

IAEA Training Workshop Nuclear Structure and Decay Data

Evaluation of Discrepant Data III

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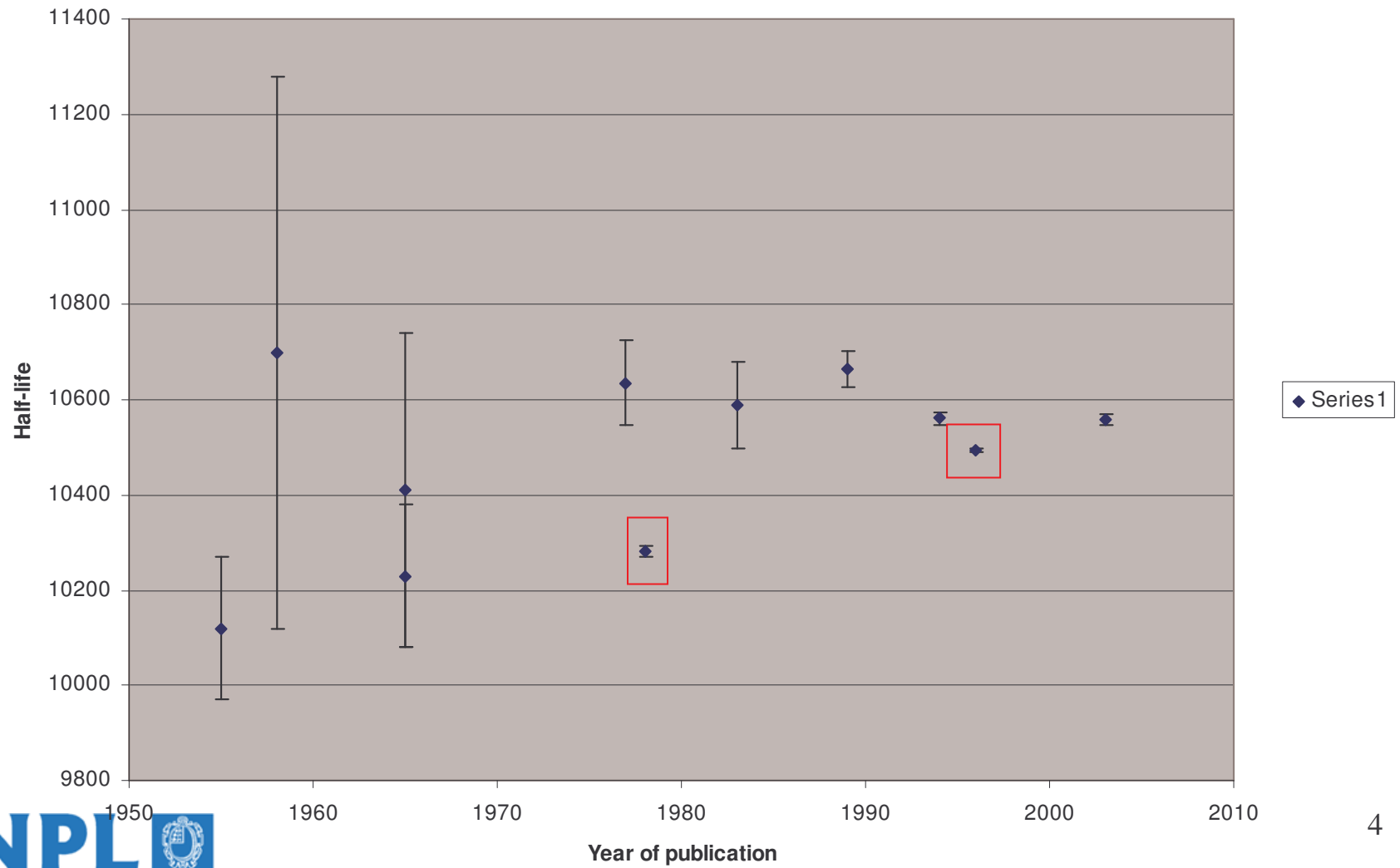
Sr-90 Half-Life Measurements

| Authors | Measured half-lives | |
|---------------------------|---------------------|----------|
| | days | |
| | $t_{1/2}$ | σ |
| Wiles & Tomlinson (1955b) | 10120 | 150 |
| Anikina et al. (1958) | 10700 | 580 |
| Flynn et al. (1965) | 10230 | 150 |
| Flynn et al. (1965) | 10410 | 330 |
| Hoppes (1977) | 10636 | 88 |
| Lagoutine et al. (1978) | 10282 | 12 |
| Ramthun (1983) | 10588 | 91 |
| Kochin et al. (1989) | 10665 | 37 |
| Martin et al. (1994) | 10561 | 14 |
| Woods & Lucas (1996) | 10495 | 4 |
| Schrader (2004) | 10557 | 11 |

