Overview of High Density Carbon Capsules for Weekly Layered NIF Target Builds

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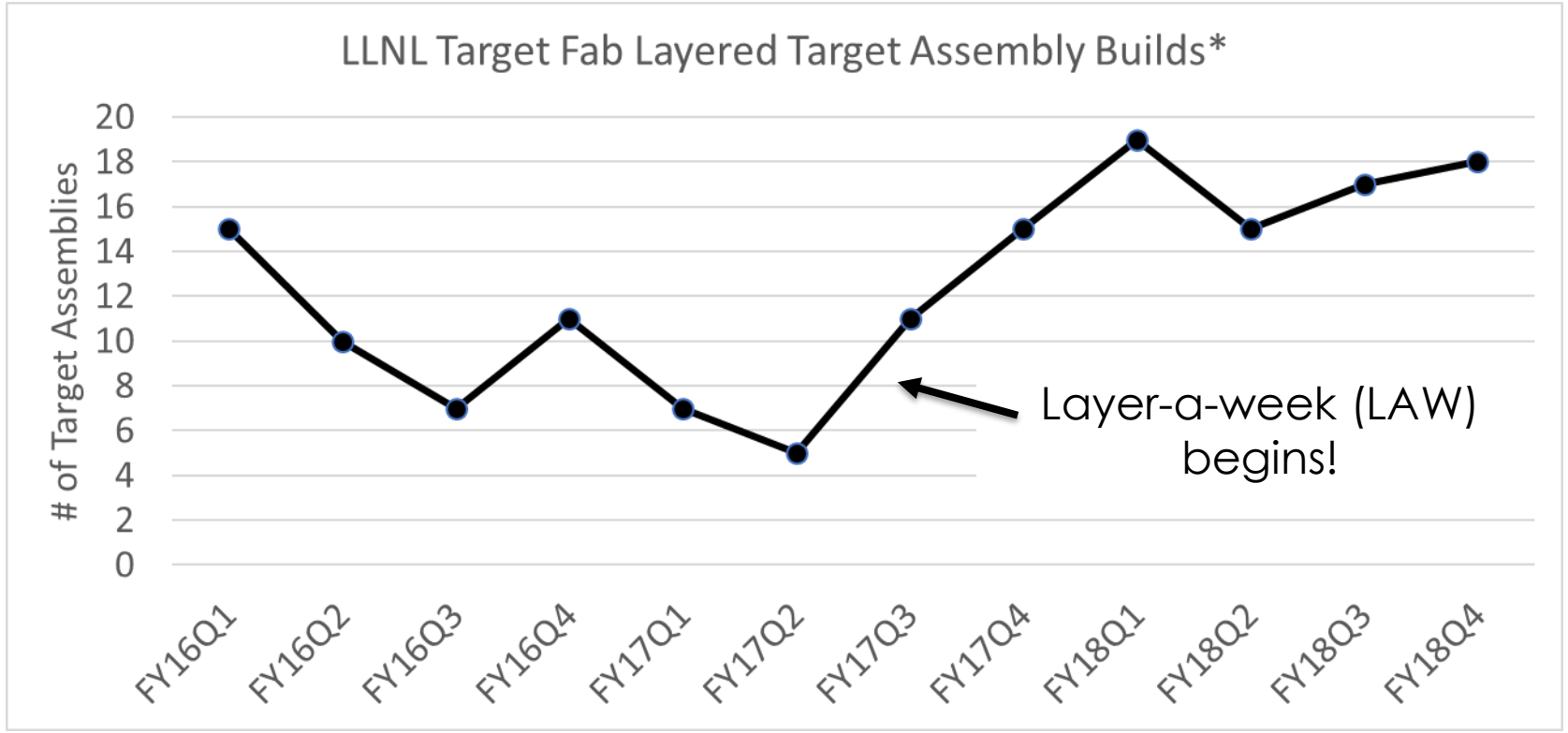
23rd Target Fabrication Meeting
Annapolis, Maryland
April 23-26, 2019

This work performed under the auspices of the U.S. Department of Energy by General Atomics under Contract DE-NA0001808 and by Lawrence Livermore National Laboratory under Contract DE-AC52-07NA27344

