Fermilab

Particle Physics Division
Mechanical Department Engineering Note

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Project: CKM

Title: CKM BEAM TRANSPORT CLOSEOUT

Author(s): ED LAVALLIE

Reviewer(s):

Key Words:

Abstract Summary:

Applicable Codes:

By: Ed LaVallie
PPD/MSD
04/21/04

Cover Sheet

CKM (E-921)

CKM PRIMARY/SECONDARY

BEAM TRANSPORT

AND EXPERIMENTAL LAYOUT

ENGINEERING NOTE

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CKM Beam Transport/Experiment Engineering Note

Opening Statement:

The purpose of this engineering note is to document the efforts expended to develop a new CKM cost estimate based upon a much more comprehensive design which hopefully complements the "review of cost estimates" presented if February of 2003, thus eliminating the need for additional contingency funds. Before this new design/cost estimate was ready to be submitted to the CKM Experiment for review, funding was denied for due to federal budget constraints, which has stopped the process for its current design, thus causing this close out summation.

Scope:

Working with designated contact people, Tom Kobilarcik (beam line physicist Accelerator Division), and Peter Cooper (CKM Experimental Spokesman) who supplied the projected CKM Experimental Layout create Primary, and Secondary Beam Transport optics that begins at a fixed point M01, and ends at another fixed point in MP-9 in the Beam Dump (existing buried beneath the road) at the downstream end of the MP-9 Experimental Hall. This transport proposal must be based upon utilizing existing Meson Laboratory Primary Beam transport enclosures from M01 through the Meson Detector Building and also utilize the existing MP-9 Experimental Hall and existing Beam Dump. Definition of required new enclosures between downstream end of Detector Building and upstream end of MP-9 constitute the bulk of the new civil construction and are definitely within the scope of this project. The ultimate goal of this task is to come up with a comprehensive design to enable all disciplines to estimate all costs related to bringing the CKM Experiment on line. As previously stated new civil construction costs, will be based to a great extent upon this study, and will ultimately be prepared by Fess Engineering Department under the direction of Tom Lakowski, assisted by Russ Alber. Definition, identification, fabrication and or re-work cost estimates of transport beam-line components will be supplied by Herman White and Rick Coleman. Cost of Cryogenic RF Cavities and their related feed systems, will be supplied by Leo Ballantoni. Roger Zimmerman will specify shielding requirements in all areas and Larry Spires will estimate steel procurement, and installation costs. VVS/VVL/DMS Detector costs by Jeff Brandt, Vacuum System Design and costs by Del Allspach, surveying needs and requirements by Virgil Bocean and George. All other transport or experimental requirement costs will be specified by, the numerous other people directly related to the specific component design including myself for Vacuum Flanges and Test Vessel.

Project Status (at outset):

Although I was not in attendance at a review process of the CKM Experimental cost estimate (current at that time), apparently the presented materials were challenged for not having adequate engineering documentation to accompany presented cost data. This in turn caused the reviewers to add additional monies to cover contingencies, which had a detrimental impact on the CKM overall cost. Due to this review outcome engineering

Documentation became a top priority. A request for immediate engineering support was made to my department head, which was communicated to me and I was told to stop working on a CKM related project (Vacuum Veto Detector Flanges) and was enlisted to develop a comprehensive plan to fortify presented cost estimate data. A Solid Model of the transport and experimental layout was recommended as the way to go by my department head.

How to proceed:

The only information available was a secondary transport optics beam sheet dated 3/6/03 (magnets only, no experimental components and no start point), which was to begin at a pre-chosen secondary target location, a very preliminary FESS interpretation of this data 8-1-82 Project Number (based upon bend centers) with proposed enclosure cross sections defined by the experiment following these bend centers, and a layout of the KTEV Experiment, which would be the foundation for the CKM Experiment. I did at this point request information that tied the secondary beam sheet to a real XYZ Meson lab location and also to the experimental layout. The initial Meson co-ordinate e-mailed to me on 3/17/03, Z = 1566.84', X = -91.27', Y = -0.19' gave me the theoretical start point for the 3/6/03 secondary transport sheet, with the tie to the experiment beginning to appear on a beam sheet dated 3/24/03. There was in fact no primary beam optics sheet available to me, which did define this secondary beam target location, nor was there an absolute end point located in the existing MP-9 beam dump, which would also have been a useful to check coordinate relationships.

