EURADOS Intercomparison 2022 for Neutron Dosemeters Overview of Results

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Outline

- Reminder of radiation qualities
- 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 5.0
2	Bare ^{252}Cf source at 30°	0.5
3	Bare ^{252}Cf source at 45°	0.5
4	D_2O-moderated ^{252}Cf source at 0° & 1 mm Cd	0.8
5	Bare ^{252}Cf source (0.45 mSv) & thermal neutron field (0.15 mSv)	0.6
6	Bare ^{241}Am-Be at 0°	1.0
7	Bare ^{241}Am-Be at 30°	0.5

Categories of Dosemeters

31 dosimetry systems from 29 individual monitoring services in 19 countries

20 track systems

- 10 etched track detectors for fast neutrons with thermal neutron converters
- 8 etched track detectors for fast neutrons with thermal neutron sensor
- 2 etched track detectors for fast neutrons without evidence of thermal sensor

11 albedo systems

- 5 thermoluminescence detectors with boron-loaded shield
- 4 thermoluminescence detectors with cadmium shield
- 1 thermoluminescence detector lacking information on shielding
- 1 active personal dosemeter

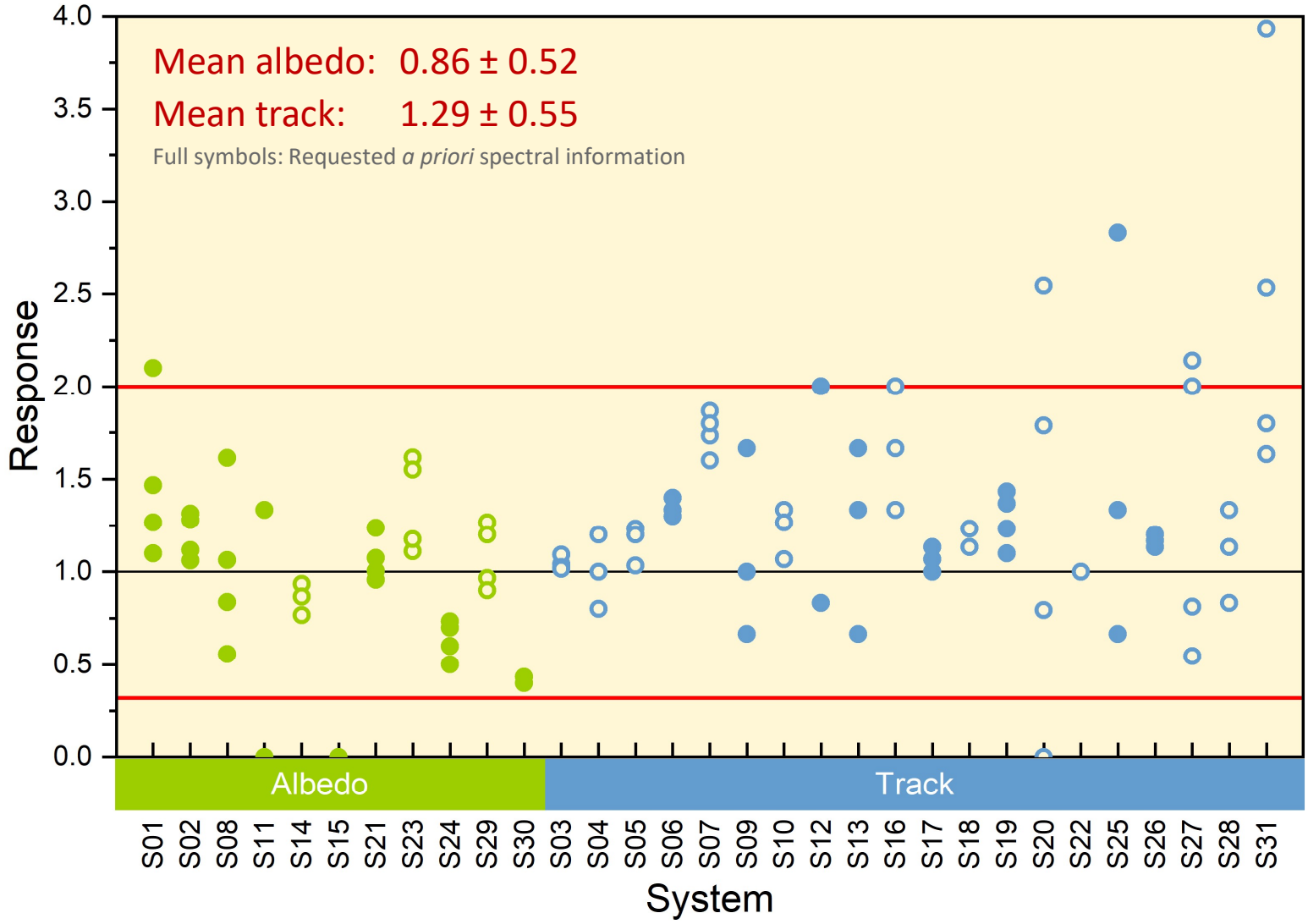
To ease identification OG reassigned dosemeters registered under types "other" or "combination"

Overall Statistics

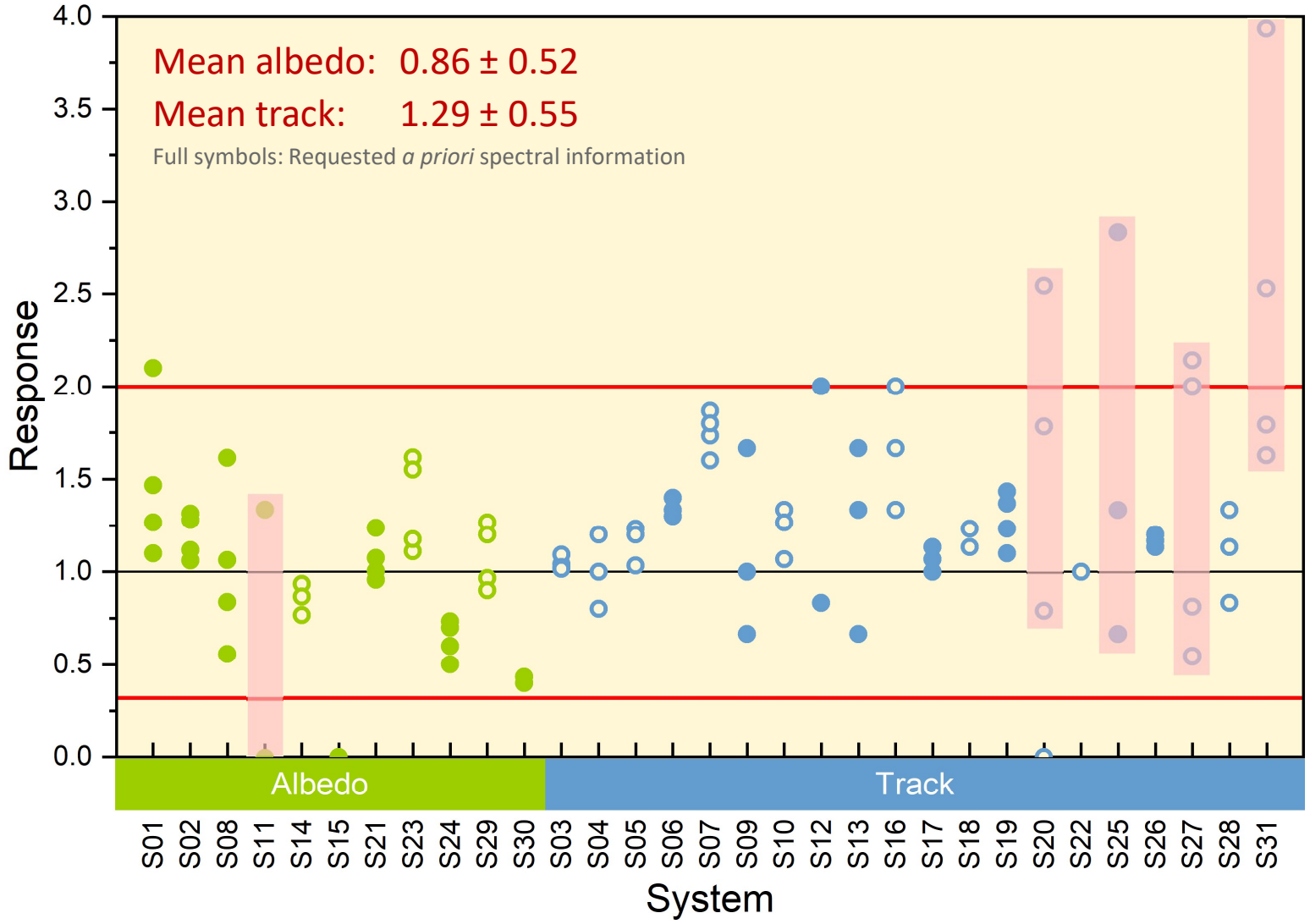
Irradiated dosemeters	744
Reported values	744

