ILD-MDI
and
Highlight from IRENG07

T. Tauchi, ATF2 meeting in Annecy,
15-17 October, 2007

New Organization : Research Director

- RD
  - **Sakue Yamada formally accepted the post.**
  - **Starting intensive activities**
- Structures under RD
  - **WWS co-chiars requested by RD to assist him**
    - Having weekly phone conference
  - **IDAG being selected by RD and WWS co-chairs**
    - Reviews LOIs and advises RD
- LOI call was sent out on 5th October.

LOI Call

Dear Colleague,

The International Linear Collider Steering Committee (ILCSC) announces a call for Letters of Intent (LOIs) to produce reference designs for the two ILC detectors. These designs will be detailed in two Engineering Design Reports (EDRs) to be completed on the timeline of the machine EDR being prepared by the Global Design Effort. The guidelines for the LOIs are presented in the appended document and a public presentation of the WWS roadmap for detectors can be found in the LCWS07 web site. The LOIs should be sent to the ILCSC by October 1, 2008 and will be reviewed by an advisory body appointed with the approval of ILCSC. This body, together with a management team led by the Research Director Sakue Yamada who has been appointed by ILCSC, will start a process leading to the formation of two groups capable of preparing the two engineering designs and the EDR documents.

Sincerely Yours,

Shin-ichi Kurokawa

Chairman of the International Linear Collider Committee

http://physics.uoregon.edu/~lc/wwstudy/lois/LOIguidelines.pdf

Goal by GDE-EC : EDR Draft, July 2010, ICHEP, Paris

ILD

http://www-flc.desy.de/ild/

- GLD/LDC → ILD
  - **Joint Steering Board**
    - Dean Karlen, Graham Wilson
    - Ties Behnke, Henri Videau
    - Yasuhiro Sugimoto, Hitoshi Yamamoto
  - **JSB had several meetings**
    - Established two working groups and a cost panel
    - Initial meetings with two WG leaders.
- Two working groups
  - **Optimization conveners**
    - Mark Thomson, Tamaki Yoshioka(+Keisuke Fujii)
  - **MDI/integration conveners**
    - Karsten Buesser, Toshiaki Tauchi

Two Working Groups

a. Optimization

The goal is to define parameters for LOI such as ECAL inner radius, coil radius, B field, Vertex radius etc. To do so, we nominate leaders who will organize the efforts. They will define the tasks, assign people, and take responsibilities for coming up with the detector parameters. They may define physics benchmark modes and low-level modes to study, formulate a set of questions to ask groups of people. Further discussions with JSB may be needed.

"Investigate the dependence of the physics performance of the ILD detector on basic parameters such as TPC radius and B-field. On the basis of these studies and the understanding of any differences observed the WG will make recommendations for the optimal choice of parameters for the ILD detector."

b. MDI, integration

The goal is to produce for LOI the design of MDI region, the assembly procedure, the push-pull design, and related experimental hall designs. The leaders are expected to define the needed tasks and organize required efforts.

Official WG charges are being drafted.

Roadmap to ILD - LoI

http://ilcagenda.linearcollider.org/categoryDisplay.py?categId=129

1. Working group activities an meetings

   Phone meetings with Webex etc, and
   the WG mailing lists.

2. Series of ILD Workshop

   1st (2.5 days), in Europe, early January 2008
   2nd (1.5 days), TILC08, Sendai, 3-7 March 2008
   more

3. Decision of ILD Detector Parameters

   in May 2008

4. ILD-LoI Submission , 1 October 2008

category | view: Indico style | manage |

First MDI/Integration WG meeting

MDI/Integration meeting

Thursday 04 October 2007
from **14:00 to 16:00**
chaired by:
Karsten Buesser (DESY) , Toshiaki Tauchi (KEK)

Material: Draft Minutes 10/6

Thursday 04 October 2007 |

Thursday 04 October 2007

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14:00 LDC-IR Overview (20') (Slides) Karsten Buesser (*DESY*)

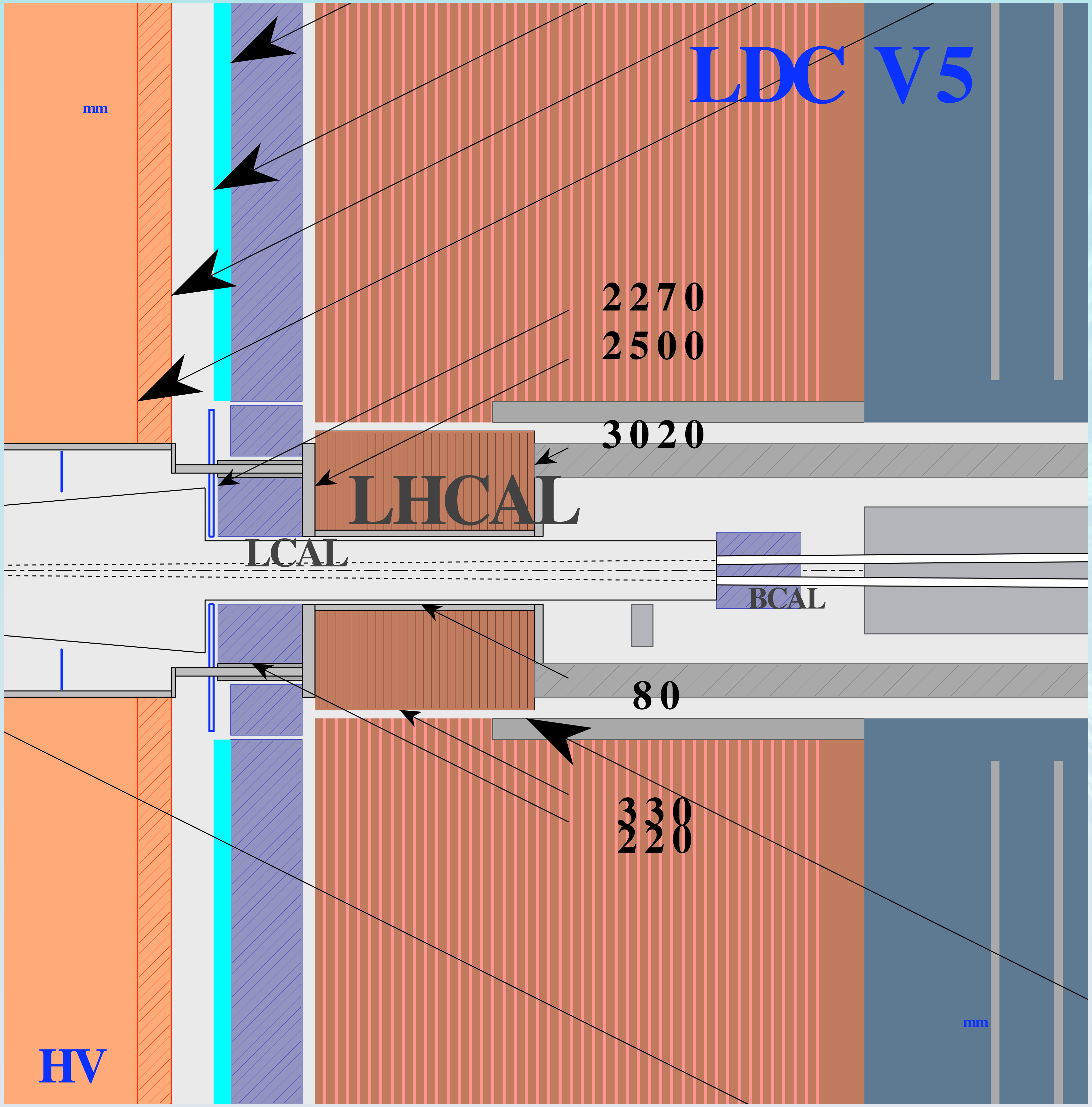
14:20 GLD-IR Overview (20') (Slides) Toshiaki Tauchi (*KEK*)

14:40 Discussion (1h20')

to firstly understand the design principles of the LDC and the GLD interaction region. This should bring us in a position to develop a joint design as soon as the parameters of the ILD detector have been defined during the next couple of months.

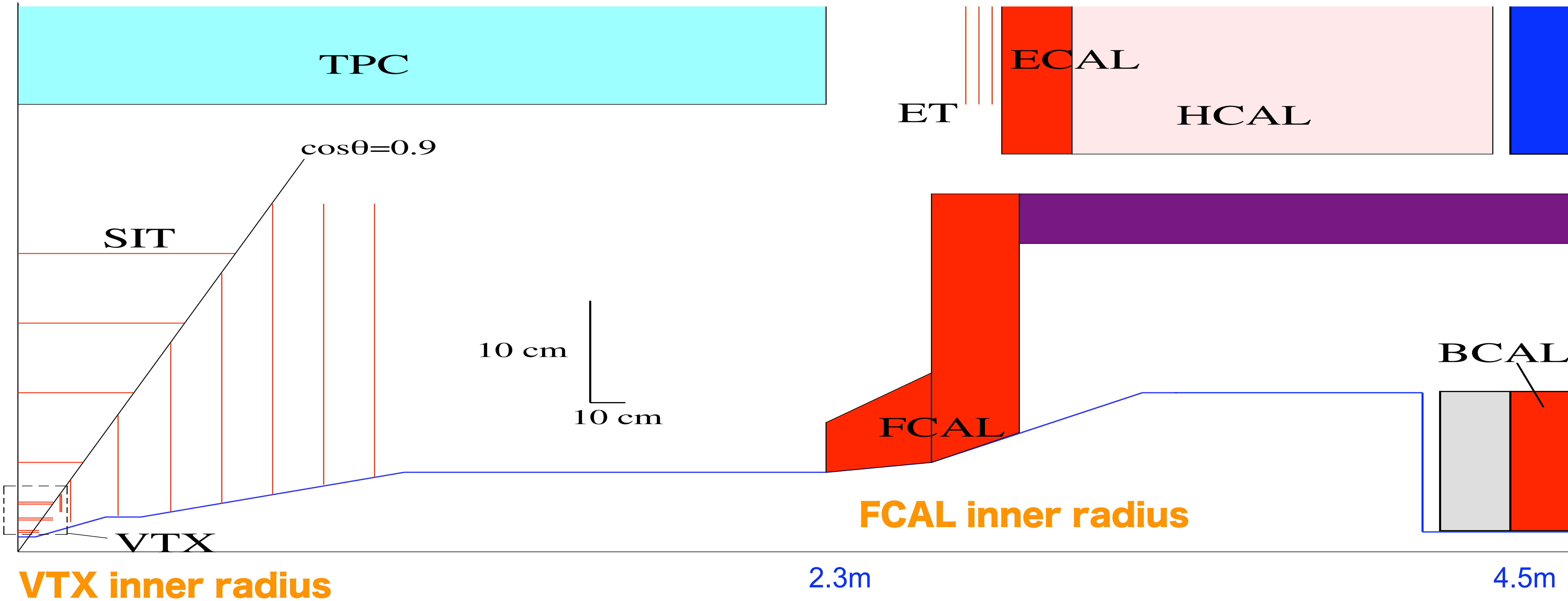
Next, we will concentrate on the detector integration after the ALCPG07.

