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WP15, D15.8:

UPGRADES TO THE BIRMINGHAM SCANNING SYSTEM IN 2017-2018.

Contributions from USFD:

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Richard French, Hector Marin-Reyes, Ben Kitchener, Gabriel Kapellmann, Alice Cryer, Kieren Howarth, Sam Edwards,

Enagelous Kourlitis

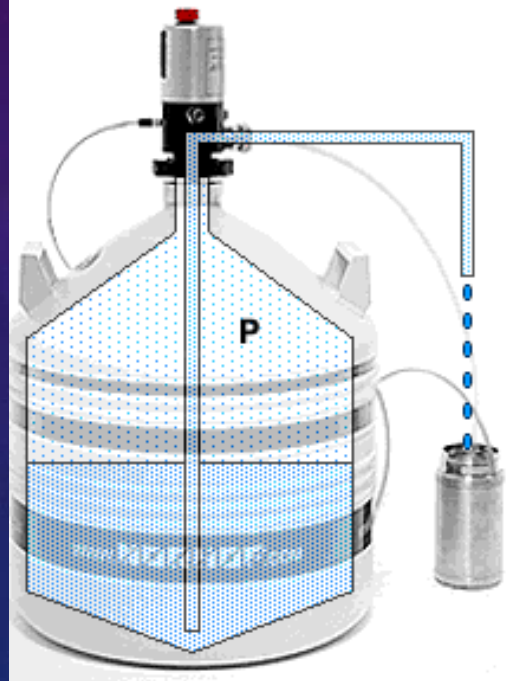
The University Of Sheffield.

AIDA 2020

Development work Following on from the original 2014-2017 prototype LN2 cooled thermal box.

- This box was a originally prototyped to use the Norhof N2, 900 series micro-dosing system.
- This allows the operator to very carefully control the dose rate of liquid N2 into the box to keep a constant temperature.
- Obviously the cooling medium, LN2 can achieve temperatures well below the standard -25deg C, obtained by glycol /radiator cooling methods.
- We put a minimum limit of -60deg C of cooling on this box, below that the insulating foam box carcass was not stable.
- We placed a PTFE tray complete with heatsink to capture/diffuse the LN2 and to prevent direct contact with the Styrofoam LBX material.

NORHOF N2 MICRO-DOSING SYSTEM 900 SERIES.



Working principle

The pressure above the liquid level inside the dewar is built by heating a small amount of liquid in the bottom of the dewar.
With only up to 100 mBar of overpressure, the liquid will gentle rise out of the rise pipe and fall into the fill hose.
The pressure above the liquid level is carefully controlled and therefor the flow.

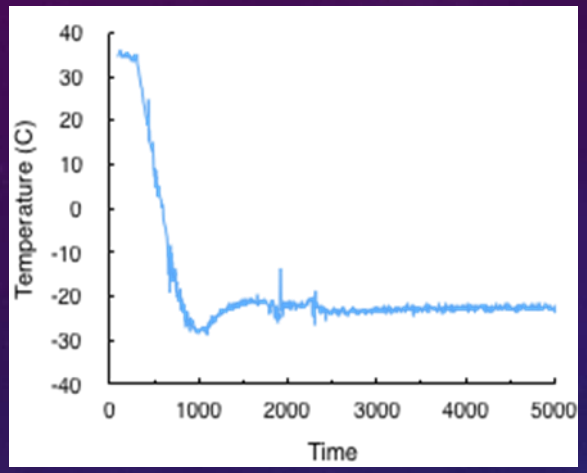
Because we evaporate some LN2 to build pressure, there is no adding of ice inside the dewar, such as with manual systems which use air from the environment.

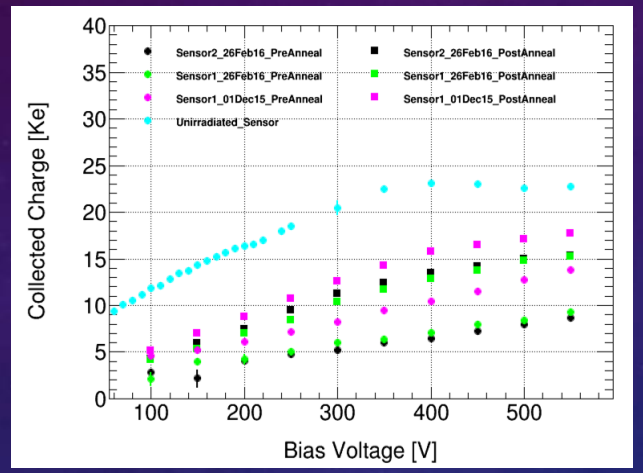
In the Norhof LN2 cooling systems Liquid Nitrogen is stored in pressure less Dewars. When LN2 is required, a small overpressure is generated by a small heater element in the LN2, and liquid flows out of the system like water from a tap, without spilling, noise, vibrations etc.

