BL and BH samples

NPL Environmental Radioactivity Proficiency Test Exercise 2007 Workshop

Arvic Harms

19 September 2007

- 6 nuclides:

  ^{3}H, ^{55}Fe, ^{63}Ni, ^{89}Sr, ^{90}Sr, and ^{99}Tc
  gross beta (i.e., ^{89}Sr, ^{90}Sr and ^{90}Y)

- Two concentration levels:

  BL $1 - 20$ Bq kg^{-1}
  BH $1 - 20$ Bq g^{-1}

NPL

BL and BH composition

	BL (Bq kg^{-1})	BH (Bq g^{-1})
^{3}H	8.15(6)	2.727(19)
^{55}Fe	10.42(18)	5.55(10)
^{63}Ni	8.6(4)	9.8(4)
^{89}Sr	15.90(10)	6.67(4)
^{90}Sr	13.37(3)	17.06(3)
^{99}Tc	16.45(4)	6.501(15)
gross beta	43(5)	40.8(19)

(i) Zeta test

pass if Abs(zeta) $\leq$ 2.58

$$\zeta = \frac{L - N}{\sqrt{u_L^2 + u_N^2}}$$

(ii) R_L outlier test

pass if not an Dixon outlier

$$R_L = \frac{u_L}{L}$$

(iii) z test

pass if Abs(z test) $\leq$ 2.58

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

R_{med} = median of participants relative uncertainties (generally between 5% and 10%)

NPL

Treatment of data

Zeta test	R_L test	z test	
pass	pass	pass	'In agreement'
pass	fail	pass	'Questionable' (a)
fail	pass/fail	pass	'Questionable' (b)
pass	pass/fail	fail	'Questionable' (c)
fail	pass/fail	fail	'Discrepant'

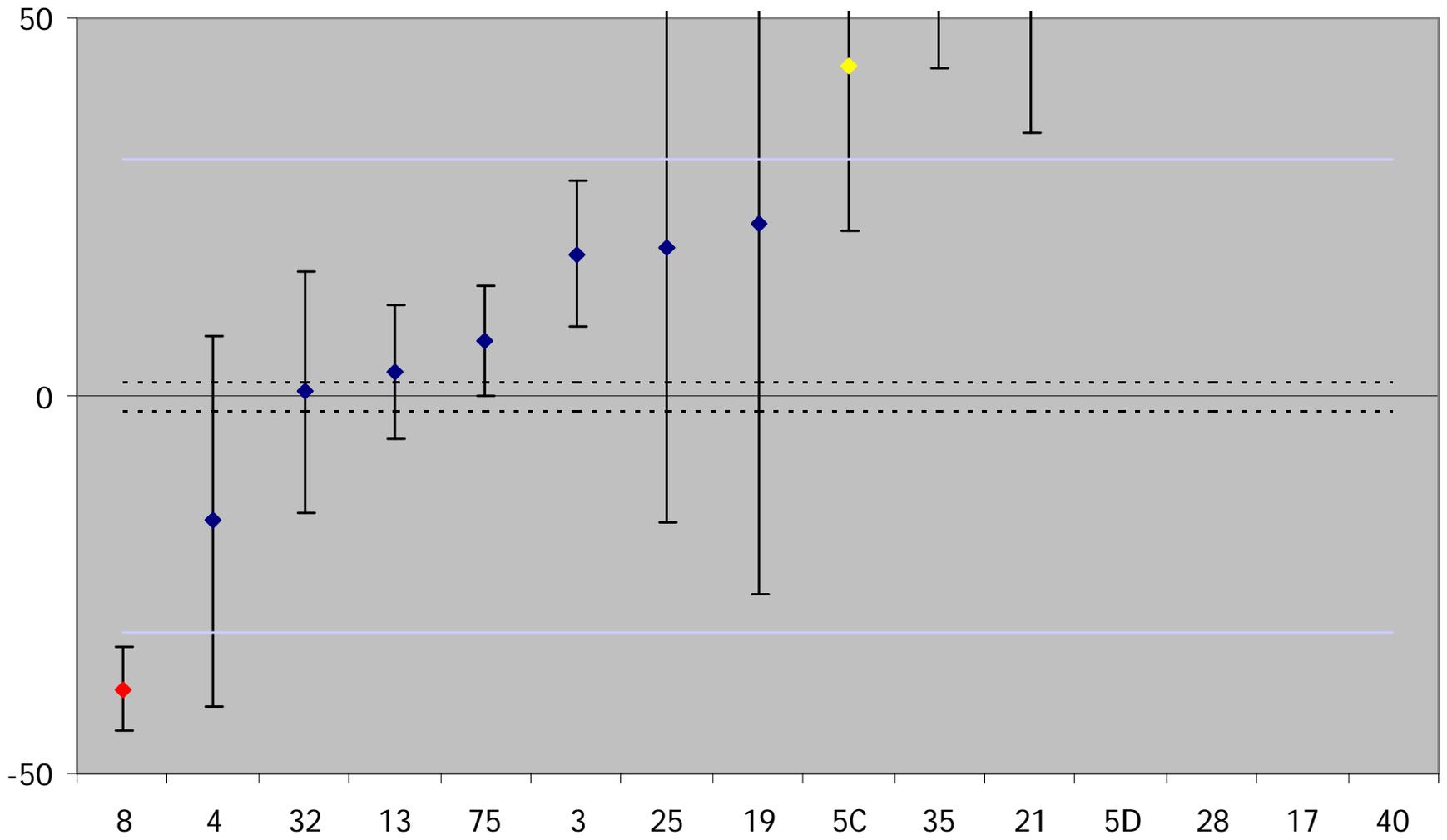(a) Result close to NPL but unacceptable large uncertainty

(b) Result close to NPL but uncertainty is too small to pass zeta test

(c) Result not close to NPL but large uncertainty results in passing the zeta test

Deviation (%)

