Conceptual Design for HYLIFE-II Maintenance

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ARIES Project Meeting

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Overview

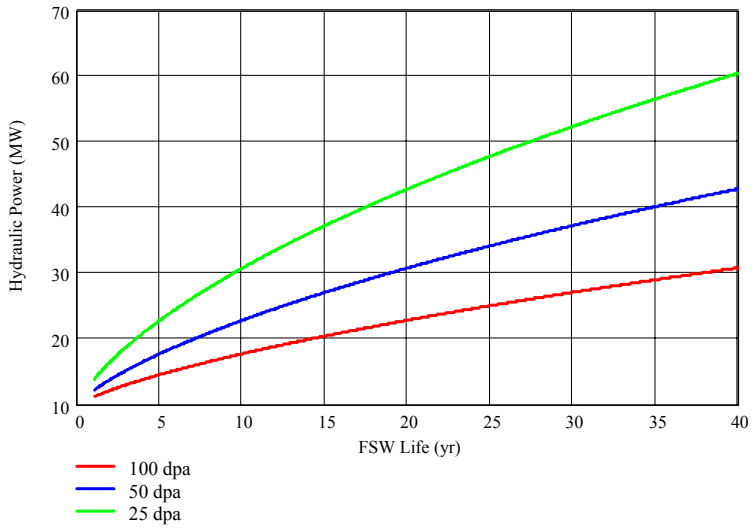
- **Motivations for periodic maintenance capability**
- **Introduction to HYLIFE-II parametric CAD model**
- **Details of maintenance capability**
- **Future work**
- **Questions and Feedback**

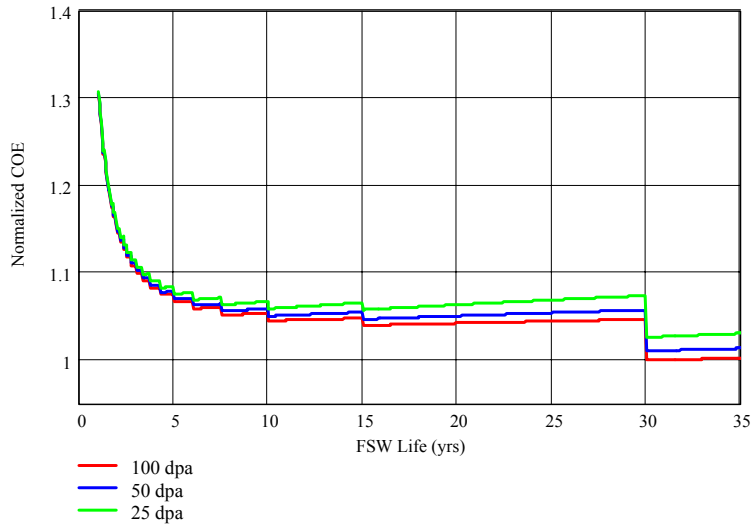
History of Periodic Maintenance Issue

- **Many threats will assault HYLIFE-II chamber components**
  - **Radiation**
    - He embrittlement
    - Volumetric swelling
    - Activation
  - **Dynamic**
    - Erosion
    - Pulsed thermal stresses and fatigue
- **Material performance uncertainties prompt an investigation into the economic tradeoffs of periodic chamber maintenance**
  - **Various material damage limits considered**
  - **Flibe pumping power and plant downtime accounted for**
  - **COE normalized to 100 dpa limit and no maintenance for 30 fpy**

History of Periodic Maintenance Issue

- **Results of investigation presented at October 2002 ARIES meeting**





- **LLNL starts parametric CAD model of HYLIFE-II chamber**
  - **Serve as a flexible platform for integrating previous concepts with future changes and innovations**
  - **Stimulate greater interaction between groups within HIF community**
- **Design decided to be updated to support periodic maintenance**
  - **Be compatible with basic remote handling equipment**
  - **Make all components down to first-wall removable**

