

Characterization of a Well-Type HPGe Detector Using Standards

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ABSTRACT

The characterization of the WELL3 detector, a well-type detector, at Pacific Northwest National Laboratory (PNNL) is an important and necessary capability for performing high-precision, lowintensity radio-isotope measurements. The characterization of the WELL3 detector provided the Advanced Radio-Emission Spectroscopy (ARES) team with another detector to analyze and obtain data for weak radioactive isotopes. A benchmarked calibrated and characterized model of the WELL3 detector was created using the CERN C++ particle simulation framework GEANT4¹ with a PNNL developed utility, the Geant4-Cascade Summing Correction tool². This benchmark was constructed by conducting quantitative intercomparison of the modeled and measured detector response to a National Institute of Standards & Technology (NIST) traceable mixed gamma standard mix 7503 from Eckert & Zeigler and a medical isotope standard of Molybdenum-99 (Mo-99) from the National Physical Laboratory. The mixed gamma standard, NIST traceable measured detection efficiency, was used to optimize the model parameters before conducting an independent validation using the Mo-99 standard. A comparison of peak ratios was performed between the measured and simulated spectra of Mo-99 to analyze the accuracy of the decay cascade summing probabilities predicted by the model. From the counted Mo-99 sample the half-life $(T_{1/2})$ was obtained for each relevant gamma ray energy lines and compared against the Evaluated Nuclear Structure Data Files (ENSDF) available from the National Nuclear Data Center. The analysis of the true-coincidence summing (TCS) corrections of the Mo-99 response from the benchmarked model show large corrections were made to simulate the spectrum from Mo-99 on WELL3. The future work will encompass further optimization of the calibrated detector model on GEANT4 with G4CSC. The current characterization of the WELL3 detector shows promise for the counting of Tb-161, an important nuclide in medical physics. Overall, the characterization of the WELL3 detector at PNNL now provides the ARES team a new capability for the high-efficiency detection of weak samples.

¹ S. Agostinelli *et al.*, "Geant4—a simulation toolkit," *Nuclear Instruments and Methods in Physics Research Section A: Accelerators, Spectrometers, Detectors and Associated Equipment*, vol. 506, no. 3, pp. 250–303, Jul. 2003, doi: 10.1016/S0168-9002(03)01368-8.

² B. Pierson, B. Archambault, A. Hagen, and C. Soren, "G4CSC." Accessed: Nov. 30, 2022. [Online]. Available: https://gitlab.pnnl.gov/ares/g4csc

SUMMARY

Introduction

A well-type high purity germanium (HPGe) detector has the capability to place samples inside the detector. This distinct characteristic results in a high detection efficiency for the activity measurement of gamma ray emissions from the decay scheme of a radioactive sample. This detector is the most sensitive form of the HPGe detector since provides the maximum feasible sensitivity for weak samples of radioactive isotopes. The characterization of the WELL3 detector, a well-type detector, at Pacific Northwest National Laboratory (PNNL) is important to provide the capability of a well-type detector for sample analysis. Overall, the characterization of the WELL3 detector at PNNL provides the Advanced Radio-Emission Spectroscopy (ARES) team with another detector to analyze and obtain data for a wide range of radioactive isotopes.

Experimental Description

A calibration sample was obtained to start the process of the characterization of the WELL3 detector. The calibration sample was then counted on the WELL3 detector. A benchmarked calibrated and characterized model of the WELL3 detector was created using GEANT4[1, p. 4] software. The process was based on creating an optimized detector model using the instrument specifications sheet from the manufacturer and physical measurements taken in the laboratory. With the benchmarked model of the WELL3 detector, Molybdenum-99 (Mo-99) was simulated to produce a spectrum of the detector model response. A single-isotope nuclide gamma standard of Mo-99 was counted on the WELL3 detector over ~40 days to produce 26 resulting spectra. Over 10 half-life ($T_{1/2}$) occurred over the counting period. The $T_{1/2}$ was obtained for each relevant gamma ray energy line and compared against the National Nuclear Data Center's Evaluated Nuclear Structured Data File (ENSDF) value available. A comparison of relevant nuclear data was performed between the measured and simulated spectra of Mo-99. The peak area of the measured spectrum and bin counts of the simulated spectrum were compared as peak ratios to analyze the accuracy of the benchmarked detector model. An analysis of the true-coincidence summing (TCS) corrections was performed, based upon measuring geometry, detector dimensions and the decay scheme of the radioactive isotope.

Initial WELL3 Detector Model

Once the input script to the detector modeling software was complete with detector measurements and required nuclear data of the calibration isotopes, it was then modeled to produce a representation of the measured spectrum. Iterative comparisons between the overall detection efficiency of the measurement and simulated detector models were performed to find an optimized representation of the detection system. Model estimates derived from the manufacturer specification sheet, detailed in *Appendix B*, indicated the detector model was inadequate since the overall detection efficiency did not match between the simulated and the measured data. The calibration and characterization of the detector model was not complete, therefore multiple iterations with adjustments to detector dimensions were performed using GEANT4 with G4CSC.

Benchmarked WELL3 Detector Model

The creation of a benchmarked detector model required adjustments to the can gap, dead layer thickness and sample placement from educated predictions for the detector response. The process method described previously to produce the detector model response of the calibration sample was performed. A comparison between the overall detection efficiency of the measured and simulated detector model was performed. The analysis indicated the initial detector model under-estimated the inner dead-layer thickness and sample positioning. After making several adjustments the model was effectively benchmarked by demonstrating good agreement between the measured detector efficiency and simulation. The WELL3 detector was deemed effectively characterized through this comparison and was then used in the analysis of the Mo-99 radioactive isotope.

Mo-99 Comparison Analysis

A single-isotope gamma standard of Mo-99 was obtained from the National Physical Laboratory and counted on the WELL3 detector at PNNL. The sample was counted for approximately 40 days, where over 10 $T_{1/2}$ occurred during that period. The sample counting resulted in 26 spectra which were analyzed using the Mirion Genie2000 software. The measured spectrum of Mo-99 was also generated using the benchmarked detector model for comparison to the measured results. The peak area of the measured spectrum and bin counts of the simulated spectrum were compared as peak ratios to analyze the accuracy of the benchmarked detector model. The inter-comparison of the peak ratios showed adequate agreement. The predicted true-

coincidence summing corrections for Mo-99 counting derived from the benchmarked model show large corrections were necessary to accurately quantify Mo-99 using a well-type HPGe detector as expected.

T_{1/2} Analysis of Mo-99

An analysis of $T_{1/2}$ was performed for the mixed gamma sample of Mo-99 using the WELL3 detector at PNNL. The sample was counted for ~40 days, where over 10 $T_{1/2}$ occurred during that period. The sample counting resulted in 26 spectra which were analyzed using the Mirion Genie2000 software, with regions of interest from ~40keV to ~1200keV. The Genie200 software was used for peak analysis of all single and complex spectral features. After the peak fitting was complete, the $T_{1/2}$ at each significant gamma ray energy line was calculated. Overall, the disadvantages of peak summing in the WELL3 detector make it less than ideal for the measurement of Mo-99, nevertheless, the $T_{1/2}$ isotope was accurately measured and agreed well with the known published value while also serving as an excellent test reference for the consistency performance of the WELL3 detector at PNNL.

Conclusion

The characterization of the WELL3 detector was performed with a mixed gamma standard and a single-isotope standard of Mo-99. To calibrate the WELL3 detector, a benchmarked model was created using GEANT4 and G4CSC. Future work will encompass further optimization of the calibrated detector model on GEANT4 with G4CSC. The current characterization of the WELL3 detector shows promise for the counting of Tb-161 an important nuclide for emerging medical physics studies. Overall, the characterization of the WELL3 detector at PNNL now provides the ARES team a new capability for the high efficiency counting of weak radioisotopes.

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NOMENCLATURE

- ARES Advanced Radio-Emission Spectroscopy
- CERN C++ Analyzing petabytes of data, scientifically for high energy physics
- ENSDF Evaluated Nuclear Structured Data File
- GEANT4 with G4CSC Toolkit for the simulation of the passage of particles through matter
- HPGe High Purity Germanium
- keV-kiloelectronvolts
- Mo-99 Molybdenum-99
- NIST National Institute of Standards and Technology
- PNNL Pacific Northwest National Laboratory
- ROI Region of Interest
- sec-seconds
- TCS True Coincidence Summing

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1.0 INTRODUCTION

A high purity germanium (HPGe) detector provides a researcher with reliable information to accurately identify radioactive isotopes based on passive gamma ray emissions from the decay scheme. A HPGe detector requires the sample to be placed on top, while a well-type HPGe detector has the capability to place samples inside the detector. This distinct characteristic results in high detection efficiency for the activity measurement of gamma ray emissions from the decay scheme of a radioactive isotope sample. A well-type detector can be considered one of the more sensitive forms of an HPGe detector since it is capable of achieving very high counting efficiency.



Figure 1. General model of a HPGe Well-type detector³

The characterization of the WELL3 detector, a well-type detector, at PNNL is important to provide the capability and usability of a well-type detector for samples. The Advanced Radio-Emission Spectroscopy (ARES) team at Pacific Northwest National Laboratory (PNNL) wants to maintain a broad range of detectors to measure relevant radioactive isotopes. The ability to detect low- and high-activity samples is needed by the Advanced Radio-Emission Spectroscopy (ARES) team to support research & development at PNNL. However, a disadvantage to the WELL3 detector is that it is most difficult to use for quantitative analysis due to complex detector physics effects induced by nested nuclear decay chains. This type of analysis is a technique that uses

³ Carvalho Conti, C. (n.d.). *Schematic figure of HPGE well detector cross section*. Research Gate. Retrieved July 18, 2022, from https://researchgate.net/figure/Schematic-figure-of-HPGe-well-detector-cross-section_fig1_265109579

mathematical and statistical modeling, measurement, and research to understand the behavior of the samples. Overall, the characterization of the WELL3 detector at PNNL provides the ARES team with another detector to analyze and obtain data for weak samples.

2.0 EXPERIMENTAL DESCRIPTION

A calibration sample was obtained to start the characterization process of the WELL3 detector. A National Institute of Standards and Technology (NIST) traceable standard was obtained. The ARES team created a secondary standard derived from the primary standard mixture received from the Eckert & Zeigler. Production of internal secondary standards at PNNL is facilitated by the Analytical Support Operations service center which maintains a HASQARD compliant quality assurance program. The calibration sample was then counted on the WELL3 detector.

A benchmarked calibrated and characterized model of the WELL3 detector was created using GEANT4 modeling software. The process was based on creating an optimized detector model starting from the detector vendor specification sheet from the manufacturer, detailed in *Appendix B*, and physical measurements taken in the lab. Once all required measurements were obtained, it was applied to the model. The detector and calibration source model were created to predict the spectral response of the instrument for comparison to measurements. The detector spectral response was predicted for each isotope in the standard and combined using the data analysis framework CERN C++. The combined simulated spectrum and efficiency were used to evaluate the accuracy of the model.

A single nuclide gamma standard of Molybdenum-99 (Mo-99) was counted on the WELL3 detector over approximately 40 days to produce 26 spectra. Over 10 half-lives ($T_{1/2}$) occurred during the counting period. Each spectrum was analyzed using Mirion's Genie2000 software for peak fitting of the relevant gamma ray energy lines produced by the sample. The $T_{1/2}$ was obtained for each relevant gamma ray energy lines and compared against the Evaluated Nuclear Structured Data File (ENSDF) value.

A comparison of relevant nuclear data was performed between the measured and simulated spectra of Mo-99. The peak area of the measured spectrum and bin counts of the simulated spectrum were compared as peak ratios to analyze the accuracy of the benchmarked detector

model. An analysis of the true-coincidence summing (TCS) corrections was also performed based upon measuring geometry, detector dimensions, and the decay scheme of the radioactive isotope. TCS occurs when two or more photons are emitted from the decay scheme from the same decay of the radioactive isotope and subsequently detected simultaneously within the resolving time of the detector. This phenomenon occurs prolifically within well-type HPGe detectors and required to correct measurement data from such instruments.

3.0 INITIAL WELL3 DETECTOR MODEL

3.1 GEANT4 Modeling with G4CSC Response

The data required for the GEANT4 script input included the detector type, detector name, position in space (x, y, and z coordinates), rotation in space (ϕ and θ), hole depth, hole diameter, inner dead layer, outer dead layer, detector diameter, detector length, detector bevel radius, detector can gap, can thickness, can diameter, can material, and manufacturer. The script required the measurements and characteristics of the sample as well – sample name, position in space, rotation in space, source diameter, container diameter, container base thickness, source height, source material, and container material. Once the input script was complete, it was then run with the GEANT4 software to produce the initial detector model.



Figure 2. Initial WELL3 detector model with GEANT4

An input script that contained the relevant nuclear data of the 12 radioactive isotopes in the calibration sample was used to estimate the detector response. The contents of this standard

included Co-60, Pb-210, Am-241, Te-123m, Cd-109, Co57, Sn-113, Sr-85, Mn-54, Y-88, Zn-65, and Cs-137. After the script was run through the appropriate software, individual spectra of each calibration isotope were produced. For each spectrum, the gamma ray energy line with the largest bin count was extracted and scaled appropriately into a resulting spectrum of the calibration sample utilizing CERN C++. The scaling was based upon the ratio of the bin count in the simulated spectrum to the peak area in the measured calibration sample spectrum. The process was done for each of the 12 radioactive isotopes of the calibration sample.



Figure 3. Initial simulated gamma-ray energy line spectrum of calibration sample from CERN C++

3.2 Comparison of Measured vs. Simulated Response

A comparison between the overall detection efficiency of the measured model and simulated detector model was performed. The appropriate files which provided the overall detection efficiency at the relevant gamma ray energy lines were obtained for analysis. A scatter plot was created in Excel[®] to show the overlapping of the measured and simulated response.



