



Linear Collider Positron Source System Integration

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Linear Collider – Positron Source

System Integration:

What is it?

What have we got?

Where are we at?

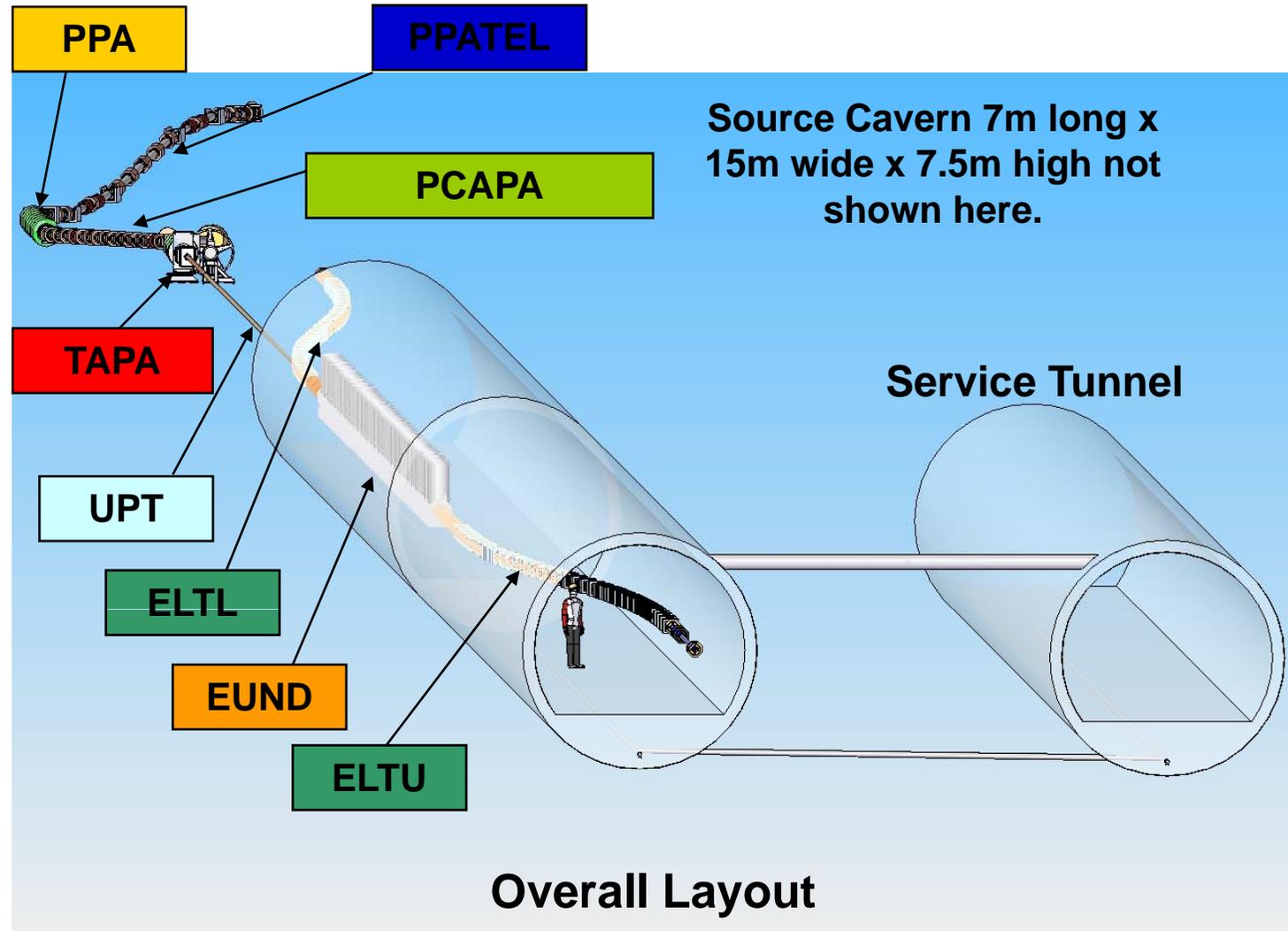
Overall layout

Issues, Risks,
Clashes,
Opportunities.

Cost Drivers

Minimal Machine and
options

Actions





Abbreviations explained

ELTU (Electron Linac To Undulator), **EUND** (Electron through Undulator), and **EUTL** (Electron Undulator To Linac) are the bypass chicane that allow the 150 GeV main linac electrons to go through the helical undulator for photon production.

UPT (Undulator Photons to Target) is the photon transport line from the end of the undulator to the positron production target(s). This beam line also has a photon collimation system.

TAPA (Target AMD Pre-Acceleration system A) and **TAPB** (Target AMD Pre-Acceleration system B) are the two positron production targets and associated capture and initial acceleration of the electromagnetic shower products. Only one of these targets is used at any one time, the other is a “hot” spare system. This system will accelerate the positrons to 125 MeV.

PCAPA (Positron CAPture system A) and **PCAPB** (Positron CAPture system B) are the beamlines that separate the positrons from the electrons and photons (again only one of these is used the other is a “hot” spare). These beam lines incorporate an electron beam dump.

PPA (Positron Pre-Accelerator) accelerates the positrons from 125 to 400 MeV.

PPATEL (Positron Pre-Accelerator To Electron Linac tunnel) is the beamline that move the 400 MeV positrons from the target hall back into the main linac tunnel for transport to the positron side of the ILC.