GENERAL ATOMICS

NIF set the goal of fielding at least one ice-layer target per week

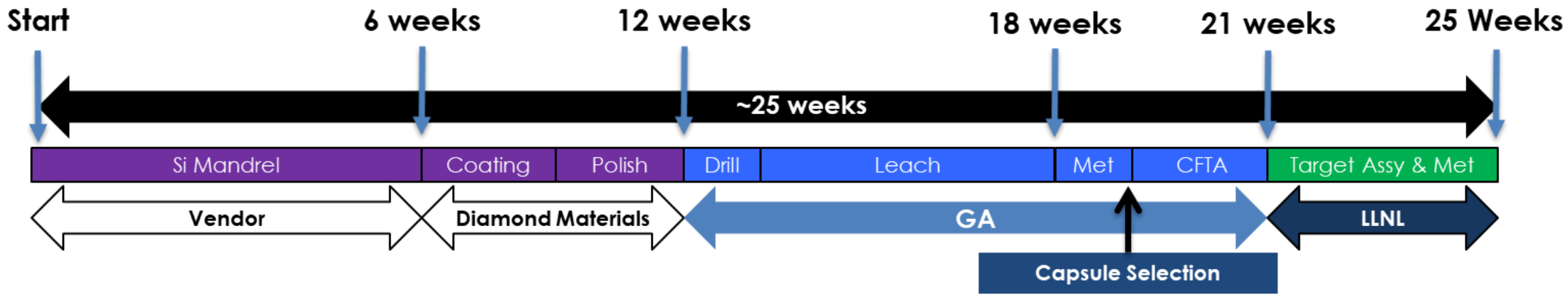


One ice-layer per week requires a reliable and flexible target supply

*Thanks to Becky Butlin & Chris Choate

HDC capsules for NIF cryo-targets require multi-month lead times

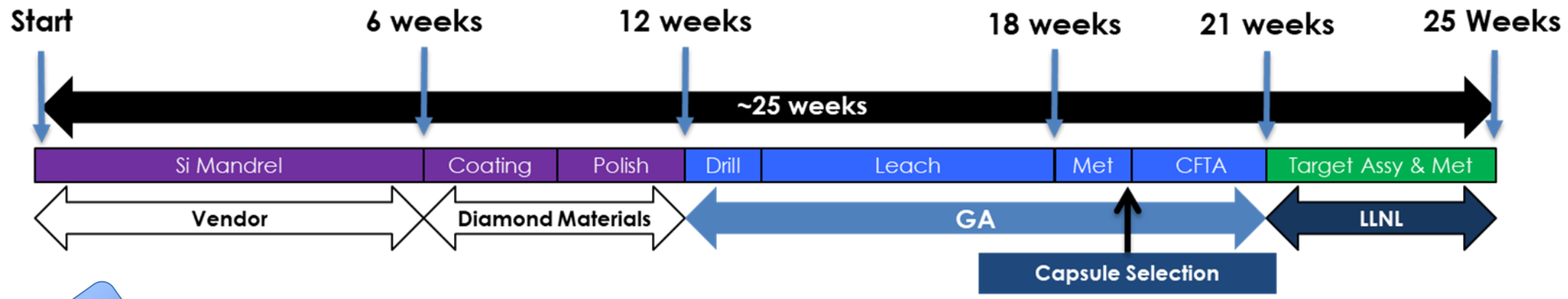
2017 HDC CFTA Process Flow



Campaign leaders do not want to wait ~6 months between experiments

- **Goal is to reduce time-to-market**