Figure 4. Overall Detection Efficiency vs. Energy (keV)



Figure 5. In In(Overall Detection Efficiency) vs. Energy (keV)

The scatter plots indicate the detector model was inadequate since the overall detection efficiency did not match between the simulated and the measured data. The two data sets show minimal overlapping further verifying the previous statement. The calibration and characterization of the detector model required multiple iterations with adjustments to multiple detector dimensions to obtain good agreement between the modeled and measured efficiency.

4.0 BENCHMARKED WELL3 DETECTOR MODEL

4.1 GEANT4 Modeling with G4CSC Response

The creation of a benchmarked detector model required adjustments to the can gap, dead layer thickness and sample placement using expert judgement and additional measurements. A thicker dead layer and an increased sample placement height was the result to create the benchmarked detector model. The dead layer thickness and can gap were unknown since they were measurements not initially recorded when the WELL3 detector was made. The sample placement needed educated predictions since the sample is placed in a plastic bag when inserted into the detector hole. The plastic bag creates uncertainty to where the sample is placed inside the hole. The benchmarked dimensions of the detector model were inputted into the script and run using GEANT4 with G4CSC to produce the calibration sample response.



Figure 6. Benchmarked WELL3 detector modeled with GEANT4

The process method described above in *Section 3.1* to create the resulting spectrum of the calibration sample from the benchmarked model utilizing CERN C++ was repeated.



Figure 7. Benchmarked simulated gamma-ray energy line spectrum of calibration sample from CERN C++

4.2 Comparison of Measured vs. Simulated Response

A comparison between the overall detection efficiency of the measured model and simulated detector model was performed. The appropriate files which provided the overall detection efficiency at the relevant gamma ray energy lines were obtained for analysis. A scatter plot was created in Excel[®] to show the overlapping of the measured and simulated response.



Figure 8. Overall Detection Efficiency vs. Energy (keV)



Figure 9. In In(Overall Detection Efficiency) vs. Energy (keV)

The scatter plots indicate the detector model was effectively benchmarked based on the good comparison between the overall detector efficiency of the measured and simulated data. The WELL3 detector was deemed effectively characterized through this comparison and validation was performed using as separate set of metrics and a different source.

5.0 MO-99 COMPARISON ANALYSIS

5.1 Mo-99 Counted on WELL3

A single nuclide gamma standard of Mo-99 was obtained to be counted on the WELL3 detector at PNNL. The sample was counted for approximately 40 days, where over $10 T_{1/2}$ occurred during that period. The sample counting resulted in 26 spectra which were analyzed using the Mirion Genie2000 software, with regions of interest (ROI) spanning ~40keV to ~1200keV.



Figure 10. A spectrum the first count of Mo-99 from WELL3, displayed by the Mirion Genie2000

A simulated response of Mo-99 on the benchmarked detector was obtained using the input script described in *Section 4.1*, including the required nuclear data of Mo-99. A simulated response with TCS corrections was produced using GEANT4 with G4CSC.

5.2 Mo-99 Simulated Response on Benchmarked Model

A simulated response of Mo-99 on the benchmarked detector was obtained using the input script described in *Section 4.1*, including the required nuclear data of Mo-99. A simulated response with TCS corrections was produced using GEANT4 with G4CSC.



Figure 11. A simulated spectrum of Mo-99 produced with the benchmarked model, displayed by CERN C++

5.3 Comparison of Mo-99 Measured vs. Simulated Response

The comparison required obtaining data from measured counts of Mo-99 on WELL3 and the simulated response of Mo-99 on the benchmarked model. For an in-depth analysis, measured counts of Mo-99 had to meet the following requirements – contained all the significant gamma ray energy lines and was chosen at different times of counting. The spectrum of counts 1, 2, 3 and 12 were compared against the simulated Mo-99 response, using a peak ratio comparison.

The peak area of the measured spectrum and bin counts of the simulated spectrum were compared as peak ratios to analyze the accuracy of the benchmarked detector model. To compare the peak ratios, the peak areas/bin counts of interest corresponded to the following gamma ray energy lines: 40.52, 181.1, 366.5, 528.6, 739.5, 778.1, 880.0, and 920.6 keV. The 739.5 keV gamma ray energy line was used for reference during the calculation of the peak ratios for each spectrum of interest, referenced in the equation below.

$$peak \ ratio = \frac{count_n}{count_{739.5keV}} \ [1]$$

Table 1. Comparison of measured and simulated peak ratio to the main gamma ray energy line at 739.5

40	V
лe	V

	Gamma	40.52	181.1	366.5	528.6	739.5	778.1	880.0	920.6	1004.0
	Ray									
	Energy									
	Line									
	(keV)									
1	-	0.2450	0.4105	0.5723	0.01928	1*	1.036	0.4760	0.7280	0.00796
2	-	0.2280	0.3950	0.5750	0.01870	1*	0.9770	0.4400	0.6720	0.00793
3	-	0.2250	0.3840	0.5570	0.01940	1*	0.9810	0.4500	0.6990	0.00737
12	-	0.2240	0.3830	0.5640	0.02020	1	0.9940	0.4570	0.6990	0.00710
Sim.	-	0.1370	0.3949	0.5941	0.01803	1*	1.034	0.6341	0.8604	0.00830

An analysis of the calculated peak ratios showed adequate agreement for the most intense gamma-ray emissions, but some discrepancy was observed for the more uncertain gamma-lines (880, 920.6, and 1004 keV). A clear discrepancy at 40.52 keV is likely the by-product of errors in the model dead-layer but could possibly point to issues in the decay feeding of this gamma-line.

The final analysis between the simulated response of Mo-99 was based on the TSC corrections obtained from the data file produced from GEANT4 with G4CSC.

Gamma Ray Energy Line (keV)	TCS Corrections
40.47	0.1137
140.4	0.3664
158.8	0.1765
181.1	0.3669
366.4	0.9862
528.6	1.074
739.6	0.2339
778.0	1.002

Table 2. Measured activity from Mo-99 detector model response with TCS corrections

The analysis of the TCS corrections of the Mo-99 response from the benchmarked model show large corrections were made to simulate the spectrum from Mo-99 on WELL3. If the TCS corrections were small, the numbers would be closer to 1, indicating less corrections were done. However, most gamma ray energy lines show a large TCS correction factor. For low energy samples in combination with another photon, the TCS corrections are more pronounced for a detector that has a high efficiency for low energy photons, like a well-type detector. If TCS corrections were not corrected for, the activity of the sample could be over- or underestimated.

6.0 T_{1/2} Analysis of Mo-99

An analysis of $T_{1/2}$ was performed for the mixed gamma sample of Mo-99 using the WELL3 detector at PNNL. The sample was counted for approximately 40 days, where over 10 $T_{1/2}$ occurred during that period. Peak fitting required careful analysis of the spectral features in the Mo-99 spectra. The insignificant peaks that did not match criteria were had to be removed as well. To further improve peak fitting, some ROIs of the peaks were adjusted to the correct region for the peak. The technique was used to clean up the inconsistency of the peaks in the spectrum due to the complexity and overlap in the spectrum from TCS effects. Another factor that contributed to complex peaks was peak summing, a phenomenon that occurs when only one detector is used; the detector will sum together two peaks to create random "sum peaks."

After the peak fitting was complete, the $T_{1/2}$ at each significant gamma ray energy line was calculated. The following data was needed from each count to perform the $T_{1/2}$ calculation: energy (keV), net peak area, realtime (sec), livetime (sec), and the time difference based on the initial count. The data needed to be analyzed for each count to ensure the proper net peak area was chosen for the corresponding gamma line.



Figure 12. T1/2 comparisons with the corresponding gamma ray energy lines

The ENDF value, 65.924 hours, is shown on the graph which compares well to the $T_{1/2}$ calculated at 142 keV. The $T_{1/2}$ obtained at 142 keV, 65.990 +/- 0.0733 hours, shows comparability to the ENDF value, verified by the smallest standard deviation, which is within 1 σ of the ENDF value. The average $T_{1/2}$ calculated for the significant gamma ray energy lines compares relatively well to the ENDF value at 65.888 +/- 0.246 hours. Overall, given the disadvantages of peak summing in the WELL3 detector it is not ideally suited for measuring the Mo-99 but the performance of the instrument over this protracted count period served as a test of the consistent reliable operation of this instrument.

7.0 CONCLUSION

The characterization of the WELL3 detector was performed with a mixed gamma standard of Mo-99. To calibrate the WELL3 detector, a benchmarked model was created using GEANT4 with G4CSC. The benchmarked model required adjustments of the can gap, increased dead layer thickness, and higher sample placement through educated predictions of the detector model response. A relevant piece of nuclear data for Mo-99 obtained by WELL3 was the $T_{1/2}$ analysis. It was an adequate detector for the analysis however the variation can be attributed to the counting statistics and the peak fitting uncertainty.

The future work will encompass further optimization of the calibrated detector model on GEANT4 with G4CSC. This will require more iterations of educated predictions of the sample placement and crystal size. The current characterization of the WELL3 detector shows promise for the counting of Tb-161 which is a relevant nuclide to nuclear forensics and medical physics. The nuclide is also an important fission product for estimating the total fissions in experimental samples. Overall, the characterization of the WELL3 detector at PNNL now provides the ARES team a new capability for the high efficiency counting of weak samples, a capability not initially available.

APPENDICIES

Appendix A – Counted Samples



Mo-99 Sample

Calibration Sample

Appendix B – Canberra Specification Sheet

A Replaces Orree New Det 3	Dat wells
DETECTOR SPECIFICATION AND PERFO	Rev. 6/15/99 RMANCE DATA
DETECTOR MODEL GCW3523S SERIAL NUM CRYOSTAT MODEL 7500SL/RDC/ULB PREAMPLIF	MBER 11051527 IER MODEL 2002CSL
The purchase specifications, and therefore the warranted perform (Slectric cooling may degrade performance by	ance, of this detector are as follows: as much as 10%.)
Active Volume Resolution cc Relative Efficienc ≤2. keV (FWHM) at 1.33 MeV keV (FWTM) at 1.33 MeV ≤1.4 keV (FWHM) at 122KeV keV (FWTM) at	y <u>35</u> %
Peak/Compton: Cryostat well diameter14.5 n	nm Cryostat well depth <u>40</u> mm
Cryostat description (if special) 3.25" Ø End Cap, 4" long RDC and Vert Background cryostat hardware.	ical Slimline dipstick cryostat and Ultra low
Physical Characteristics	
Geometry Closed-end coaxial well Diameter 61.5 Mength 63 Distance from window 10	$\begin{array}{c} me & cc \\ \underline{-40.586} & mm & .570\% \\ er & \underline{-14.1478} & mm & .537\% \\ \end{array}$
Depletion voltage (+)2600 V dc Recommended bias voltage (+)3000 V dc Test point voltage at recommended bias (-)0.81 V dc (RC preamp only) Reset interval at recommended bias sec. (Reset preamp only) Capacitance at recommended bias pF)
With amp time constant of6 microseconds	
Isotope ³⁷ Co ⁶⁰ Co Energy (keV) 122 1332 FWHM (keV) 1.25 2.00 FWTM (keV) 2.27 3.69 Peak/Compton 50.9:1	
Cool Down Time <u>8</u> Jours. Cryostat Liquid Nitrogen Con Tested by: <u>Stoppien Biopp</u> Date:	sumption Rate <1.8 Liters per Day.
Approved by: Date:	<u>11/23/05</u> Frac. 203-639-2420

Appendix C – WELL3 Detector



WELL detector

Standard in WELL detector

Appendix D – GEANT4 with G4CSC Script File

Open ~ 🕞		user. ~/Applications	mac s/g4csc-build						• • ×
<pre># ************************************</pre>		 *** 							
12 #/g4csc/src/cylindricalshape <name> <x> <y> <z> <phi> <container material=""></container></phi></z></y></x></name>	<theta> <sour< td=""><td>ce_dia> <co< td=""><td>ntainer_dia> •</td><td><container_b< td=""><td>ase_thickness></td><td><source_heigh< td=""><td>nt> <source_materi< td=""><td>al></td><td></td></source_materi<></td></source_heigh<></td></container_b<></td></co<></td></sour<></theta>	ce_dia> <co< td=""><td>ntainer_dia> •</td><td><container_b< td=""><td>ase_thickness></td><td><source_heigh< td=""><td>nt> <source_materi< td=""><td>al></td><td></td></source_materi<></td></source_heigh<></td></container_b<></td></co<>	ntainer_dia> •	<container_b< td=""><td>ase_thickness></td><td><source_heigh< td=""><td>nt> <source_materi< td=""><td>al></td><td></td></source_materi<></td></source_heigh<></td></container_b<>	ase_thickness>	<source_heigh< td=""><td>nt> <source_materi< td=""><td>al></td><td></td></source_materi<></td></source_heigh<>	nt> <source_materi< td=""><td>al></td><td></td></source_materi<>	al>	
13 /g4csc/src/cylindricalshape p0psv2mlw 0 0 28 0 14	0 9.62						G4_WATER	G4_POLYETH	IYLENE
15# 16#		 *** 							
<pre>18 # DL=deadlayer D,K, is PGT (bevel both sides) 19 #</pre>									
<pre>20 #####/g4csc/det/detectorshape <type> <name> <x> <y> <z> <phi> <</phi></z></y></x></name></type></pre>	theta> <hole (<br="">manuf.></hole>	depth> <hol< td=""><td>e dia> <inner< td=""><td></td><td>DL> <detector< td=""><td>dia> <detector< td=""><td><pre>- length> <detecto< pre=""></detecto<></pre></td><td>r bevel radi</td><td>.us></td></detector<></td></detector<></td></inner<></td></hol<>	e dia> <inner< td=""><td></td><td>DL> <detector< td=""><td>dia> <detector< td=""><td><pre>- length> <detecto< pre=""></detecto<></pre></td><td>r bevel radi</td><td>.us></td></detector<></td></detector<></td></inner<>		DL> <detector< td=""><td>dia> <detector< td=""><td><pre>- length> <detecto< pre=""></detecto<></pre></td><td>r bevel radi</td><td>.us></td></detector<></td></detector<>	dia> <detector< td=""><td><pre>- length> <detecto< pre=""></detecto<></pre></td><td>r bevel radi</td><td>.us></td></detector<>	<pre>- length> <detecto< pre=""></detecto<></pre>	r bevel radi	.us>
21 /g4csc/det/detectorshape Well WELL3 0 0 0 180 1.5 2. 1.0 100 22	0 G4_Al	40.37 canberra	14.15 0.0	9003 0.					
23 # 24 # ***********************************	****	 * * * * * *							
20 # CERN root histogram definitions used for output of spectrum p	redictions								
28# 29/gun/particle ion 20									
30 ##Co-60 32 /g4csc/gun/target co60 1 86400. 27 60 0. 1 33 #/run/beamOn 1000000									
35 ##Pb-210 36 /g4csc/gun/target pb210 1 86400. 82 210 0. 1 37 /run/beamOn 1000000 38									
39 ##Am-241 40 /g4csc/gun/target am241 1 86400. 95 241 0. 1 41 /run/beamOn 1000000 42									
43 ##Te-123m 44 /g4csc/gun/target te123m 1 86400. 52 123 247.5 1 45 /run/beamOn 1000000									
77 ##2d-109m 48 /g4csc/gun/target cd109 1 86400. 48 109 462.7 1 49 /run/beamOn 1000000									
30 51 ##Co-57 52 /g4csc/gun/target co57 1 86400. 27 57 0. 1 53 /run/beamOn 1000000									
55 ##In-113m 56 /q4csc/gun/target sn113 1 86400. 49 113 391.7 1 57 /run/beamOn 1000000									