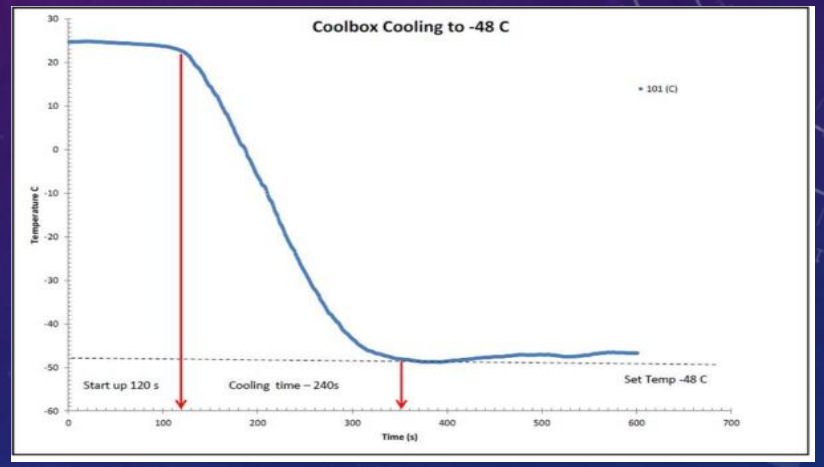
NORHOF
www.norhof.com
see for complete information our website
Microdosing of LN2, our #900 series systems
Pressureless dosing of Liquid Nitrogen

