

Cryogenics Installation plans and requirements

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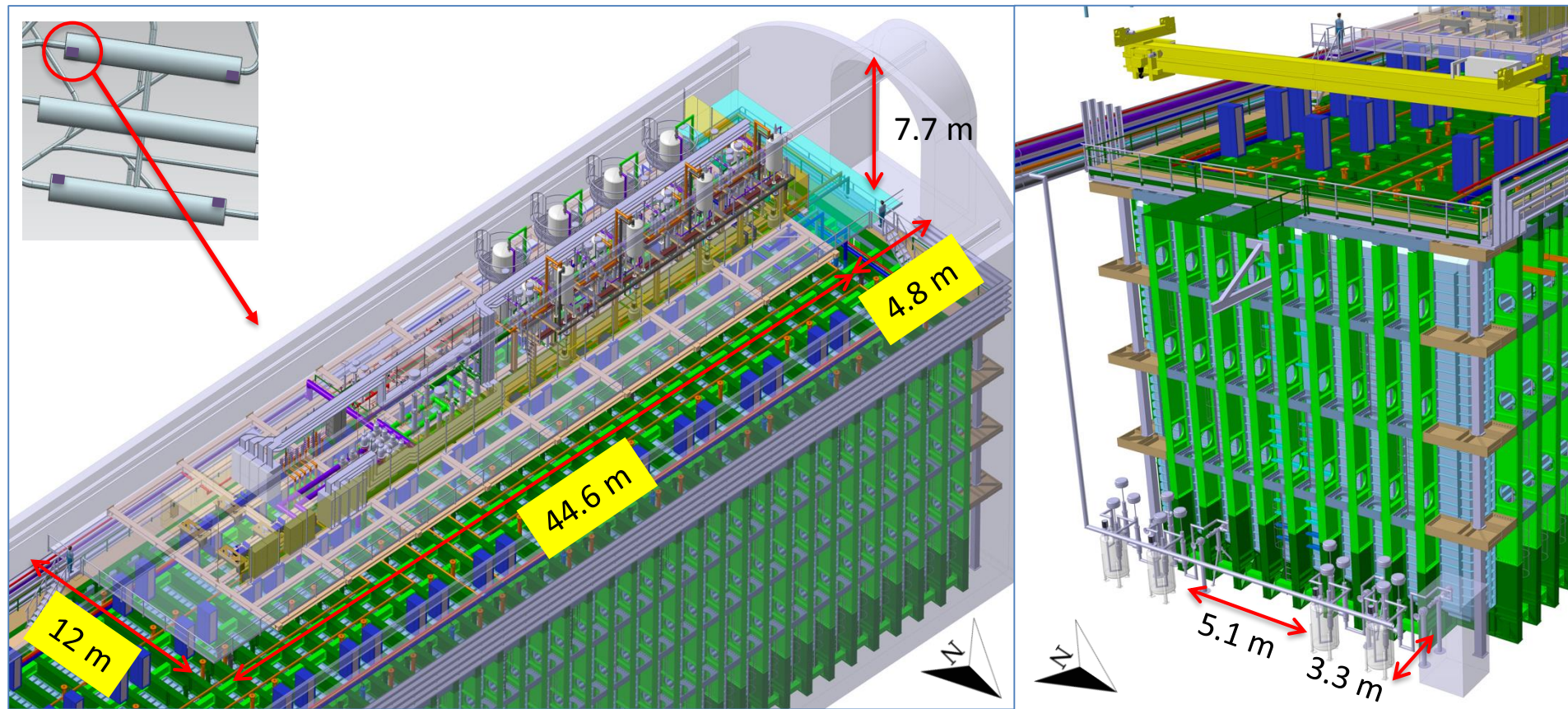
LBNF @CERN

