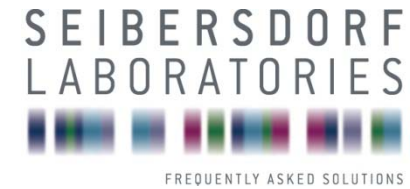




HelmholtzZentrum münchen
German Research Center for Environmental Health



EURADOS INTERCOMPARISONS ON WHOLE BODY DOSEMETERS (2018) –

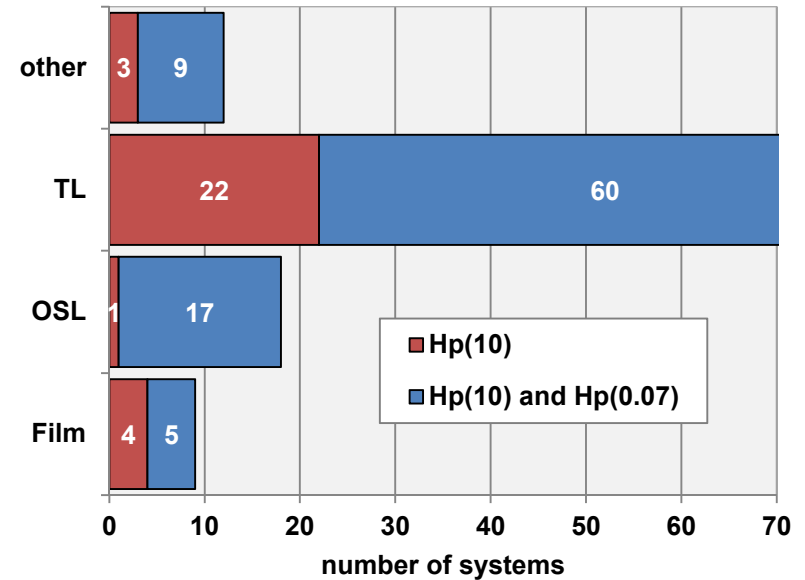
Results

European Radiation Dosimetry Group

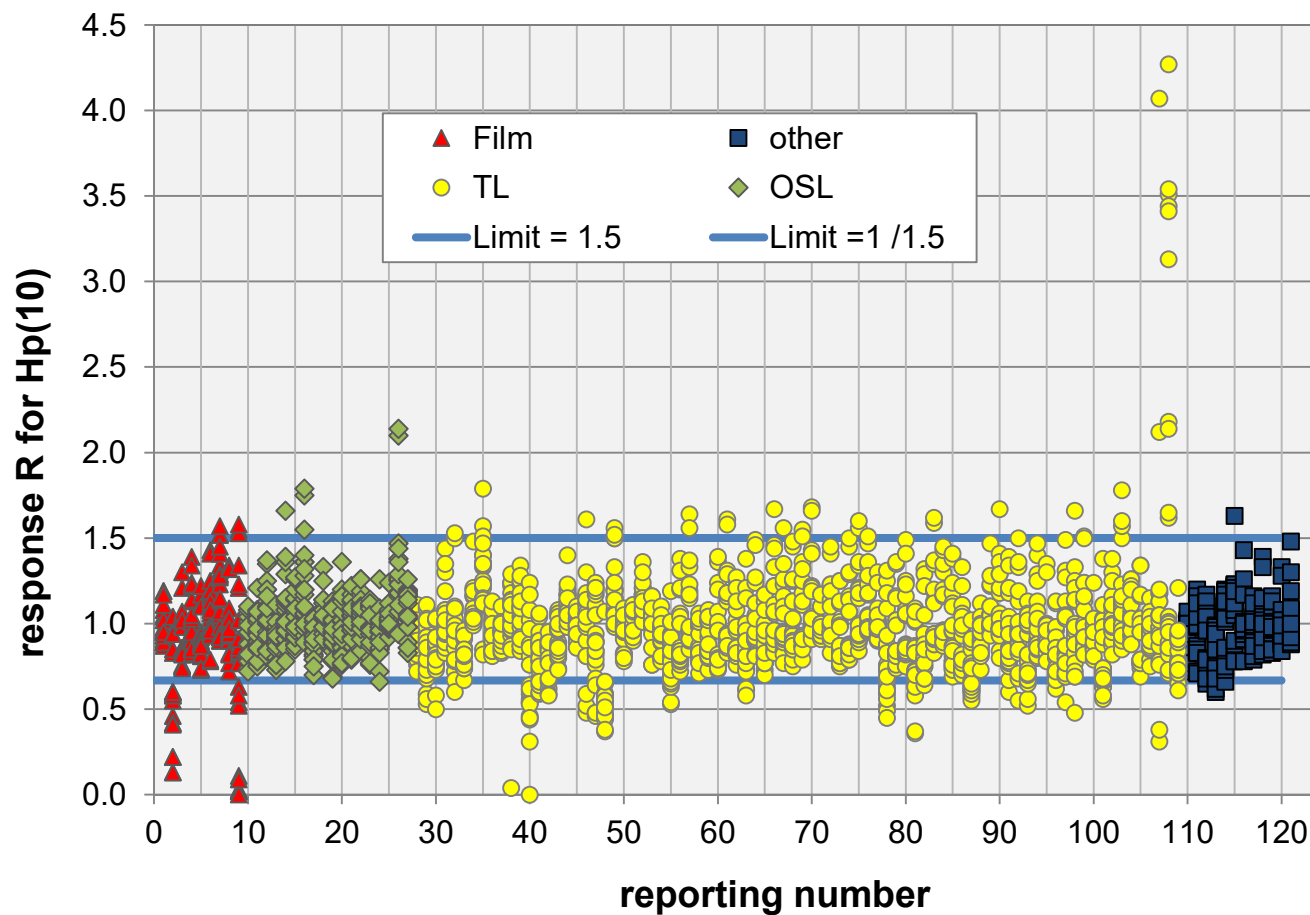
EURADOS →

Dosemeter types and detectors

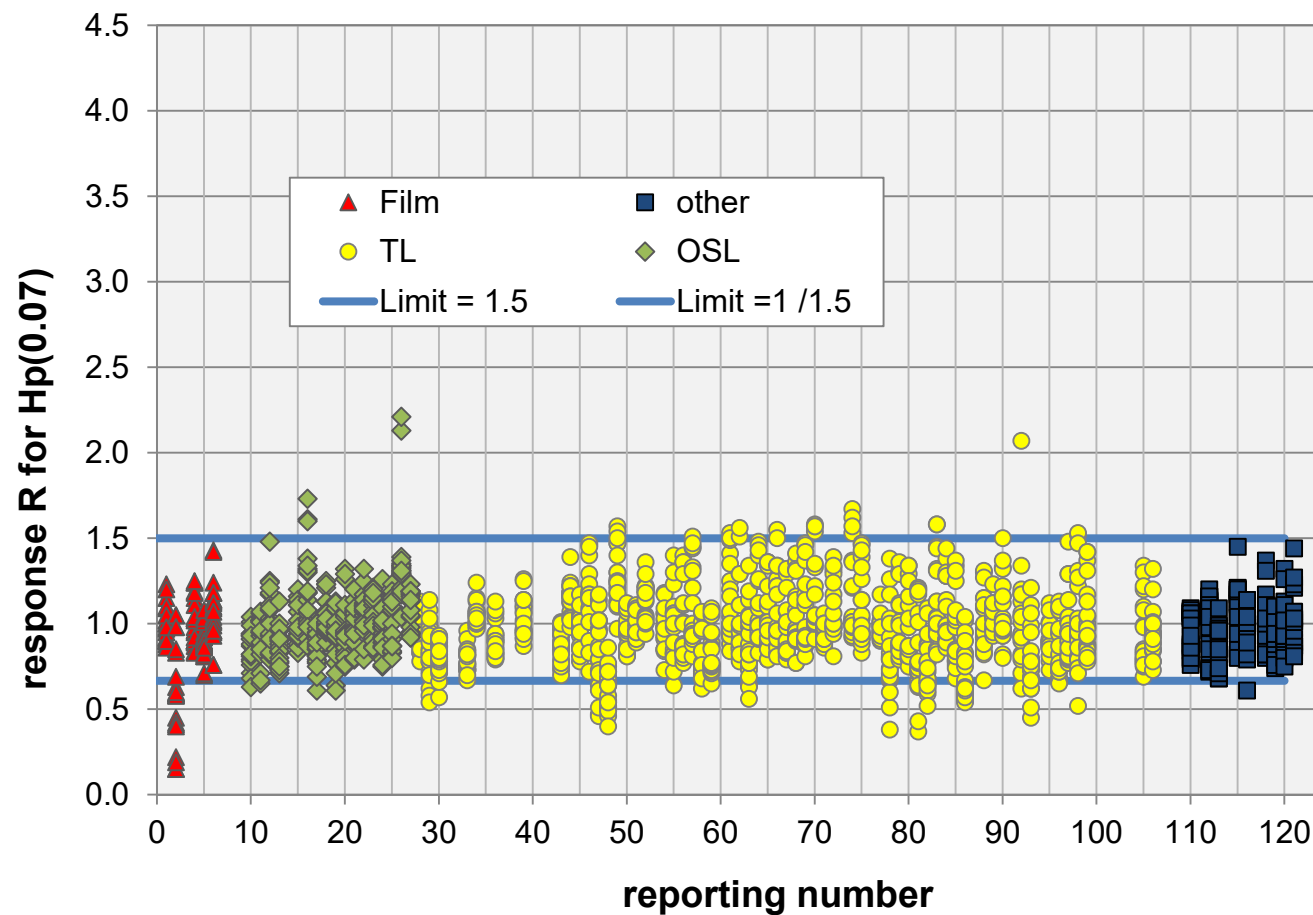
	systems	% of all	% of type
TL	82	68%	68%
LiF:Mg, Ti	47	39%	57%
Li ₂ B ₄ O ₇ /CaSO ₄	15	12%	18%
LiF:Mg, Cu, P	13	11%	16%
TL - Other	7	6%	9%
other	12	10%	10%
DIS	7	6%	58%
RPL	4	3%	33%
APD	1	1%	8%
Film	9	7%	7%
agfa	7	6%	78%
FOMA	2	2%	22%
OSL	18	15%	15%
Al ₂ O ₃ :C	13	11%	72%
BeO	5	4%	28%
All	121	100%	100%