A   Q a   Q b   Q c   D
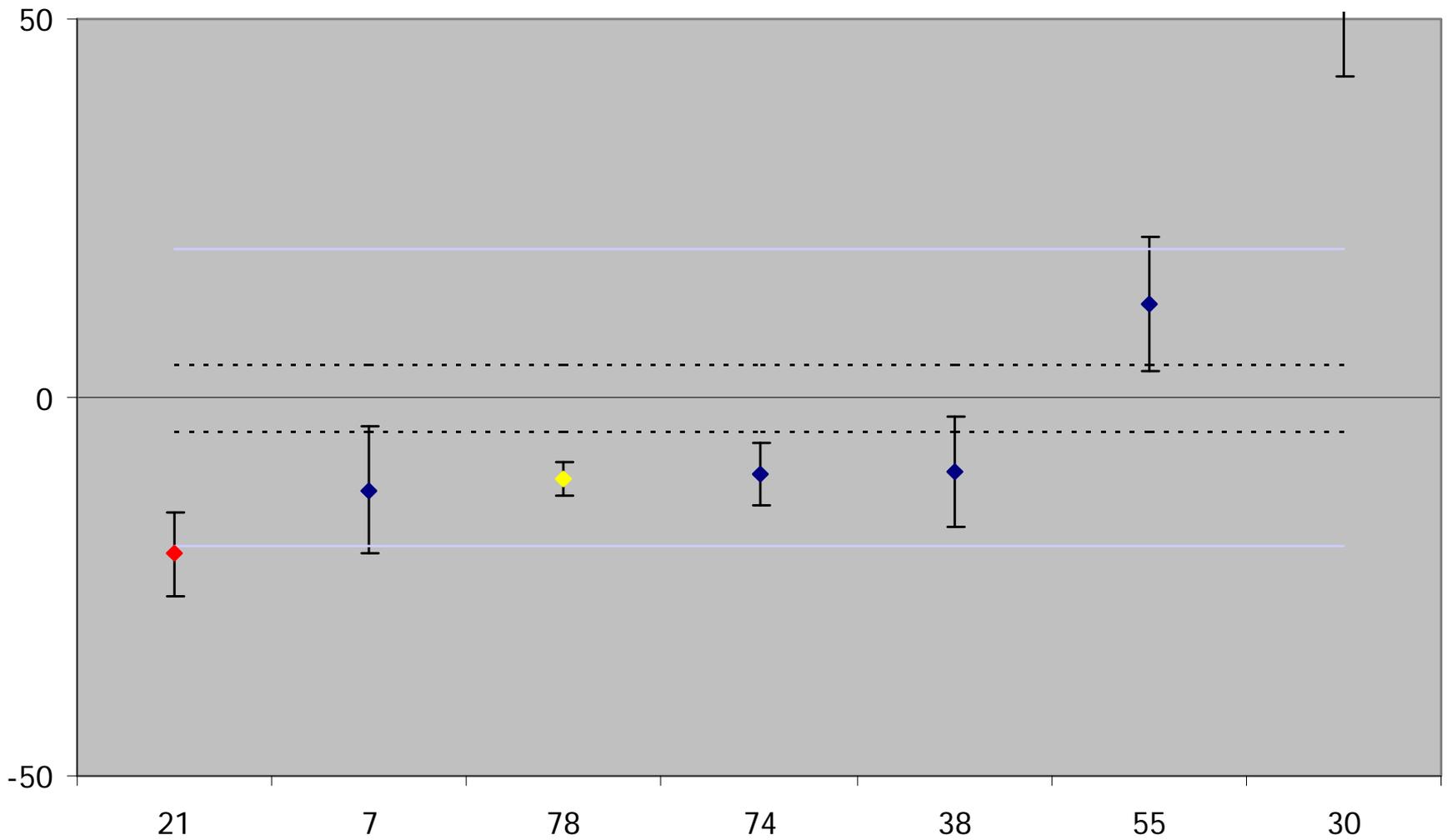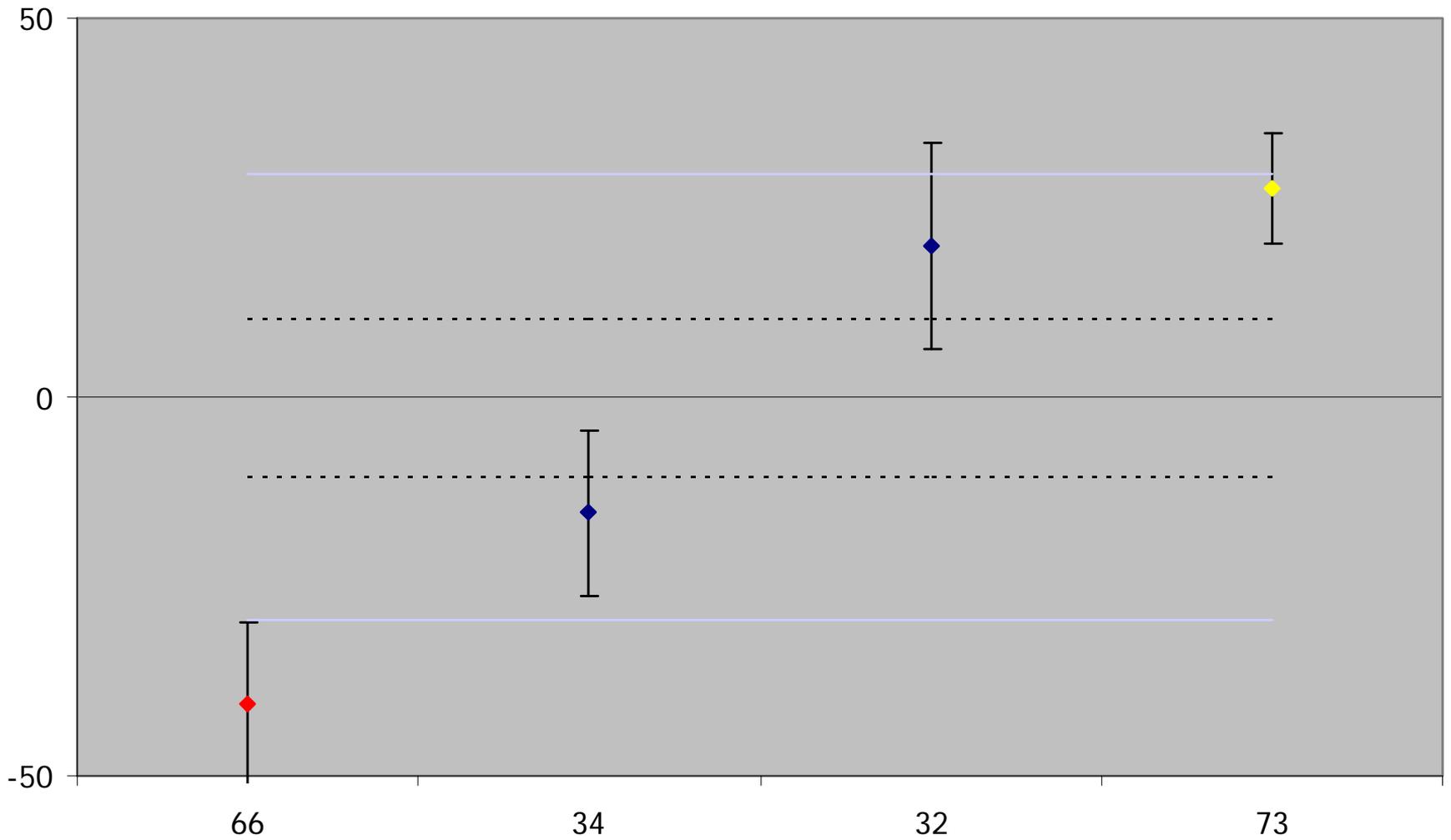
NPL
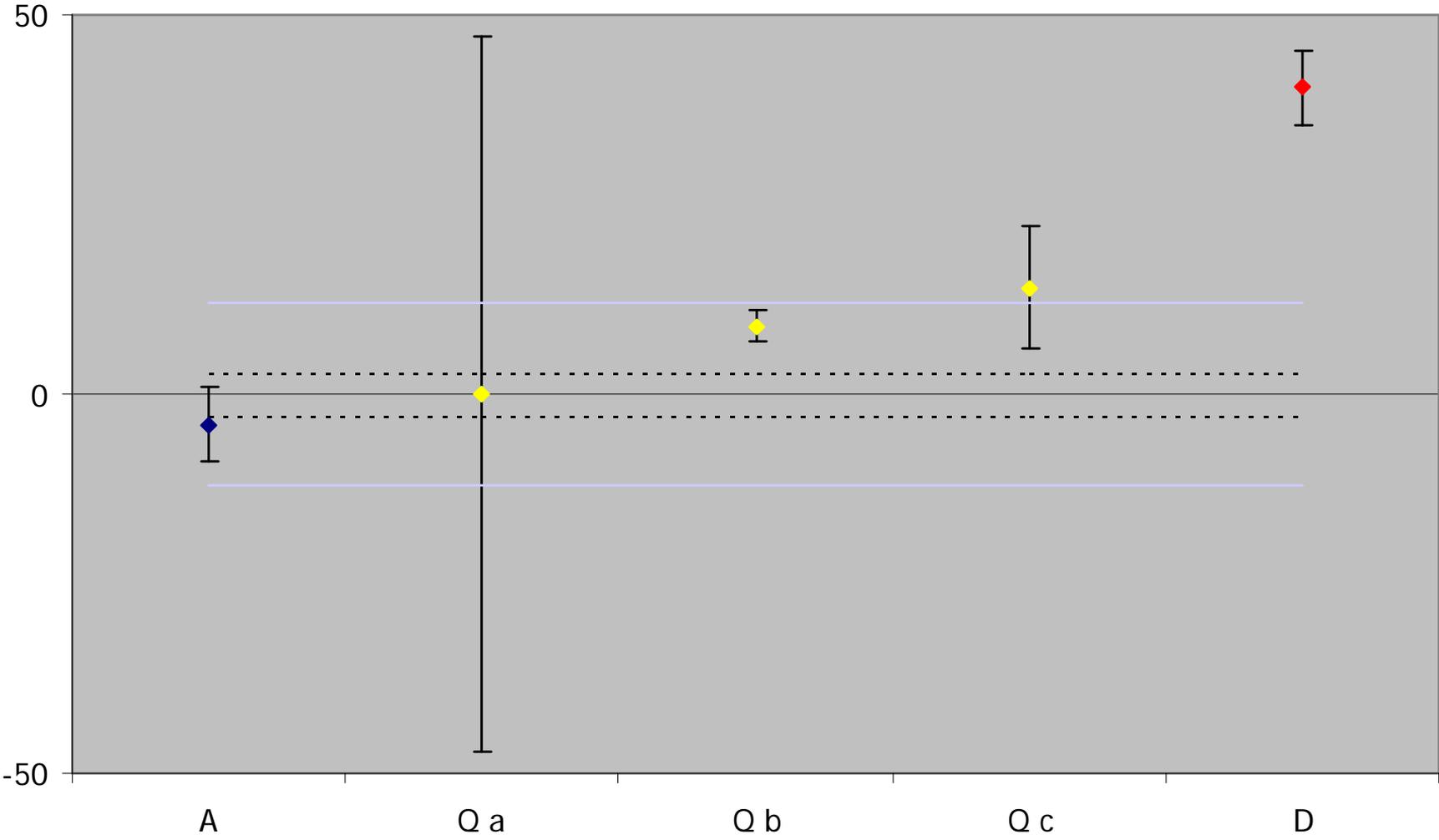
