Overview of the IC2017n Results

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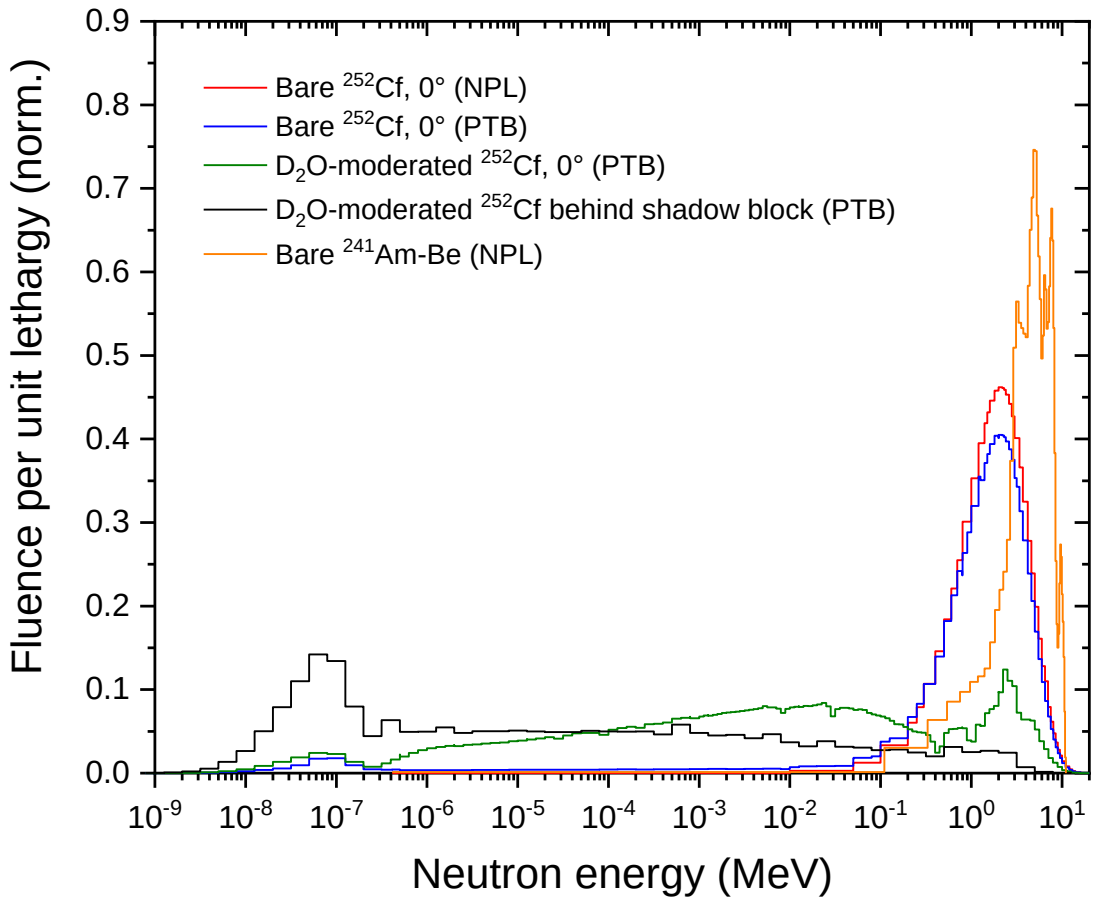
Outline

- Reminder of radiation qualities and spectra
- Categories of dosemeters
- Overview of participants' results
- Results for specific radiation qualities

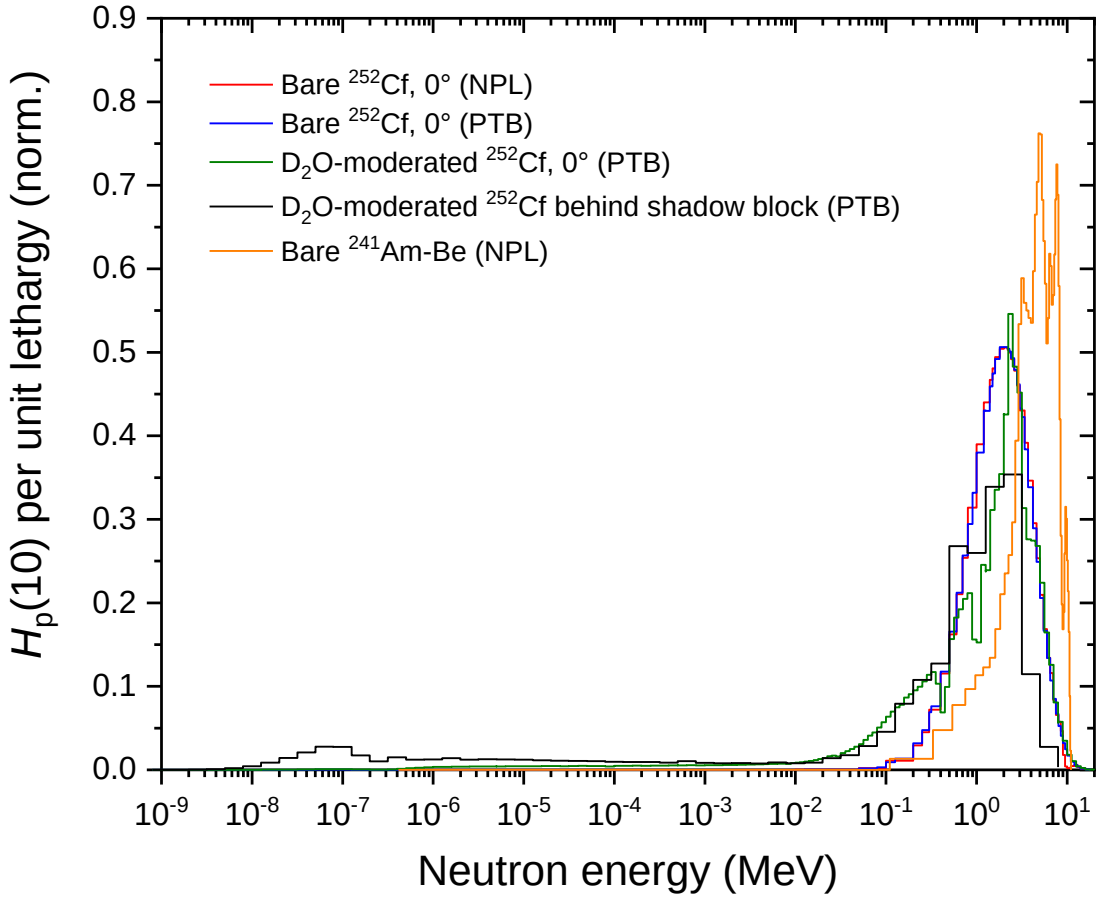
Reminder — Radiation Qualities

No.	Radiation quality	$H_p(10)$ (mSv)		
1	Bare ^{252}Cf source at 0°	0.3	1.5	12
2	Bare ^{252}Cf & ^{137}Cs sources at 0° [$H_p(10)$ photons = 1 mSv]		1.5	
3	Bare ^{252}Cf source at 45°		1.5	
4	D_2O-moderated ^{252}Cf source at 0°		1.2	
5	D_2O-moderated ^{252}Cf source behind shadow block		1.0	
6	Bare ^{241}Am-Be at 0°		1.5	

