US NAVY RADIAC STANDARDS

Keith D. Turner, P. E.

NMCLANT Code 233

US NAVY RADIAC STANDARDS

US NAVY RADIAC STANDARDS

- Navy RADIAC Standards Mission
- Definitions
- Gamma Standards
- Alpha Standards
- Beta Standards
- Neutron Standards
- New Technology
- US Navy RADIAC Standards Work

US NAVY RADIAC STANDARDS

US Navy RADIAC Standards Mission

“Provide safe, reliable and accurate RADIAC Calibrators with NIST traceable data to the RADIAC Calibrations Laboratories.”

US NAVY RADIAC STANDARDS

Who do we serve?

US Navy's 7 RADIAC Calibration Laboratories (RCLs)

PEJ	S/N
AN/UDM-10	A-689
AN/UDM-12	A11
AN/UDM-13	Be15
AN/UDM-13	Be10
AN/UDM-1B	7

PSJ	S/N
AN/UDM-10	A-776
AN/UDM-12	A15
AN/UDM-13	Be5
AN/UDM-1B	2
AN/UDM-1B	6

SDJ	S/N
AN/UDM-10	A-700
AN/UDM-12	A22
AN/UDM-13	Be12
AN/UDM-1B	5
AN/UDM-1B	22
TS-1216C/UD	C4

NLJ	S/N
AN/UDM-10	A-688
AN/UDM-12	A7
AN/UDM-13	Be4
AN/UDM-1B	25

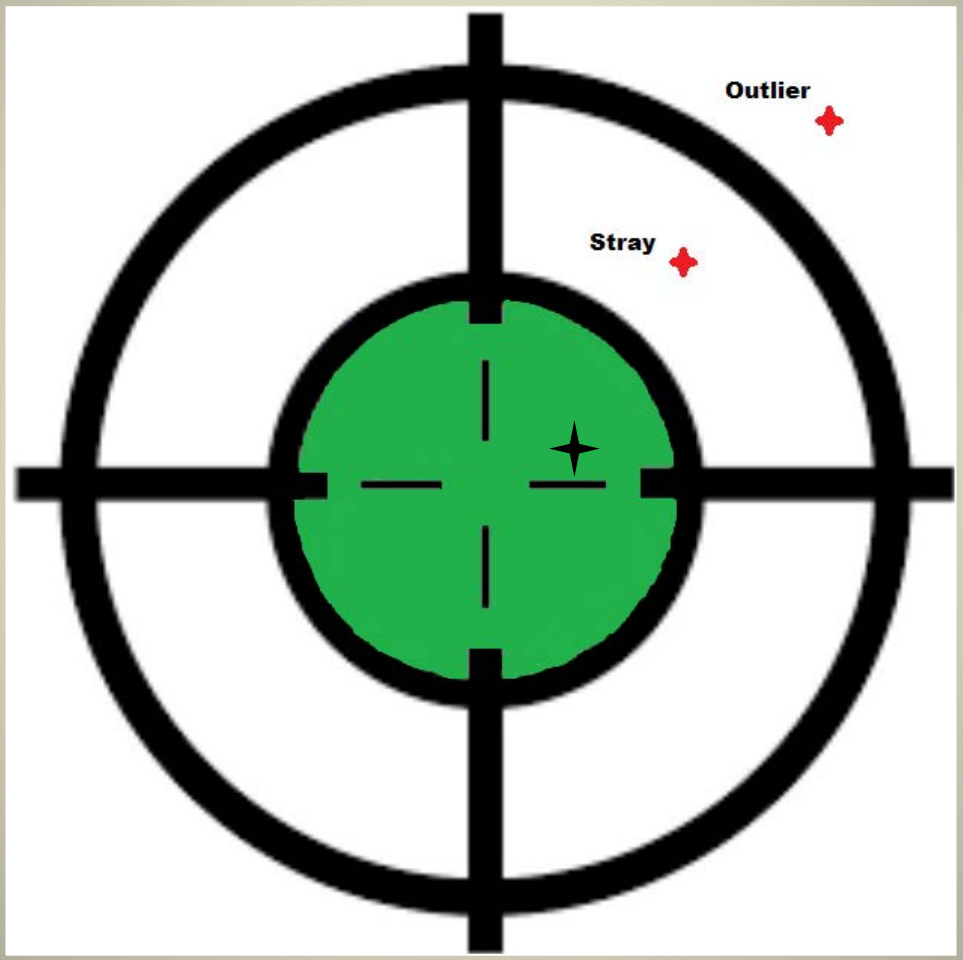
WAJ	S/N
AN/UDM-10	A-722
AN/UDM-12	A5
AN/UDM-12	A6
AN/UDM-13	Be3
AN/UDM-13	Be8
AN/UDM-1B	1
AN/UDM-1B	23
TS-1216B/UD	C5/M

