cyclife aquila nuclear
EDF GROUP

Pelletron Beamline Target Cells

Client: Dalton Cumbrian Facility

Shielded Facilities

Aims and objectives

Aquila won the contract to scheme design, manufacture, and install, a set of hot cells for the Dalton Cumbrian Facility (DCF) University of Manchester. The cells are located at the end of a high energy Pelletron 5MV Beam line.

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The client

The University of Manchester's Dalton Nuclear Institute (DNI) is a leading International centre for nuclear research and education. The DCF has been created for the academic community to use for research into radiation sciences.

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Project overview

What is the equipment for?

The equipment enables an increased scope of radiation damage experiments at DCF.

It provides biological shielding from metallic targets both during, and following, irradiation. The Hot Cells include facilities for remote handling, storage, and posting of samples to a nominated proprietary 'Type A' transport package.

The facility uses a 'tandem ion beam accelerator' (pelletron) to produce a high-energy ion beam. Due to a requirement to use higher beam energies, irradiated target materials need to be located and handled within radiologically shielded Hot Cells. The Hot Cell Suite comprises a 'Target Rig Hot Cell' and a 'Handling and Storage Hot Cell'. The Target Rig Hot Cell receives the beam line through its end wall and houses the target rig vacuum chamber, where targets are irradiated. This cell incorporates neutron shielding and gamma shielding. Following irradiation, samples are transferred into the Handling and Storage Hot Cell for de-mounting, storage, and posting out. Since the samples are not irradiated in this cell, the cell only features gamma shielding.

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Target Cell

The Target cell houses the DCF equipment for irradiating the target. The Pelletron vacuum Beam Line enters the cell at the opposite end to the Handling Cell.

The Shielding which covers the entire cell is made up of a layer of borated plastic 90 – 100mm thick and a layer of lead which is 130mm thick. Supporting the lead and plastic is an external steel frame. The beam line shielding, at the far end of the cell, surrounds the beam line which collimates the shine path, from the target offering radiological protection, to users. A plastic and lead labyrinth sits on the roof of the cell.

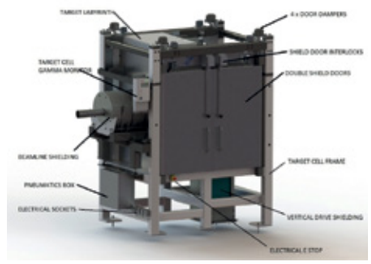
In order to remove the large DCF target vacuum chamber and associated equipment, the Target Cell has two double doors on either side. These doors are interlocked to the frame. Due to the doors large mass, and to stop the door contacting the frame when opening, door dampers and end stops have been included above the doors.

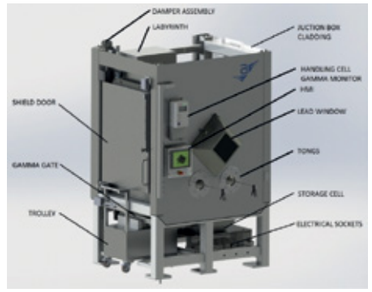
Beneath the Vacuum Chamber is the vertical drive for removing the sample. Due to its length, it protrudes beneath the Target cell and requires additional shielding. For maintenance, some of this shielding is removable from outside the Target Cell.

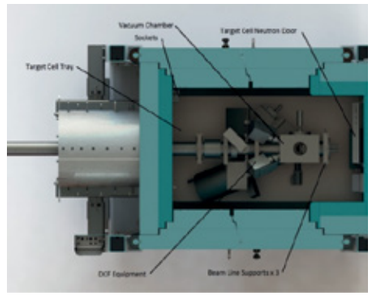
Emergency stops are attached to the frame at either side of the cell, under the shield doors. Above and to the left of the doors facing the room entrance is the Gamma Monitor. The main pneumatics box for the Target cell and Handling Cell sits beneath the beam line shielding at the far end of the Target Cell. Sockets sit alongside the pneumatics box.

Stainless steel cladding offers a visually appealing cell, as well as offering protection against finger entrapment around door hinges.

The majority of assemblies housed within the Target Cell are the DCF vacuum chamber and Target equipment. The image below shows the Aquila equipment housed within the Target Cell.







These include the following assemblies:

- Neutron door
- Electrical Sockets
- Target cell Tray, including Tray infills
- Beamline Supports

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Handling Cell

The Handling Cell, whose shielding interlocks with the Target cell, is used to store, and post out, irradiated samples.

As well as the above shielding, the only other interfacing part is the tunnel which allows the passing of samples from the Target Cell to the Handling Cell and vice versa.

The Shielding which covers the cell is made up of a layer of lead which is 160mm thick. On the front face of the cell are the two tongs for remote operation and a lead window for viewing activities within the Handling Cell. To the left of the lead window is the HMI which is used to operate the Target and Handling Cells control features. This Human Machine Interface (HMI) Mounting panel also houses an emergency stop button and, above this, is the Handling Cell Gamma monitor.

The Cell has a lead labyrinth which is located on the roof of the cell. The storage assembly lead is located beneath the cell, on the right hand side. Just in front of this are the electrical sockets.

On the left hand side of the cell is the main shield door for access into the Handling Cell, which has the same damper as the Target Cell. Underneath the shield door is the Trolley for posting in and out samples. Above the trolley is the Gamma Gate.

The assemblies housed within the Handling cell liner include the following:

- Post Out Internal Assembly
- Handling Cell Electrical Sockets
- Light Assembly
- Storage Assembly
- Internal Door
- Inner Windoww
- Tunnel
- Tunnel Shield Door

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