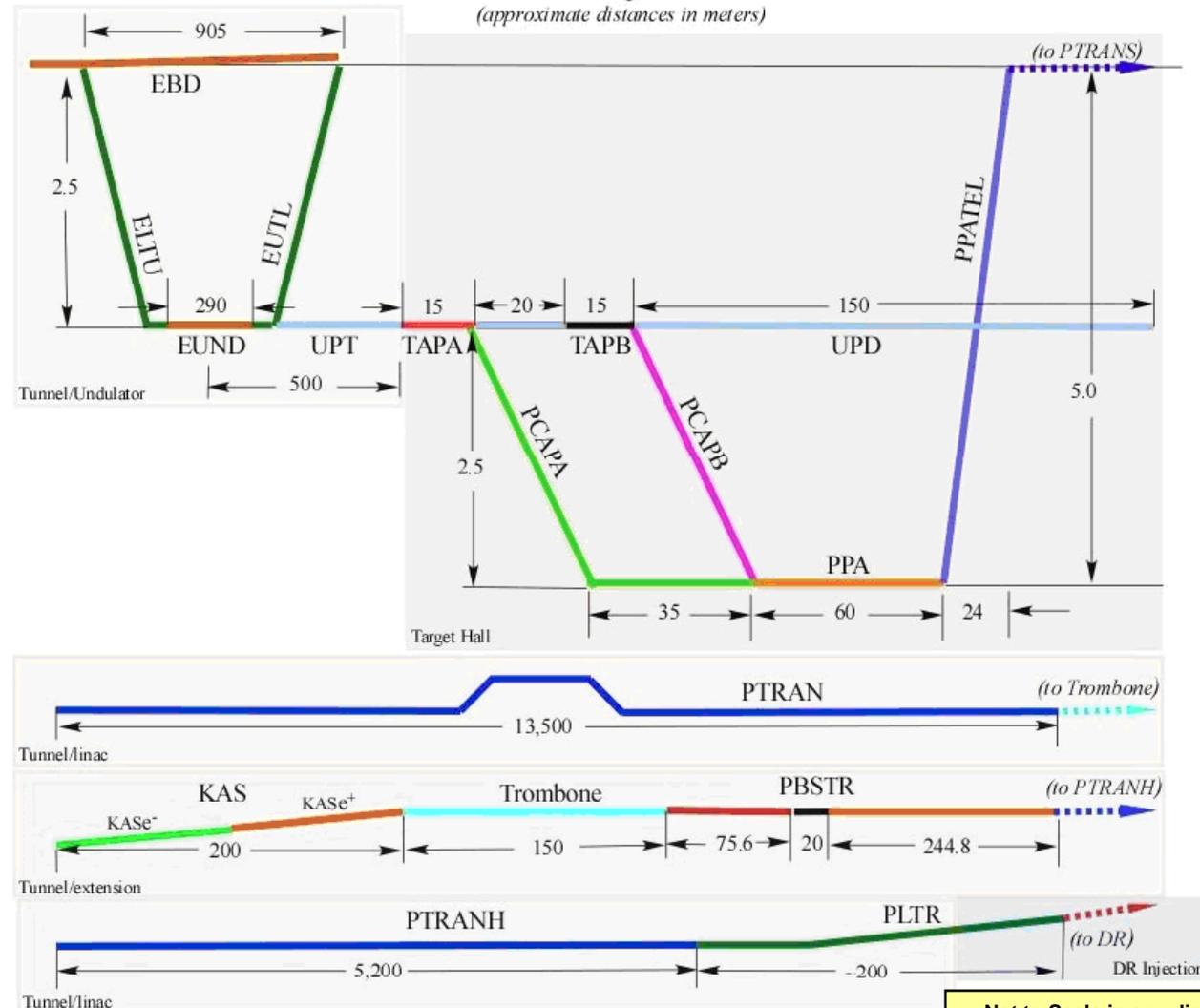
Linear Collider – Positron Source

ILC Positron System Beamlines

Information from end of PPATEL onwards is not included in 3D CAD.

Decision was made to exclude this until the minimum machine discussions have concluded.

KAS info not yet included in 3D model.





Linear Collider – Positron Source

Mission

The Technical Coordination shall care for the entire Positron Source facility.

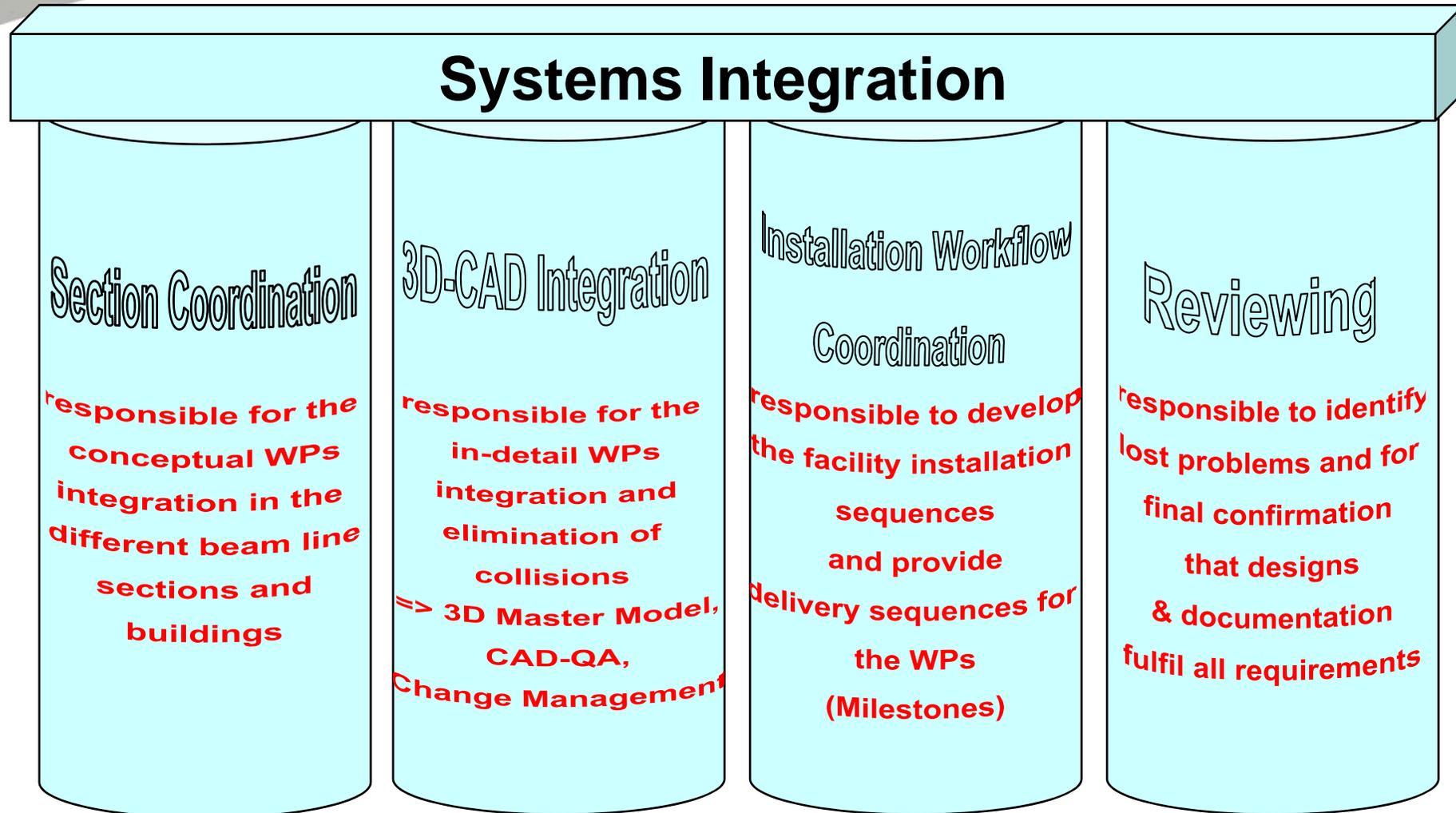
The Systems Integration shall identify and solve problems and satisfy all needs, which arise out of the WPs integration towards the final facility.