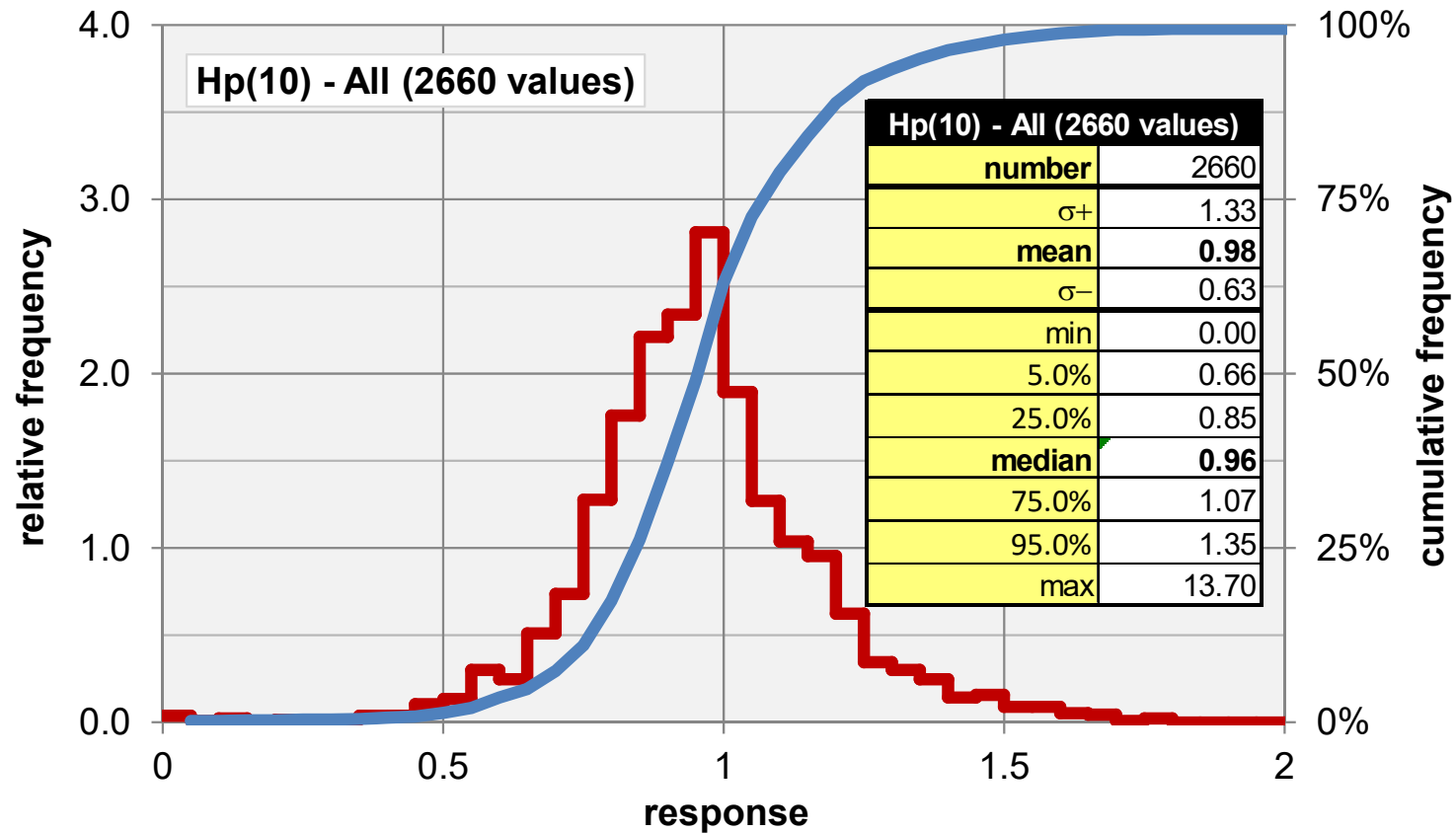
All individual results for $H_p(10)$



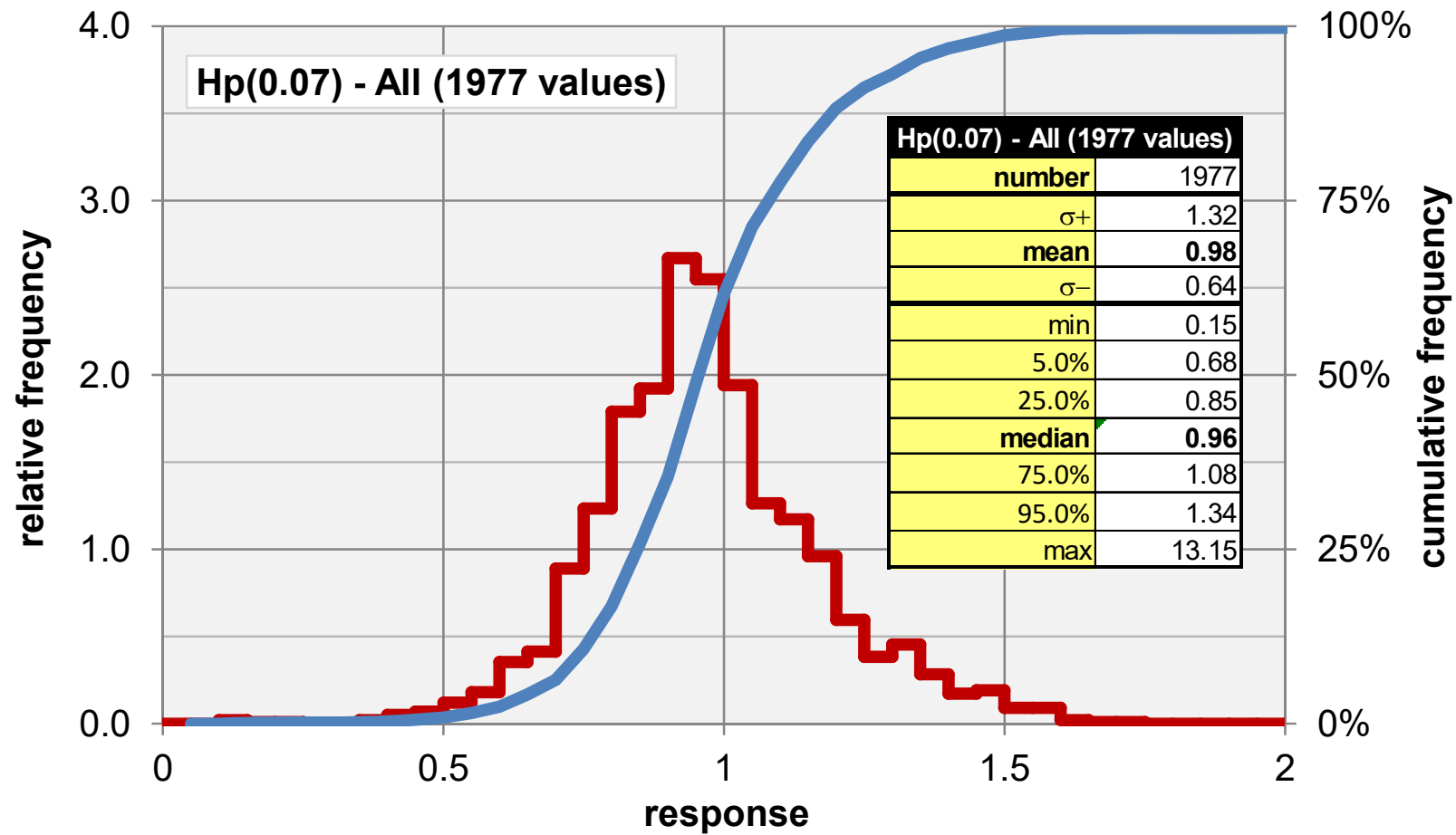