	$R = G/H_{ref}$
Arithmetic mean	1.34
Median	**0.94**
Standard deviation	**3.04**
2.5th-percentile	0.00
97.5th-percentile	8.26

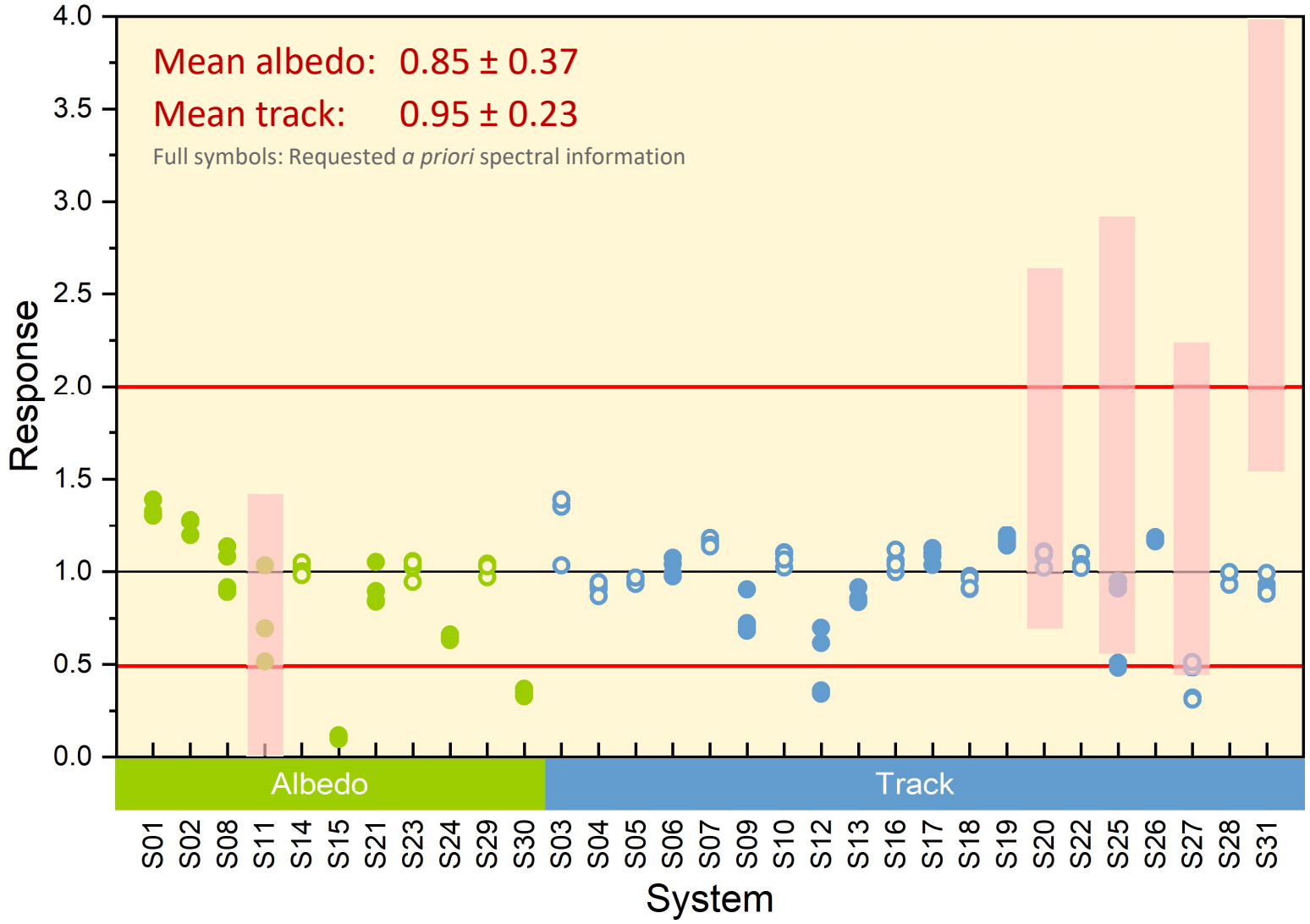
Bare ^{252}Cf Source at 0° — 0.3 mSv



