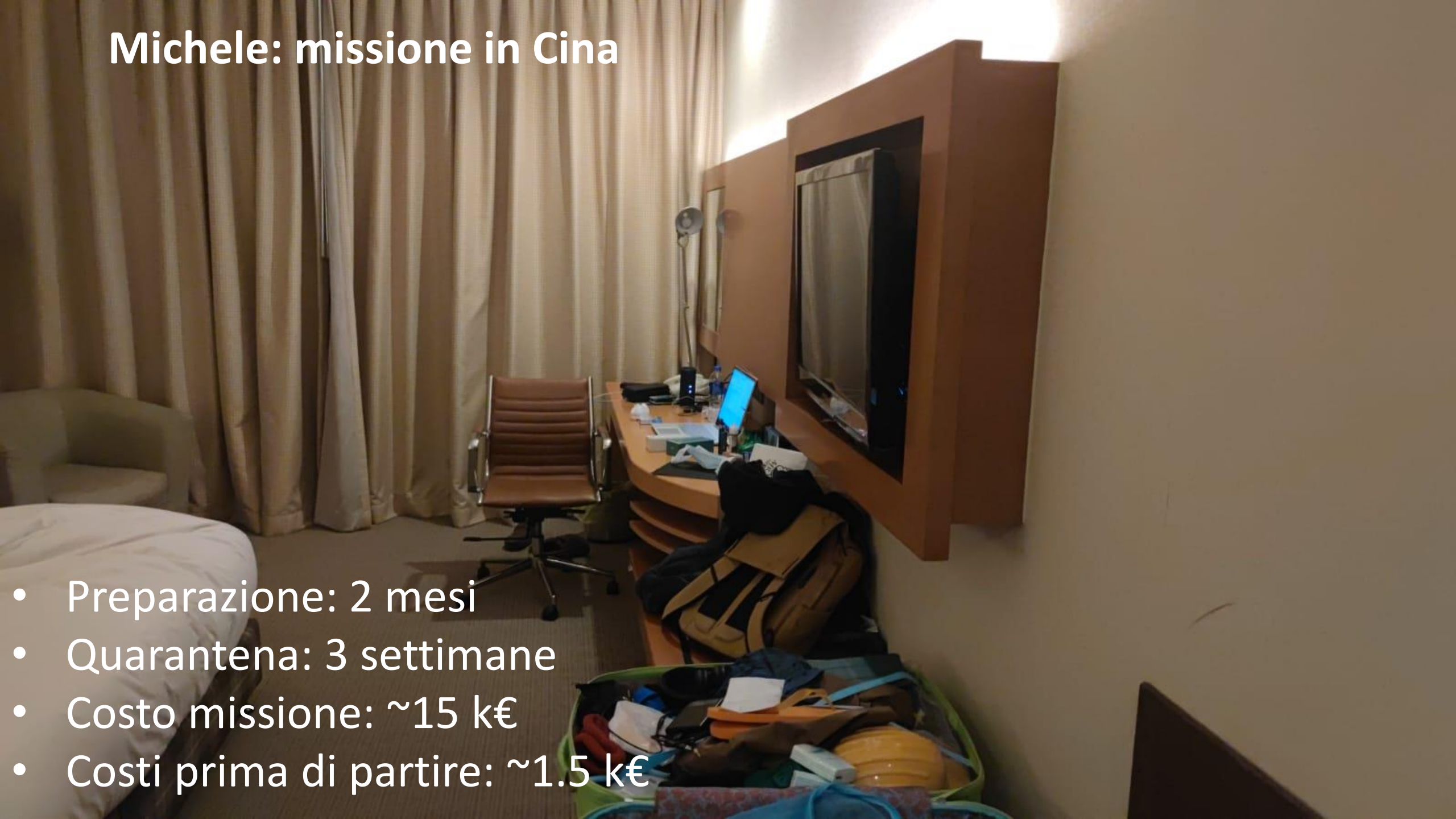


Status of Ferrara JUNO group



Michele: missione in Cina

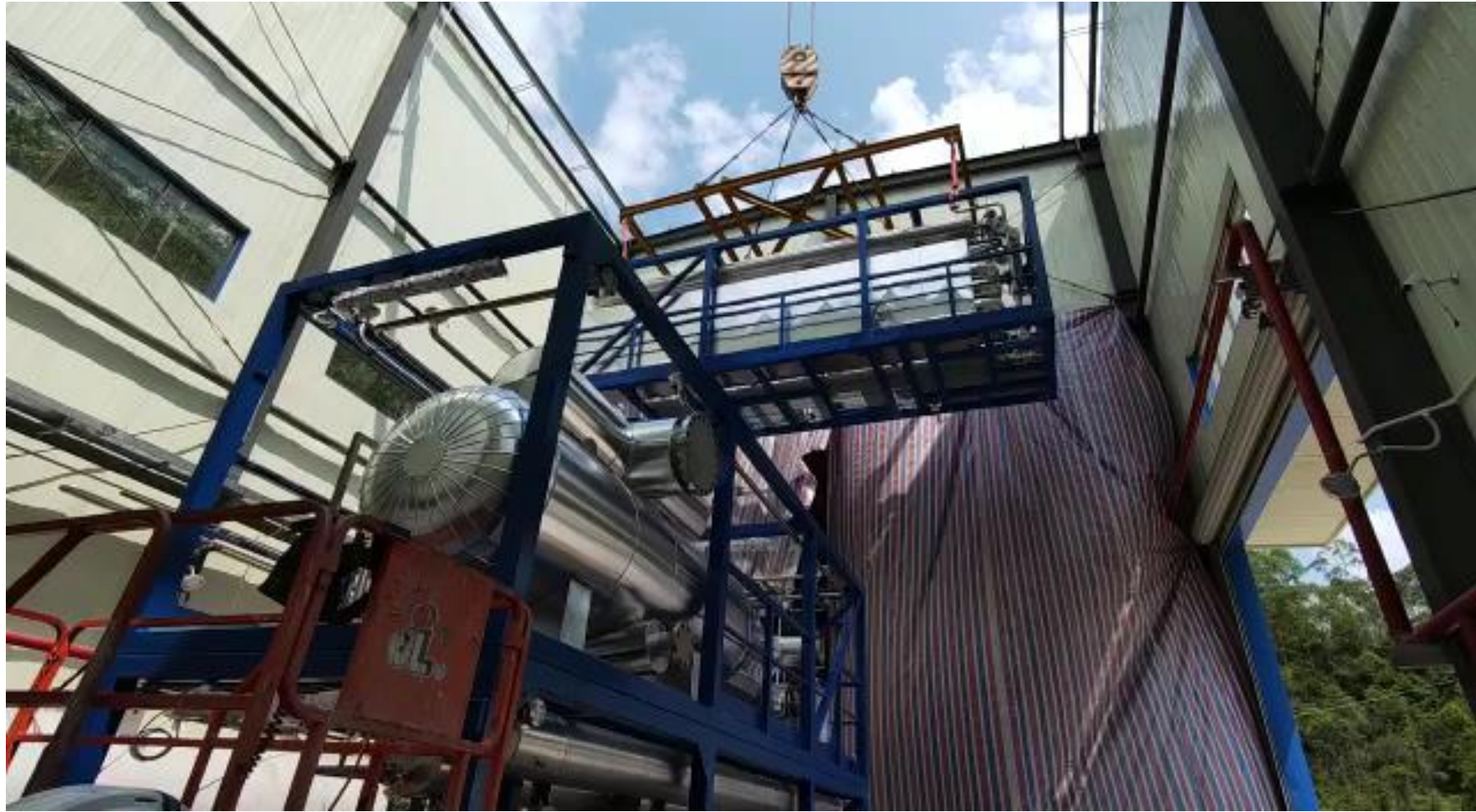
- Preparazione: 2 mesi
- Quarantena: 3 settimane
- Costo missione: ~15 k€
- Costi prima di partire: ~1.5 k€





Alcune foto ricordo...





Cosa abbiamo imparato?