Individual results for $H_p(0.07)$



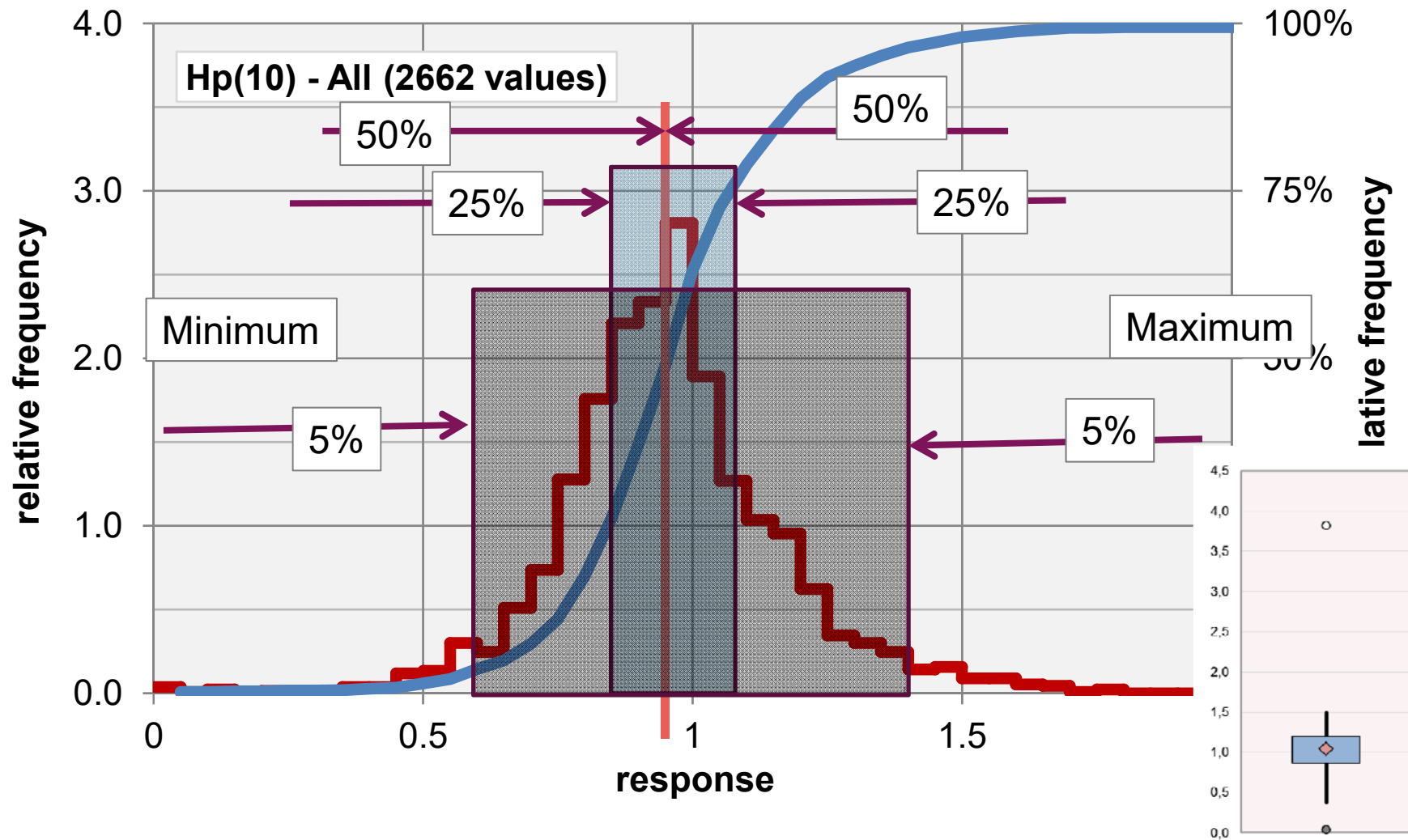
All response values

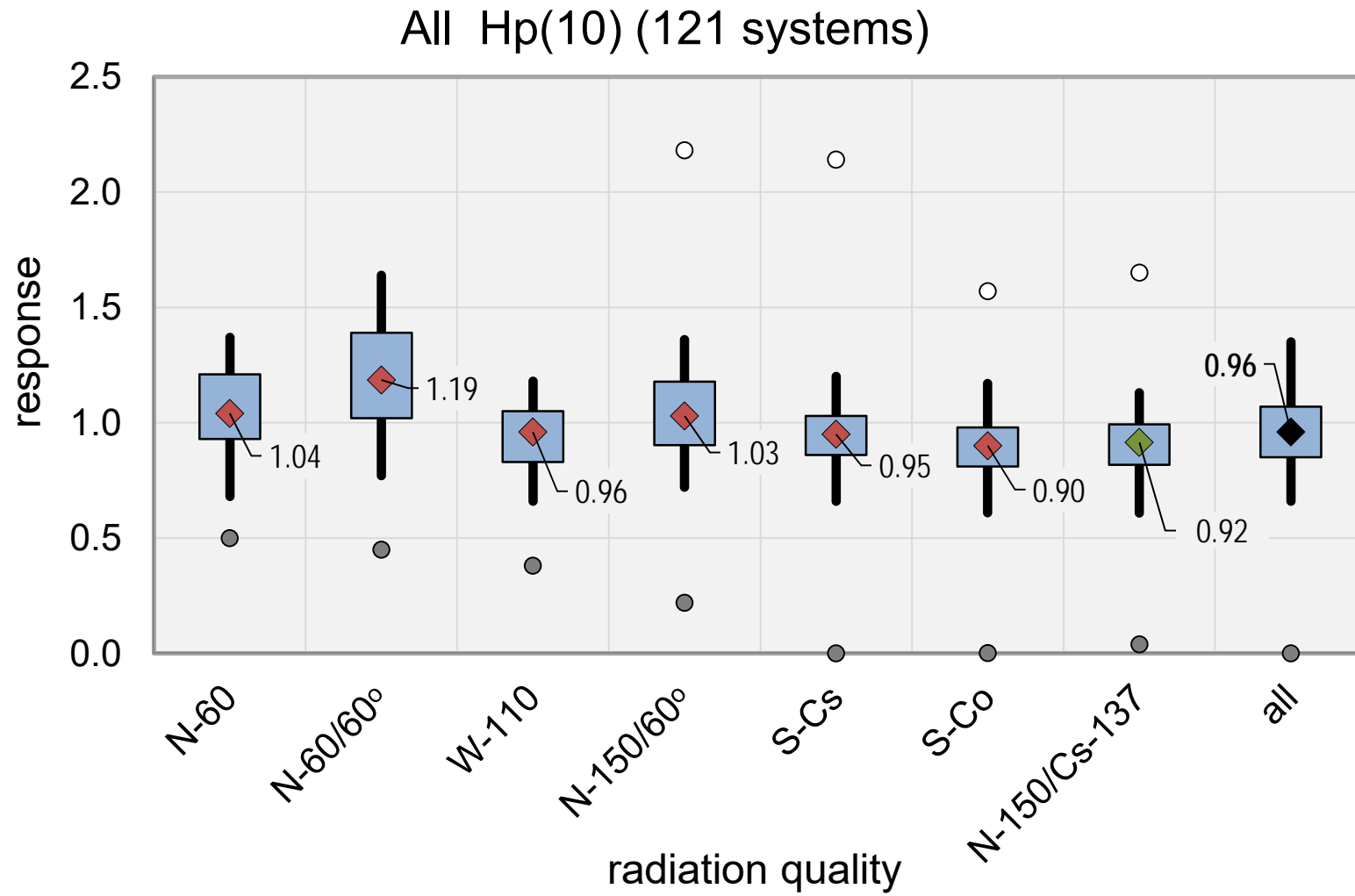


