designed to enable mass manufacturing



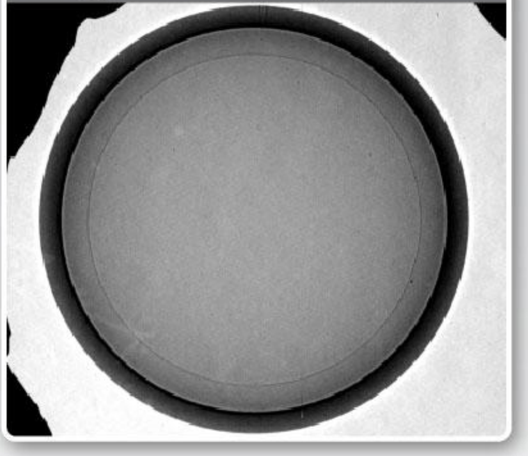


Die-cast hohlraum parts



Carbon Capsule

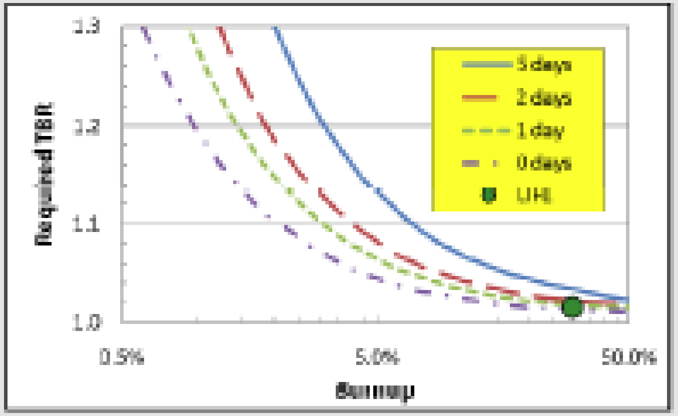
Uniform walls in high density shells



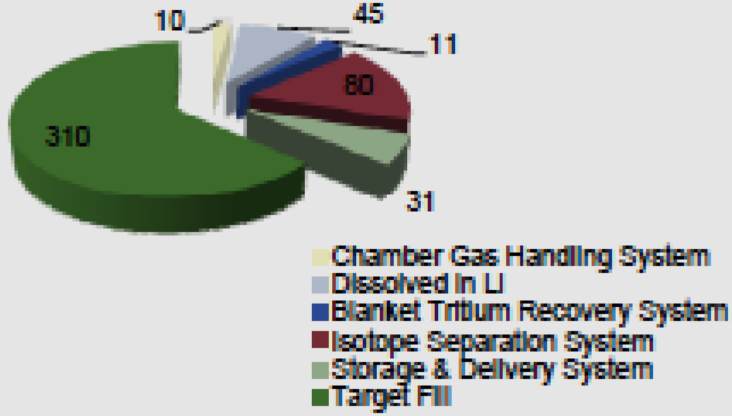
Optical quality films without polishing

LIFE Fuel cycle expected to allow for limited (< 1 kg) site tritium inventory

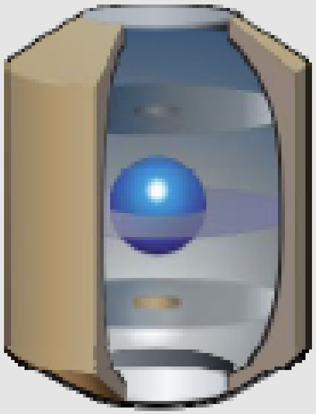
High burnup results in low TBR requirement for reasonable storage times (Abdou 1986)