Systems Integration -> Primary Scope

- 1. Ensure all inter-WP interfaces get clarified / defined, i.e all components will match.**
- 2. Ensure all components will fit into the buildings, i.e there are no spatial collisions.**
- 3. Establish an overall-optimised installation sequence, i.e all components can get installed in the shortest possible time with a minimum of mutual disturbances. This is possibly a long way off, but well worth keeping in mind for the design.**
- 4. Provide information to all relevant parties in order to achieve the most cost effective and value engineered solution.**



Systems Integration => Based on 4 pillars





What have we got from an Engineering point of view?

Physical Systems

Undulator Design

Target

OMD

**Standing Wave
Accelerator**

Information/Specification

Lattice Deck

CFS Layout

Vacuum Spec.

Magnet Info



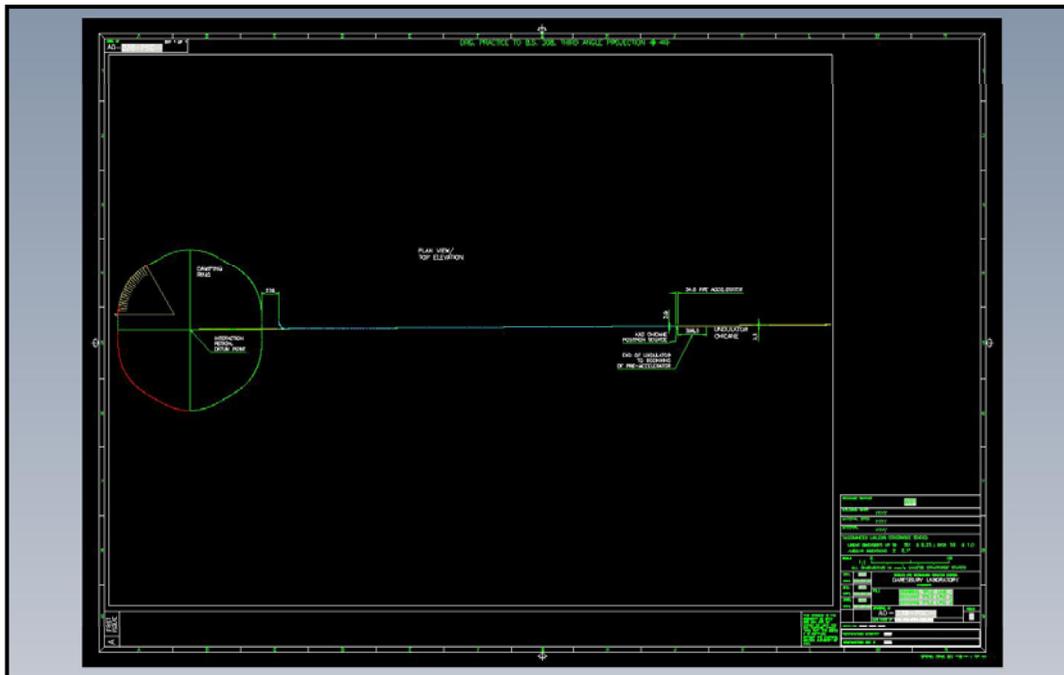
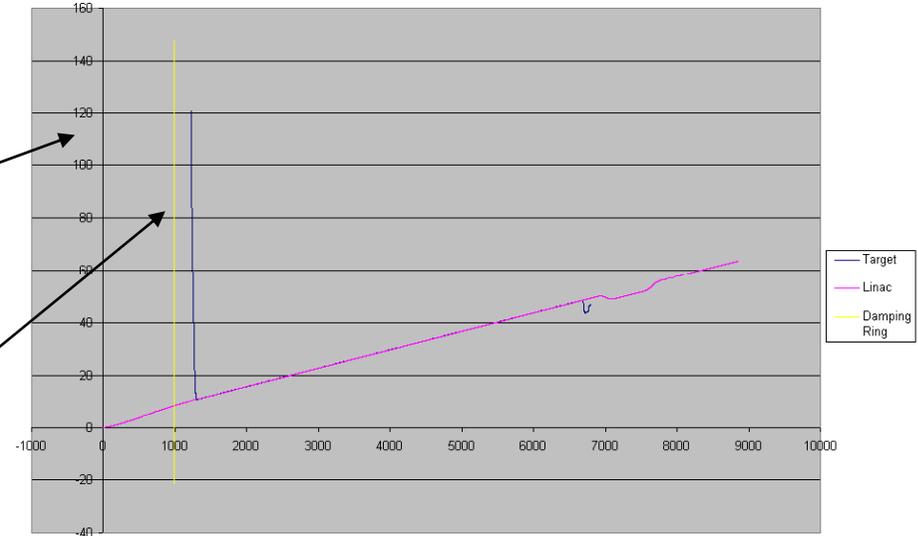
Where are we at, again, from an Engineering point of view

- Checked Lattice Deck to illustrate data is sound (validation).
 - Conversion into Excel data,
 - Import into CAD after data manipulation,
 - Verify layout agrees with other WG, in particular CFS,
 - Create 3D model and verify.
- Identified some Issues, Risks and Opportunities.
 - Apparent clash of components with tunnel,
 - Shallow departure angles require serious thinking during detail design, e.g. beam going through magnet structure,
 - Reduction in Source cavern size,
 - Side (location) of Service tunnel discussion.



After some data translation efforts and a few iterations, the final spreadsheet could be converted to illustrate the Target, LINAC and Damping Ring data as initial layout (graph plot).

It was observed that the Target does NOT join the Damping Ring using the baseline MAD files.



More data manipulation was required to 'convert' the Excel data into '2D-CAD' format.

