Commissioning of the NIF Cryogenic Target System

20th Target Fabrication Meeting
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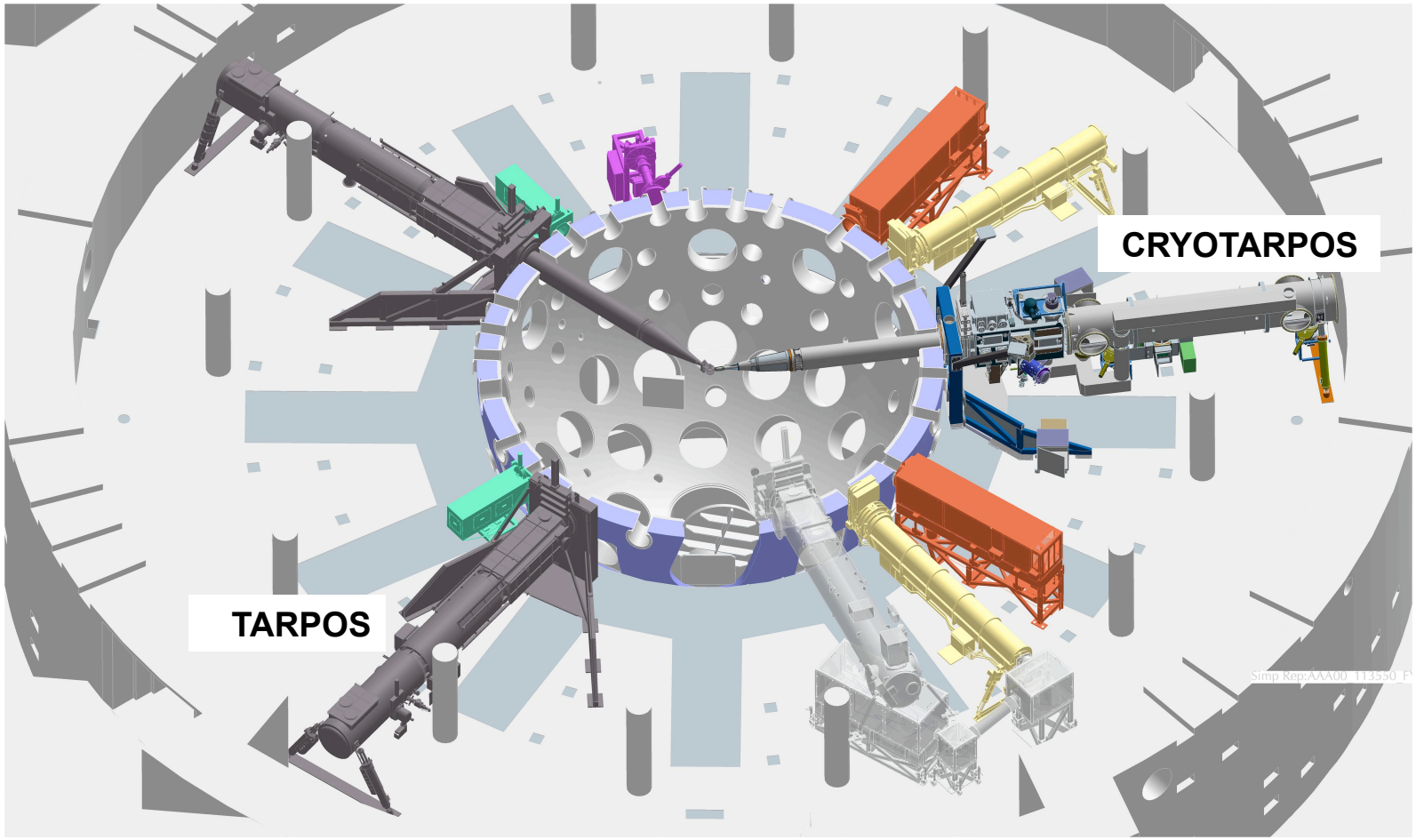
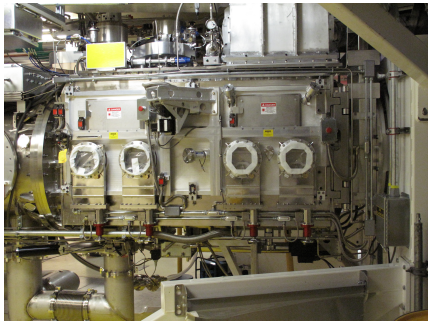
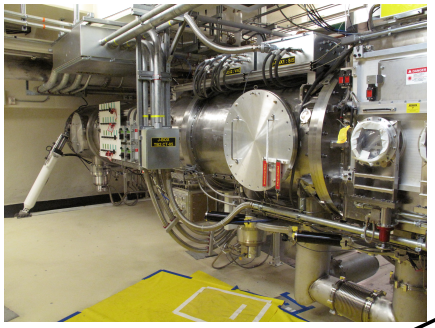
The NIF Cryogenic Target System includes both the TARPOS and CRYOTARPOS.