Forward Region Modification



Preliminary changes, need to be studied in detail:

- Modified LumiCal simplifies detector opening procedure
- ECAL ring extends to lower angles to cover the gap between LumiCal and ECAL
- No tungsten tube around BeamCal
- Tungsten shield attached to HCAL

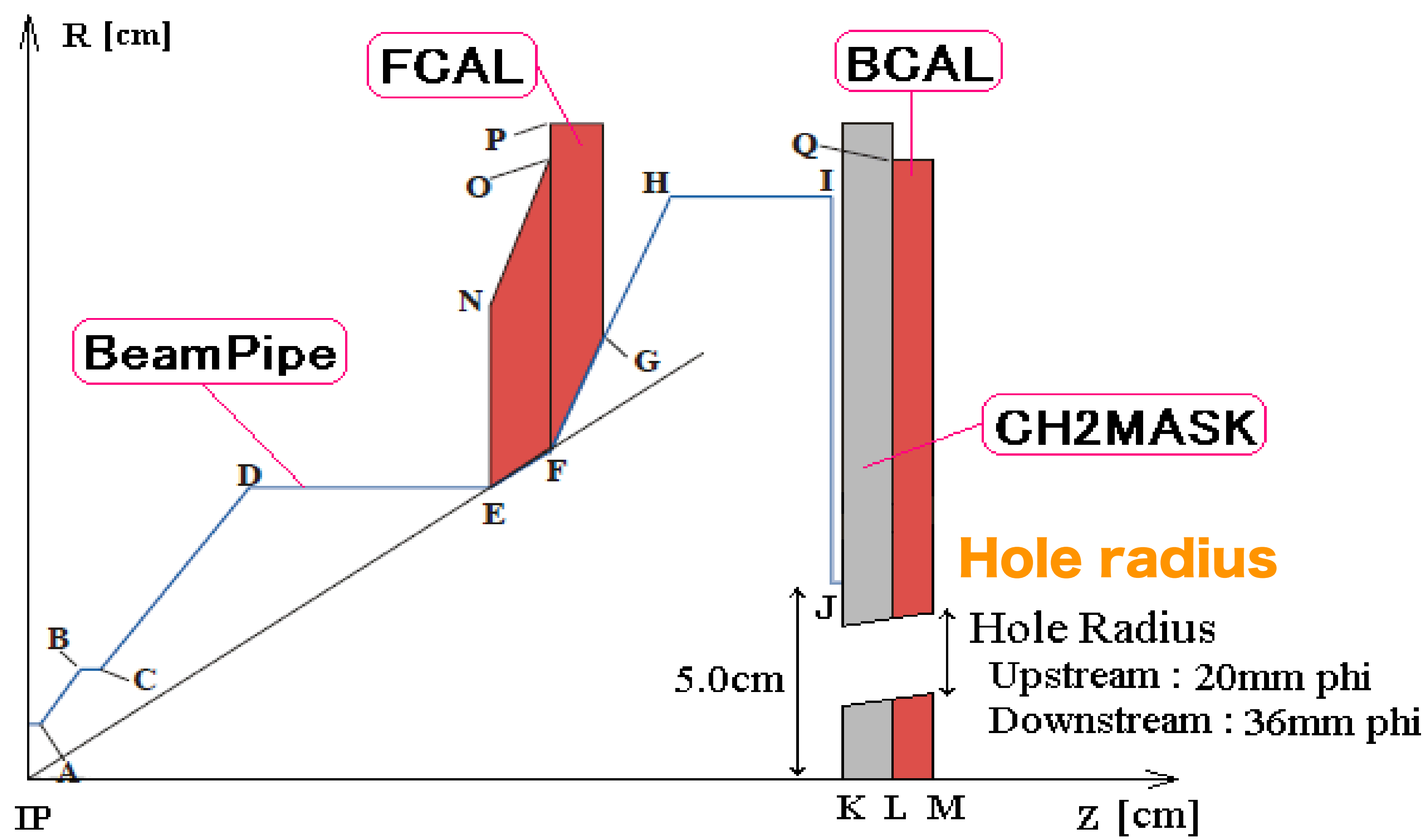


IR Optimization

FCAL inner radius for TPC background hits.

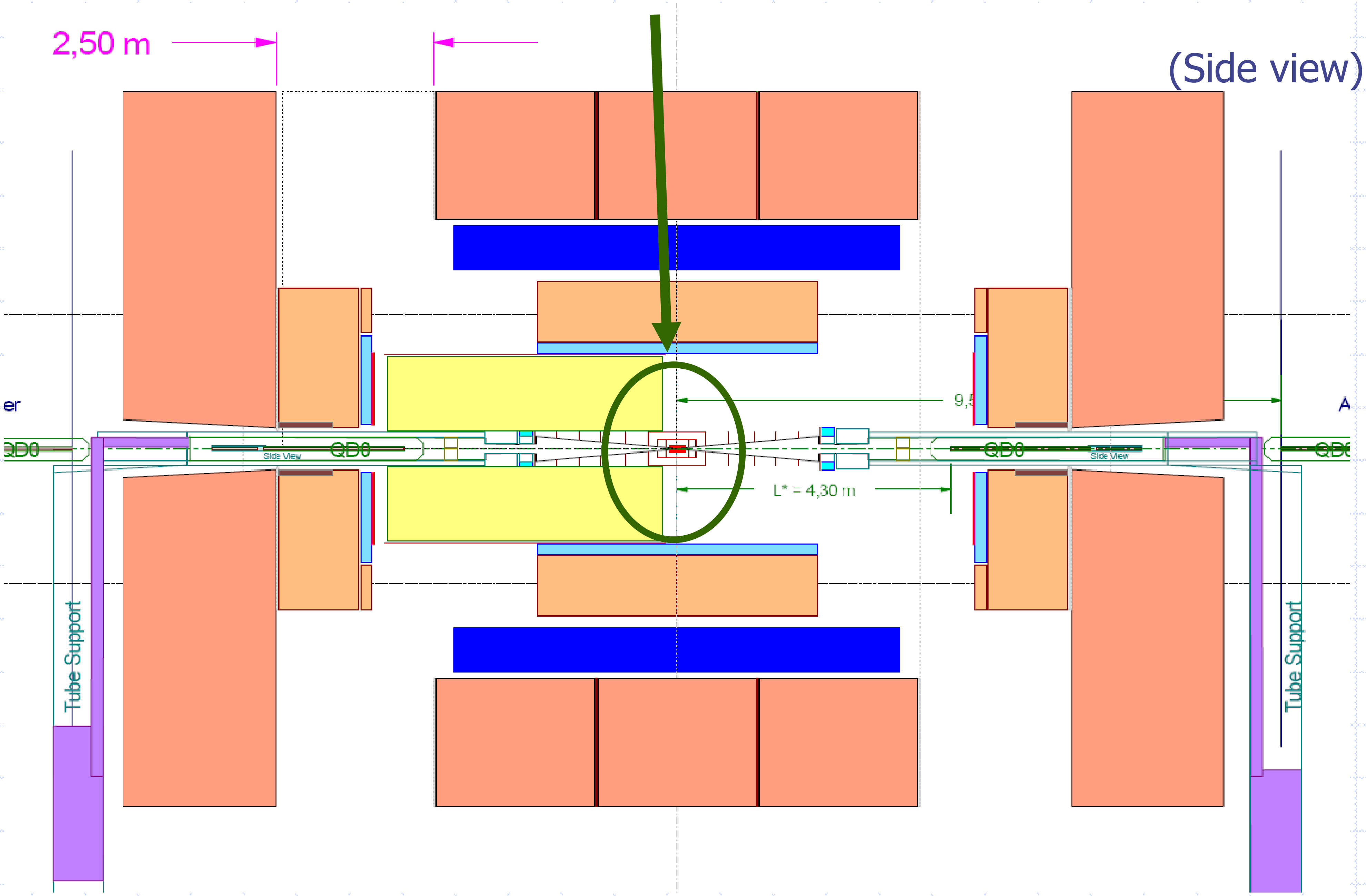
Hole radius of extraction to decrease backscattering.

Radius of beam pipe @VTX

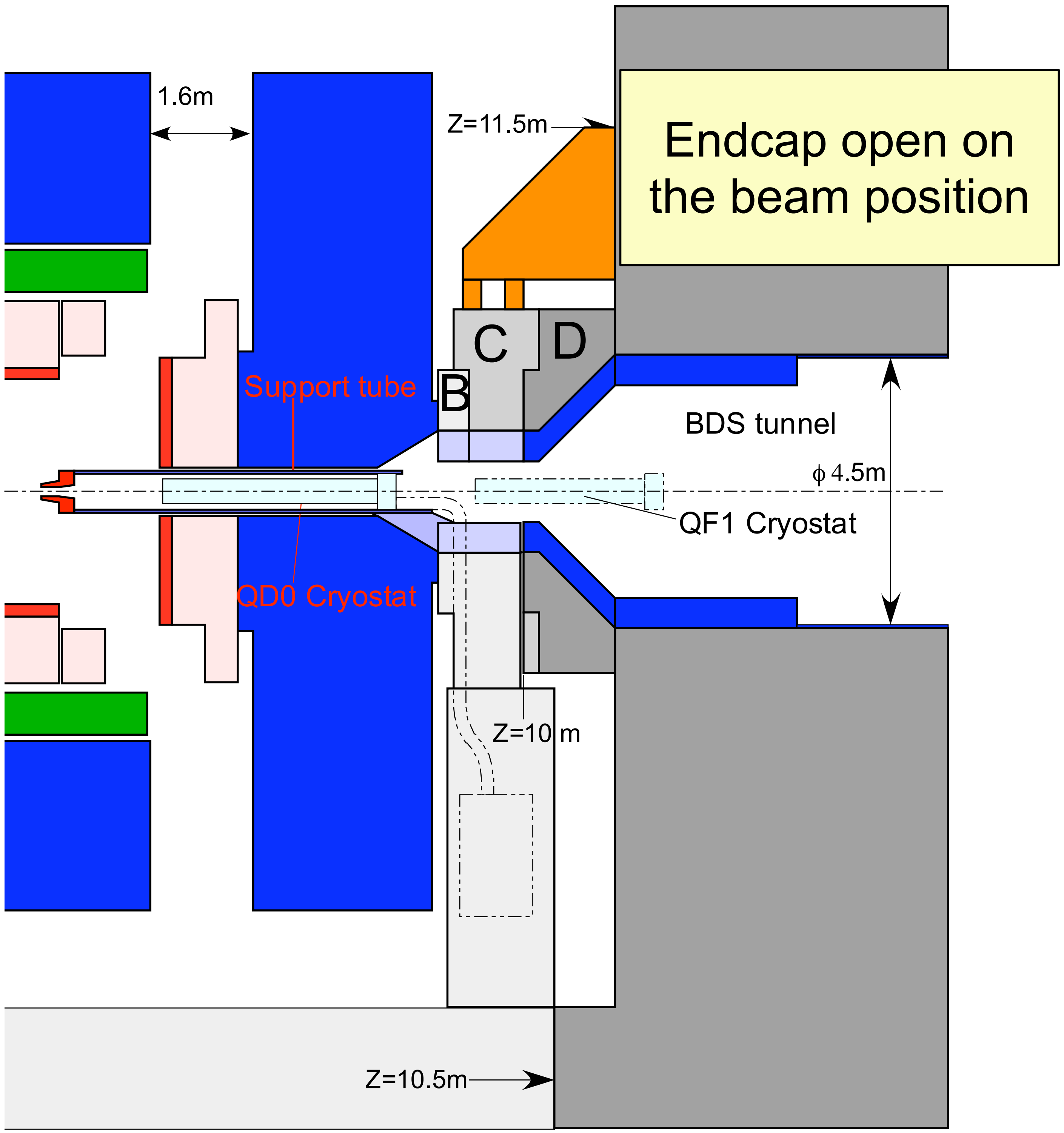


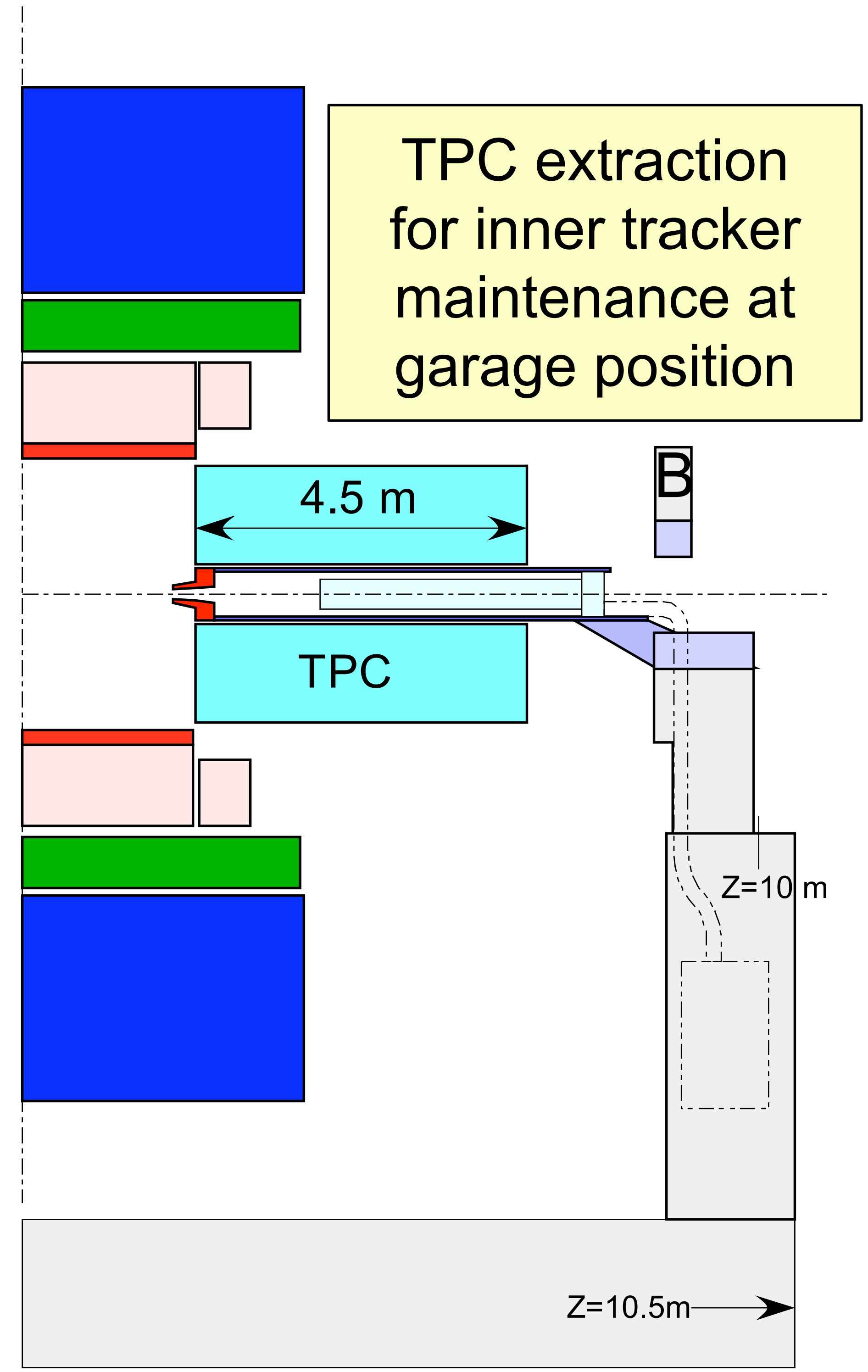
Detector Opening (Vertex Detector Maintanence)