Norhof
Binnenweg 40
3604AD Maarssen
the Netherlands
tel (00-31)-(0)-346-575058

LN2 COOLING & SENSOR CCE



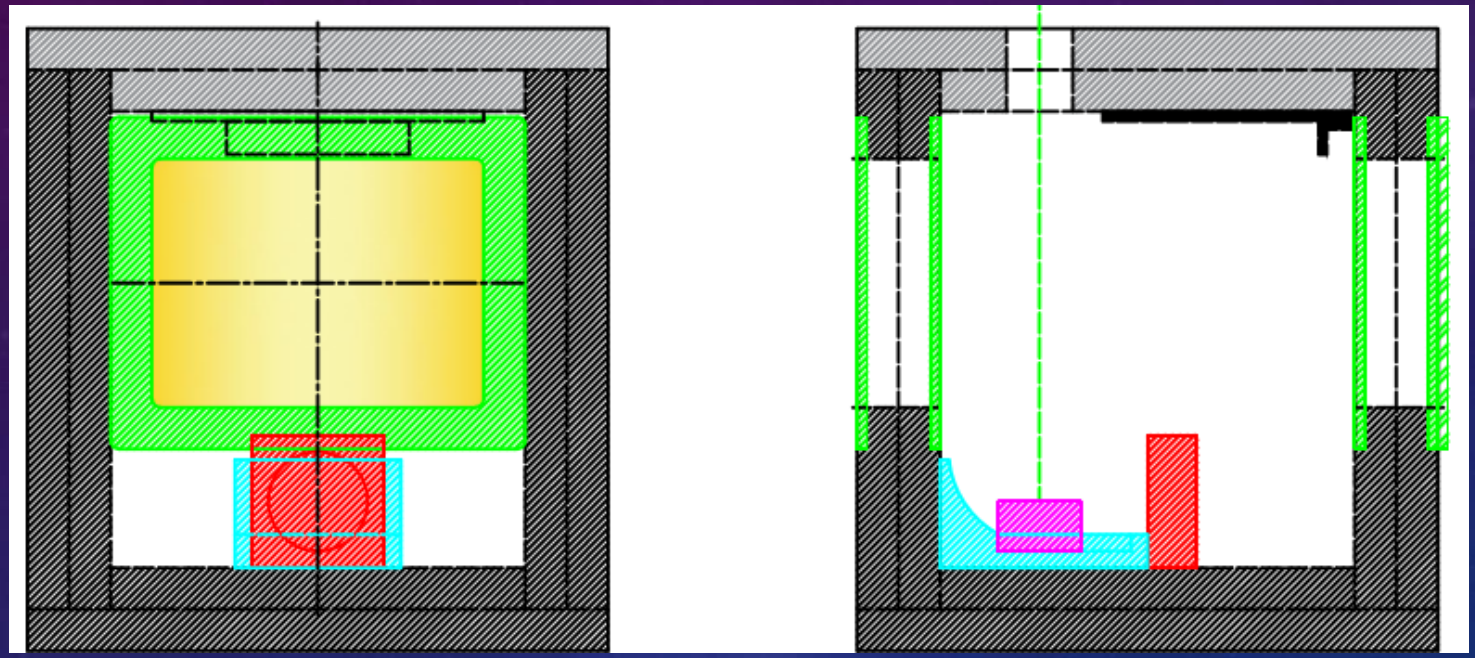




Success measured as the CCE in sensors now matches other AIDA 2020 irradiation facilities (Feb 2016)

Temperature within the thermal chamber when cooled, operates uniformly at -25°C

NEW DESIGN LN2 BOX….
CURRENTLY UNDER CONSTRUCTION IN SHEFFIELD.



- Increased window size for greater scanning ability (new).
- Smaller overall box dimensions for system stability. Now only 355mm2 (new).
- New improved support (Z) pillar for better movement control (new).
- Reduced fan and heatsink size proportional to box, reduction of heat-load from fan (new).
- Size of sample mount area increased relative to new window size (as per 2017 report)

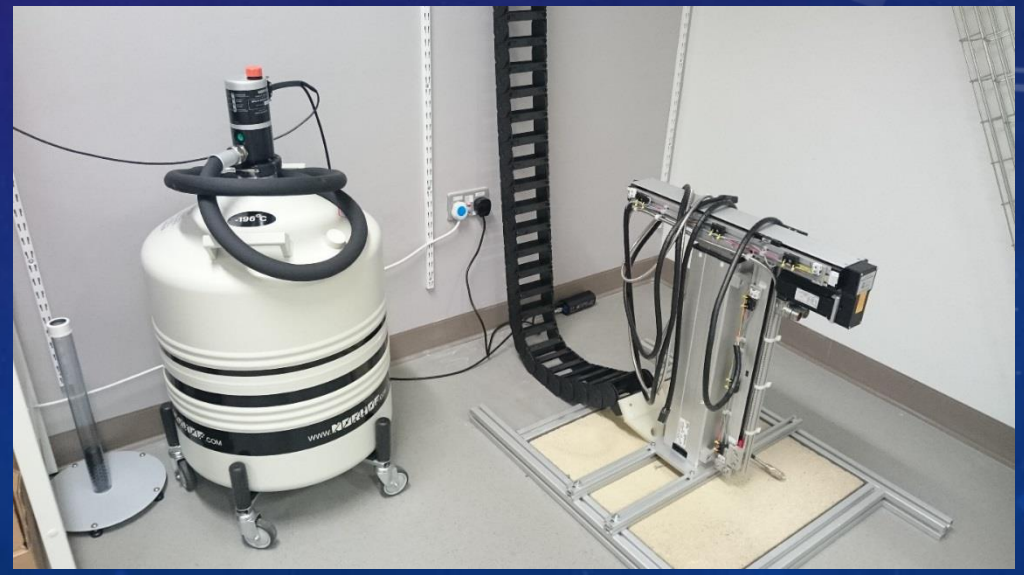
DUPLICATE R&D SYSTEM IN SHEFFIELD

To test and implement upgrades to the scanning system and software, a second scanning system and LN2 cooling unit is undergoing installation in Sheffield Robotics. Sited in the 300m^2 Robotics Foundry in the new purpose built 7 story, 5355m^2 Pam Liversidge Building for “Interdisciplinary Research”.

This 2nd system is used for:

- Remote troubleshooting of the system in Birmingham
- Testing of software to improve user instructions
- Student teaching
- Staff training (software, engineering & users)
- Continued upgrades to the prototype system.

Have provided considerable staff training to Birmingham University staff on system software development.



REVISION OF LIFTING PILLAR

- The SKF lifting pillar (taken from previous AIDA FP7 design) over time, has become a source of operational problems at Birmingham.