Deviation H-3 BL (%)
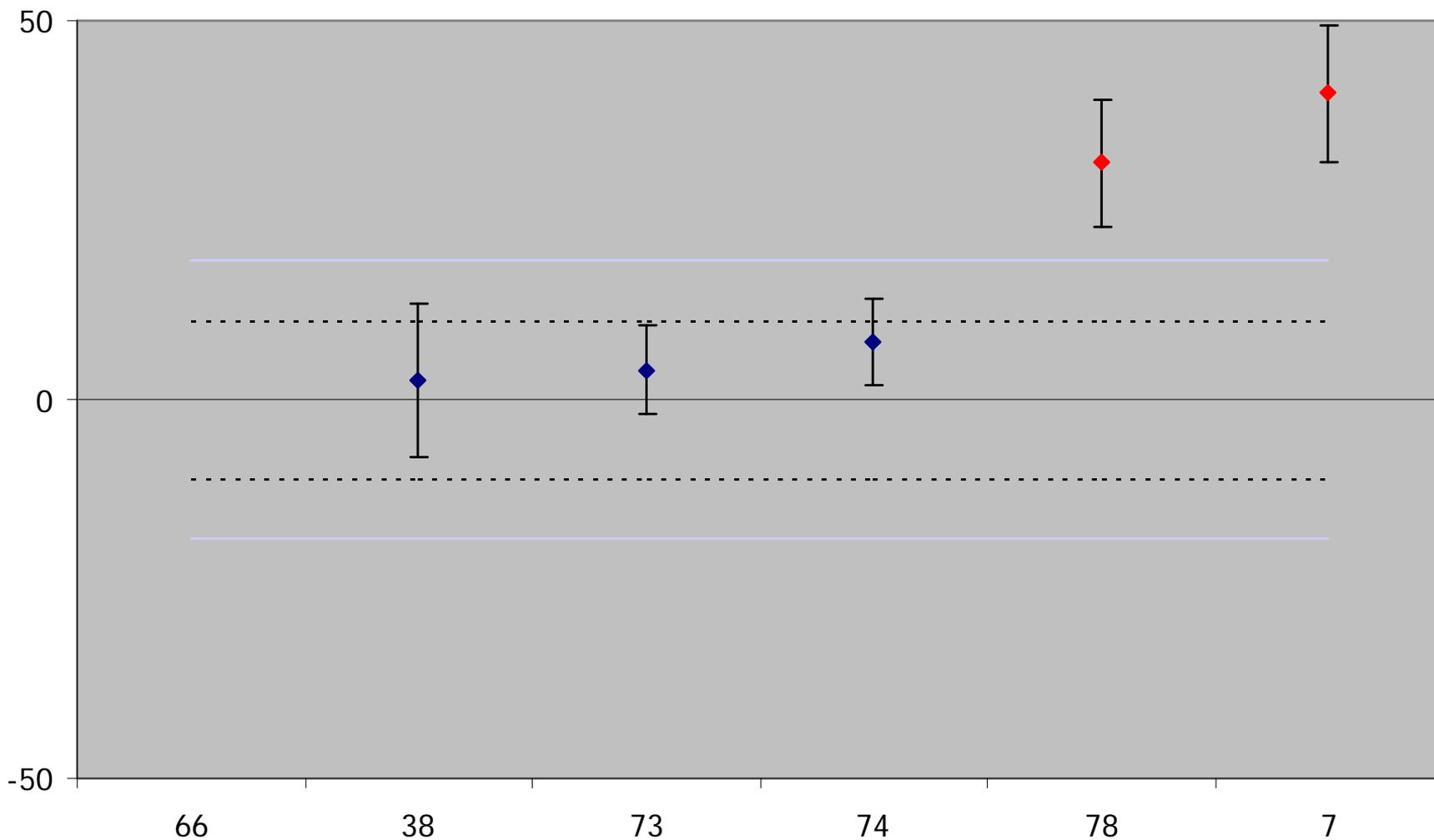
Deviation H-3 BH (%)
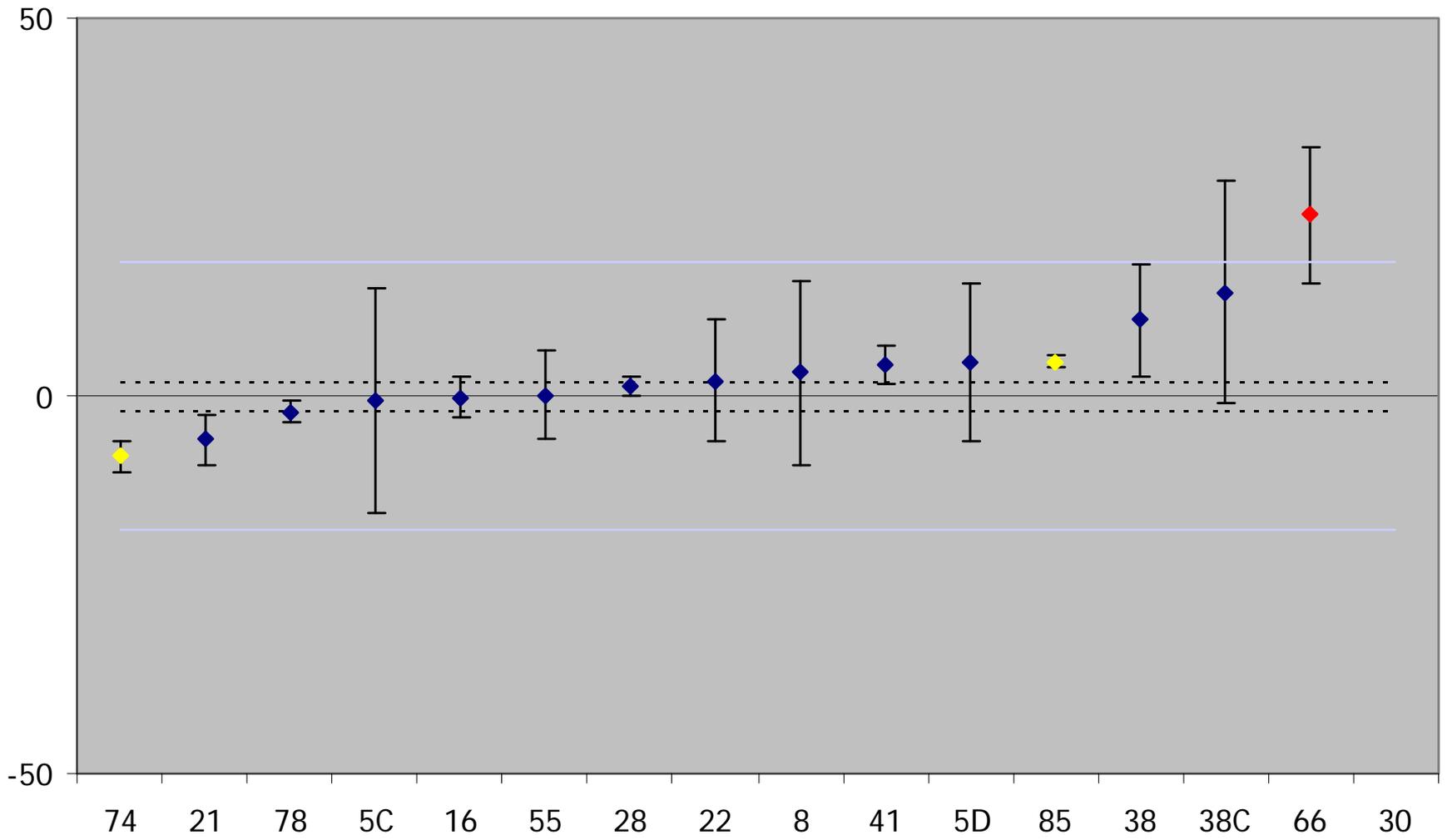