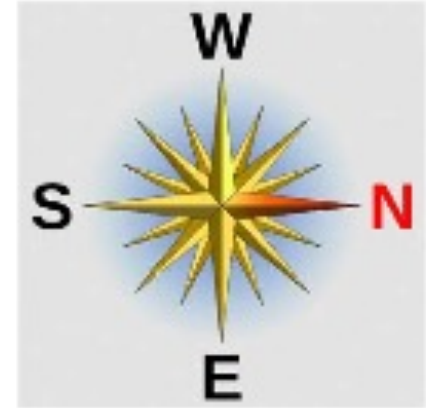


# ND-GAr-Lite CDR Summary

ND-GAr Strategy Meeting, 2021/09/30

J. Raaf

# TMS → ND-GAr Transition



Assemble ND-GAr in this position on West rails, while TMS continues to run

When ready to install ND-GAr:

- Move TMS to this middle position (required for removing 7-m-long bus bars)
- Transfer TMS to East rails and out of the way of ND-GAr

(Removal plan from Tom LeCompte)

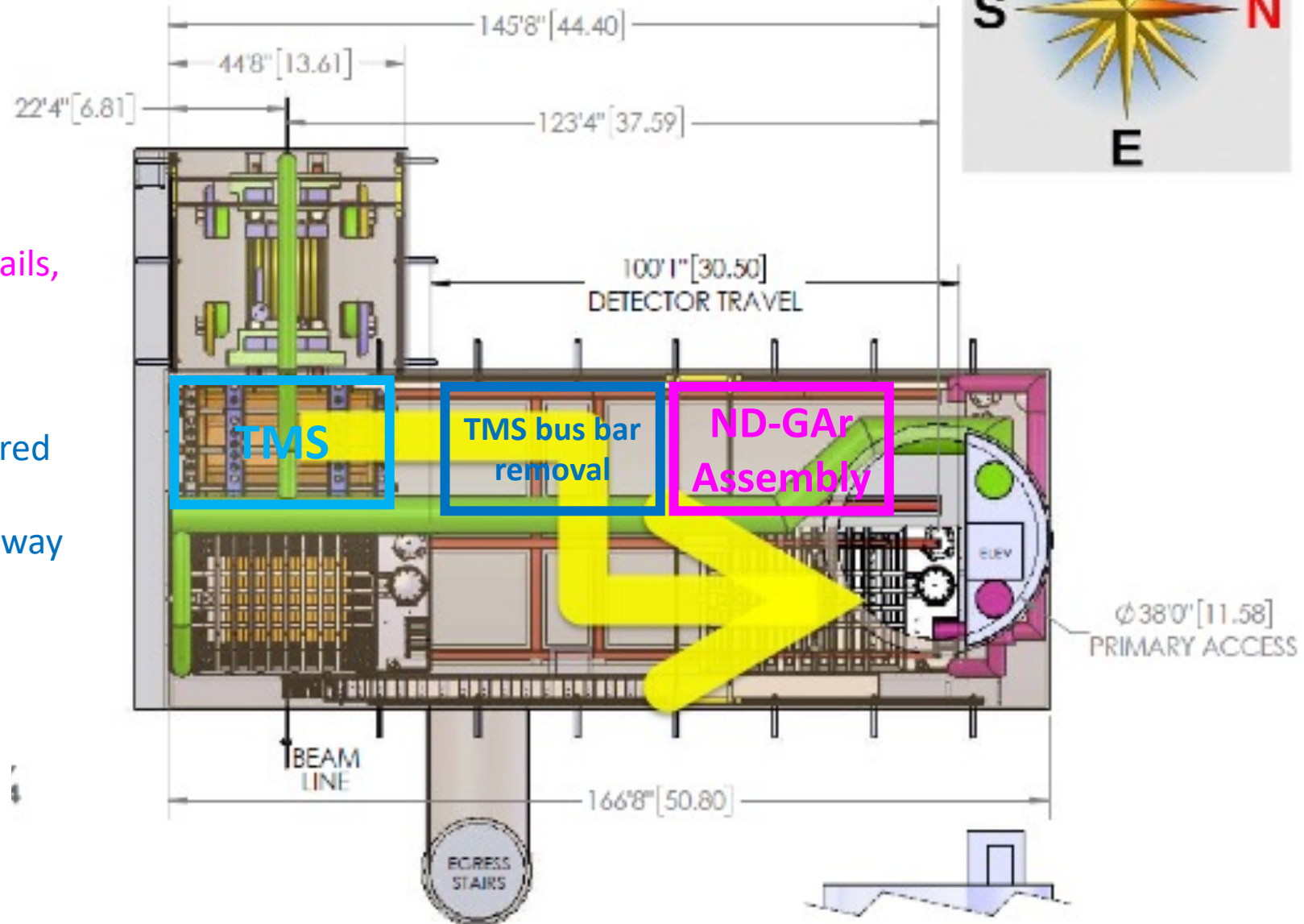


Table 3: Transition from TMS to full ND-GAr detector.

| Task  | Duration (weeks) | Resources            | Comments/Notes  |
|---|------------------|----------------------|---|
| Install temp supports and cradles in staging area on west rails                       | (4)              | Riggers, Techs       | (TMS operating)   |
| Install lower portion of steel yoke, align, secure with bolts                         | (3)              | Riggers, Techs       |   |
| Stage rigging for craning-in cryostat, lowering into hall, removal of rigging         | (1-2)            | Riggers, Techs       | Includes fixturing to rotate magnet after lowering into hall  |
| Rig cryostat onto the lower yoke steel, secure, and align                             | (4-8)            | Riggers, Techs       |   |
| Install remaining steel barrel yoke pieces  | (8)              | Riggers, Techs       |   |
| Stage ECAL modules, lower into hall   | (1-2)            | Riggers, Techs       |   |
| Install ECAL (including cable routing & connectivity tests)                           | (4)              | Techs, un-costed sci |   |