Reminder — Fluence Spectra



Reminder — Personal Dose Equivalent Spectra



Categories of Dosemeters

33 dosemeter systems from 32 individual monitoring services

18 track systems

- 7 etched track detectors for fast neutrons with thermal neutron TLD
- 7 etched track detectors for fast neutrons with thermal neutron converters
- 3 etched track detectors for fast neutrons without evidence of thermal sensor
- 1 fission track detector

15 albedo systems

- 10 TLD with boron-loaded shield
- 3 TLD with cadmium shield
- 1 OSLD
- 1 TLD lacking information on shielding against direct thermal neutrons

To ease identification OG reassigned dosemeters registered under types "other" or "combination"

Partial Repeat of Irradiations

- Possibility of unexpected photon exposure for some of the participants' dosemeters could not be excluded
- OG requested submission of photon doses evaluated for all dosemeters without correction/subtraction due to issuing period or transportation
- Photon doses reported were not included in certificates but helped OG resolve the issues
- As results might have been impacted, three systems were offered a repeat for part of the irradiations at no additional cost

Dosemeter Response

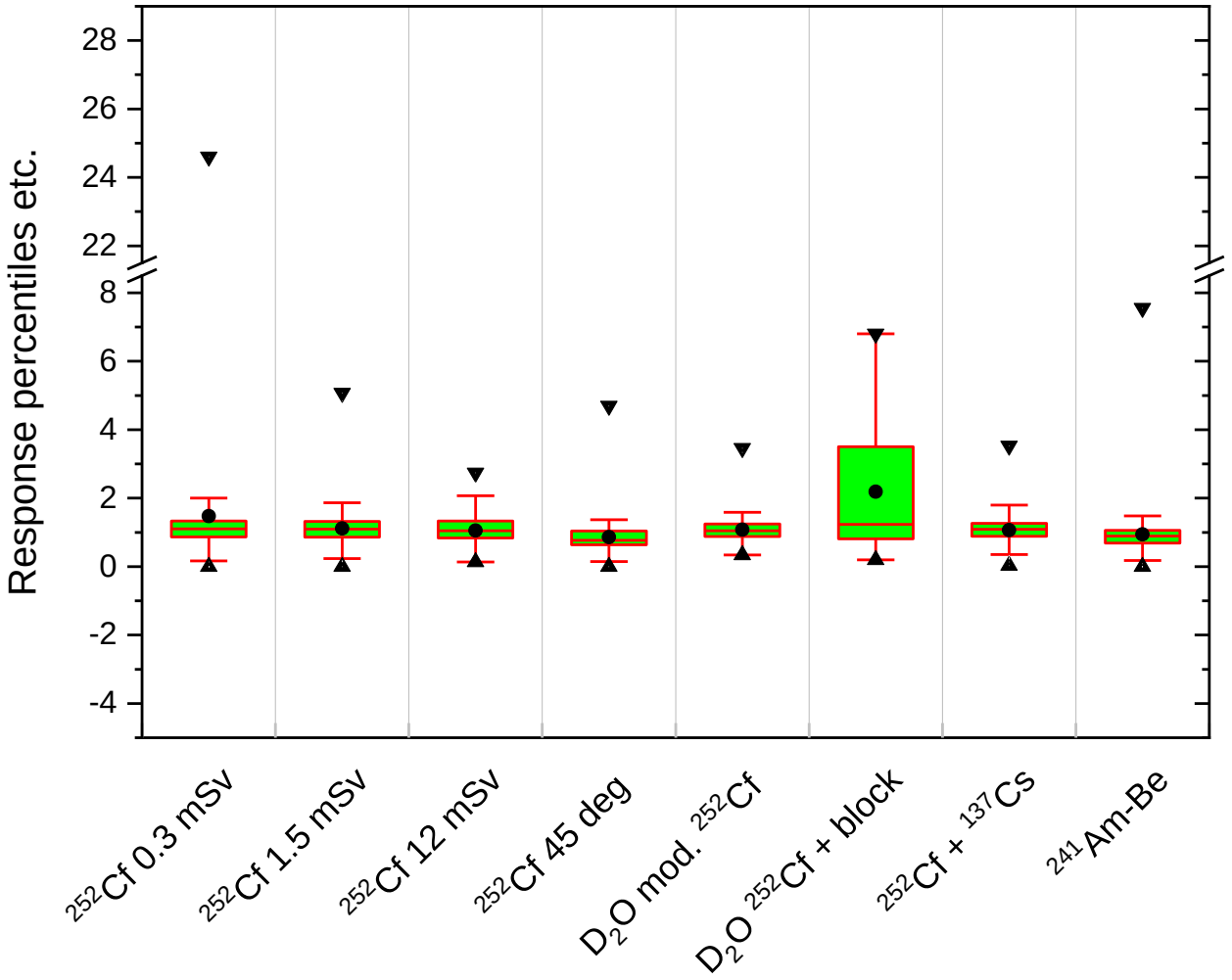
$$R = \frac{H_m}{H_{ref}}$$

Irradiated dosemeters	924
Reported values	924
	R
Arithmetic mean	1.18
Median	**1.02**
Standard deviation	**1.23**
2.5th-percentile	0.13
97.5th-percentile	4.52

