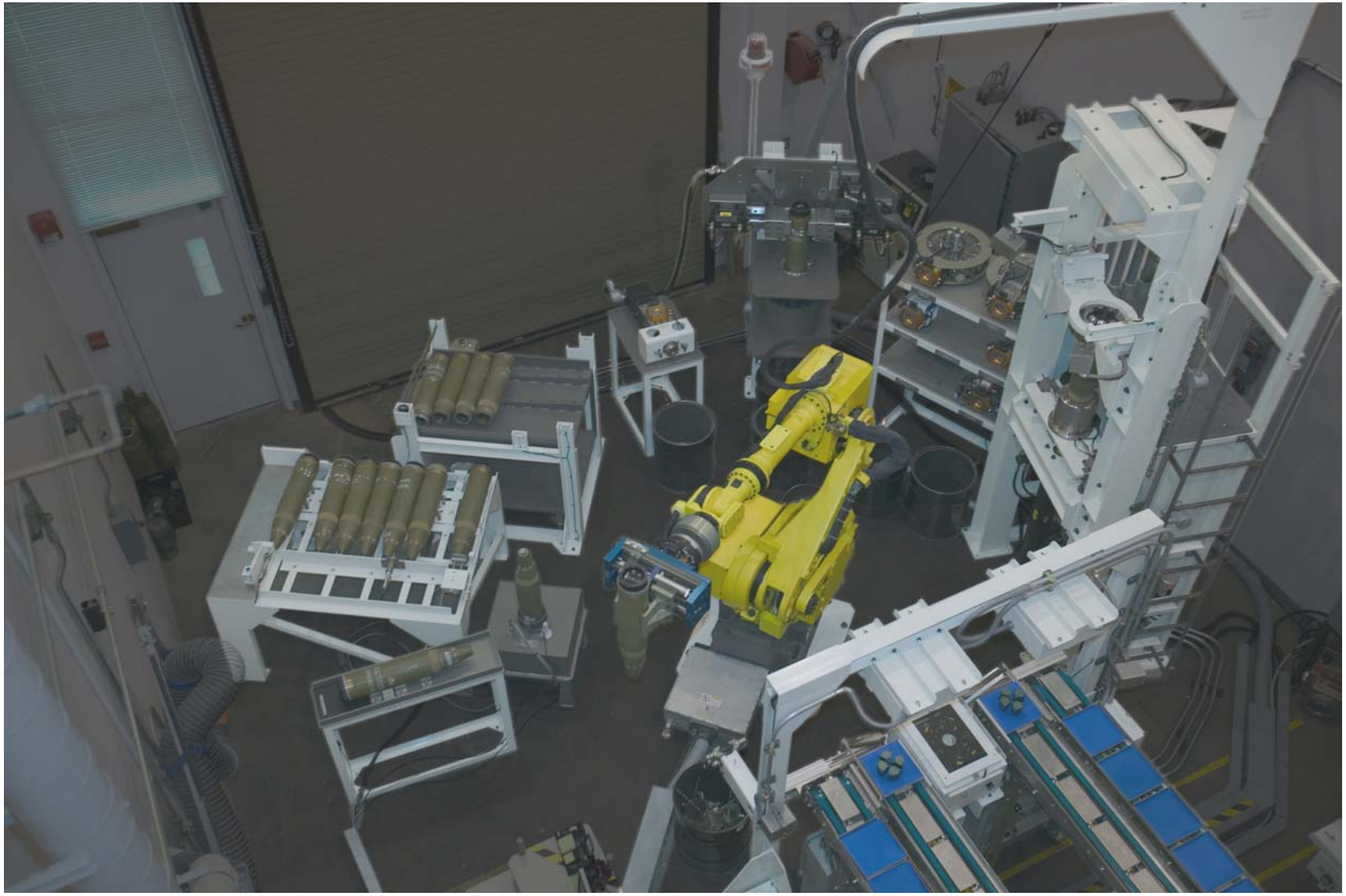
ADAM Projectile Download Workcell



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Workcell at McAlester Army Ammunition Plant

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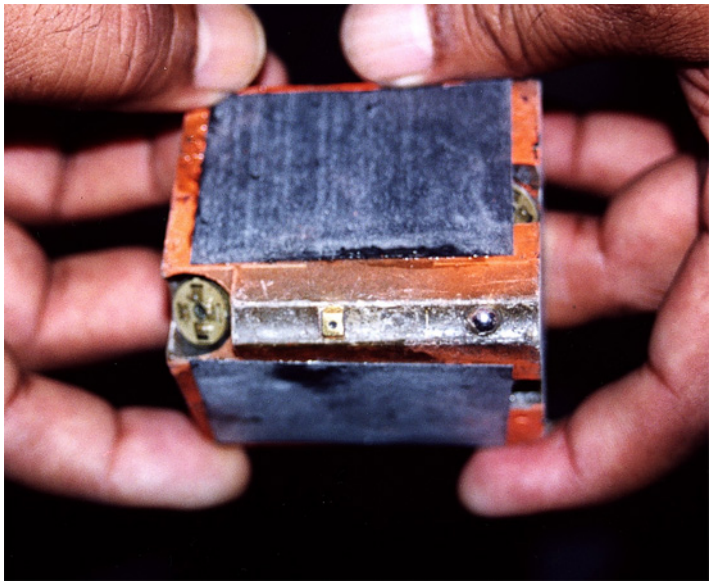
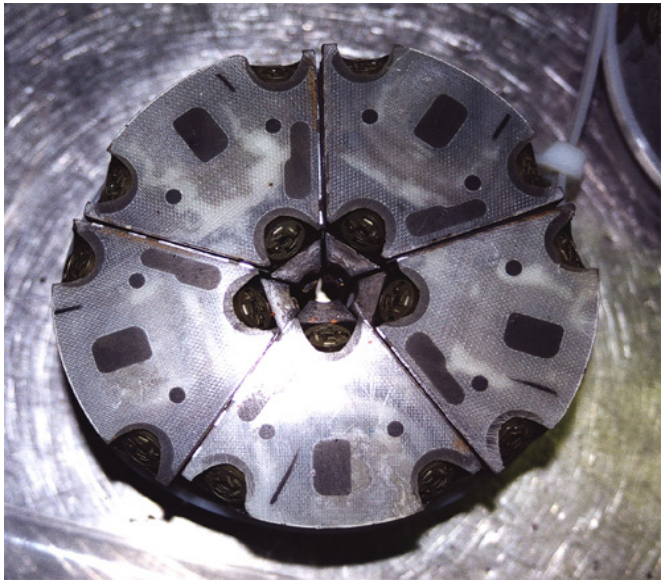
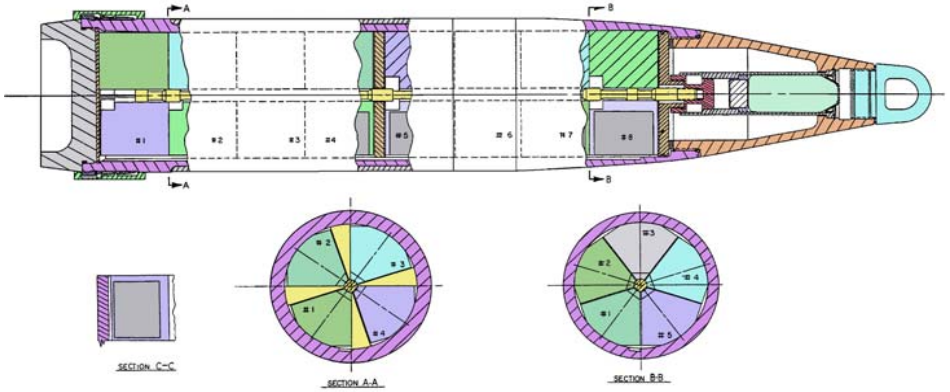
ADAM Mine and ICM Projectile







Projectile Download Workcell

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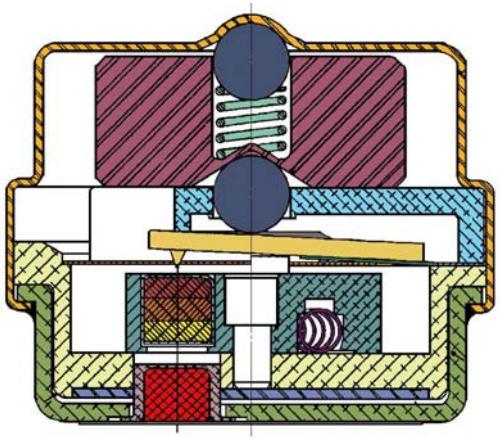
Secretary of the Army – Francis Harvey

Sandia National Laboratories

Cluster Bomb Unit (CBU) Assembly and Issues



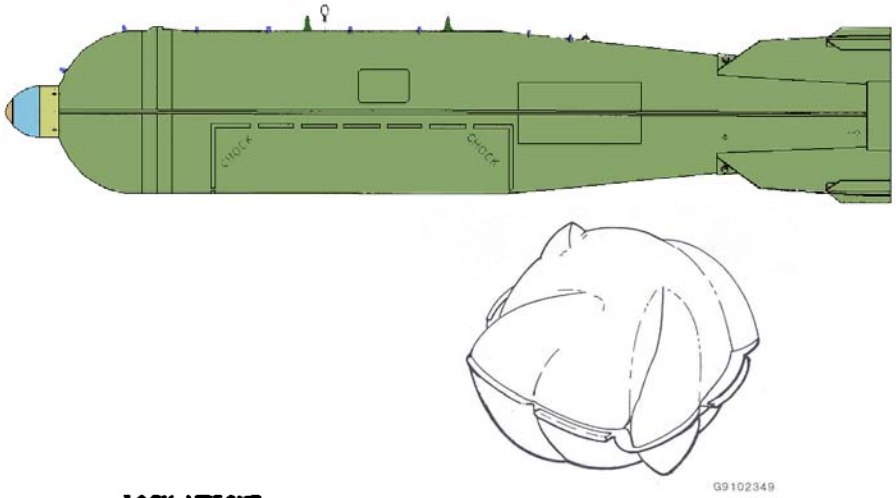
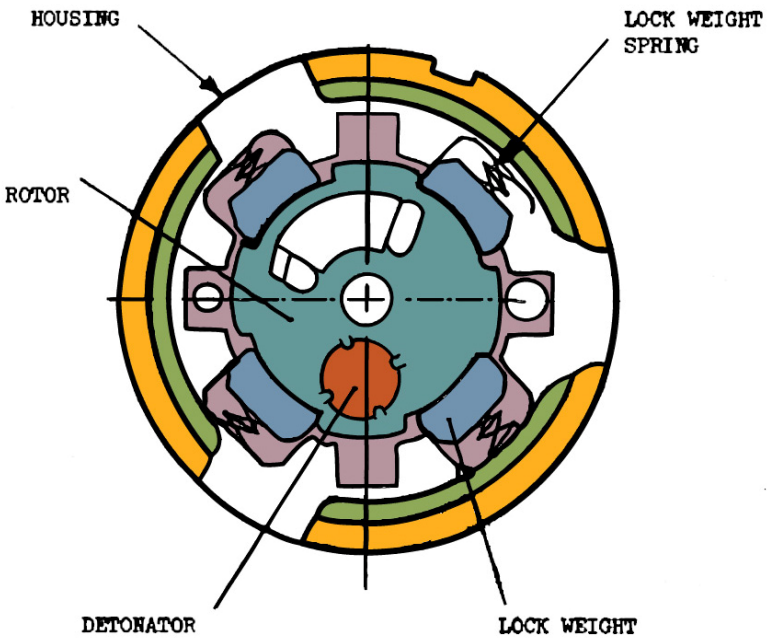
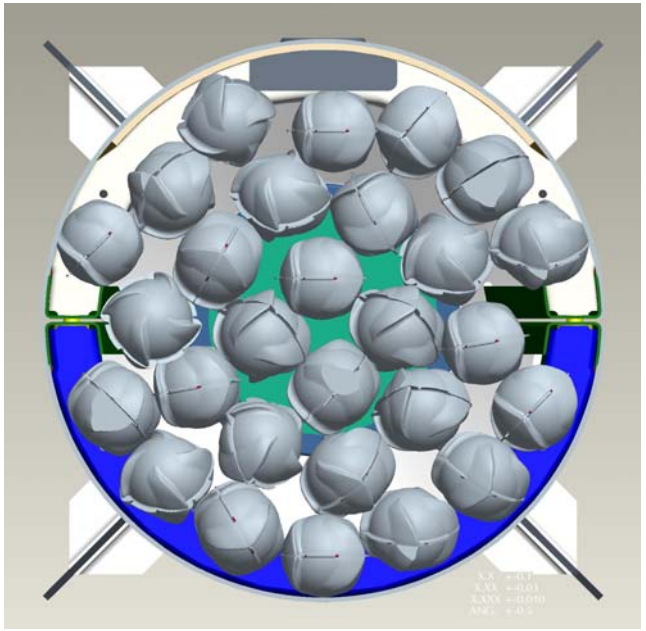
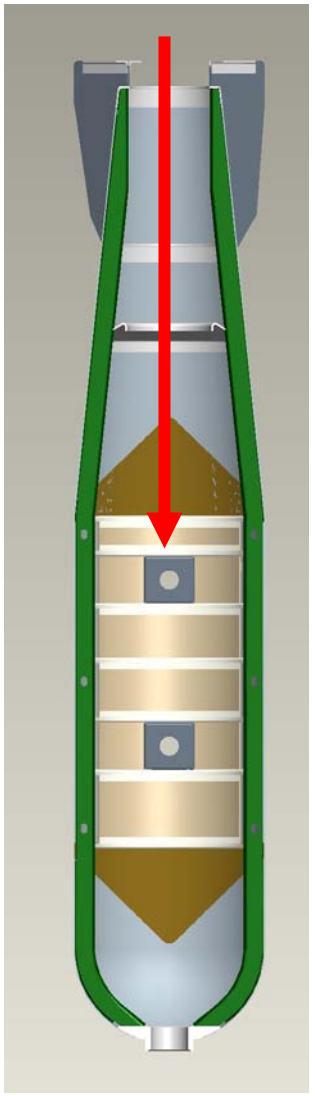