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Sr-90 Half-Life data

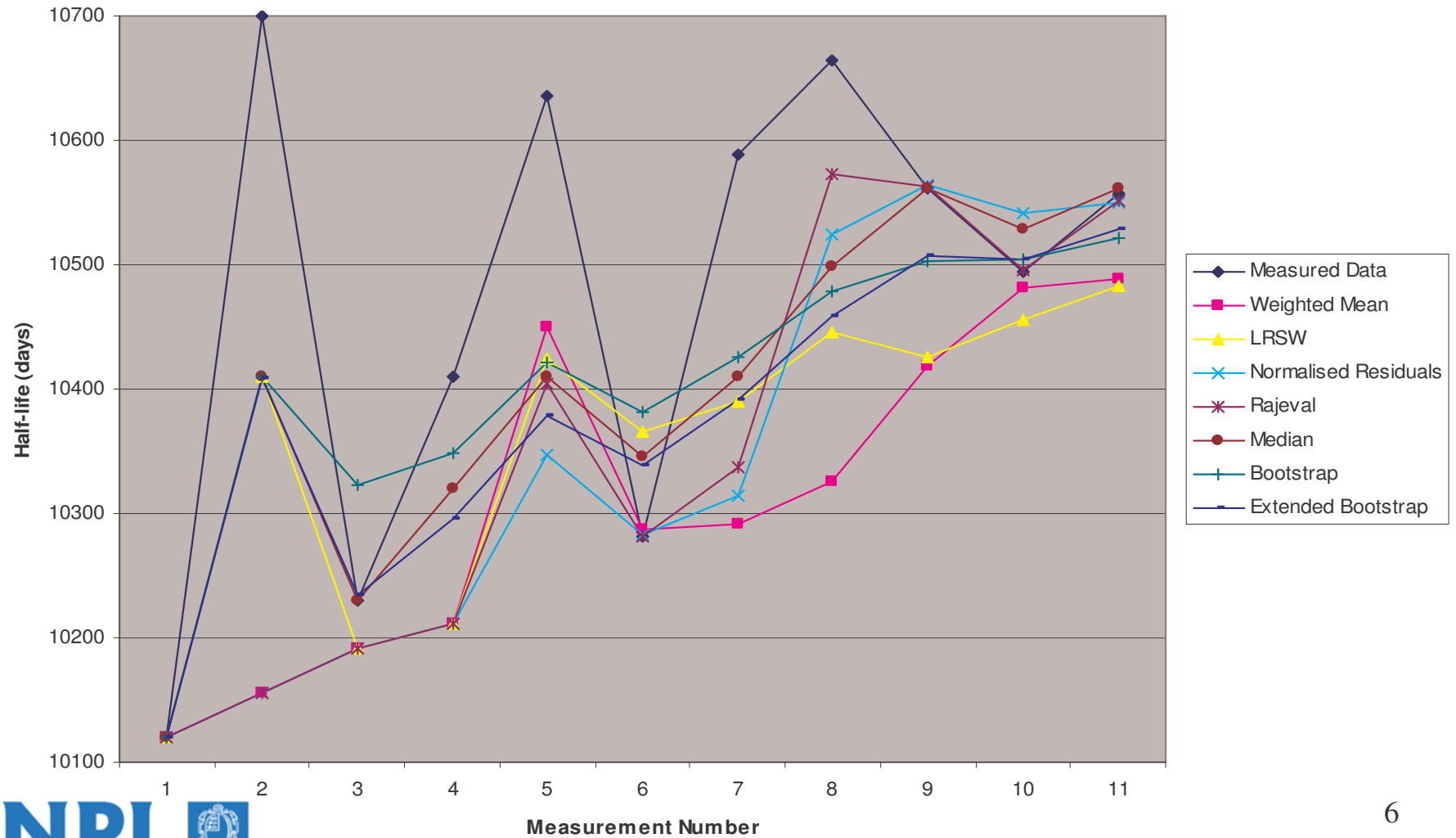


Evaluations of Sr-90 Half-Life
Measurements:
reduced chi-squared = 40

| Evaluation Technique | Result - days | Uncertainty - days |
|----------------------|---------------|--------------------|
| Weighted Mean | 10489 | 3 |
| LRSW | 10483 | 30 |
| Normalised Residuals | 10550 | 14 |
| Rajeval | 10552 | 10 |
| Median | 10561 | 62 |

