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Date:	31 March 2009	Refer to:	L0900059-v1
Subject:	Notes on the optomechanical layout meeting, 31-Mar-2009		
To:	Ed Chavez, Mike Smith, Calum Torrie, Luke Williams		
From:	Dennis Coyne		

Attending:
Ed Chavez
Dennis Coyne
Mike Smith
Calum Torrie
Luke Williams

1) There will be 6 top-level layout assemblies (mirroring the vacuum equipment layouts by PSI):
   - LHO corner
   - LHO x-end
   - LHO y-end
   - LLO corner
   - LLO x-end
   - LLO y-end

Currently there are just a few incomplete top level assemblies which are notional -- we've been concentrating on the chamber-level assemblies. (see Figure 1)

2) The chamber folder names must change to be consistent with the Vacuum Equipment chamber designations. For example, BSC2 should be either WBSC2 or LBSC2 (meaning either Washington, LHO BSC2 or Louisiana, LLO BSC2). Note that not all BSCN chambers are in the same location at the two observatories – see Figure 2, Figure 3, and Figure 4

3) Note that “RM_structure” is no longer the proper name. It should be “HSTS_structure”. A minor point to be eventually corrected. See Figure 1

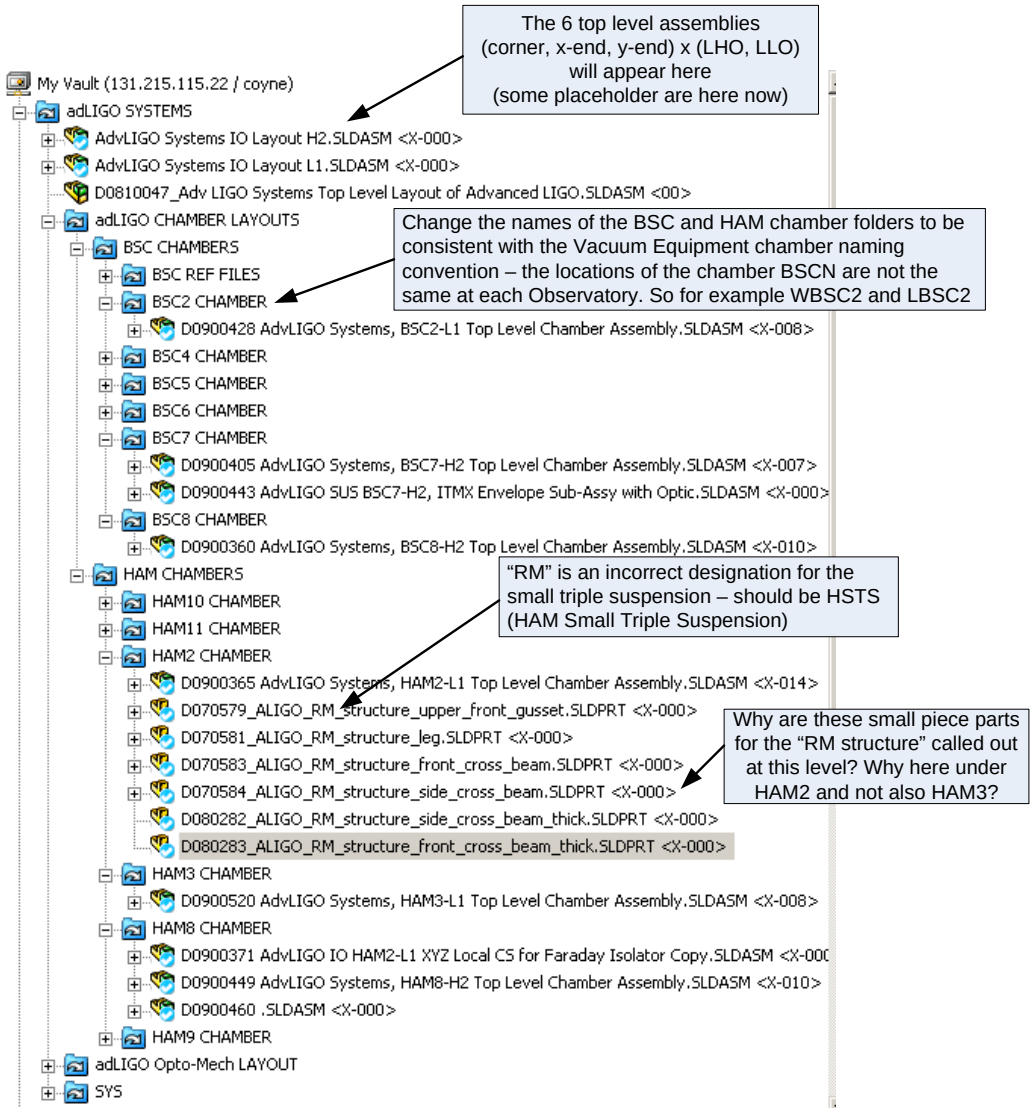

Figure 1: PDMWorks Vault directory & file structure for integrated optomechanical layouts

4) remote desktop seems to have problems supporting opening of large models (at least running WebCamXP). To be investigated some more.

5) Reviewed/explained levels of models and ownership & uniqueness of instances (optic, struts, clamps, etc.) using HAM8 as example … Chamber has two basic configurations: complete and simple (with simple having all mass/envelopes or suspended mass/envelopes

6) Attempted to open BSC8 full detail configuration with the engineering workstation in the SCR (a fairly capable machine) but it failed after many minutes. Works ok on Ed's exceedingly fast (quad processor) with lots of RAM. May need to "dumb" down the full detail configuration – or create another configuration for each chamber with most of the key features, but some reduction in complexity to permit use by more engineers and allow for quicker access & manipulation. Low priority for now.