Poiché mancano i punti di riferimento organizzativi:

- prontezza nel risolvere i problemi
- avere sempre un piano B
- capacità di adattamento

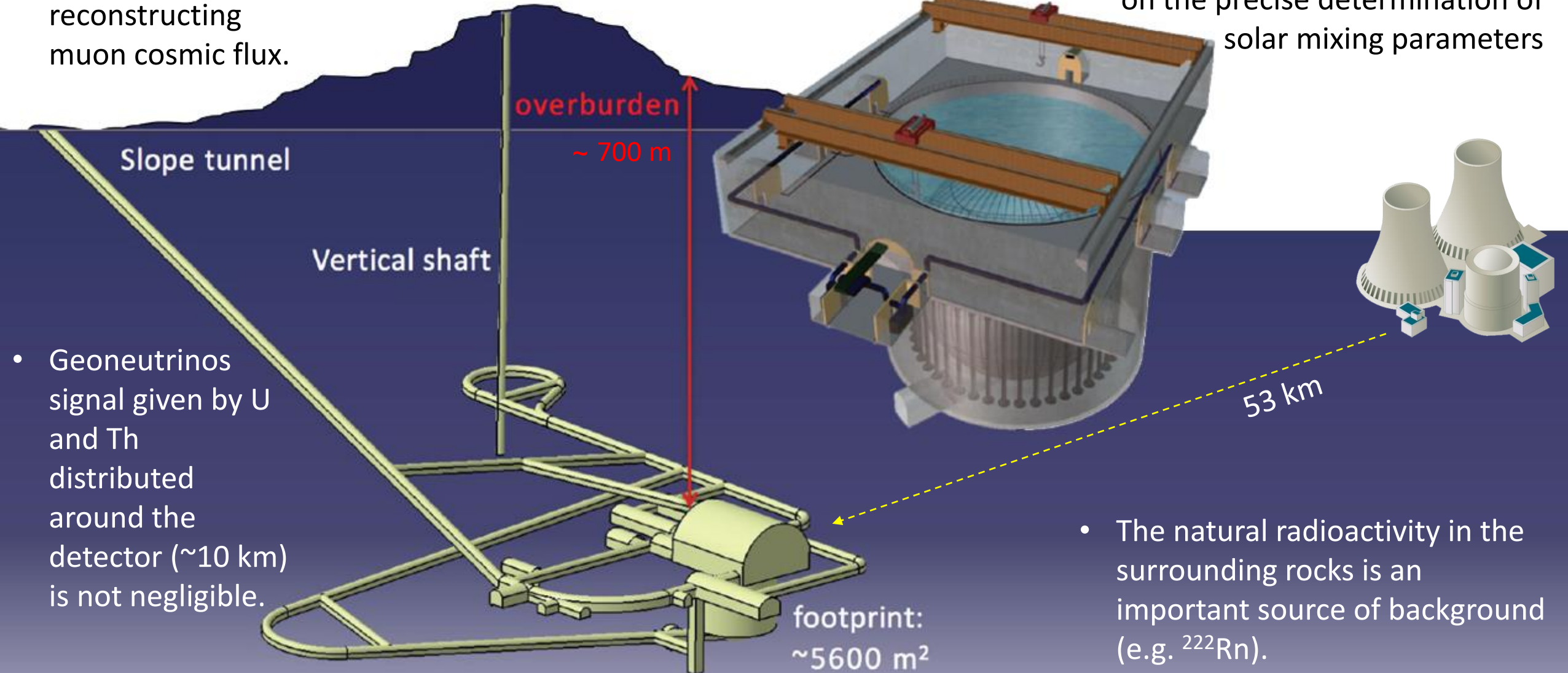


Grazie!



Why do we need to study rocks around JUNO?

- Density of rocks overburden JUNO are relevant ingredients for reconstructing muon cosmic flux.



- The density of the rocks crossed by the reactor antineutrinos impacts on the precise determination of solar mixing parameters

- Geoneutrinos signal given by U and Th distributed around the detector (~10 km) is not negligible.