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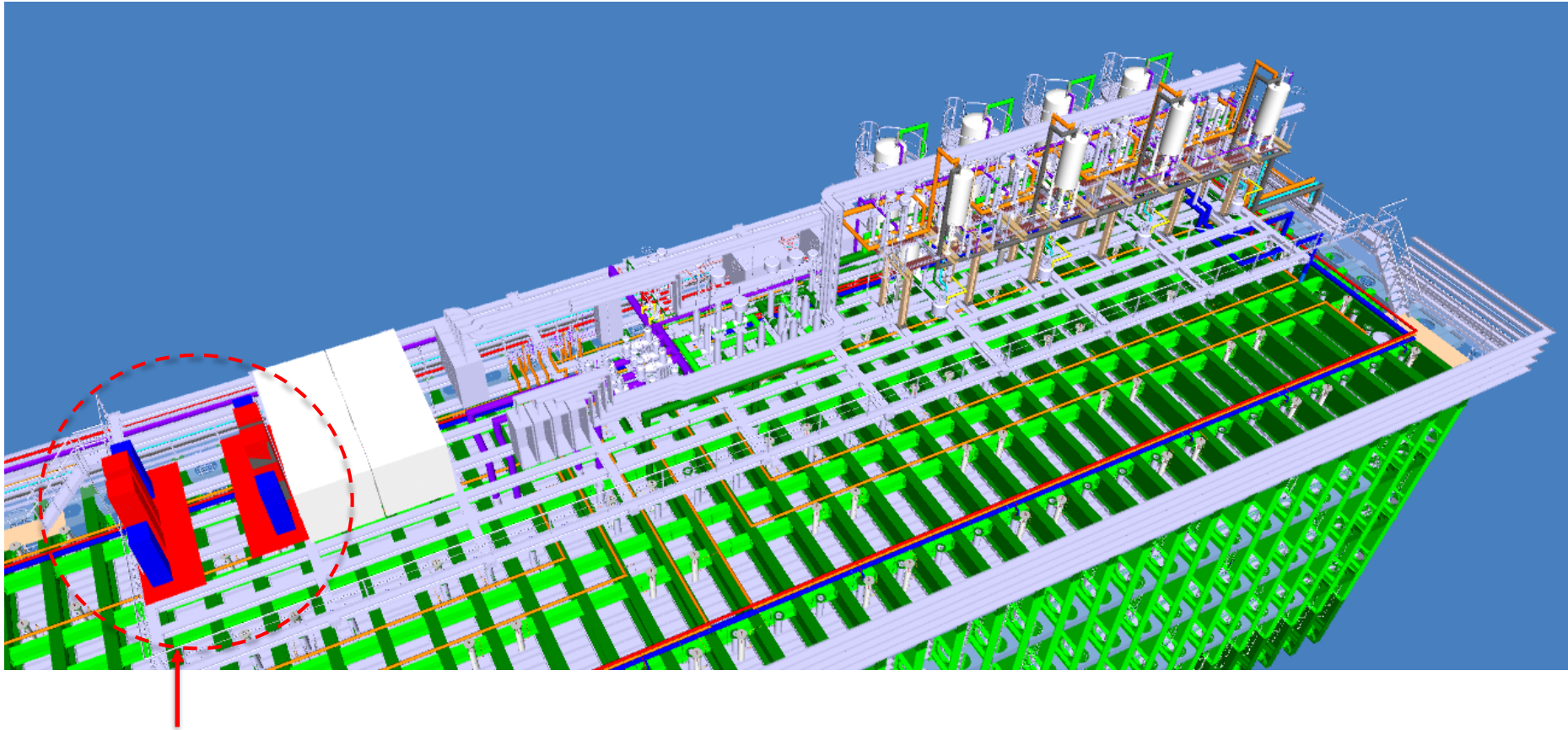
Intro

- Info provided is best guess as of today.
- No detailed study of installation performed to date.
- Personnel estimates do not include LBNF oversight personnel (that needs to be added).
- Actual installation sequence and requirements to be provided by installation company.