H_m … measured $H_p(10)$ as provided by IMS

H_{ref} … reference $H_p(10)$ as determined by irradiating laboratory

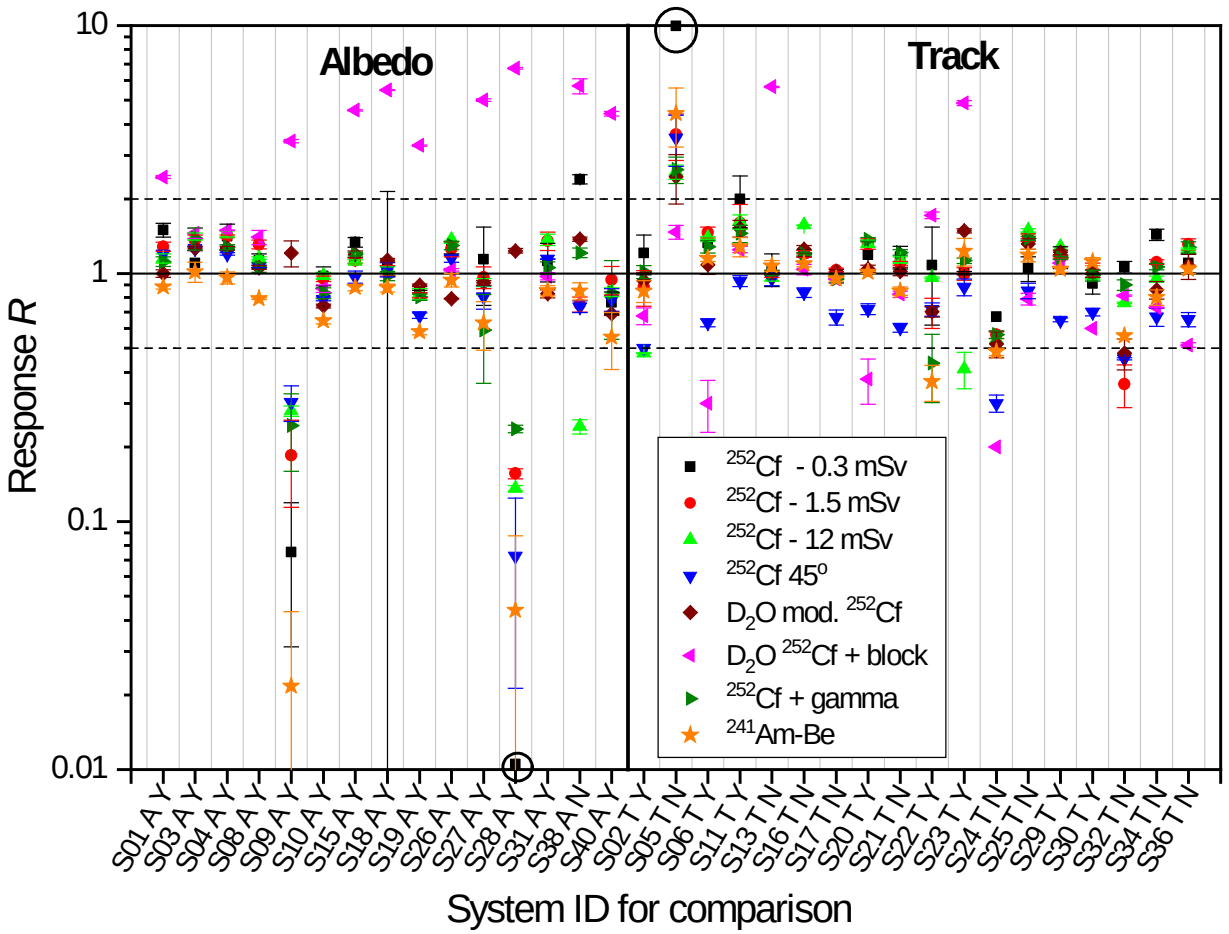
Distribution of Response



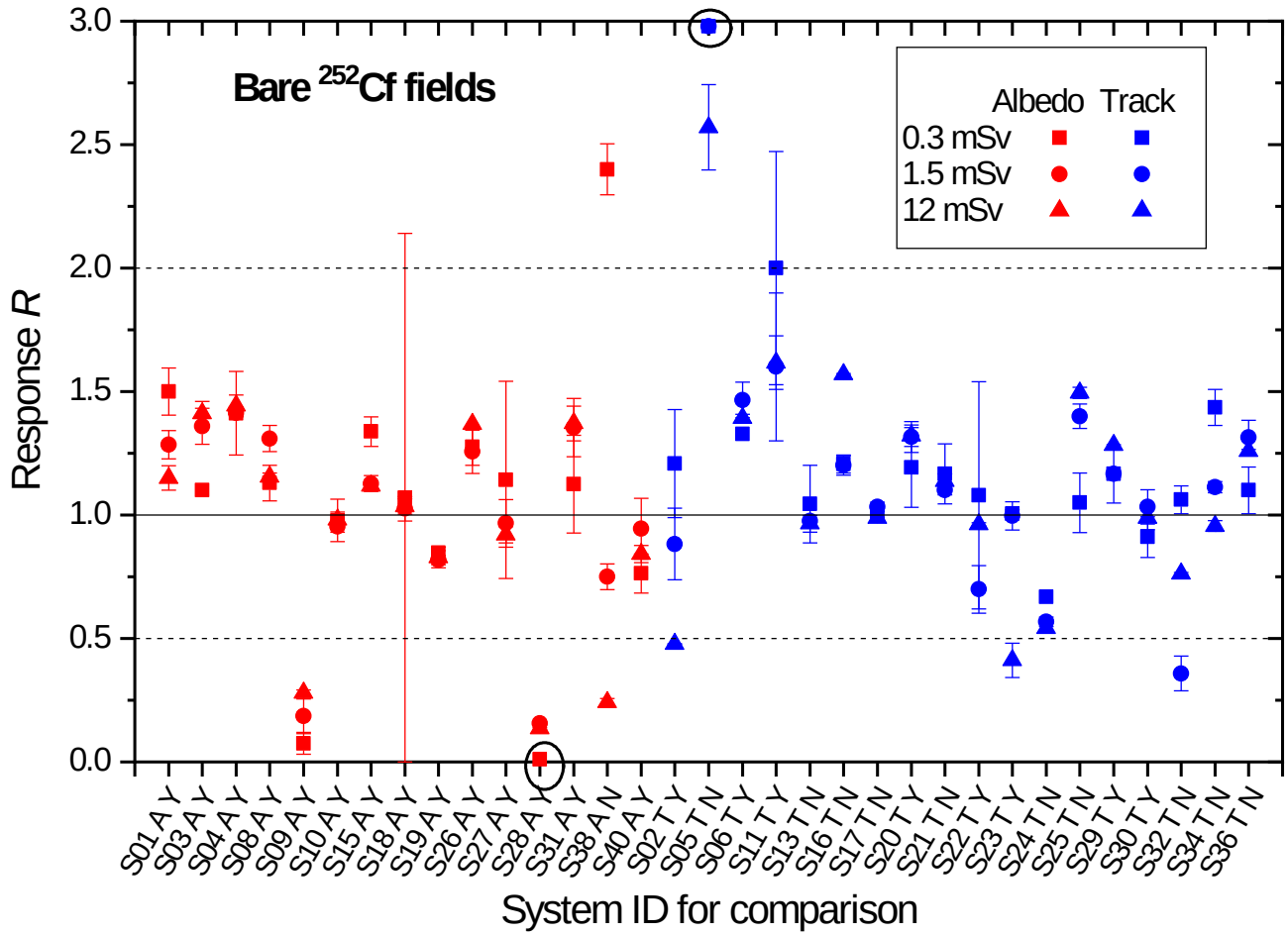
Mean and Standard Deviation of Response

Radiation quality	$H_p(10)$ (mSv)	All		Albedo		Track	
		Mean	σ	Mean	σ	Mean	σ
Bare ^{252}Cf at 0°	0.3	1.47	2.52	1.06	0.78	1.82	3.31
	1.5	1.11	0.63	0.99	0.40	1.21	0.75
	12	1.05	0.46	0.95	0.42	1.13	0.48
Bare ^{252}Cf & ^{137}Cs at 0°	1.5	1.07	0.45	0.94	0.40	1.17	0.47
Bare ^{252}Cf at 45°	1.5	0.86	0.59	0.88	0.34	0.85	0.74
D_2O-mod. ^{252}Cf at 0°	1.2	1.08	1.94	1.04	0.23	1.11	0.50
D_2O-mod. ^{252}Cf behind SB	1.0	2.19	1.94	3.22	1.96	1.33	1.47
Bare ^{241}Am-Be at 0°	1.5	0.94	0.78	0.70	0.32	1.14	0.97

