Overview of Omega Capsule Fabrication for Direct Drive at General Atomics

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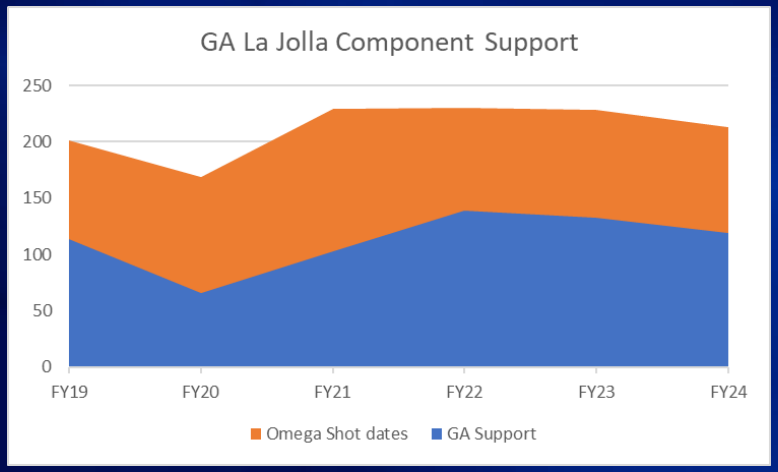
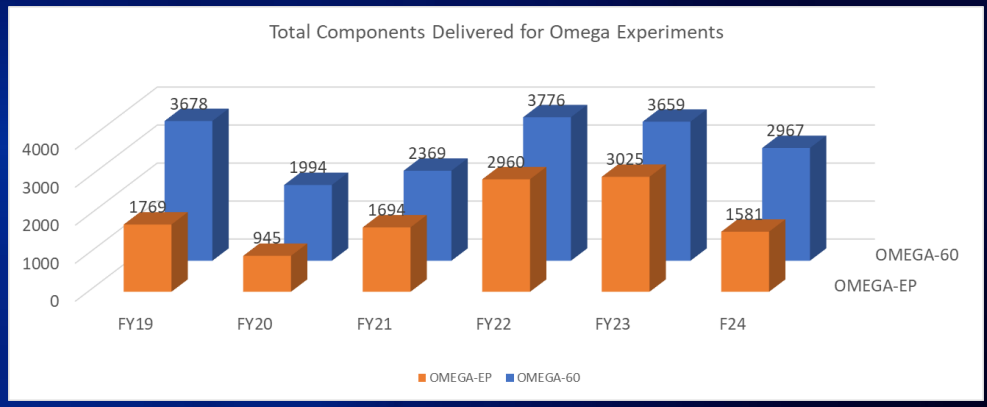
Agenda

- Omega shot support overview
- Capsule deliveries overview
- Capsule fabrication process
- Equipment improvements