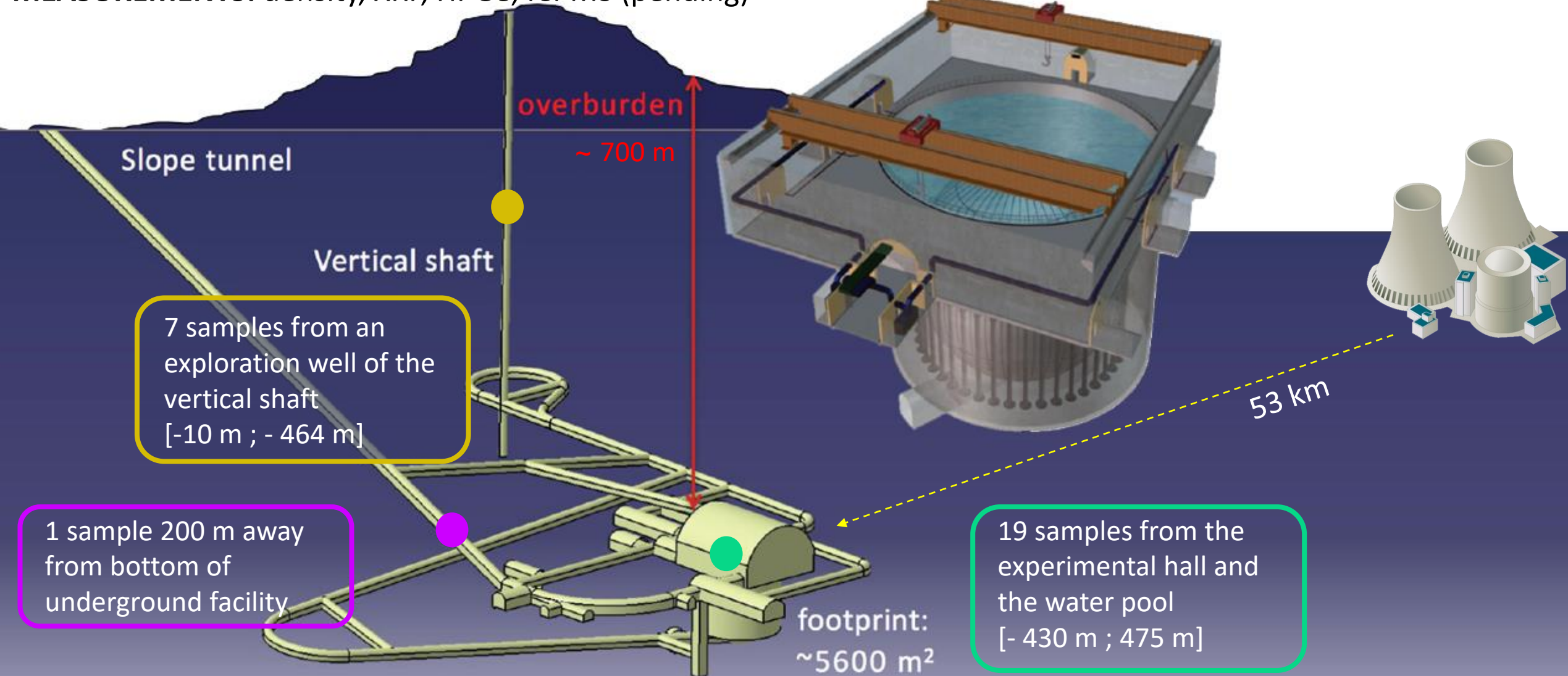
- The natural radioactivity in the surrounding rocks is an important source of background (e.g. ^{222}Rn).

Where are the rock samples come from?

TOTAL NUMBER OF SAMPLES: 27

TYPE OF ROCK: GRANITES

MEASUREMENTS: density, XRF, HPGe, ICPMS (pending)



Measured Rock samples (27)