MAJ	S/N
AN/UDM-10	A-713
AN/UDM-12	A9
AN/UDM-12	A10
AN/UDM-13	Be6
AN/UDM-1B	21
AN/UDM-1B	24
TS-1216B/UD	C2

NOJ	S/N
AN/UDM-10	A-717
MX-9335/UDM	M-588
AN/UDM-12	A4
AN/UDM-13	Be9
AN/UDM-1B	4
TS-1216B/UD	C3NOR

US NAVY RADIAC STANDARDS

Goal



normal range of expected results

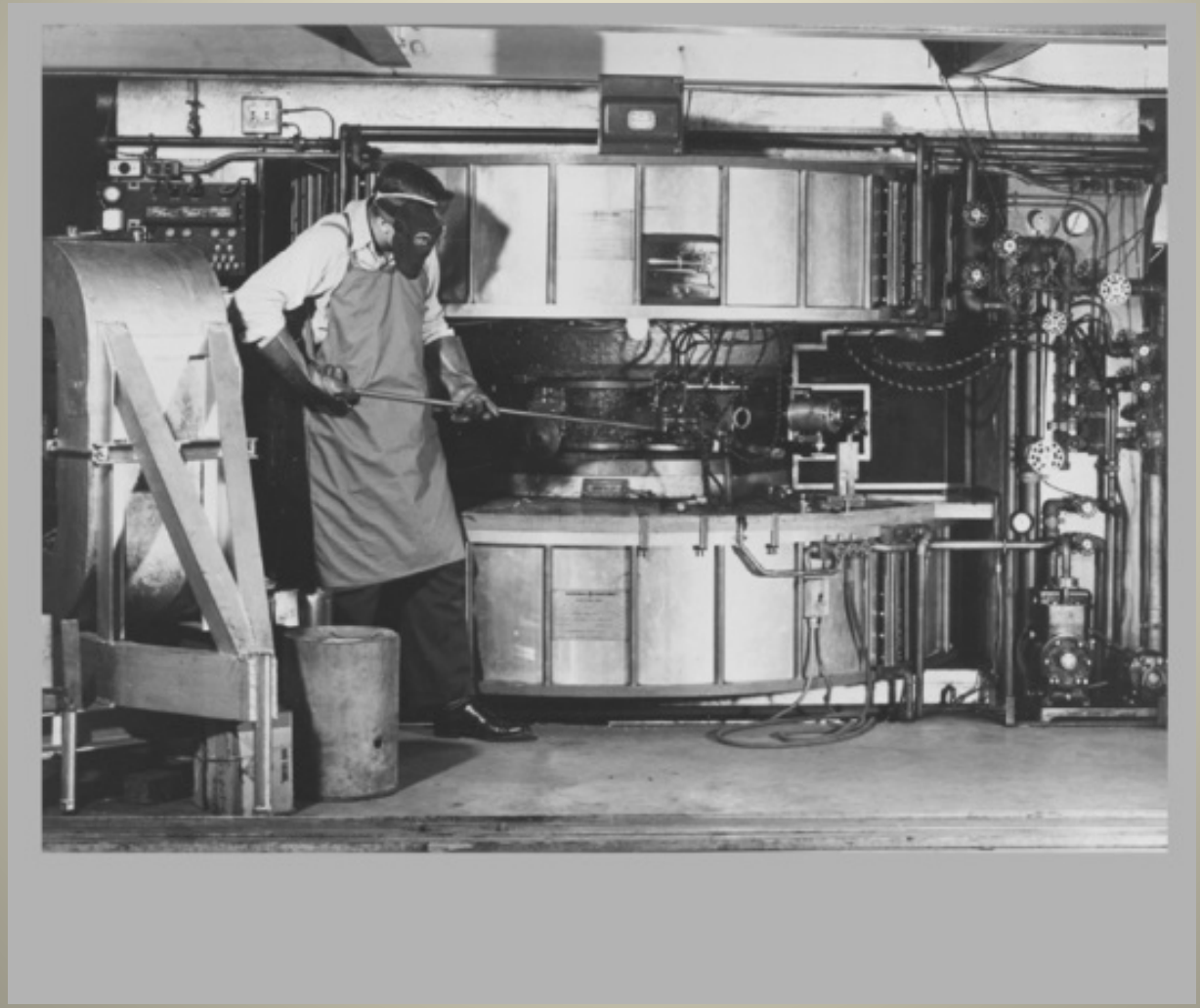
US NAVY RADIAC STANDARDS

Definitions

- Calibration – A quantitative comparison between a known standard and an instrument under test in order to determine how accurately the test instrument is performing.
- Characterization – Process of obtaining data from a radiation calibration standard and using that data to develop a mathematical model.
- Mathematical Model - A "*Mathematical Model*" attempts to copy how a real-world thing behaves utilizing an equation.
- Outlier – An out-of-tolerance data point that lies an abnormal distance from the normal range of expected results.
- Pre/Post Checks – Performed on Transfer Standard probes to validate data taken in the field.
- Stray – An out-of-tolerance data point that is found between an outlier and the normal range of expected results.
- Tolerance – The permissible variation of a piece or set of data.
- Verification – The act or process of confirming or checking the accuracy of something. In RADIAC it means making sure that a radioactive source (calibrator) is performing within the normal range of expected results as it decays. Finding out if the source is decaying or "behaving" as expected.