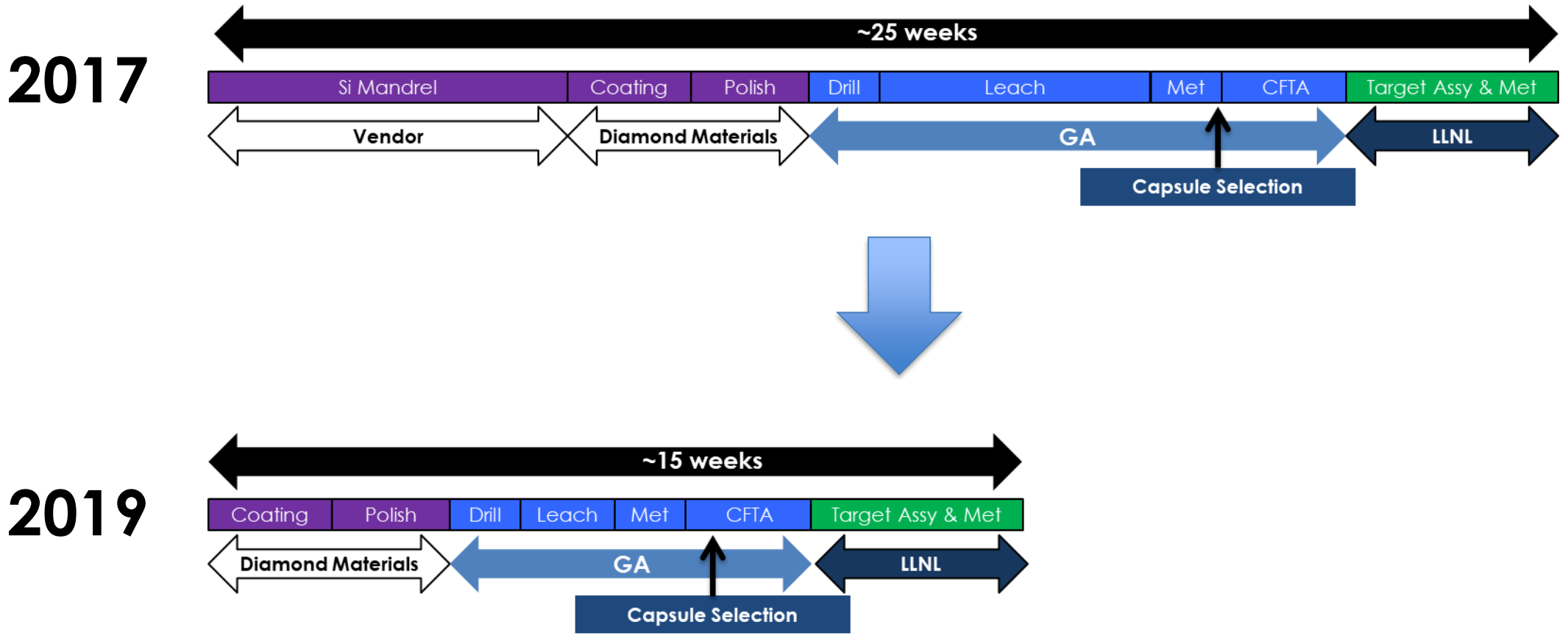
Improvements on rate-limiting steps can reduce overall processing time



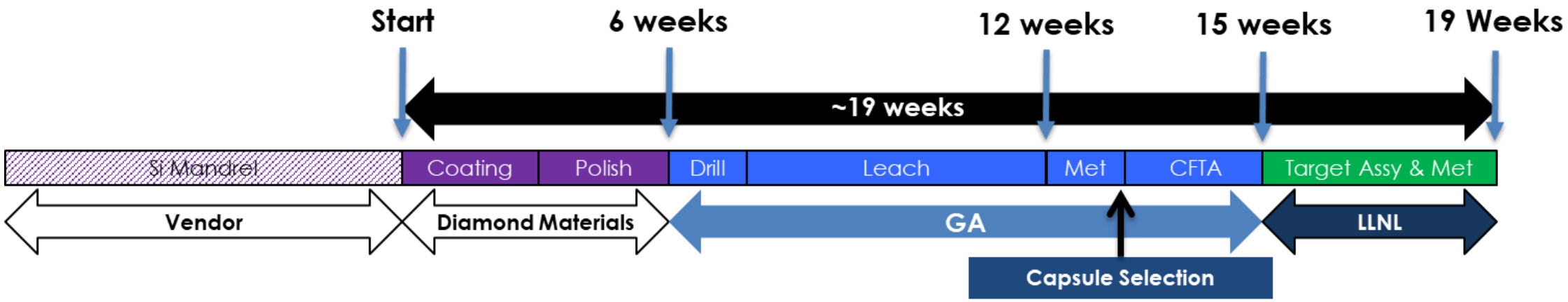
*Discussed in this talk-

- *Mandrel Acquisition – 6 weeks
- Coating/Polishing – 6 weeks, governed by physics of the process
- *Leaching – 6 weeks (for 5 µm drill hole)
- *CFTA – 2 weeks

Optimization in HDC capsule processing has reduced time-to-market by ~10 weeks and enhanced process reproducibility