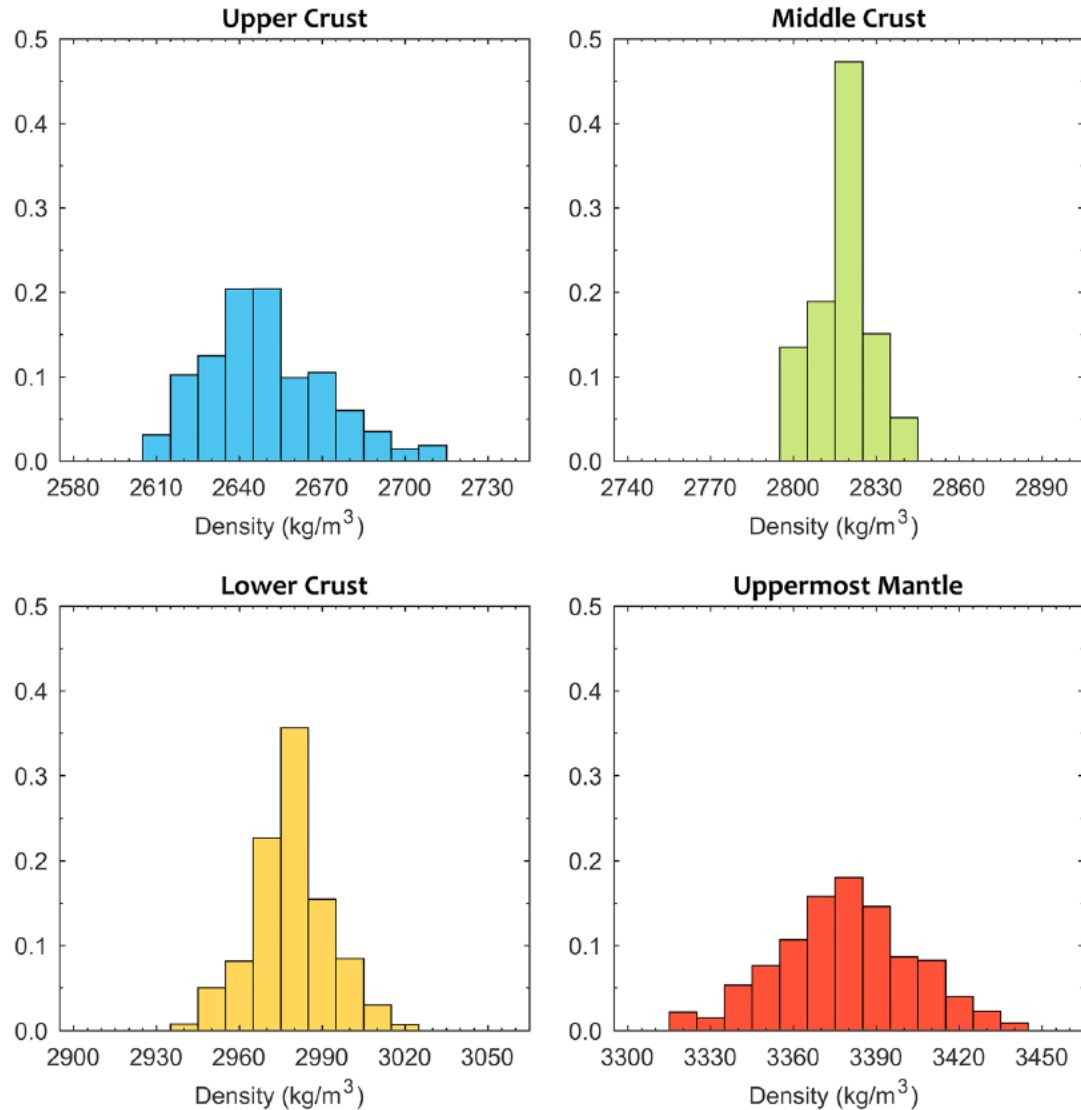
ID	Sample	Depth (m)	Notes
1	JUNO FRESH	10	Exploration well
2	JUNO ZK1 100	36	Exploration well
3	JUNO ZK1 200	64	Exploration well
4	JUNO ZK1 300	164	Exploration well
5	JUNO ZK1 400	264	Exploration well
6	JUNO ZK1 500	364	Exploration well
7	JUNO 2 HWP 430 A	430	Lower part of the water pool
8	JUNO 2 HWP 430 B	430	Above the water pool
9	JUNO HWP 430 A	430	Hall/water pool
10	JUNO HWP 430 B	430	Hall/water pool
11	JUNO HWP 460	460	Hall/water pool
12	JUNO 3 EP 1	460	Experimental Hall
13	JUNO 3 EP 2	460	Experimental Hall
14	JUNO 3 EP 3	460	Experimental Hall
15	JUNO 3 EP 4	460	Experimental Hall
16	JUNO 3 ST 1000	460	Slope tunnel
17	JUNO 2 HWP 464	464	Lower part of the water pool
18	JUNO ZK1 600	464	Exploration well



ID	Sample	Depth (m)	Notes
19	JUNO HWP 465	465	Hall/water pool
20	JUNO 2 HWP 467	467	Lower part of the water pool
21	JUNO HWP 467	467	Hall/water pool
22	JUNO HWP 474	474	Hall/water pool
23	JUNO 2 HWP 475	475	Hall/water pool
24	JUNO 3 WP B3	495	Bottom of water pool
25	JUNO 3 WP B4	495	Bottom of water pool
26	JUNO 3 WP B1	507	Bottom of water pool
27	JUNO 3 WP B2	507	Bottom of water pool