Figure 2-5. BLU-63/B, BLU-63A/B, BLU-86/B, and BLU-86A/B







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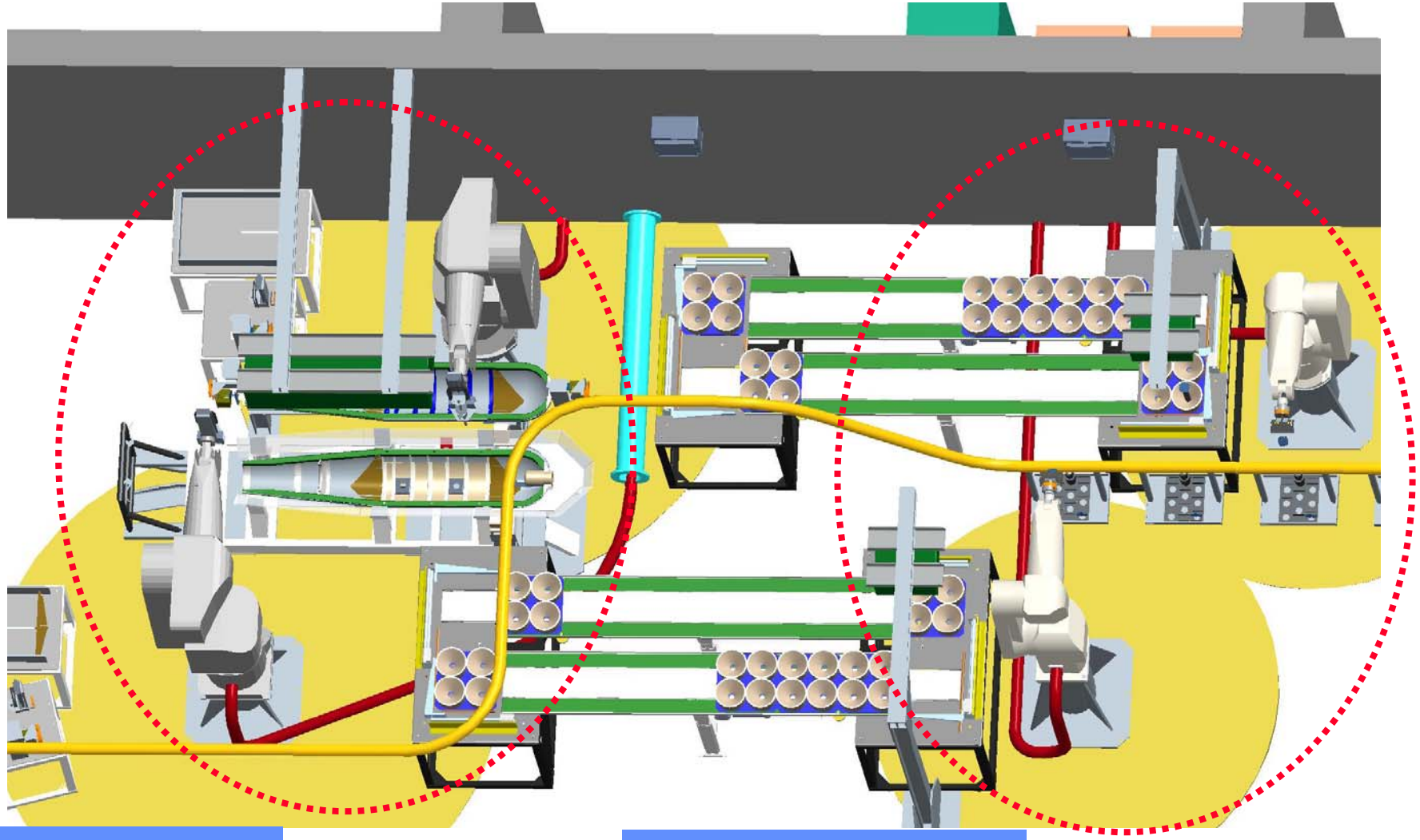
CBU Download Workcell



Open dispenser and unload

Orient bomblet and place in fixture

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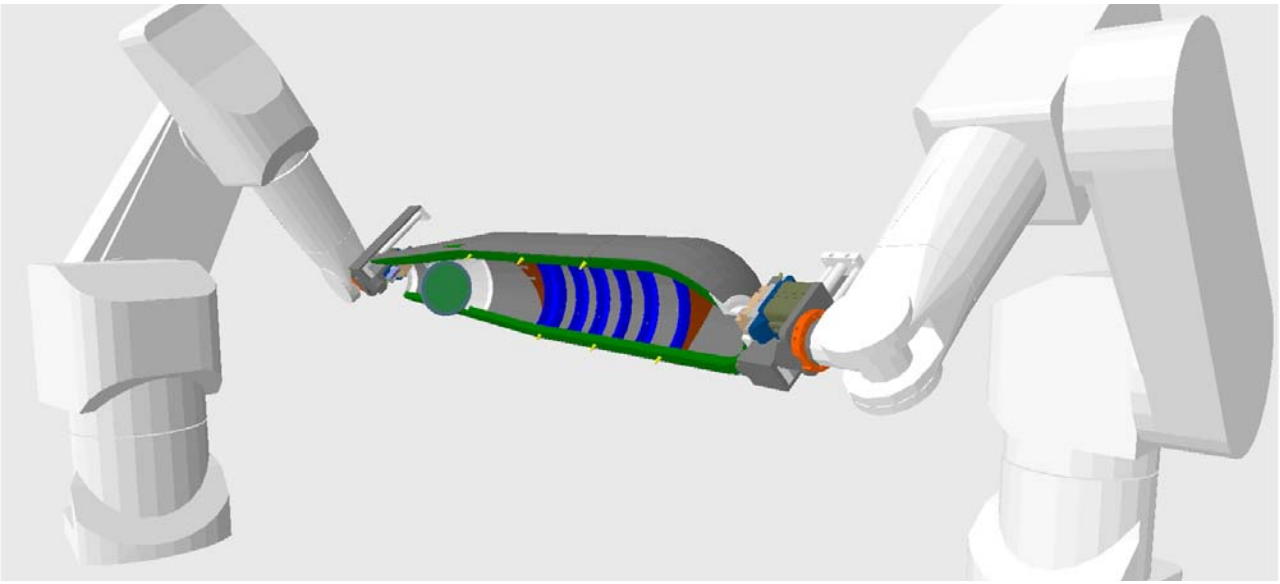
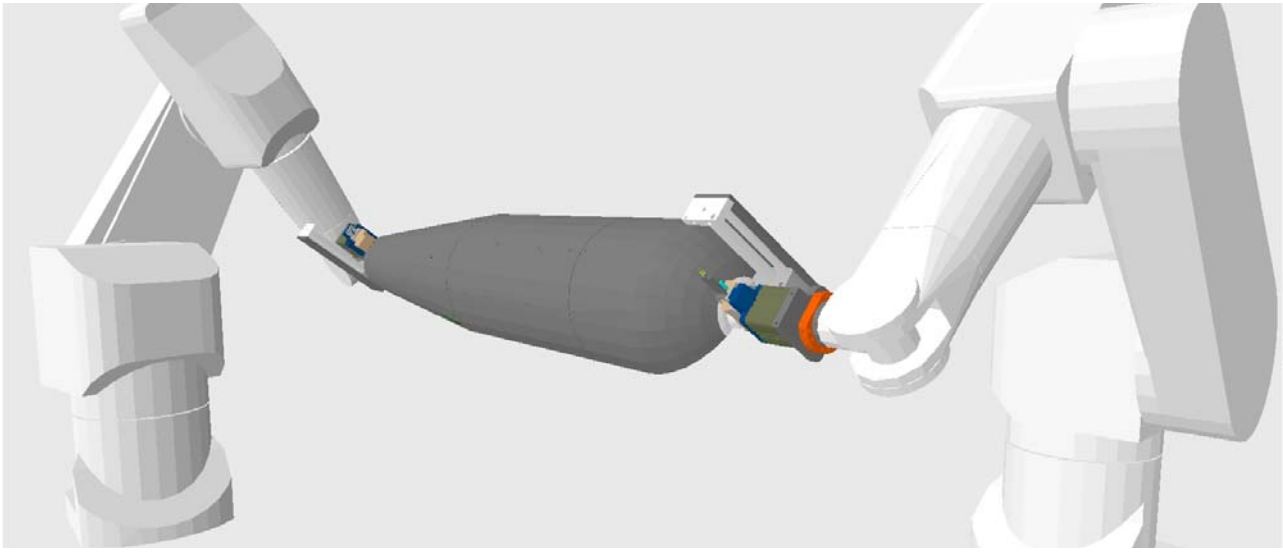
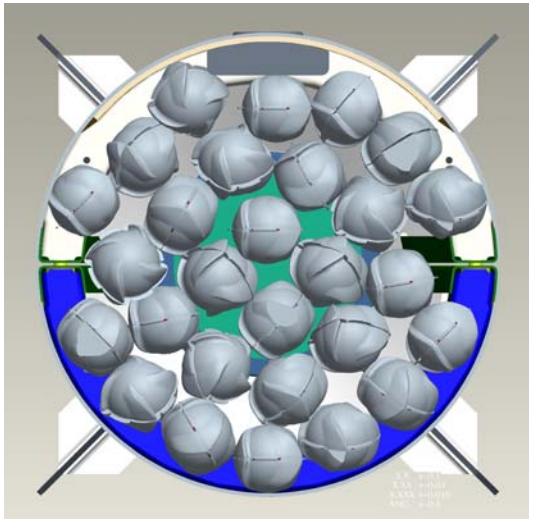
Coordinated Robot Motion is Used to Remove the Dispenser