With this level of information, attempting to build a Solid Model of this layout would have been premature. As there was no drafting assistance available at that time the only way to proceed was to jump into the fray myself unassisted to get a 2-D layout started, which I did. With the only information available being related to the secondary beam line, KTEV Experiment and now an XYZ coordinate start point this was the only place to start. By understanding the transport and experimental components, sizes, relationships, how used, accessed, feed requirements, vacuum requirements, and shielding requirements in the secondary transport line, and experimental hall I would be able to start creating a 2-D layout of how much of this went together and in some cases didn't. This would also prove that the beam optics where such, that the existing beam dump was suitable and its location was acceptable for reuse thus establishing some beginning criteria. After I understood and digested the aforementioned parameters I could then define the enclosure cross sections, giving consideration to alignment requirements, component supports, shielding requirements etc..

Initial Findings:

Upon proceeding I found there were undefined components, potential interferences and upon attachment of the KTEV Experiment to the outgoing transport beam, the beam dump, in its current location was unserviceable. The entire secondary transport beam and experiment would need to be translated upstream some 30' to allow for use of the MP-9 beam dump in its current location. Although I felt these interference problems *could be easily worked out in the secondary beam line via. a new optics sheet, I was concerned that with some transport magnets not being identified, no secondary transport design could be totally believed. Even more important, could a primary beam be designed to weave its way through all the primary enclosures and end up joining the Secondary Beam target point at the now new location with angular compatibility between incoming and outgoing beam angles. As this bits and pieces approach was changing rapidly and wasn't going anywhere very fast I stated/requested that the full transport of Primary/ Secondary/ Experiment/Beam Dump optics all being tied together was needed to constitute a comprehensive starting point, after which I could lay it out to see if the beam made it through the many enclosures without costly modifications being needed and end up in the beam dump at a usable angle.*

Requested Direction Change:

This methodology was accepted and I in fact received the first full transport sheet from MO-1 through MP-9 Beam Dump on 4/10/03 which would in part the basis for the completely new "transport drawing" using the aforementioned FESS Project information to the extent possible. There have been two subsequent beam transport sheets dated 5/7/03 and 6/ 9/03 which have corrected some component interferences, redefined intermediate beam dumping locations, hopefully defined/added all required experimental components and finally, optimized angle at which MP-9 existing Beam Dump is struck to offer maximum shielding. This optics layout when begun would be an ongoing drawing and single depository of all CKM parameters.

Meson Lab Layout Drawing:

With the aforementioned as the optics start point I now needed a Meson Lab enclosure drawing to attach this information to. After much searching within PPD and Accelerator Division groups for an electronic 2-D illustration of Meson Lab as a base for the component layout. I discovered, that none existed, only some not to scale Auto-Cad electrical component drawings passed to Accelerator Division (Tony Parker) from PPD years before (not useful). Due to this immediate need to proceed and the continuing lack of drafting help at that time I personally began creating such a 2-D drawing. I began by requesting hard copy drawings on the numerous phases of civil construction dating back to 1970, from Russ Albur (FESS), but without direct access to Fess drawing files even requesting pertinent information was difficult. I then requested from Tom Lakowski (FESS) that I be granted this needed access to FESS electronic drawing files, which for some reason was no longer accessible to anyone outside of FESS. After a few days I was in fact granted requested access. None of the drawing information was usable directly (all photocopies), although information on the hard copies could then be copied and used to recreate the layout drawing, which I could then add the transport information to.

