JUNO at Ferrara

Fabio Mantovani

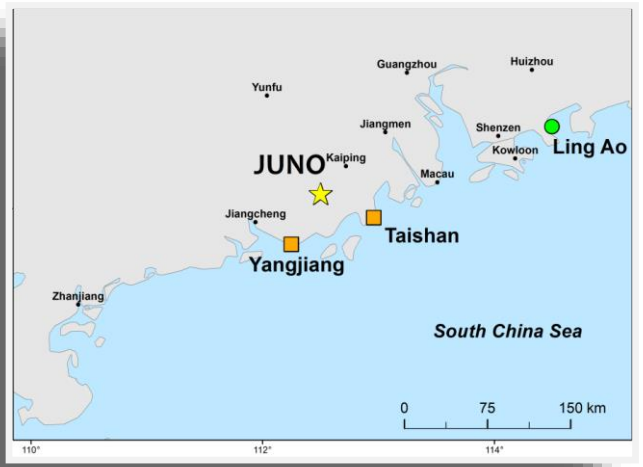
Consiglio di sezione – 6 luglio 2021

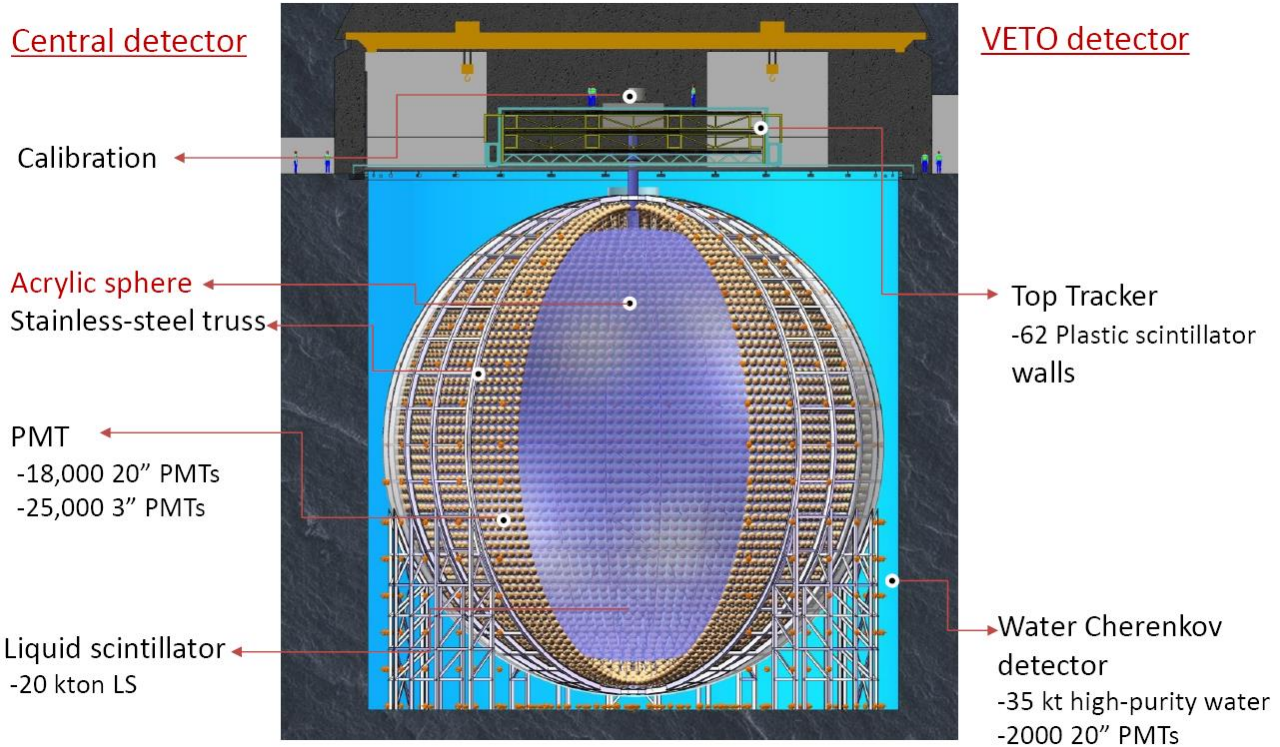
JUNO: status

- **Obiettivi dell'esperimento:** Neutrino mass hierarchy (reactor antineutrinos), precision measurements of neutrinos parameters, supernova neutrinos, solar neutrinos, atmospheric neutrinos, geoneutrinos, nucleon decays…
- **Roadmap dell'esperimento:**