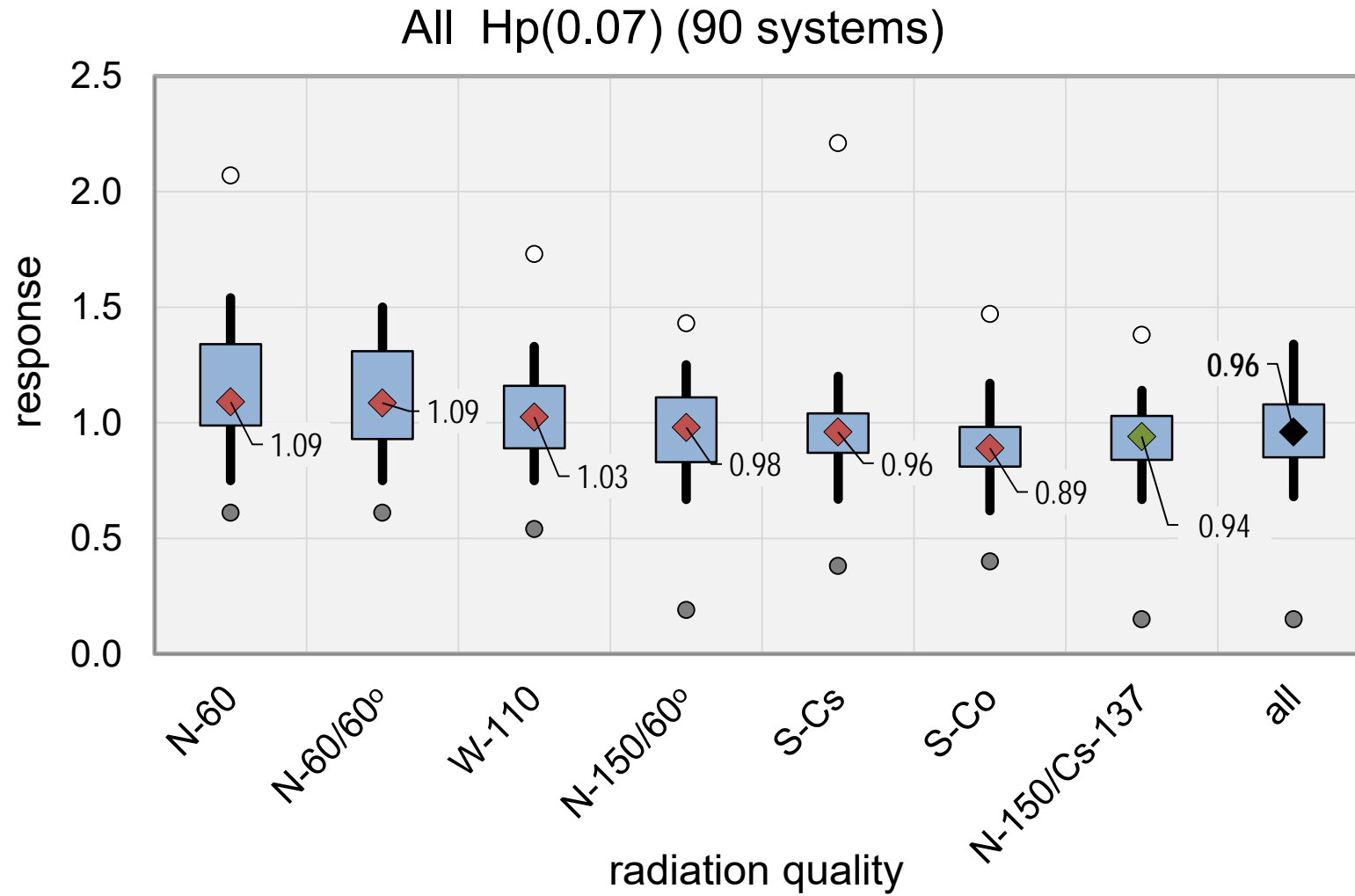
All response values



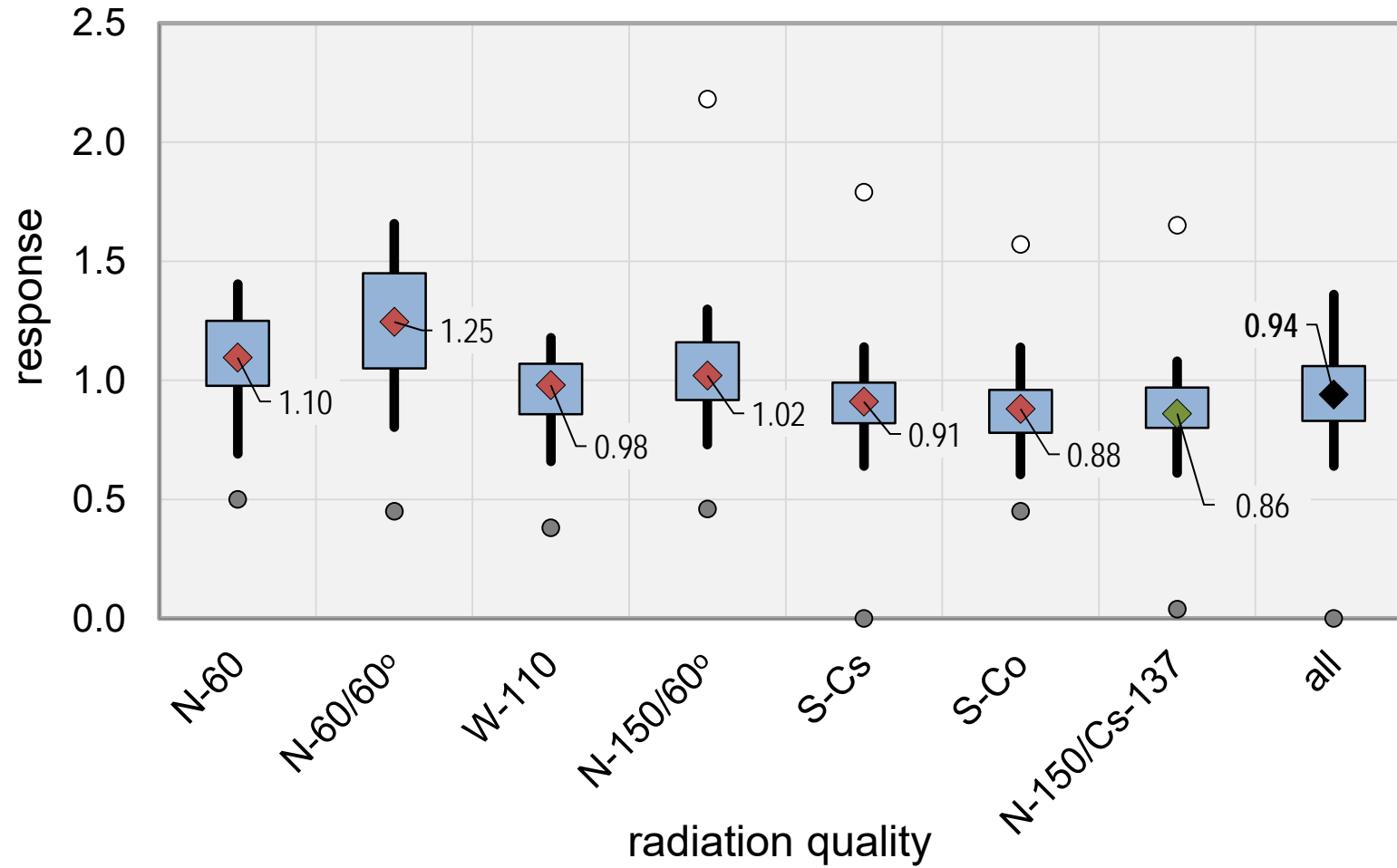
Frequency distribution of all Responses (R)



