

Yemilab Facility Overview



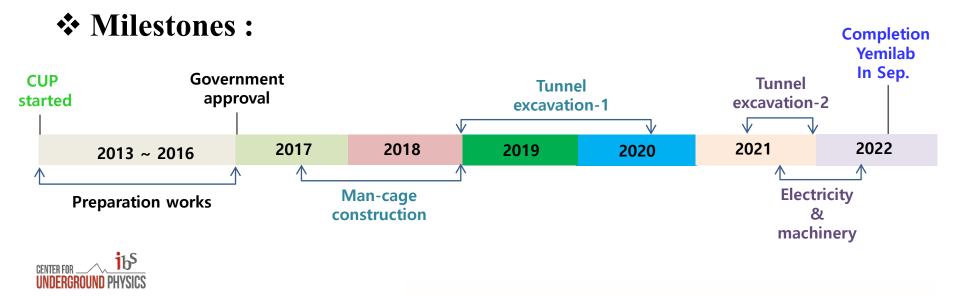
Kangsoon Park,
On behalf of Yemilab construction/operation team

The 1st Yemilab Mini Workshop @ High1 16~18 Oct. 2022

1. Yemilab, the new deep Underground Lab.

***** Motivation:

- For dark matter, neutrino experiments and other future experiments, we need much bigger new underground space than the Y2L(YangYang Lab.) space.
- The current Handeok mine(HD) site was found to be one of the best places to have the new UL.
- > The new underground laboratory is placed about 1,000m down in HD area



- > The only operating iron ore mine in Korea.
- ➤ A 600 m long 2nd shaft already constructed.
- > 0.7 million ton iron ores being produced per year

Handeok iron mine, Jeongseon, Gangwon, Korea



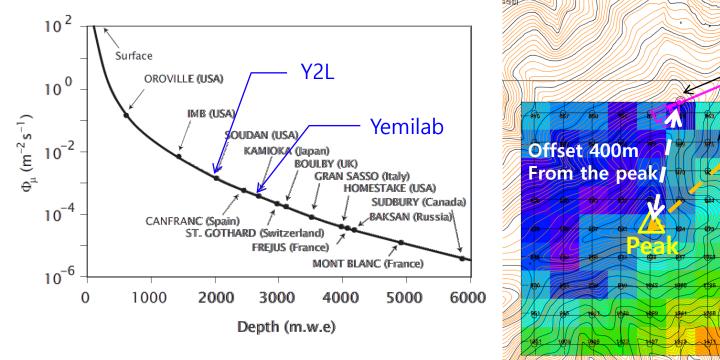
Bird view of Handeok Iron Mine

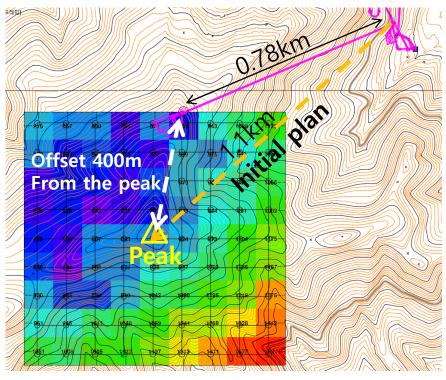


Handeok has two shafts for mining 1^{st} shaft ~ 300 m long(closed in 2019) 2^{nd} shaft 600 m long (NEW)

Muon reduction

Access tunnel for more overburden was shortened to 782m by a simulation study considering detail profile of the region