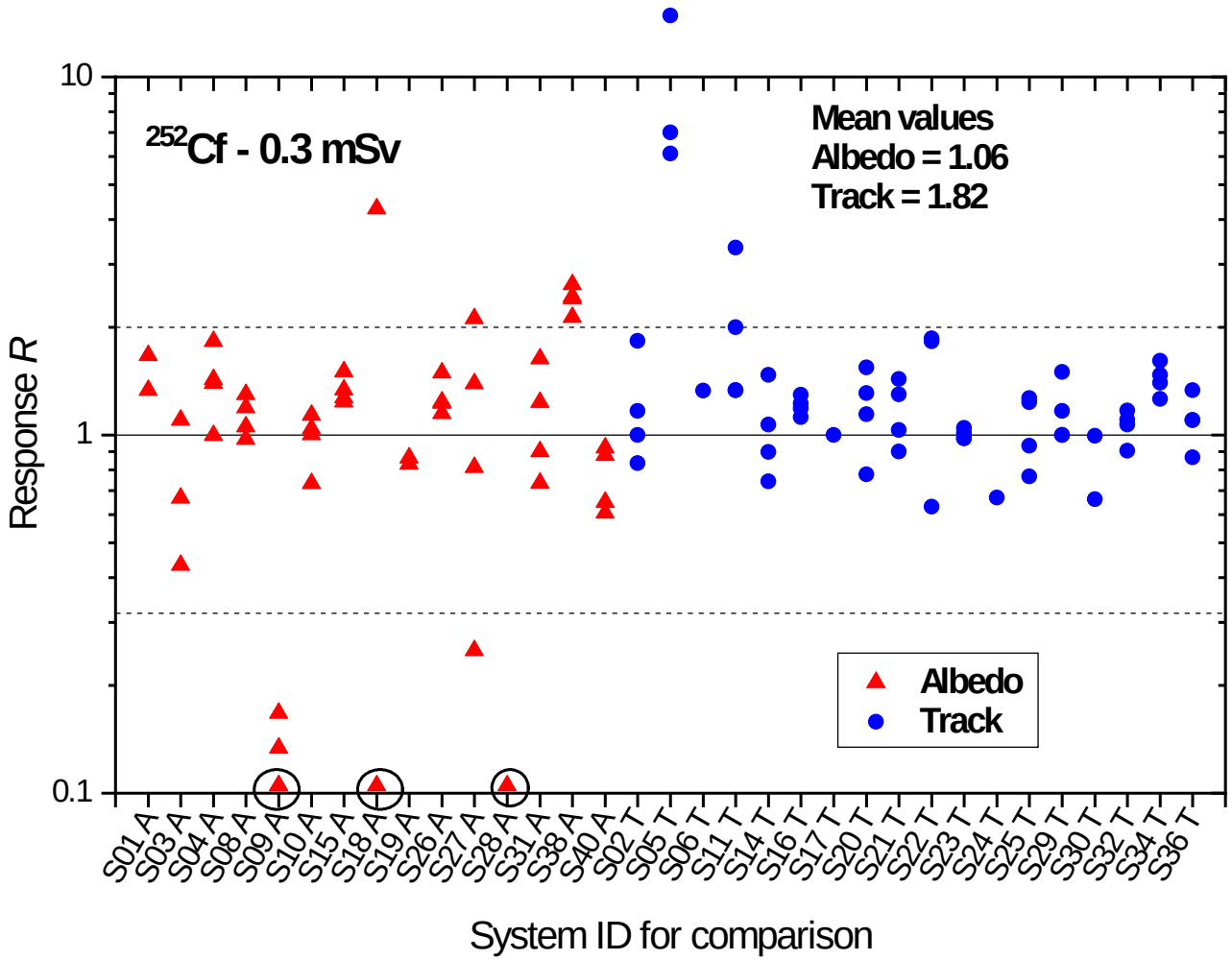
Summary of Reported Responses



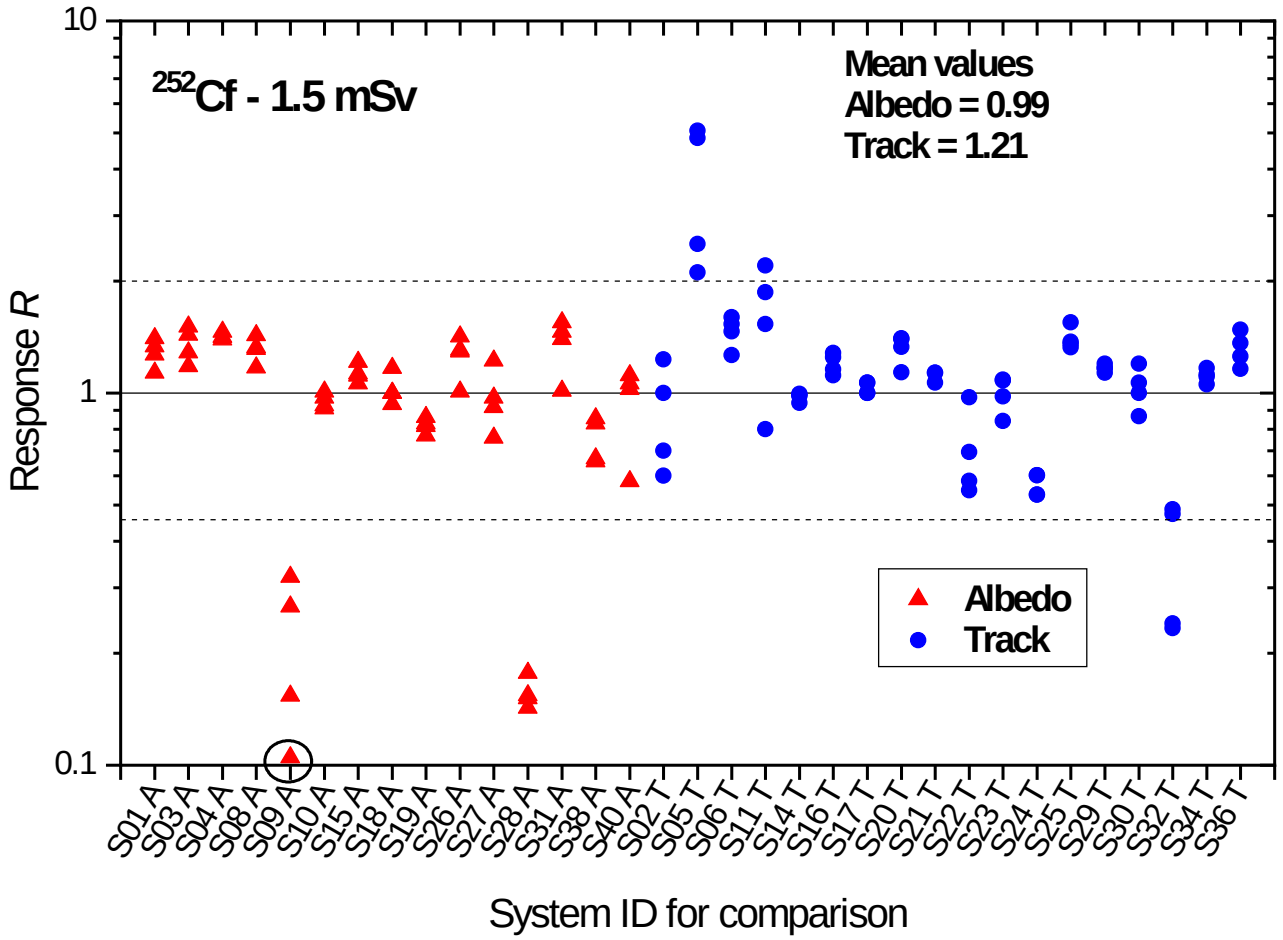