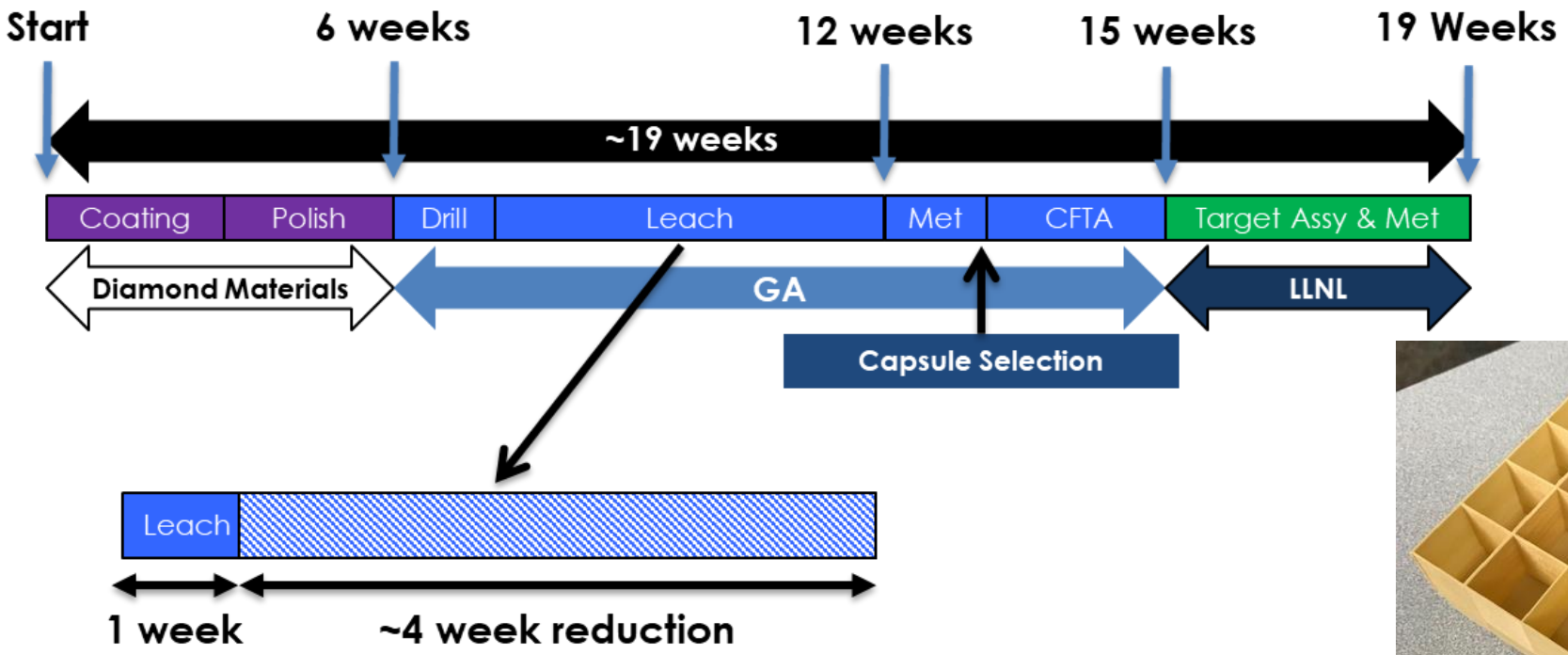


Standardizing mandrel sizes and prepositioning at Diamond Materials reduces lead time by ~6 weeks

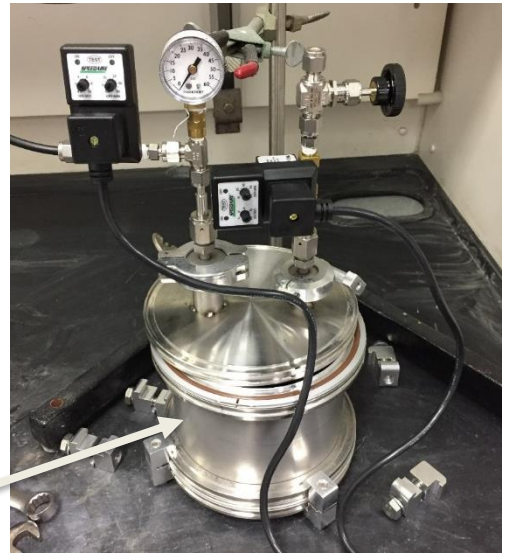


Specifying capsule inner diameter ranges allows bulk acquisition of mandrels increasing flexibility and lowering time & cost within a size range

Implementing pressure leaching process* on average reduces 5 µm drill hole leach time by 80%!