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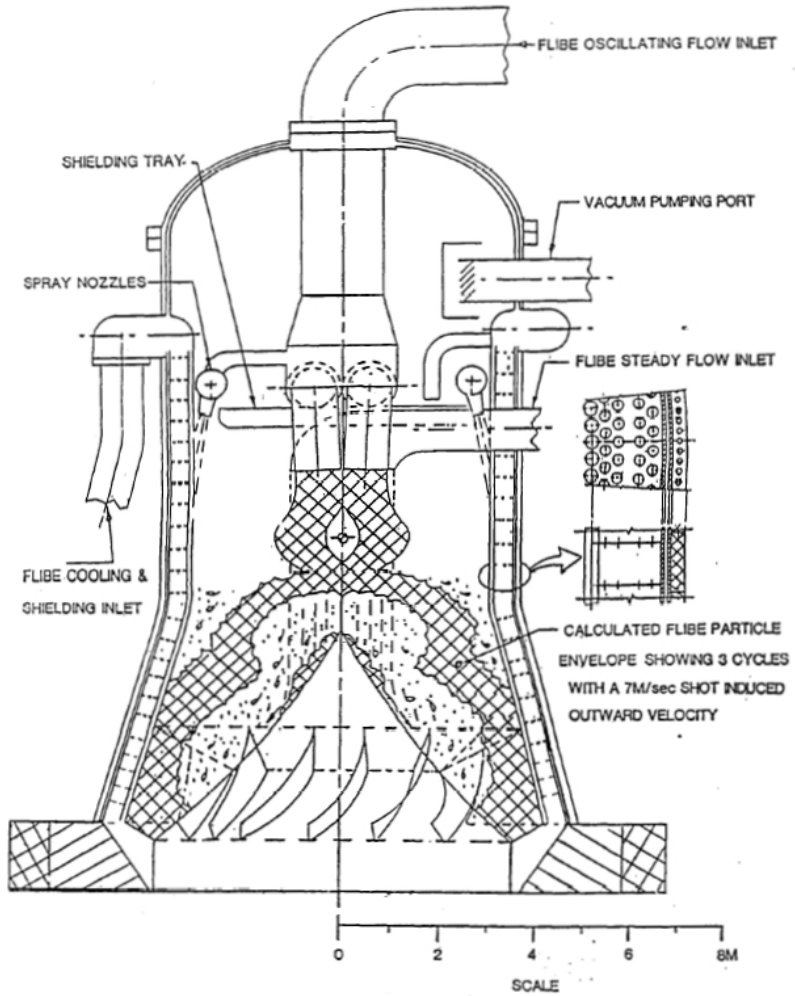
HYLIFE-II Parametric CAD Model - Introduction

- **Previous graphical design work**
  - **Restricted to 2-D**
  - **Updates time consuming**
  - **Difficult visualization for uninitiated**
  - **No interference checking**
- **Current model**
