

DRAFT



CALIFORNIA INSTITUTE OF TECHNOLOGY
MASSACHUSETTS INSTITUTE OF TECHNOLOGY

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DATE: 4/5/00

INSTALLATION SPECIFICATION

1 SHEET **1** OF **8**

TITLE

2K IFO Alignment & COS Installation Completion

APPROVALS:	DATE	APPROVALS:	DATE
DRAWN: Larry Jones	4/7/00	CHECKED: Stan Whitcomb	
CHECKED: Stan Whitcomb		CHECKED:	
CHECKED:		DCN NO	APPROVED
CHECKED:			DATE

1 SCOPE

Eighteen tasks are to be performed in the diagonal section and X manifold during the next vented period. The major tasks include core optics alignment (centering) and completion of COS component installation (telescopes, baffle and beam dumps) and alignment. In addition to these 18 tasks, standard chamber entry and exit tasks will be performed.

2 APPLICABLE DOCUMENTS

Listed below are all of the applicable and referenced documents for this task procedure. This list gives the latest revisions of the documents; within the installation steps, only the document number (and not the revision) is quoted.

T970151-B1	ASC Initial Alignment Procedures (Reference only: The alignment procedures defined within this procedure supersede the initial alignment procedures defined in T970151.)
T990088-01	COS 2 km Interferometer Re-Alignment Procedure N.B.: Changes pending for this re-alignment or
T980072-01	COS alignment telescope/autocollimator/projector system
M990034-B	Contamination Control Plan
E000062-C	LOS Installation Procedures for BSC Chambers
E990344-00	LOS Installation Procedures for HAM Chambers
E000116-00	Procedure for Realignment of Large Suspended Optics
E000046-A	Beam Tube Opening and Closing Procedures
M980133-B	Vent Isolatable Volumes
E000119-A	Hanford Checklist - Vent Isolatable Volumes
E000121-A	Hanford Checklist - Spool Removal
M980101-B	Procedure for Isolatable Volume Pump Down



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E000118-A	Hanford Checklist - Isolatable Volume Pump Down
M980136-A	HAM Chamber Access Door Removal Procedure
E000120-A	Hanford Checklist - BSC Door Rmovaal
M980132-B	O-Ring Installation and Flange Assembly Procedure for HAM and BSC Doors
E000065-04	Chamber Entry/Exit Checklist
E000002-D	Z Pivot Procedures
D?	Layout Drawing
D?	Arm Cavity Baffle Assembly drawing

3 PRE-REQUISITES

- 1. A BSC cleanroom must be in place over WBSC 7 and operable.
A HAM cleanroom must be in place over WHAM 7 and operable.
A BSC cleanroom must be in place over WHAMs 8 & 9 and operable.
- 2. The vacuum equipment purge air system must be operable before starting the task.
- 3. Laser safety walkthroughs per M990315 for unescorted workers in the LVEA.

4 PREPARATION

All preparation must be in accordance with the Contamination Control Plan (M990034).

- 4. Clean the LVEA, particularly the floor; Particulates and dust should be removed by mopping with clean water.
Clean BSC 7 (wipe or mop with clean water) from the stiffening ring above the east door down, as well as the floor in the vicinity of the chamber well in advance of the opening of the vacuum system.
Clean each HAM chamber (wipe or mop with clean water) from its top down, as well as the floor in the vicinity of the chamber well in advance of the opening of the vacuum system: HAMs 7, 8, 9 & 10.
- 5. Insure that there are no large openings to the exterior or the beam tube enclosure where insects or dust can get into the LVEA.



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- 6. Transport the following items to the LVEA:
 - Appropriate cleanroom garb, including gloves
 - In-Chamber Overshoe Covers
 - 2-3 flashlights
 - Arm Cavity Baffle Installation Tools
 - Parts for Two Arm Cavity Baffles, including hardware
 - Five CLASS A Ground Strips (D000068)
 - Five CLASS A 1/4-20x1/2" SHCS
 - COS Tool pan (wrenches and allen keys)
 - Camera and lens
 - CO2 gun and portable bottle
 - Precision Bubble level
 - Cleanroom from X end
 - Belly Bar utility brackets
 - BSC 7 replacement Viton O-rings
 - 3 PO telescope assy's & optical train assy's
 - Faraday Isolator for HAM 10
 - Beam dump assy's for BSCs 4, 7 & 8, including hardware
 - APS telescope baffle
 - PO telescope installation tools & fixture
 - View port beam dump assy's
 - COS COC alignment equipment
 - IR beam viewer
- 7. Perform 'Tilt zero point' adjustment & 'Collimation error' adjustment on Sokkia Total Station per Sokkia Operator's Manual and verify performance.