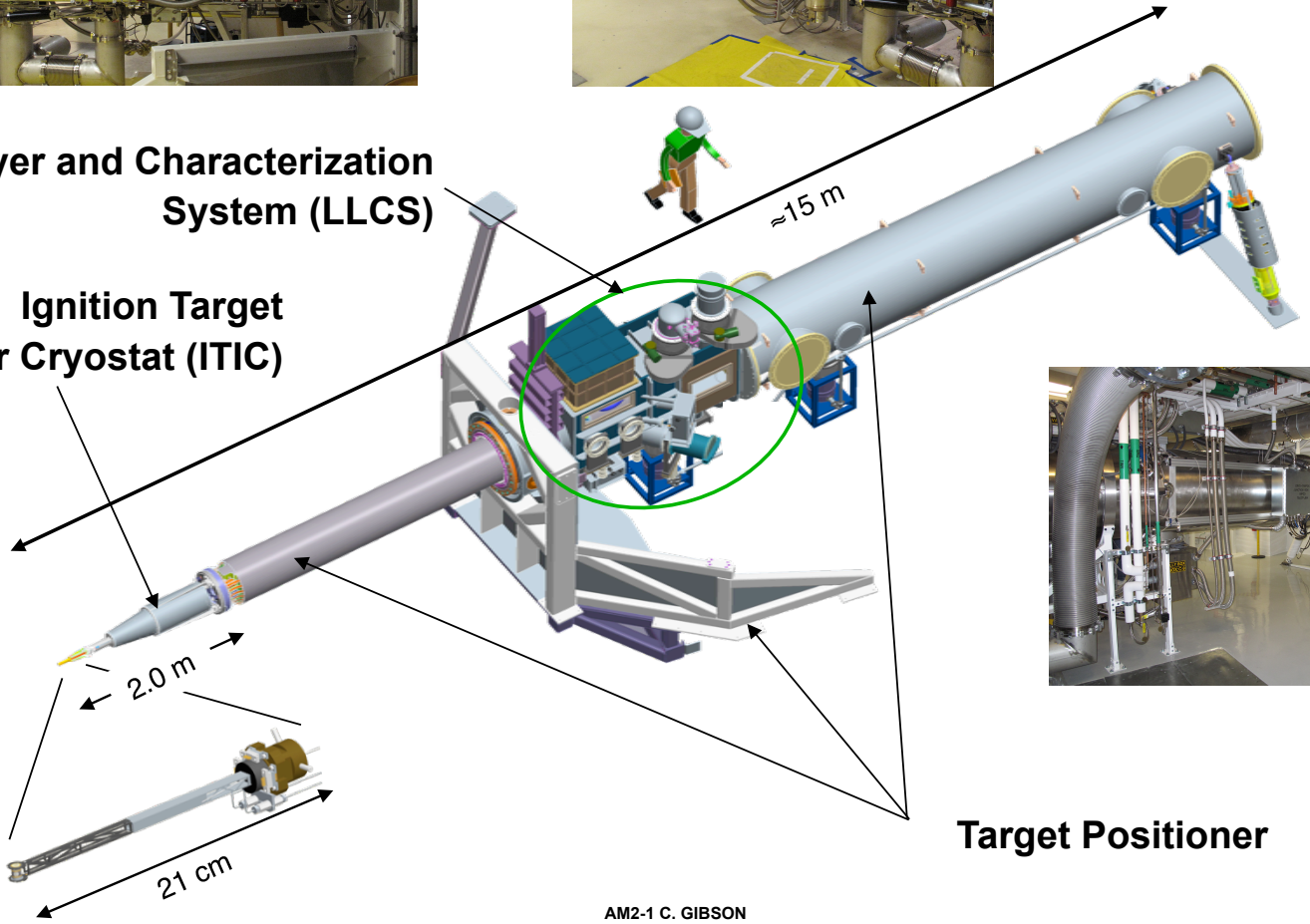
The Cryogenic Target System consists of three major mechanical sub-systems.





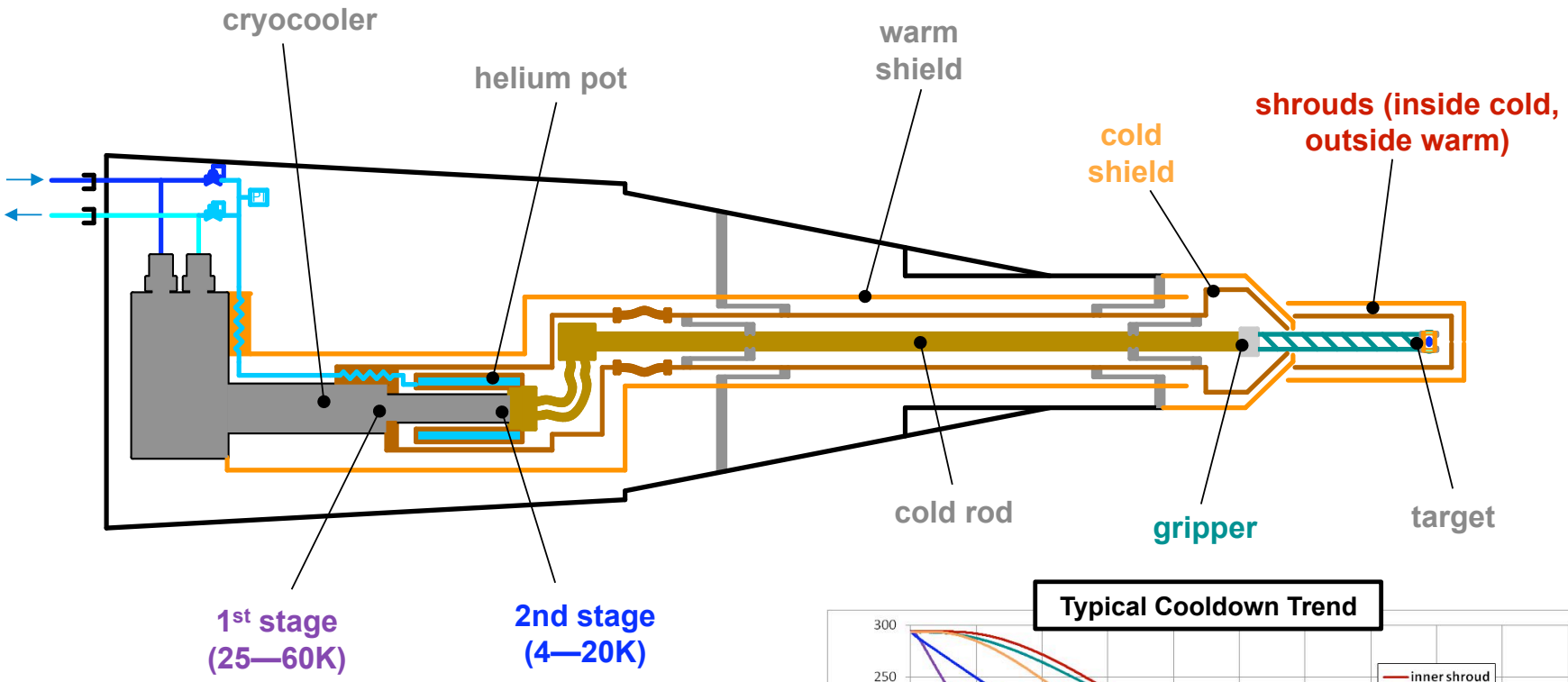
Load, Layer and Characterization System (LLCS)

