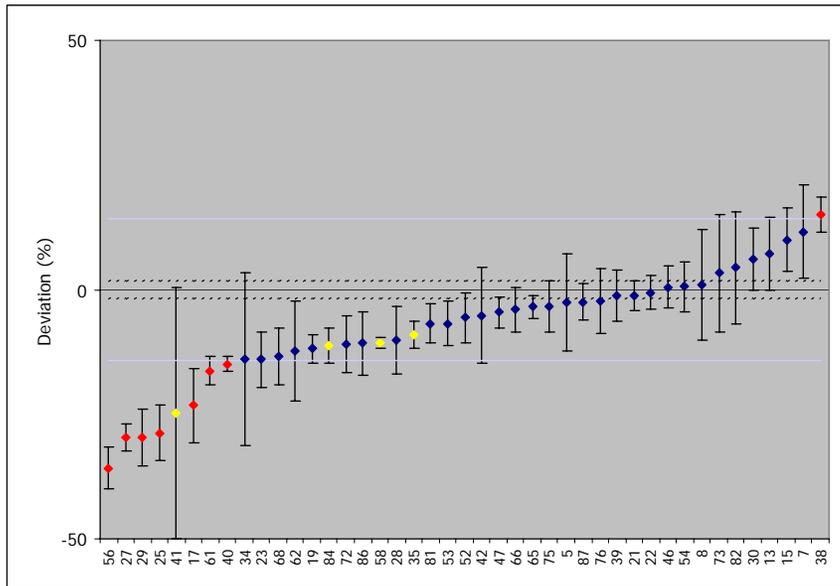# Data treatment

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Contents

Data evaluation (zeta test, uncertainty outlier test and z-test)

Kiri plots

Comparison to another method (IAEA evaluation)

Data evaluation (I)

(i)   zeta test (past NPL)

пass if |zeta| $\leq$ 2.576 (99%)

$$\zeta = \frac{L - N}{\sqrt{u_{\mathrm{L}}^2 + u_{\mathrm{N}}^2}}$$

(ii) R_{L} outlier test

pass if not an outlier (IQR test)

$$R_{\mathrm{L}} = \frac{u_{\mathrm{L}}}{L}$$

(iii)   z-test (ISO 13528)

pass if |z-test| $\leq$ 2.576 (99%)

$$z = \frac{L - N}{R_{\mathrm{med}} N}$$

Data evaluation deviates from ISO 13528:2005 standard
(NPL evaluation of measurement uncertainties)

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Data evaluation (II)

Zeta test	R_L test	z-test	
pass	pass	pass	'In agreement'
pass	fail	pass	'Questionable'
fail	-	pass	'Questionable'
pass	-	fail	'Questionable'
fail	-	fail	'Discrepant'

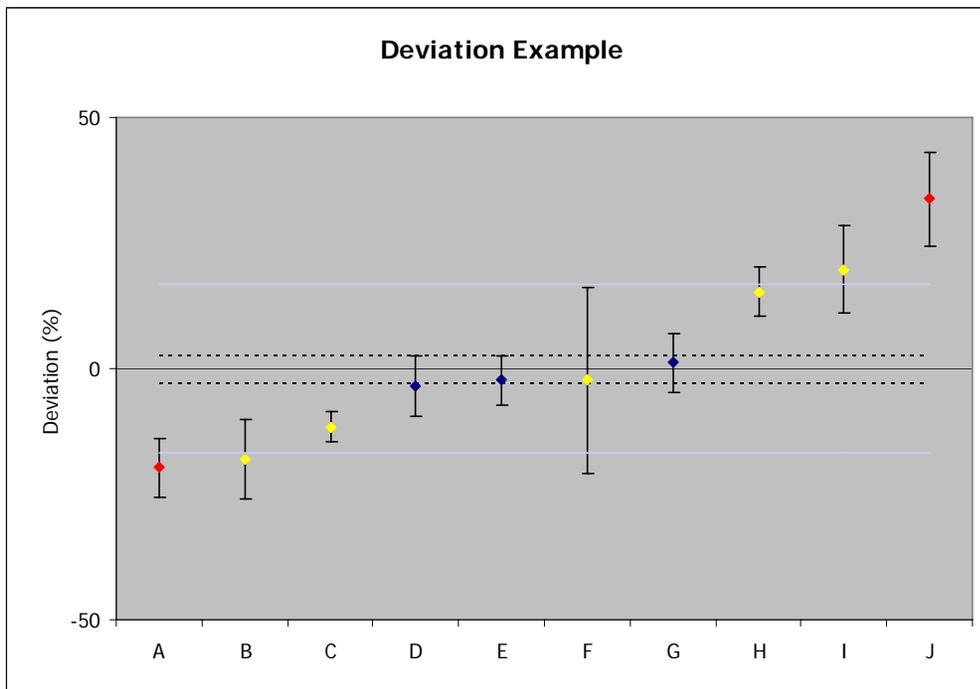Deviation (%) from the assigned NPL values:

$$D = 100 \frac{L - N}{N} = 100\left(\frac{L}{N} - 1\right)$$

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Example data evaluation (deviation plot)

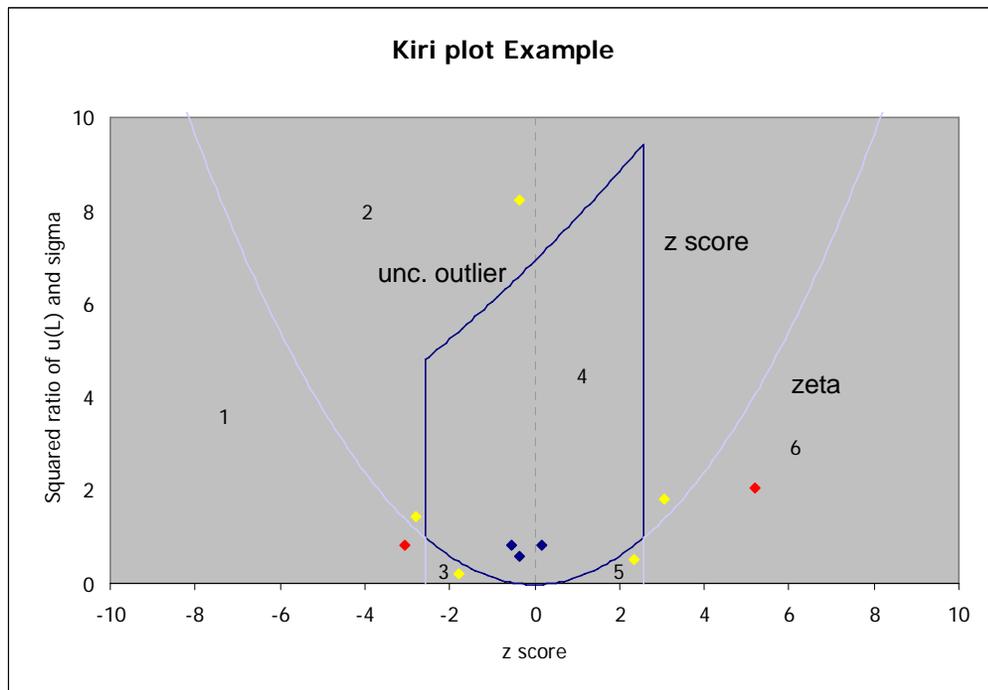Results A and J 'Discrepant'   D, E and G 'In agreement'

'Questionable': B and I (z test failure); C and H (zeta test failure); F (uncertainty outlier)