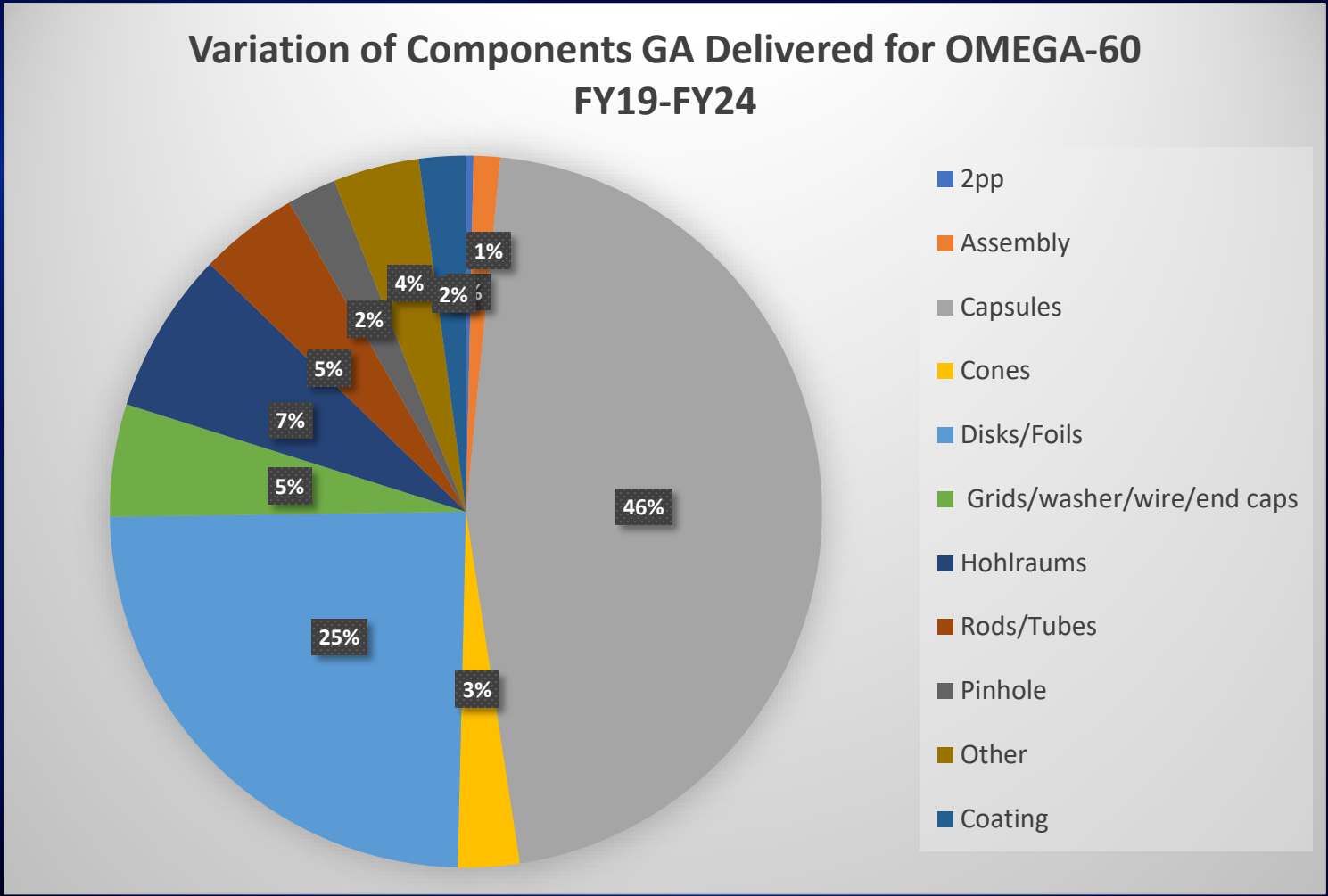
GA La Jolla Supports on Average 55% of the Omega Shot Dates by Delivering >4,000 components