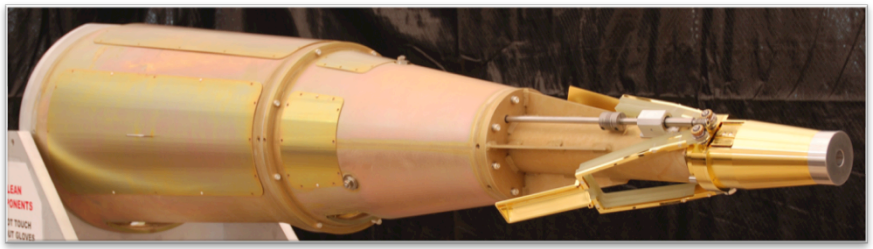
Ignition Target Inserter Cryostat (ITIC)

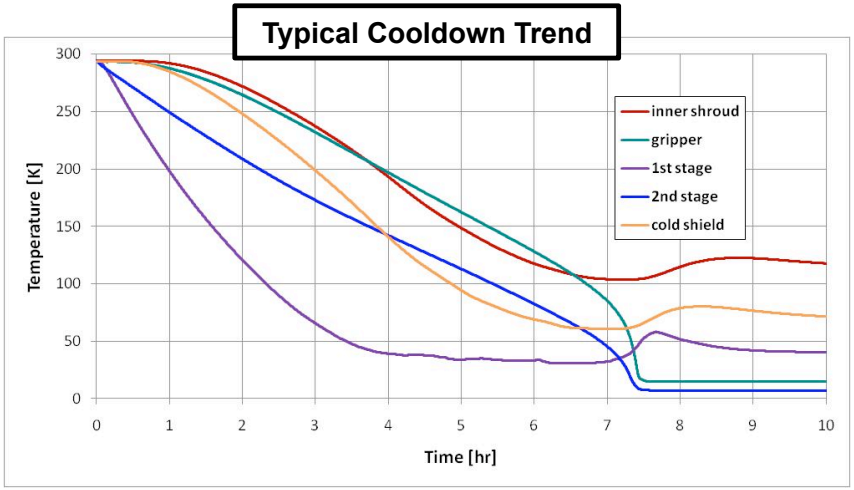


Target Positioner

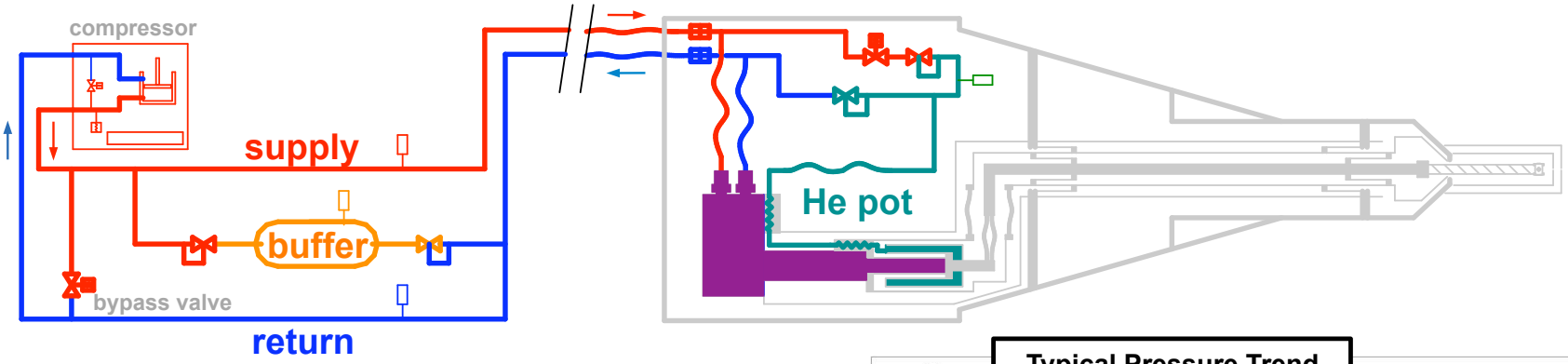
The target is cooled using a commercial cryocooler cold head located inside the ITIC.

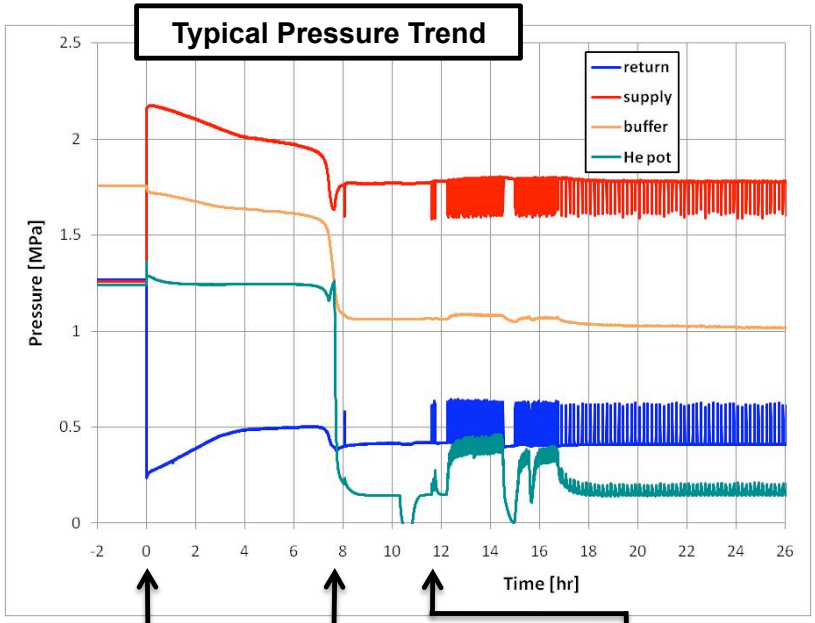






A compressor provides pressurized helium to the cold head and helium pot from a remote location.