  - **Fully 3-D solid**
  - **Rapid design changes**
  - **Components export directly to finite element analysis routines**
  - **Subsystems easy to isolate**
  - **Animation and rendering capability**



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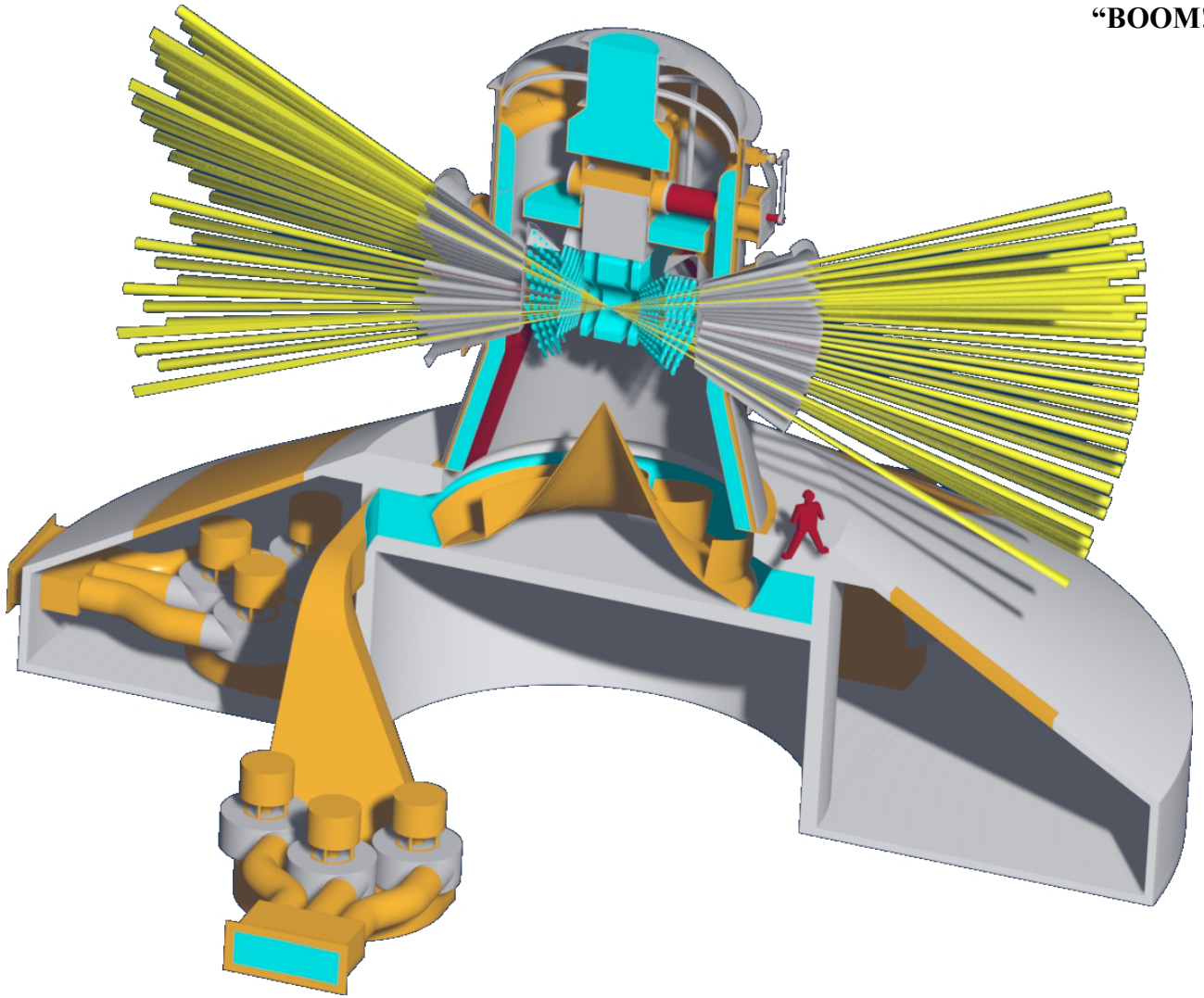
HYLIFE-II Parametric CAD Model - Pictures