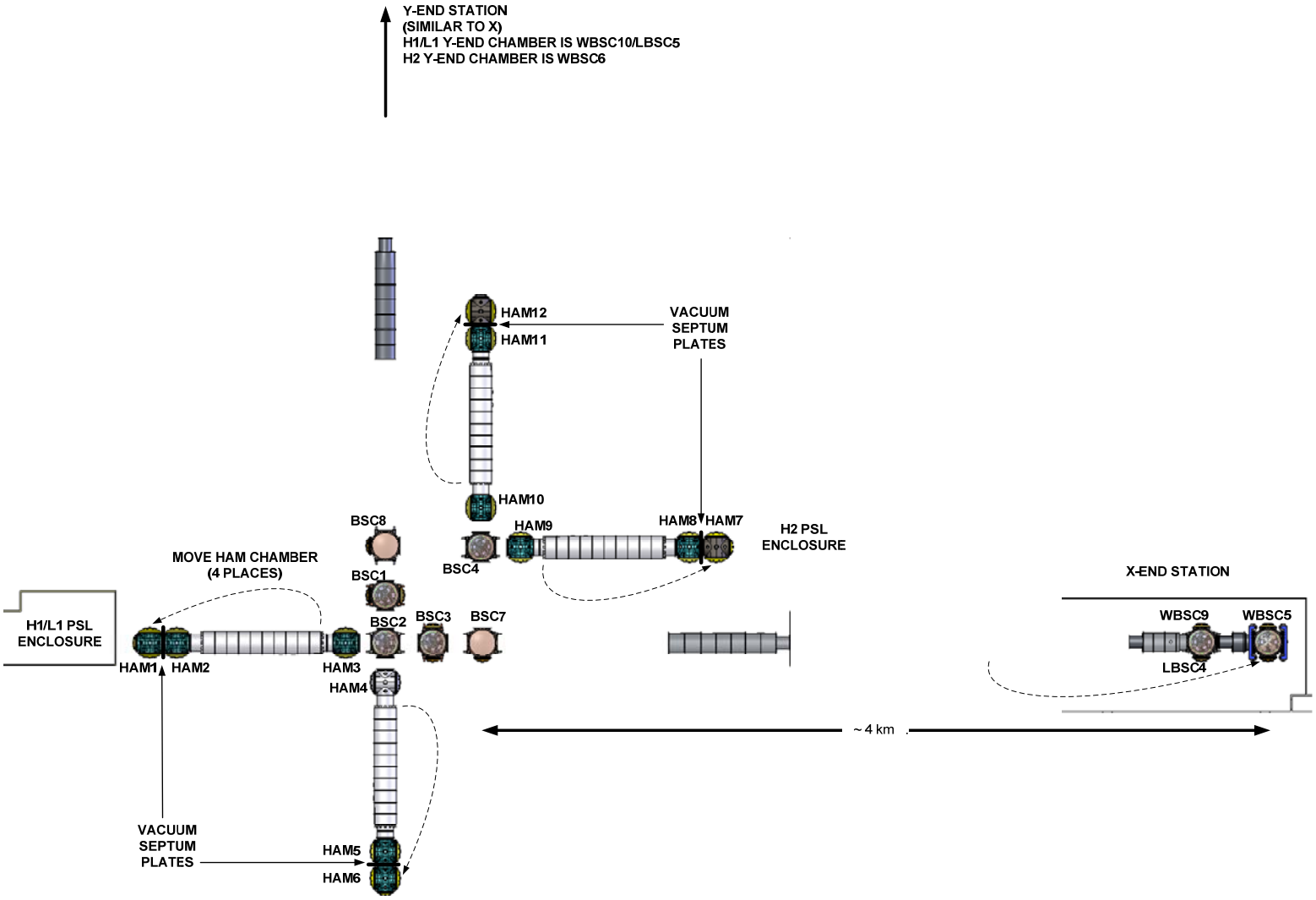

Figure 2: Advanced LIGO Vacuum Envelope (New layout overlaid on existing layout) Where neither L or W precede a BSC or HAM chamber designation, the chamber is not unique in position. See Figure below for specific LHO (Wasington) and LLO (Louisiana) chamber designations. *[Figure 1 from T010076-02 for reference.]*