01/01/2023 Start test run

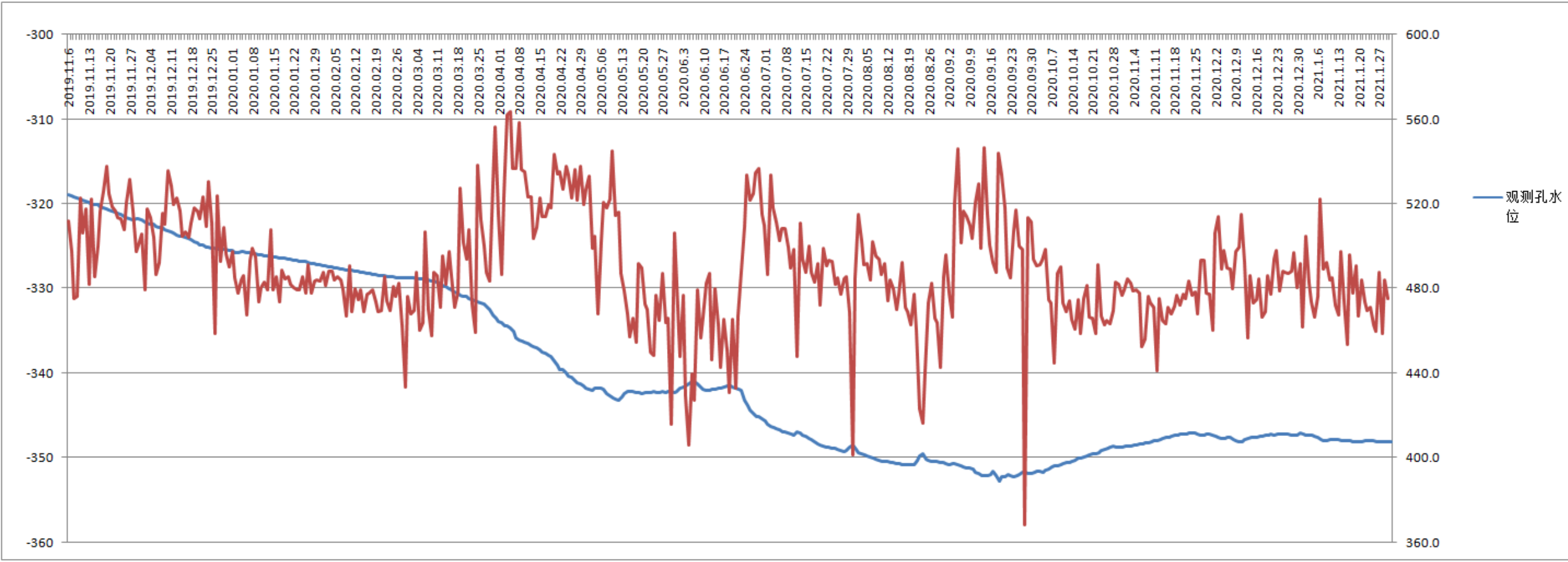
- **Sezioni INFN:** CT, FE, PD, RM3, LNF, MIBI, MI, PG, CT