Kiri plot example

Visualisation of example data A – J

Defines the "in agreement" area, "questionable" areas and "discrepant" areas

Data evaluation IAEA PTEs

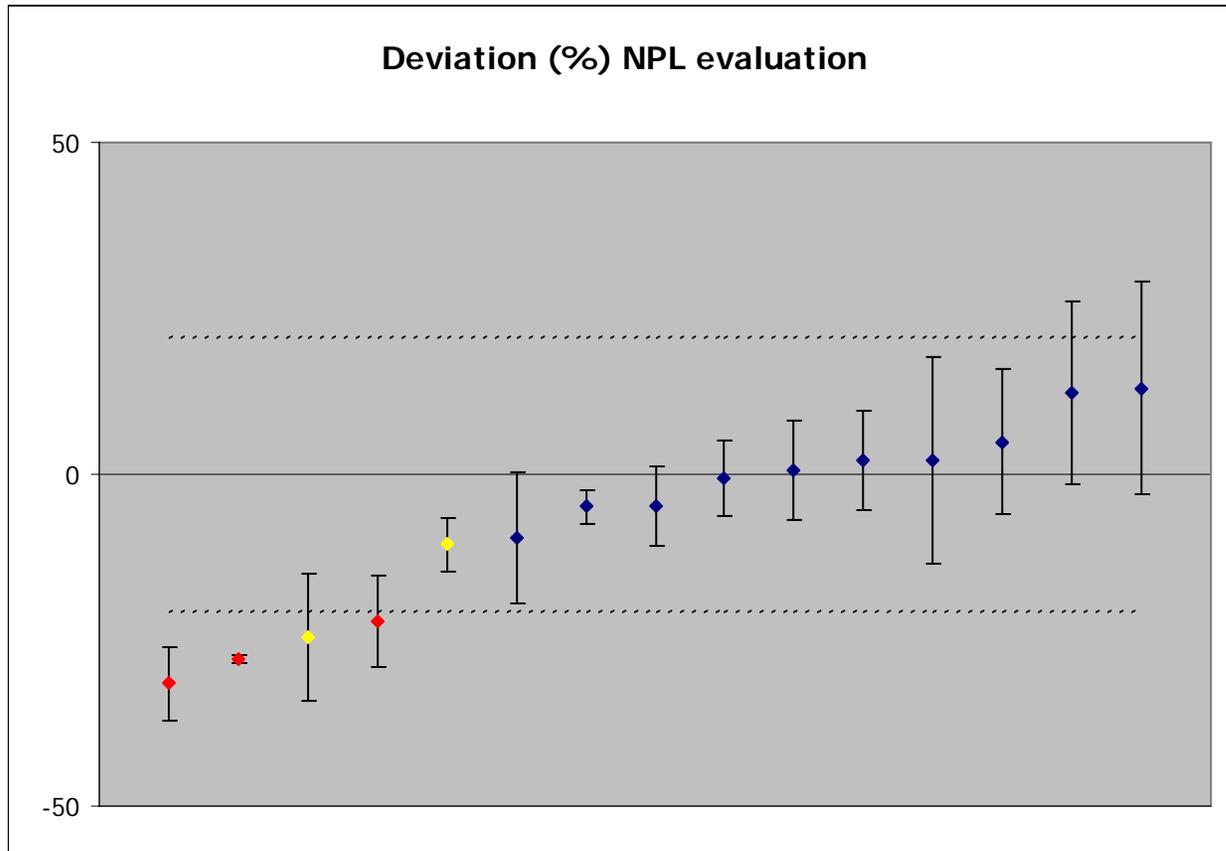| Zeta test	P test	Deviation		(NPL)
pass	pass	-	A	(A or Q)
pass	fail	pass	Q	(Q)
fail	pass	pass	Q	(Q)
pass	fail	fail	D	(Q)
fail	pass	fail	D	(D)
fail	fail	-	D	(Q or D)

