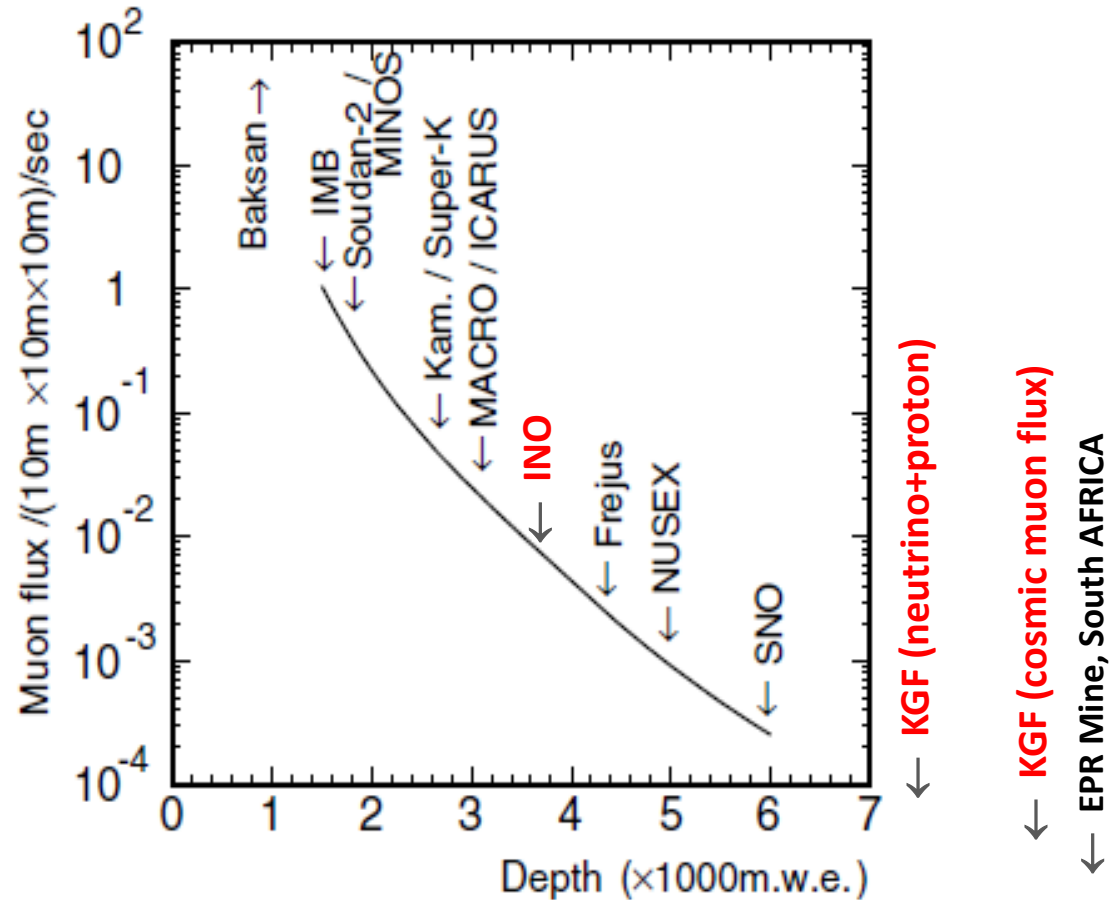
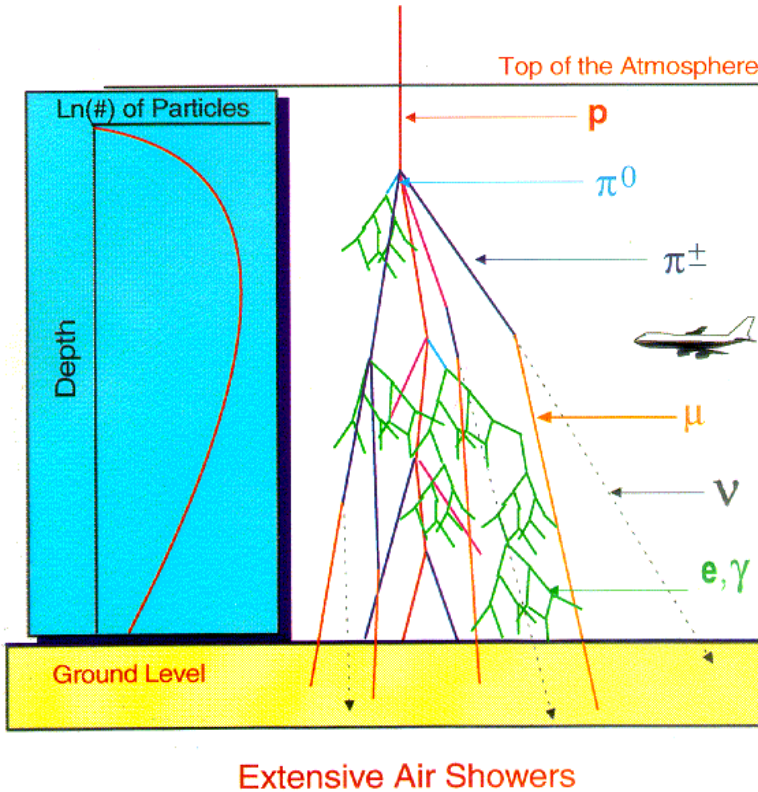


# Cosmic muon and cosmogenic background and Underground lab



The rate of the atmospheric **neutrino** interactions is about  **$200 \text{ kt}^{-1} \text{ year}^{-1}$** .