58
59 ##Sn-113 60 /gadssc/gun/target sn113 1 86400. 50 113 0. 1 61 /run/beam0n 1000000 62
63 ##57-85 6/ /g4cs.c/gun/target sr85 1 86400. 38 85 0. 1 65 /run/beamOn 1000000
57 ##Mn-54 67 /g4Gsc/gun/target m54 1 86400. 25 54 0. 1 67 /run/beamOn 1000000
77 72 /g4csc/gun/target y88 1 86400. 39 88 0. 1 73 /run/beam0n 1000000 74
75##Zh-65 76 /g4csc/gun/target zn65 1 86400. 30 65 0. 1 77 /run/beamOn 1000000 78
79##8a-137m 80 /g4csc/gun/target ba137m 1 86400. 56 137 661.7 1 81 /run/beamOn 1000000
82 83 # 44 #*********************************
85# visualization commands used to setup the coloring
00 # Visuatzation commins used to stelp the toto ing. 87#
88 # Set visibility of logical volumes 89 /visidnewVolume
<pre>00 /vis/geometry/set/visibility world 0 felse 01 /vis/geometry/set/visibility acture ce_logical 1 true 02 /vis/geometry/set/visibility cu_coldfinger_logical 1 true 03 /vis/geometry/set/visibility outer_deadlayer_logical 1 true 04 /vis/geometry/set/visibility cu_coldcal 1 true 05 /vis/geometry/set/visibility G_re_loner_cover_logical 1 true 07 /vis/geometry/set/visibility G_re_loner_cover_logical 1 true 09 /vis/geometry/set/visibility G_re_loner_cover_logical 1 true 09 /vis/geometry/set/visibility G_re_loner_cover_logical 1 true 09 /vis/geometry/set/visibility Set/G_loner_cover_logical 1 true 09 /vis/geometry/set/visibility Set/G_loner_cover_logical 1 true 00 /vis/geometry/set/visibility Set/G_loner_cover_logical 1 true 00 /vis/geometry/set/visibility Set/G_logical 1 true 00 /vis/geometry/set/visibility Set/G_logical 1 true</pre>
<pre>01 # Set color of logical volumes: surface view 03 /vis/yeemer/yset/colour Morid 0 0.95 0.95 0.95 1 04 /vis/geometry/set/colour acc_loditinger_logical 1 0.94 0.92 0.99 0.2 05 /vis/geometry/set/colour cu_colditinger_logical 1 0.99 0.80 0.99 0.2 06 /vis/geometry/set/colour duc_loditinger_logical 1 0.99 0.80 0.99 0.2 07 /vis/geometry/set/colour duc_loditinger_logical 1 0.99 0.80 0.99 0.2 08 /vis/geometry/set/colour duc_loditinger_logical 1 0.99 0.80 0.99 0.2 09 /vis/geometry/set/colour ident/set/colour ident</pre>
17 18 # Set color of logical volumes: wireframe w/ cut plane view 19 #/vis/viewer/set/sityle wireframe 20 #/vis/geometry/set/colour active_Ge_logical 1 0.42 0.92 0.99 1 21 #/vis/geometry/set/colour cut_coldfinger_logical 1 0.99 0.27 0.000 1 23 #/vis/geometry/set/colour inner_deadlayer_logical 1 0.99 0.00 0.99 1 23 #/vis/geometry/set/colour outer_deadlayer_logical 1 0.99 0.00 0.99 1 23 #/vis/geometry/set/colour Gecal in Golcal 1 0.51 0.51 0.51 1