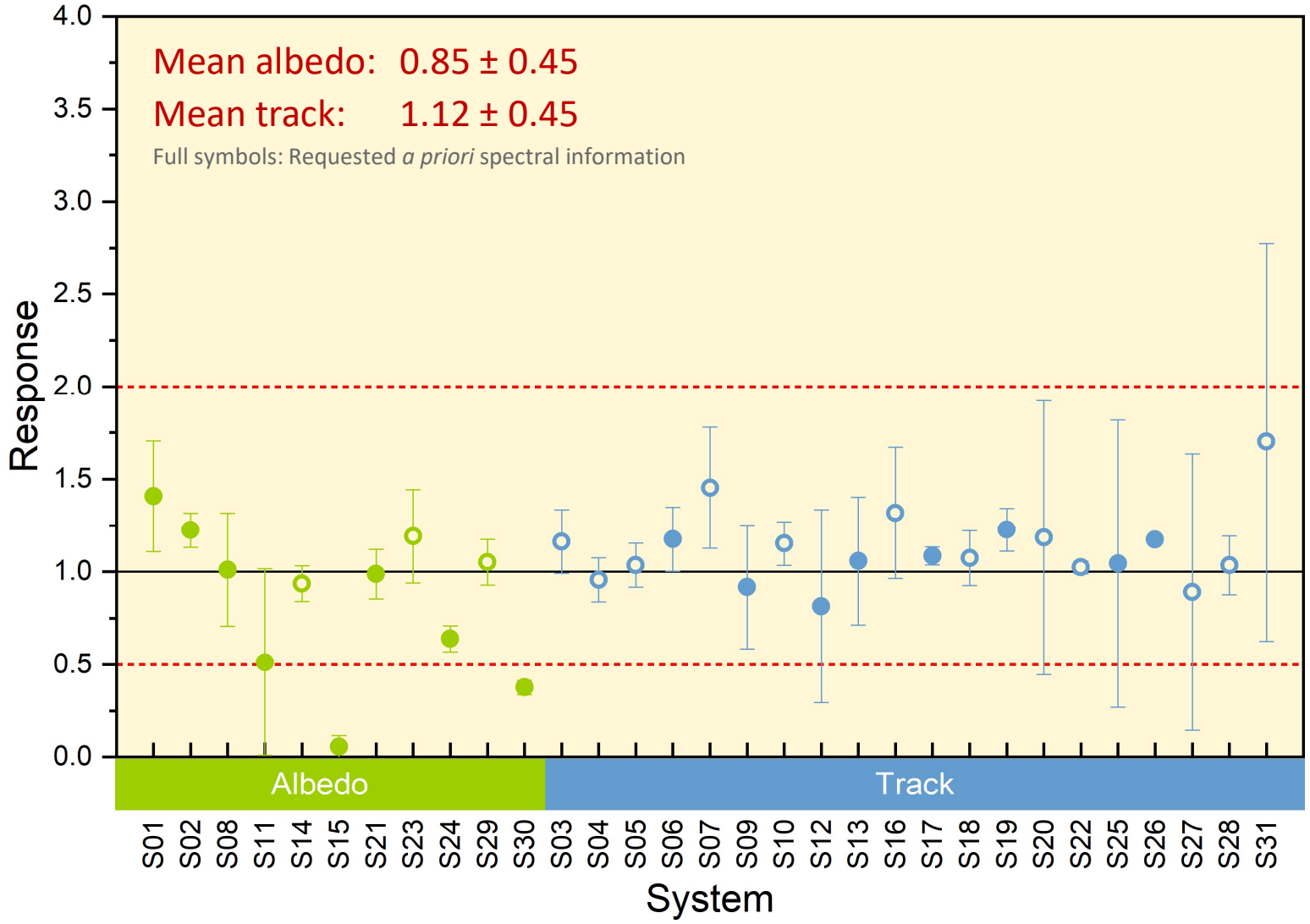
Bare ^{252}Cf Source at 0° — 0.3 mSv



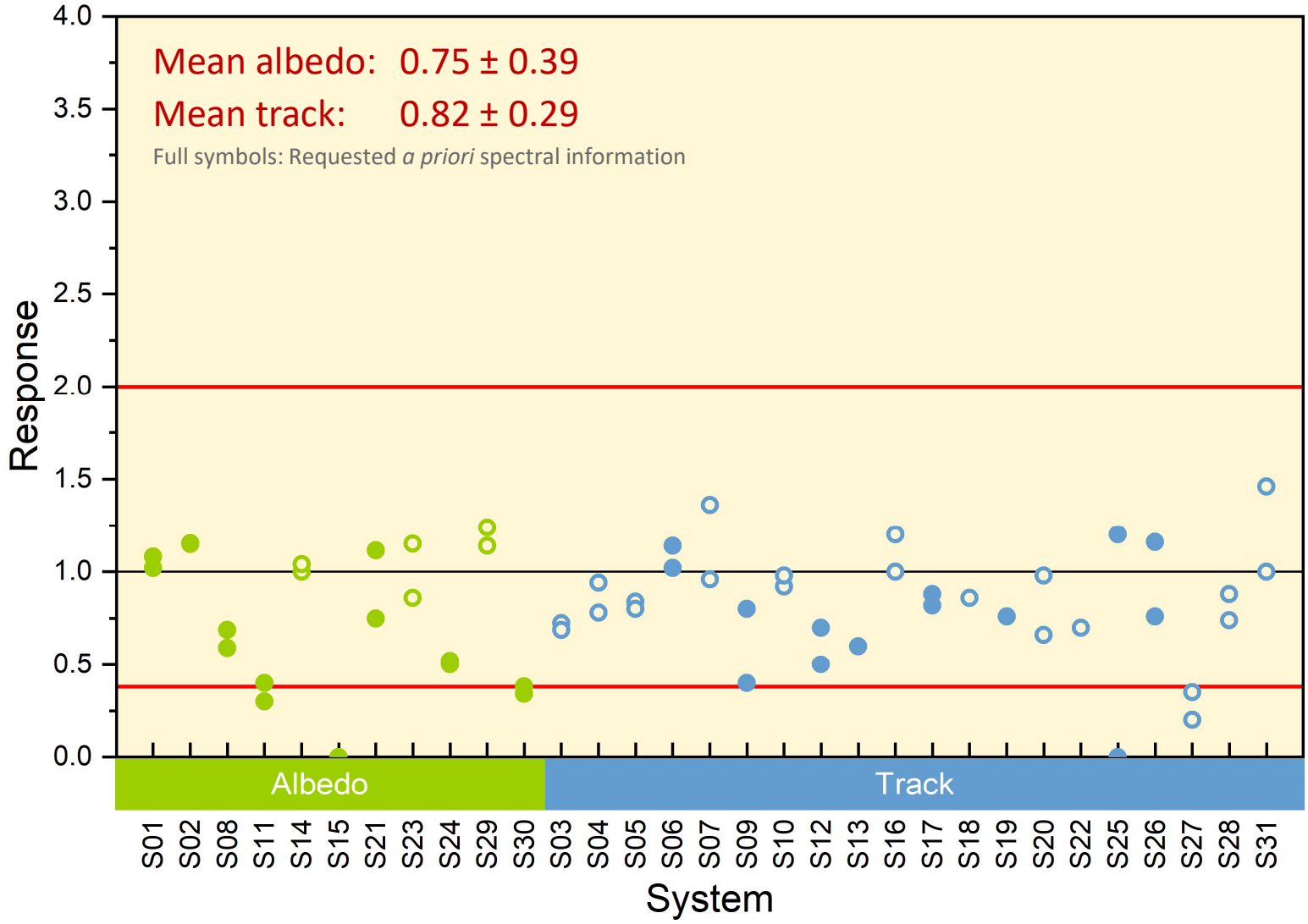
Bare ^{252}Cf Source at 0° — 5.0 mSv



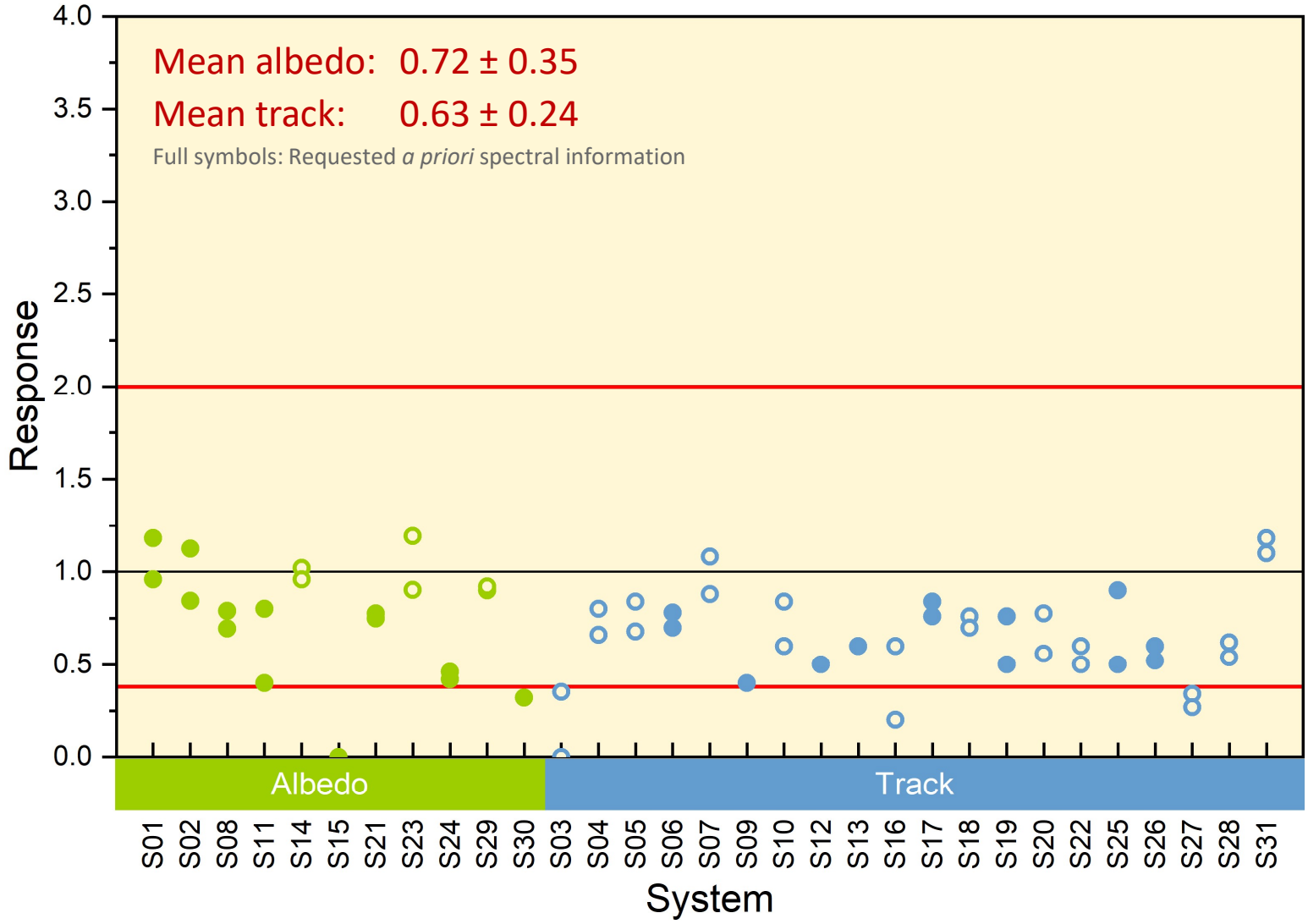