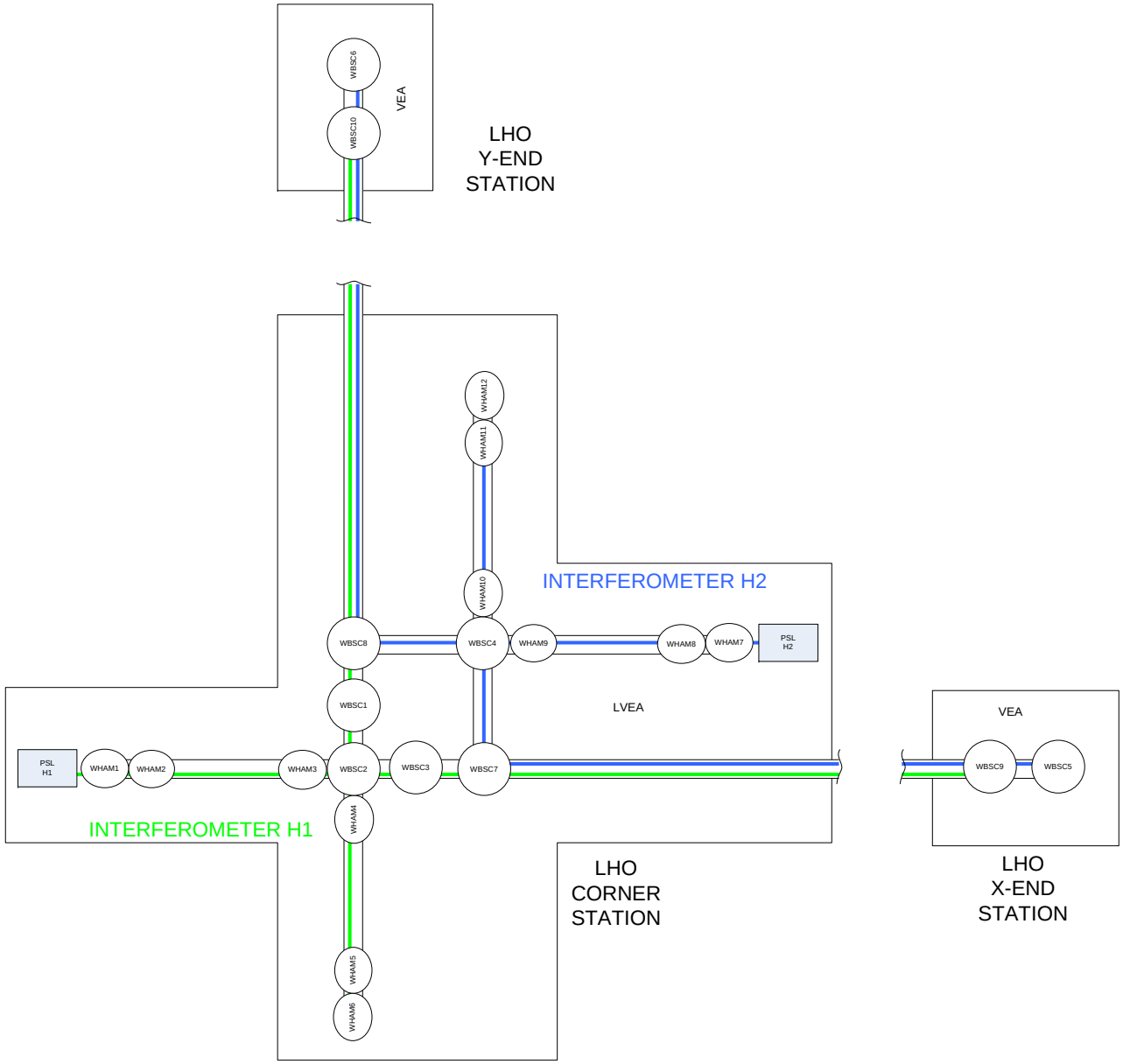

Figure 3: Vacuum Chamber Designations for the LHO Observatory (Hanford, Washington). Spools, gate valves, electronic equipment racks, exo-vacuum optical readout tables, etc. are not shown.