| Crane HPgTPC (on transport fixture) into hall, stage for installation                 | (1-2)            | Riggers, Techs       |   |
| Install HPgTPC (including cable routing & connectivity tests)                         | (8)              | Techs, un-costed sci |   |
| Install and align laser system  | (2)              | Metrology            |   |
| Install rigging, install end yoke plates  | (4)              | Riggers, Techs       |   |
| Install magnet cryo system  | (8-16)           | Techs, Welder        | Assumes all parts pre-staged and ready to go  |
| Remove TMS (estimate from Tom L.)   | 3-6              | Riggers, Techs       | Current TMS design: must be in mid-off-axis position on west rails to remove 7 m magnet bus bars. Alternative TMS magnet design would reduce task duration.                       |
| Move Hilmans to ND-GAr, raise, remove temp supports. Move to south end of west rails. | 2                | Riggers, Techs       |   |
| Make system operational and pass ORC  | 16               |                      | Assumes review documentation prepared in parallel with previous tasks. Includes cryo, fringe field, gas system, ODH, high-pressure. Magnet cryo review estimate based on Mu2e DS. |

TMS operating during these steps

**Total downtime:**

**21-24 wks. (5-6 mos.)**

# ND-GAr-Lite Installation for Day-One

Assemble SPY on Hilmans on West rails (details in Magnet CDR).

- ECAL and HPgTPC not installed at Day-One
- ~6 scintillator tracker stations instrument central region of magnet