- The desired speed of operation (frequency) has exceeded the duty cycle of the motor within the pillar.
- A new lifting pillar housing has been procured.
- A high capacity stepper motor has been procured.

The assembly of the new custom made lifting pillar is now completed with a modified pillar housing to accept the new motor made in Sheffield.

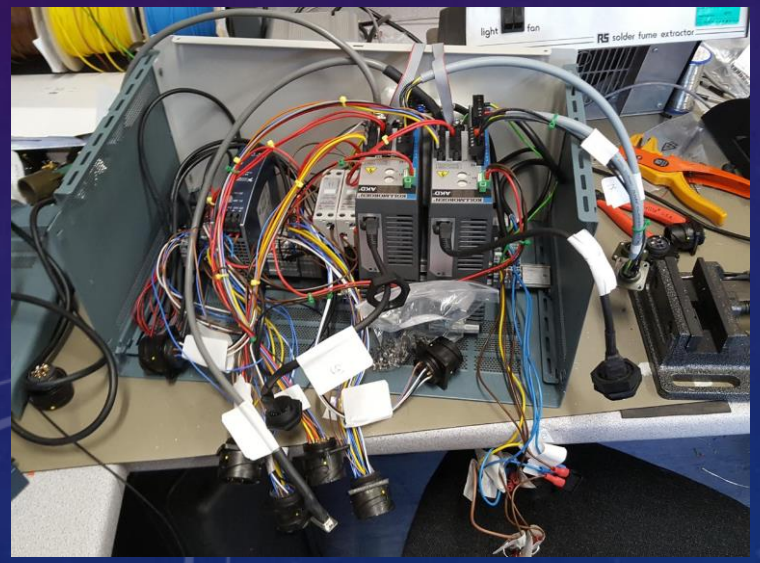
SKF DATASHEET

Technical data		Unit	THC 8AWAS
Push load		N	1 800
Pull load		N	1 800
Max. bending load		Nm	up to 250*
Speed (full load to no load)	120 V AC	mm/s	15 to 20
	230 V AC	mm/s	12 to 17
Telescopic pillar version		# of section	2-section
Stroke		mm	200 to 700
Retracted length		mm	S+155
Voltage		V AC	120 or 230
Power	120 V AC	W	750
	230 V AC	W	500
Current	120 V AC	A	6
	230 V AC	A	2,2
Duty cycle: intermittent operation	120 V AC	min.	0,7 min./30 min.
	230 V AC	min.	1 min./27 min.
Duty cycle: short-time operation	120 V AC	min.	1
	230 V AC	min.	2
Ambient temperature		°C	+10 to +40
Type of protection		IP	20/30
Protection class		–	I
Type of control		–	electrical
Weight		kg	7,9 to 13,5

REVISION OF LIFTING PILLAR

- The original SKF pillar was the most compact COTS telescopic lifting pillar.
  - Low duty cycle; Terrible positional accuracy; Required significant customisation to work effectively

- The NEW UoS lifting pillar is not as compact
  - New cold box designed to incorporate extra height of pillar
  - Motor control is simplified with internal encoders.
  - Requires complete redesign of control “boxes” and wiring.
- Promising bench test results, now installing at Birmingham during February 2018. Sheffield installation will be during the late summer period of 2018.



