



EURADOS

IC2012n results

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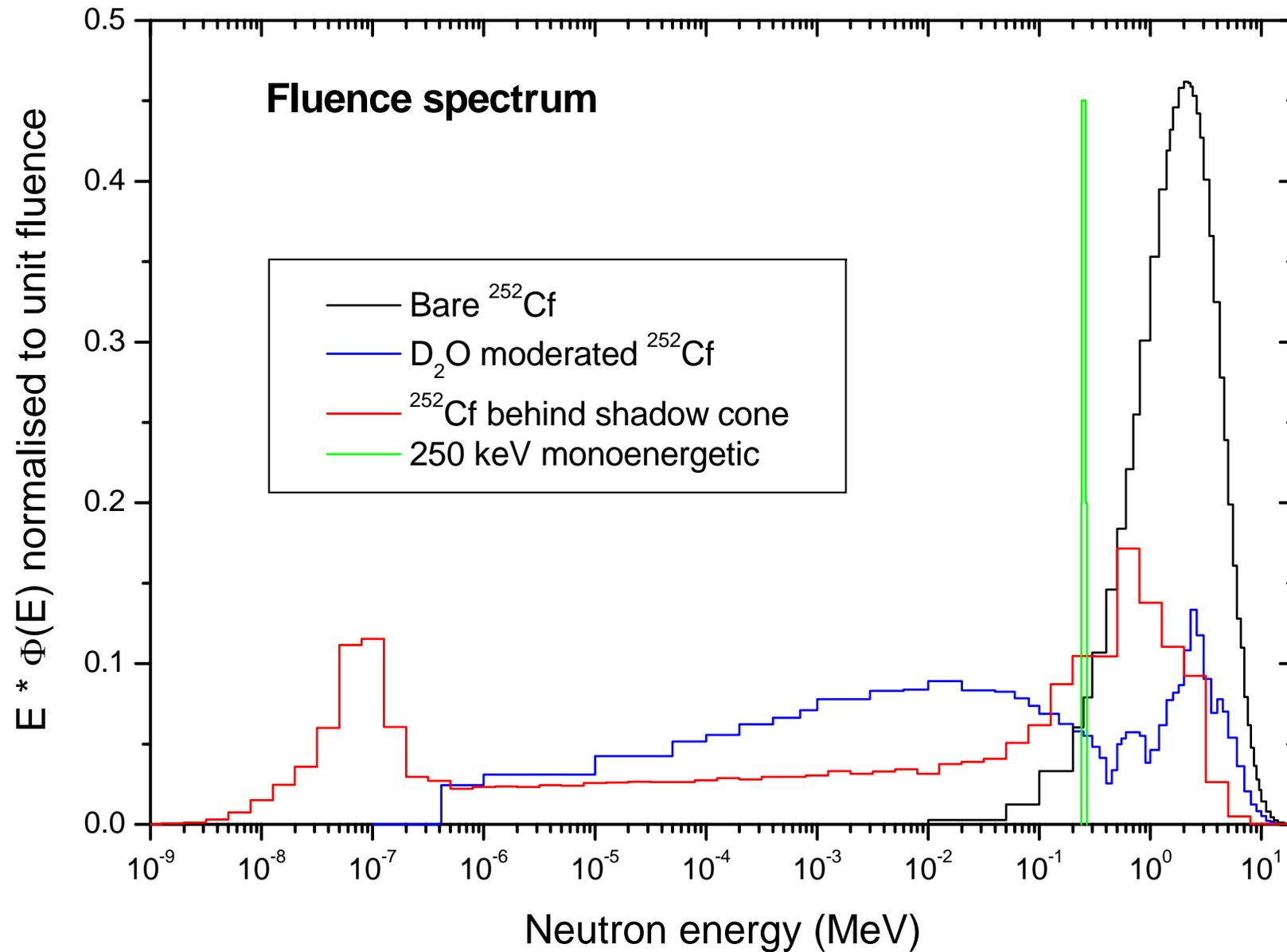
Talk breakdown

- **Irradiation fields - reminder**
- **Participants and types of dosimeters**
- **Overall results**
- **Results for the different irradiation fields**
- **Step I to step II changes**
- **Services which use the DIN 6804-2 area application codes (N1 to N4)**