51 0.51 1

0 1 1.00 1.00 1

Appendix E - $T_{1/2}$ Raw Data Calculations

Note – All rows with cells highlighted in RED	are omitted from calculations
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Dot of Construct/Time Instantion (hp) Inst	- A	В	С	D	E	F	G	Н	1	J	К	L	м	N	0	Р	Q
Norm Norm <th< td=""><td>Count</td><td>Count Start Date/Time</td><td>Time Diff (days)</td><td>Realtime (cos)</td><td>Energy (keV) select</td><td>41 Not Rook Arcc</td><td>Not Count-rate (1/cos)</td><td>RAD</td><td></td><td>Log-Linear Fit</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></th<>	Count	Count Start Date/Time	Time Diff (days)	Realtime (cos)	Energy (keV) select	41 Not Rook Arcc	Not Count-rate (1/cos)	RAD		Log-Linear Fit							
1 2 0.47702 2.201313 0.02728 2.20131 0.02728 2.20131 0.02728 2.20131 0.02728 2.20131 0.02728 2.20121 0.02728 2.20121 0.02728 0.02728 0.02728 0.02728 0.02728 0.02728 0.02728 0.02728 0.02788 0.02788 0.02788 0.02788 0.02788 0.02788 0.02788 0.02788 0.02788 0.02788 0.02788 0.02788 0.02788 0.02788 0.02788 0	2 Count	1 5/25/2022 19:25	Time Diri. (uays)	72870 g	Elvetime (sec)	Net Peak Area	12 67602160	BAD		2 529712942			0	3 520712		2 52065 01	3 53995+00
1 1 1/1/1/2012 123 1	1	2 5/26/2022 15:52	0.952929241	72070.3	64900	647500	9 997792951			2.333712342			0.952929	2.353713		5 20595-04	6.6727E-02
1 2	5	3 5/27/2022 13:33	1 715266204	712050.1	64800	527900	8 146604939			2.097601268			1 715266	2.097601		9 99965-01	1.4519E-02
3 5/20/20212/21 3.532/2021 1.502/2 1.1 0 3.520 1.1 0 3.520 1.1 0 3.520 1.1 1.2 1.0 1.0 0 5.7 1.0 1.0 0 5.7 0 1.0 0 5.7 0 1.0 0 5.7 0 1.0 0 5.7 0 1.0 0	6	4 5/28/2022 12:54	2 853668981	91600.8	85480 5	506300	0.140004550	5 922988		2.037001200			4 963646	1 280108		2 3797E+05	1.4010E+01
8 6 5/9/0/221812 4.5988433 82502 7944.7 234700 1.39078882 1.2007881 6.5036 35302 'y'. 0.85366 9 7 5/1/1/2212172 5.5882/256 85846 21700 2.5119297 1.280778 2.5892 'y'. 0.180 9 6/1/2212484 6.57186 85746 85746 313000 1.1805355 0.7588487 1.280778 2.5892 'y'. 0.180 10 6/1/2212484 6.57186 8597.6 8597.6 2.2200 0.75782077 -2.7883182 4.2718 1.180778 2.00141 1.1807 2.00141 4.072 1.180778 2.00141 4.072 1.180778 2.00141 4.072 1.01177 1.287784 2.00141 4.072 1.01177 1.287784 2.00141 4.072 1.01177 1.287784 2.00141 4.0712 1.01177 1.01177 1.01177 1.01177 1.01177 1.01177 1.01177 1.01177 1.01177 1.01177 1.01177 1.01177 <td< td=""><td>7</td><td>5 5/29/2022 17:21</td><td>3,914236111</td><td>90627</td><td>85939.3</td><td>400100</td><td></td><td>4,655612</td><td></td><td></td><td></td><td></td><td>5,918623</td><td>1.012022</td><td></td><td></td><td></td></td<>	7	5 5/29/2022 17:21	3,914236111	90627	85939.3	400100		4,655612					5,918623	1.012022			
9 7 5.71/2022184 5.9186/97 5.9186/97 1.0202199 1.0	8	6 5/30/2022 18:32	4,963645833	82500.2	79148.7	284700	3.597026862			1.280107633			6.971887	0.750498		Half-life (hrs)	65,5056
0 1 0/1/2021104 6.9538630 13000 2.1303354 0.7969877 1.26723 -0.7885 0 1 0 0/1/2021104 9.8138478 97841 8860 13000 1.33891568 13.3917 -0.9802 -0.9902 -0.9802 -0.9902 -0.9802 -0.9902	9	7 5/31/2022 17:27	5,918622685	89247.6	86400	237700	2,751157407			1.012021699			8.615266	0.333492		`+/-	0.1340
11 9 0/1/202120100 8.620253003 87461 86400 1.2592333 0.3379290 1.959232 1.959334 1.91772 0.93922 1.91772 0.93922 1.91772 0.93922 1.91772 0.93922 1.91772 0.93924 1.91772 0.93924 1.91772 0.93924 1.91772 0.93924 1.91772 0.93924 1.91772 0.93924 1.91772 0.93924 1.91772 0.93924 1.91772 0.93924 1.91772 0.93924 1.91772 0.93924 1.91772 0.93924 1.91772 0.93924 1.91772 0.93924 1.91772 0.93924 1.91772 0.93924 1.91772 1.91772 0.91774 1.91772 1.91772 1.91772 1.91772 1.91772 1.91774	10	8 6/1/2022 18:44	6.971886574	88584	86400	183000	2.118055556	;		0.750498477			12.86723	-0.73885			
2 10 6/4/2021240 3.8600 93500 - - 14.3100 -1.3472 - - 8 11 6/1/2021240 13.917191 6273.3 2228 0.3731988 -	11	9 6/3/2022 10:10	8.615266204	87840.1	86400	120600	1.395833333			0.333491608			13.91772	-0.98032			
3 11 047/202212 12.08738 0407400217 4.7858182 20.858182 4.078281	12	10 6/4/2022 14:49	9.8084375	87463	86400	93500)						14.9169	-1.2472			
4 12 04/0202126 13.977999 62.77.4 60.77.3 22200 0.7759848 -0.809240 20 20.971874 -0.7782 1.247787 -0.87724 -1.247787 -0.87724 -1.247787 -0.87724	13	11 6/7/2022 16:13	12.8672338	86930.5	86400	41270	0.477662037	,		-0.738851832			22.91881	-3.31476			
3 13 6/9/2022172 15.44837743 86507 13640 0.0270872 1.47373786 1.473737786 </td <td>14</td> <td>12 6/8/2022 17:26</td> <td>13.91771991</td> <td>62379.4</td> <td>62075.3</td> <td>23290</td> <td>0.375189488</td> <td></td> <td></td> <td>-0.98032408</td> <td></td> <td></td> <td>26.05416</td> <td>-4.07782</td> <td></td> <td></td> <td></td>	14	12 6/8/2022 17:26	13.91771991	62379.4	62075.3	23290	0.375189488			-0.98032408			26.05416	-4.07782			
6 6/10/022 15.458/0505 8659.7 86400 0.0994 1	15	13 6/9/2022 17:25	14.91689815	65471.1	65226	18740	0.287308742			-1.247197886							
7 0	16	14 6/10/2022	15.84828704	86639.7	86400	1464		0.016944									
8 6/1/2022 10:2 18.579/259 19.073 3.43000 3 5588 0.402748 0.402777 0.404497 0.40778 0.404778 0.404778 0.404778 0.404778 0.404778 0.404778 0.404778 0.404787 0.404978 0.4077877 0.404978 0.404978 0.404978 0.40	17	15 6/11/2022 16:59	16.89908565	86590.7	86400												
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19 61/7/022 17.8 22.9180787 9649.1 9649.0 0.06842939 -3.3476476 4.0778126 20 61/2/022 15.6 27.8004981 8640.0 1644 0.01894444 4.0778126 1 1 21 61/2/022 15.0 27.8004981 8640.0 8640.0 - - 0 14.0478 4.54762 -	20	18 6/15/2022 16:59	20.89899306	86499.8	86400												
2 20 6/20/2022 bit 52.50041590 88451.1 65.600 5 6	21	19 6/17/2022 17:28	22.91880787	86469.1	86400	3140	0.036342593			-3.314764876							
3 8 64/2/20215:50 72.8004981 86447_2 86400 0 140.4276 4.94042 5 5 8 6/28/20215:50 33.8720619 85123_2 85093_9 0 140.4276 4.94042 5 6 6/28/20215:51 34.886868 8646.0 0.53291 10.9014 4.97071 5 7 6/30/20216:31 36.9517454 8644.2 86400 0.53291 10.9014 4.97071 5 8 7/5/20218:17 40.9530393 8644.2 86400 3.91243 8.9376 4.93305 4.93426 4.94	22	20 6/20/2022 20:42	26.05415509	86451.1	86400	1464	0.016944444			-4.07781526							
4 6 6/24/20221760 33.870019 5512-2 50039.9 0 140.270 5.49070 5.49070 57 6 6/25/20221631 34.8866898 86436.7 86400 1.71269 8.877 4.8478 58 6 7/5/20221817 40.9530439 86418.8 86400 2.35560 0.35722 4.9877 50 7 6 7/5/2021817 40.9530439 86418.8 86400 2.35560 4.98762 4.98762 50 7 7 6 7.972021817 40.9530439 86418.8 86400 2.35560 4.98762	23	21 6/22/2022 15:06	27.82043981	86447.2	86400												
5 3 6/2/20221620 33.47200019 85/02.2 85/03.9 0 0.104.276 3494692 0 0 7 0 6/2/20221051 34.6860868 86418.4 86400 1.17556 86.6514 .48977 0 0 8 7/5/202218.37 40.9537454 86418.8 84400 1.17556 86.6514 .48977 0 <td< td=""><td>24</td><td>22 6/24/2022 17:06</td><td>29.90413194</td><td>86440.8</td><td>86400</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></td<>	24	22 6/24/2022 17:06	29.90413194	86440.8	86400												
8 6/2/302216.15 34.88960898 8436.7 8440 1.71566 8.6771 4.87771 7 1.01767 7.9176 1 1.0176 7.9176 1 1.0176 7.9176 1 1.0176 7.9176 1 1.0176 7.9176 1 1.0176 7.9176 1 1.0176 7.9176 1 1.0176 7.9176 1 <t< td=""><td>25</td><td>23 6/28/2022 16:20</td><td>33.87206019</td><td>85129.2</td><td>85093.9</td><td></td><td></td><td></td><td></td><td></td><td>0</td><td>140.4276</td><td>4.944692</td><td></td><td></td><td></td><td></td></t<>	25	23 6/28/2022 16:20	33.87206019	85129.2	85093.9						0	140.4276	4.944692				
7 8 6/30/2022 16:49 33.8977454 66434.2 8640 175296 88.678 4.8478 84478 84478 9 7/5/2022 16:17 40.9530439 85418.8 85400 333423 59.3785 40.3300 86418.8 8640 11.91296 86.47831 333217 86.47831 333217 86.47831 333729 11.91296 86.97887 72.31481 307429 11.91296 86.97887 72.31481 307429 11.91296	26	24 6/29/2022 16:15	34.86866898	86436.7	86400						0.852928	109.6914	4.697671				
8 3 7/5/2022 18:17 40.95304386 B418.8 B400 3.91423 59.9705 4.09305	27	25 6/30/2022 16:49	35.89172454	86434.2	86400						1.715266	88.65741	4.48478				
9 3,34236 593765 4,093365 4 11 5,31823 3,10208 3,03237 4 12 5,31823 3,10208 3,03243 5 13 11 5,31823 3,10208 3,03243 5 14 5,31823 3,10208 3,03243 5 5 5 5 5 5,31823 3,10208 3,03243 5 3,03243 5 5 5 5 5 5,31823 3,115444 2,57976 1 1 5 <td< td=""><td>28</td><td>26 7/5/2022 18:17</td><td>40.95304398</td><td>86418.8</td><td>86400</td><td></td><td></td><td></td><td></td><td></td><td>2.853669</td><td></td><td></td><td></td><td></td><td></td><td></td></td<>	28	26 7/5/2022 18:17	40.95304398	86418.8	86400						2.853669						
00 4.463646 4.74933 3.823177 () 10 5.1562 0.1572 4.71933 3.823177 () 12 0.977 7.71841 3.07429 () () () 13 0.9787 7.71841 3.07429 () <td>29</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>3.914236</td> <td>59.93765</td> <td>4.093305</td> <td></td> <td></td> <td></td> <td></td>	29										3.914236	59.93765	4.093305				
11 5.916223 30.16244 34.06544 12 6 6.971887 7.21484 3.3029 15 12.69723 5.409724 1.581944 2.59796 16 12.69733 5.409722 1.581944 2.59796 17 13.91772 4.25128 1.447222 18 1.584796 1.584796 19 0 0 1.584729 </td <td>30</td> <td></td> <td></td> <td>14</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>4.963646</td> <td>45.74933</td> <td>3.823177</td> <td></td> <td></td> <td></td> <td></td>	30			14							4.963646	45.74933	3.823177				
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$ \begin{array}{c} 9,80437 \\ 3,1944 \\ 2,5796 \\ 13,9172 \\ 4,25128 \\ 1,4722 \\ 13,9072 \\ 1,63909 \\ 1,6390 \\ 1,6300 \\ 1,630$	33		1/se	10		R ² = 9.9985E-0	1				8.615266	16.99074	2.832669				
12.8723 5.40972 1.688198 13.9772 1.588198 1.58829 14.9999 3.33027 1.20381 1.88772 16 14.9199 3.33027 1.20381 1.88774 17 1.89998 1.89999 1.89999 1.89999 18 1.89999 1.89999 1.89999 1.89999 19 1.89999 1.89999 1.89999 1.89999 10 1.89999 1.89999 1.89999 1.89999 1.89999 10 1.89999 1.89999 1.89999 1.89999 1.89999 1.89999 18 1.977 2.91818 0.4000 0.8439 1.8999 1.89999 1.89999 1.89999 1.89999 1.89999 1.89999 1.89999 1.89999 1.89999 1.8999 1.89999 <	34		te	8							9.808437	13.19444	2.579796				
66 13.9172 4.25128 1.44722 18 15.48429 15.48429 15.48429 19 16.8576 16.8576 16.8576 11 19.972 19.97214 19.97214 19.97214 11 10.9756 19.97214 19.97214 19.97214 12 10.9756 19.97214 19.97214 19.97214 13 10.9726 19.97214 19.97214 19.97214 14 19.97214 19.97214 19.97214 19.97214 15 19.97214 19.97214 19.97214 19.97214 16 19.97214 19.97214 19.97214 19.97214 16 19.97214 19.97214 19.97214 19.97214 17 26.95416 0.190278 1.95927 19.97214 18 19.972 19.97214 19.97214 19.97214 19.97214 18 19.972 19.97214 19.97214 19.97214 19.97214 19.97214 19 19.97214 19.97214 19.97214 19.97214 19.97214 19.97214 <tr< td=""><td>35</td><td></td><td>t-ra</td><td>. \</td><td></td><td></td><td></td><td></td><td></td><td></td><td>12.86723</td><td>5.409722</td><td>1.688198</td><td></td><td></td><td></td><td></td></tr<>	35		t-ra	. \							12.86723	5.409722	1.688198				
77 14.9199 3.33027 1.20381 88 15.64239 1 1.639309 1 99 0 5 30 35 40 45 19.977.14 1 11 0 0 5 30 35 40 45 19.977.14 1 1 12 0 5 30 15 20 25 30 40 45 19.977.14 1	36		Ino	0							13.91772	4.251288	1.447222				
13 15.8429 16.8909 1 10 18.6776 18.6776 18.6776 11 18.6776 19.909 1 12 0 5 30 35 40 45 12 19.909 19.909 19.909 19.9099 19.9099 13 19.909 19.9028 19.9028 19.9028 19.9028 19.9028 1.65927 19.9028 19.9028 1.65927 19.9028 19.9028 1.65927 19.9028 19.9028 1.65927 19.9028 19.9028 1.65927 19.9028 <t< td=""><td>37</td><td></td><td>et c</td><td>4</td><td></td><td></td><td></td><td></td><td></td><td></td><td>14.9169</td><td>3.333027</td><td>1.203881</td><td></td><td></td><td></td><td></td></t<>	37		et c	4							14.9169	3.333027	1.203881				
10 16.69999 18.65796 1 11 0 5 10 15 20 25 30 35 40 45 13.85796 1 14 12 0 5 10 15 20 25 30 35 40 45 22.9181 0.43298 -0.4349 1 14 22.9181 0.43208 -0.4349 1	38		Z								15.84829						
0 0 5 10 15 20 35 30 35 40 45 20.9899	39			2	•						16.89909						
1 0 5 10 15 20 25 30 35 40 40 20.58399 0 <td>40</td> <td></td> <td></td> <td>0</td> <td>******</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>18.65796</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>	40			0	******						18.65796						
2 1 20.989 - <td< td=""><td>41</td><td></td><td></td><td>0 5</td><td>10 15 20</td><td>25 30 35</td><td>5 40 45</td><td></td><td></td><td></td><td>19.87214</td><td></td><td></td><td></td><td></td><td></td><td></td></td<>	41			0 5	10 15 20	25 30 35	5 40 45				19.87214						
3 2.5181 0.40208 -0.61349 0 15 26.65416 0.19028 -1.65927 0 16 0 0 0 0 0 17 0 0 0 0 0 18 0 0 0 0 0 19 0 0 0 0 0 10 0 0 0 0 0 13 0 0 0 0 0 14 0 0 0 0 0 15 0 0 0 0 0 14 0 0 0 0 0 15 0 0 0 0 0 16 0 0 0 0 0 17 0 0 0 0 0 18 0 0 0 0 0 19 0 0 0 0 0 10 0 0 0 0 0 10 0 0 0 0 0 10 0 0 0 0 0 10	42				Time Diff ((days)					20.89899						
1 26.6416 0.19028 1.65927 1.65927 1.65927 16 1 1 1 1 1 1 17 1 1 1 1 1 1 18 1 1 1 1 1 1 19 1 1 1 1 1 1 10 1 1 1 1 1 1 12 1 1 1 1 1 1 13 1 1 1 1 1 1 14 1 1 1 1 1 1 16 1 1 1 1 1 1 16 1 1 1 1 1 1 16 1 1 1 1 1 1	43										22.91881	0.430208	-0.84349				
0 0 <td>44</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>26.05416</td> <td>0.190278</td> <td>-1.65927</td> <td></td> <td></td> <td></td> <td></td>	44										26.05416	0.190278	-1.65927				
0 0 <td>45</td> <td></td>	45																
M M <td>40</td> <td></td> <td>•••</td> <td>_</td> <td></td>	40		•••	_													
1 1 <td>47</td> <td></td> <td></td> <td>·</td> <td></td>	47			·													
19 1 </td <td>48</td> <td></td> <td></td> <td>100</td> <td></td>	48			100													
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	51				100 million (100 million)												
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 $Gamma\ ray\ energy\ line\ 42\ keV$

	Α	В	С	D	E	F	G	н	1.1	J	к	L	м	N	0	Р	Q
1					Energy (keV) select	142											
2	Count	Count Start Date/Time	Time Diff. (days)	Realtime (sec)	Livetime (sec)	Net Peak Area	Net Count-rate (1/sec)	BAD		Log-Linear Fit							
3	1	5/25/2022 19:25	0	72870.9	62850.9	370900000	5901.267921			8.682922509			0	8.682923		-2.5209E-01	8.6552E+00
4	2	5/26/2022 15:53	0.852928241	72838.1	64800	302700000	4671.296296			8.449191892			0.852928	8.449192		2.8048E-04	5.9763E-03
5	3	5/27/2022 12:34	1.715266204	71216.6	64800	243800000	3762.345679			8.232797893			1.715266	8.232798		9.9998E-01	1.6380E-02
6	4	5/28/2022 15:54	2.853668981	91600.8	85480.5	234100000		2738.636					3.914236	7.648181		8.0783E+05	1.8000E+01
7	5	5/29/2022 17:21	3.914236111	90627	85939.3	180200000	2096.828808			7.648181391			4.963646	7.394688			
8	6	5/30/2022 18:32	4.963645833	82500.2	79148.7	128800000	1627.316684			7.394687731			5.918623	7.142864		Half-life (hrs)	65.9899
9	7	5/31/2022 17:27	5.918622685	89247.6	86400	109300000	1265.046296			7.142863998			6.971887	6.878393		`+/-	0.0733
10	8	6/1/2022 18:44	6.971886574	88584	86400	83900000	971.0648148			6.878393217			8.615266	6.46461			
11	9	6/3/2022 10:10	8.615266204	87840.1	86400	55470000	642.0138889			6.464609937			9.808437	6.16234			
12	10	6/4/2022 14:49	9.8084375	87463	86400	41000000	474.537037			6.16233967			12.86723	5.417129			
13	11	6/7/2022 16:13	12.8672338	86930.5	86400	19460000	225.2314815			5.41712868			13.91772	5.173659			
14	12	6/8/2022 17:26	13.91771991	62379.4	62075.3	10960000	176.5597589			5.173659396			14.9169	4.925787			
15	13	6/9/2022 17:25	14.91689815	65471.1	65226	8988000	137.7978107			4.925787471			22.91881	2.88055			
16	14	6/10/2022 15:46	15.84828704	86639.7	86400	699400		8.094907					26.05416	2.091235			
17	15	6/11/2022 16:59	16.89908565	86590.7	86400	#REF!		#REF!					27.82044	1.644242			
18	16	6/13/2022 11:12	18.65796296	14087.3	14060.9	804400		57.20829					29.90413	1.118475			
19	17	6/14/2022 16:20	19.8721412	86518.9	86400	#REF!							33.87206	0.113904			
20	18	6/15/2022 16:59	20.89899306	86499.8	86400	#REF!							34.86867	-0.14083			
21	19	6/17/2022 17:28	22.91880787	86469.1	86400	1540000	17.82407407			2.88055002			35.89172	-0.39923			
22	20	6/20/2022 20:42	26.05415509	86451.1	86400	699400	8.094907407			2.091235149			40.95304	-1.66844			
23	21	6/22/2022 15:06	27.82043981	86447.2	86400	447300	5.177083333			1.644241835							
24	22	6/24/2022 17:06	29.90413194	86440.8	86400	264400	3.060185185			1.118475432							
25	23	6/28/2022 16:20	33.87206019	85129.2	85093.9	95360	1.120644371			0.113903851							
26	24	6/29/2022 16:15	34.86866898	86436.7	86400	75050	0.868634259			-0.140833118							
27	25	6/30/2022 16:49	35.89172454	86434.2	86400	57960	0.670833333			-0.399234558							
28	26	7/5/2022 18:17	40.95304398	86418.8	86400	16290	0.188541667			-1.668436253							
29																	
30		40000															
31		10000															
32																	
33		1000	•														
34			**.														
35		/se	100 C	v = 5,739	7E+03e ^{-2.52096-01x}												
36		- 100 e		R ² =	9.9972E-01												
37		rat	· · · · ·	S													
38		10		1 No. 1													
39		0 10															
40		J N		•	<												
41		1			1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1												
42		0 5	10 15 2	D 25 30	35 40	45											
43					`												
44		0.1	Tim	e Diff (days)													
45																	

