

Action Items For ARIES-IFE Study

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ARIES Project Meeting

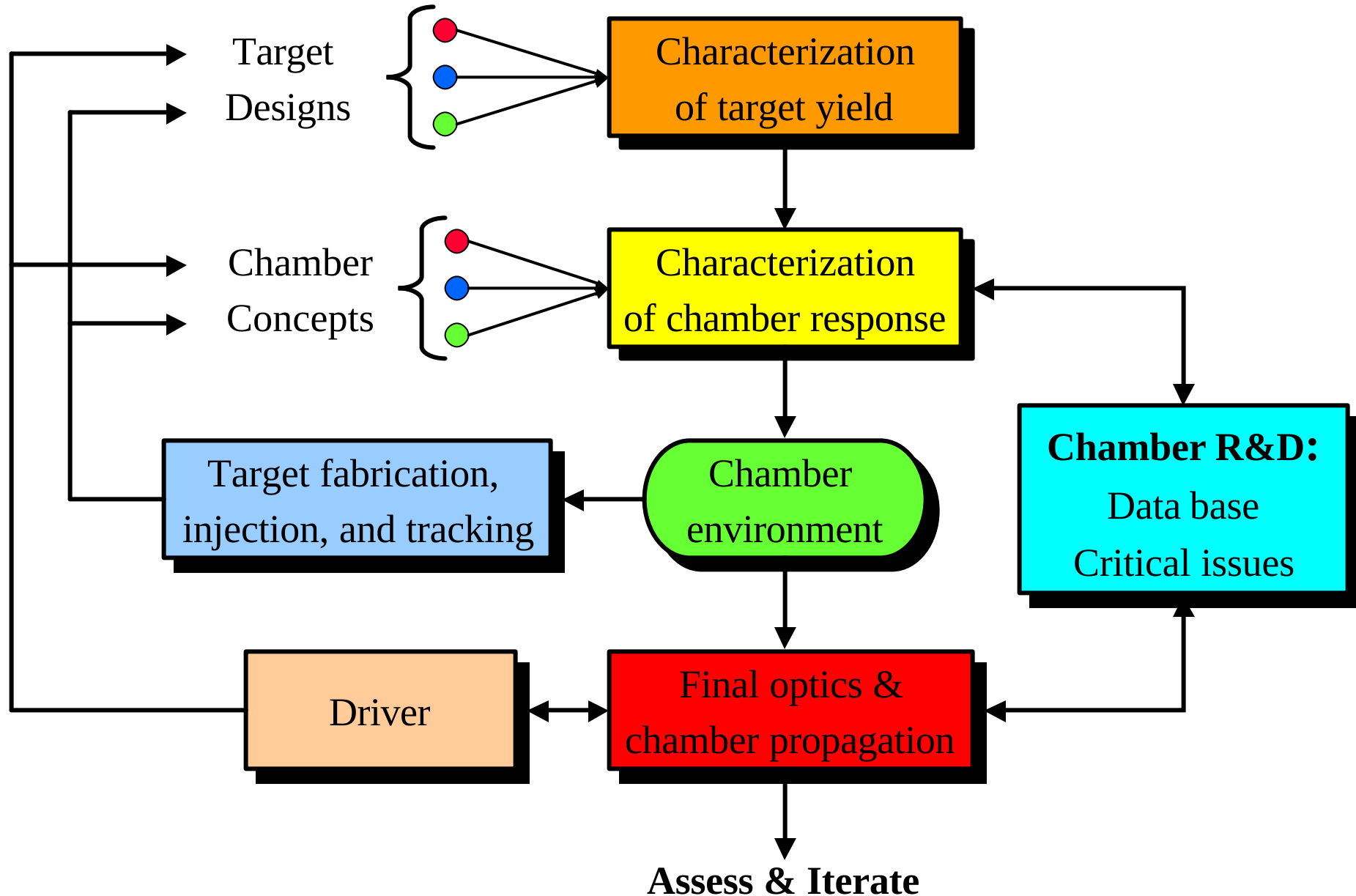
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University of Wisconsin, Madison

Electronic copy: <http://aries.ucsd.edu/najmabadi/TALKS>

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An Integrated Assessment Defines the R&D Needs



ARIES Integrated IFE Chamber Analysis

Near-Term Tasks (6/23/00)

- Focus is on dry-wall chambers.
- In each task, we should start to identify the present data base and start the definition of R&D needs.
- Two task groups have not yet organized fully (chamber clearing and heavy-ion final optics) They should be up and running by the end of June.

