Australian Government

Australian Nuclear Science and Technology Organisation

New Silicon Irradiation Rig Design for OPAL Reactor

RRFM-IGORR

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Silicon Irradiation?

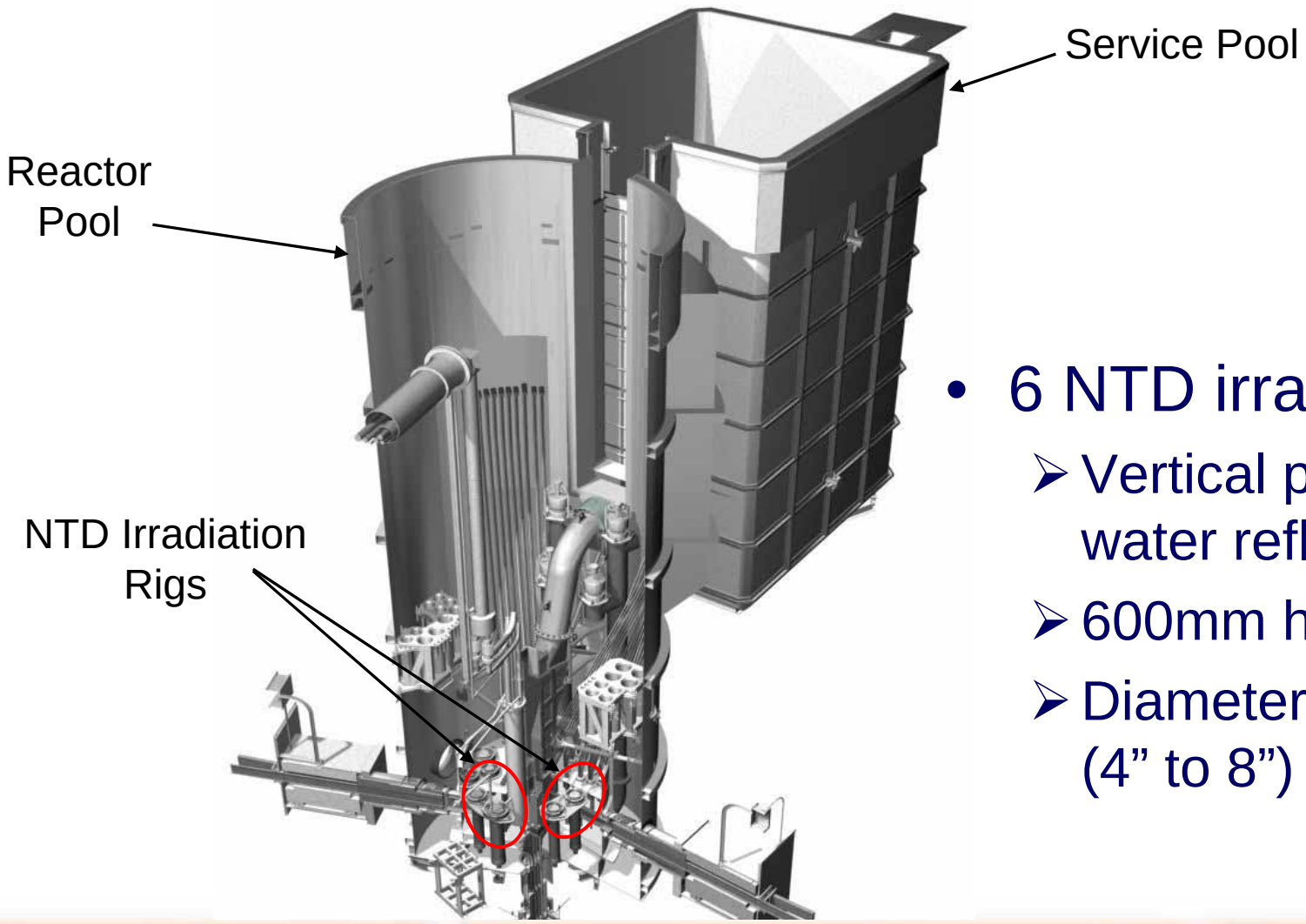
- **Silicon irradiation** (Neutron Transmutation Doping)

  ^{30}Si + neutron $\rightarrow$ ^{31}Si - ß $\rightarrow$ ^{31}P

  for the production of N-type (donor-type) Si with precisely defined resistivity (less than ~5% variation - axial and radial).