2.5m detector opening would just allow to maintain the vertex detector in the garage posistion without breaking the vacuum.
(Pumping the central beam pipe is assumed to be very time consuming.)



Pacman design and FD support





Summary : LDC-IR

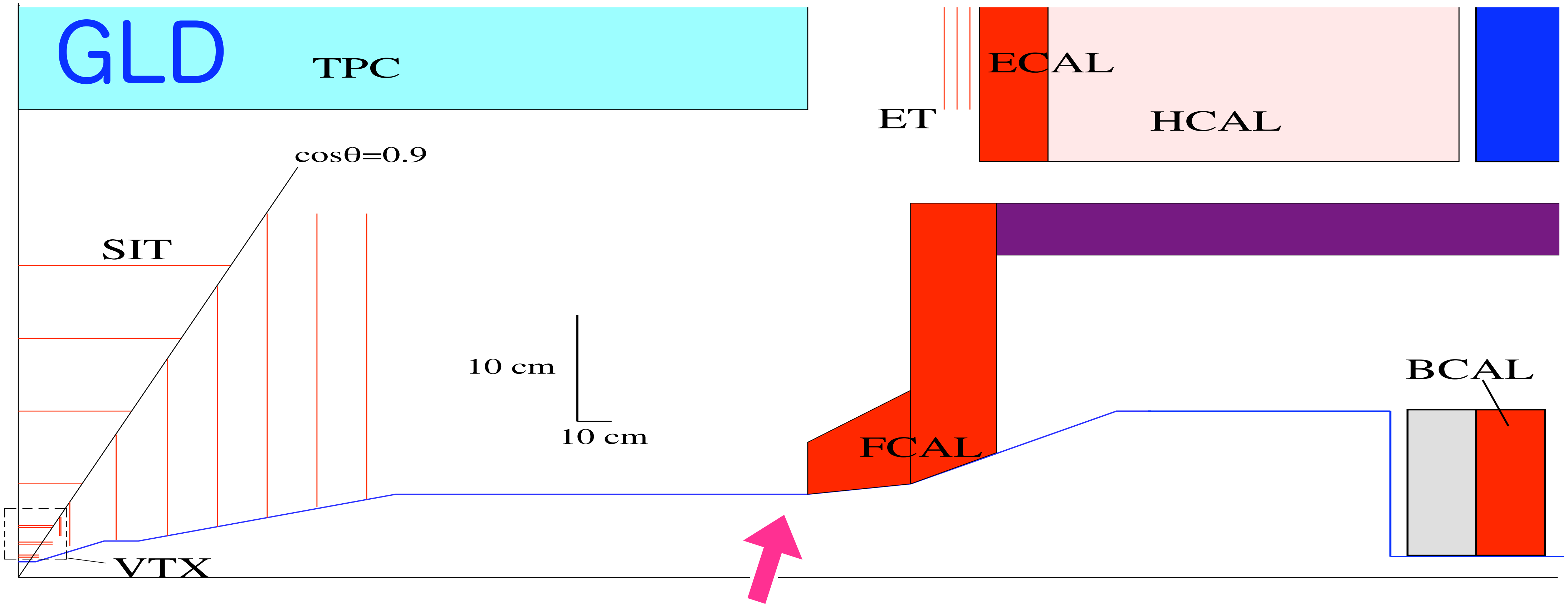
- LDC interaction region design is optimised with respect to
  - Background suppression
  - Low angle instrumentation
- Background suppression works well
- LumiCal: Precision luminosity measurement via Bhabha scattering
- BeamCal:
  - Hermeticity to low angles → 2γ veto
  - Beam parameter determination
- Detailed design depends on full detector simulations which are very time consuming
- Engineering solutions exist on conceptual level

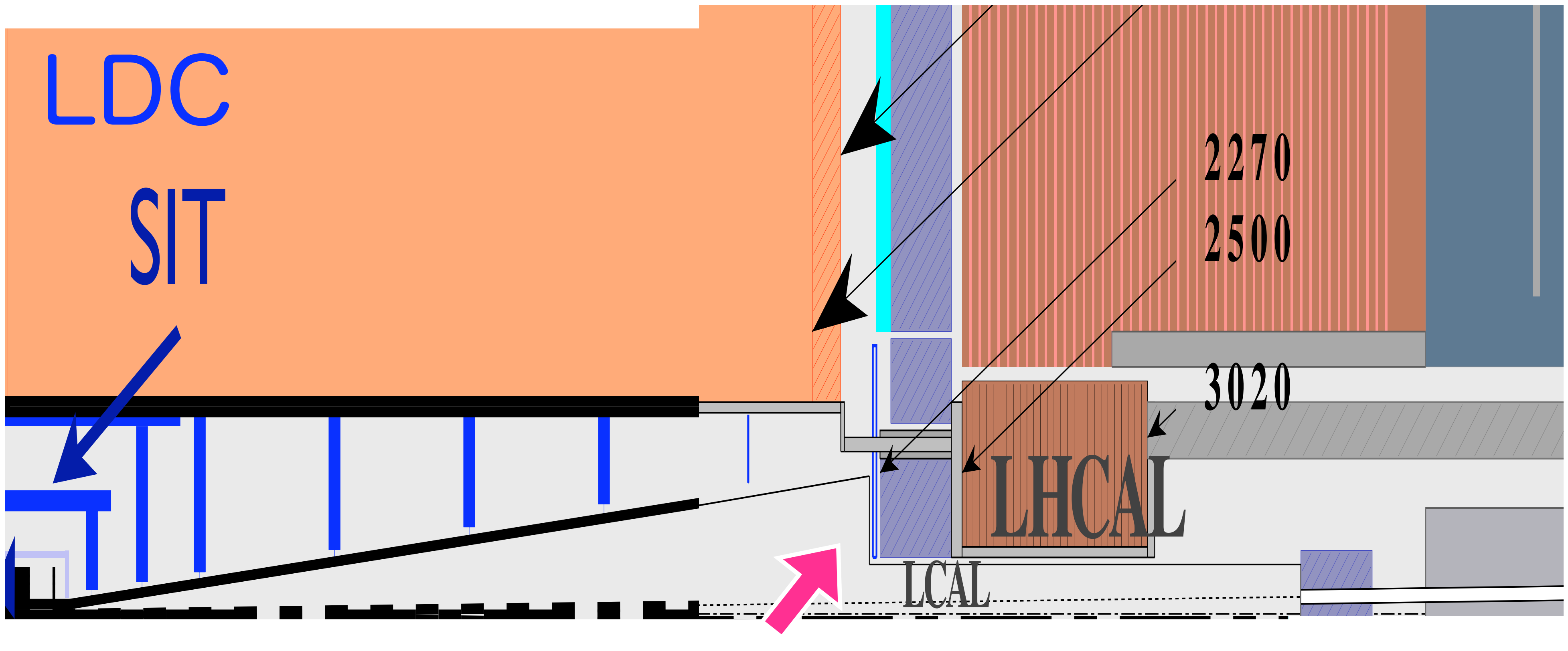
Summary : GLD-IR

1. GLD will evolve to GLDc for the push-pull scheme, while we need detailed evaluation for optimization with full simulation.
2. GLD IR region has been optimized with respect to backgrounds (pairs, synchrotron photons, muons ..) at VTX, TPC and minimum veto angle for 2 photon process.
3. Relevant parameters for IR optimization are listed below;

Machine parameter sets	1TeV, HiLum-1		LDC
L* (m)	4.5	same at GLDc	4.05
B (Tesla)	3	3.5 at GLDc	4
R_{Be} (cm)	1.5	z < 5cm	
R_{VTX} (cm)	2.0	FPCCD	1.6
VTX angular acceptance	|cos|<0.95	3 super-layers	|cos|<0.952
R_{FCAL} (cm)	8	z=2.3m	8
R_{BCAL} (cm)	1 and 1.8	z=4.3m	1.3
QD0,FCAL,BCAL support	canti-lever 70cm Φ	W-tube	canti-lever 58cm Φ

IR of GLD and LDC





Detector Integration Issues

Detector assembly on surface,

Iron structure

- deformation due to B-field
- Leakage magnetic field,

How to support inner detectors and QD0,

Opening, closing procedures, etc.,

Underground hall requirements

- temperature, humidity stability, the gradient
- utility (power, cooling water, gases, cables etc.)
- safety for fire, earth quake

Push-pull issues such as;

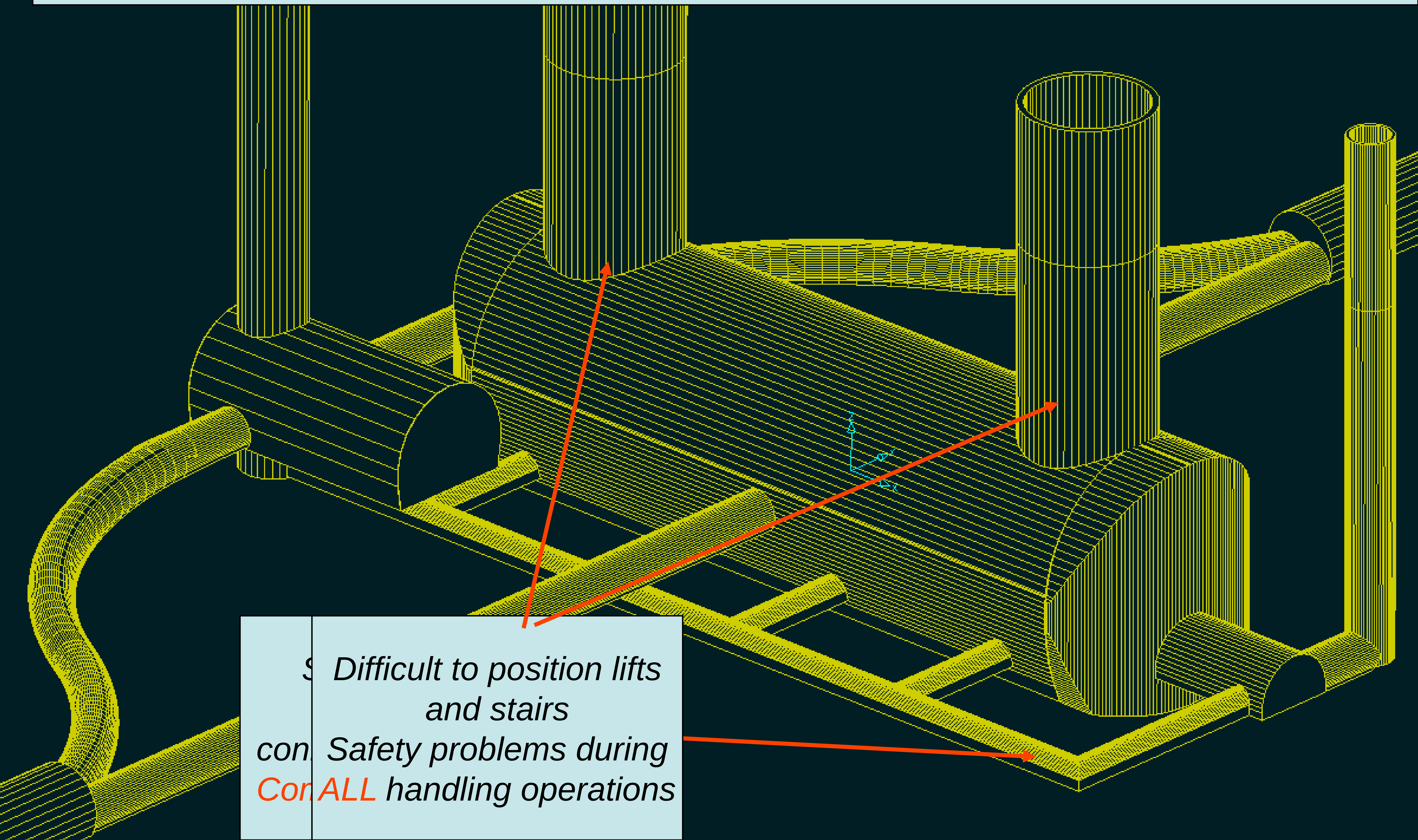
- alignment of VTX and QD0
- slow settlement (100 μm/month is tolerable ?)
- Radiation, shielding around beam line
- Cryogenics system for solenoid, QD0