$$P = 100\sqrt{\left(\frac{u_L}{L}\right)^2 + \left(\frac{u_N}{N}\right)^2}$$

P and D $\leq$ 10, 15, 20, 25 or 30%

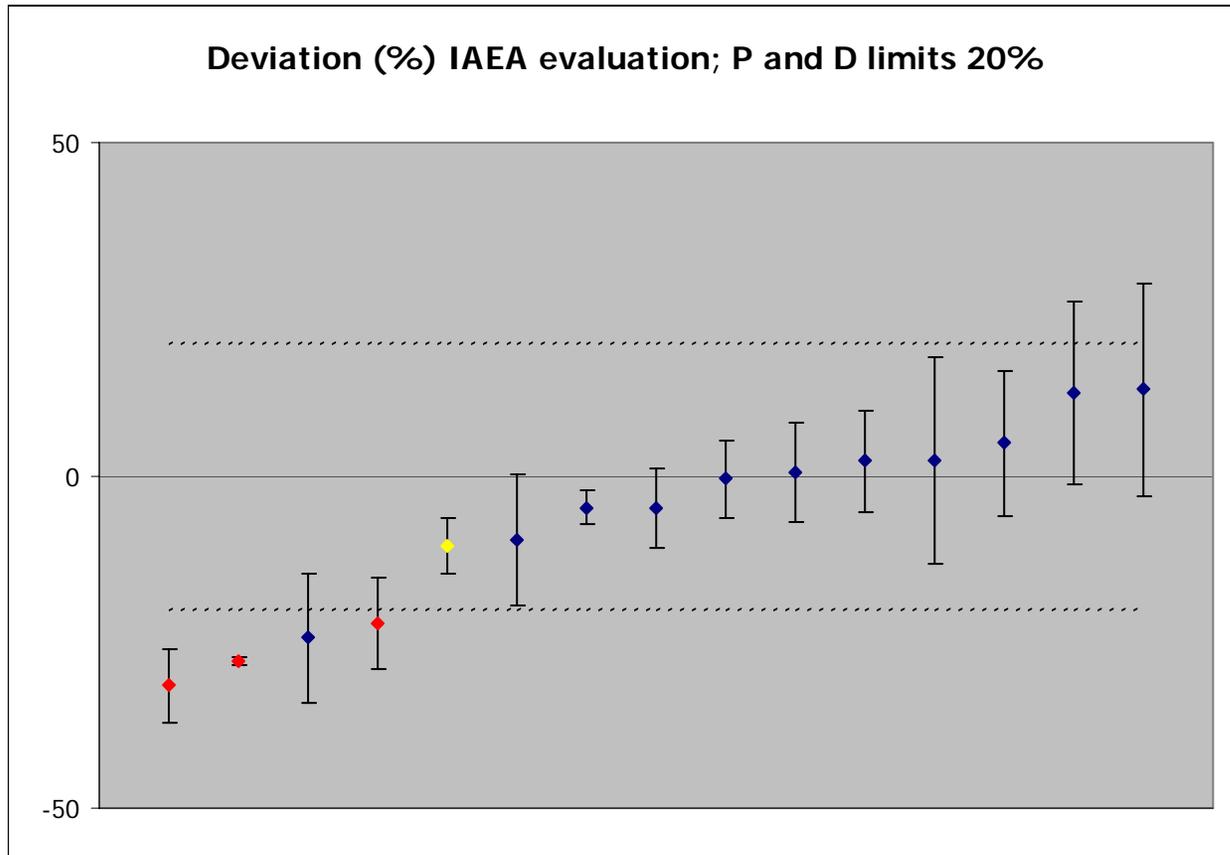Deviation and z-test are related!