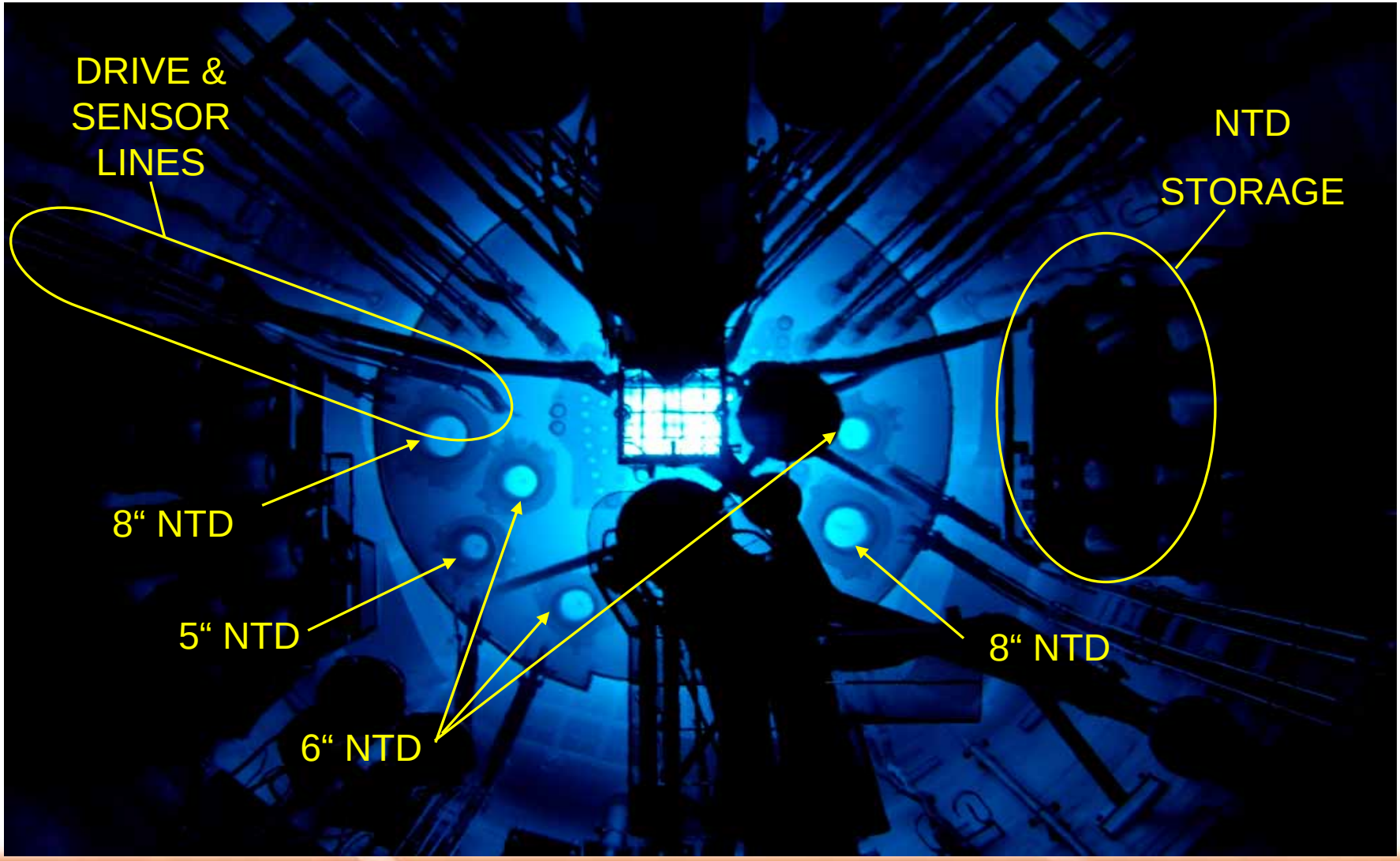
  ➢ Used for a wide range of semi-conductor devices.