"BOOM!" – John Madden



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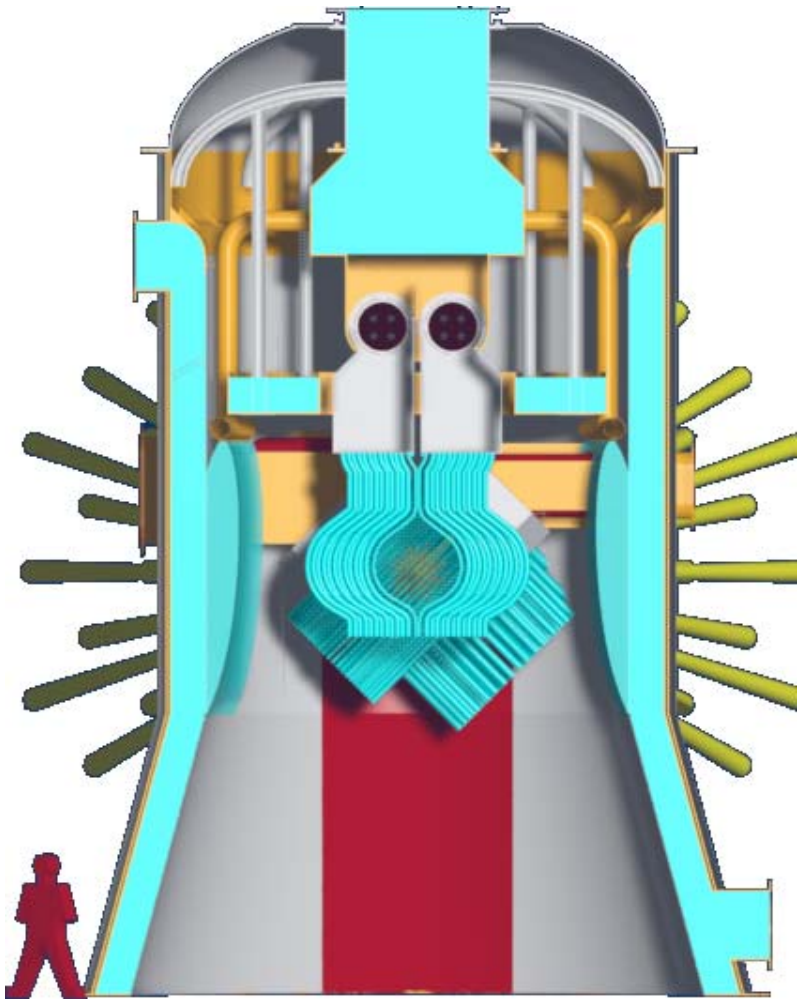
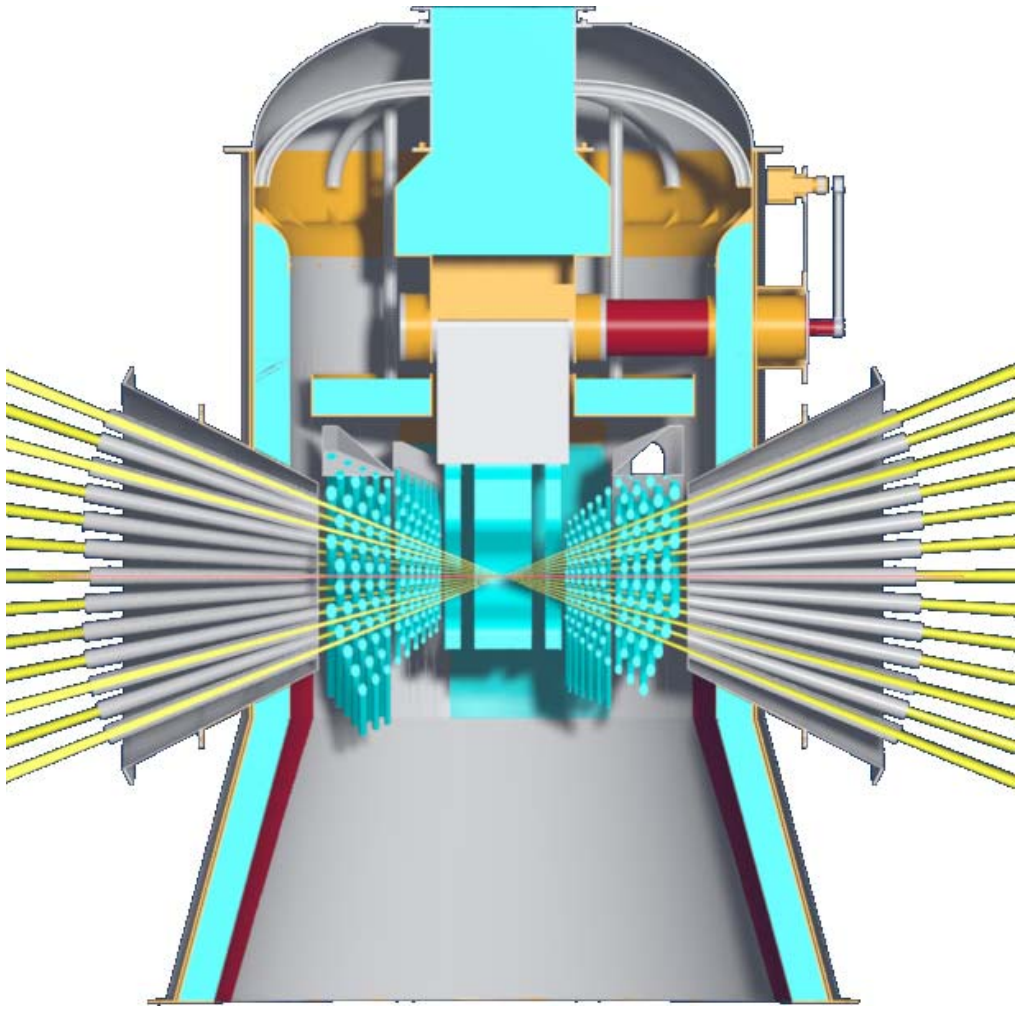
HYLIFE-II Parametric CAD Model - Pictures