Gamma ray energy line 142 keV

1	Α	В	С	D	E	F 160	G	н	1	J	K	L	М	N	0	Р	Q
2	Count	Count Start Dat	/Tim Time Diff (daw)	Popltime (rec)	Livetime (rec)	Not Poak Area	Not Count-rate (1/rec)	RAD		Log-Linear Eit							
2	count	1 E /2E /2022	10.25	0 72870 (civetime (sec)	Net Feak Area	15 96124905	BAD		2 762995200			0	3 762995		2 52675 01	
4		1 5/25/2022 2 5/26/2022	15.23	11 72020 1	64900	905100	13.00134003			2.703883209			0.952029	2.703003		1 52065 02	1 60125 00
5		2 5/20/2022	13.33 0.63252624	1 72030.3	C 64800	629100	0.94700272			2.31900089			1 715266	2.315001		0.00675.01	2 47225 02
6		5 5/27/2022	12.54 1.71320020	01600 g	04000	6038100	3.04/22222	7.046051		2.20/105400			2.014326	1 601057		2 74675-04	3.47321-02
7		5/28/2022	17.01 2.0000000	11 0062	7 95020 2	461600	E 2712220E2	7.040031		1 691057493			4.062646	1.001037		2.74071404	******
0		5 5/29/2022	17:21 5.9142501.	9062	7 85959.5	401000	5.571252952			1.081057482			4.903040	1.428007		11-16 116- (h)	CE 5005
0		5/50/2022	18:52 4.9050458:	55 82500.2	/9148./	330100	4.170650724			1.428067277			5.918023	1.100088		main-line (hrs)	00.0800
10		7 5/51/2022	17:27 5.91802200	55 69247.0	80400	2/5800	3.19212903			1.16068829			0.9/188/	0.890055		+/-	0.5955
10		8 6/1/2022	18:44 6.9/18865	74 88584	1 86400	211800	2.451388889			0.896654757			12.86723	-0.54537			
11		9 6/3/2022	10:10 8.61526620	04 8/840.1	1 86400	137300		1.58912					13.91//2	-0.8008			
12	1	6/4/2022	14:49 9.80843	/5 8/463	3 86400	101000		1.168981					14.9169	-1.05066			
13	1	1 6/7/2022	16:13 12.86723	38 86930.5	86400	50080	0.57962963			-0.545365949			22.91881	-3.10289			
14	1	2 6/8/2022	17:26 13.917719	91 62379.4	4 62075.3	27870	0.448970847			-0.800797323							
15	1	3 6/9/2022	17:25 14.916898:	15 65471.1	1 65226	22810	0.349707172			-1.050659126							
16	1	4 6/10	/2022 15.8482870	04 86639.7	7 86400	1445											
17	1	5 6/11/2022	16:59 16.8990850	65 86590.7	7 86400												
18	1	6 6/13/2022	11:12 18.6579629	96 14087.3	3 14060.9	2293		0.163076									
19	1	6/14/2022	16:20 19.87214:	12 86518.9	9 86400												
20	1	6/15/2022	16:59 20.8989930	06 86499.8	8 86400												
21	1	9 6/17/2022	17:28 22.9188078	87 86469.1	1 86400	3881		0.044919		-3.102894823							
22	2	6/20/2022	20:42 26.0541550	09 86451.1	1 86400	1445		0.016725									
23	2	6/22/2022	15:06 27.8204398	81 86447.2	2 86400	1											
24	2	6/24/2022	17:06 29.9041319	94 86440.8	86400	1											
25	2	6/28/2022	16:20 33.872060:	19 85129.2	85093.9												
26	2	6/29/2022	16:15 34.8686689	98 86436.7	7 86400	1		0	15.86135	2.763885209							
27	2	5 6/30/2022	16:49 35.891724	54 86434.2	2 86400	1		0.852928	12.42438	2.51966089							
28		6 7/5/2022	18:17 40.9530439	98 86418.8	86400	1		1.715266	9.847222	2.287189408							
29								2.853669									
30		10						3.914236	5.371233	1.681057482							
31		10						4,963646	4,170631	1.428067277							
32		16 •						5,918623	3,19213	1,16068829							
33		G 14	y=	1.5026E+01e ^{-2.5375E-01}				6.971887	2,451389	0.896654757							
34		F 12		R ² = 9.9882E-01				8 615266	1 58912	0.463180637							
35		2 10						9 808437	1 168981	0 156132841							
36		s t-rs						12 86723	0.57963	-0 545365949							
37		ino	N					13 01772	0.448971	-0.800797323							
38		et C						1/ 0160	0 3/9707	-1.050659126							
20		Z 4	and the second se					15 94930	0.345707	-1.030035120							
40		2	· · · · · · · · · · · · · · · · · · ·	·····				16 90000									
41		0		••••				18 65706	0 163076		-1 81354						
42		0 2	4 6 8	10 12 1	4 16			10.03790	0.103076		-1.01334						
42			Time Diff (day	/S)				20 90900									
43								20.05055	0.044040	2 40200 4022							
44		4						22.91661	0.044919	-5.102894825	4.00000						
43								20.05410	0.016/25	• 	-4.09088						
40		3															
4/		2															
48																	
49		1	100 C														
50		0	State of the second sec														
51		0 5	10 15	20 25	30												
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53	-	2		State of the second													
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55				and the second													
56		4															
57	-	5															
50																	

 $Gamma\ ray\ energy\ line\ 160\ keV$

	A		В	С	D	E	F	G	н	1	J	К	L	M	N	0	Р	Q
1						Energy (keV) select	182											
2	Count	Count St	art Date/Tim	Time Diff. (days)	Realtime (sec)	Livetime (sec)	Net Peak Area	Net Count-rate (1/sec)	BAD		Log-Linear Fit							
3	1	5/2	25/2022 19:25	0	72870.9	62850.9	13340000	212.2483528			5.357757065			0	5.357757		-2.5309E-01	*****
4	2	5/2	6/2022 15:53	0.852928241	72838.1	64800	11190000	172.6851852			5.151470198			0.852928	5.15147		5.4973E-04	1.1870E-02
5	3	5/2	27/2022 12:34	1.715266204	71216.6	64800	9009000	139.0277778			4.934673753			1.715266	4.934674		9.9992E-01	3.2085E-02
6	4	5/2	8/2022 15:54	2.853668981	91600.8	85480.5	8644000		101.1225					3.914236	4.348731		2.1196E+05	*****
7	5	5/2	29/2022 17:21	3.914236111	90627	85939.3	6650000	77.38019742			4.348730901			4.963646	4.088236			
8	e	5/3	80/2022 18:32	4.963645833	82500.2	79148.7	4720000	59.63458654			4.088235717			5.918623	3.843774		Half-life (hrs)	65.7294
9	7	5/3	31/2022 17:27	5.918622685	89247.6	86400	4035000	46.70138889			3.843773905			6.971887	3.58017		`+/-	0.1425
10	8	6/	/1/2022 18:44	6.971886574	88584	86400	3100000	35.87962963			3.580169715			8.615266	3.164654			
11	9	6/	/3/2022 10:10	8.615266204	87840.1	86400	2046000	23.68055556			3.164654271			9.808437	2.867478			
12	10	6/	/4/2022 14:49	9.8084375	87463	86400	1520000	17.59259259			2.867477938			12.86723	2.10388			
13	11	. 6/	/7/2022 16:13	12.8672338	86930.5	86400	708300	8.197916667			2.103880057			13.91772	1.861114			
14	12	6/	/8/2022 17:26	13.91771991	62379.4	62075.3	399200	6.430899247			1.86111438			22.91881	-0.42157			
15	13	6/	/9/2022 17:25	14.91689815	65471.1	65226	328400	5.034802073			1.616374215			26.05416	-1.22266			
16	14	6/1	0/2022 15:46	15.84828704	86639.7	86400	25440		0.294444					27.82044	-1.67336			
17	15	6/1	1/2022 16:59	16.89908565	86590.7	86400	#REF!							29.90413	-2.21552			
18	16	6/1	3/2022 11:12	18.65796296	14087.3	14060.9	29360		2.08806					33.87206	-3.17963			
19	17	6/1	4/2022 16:20	19.8721412	86518.9	86400	#REF!							34.86867	-3.44339			
20	18	6/1	15/2022 16:59	20.89899306	86499.8	86400	#REF!							35.89172	-3.68564			
21	19	6/1	7/2022 17:28	22.91880787	86469.1	86400	56680	0.656018519			-0.421566261			40.95304	-5.11311			
22	20	6/2	20/2022 20:42	26.05415509	86451.1	86400	25440	0.294444444			-1.222664937							
23	21	6/2	2/2022 15:06	27.82043981	86447.2	86400	16210	0.187615741			-1.67335934							
24	22	6/2	24/2022 17:06	29.90413194	86440.8	86400	9426	0.109097222			-2.215515847							
25	23	6/2	8/2022 16:20	33.87206019	85129.2	85093.9	3540	0.041601102			-3.179628625							
26	24	6/2	9/2022 16:15	34.86866898	86436.7	86400	2761	0.031956019			-3.443394743							
27	25	6/3	80/2022 16:49	35.89172454	86434.2	86400	2167	0.025081019			-3.685643953							
28	26	7)	/5/2022 18:17	40.95304398	86418.8	86400	519.9	0.006017361			-5.113106469							
29																		
30		1000																
31		1000																
32			1															
33		100 -																
34		0		•. Y	= 2.1269E+02e ^{-2.5311}	E-01x												
35		S 10 -		1	R ² = 9.9990E-01													
36		() ()																
37		- 1-																
38		unt i	0 5	10 15 20 2	30 35	40 45												
39		0 10 0.1 -																
40		ž			1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1													
41		0.01			1													
42		0.01																
43																		
44		0.001		Time Diff (d	lays)													
45																		

Gamma ray energy line 182 keV

	А	В	C	D	E	F	G	н	1	1	к	L	м	N	0	р	0
1		-	-		Energy (keV) select	367	-										
2	Count	Count Start Date/Time	Time Diff. (days)	Realtime (sec)	Livetime (sec)	Net Peak Are	Net Count-rate (1/sec)	BAD		Log-Linear Fit							
3	1	5/25/2022 19:25	0	72870.9	62850.9	1860000	29.5938483			3.387566512			0	3.38757		-2.5072E-01	*****
4	2	5/26/2022 15:53	0.852928241	72838.1	64800	1629000	25.13888889			3.224416005			0.85293	3.22442		1.0410E-03	*****
5	3	5/27/2022 12:34	1.715266204	71216.6	64800	1307000		20.1698		3.00418411			1.71527	3.00418		9.9974E-01	******
6	4	5/28/2022 15:54	2.853668981	91600.8	8 85480.5	1258000		14.7168					3.91424	2.42097		5.8009E+04	*****
7	5	5/29/2022 17:21	3.914236111	90627	85939.3	967400	11.2567824			2.420970827			4.96365	2.16565			
8	6	5/30/2022 18:32	4.963645833	82500.2	79148.7	690200	8.720294837			2.165653049			5.91862	1.91978		Half-life (hrs)	66.3522
9	7	5/31/2022 17:27	5.918622685	89247.6	86400	589200	6.819444444			1.919778009			6.97189	1.65226		`+/-	0.2744
10	8	6/1/2022 18:44	6.971886574	88584	86400	450900	5.21875			1.65225791			8.61527	1.23205			
11	9	6/3/2022 10:10	8.615266204	87840.1	86400	296200	3.428240741			1.232047226			9.80844	0.93918			
12	10	6/4/2022 14:49	9.8084375	87463	86400	221000	2.55787037			0.939175026			12.8672	0.18348			
13	11	6/7/2022 16:13	12.8672338	86930.5	6 86400	103800	1.201388889			0.183478295			13.9177	-0.05523			
14	12	6/8/2022 17:26	13.91771991	62379.4	62075.3	58740	0.946270095			-0.055227238			14.9169	-0.31021			
15	13	6/9/2022 17:25	14.91689815	65471.1	65226	47830	0.733296538			-0.310205105			18.658	-1.155			
16	14	6/10/2022	15.84828704	86639.7	86400	3747		0.04337					22.9188	-2.30827			
17	15	6/11/2022 16:59	16.89908565	86590.7	86400								26.0542	-3.13803			
18	16	6/13/2022 11:12	18.65796296	14087.3	14060.9	4430	0.315058069			-1.154998312			27.8204	-3.52722			
19	17	6/14/2022 16:20	19.8721412	86518.9	86400								29.9041	-4.16781			
20	18	6/15/2022 16:59	20.89899306	86499.8	8 86400												
21	19	6/17/2022 17:28	22.91880787	86469.1	86400	8591	0.09943287			-2.308272532							
22	20	6/20/2022 20:42	26.05415509	86451.1	86400	3747	0.043368056			-3.138032156							
23	21	6/22/2022 15:06	27.82043981	86447.2	86400	2539	0.029386574			-3.527217373							
24	22	6/24/2022 17:06	29.90413194	86440.8	8 86400	1338	0.015486111			-4.167811714							
25		6/28/2022 16:20	33.87206019	85129.2	85093.9												
26	24	6/29/2022 16:15	34.86866898	8 86436.7	86400												
27	25	6/30/2022 16:49	35.89172454	86434.2	86400												
28	26	7/5/2022 18:17	40.95304398	8 86418.8	8 86400												
29		25															
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31		30															
32		\$ 25	y = 3.035 R ² =	9.9923F-01													
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Gamma ray energy line 367 keV