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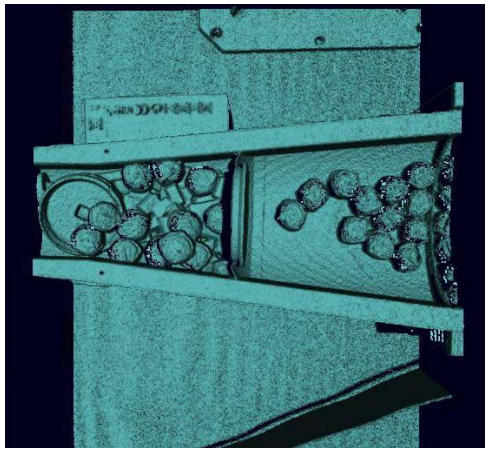
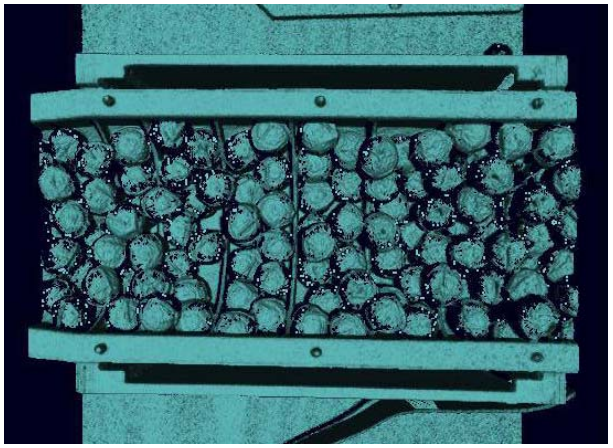
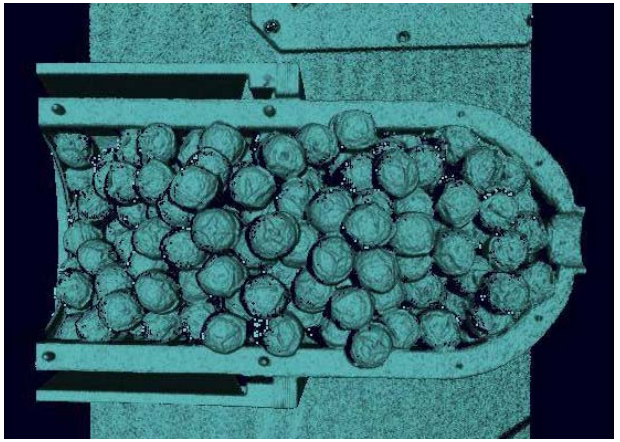
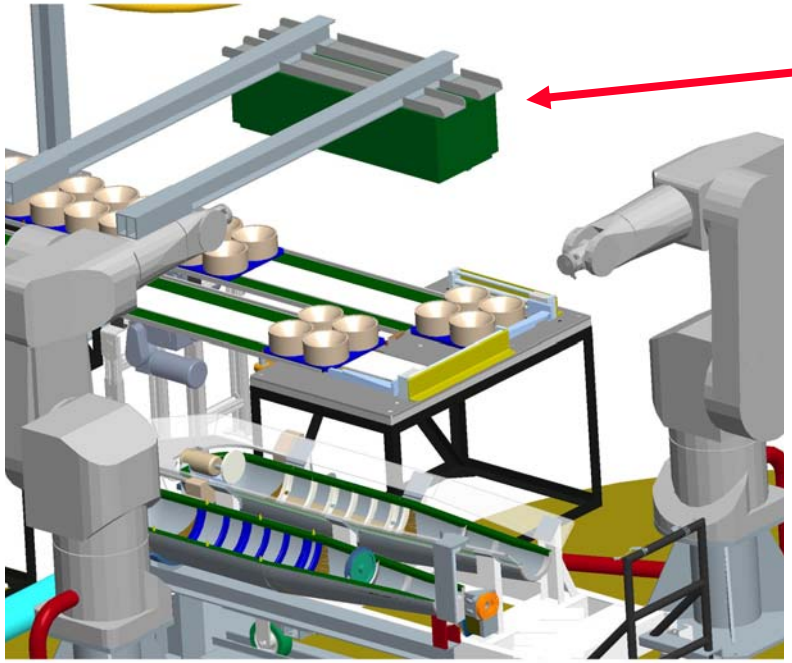
3D Laser Scan of dispenser









1. **The camera box contains a 3D Laser Scanner System, cameras and lights.**
2. **The laser scanner is eye safe and provides cloud data for analysis.**

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Konica Minolta Scanner

- **Low resolution: 320 * 240 = 76,800 points /scan**
- **High resolution: 640 * 480 = 307,200 points /scan**
- **Scan rate is 5 seconds at high resolution**
- **The scanner is rated for a maximum offset of 2 meters and has a volume of 47.3 x 35.6 x 15.7 inches, at that distance.**

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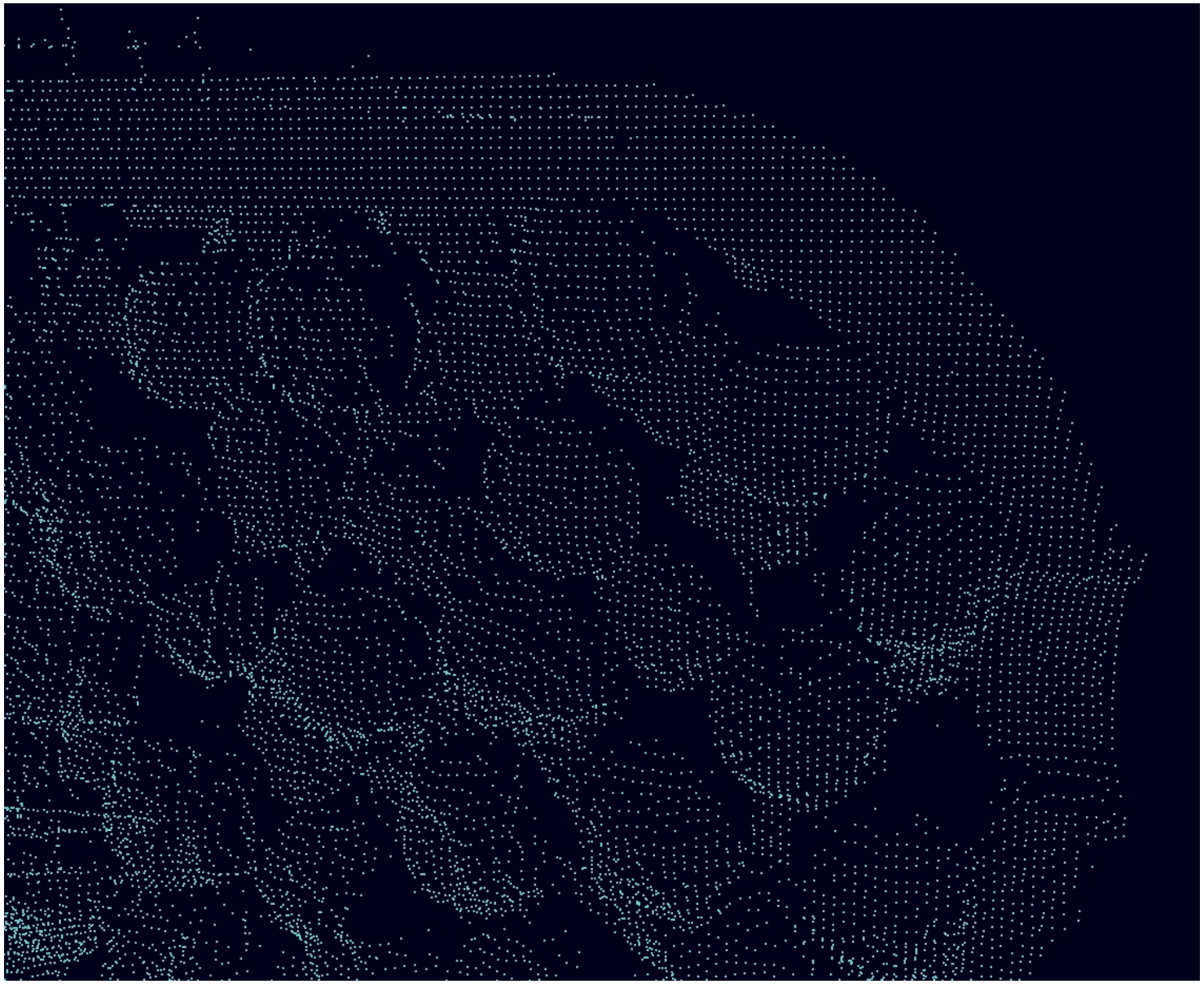
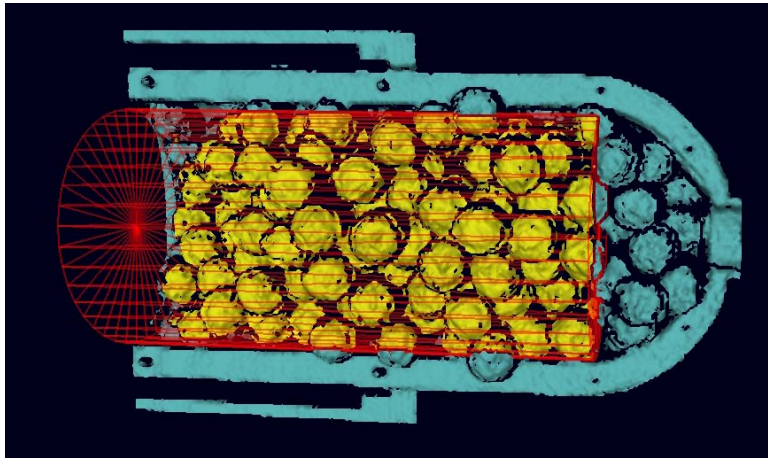
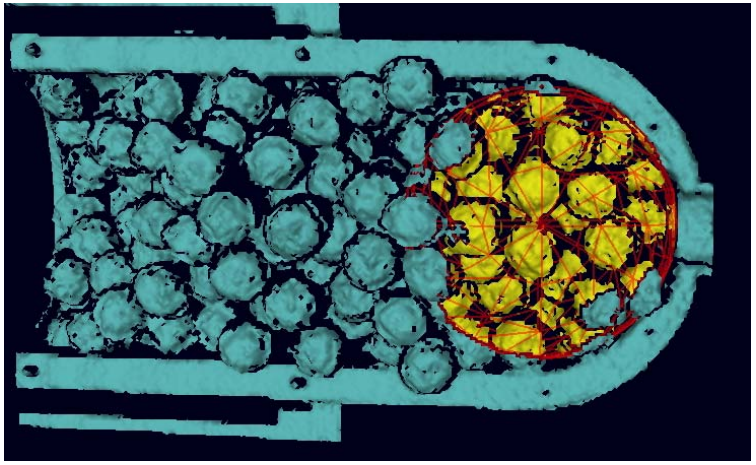
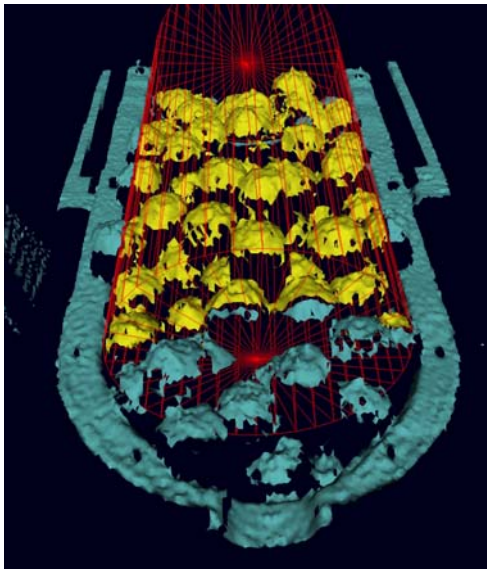
Cloud Data (307,000 points/scan)