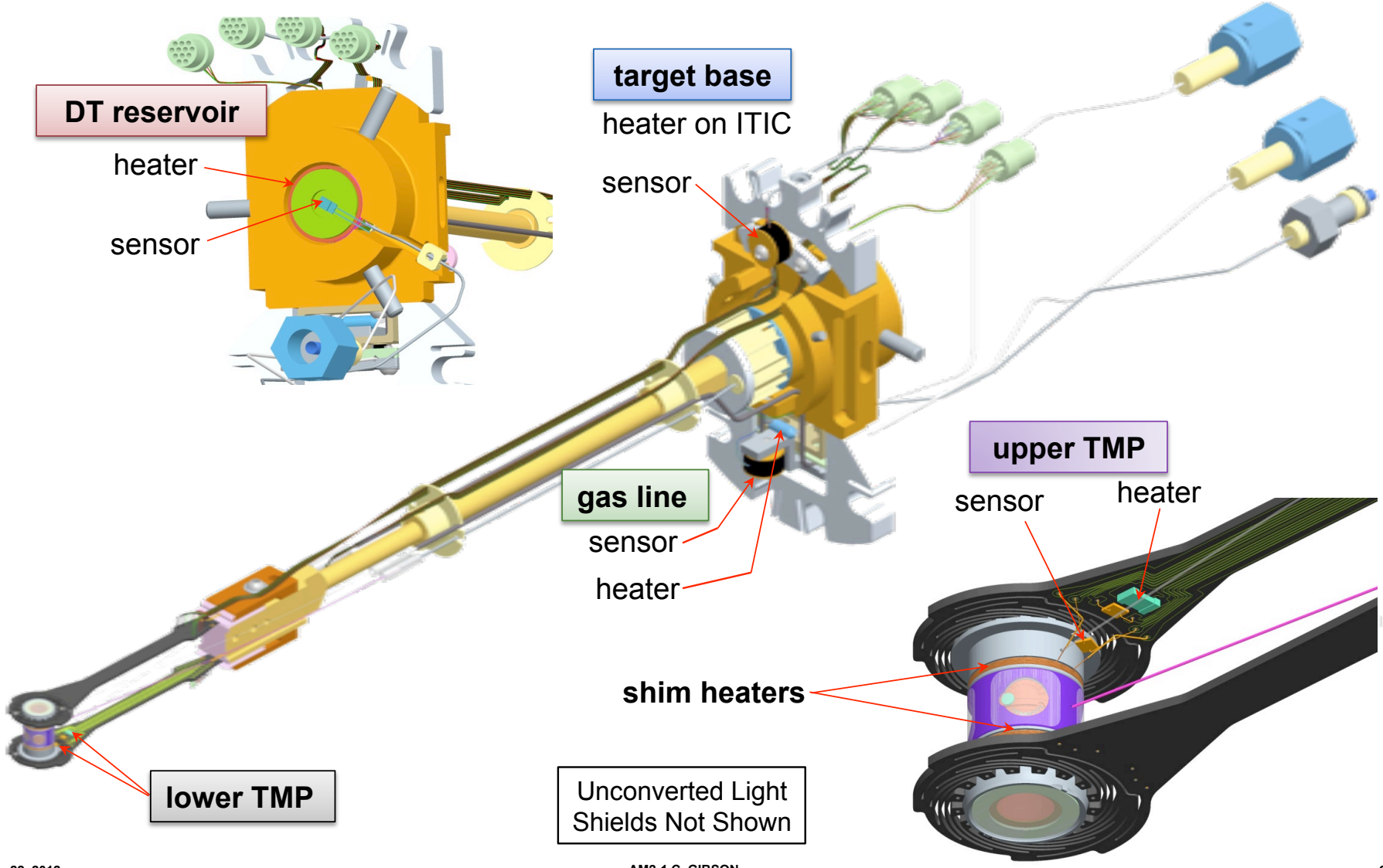


begin cooldown

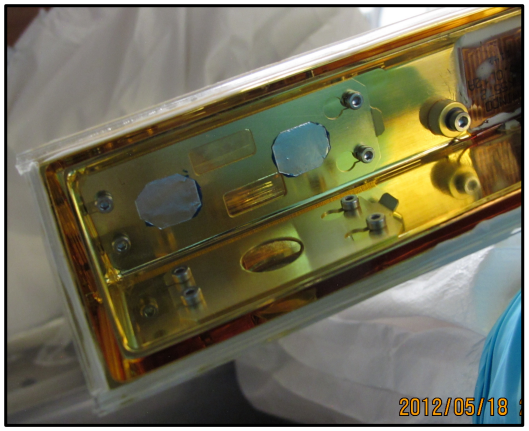
He pot fill stopped

begin x-ray imaging / bypass cycling

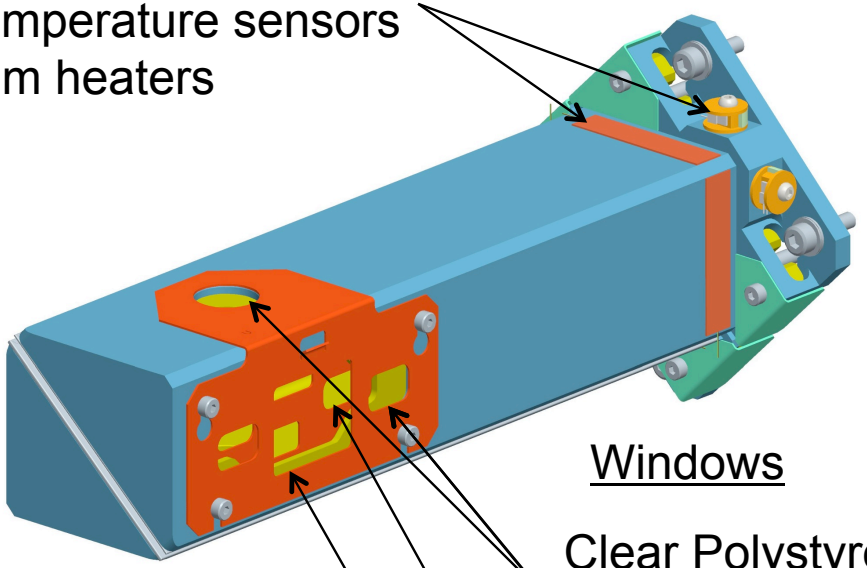
A layered target includes 5 temperature control points.



The latest shroud designs (Gen3) have recently been commissioned.