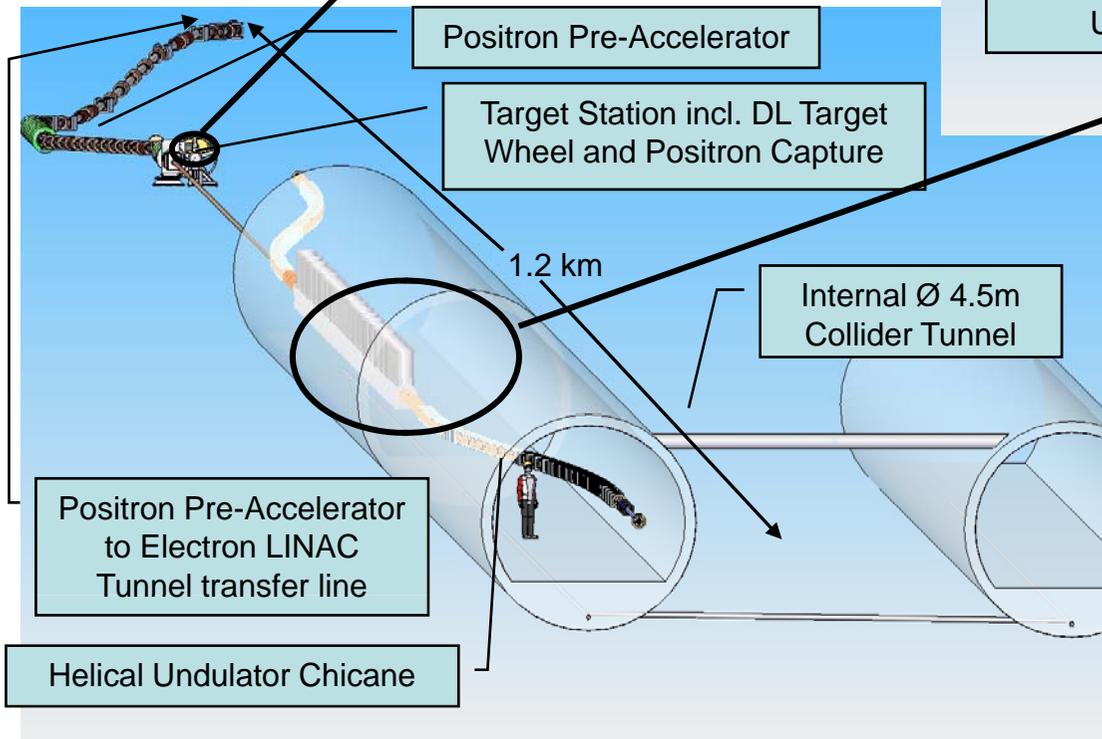
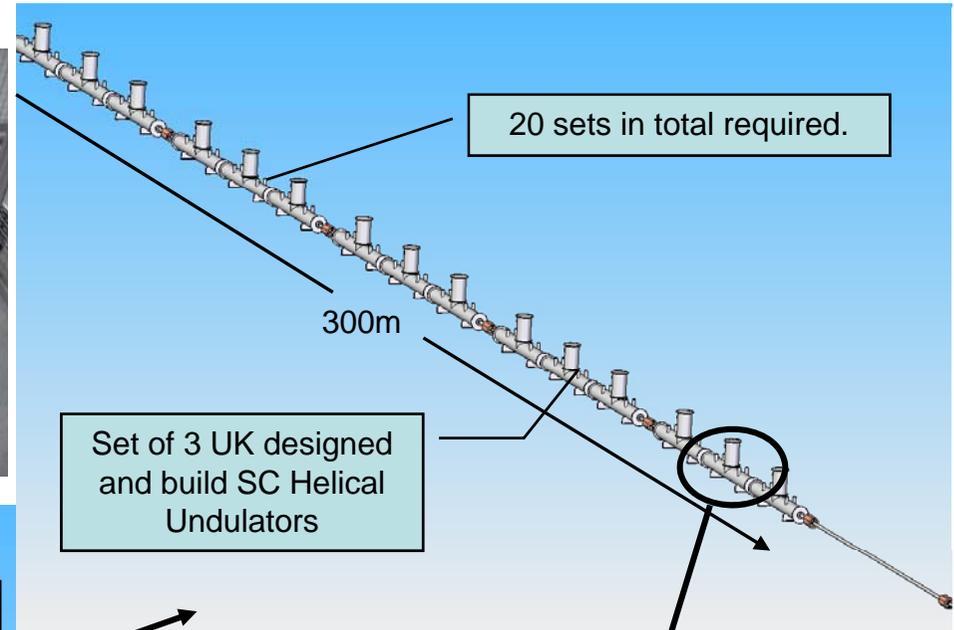
A larger than expected time was spend on this process before results proved satisfactory.

Inconsistencies between the Excel data compared with the CAD results proved that we required an automation process to reduce the iteration time.

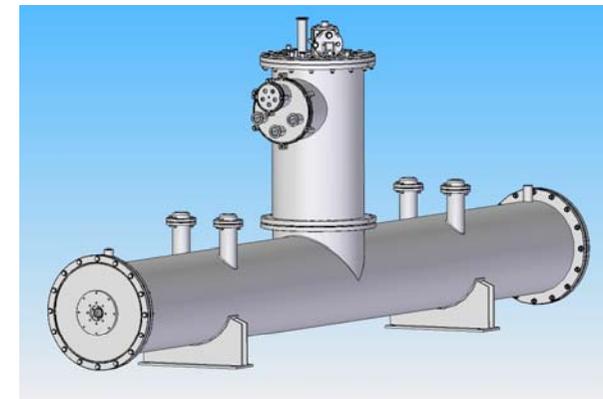


Linear Collider – Positron Source

Target Wheel
installation and
testing at
Daresbury
Laboratory



4m long Superconducting Helical Undulator



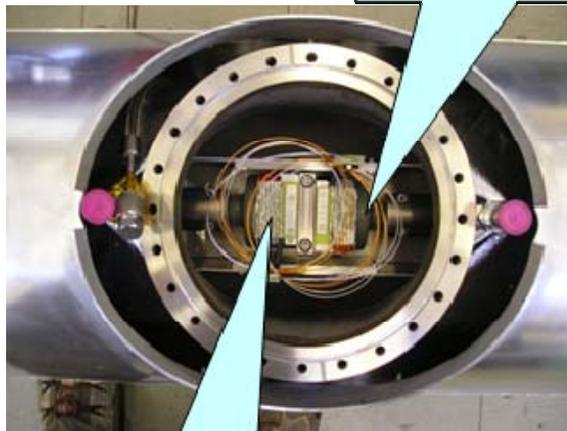


Linear Collider – Positron Source

Following winding each coil is potted
and end connections to ribbon made



Mag 2 connection



Mag 1 connection



Logging system connected

**Testing successful.
One down – 59 to go**

29/10/2008

N.Collomb

11



Linear Collider – Positron Source



**Target
Wheel
Installation
and Testing
at low RPM**



**Magnets
placed
using Laser
Tracker for
alignment**



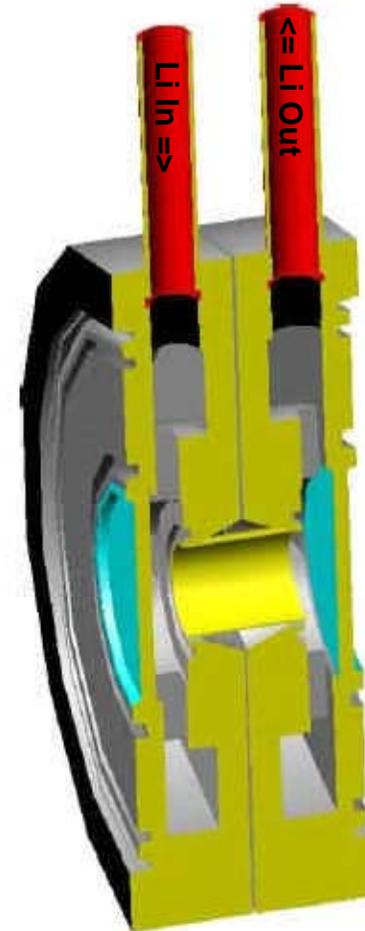
**Now you
see it – now
you don't.
Enclosure
required for
Health and
Safety**



