

LA-UR-24-22691

Approved for public release; distribution is unlimited.

Title: LANL's 2PP Requirement for Mix & Burn Study

Author(s): Kim, Yong Ho
Levesque, Joseph Maurice
Haines, Brian Michael

Intended for: Project discussion with University of Nebraska's 2PP team

Issued: 2024-03-25



Los Alamos National Laboratory, an affirmative action/equal opportunity employer, is operated by Triad National Security, LLC for the National Nuclear Security Administration of U.S. Department of Energy under contract 89233218CNA000001. By approving this article, the publisher recognizes that the U.S. Government retains nonexclusive, royalty-free license to publish or reproduce the published form of this contribution, or to allow others to do so, for U.S. Government purposes. Los Alamos National Laboratory requests that the publisher identify this article as work performed under the auspices of the U.S. Department of Energy. Los Alamos National Laboratory strongly supports academic freedom and a researcher's right to publish; as an institution, however, the Laboratory does not endorse the viewpoint of a publication or guarantee its technical correctness.



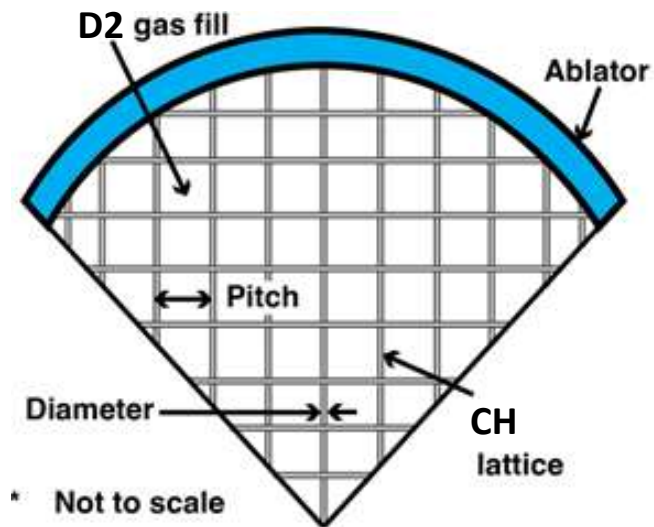
LANL's 2PP Requirement for Mix & Burn Study

Yongho Kim, Joseph Levesque, and Brian Haines (LANL, Bosque Team)

March 22, 2024

Idea 1: 2PP printed spherical capsule

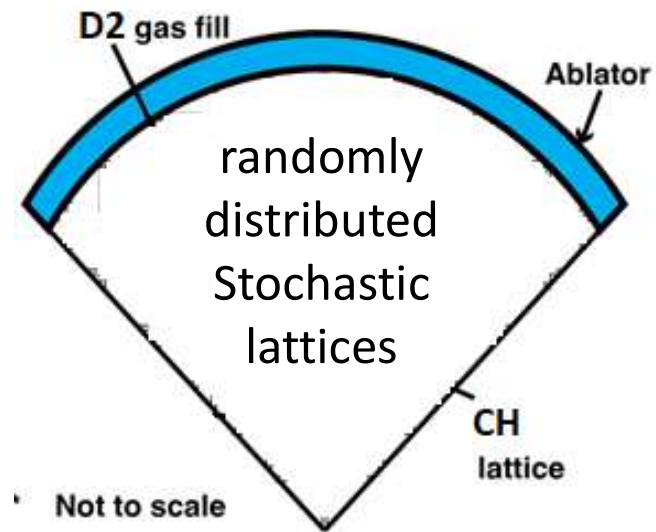
Pie Diagram of Spherical Capsule



- Goal is to investigate how much CH lattices will mix with D2 gas and how well can we simulate?
- Cubic shape with a fixed pitch size = 50 um x 50 um
- Can an ablator be printed by 2PP ?
- Can ablator hold a gas pressure (3 atm)?
- Capsule types:
 - A = lattice diameter of 1 um
 - B = lattice diameter of 2 um
 - C = lattice diameter of 3 um