Referenced FESS Project Numbers:

For record keeping purposes the primary FESS Project Numbers which I have accessed, and referenced drawings from, are 7-2-1 from Switchyard Projects, and 8-1-1, 8-1-2, 8-

*1-3, 8-1-3B, 8-1-4, 8-1-6, 8-1-27, 8-1-31, 8-1-47, 8-1-48, 8-1-48A from Meson Laboratory Projects, plus numerous other Meson Lab smaller modify/ upgrade projects most of which are in the enclosed 8-1-*** series. There were also a couple of enclosure modifications that were done directly by Meson Lab Engineering department at that time, these drawing are on file in now, Particle Physics Division drawing files. It also should be noted here that information on the MP-9 Beam Dump was taken From: Don Cossairt memo, dated 3/6/1983, To: Ray Stefanski titled "MW and MP Final Beam Dumps-Sequel to 2/16/83 Memo". This information gathering has required accessing literally hundreds of drawings that I will not attempt to list and a lot of searching that covers a linier distance in excess of 1/2 mile (fortunately I had some prior knowledge of original Meson Lab Enclosures (but little recall of subsequent modifications). Additionally I accessed a couple of FESS drawings specific to CKM Experiment (proposal) listed under FESS 8-1-82 from February of 2002, which was used for the earlier cost estimate. These drawings had some useful information I attempted to integrate along with a Secondary Transport sheet dated 3/6/03 and beyond to the extent possible. Subsequent transport data sheets all supplied by, Tom Kobolarcik are dated 3/13/03, 3/24/03, 3/25/03, 4/10/03,5/7/03 and 6/9/03. The initial Meson co-ordinate e-mailed to me on 3/17/03, Z = 1566.84', X = -91.27', Y = -0.19' gave me a theoretical start point for the 3/6/03 secondary transport sheet. The following is a complete list of Projects related to Meson Laboratory category 8-1, and 7-2-1 from Switchyard Project list.*

7-1

SWITCHYARD PROJECTS

7-1-1 Jan-74 Proton Beam Enclosure (Switchyard)

7-1-2 Addition to Emergency Exit G-2

7-1-4 Aug-76 Addition to Switchyard Service Building

7-1-4E Nov-76 Switchyard Service Building Electrical

7-1-4M Dec-77 Switchyard Service Building Ventilation, A/C

7-1-5 Nov-76 G-2 Manhole Access

7-1-6 May-81 Switchyard SB Addition

7-1-7 Mar-83 G-2 Service Building

7-1-7A G-2 Manhole, Electric

7-1-8 Sept-83 G-2 Service Building Air Conditioning

7-1-8 Nov-81 Shielding at Enclosure F-2

7-1-9 Apr-86 Enclosure C South Addition

7-1-10 Dec-89 Cathodic Prot- Switchyard

9-7-1-11 Substation Shielding

9-7-1-12 Switchyard Shielding

7-1-13 Switchyard Tunnel Source Detection

7-1-14 Exp. Area Re-roofing

7-1-15 July-95 Swtichyard Emergency Lighting

7-1-16 Jan-02 Enclosure C Hatch Cover

7-2-1 Jan-74 Meson Lab Phase I (Switchyard)

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8-1

MESON LABORATORY PROJECTS

8-1-1 Jan-74 Meson Lab II

8-1-2 Feb-74 Meson Lab IIIA

8-1-3B Mar-74 Meson Lab, Phase IIIB, Detector Building

8-1-3C Mar-74 Meson Lab IIIB

8-1-3D Apr-74 Meson Lab Detector Building, North Elevator Repair

8-1-4 Dec-73 Meson Lab IV, Experimental Enclosure

8-1-5 Meson Lab, Phase V

8-1-6 Dec-73 Meson Lab VI

8-1-6E July-74 Meson Lab VI Electrical

8-1-7 Meson Lab Detector Building, Sprinkler System

8-1-7A July-74 Meson Detector Building Mezzanine Heating, Ventilating and Air Conditioning