Bare ^{252}Cf Source at 0° — Summary



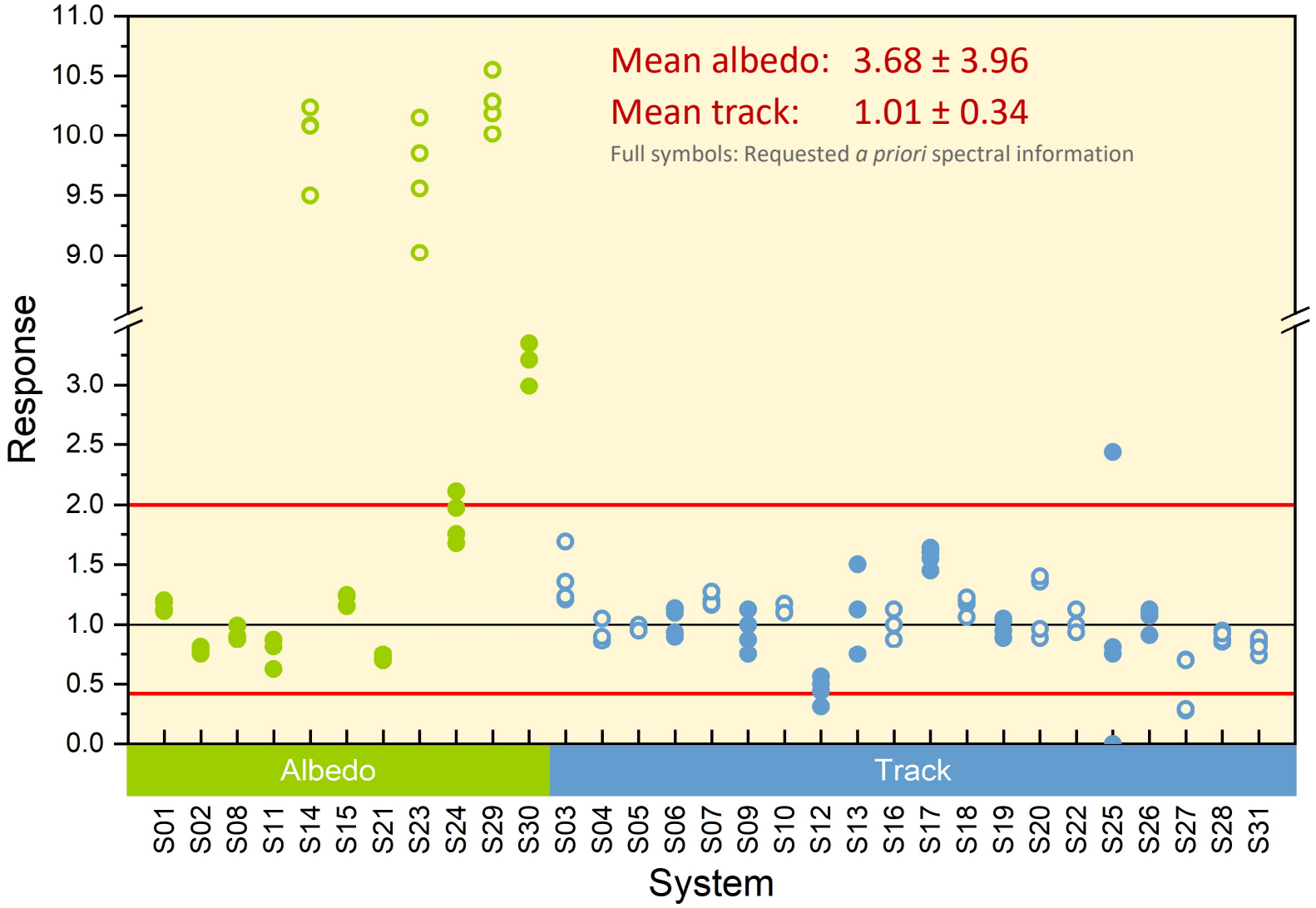
Bare ^{252}Cf Source at 30° — 0.5 mSv



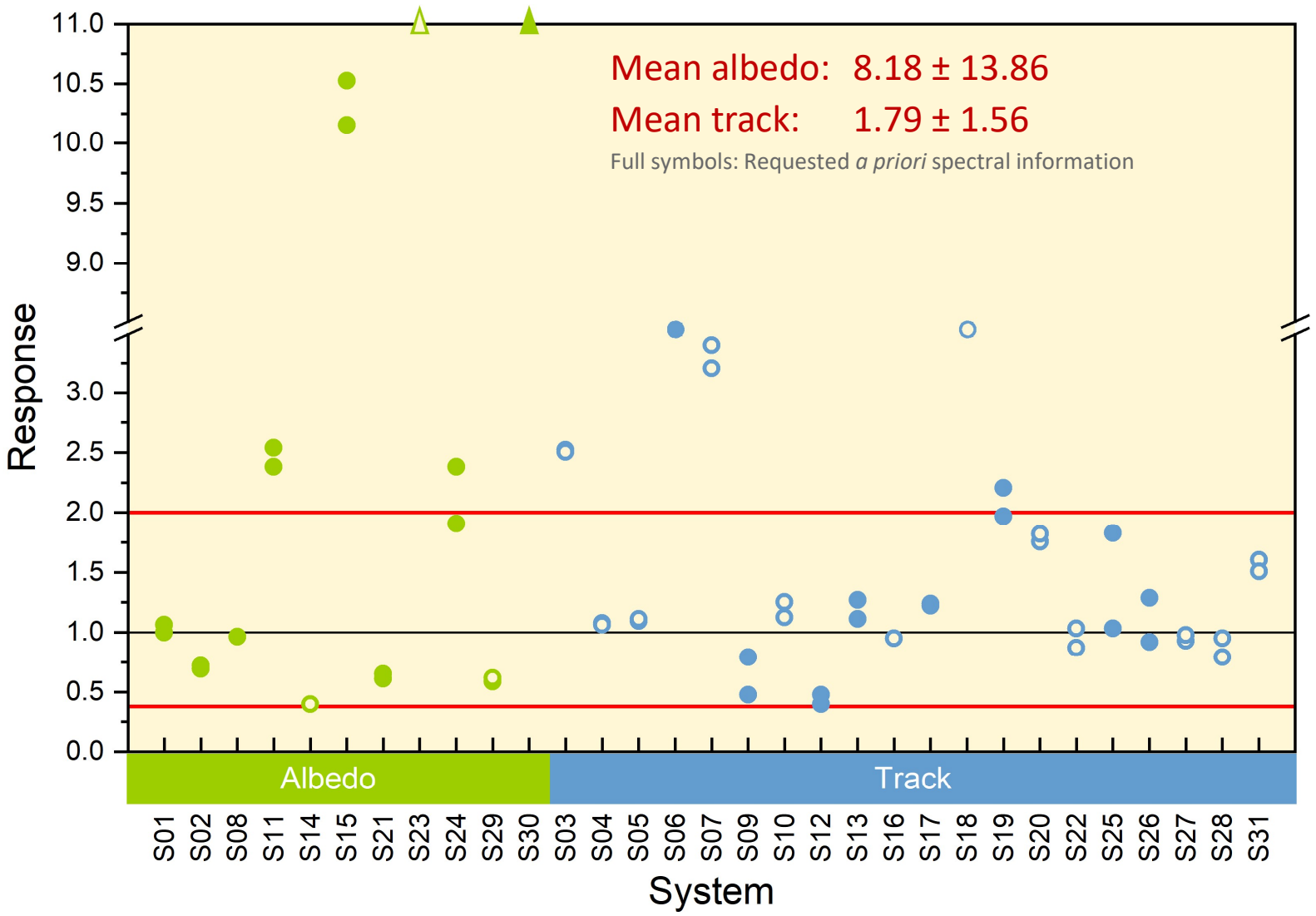
Bare ^{252}Cf Source at 45° — 0.5 mSv