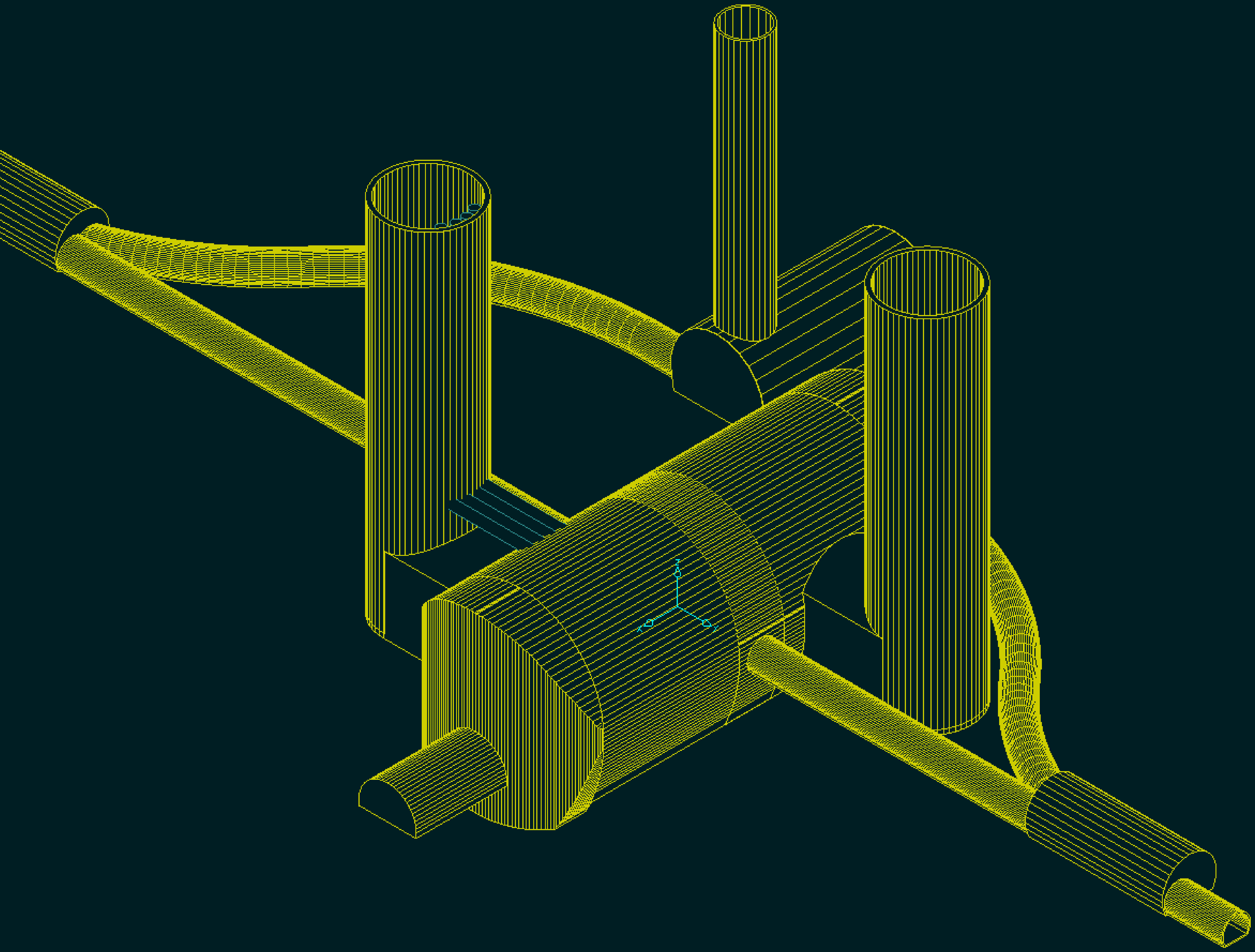
Highlights from IRENG07

17 - 21 September, SLAC

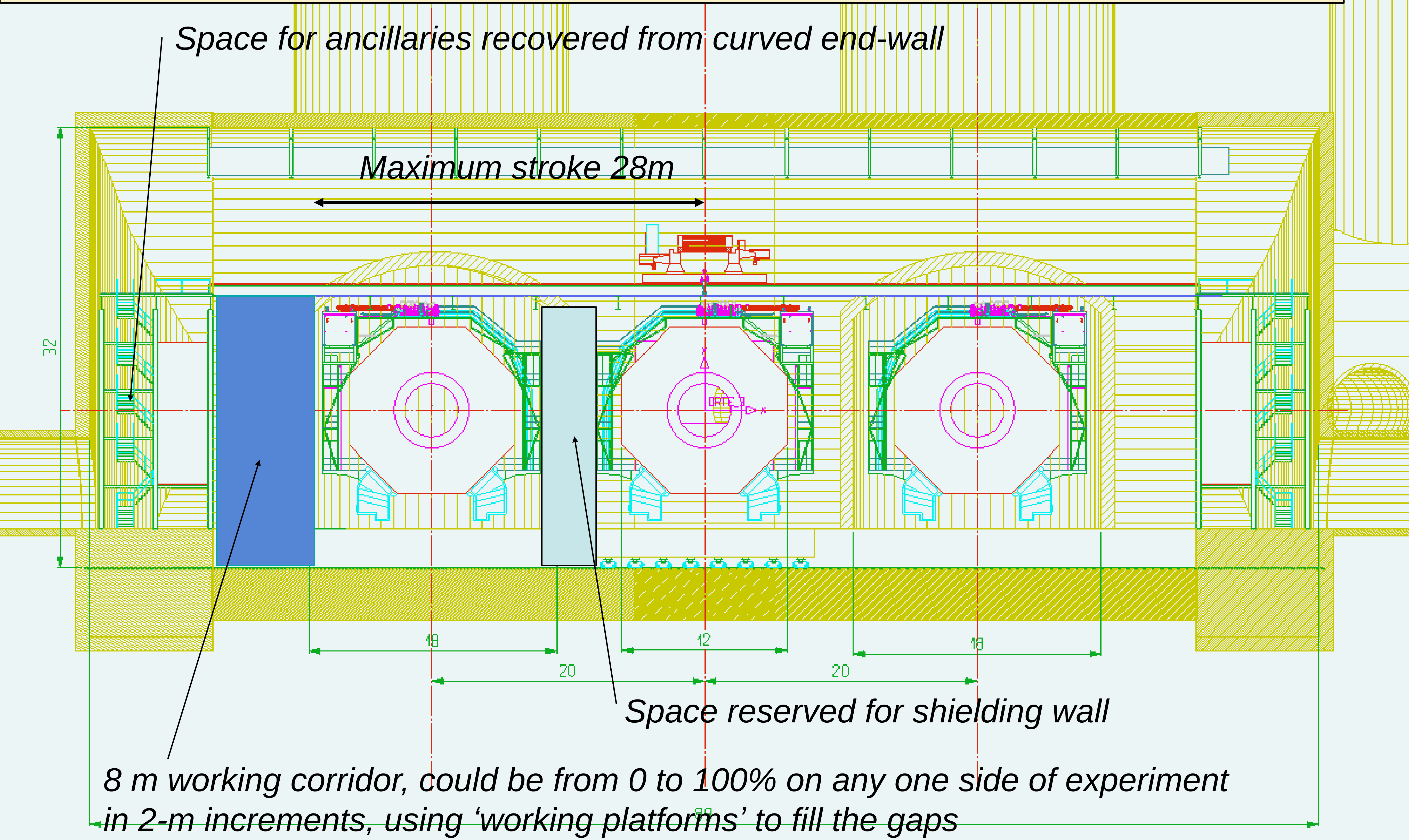
http://ilcagenda.linearcollider.org/conferenceDisplay.py?confId=2169

RDR design has been put aside looking for better solutions





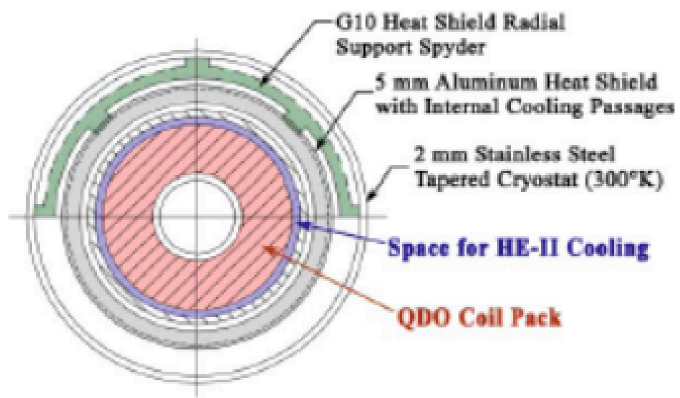
Hall Parameters - Length around 90 m

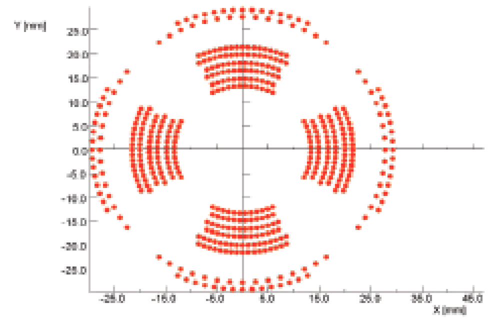


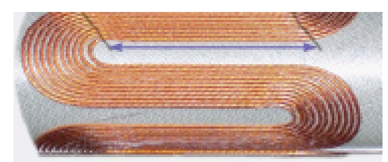
M. lopes (Fermilab)

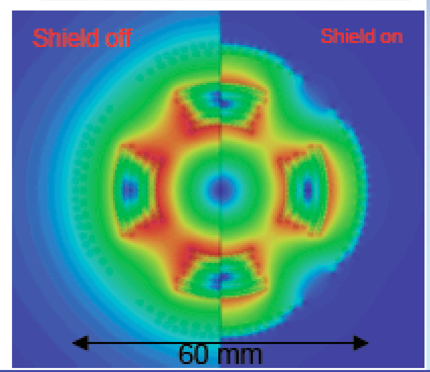
FD Magnet Design with Rutherford cable

BNL design





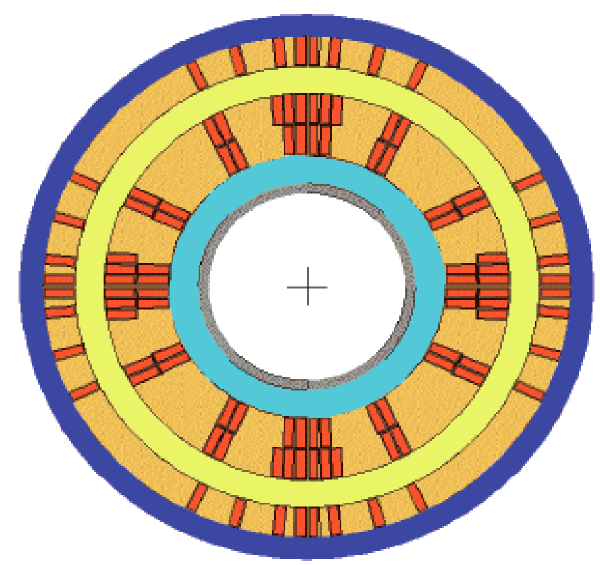




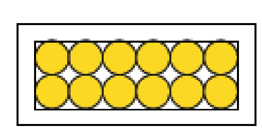
- Well advanced design based on the direct wind technology (BNL)