Instrumentation
- Temperature sensors
- Film heaters



Windows

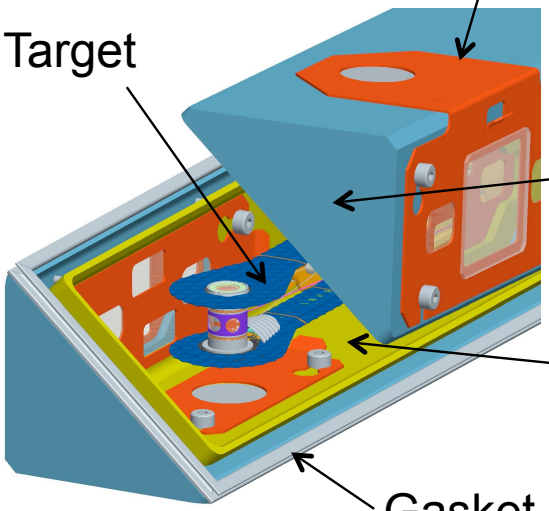
Clear Polystyrene
-25 μm thk
-Au coated (16 nm)

Aluminum
-6 μm thk

Polycarbonate
-760 μm thk
-Frosted

Mask

Target

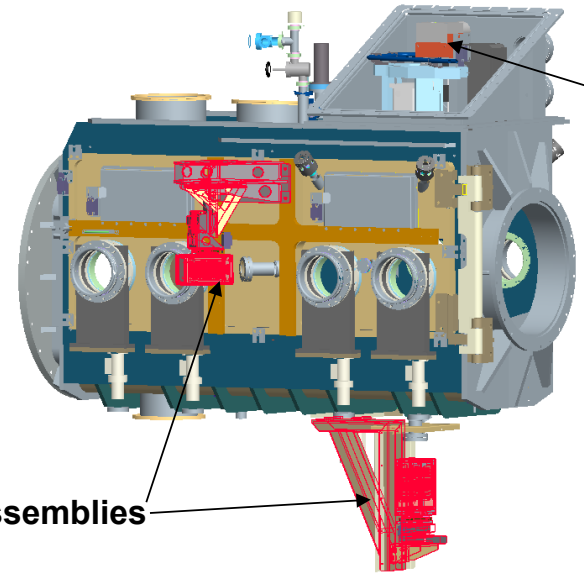


Outer shroud
- Controlled to 293K
- Gold coated aluminum

Inner shroud
- Operates at ~100K
- Gold coated copper

Gasket on outer shroud

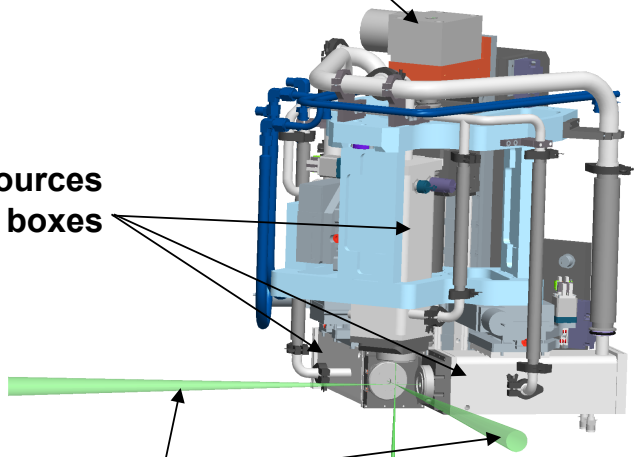
The LLCS Characterization System images the target through the LEH and starbursts.



vertical translation stage
raises & lowers x-ray sources

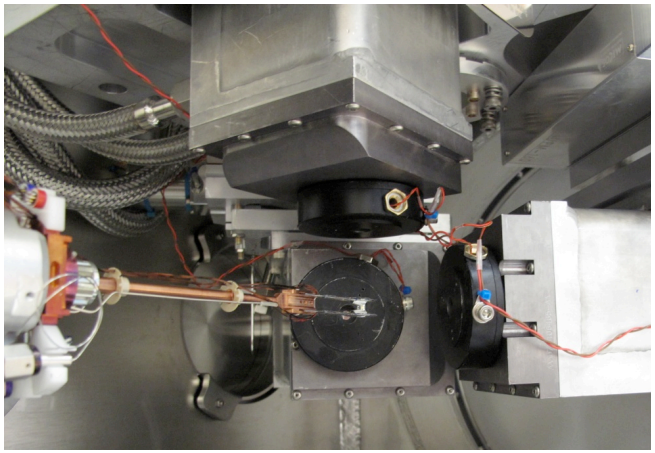
CCD assemblies

three x-ray sources
enclosed in air boxes



starburst view
beam envelopes

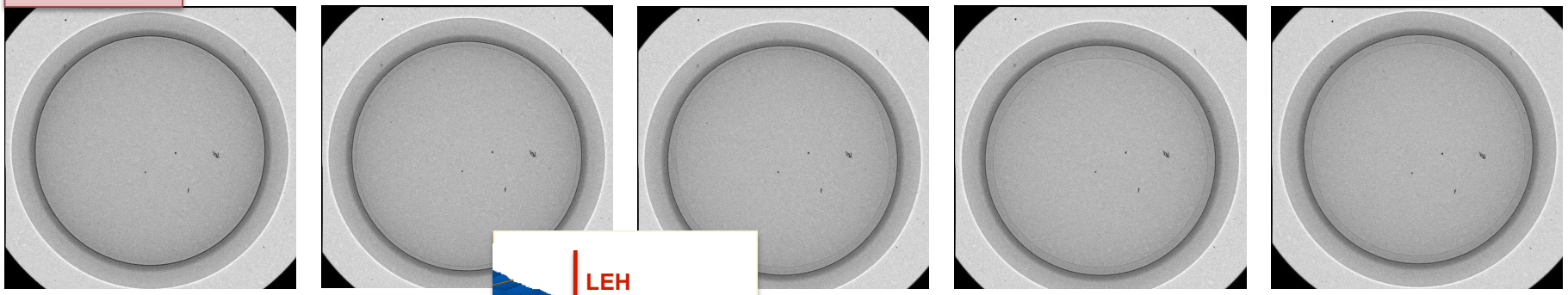
LEH view



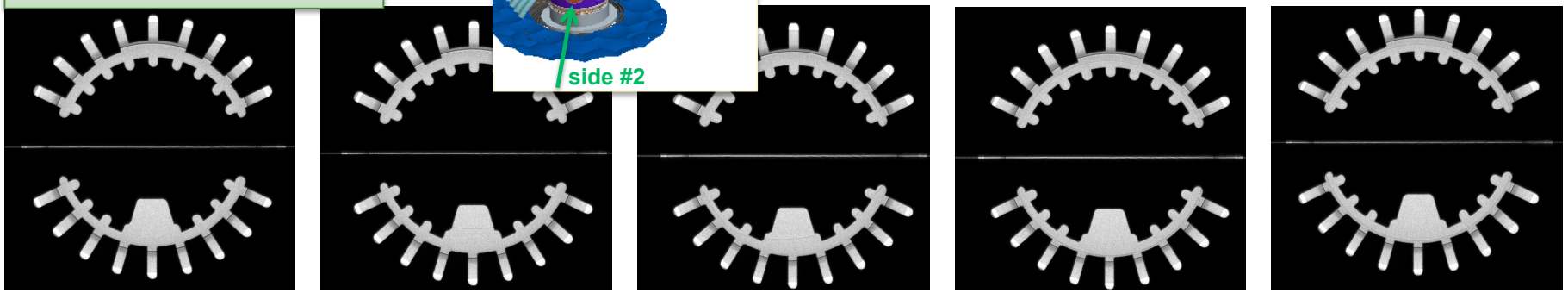
(shrouds and shields removed in this photo)