Bare ^{252}Cf Source at 0° — Summary



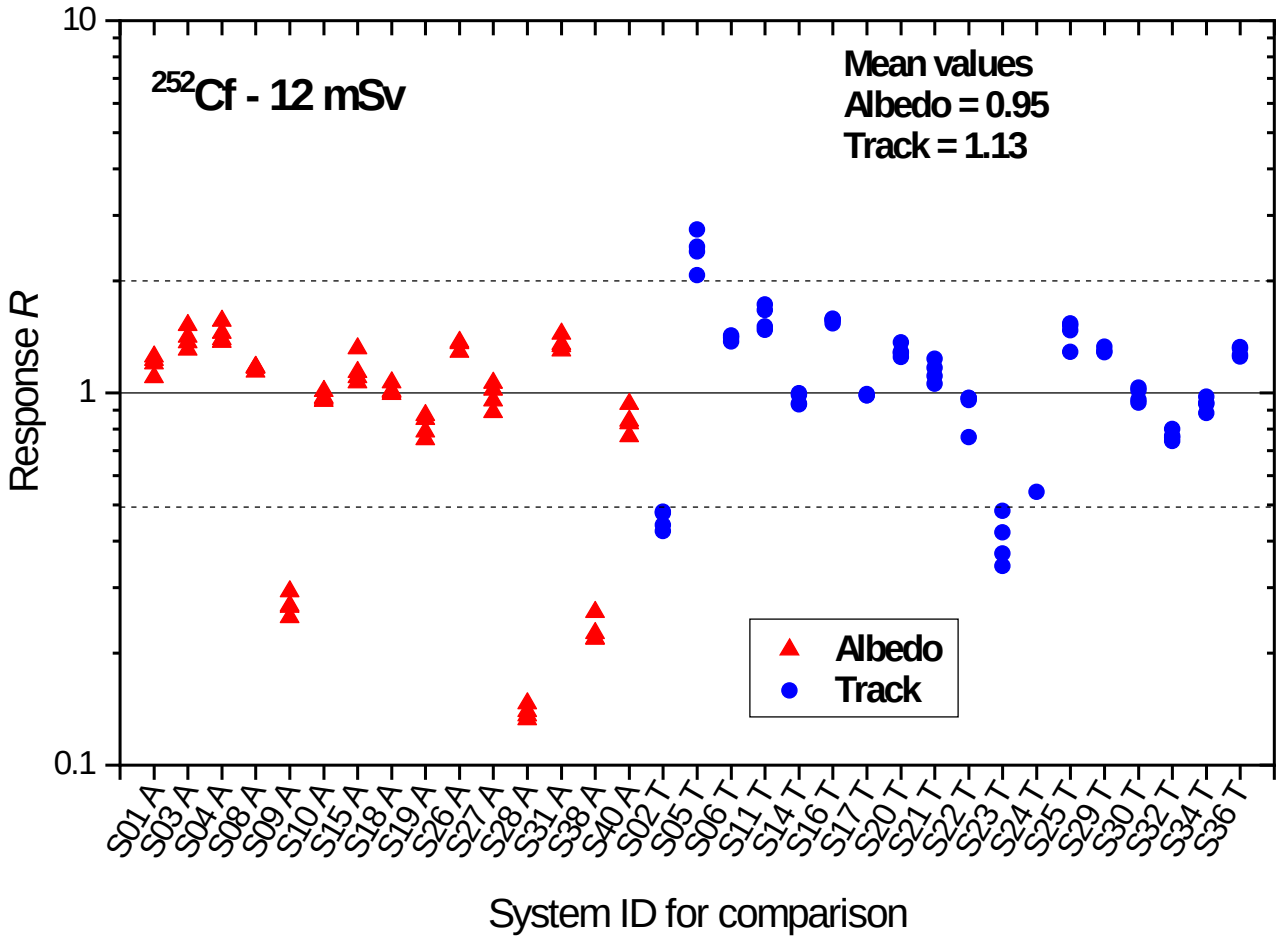
Bare ^{252}Cf Source at 0° — 0.3 mSv