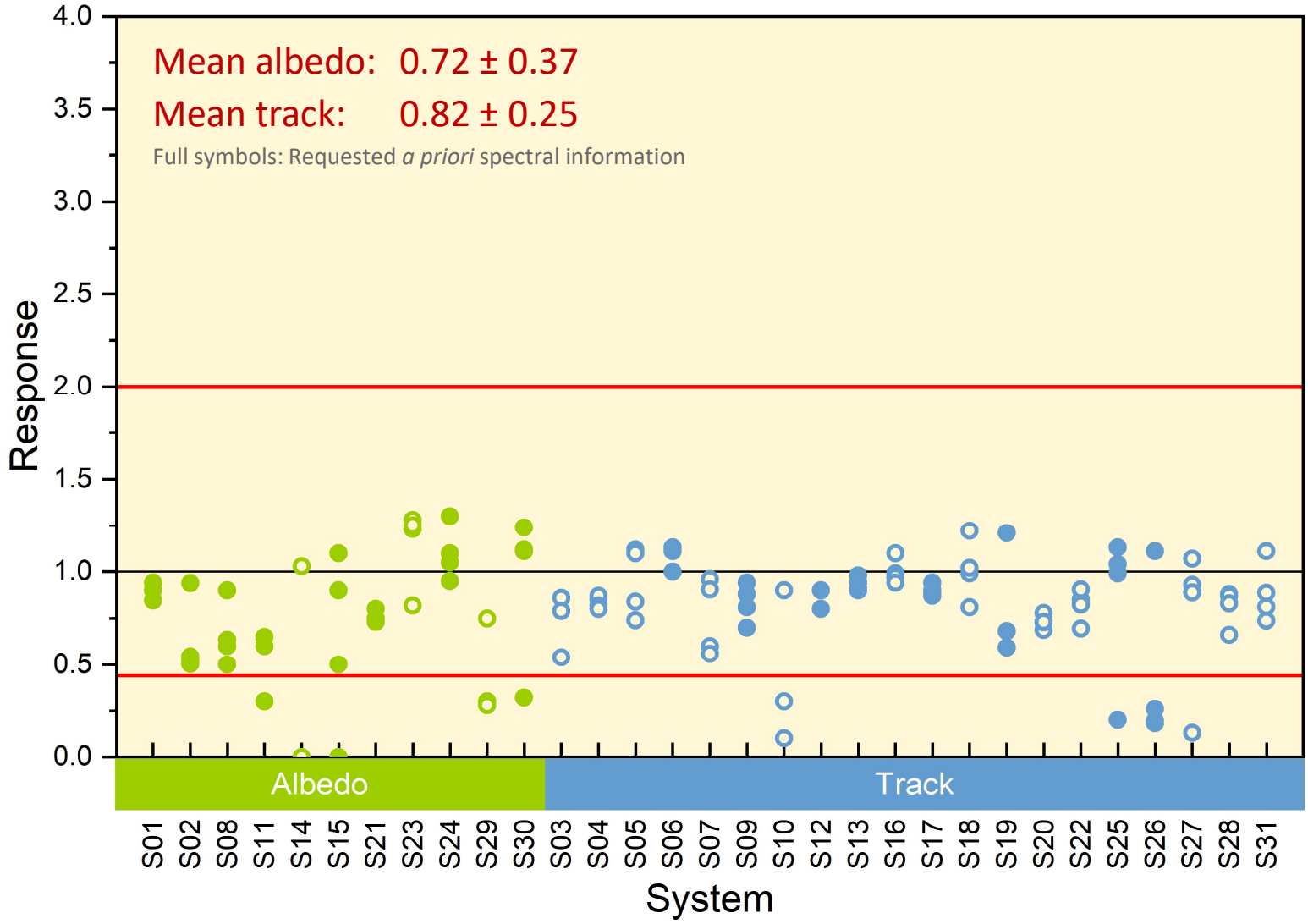
D_2O-moderated ^{252}Cf Source at 0° — 0.8 mSv



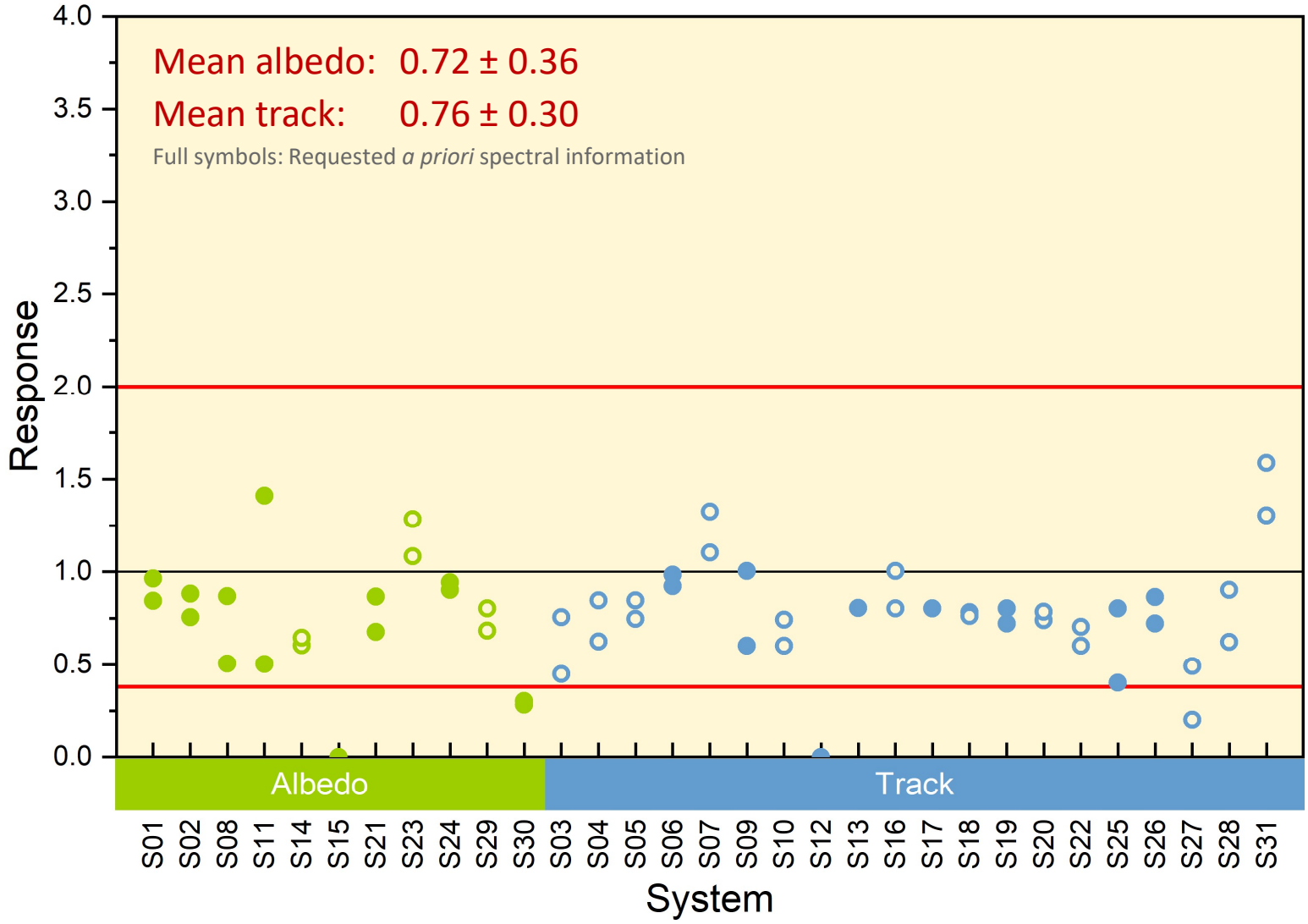
Bare ^{252}Cf Source & Thermal Field — 0.6 mSv



