TARGET SELECTION FOR ARIES-IFE

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GENERAL ATOMICS

PHASE I OF ARIES-IFE WILL EXPLORE INTEGRATED DESIGN CONCEPTS

- Focus on chamber issues
  - Wall and optic protection
  - Blanket performance
    - TBR, efficiency, practicality
  - Target fabrication
  - Target injection and tracking

- Explore integrated driver/chamber/target systems
  - Do design windows exist?
  - Earlier studies were not consistent
  - Much new information is available

- Optimize chamber and target together

- Investigate integrated design concepts
  - Select design points at end of Phase

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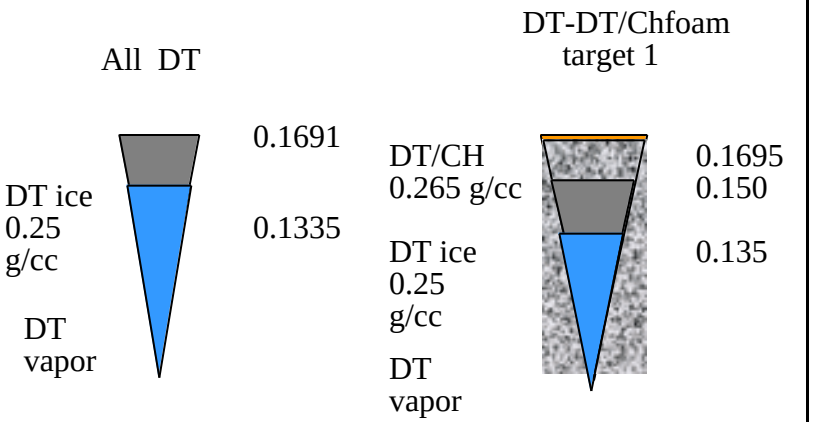
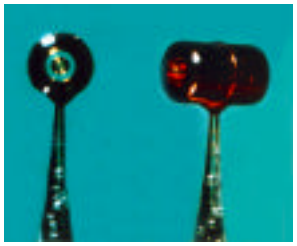
ARIES-IFE MUST CONSIDER LASER AND HEAVY ION DRIVERS

- **Look at 4 classes of targets:**

Laser	—	**direct drive shock preheat**
	—	**direct drive radiation preheat**
	—	**indirect drive x-ray drive**
Heavy ion	—	**indirect drive close-coupled, distributed radiator**





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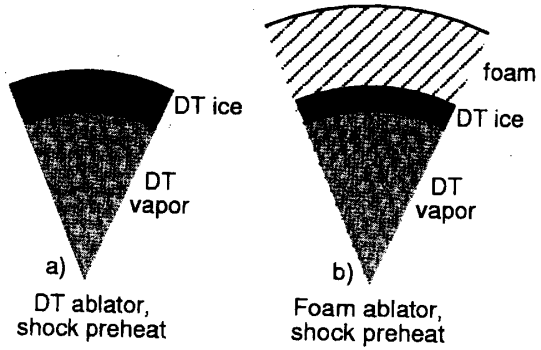
TARGETS MUST MEET SELECTION CRITERIA

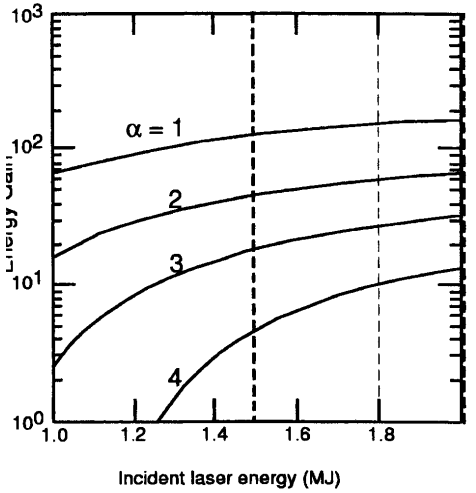
- "Reasonable" gain: $GM\eta_{driver}\,\eta_{elect.} \geq 5$ (< 20% recirculating power)
  - Gain curve (G vs. E_{driver}) will be needed at end of Phase I
- Calculational basis for target physics
  - burn analysis
  - expected stability
  - output spectrum calculated
  - fast ignition is not yet ready
- Output spectrum
  - x-ray and debris fractions
  - burn temperature and x-ray spectrum
- Fabrication
  - feasibility
  - projected cost
- Injection
  - survival in chamber environment
  - speed, acceleration, strength, thermal response