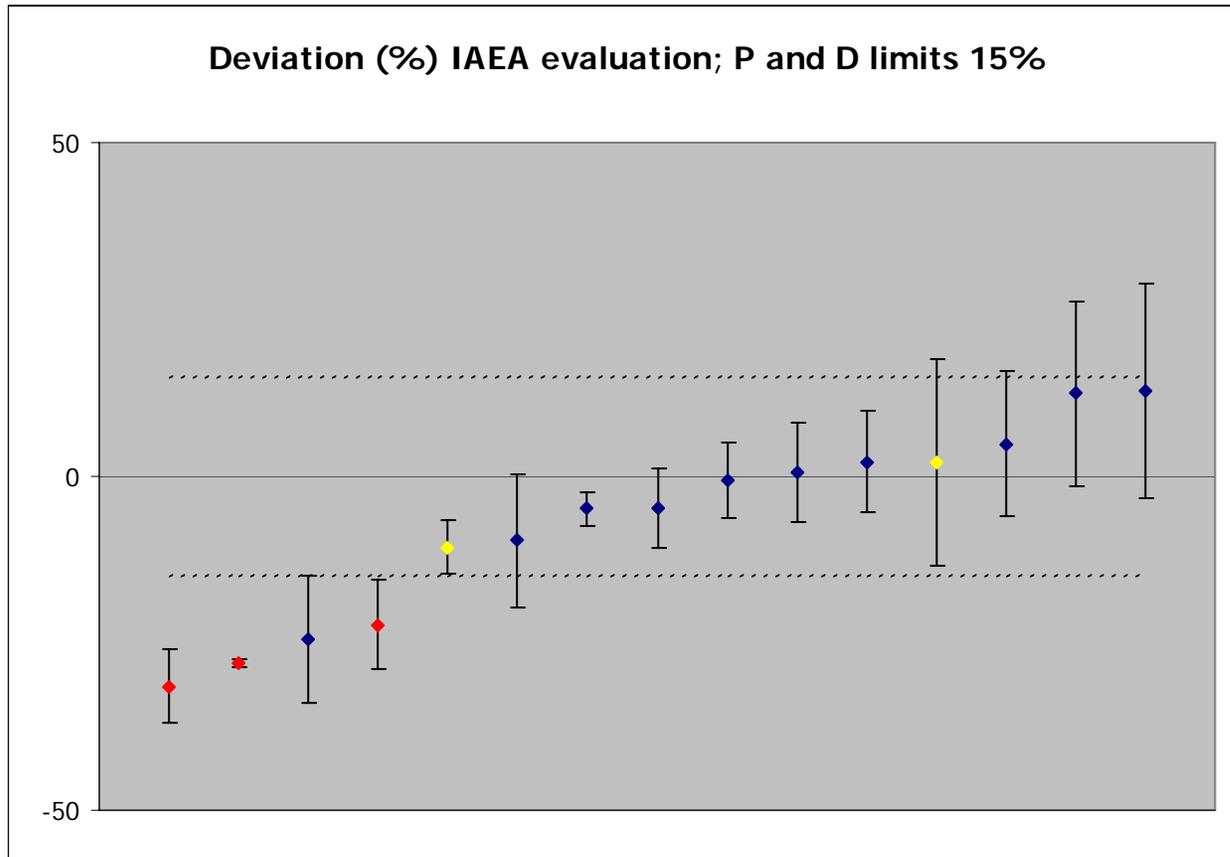D = 20% is equivalent to R_{med} of 7.8% (i.e., 20/2.576)

NPL R_{med} = 8.0% (equiv. to D limit 20.6% ; R_{lim} = 20.0%)