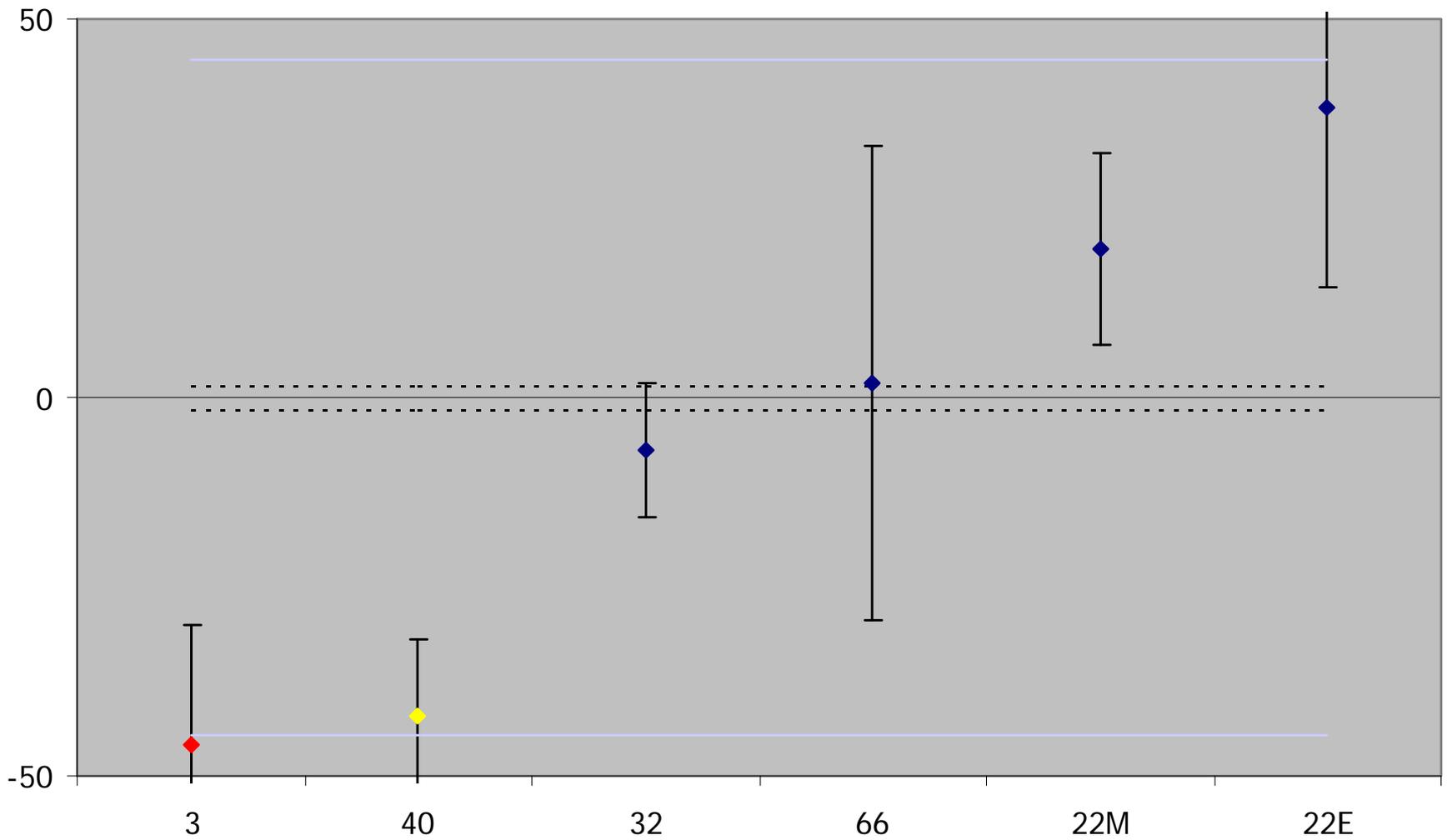
Deviation Fe-55 BL (%)
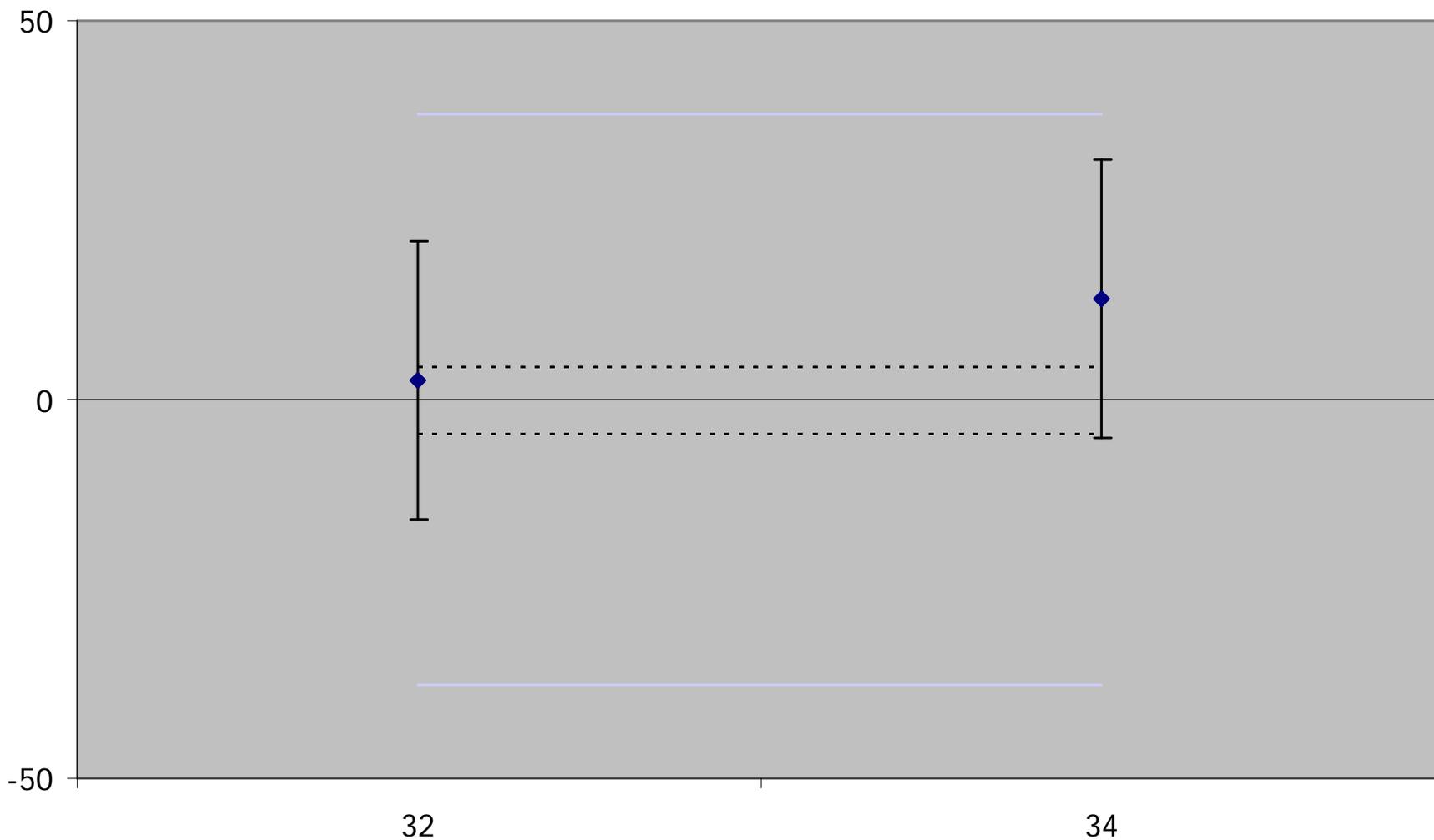
Deviation Fe-55 BH (%)