More than 50% of plant's T inventory resides in the target fill area

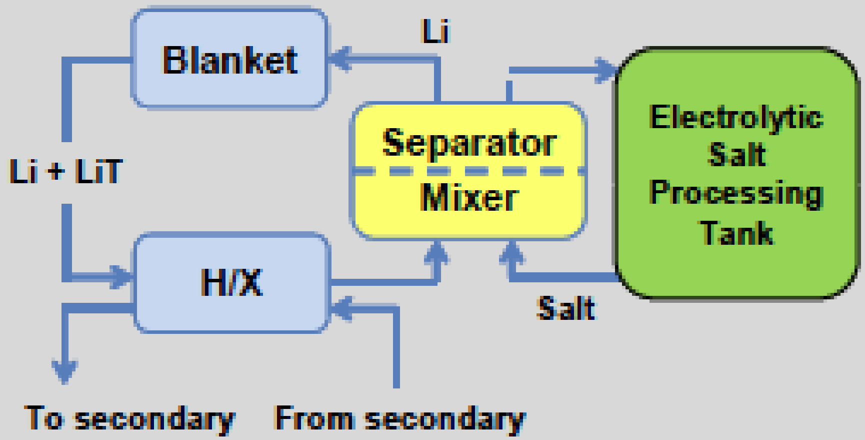


LIFE targets each contain only ~ 0.7 mg of tritium

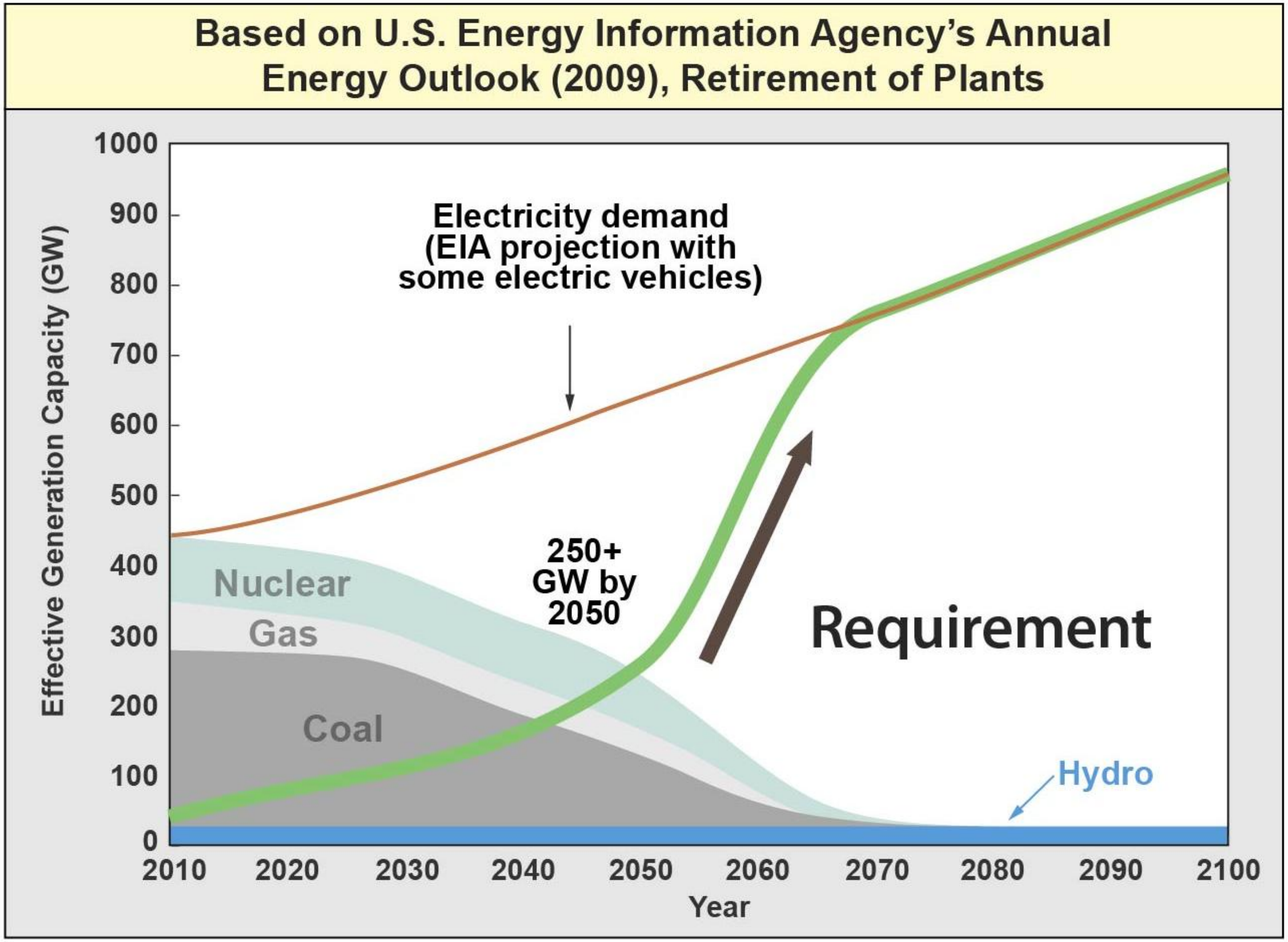


- Tritium throughput is ~ 1 kg/day
- 288 g/day is burned
- 294-426 g/day can be bred in the blanket
- A new plant can be supplied with T inventory every week

T recovery from Li (demonstrated in 1974) is compact; limits inventory to 60 g



Goal of LIFE is to commercialize in time to play a role in coming recapitalization electric power sector



LIFE strategy is to pursue design and physics solutions that can implemented and demonstrated within about a decade of ignition