DIRECT DRIVE SHOCK PREHEATED TARGET

- "All DT" Target
  - modest gain, <80 @ 3MJ
  - well analyzed, Omega base design
  - hard spectrum in large sizes
  - fabrication by current techniques
  - thermally fragile



- "Foam Ablator" Target
  - modest gain, <80 @ 3MJ
  - foam should help stability
  - fabrication by current techniques
  - mechanically and thermally fragile



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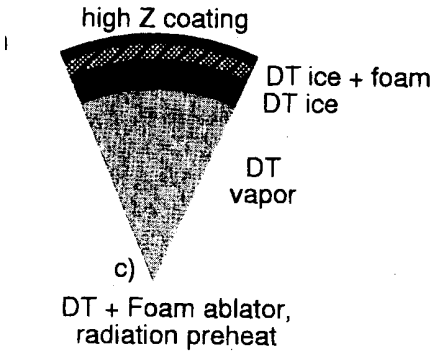
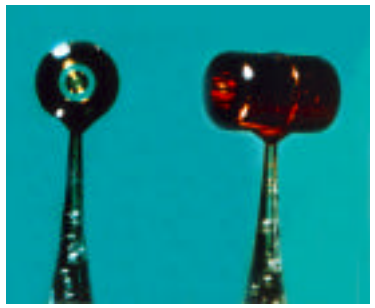
RADIATION PREHEATED DIRECT DRIVE TARGET

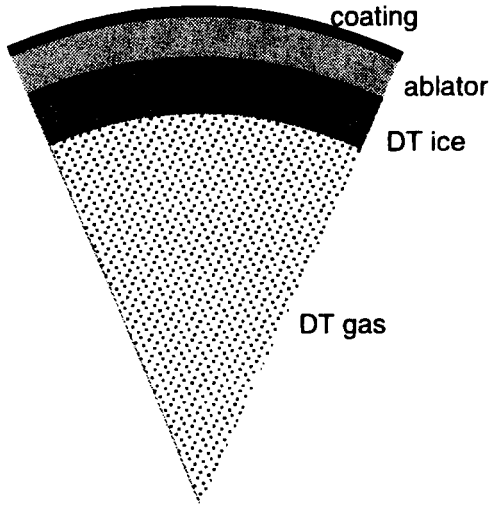
- improved gain, 72 @ 2 MJ
  125 @ 1.3 MJ with
  "zooming"
- less analyzed
- fabrication by integration of current separate techniques
- ? thermal protection (reflection) from high-Z coating?



LASER-DRIVEN INDIRECT DRIVE TARGET

- improved gain, 72 @ 2 MJ
- strong physics basis, Omega design
- emits hohlraum debris and low energy X rays; asymmetric
- fabricate by current techniques; cost??
- fill and assembly (or assembly and fill) a concern
- mechanically robust





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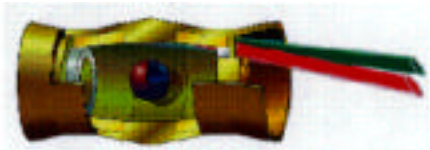
HEAVY ION-DRIVEN INDIRECT DRIVE TARGET

- close-coupled distributed radiator design
- improved gain 133 @ 3.3 MJ
- well analyzed; no experiments
- emits hohlraum debris and low-energy X rays
- fabrication to be developed (metal oxide aerogels?); cost a concern
- mechanically and thermally robust



INDIRECT DRIVE TARGET FOR IFE (LLNL)

ARIES-IFE PHASE I TARGET SELECTION TASKS

- Consider four classes of targets
- Investigate and optimize each class with a driver and chamber concept as an integrated system
  - gain, chamber damage, fabrication, injection
- Consider:
  - Effect of 1/3 μ vs. 1/3 μ (vs. 1/2 μ?) light
  - Impact of alternate materials
    - CH vs. Be capsules, hohlraum materials
  - Cost and EH&S aspects of targets
  - Fill and layering of targets
  - Injection and survival

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ARIES-IFE TARGET SELECTION PHASE I GOALS

- Select one integrated design concept for each class
- Evaluate if an open design window exists
- Provide characteristics and gain curves for overall system optimization in Phase II

These are ambitious goals given the complexity of the issues, the wide range of options and the modest level of the ARIES-IFE effort.