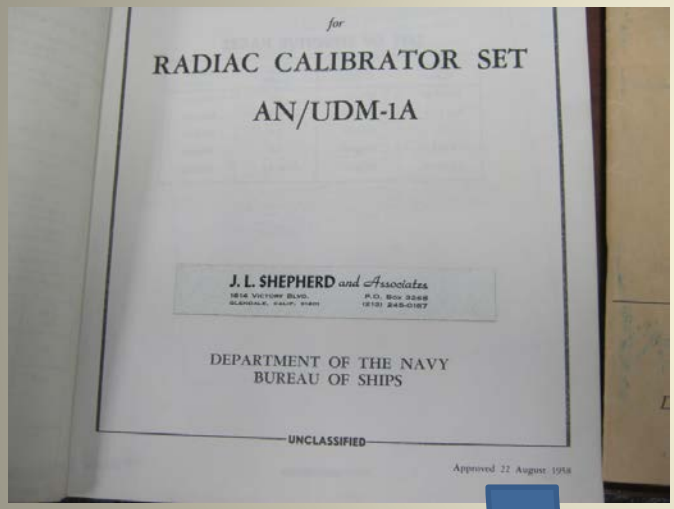
US NAVY RADIAC STANDARDS

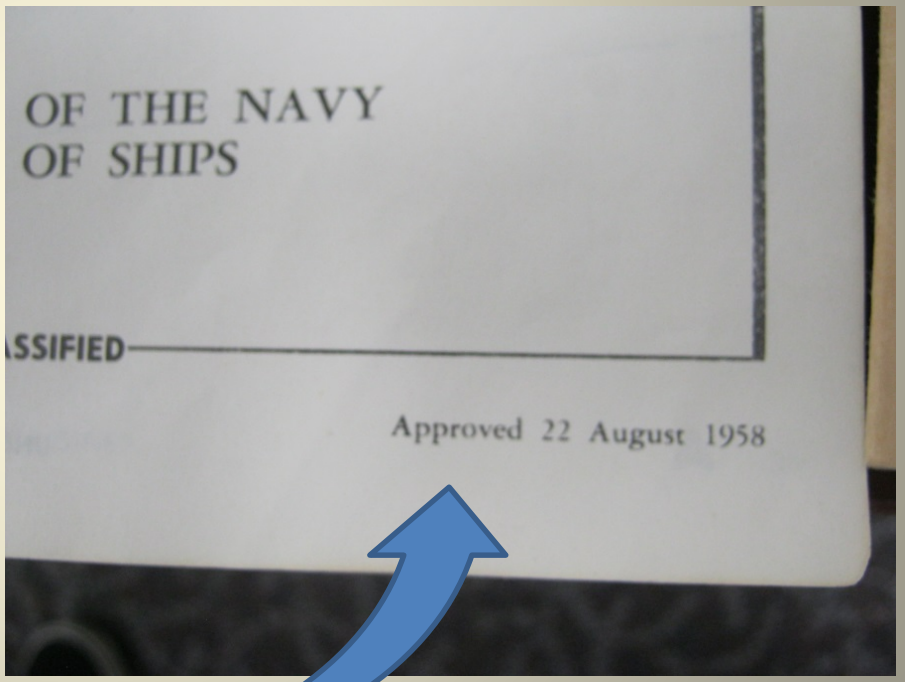
Gamma Calibration History



US NAVY RADIAC STANDARDS

AN/UDM-1A History





US NAVY RADIAC STANDARDS

AN/UDM-1A History

- Late 1950s first used
- Very simple mechanical design
- Decent sized source
- Parts wore out over years

US NAVY RADIAC STANDARDS

AN/UDM-1A History

- Parts became obsolete

(Keyway)

(Circular Collimator)

