



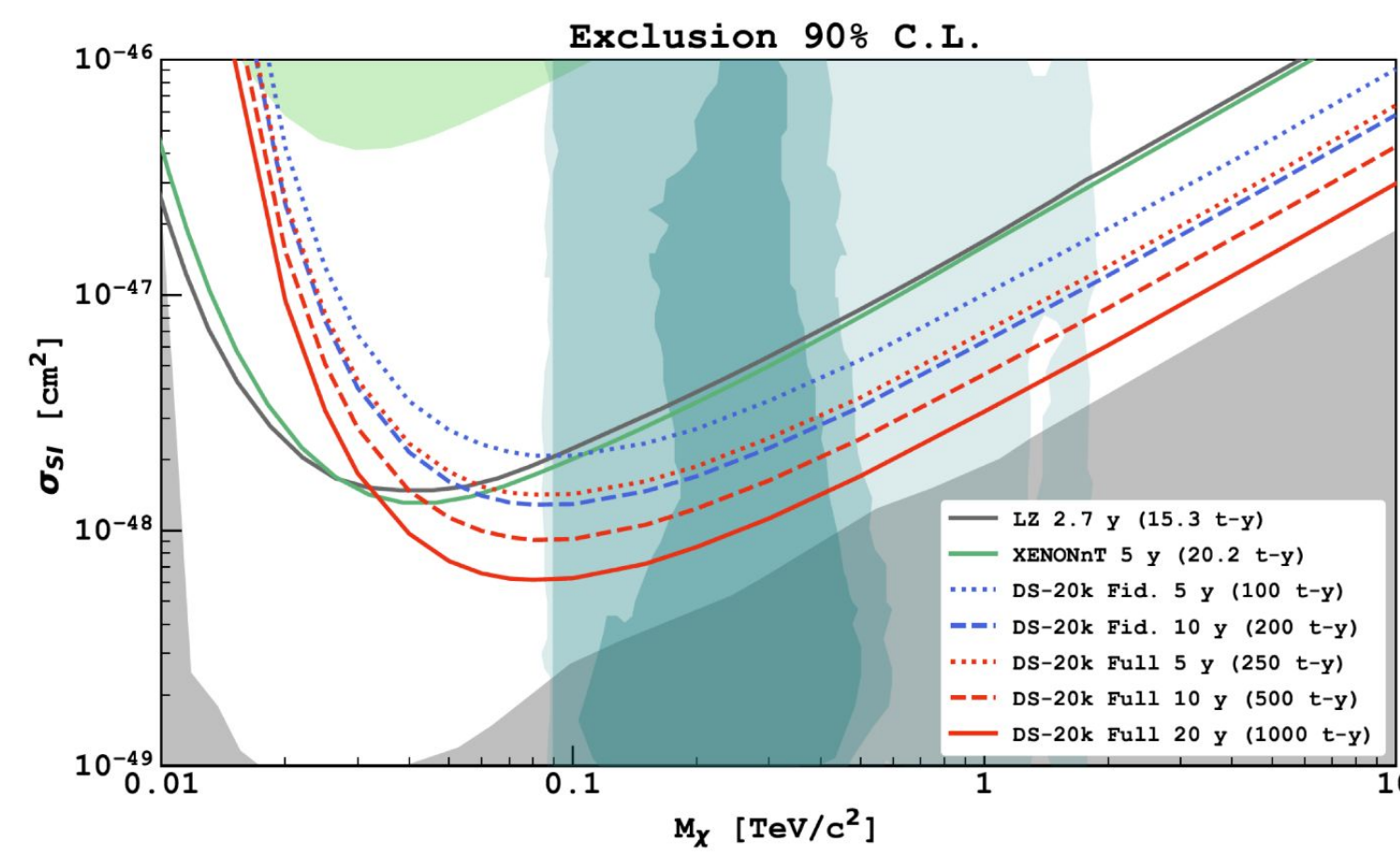
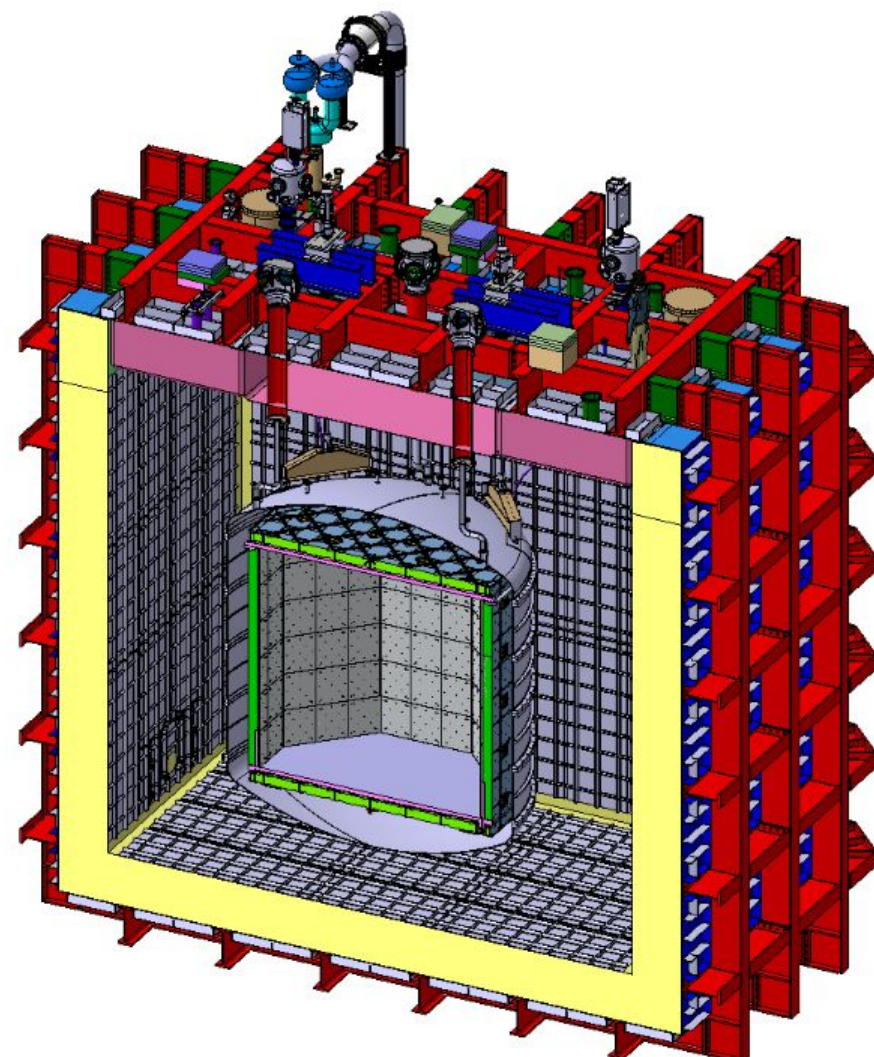
Cosmogenic Activation Calculation of experiments using LAr as the target