1	Α	В	С	D	E	F	G	н	1	J	K	L	M	N	0	P	Q
1					Energy (keV) select	528											
2	Count	Count Start Date/Time	Time Diff. (days)	Realtime (sec)	Livetime (sec)	Net Peak Area	Net Count-rate (1/sec)	BAD		Log-Linear Fit							
3	1	5/25/2022 19:25	0	72870.9	62850.9	1860000	29.5938483			3.387566512			0	3.38757		-2.5077E-01	******
4	2	5/26/2022 15:53	0.852928241	72838.1	64800	1629000	25.13888889			3.224416005			0.85293	3.22442		1.2645E-03	******
5	3	5/27/2022 12:34	1.715266204	71216.6	64800	1307000	20.16975309			3.00418411			1.71527	3.00418		9.9977E-01	******
6	4	5/28/2022 15:54	2.853668981	91600.8	85480.5	1258000		14.7168					3.91424	2.42097		3.9331E+04	*****
7	5	5/29/2022 17:21	3.914236111	90627	85939.3	967400	11.2567824			2.420970827			4.96365	2.16565			
8	6	5/30/2022 18:32	4.963645833	82500.2	79148.7	690200	8.720294837			2.165653049			5.91862	1.91978		Half-life (hrs)	66.3381
9	7	5/31/2022 17:27	5.918622685	89247.6	86400	589200	6.819444444			1.919778009			6.97189	1.65226		`+/-	0.3328
10	8	6/1/2022 18:44	6.971886574	88584	86400	450900	5.21875			1.65225791			8.61527	1.23205			
11	9	6/3/2022 10:10	8.615266204	87840.1	86400	296200	3.428240741			1.232047226			9.80844	0.93918			
12	10	6/4/2022 14:49	9.8084375	87463	86400	221000	2.55787037			0.939175026			12.8672	0.18348			
13	11	6/7/2022 16:13	12.8672338	86930.5	86400	103800	1.201388889			0.183478295			13.9177	-0.05523			
14	12	6/8/2022 17:26	13.91771991	62379.4	62075.3	58740	0.946270095			-0.05522724							
15	13	6/9/2022 17:25	14.91689815	65471.1	65226	47830											
16	14	6/10/2022	15.84828704	86639.7	86400	1502											
17	15	6/11/2022 16:59	16.89908565	86590.7	86400												
18	16	6/13/2022 11:12	18.65796296	14087.3	14060.9	4430											
19	17	6/14/2022 16:20	19.8721412	86518.9	86400												
20	18	6/15/2022 16:59	20.89899306	86499.8	86400												
21	19	6/17/2022 17:28	22.91880787	86469.1	86400	8591											
22	20	6/20/2022 20:42	26.05415509	86451.1	86400	1502											
23	21	6/22/2022 15:06	27.82043981	86447.2	86400												
24		6/24/2022 17:06	29.90413194	86440.8	86400												
25	23	6/28/2022 16:20	33.87206019	85129.2	85093.9												
26	24	6/29/2022 16:15	34.86866898	86436.7	86400												
27	25	6/30/2022 16:49	35.89172454	86434.2	86400												
28	26	7/5/2022 18:17	40.95304398	86418.8	86400												
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33	1		x = 3.0277E+	01e-2.50778-01x													
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40		5	Contraction of Street, or other														
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43			Time Diff (days)														
44																	

Gamma ray energy line 528 keV

1	Α	В	C	D	F	F	G	н	1	1	к	1	M	N	0	Р	0
1					Energy (keV) select	741											-
2	Count	Count Start Date/Tim	Time Diff. (days)	Realtime (sec)	Livetime (sec)	Net Peak Area	Net Count-rate (1/sec	BAD		Log-Linear Fit							
3	1	5/25/2022 19:25	0	72870.9	62850.9	3250000	51.70968117			3.945645021			0	3.945645		-2.5374E-01	*****
4		5/26/2022 15:53	0.852928241	72838.1	64800	2834000	43.7345679			3.778138817			0.852928	3.778139		7.2328E-04	1.3880E-02
5		5/27/2022 12:34	1.715266204	71216.6	64800	2348000	36.2345679			3.590013578			1.715266	3.590014		9.9987E-01	3.7161E-02
6		5/28/2022 15:54	2.853668981	91600.8	85480.5	628600		7.353724					3.914236	3.007999		1.2308E+05	*****
7		5/29/2022 17:21	3.914236111	90627	85939.3	1740000	20.24684865			3.007999159			4.963646	2.75315			
8	(5/30/2022 18:32	4.963645833	82500.2	79148.7	1242000	15.69198231			2.753149901			5.918623	2.50136		Half-life (hrs)	65.5608
9		5/31/2022 17:27	5.918622685	89247.6	86400	1054000	12.19907407			2.501360053			6.971887	2.235822		`+/-	0.1863
10	8	6/1/2022 18:44	6.971886574	88584	86400	808200	9.354166667			2.235821877			8.615266	1.823466			
11	9	6/3/2022 10:10	8.615266204	87840.1	86400	535100	6.193287037			1.82346597			9.808437	1.522427			
12	10	6/4/2022 14:49	9.8084375	87463	86400	396000	4.583333333			1.522426535			12.86723	0.752136			
13	11	6/7/2022 16:13	12.8672338	86930.5	86400	183300	2.121527778			0.752136479			13.91772	0.517964			
14	12	6/8/2022 17:26	13.91771991	62379.4	62075.3	104200	1.678606467			0.517963965			14.9169	0.260785			
15	13	6/9/2022 17:25	14.91689815	65471.1	65226	84660	1.297948671			0.260785073			22.91881	-1.7725			
16	14	6/10/2022 15:46	15.84828704	86639.7	86400	6558		0.075903					26.05416	-2.5783			
17	13	6/11/2022 16:59	16.89908565	86590.7	86400								29.90413	-3.58394			
18	10	6/13/2022 11:12	18.65796296	14087.3	14060.9	4430		0.315058					33.87206	-4.63601			
19	1	6/14/2022 16:20	19.8721412	86518.9	86400								34.86867	-4.77878			
20	18	6/15/2022 16:59	20.89899306	86499.8	86400								35.89172	-5.1793			
21	19	6/17/2022 17:28	22.91880787	86469.1	86400	14680	0.169907407			-1.772501653							
22	20	6/20/2022 20:42	26.05415509	86451.1	86400	6558	0.075902778			-2.578301997							
23	2:	6/22/2022 15:06	27.82043981	86447.2	86400												
24	22	6/24/2022 17:06	29.90413194	86440.8	86400	2399	0.027766204			-3.583935692							
25	23	6/28/2022 16:20	33.87206019	85129.2	85093.9	825.1	0.009696347			-4.636006041							
26	24	6/29/2022 16:15	34.86866898	86436.7	86400	726.3	0.00840625			-4.778779802							
27	25	6/30/2022 16:49	35.89172454	86434.2	86400	486.6	0.005631944			-5.179300524							
28	20	7/5/2022 18:17	40.95304398	86418.8	86400												
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Gamma ray energy line 741 keV

	Α	В	C	D	E	F	G	H	I J	K	L	M	N	0	Р	Q
1				×	Energy (keV) select	778.7										
2	Count	Count Start Date/Tim	Time Diff. (days)	Realtime (sec)	Livetime (sec)	Net Peak Area	Net Count-rate (1/sec	BAD	Log-Linear Fit							
3	:	5/25/2022 19:25	0	72870.9	62850.9	3367000	53.57122969		3.981012164			0	3.981012		-2.5256E-01	*****
4		5/26/2022 15:53	0.852928241	72838.1	64800	2769000	42.73148148		3.75493592			0.852928	3.754936		7.0763E-04	1.3968E-02
5	3	5/27/2022 12:34	1.715266204	71216.6	64800	2303000	35.54012346		3.570662296			1.715266	3.570662		9.9987E-01	3.7433E-02
6		5/28/2022 15:54	2.853668981	91600.8	85480.5	1592000		18.62413				3.914236	2.983565		1.2738E+05	*****
7		5/29/2022 17:21	3.914236111	90627	85939.3	1698000	19.75813161		2.983565134			4.963646	2.728699			
8	(5/30/2022 18:32	4.963645833	82500.2	79148.7	1212000	15.31294892		2.728698805			5.918623	2.479297		Half-life (hrs)	65.8688
9	:	5/31/2022 17:27	5.918622685	89247.6	86400	1031000	11.93287037		2.479296808			6.971887	2.214942		`+/-	0.1840
10	1	6/1/2022 18:44	6.971886574	88584	86400	791500	9.16087963		2.214942204			8.615266	1.798488			
11	9	6/3/2022 10:10	8.615266204	87840.1	86400	521900	6.040509259		1.798488323			9.808437	1.499437			
12	1(6/4/2022 14:49	9.8084375	87463	86400	387000	4.479166667		1.499437017			12.86723	0.634149			
13	1:	6/7/2022 16:13	12.8672338	86930.5	86400	162900	1.885416667		0.63414884			13.91772	0.512189			
14	1	6/8/2022 17:26	13.91771991	62379.4	62075.3	103600	1.668940786		0.512189166			14.9169	0.256049			
15	13	6/9/2022 17:25	14.91689815	65471.1	65226	84260	1.291816147		0.256049094			22.91881	-1.78002			
16	1	6/10/2022	15.84828704	86639.7	86400	6623		0.076655				26.05416	-2.56844			
17	1	6/11/2022 16:59	16.89908565	86590.7	86400							27.82044	-2.99365			
18	1	6/13/2022 11:12	18.65796296	14087.3	14060.9	7616		0.541644				29.90413	-3.58937			
19	1	6/14/2022 16:20	19.8721412	86518.9	86400							33.87206	-4.55056			
20	1	6/15/2022 16:59	20.89899306	86499.8	86400							34.86867	-4.88931			
21	19	6/17/2022 17:28	22.91880787	86469.1	86400	14570	0.168634259		-1.78002306			35.89172	-5.10106			
22	20	6/20/2022 20:42	26.05415509	86451.1	86400	6623	0.076655093		-2.56843924							
23	2:	6/22/2022 15:06	27.82043981	86447.2	86400	4329	0.050104167		-2.99365111							
24	2	6/24/2022 17:06	29.90413194	86440.8	86400	2386	0.027615741		-3.58936935							
25	2	6/28/2022 16:20	33.87206019	85129.2	85093.9	898.7	0.010561274		-4.55056136							
26	24	6/29/2022 16:15	34.86866898	86436.7	86400	650.3	0.00752662		-4.88930916							
27	2!	6/30/2022 16:49	35.89172454	86434.2	86400	526.2	0.006090278		-5.10106159							
28	2	7/5/2022 18:17	40.95304398	86418.8	86400											
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43			Lime Diff (i	ays)												
44																

Gamma ray energy line 778.7 keV

	А	В	С	D	E	F	G	н	1	J	К	L	M	N	0	Р	Q
1				•	Energy (keV) select	881											
2	Count	Count Start Date/Time	Time Diff. (days)	Realtime (sec)	Livetime (sec)	Net Peak Area	Net Count-rate (1/sec)	BAD		Log-Linear Fit							
3	1	5/25/2022 19:25	0	72870.9	62850.9	1547000	24.61380824			3.203307596			0	3.20331		-2.5305E-01	*****
4	2	5/26/2022 15:53	0.852928241	72838.1	64800	1257000	19.39814815			2.965177605			0.85293	2.96518		5.3314E-04	*****
5	3	5/27/2022 12:34	1.715266204	71216.6	64800	1056000	16.2962963			2.790937861			1.71527	2.79094		9.9993E-01	*****
6	4	5/28/2022 15:54	2.853668981	91600.8	85480.5	284200		3.32473					3.91424	2.20321		2.2528E+05	******
7	5	5/29/2022 17:21	3.914236111	90627	85939.3	778100	9.054064904			2.203213818			4.96365	1.94728			
8	6	5/30/2022 18:32	4.963645833	82500.2	79148.7	554800	7.009590808			1.947279327			5.91862	1.69438		Half-life (hrs)	65.7406
9	7	5/31/2022 17:27	5.918622685	89247.6	86400	470300	5.443287037			1.694383113			6.97189	1.42989		`+/-	0.1382
10	8	6/1/2022 18:44	6.971886574	88584	86400	361000	4.178240741			1.429890283			8.61527	1.01664			
11	9	6/3/2022 10:10	8.615266204	87840.1	86400	238800	2.7638888889			1.016638706			9.80844	0.71716			
12	10	6/4/2022 14:49	9.8084375	87463	86400	177000	2.048611111			0.717162057			12.8672	-0.01846			
13	11	6/7/2022 16:13	12.8672338	86930.5	86400	84820	0.981712963			-0.01845631			13.9177	-0.26426			
14	12	6/8/2022 17:26	13.91771991	62379.4	62075.3	47660	0.7677772			-0.26425569			14.9169	-0.51455			
15	13	6/9/2022 17:25	14.91689815	65471.1	65226	38990	0.597767761			-0.51455296			22.9188	-2.57056			
16	14	6/10/2022	15.84828704	86639.7	86400	2913		0.03372					26.0542	-3.3898			
17	15	6/11/2022 16:59	16.89908565	86590.7	86400								29.9041	-4.36186			
18	16	6/13/2022 11:12	18.65796296	14087.3	14060.9	7745		0.55082					33.8721	-5.38665			
19	17	6/14/2022 16:20	19.8721412	86518.9	86400								34.8687	-5.63275			
20	18	6/15/2022 16:59	20.89899306	86499.8	86400												
21	19	6/17/2022 17:28	22.91880787	86469.1	86400	6609	0.076493056			-2.57055532							
22	20	6/20/2022 20:42	26.05415509	86451.1	86400	2913	0.033715278			-3.3898042							
23	21	6/22/2022 15:06	27.82043981	86447.2	86400												
24	22	6/24/2022 17:06	29.90413194	86440.8	86400	1102	0.01275463			-4.36186097							
25	23	6/28/2022 16:20	33.87206019	85129.2	85093.9	389.5	0.004577296			-5.38664677							
26	24	6/29/2022 16:15	34.86866898	86436.7	86400	309.2	0.003578704			-5.63275464							
27		6/30/2022 16:49	35.89172454	86434.2	86400												
28		7/5/2022 18:17	40.95304398	86418.8	86400												
29																	
30		30															
31																	
32		1															
33		95 20	У	= 2.4759E+01e ^{-2.5308E+} R ² = 9.9966E-01	OLX												
34		e (1		11 - 5.55002 01													
35		15															
36		anna /															
37		0 10															
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42			Time Diff (davs)													
43				. /													