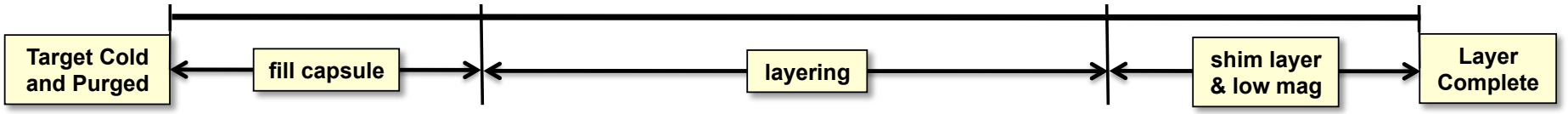
Hundreds of layer images are taken within a single layering sequence.

LEH view



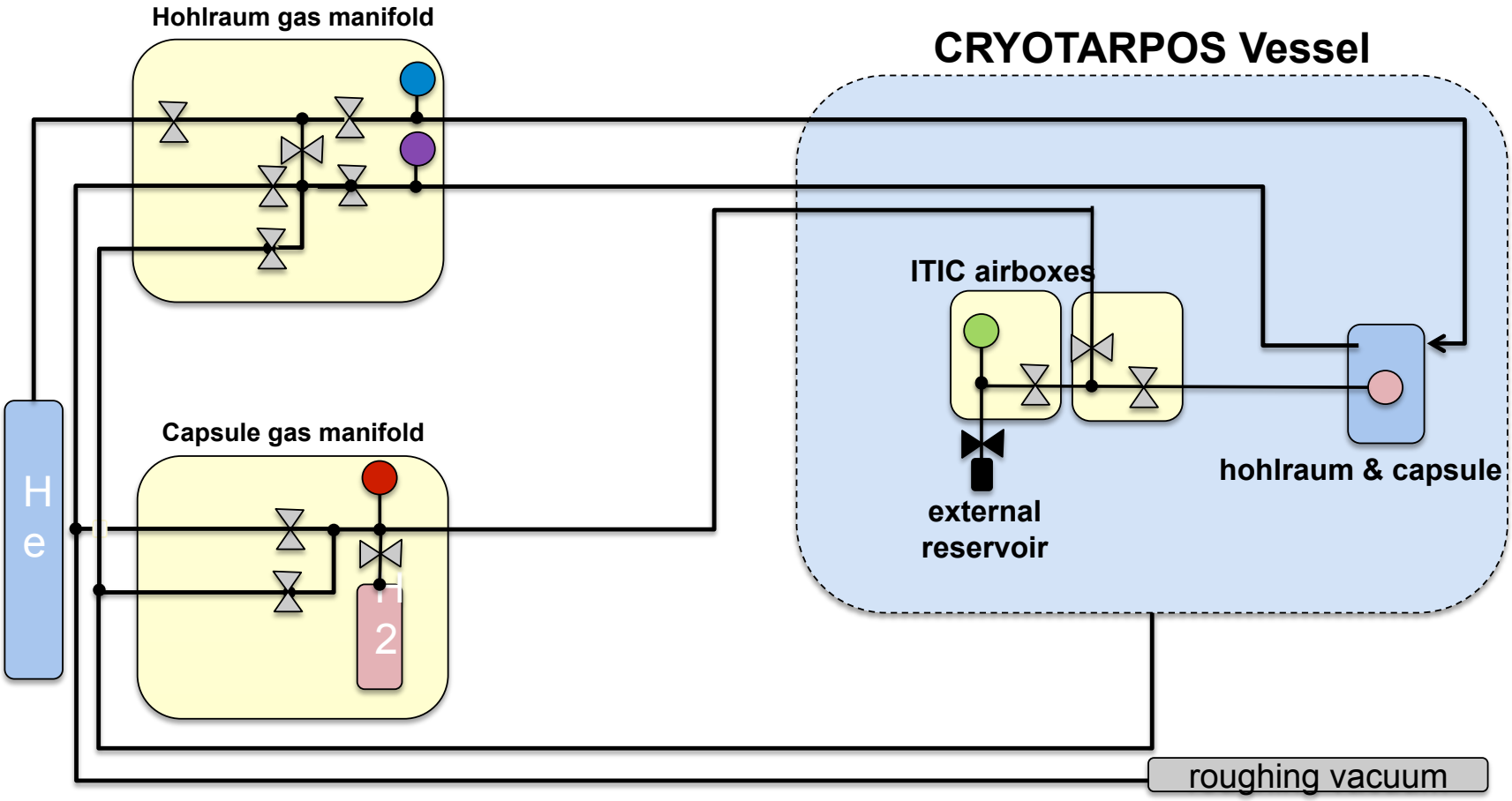
side #2 starburst view



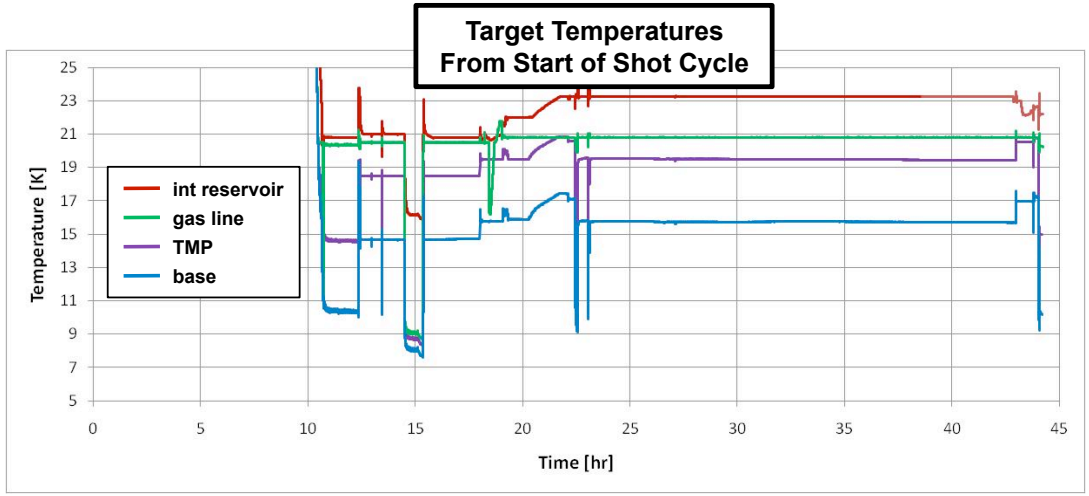


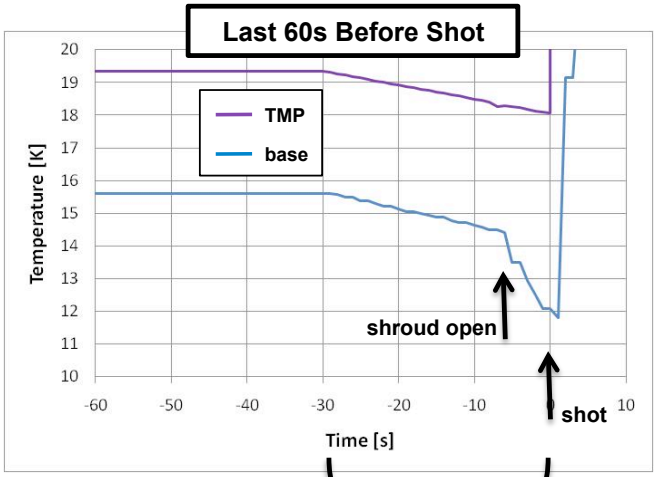
Separate gas manifolds provide purging and filling of the hohlraum and capsule.

Simplified P&ID



The sequence of steps for target gas and temperature control are developing into a well-defined process.