- Final AN/UDM-1A removed from US Navy service in November 2015

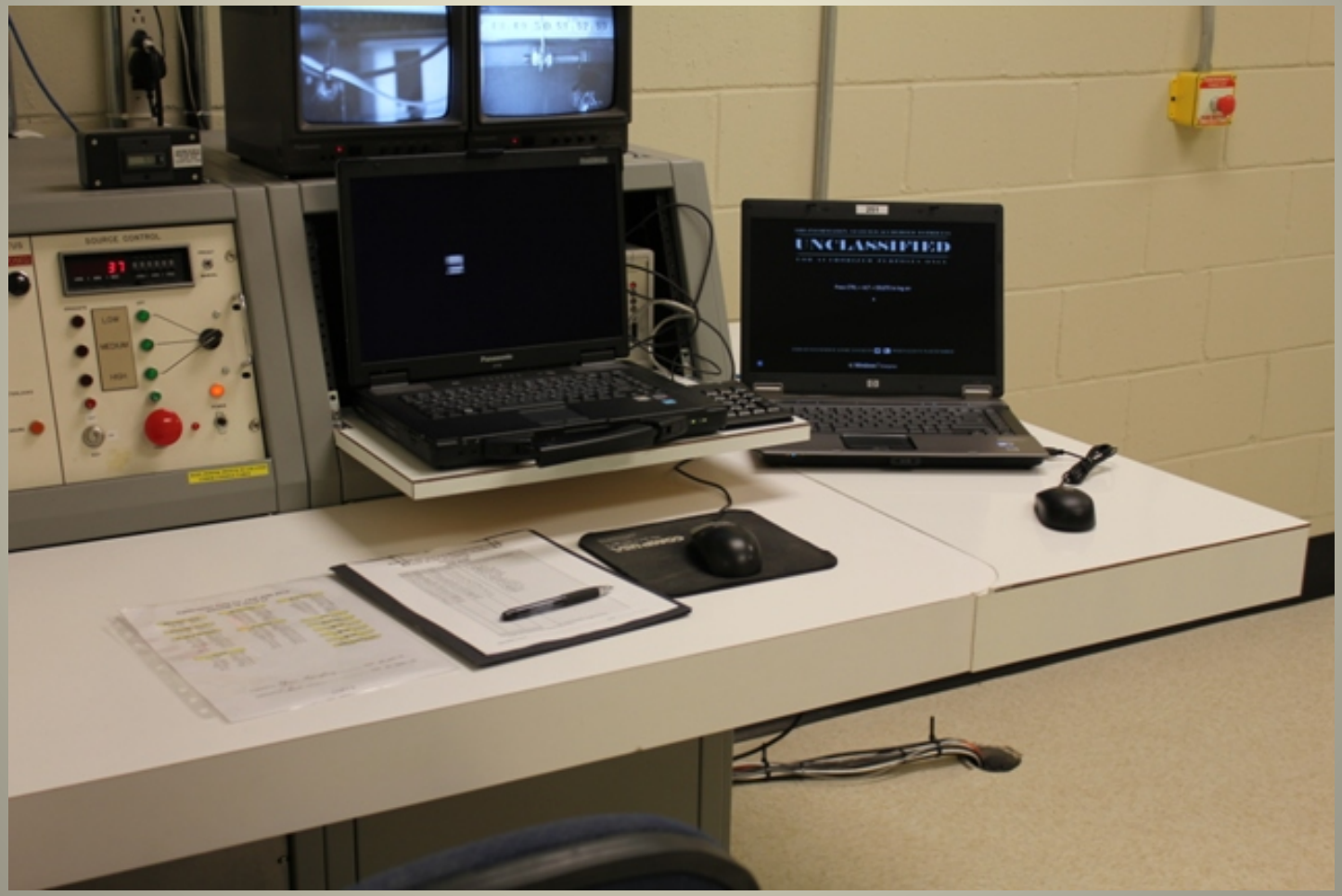
US NAVY RADIAC STANDARDS

AN/UDM-1B History

- Mid 1990s first used
- JL Shepherd & Associates
- 12 fielded units
- 1 Mockup unit

US NAVY RADIAC STANDARDS

AN/UDM-1B Console at Mayport RCL



US NAVY RADIAC STANDARDS

AN/UDM-1B Controls

US NAVY RADIAC STANDARDS

AN/UDM-1B Mock Up

US NAVY RADIAC STANDARDS

AN/UDM-1B Mock Up

US NAVY RADIAC STANDARDS

AN/UDM-1B GAMMA CALIBRATOR VERIFICATIONS

- Same equipment/processes as used in characterizations with fewer test points. A4 through A8 ionization chambers with electrometer and HVPS.
- 3 year periodicity and +/- 5% is the allowable tolerance.
- RADIAC Calibration Laboratories are issued a new letter once data has been verified as acceptable by Navy RADIAC Standards Engineers.