OPAL Silicon NTD

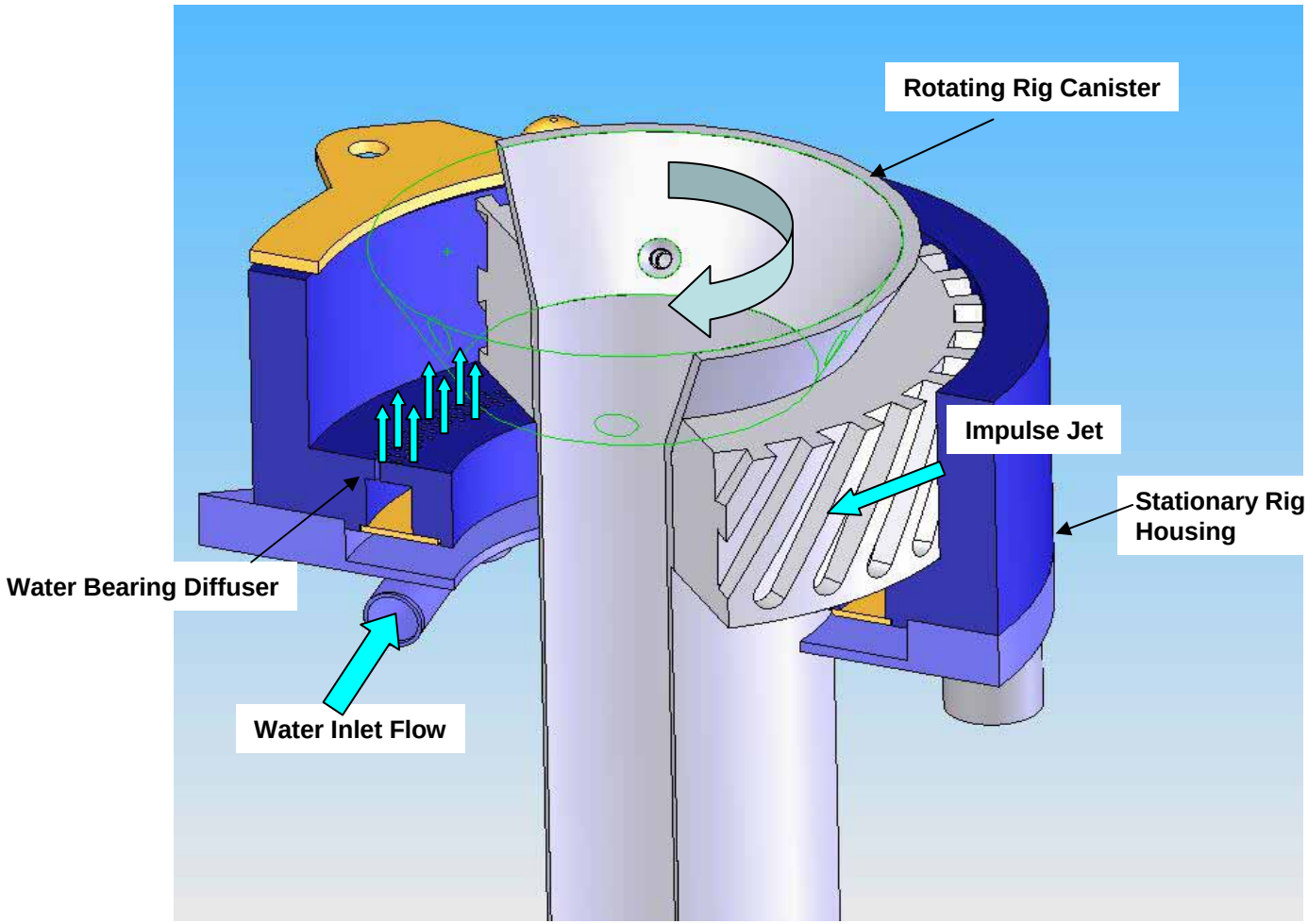


- 6 NTD irradiation rigs:
  - Vertical position in heavy water reflector vessel
  - 600mm high arrays
  - Diameter 100 to 203mm (4” to 8”)