25 Capsule Vial Holder



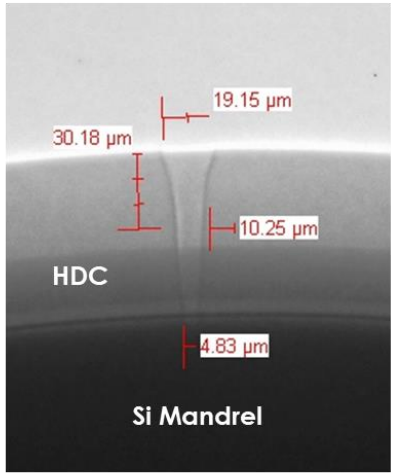
Pressure cycle system

Manipulating the reaction generated gas bubble improves fluid exchange and reduces etch time

***Details in Casey Kong's presentation**

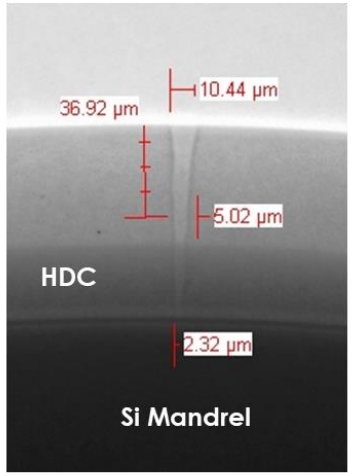
Pressure leaching provides feasibility of further improvements such as 2 µm fill tubes*