5 TASK STEPS

All tasks must be in accordance with the Contamination Control Plan (M990034)..

- 8. Close gate valves GV3 & GV4.
Vent the diagonal section and X beam manifold volumes (per procedures M980133 and E000119); remember to kill the power to the suspension controllers and to turn off the RGA prior to venting.
- 9. Perform tasks as described below, with attention to precedent requirements as shown in Figure 1; many of these tasks may be running concurrently.
- 10. As chambers are opened, perform chamber entry tasks per applicable steps of E000065.



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- 11. **NOTE!** It is very important that we limit exposure of the vacuum surfaces to atmospheric moisture, to minimize pumping time required before gate valves can again be opened. This is largely a function of purge air flow volume and the duration of chamber open times. This procedure is written to minimize the numbers of doors removed, and the durations of removal. Purge air should be adjusted to maximum flow. **Fabric door covers afford a surprising amount of shielding (with purge), so they should be installed whenever access through the door opening is not required within a short time period. This includes the practice of installing a cover when workers are inside a chamber. HAM tasks that require ongoing access shall utilize “belly bars”, utility brackets (normally used to mount instruments on the belly bar, used here to clamp the excess fabric cover) to minimize the area of the open section.**

- 12. **TASK 1:** Confirm all air bearings have bases and caps installed symmetrically about each chamber’s plan view centerlines, HAMS 7-10.
Install Quick Disconnects and distribution hoses at HAM 10.
Ensure rubber bellows are installed on all air bearings, HAMS 7-10.
Ensure Z pivot assemblies are installed on all air bearings, HAMS 7-10, per procedure E000002, Z Pivot Procedures
Ensure bellows bands on all air bearings are installed, HAMS 7-10.
Ensure all air bearings have free movement, per procedure E000140, Seismic Isolation Subsystem Coarse Actuation System Operation.

- 13. **TASK 2:** Warn personnel in north bay that HAM doors will be removed and reflected laser beams may be present; setup yellow hazard warning tape as a reminder.
Close shutter on input beam from the PSL.
Remove doors H7E & H8W.
Turn up purge air.
Install targets on structures at optics MMT2 and MMT3. **Reminder: cover door openings when access is not being required!**
Open shutter on PSL and record position of PSL beam on targets: MMT2: Y: _____ cm,
Z: _____ cm; MMT3: Y: _____ cm, Z: _____ cm.
Close shutter on PSL.
Remove targets from structures. **Reminder: cover door openings when access is not being required!**

- 14. **TASK 3:** Redo laser emergency stop circuit, details **TBD**.

- 15. **TASK 4:** Reconfigure ISC 10 table, details **TBD**.

- 16. **TASK 5:** Install vacuum fittings at HAM 12 and BSC 4, positions **TBD**.

