

# Approach to design, procurement and installation of SBN cryogenics

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Director's Progress Review of SBN

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This presentation shows:

- ❑ Staged approach to design, procurement and installations of the SBN cryogenics
- ❑ Division of cryogenics per institutional deliverables defined as external, proximity and internal subsystems
- ❑ Work Breakdown Packages following cryogenics sub-system definitions

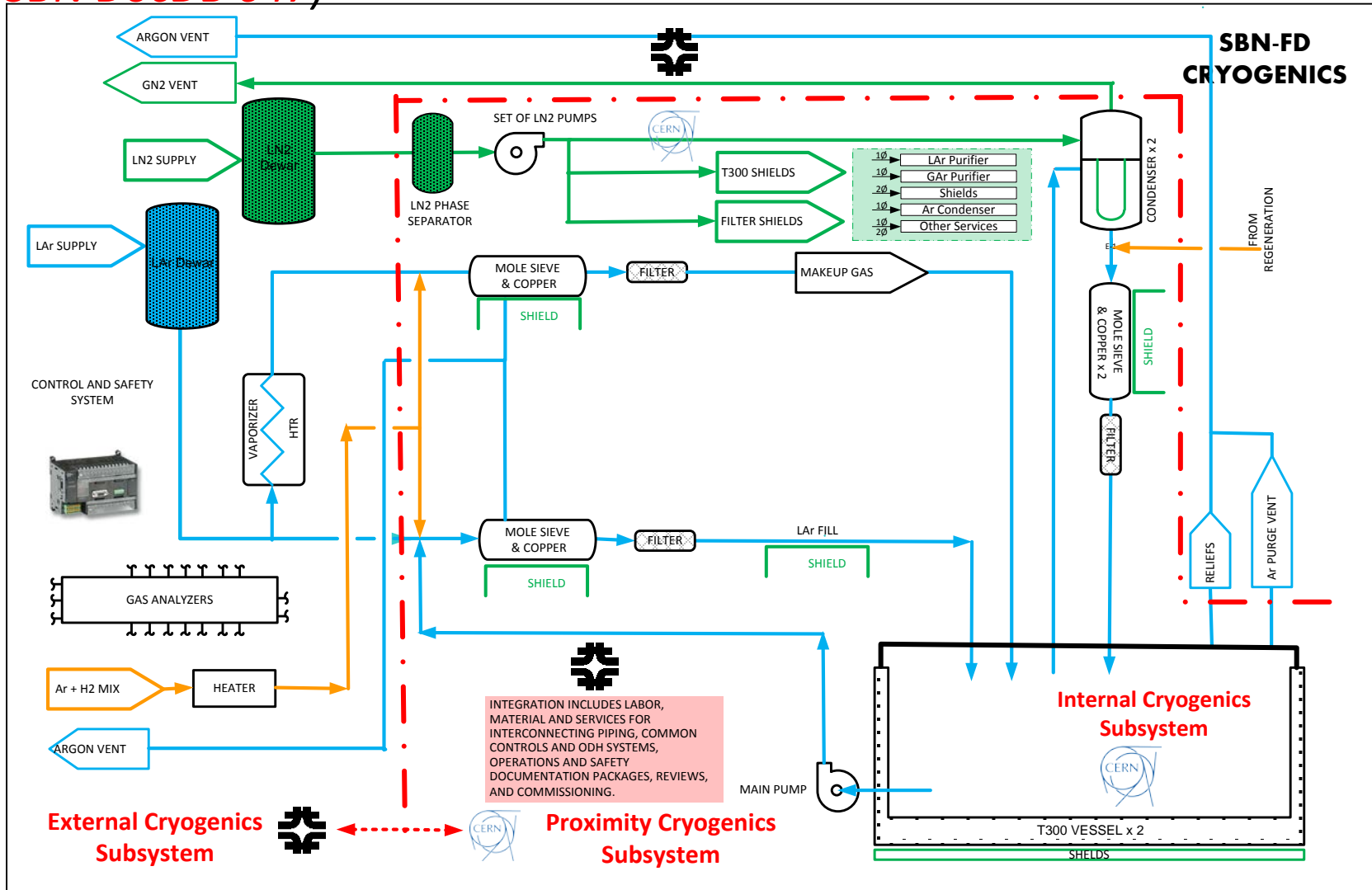
This presentation discusses:

- ❑ Tasks to be completed at each stage and coordination of efforts between CERN and Fermilab
- ❑ Technical issues at each stage
- ❑ Overview of the proposed schedule

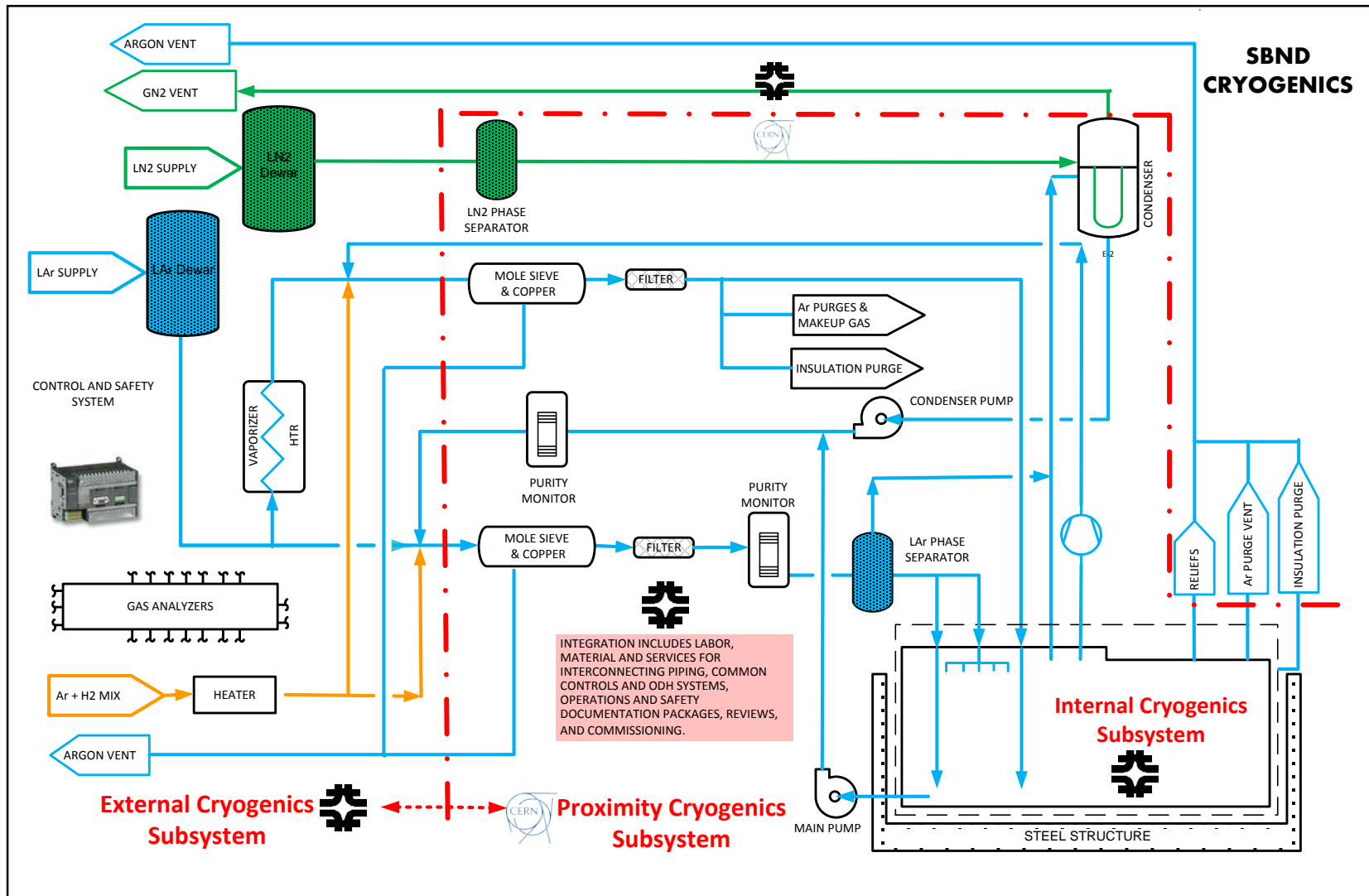
## The following is complete as part of the conceptual design:

- ✓ Requirements for cryogenics
- ✓ Division of cryogenics to external, proximity and internal subsystems and completion of Work Breakdown Packages describing responsibilities of CERN and Fermilab for specific subsystems and work packages
- ✓ Initial release of P&IDs (continued discussion on-going about selection of filtration equipment for SBN FD)
- ✓ Proposed pressure ratings for vessels and piping
- ✓ Proposed layout of top plate with piping interfaces
- ✓ Proposed piping interfaces (continued discussion on design codes)
- ✓ MOU on safety for design and installation of SBND cryostat
- ✓ Desire MOU on safety for design and installation of SBN FD cryostat
- ✓ Requirements for bldg. ODH and initial ODH classification

# SBN FD: Work Package Agreement (EDMS #1549951 and #1510388; SBN DocDB 647)



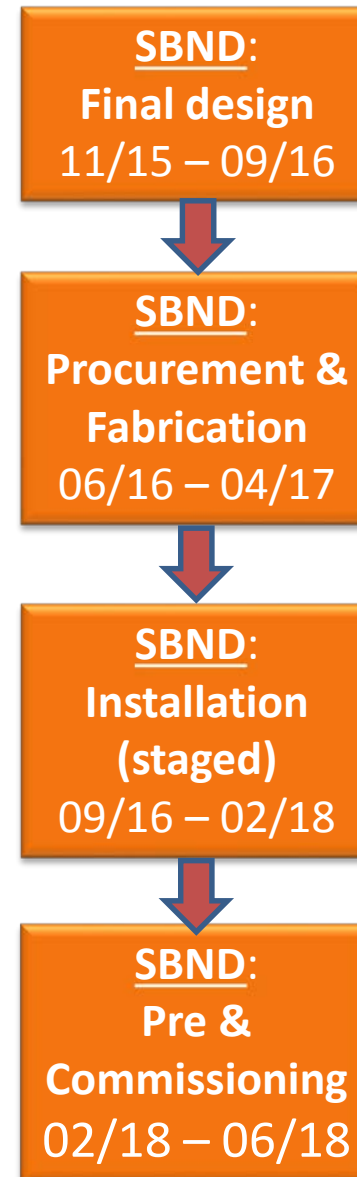
# SBND: Work Package Agreement (EDMS #1510390; SBN DocDB 648)