LIFE is designed to use commercially available technology and material

Semiconductor diode lasers

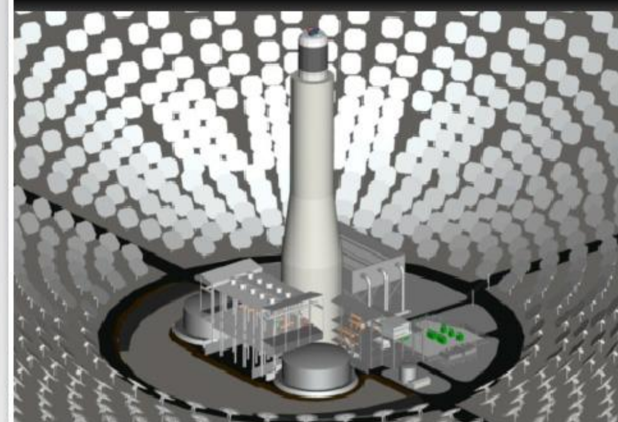
Conventional steel boiler

Steam turbine cycle

Mass manufacture of fuel

Optics production

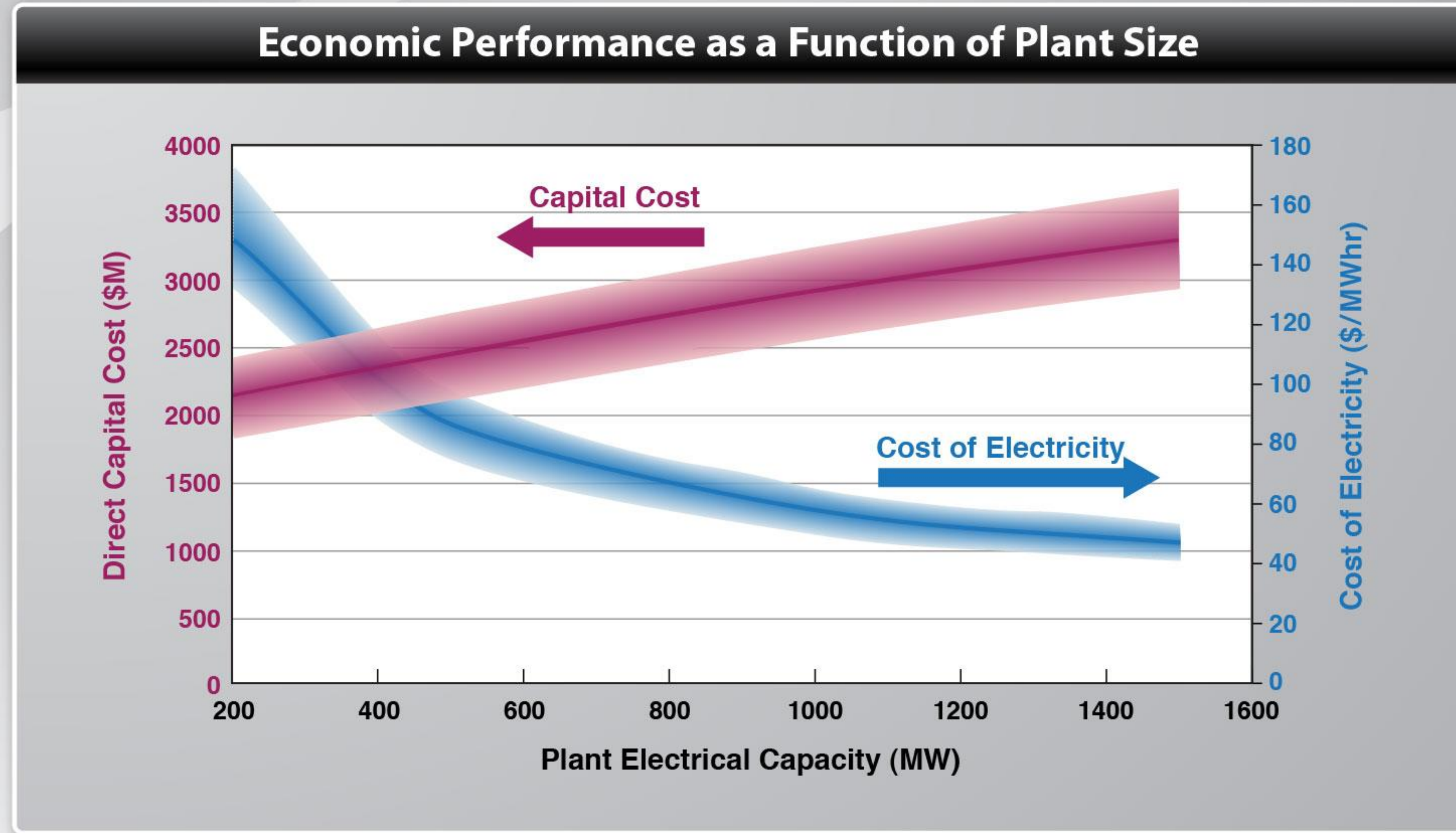
Coolant systems



LIFE design is being guided by U.S. utilities

- **Held first meeting of the LIFE Industry Stakeholders Advisory Board involving CEOs from electric utility companies, environmental leaders, etc.**