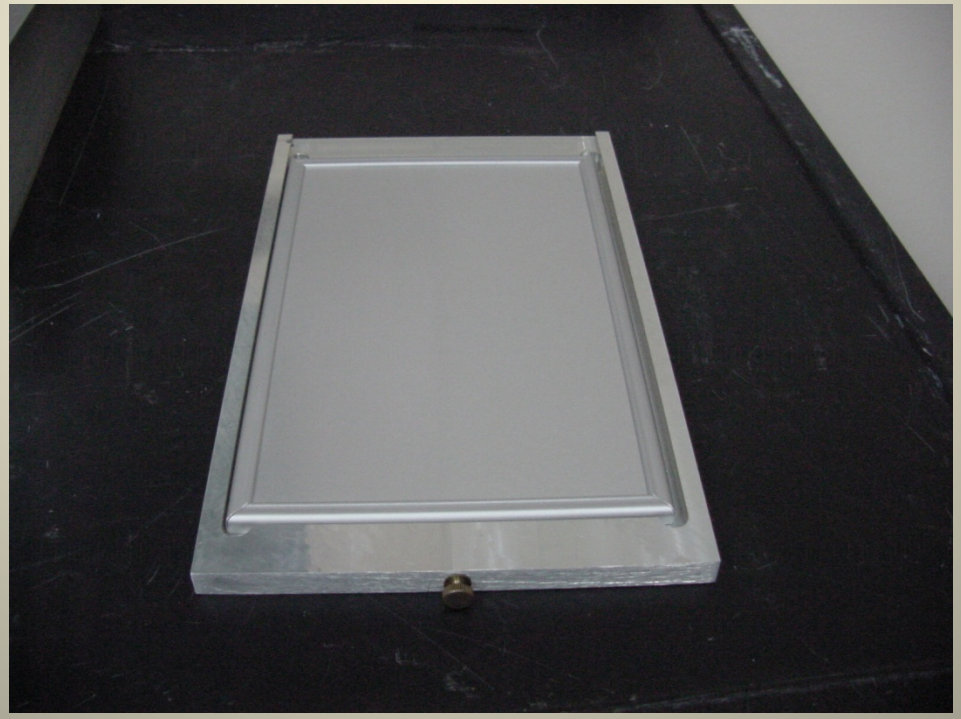
US NAVY RADIAC STANDARDS

AN/UDM-12 ALPHA CALIBRATOR

US NAVY RADIAC STANDARDS

AN/UDM-12 ALPHA CALIBRATOR

- Used to calibrate DT-681 and ADM-300 (AP-100) Alpha Probes
- Pu238 (Amersham PP-100 trays)
- 5 Trays/Ranges
  - 0.0012 Ci
  - 0.012 Ci
  - 0.12 Ci
  - 1.2 Ci
  - 12 Ci