Deviation (%) NPL evaluation

IAEA 20/20   accepts Lab 3

Deviation (%) IAEA evaluation; P and D limits 20%

IAEA 15/15   Lab 12 becomes Q; Lab 3 still accepted

Deviation (%) IAEA evaluation; P and D limits 15%

IAEA 10/10   Accepts only 5 results

Deviation (%) IAEA evaluation; P and D limits 10%
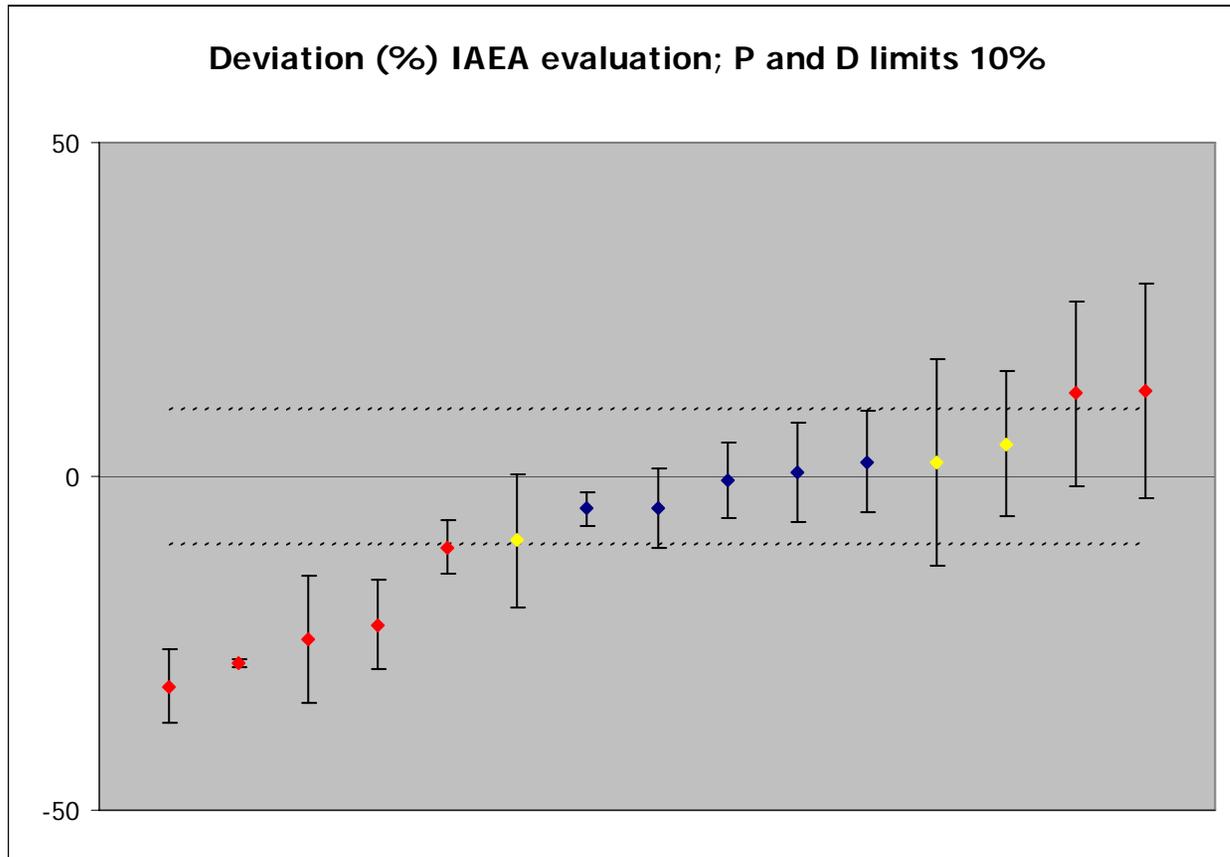
IAEA example

Assume assigned value = 10.0(1)

P and D limits of 15%

Lab's uncertainty = 2

Lab value:

<8.5	Discrepant
8.5-11.5	Questionable
11.5-13.4	Discrepant
13.4-15.2	In agreement
>15.2	Discrepant

Favours a result of 15(2) over 10(2) when the assigned value is 10.0(1)