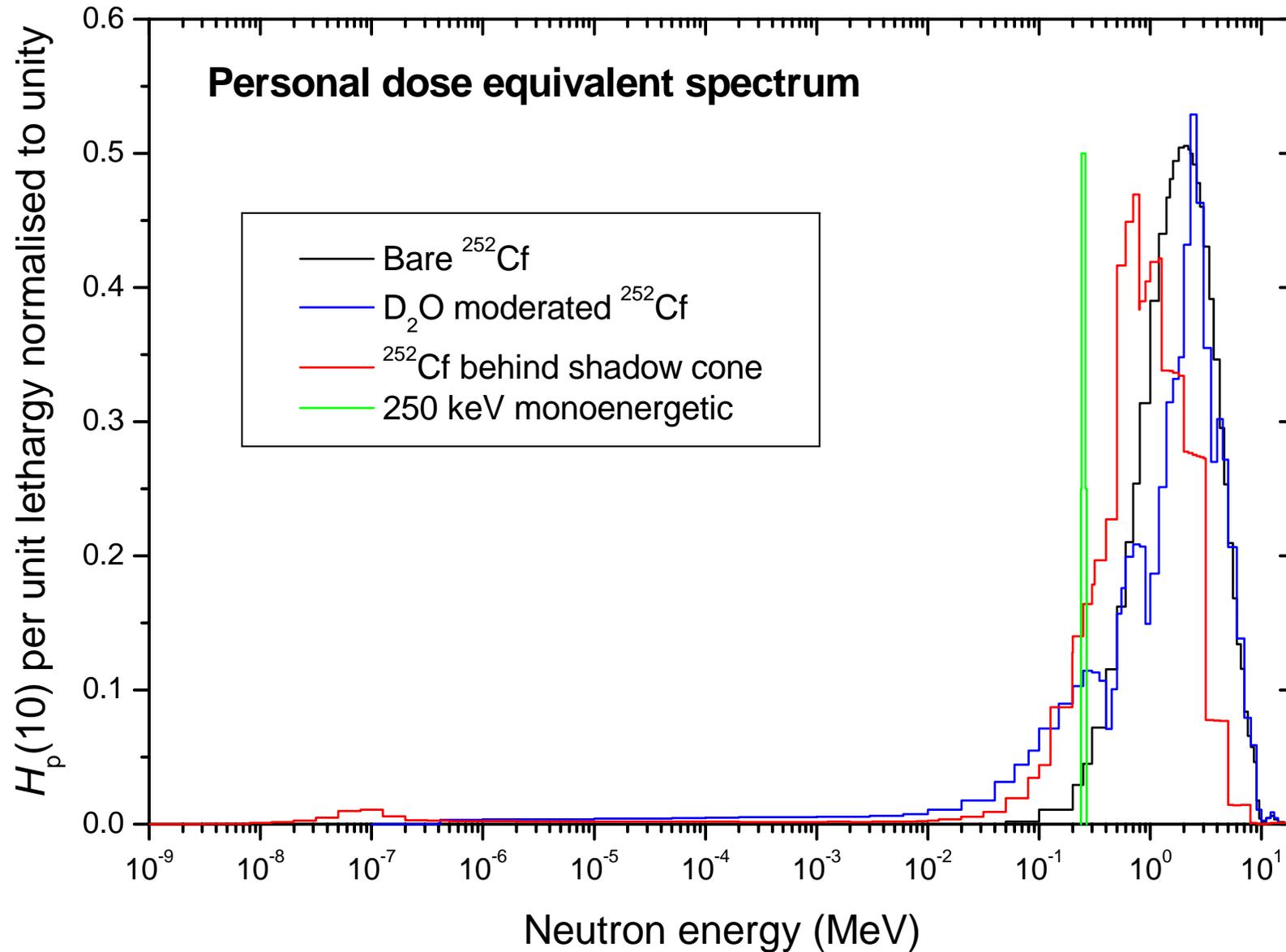
Irradiation fields - reminder

- Bare ^{252}Cf source
 1. $H_p(10)$ - 0.3 mSv
 2. $H_p(10)$ - 3.0 mSv
 3. $H_p(10)$ - 15 mSv
- Bare ^{252}Cf source - neutrons incident at 45°
 $H_p(10)$ - 2 mSv
- Heavy water (D_2O) moderated ^{252}Cf source
 $H_p(10)$ - 3 mSv
- ^{252}Cf source behind a shadow cone $H_p(10)$ - 2 mSv
- Monoenergetic 250 keV neutrons $H_p(10)$ - 1 mSv

Irradiation fields - reminder



Irradiation fields - reminder



Participants

- There were 34 dosimeter systems from 31 dosimetry service providers
- No results were forthcoming from two services. One withdrew before receiving results from the organising committee (OC) with no reason given; the other was unable to provide full results because of reader problems.
- One service only had a calibration for a reactor workplace and only provided results for the D₂O moderated ²⁵²Cf field and for the ²⁵²Cf source behind a shadow cone stating that the other fields were “Not applicable”
- Another service stated they only had a calibration for their particular reactor field. They provided readings for all fields although several were zero.

Dosemeter categories (those with results)

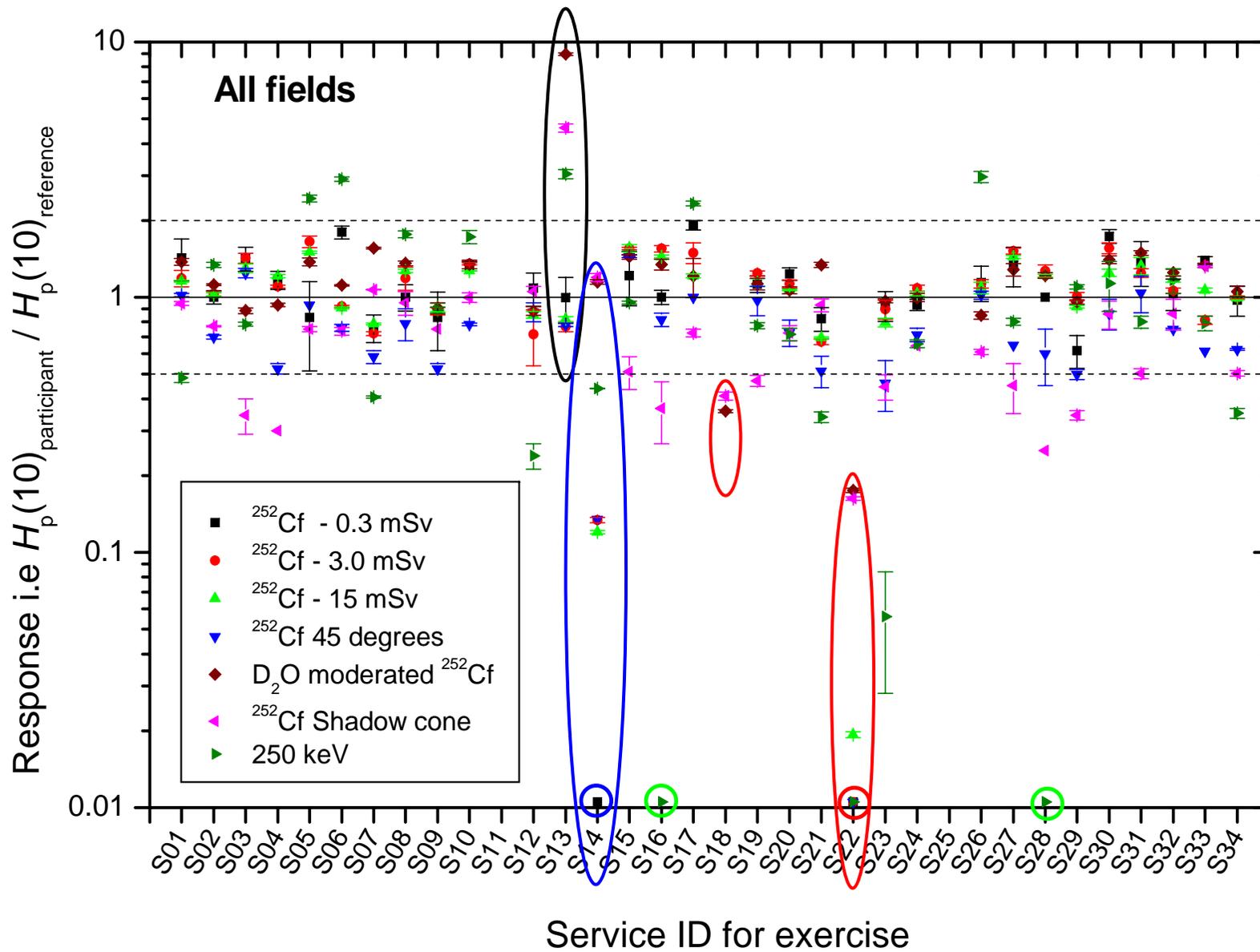
- **A. Etched track + TLD (4 systems)**
etched track sensor for fast and TLD for albedo
- **B. Etched track + converter (9 systems)**
etched track for fast and etched track with converter for albedo
- **C. Etched track fast only (4 systems)**
no evidence of a thermal sensor
- **D. Albedo TLD + Cd shield (3 systems)**
- **E. Albedo TLD + B loaded shield (6 systems)**
- **F. Albedo ! (3 systems)**
no information about shielding of direct neutrons
only a limited no. of results provided by one system
- **G. Fission track (1 system)**
- **H. Electronic (2 systems)**