Linear Collider – Positron Source

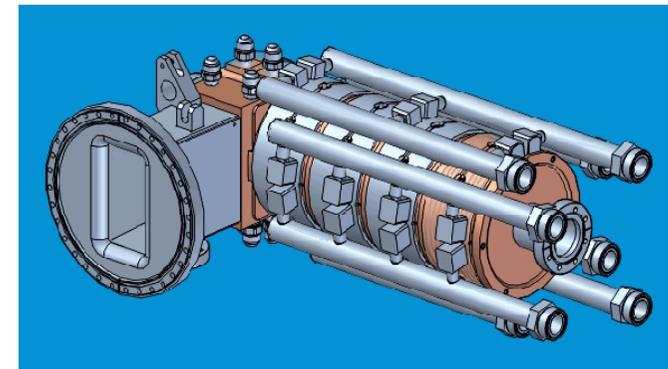
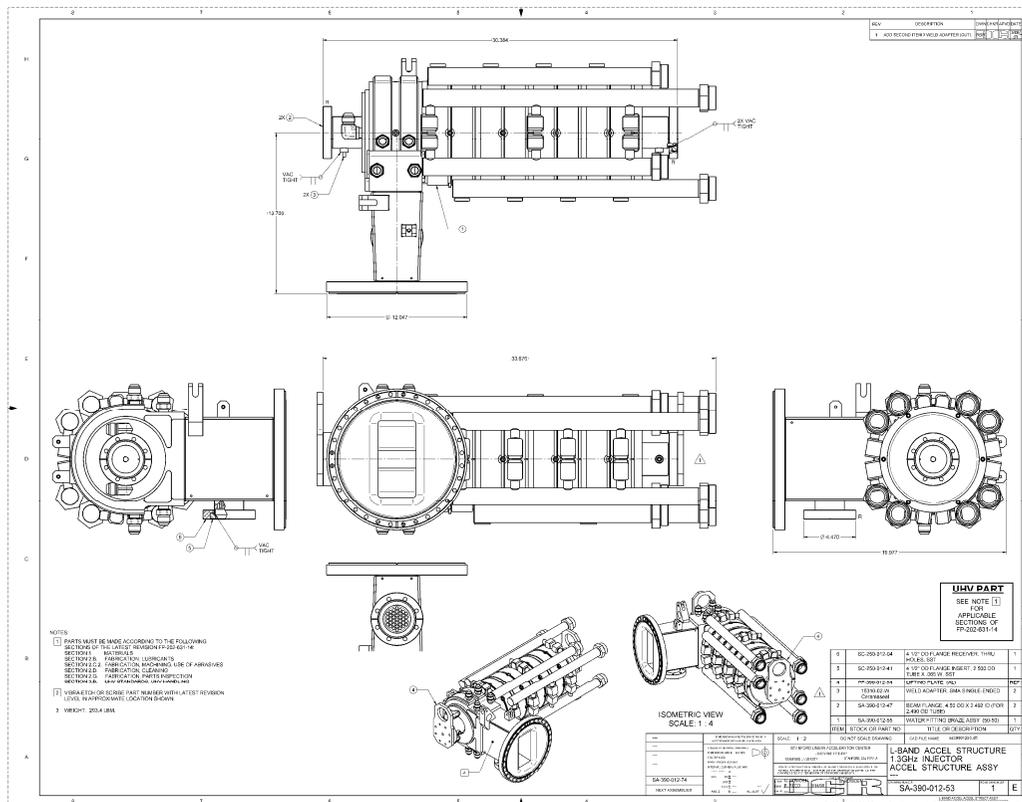


Lithium Lens with feeding cables.
(Courtesy of Yu. Shatunov, BINP)

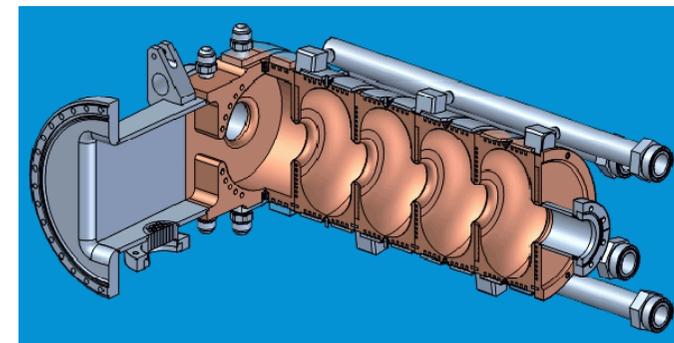


Lithium Lens CAD model section view.
(Courtesy of Alexander Mikhailichenko,
Cornell)