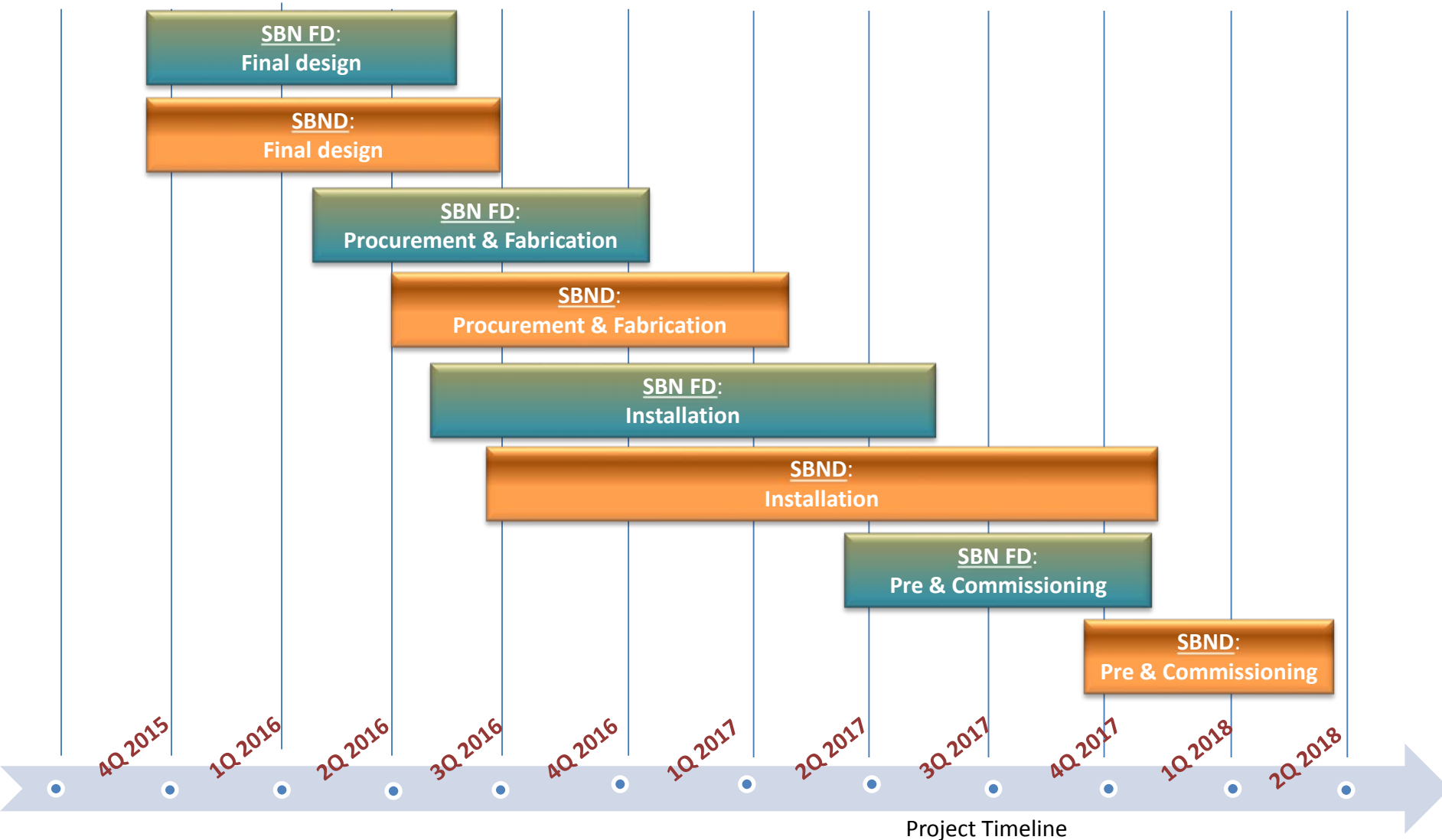
## Four Steps to SBN FD Completion



## Four Steps to SBND Completion



# SBN Project Cryogenics Coarse Timeline



## Integration

- Determine filtration scheme ( Icarus vs. Fermi design)
- Controls requirements and design (S7/iFix design)
- Process calcs and sizing
- Interface document - final (incl. piping, electrical and controls)
- Prelim documentation per FESHM (vessels, piping, ODH, controls, P&IDs with VIE/FMEA)
- Safety issues for EU piping and for T600 per FESHM

## Proximity

- Design for new filter skids
- Design for new (upgraded) T600 cryo components
- Refurbishment of T600 cryo components

## External

- Piping RFI and RFP and prepare for bids
- Solid model for locations, routing and veto
- Piping design in Smart P&ID with further outsourcing to subcontractors

## Internal

- Re-design (if necessary) internal cryogenics



## Integration

- Procure controls hardware and software
- Procure ODH hardware
- Procure misc. controls

## Proximity

- Continue refurbishment of existing equipment
- Procure new equipment (filters, pumps, valves, instrumentation, etc.)
- Procure piping
- Recertify and reinstall reliefs
- Ship equipment to FNAL

## External

- Procure piping (design, manufacturing & installation)
- Procure new components (valves, instrumentation, etc.)
- Procure gas analyzers, main reliefs, Ar/H2 trailer

## Internal

- Refurbish internal cryogenic components

## Integration

- Prewire and mount equipment in cabinets
- Install process tubing and instrumentation
- Install process controls hardware and software
- Install ODH and bldg. controls

## Proximity

- By subcontractors:
- Receive and install proximity equipment
- Install interconnecting piping spool pieces
- Connect to interfaces to internal and external piping

Separately: set up test facility for feedthroughs and other “unlisted” pressure piping components.