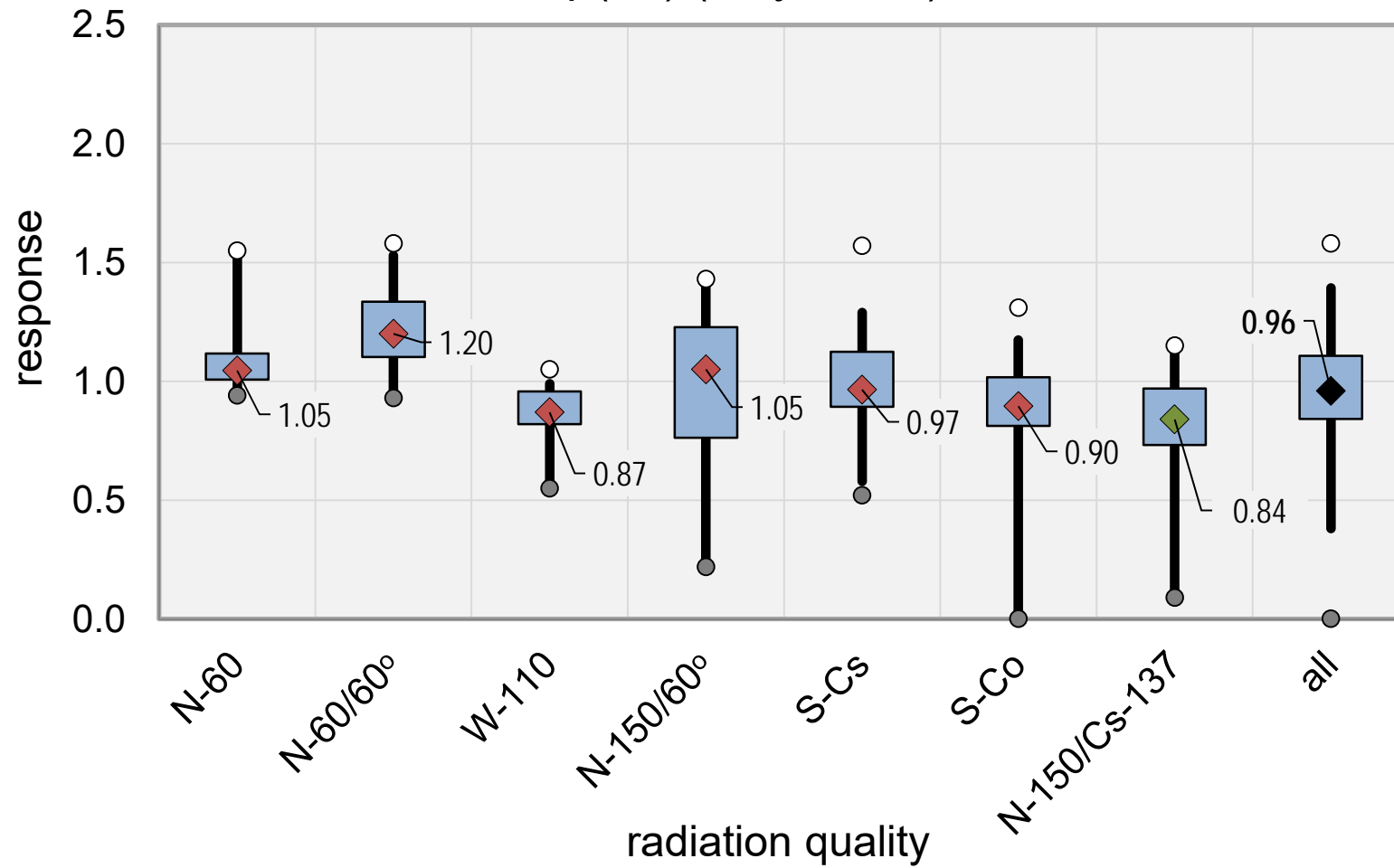


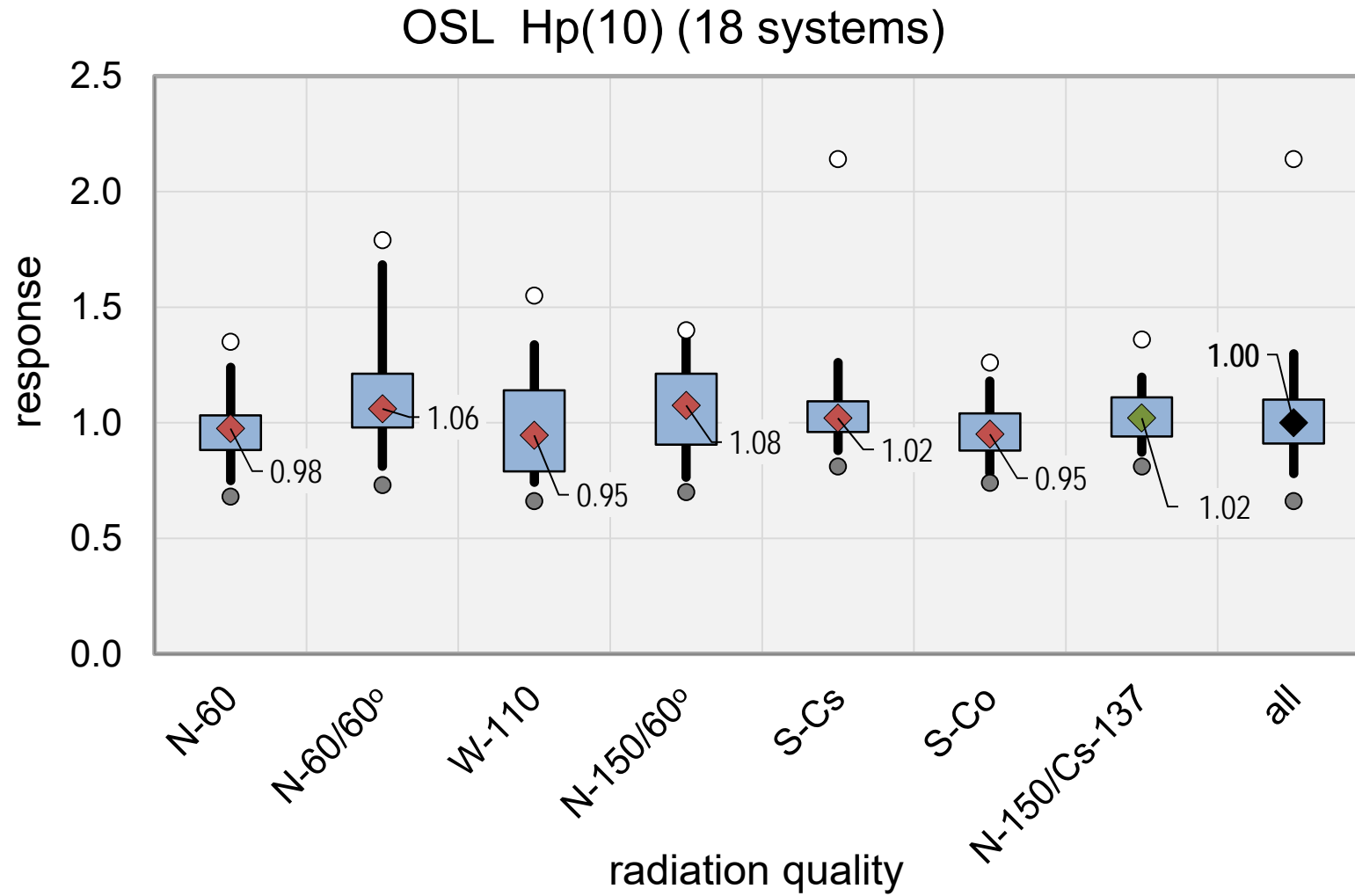


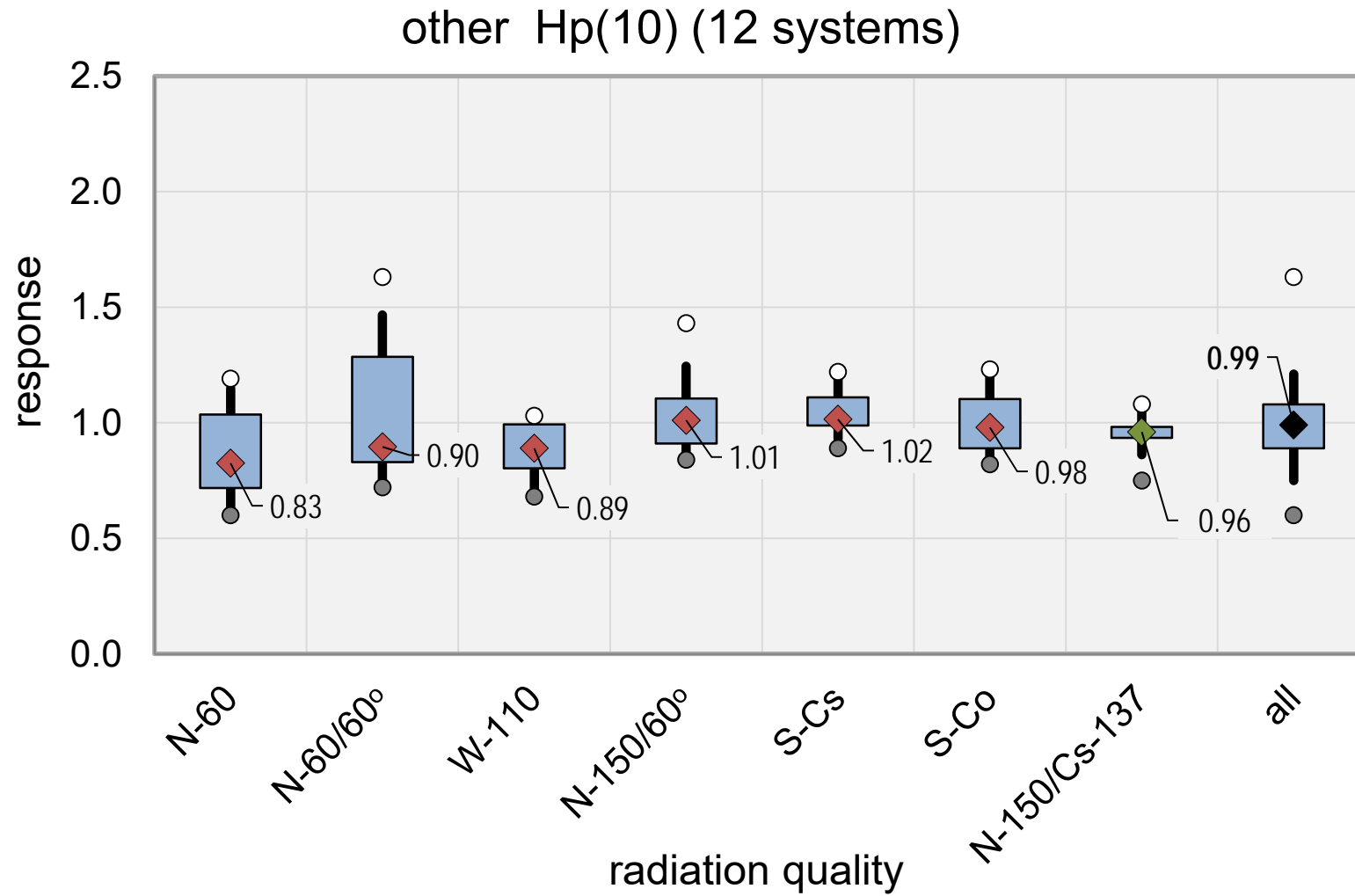
TL Hp(10) (82 systems)