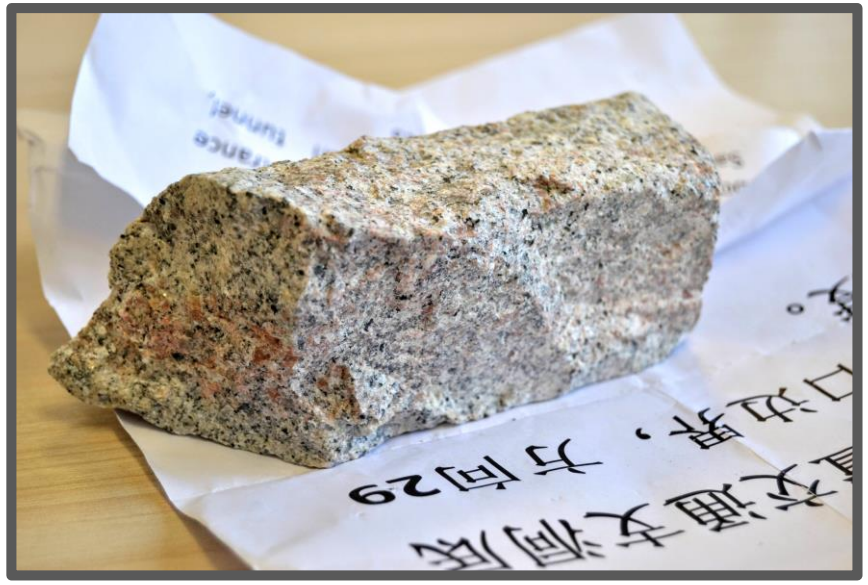
JUNO: infrastrutture esterne

Water pumps still keep running at the level of ~ 500 m^3/hr



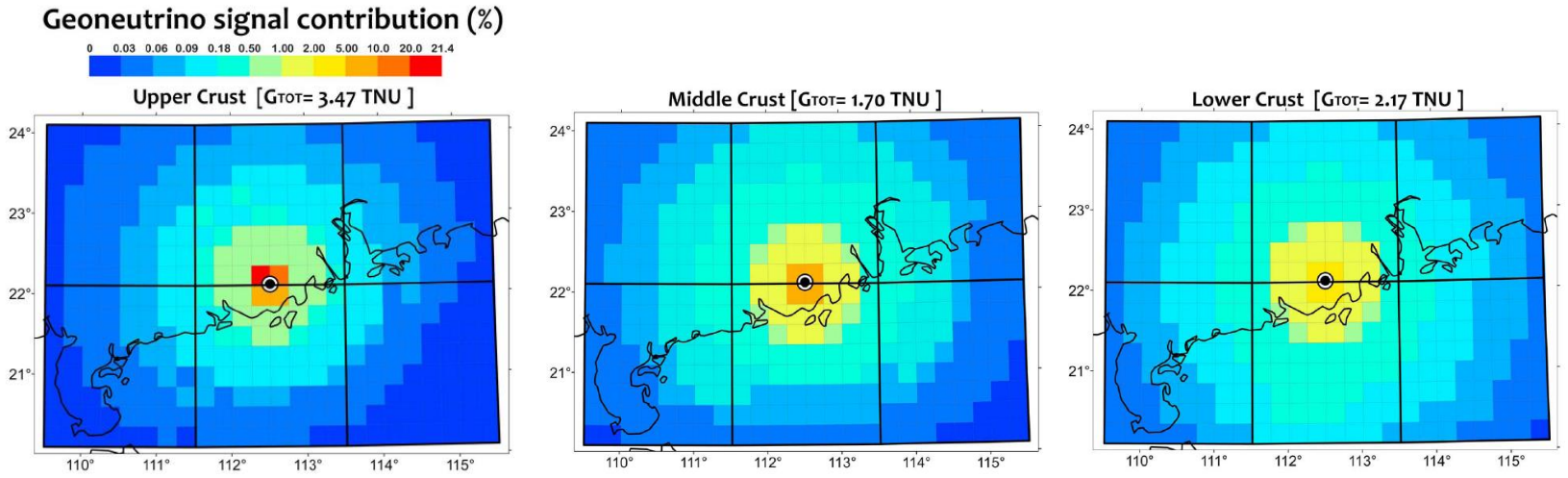
Main activities at Ferrara

- Designing, realizing and testing the distillation and stripping plants for JUNO LS in collaboration with Polaris company.