Estimated duration: 13-16 months

BOE: Past experience of Mu2e DS engineer + DUNE/LBNF engineers

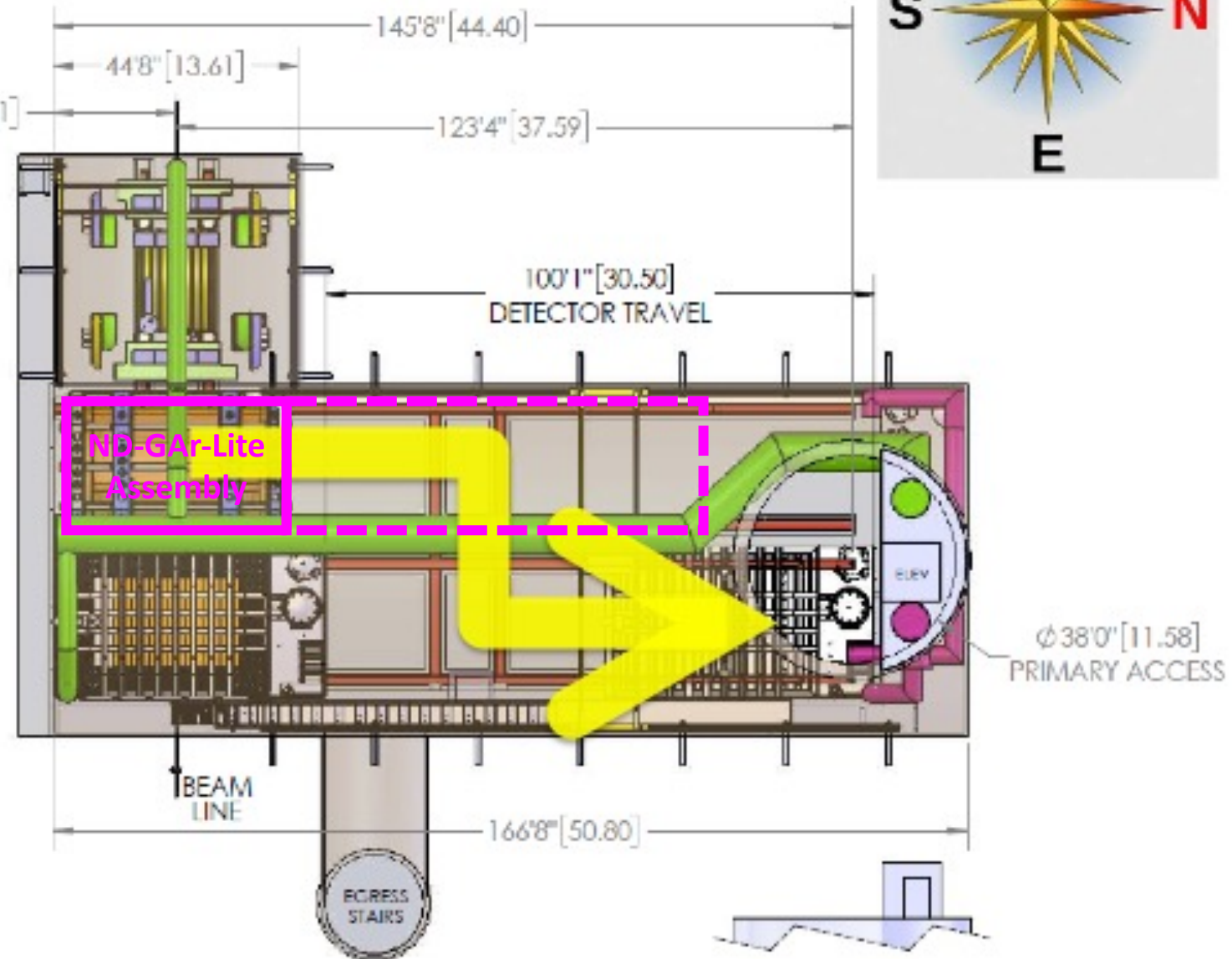
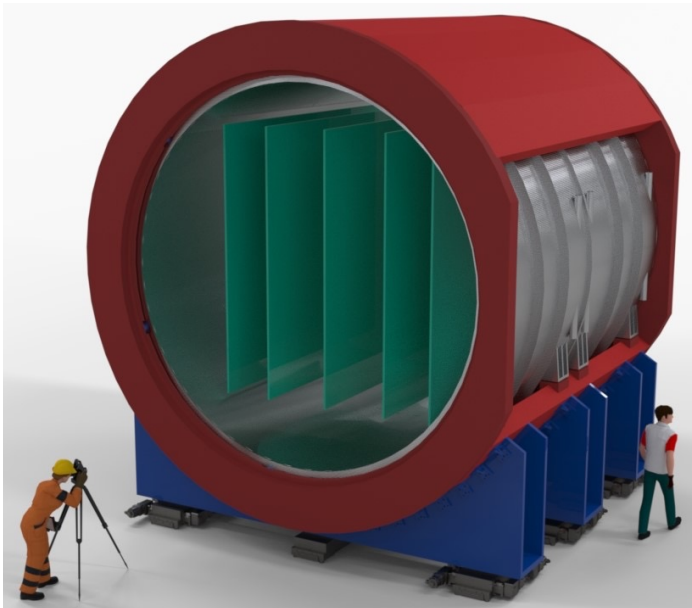


Table 1: Preliminary installation plan for ND-GAr-Lite detector.