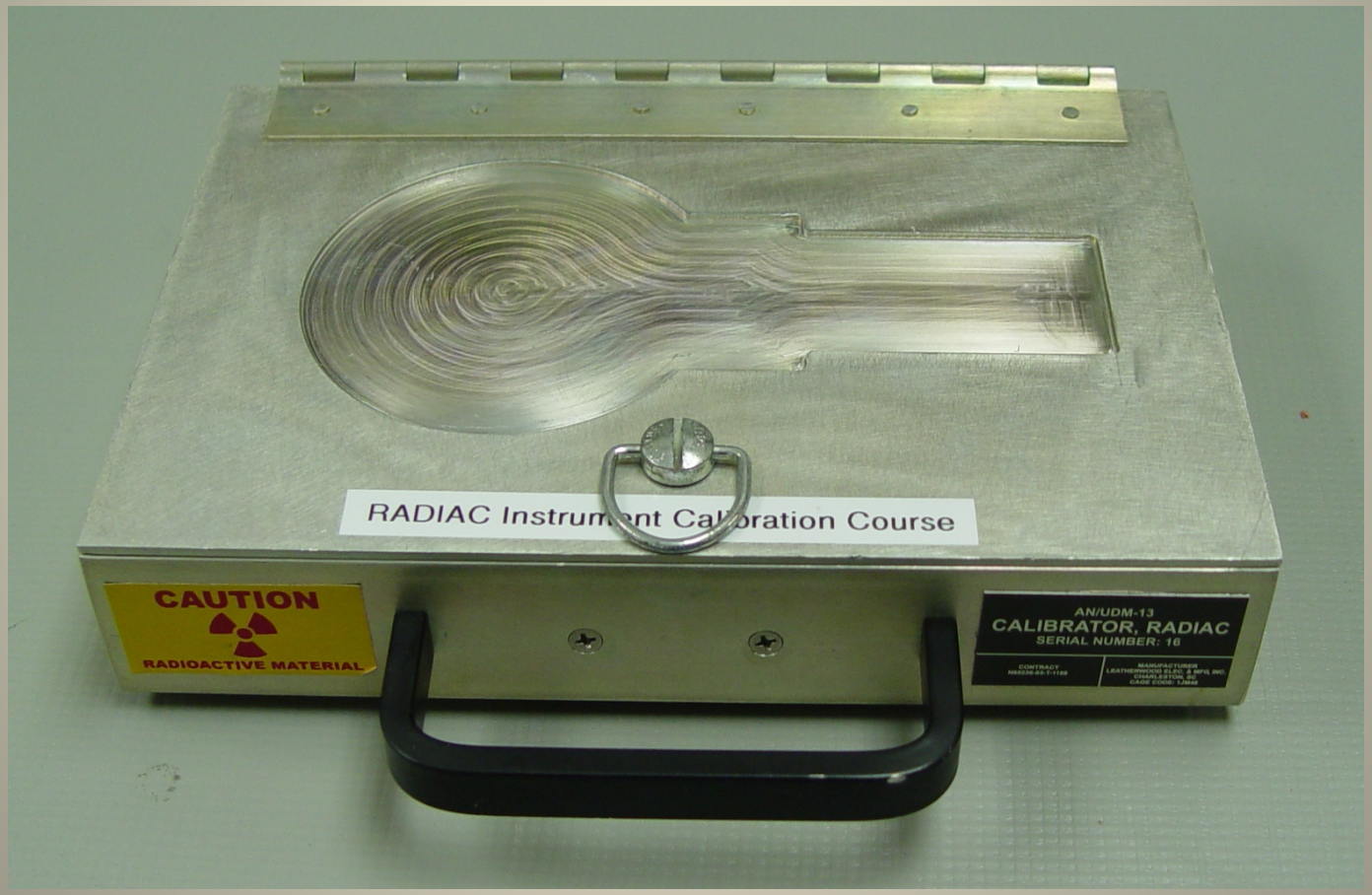
US NAVY RADIAC STANDARDS

AN/UDM-12 ALPHA CALIBRATOR

- Verified using three DT-681 Transfer Standard Alpha Probes
- Transfer Standard Probes are pre and post checked against the Navy AN/UDM-12 Alpha Standard.
- 3 year periodicity and +/- 5% is the allowable tolerance.
- RADIAC Calibration Laboratories are issued a new letter once data has been verified as acceptable by Navy RADIAC Standards Engineers.

US NAVY RADIAC STANDARDS

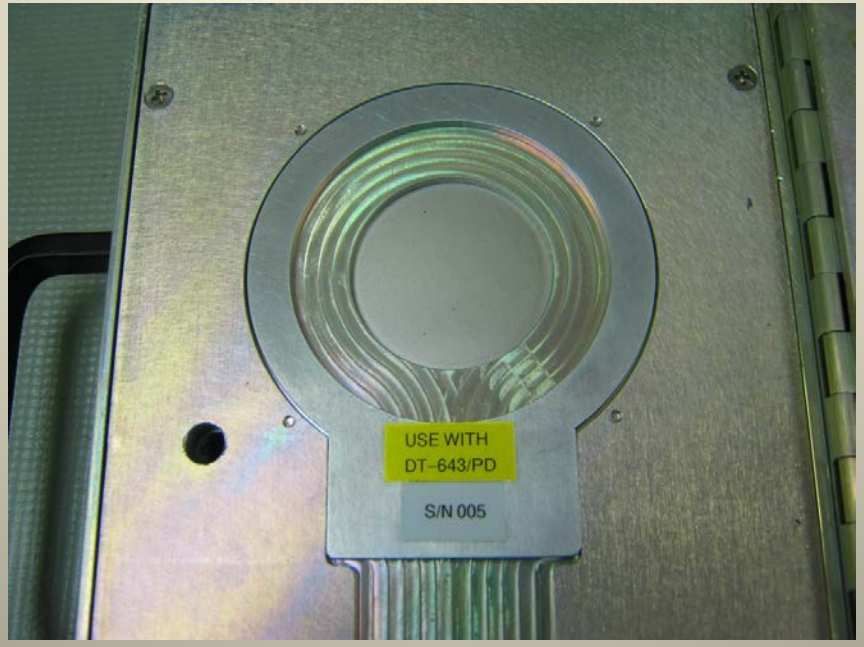
AN/UDM-13 BETA CALIBRATOR



US NAVY RADIAC STANDARDS

AN/UDM-13 BETA CALIBRATOR

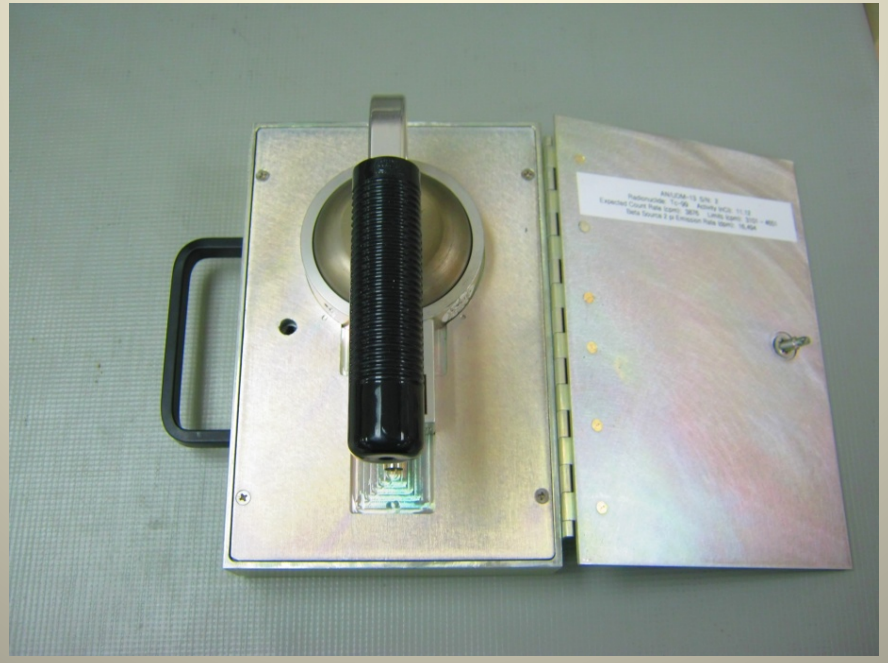
- Used to calibrate DT-304, DT-643 and ADM-300 Beta Probes (BP-100)
- Tc99 (approximately 10 nanoCuries), exempt quantity + long half-life!
- Single source/energy range
- 11,000 – 13,000 dpm (approximate)