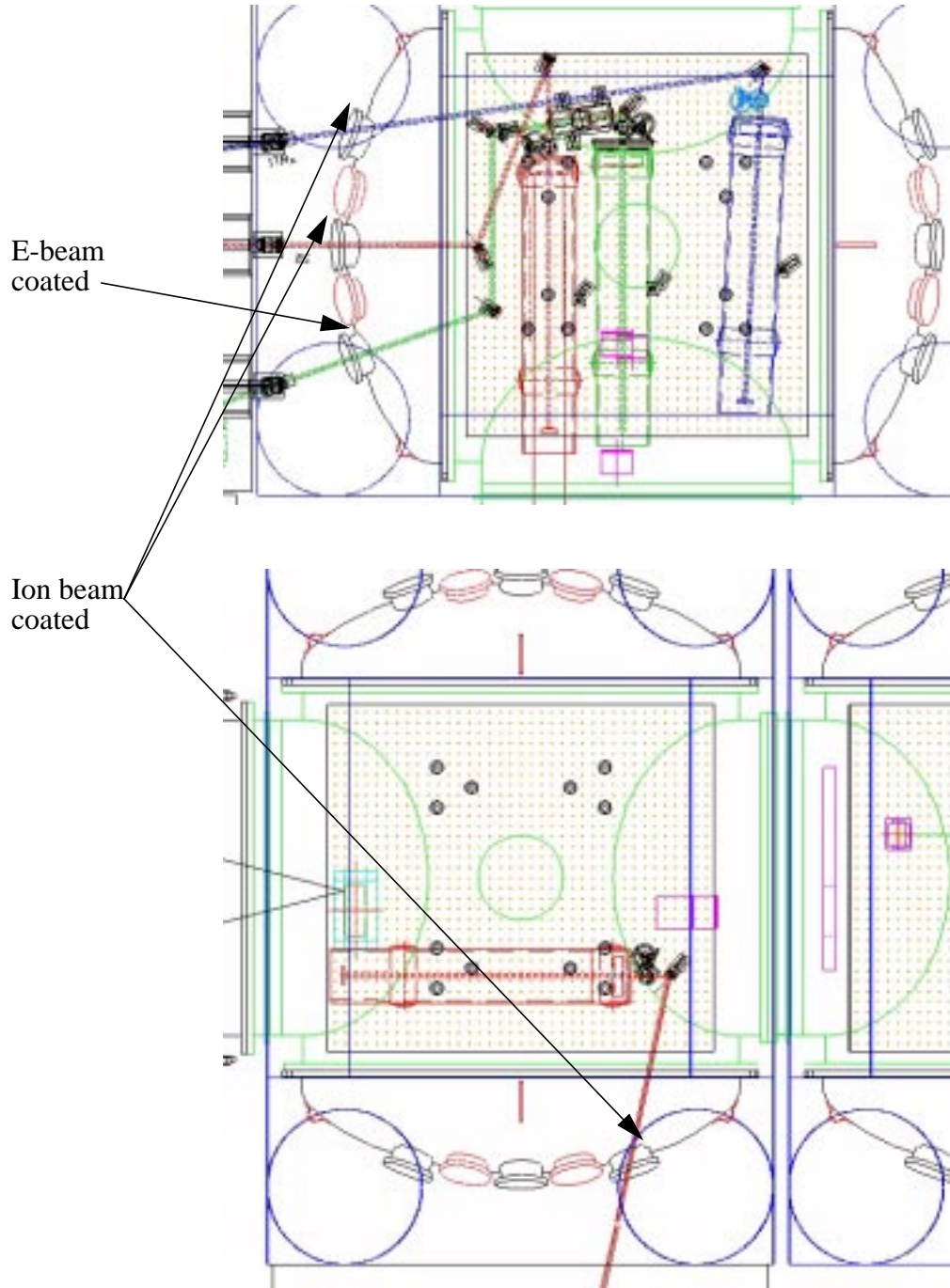


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- ❑ 17. **TASK 6:** Install high quality viewports at HAMs 9 & 10, positions as indicated in the figures. Note: this task had already been performed prior to the release of this checklist.



- ❑ 18. **TASK 7:** Install viewports and cameras at TBD.



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- 19. **TASK 8:** Remove spool WA-1A from X beam manifold, covering openings with Ameristat. Position small clean room over openings. Remove east door from BSC 7; enter chamber and install target on +X side of ITMx; exit chamber. **Reminder: cover door opening when access is not being required!** Setup Brunson optical square on X arm offset beamline; check and adjust mirror as required per T970151; setup periscope to see around optical lever pier. Setup total station theodolite on 2K theoretical beam line at spool opening and measure position of ITM optic. Record: _____
- 20. **TASK 9:** move X arm cavity baffle components to clean room alongside BSC 7 and assemble sub-assemblies. Enter chamber with baffle subassemblies; carry them into beam manifold. **Reminder: cover door opening when access is not being required!** Install arm cavity baffle. Exit chamber. **Reminder: cover door opening when access is not being required!**
- 21. **TASK 10:** Shut down the suspension racks and data acquisition racks; reorganize cables and redistribute power inside of these racks. Upgrade the suspension controllers so they are all the same and meet the new established requirements.
- 22. **TASK 11:** Remove and replace MCM2 SOS/optic assembly with unit of the proper height, with proper suspension wire dia. **Reminder: cover door opening when access is not being required!**
- 23. **TASK 12:** Remove BSC 7 dome and replace dome flange O-rings as required; replace dome.
- 24. **TASK 13:** Using total station theodolite on 2K theoretical beam line at spool opening, recheck position of target at ITMx. **Reminder: cover door opening when access is not being required!** Record: _____
Adjust PAM magnets of ITMx to maintain its position with OSEM voltages removed, according to total station theodolite. Record final position: _____