| <b>Task</b>   | <b>Duration<br/>(weeks)</b> | <b>Resources</b>          | <b>Comments/Notes</b>   |
|---|-----------------------------|---------------------------|---|
| Install Hilmans and cradles on west rails   | 4                           | Riggers,<br>Techs         |   |
| Install lower portion of steel yoke, align, secure with bolts                       | 3                           | Riggers,<br>Techs         |   |
| Stage rigging for craning-in cryostat, lowering into hall, removal of rigging       | 1-2                         | Riggers,<br>Techs         | Includes fixturing to rotate magnet after lowering into hall  |
| Rig cryostat onto the lower yoke steel, secure, and align                           | 4-8                         | Riggers,<br>Techs         |   |
| Install remaining steel barrel yoke pieces  | 8                           | Riggers,<br>Techs         |   |
| Stage scintillator tracker modules, lower into hall                                 | 1                           | Riggers,<br>Techs         |   |
| Install scintillator tracker modules (including cable routing & connectivity tests) | 2                           | Techs & un-<br>costed sci |   |
| Install rigging, install end yoke plates  | 4                           | Riggers,<br>Techs         |   |
| Install magnet cryo system  | 8-16                        | Techs,<br>Welder          | Assumes all parts pre-staged and ready to go  |
| Make system operational and pass ORC  | 16                          |                           | Assumes review documentation prepared in parallel with previous tasks. Includes cryo, fringe field, gas system, ODH, high-pressure. Magnet cryo review estimate based on Mu2e DS. |
| <b>Total downtime:</b>  |                             |                           | <b>51-64 wks. (13-16 mos.)</b>  |

# ND-GAr-Lite → ND-GAr Transition “Single Pass”

- Remove magnet end-yoke plates
- Remove tracker stations
- Install ECAL & HPgTPC (w/cabling and connectivity tests)
- Install/align laser calibration system
- Install stayed head & re-install magnet end-yoke plates