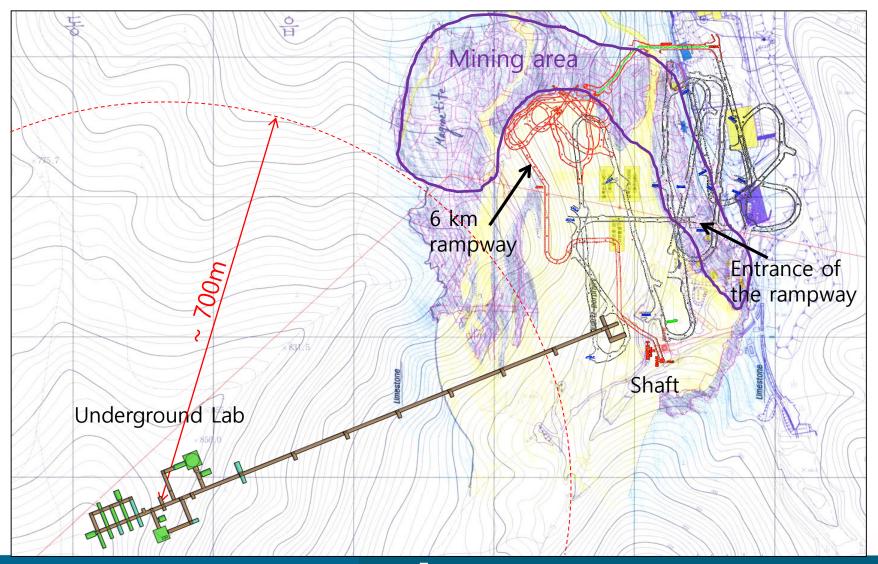




Muon reduction factor @ Yemilab by simulation $\sim 8 \times 10^{-6}$

* Independent operation from the mining activity

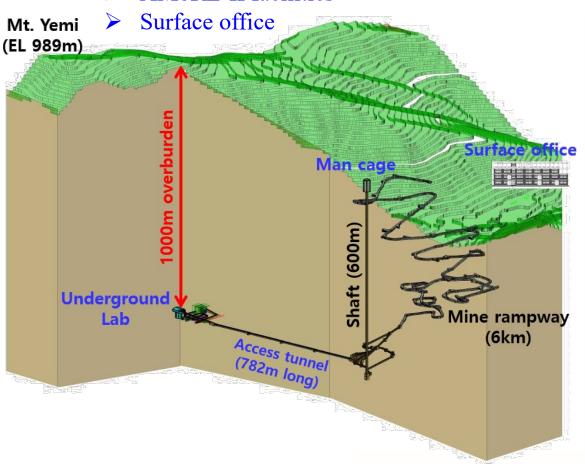
 \triangleright The UL is going to be located further away from the active mining area by ~ 700 m

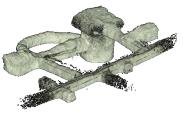


2. Which facilities we built

❖ 5 major sub-constructions

- > Tunnel excavation
- Man cage
- > Electrical/mechanical facilities
- ➤ AMoRE-II facilities





Tunnel Excavation



Man cage



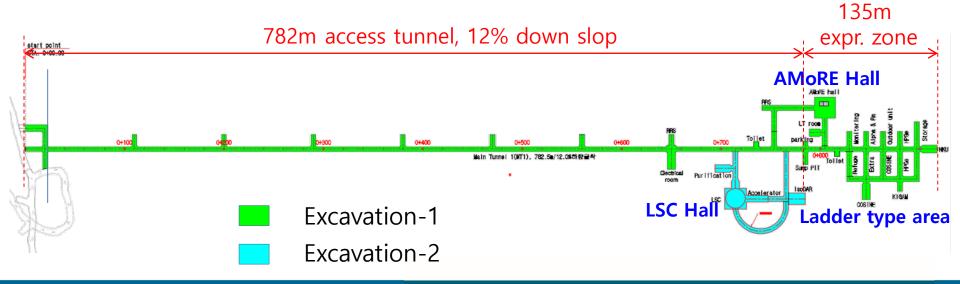
Electrical/mechanical facilities



Surface office

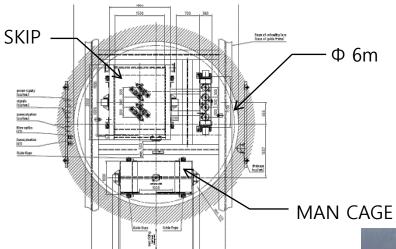
\Rightarrow Yemilab Constructions (2017.09 – 2022.09, 60 months)

- Yemilab construction had two steps
- ightharpoonup 1st construction (2017.09 2020.08)
 - Tunnel excavation: 70% of whole Yemilab volume
 - Building cage system
 - Purchase of surface office building
- \triangleright 2nd construction (2021.06 2022.09)
 - LSC tunnel excavation: 30% of whole Yemilab volume
 - Electricity, machinery, refuge, toilets
 - Hoist, detector room, clean rooms for AMoRE-II
 - Renovation of surface office

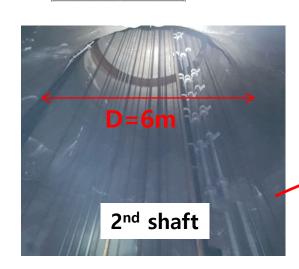


♦ Man-cage

Tow view of the shaft



- 2nd shaft will be main entrance to UL
- SIEMAG Tecberg(Germany) design
- 600 m moving distance
- 4 m/s cage speed → go down 600m in 2.5 minutes
- 1.5 ton payload
- Constructed by Handuk