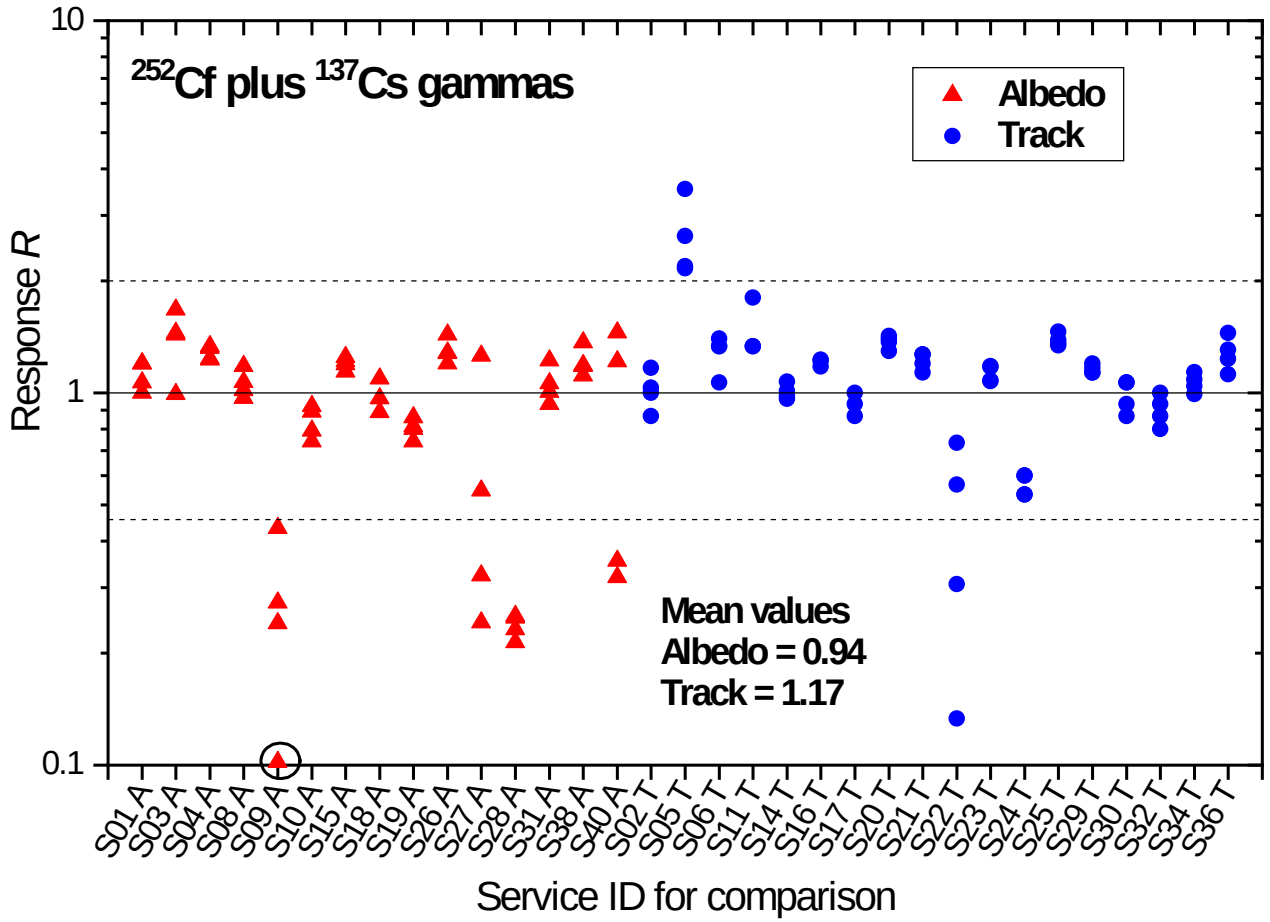
Bare ^{252}Cf Source at 0° — 1.5 mSv



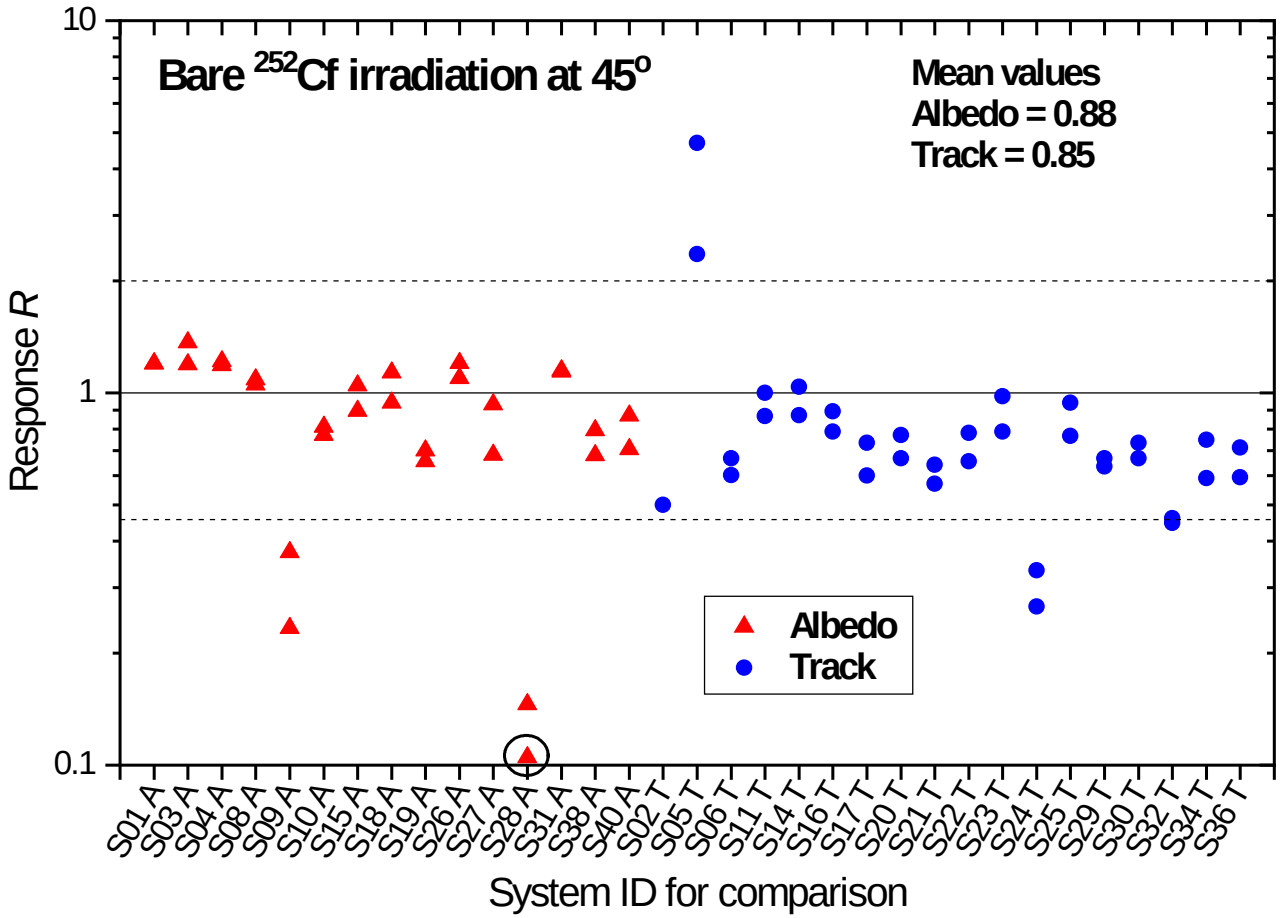