Bare ^{241}Am-Be Source at 0° — 1.0 mSv



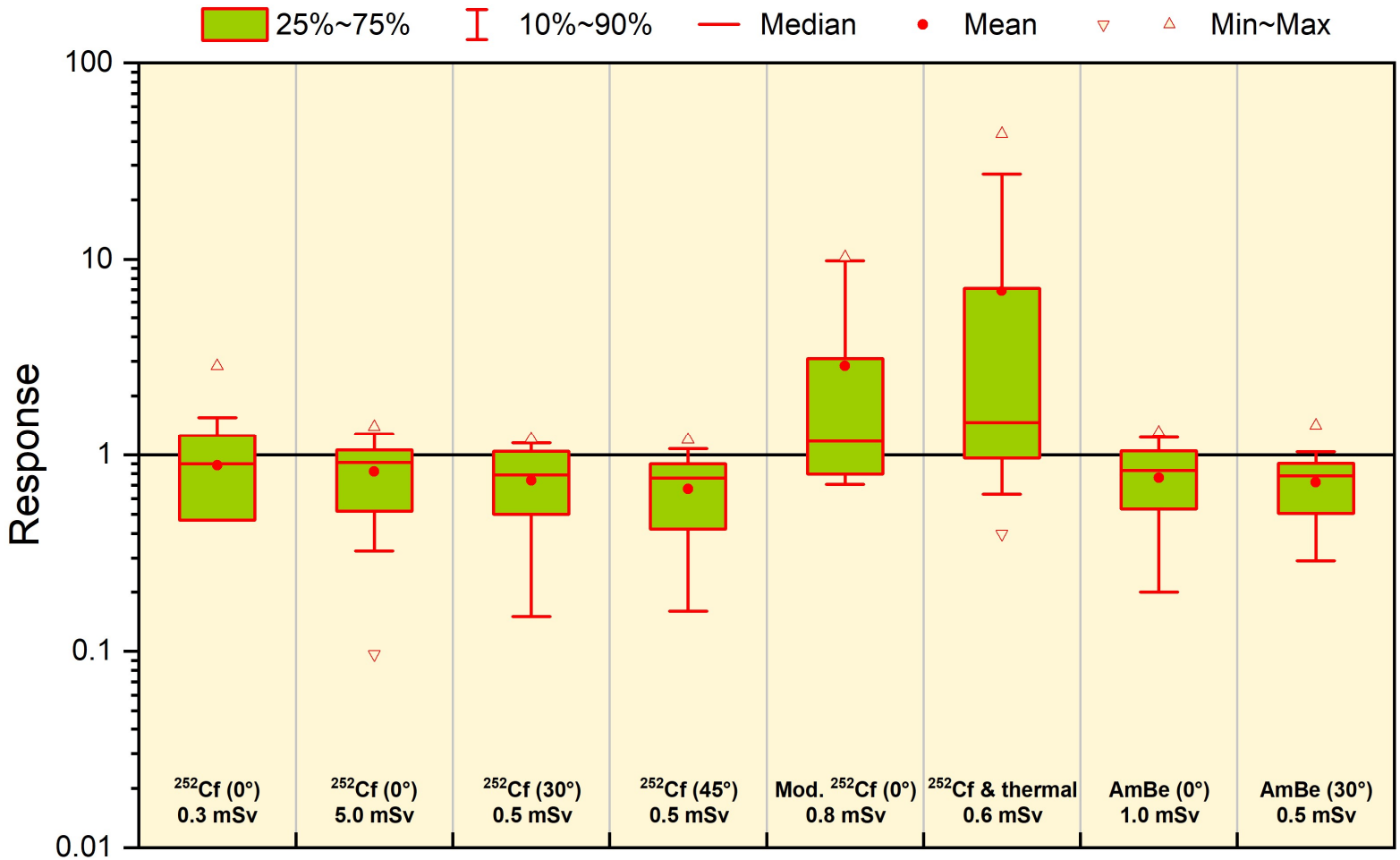
Bare ^{241}Am-Be Source at 30° — 0.5 mSv