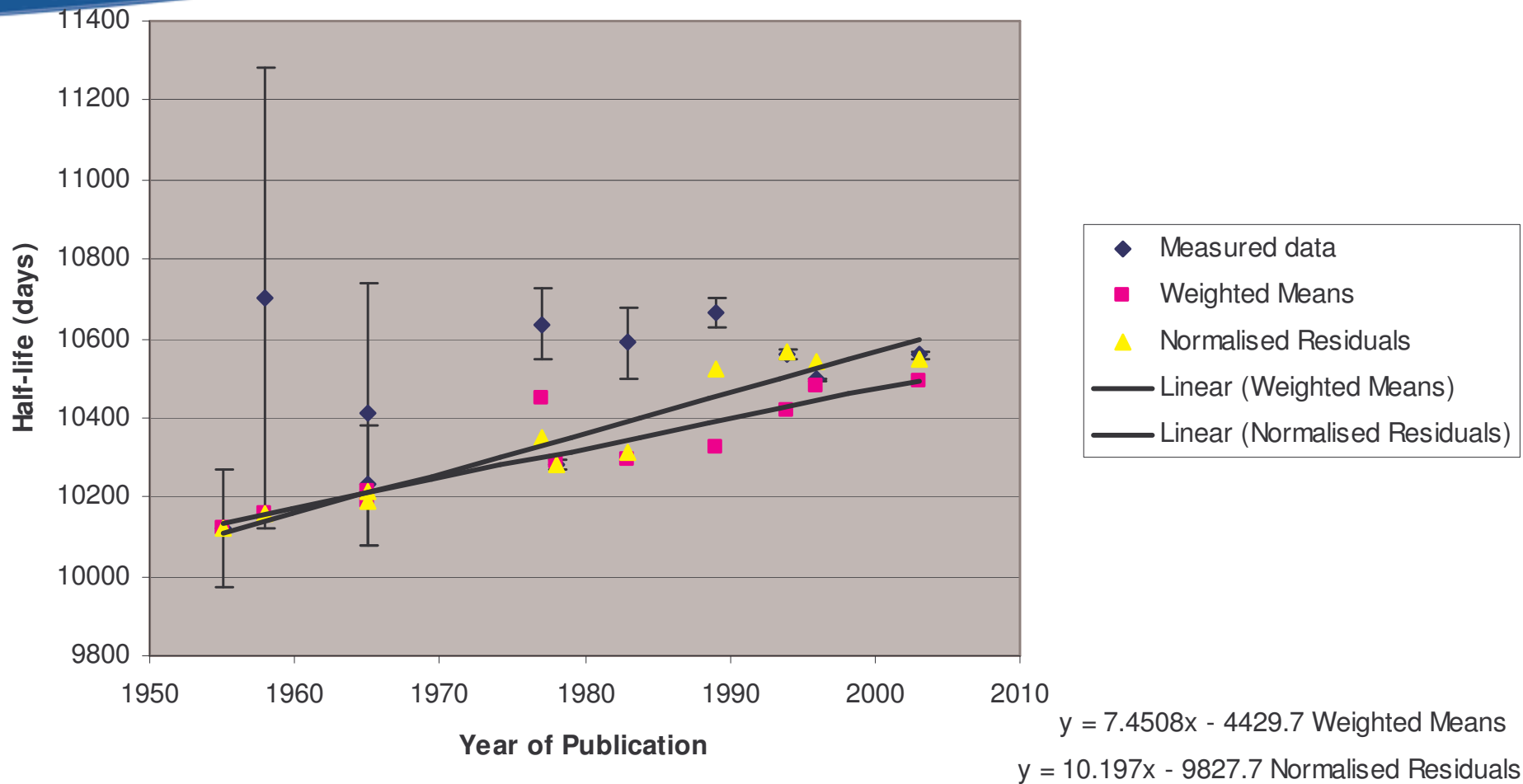
Sr-90 Half-Life Data

Sr-90 Half-Life Data Evaluations



Sr-90 Half-Life Data

Half-life of Sr-90



Sr-90 Half-Life Data

- The previous figure shows that the last four Normalised Residuals results (1989 – 2004) are rather close together. Taking into account their uncertainties (one standard deviation) they are consistent:
 - 1989 10525(69) days
 - 1994 10565(23) days
 - 1996 10542(21) days
 - 2004 10550(14) days

Sr-90 Half-Life Data

- The final Normalised Residuals result is thus 10550 (14) days
- The Rajeval result is 10552 (10) days.
- The recommended half-life is thus: **10551 (14) days**

