Five Top Challenges for MFE and IFE in the Next Decade

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Five Top Challenges for MFE and IFE in the Next Decade

• Over the past 30 years scientists and engineers have encountered dozens of physics and technology issues.

• Proposed solutions to these problems have been incorporated into designs.
  
  a) Near-term experiments (ETR, CIT, BPX, ITER, etc.)

  b) MFE power plants (UWMAK series, STARFIRE, ARIES series, etc.)

  c) IFE power plants (SOLASE, HYLIFE, HIBALL, LIBRA, SOMBRERO, Prometheus, etc.)

• What is the current view of the top 5 MFE and 5 IFE technology issues from a reactor design group? (aside from plasma physics, beam transport, and target physics issues)
## Five Top Technology Challenges for MFE and IFE in the Next Decade

<table>
<thead>
<tr>
<th>Magnetic Fusion</th>
<th>Inertial Fusion</th>
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<tbody>
<tr>
<td>• Neutron radiation damage</td>
<td>• First-wall protection from blast and neutrons</td>
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<tr>
<td>• Divertor design (Steady state and disruptions)</td>
<td>• Cavity clearing</td>
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<tr>
<td>• Insulator coatings for liquid metal coolants</td>
<td>• Final focusing protection</td>
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<td>• Reduction of maintenance complexity</td>
<td>• Low-cost target fabrication, injection, and tracking</td>
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<tr>
<td>• Low-cost, high-field S/C magnets</td>
<td>• Driver efficiency and rep-rate</td>
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The Low Radiation Damage in D³He Reactors Allows Permanent First Walls to be Designed

"Permanent" Life Regime for Steel
Conclusions

• Many of the key technology issues identified in the early 1970's still remain unsolved.

• Current (FY-99) Fusion Energy Sciences budget devotes less than 10% of its resources to the solution of these "show-stoppers".

• In spite of 3 decades of research, we still do not have a demonstrated solution for the neutron radiation damage problem in either MFE or IFE.

Recommendations

• The construction of a "real" volumetric 14 MeV neutron source should take the highest priority in the MFE technology program.

• A vigorous research program should be established to validate IFE chambers designed to protect the first walls and allow rapid rep rates.