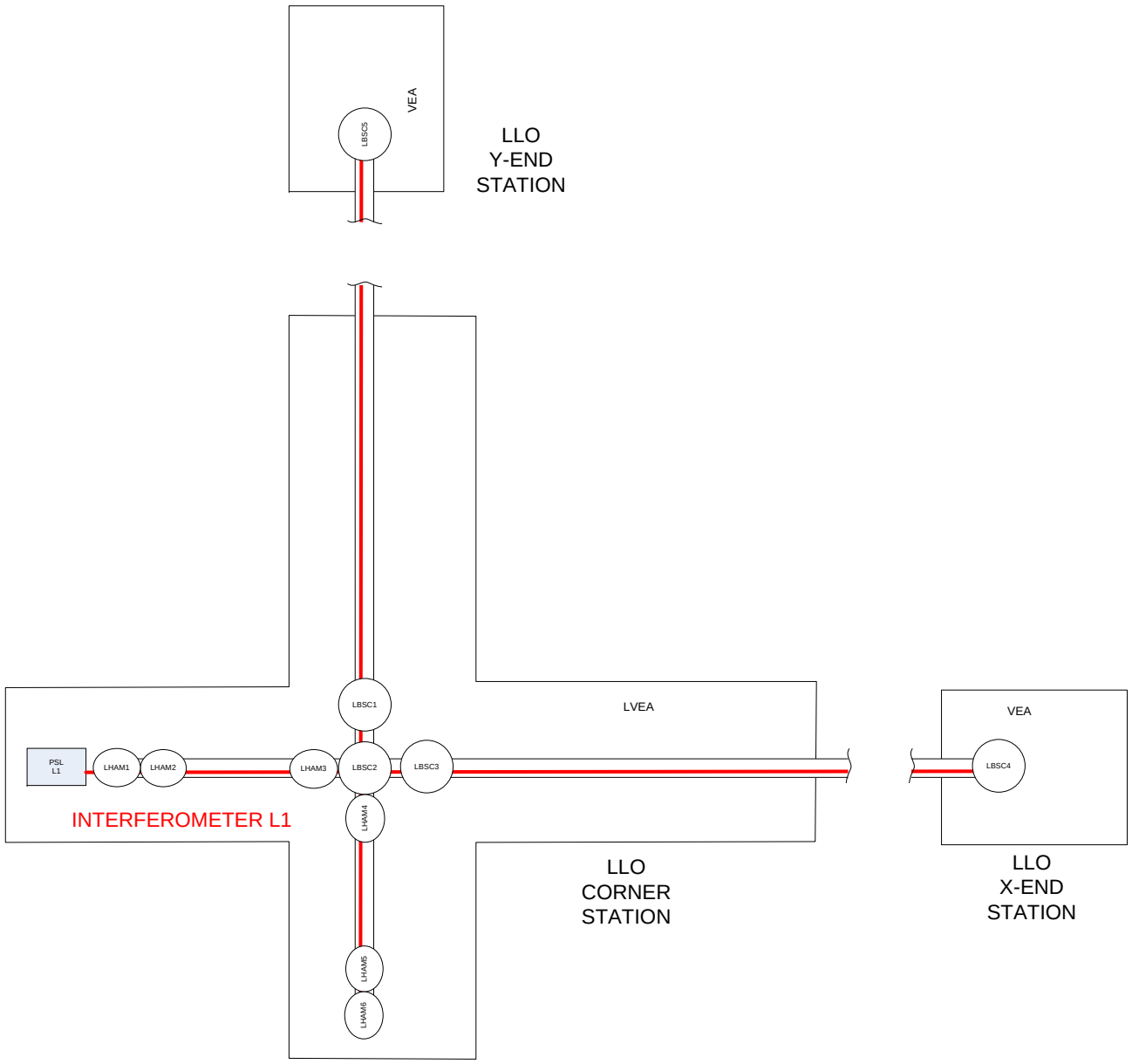

Figure 4: Vacuum Chamber Designations for the LLO Observatory (Livingston, Louisiana) Spools, gate valves, electronic equipment racks, exo-vacuum optical readout tables, etc. are not shown.

7) need someone in SYS to identify/collect or build COC solid models for the layout [action Dennis]

8) need Mike to export zemax pitch into values appropriate for SW (accounting for wedge angle) (low priority)

9) Action: Ed will raise the HAM2 optics table by 67 mm and revise the suspension shims (which should leave about 10 mm of shim remaining). This should increase available mass for stiffening the suspensions, balancing the payload and (possibly and if needed, table extensions)
see L0900030-v2 pg. 4 and action item #6, discusses effect of ITM wedge angle tolerance on this height -- nominally +/- 7 mm uncertainty -- GariLynn is tasked to see if this can be reduced.

10) The HAM2 layout in the PDMWorks vault is not the latest layout as discussed at the layout & interface meeting held recently at UFL (L0900030). Luke subsequently created a very rough, notional layout more consistent with the layout discussed at the UFL meeting (see Figure 5). This layout extends too far beyond the table. It is not advisable to have large table extensions and we may not have the mass available to make even small, stiff table extensions. IO (Luke) was encouraged to work on layout alternatives to either eliminate the need for table extensions or minimize their extent. We discussed