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On behalf of the DarkSide-20k Collaboration



DarkSide-20k (DS-20k)

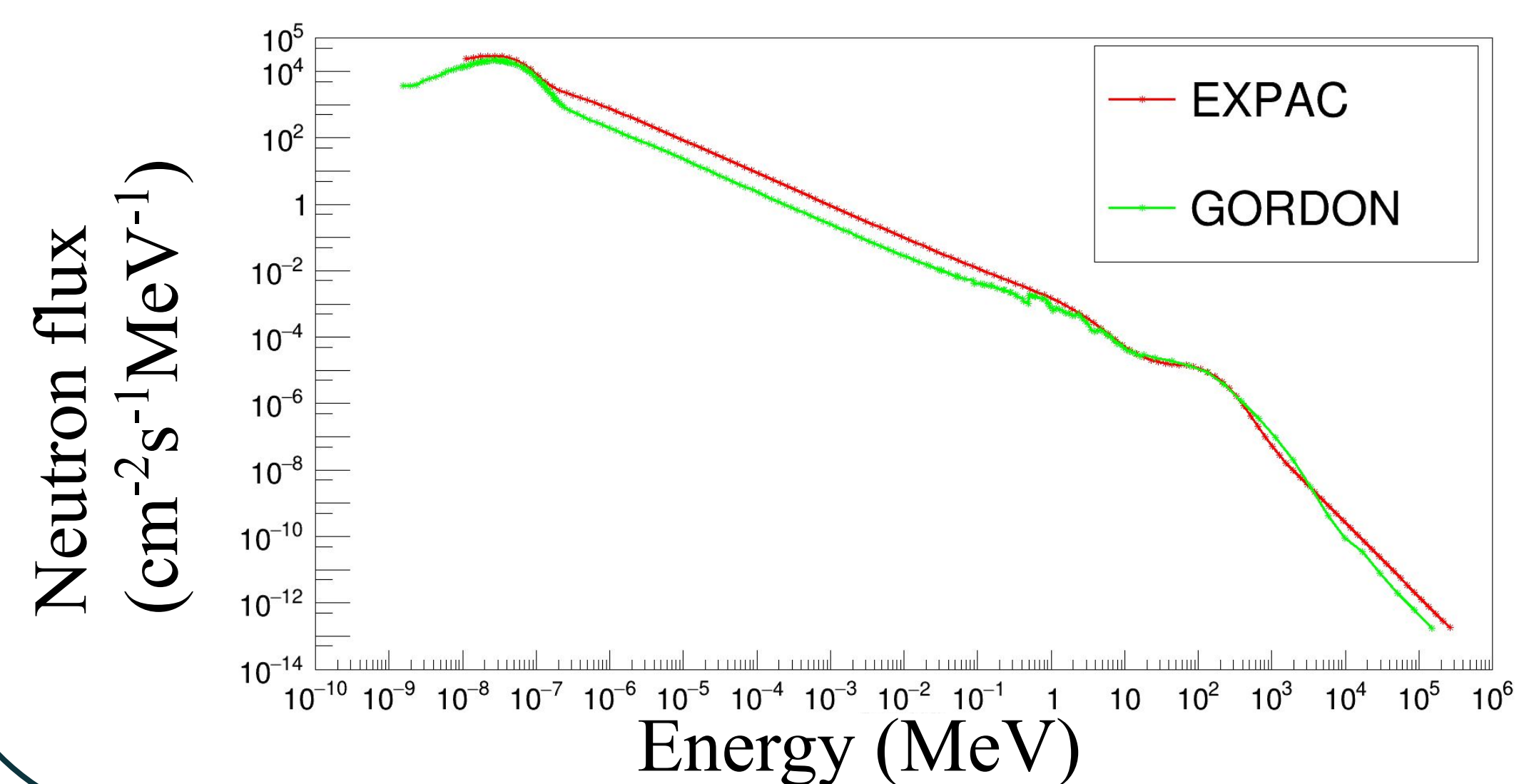


Dual-phase TPC filled with 50 tons of underground Argon (UAr).
Extremely low levels of ³⁹Ar radioactivity in UAr compared to AAr.

Flux Libraries

EXPAC Simulation → n,p,γ
Gordon Model → n

Altitude=0 m
Latitude=42.28°N
Longitude=48.18°W
Date: 14/01/2015



Outline of the study

Estimation of ³⁷Ar and ³H activation yields.