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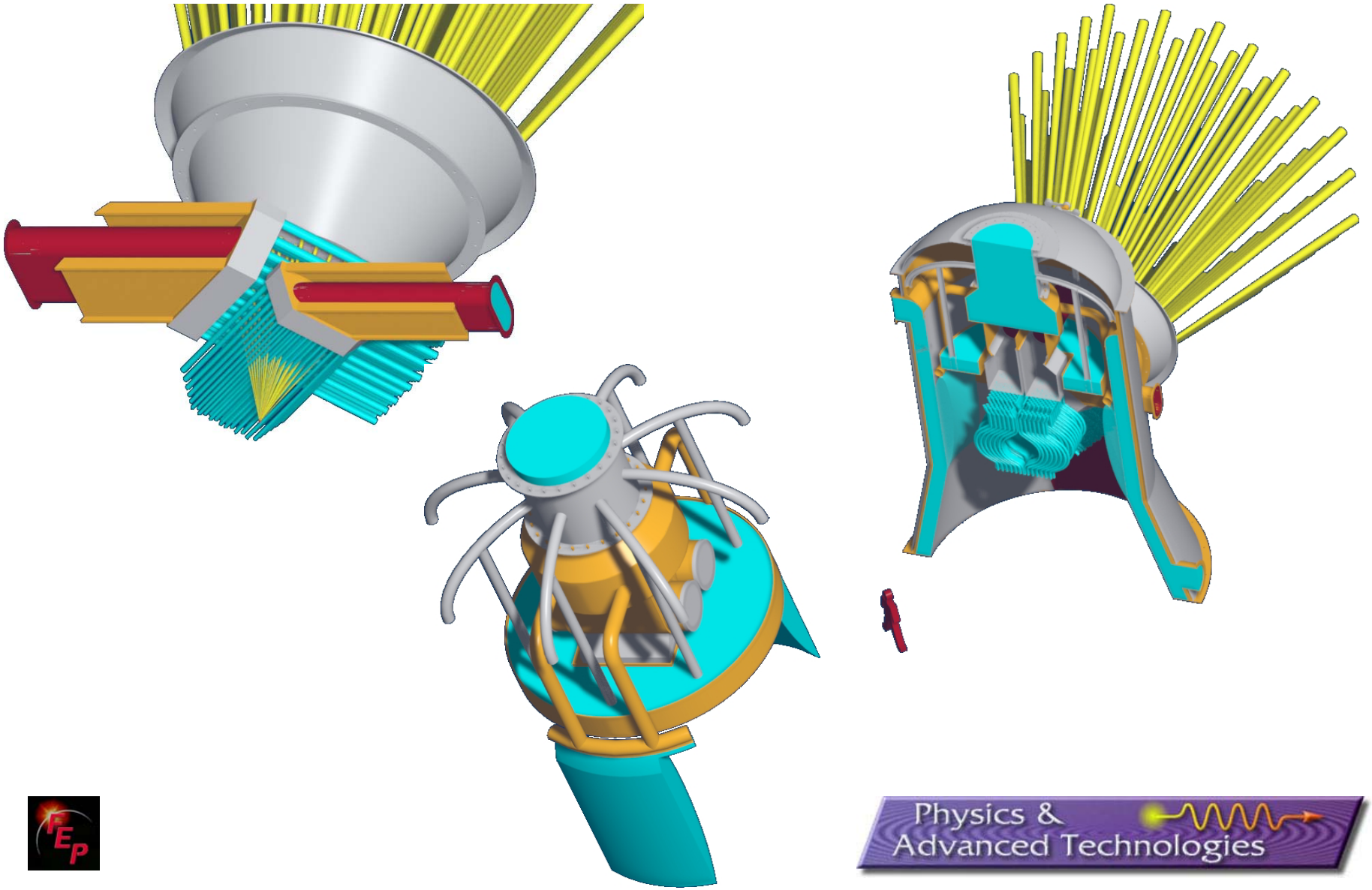
HYLIFE-II Parametric CAD Model - Pictures