a couple of possibilities to make a more workable layout, e.g. rotate the {SM1, PMMT1, FI, PMMT2, SM2} ensemble clockwise about PMMT1 until SM1 is on the optics table & shift the PSL injection periscope to the right, use periscopes to point beams off to viewports, consider adding viewports, consider sending beams to HAM1 instead of IOT1, etc. Action: Luke to try different layout scenarios in attempt to move all SOSs onto the table and minimize or eliminate the need for fixed mirror mounts beyond the current extent of the optics table.

11) The plane defined by the centers of the MC1, MC2 and MC3 optics must be locally horizontal. At the time of the meeting we observed that MC1 and MC3 in HAM2 had their bases on the optics table surface whereas MC2 in HAM3 was ~100 mm above the table. Since the maximum height change between HAM2 and HAM3, due to the tilt of the global x-axis with regard to the local horizontal, is ~10 mm, there was clearly an error. After the meeting Mike checked his Zemax optical layout and found it was correct and Ed checked that his positioning sketch values were in agreement with Mike's Zemax numbers. Then Dennis & Mike discovered that the MC1 and MC3 assembly coordinate system was not properly placed relative to the positioning sketch (in the HAM2 top level layout as downloaded from the vault 31-Mar-2009 onto the engineering workstation in the SCR).The MC1 & MC3 coordinate frames were positioned ~100 mm below the proper location. Action: Ed must correct immediately.