Rate at the surface due to **cosmic ray particles** is very frequent, namely  **$\sim 200 \text{ m}^{-2} \text{ s}^{-1}$** ,

**Deepest experimental halls :**

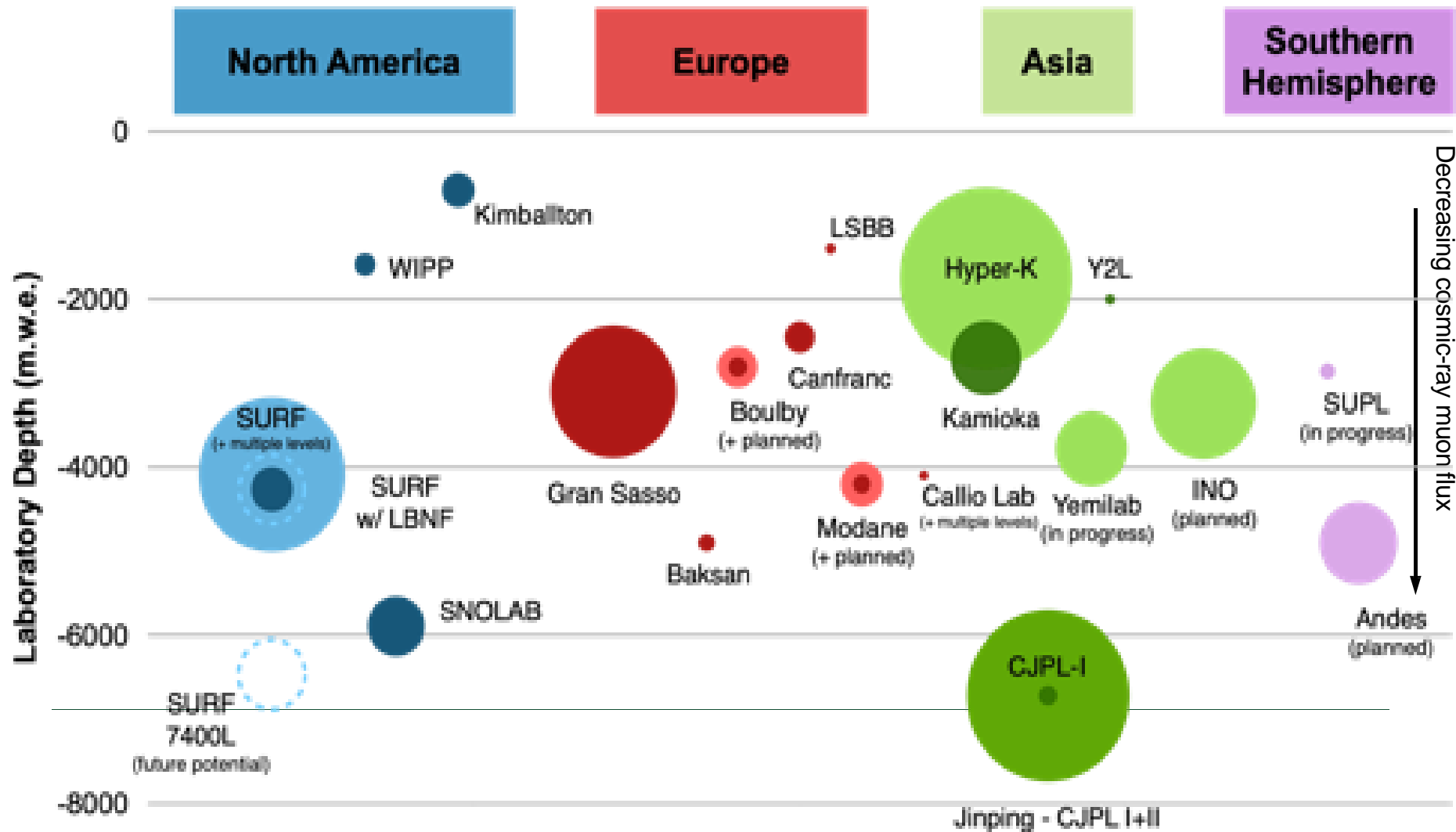
**EPR Mine in South Africa : 8800 m.w.e**