SLAC Standing Wave Accelerator



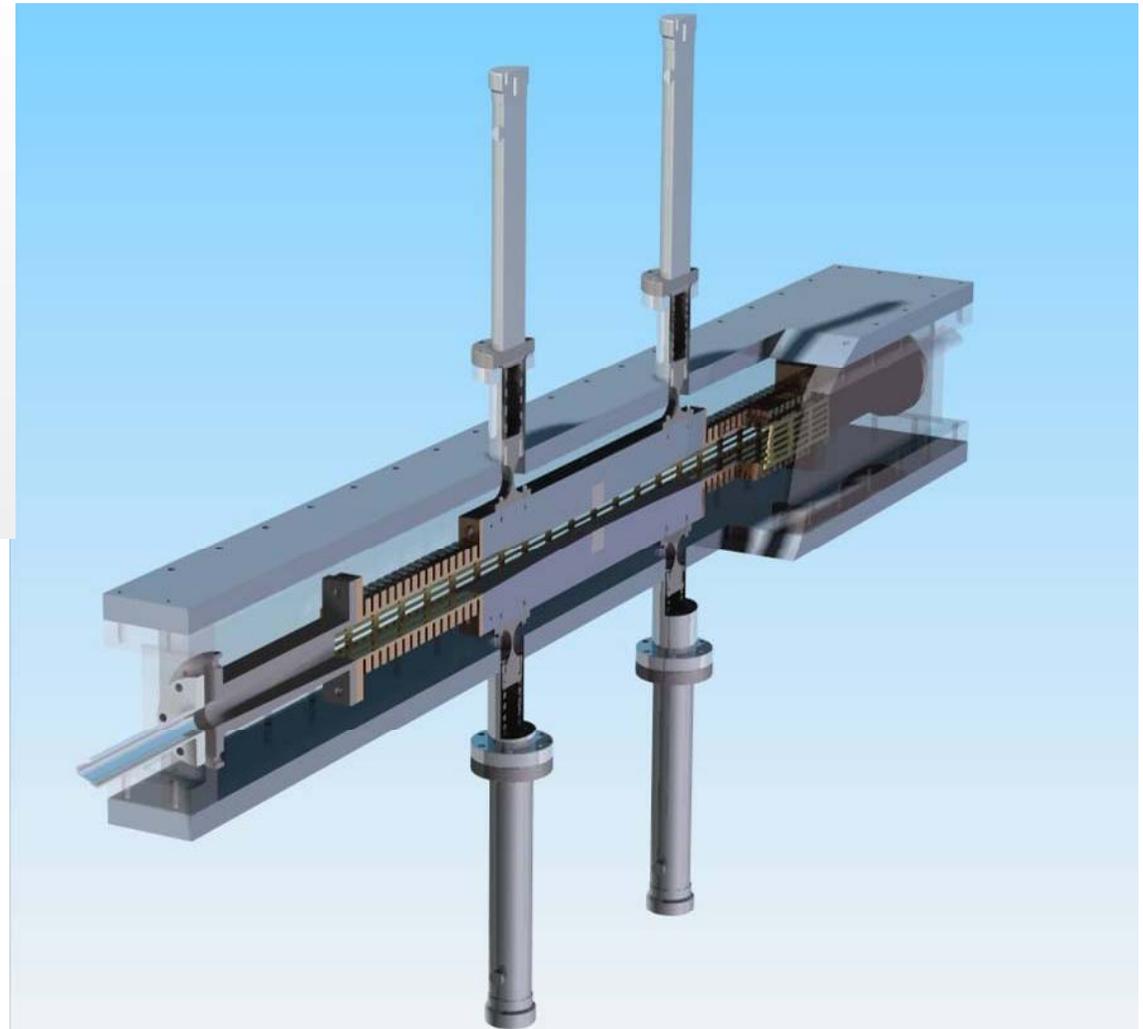
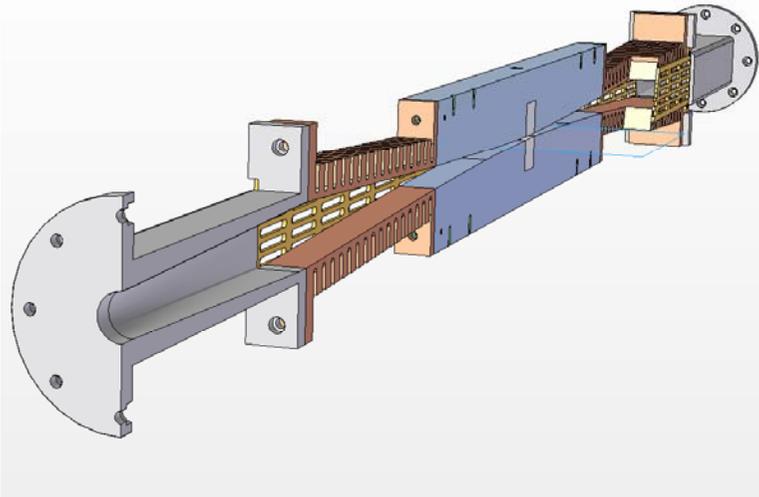
Section View





Linear Collider – Collimator

Status: Number of initial realistic concept scheme released (July 08) as STL files for RF wakefield modelling. EPAC Paper produced > Work now halted

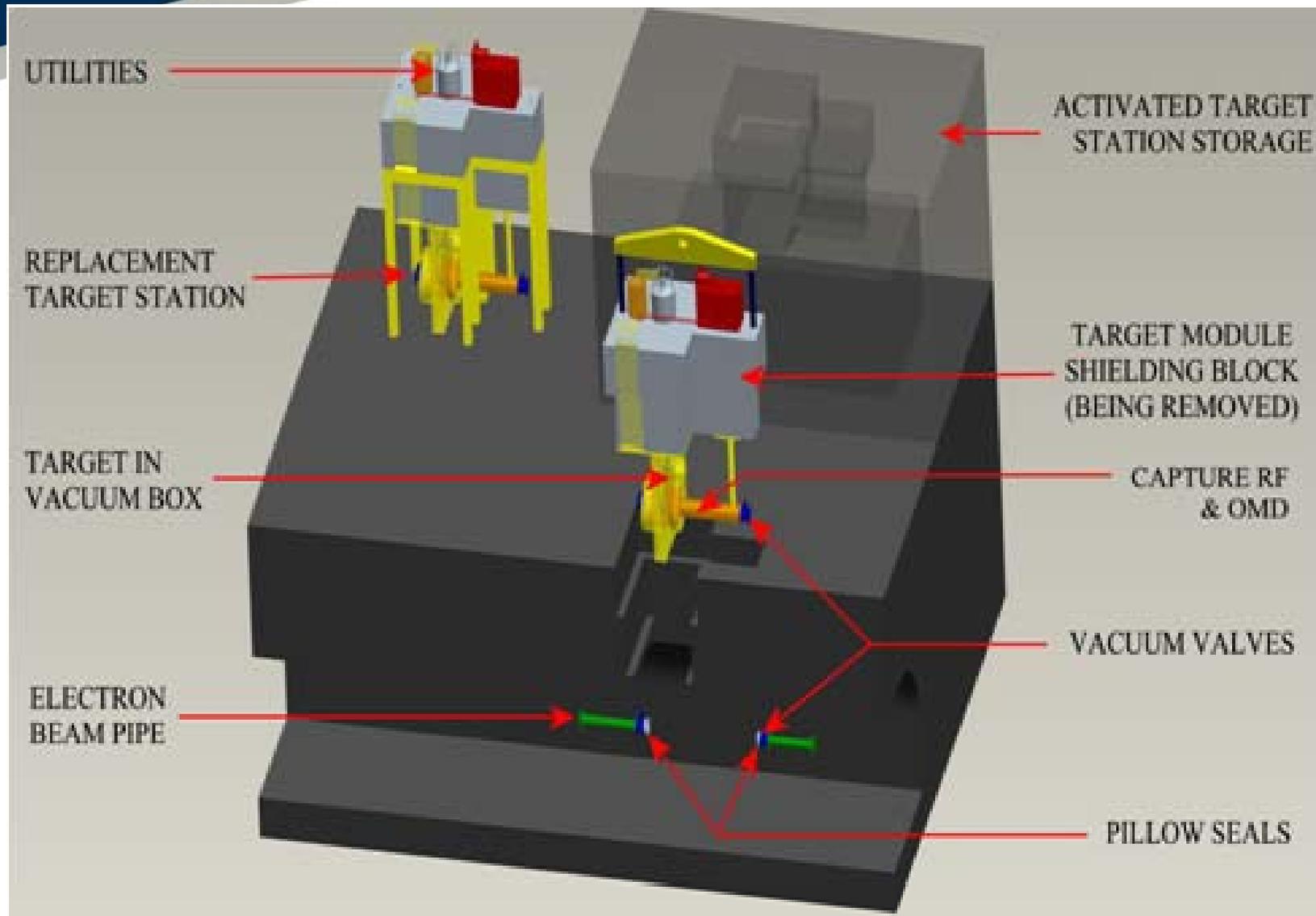


Project 228

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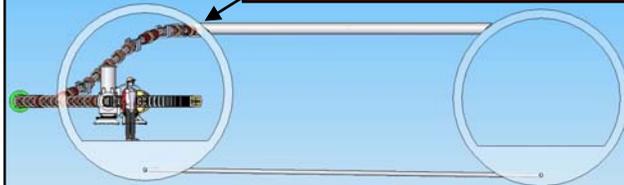
Linear Collider – Positron Source



Linear Collider – Positron Source

Mind your head.