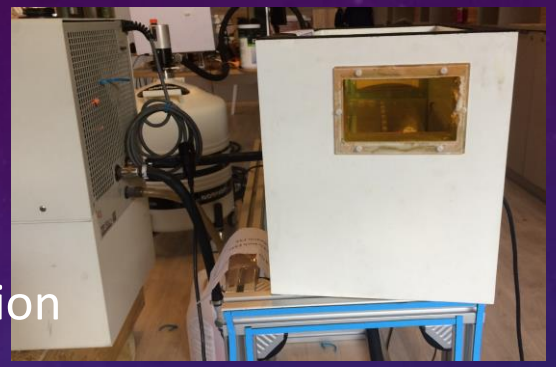
INDUSTRIAL IRRADIATION

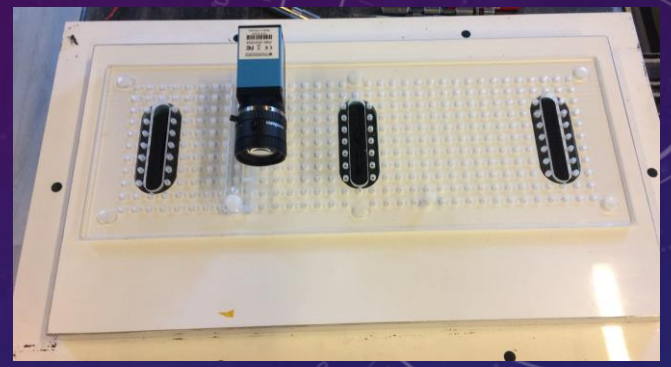
- Purpose - to determine operational capability of robotic and vision system in highly radioactive environments.
- Dual purpose motivation
  - ATLAS Inner Detector Decommissioning (Potential Hot I.D)
  - Aid Nuclear Decommissioning studies (Chernobyl & Doonreay).
- Irradiation conducted over 3 days
  - Set up > irradiation > cool down > new set up > irradiation > cool down
- Entire R&D started and completed in December 2017.
- Data for results - still under analysis in 2018.
  - Target is to make 3x research journal

INDUSTRIAL IRRADIATION

CAMERA IRRADIATION

- ❑ Imaging Source CMOS Camera (GigE)
- ❑ Capture of one image per second during the irradiation
- ❑ Monitor of pixel degradation
- ❑ Kept at 10°C using a glycol chiller

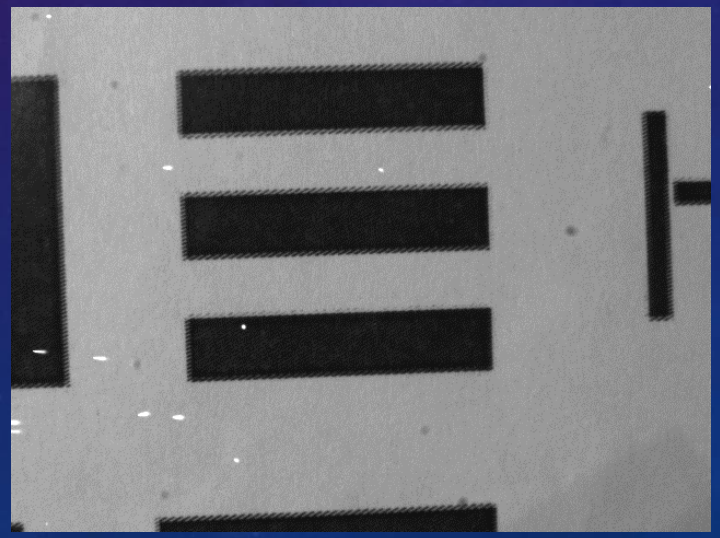




Camera set up in previous AIDA FP7 “Glycol” cold box to avoid fogging of optics from LN2 boil off. Aligned and focussed on optical target shown bottom left