Issues:
- Works for NbTi strand
- Need inner support tube
- Limited radial and azimuthal thermal conductivity

FNAL concept



- Use Rutherford cable
  - Self-supported Roman arch
  - Smaller number of turns
  - Better turn position control
  - Low inductance
  - Better radial thermal conductivity
- Thermally decouple beam pipe and coil
- Active shield
- Same beam pipe size
- Smaller coil OD



Cable:
N=12, D=0.5 mm
1 x 3 mm

Parameters

	BNL*	FNAL V1 (NbTi)	FNAL V1 (Nb_3Sn)	FNAL V2 (Nb_3Sn)
Strand Diameter (mm)	1.0	0.5	0.5	0.5
Cable dimensions (mm)	Ø 1.0	3.0 x 1.0	3.0 x 1.0	3.0 x 1.0
Cable Insulation (μm)	-	125	125	125
Number of layers for the main coil	6	2	2	1
Outer radius (mm)	29.8	26.7	26.7	22.2
Total SC cross section (mm^2)	364	245	245	113
Bmax (T)	3.04	4.25	7.31	5.88
Imax (kA)	1.8	6.3	10.8	13.7
Gmax (T/m)	330.0	191.0	330.0	200.0
Stored Energy (kJ/m)	8.5	3.36	9.44	3.52
Inductance (mH/m)	5.08	0.17	0.16	0.04

* Estimated

WG B Cryogenics Summary

K.Tsuchiya

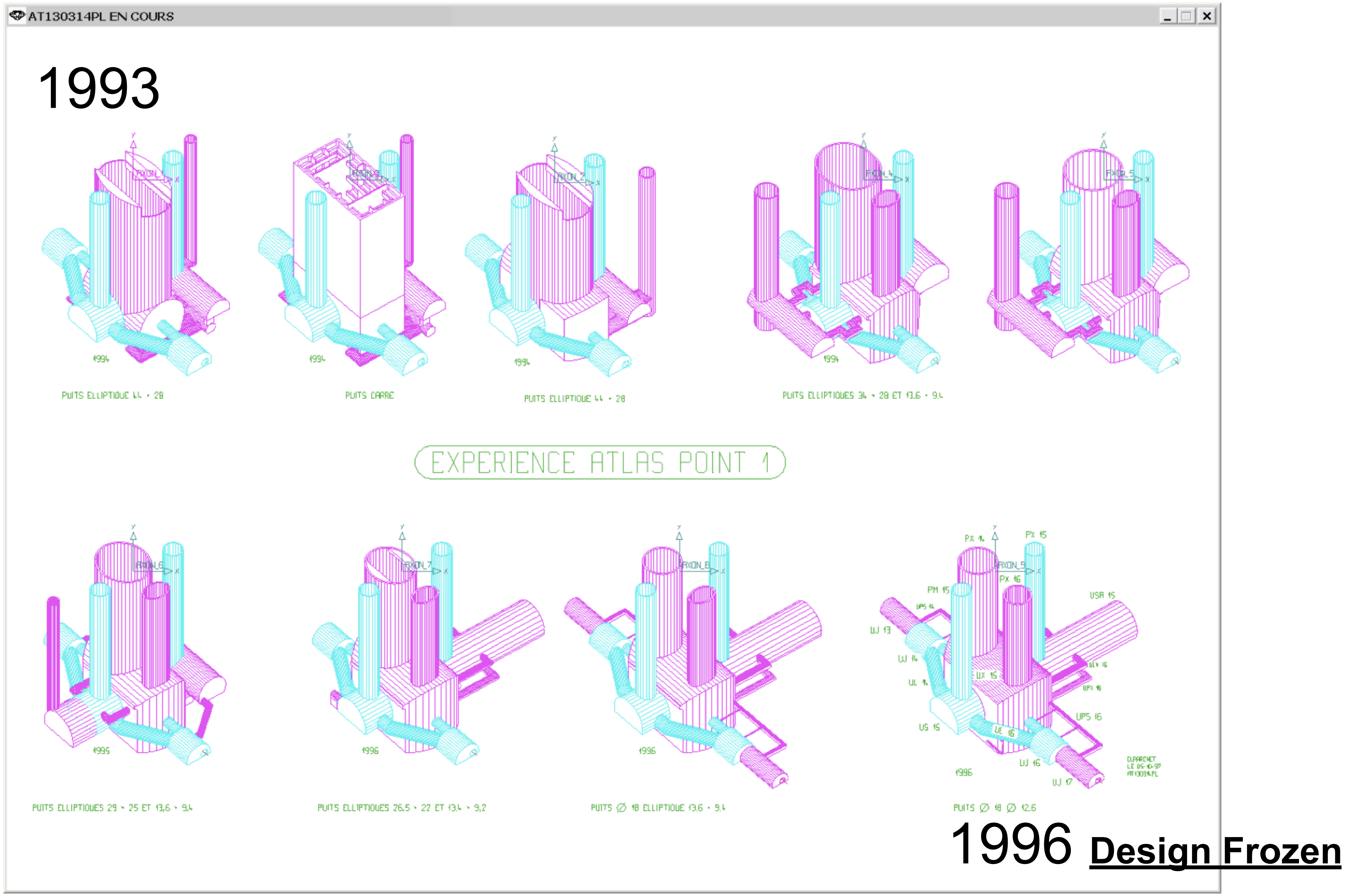
- IR Hall Cryogenics are assumed to be independent from the Linac cryogenic system. IR Hall cryogenics includes the cooling of the Crab cavities and QF1.
- Each detector will need sufficient LHe storage.
- Warm helium compressors will be located on the surface.
- Cold box will be located in the IR Hall.
- Moving detectors while cold is certainly possible with proper design and planning.
- In order to move forward on the number(1,2,or 3) and size of refrigerators, more detailed studies are needed. 2 or more working groups should be established to carry out this work.

  1; Detector A + QD0 x 2

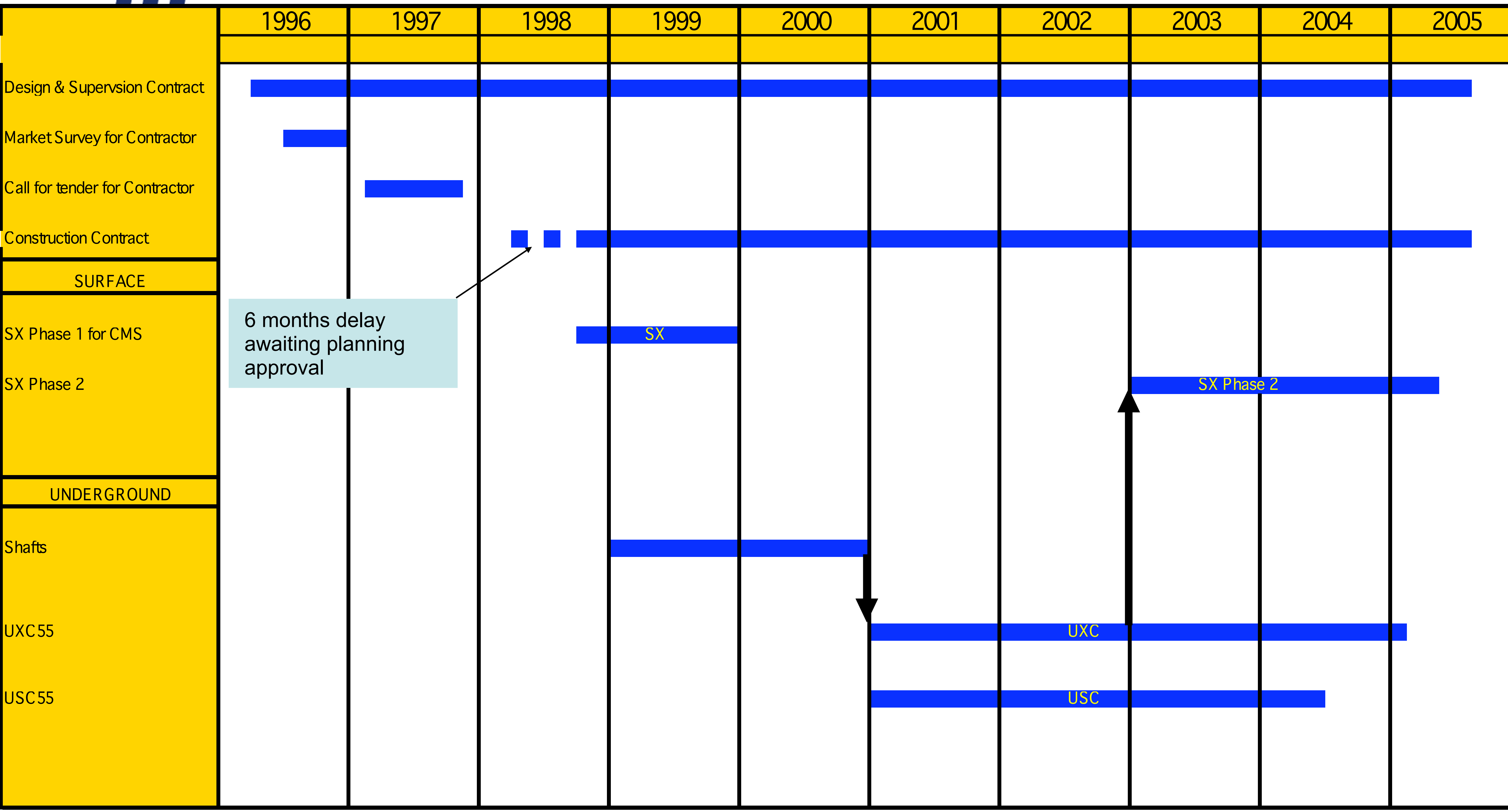
  2; Detector B + QD0 x 2

  3; (QF1 + Crab) x 2

ATLAS design progression for experimental area prior to award of civil engineering contract :