IAEA data treatment; N = 10.0(1) and u_L = 2
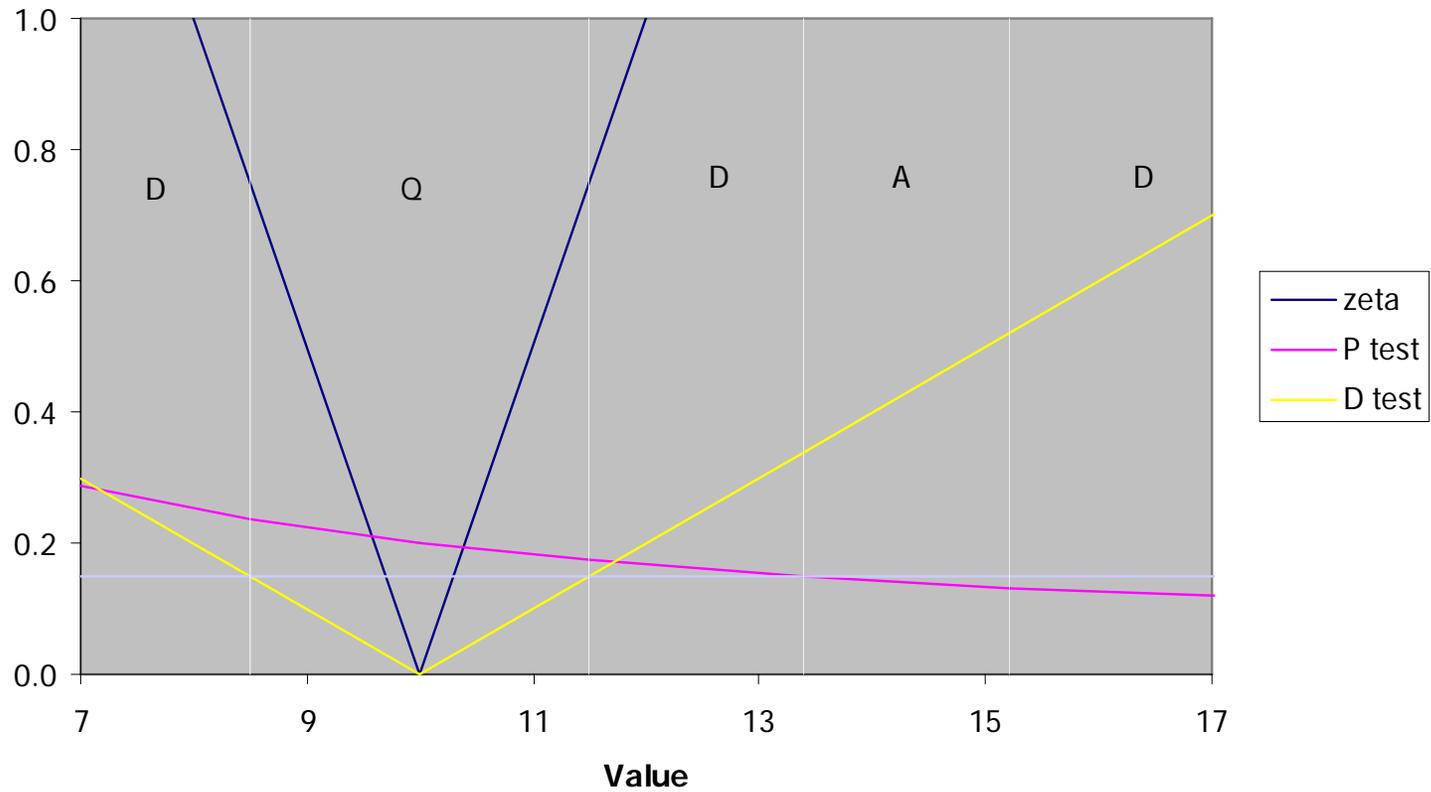
NPL example

Assume assigned value = 10.0(1)

Uncertainty outlier and zeta limits of 15%

Lab's uncertainty = 2

Lab value:

<4.8	Discrepant	(both zeta and z score failure)
4.8-15.2	Questionable	(4.8-13.4 u_L outlier failure; >11.5 z score failure; zeta score pass)
>15.2	Discrepant	(both zeta and z score failure)

Thank you