8-1-7B April-74 Meson Detector Building Mezzanine Power and Light

8-1-7C July-73 Meson Detector Bldg. Mezzanine Sprinkler System

8-1-8 Apr-74 Meson Lab Substations ML-10 and ML-11

8-1-9 Meson Lab Detector Bldg. Mezzanine Raised Floor

8-1-10 Sept-74 Meson Lab Addition to Service Building M-3

8-1-10E Sept-75 Meson Service Building M-3 Electrical

8-1-11 Meson Lab Addition to M-1 Beam Line

8-1-11A Nov-74 Meson Lab M-1 Beam Line Addition

8-1-11B June-75 Addition to Beam Enclosure M-1 Phase B

8-1-11E Addition to Beam Enclosure M-1 Electrical

8-1-12 Sept-83 Meson Assembly Building

8-1-12A July-88 Meson Assembly Building Addition

8-1-12B Meson Assembly Building 20 Ton Crane

8-1-13 Cerenkov Counter Enclosure at M-2

8-1-14 Jan-75 Exterior Lighting East Side Meson Det. Bldg.

8-1-15 Apr-75 Removal of Polyurethane Insulation at M-6

8-1-16 Re-insulation of Beam Enclosure at M-6

8-1-17 Apron Modification at Meson Equipment Access way

8-1-18 Retaining Wall at Service Building M-3

8-1-19 Mar-76 Air Conditioning for Service Building M-1

8-1-20 Meson Parking Lot Lighting

8-1-21 Heat Reclaim - Meson Detector Building

8-1-22 Meson Paving

8-1-23 M-4 Drainage

8-1-24 Meson Beam Line Improvements

*8-1-24 Meson Lab Enclosure Upstream Half South 2802MI, 955565

8-1-24A July-78 Meson Lab Front End Hall Extension

8-1-24B Dec-78 Meson Lab F3 Manhole to Target Hall

8-1-24C Sept-78 Meson LAb Target Hall Extension

8-1-24D Sept-78 Meson Lab F3 Manhole to Target Hall

8-1-24E Sept-78 Meson Lab MI Enclosure

8-1-24F Dec-78 Meson Lab MI Enclosure

8-1-25 M-6 Line Access way

8-1-26 Apr-80 Meson Cryo Building

8-1-27 Dec-81 M-1 Extension and Exp. 605, Meson

8-1-28 Apr-82 Meson Sanitary Sewer

8-1-29 Mar-80 Meson Lab M-1 Extension Gas Line

8-1-30 June-80 Switchyard\Meson Enclosure Suction Header

8-1-31 M-1 Service Building Addition

8-1-31 May-81 Meson M-1 Pion Target Hall

8-1-32 Pion Target Hall Addition

*8-1-32 Meson Lab MS-1 Extension

8-1-33 Leakproof Meson Detector Building Roof

8-1-34 Oct-83 Meson Detector West Toilets

8-1-35 Meson Cryogenics Building Crane

8-1-36 Meson Detector Building Panel Replacement

8-1-37 Mar-84 MS-4 Service Building

8-1-38 Dec-82 M-West Enclosure and Pipe

8-1-39 Nov-84 Meson West Side Primary Duct Extension

8-1-40

8-1-41

8-1-42 Apr-83 Meson Cryogenic Building Extension

8-1-43 Meson Cryogenic Sewer and Water

8-1-44 EAO (Exp. Areas Planning Group)