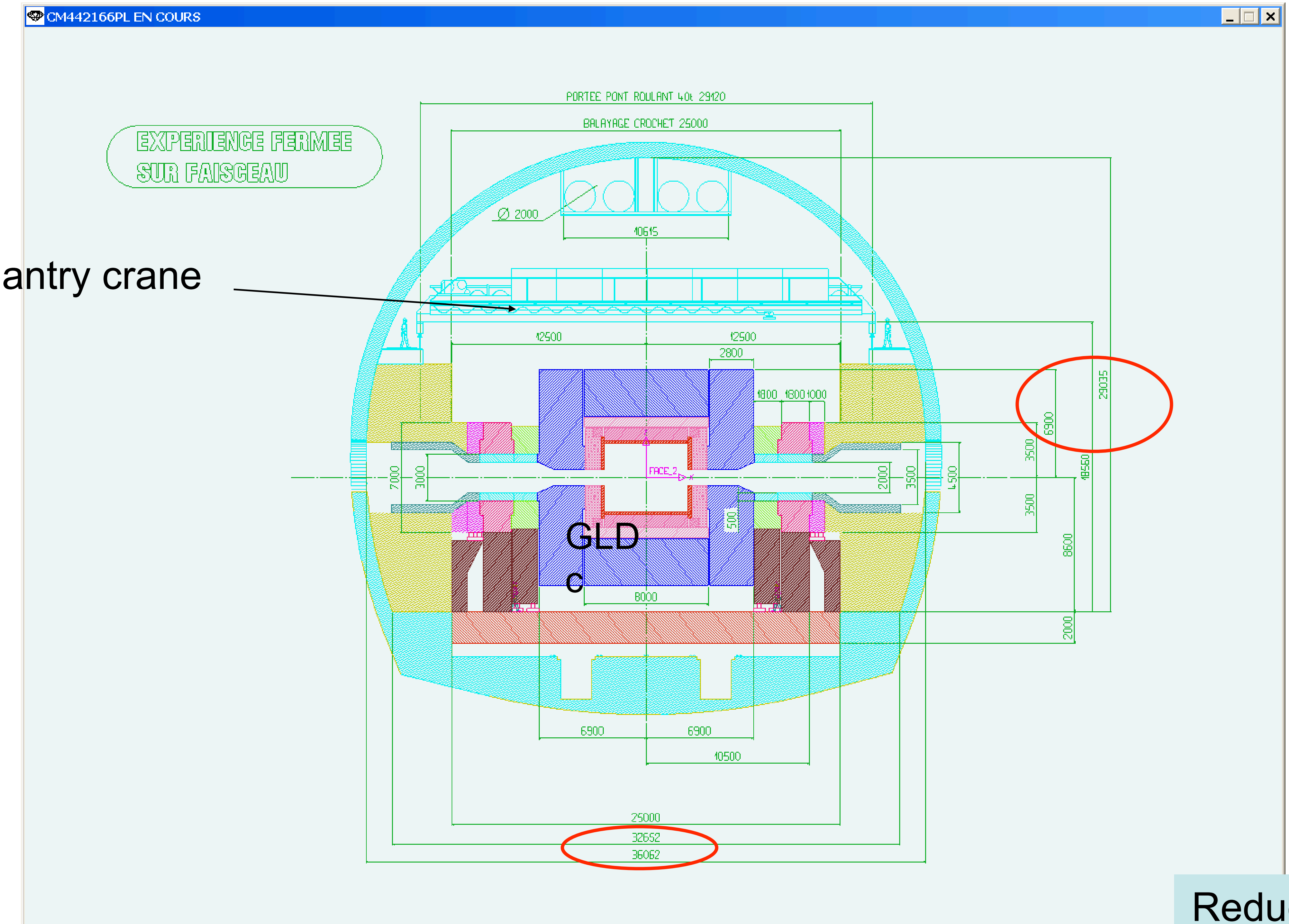
LHC CIVIL ENGINEERING AS-BUILT FOR CMS



J.Osborne October 2006

Value Engineering : Reduce capacity of cavern gantry from 400tons to 20tons ?

20ton gantry crane



Reduce cavern height, but increase width ? Cost neutral.

Criteria Examples

					Draft		J. Aarons (SLAC) 09/19/2007	
Initial Assumptions								
Push-Pull Design (RDR)								
Used GLDc Design as largest Detector Concept to size IR Hall							IRENG07 Workshop- SLAC (9/17-9/21/2007)	
Two 16 m diam. Shafts at Opposite ends of IR Hall (RDR Design)								
Exp'mt cavern dimension (in RDR)	120m x 25m x 39m H							
IR hall invert depth	>100m below surface							
Overhead Bridge cranes in IR Hall	2 primary w/ 2 auxiliary							
crane capacity (Max.)	Primary = 100 metric tonnes ea. + aux 10 ton cranes ea.							
	design to be based on hook height							
	One-time lift items can be slid into place							
	min. lift = 11 m above beamline							
	SiD	**GLD**	**GLDc**	**LDC**	**4th**	Comments	Comment from	Resolution
HALL DIMENSIONS								
IR Hall Dimension	25m x 120m x 39m H (in RDR)		31m x 120m x 39m H	30m floor x 120m x 39m H		in GLD & LDC Presentation	Tauchi-San +Norbert Meyners talk	
Floor of Detector Hall			6.9m + 1 m to the flat surface of the IR hall			2 m reinforced concrete platform (John Amman's Talk)	Tom Markiewicz	
traveling platform w/ Hillman rollers								
							Norbert Meyners talk	
sub floor trenches for cables								
fixed floor - no platform								
						showed an option for Adding 6m in IR Hall for Detector Services	John Osborne	
						do designs have enough support at base of Detector to be seismically stable?	M. Bridenbach	
width of hall	25m	39m	31 m	31m		need more width in hall to accommodate crane travel & rails - center of hook need to be over load	Clay Corvin	
Detector end cap door opening	max 2 m		max 6 m					
CRANE CRITERIA								
crane capacity per crane		~400 tonne	~100 tonnes			Height of Hall will increase based on sizes of crane	A. Herve	

Criteria Examples

IRENG07 Draft Utilities Requirements

20-Sep-07

Item	Description	Generic	GLD	GLDc	LDC	SiD	4th Type
1	Hall SA End Temperature (Deg C)	21	21	21	21	21	21
2	Hall Stratified Temperature Rise (Deg C)	3	3	3	3	3	3
3	Hall Air Temperature Stability (+/- Deg C)	2	2	2	2	2	2
4	Hall Dew Point Temperature (Deg C)	13	13	13	13	13	13
5	Hall Maximum Relative Humidity (%)	60	60	60	60	60	60
6	Process Load to Hall Air per Detector (kW)	40	40	40	40	40	40
7	Process Detector Load to CHW per Detector (kW)	200	200	200	200	200	200
8	Process Load to Other CHW per Detector (kW)	100	100	100	100	100	100
9	Process Load to LCW per Detector (kW)	200	200	200	200	200	200
10	Hall Space Load to Air (W/Sq M - Dry Xfmrs, tools, pumps, lights, etc.) ???	40	40	40	40	40	40
11	Ventilation (Numer of Persons in Hall - Add separate fan coil people heat load)	100	100	100	100	100	100
12	Ventilation (Cu M/Hr)	4300	4300	4300	4300	4300	4300
13	Hall Pressurization (Negative milliBars)	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2
14	Hall Pressurization Stabilization (+/- milliBar - Bubblers or Chambers)	0.05	0.05	0.05	0.05	0.05	0.05
15	Shaft/Egress Pressurization (Positive milliBar)	0.2	0.2	0.2	0.2	0.2	0.2
16	Process CHW Supply Temperature (Deg C)	16	16	16	16	16	16
17	LCW Supply Temperature (Deg C)	16	16	16	16	16	16
18	LCW Make Up Source (Accelerator? Y/N)	Yes	Yes	Yes	Yes	Yes	Yes
19	Hall ODH Purge (Y/N - Cu M/ Hr if Y)	No	No	No	No	No	No
20	Hall Activated Air Purge (Y/N - Cu M /Hr if Y)	No	No	No	No	No	No
21	Permanent Hall Smoke Purge (Y/N - If No use ventilation AHU at high-speed)	No	No	No	No	No	No
22	Thermal Dimensional Stability Provided from Skids (Y/N)	Yes	Yes	Yes	Yes	Yes	Yes
23	Sub-Atmospheric Utility Water Systems Needed (Y/N)	No	No	No	No	No	No
24	CHW Cooling for Magnets & Power Supplies (Y/N)	Yes	Yes	Yes	Yes	Yes	Yes
25	Non-Dessicant Dehumidification for Hall (Y/N - If Yes Hall surfaces are sealed)	Yes	Yes	Yes	Yes	Yes	Yes
26	Ventilation Provided by Ground Level AHU's (Y/N)	Yes	Yes	Yes	Yes	Yes	Yes
27	Hall Air Load & Dehumidification Provided by Hall Fan-Coils (Y/N)	Yes	Yes	Yes	Yes	Yes	Yes
28	All Cooling to Hall Provided by Insulated CHW to HXs (Y/N)	Yes	Yes	Yes	Yes	Yes	Yes
29	Surface to Hall CHW Pressure Interruption Provided by HXs (Y/N)	Yes	Yes	Yes	Yes	Yes	Yes
30	Utility / Detector Interface at Hall Spiggots (Y/N)	Yes	Yes	Yes	Yes	Yes	Yes
31	Compressed Air Supply Volume per Detector (Standard Cu M /Min)	200	200	200	200	200	200
32	Compressed Air Supply Pressure (MegaPascals)	1	1	1	1	1	1
33	Compressed Air Supply Oil-Free Plant at Ground Level (Y/N)	Yes	Yes	Yes	Yes	Yes	Yes

Vacuum System : Issues_1

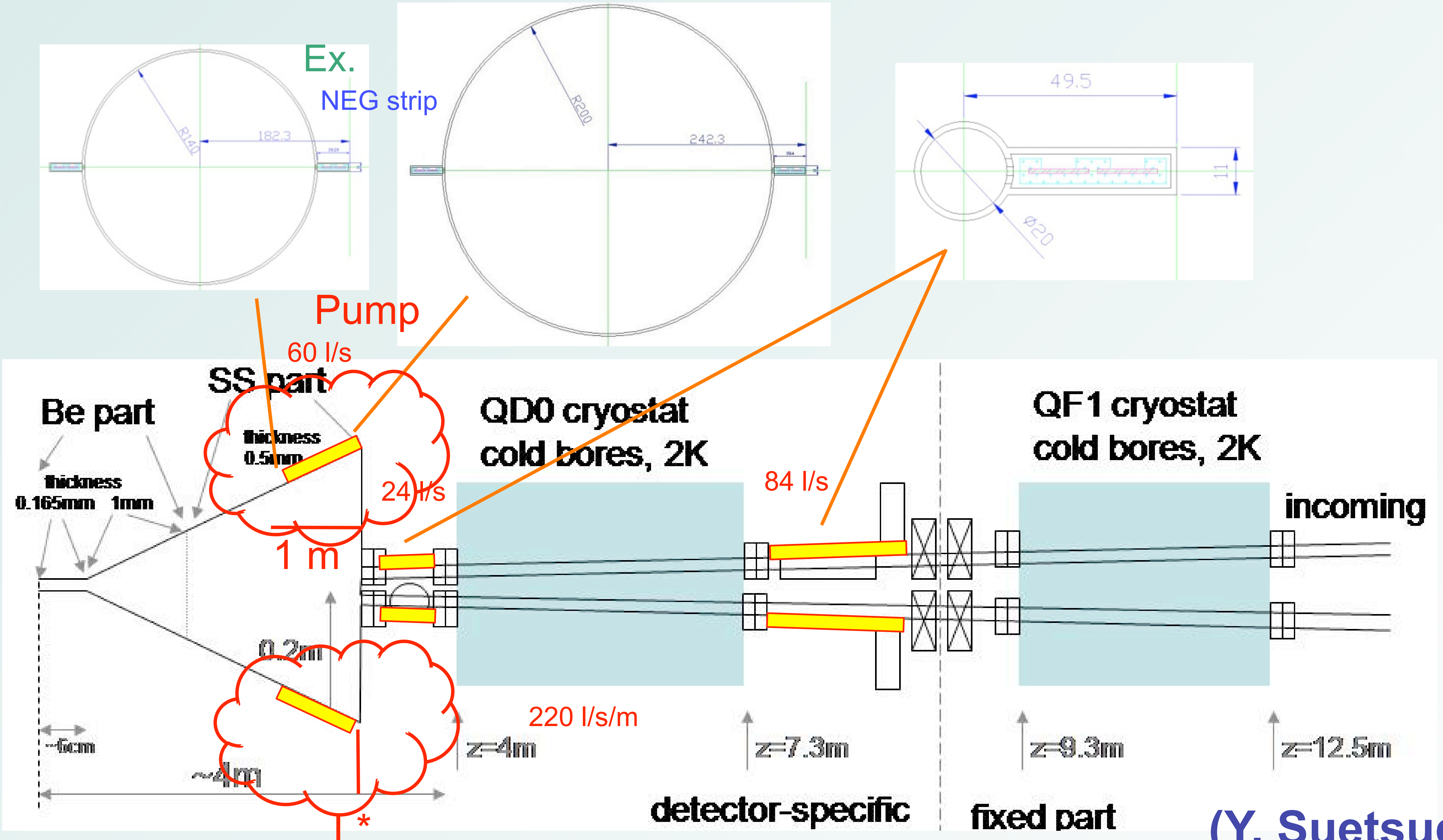
- Pumping scheme at z < L* (Cone) depends on the required pressure;
  - **If P >10 nTorr is OK,**
    - No baking and no pump are OK
  - **If 10 nTorr > P >1 nTorr is OK,**
    - No baking is OK, but some pumps are required
  - **If P < 1 nTorr is required,**
    - NEG coating and baking are required.