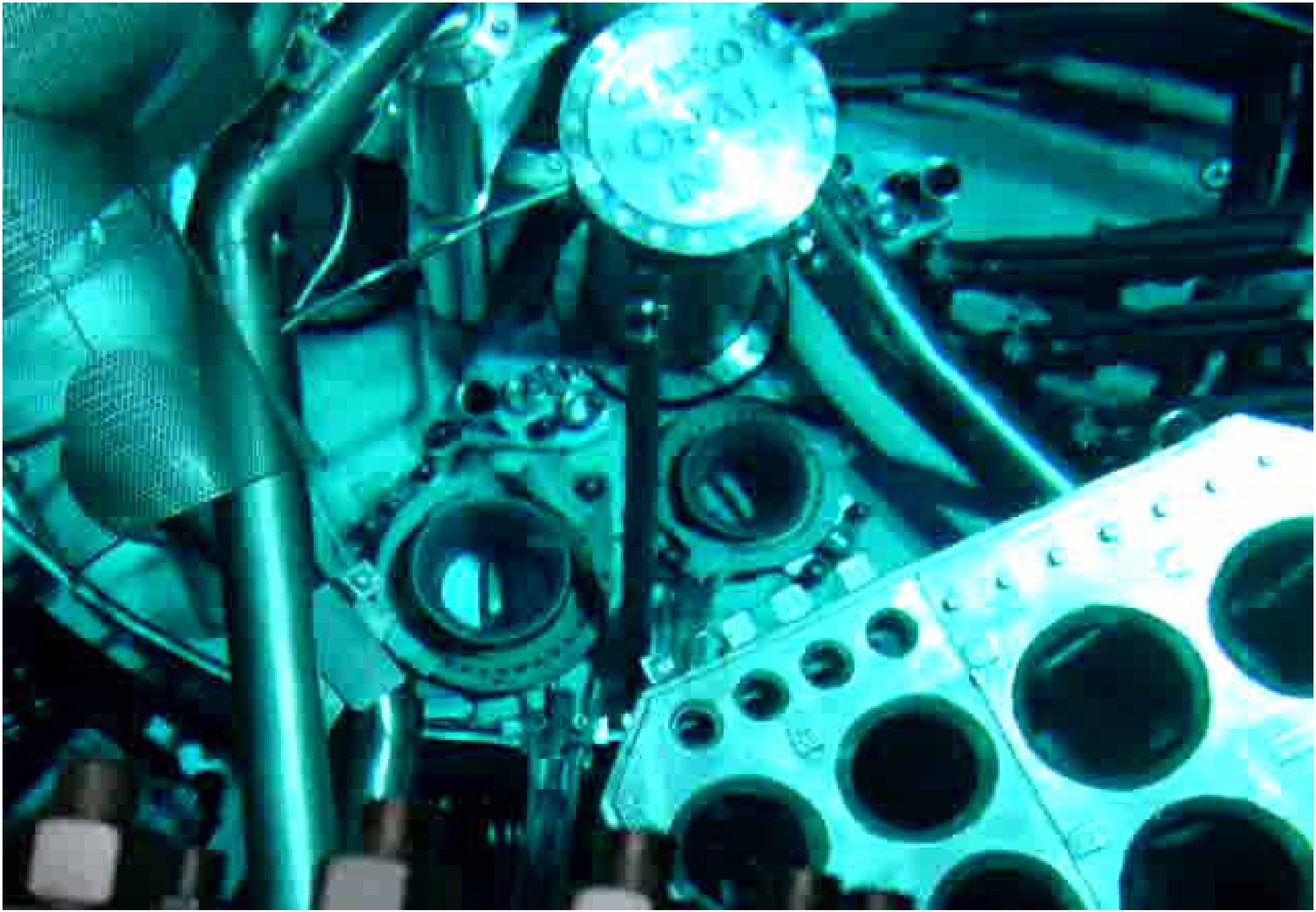
OPAL Silicon NTD



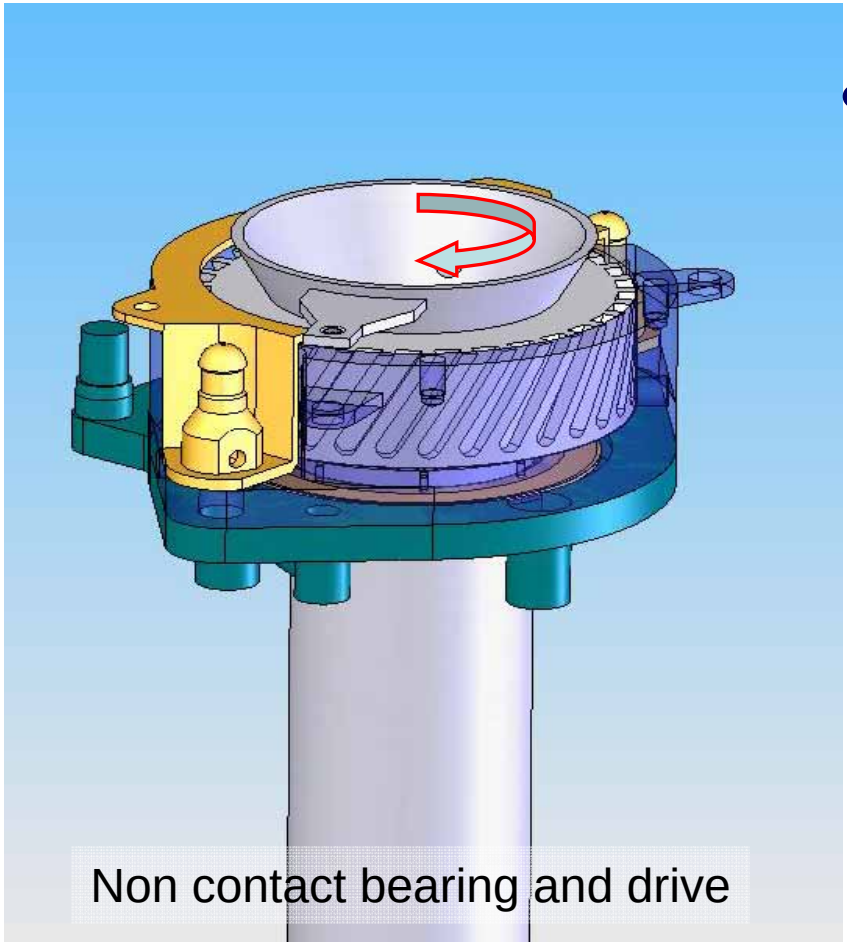
Design Description



Hydraulic Silicon Irradiation Rig



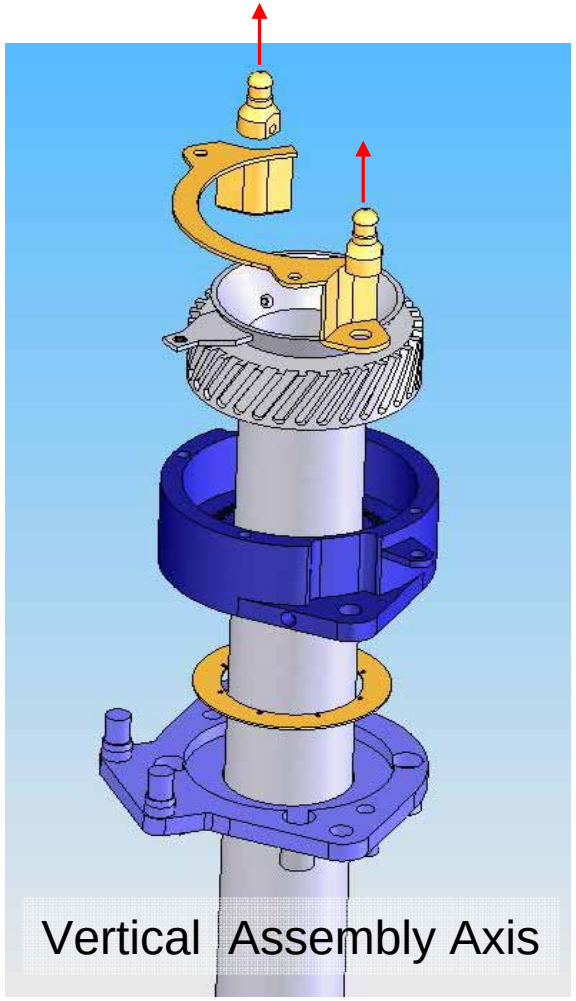
Ease of Maintenance


Non contact bearing and drive