10 µm fill tube
Vol = ~6900 µm^3
Mass = ~26 ng



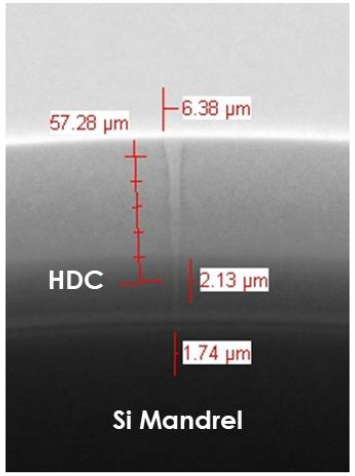
< July 2016

5 µm fill tube
Vol = ~2100 µm^3
Mass = ~8 ng

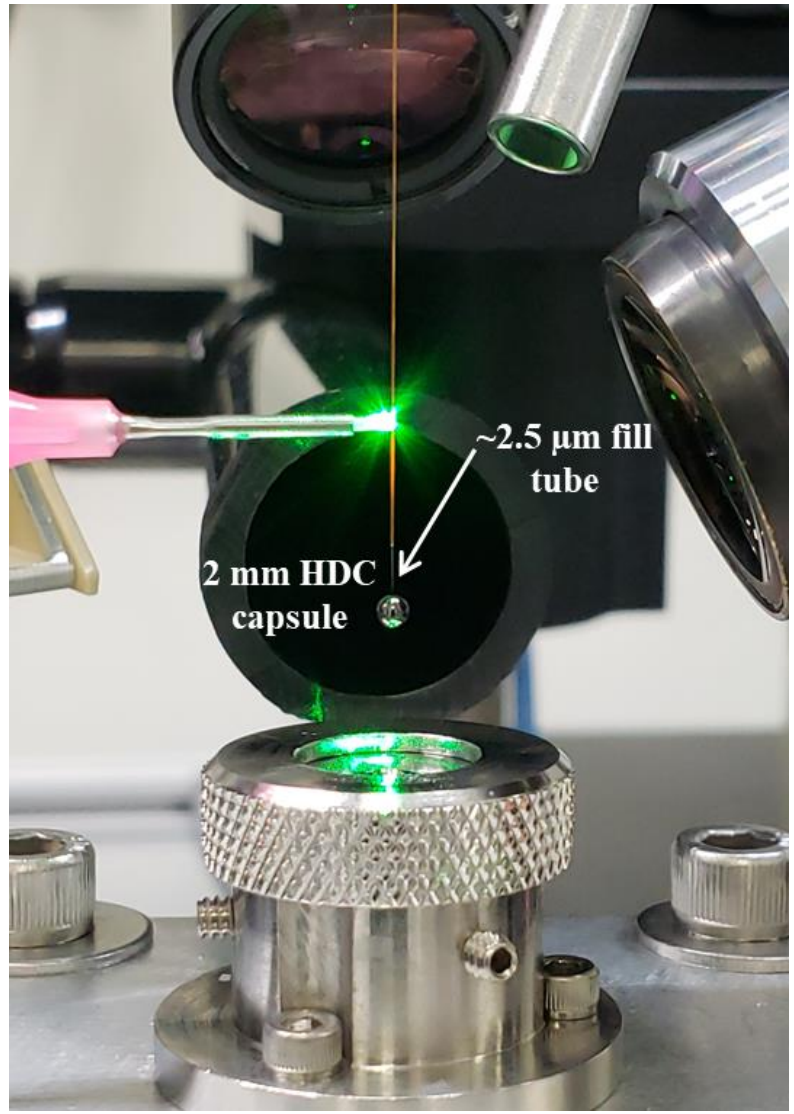


July 2016

2 µm fill tube
Vol = ~880 µm^3
Mass = ~3 ng



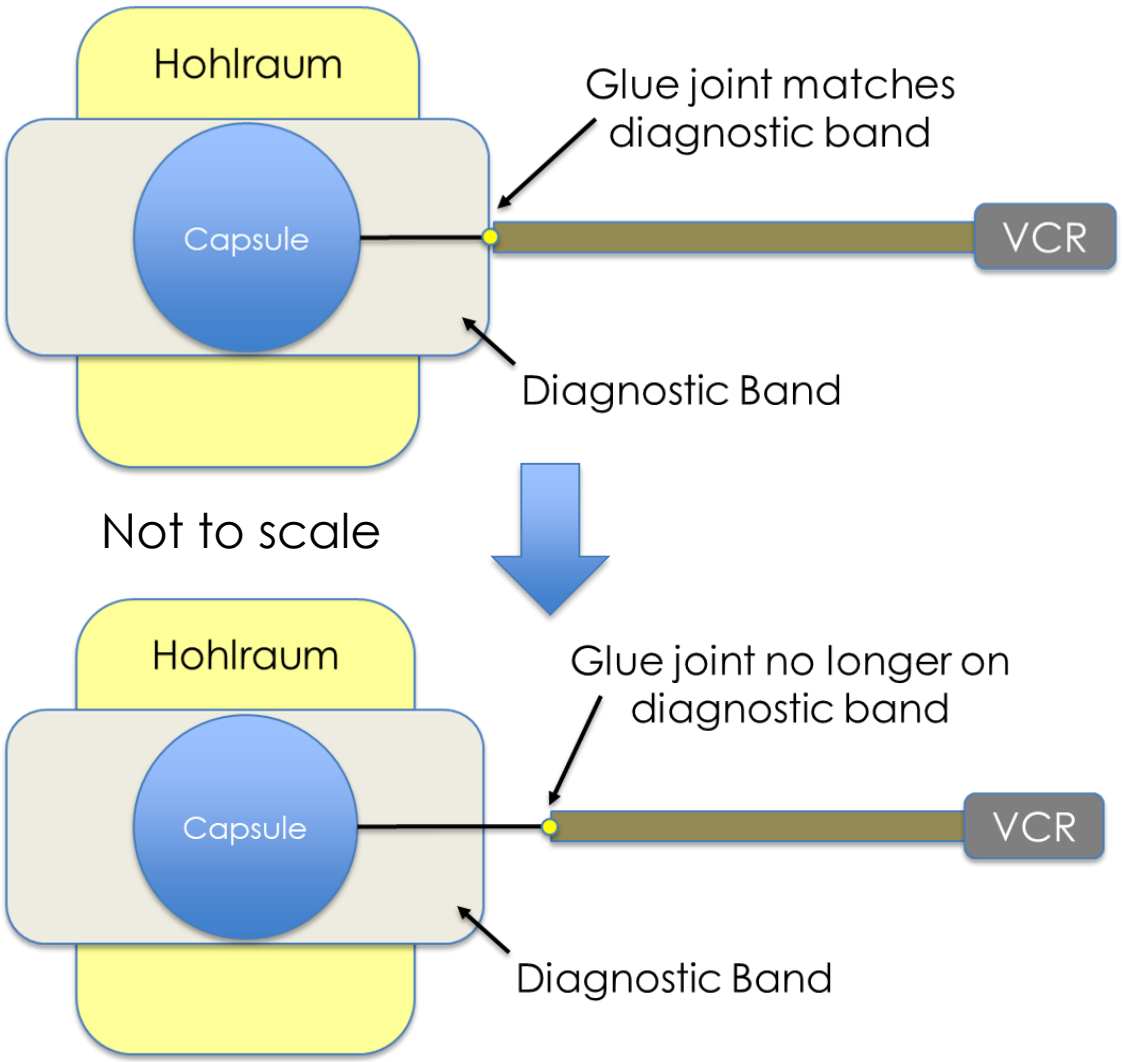
February 2018



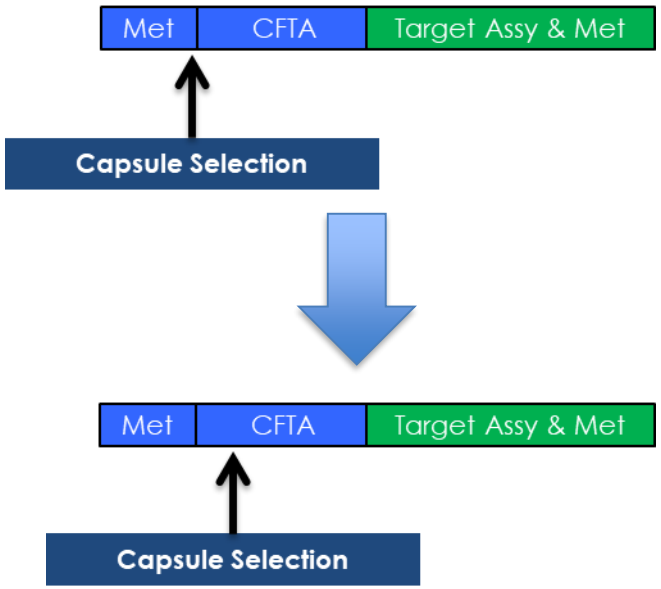