Bare ^{252}Cf Source at 0° — 12 mSv



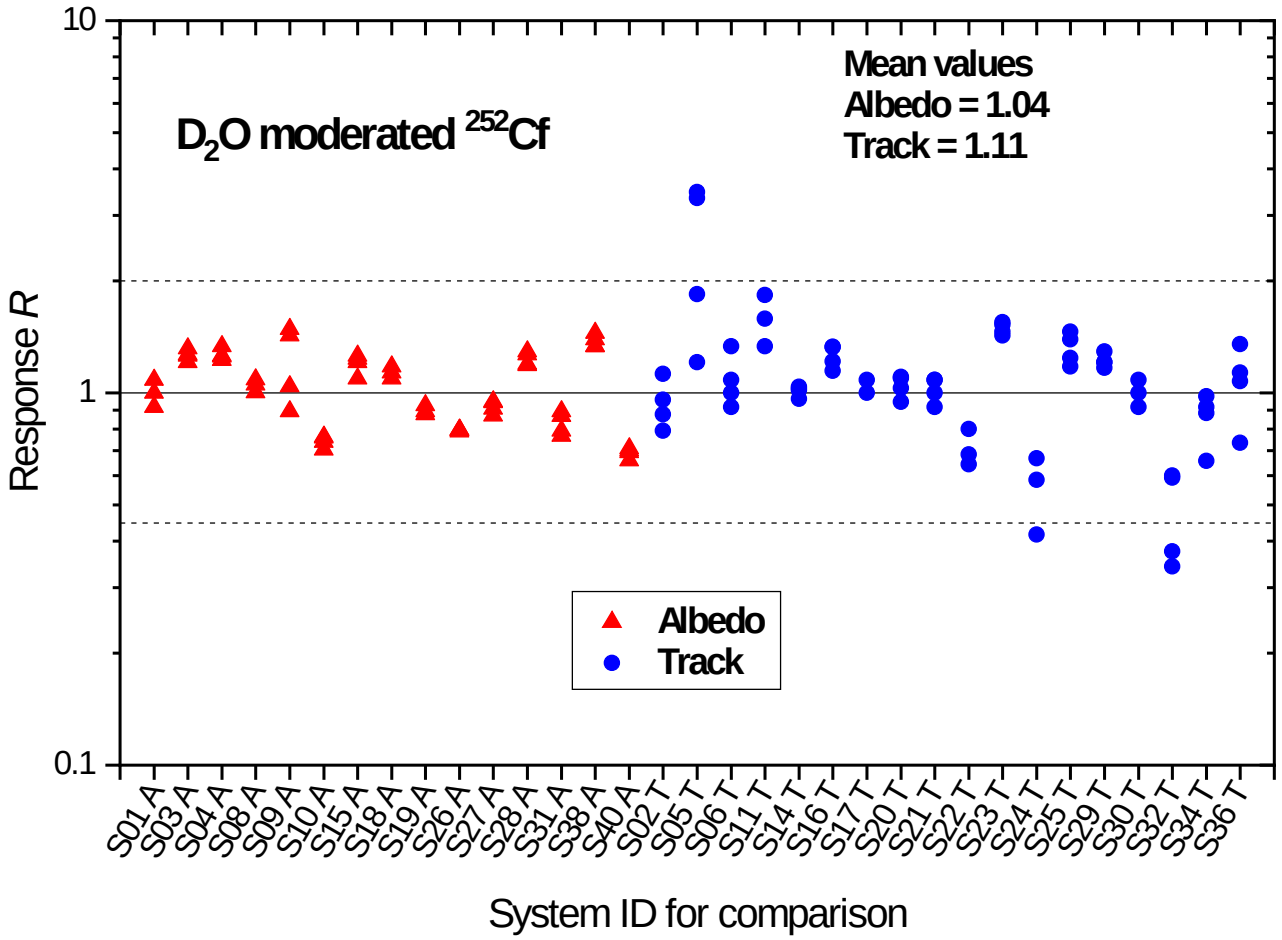
Bare ^{252}Cf & ^{137}Cs Sources at 0° — 1.5 mSv (neutrons)