Deviation Ni-63 BL (%)

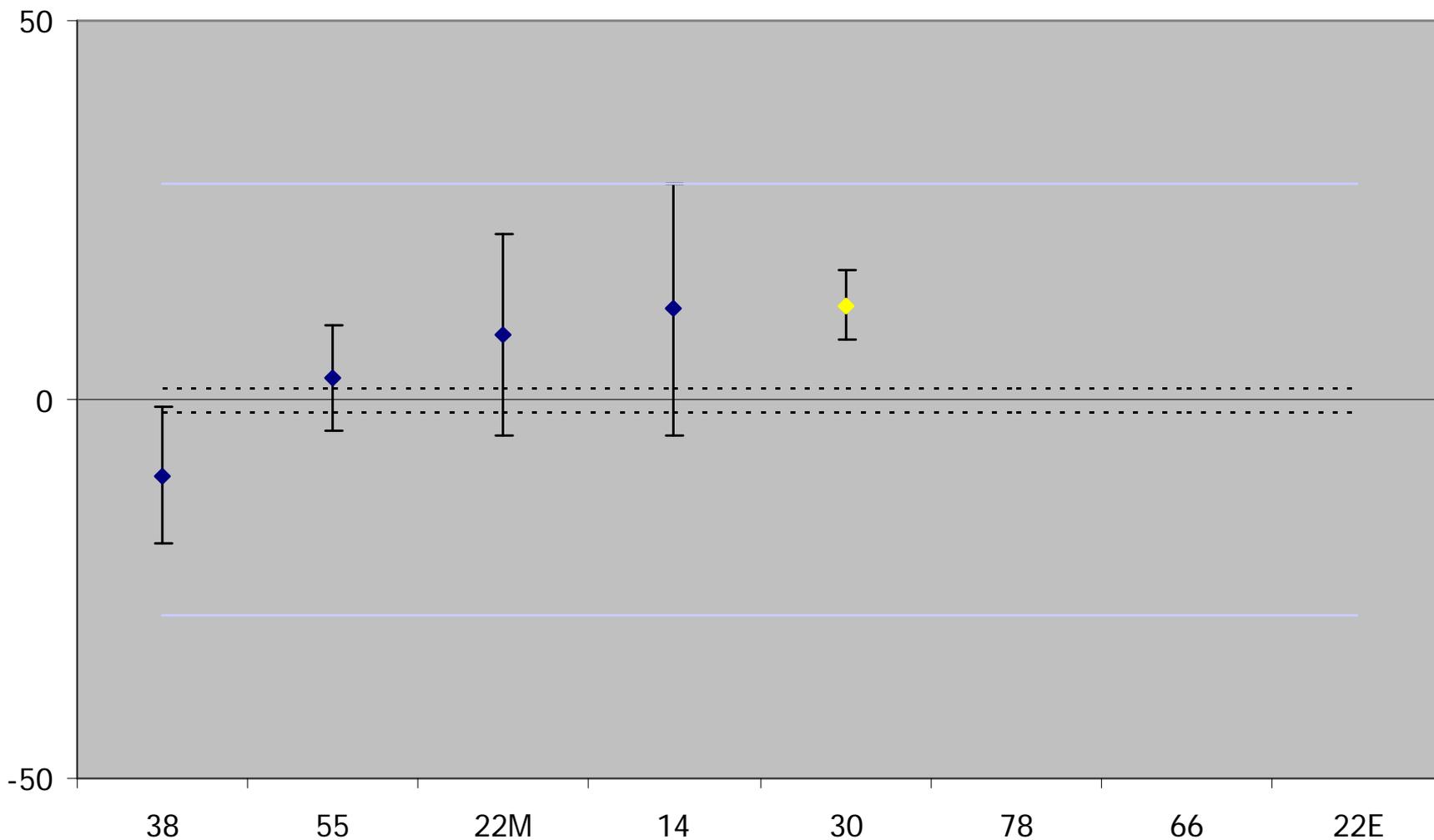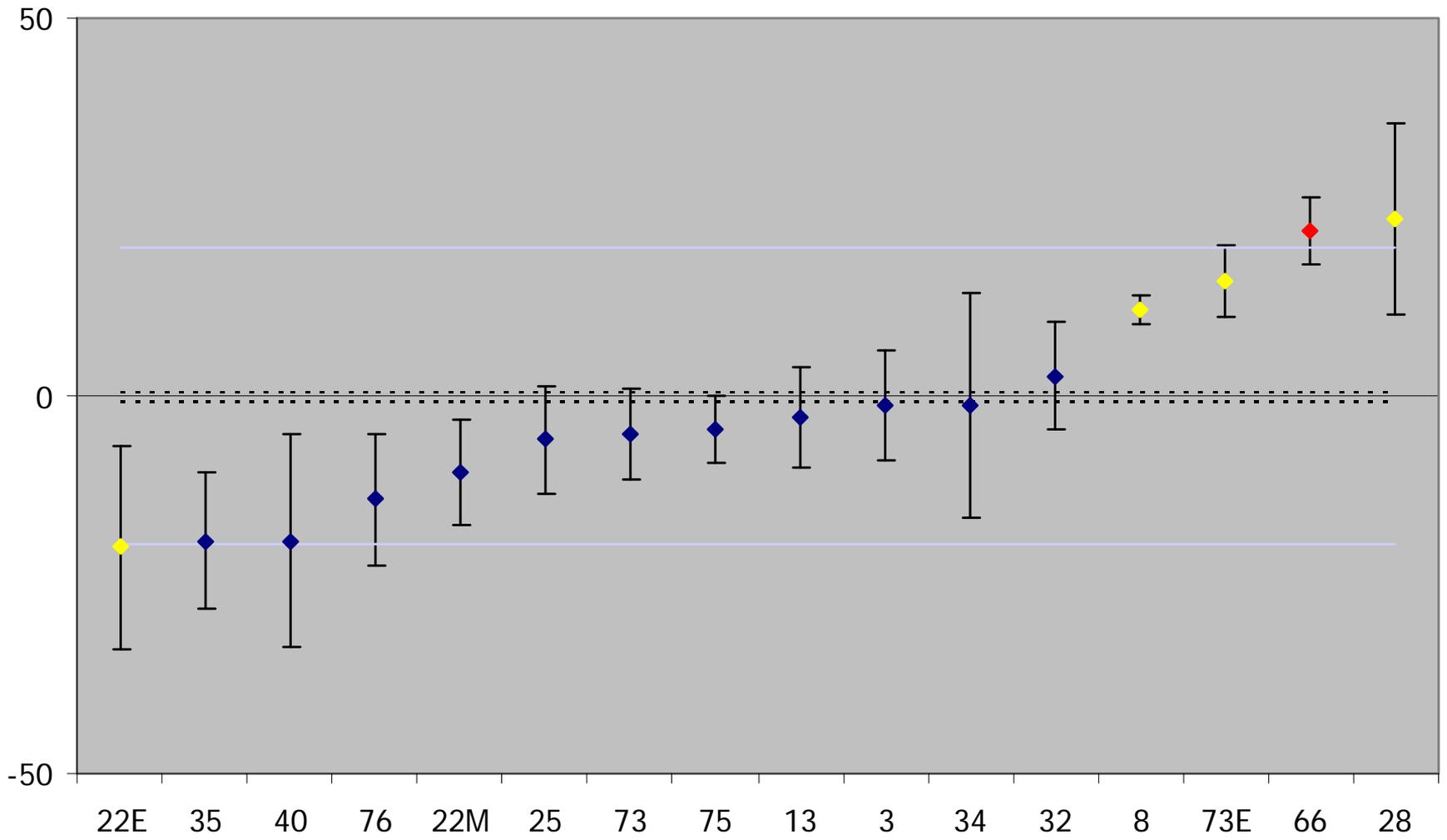Deviation Ni-63 BH (%)