Proximity Cryogenics in Detector Cavern



Proximity Cryogenics on Mezzanine

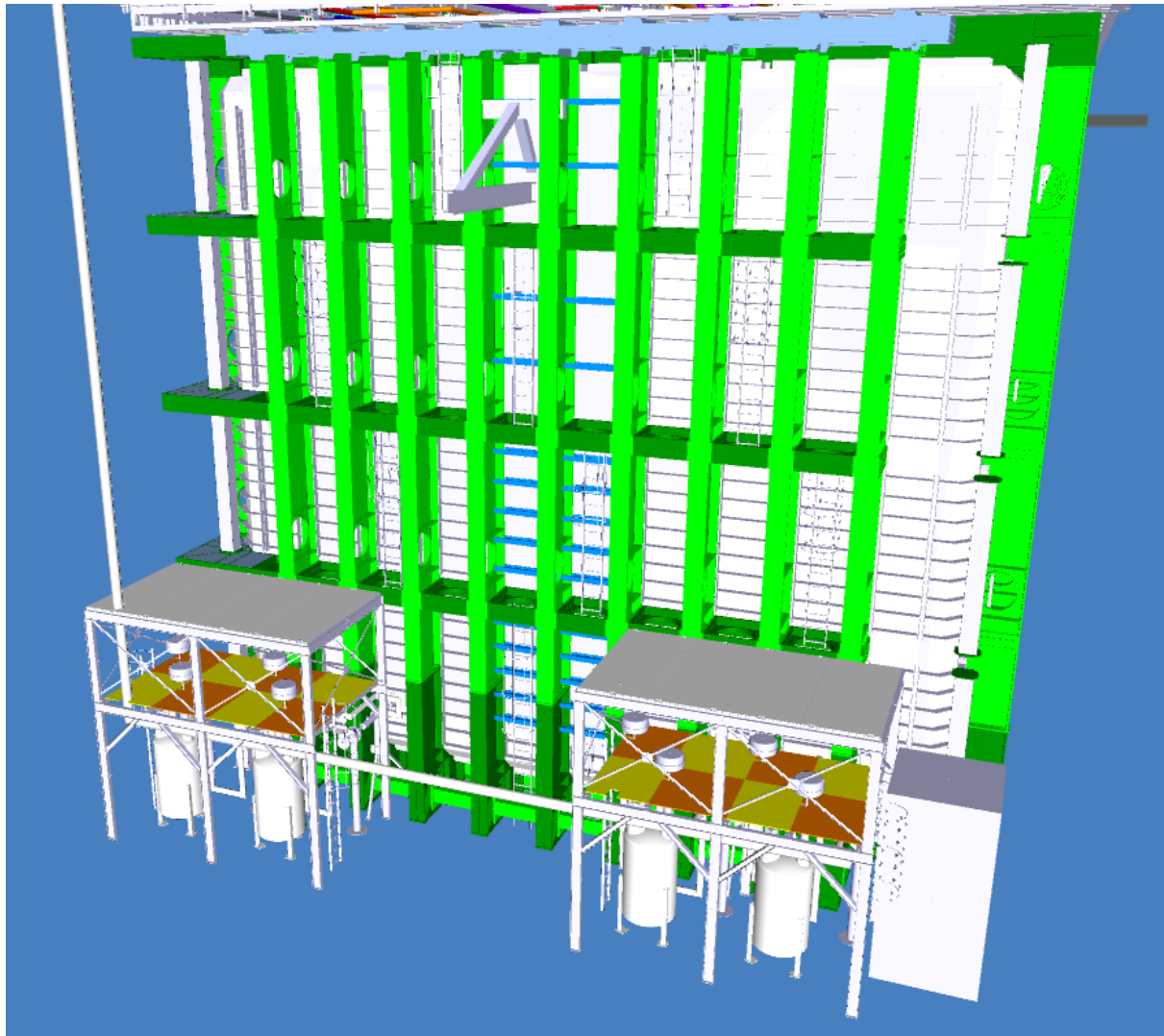


DUNE Scope

Proximity Cryogenics on Mezzanine

- Excludes the DUNE power racks.
- Lifting device(s) and lifting eyes on crown of cavern.
- Material handling.
- Survey.
- Power outlets for welding machines/power tools/etc. per requirements.
- Welding Argon gas.
- Personnel estimate: 10 tech/welders.
- Ventilation.
- Lighting.
- Compressed air per requirements.
- Power/Hand tools and welding machines to be supplied by contractor.
- Operations:
 - Survey and Lift.
 - Fit up and weld
 - Grind and polish.
 - Field adjustments as needed.
 - Run compressed air lines to valves.
 - Wire instruments, valves, etc.
 - Install PLC racks.
 - Install vessels support structures and platforms.