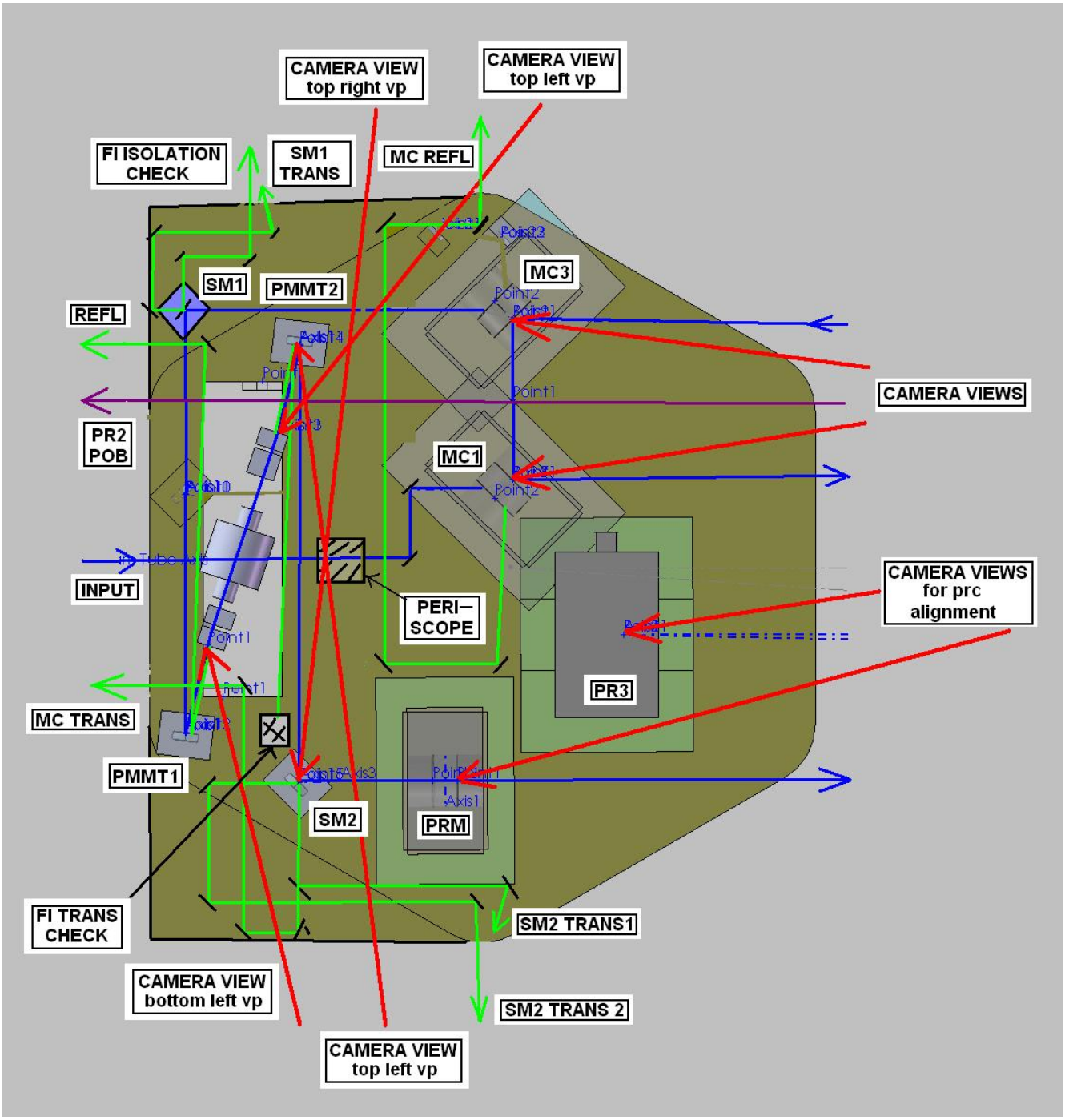

Figure 5: VERY ROUGH, NOTIONAL Layout for HAM2 shown with Optics Table Extensions which are far too large – working to eliminate need for optics table extensions or minimize extensions. Note that the PRM HSTS must be able to move +/- ~25 mm (not sure of this value) in order to accommodate uncertainty in the ROC. Consequently SM2 cannot move closer to PRM. Not shown in this image is the magnetic field keep-out zone for suspensions (ellipsoidal volume surrounding the Faraday Isolator). This keep-out zone might be minimized with the addition of a magnetic field containment shield of iron around the FI magnets.

12) After the meeting Dennis & Mike discovered that the HSTS (aka MC) suspension has an incorrect height separation between the base and the center of the optic. This is true for both the detailed model/configuration (which has an incorrectly positioned substitute metal mass instead of an optic) and the simple envelope model/configuration. The simple

envelope model/configuration has a beam height (distance from base to center of optic) of 135 mm, whereas it should be 139.7 mm (5.50 inch). Action: Ed must correct the HSTS envelope, while maintaining the mass properties.

Sadly I can find no documentation from SUS which gives key dimensions of the HSTS. For example, the requirements document (), the preliminary design document (T080187-00) and the top assembly drawing (D020700-A) do not list the envelope dimensions or the beam height. Action: Dennis to get a RODA with key envelope and beam height dimensions for all suspensions signed ASAP.

13) After the meeting, Dennis & Mike also discovered that the simple envelope model/configuration for the HLTS (aka RM) suspension has an incorrect beam height of 140 mm. It should be 158.5 mm. Action: Ed must correct the HLTS envelope, while maintaining the mass properties.

14) Action: In lieu of true solid model designs, Mike will export Zemax solid models of baffles, beam dumps to, output Faraday Isolator, ETM Transmission Telescope, etc. for use as place holders in the integrated layouts. Materials and/or total mass estimates must also be given.