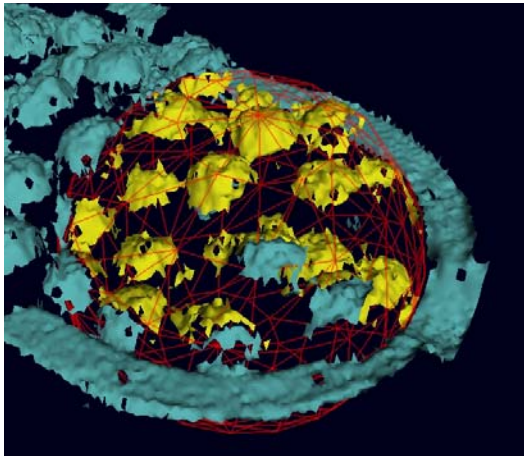


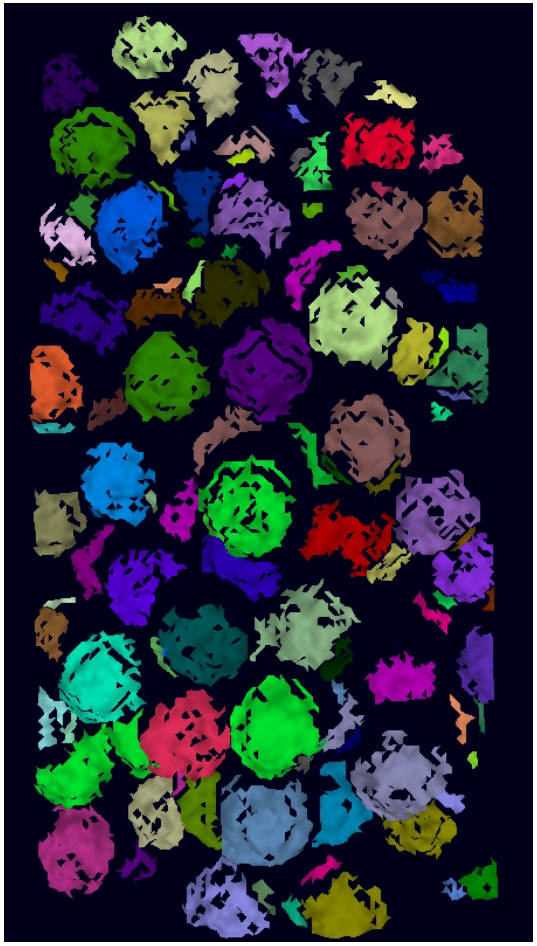
Cylindrical and Spherical Data Filters for Data Extraction











1. We have also developed box, truncated cone, and plane filters.

2. Filters can be cascaded

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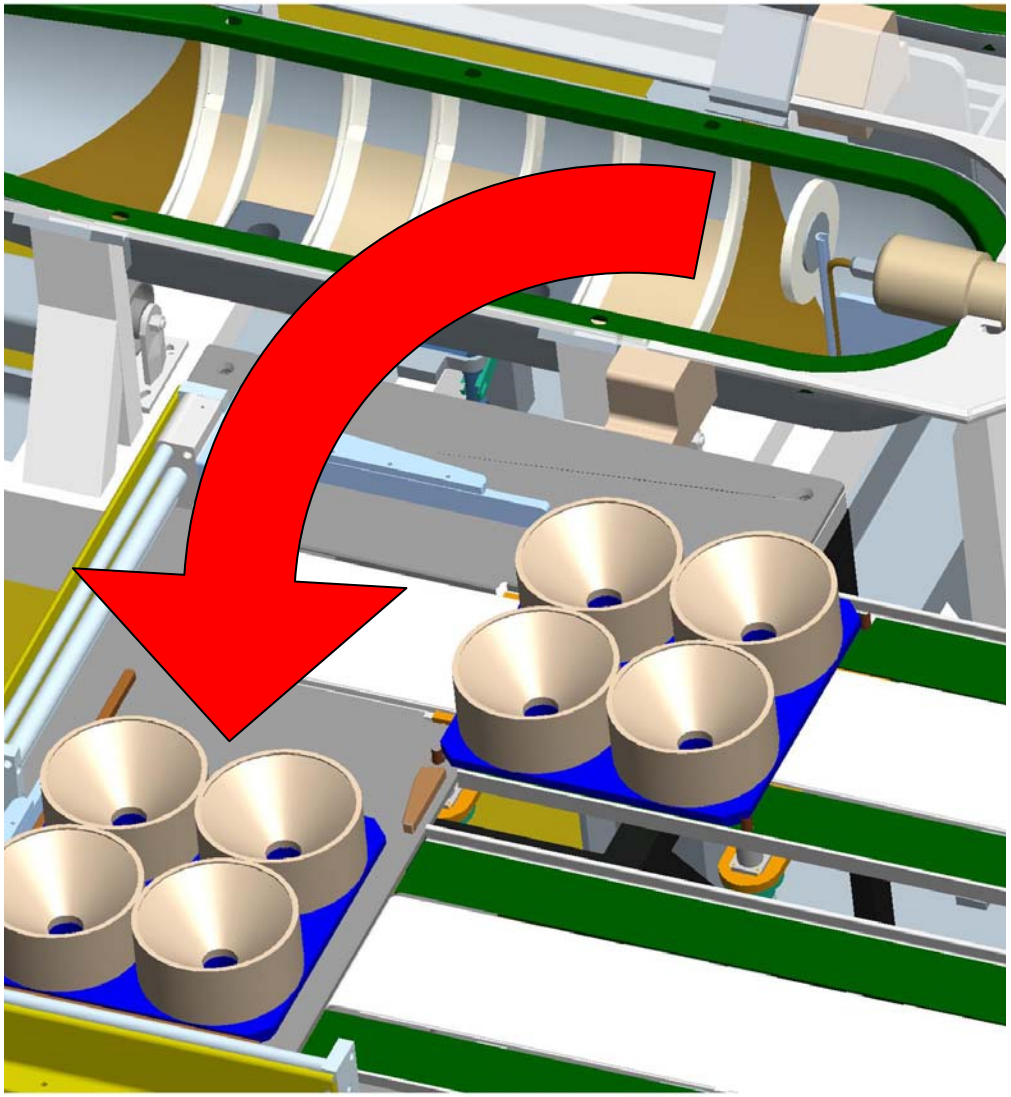
Bomblet Removal Robot

- Vision system provides x, y, z contact location of next bomblet to remove and dispenser offset location in workcell.
- Automated path planning is used to pick up the bomblet based on vision data and bomblet location in dispenser.
- Robot places bomblet in one of 4 pallet pockets based on thru beam sensor information



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CBU Unloading Laser Scanner / Robot Integration

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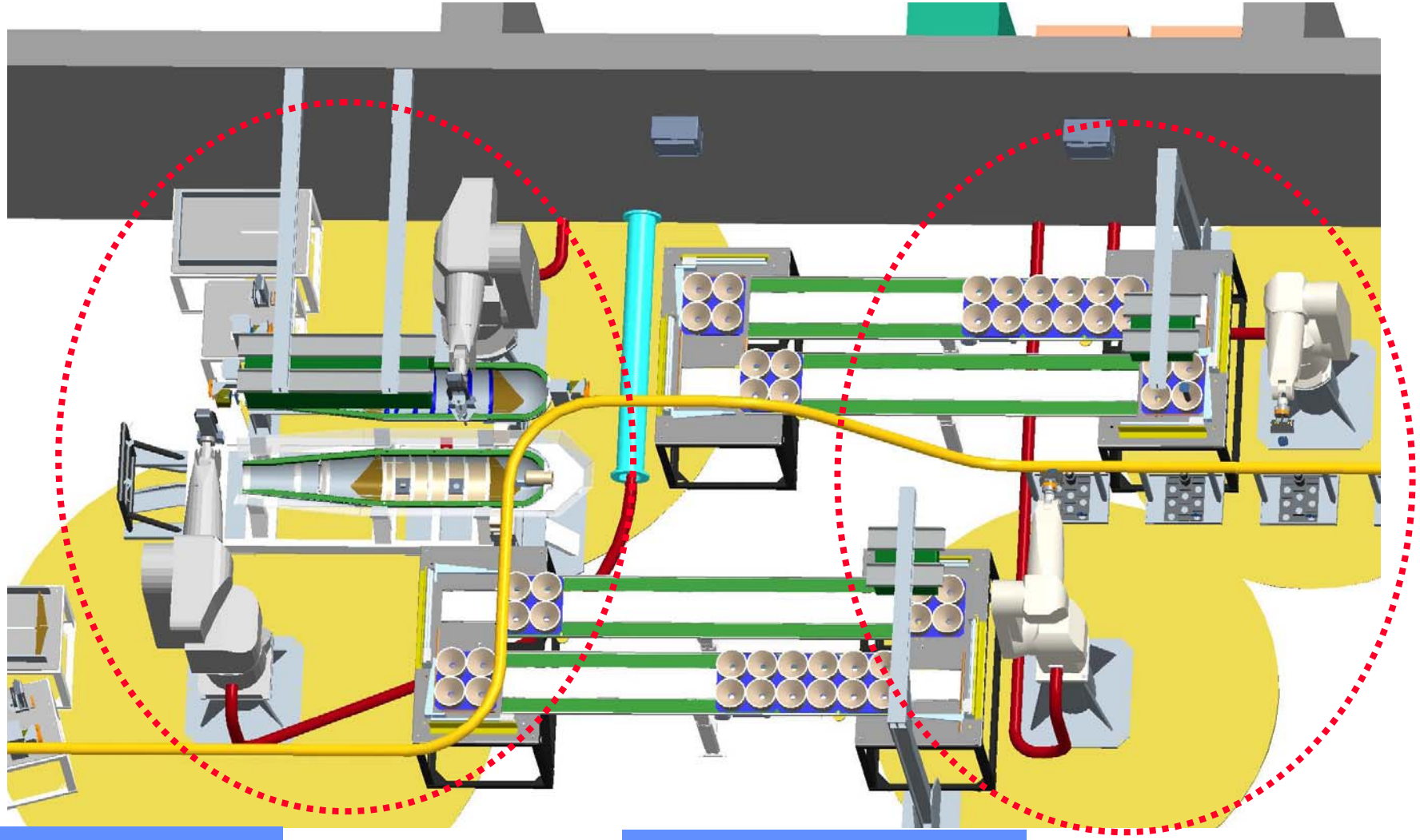
CBU Download Workcell