- Geophysical and geochemical characterization of rocks from JUNO site

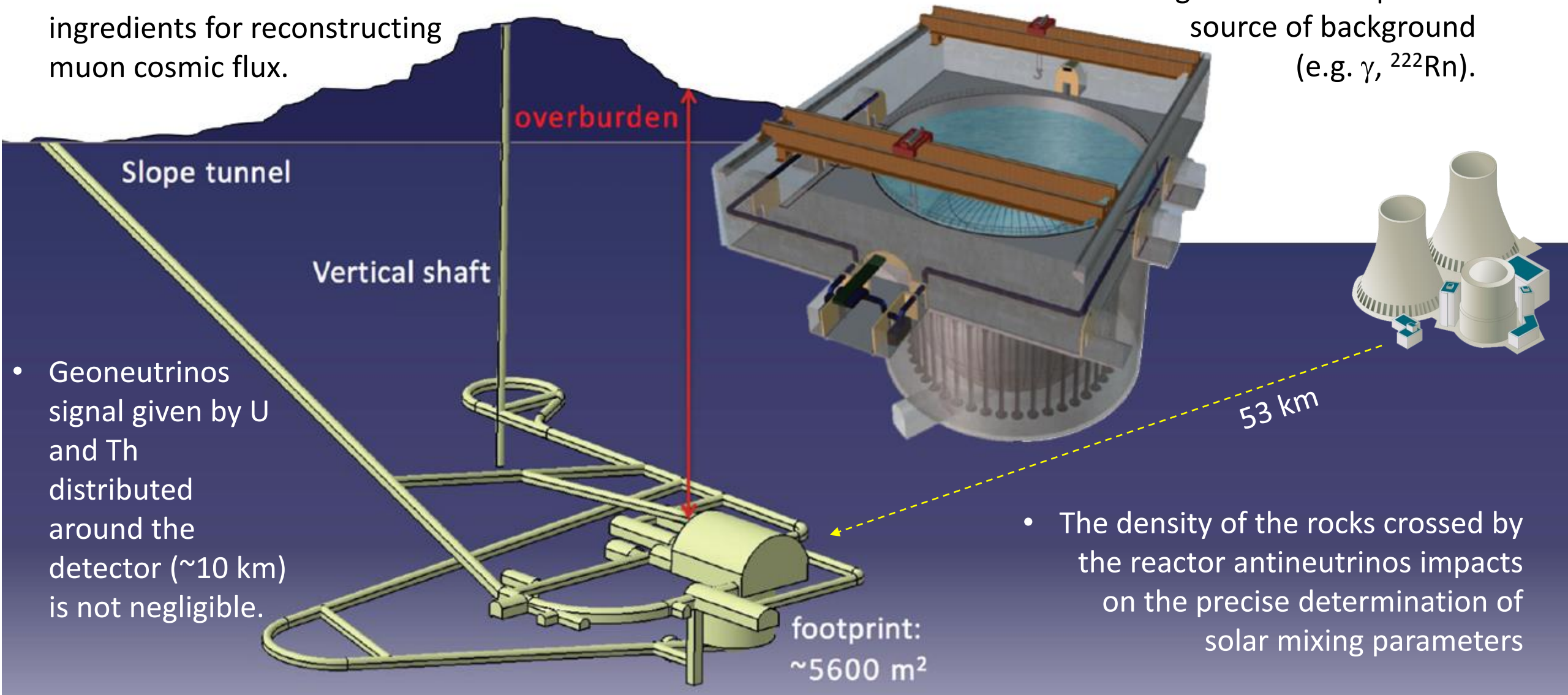
- Modelling geoneutrino signal expected in JUNO.



Why do we need to study rock around JUNO?