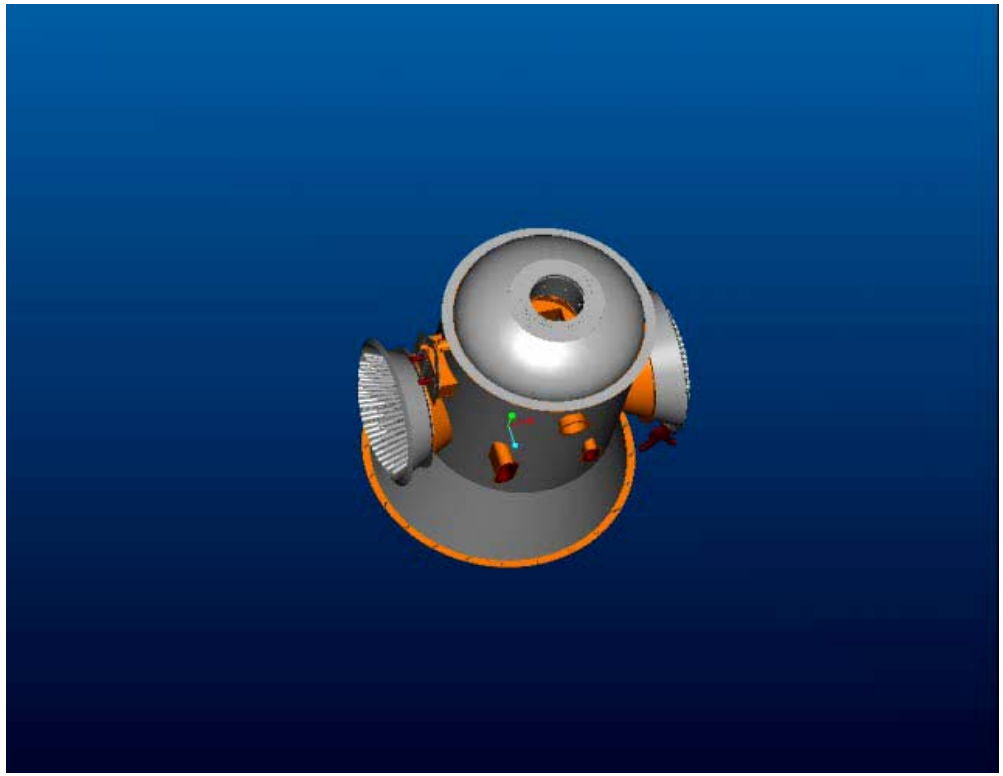


HYLIFE-II Maintenance Concept - Introduction

- **Broad features**
  - **Depends only on vertical cranes and simple robotic manipulators**
  - **Does not compromise any functional capability of previous chamber**
  - **Most internal components assembled as a single modular unit to be replaced in entirety**
  - **All structures down to first-wall easily accessible**

HYLIFE-II Maintenance Concept - Animation

- **Procedure details**
  - **Remove chamber top**
  - **Pull beamline assembly**
  - **Extract main drive shafts**
  - **Lift out pocket nozzle assembly**
  - **Pull cross jet nozzles**
  - **Remove cross jet supports**
  - **Service first-wall**
  - **Reinstall new components in reverse order**



Double-click on picture to play animation

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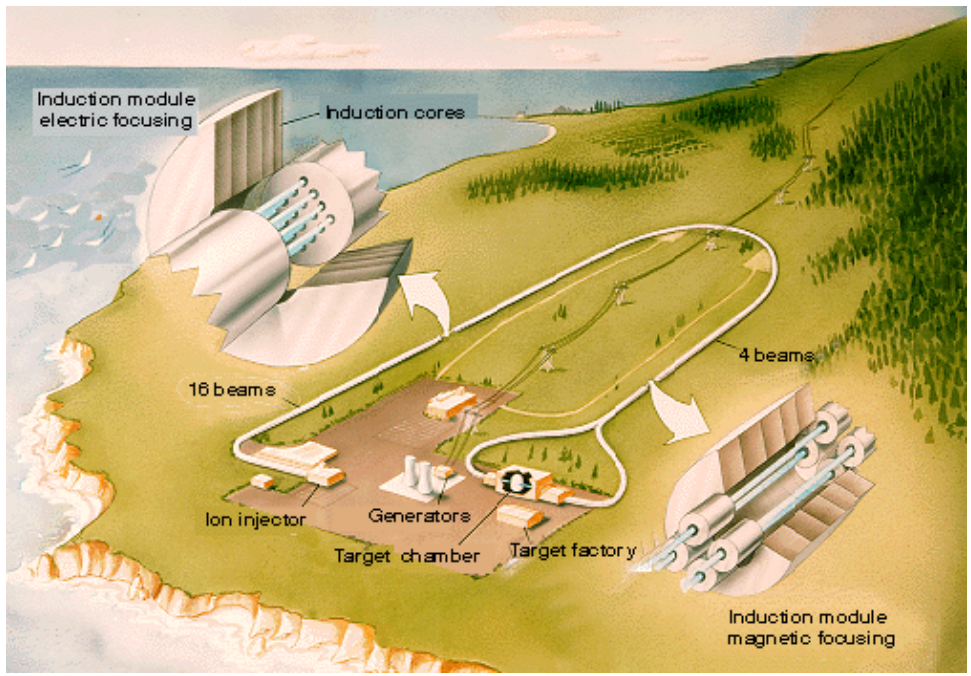
Future Work on HYLIFE-II Model

- **Beamline region**
  - **Add vortex shielding systems**
  - **Beam neutralizers**
  - **Target injection apparatus**
- **Main chamber**
  - **Cross-jet flow redirectors**
  - **First-wall detail**
  - **First-wall removal procedure**
- **Rest of plant**
  - **Integrate chamber model with other plant systems**



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Interactive Question and Answer