8-1-44A Oct-83 Experimental Areas Operations Center Addition

8-1-44B Feb-84 EAO Meson Yard East Side Power Supply Area

8-1-44C Nov-83 EAO Meson North Area Utilities

8-1-45 June-84 M-W and M-P Beams Title I Report

8-1-46 Meson Roads and Utilities

8-1-47 Mar-86 M-W and M-P Beam Enclosures

8-1-47A M-W and M-P Heat Exchanger

8-1-48 Jul-85 M-W and M-P Experimental Halls

8-1-48A June-81 MW & MP Building Foundations

8-1-48B Feb-85 MW Steel Shell

8-1-48C Apr-85 MW Dewar Gantry

8-1-48D Jan-87 MW Counting House Addition

8-1-48E MP Experimental Hall Crane

8-1-48F

8-1-48G Feb-87 MW & MP Heater Modifications

8-1-49 Dec-86 Meson Cryo Building Addition

8-1-50 June-86 Misc. Meson Electrical

8-1-50A Feb-87 Misc. Meson Electrical

8-1-51 Sept-90 Meson F2 Beam Pipe Repair

8-1-51A Sept-90 Meson F2 Beam Pipe Repair- Phase 2

9-8-1-52 Meson Shielding I

9-8-1-53 Mason Shielding II

9-8-1-54 Meson Shielding III

8-1-55 Jul-91 MS 3 Service Bldg. Fire Alarm Upgrade

8-1-56 Sept-91 MS 2 Service Bldg. Fire Alarm Upgrade

8-1-57 Sept-91 MS 1 Service Bldg. Fire Alarm Upgrade

8-1-58 Meson Detector Bldg. Grove Remote

8-1-59 M-East Portakamp Sprinklers

8-1-60 Feb-91 MS-7 Fire Alarm Upgrade

8-1-61 Meson Detector Bldg. Smoke Detection

8-1-62 Target Service Bldg. Reroofing

8-1-63

8-1-64

8-1-65 Purchase Requisitions - Box Culverts

8-1-66 Meson Detector Bldg. 20 Ton Radio Control

8-1-67 Meson E-Portakamp 49 & 50 FP\

8-1-68 MWG & MS7 Reroofing

8-1-69 MPG Reroofing

8-1-70 MDB Heating Upgrade

8-1-71 July-95 MS1, MS2, MS3 Reroofing

8-1-72 M Bottom Pit Removal

8-1-73 May-97 MW9 Mezzanine

8-1-74 Sep-98 Meson Detector Building Roof Study

8-1-74 July-00 Meson Detector Building Roof Study

8-1-75 Nov-98 MP-9 Crane Access Safety Cage

8-1-76 May-00 MW9 Jib Crane

8-1-77 May-00 MW9 Monorail

8-1-78 Aug-00 MS-6 Magnet Test String Trench

8-1-79 Oct-00 MW9 Add'l Parking

8-1-80 Sept-00 Inspection Report of Fixed Target Area Enclosures

8-1-81 Aug-01 MCC-M-West Cryo Line

8-1-82 Feb-02 CKM Experiment - Meson Line

Last Updated: 08 February 2002
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Accessing the many drawings going back to construction contracts from the 1970's, creating an all new layout drawing from this information and then going back and modifying what I had just completed based upon later modifications was labor intensive, but a necessity. Due to the fact that there is no overall electronic drawing of Meson Lab *and Meson Construction Projects are such that all primary beam enclosures were tied together it seemed appropriate to not confine this layout to only parts of a given contract but illustrate all seven original Meson Lab Primary Beam Enclosures into a single document (drawing). I carried this approach on through the Meson Detector Building, which is also illustrated in its entirety covering all beam lines. Downstream from the Detector Building the approach could be somewhat different, in that you might only need to illustrate what impacts the proposed new CKM New Enclosures, in this case the MP Beam line enclosures, which has been my initial direction (Note: downstream enclosures also for the most part were individual contracts with some exceptions).*

