

# Automation System for Fuel Pellet Handling & Inspection in Shielded Facility

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Fabrication of  $^{233}\text{U}$  based fuel for Advance Heavy Water Reactor (AHWR) is a challenging task due to presence of highly gamma active  $^{232}\text{U}$  contamination in the fuel. This requires entire operations of this fuel fabrication to be performed remotely in shielded cells. In order to demonstrate fully automated fuel fabrication, a first of its kind mock-up facility was developed and commissioned in BARC. This mock-up facility includes automation systems developed for fuel pellet fabrication, sintered pellet handling & inspection and fuel pin fabrication.

Brief communication articles on the automation systems developed for this mock-up facility, i.e. “Automated Powder Processing, Pelletisation System” and “Automated Fuel Pin Fabrication System” have already been published in recent editions of BARC newsletter.

This article describes, a full scale automation system, recently developed and installed at BARC, to demonstrate automated sintered fuel pellet handling and inspection in shielded facility.

Sintered pellets fabricated through the powder-pellet ceramic route are required to be inspected for their diameters and surface defects; sorted based on their diameters; degassed; stacked to specified lengths and inserted into a tube. The automated operation starts with receiving of sintered pellets in boats and ends with loading accepted pellets into clad tube after thorough inspections, degassing and stack length confirmation. Cylindrical pellets of  $9.8 \pm 0.4$  mm diameter and

$13 \pm 1$  mm length are used for demonstration of system operation.

Following major operations are automated;

- Boat transfer & pellets unloading from the Boat
- Pellet sorting using Mechanical sorting system, LASER Micrometer and LVDT based system
- Visual Inspection of the pellets
- Loading the pellets into a Degassing Cage
- Degassing Cage handling
- Degassing furnace operations
- Unloading the pellets from the Degassing Cage
- Pellet Stacking and stack length measurement
- Insertion of the pellets & other structural components into the Clad Tube

All equipments are designed for remote maintenance, including their remote removal and remote installation. All operations are controlled automatically and remotely monitored. Operator can intervene and control the system in semi-automated or manual modes. Inspection results of all pellets are logged and are available for analysis. The online status of all stations is available at control station on a SCADA screen. Images from CCTV cameras are monitored continuously to monitor the safe operation. System reliable operation in the given space constraints of shielded cell has been the real challenge in system design.

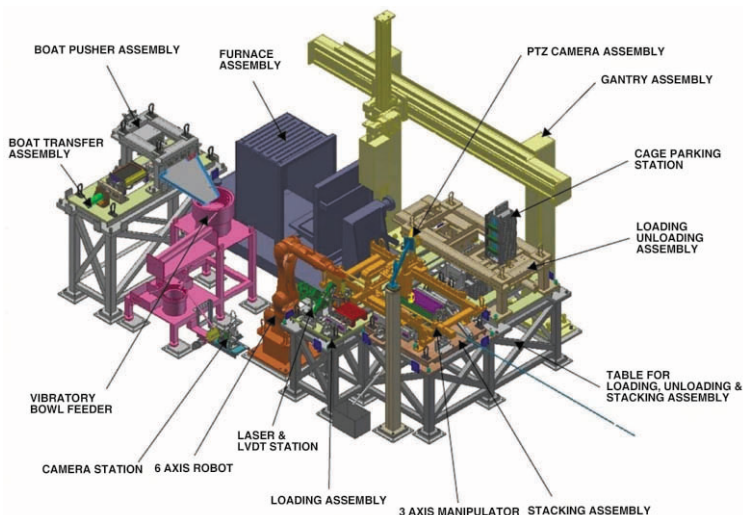


Fig 1: Full Scale Mock-up Facility (3D Model)

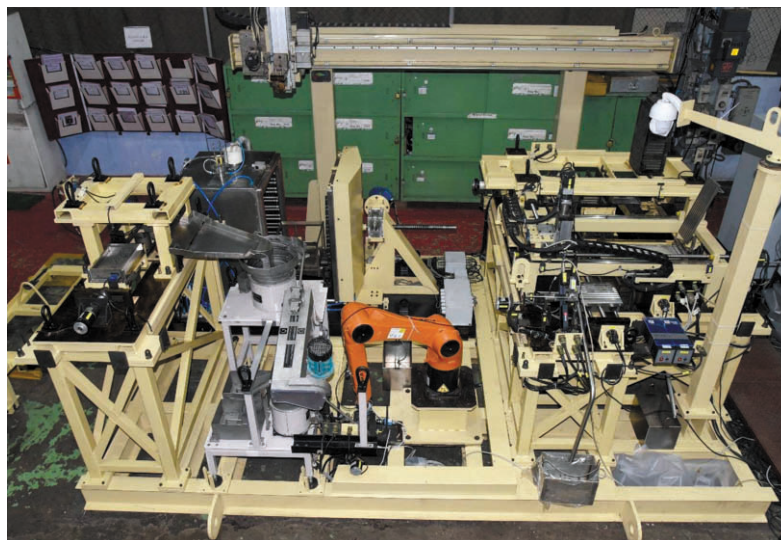


Fig 2: Full Scale Mock-up Facility (Installation)