Gamma ray energy line 881 keV

	А	В	С	D	E	F	G	н		J	К	L	М	N	0	Р	0
1					Energy (keV) select	922											-
2	Count	Count Start Date/Tim	Time Diff. (days)	Realtime (sec)	Livetime (sec)	Net Peak Are:	Net Count-rate (1/sec	BAD		Log-Linear Fit							
3	1	5/25/2022 19:25	0	72870.9	62850.9	2366000	37.64464789			3.62819079			0	3.628191		-2.5245E-01	
4	2	5/26/2022 15:53	0.852928241	72838.1	64800	1905000	29.39814815			3,380931684			0.852928	3.380932		9.0727E-04	1.7909E-02
5	3	5/27/2022 12:34	1,715266204	71216.6	64800	1620000	25			3,218875825			1,715266	3,218876		9.9978F-01	4.7993E-02
6	4	5/28/2022 15:54	2.853668981	91600.8	85480.5	437200		5.114617					3.914236	2.630585		7.7424E+04	****
7	5	5/29/2022 17:21	3,914236111	90627	85939.3	1193000	13.88189106			2,630585189			4.963646	2,380591			
8	6	5/30/2022 18:32	4,963645833	82500.2	79148.7	855700	10.8112957			2.380591486			5.918623	2.122622		Half-life (hrs)	65,8967
9	7	5/31/2022 17:27	5,918622685	89247.6	86400	721700	8.353009259			2,122621864			6.971887	1.859259		`+/-	0.2360
10	8	6/1/2022 18:44	6.971886574	88584	86400	554600	6.418981481			1.859259457			8.615266	1.445011			
11	9	6/3/2022 10:10	8.615266204	87840.1	86400	366500	4.241898148			1.445010846			9.808437	1.135724			
12	10	6/4/2022 14:49	9 8084375	87463	86400	269000	3 113425926			1 135723704			12 86723	0.416973			
13	11	6/7/2022 16:13	12,8672338	86930.5	86400	131100	1.517361111			0.416972715			13.91772	0.159368			
14	12	6/8/2022 17:26	13 91771991	62379.4	62075 3	72800	1 172769201			0 159367791			14 9169	-0.07621			
15	13	6/9/2022 17:25	14 91689815	65471.1	65226	60440	0.926624352			-0.076207025			22 91881	-2 12297			
16	14	6/10/2022	15 84828704	86639.7	86400	4722	0.520024552	0.054653		0.070207025			26.05416	-2 90676			
17	10	6/11/2022 16:59	16 89908565	86590.7	86400			01001000					27 82044	-3 36271			
18	16	6/13/2022 11:12	18.65796296	14087 3	14060.9	3487		0 247993					29 90413	-3.8835			
19	17	6/14/2022 16:20	19 8721/12	86518.9	86400	0.107		012110000					33,87206	-4 97597			
20		6/15/2022 16:50	20 89899306	86499.8	86400								34 86867	-5.09273			
21	10	6/17/2022 17:28	22,050555500	86469.1	86400	10340	0 119675926			-2 122967807			35,89172	-5 5583			
22	20	6/20/2022 20:42	26.05415509	86451.1	86400	4722	0.054652778			-2 906755237			55.05172	3.3303			
23	21	6/22/2022 20:42	27,820/3981	86447.2	86400	2993	0.034641204			-3.362711447							
24	22	6/24/2022 17:06	20.02043301	86440.8	86400	1778	0.020578704			3 883/08530							
25	23	6/28/2022 16:20	33 87206019	85129.2	85093.9	587 3	0.006901787			-4 975974869							
26	24	6/20/2022 16:15	34 86866898	86436.7	86400	530.6	0.006141204			5.092734513							
27	29	6/30/2022 16:49	35 89172454	86434.2	86400	333.1	0.003855324			-5.55830021							
28	26	7/5/2022 18:17	40.95304398	86418.8	86400	555.1	0.005055524			5.5505002.1							
20		77572022 20127	40155504550	00410.0	00400		0	37 64465	3 628191								
30		40 -					0.852928241	29 39815	3 380932								
31		40					1 715266204	25.55015	3 218876								
32							2.853668981	20									
33		98 30 Q		y = 3.	7915E+01e-2-5245E-018		3 914236111	13,88189	2 630585								
34		1 25 A			- 5.55472.01		4.963645833	10.8113	2.380591								
35		P 20					5,918622685	8.353009	2.122622								
36		15 15	/				6.971886574	6.418981	1.859259								
37		0 10	N				8 615266204	4 241898	1 445011								
38		ž 10					9 8084375	3 113426	1 135724								
39		5	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1				12 8672338	1 517361	0.416973								
40		0	······	••••••			13.91771991	1.172769	0.159368								
41		0	5 10 15	20 2	5 30 35	40	14,91689815	0.926624	-0.07621								
42				Time Diff (days)			15.84828704	01520021	0107022								
43							16.89908565										
44							18.65796296	0.247993	-1.39436								
45		1 mag					19.8721412										
46		100 million (100 million)					20.89899306										
47			1.				22,91880787	0.119676	-2.12297								
48			100 million (100 m				26.05415509	0.054653	-2.90676								
49			and the second se														
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Gamma ray energy line 922 keV