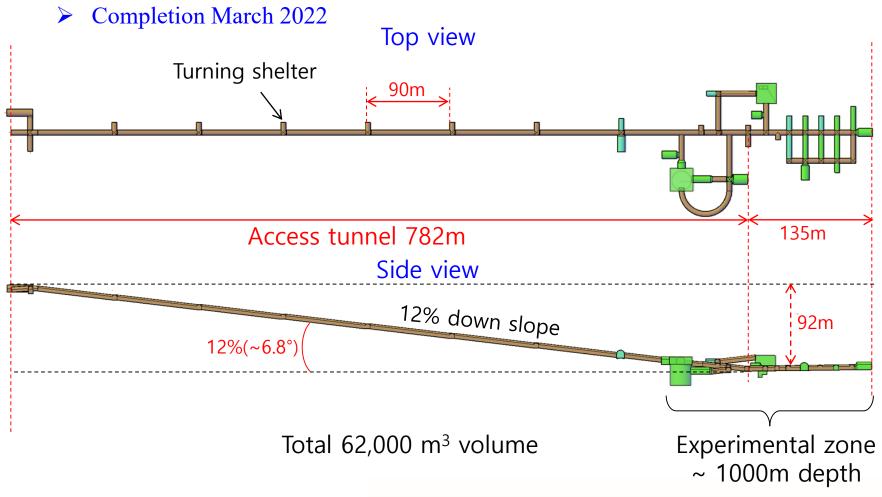






* Excavation

- ➤ Totally 62,000 m³ excavation
- > 3,000 m² area, 28,000 m³ volume for experiment only
- ➤ Independent 15 spaces for experiments, 7 spaces for operation (except turning shelter)



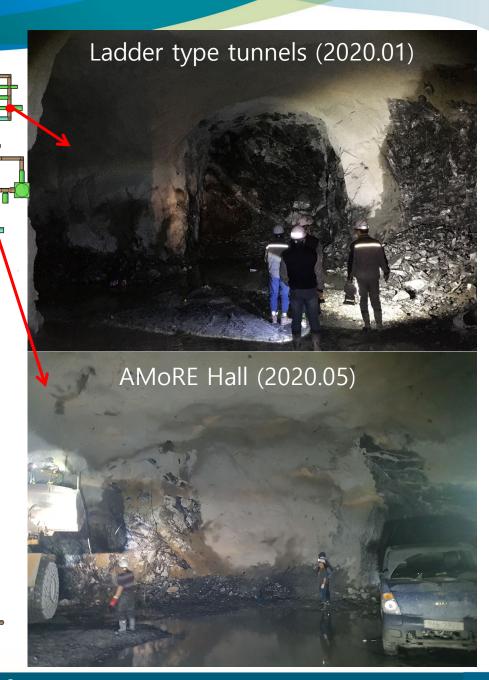
♦ Yemilab tunnels

• 3,000m² area & 27,796m³ volume for experiment only (green)

				Sį		s of tunnels	5				
spaces		Cross-section(m)								area	volume
		5(W)×5(H)	7(W)×7(H)	8(W)×8(H)	10(W)×12(H)	21(W)×16.4(H)	22(W)×8.0(H)	4.1(W)×7.3(H)	20.0(D)	(m^2)	(m³)
Access T/L		782.5								3,912.5	19,562.5
Ventilation T/L		19.3								96.5	482.5
Multi Purpose		15.0	28.0							271.0	1,747.0
Turning Shelter		72.0								360.0	1,800.0
Electrical room				18.0						144.0	1,152.0
RRS/UPS room		12.0								60.0	300.0
Toilet		10.0								50.0	250.0
Parking		8.0								40.0	200.0
Sump pit		13.0								65.0	325.0
Main hallway		215.0								1,075.0	5,375.0
Monitor room		15.0								75.0	375.0
Refuge		25.0								125.0	625.0
Alpha & Rn		15.0								75.0	375.0
Spare		25.0								125.0	625.0
COSINE		25.0		15.0						245.0	1,585.0
Outdoor unit		15.0								75.0	375.0
HPGe		40.0								200.0	1,000.0
KIGAM		10.0								50.0	250.0
Storage		25.0								125.0	625.0
Test/KNU				15.0						120.0	600.0
AMoRE	Hall					21.0				441.0	7,232.4
	LT			10.0						80.0	640.0
	Pit							9.6			192.0
	RRS	10.0								50.0	250.0
	AMoRE Access	108.0								540.0	2,700.0
LSC	Purification			18.0						144.0	1,152.0
	Upper Dome						22.0			484.0	3,872.0
	Pit								20.0		6,280.0
	Accelerator		22.0							154.0	1,078.0
	IsoDAR				17.0					170.0	2,040.0
	LSC Access	174.0								870.0	4,350.0
Amount		1,244.8	28.0	76.0		21.0	22.0	9.6	20.0	7,953	62,040
					11						