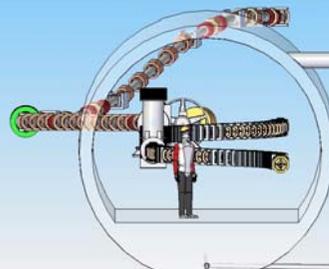
**PPATEL clash
with tunnel!**



**Looking Down the
Beam line**

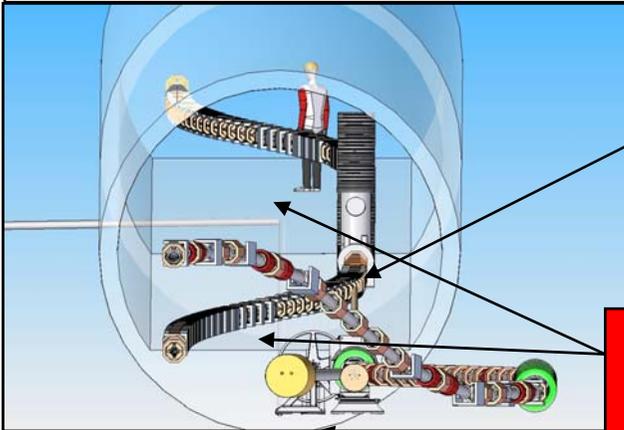
← IP

Is that really so close...?



← IP

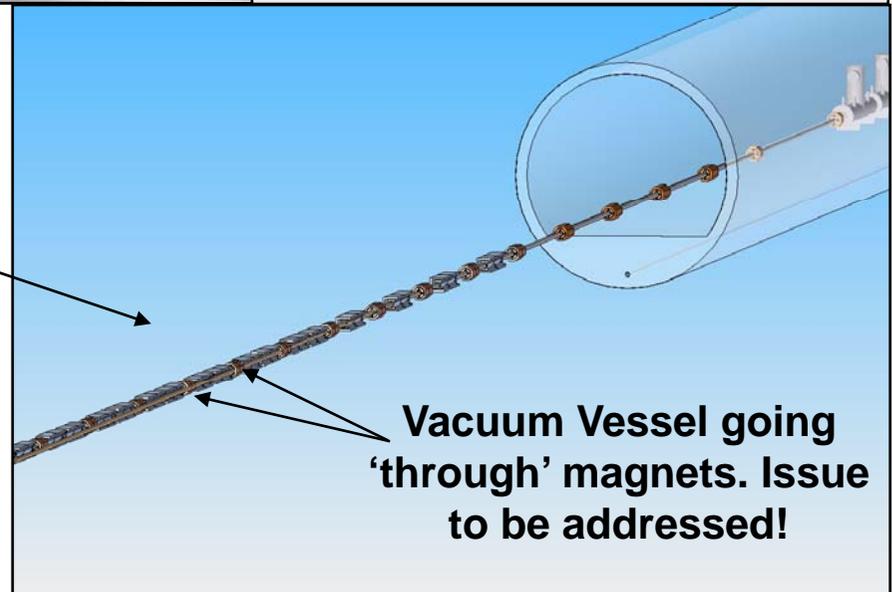
**No, a better perspective
illustrates a more realistic
scale.**



**What's going
on here?**

Ah, I see.

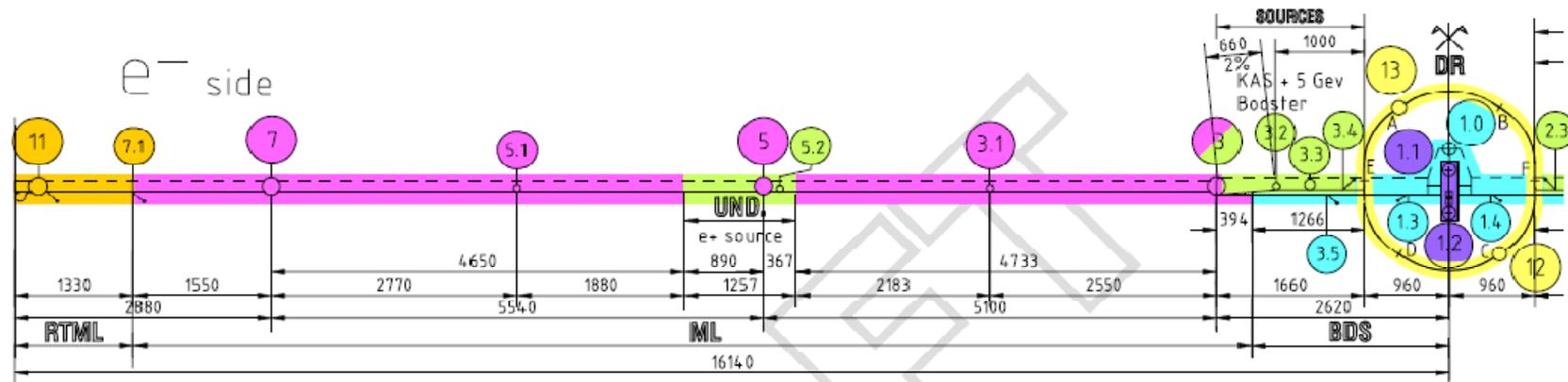
**Access to areas
for installation,
commissioning
and
maintenance?**



