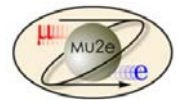




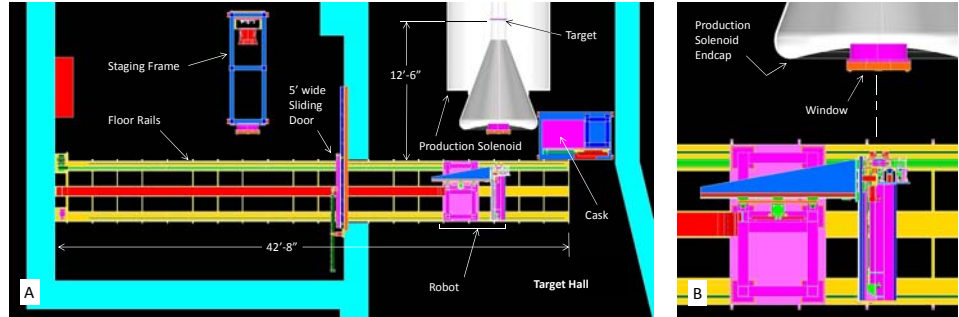
Mu2e Production Target Remote Handling



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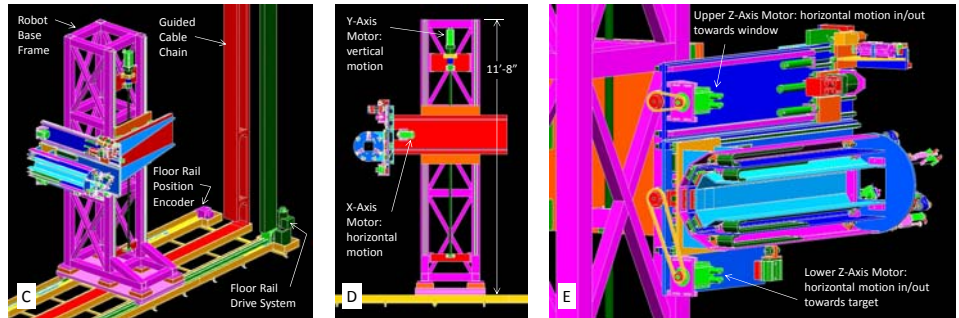
System Layout

The Production Target Remote Handling system for Mu2e primarily consists of a robotic machine that travels from a side room into the target hall on floor rails. The robot is able to autonomously remove and replace both the target access window and the target assembly from the production solenoid. Both of the old components are placed into a radioactive storage cask. Figure (A) shows the overall system layout. Figure (B) shows the robot positioned in front of the production solenoid.



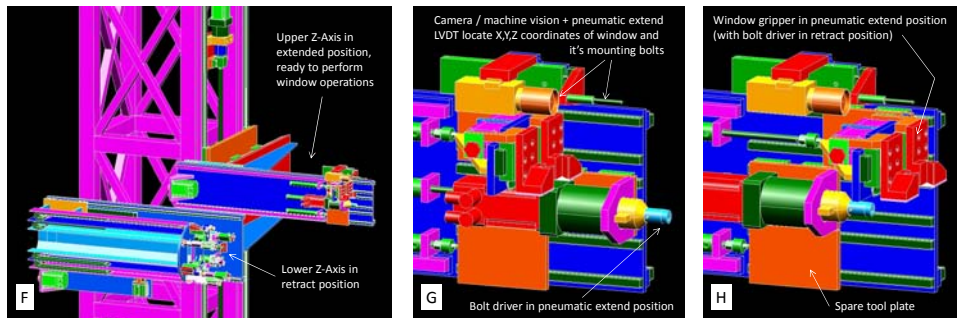
Basic Robot Structure

Figure (C) shows the robot on its floor rails. The robot frame is constructed of welded stainless steel tubing. The floor rails are embedded in the concrete floor of the facility. The floor rail motion axis is driven by a motorized push/pull chain system. Also included is a pull-wire encoder to measure the robot's position in the room. Figure (D) shows the X and Y axes of motion. Both are powered by servo motors and ballscrews. Figure (E) shows the two Z axes of motion, both also powered by servo motors and ballscrews. The upper Z axis is for handling the window. The lower Z axis is for handling the target.



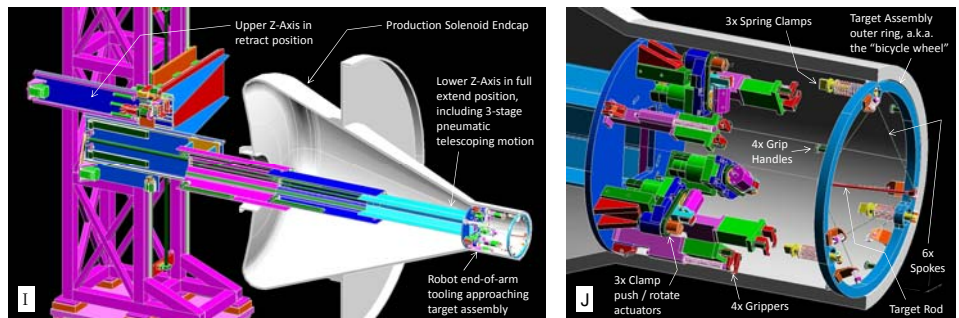
Upper Z-Axis: Handles the Target Access Window

Figure (F) shows the upper Z-axis extended forward to perform remote handling tasks for the window. When the upper Z-axis is extended, the lower Z-axis is retracted out of the way. The upper Z-axis contains up to 3 actuators to perform its tasks. Figure (G) shows the bolt driver in the out position, ready to remove/install the 36x bolts in the window bolt circle. Figure (H) shows the gripper in the out position, which is used to remove/replace the window. There is also space to add a 3rd actuator.



Lower Z-Axis: Handles Target

In Figure (I), the robot is shown with its lower Z-axis extended to perform remote handling tasks for the target. This axis includes a 3-stage telescoping extend mechanism to enable a forward reach of over 12 feet. Figure (J) is a close-up view of the robot end-effector tooling as it approaches the target. The target assembly is held in place by 3 spring-loaded clamps around its outer ring. These clamps must each be pushed-in, turned 90°, and backed out to release the ring from its mount. Once released, the ring is held by the robot's 4 grippers. Installation of the new target is the same process in reverse order.



Other System Components: Staging Frame, Cask, Door

The remote handling system also includes a staging frame, the radioactive storage cask, and the sliding shield door. The staging frame, shown in Figure (K), is the place where the new window and target are staged so that the robot can come back and autonomously get them after the old ones have been removed. Figure (L) shows the cask where the old window and target are placed. Figure (M) shows the sliding shield door that separates the target hall from the side room.