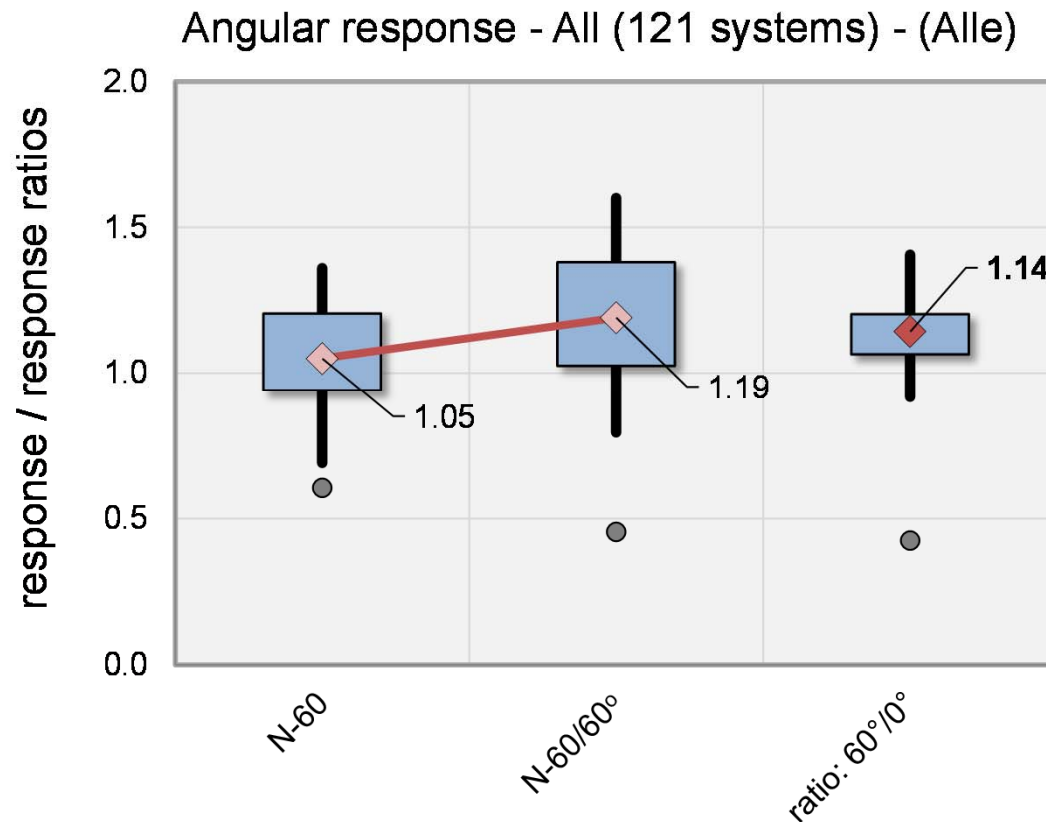
Film Hp(10) (9 systems)







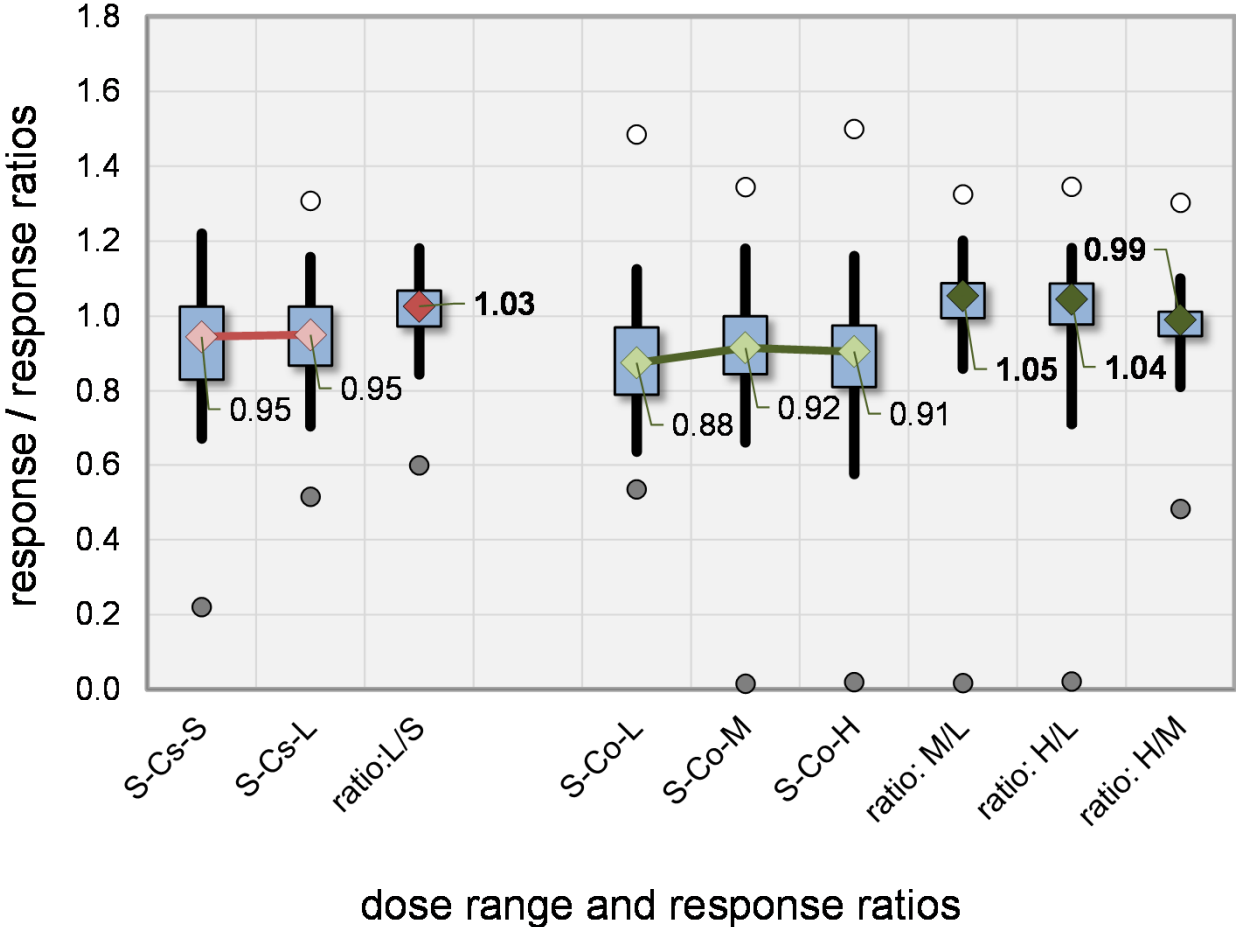
Angular response ($\pm 60^\circ$)



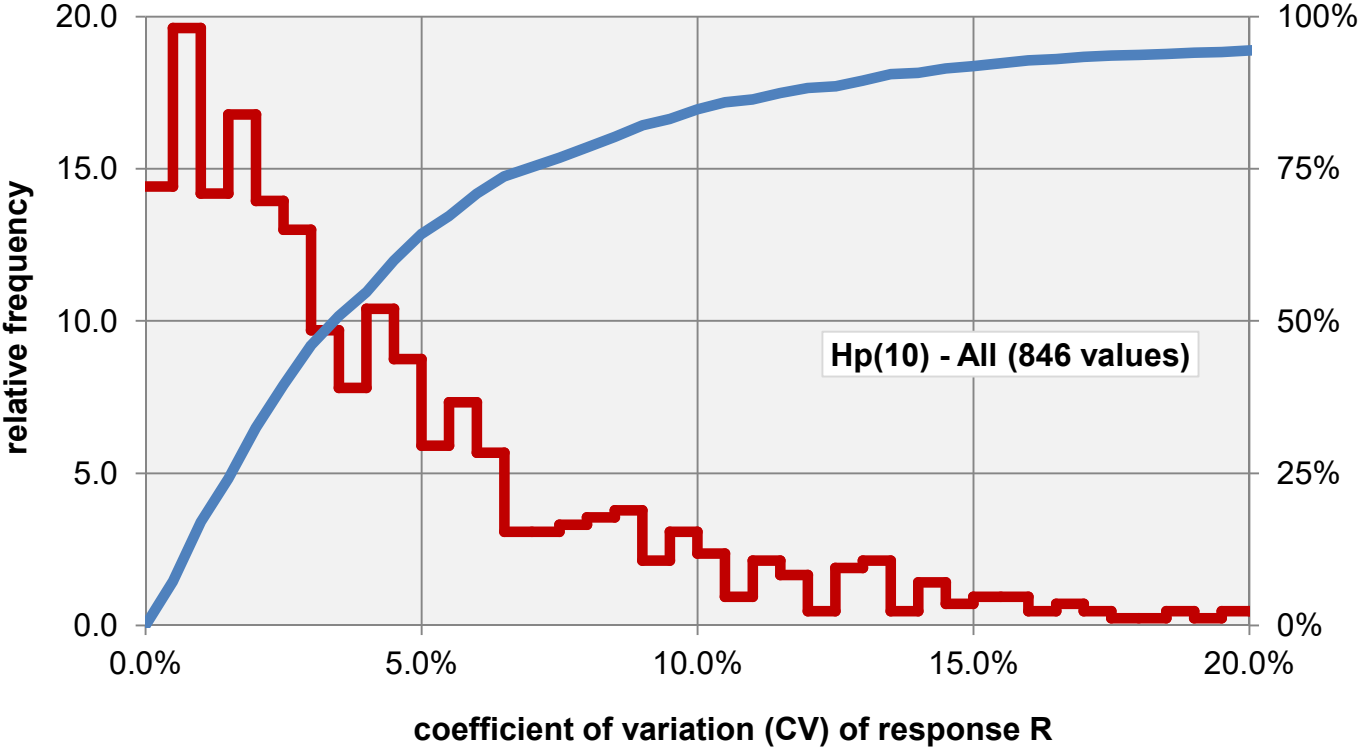
angular response (Alle)	
number	121
σ^-	1.65
mean	1.18
σ^+	0.72
min	0.42
5.0%	0.92
25.0%	1.06
median	1.14
75.0%	1.20
95.0%	1.41
max	5.92