Further improvements underway to increase repeatability of small hole laser drilling

***Details in Jay Crippen's presentation**

Implementing universal parts streamlines fill tube assemblies*

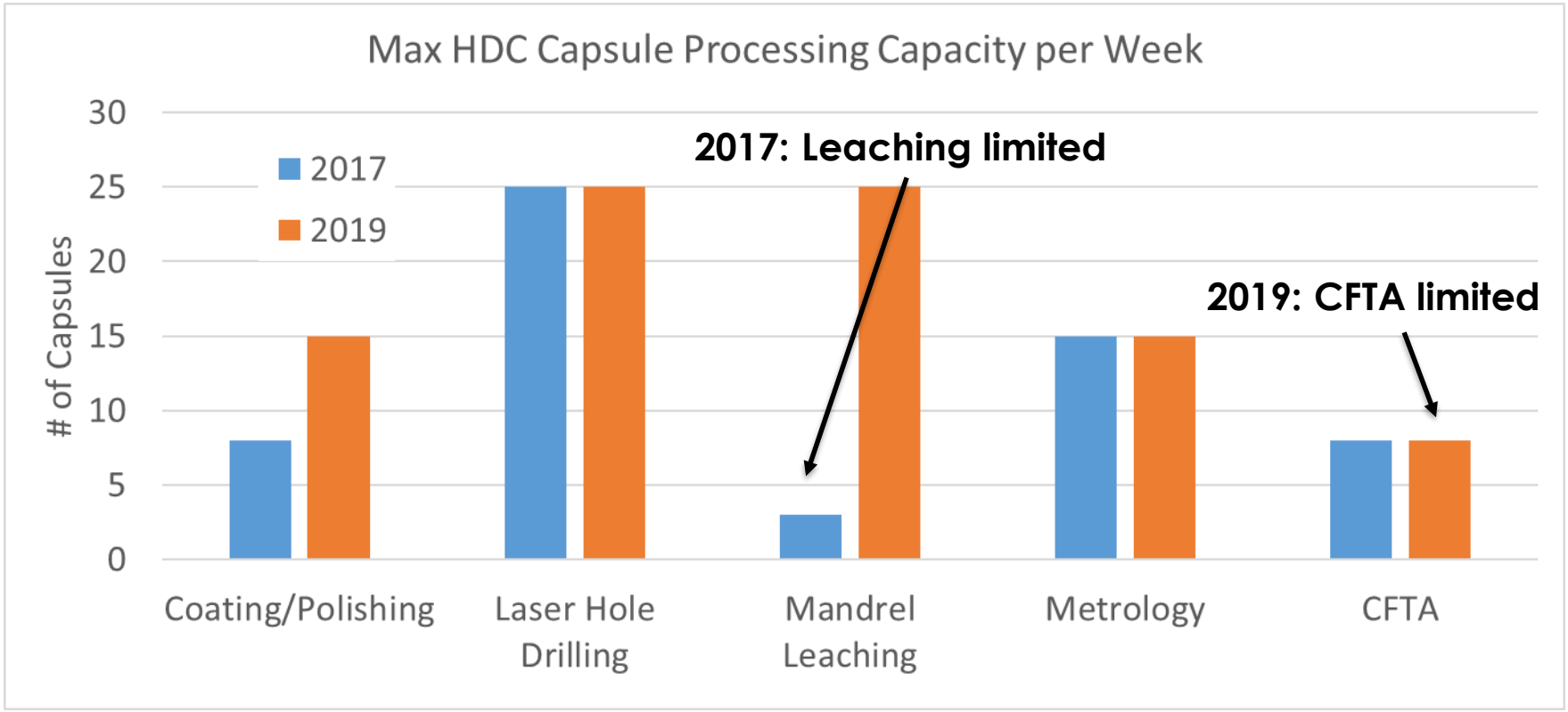


Newer target design allows flexible location of joint as long as it's outside the hohlraum