Survey Data MP-9

After all this information was compiled into a 2-D layout, illustrated over time, and utilizing the Meson co-ordinate system as a baseline with X=0, Y=0 originating in the target tube upstream from Front End Hall I proceeded to work upstream and then downstream from this baseline location adding/illustrating components and checking for interferences as I moved along, finally ending up in the MP-9 Beam Dump. Upon completion of making this new layout based upon known enclosure locations from FESS Project Construction Drawings and adding components from 6/9/03 Beam Transport Sheets, proof existed that all components were in clear/open locations and parallel to walls. This 2-D layout drawing is know the single depository of CKM Experiment and transport information and is called "CKM_2/27/04.mf1". There was at this time one other item that needed to be verified, the exact location of the MP-9 Experimental Hall. A request was initiated with the survey group to in fact prove or disprove information I had gathered (does it match). The following survey data shown to the right of the page under "Meson" illustrates wall locations in X and Z (in feet) relative to Meson Laboratory baseline coordinate system. Although there is survey data in many locations around the experimental hall my main interest is in proving that the building is close to where the FESS drawings indicate. Particular points I looked at are295364, 295445, 295454, 295385, 295384, 295383, 295350 and 295353, which are in fact illustrated on the 2-D layout. This data indicates that the hall is in fact within a couple of inches of predicted location, which for my purposes at this time is adequate.

COORDINATES OF WALLS AP8 AND AP9

DUSAF					MESON			
Pt	**E(feet)**	**N(feet)**	**H(feet)**	**Z(feet)**	**Pt**	**z(feet)**	**x(feet)**	**H(feet)DUSAF**
295350F	99237.294	106704.954	741.94	740.76	**295350F**	2426.633	98.157	741.94
295351F	99241.912	106662.831	741.94	740.78	**295351F**	2384.324	95.797	741.94
295352F	99230.007	106661.448	741.94	740.78	**295352F**	2384.914	83.826	741.94
295353F	99225.384	106703.521	741.94	740.76	**295353F**	2427.175	86.173	741.94
295350C	99237.294	106704.954	750.90	749.72	**295350C**	2426.633	98.157	750.90
295351C	99241.912	106662.831	750.90	749.73	**295351C**	2384.324	95.797	750.90

295352C	99230.007	106661.448	750.90	749.73	295352C	2384.914	83.826	750.90
295353C	99225.384	106703.521	750.90	749.72	295353C	2427.175	86.173	750.90
295383	99255.750	106707.251	737.93	736.76	295383	2425.869	116.740	737.93
295384	99254.996	106714.472	737.93	736.76	295384	2433.116	117.181	737.93
295385	99272.463	106716.465	737.93	736.76	295385	2432.214	134.739	737.93
295386	99269.631	106740.650	737.93	736.75	295386	2456.536	135.916	737.93
295387	99261.063	106739.697	737.93	736.75	295387	2457.003	127.308	737.93
295388	99259.105	106756.940	737.93	736.74	295388	2474.333	128.207	737.93
295389	99266.220	106770.428	737.93	736.74	295389	2486.470	137.440	737.93
295422	99250.699	106906.223	737.93	736.69	295422	2622.971	144.424	737.93
295364	99210.769	106703.282	737.93	736.76	295364	2429.339	71.717	737.93
295368	99204.834	106754.380	737.93	736.74	295368	2480.718	74.252	737.93
295409	99191.997	106866.681	737.93	736.70	295409	2593.603	80.027	737.93
295412	99188.670	106895.333	737.93	736.69	295412	2622.412	81.449	737.93
295413	99190.020	106900.459	737.93	736.69	295413	2627.247	83.622	737.93
295418	99220.396	106903.890	737.93	736.69	295418	2625.644	114.149	737.93
295419	99248.765	106907.216	737.93	736.69	295419	2624.268	142.679	737.93
295454	99250.558	106907.426	737.93	736.69	295454	2624.180	144.482	737.93
295455	99188.115	106900.244	737.93	736.69	295455	2627.348	81.708	737.93

Shielding Requirements:

Next it was time get a handle on shielding requirements which would further be a check for clearances in the Meson Detector Building particularly and get some understanding of shielding requirements in or outside of new enclosures between Meson Detector Building and MP-9. The following information relative to steel and concrete shielding requirements internal to enclosures was received from Larry Spires.