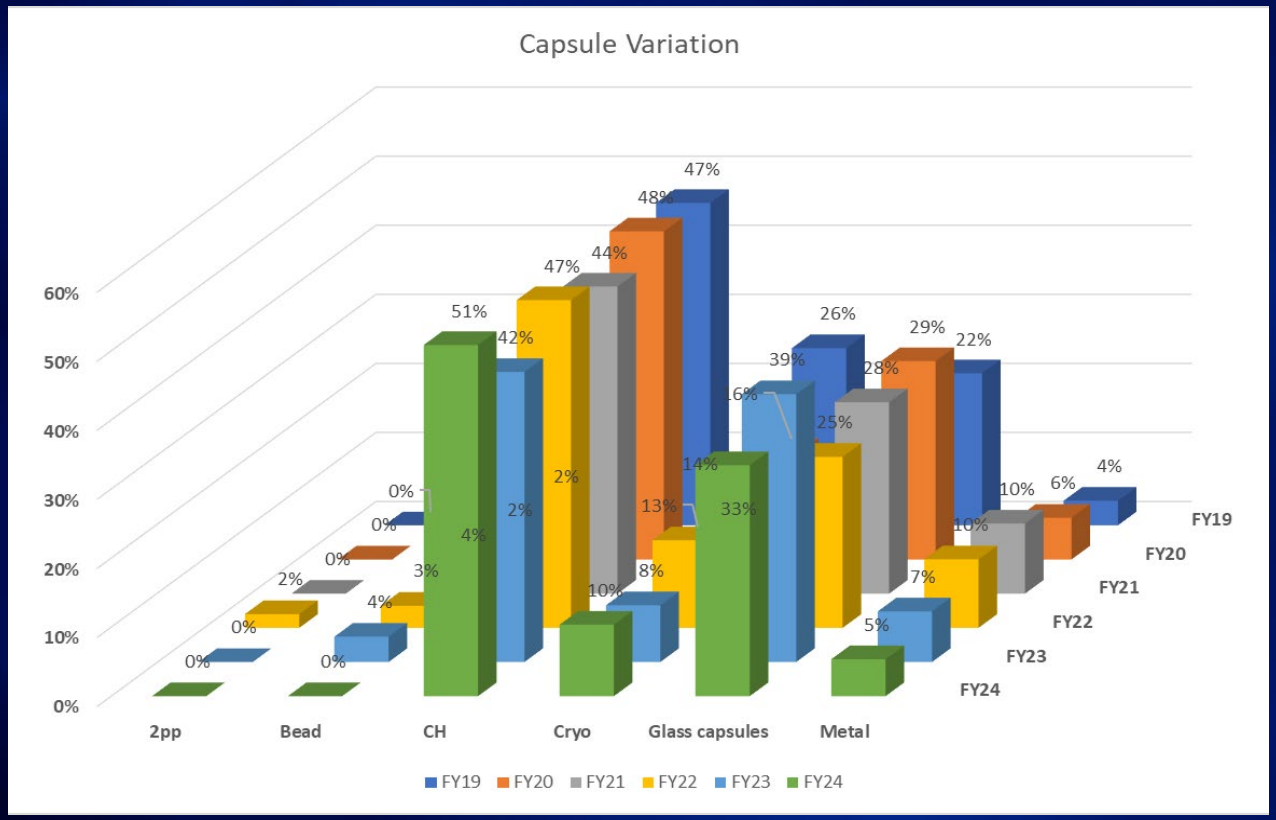


- GA delivered 4,600 components in FY24 to support 55% of the shot dates at Omega Facility
- In FY24 GA supported 66% of the Omega-60 experiments

Capsules Account for 46% of the Components Delivered for OMEGA-60 for FY19-FY24



Capsule Type Variation Delivered in the Past 5 Years



Capsule type variation has remained the same over time, but complexity of each type has evolved

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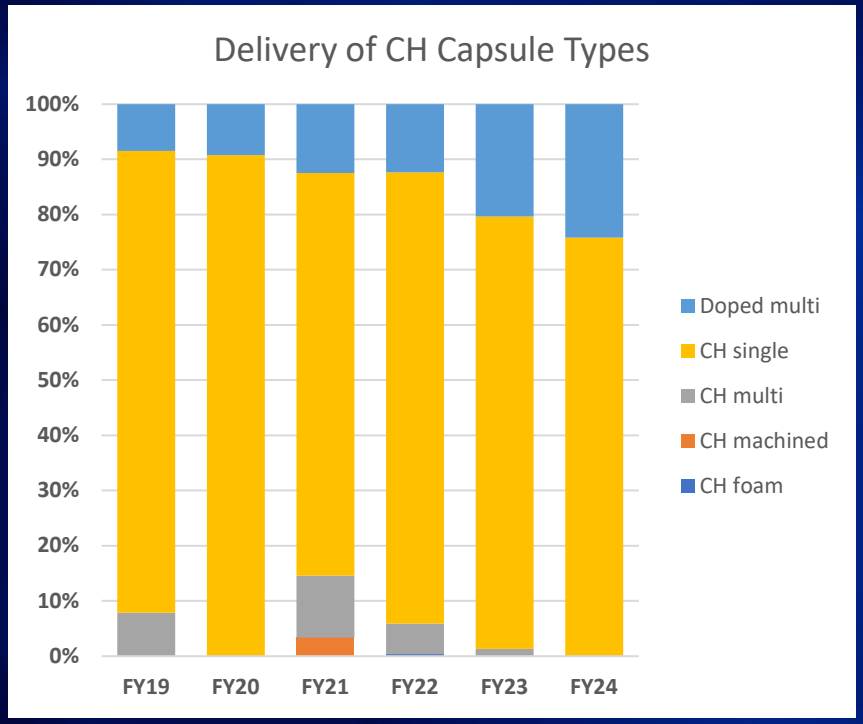
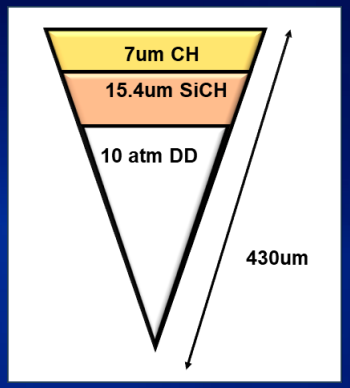
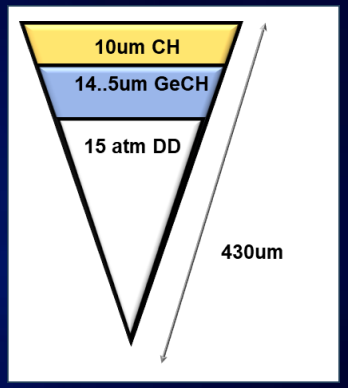
CH Type - Requests for Doped Multilayer Capsules Increased Over Time