Etched track

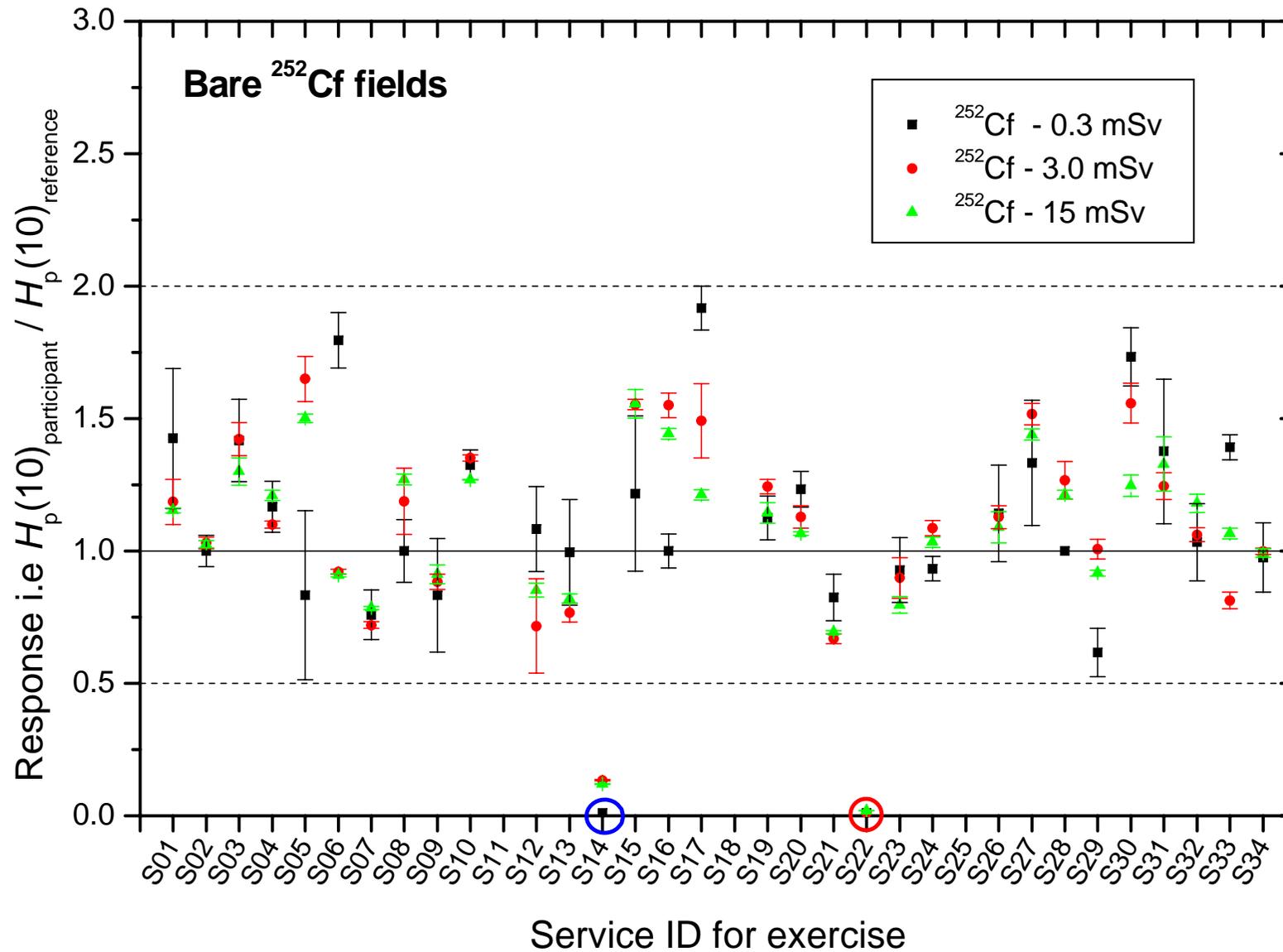
Albedo

Other

All results



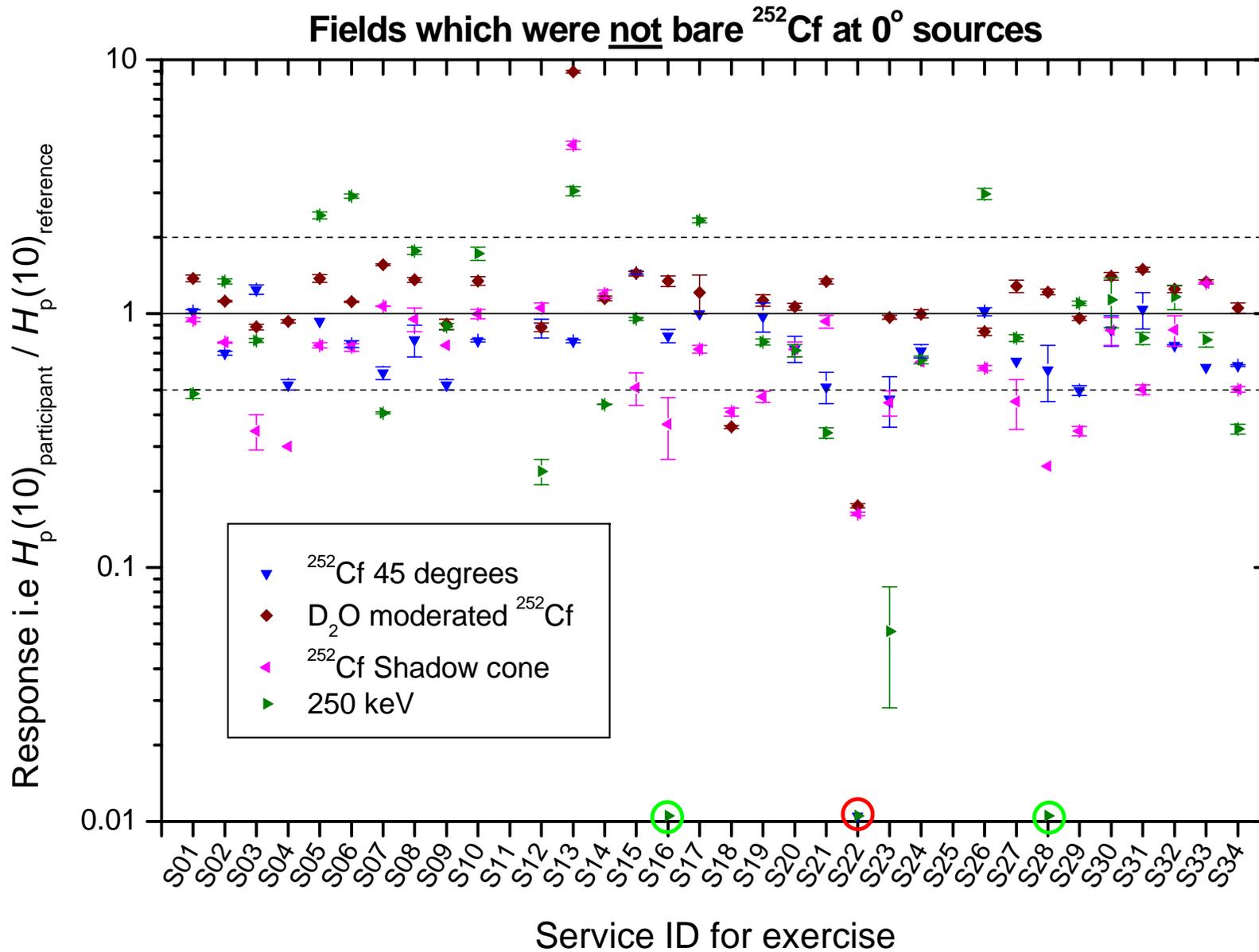
Bare ^{252}Cf results for 0° irradiation



