

Abstract

- Process Engineering Team refines production processes, designs, and methodologies to optimize target performance and yield. Emphasis is placed on meticulous assessment of equipment, procedures, and risk factors to propose effective mitigation strategies.
- Complex studies and analyses are conducted to improve processes and face challenges such as off-normal events, capsule and hohlraum leaks and depleted uranium (DU) oxide slivers in starbursts.
- Best practices are evaluated based on operator expertise and historical target data.

Process Engineering Overview

Process Engineering ensures efficiency, quality and performance in target production. Engineering Controls achieve desired outcomes and promotes safety for the personal, equipment and targets.

Target Fabrication Process Engineering Team

Target production Facility

Clean Room | Target

Disciplines

- Chemical Engineering
- Mechanical Engineering
- Physics

Objectives

- Strengthen and standardize procedures.
- Ensure quality control, assurance, procedure detail and off normal events tracking.
- Commission new processes for production.
- Personnel training.

Engineering Skills

Technical Expertise, problem solving, data analysis, communication, process modeling, safety awareness, periodical improvement.

Current Work

- Process improvement through robust procedures.
- Use deliberate operations to evaluate procedures and practices.
- Transfer process developed by R&D into production.

Process Standardization and Best Practices

- Identify best practices and update procedures to standardize target assembly.
- Perform IPT meetings with subject matter experts to review updates, analyzed data and quality control methods to set best techniques.



Assembly / Bonding Process

Laser Entrance Hole (LEH) Window Installation

Operator A

Diagnostic Band (DB) Window Installation

Operator B

Procedure walkthrough findings:

- Differences in UV curing method and times, as well as the amount and locations of the glue.

Key parameters for Bonding:

- Curing time and method.
- Bonding locations
- Type and amount of glue.
- Glue properties and behavior at Cryo conditions.
- Glue Compatibility with the component materials.

Image Author: Yailiss Macallop

Addition of the new process to target production

Transition processes developed by the R&D group to the production environment.

- Provide necessary resources and equipment.
- Develop the failure modes and effects analysis (FMEA) for every process.
- Ensure safety regulations and standards are met.
- Improve tools by designing for process robustness and ergonomics

Acid Etch Process for Depleted Uranium Slivers Mitigation

(see Alexander Schwartz poster)

Hohlraums DU Slivers formation

Depleted Uranium Hohlraum Cleaning

SEM Images: Pre - Etch

SEM Images: Post - Etch

Image Author: Suhas Bhandarkar | *Images Author: Alexander Schwartz*

Identify Issues and Risk – Problem Solving - Collaborative Process

Tooling issues during Acid Etch Process

Improper draining

Hohlraum Damaged

Image Author: Jonathan Monterrosa

Tool Modification

- Drill tool to increase the diameter of the drain holes

Proper tool handling

Tool redesign and Testing

Fill Tube Curvature found at Wanding and Close Processes

Polymicro (PM) curvature occurs during the assembly of the CFTA when a thermal cure can cause the PM to bow. CFTAs with PM curvature increases the effort required to wandle the CFTA, and if severe enough, can require the operator to use heroic techniques to complete the task. This can ultimately lead to curvature of the fill tube after the target is closed, CFTA leaks, and fill tube beaks and pullouts.

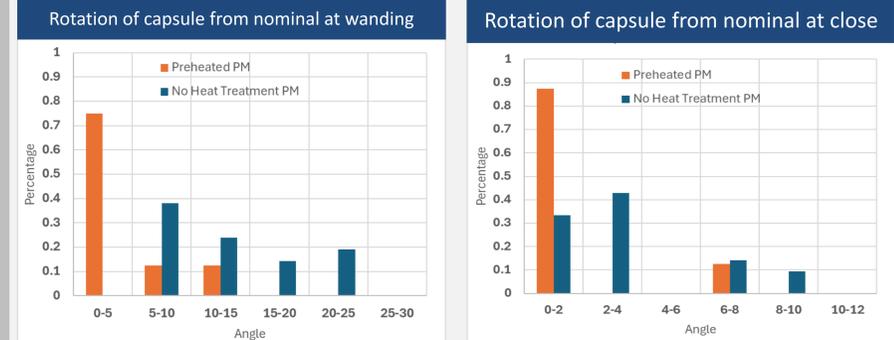
Fill Tube Curvature at Wanding

Fill Tube Curvature Shown after Target is Closed

Graphs, images and data Author: Marcus Monticelli

(see Xavier Lepro poster)

To reduce PM curvature, it was proposed to preheat the PM tubes and select only the straightest ones for CFTA assembly. A joint effort between component and process engineering tracked the results of this pilot.



Selecting straight PM after preheating led to a significant reduction in bent fill tubes at wanding and at close. This process has now been implemented as standard procedure.

Graphs, images and data Author: Marcus Monticelli

Off Normal Events Found at Bonding process

LEH window motion during Installation

Develop off bond process to address this issue and prevent hohlraum leaks

Equipment Failure

UV Light Curing method - Bonding process

Process engineers establish proper corrective actions on how to proceed when these events occur. Likewise, they ensure that the equipment for each process works correctly and is periodically calibrated.

Conclusion



Engineering rigor, robust procedures, quality control methods, addition of new process, component treatments, materials analysis and R&D studies are key parameters to maintain and improve target fabrication yields.