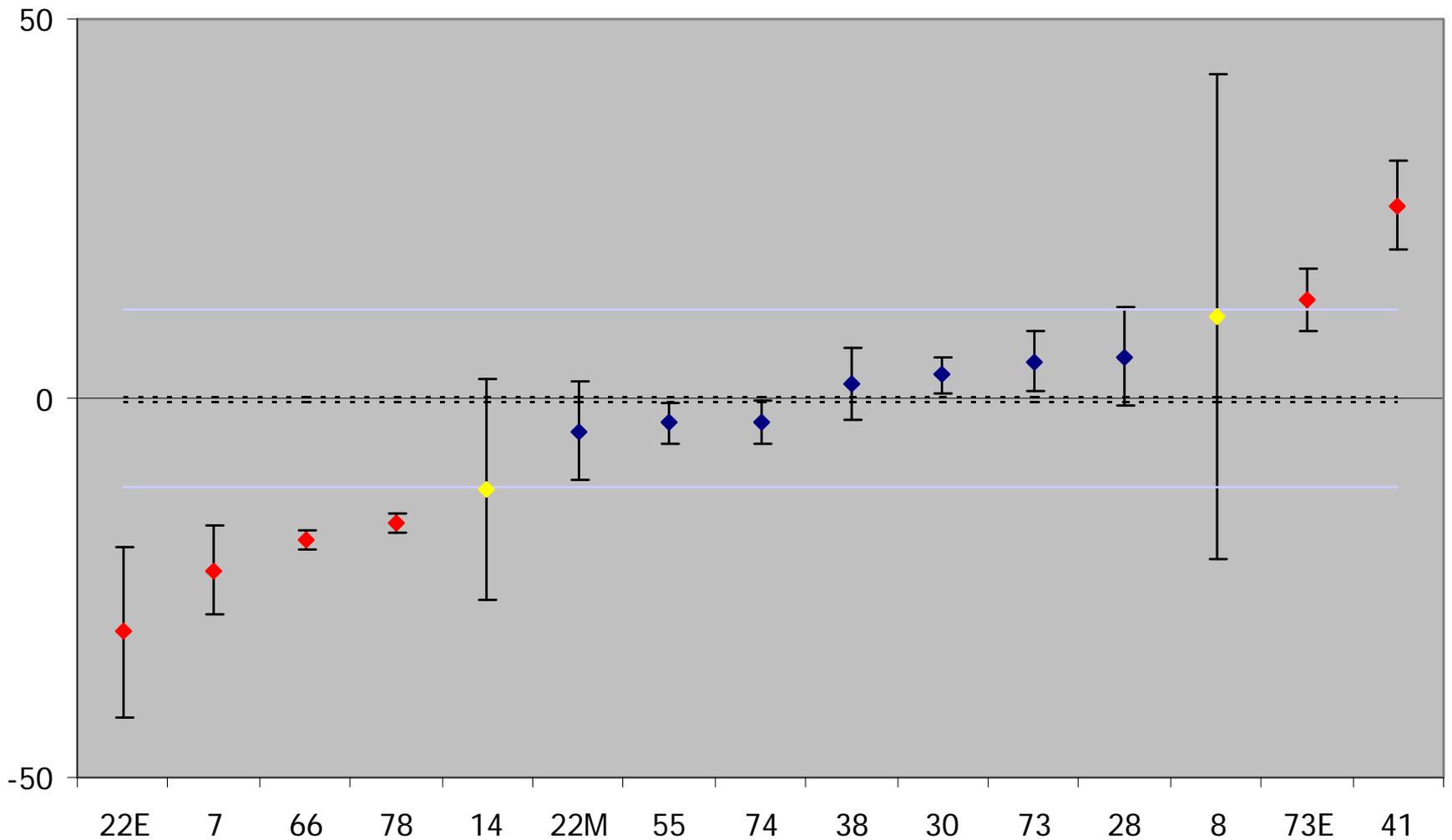
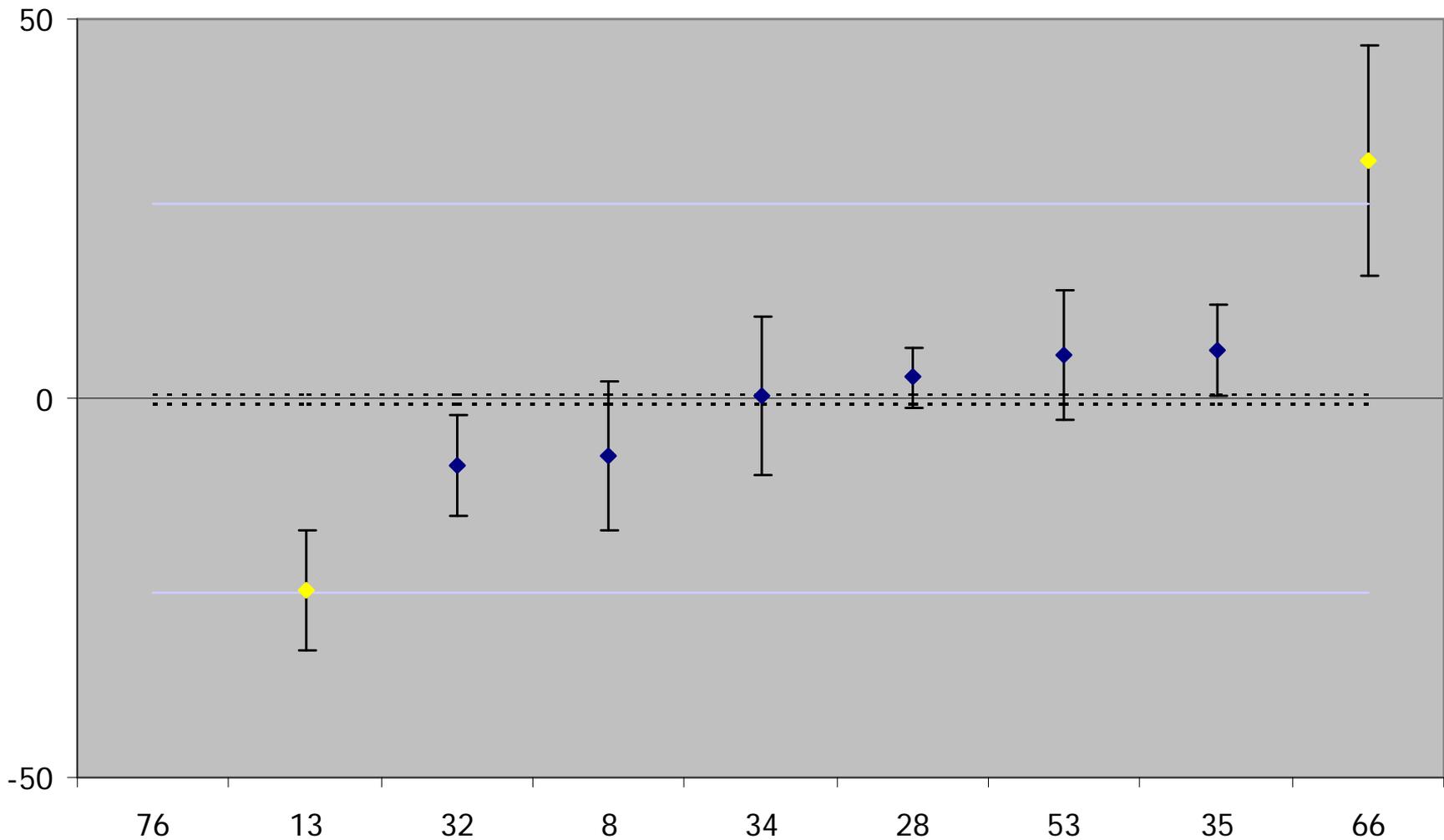**Deviation Sr-89 BL (%)**