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

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



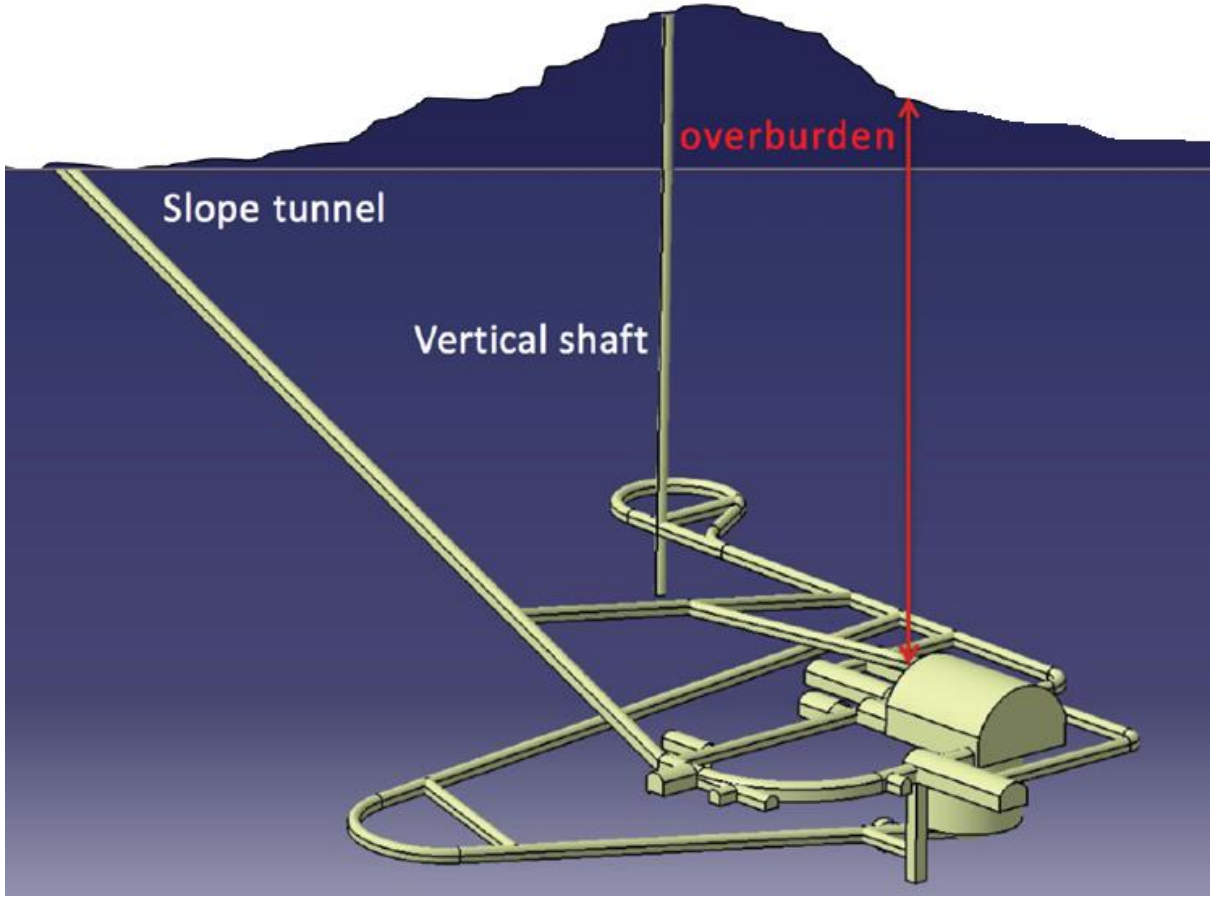
- Geoneutrinos signal given by U and Th distributed around the detector (~10 km) is not negligible.