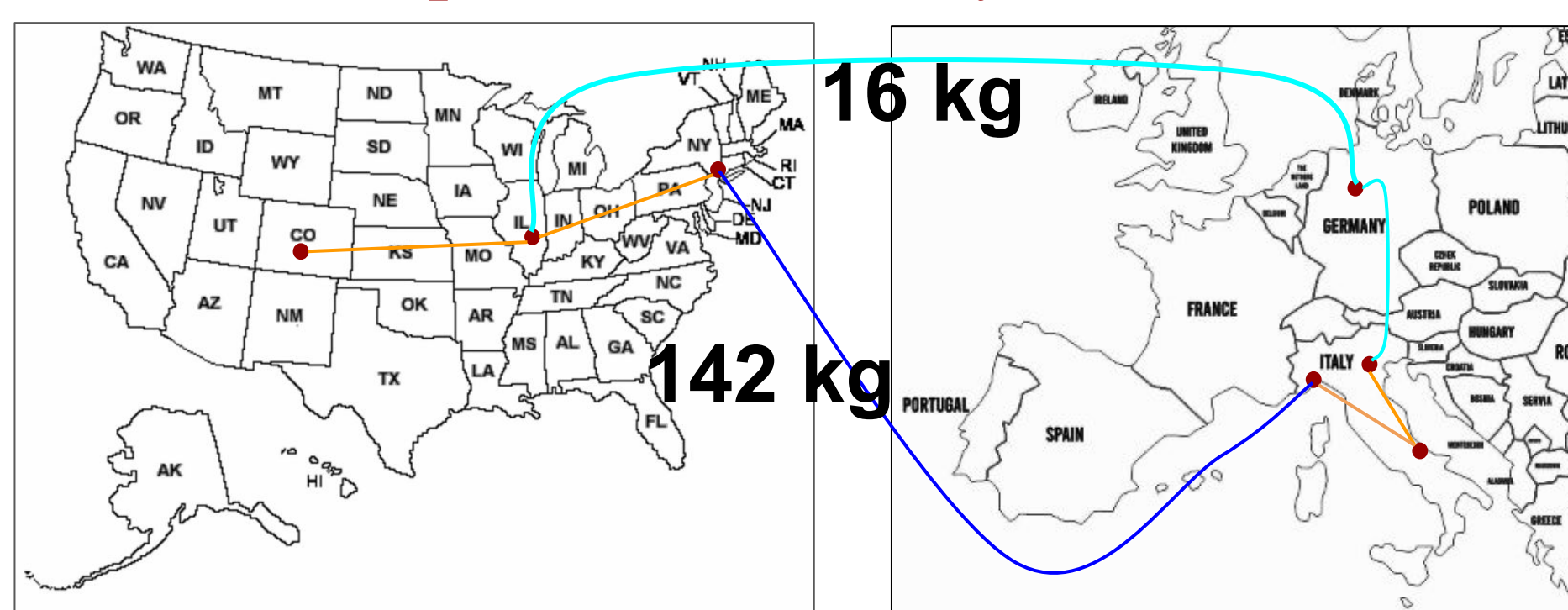
- Backgrounds**
- ³⁷Ar- e⁻ capture on K (2.83 keV) & L1 (0.28 keV).
 - ³H- β emission (18.59 keV)

Validation with DS-50 data

Main Goal

Prediction of DS-20k activation yields.