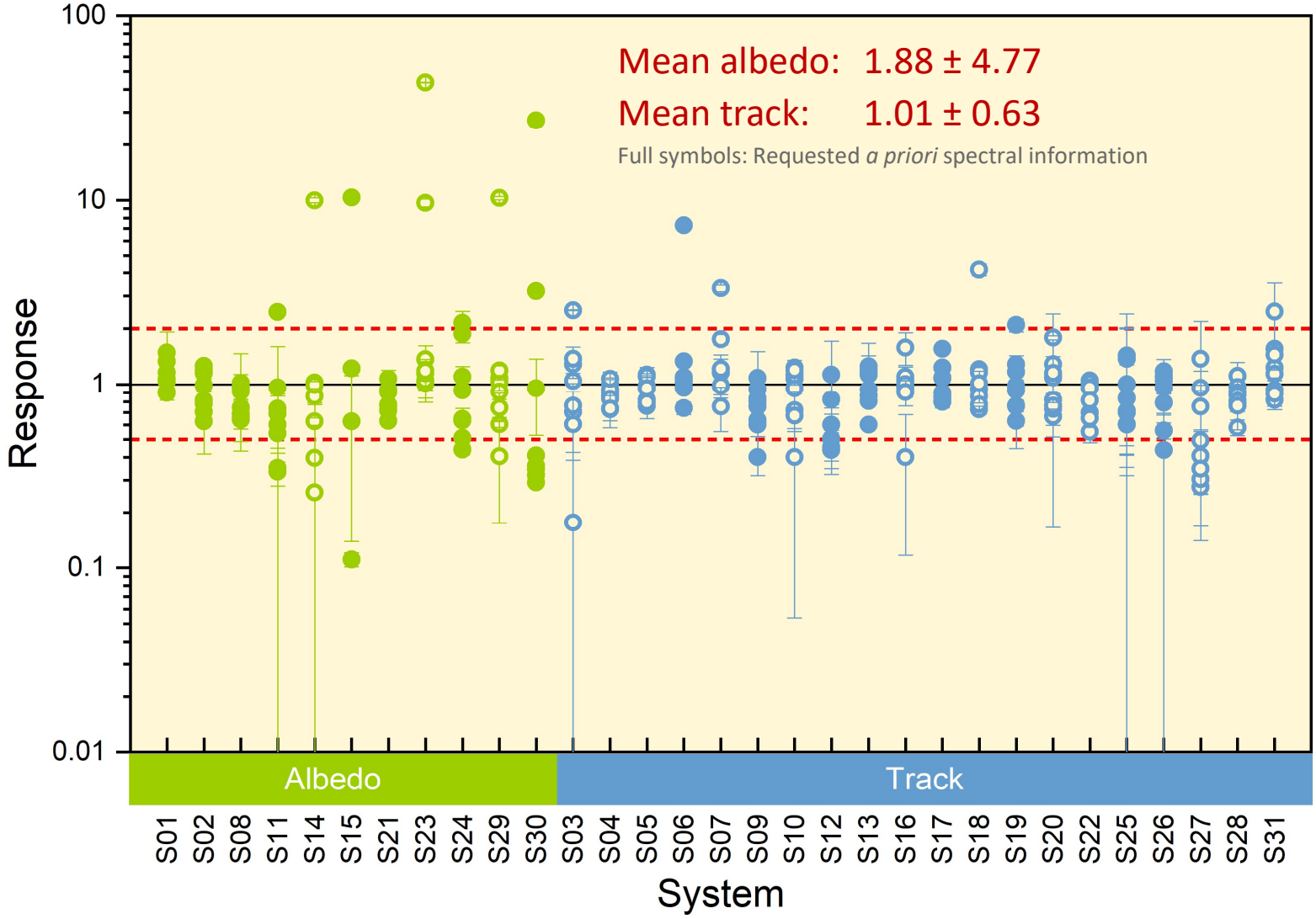
Mean and Standard Deviation of Response

Radiation quality	$H_p(10)$ [mSv]	All		Albedo		Track	
		$\bar{R}$	σ	$\bar{R}$	σ	$\bar{R}$	σ
Bare ^{252}Cf at 0°	0.3	1.14	0.57	0.86	0.52	1.29	0.55
	5.0	0.92	0.29	0.85	0.37	0.95	0.23
Bare ^{252}Cf at 30°	0.5	0.79	0.33	0.75	0.39	0.82	0.29
Bare ^{252}Cf at 45°	0.5	0.66	0.28	0.72	0.35	0.63	0.24
D_2O-mod. ^{252}Cf at 0°	0.8	1.96	2.68	3.68	3.96	1.01	0.34
Bare ^{252}Cf & thermal field	0.6	4.06	8.79	8.18	13.86	1.79	1.56
Bare ^{241}Am-Be at 0°	1.0	0.79	0.30	0.72	0.37	0.82	0.25
Bare ^{241}Am-Be at 30°	0.5	0.75	0.32	0.72	0.36	0.76	0.30

