

Target Fabrication of Colliding Planar Shock Targets

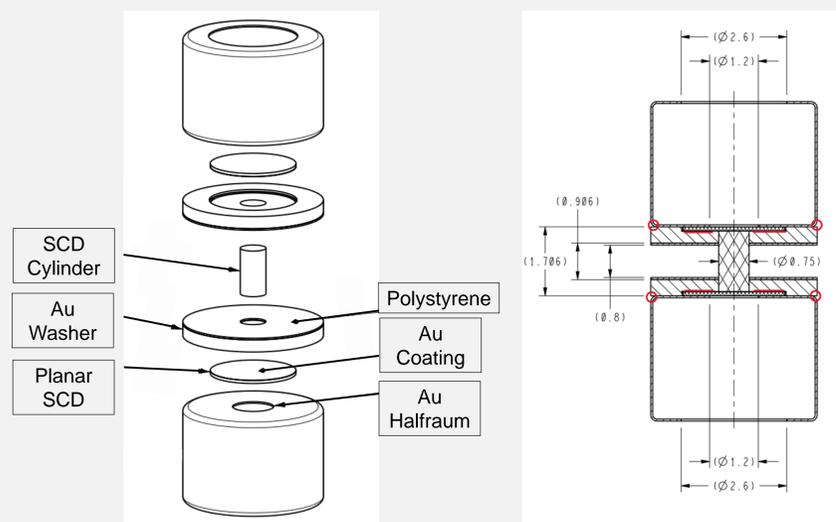
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Target Objective and Key Points

- Colliding Planar Shock targets marked the first test of a new design aimed at quantifying carbon ionization at extreme densities
- Target uses a symmetrical two halfraum physics package design to send shocks through a centralized Single Crystal Diamond (SCD) sample
- No glue use was allowed within the designated region of interest, necessitating an interference fit assembly of the diamond sample using high precision machining and micron level tolerances
- Heavy use of dimpled of 25um, 50um, and 75um gold shielding necessitated a full process overhaul to yield in spec dimpled shields

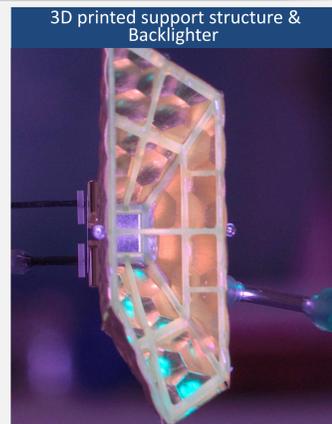
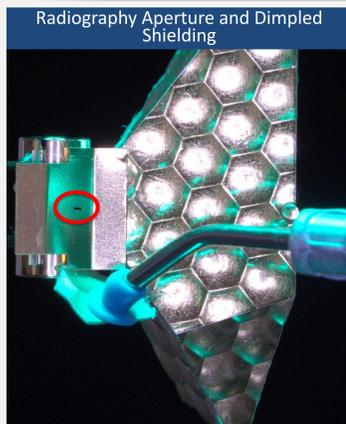
Physics Requirements and Overview of Design

Why did we need an interference fit between the Au washers and SCD Cylinder?



- Glue permitted in red highlighted areas only
- SCD faces must be in contact with each other
- Glue mix in the shock front could impede diagnostic view

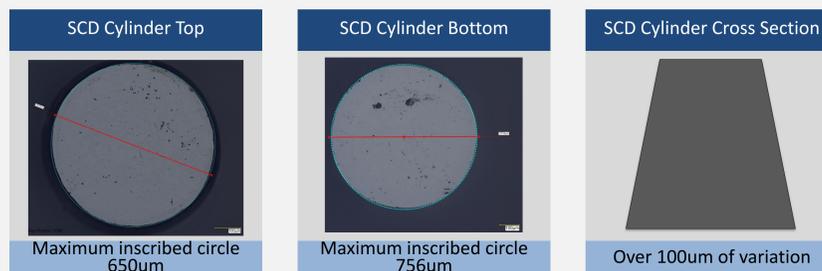
Additional Target Features: Backlighter Assembly, Au Shielding, and Diagnostic LOS



- 3D printed structure supports Au dimpled shielding and houses the backlighter + collimator assembly
- The secondary aperture shown in the left image is used for an x-ray scattering measurement

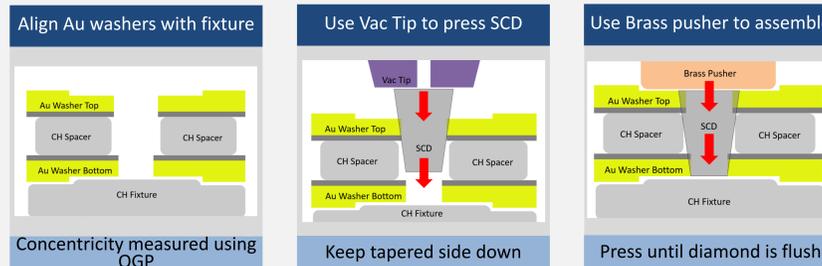
Machining and Metrology of Physics Package Assembly

Au washers were match machined to the SCD cylinder to ensure a 5um-10um interference



- Growth process of SCD cylinders at 1.5mm in length yielded slightly conical parts
- Au washers match machined individually in accordance with top and bottom cylinder measurements of each SCD cylinder