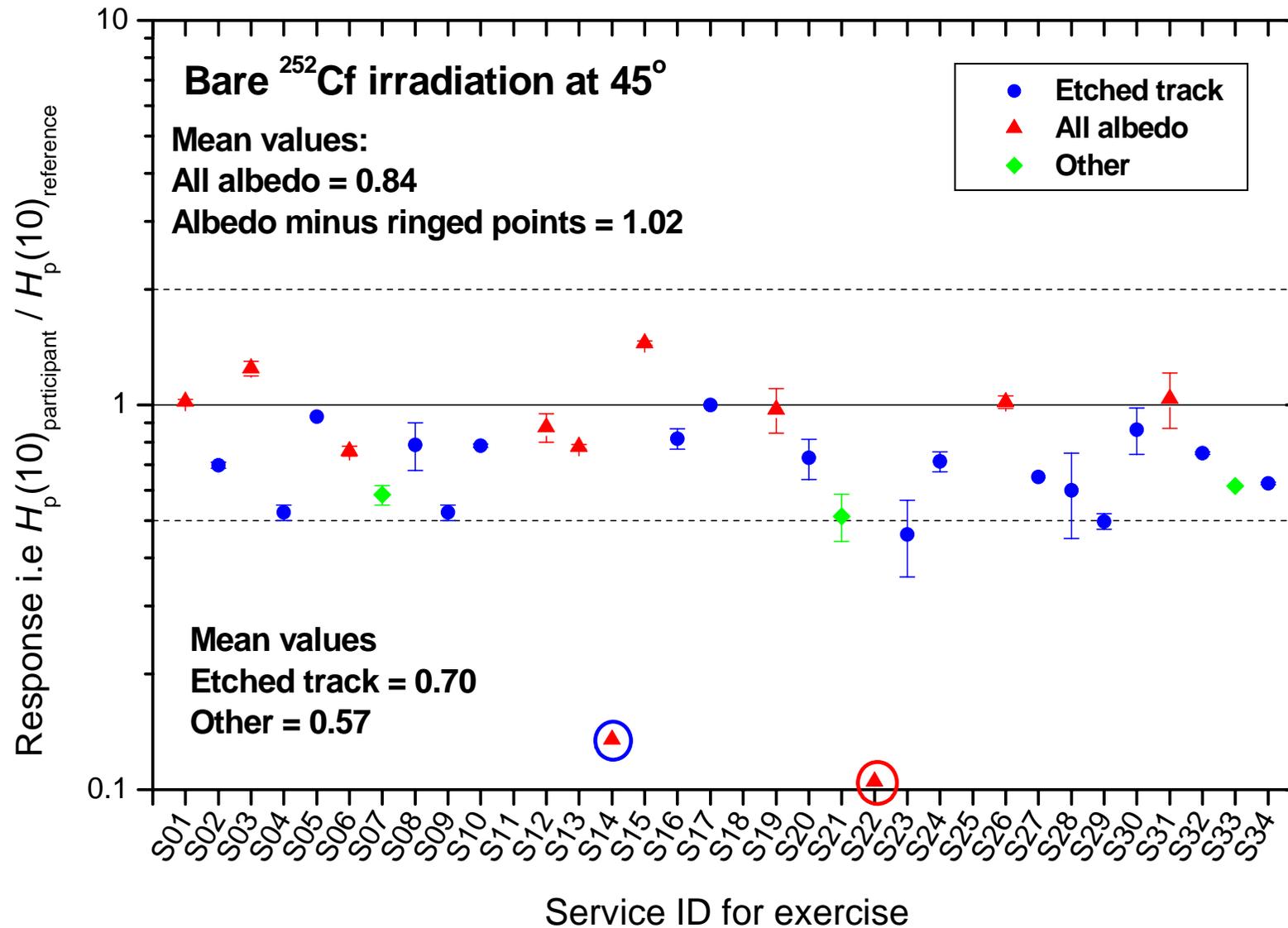
Average responses and nos outside 0.5 - 2

Category	0.3 mSv	H (>2) L (<0.5)	3 .0 mSv	H (>2) L (<0.5)	15 mSv	H (>2) L (<0.5)
Track + TLD	0.89		1.16		1.11	
Track + converter	1.13		1.22		1.18	
Track fast only	1.28		1.29		1.18	
All track	1.11		1.22		1.16	
Albedo TLD + cadmium shield	1.45		1.08		1.05	
Albedo TLD + boron capsule	1.20		1.16		1.17	
Albedo with shield information	1.29		1.13		1.13	
Albedo no shield information (2 systems)	0.00	2 L	0.07	2L	0.07	2 L
All albedo	1.05		0.94		0.94	
Others	0.99		0.73		0.85	
Sum	1.08	2 L	1.07	2L	1.05	2 L