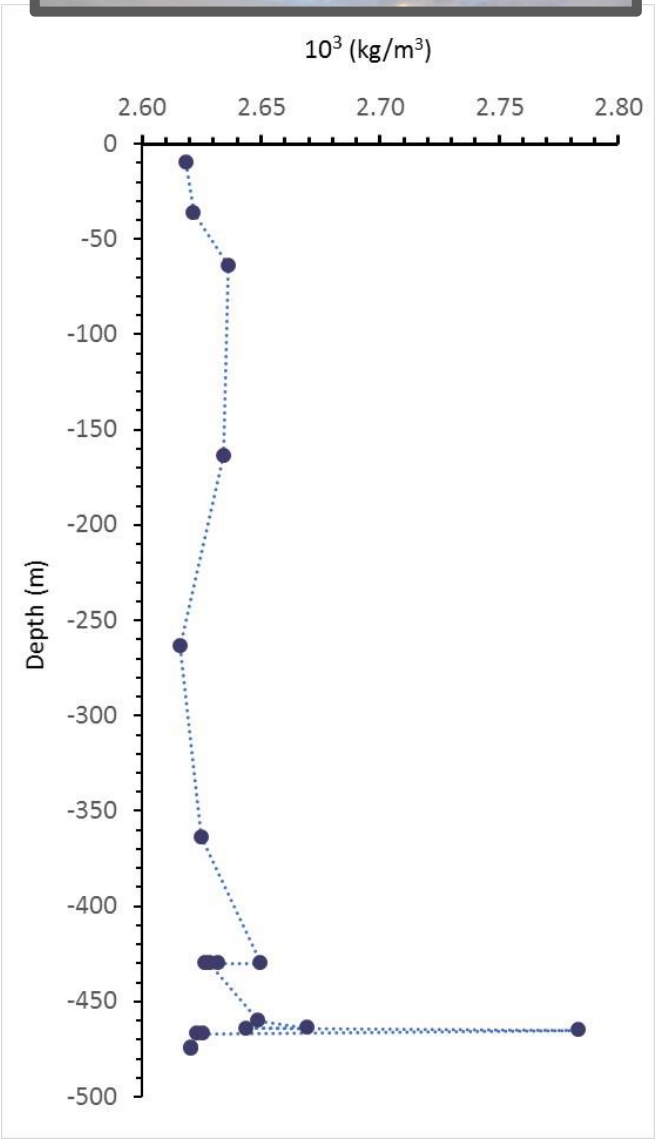
- The density of the rocks crossed by the reactor antineutrinos impacts on the precise determination of solar mixing parameters

Rock density around JUNO

Depth (m)	ρ 10^3 (kg/m^3)
10	2.6185
36	2.6218
64	2.6363
164	2.6344
264	2.6162
364	2.6251
430	2.6500
430	2.6319
430	2.6267
430	2.6284
460	2.6489
464	2.6695
464	2.6438
465	2.7832
467	2.6257
467	2.6233
474	2.6209
475	2.6205

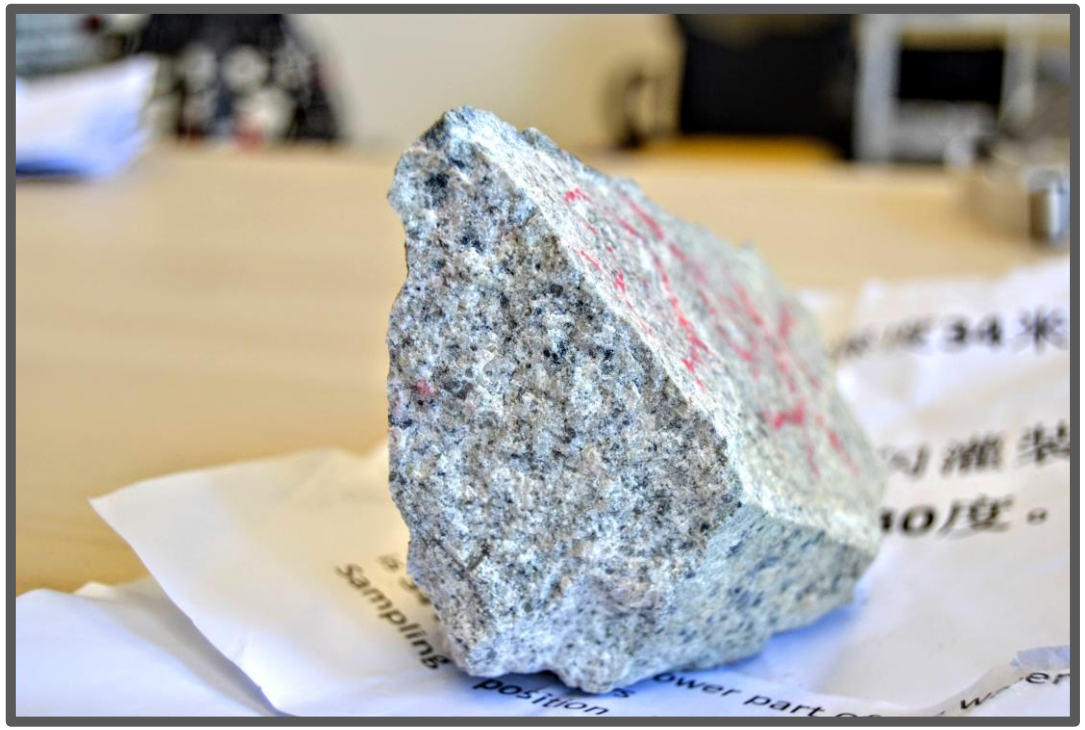
- Experimental relative uncertainty ~ 10^{-4}
- $\langle\rho\rangle = 2.6403 \pm 0.0382\ 10^3$ (kg/m^3)
- Std. dev. ~ 1.4% -> homogeneity