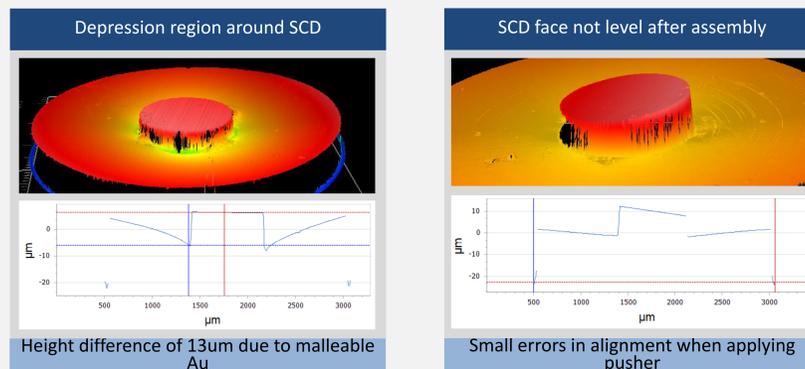
Custom fixturing needed to create full assembly



Hohlraum assembly process after planar SCD is assembled into gold Au washer



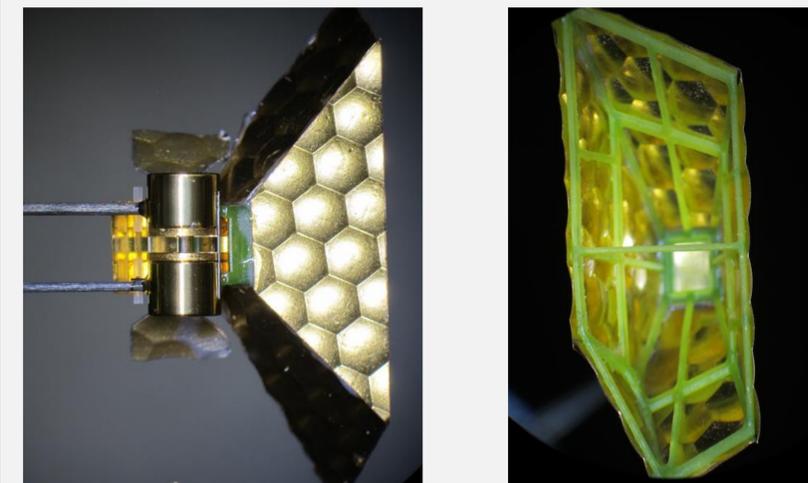
Challenges associated with interference fit



- Depression regions were acceptable as it was easier to ensure full contact with planar SCD
- Manufacturing defects meant that SCD faces weren't entirely level

Dimpled Shield Process Development and Resolution

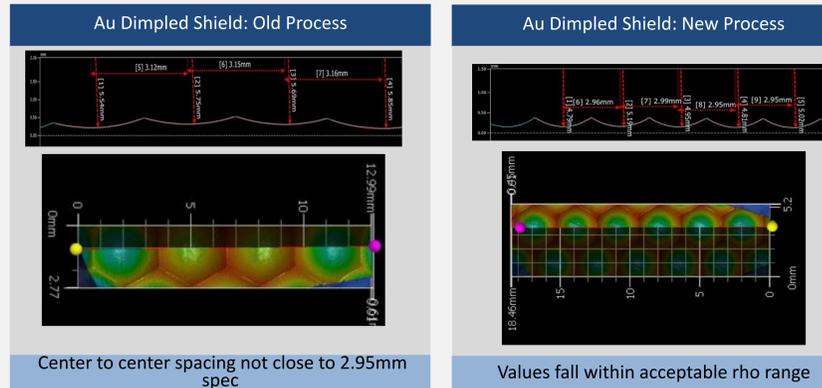
Heavy use of gold dimpled shielding



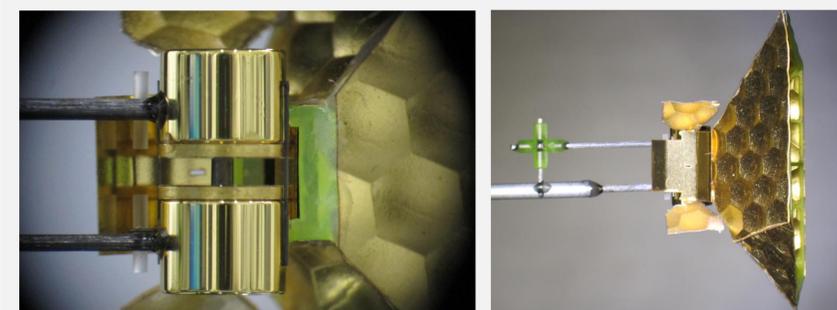
- Dimpled shielding is used in targets mitigate the 1 omega unconverted light risk
- CPS targets used gold to contain and isolate plasma and X-rays from interfering with measurement
- The current dimpling process was found to be flawed, necessitating a re-design of the process

Gold shields made using the new process parameters meet specification

- Dimples are defined as in spec if they fall within a rho value of 0.25 to 0.35
- Rho is equal to half of the center to center distance divided by the radius of the dimple
- Process development included parameter changes to temperature, pressure, and dwell time



All three targets performed as expected yielding exceptional physics data



The team will look to make improvements to this platform ahead of 3 shot allocations in FY25