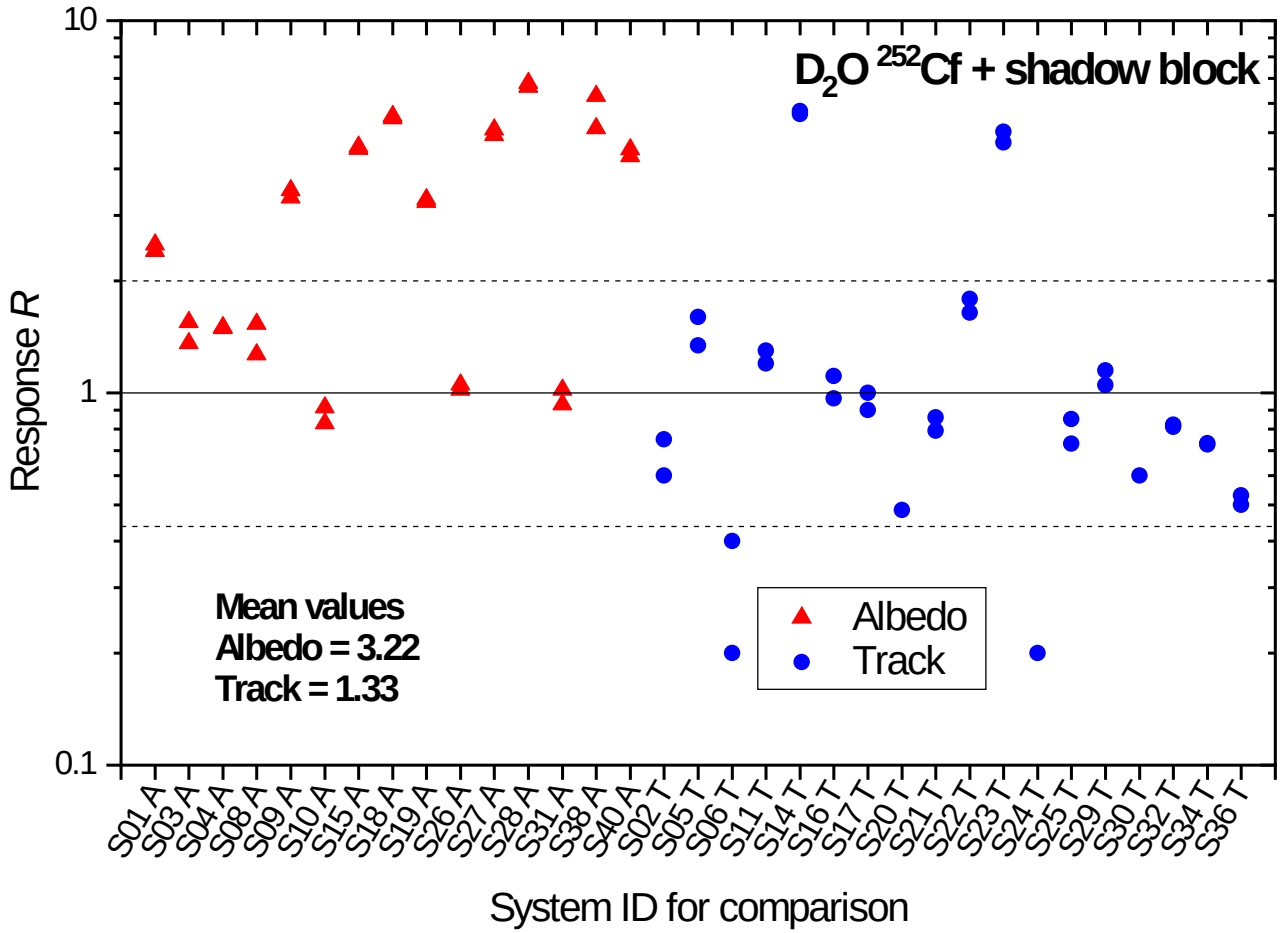
Bare ^{252}Cf Source at 45° — 1.5 mSv



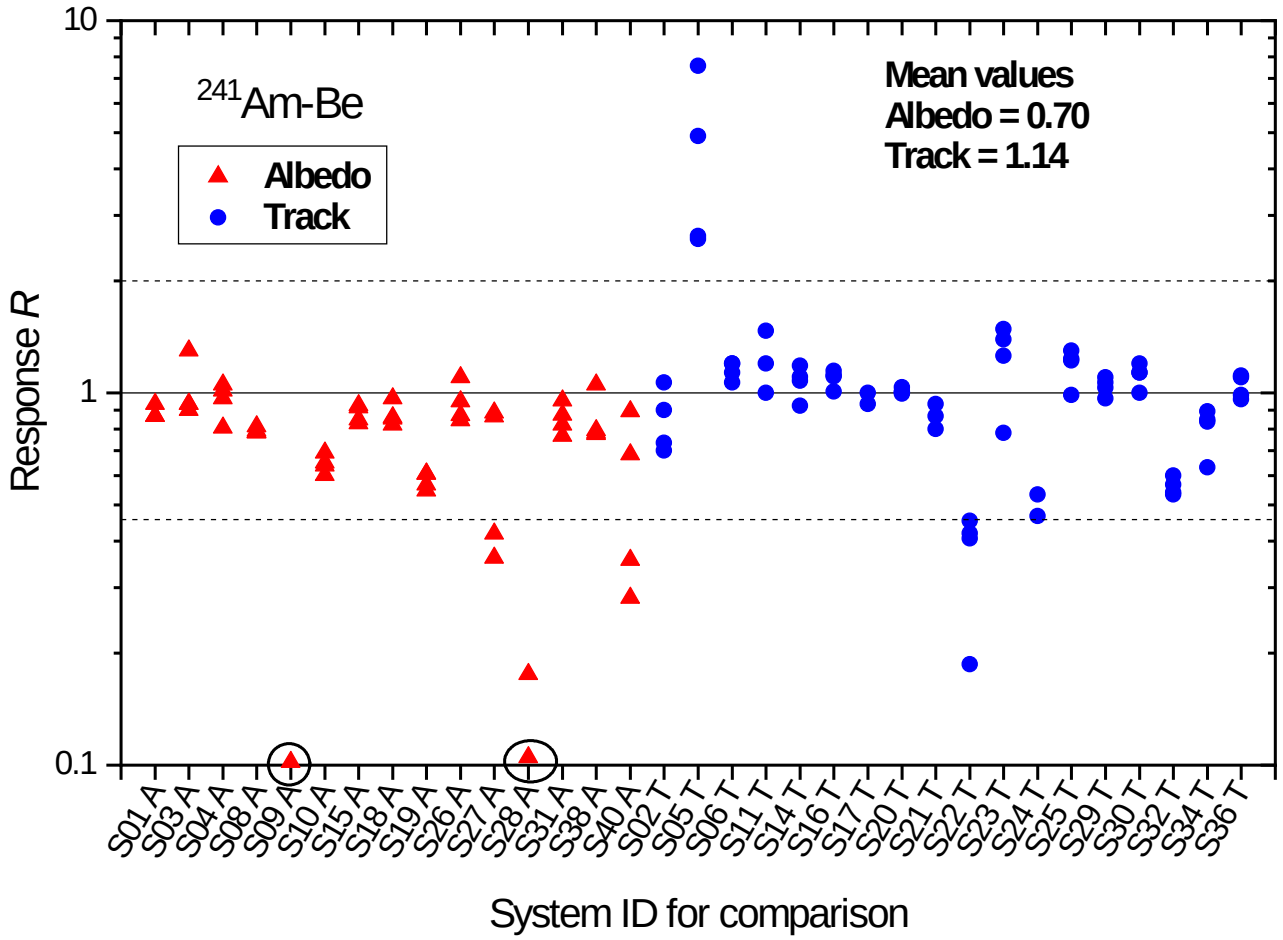
D_2O-moderated ^{252}Cf Source at 0° — 1.2 mSv



D_2O-mod. ^{252}Cf Source, Shadow Block — 1 mSv



Bare ^{241} Am-Be Source at 0° — 1.5 mSv



Conclusions

- Applying approval criterion and performance limits of ISO 14146:2018, 9 (out of 15) albedo and 12 (out of 18) track systems passed with not more than two outliers

- Overresponse of albedo systems for D_2O-moderated ^{252}Cf source behind shadow block due to nearly isotropic distribution and very soft field
  - *Some albedo systems responded within performance limits because of improved side shielding or correction based on ratio of readings behind front and albedo window*

- Track detectors tend to underestimate low-energy neutrons at high angles of incidence

PAUL SCHERRER INSTITUT PSI

IRSN INSTITUT DE RADIOPROTECTION ET DE SÛRETÉ NUCLÉAIRE

NPL National Physical Laboratory

PTB

IAEA International Atomic Energy Agency *Atoms for Peace and Development*

Public Health England

ENEA Italian National Agency for New Technologies, Energy and Sustainable Economic Development

SCK•CEN STUDIECENTRUM VOOR KERNENERGIE CENTRE D'ÉTUDE DE L'ÉNERGIE NUCLÉAIRE

Please let us know your suggestions or claims
by e-mail to coordinator@ic2017n.org

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