Open dispenser and unload

Orient bomblet and place in fixture

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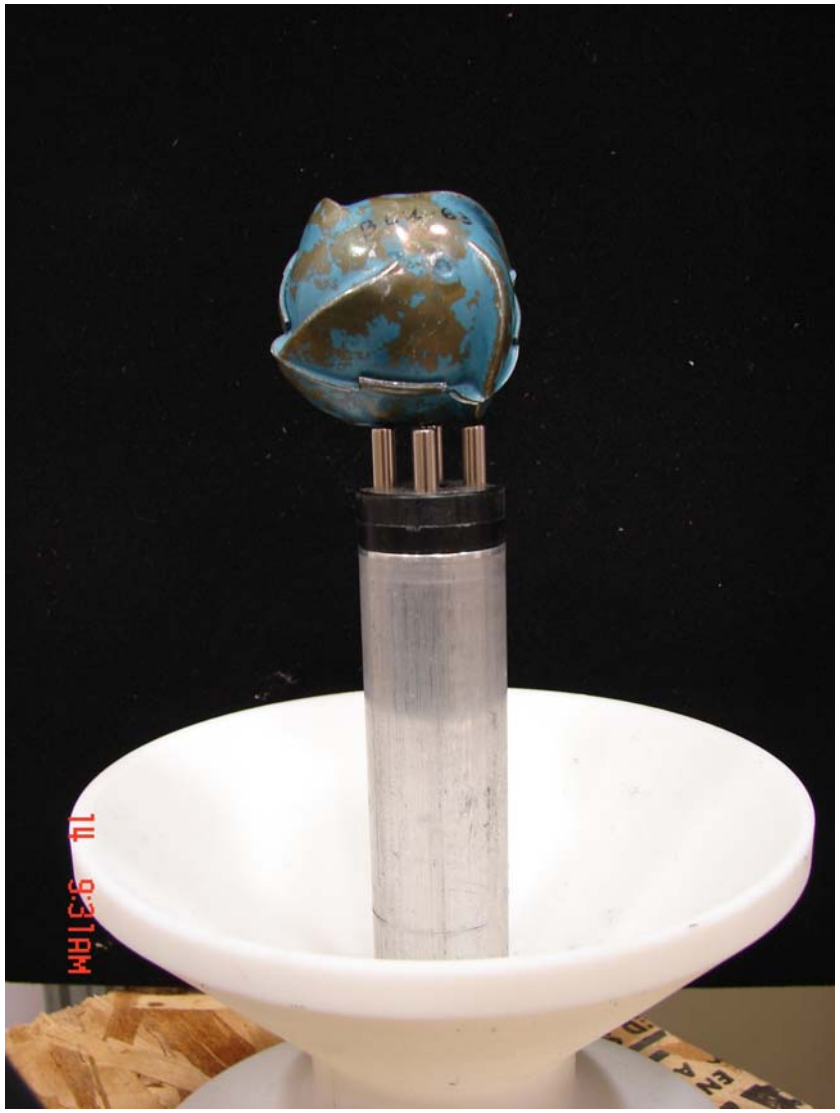
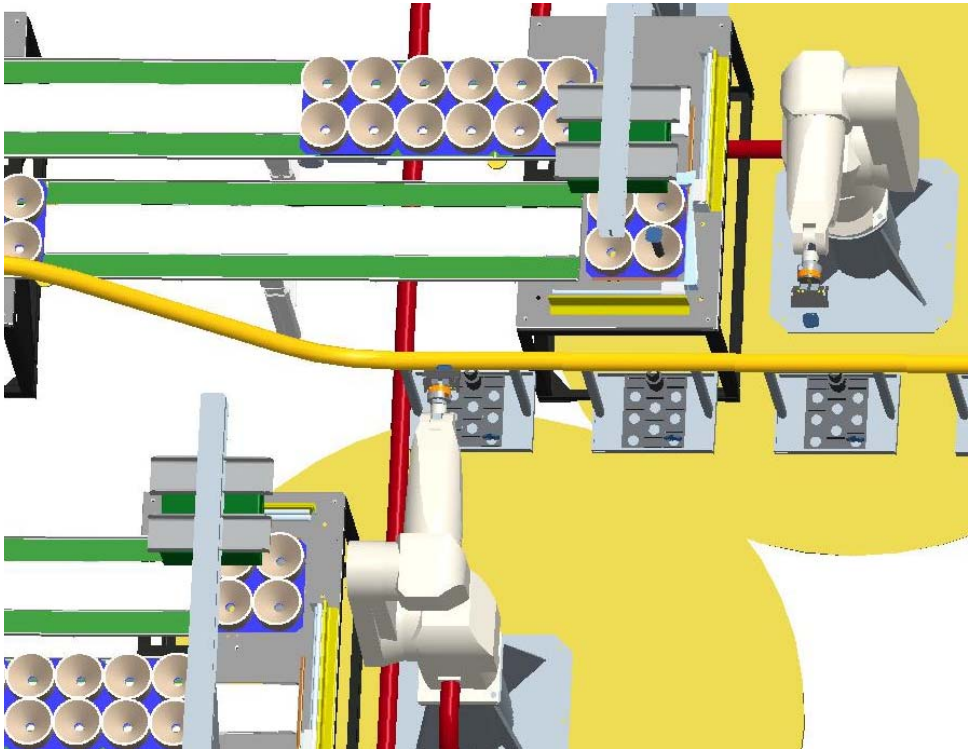
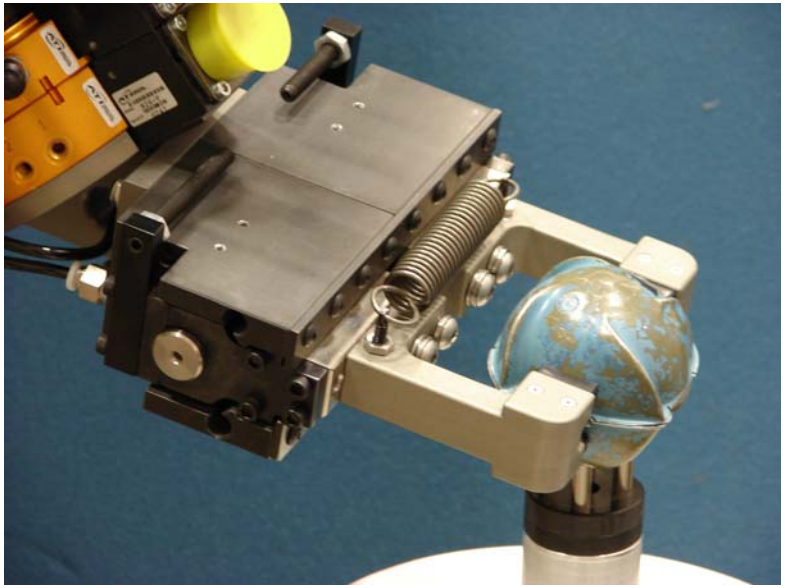
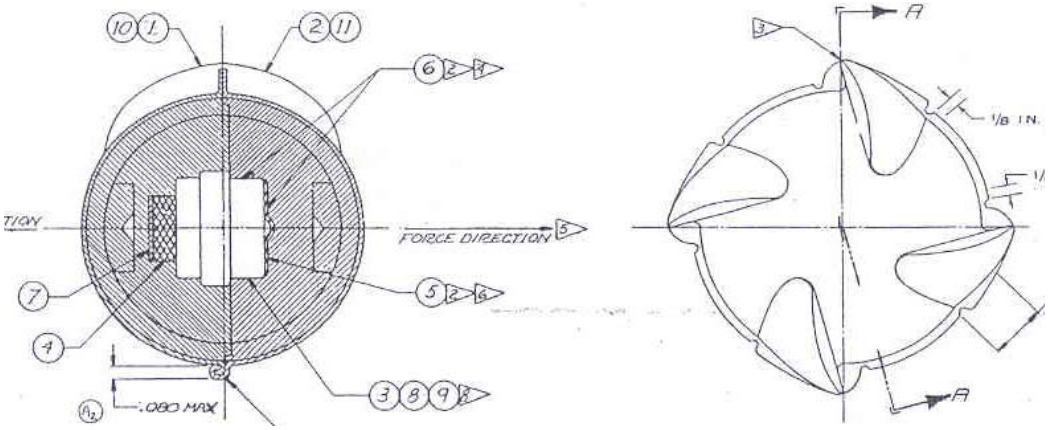
Raised Positions Are Random and Stable