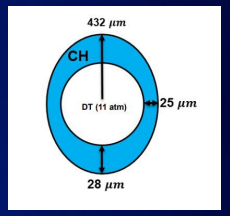




PreheatMitigation-22A



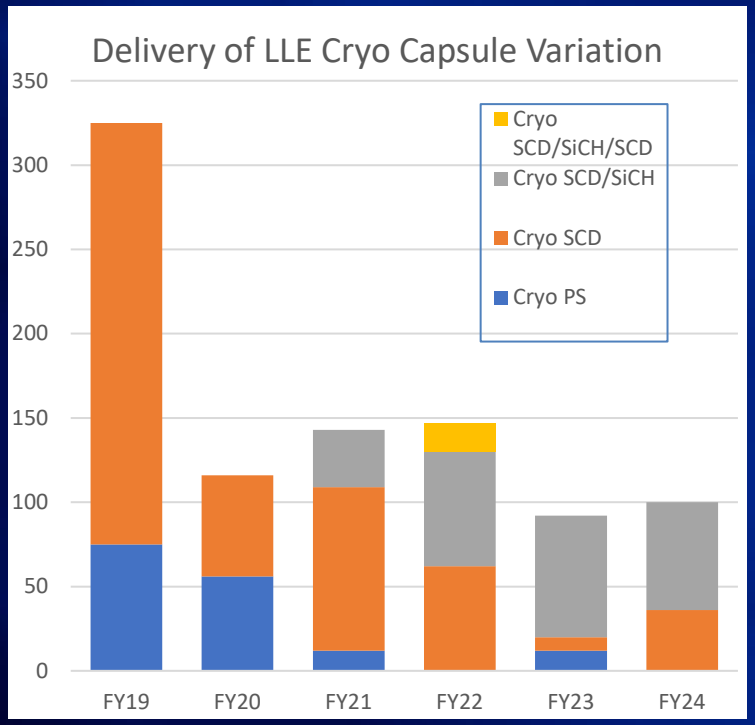
MidMode-21A

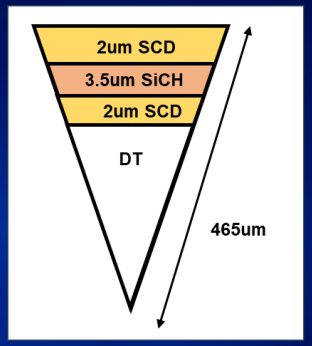


SymmetryControl-23A*

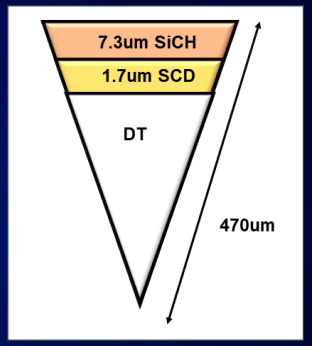
*See poster: "Fabrication and Characterization of Shimmed Capsules for OMEGA Experiment" by Rain Luo

Cryo Type - LLE Cryo Request Complexity Increased Over time





Cryo_Optimization-22E



Cryo-Optimization-24D

- **GA has improved the fabrication of SiCH capsules that resulted in a smooth surface to meet LLE Cryo quality. GA also investigated the highest achievable at%**
  - see poster "Smooth High at% Silicon SiCH and Ultra-thin SiCH Capsules" by Marty Hoppe
- **Due to increased demand of doped silicon capsules, oxygen pick up has been studied on SiCH**
  - See poster: "Reducing Oxygen Absorption in Si-Doped GDP Capsules by Improving Storage Conditions" by Isaac Ruiz