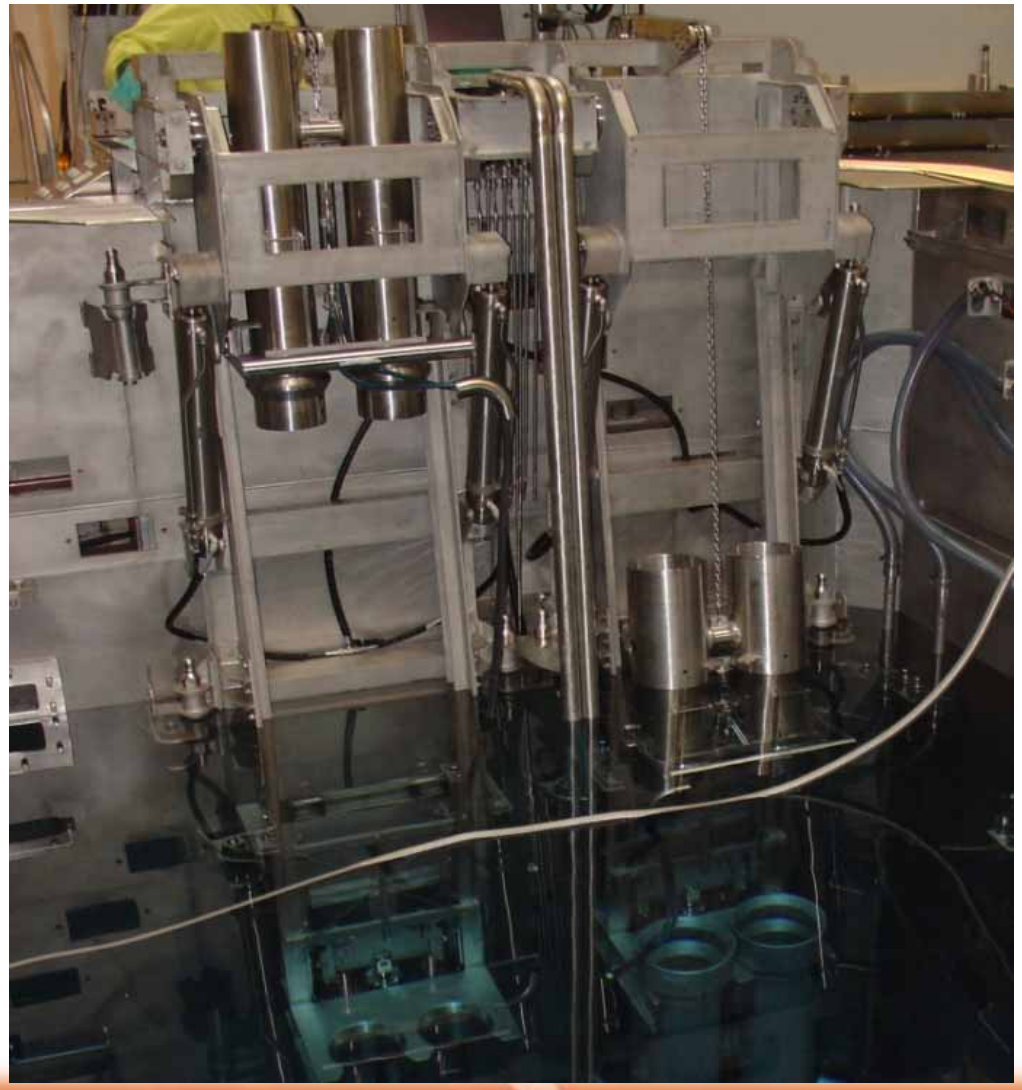
- No moving parts except the rig canister and the pool water.
  - When running there is no physical contact between static and moving components.
    - Therefore no wear.

Ease of Maintenance

- Rig can be removed from operations bridge.
- High maintenance components are removed from pool to easily accessible plant rooms.
  - ➢Pumps, valves, seals and bearings are accessible.
  - ➢Pump bank allows servicing while all rigs running.