1 1	2.5614E-01 -8.6801E-0 1.3730E-03 1.0611E-0 9.974E-01 2.0238E-0 3.4803E+04 9.0000E+0 alf-life (hrs) 64.947 '+/- 0.346
2 Control contro control control control control control control control	2.5614E-01 -8.6801E-0 1.3730E-03 1.0611E-0 9.9974E-01 2.0238E-04 9.4803E+04 9.0000E+0 alf-life (hrs) 64.947 `+/- 0.346
3 1 5/5/2022 19:25 0 7287.09 6287.09 6287.09 0.4116096.05 -0.8878126 0 0.88783 1.0 0.88783 1.0 0.88783 1.0 0.88783 1.0 0.88783 0.83733 1.0586758 0.83733 1.0586758 0.83733 1.0306 1.1112 1.3126 0.83733 1.0586758 0.0534 -1.3205991 1.17127 1.3126 0.83733 1.0597 1.320591 1.17127 1.3126 0.83733 1.0597 1.320591 1.1894614 4.94355 0.83733 0.0534 8 6 5/20/20211727 5.91862285 88247.6 86400 0.015115339 -1.8894614 6.9189 -2.469069 8.61527 -0.9047 -0.9047 -0.90471783 -2.649069 8.61527 -0.9047 -0.9047 -0.90471783 -2.649069 8.61527 -0.9047 -0.90471783 -2.649069 8.61527 -0.9047 -0.90471783 -2.649069 8.61527 -0.9047 -0.90471783 -2.649069 8.61527 -0.9047 -0.90471783	2.5514F01 - 8.6801E-0 1.3730E-03 1.0611E-0 9.974E-01 2.0238E-0 3.4803E+04 9.0000E+0 alf-life (hrs) 64.947 `+/- 0.346
4 2 5/52(2022 15:3) 0.85222841 728381 6400 22400 0.34691385 -1.05867958 0.85293 -1.05869 1.3 6 3 5/72/2022 15:34 1.71526604 71216.6 64000 0.7300 0.26697530 0.1320591 1.71527 -1.05869 3.9124 -1.889461 4.9365 -1.09447 7 5 5/72/20217:21 3.914236111 9067 8593.3 1290 0.15115318 -1.889461 4.9635 -2.09047 -3.3255 Haff 9 7 5/31/2021727 5.91862268 882502 791487 0605 0.0222222 -2.3855416 6.91792 -2.64906 8.6157 -3.09647 10 6/1/2021844 6.97188573 88540 6400 0306 0.00422022 -3.363739 12.8672 -4.41786 11 0.6 6/3/2021103 1.867738 86400 1326 0.01919395 -4.429584 -1.08 -1.08 -1.08 -1.08 -1.08 -1.08 -1.08 -1.08<	1.3730F-03 1.0611E-0 9.9974E-01 2.0238E-0 3.4803E+04 9.0000E+0 alf-life (hrs) 64.947 °+/- 0.346
5 3 5/27/2022 12:34 1.715266204 71216.6 6400 17200 0.26697509 1.320591 1.71527 1.3206 9.9 7 5 5/28/2022 17:21 3.9142 3.1686981 91600.8 85480.5 4555 0.053 1 3.9142 3.16896 3.9142 3.16896 3.9142 3.16896 3.9142 3.16896 3.9142 3.16896 3.9142 3.16896 3.9142 3.16896 3.9142 3.16896 3.9142 3.16896 3.9142 3.16896 3.9142 3.16896 3.9142 3.16896 3.9142 3.16896 3.9142 3.16896 3.9144 3.16896 3.9144 3.16896 3.9144 3.16896 3.9144 3.16896 3.9144 3.16896 3.9144 3.16896 3.9148 3.16896 3.9148 3.16896 3.9148 3.16896 3.9148 3.16896 3.9148 3.16896 3.9148 3.16896 3.9148 3.16896 3.9148 3.16896 3.9148 3.16896 3.9148 3.16896 3.9148 3.16896 3.9148 3.16896 3.9148 3.16896 3.9148 3.16896 3.9148 3.16896 3.9168 3.16896 3.9168 3.16896 3.9168 3.16896 3.9168 3.16896 3.9168 3.16896 3.9168 3.16896 3.9168 3.16896 3.9168 3.16896 3.9178 3.16896 3.9178 3.16896 3.9178 3.16896 3.9168966	9.9974E-01 2.0238E-0 3.4803E+04 9.0000E+0 alf-life (hrs) 64.947 `+/- 0.346
6 5/28/20215:54 2.83566981 9160.8 8840.5 4465 0.0534	3.4803E+04 9.0000E+0 alf-life (hrs) 64.947 `+/- 0.346
7 5 5/2/2022 17:21 3.914/3611 9067 87939.3 1290 0.15115389 1.8894614 4.9636 -2.10904 9 7 5/30/202 17:27 5.91862 2883 822002 79148.7 9605 0.12133887 -2.1090447 5.91862 2.8355 Heit 9 7 5/31/202 17:27 5.91862 2883 82907.6 84600 010 0.09222222 -2.83355416 6.9718 -2.649006 8.6127 -3.09677 10 8 6/1/20214:44 6.971886274 88784.1 86400 3000 0.09222222 -3.3057359 12.8672 4.1768207 11 0.6/1/20214:49 9.8084375 87840.1 86400 3000 0.00472222 -3.3057395 12.8672 4.1768207 13 11 6/1/20216:3 12.867238 86930.5 86400 0.0057 -4.42588 0.1861 0.0661 15 6 6/13/20216:59 16.8996565 86539.7 86400 586.1 0.0676 2.42588 2.42588 2.42588 <td>alf-life (hrs) 64.947 `+/- 0.346</td>	alf-life (hrs) 64.947 `+/- 0.346
8 6 5/3/02/22 13:22 4.96364333 8250.2 7914/22 905 0.12133857 -1.0004457 5.91862 -3.8355 Haff 10 8 6/1/2022 18:44 6.97188 6.8027 3.0964 1 6.97189 -2.649069 8.61527 3.0964 1 1 9 6/3/2022 10:10 8.61526 204 87840.1 86400 3006 0.0070717533 -2.649069 8.61527 3.09647 1 3.09647 1 3.09647 1 3.09647 1 1.09 6/3/2022 10:10 8.61526 204 87840.1 86400 3000 0.007717533 -3.06947384 9.80847 8.417682 1.0827 4.17682 1.1877 4.425984 1.28672 4.17682 1.3817 4.4259 1.3817 4.4259 1.3817 4.425984 1.8677 4.425984 1.8877 4.425984 1.8677 4.425984 1.8677 4.425984 1.8677 4.425984 1.8677 4.425984 1.8677 4.425984 1.8677 4.425984 1.8610 1.8677	alf-life (hrs) 64.947 `+/- 0.346
9 7 5/31/2022 17:27 5.918622685 88247.6 86400 766 0.009222222 -2.8355416 6.97189 -2.64906 10 8 6/1/2022 18:44 6.971886574 88584 86400 3006 0.007217593 -2.649069 8.61527 -3.00947 12 10 6/4/2022 18:49 9.8084375 87403 86400 3006 0.004520833 -3.0947384 9.8044 -3.0038 12 10 6/4/2021 1:49 9.8084375 87403 86400 3006 0.00537329 12.8672 -4.17682078 14 12 6/6/2021 7:26 13.9177 191 62374 62075.3 739.9 0.011919395 -4.425884 -4.42584 -4.42584 -4.42584 -4.42584 -4.42584 -4.4259 -4.42584 -4.42584 -4.42584 -4.42584 -4.42584 -4.42584 -4.42584 -4.42584 -4.42584 -4.42584 -4.42584 -4.42584 -4.42584 -4.42584 -4.42584 -4.42584 -4.42584 -4.42584 -4.42584 <t< td=""><td>`+/- 0.346</td></t<>	`+/- 0.346
10 8 6/f/2022 13:41 6.971886574 88893 86400 610 0.0707/7993 -2.6490009 8.61527 -3.0967738 11 9 6/d/2022 14:49 9.8084375 87401 86400 3000 0.05208333 -3.0967738 9.8084 -3.3608 9.8084 -3.3608 12.672 4.17682078 12.672 4.17682078 13.917 -4.42958 4.17682078 13.917 -4.42958 4.17682078 13.917 -4.42958 4.17682078 13.917 -4.42958 4.17682078 13.917 -4.42958 -4.42958 -4.429584 -4.429584 -4.429584 -4.429584 -4.429584 -4.42958 -4.429584 <t< td=""><td></td></t<>	
11 9 6/1/2022 10:10 8.6157662.04 87840.1 87640.0 3000 0.04520833.3 -3.09647384 9.8084/3 3.6003 12 10 6/1/2022 16:13 12.8672338 86930.5 86400 3000 0.03472222 -3.36037539 12.8672 -4.17682078 13.9177 -4.42559 14 12 6/8/2022 17.25 13.9177/391 66377.4 62075.3 7379.9 0.011919395 -4.425584 -	
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14 12 6/8/2022 17:26 13.9177190 62379.4 62075.3 739.9 0.011919395 -4.429584 15 16 6/9/2022 17:26 14.91889815 65471.1 65226 431.1 0.00661 <td></td>	
15 16 6/9/2022 17.25 14.91689815 6.6471.1 6.5226 43.1.1 0.00661 16 14 6/10/202 15.8482704 86639.7 86640 0.00678 17 15 6/11/2022 15.9 16.8990855 86590.7 86400 586.1 0.00678 18 16 6/13/2022 11.12 18.65796296 144087.3 14060.9 533 0.37942 20 16 6/14/2022 15.9 20.898939306 86490 <t< td=""><td></td></t<>	
16 14 6/10/202 15.84828704 86639.7 86640 0.00678 17 15 6/11/20221659 16.89908565 86590.7 86400 0.00678 18 10 6/11/20221652 116.89908565 86590.7 86400 0.0078 19 17 6/11/20221659 13.8721412 86518.9 86400 0.01968 0.01968 21 0.15 6/15/202217.28 22.91880787 8649.1 86400 0.11968 0.05465 22 20 6/20/2022.042 26.05415509 86491.1 86400 0.11968 0.01968 0.01968 24 22 6/24/2022.17.06 27.8043981 86440.8 86400 0.01968 0.01968 0.01968 25 24 6/22/2022.17.06 27.8043981 86440.8 86400 0.01968	
17 16 6/11/2022 16:59 16.89908565 86590.7 86400 0.37942 18 10 6/13/2022 11:12 18.65796296 14087.3 14060.9 5335 0.37942 19 10 6/14/2022 16:59 20.89899306 86400 0 0 20 14 6/17/2022 17:28 22.9889730 86409.1 0.10340 0.11968 22 20 6/20/2022 17:26 27.82043981 86407.2 0.05465 0 23 21 6/22/2022 17:06 27.82043981 86447.2 86400 0 24 2 6/24/2021 17:06 27.82043981 86447.2 86400 0 25 22 6/28/2022 17:06 33.87206019 8512.9 8593.9 0 0 26 24 6/29/2022 17:05 33.8866898 86430.7 86400 0 0 0 27 26 6/30/2022 16:49 35.8917244 86430.2 86400 0 0 0 0 28 7/52022 18:17 40.95304398 86418.8 86400 0 0 <td></td>	
18 16 6/12/022 11:12 18.65796296 14087.3 14060.9 5335 0.37942 19 17 6/14/2022 16:20 19.8721412 86518.9 86400 <	
19 17 6/14/2022 16:20 19.8721412 8651.89 86400 20 16 6/15/2022 16:59 20.88989306 86499.8 86400 0 21 16 6/17/2022 17:28 22.91880787 86469.1 86400 0.11968 0 22 20 6/20/2022 10:42 26.05415509 86461.1 86400 4722 0.05465 0 24 22 6/22/2022 17:06 27.8043981 86440.8 86400 0 0 0 25 23 6/24/2022 17:05 23.87206019 8512.2 8593.9 0 0 0 26 24 6/29/2022 15:15 34.8666898 86400 0 0 0 0 0 27 6/29/2022 15:15 34.8666898 86430.7 86400 0	
20 16 6/15/2022 16:59 20.8989306 86499.8 86400 21 10 6/17/2022 17:28 22.9180787 86469.1 86400 10340 0.11968 22 20 6/20/202 20:42 26.05415509 86451.1 86400 4722 0.05465 23 2 6/22/2022 15:06 27.82043981 86440.2 86400 10340 11968 24 26 6/24/2022 15:06 33.87206019 8512.2 85993.9 1000000000000000000000000000000000000	
21 19 6/17/2022 17:28 22.91880787 86469.1 86400 0.1300 0.11968 22 20 6/20/2022 20:42 26.05415509 86451.1 86400 4722 0.05465 24 21 6/22/2021 5:06 27.82043981 86440.8 86400 4722 0.05465 25 23 6/28/2022 16:02 33.8706019 85129.2 85093.9 4 4 26 24 6/29/2022 16:15 33.889172454 86400 4 4 27 25 6/30/2022 16:49 35.89172454 86434.2 86400 4 28 25 7/5/2022 18:17 40.95304398 86418.8 86400 4	
22 20 6/20/202 20:42 26.0541559 86401.1 86400 4722 0.05465 24 20 6/22/022 15:06 27.8043981 86402 86400 8 24 20 6/24/022 17:06 27.8043981 86402 8 8 25 27 6/28/022 15:15 33.87206019 85129.2 8509.9 8 8 26 24 6/29/022 15:15 33.8866898 86430.7 86440.8 8 8 27 26 6/29/022 15:15 34.8866898 86430.7 86440.8 8	
23 21 6/22/2022 15:06 27.82043981 86440.2 86400 24 22 6/24/2022 15:06 23.920413194 86440.8 86400 25 23 6/28/2022 15:05 33.8700019 85129.2 8509.9 26 24 6/29/2022 16:15 34.86866898 86436.7 86400 27 25 6/30/2022 16:49 35.89172454 86434.2 86400 28 29	
24 29 6/24/2022 17:06 29.9013134 8640.8 86400 25 23 6/28/2022 16:20 33.8720619 85129.2 85093.9 26 24 6/29/2022 16:15 33.8720619 85129.2 85093.9 27 25 6/30/2022 16:49 35.89172454 86436.7 86400 28 25 7/5/2022 18:17 40.95304398 86418.8 86400	
25 27 6/28/2022 16:20 33.87206019 85129.2 85093.9 26 26 6/29/2022 15:15 34.866698 86436.7 86400 27 25 6/30/2022 16:49 35.89172454 86434.2 86400 28 27 7/5/2022 18:17 40.95304398 86418.8 86400	
26 2i 6/29/2022 16:15 34.86866898 8640.7 86400 27 25 6/30/2022 16:49 35.89172454 86434.2 86400 28 26 7/5/2022 18:17 40.95304398 86418.8 86400 29	
27 25 6/30/2022 16:49 35.89172454 86434.2 86400 28 26 7/5/2022 18:17 40.95304398 86418.8 86400 29	
28 26 7/5/2022 18:17 40.95304398 86418.8 86400 29	
29	
30 0.45	
31 0.4 %	
32 0.035	
33 y 4 0.3 y 4 0.1 y 4 0.1 y 5 0.0 y 5	
35 € 0.25	
36 <u><u><u></u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u></u>	
37 0 0.15	
38 Ž 0.1	
39 0.05	
40	
41 0 2 4 6 8 10 12 14 16	
42 Time Diff (days)	
43	

Gamma ray energy line 1005 keV

4	4	В	с	D	E	F	G	н	1	J	К	L	М	N	0	р	Q
1					Energy (keV) select	1145	i										
2 Coun	t I	Count Start Date/Tim	Time Diff. (days)	Realtime (sec)	Livetime (sec)	Net Peak Area	Net Count-rate (1/sec)	BAD		Log-Linear Fit							
3	1	5/25/2022 19:25	0	72870.9	62850.9	16840	0.267935702			-1.317008246			0	-1.31701		-2.5321E-01	-1.3257E+00
4	2	5/26/2022 15:53	0.852928241	72838.1	64800	13980	0.215740741			-1.533677867			0.852928	-1.53368		1.8766E-03	1.3155E-02
5	3	5/27/2022 12:34	1.715266204	71216.6	64800	11480	0.177160494			-1.730699212			1.715266	-1.7307		9.9956E-01	2.4480E-02
6	4	5/28/2022 15:54	2.853668981	91600.8	85480.5	3283		0.038406					3.914236	-2.32529		1.8206E+04	8.0000E+00
7	5	5/29/2022 17:21	3.914236111	90627	85939.3	8401	0.097755043			-2.325290487			4.963646	-2.59468			
8	6	5/30/2022 18:32	4.963645833	82500.2	79148.7	5910	0.074669578			-2.59468253			5.918623	-2.82661		Half-life (hrs)	65.6975
9	7	5/31/2022 17:27	5.918622685	89247.6	86400	5116	0.059212963			-2.826614792			6.971887	-3.11273		`+/-	0.4833
10	8	6/1/2022 18:44	6.971886574	88584	86400	3843	0.044479167			-3.112734364			8.615266	-3.5395			
11	9	6/3/2022 10:10	8.615266204	87840.1	86400	2508	0.029027778			-3.539502053			9.808437	-3.82241			
12	10	6/4/2022 14:49	9.8084375	87463	86400	1890	0.021875			-3.822410847			13.91772	-4.80641			
13	11	6/7/2022 16:13	12.8672338	86930.5	86400	940.7	0.010887731										
14	12	6/8/2022 17:26	13.91771991	62379.4	62075.3	507.6	0.008177165			-4.806409707							
15	13	6/9/2022 17:25	14.91689815	65471.1	65226	353.4		0.005418									
16	14	6/10/2022 15:46	15.84828704	86639.7	86400	451.6											
17	15	6/11/2022 16:59	16.89908565	86590.7	86400			0.005227									
18	16	6/13/2022 11:12	18.65796296	14087.3	14060.9	5335											
19	17	6/14/2022 16:20	19.8721412	86518.9	86400												
20	18	6/15/2022 16:59	20.89899306	86499.8	86400												
21	19	6/17/2022 17:28	22.91880787	86469.1	86400	10340											
22	20	6/20/2022 20:42	26.05415509	86451.1	86400	4722											
23	21	6/22/2022 15:06	27.82043981	86447.2	86400												
24	22	6/24/2022 17:06	29.90413194	86440.8	86400												
25	23	6/28/2022 16:20	33.87206019	85129.2	85093.9												
26	24	6/29/2022 16:15	34.86866898	86436.7	86400												
27	25	6/30/2022 16:49	35.89172454	86434.2	86400												
28	26	7/5/2022 18:17	40.95304398	86418.8	86400												
29																	
30		1															
31		0 2	4 6 11	8 10	14 16												
32				y = 2.6393E-01e ^{-2.512} R ² = 9.9972E-01	con												
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35		(1															
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Gamma ray energy line 1145 keV

	Α	В	С	D	E	F	G	н	1	J	К	L	м	N	0	Ρ	Q	R	S	т	U	V
1	Gamma-Ray Energy Line	Half-Life	Uncertainty																			
2	41	65.5056	0.13400791		65.88767418	65.6420385	66.13330983	65.924		67												
3	142	65.98988	0.0733391		65.88767418	65.6420385	66.13330983	65.924														
4	160	65.58052	0.39333227		65.88767418	65.6420385	66.13330983	65.924		66.9												
5	182	66.10041	0.25122138		65.88767418	65.6420385	66.13330983	65.924		00.0												
6	367	66.48553	0.28936956		65.88767418	65.6420385	66.13330983	65.924								1						
7	528	66.33807	0.33282215		65.88767418	65.6420385	66.13330983	65.924		66.6												
8	741	65.56076	0.18634609		65.88767418	65.6420385	66.13330983	65.924						*								
9	778.7	65.86884	0.18404133		65.88767418	65.6420385	66.13330983	65.924		66.4												
10	881	65.74062	0.1382163		65.88767418	65.6420385	66.13330983	65.924								Ť						
11	992	65.89666	0.23597618		65.88767418	65.6420385	66.13330983	65.924		66.2												
12	1145	65.69752	0.48331993		65.88767418	65.6420385	66.13330983	65.924		12												-
13					65.88767418	65.6420385	66.13330983	65.924		는 관 65		1 T						1				
14					65.88767418	65.6420385	66.13330983	65.924		17		Ť										
15					65.88767418	65.6420385	66.13330983	65.924		18 H		•••••			•••••		•••••	***		·····*	•••••	
16					65.88767418	65.6420385	66.13330983	65.924		65.8									4			
17					65.88767418	65.6420385	66.13330983	65.924											Ĩ			*
18					65.88767418	65.6420385	66.13330983	65.924		65.6		*						-1-				
19	average	65.88767	0.24563565								*							T				
20										65.4												
21																						
22	1005	64.9472	0.34628072							65.2												
23										00.2		·										
24																						
25										65)	20	0	40	0	60	0	80	10	10	00	1200
26											/	24		-	Gam	ma-Ray Fru	o erav Line (k	eV/)		10		1200
27							Gainina-kay Line (key)															
28		X Maaarinota																				
29									1													

Compiled $T_{1/2}$ calculations