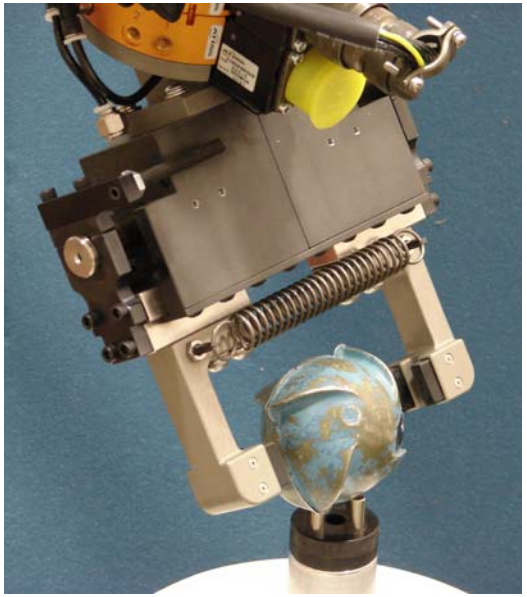


Fixture Loading Scanner Robot Operations









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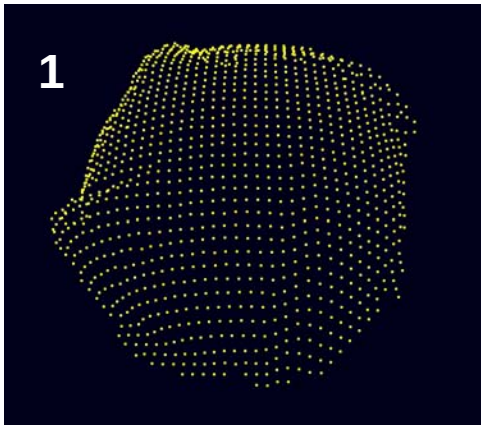
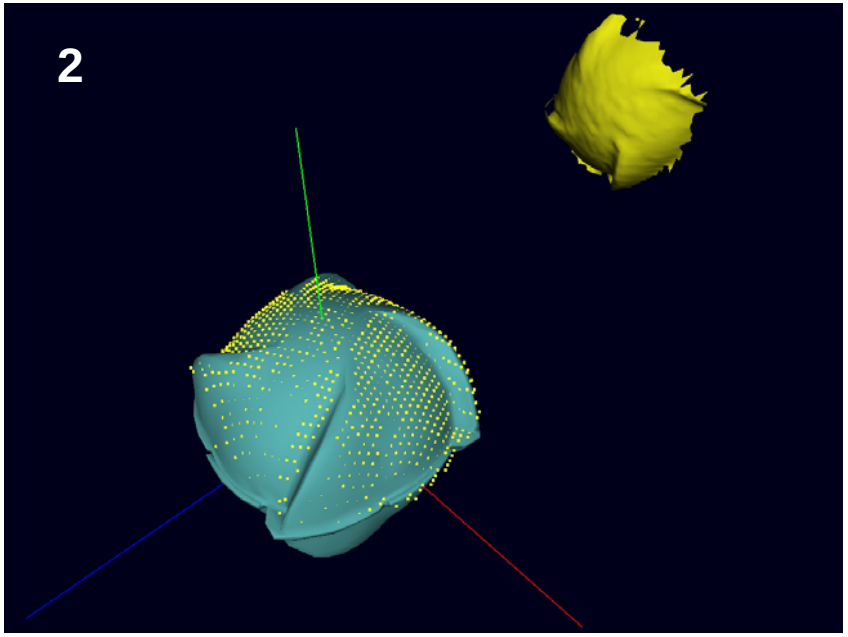
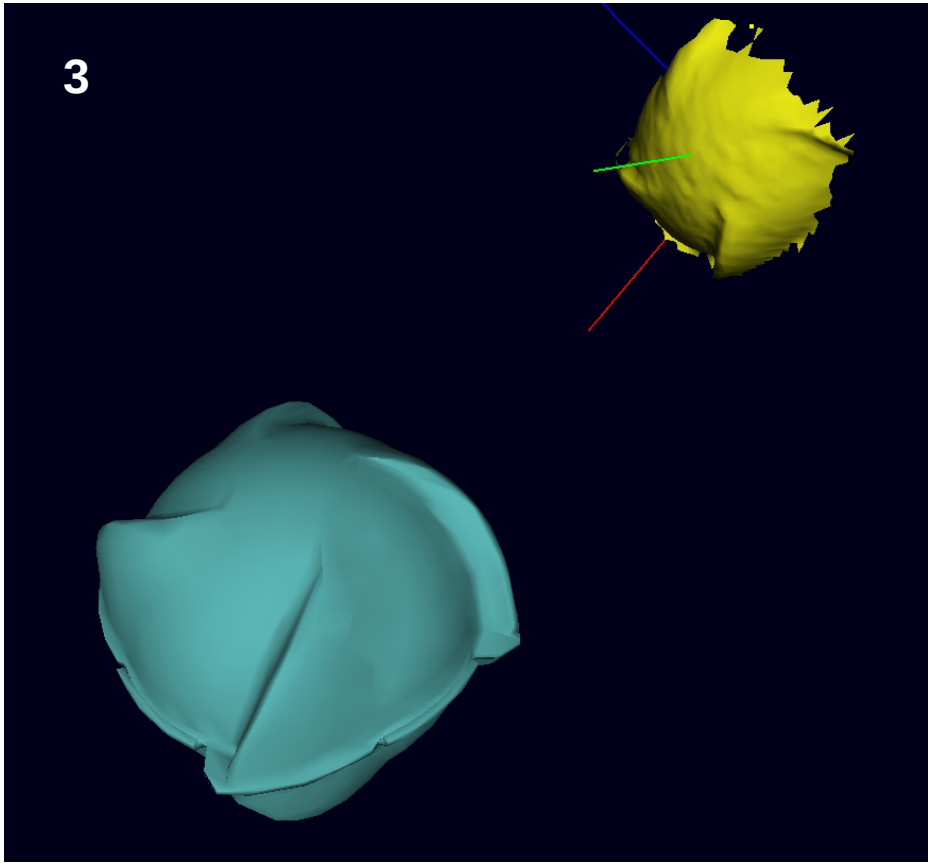
Locating & Orienting Bomblet







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Automated Path Planning for Robot Pick Operation

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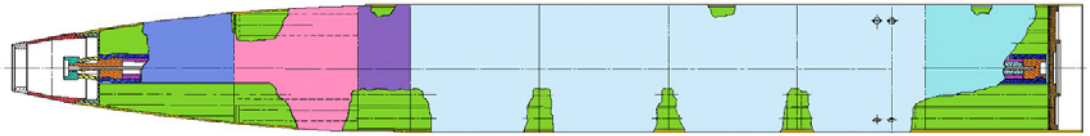
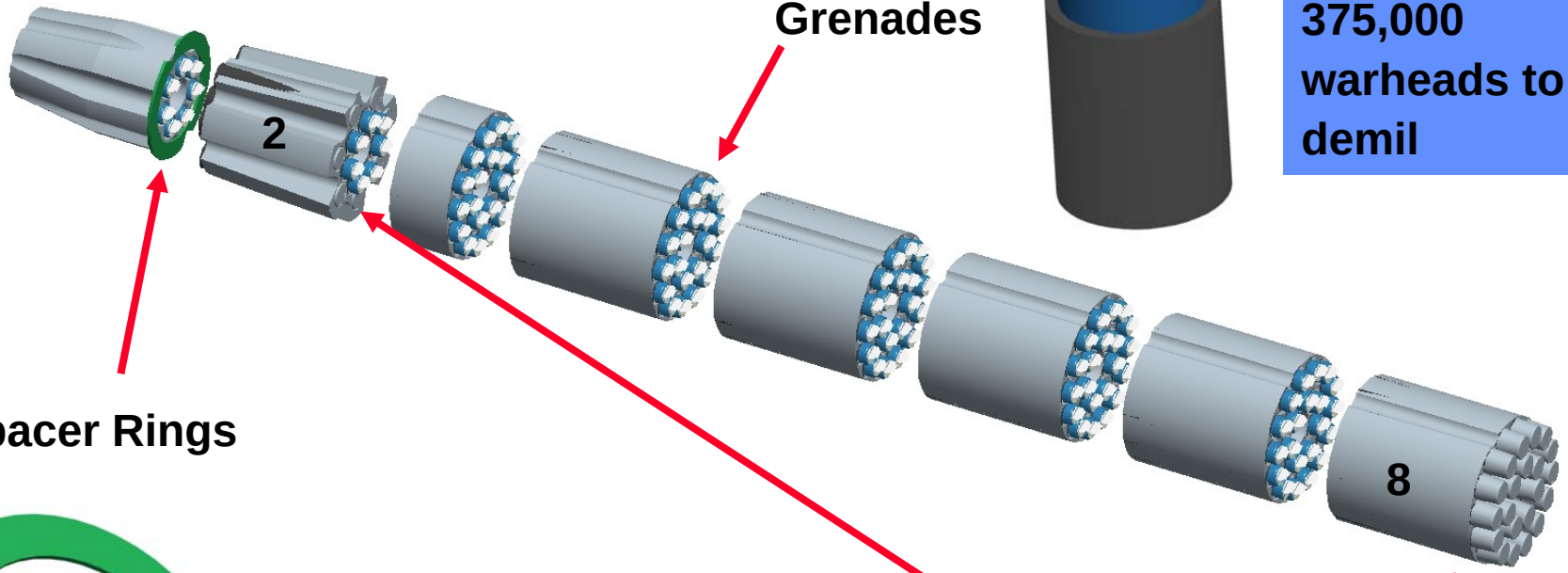
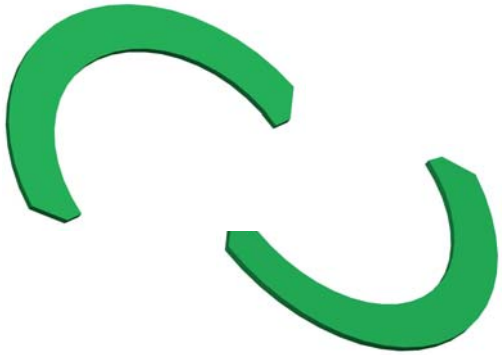
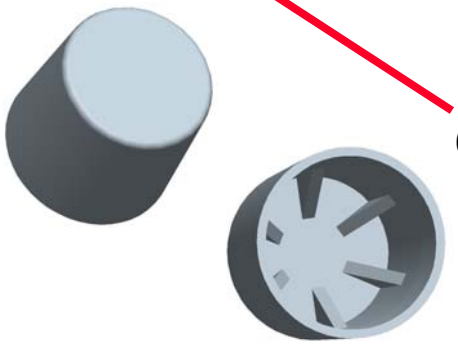
MLRS Warhead Foam Packs and Hardware



644 grenades in a warhead. 375,000 warheads to demil







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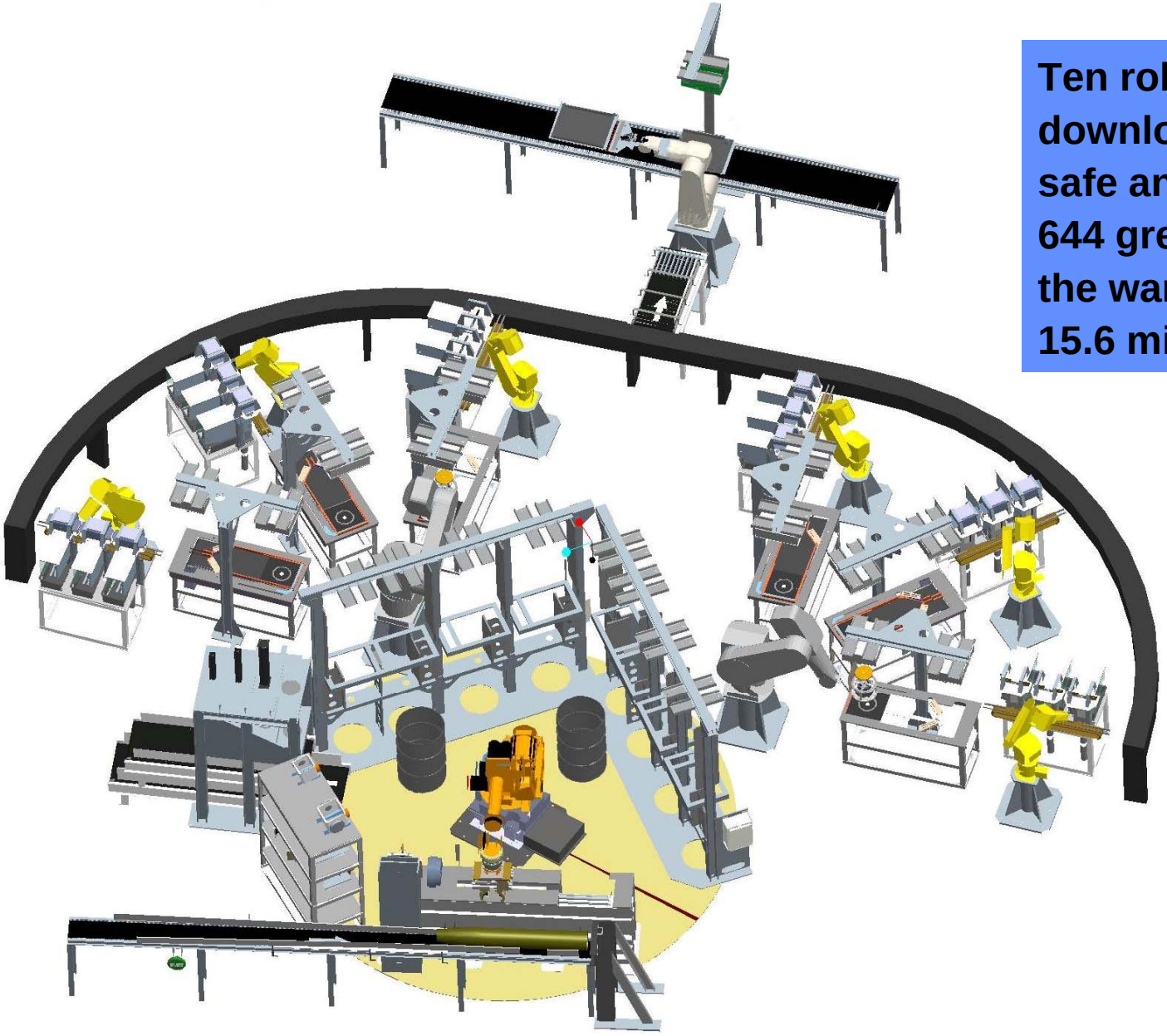
Automated MLRS Warhead Download Workcell



Ten robots will download, inspect, safe and package 644 grenades from the warhead every 15.6 minutes.