quench

purge

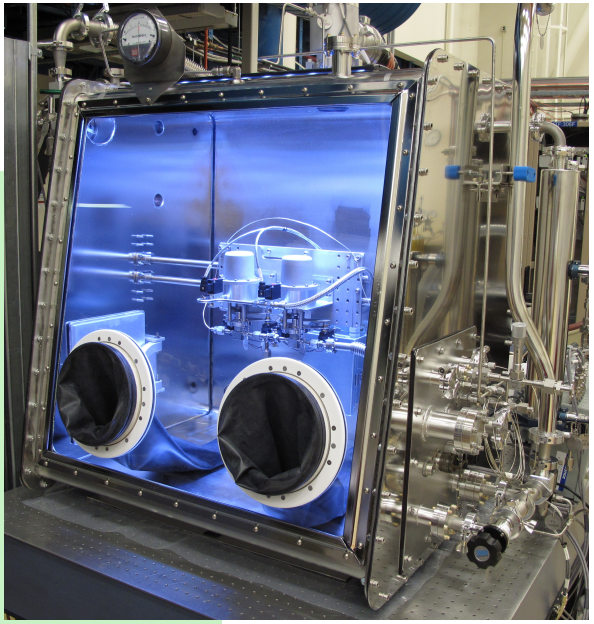
cool-down

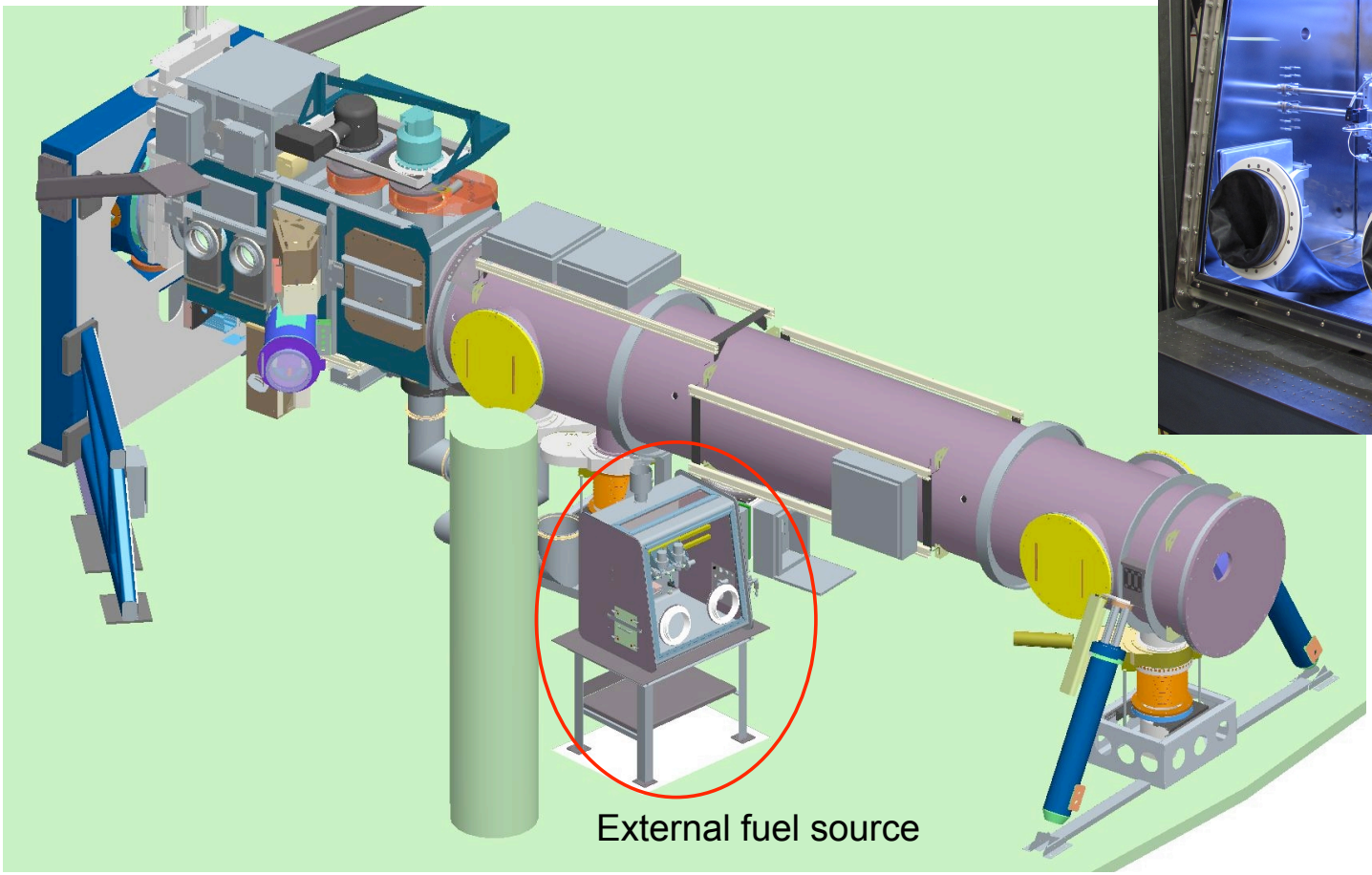
fill

first layer attempt

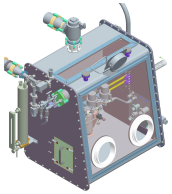
- TMP temperature stability on the order of 1-2 mK is routinely demonstrated

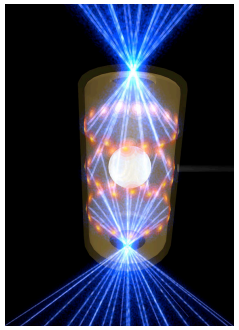
The CryoTARPOS External Fuel Source (EFS) has recently been commissioned.





The ignition shot cycle using EFS.





Complete fill of reservoir in B331 (He3 clock starts)

Start installation of reservoir in glovebox

~ 36 hours

Time (hrs)

0 10 20 30 40 50

Begin vacuum pumpdown

Begin cooldown

Target cold

Start pump & purge of fuel lines

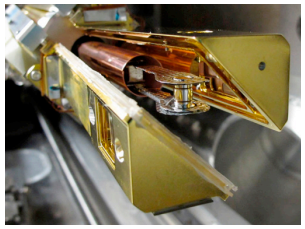
Start fuel fill to capsule

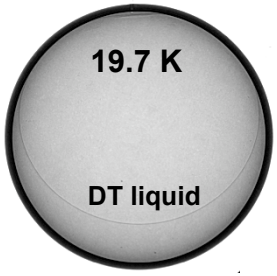
Ignition quality layer