Idea 2: stochastic lattices

Pie Diagram of Spherical Capsule

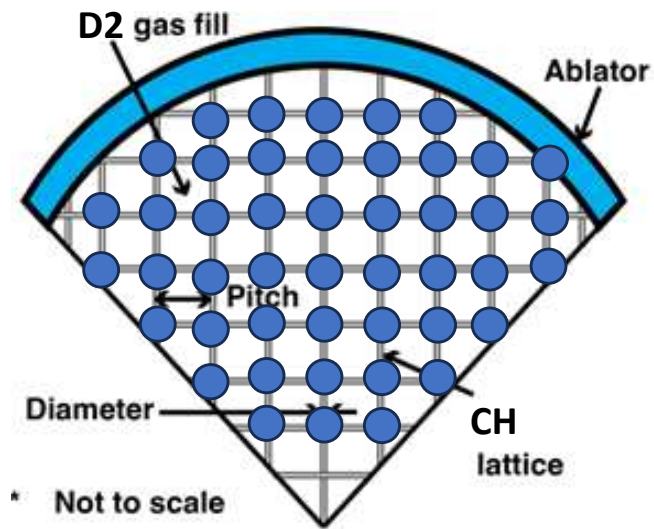


← Capsule diameter (OD) = 860 μm →

- Can 2PP capsule be printed with stochastic lattices?
- Can average density be varied?

Idea 3: de-mixing capsule

Pie Diagram of Spherical Capsule

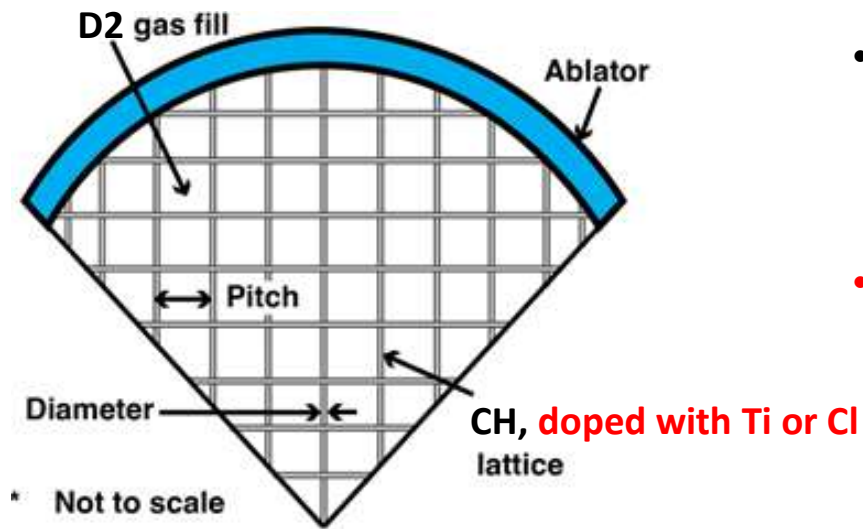


← Capsule diameter (OD) = 860 um →

- Goal is to investigate the de-mixing effect by using dots connected with lattices
- Cubic shape with a fixed pitch size = 50 um x 50 um x 50 um & a fixed lattice diameter = 1 um
- **Can lattices be connected with dots ?**
Diameter of dots will be determined by further design study