US NAVY RADIAC STANDARDS

AN/UDM-13 BETA CALIBRATOR

- Characterized using three DT-304 Transfer Standard Beta Probes (3)
- Transfer Standard Probes are pre and post checked against the Navy AN/UDM-13 Beta Standard.
- 3 year periodicity and new dpm/cpm data is issued each time the calibrator is characterized.



US NAVY RADIAC STANDARDS

AN/UDM-10 NEUTRON CALIBRATOR


100 MCI
A708

US NAVY RADIAC STANDARDS

AN/UDM-10 NEUTRON CALIBRATOR

- Used to calibrate AN/PDR-70s only. (SNOOPY)
- 100 milliCurie Ambe source
- Hi Range approximately 11 - 13 mR/hr
- Low Range approximately 1 – 3 mR/hr

US NAVY RADIAC STANDARDS

AN/UDM-10 NEUTRON CALIBRATOR

- Calibrated using AN/PDR-70 Standard Transfer Neutron Probes (3) and a CP-792D/UD Scalar counter
- 3 year periodicity and +/- 5% is the allowable tolerance.
- RADIAC Calibration Laboratories are issued a new letter once data has been verified as acceptable by Navy RADIAC Standards Engineers.
- AN/PDR-70 Transfer Standards are verified against data obtained from the Navy Neutron Standards

US NAVY RADIAC STANDARDS

OAFNR

US NAVY RADIAC STANDARDS

OAFNR

US NAVY RADIAC STANDARDS

OAFNR

US NAVY RADIAC STANDARDS

OAFNR

US NAVY RADIAC STANDARDS

New Technology

HOPEWELL DESIGNS INC.