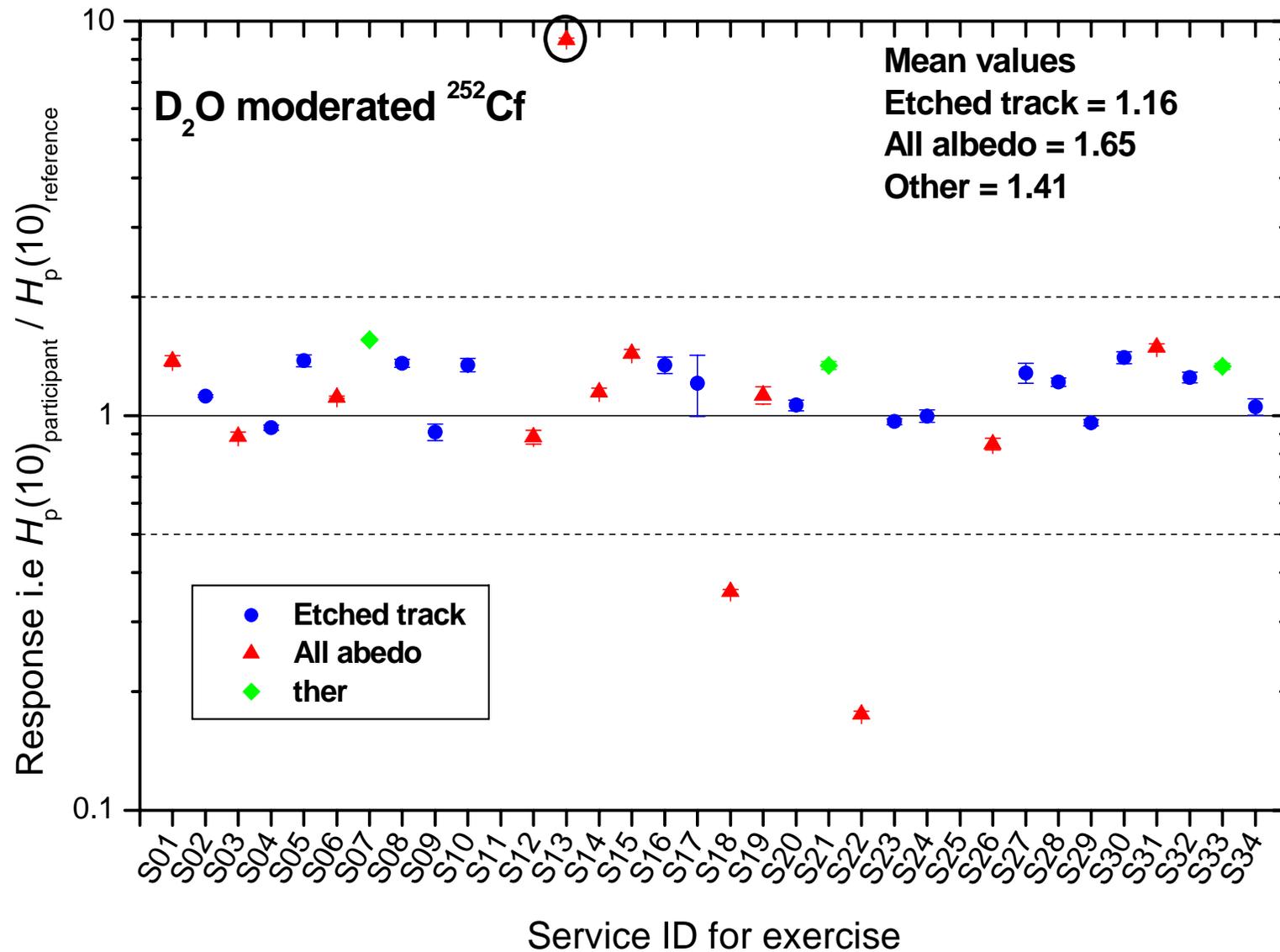
Fields other than bare ^{252}Cf at 0°



Bare ^{252}Cf at 45°



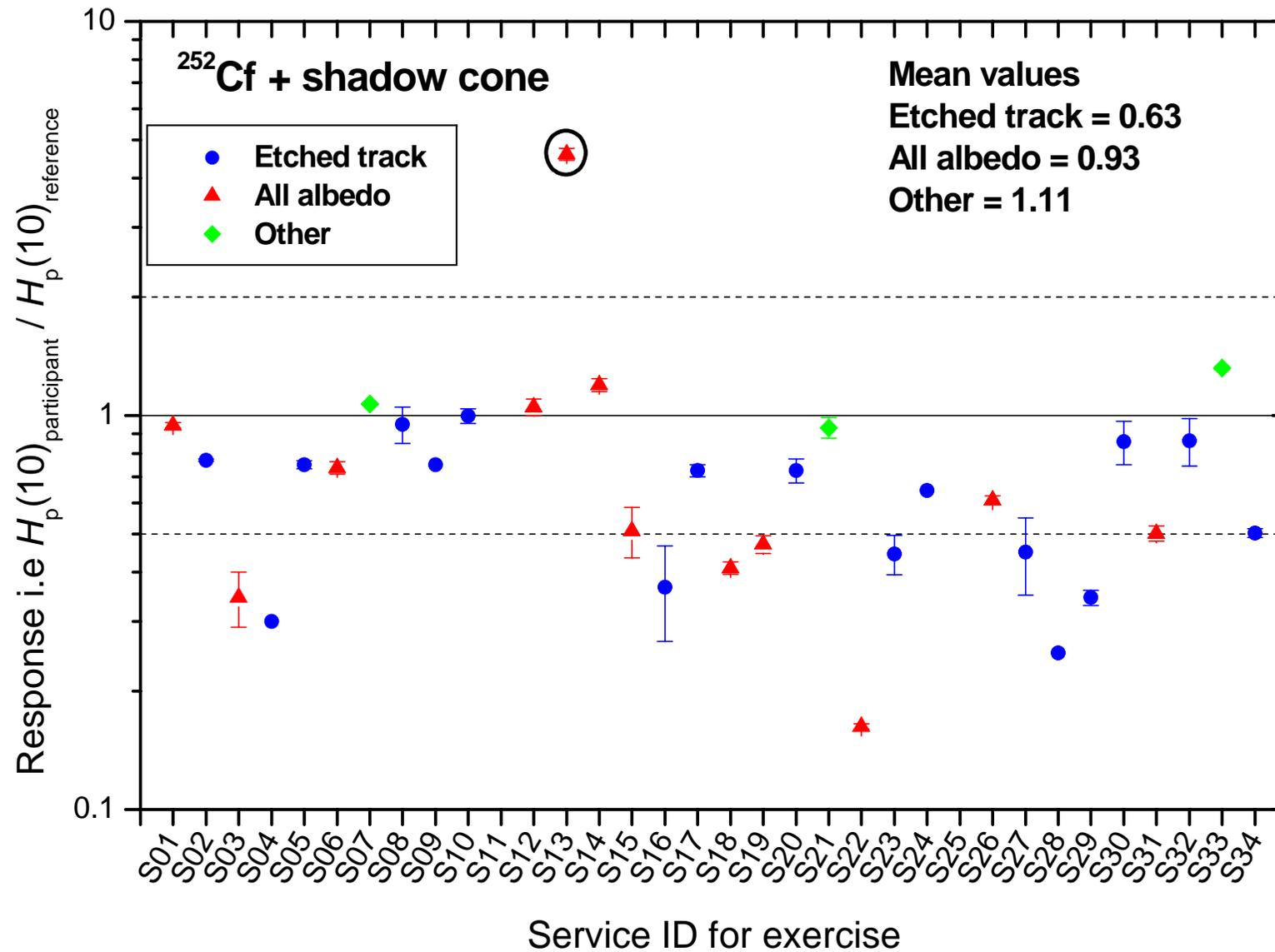
D₂O moderated ²⁵²Cf



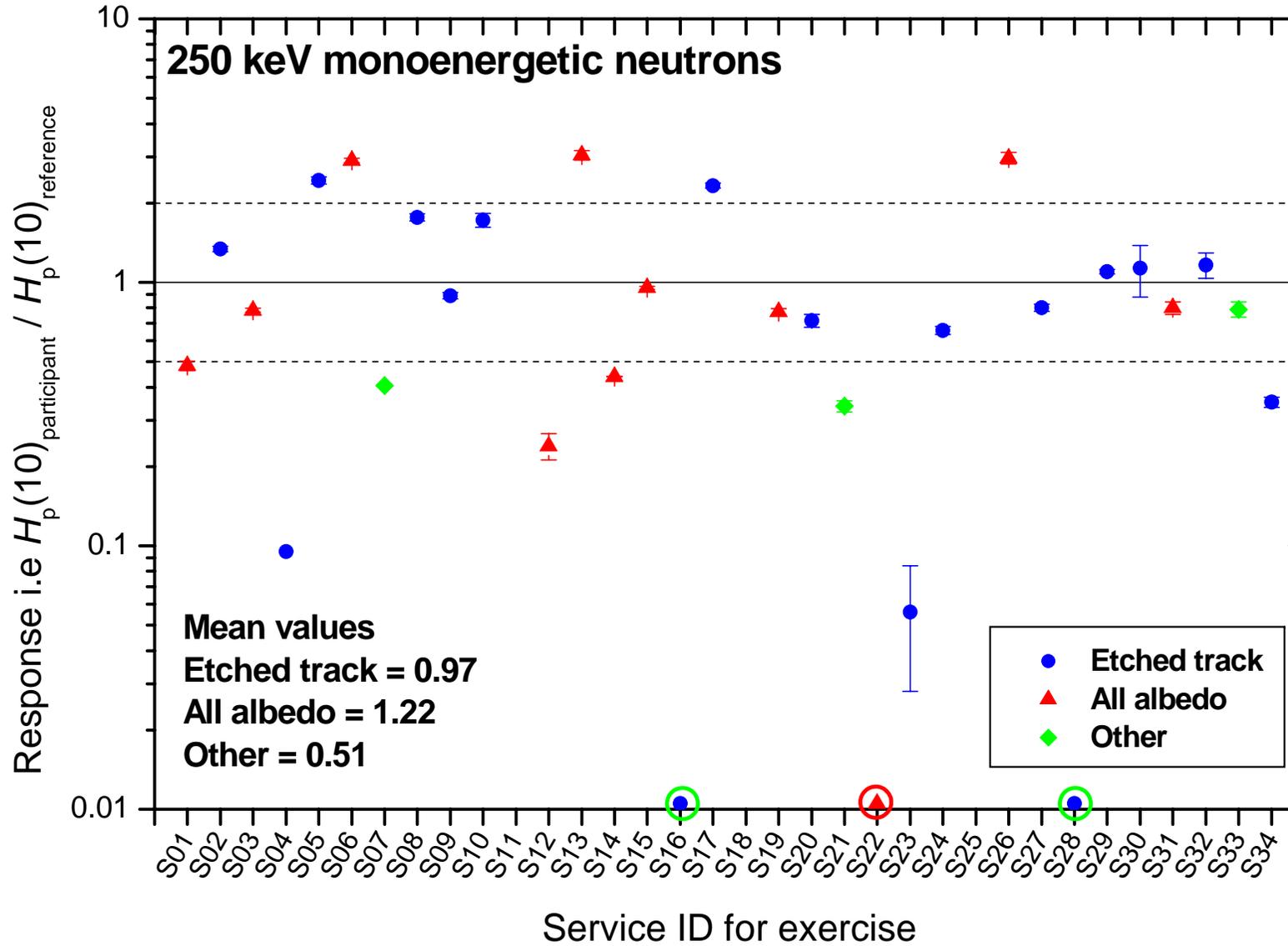
Average responses and nos outside 0.5 - 2

Category	^{252}Cf at 45° 2 mSv	H (>2) L (<0.5)	D ₂ O ^{252}Cf 3 mSv	H (>2) L (<0.5)
Track + TLD	0.60		1.06	
Track + converter	0.71		1.21	
Track fast only	0.79		1.17	
All track	0.70		1.16	
Albedo TLD + Cd shield	0.93		1.11	
Albedo TLD + boron capsule	1.06	1 H	2.46	1 H
Albedo with shield information	1.02		2.01	
Albedo no shield information	0.07	2 L (2 systems)	0.56	2 L (3 systems)
All albedo	0.84		1.65	
Others	0.57		1.41	
Sum	0.74	1 H 2 L	1.37	1 H 2 L

^{252}Cf behind shadow cone



250 keV monoenergetic neutrons



Average responses and nos outside 0.5 - 2

Category	²⁵² Cf + cone 2 mSv	H (>2) L (<0.5)	250 keV 1 mSv	H (>2) L (<0.5)
Track + TLD	0.46	3 L	0.92	1 H 2 L