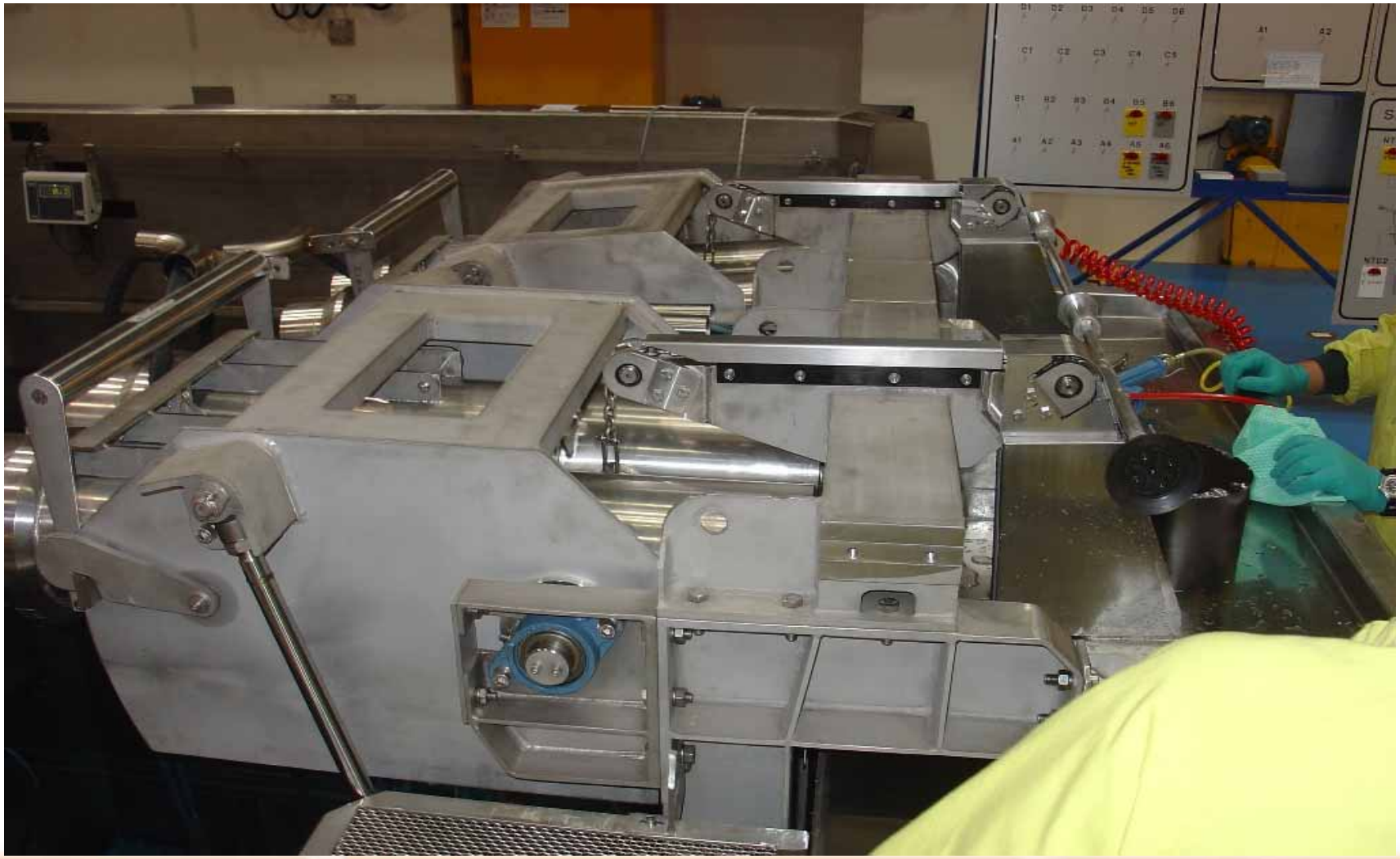


Ingot Handling System



- Loading station:
  - Transfers silicon between operators and activated canisters.
  - Mechanical interlocks remove the need for electronic control.

Ingot Handling System



Ingot Handling System

- Dedicated lifting tool for movement of canisters in the pool.
  - Features guard against accidental load release.
  - Radiation resistant operation.
  - Maintainable.

Conclusion

- A simple and reliable soluti for NTD Silicon processing
- Increased reliability and availability.
- A production solution to me market demand.