1st. All beam transport magnets and beam tube passing through the Meson Detector Building and including the last pre target Quadupole Magnet downstream from the Detector Building will require a minimum of 6' of steel shield on both sides and top, none beneath. All of this steel would then need to be enclosed in 3' of concrete.

2nd. From the last pre-target Quadrupole Magnet through the last BM-105 Magnet, 4.333' of steel will be required around all these components. Additionally 3' of concrete is needed to enclose this steel.

3rd. From this point downstream, to upstream wall of MP-9 Experimental Hall I have followed the original FESS proposal which stated that all enclosures are bermed and the earth covering must be 8' thick.

I

developed a pair of designs to cover the 1st set of parameters, which are illustrated in sections A-A and B-B of CKM_2-27-2004.mfl. Steel thickness sides and top are 6" greater then minimum.

I also developed an additional pair of designs to cover the 2nd set of parameters, which are illustrated in sections C-C and D-D of CKM_2-27-2004.mfl. Steel thickness sides at minimum of 52", with top 9" greater then minimum up top.

I also developed and additional pair of designs to cover the 3rd set of parameters, which are illustrated in sections E-E and F-F of CKM_2-27-2004.mfl. (earth berms)

Note:
The above designs were developed using 26" x 52" x 52" steel blocks which can be purchased inexpensively and are suitable for shielding purposes. Some 9" Cast Steel Plate will also be used where necessary as a bridge beam increasing thickness up top. Concrete shielding is made up from standard shield blocks with sizes as needed.

Existing Enclosures Usable/Unusable:

The existing enclosure 61' wide x 92' long enclosure coming off the downstream Northeast corner of the Meson Detector Building is square to the Detector Building as is its crane coverage, which goes well back into the detector building. This building cannot be lengthened, as it would run into the adjacent MP Service Building. The hoop roof enclosures downstream from this building although angled are displaced from the new optics requirements and are also not large enough therefore unusable. I must recommended that these existing buildings be removed and replaced with a new Target Hall Building being defined with crane coverage hopefully through the entire length of detector building. The new enclosures downstream form the New Target Hall to the MP-9 Experimental Hall would then follow the new beam line optics. Salvaging the existing crane, which seems to be in good repair and adequate load carrying capacity to handle transport components and shielding which will be a must in a new Target Hall is without doubt a worthwhile undertaking.

Sizing of Enclosures:

Elevations for all existing transport enclosures from M0-1 through the Meson Detector Building are at 742'. The MP-9 Experimental Hall floor elevation is at 738'. It is desirable to have all components of the experiment at the same floor elevation therefore the floor elevation change will occur just downstream from UMAG-02 which is a BM-105 Magnet.

The Target Hall will be defined as beginning at the downstream wall of the Meson Detector Building and will include the string of pre and post target Quadrupole Magnets, targeting, a string of eight BM-105 Magnets, last one being B14-2 Magnet, and a pair of beam dumps interspersed between BM-105's. The second criteria was, the need for large quantities of steel and concrete shielding surrounding all these components with access *labyrinths. The minimum steel/concrete shielding width not including external access or utilities would be 24'2". The existing crane beams center to center of 41'10" minus 24'2" shielding width = 212" / 2 =106" (8'10") per side if split if centered. As the lateral pick areas are defined by the bridge length and troll pick center, crane coverage would be a minimum of 3' to 4' from the rail centerline at each end thus the usable area would be 4'10" to 5'10" if split, not an over abundance, so the crane rail width (crane) will define the building width to be 43'4" inside width minimum. Further, because components will be serviced from the East side of enclosure and to minimize intrusion into the MP Service Building the isle access on the East side of beam will be maximized.*