Track + converter	0.73	2 L	1.05	1 L
Track fast only	0.58	1 L	0.85	1 H 2 L
All track	0.63		0.97	
Albedo TLD + Cd shield	0.76		2.12	2 H 1 L
Albedo TLD + B capsule	1.25	1 H 2 L	1.10	1 H 1 L
Albedo with shield information	1.09		1.44	
Albedo no shield information	0.59	2 L (3 systems)	0.22	2 L (2 systems)
All albedo	0.93		1.22	
Others	1.11		0.51	2 L
Sum	0.80	1 N 10 L	0.99	5 H 11 L

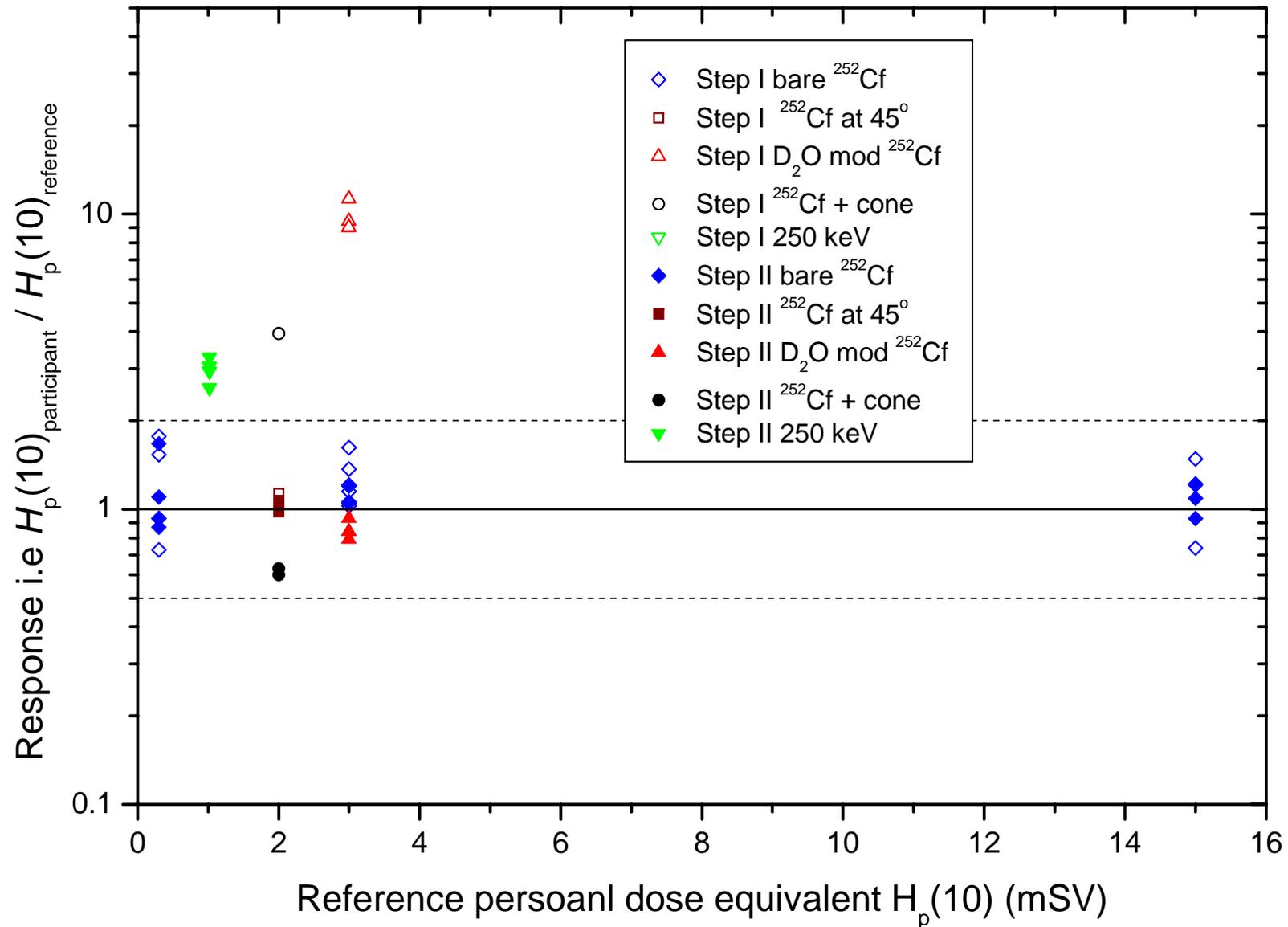
Use of spectral data in step II

- 4 albedo systems required the DIN 6802-4 'N1 to N4' designations of application areas for the fields in order to use an appropriate calibration factor – treat these later
- 13 participating systems did not change their results at step II (9 etched track, 2 albedo and 2 electronic)
- 15 participating systems did make changes (8 etched track, 6 albedo, and fission track)
- Changes were in some cases quite significant
- Cannot show them all but can show a few examples