Image before irradiation

Image after irradiation

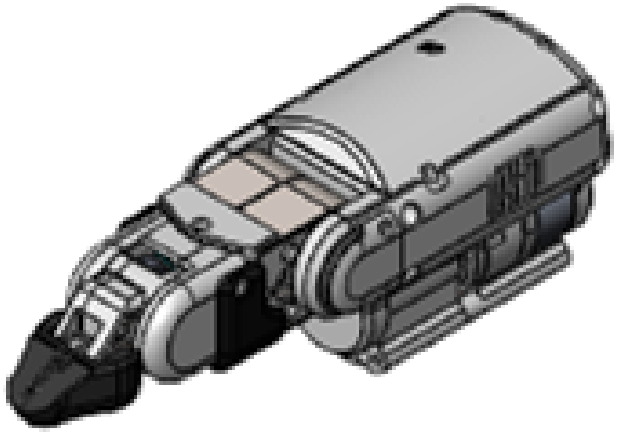


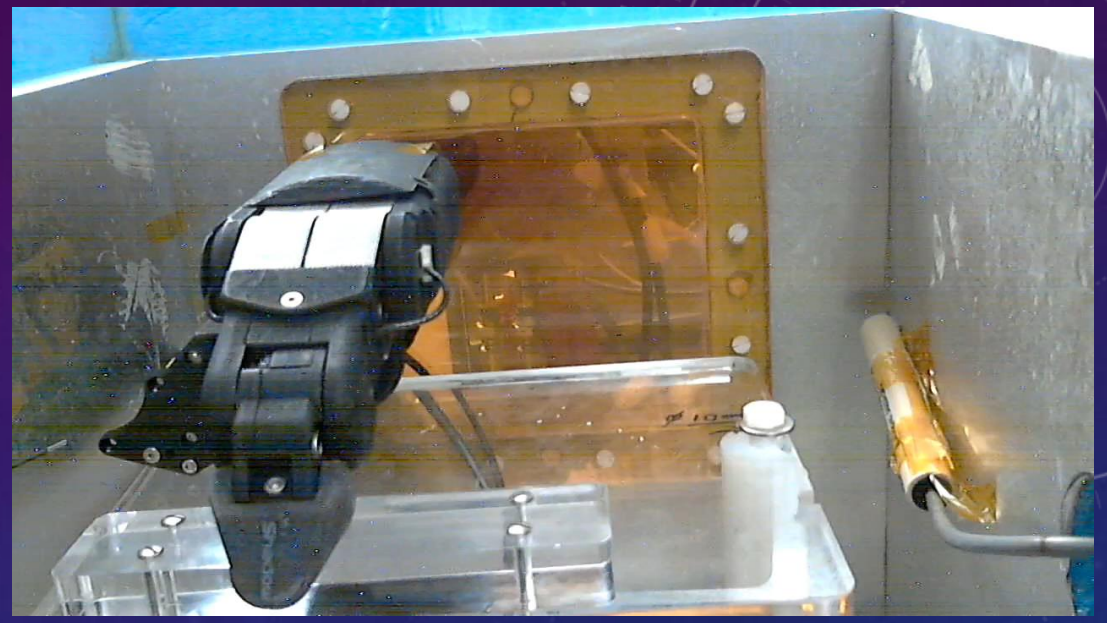
Scrapheap challenge

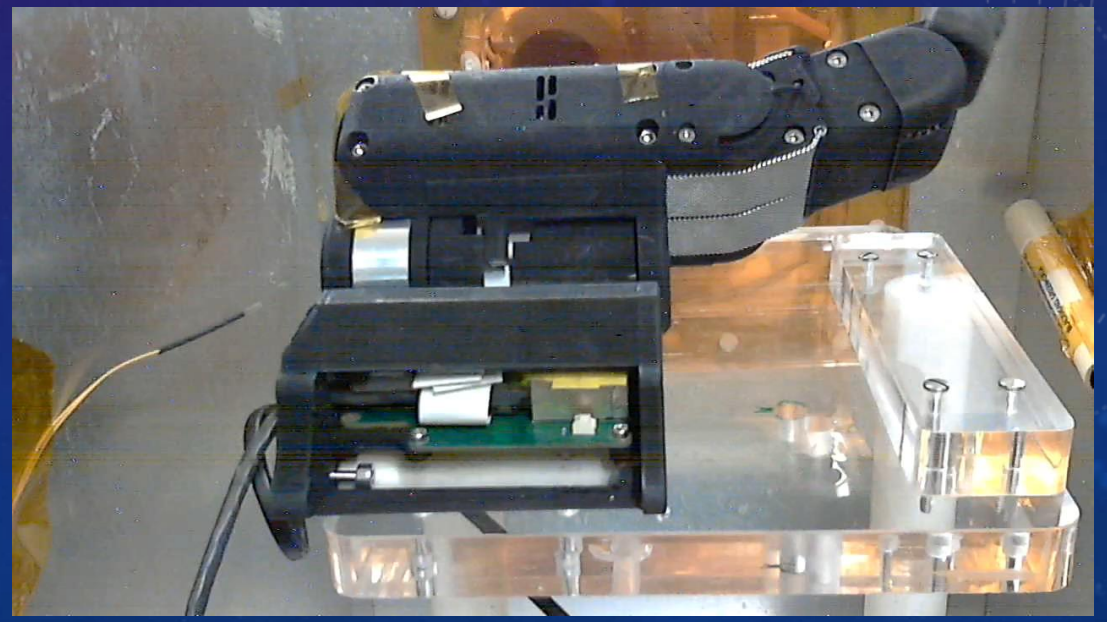
INDUSTRIAL IRRADIATION

ROBOT GRIPPER IRRADIATION

- ❑ Shadow Robot finger
- ❑ Finger moves within a static beam
- ❑ Monitor via webcam
- ❑ Two orientations







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- Phil Allport, Laura Gonnella, Tony Price
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