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25. **TASK 14a:** Setup AutoCollimator 1 on beam axis in X manifold, aligned with ITMx HR surface. Open gate valve GV4.
- Reminder: cover door opening when access is not being required!**
- Install target on +X side of ITMx. Record AC1 offsets: Y: _____ mm, Z: _____ mm.
- Install target on +X side of FMx. Record AC1 offsets: Y: _____ mm, Z: _____ mm.
- Remove targets from ITMx & FMx & install target on BS optic, -Y side.
- Setup optical level viewing through B7E door to BS target elevation. Record global elevation: Z: _____ mm **Reminder: cover door opening when access is not being required!**
- Record AC1 offsets on BS target: X: _____ mm, Z: _____ mm.
- Adjust PAM magnets of FMx optic for acceptable BS offsets: X: _____ mm, Z: _____ mm.
- Remove target from BS and install target on MMT3, -X side.
- Record AC1 offsets on MMT3 target: Y: _____ mm, Z: _____ mm.
- Adjust PAM magnets of BS optic for acceptable MMT3 offsets: Y: _____ mm, Z: _____ mm.
- Setup optical level viewing through H7E door to MMT3 target elevation. Record global elevation: Z: _____ mm.
- Remove door H9E. **Reminder: cover door opening when access is not being required!**
- Remove target from MMT3 and install target on -X side of RM optic.
- Record AC1 offsets on RM target: Y: _____ mm, Z: _____ mm.
- Determine amount of elevation HAM 9 optics table is to be moved: Z: _____ mm.
- Setup optical level to view 4 corners (approx.) of HAM 9 optical table.
- Adjust scissors table stop screws to achieve the target elevation change (_____ mm) at each table corner. Record new AC1 offsets on RM optic: Y: _____ mm, Z: _____ mm.
- Determine amount of lateral shift HAM 9 optics table is to be moved: Y: _____ mm.
- Setup dial indicator trees and adjust HAM 9 optics table per Section 3 of E000002, Z Pivot Procedures. Re-establish preloads and record lateral shift as shown by dial indicators: X: _____ mm, Y: _____ mm.
- Recheck RM, record AC1 offsets: Y: _____ mm, Z: _____ mm. **Reminder: cover door opening when access is not being required!**
- Remove target from RM and install target on +X side of MMT2.
- Record AC1 offsets on MMT2 target: Y: _____ mm, Z: _____ mm.
- Adjust PAM magnets of MMT3 optic for acceptable MMT2 offsets: Y: _____ mm, Z: _____ mm.
- Remove target from MMT2 and install target on +Y side of ITMy.
- Vent BSC 8 and Y beam manifold, if not already vented; remember to kill the power to the suspension controllers and to turn off the RGA prior to venting.
- Open gate valve GV3.
- Setup AutoCollimator 2 on HAM 9 table, +X side of RM optic, aligned with AC1. **Reminder: cover door opening when access is not being required!**
- Record AC2 offsets when retroreflecting from ITMy optic: Y: _____ mm, Z: _____ mm.
- Adjust PAM magnets of FMy optic for acceptable retroreflecting offsets: Y: _____ mm, Z: _____ mm.



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- 26. **TASK 14a:** Record AC2 offsets on ITMy target: X: _____ mm, Z: _____ mm.
Install target on +X side of FMy. Record AC2 offsets: Y: _____ mm, Z: _____ mm.
Remove targets from ITMy & FMy. **Reminder: cover door opening when access is not being required!**
Record AC2 offsets when retroreflecting from RM optic: Y: _____ mm, Z: _____ mm.
Adjust PAM magnets of RM optic for acceptable retroreflecting offsets: Y: _____ mm, Z: _____ mm.
- 27. **TASK 15:** Align Faraday Isolator in HAM 7
- 28. **TASK 16:** Co-align COS alignment beam and PSL beam at MMT 2 and MMT 3 centers
- 29. **TASK 17:** Remove HAM doors 10S & 10N. **Reminder: cover door opening when access is not being required!**
Install and align the three COS pick-off telescopes in HAMs 9 & 10.
Realign pick-off mirrors in BSC 7 & BSC 4.
Install & align HAM 10 Faraday Isolator
Install APS telescope baffle. **Reminder: cover door opening when access is not being required!**
Install optical trains for pick-off telescopes.
- 30. **TASK 18:** Complete installation of BSC beam dumps: BSCs 4, 7 & 8. **Reminder: cover door opening when access is not being required!**
Install beam dumps for all viewport reflections in BSCs and HAMs.
Using handheld scanner, look for all other stray beams and install beam dumps as required, in each of the 2K LVEA chambers: BSCs 4, 7, & 8; HAMs 7, 8, 9 & 10. As chambers are being completed, individually perform exit tasks per next step.
Measure resonant frequencies for beam dump structures at postions **TBD**.
- 31. Remove alignment equipment and replace spool WA-1A at X beam manifold.
- 32. **Chamber Exit Tasks:**
As each chamber/manifold volume is being exited, perform exit tasks in accordance with applicable steps of E000065.
Reinstall door.
Log all data in electrical and hard copy logs.
Label and file digital photos.
- 33. Pumpdown vacuum sections per M980101.