LAr Pumps, Protego and Protection



Inline safety valve (Protego) in NP-04 cryostat



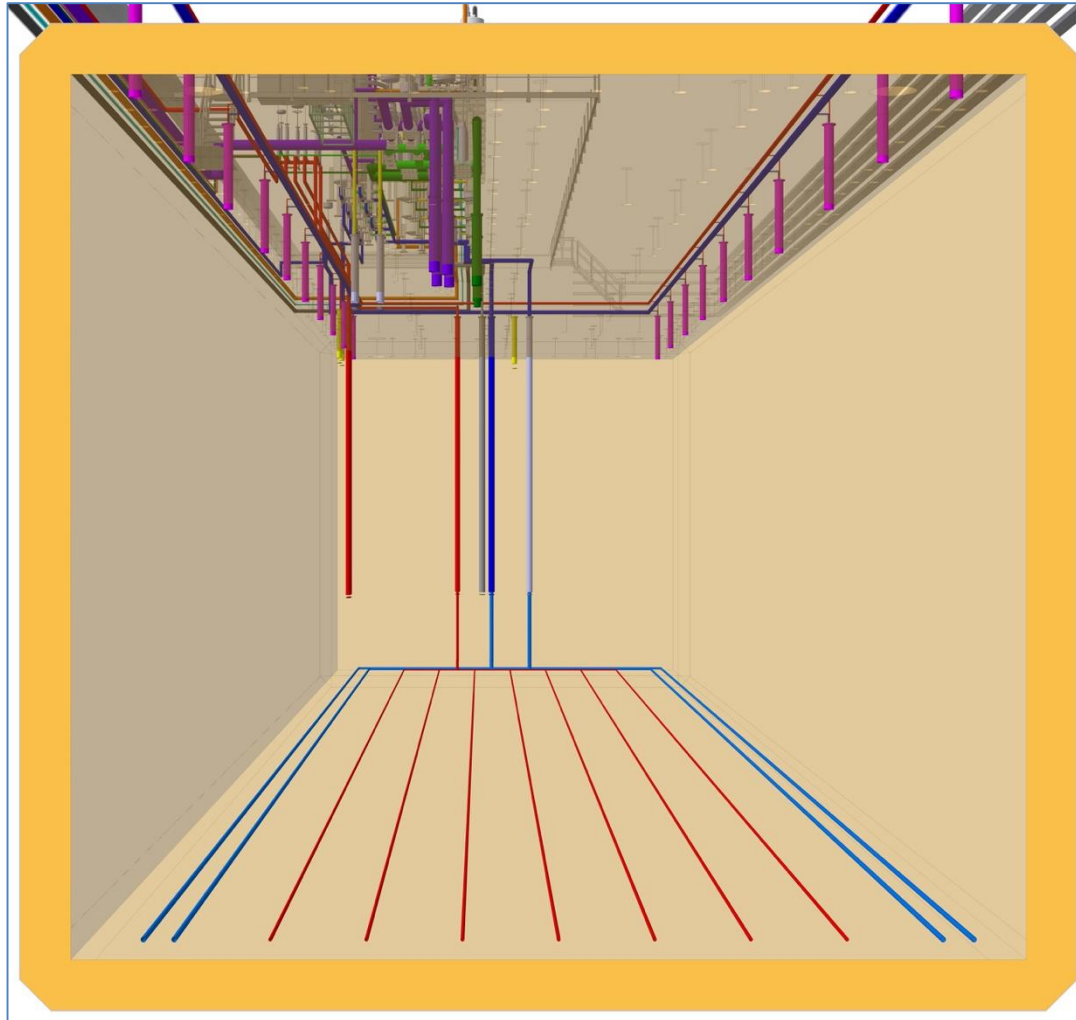
LAr Pumps, Protego and protection

- Lifting device(s) and/or lifting eyes on crown of cavern.
- Material handling.
- Survey.
- Power outlets for welding machines/power tools/etc. per requirements.
- Welding Argon gas (could be on top of the cryostat and a line lowered in).
- Personnel estimate: 4 tech/welders.
- Ventilation.
- Lighting.
- Compressed air per requirements.
- Power/Hand tools and welding machines to be supplied by contractor.
- Operations:
 - Survey and Lift.
 - Fit up and weld
 - Grind and polish.
 - Field adjustments as needed.
 - Insulation (TBD). May need a Nitrogen line also.
 - Run compressed air lines to valves.
 - Wire instruments, valves, etc.
 - Install PLC racks.