NPL

Deviation Sr-89 BH (%)
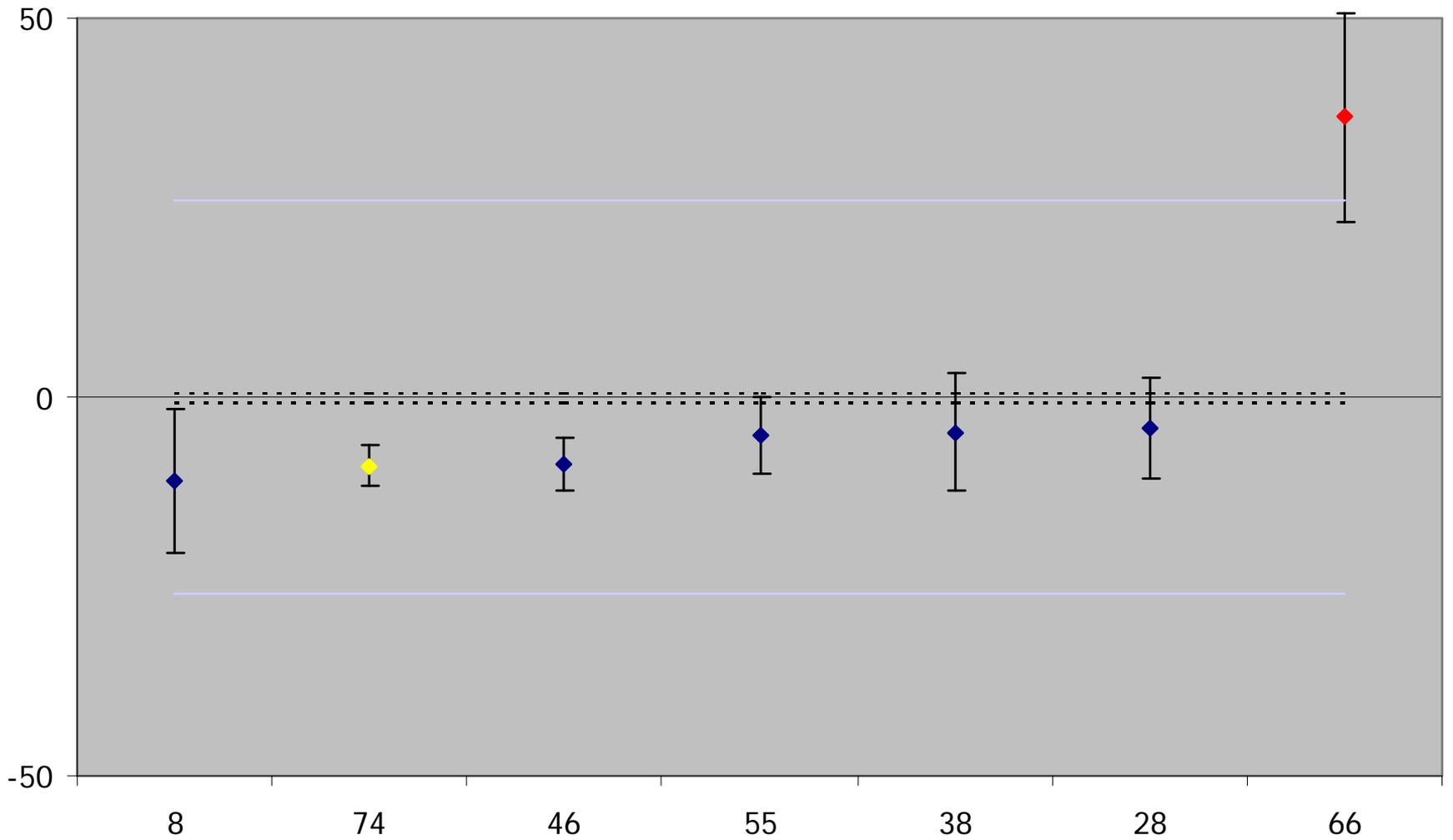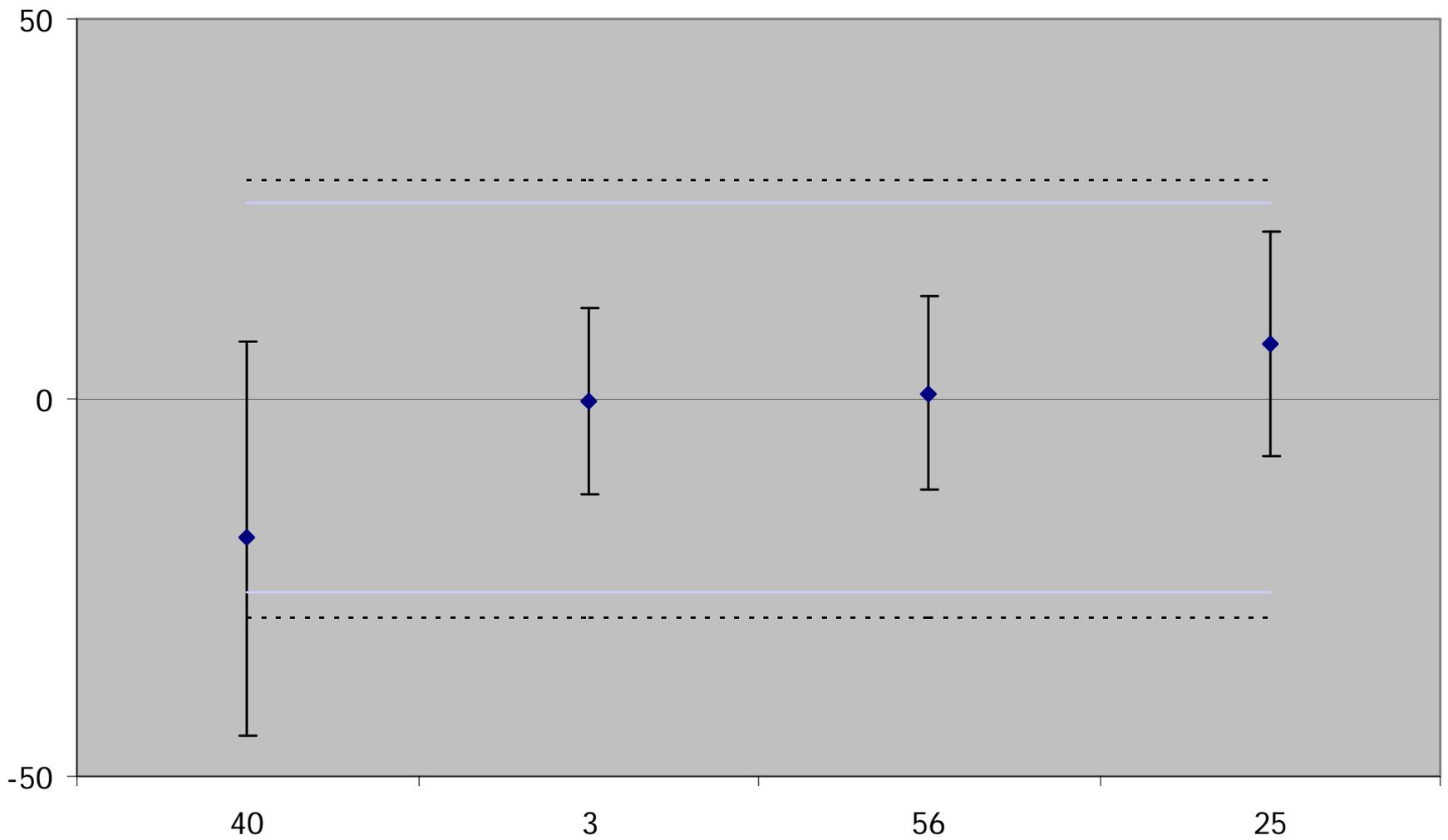
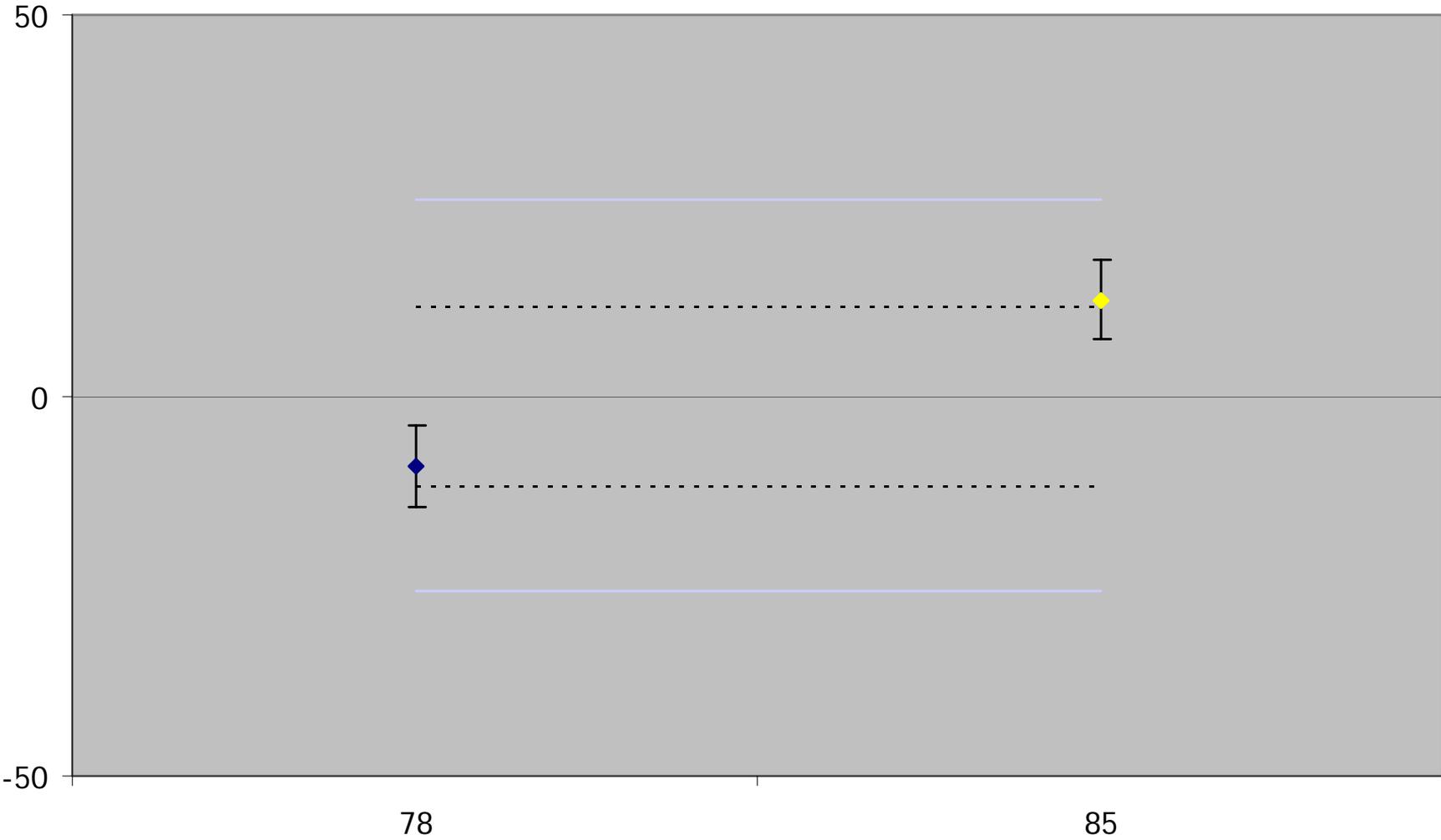Deviation Sr-90 BL (%)

Deviation Sr-90 BH (%)

Deviation Tc-99 BL (%)

Deviation Tc-99 BH (%)

