



*The Abdus Salam*  
International Centre for Theoretical Physics



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**Joint ICTP-IAEA Workshop on Nuclear Structure and Decay Data:  
Theory and Evaluation**

*28 April - 9 May, 2008*

**Data Analyses  
(Evaluation of Discrepant Data III)**

Desmond MacMahon  
*National Physical Laboratory  
London  
U.K.*

# IAEA Training Workshop Nuclear Structure and Decay Data

Evaluation of Discrepant Data III

Desmond MacMahon  
United Kingdom

# Sr-90 Half-Life Measurements

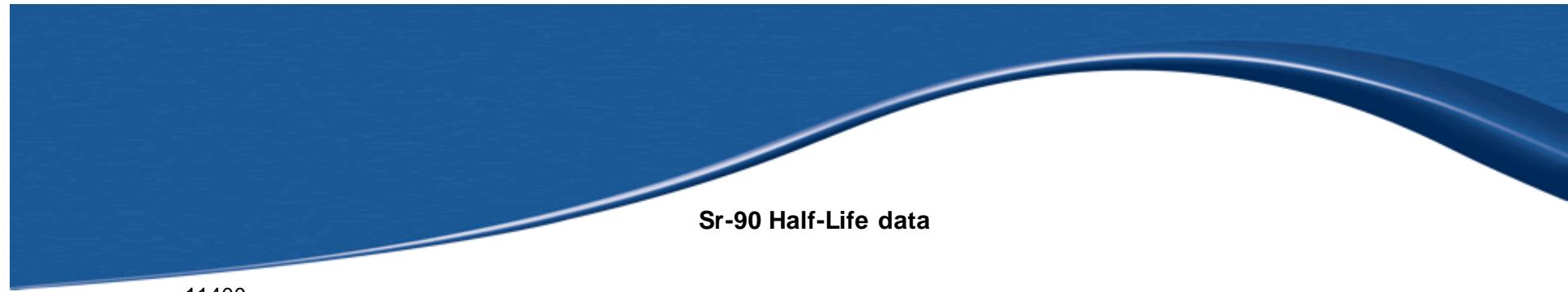
Authors	Measured half-lives	
	days	$\sigma$
	$t_{1/2}$	
Wiles & Tomlinson (1955b)	10120	150
Anikina et al. (1958)	10700	580
Flynn et al. (1965)	10230	150
Flynn et al. (1965)	10410	330
Hoppe (1977)	10636	88
Lagoutine et al. (1978)	10282	12
Ramthun (1983)	10588	91
Kochin et al. (1989)	10665	37
Martin et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