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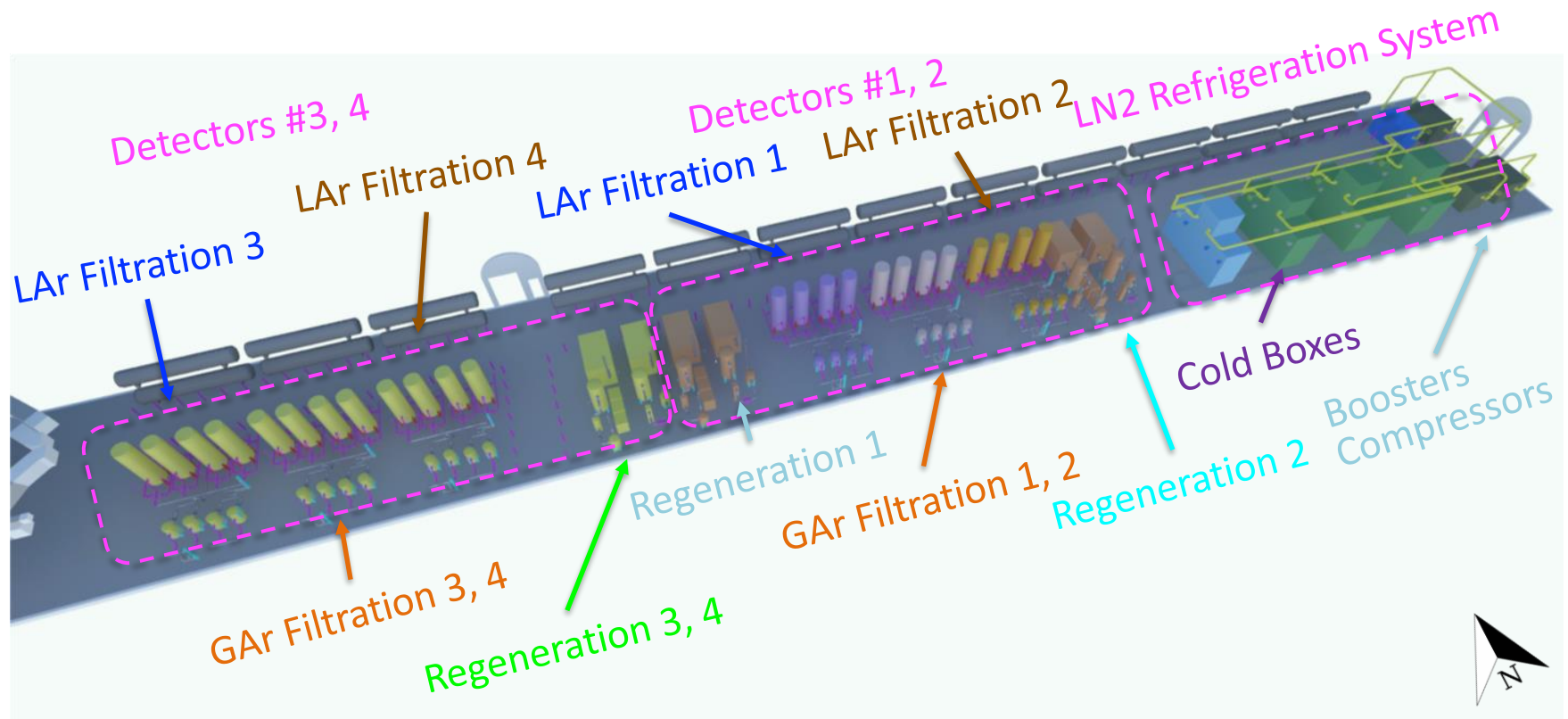
Internal Cryogenics Layout



Internal Cryogenics

- Part of this work is on the roof of the cryostat. This applies to both.
- Lifting device(s) for vertical pieces.
- Material handling.
- Survey.
- Power outlets for welding machines/power tools/etc. per requirements.
- Welding Argon gas (could be outside the cryostat and a line lowered in).
- Personnel estimate: 4 tech/welders.
- Ventilation.
- Lighting.
- Compressed air per requirements.
- Power/Hand tools and welding machines to be supplied by contractor. If in house, will need to be provided.
- Operations:
 - Survey and Lift.
 - Fit up and weld
 - Grind and polish.
 - Field adjustments as needed.

Cryogenics in the CUC – Proximity and Nitrogen System



Proximity Cryogenics and Nitrogen System in CUC

- Two separate jobs (at different time probably), but similar requirements.
- Lifting device(s) and lifting eyes on crown of cavern.
- Material handling.
- Survey.
- Power outlets for welding machines/power tools/etc. per requirements.
- Welding Argon gas.
- Personnel estimate: 10-15 tech/welders (per site: Proxy cryo and Nitrogen System). Nitrogen System is 2 x 10 hr shifts.
- Ventilation.
- Lighting.
- Compressed air per requirements.
- Chilled water for Nitrogen System per requirements.
- May need reinforced concrete pads for Nitrogen System equipment.
- Power/Hand tools and welding machines to be supplied by contractor.
- Operations:
 - Survey and Lift.
 - Fit up and weld
 - Grind and polish.
 - Field adjustments as needed.
 - Run compressed air lines to valves.
 - Wire instruments, valves, etc.
 - Install PLC racks.
 - Connection to chilled water (Nitrogen System only).