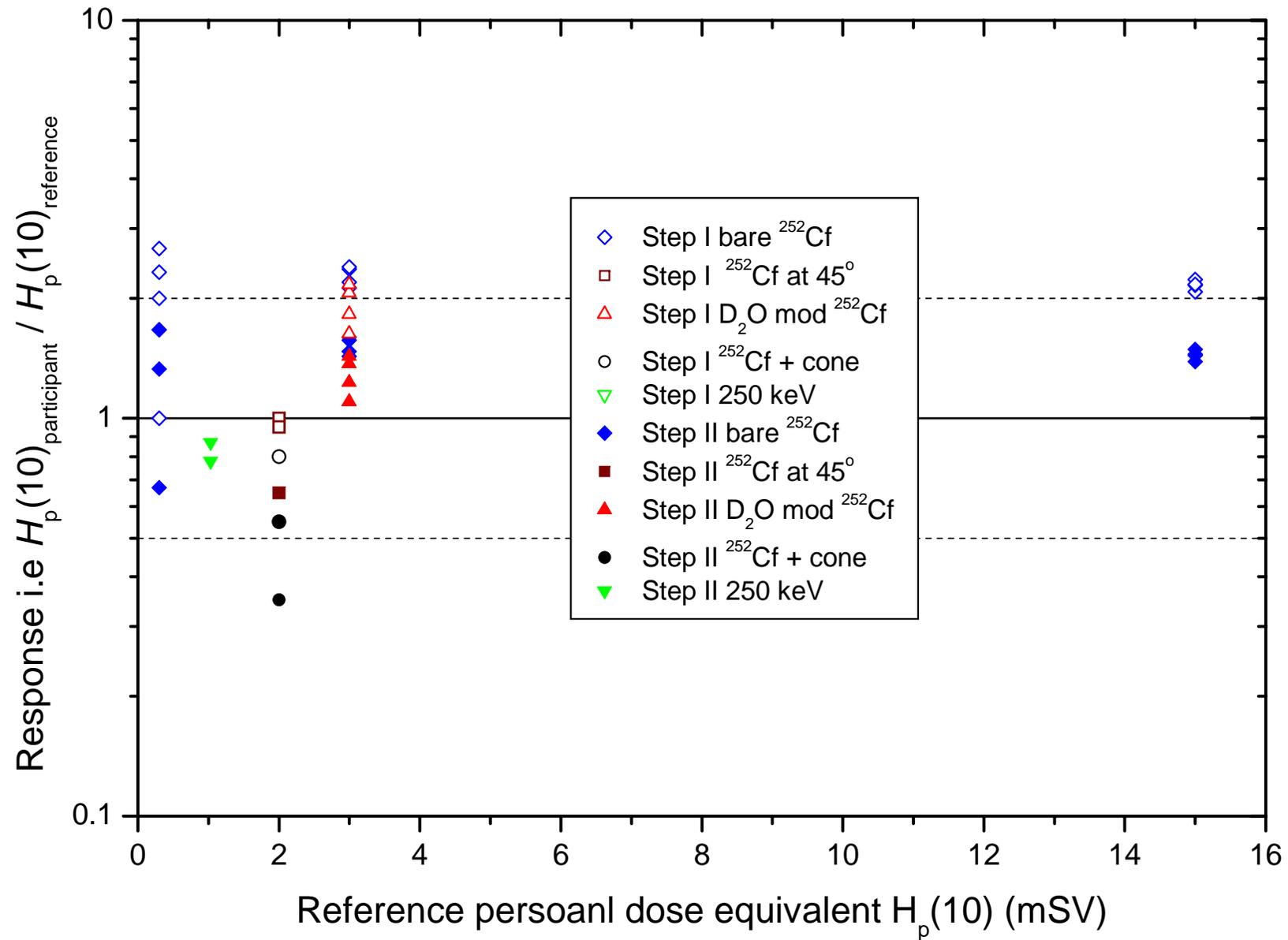
Use of spectral data

Irradiation condition	Information provided to participants
^{252}Cf at 0° and 45°	Bare radionuclide source
250 keV monoenergetic neutrons	250 keV monoenergetic neutrons
D_2O moderated ^{252}Cf	Radionuclide source with significant moderated neutron fluence component
^{252}Cf shielded with shadow cone	Radionuclide source with significant moderated neutron fluence component

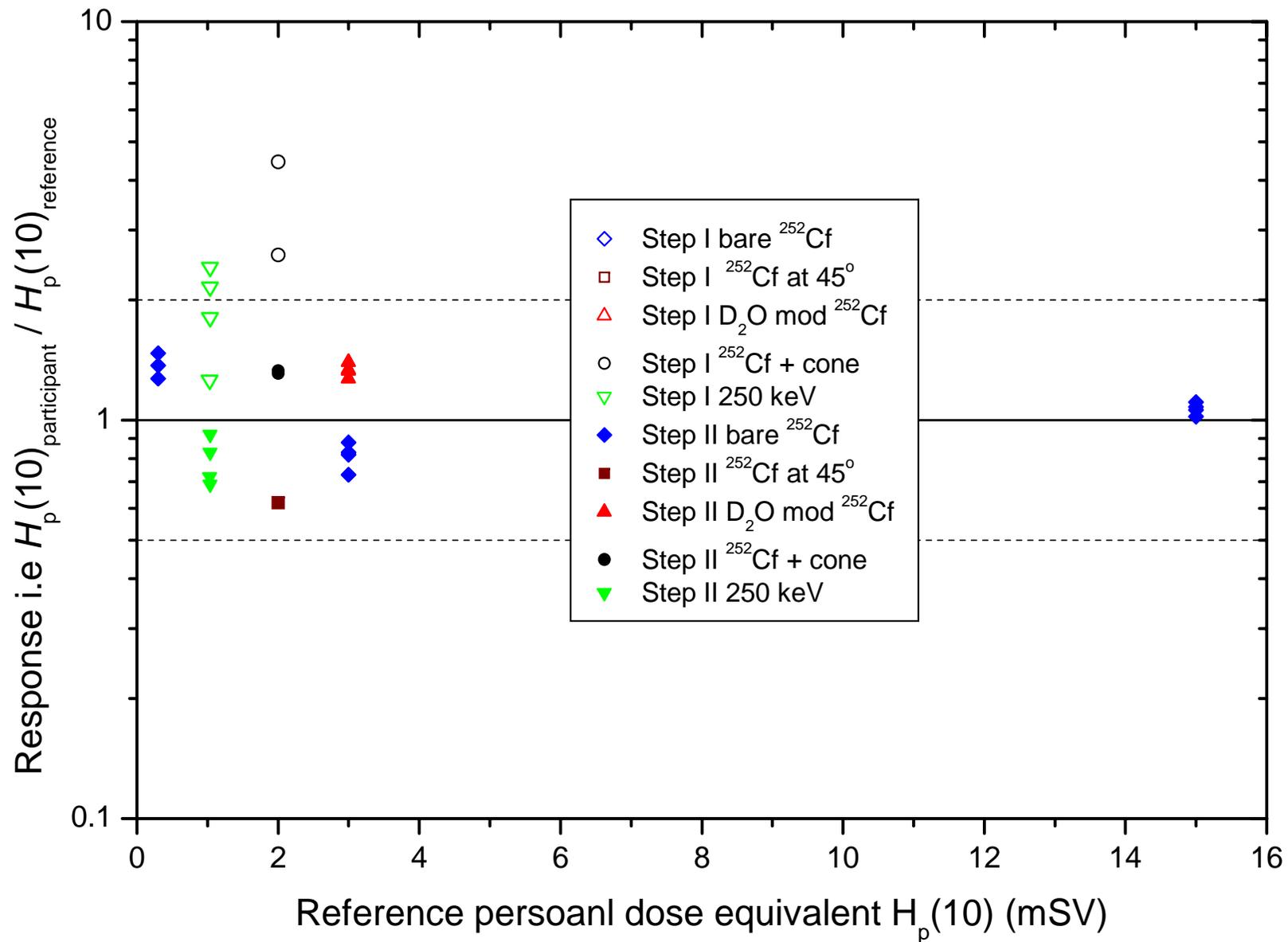
Effect of spectrum correction – an albedo