Build cycle can begin before capsule selection

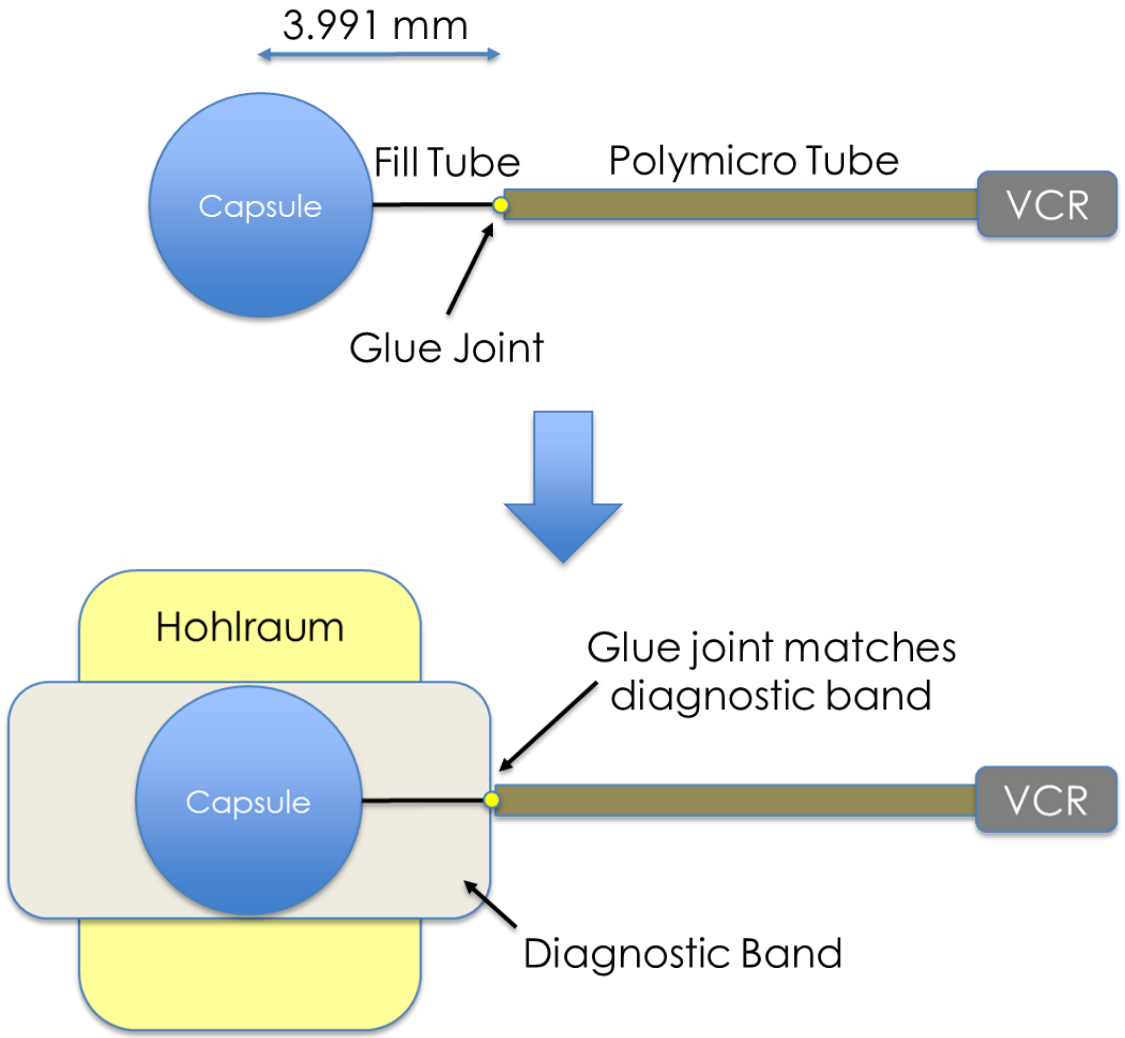
CFTA assembly becomes limiting step following capsule processing rate improvement



Capsule can be group processed into "bins" ready to be assembled into CFTAs

Questions?

Implementing universal parts streamlines fill tube assemblies*



Not to scale

- **Historical target design required the CFTA to be glued to the diagnostic band at the fill tube-polymicro joint**
- **Standardized fill tubes eliminate a sequential build step and allow prefabrication**