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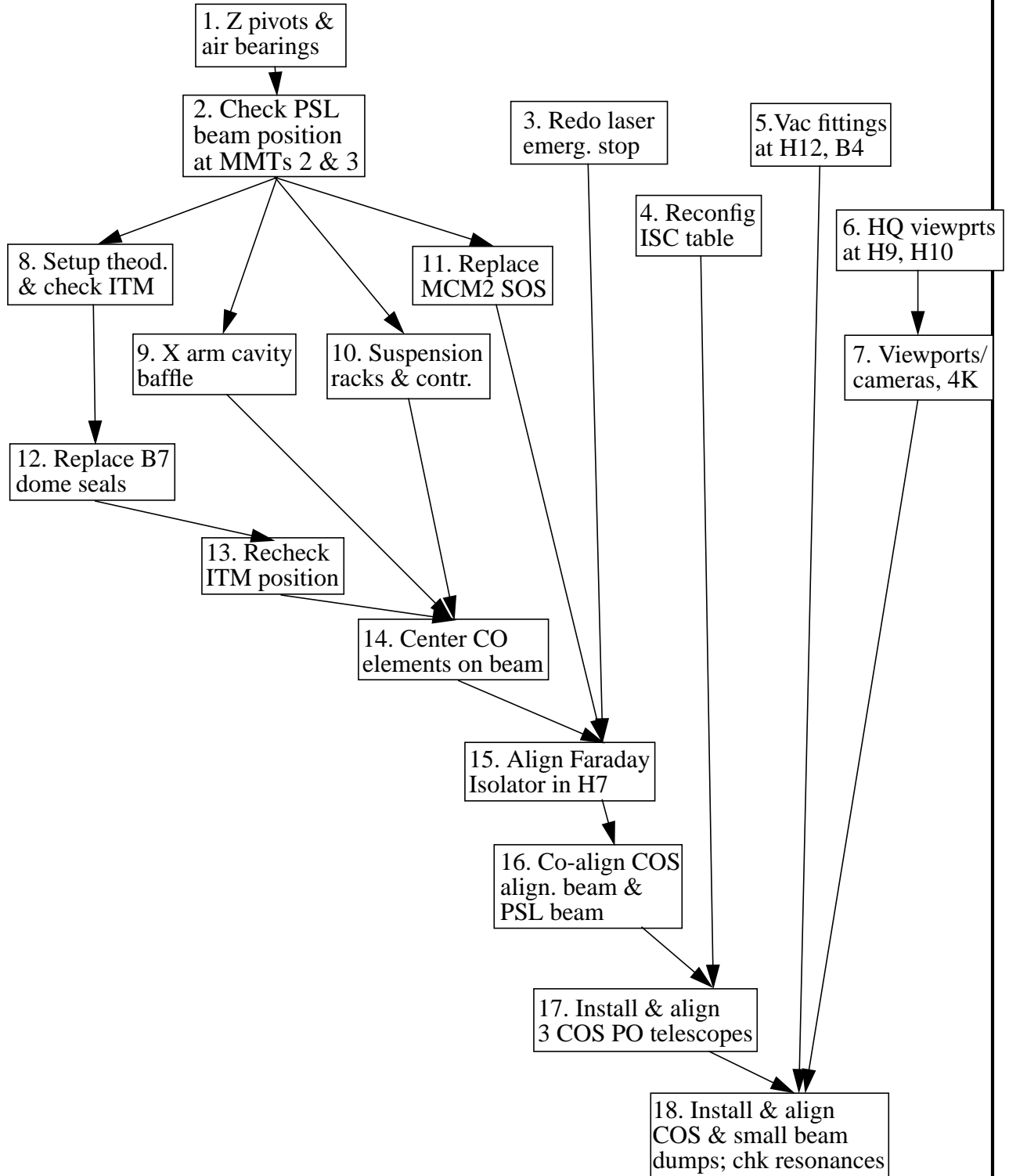


Figure 1: Sequencing of Tasks