**KGF : Deepest : 8400m.w.e (whereas neutrino discovery at 7500m.w.e)**

# Underground facilities

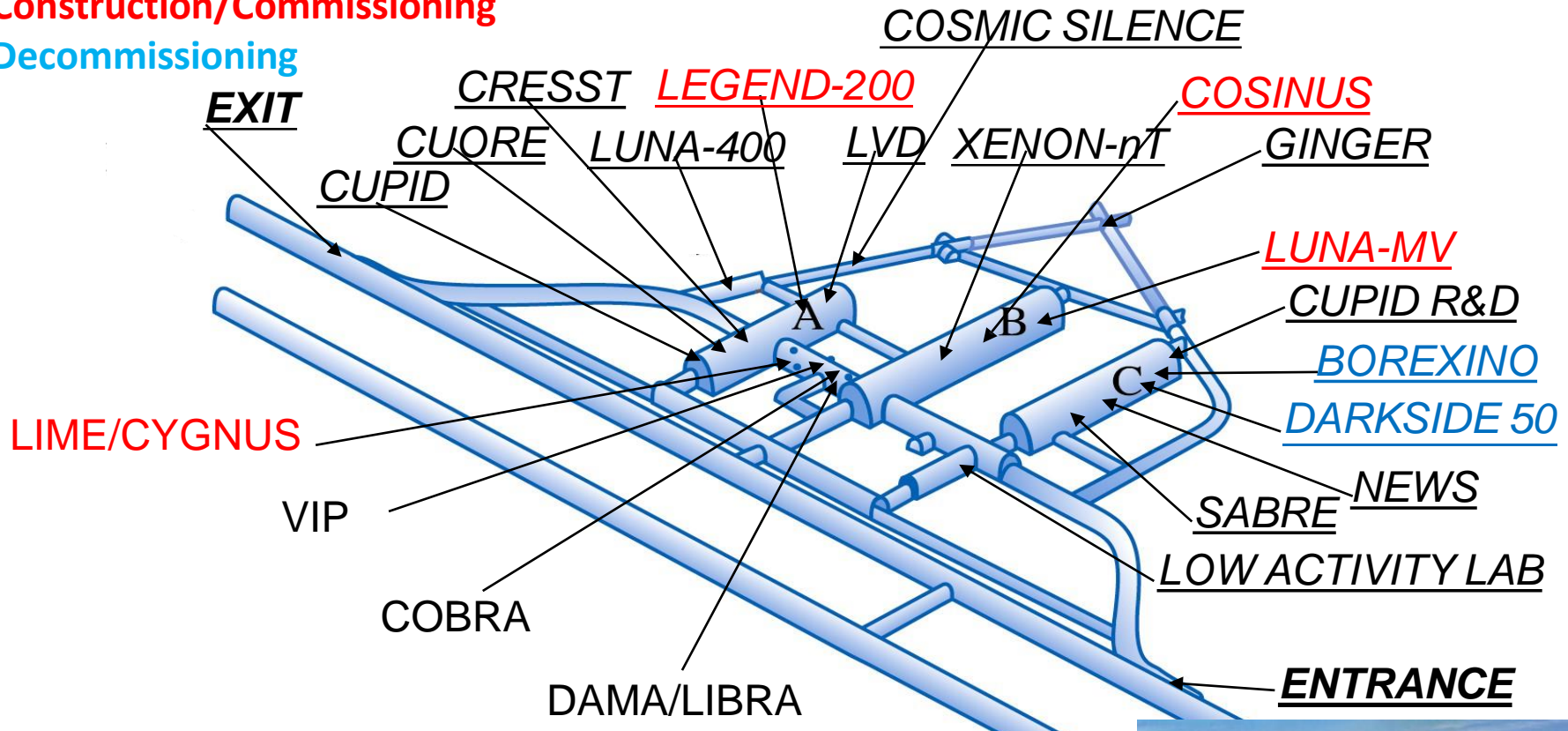
- **UG Facilities serve a diverse community e.g., Neutrino, dark matter, astroparticle, .....**
- **UG Facilities can provide:**
  - **Overburden protection from cosmic-ray muons**
  - **Local radiation shielding**
  - **Material screening**
  - **UG material production or purification**
  - **Environmental control**
  - **Implementation and operations support**

# Underground Facilities : Present and future



# Gran Sasso Deep Underground Laboratory

- Running
- Construction/Commissioning
- Decommissioning



Shielded by 1400 m (3800 m.w.e.) of rock ( Gran Sasso Mountain)

**Total Muon flux  $3 \times 10^{-8} \text{cm}^{-2} \text{s}^{-1}$**

Easy access directly from the A24 highway

3 main experimental halls 100 m long, 20 m width and 18 m height

**Many small tunnels for lab facilities and small experiments**

There are 20 experiments in data taking or under construction



# Different experiments at LNGS

(Laboratori Nazionali del Gran Sasso)

- **Dark matter** : CRESST, XENON-nT, COCINUS, DARKSIDE, SARBE (NaI), DAMA/LIBRA, LIME/CYGNUS
- **NDBD** : CUPID, CUORE, COBRA, LEGEND, COBRA
- **Nuclear Astrophysics** : LUNA
- **Neutrino** : LVD, BOREXINO
- **COSMIC SILENCE** : “On the potential adaptive role of environmental background radiation”
- **GINGER** : Fifth force ?
- **VIP** : Violation of the Pauli Exclusion Principle