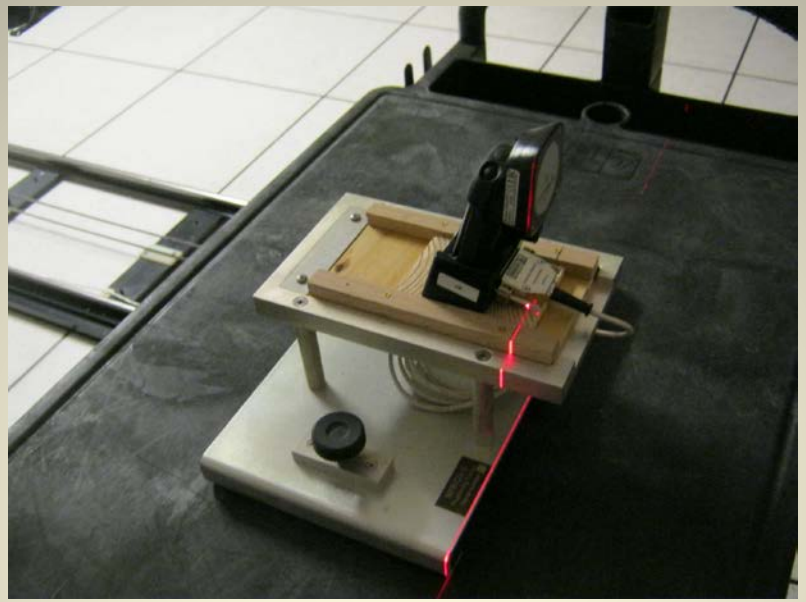
G10 – Gamma Beam Irradiator

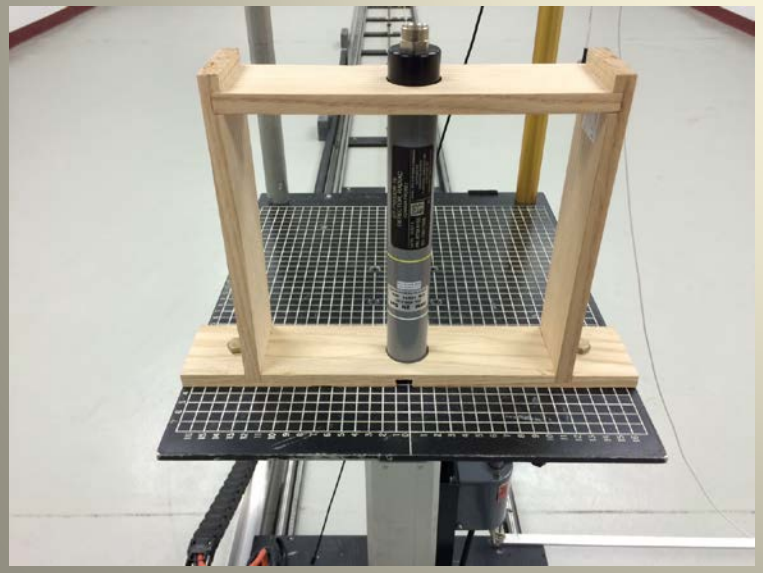
- 1 or 2 sources
- Cs-137 up to 2200 Ci
- Co-60 up to 10 Ci
- 0-8000X attenuator set
- Automated computer control
- (or) Electronic control

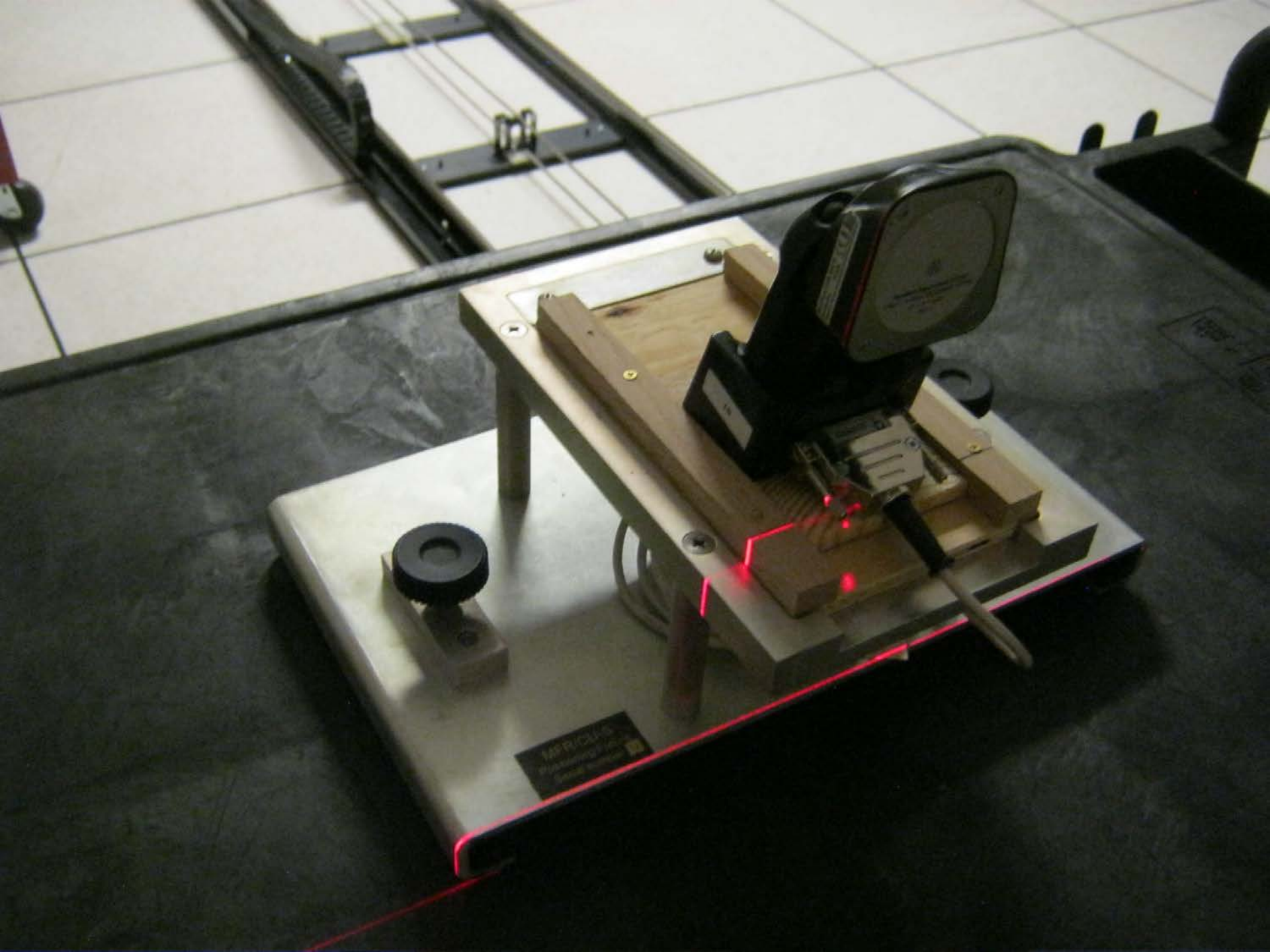
US NAVY RADIAC STANDARDS

Carderock GC60

US Navy RADIAC Standards Work







Thank you and STAY SAFE!