Estimated duration: ~8 months

BOE: Past experience of Mu2e DS engineer + DUNE/LBNF engineers

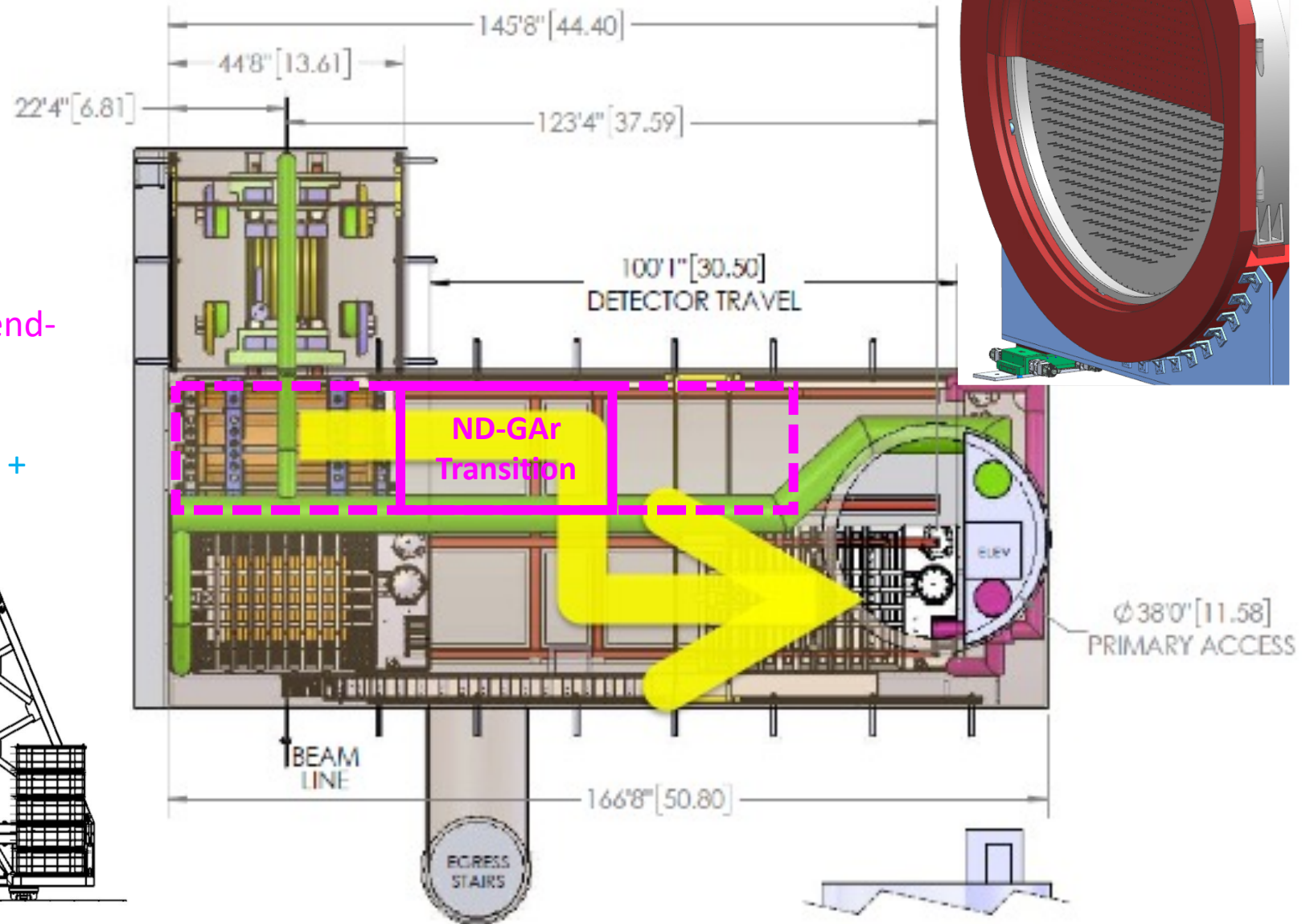
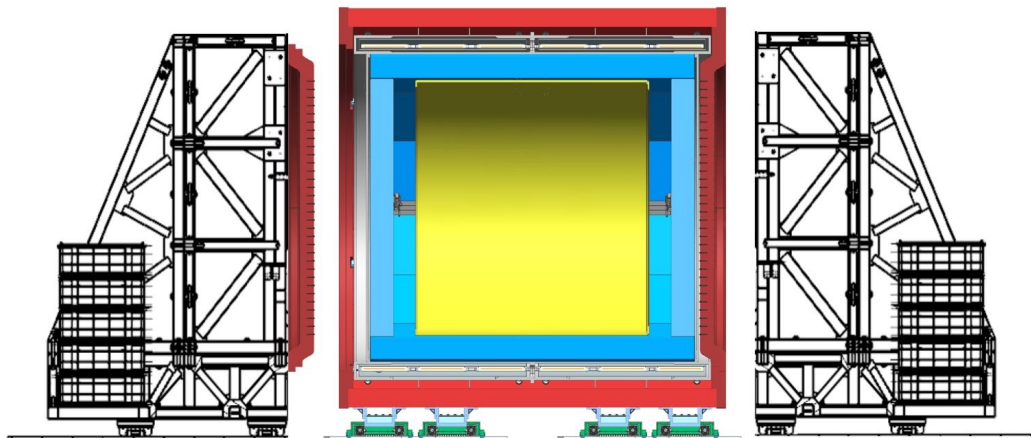


Table 2: Transition from ND-GAr-Lite to full ND-GAr detector.

| <b>Task</b>   | <b>Duration<br/>(weeks)</b> | <b>Resources</b>                              | <b>Comments/Notes</b>   |
|---|-----------------------------|---|---|
| Remove end yoke plates  | 2                           | Riggers,<br>Techs                             |   |
| Remove ND-GAr-Lite tracker planes                                     | 1                           | Techs & un-<br>costed sci la-<br>bor          |   |
| Stage ECAL modules, lower into hall                                   | 1-2                         | Riggers,<br>Techs                             |   |
| Install ECAL (including cable routing & connectivity tests)           | 4                           | Riggers,<br>techs, un-<br>costed sci<br>labor |   |
| Crane HPgTPC (on transport fixture) into hall, stage for installation | 1-2                         |   |   |
| Install HPgTPC (including cable routing & connectivity tests)         | 8                           |   |   |
| Install and align TPC laser system                                    | 2                           |   |   |
| Install rigging, install end yoke plates                              | 4                           |   |   |
| Make system operational and pass ORC                                  | 8                           |   | Assumes review documentation was prepared in parallel with previous tasks. Magnet review not included, but does include reviews of gas system, ODH, high-pressure, etc. |
| <b>Total downtime:</b>  |                             |   | <b>31-33 wks. (~ 8 mos.)</b>  |