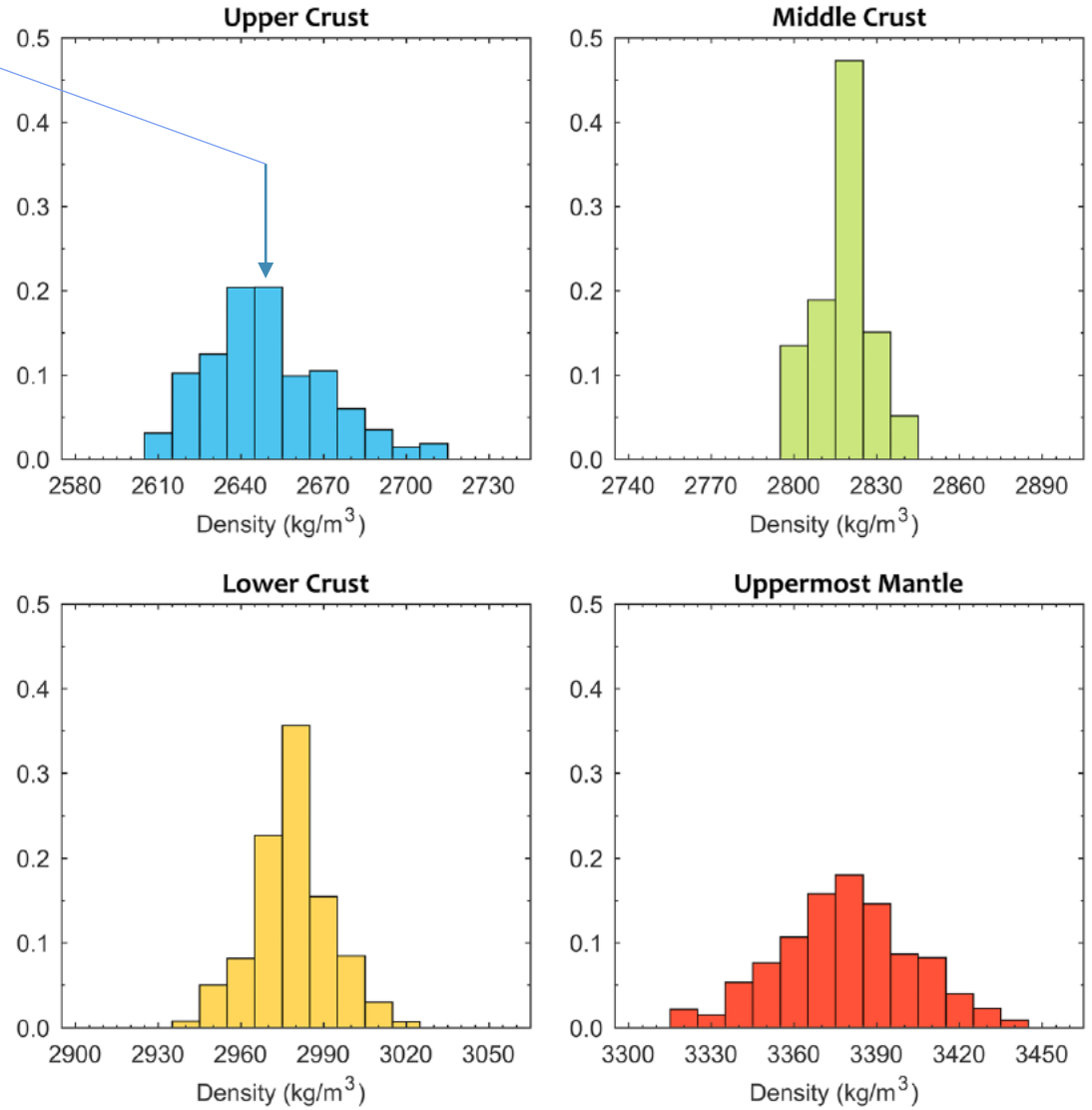


Excellent agreement between measured and modeled density values

$\langle\rho\rangle = 2.6403 \pm 0.0382\ 10^3\ (kg/m^3)$



Frequency distributions of crustal density values calculated in GIGJ model*



JGR Solid Earth*

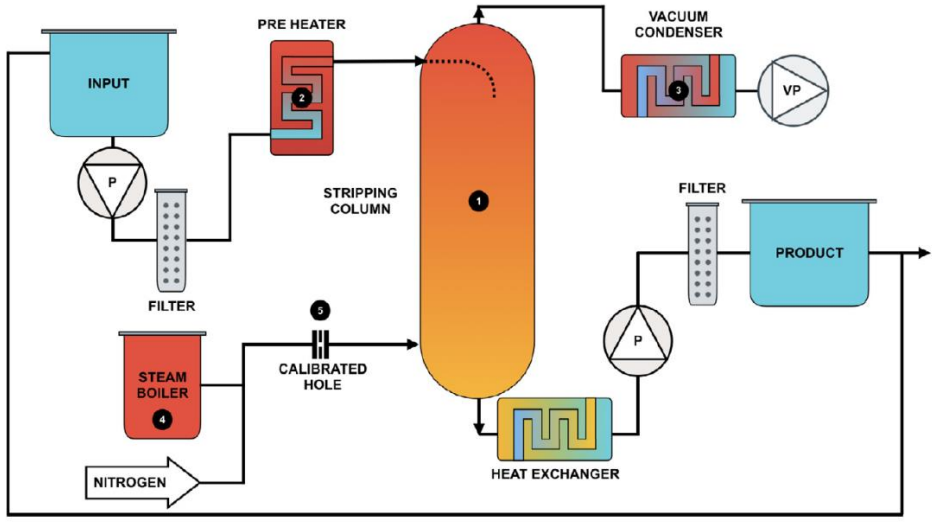
AGU100 ADVANCING EARTH AND SPACE SCIENCE

RESEARCH ARTICLE
10.1029/2018JB016681

GIGJ: A Crustal Gravity Model of the Guangdong Province for Predicting the Geoneutrino Signal at the JUNO Experiment

Distillation and stripping plants for JUNO

- One of the signal background for the JUNO experiment will be the radio impurities contained in the Liquid Scintillator.
- The main purification technique used to remove the heaviest radio-impurities (U, Th, K) is the distillation while gaseous radio-impurities (Ar, Kr, Rn) are reduced with the steam stripping.
- The Ferrara team contributed to design, realize and test the distillation and stripping plants for JUNO



JUNO @ Ferrara 2022








GRAZIE!

PRELIMINARY

Previsioni di spesa (k€)	
Missioni	**25**
Inventario	**32**
Consumi	**5**

Persone		
Cognome	**Nome**	**FTE**
Montuschi	Michele	1.0
Strati	Virginia	0.8
Serafini	Andrea	1.0
Mantovani	Fabio	0.8
Ricci	Barbara	0.6
Fiorentini	Giovanni	0.0
Alberi	Matteo	1.0
Totale		**5.2**