DS-50 UAr was transported in two ways from Colorado to LNGS

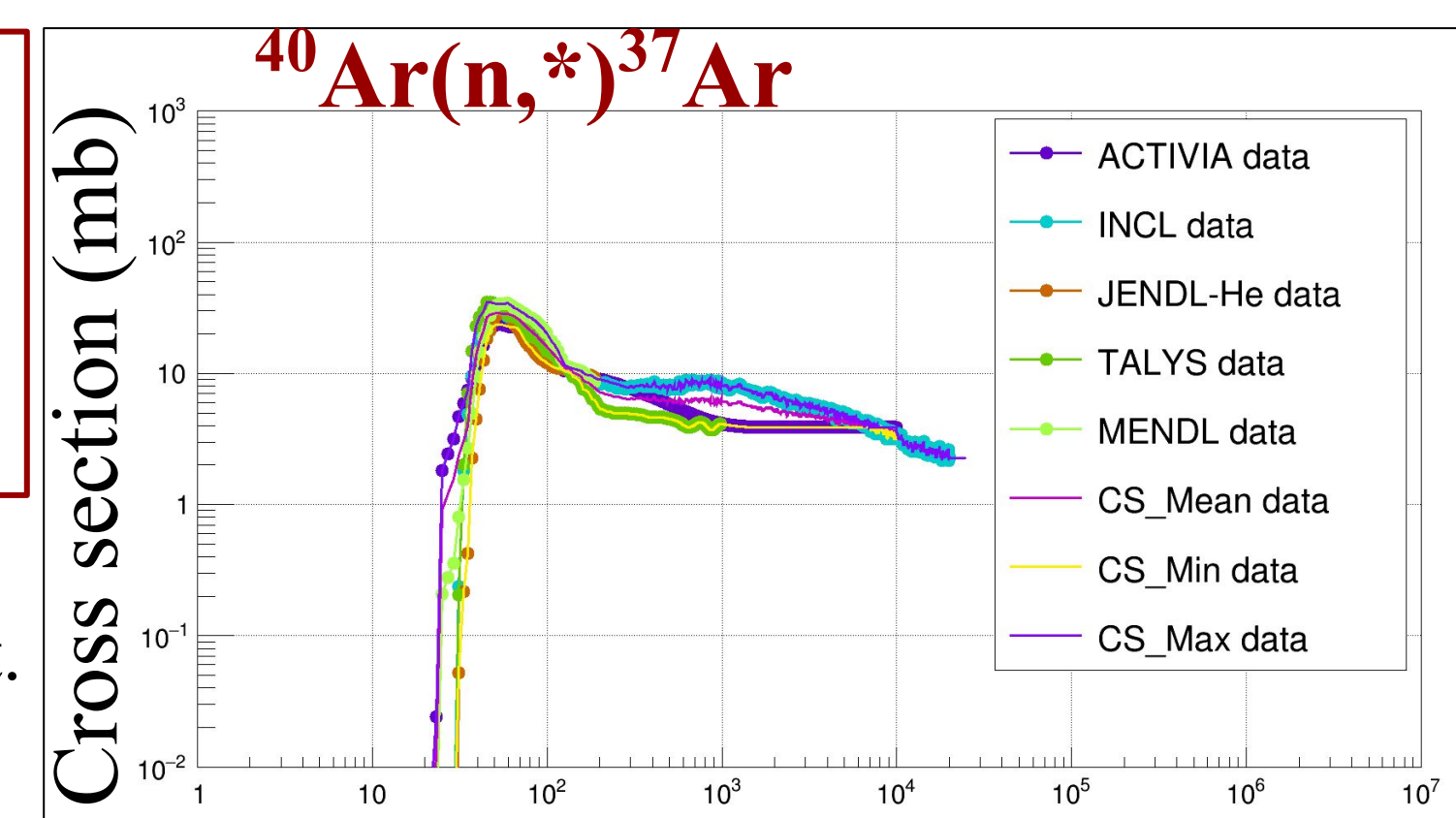


Sketch of the UAr transportation path

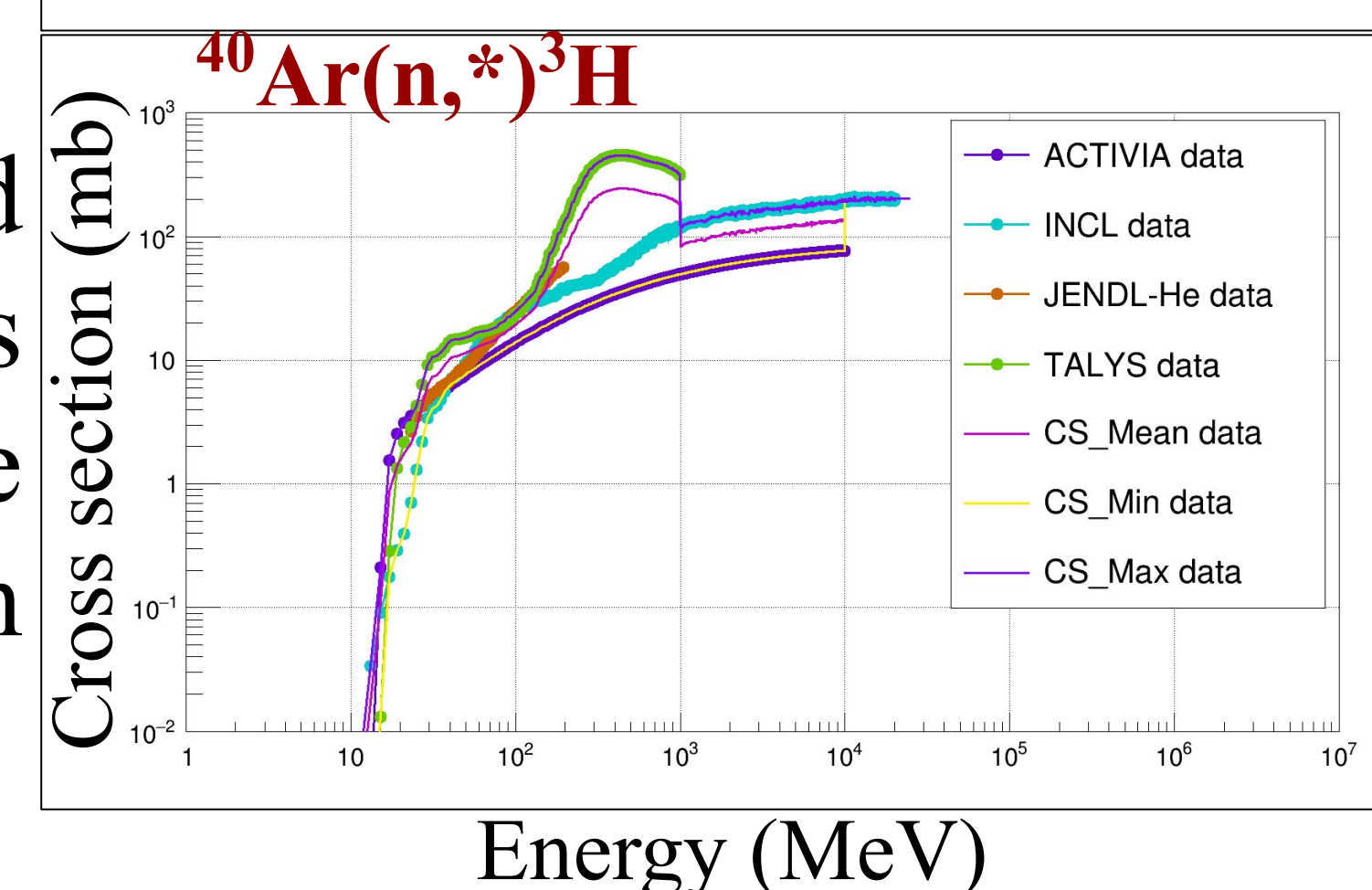
Cross section Libraries

Projectiles: n,p,γ
Target : Stable Ar isotopes

Cross section_{Uncert.}



Maximum and minimum values of the available cross section in that energy range.