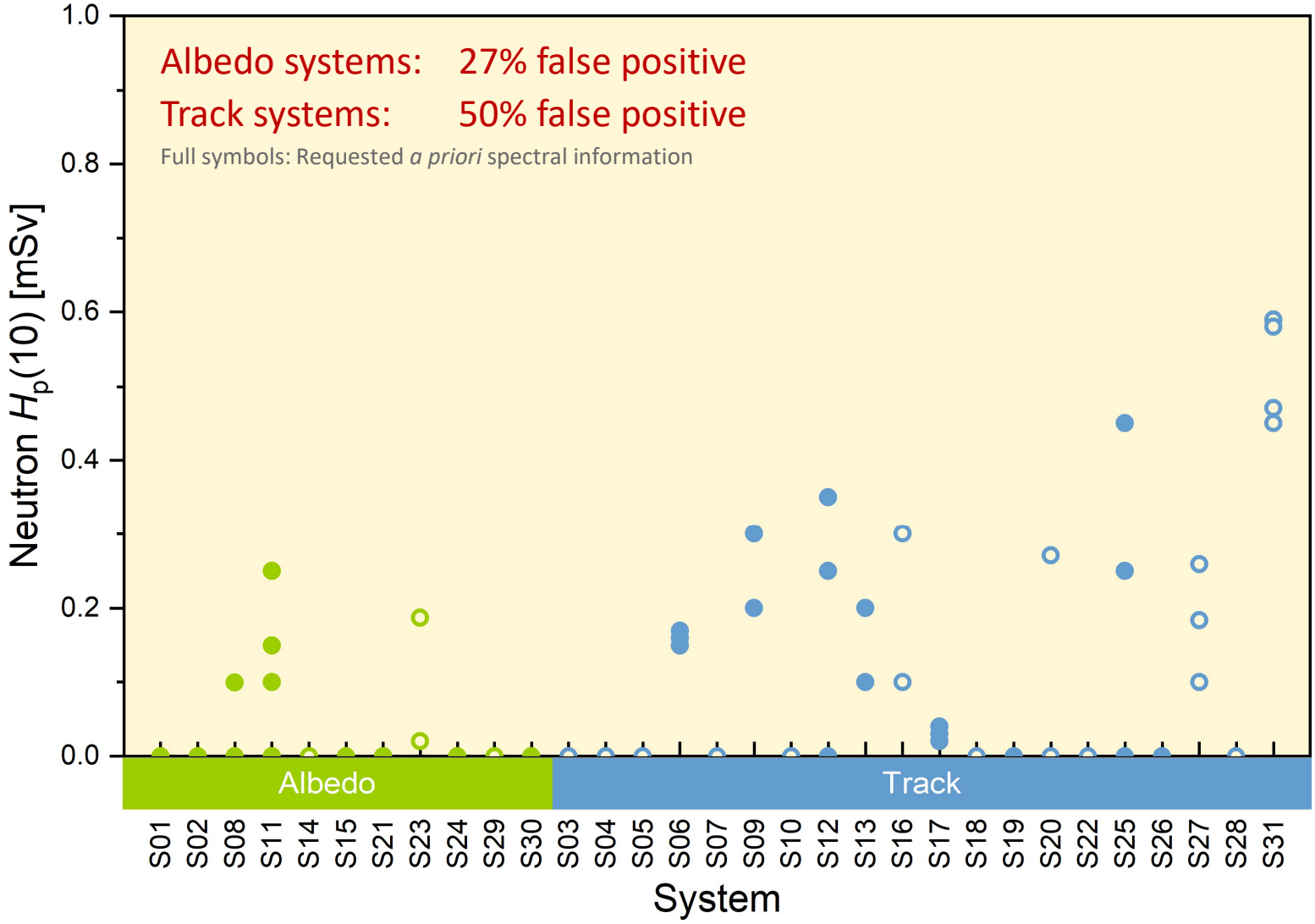
Distribution of Response



Summary of Reported Responses



Test for False Positive Response — Unirradiated



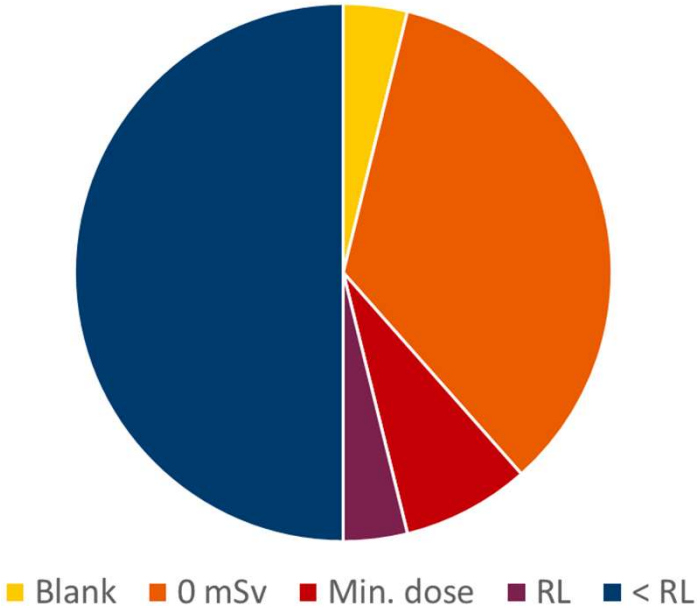
Reporting Levels

20 track systems

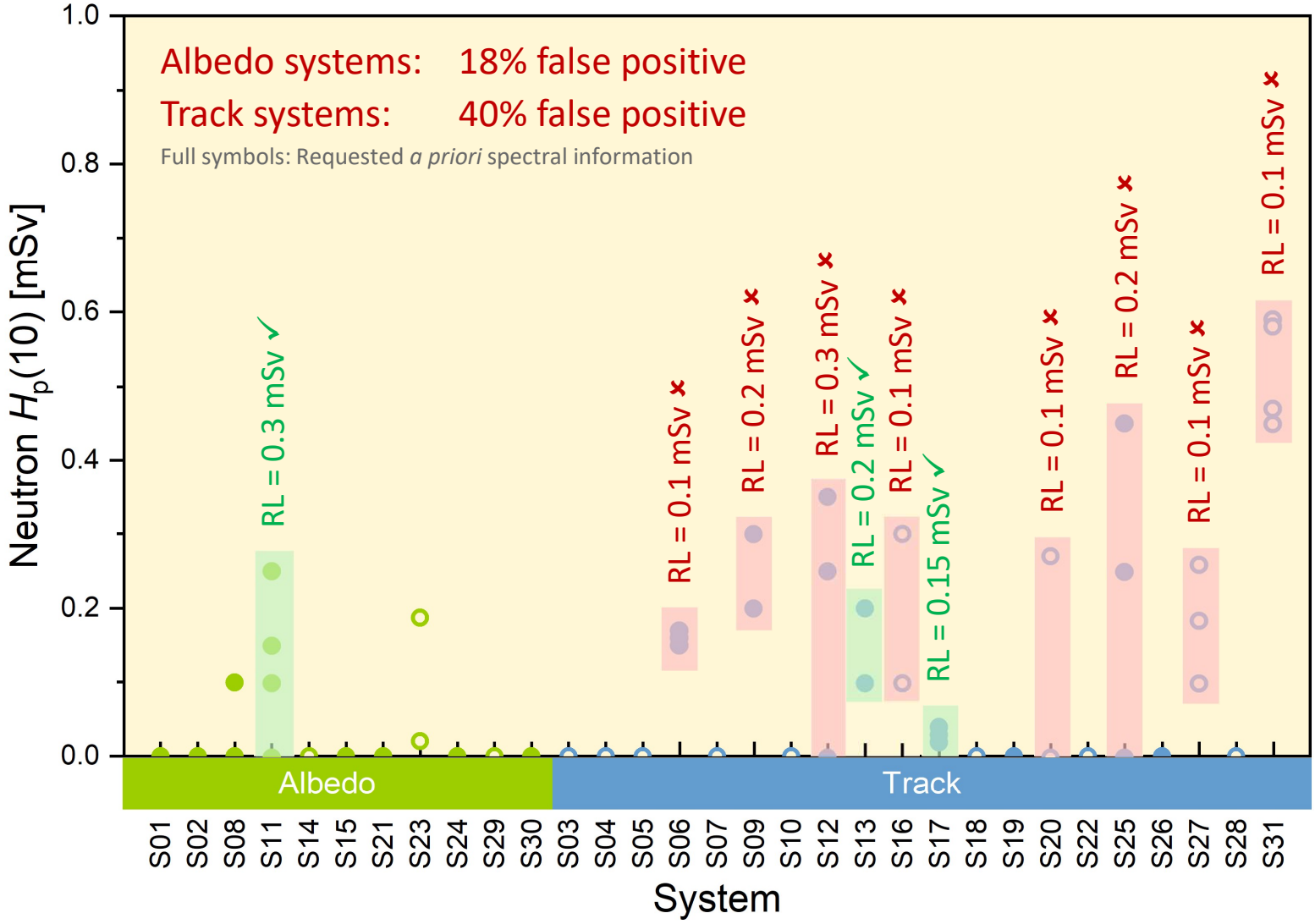
- 0.1 mSv (11 IMSs), 0.15 mSv (1), 0.2 mSv (4), 0.3 mSv (2) and 0.5 mSv (2)

11 albedo systems

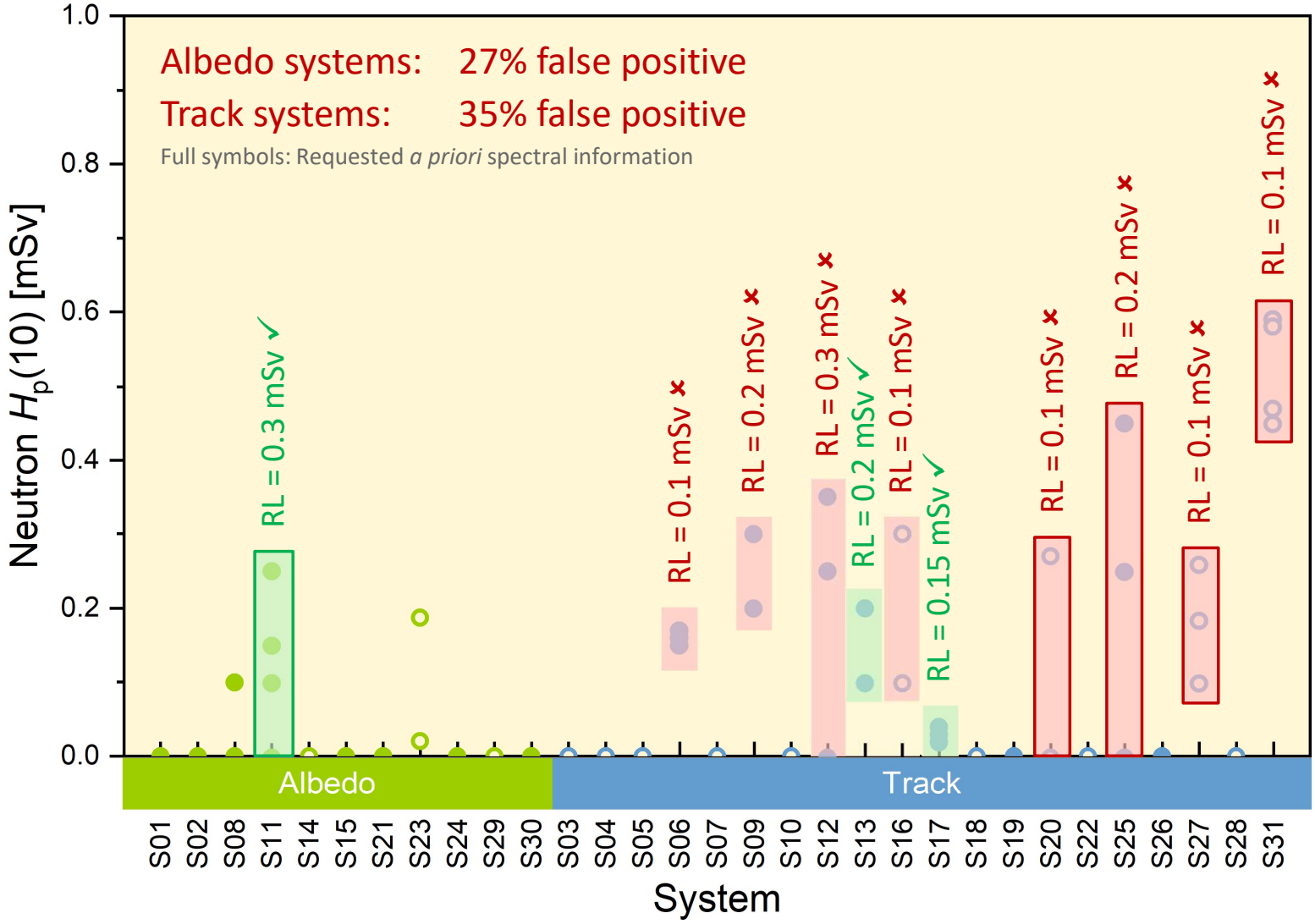
- 0.1 mSv (4 IMSs), 0.2 mSv (1), 0.3 mSv (1) and DL (1)



Test for False Positive Response — Unirradiated



Test for False Positive Response — Unirradiated



Conclusions

- Applying approval criterion and performance limits of ISO 14146:2018, 5 (out of 11) albedo and 16 (out of 20) track systems passed with not more than two outliers

- Significant overresponse of albedo systems to moderated and thermal neutrons due to very soft field and/or nearly isotropic distribution
  - *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 systems generally provided better estimate of neutron personal dose equivalent at lower uncertainty
  - *Track detectors tend to slightly underestimate neutron personal dose equivalent at higher angles of incidence*

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

IAEA
International Atomic Energy Agency
Atoms for Peace and Development

IRSN
INSTITUT DE RADIOPROTECTION ET DE SÛRETÉ NUCLÉAIRE

PAUL SCHERRER INSTITUT
PSI

Please let us know your suggestions or claims
by e-mail to coordinator@ic2022n.org

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