## External

- Prepare dewars, move and install on piers
- Fabricate and install cold and warm piping per external contract. Connect to proximity and internal interfaces
- Recertify and reinstall reliefs
- Install gas analyzers, Ar/H<sub>2</sub> trailer and panel
- Paint dewars and other misc. equipment

## Internal

- Cryostat with internal cryo and TPC is installed in bldg.

## Integration

### Pre-Commissioning

- Documentation per FESHM (P&ID w/VIE, FEA, WHATIF, OPS)
- Pressure tests for piping
- Pressure piping engineering notes FESHM5031.1
- Pressure vessel engineering notes FESHM5031
- Cryostat engineering note FESHM5031.5
- ODH analysis and testing of ODH system
- Safety review
- **ORC is received**

## Proximity

### Commissioning

- Inspection of dewars by vendor and approval to operations
- Commissioning of control system
- Fill of LN2 dewar and commission of LN2 system
- Fill of LAr dewar
- Leak hunt and repairs
- Purification of the system
- Pump & backfill of the cryostat
- Cooldown and fill of the cryostat - test by fill
- Start of filtration system
- Tuning and stabilization
- **Cryo commissioning is complete**

## External

## Internal

## Integration

- Determine filtration scheme
- Controls requirements and design (S7/iFix design)
- Process calcs and sizing
- Interface document - final (incl. piping, electrical and controls)
- Prelim documentation per FESHM (vessels, piping, ODH, controls, P&IDs with VIE/FMEA)
- Safety issues for EU piping and for T600 per FESHM

## Proximity

- Design for new filter skids, condensers, separators, pumps, valves, instrumentation
- Design for new piping, incl. valve and bayonet boxes

## External

- Piping RFI and RFP and prepare for bids
- Solid model for locations, routing and veto
- Piping design in Smart P&ID with further outsourcing to subcontractors

## Internal

- CFD analysis
- Piping layout and design/drafting through solid model

## Integration

- Procure controls hardware and software
- Procure ODH hardware
- Procure misc. controls

## Proximity

- Procure new filter skids, condensers, separators, pumps, valves, instrumentation
- Procure new piping, incl. valve and bayonet boxes (design, manufacturing w/o installation)

## External

- Procure piping (design, manufacturing & installation)
- Procure new components (valves, instrumentation, etc.)
- Procure gas analyzers, main reliefs, Ar/H2 trailer
- Recertify and reinstall reliefs

## Internal

- Procure internal piping spool pieces
- Procure misc. parts, i.e. for purge system

## Integration

- Prewire and mount equipment in cabinets
- Install process tubing and instrumentation
- Install process controls hardware and software
- Install ODH and bldg. controls

## Proximity

- Receive and install proximity equipment
- Install interconnecting piping spool pieces
- Connect to interfaces to internal and external piping

Separately: set up test faculty for feedthroughs and other “unlisted” pressure piping components.

## External

- Prepare dewars, move and install on piers
- Fabricate and install cold and warm piping per external contract. Connect to proximity and internal interfaces
- Recertify and reinstall reliefs
- Install gas analyzers, Ar/H<sub>2</sub> trailer and panel
- Paint dewars and other misc. equipment

## Internal

- Install piping
- Install instrumentation

Integration

Pre-Commissioning

- Documentation per FESHM (P&ID w/VIE, FEA, WHATIF, OPS)
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Proximity

Commissioning

- Inspection of dewars by vendor and approval to operations
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- Tuning and stabilization
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External

Internal