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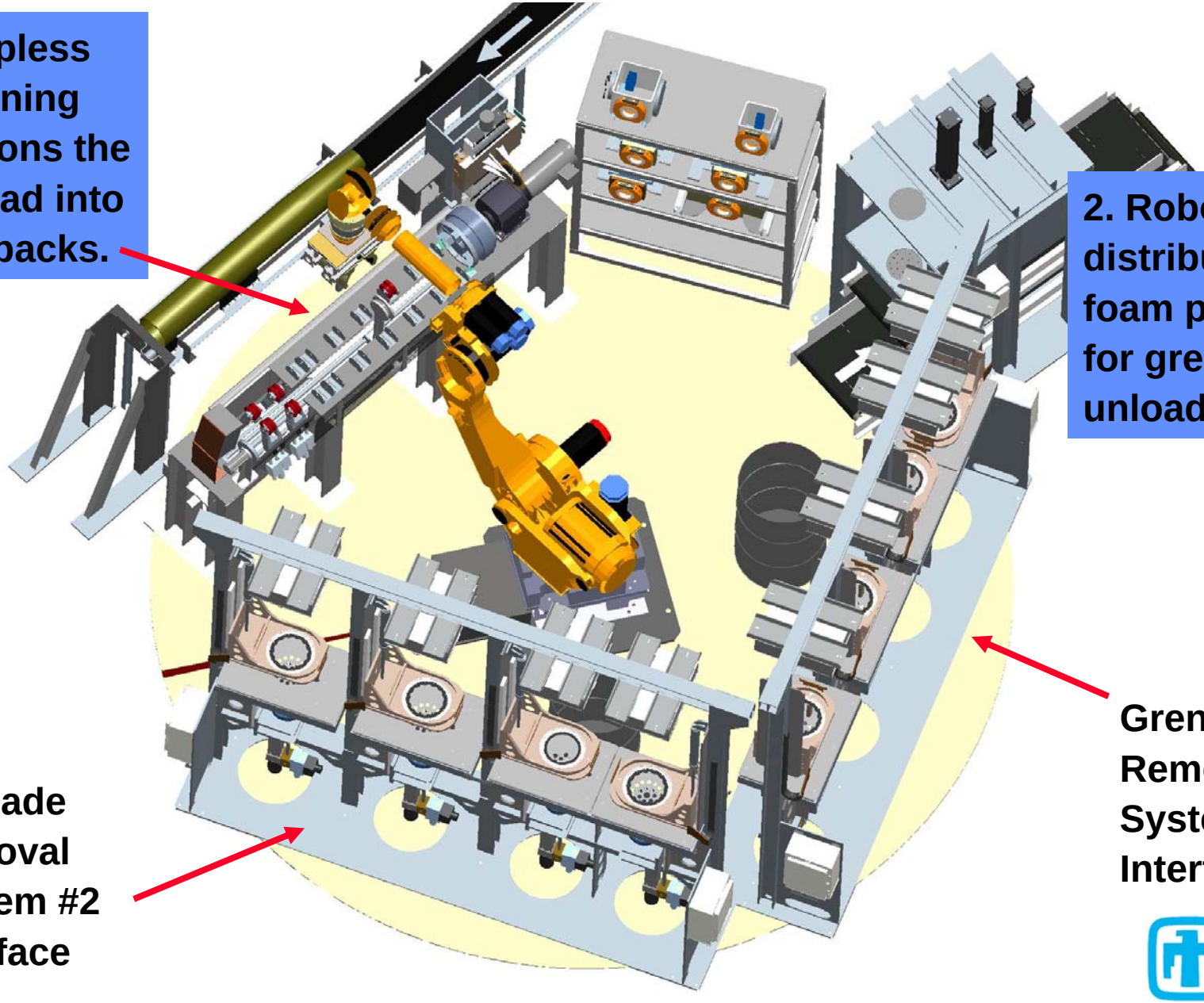
Warhead Disassembly System



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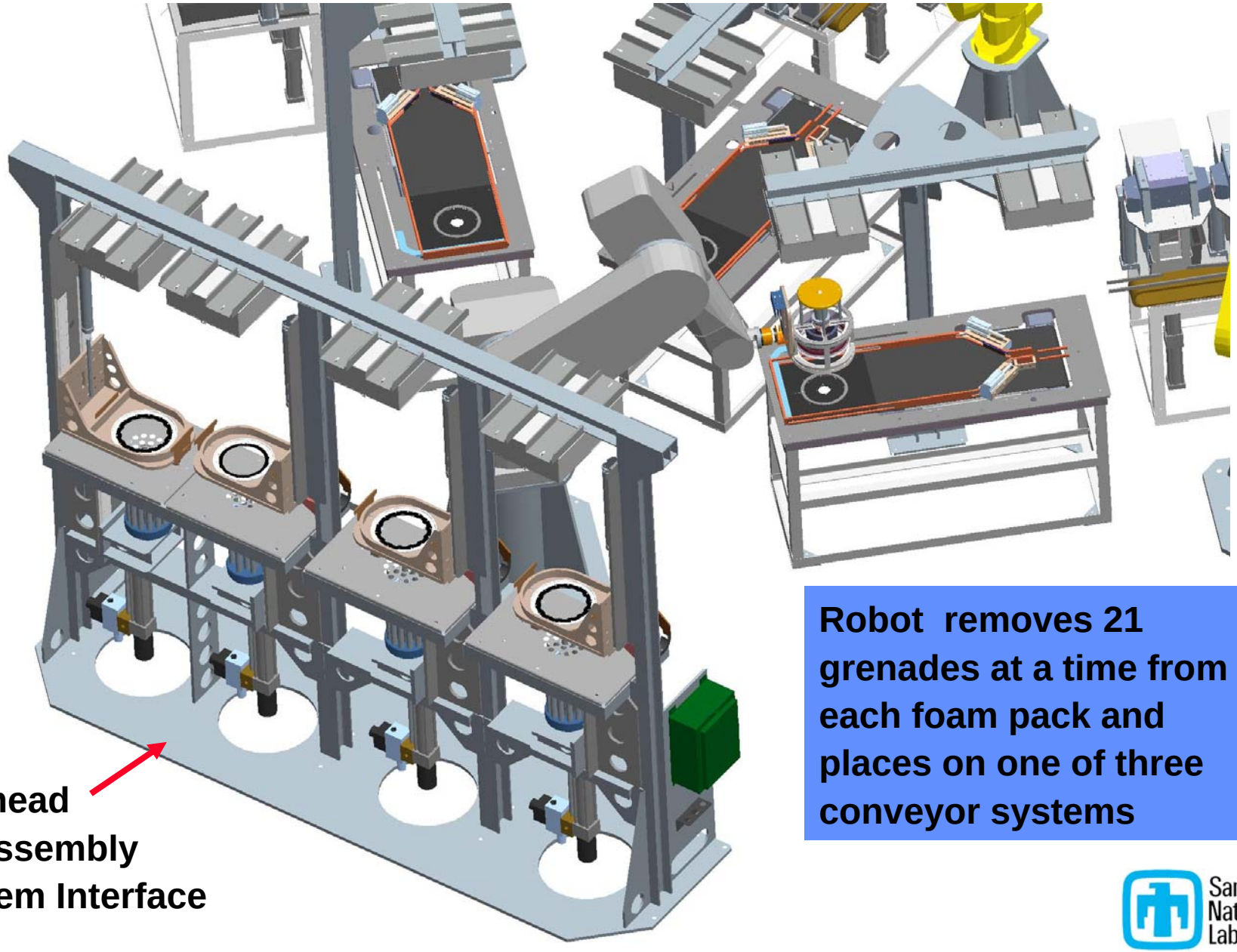
Grenade Removal System #1



Warhead Disassembly System Interface

Robot removes 21 grenades at a time from each foam pack and places on one of three conveyor systems

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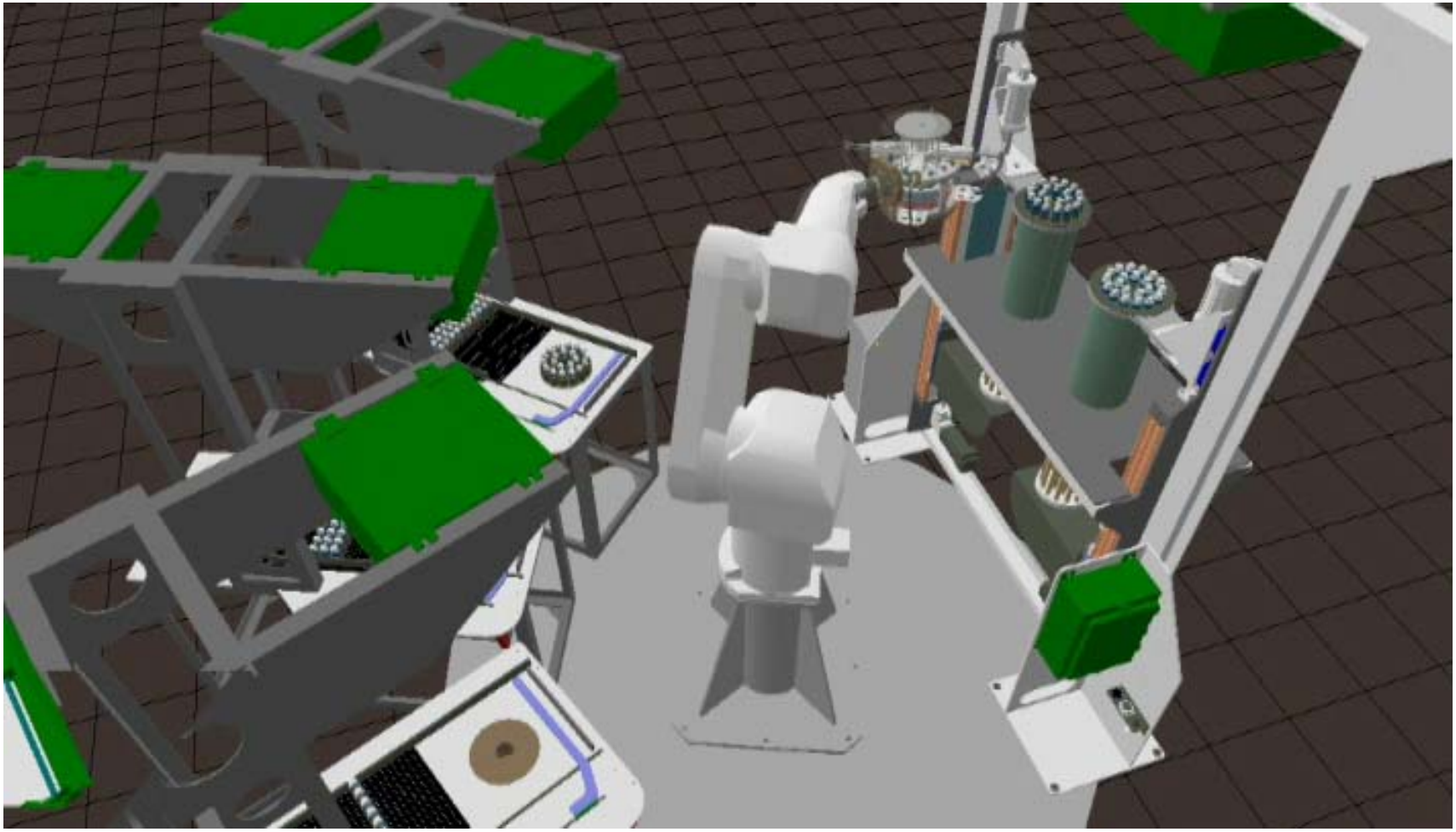
Grenade Removal Operations