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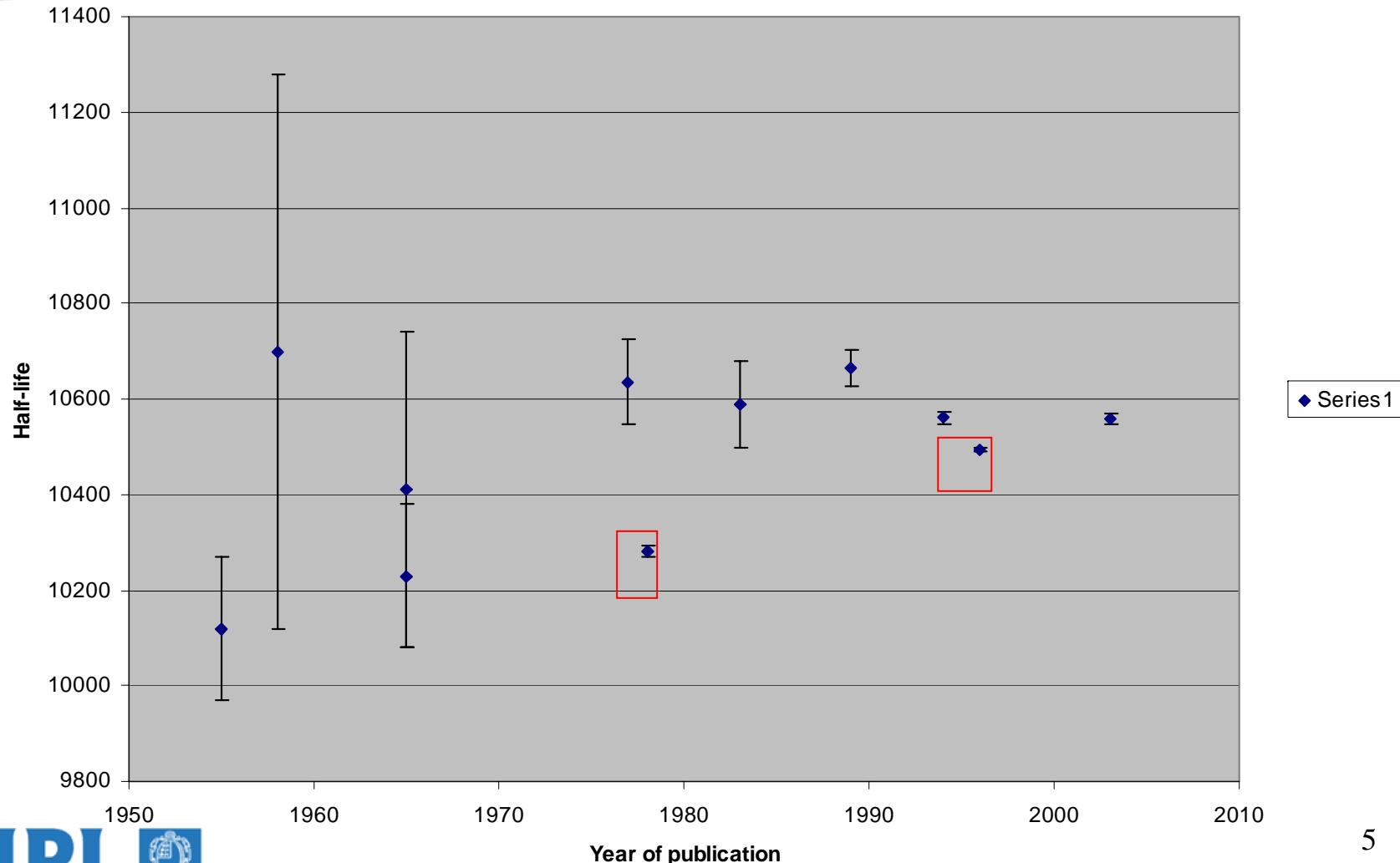
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### Sr-90 Half-Life data