- Other room temperature region needs pumps (distributed or lumped pumps or NEG coating)

(Y. Suetsugu)

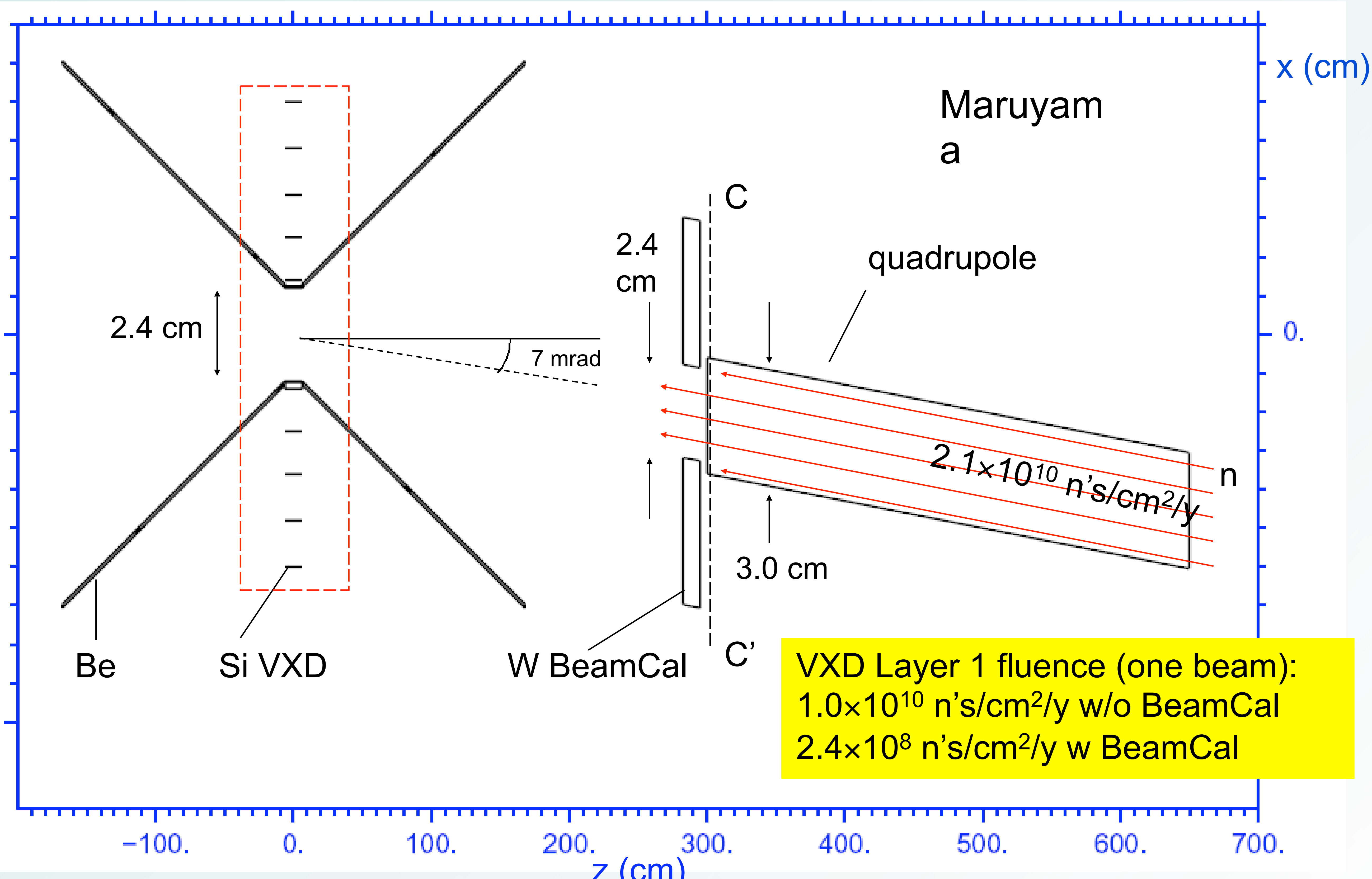
Vacuum System : Basic design_8

- For example, NEG pumps at the last 1 m of cone



(Y. Suetsugu)

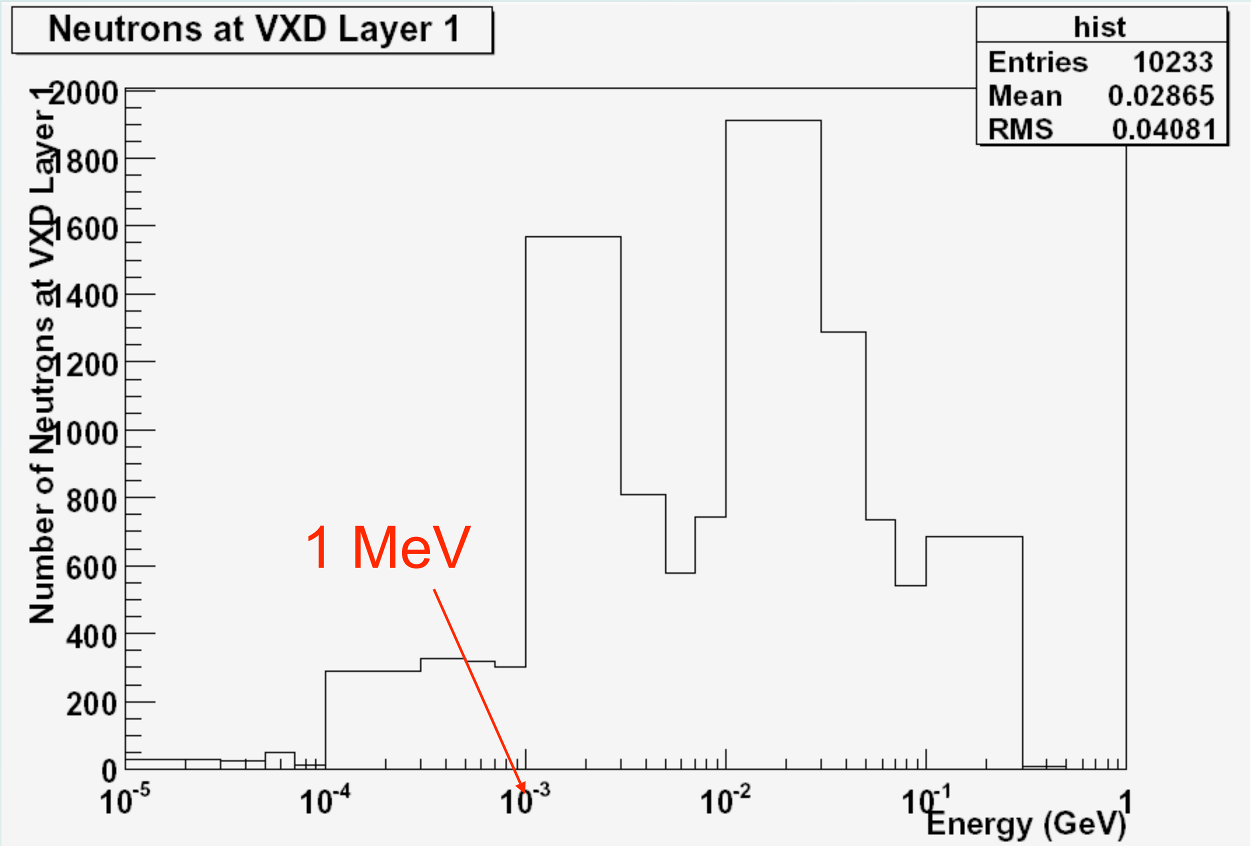
Neutron Background in SiD Vertex Detector

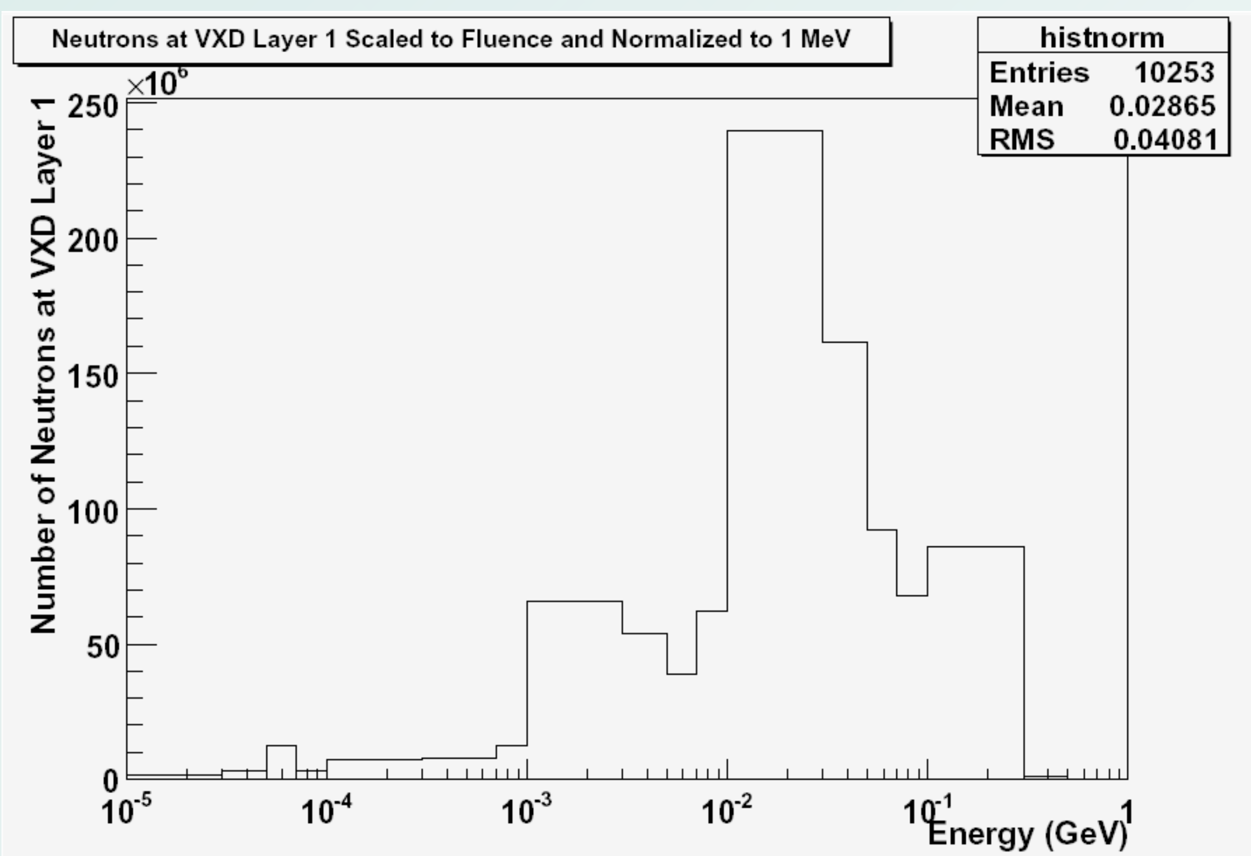


VXD Layer 1 fluence (one beam):
1.0×10^{10} n's/cm^2/y w/o BeamCal
2.4×10^{8} n's/cm^2/y w BeamCal

1 MeV Neutron Equivalent Fluence

Maruyama





- However, the amount of displacement damage done to CCD Si detector by neutrons is a function of neutron energy
- When relative damage to Si is considered, normalized to 1 MeV, the fluence is: 5.3×10^{8} n/cm^2/year
- When e^+ beam is considered also, value is doubled to 1.1×10^{9} n/cm^2/year
- A value of 10^{10} n/cm^2 would damage the CCD Si detector by this measure