Linearity

Linearity - All (121 systems) - Hp(10)

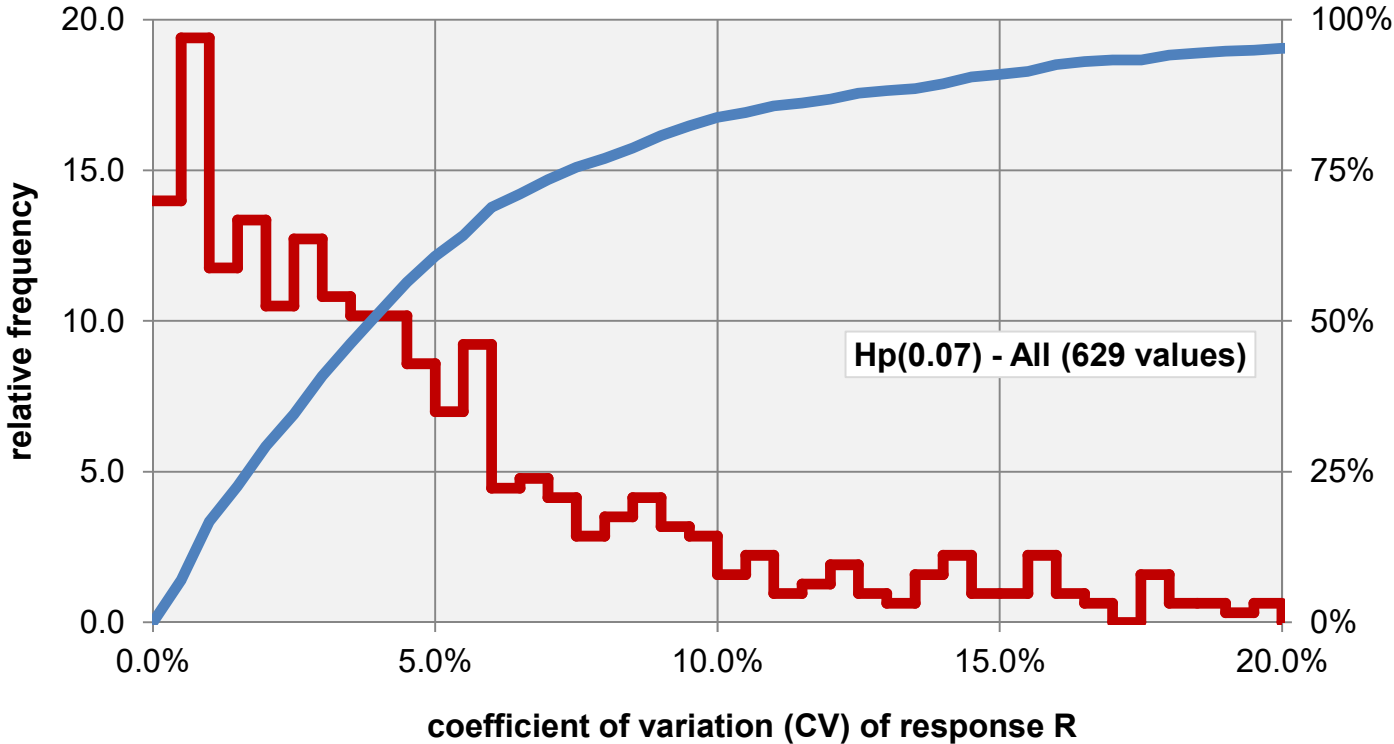


Coefficient of variation (CV)



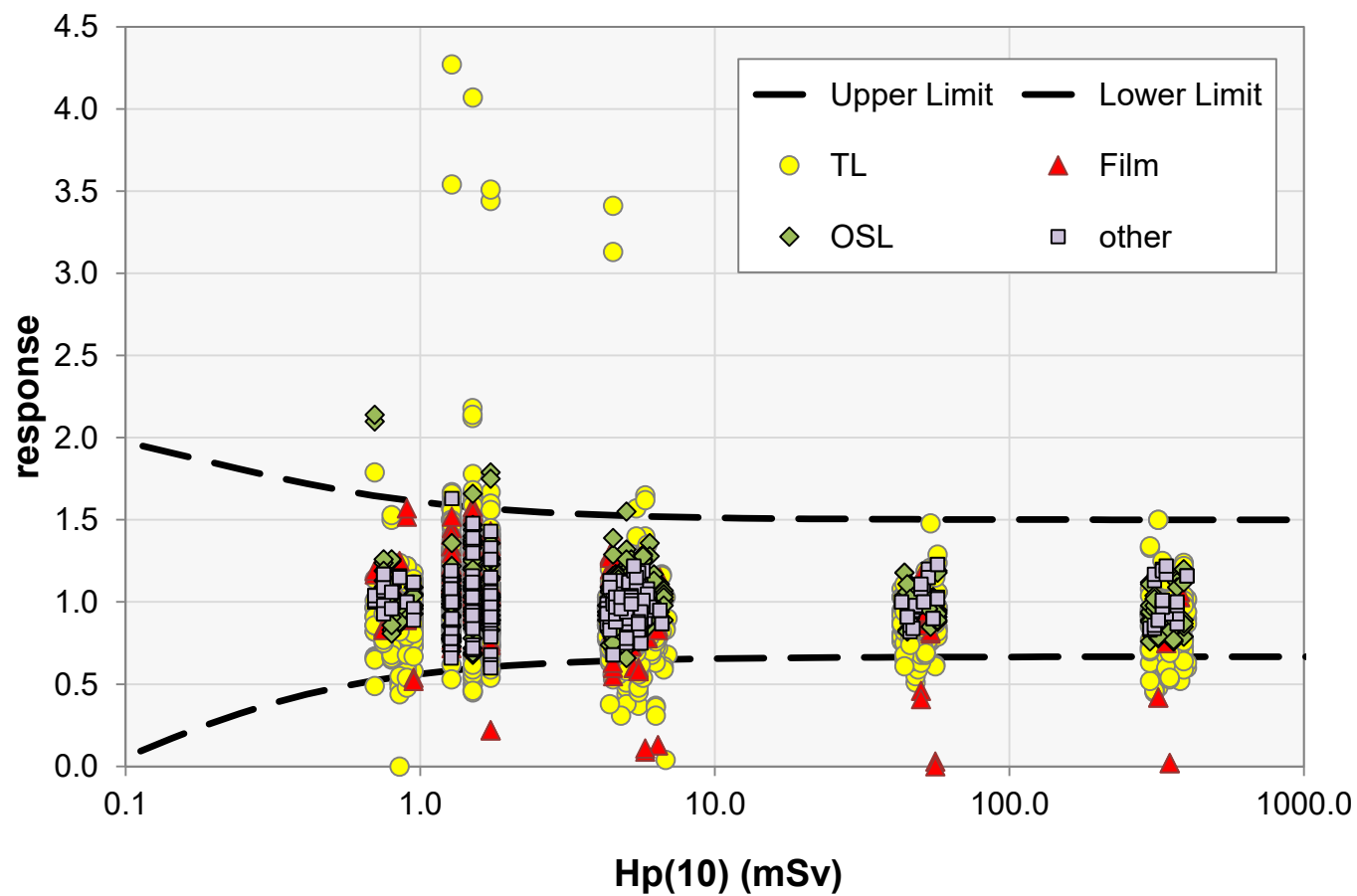
Hp(10)	
number	846
σ^-	17.4%
mean	6.3%
σ^+	-4.8%
min	0.0%
5.0%	0.0%
25.0%	1.5%
median	3.4%
75.0%	6.8%
95.0%	21.4%
max	147.4%