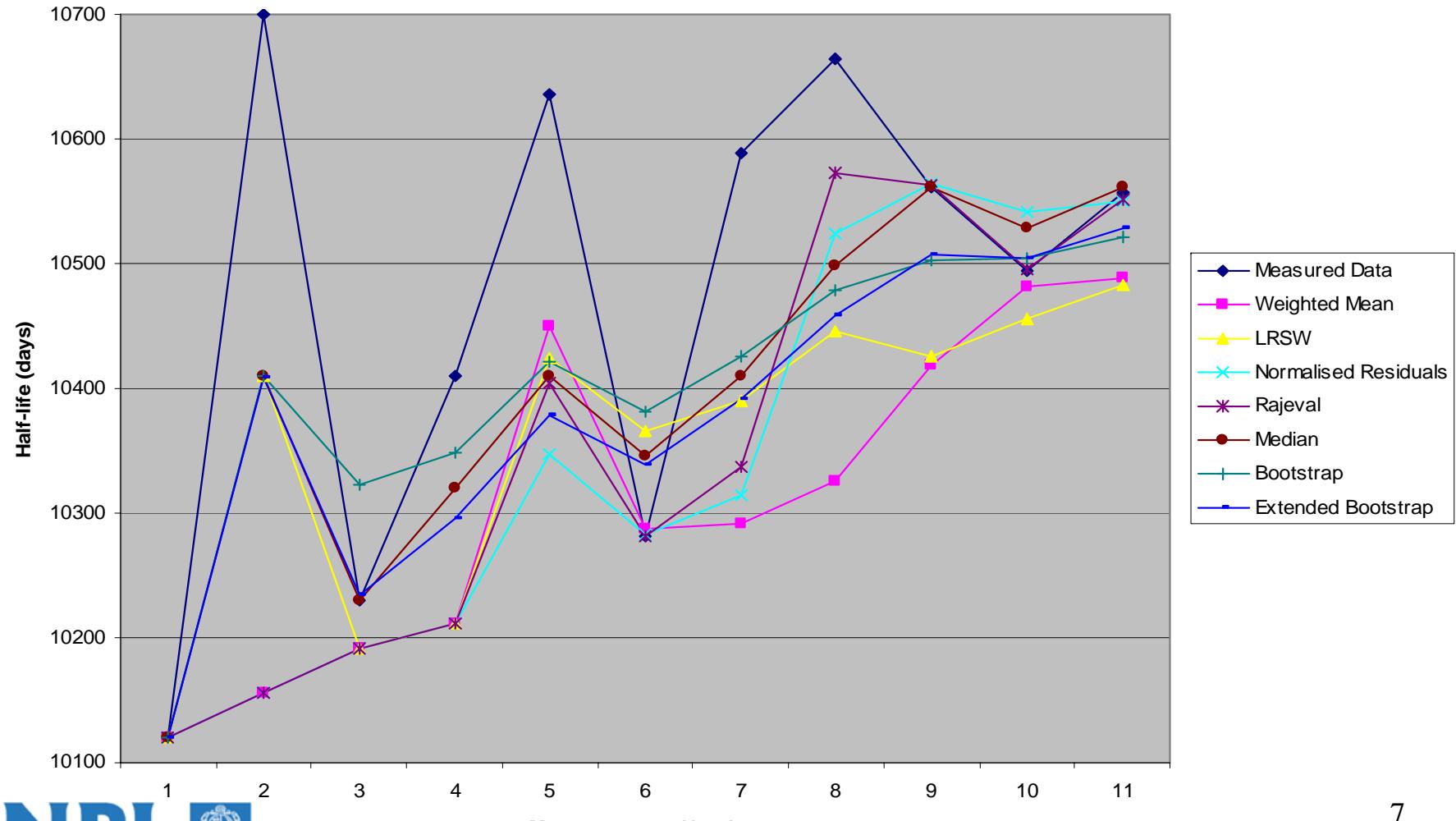


# Evaluations of Sr-90 Half-Life Measurements: reduced chi-squared = 40

Evaluation Technique	Result - days	Uncertainty - days
Weighted Mean	10489	3
LRSW	10483	30
Normalised Residuals	10550	14
Rajeval	10552	10
Median	10561	62
Bootstrap	10521	82
Extended Bootstrap	10528	32