ARIES Integrated IFE Chamber Analysis

Target and Chamber Physics

- Four target designs are identified:
- Characterization of target yield:
 - John Perkins characterized target yield for one candidate at one gain.
 - We need to proceed with parameter survey of expected chamber environment condition (e.g., chamber wall fluxes as functions of chamber gas density, target total energy yield, etc.) and identify uncertainties. [Peterson, Haynes,](#)
 - We need to generate yields for the other target candidates: ?
 - To get analysis started, set up a group to set up an estimated range of target yield (total energy and spectrum).
 - Suggestion: [Schultz, Peterson, Andy Schmitt, Meier, and Tillack](#)

ARIES Integrated IFE Chamber Analysis

Chamber Wall Engineering

Task group: Raffray, Tillack, El-Guebaly, Peterson, Sviatoslavsky, Billone, Sze, Brooks, Hassanian, Petti, Mogahed

- Concept development (material, microstructure & configuration)
- Scoping of options by parametric analysis
 - Transient thermal
 - Dynamic stress
 - Gas pressure
 - Isochoric heating (neutronics support)
 - Thermal gradient
 - Erosion/redeposition and implantation (interface with chamber clearing task)
 - Tritium behavior
- Material support:
 - Basic properties and radiation damage
 - Guidance on microstructure and fabrication

ARIES Integrated IFE Chamber Analysis

Chamber Nuclear Analysis

Task group: El-Guebaly, Sawan, Henderson, Wilson, Abdou, Latokowski

- Neutronics:
 - n and γ source strength & spectra (Need: yield, rep rate, pulse width)
 - Nuclear heat load to first wall
 - Pulsed radiation damage (Need: candidate material, radius of first wall)
- Shielding
 - Innovative protection options for final focus mirrors (Need: ducts, size of penetrations, location of mirrors, mirror composition)
- Activation (All need composition)
 - Target material
 - Chamber gas
 - First wall
- Response to request for specific nuclear analysis

ARIES Integrated IFE Chamber Analysis

Chamber Clearing

Task group: (Tillack, Brooks), TBD

- Chamber dynamics at long time scale (> 1 ms)
- Issues:
 - Gas dynamic
 - Erosion/redeposition and implantation (interface with chamber wall eng. task)
 - Aerosol and dust generation and transport
 - Exhaust stream (impurity control) and cleanup
 - Vacuum pumping
 - Tritium recovery
 - Chemistry?

ARIES Integrated IFE Chamber Analysis

Laser Final Optics

- Task group: Tillack, El-Guebaly/Sawan, Sethian, Payne/Rothenberg, Springer, Billone
- Characterize options, configurations, new ideas, lifetime criteria
- Shielding neutronics
- Photonics
 - LIDT, reflectivity, other damage mechanisms
- Mechanical design
- Photon and debris protection
- Similar group to be formed for heavy-ion final optics per discussion among Meiere/Najmabadi/Simone Yu

ARIES Integrated IFE Chamber Analysis

Target Fabrication, Injection, & Tracking

- Task group: Goodin, Schultz, Petzoldt, Alexander, Schmitt, Sviatoslavsky,
- Main Issues:
 - Direct drive: Target Injection
 - Indirect drive: Target Fabrication
- For direct drive, expand injection operating envelope (Goal: a self-consistent scenario):
 - Work with NRL on target design changes
 - Develop direct simulation capability for convective heating
 - Calculate thermal benefits of thicker polymer layer
 - Fabricate thin gold layers and measure reflectivity
 - Evaluate frozen gas as target protection method
 - Injection tubes
- Integrate indirect drive target fabrication activities into ARIES activity (Goal: begin to show a credible pathway for target fabrication)
 - Propose preliminary fab, assembly, fill, and layering pathways.

ARIES Integrated IFE Chamber Analysis Systems Tasks

- Task group: Miller, Meier, Waganer
- Link models for driver, chamber, target, etc. into a comprehensive picture at appropriate level of detail (tool integration and development).
- Use COE and other metrics subject to requirements, goals, and constraints
- Parametric investigation of design windows and uncertainty/sensitivity analysis.

ARIES Integrated IFE Chamber Analysis

Safety Tasks

- Task group: Petti, Latkowski, Sze, El-Guebaly
- Detailed design and many safety-important aspects of the facility will not be known in sufficient detail for a full safety & environmental assessment
- Need a variety of safety & environmental metrics to be used to compare different concepts at this early concept definition phase
- These metrics are based on four factors
 - Mobilizable tritium, activation products, and dust/debris
 - Decay heat
 - Chemical reactivity/combustible gas generation
 - Waste/environmental issues
- It may not be possible to apply all the metrics to a given concept, however they should be used to the extent possible.
- In some cases, it may only be possible to make a judgment as to whether a concept has reasonable potential to meet a particular metric.