Activation & Induced Activity

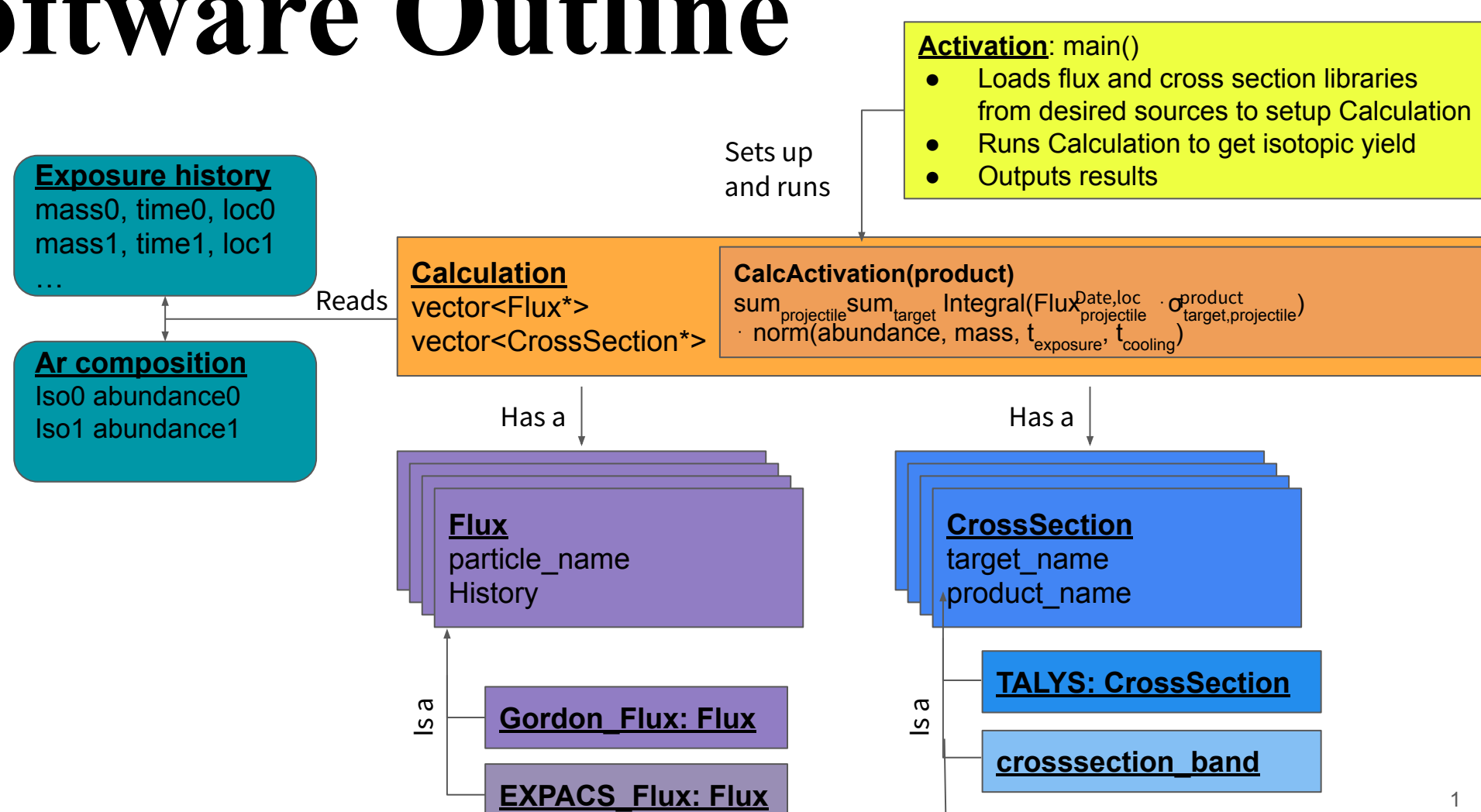
$$R = N_{Ar} \int f(E) \cdot \sigma(E) dE$$

$$IA = R(1 - e^{-\lambda t_{exp}}) e^{-\lambda t_{cool}}$$

t_{exp} : exposure time

t_{cool} : cooling time

Software Outline



Conclusions

Total Induced Activity PRELIMINARY RESULTS

	UAr transported via Flight	UAr transported via Overseas
³⁷ Ar	1.7 ^{+0.38} _{-0.4} mBq/kg	0.26 ^{+0.09} _{-0.09} mBq/kg
³ H	0.14 ^{+0.11} _{-0.11} mBq/kg	0.46 ^{+0.32} _{-0.34} mBq/kg

The half life of ³⁷Ar is shorter than the exposure time at overseas level. Therefore, the induced activity of ³⁷Ar at the flight level is greater than that of the overseas level.

The software can perform ³⁷Ar calculations. Include ³⁹Ar and ⁴²Ar cross-sections in the package.
Next steps → Validate the results with DS-50 data with ³⁷Ar (Blind Analysis).
Predict the cosmogenic activation of DS-20k.