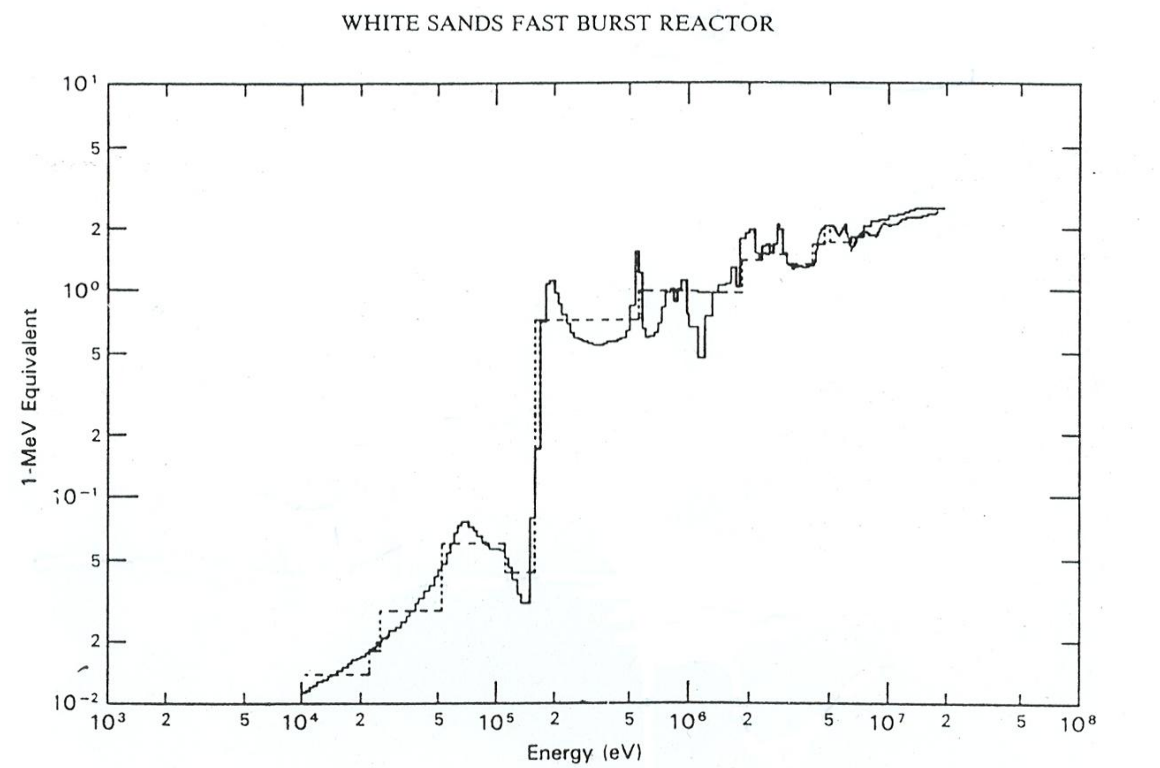
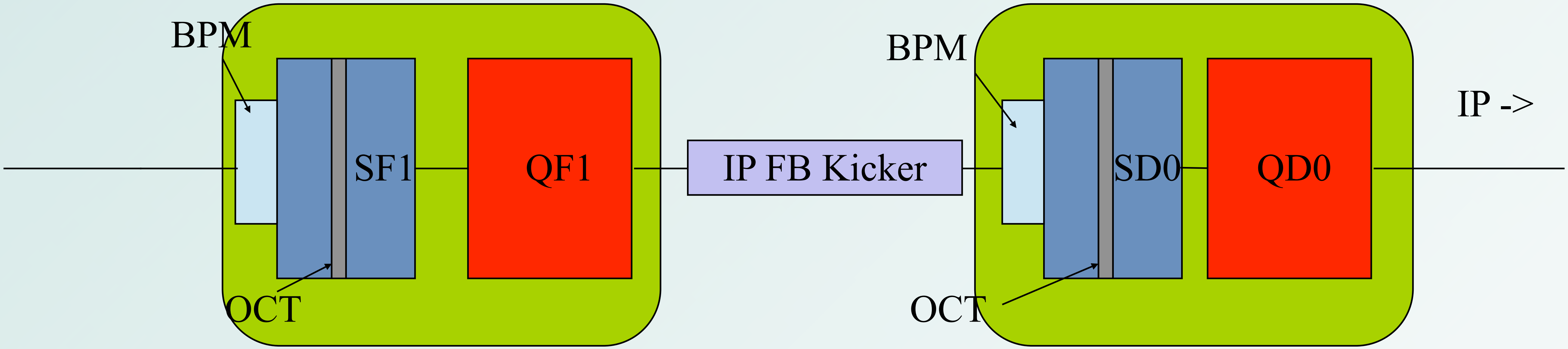


Fig. 3. Silicon displacement kerma as a function of energy. The fine-group histogram is the tabulated kerma values from Ref. 13. The broader group histogram is the function used in this work.

T. M. Flanders and M. H. Sparks, *Nuclear Science and Engineering*, 103, 265, 1989.

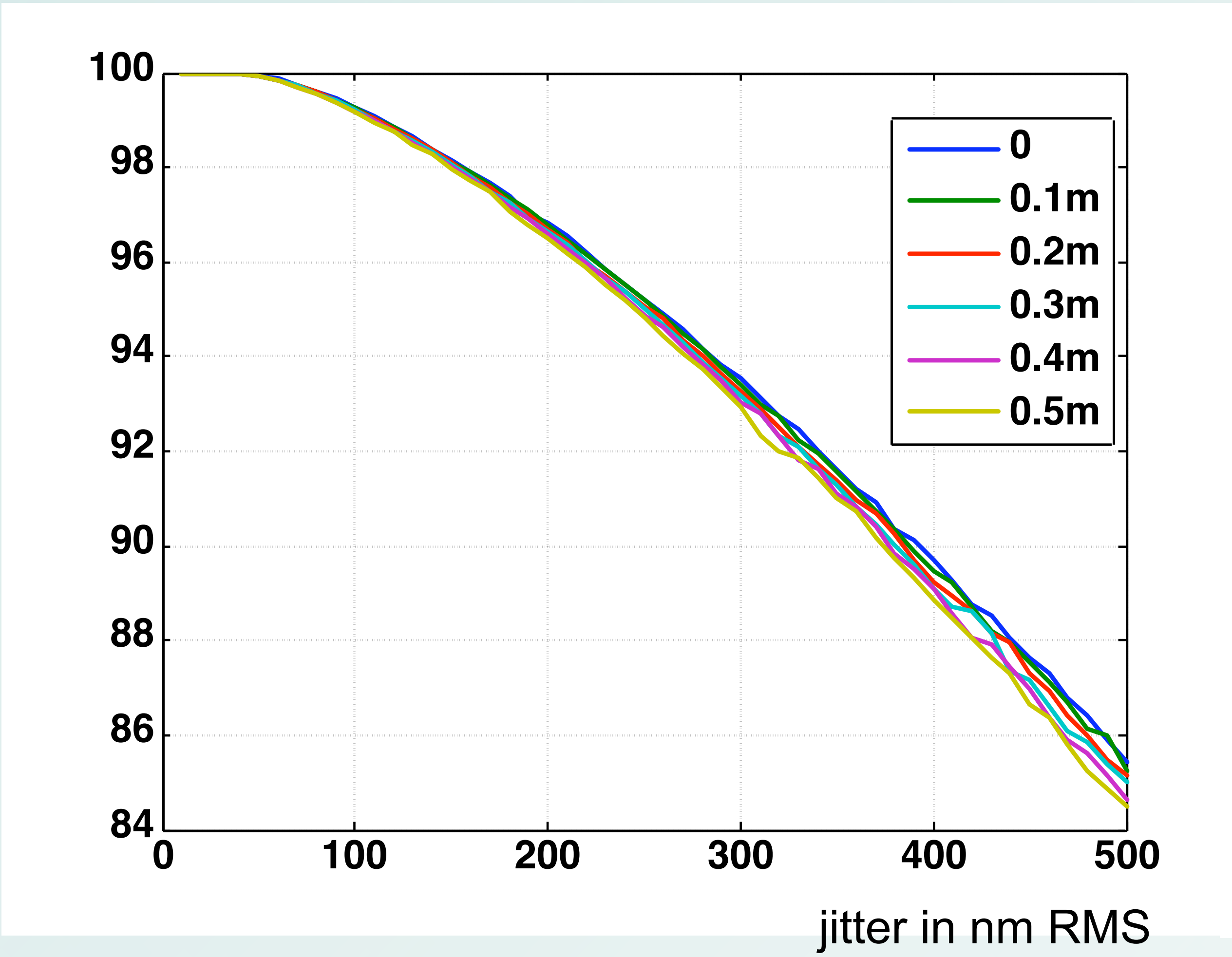
Modeled Final Doublet Layout

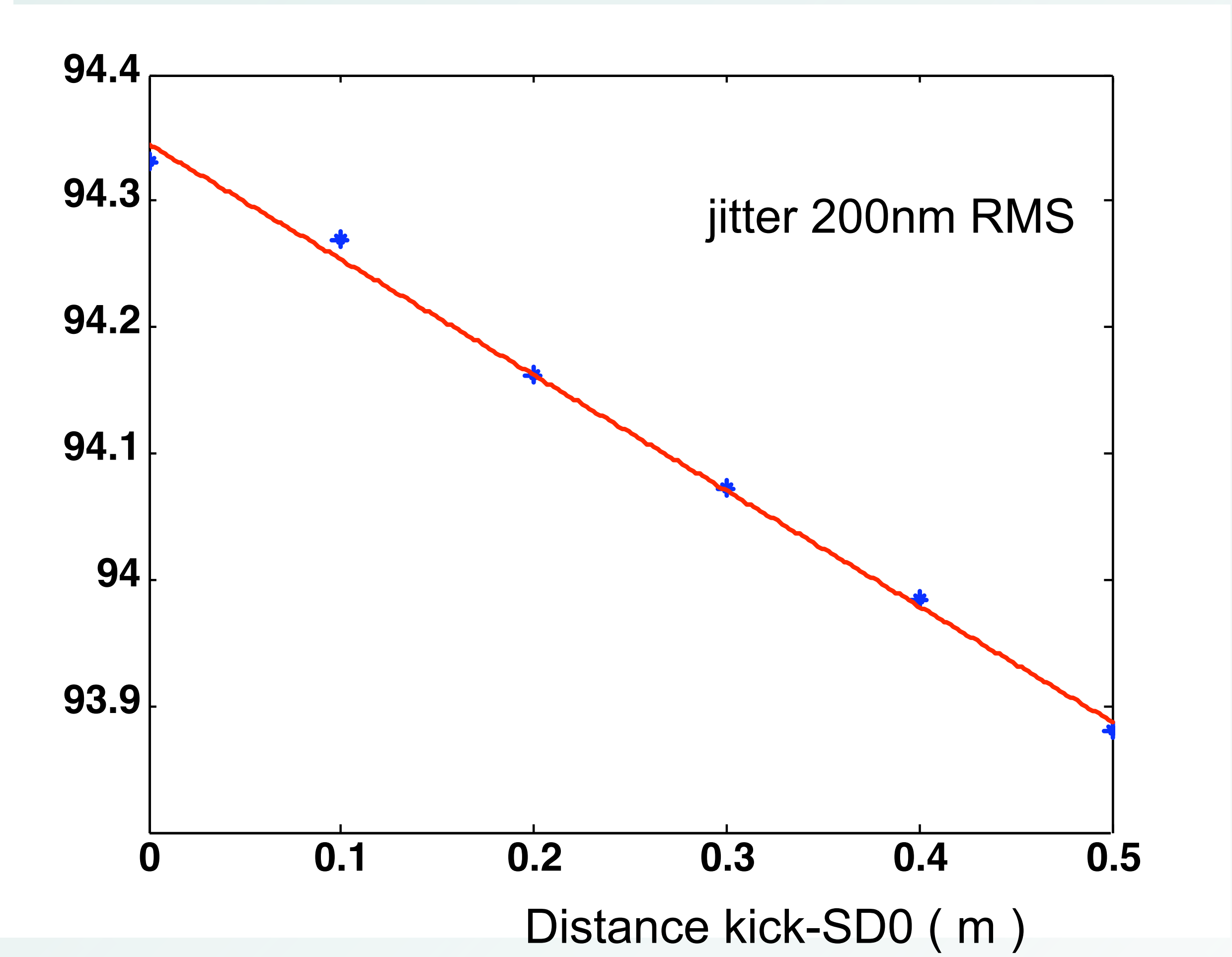


- IP FFB kicker (~1m) gap between 2 cryomodules near IP.
- Distance of kick from SD0 face affects lumi as beam is kicked off-center through SD0.
- Advantage to using shorter kicker?

White

Luminosity vs. QD0/SD0 RMS Jitter and Kick Distance





- Calculate Luminosity loss for different jitter / kick distance cases using ‘SD0 lumi loss’ and ‘FFB lumi loss’ look-up tables (horizontal + vertical).
- Left plot shows % nominal luminosity with given RMS SD0/QD0 jitter and varying kick-SD0 distance.
- Right plot shows all jitter cases plotted vs. kick distance and shows the expected dependence on kick distance.

White

Vibration Tolerance Summary

- Added luminosity loss due to jitter of final doublet cryomodules (>5% @ ~200nm RMS) .
  - **Needs to be convolved with 'background' environment of GM and other jitter sources.**
- Results are worse-case here where everything else is perfect, other errors (e.g. non-linear train shape) will mask this effect to some degree.
- Small effect due to kicker distance from SD0, becomes more pronounced in cases with larger RMS jitter.
- Simulations of BDS tuning show something like ~10% overhead in luminosity after initial tuning. All dynamic lumi-reducing effects should total less than this.
  - **Remaining luminosity overhead dictates how long ILC can run before some (online) re-tuning required (~ 3 days with current assumptions).**