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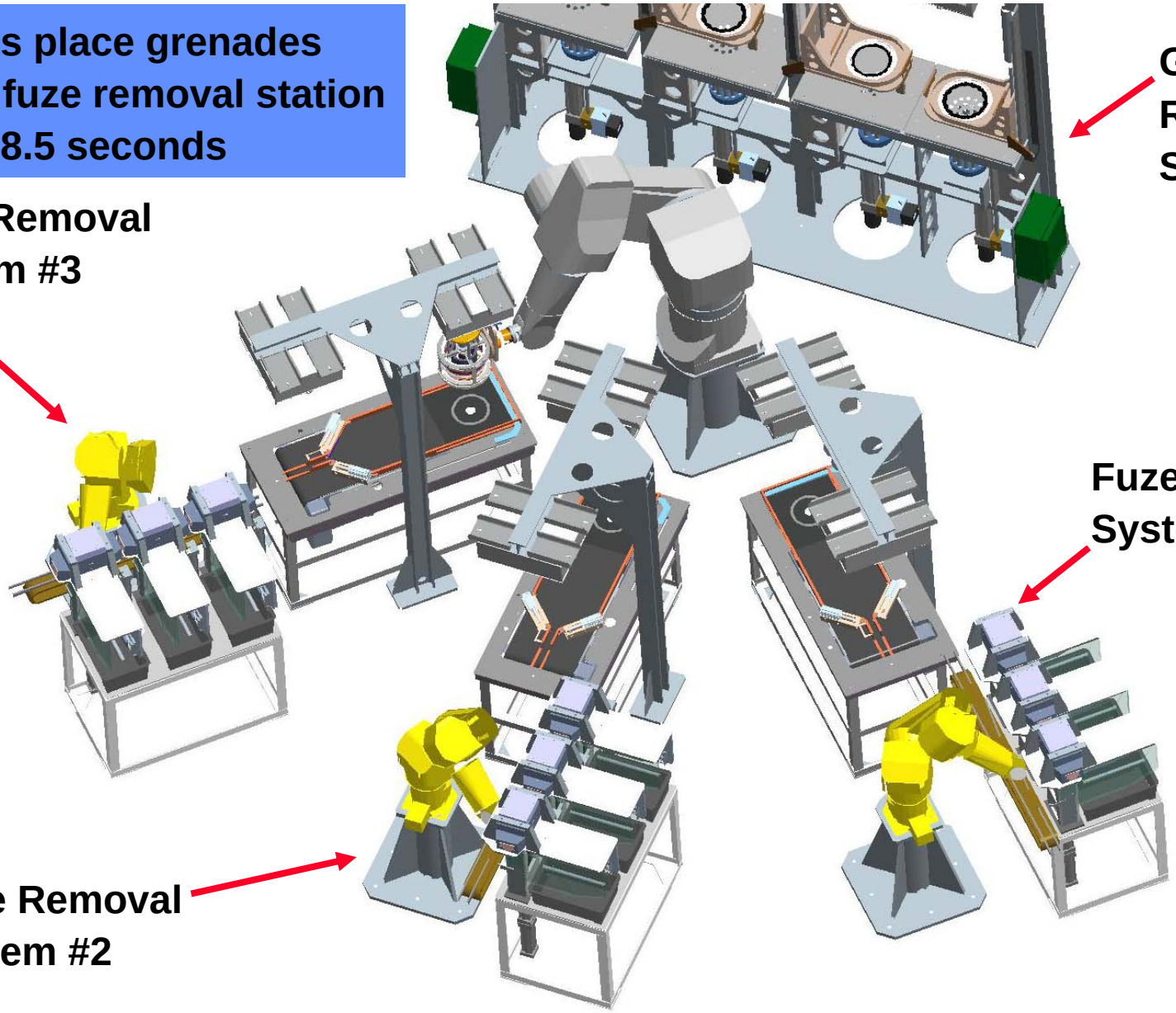
Fuze Removal Systems 1 - 3

Robots place grenades into a fuze removal station every 8.5 seconds



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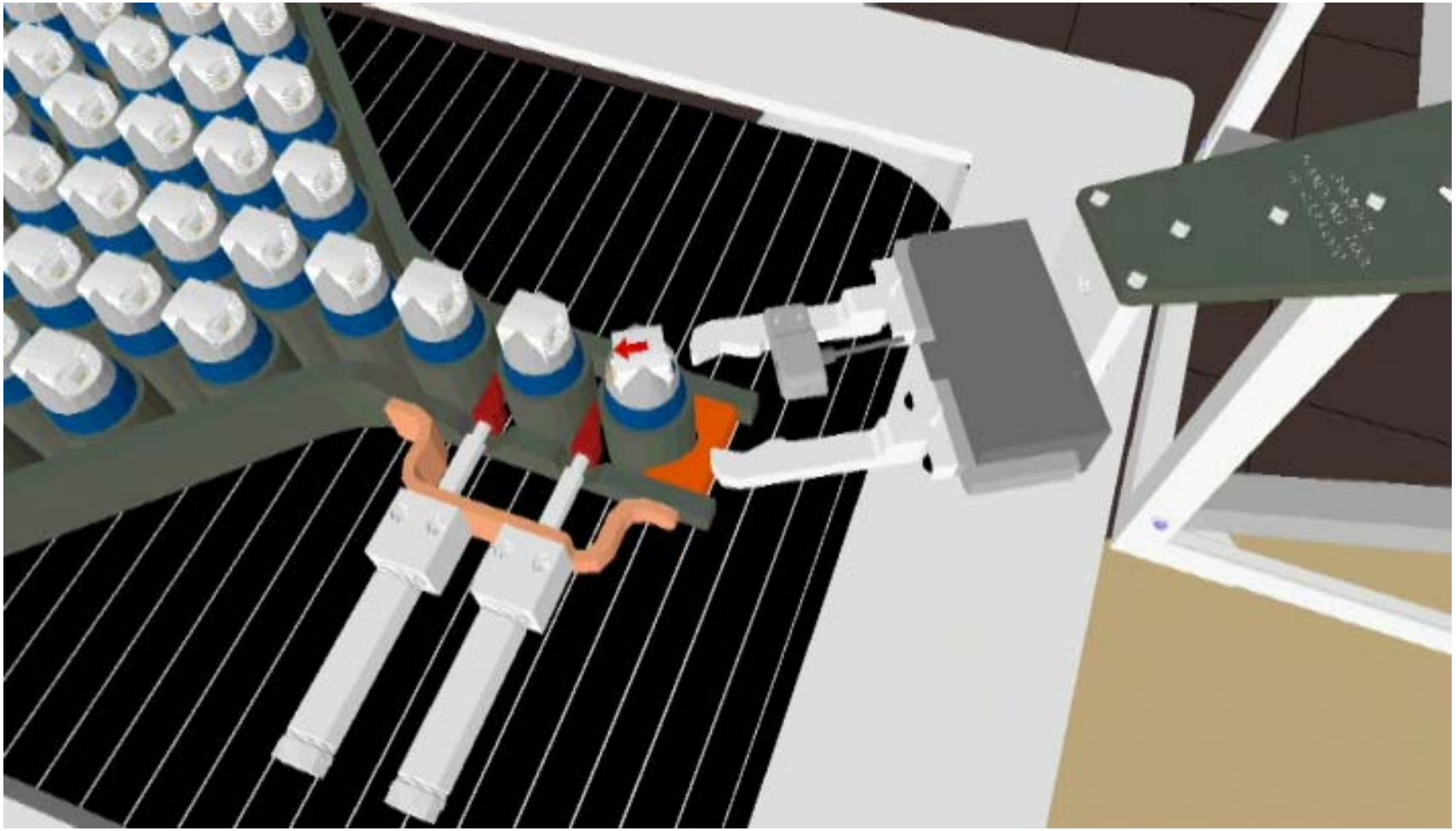
Fuze Removal Operations



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Prototype Tooling Operations March 2006

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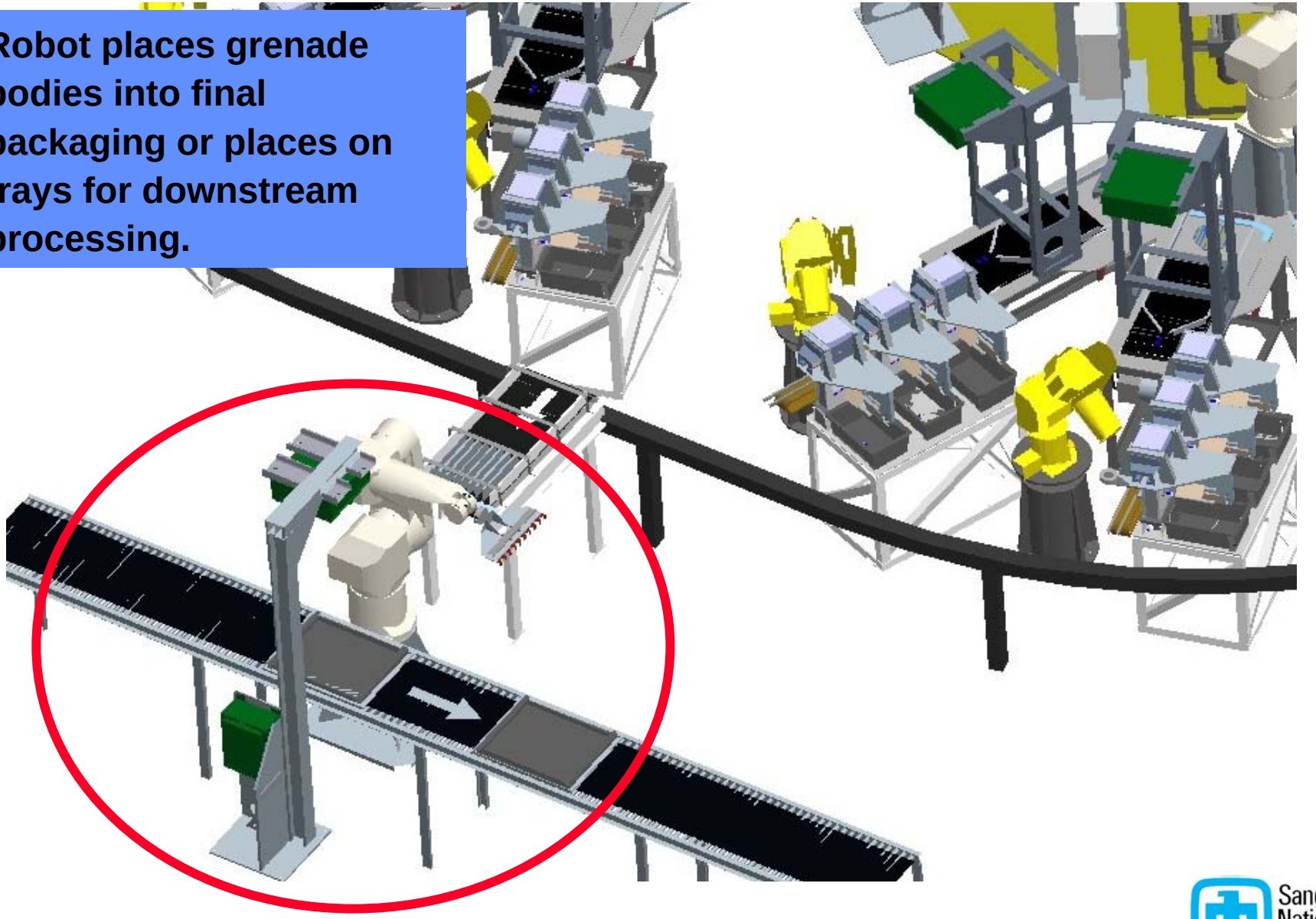
Fixture Loading System

Robot places grenade bodies into final packaging or places on trays for downstream processing.



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