Effect of spectrum correction – track



Effect of spectrum correction – other

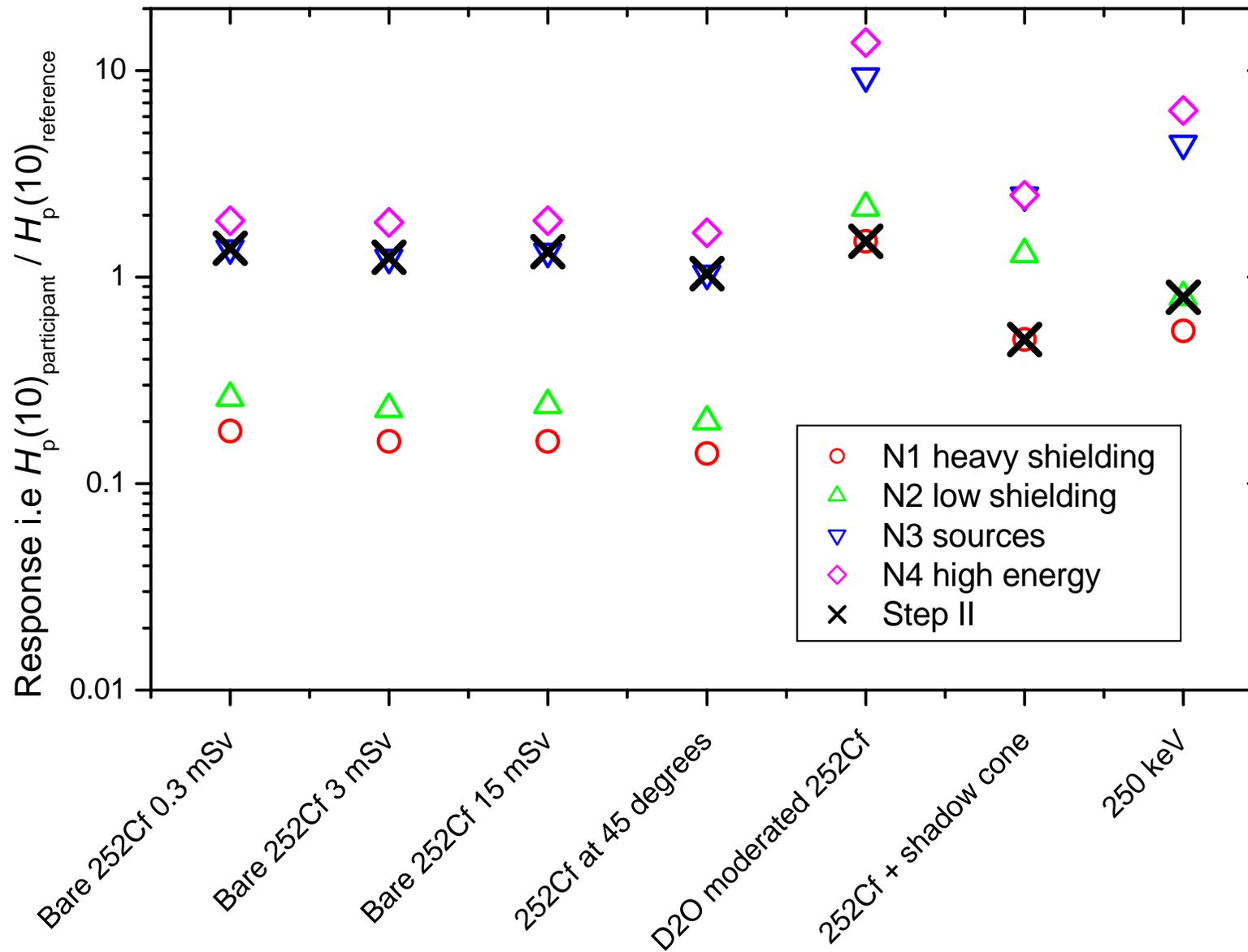


Use of spectral data for areas DIN 6804-2

N1	Reactors and accelerators, heavy shielding Nuclear power stations; Research reactors; Betatron, Linacs; Therapy particle Accelerators
N2	Fuel element cycle, criticality, low shielding Fuel element cycle; Experimental reactors; Criticality; Handling fissile materials CASTOR Transports
N3	Radionuclide neutron sources Am-Be, Pu-Be, ^{252}Cf
N4	Accelerators for research Particle accelerator; High-energy accelerator for electrons High-energy accelerator for protons, deuterons, alphas and heavy Particles

Irradiation condition	Information provided to participants
^{252}Cf at 0° and 45°	Bare radionuclide source
250 keV monoenergetic neutrons	250 keV monoenergetic neutrons
D_2O moderated ^{252}Cf	Radionuclide source with significant moderated neutron fluence component
^{252}Cf shielded with shadow cone	Radionuclide source with significant moderated neutron fluence component

Effect of spectrum correction – N1 to N4



Conclusions

- **Good results in most cases for radionuclide sources, D₂O moderated ²⁵²Cf a little high on average**
- **Results tend to be low at 45° highlighting known problems with angle dependence of response**
- **Varied responses for ²⁵²Cf behind shadow cone and for monoenergetic 250 keV neutrons**
- **Step I to step II corrections highlight importance of spectral information and of interpreting this information correctly**

Irradiation fields - reminder