Construction progress









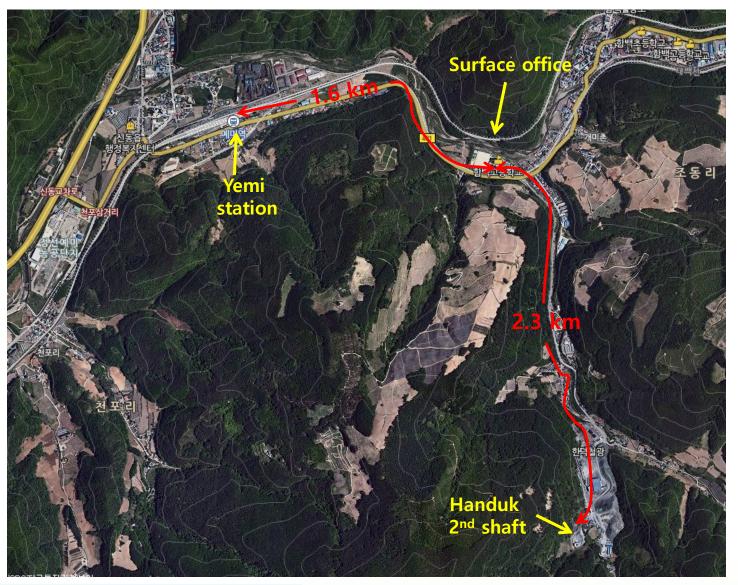






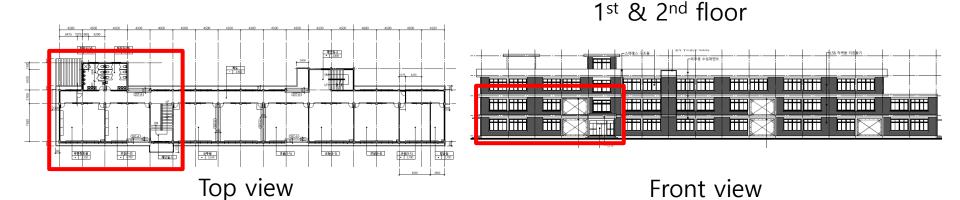
Surface Office(Closed school)

> Site of the surface office



Surface Office(Closed school)

- Renovation was done last Sep.
- 128m²[8m(W)x16m(L)], 3.2m(H) laboratory, 1 office (1F)
- 3 offices and 1 meeting room (2F), about 20 people can be contained





3. Electricity, Machinery and Others

> Electrical Power

- Enough power, 2,000kW for only underground
- About 200kW cooling power, need more? more can be assigned
- 180kW UPS for 40 minutes for operation & AMoRE-II
- 360kW diesel generator against power outage (@ ground)
- But more distribution cables need to be

Mechanical equipment

- Basically 100,000 class fresh air suppling to each room
- 39,000 m3/hr fresh air supply for 8 changes per day
- Especially 750 changes per day for outdoor unit room
- Automatic pumping system for draining u-water about 4 tons/day

> Communication facilities

- For cell phone, KT service is only, others(SK & U+) are coming soon
- 48 optical cores are running to experimental zone

> Fire protection systems

- Smoke detectors & flame detectors
- Six 4K zoom cameras for watching access tunnel
- Many fire extinguishers placement around whole region
- Refuge for 40 people, 72 hours

Underground transportation

- One 8-seater electric vehicle is operated, 2 more coming next year
- One electric fork-lift(2.5ton), aerial work platform
- Car washing system will be built



4. Summary

• 60 months Yemilab constructions are done

- \triangleright The constructions have been done for last 5 years (2017.09 2022.09)
- ➤ Now we have 3,000 m² of experiment dedicated area in 1,000 m underground
- ➤ But still we have a lot of thing to do, maybe it takes next 5 years
- From the end of Oct., the stage of Yemilab is going to be changed as operation

Ground office

- ➤ 1 office, 1 laboratory (1F) and 3 offices, 1 meeting room (2F)
- ➤ Lot of storage space

CUP town (IBS Sindong residence)

- > 7 houses are ready among 12
- ➤ 4 houses are opened to short-term business trippers
- Remaining 5 will be ready by Dec.