Rock density: measures vs model

Frequency distributions of crustal density values of GIGJ model voxels



From model:

$$\langle \rho \rangle = 2.6493 \pm 0.0074 \cdot 10^3 \text{ (kg/m}^3\text{)}$$

From measurements:

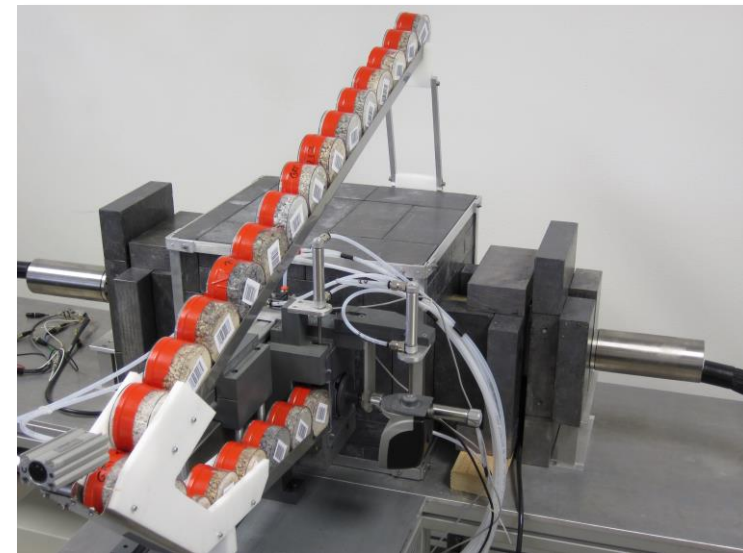
$$\langle \rho \rangle = 2.6598 \pm 0.0600 \cdot 10^3 \text{ (kg/m}^3\text{)}$$



What are the implication for reactor antineutrino spectrum?

Results of gamma-ray measurements

Sample	Depth	K \pm σ K [%]	U \pm σ U [ppm]	Th \pm σ Th [ppm]
JUNO FRESH	10	3.92 \pm 0.23	15.8 \pm 1.3	32.1 \pm 2.1
JUNO ZK1 100	36	4.2 \pm 0.24	13.8 \pm 1.1	32.6 \pm 2.1
JUNO ZK1 200	64	4.07 \pm 0.24	12.8 \pm 1	31.9 \pm 2.1
JUNO ZK1 300	164	3.85 \pm 0.22	14.4 \pm 1.2	32.7 \pm 2.1
JUNO ZK1 400	264	4.25 \pm 0.25	11.3 \pm 0.9	26.3 \pm 1.8
JUNO ZK1 500	364	3.98 \pm 0.23	13.4 \pm 1.1	30.7 \pm 2
JUNO ZK1 600	464	2.15 \pm 0.13	4.9 \pm 0.4	14.5 \pm 1.1
JUNO_HWP_430A	430	3.66 \pm 0.22	13.2 \pm 1.1	33.8 \pm 2.3
JUNO2_HWP_430A	430	3.65 \pm 0.22	13.1 \pm 1.1	31.2 \pm 2.1
JUNO_HWP_430B	430	3.8 \pm 0.23	13.4 \pm 1.1	36.2 \pm 2.4
JUNO2_HWP_430B	430	3.9 \pm 0.22	12.4 \pm 1	30.7 \pm 2.1
JUNO_HWP_460	460	3.63 \pm 0.21	11.8 \pm 1	32.8 \pm 2.2
JUNO2_HWP_464	464	3.59 \pm 0.21	11.8 \pm 0.9	31.1 \pm 2.1
JUNO_HWP_465	465	2.89 \pm 0.17	12.2 \pm 1.0	34.4 \pm 2.2
JUNO_HWP_467	467	3.45 \pm 0.2	11.8 \pm 0.9	32.3 \pm 2.1
JUNO2_HWP_467	467	3.95 \pm 0.23	11.6 \pm 0.9	28.7 \pm 1.9
JUNO_HWP_474	474	3.68 \pm 0.21	11.1 \pm 0.9	31.4 \pm 2.1
JUNO2_HWP_475	475	3.48 \pm 0.21	11.7 \pm 0.9	30.9 \pm 2.1
	Avg \pm st.dev	3.67 \pm 0.49	12.3 \pm 2.2	30.8 \pm 4.6



Update about geoneutrinos
(@ Nantes)



"That's all Folks!"