Plastic Capsule Fabrication Process

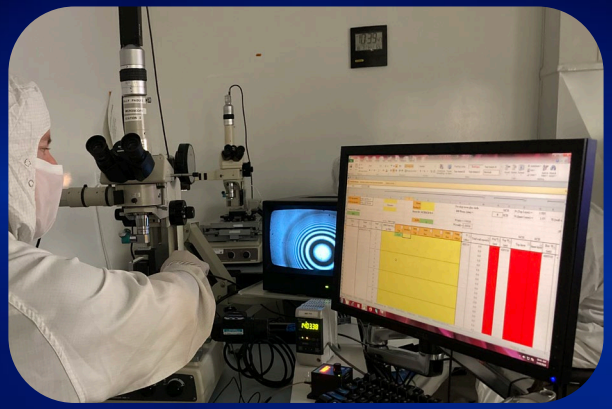
LLE CRYO Target Fabrication Process:

	PAMS mandrel	Doped Layer on mandrel	SCD/CH on Doped layer with mandrel	Mandrel removal	SCD/CH with doped layer
Characterization method:	Interferometer	Interferometer Edge for at%	Interferometer Edge for at%		Interferometer, Edge, Optical inspection

Omega Warm Shot process

	Permeation layer	Gas fill for half-life measurement	Half-life
Characterization method:	Profilometer	Gas fill station	Mass spectrometer

White Light Interferometer Upgrade



Old Interferometer

- Manual measurement – 5 min operator time per capsule
- Wall thickness measurement uncertainty is 0.3um based on equipment limitation and operator error
- Repetitive motion has caused operator injury

New interferometer

- Automatic measurement – operator setup, goal is 1min per capsule
- Statistic analysis shows that 100 measurements will reduce measurement uncertainty to 0.1um
- Analysis to data via software

Hoppe Glass Fabrication Process

Hoppe Glass Fabrication Process:

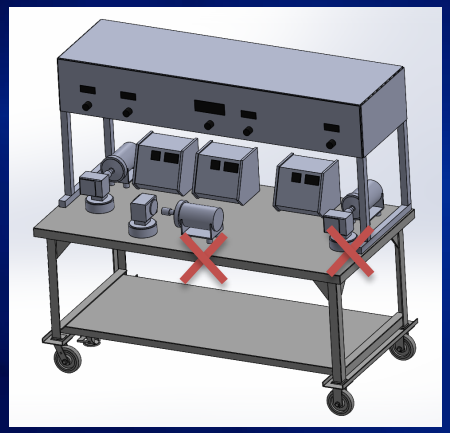
Characterization method:	Interferometer	Interferometer Edge for at%	Interferometer Edge for at%	Interferometer

Gas Fill

Characterization method:	Profilometer	Gas fill station	Mass spectrometer	Auto Heated Gas fill station

See poster: "Hoppe Glass Capsules Properties Synopsis" by Joshua Murray

Glass Conversion Ovens Upgrade



Old Conversion Ovens

- 1 working oven
- Discontinued parts
- Manual operation
- Analog readouts

New Conversion Ovens

- 3 ovens
- Digital readouts
- PLC connection
- Logs data during operation which enhances troubleshooting for higher batch yields

Gas Fill Station Upgrade

Old Gas Fill Station

- One manual and one auto heated system
- Bottleneck on auto heated system due to each process requiring 3 to 10 days
- Computer operated, outdated software
- Analog readouts
- Discontinued parts

New Gas Fill Station

- One manual and 2 independent auto heated system
- PLC (programmable logic controller)
- Digital readouts
- User friendly
- Upgraded components

Questions?

Posters:

- "Smooth High at% Silicon SiCH and Ultra-thin SiCH Capsules"
  by Marty Hoppe
- "Reducing Oxygen Absorption in Si-Doped GDP Capsules by Improving Storage Conditions"
  by Isaac Ruiz
- "Fabrication and Characterization of Shimmed Capsules for OMEGA Experiment"
  by Rain Luo
- "Hoppe Glass Capsules Properties Synopsis"
  by Joshua Murray