**Vacuum Vessel going
'through' magnets. Issue
to be addressed!**



John Andrew Osborne Dubna Presentation

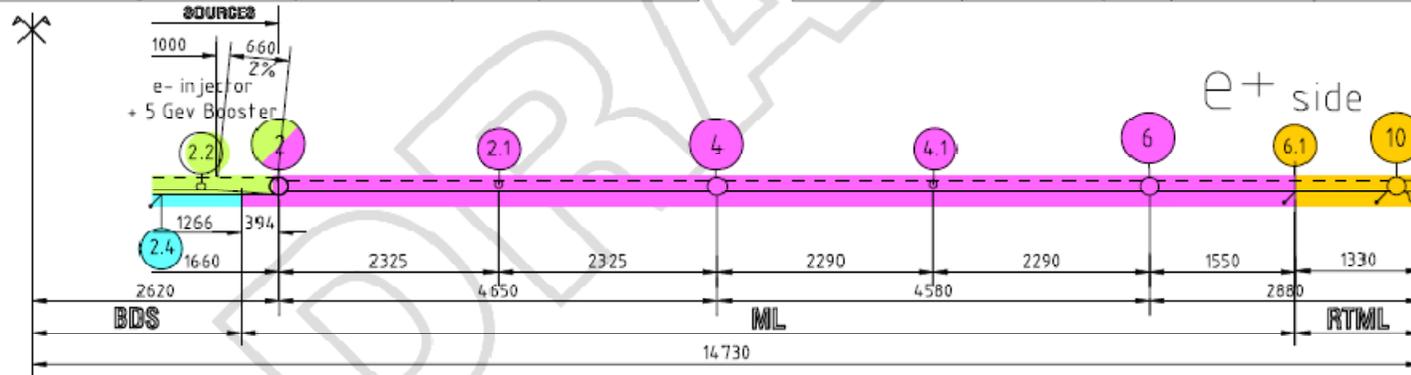


SITE / TUNNEL LENGTHS (m)

e- side + Undulator ML + RTML	e+ side ML + RTML	BDS + sources	DR	TOTAL
13 914 / 27 948	12 504 / 25 128	4 452 / 12 236	0 / 6704	30 870 / 72 016

TUNNELS

Area	e- inject., KAS beam + serv	DR	RTML beam + serv	ML beam + serv	BDS beam + serv	BDS Survey
φm	4.5	5.0	4.5 + 4.5	4.5 + 4.5	4.5 + 4.5	1.5 x 2.2

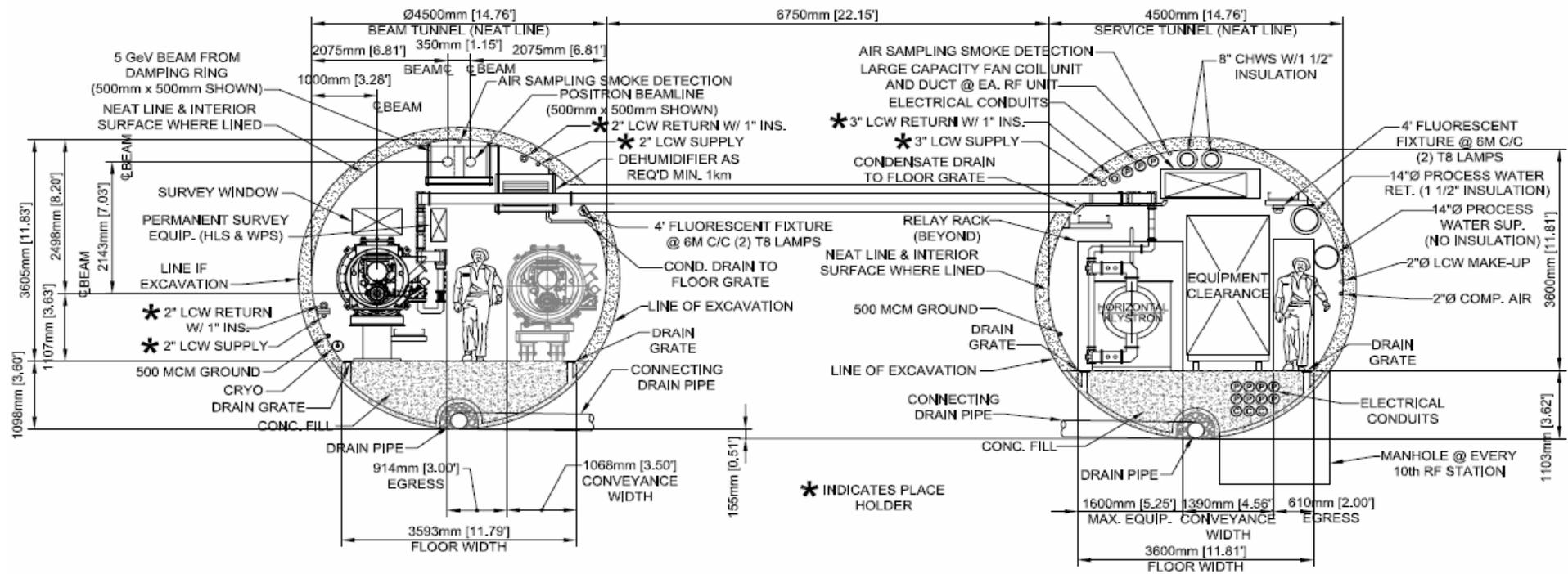


- Legend :
- RTML
 - ML
 - DR
 - Sources e- KAS
 - BDS
 - Detectors Area

SHAFTS													BORINGS			SHAFT BASE CAVERNS		MUON WALL WIDENINGS					
Point	1.0	1.1	1.2	2	3	3.3	5.2	4	5	6	7	10	11	12/C	13/A	Point	2.1, 3.1, 4.1, 5.1	2.2, 3.2	1.3, 1.4, 2.4, 3.5	Point	2, 3, 4, 5, 6, 7, 10, 11	Point	1.3, 1.4
φm	9	16	16	14	14	4	4	14	14	9	9	14	14	9	9	φm	1.50			(l x w x h) m	4.9 x 16 x 18 + 3 storeys	(l x w x h) m	25 x 7 x 6 + 15 x 7 x 6
SOURCES CAVERNS				DR ALCOVES			DETECTORS HALL			BEAM DUMPS CAVERNS (~)			BEAM DUMP SERVICE HALLS (~)										
Point	Undulator 5.2	KAS 3.3	2.2, 3.2	Point	12/C, 13/A	B, D, E, F	Point	11, 12	1.0	Point	SOURCES 2.3, 3.4	RTML 6.1, 7.1, 10, 11	BDS 1.3, 1.4, 2.4, 3.5	Point	BDS 1.3, 1.4, 2.4, 3.5								
(LxWxH) m	21 161m ³	6 574m ³	7 X 15 X 7.5	(LxWxH) m	7.5 x 10 x 10 + 1 storey	16 x 8 x 8	(LxWxH) m	120 x 25 x 39	40 x 15 x 15	(LxWxH) m	5 x 4 x 4	20 x 9 x 15 + 1 storey	(LxWxH) m	30x20x 10									



RDR Tunnel Layout (p.III-213)





Linear Collider – Positron Source

The lattice information is now 'spot on' (to RDR baseline).

We have a crude virtual Positron source machine.

We are making good progress on a number of systems.

Decision on which CAD package to use needs to be made in order to progress to the next level.

The next level is the inclusion of more detail design into the model.

Address issues raised and propagate the information to relevant persons for discussion.

Look at more detailed and feasible Remote Handling design.

Liaise with other WG to identify space requirements.

Start support and vacuum design phase.

Incorporate 'new lattice' if available.