Coefficient of variation (CV)



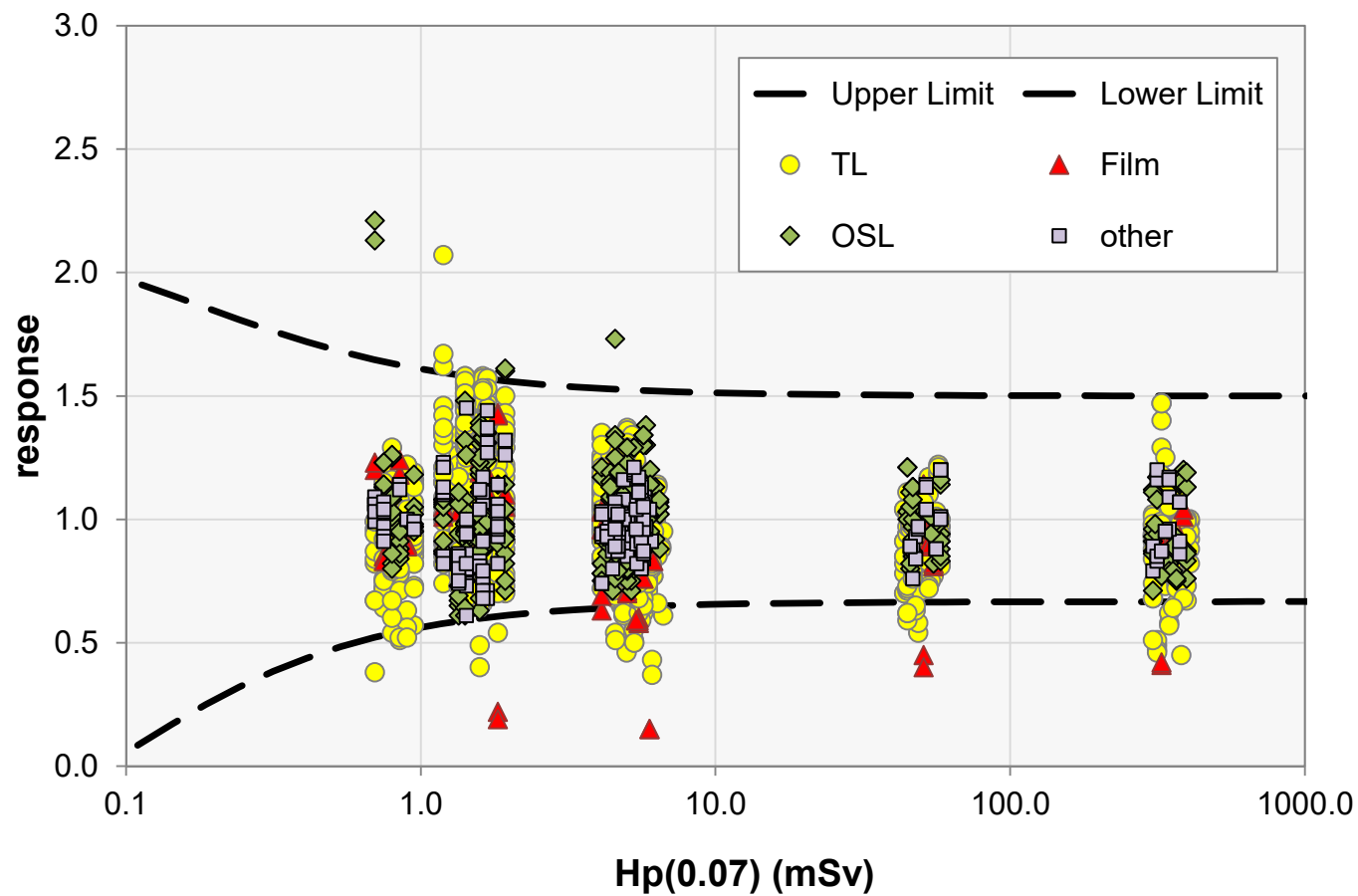
Hp(0.07)	
number	629
σ^-	13.7%
mean	6.0%
σ^+	-1.7%
min	0.0%
5.0%	0.0%
25.0%	1.8%
median	3.8%
75.0%	7.3%
95.0%	19.6%
max	116.2%

Trumpet curve for $H_p(10)$



ISO 14146:2010

Trumpet curve for $H_p(0.07)$



ISO 14146:2010

Outliers (trumpet curve)

Outliers / Trumpet						
Quantity	Quality	TL	Film	OSL	other	All
Hp(10)	N-60	5%	0%	0%	4%	4%
	N-60/60°	12%	6%	8%	4%	10%
	W-110	5%	17%	3%	0%	5%
	S-Cs	5%	13%	2%	0%	4%
	S-Co	8%	19%	0%	0%	7%
	N-150/60°	4%	11%	0%	0%	3%
	N-150/Cs-137	7%	22%	0%	0%	7%
	All	6%	14%	2%	1%	6%
Outliers / Trumpet						
Quantity	Quality	TL	Film	OSL	other	All
Hp(0.07)	N-60	3%	0%	0%	0%	2%
	N-60/60°	3%	0%	6%	0%	3%
	W-110	1%	10%	3%	0%	2%
	S-Cs	5%	13%	2%	0%	4%
	S-Co	8%	20%	0%	0%	6%
	N-150/60°	3%	20%	0%	0%	3%
	N-150/Cs-137	4%	20%	0%	0%	4%
	All	5%	14%	1%	0%	4%

IC2018

Previous intercomparisons

Outliers / Trumpet						
Quantity	Quality	TLD	Film	OSL	Other	All
Hp(10)	RQR7	5%	8%	0%	10%	5%
	W-80	6%	8%	0%	0%	5%
	W-80/60°	8%	25%	0%	5%	9%
	W-150	5%	17%	0%	0%	5%
	S-Cs	1%	14%	0%	2%	3%
	S-Co	5%	24%	0%	0%	6%
	All	4%	17%	0%	2%	5%

IC2014

Outliers / Trumpet						
Quantity	Quality	TL	Film	OSL	other	All
Hp(10)	N-40	7%	6%	0%	0%	5%
	N-40/60°	32%	6%	12%	0%	24%
	N-150	6%	13%	0%	0%	5%
	N-150/45°	5%	25%	3%	0%	6%
	S-Cs	5%	4%	2%	0%	4%
	S-Co	5%	8%	0%	7%	5%
	S-Cs/Sr-90	17%	25%	6%	0%	14%
	All	9%	10%	2%	2%	7%

IC2016

Number of outliers (approx. 1 out of 10)

Hp(10)														
# outliers (sys)	0	1	2	3	4	6	7	10	11	12	16	18	0-2	> 2
TL	56%	18%	11%	2%	5%	1%	1%	2%	-	1%	-	1%	85%	15%
Film	78%	-	-	-	-	-	-	-	11%	-	11%	-	78%	22%
OSL	83%	6%	6%	6%	-	-	-	-	-	-	-	-	94%	6%
other	83%	17%	-	-	-	-	-	-	-	-	-	-	100%	0%
All	64%	15%	8%	2%	3%	1%	1%	2%	1%	1%	1%	1%	88%	12%
	88%			12%										

Hp(0.07)												
# outliers (sys)	0	1	2	3	4	5	6	10	13	15	0-2	> 2
TL	72%	8%	3%	8%	2%	2%	2%	2%	2%	-	83%	17%
Film	80%	-	-	-	-	-	-	-	-	20%	80%	20%
OSL	88%	-	6%	6%	-	-	-	-	-	-	94%	6%
other	100%	-	-	-	-	-	-	-	-	-	100%	0%
All	78%	5%	3%	7%	1%	1%	1%	1%	1%	1%	87%	13%
	87%			13%								

IC2018

$$\frac{1}{F} \left(1 - \frac{2H_0}{H_0 + H_c} \right) \leq R \leq F \left(1 + \frac{H_0}{2H_0 + H_c} \right)$$

$$F = 1.5 \quad H_0 = 0.085 \text{ mSv}$$

10% of outliers are accepted

Summary 1

Number of participating systems was strongly increasing
(from 103 to 121)

Radiation qualities:

- Gammas and X-ray and mixed radiation were used

Fraction of outliers $H_p(10)$:

- 64% systems show no outliers of the trumpet curve criteria.
- **88% systems meet the ISO 14146:2010 performance criteria**
(max. 2 outliers are allowed)
- **Overall performance results** remains stable (from 7% to 6%)
- FILM number of outliers increased (from 10% to 14%)
- TLD number of outliers decreased (from 9% to 7%)
- OSL performance stable (2%)

Summary 2

Responses $H_p(10)$ and $H_p(0.07)$:

- Overall mean response **0.98**
- Overall median response **0.96**

Calibration:

- Better results could be achieved by improved calibration procedure by some services

Radiation qualities/Problems:

- The radiation quality N-60/60° shows over response for a number of systems (10 % outliers)

Coefficient of variation (CV):

- Typical CVs for identical irradiation conditions are 1 - 7% (similar in previous intercomparisons)