Start layer prep including shimming & low mag images

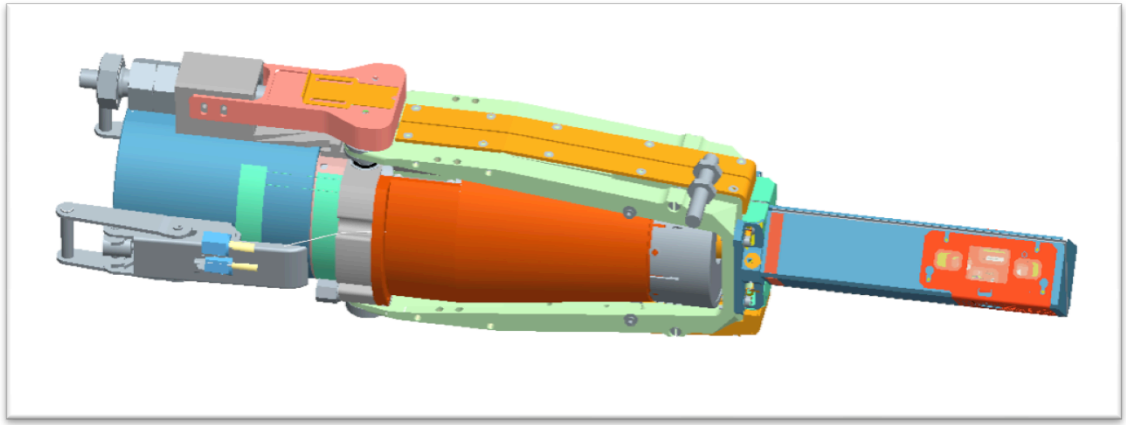
Begin shot cycle

SHOT

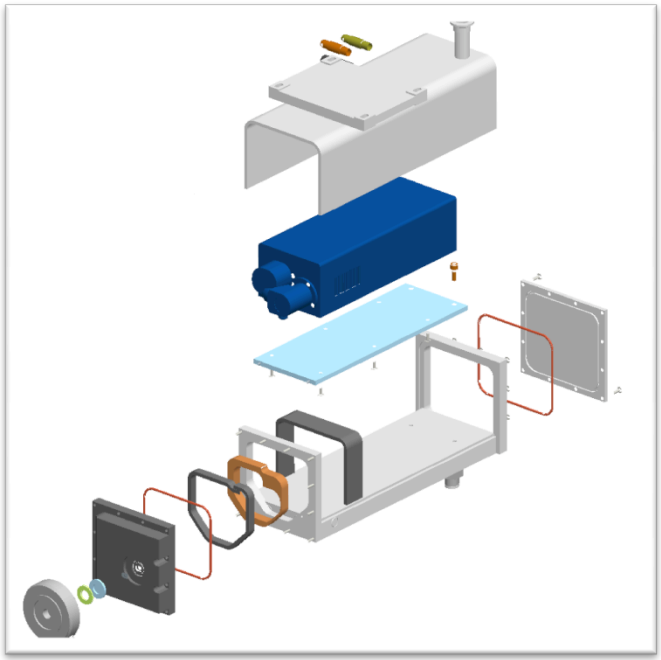




Several major upgrades will be implemented over the next year.



•Removable ITIC front end



•Remote x-ray source electronics

•Target gas manifold automation

Conclusions

- The NIF Cryogenic Target Systems are fully commissioned
  - CryoTARPOS
  - TARPOS
- Refinements have been made since the last Target Fab Meeting
  - Upgraded Gen3 shrouds
  - External Fuel Source
- Upgrades are planned for the following year
  - Removable ITIC front end
  - Remote x-ray source electronics

The NIF Cryogenic Target Systems is fully commissioned and ready to support the push toward ignition


NIC