- **Contractual discussions with major vendors is well underway**

LIFE is economically viable over a range of plant sizes

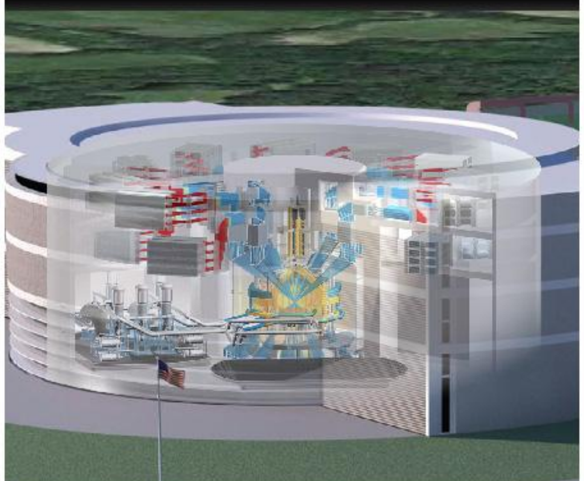


Rapid market entry strategy for LIFE

NIF/NIC → Performance

2012

Market Entry Plants → Integration



400 MW to 1,000 MW_{th}

2020's

Mature LIFE Technology

400 MW to 1,600 MW_{e}

2030's


LIFE