Deviation gross beta BL (%)

Deviation gross beta BH (%)

BL and BH results in agreement

	BL (%)	BH (%)
^{3}H	47	75
^{55}Fe	100	57
^{63}Ni	50	50
^{89}Sr	67	50
^{90}Sr	69	47
^{99}Tc	67	71
gross beta	100	50

NPL

Results

64%	'in agreement'
16%	'questionable'
20%	'discrepant'

Problematic nuclides: ^{3}H and ^{63}Ni

Less problematic: ^{55}Fe, ^{89}Sr, ^{90}Sr, ^{99}Tc

NPL

Results

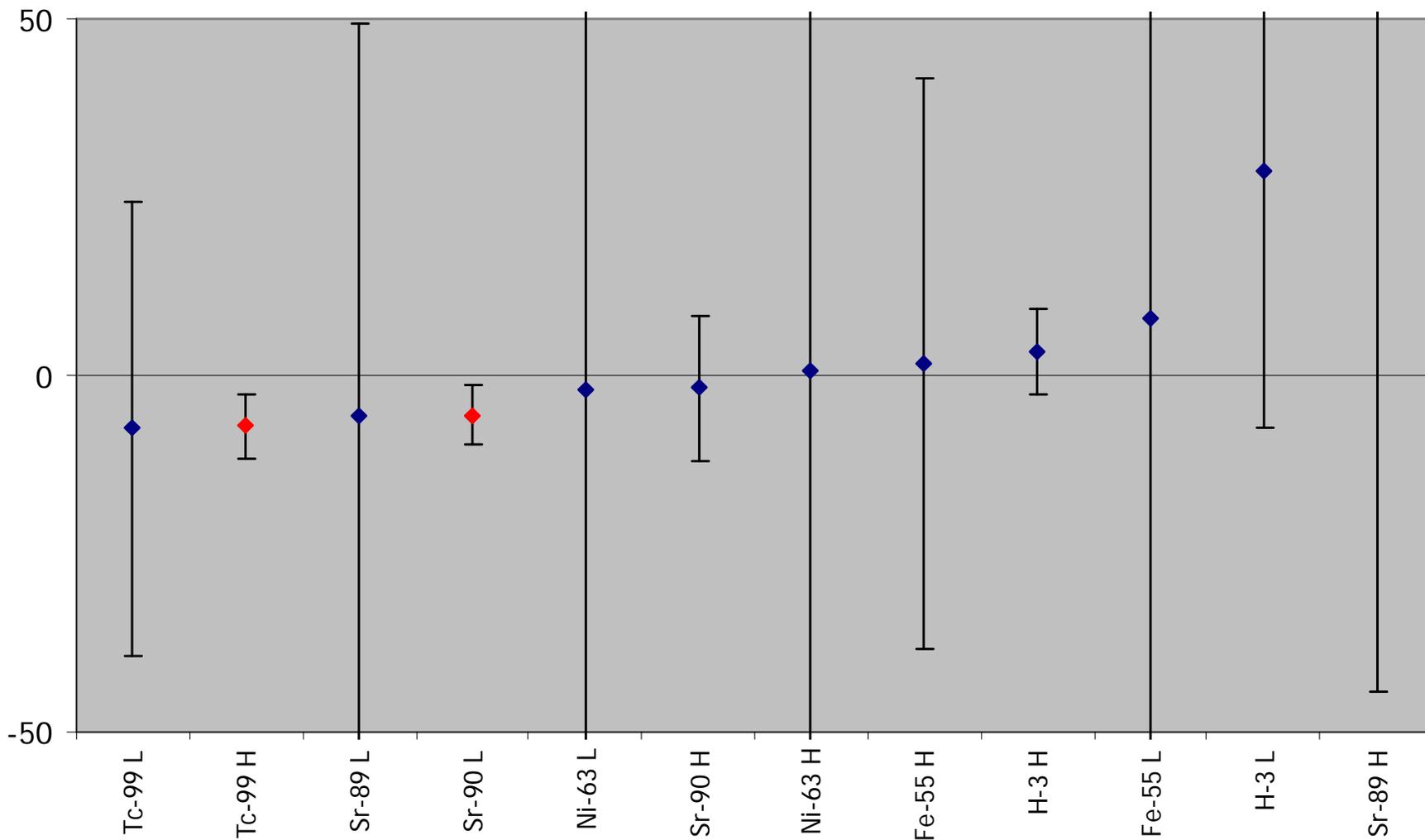|	
59%	'in agreement'
13%	'questionable'
28%	'discrepant'

Problematic nuclides: ^{63}Ni, ^{89}Sr and ^{90}Sr

Less problematic: ^{3}H, ^{55}Fe and ^{99}Tc

NPL
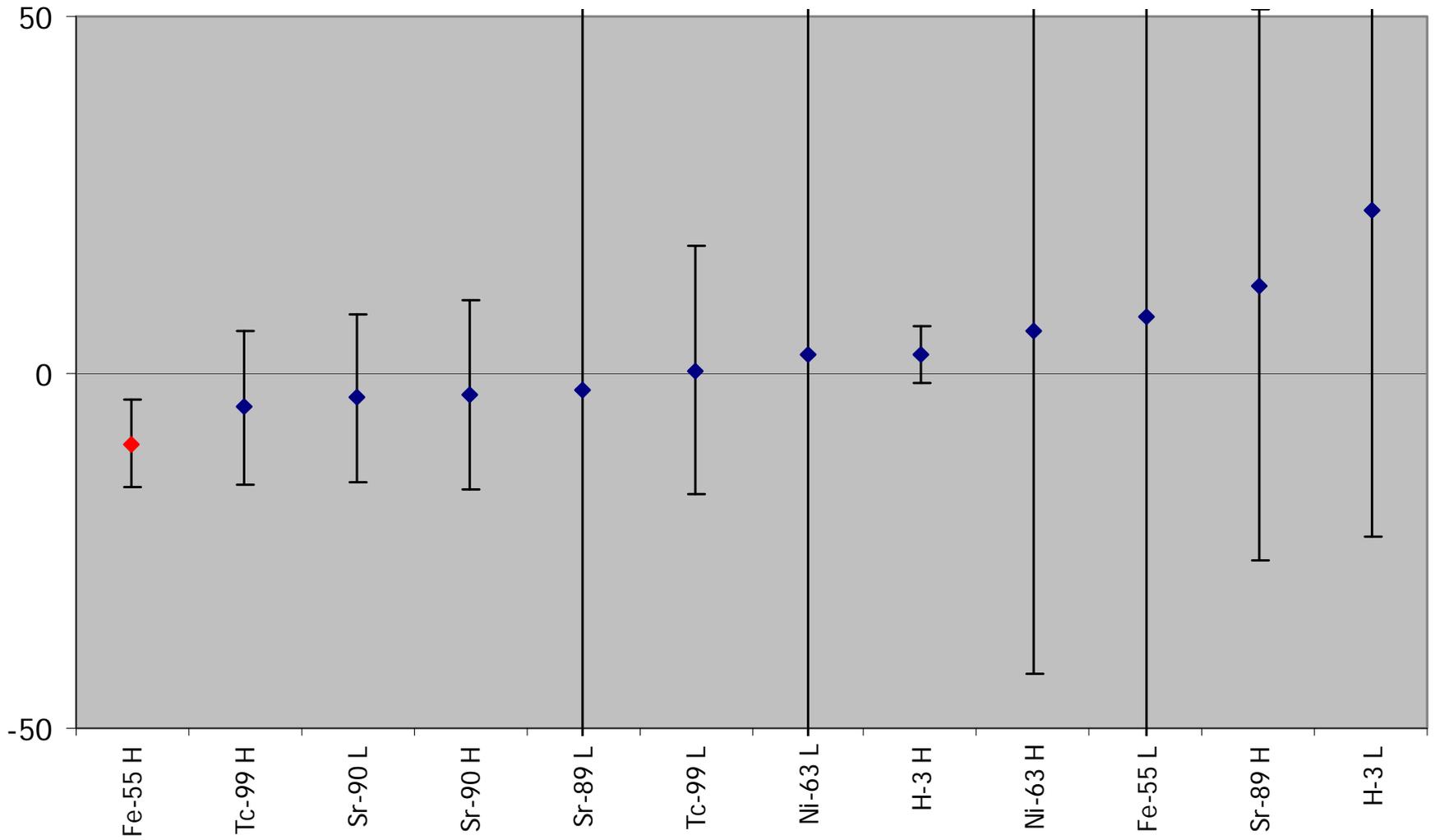
Mean deviation (%) with 99% conf. interval

Median deviation (%) with 99% conf. interval

Thank you

NPL