15) HAM8 & HAM9 height discussion: Luke re-iterated observation from the recent UFL meeting that the MC cavity (MC1, MC2, MC3) must remain “on the deck” (i.e. their bases on the HAM optics table with minimal shimming, only to account for setting the MC cavity onto a locally horizontal plane) with the HAM optics tables at their lowest position (-325 mm global Z). This is necessary due to their placement within the chamber relative to the limited HAM chamber ceiling height at these positions.

16) The balance mass for the HAM8 was only 20 lb. This seems incorrect if the MC1 and MC3 are “on the deck”, given that there is considerably more balance mass on HAM2 and approximately the same complement of payload, albeit distributed differently. Action: Dennis to check for proper mass and mass balancing on HAM8. It was mentioned that using the FMs, we could set the PR3 (HLTS) “on the deck” (or close to it) to minimize mass spent in shimming this suspension. However, this aggravates vertical to length coupling in the recycling cavity (see action 18 from L0900030)

17) Action: Ed to create small fixed optics models using the DLC mount (D99001) in the vault, including posts of appropriate height for each instance (perhaps start with just a generic approximately correct height). Note that some post models are also likely in the valut as well.

18) Action; Luke to provide a model for the Arm Cavity Baffle (ACB) to Ed.
Action: Mike to give position and orientation data for the ACB to Ed.
see T010076 table for basic in-vacuum assemblies

19) We need to add locations for counter-balance mass other than the optics table in the simplified model, i.e. HAM-ISI stage-1 & BSC-ISI stage-2 keel & HAM-ISI stage-1 sides. Also need to define masses appropriate for these locations eventually.
Action: Calum and Ed, lower priority

20) Action: Dennis to work with subsystem leaders to define cognizant engineer for each and every assembly (e.g. not just “SUS”, but an individual in SUS). SYS (Ed, Calum, Dennis,

…) would then work with these cognizant engineers when models have problems or questions arise.