Idea 4: lattices with a tracer dopant

Pie Diagram of Spherical Capsule

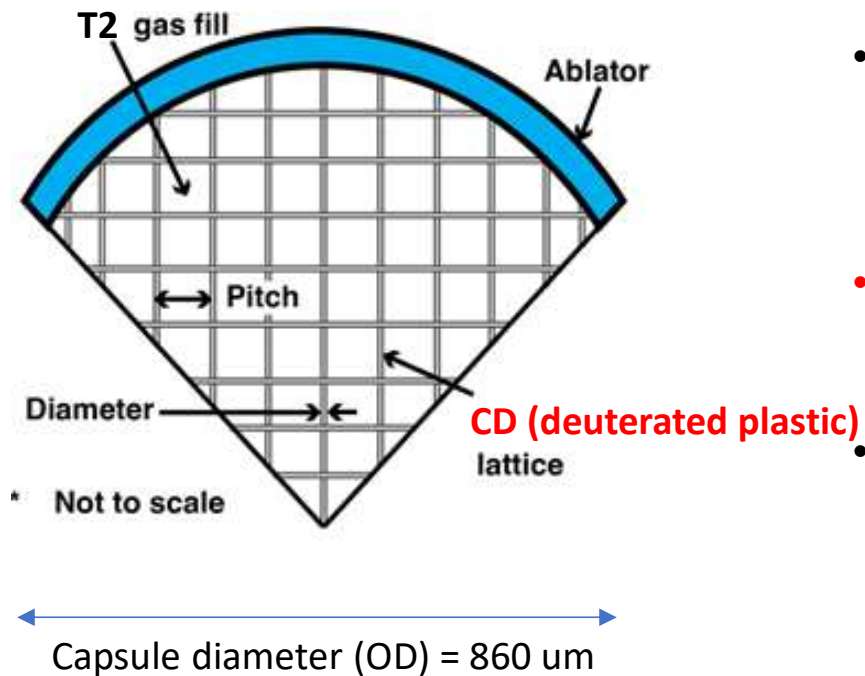


←—————→
Capsule diameter (OD) = 860 μm

- Goal is to investigate the degree of thermal equilibrium between lattice and gas
- Cubic shape with a fixed pitch size = 50 μm x 50 μm x 50 μm & a fixed lattice diameter = 1 μm
- Can a CH lattice be doped with few % Ti or few % Cl?

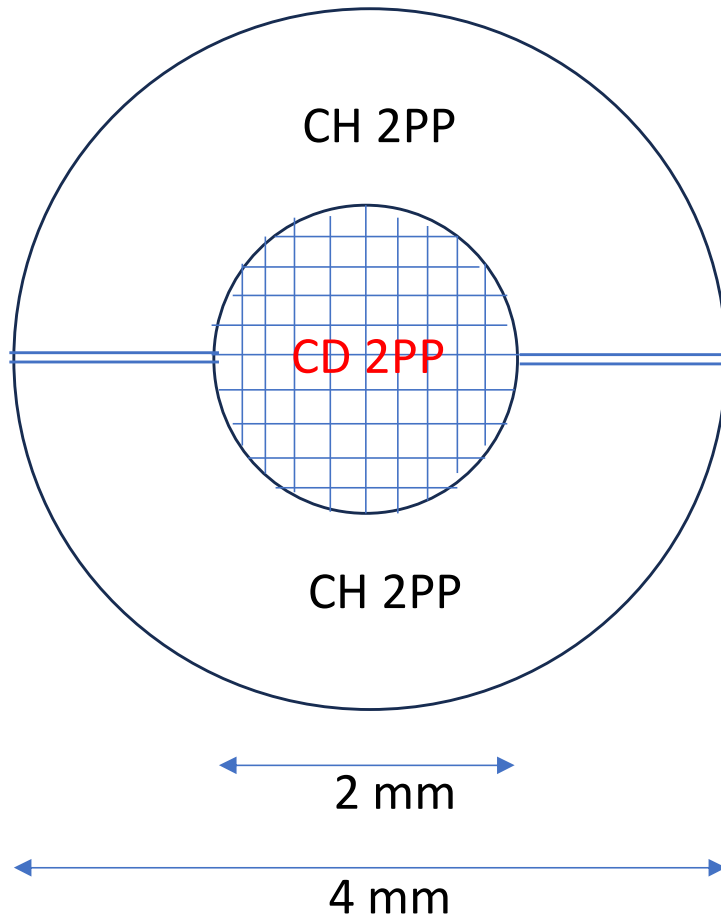
Idea 5: Deuterated 2PP sphere

Pie Diagram of Spherical Capsule



- Goal is to investigate the degree of thermal equilibrium between lattice and gas
- Cubic shape with a fixed pitch size = 50 μm x 50 μm & a fixed lattice diameter = 1 μm
- Can a lattice be made of deuterated plastic (CD)?
- Capsule types:
 - A = lattice diameter of 1 μm
 - B = lattice diameter of 2 μm
 - C = lattice diameter of 3 μm

Hybrid capsule can be beneficial for future campaign



- **CD-2PP full sphere**
 - Diameter = 2 mm
 - Cell size = 50 μm x 50 μm x 50 μm
 - Density = 15 mg/cc requested to GA (but 55 mg/cc for simulation study)
 - Deuteration fraction = 90% requested to GA (75% for simulation study)
- CH-2PP hemi-sphere
 - Out Diameter = 4 mm
 - Inner Diameter = 2 mm
 - Cell size = 50 μm x 50 μm x 50 μm
 - Density = 10 mg/cc