Mo-99 half-life exercise

| Half-Life of Mo-99 | | | | | | | | | | | | | |
|--|--|--|----------|------------|--|--------|--------------|---------------------|------------------|--|-----------------------------|--------|----------------------------|
| | | | x_i | σ_i | $w_i = 1/\sigma_i^2$ $\times 10^{-6}$ | RSW | Adjusted RSW | Adjusted σ_i | Adjusted weights | | NORM Adjusted σ_i | | RAJ Adjusted σ_i |
| Emery (1972) | | | 2.75083 | 0.00042 | | | | | | | | | |
| Houtermans (1980) | | | 2.74771 | 0.00013 | | | | | | | | | |
| Unterweger (1992) | | | 2.746829 | 0.000242 | | | | | | | | | |
| Schrader (2004) | | | 2.7489 | 0.0006 | | | | | | | | | |
| Unweighted Mean $\mu = \sum x_i/n$ | | | | | | | | | | | | | |
| Uncertainty = $\sqrt{\sum (x_i - \mu)^2 / n(n-1)}$ | | | | | | | | | | | | | |
| | | | | | | LRSW = | | | | | NORM = | RAJ = | |
| | | | | | | unc. = | | | | | unc. = | unc. = | |
| Weighted Mean = $(\sum w_i x_i) / \sum w_i$ | | | | | | | | | | | | | |
| Uncertainty = $1/\text{SQRT}(\sum w_i)$ | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |

Mo-99 half-life exercise

| Half-Life of Mo-99 | | | | | | | | | | | | |
|---|--|--|----------------|------------|--|--------|--------------|---------------------|------------------|-----------------------------|----------------------------|--------|
| | | | x_i | σ_i | $w_i=1/\sigma_i^2$ $\times 10^{-6}$ | RSW | Adjusted RSW | Adjusted σ_i | Adjusted weights | NORM Adjusted σ_i | RAJ Adjusted σ_i | |
| Emery (1972) | | | 2.75083 | 0.00042 | 5.67 | | | | | | | |
| Houtermans (1980) | | | 2.74771 | 0.00013 | 59.17 | | | | | | | |
| Unterweger (1992) | | | 2.746829 | 0.000242 | 17.08 | | | | | | | |
| Schrader (2004) | | | 2.7489 | 0.0006 | 2.78 | | | | | | | |
| | | | | | 84.69 | | | | | | | |
| Unweighted Mean $\mu = \sum x_i/n$ | | | 2.7486 | | | | | | | | | |
| Uncertainty $= \sqrt{\sum(x_i-\mu)^2/n(n-1)}$ | | | 0.0009 | | | | | | | | | |
| | | | | | | LRSW = | | | | NORM = | | RAJ = |
| Weighted Mean $= (\sum w_i x_i)/\sum w_i$ | | | 2.74778 | | | unc. = | | | | unc. = | | unc. = |
| Uncertainty $= 1/\text{SQRT}(\sum w_i)$ | | | 0.00011 | | | | | | | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |

Mo-99 half-life exercise

| Half-Life of Mo-99 | | | | | | | | | | | | | |
|---|--|--|----------------|------------|--|--------|----------------|---------------------|------------------|-----------------------------|----------------------------|--------|----------------|
| | | | x_i | σ_i | $w_i=1/\sigma_i^2$ $\times 10^{-6}$ | RSW | Adjusted RSW | Adjusted σ_i | Adjusted weights | NORM Adjusted σ_i | RAJ Adjusted σ_i | | |
| Emery (1972) | | | 2.75083 | 0.00042 | 5.67 | 0.067 | 0.111 | 0.00042 | 5.67 | 0.00144 | 0.00247 | | |
| Houtermans (1980) | | | 2.74771 | 0.00013 | 59.17 | 0.699 | 0.500 | 0.00020 | 25.00 | 0.00013 | 0.00013 | | |
| Unterweger (1992) | | | 2.746829 | 0.000242 | 17.08 | 0.202 | 0.335 | 0.000242 | 17.08 | 0.00041 | 0.00071 | | |
| Schrader (2004) | | | 2.7489 | 0.0006 | 2.78 | 0.033 | 0.054 | 0.0006 | 2.78 | 0.0006 | 0.00095 | | |
| | | | | | 84.69 | 1.000 | 1.000 | | 50.52 | | | | |
| Unweighted Mean $\mu = \Sigma x_i/n$ | | | 2.7486 | | | | | | | | | | |
| Uncertainty = $\Sigma(x_i-\mu)^2/n(n-1)$ | | | 0.0009 | | | | | | | | | | |
| | | | | | | LRSW = | 2.74783 | | | NORM = | 2.74770 | RAJ = | 2.74771 |
| Weighted Mean = $(\Sigma w_i x_i)/\Sigma w_i$ | | | 2.74778 | | | unc. = | 0.00014 | | | unc. = | 0.00025 | unc. = | 0.00013 |
| Uncertainty = $1/\text{SQRT}(\Sigma w_i)$ | | | 0.00011 | | | | | | | | | | |