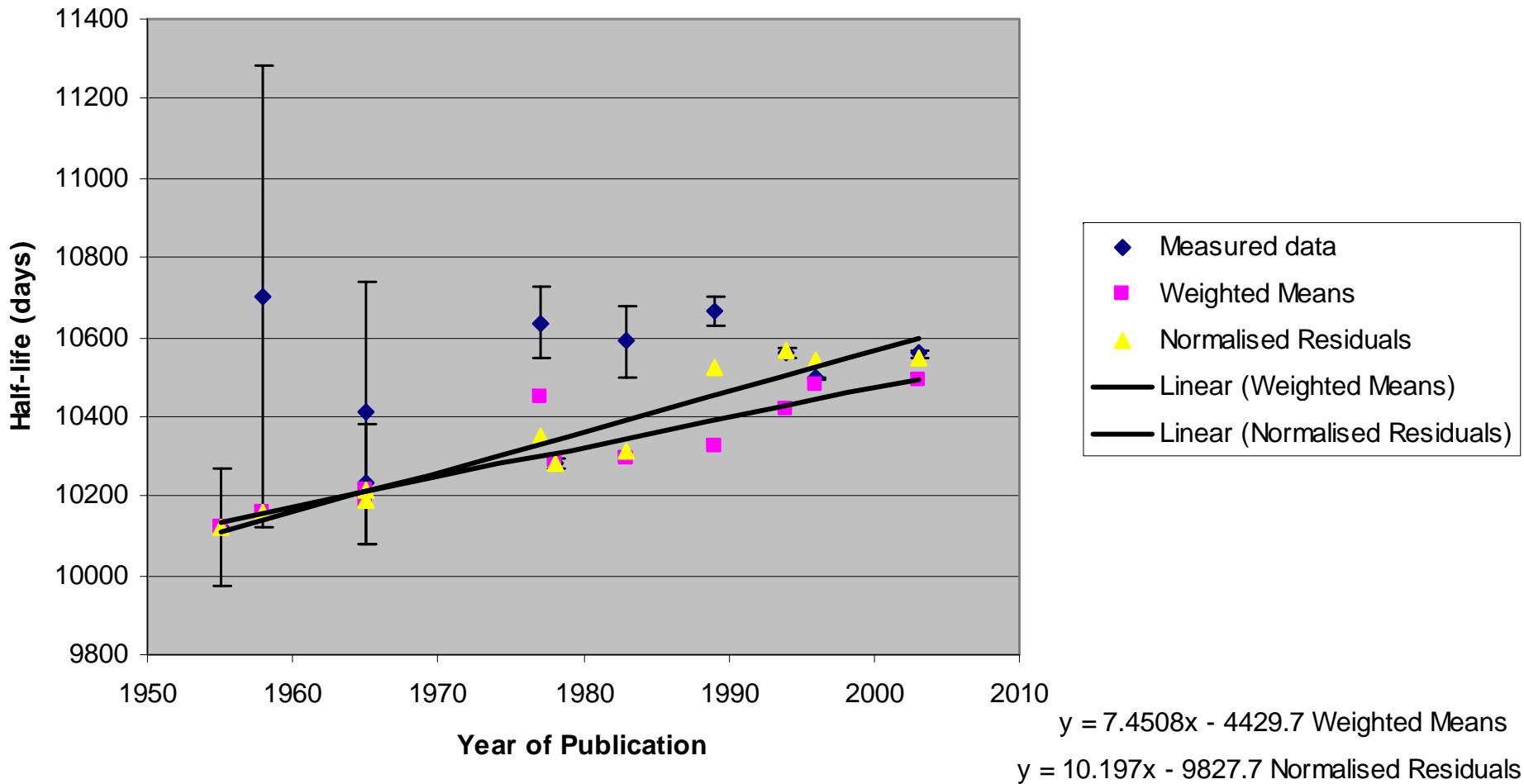
# Sr-90 Half-Life Data

## 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 (days)								
	$x_i$	$\sigma_i$	$w_i = 1/\sigma^2 \times 10^{-6}$	RSW	Adjusted RSW	Adjusted $\sigma_i$	Adjusted weights	NORM	Adjusted $\sigma$
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 = $\sum (x_i - \mu)^2 / n(n-1)$									
Weighted Mean = $(\sum w_i x_i) / \sum w_i$				LRSW =				NORM =	
Uncertainty = $1/\text{SQRT}(\sum w_i)$				unc. =				unc. =	

# Mo-99 half-life exercise

			Half-Life of Mo-99 (days)						
		$x_i$	$\sigma_i$	$w_i = 1/\sigma_i^2 \times 10^{-6}$	RSW	Adjusted RSW	Adjusted $\sigma_i$	Adjusted weights	NORM Adjusted $\sigma_i$
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 $\mu = \sum x_i/n$		<b>2.7486</b>							
Uncertainty = $\sum (x_i - \mu)^2 / n(n-1)$		0.0009							
Weighted Mean = $(\sum w_i x_i) / \sum w_i$		<b>2.74778</b>			LRSW =				NORM =
Uncertainty = $1/\text{SQRT}(\sum w_i)$		0.00011			unc. =				unc. =

# Mo-99 half-life exercise

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