The enclosures downstream from the Target Hall would be a minimum of 9 concrete pours achieving a gradual bend left or to the West. Keeping the tunnel cross section the same throughout its length would be a real plus and if the enclosure did not exceed 10' height it is easily done. Looking at all the components downstream from Target Hall, the cryogenic RF Cavitiy System requires the largest tunnel cross-section 10' x 12' and 310' in length, so these 8 cryostats along with their cryogenic feed lines should be a primary parameter in determining tunnel cross section. There is also a need for a 33' x 65' cryogenic service building as well as 2 smaller control enclosures within 35' to 45' of the two cryostat groupings. After much discussion about tunnel height/width and a walk through of the adjacent, existing MP Beam line with Leo Bellatoni spokesperson for cryostats and feed systems. it was agreed upon in principle to the tunnel cross section as well as using the MP Beam enclosures for the control enclosures. Beginning at the MP-9 upstream wall and continuing upstream some 140' the enclosure cross section will be 16' wide x 14' high although the ceiling inside height will match the enclosures upstream from that, also the 16' width would also be centered on the 12' width.

After putting all this information together and before attempting to go any further I thought it an appropriate to have a meeting to discuss where we were and how we should proceed. I presented this information to Herman White, Rick Coleman, Tom Kobolarcik and Peter Cooper prior to moving on to what was required within the enclosures. All were on board conceptually with exception to the amount of space remaining before entering the MP-9 beam dump which needed to be increased for personnel passage from on side of the hall to the other.

After verifying that the conceptual beam transport design, and experimental layout then give consideration to radiation shielding requirements along the beam, in the Target Area (including handling requirements), Cryogenic RF Cavity requirements (two local enclosure stations plus Cryogenic Building) and experimental requirements (detectors, analysis magnets, shielding), after which define/recommend enclosures downstream from Meson Detector building connecting to MP-9 capable of handling the needs of transport and the experiment which I would then forward to FESS Engineering for final "new enclosure design" necessary re-work and costing for same.

I was initially asked by my department head to create a Solid Model of CKM for purposes of defining new enclosure parameters. Due to limited time help thus limited information from the outset, the creation of a good plan of action has occurred in stages starting with *several corrected versions of transport information. A conceptual layout in 2-D was the way to go as a precursor to any Solid Model, which is in fact currently in process.*

With the enclosures and transport now defined pretty well I began looking into what information I had received from Larry Spires as an initial steel shielding proposal. I have illustrated these needs in the various locations within the Meson Detector Building and the non-existent Target Hall. I have attempted to make the steel/concrete stack as compact as possible and provide material handling capabilities (relocating existing crane) and access, but have not addressed surveying requirements at this juncture. As MP transport enclosures are in very close proximity to CKM transport enclosures as it exits the Meson Detector Building consideration to these adjacent enclosures is a must, and will require reworking or merging of enclosures.

This same kind of thoroughness went into locating the CRYO building with its radiation requirements which have driven its location as far to the East away from enclosures as possible and attempting to minimize straight shots to CRYO building via: piping raceway. The RF Cavities are 16 in number, or two strings of four Cryostats with two RF Cavities each, are located in beam transport line, and require short distance cable termination as well as local manning during running periods. I proposed that these local stations (enclosures) be located in adjacent MP Beam tunnels utilizing nearby rollup access doors with some modifications for cable entrance. After some investigation of adjacent MP tunnels with Leo Bellatoni he accepted this approach and further concluded it might even be advantageous to have the two manned locations within the same enclosure, for communication reasons.

Now with some understanding of the cryostats, formulating the experimental layout comes to the fore. As there was much confusion as to the makeup of the experiment as well as the naming conventions I requested a listing of all detectors, magnets etc. along with spacing requirements. This was a must in developing the transport sheets by Tom Kobolarcik and tied transport, experiment, and beam dump together. Peter Cooper (spokesman) has in fact given me this information along with a copy of the CKM Proposal, which at some level defined components and has been very helpful to me in putting the drawing together.