

CLIC Civil Engineering Update



Matthew Stuart - John Osborne SMB-SE-FAS

Reminder - Summary From 31/03/2017

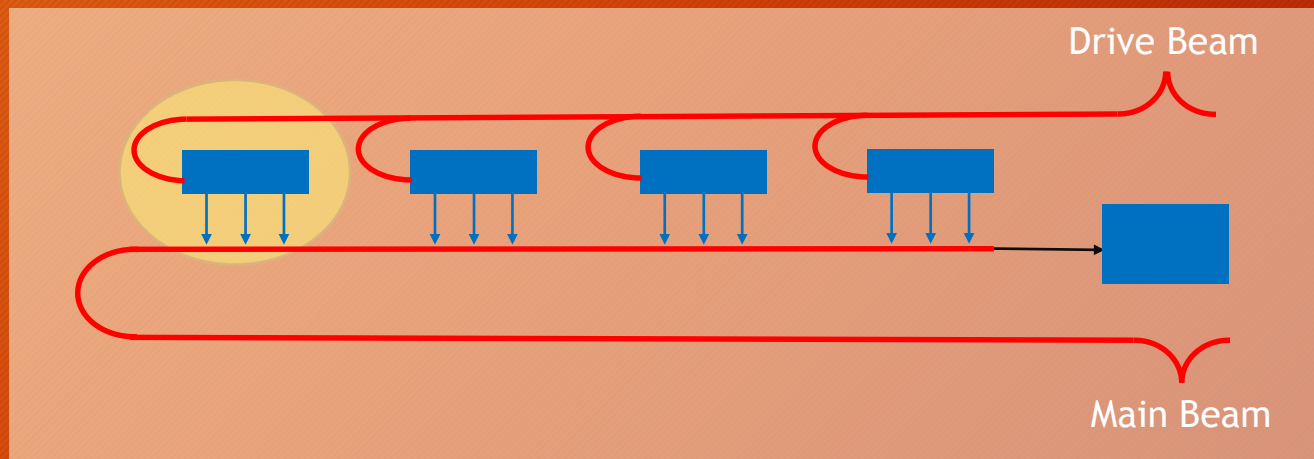


- 380GeV, 1.5TeV and 3TeV machine layouts to be created
- Develop new engineering layout for 380GeV machine using Klystron technology
- Develop a layout for the interaction region
- CLIC-TOT to be produced to allowed optimisation of tunnel location.
- A detailed cost estimate for infrastructure to be produced and work together with ILC on areas of synergy

380 GeV



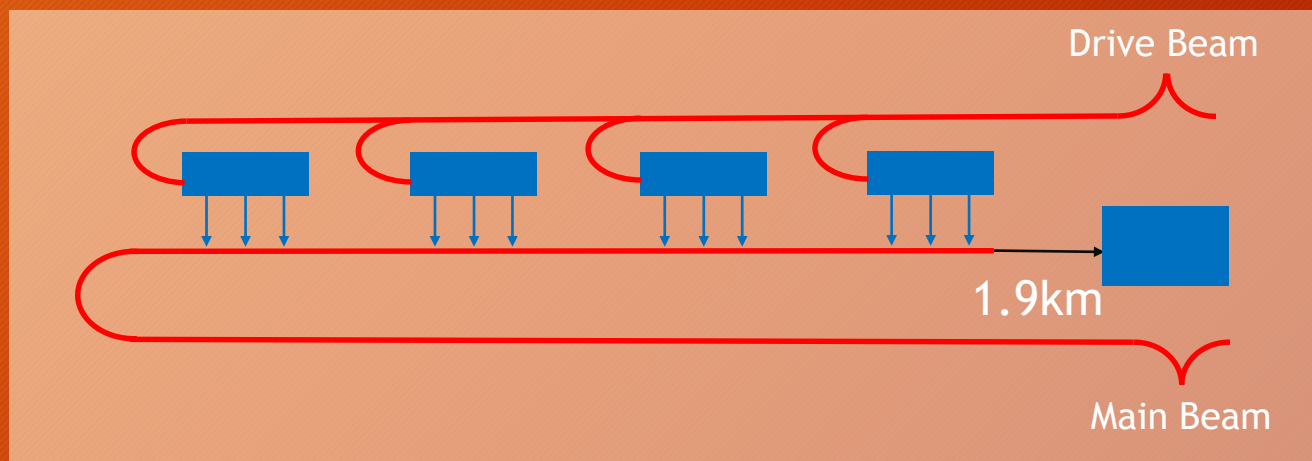
- 4 turnarounds and accelerator sections either side of the Interaction Region
- 1.9 km Beam Delivery System
- Total length of 10km
- Shafts every 5km
- Central Injector Complex, one drive beam - Located on CERN land



380 GeV



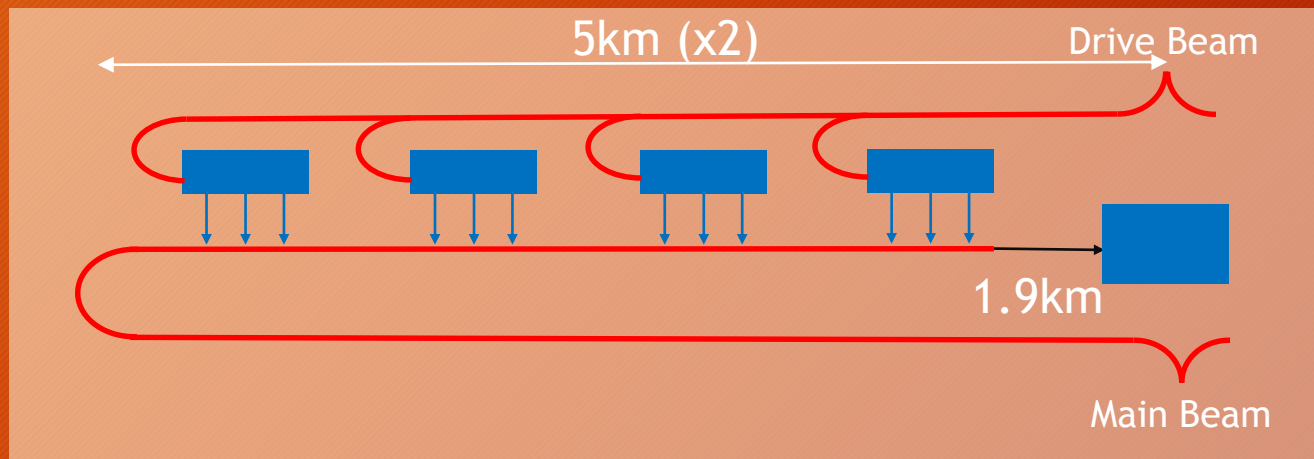
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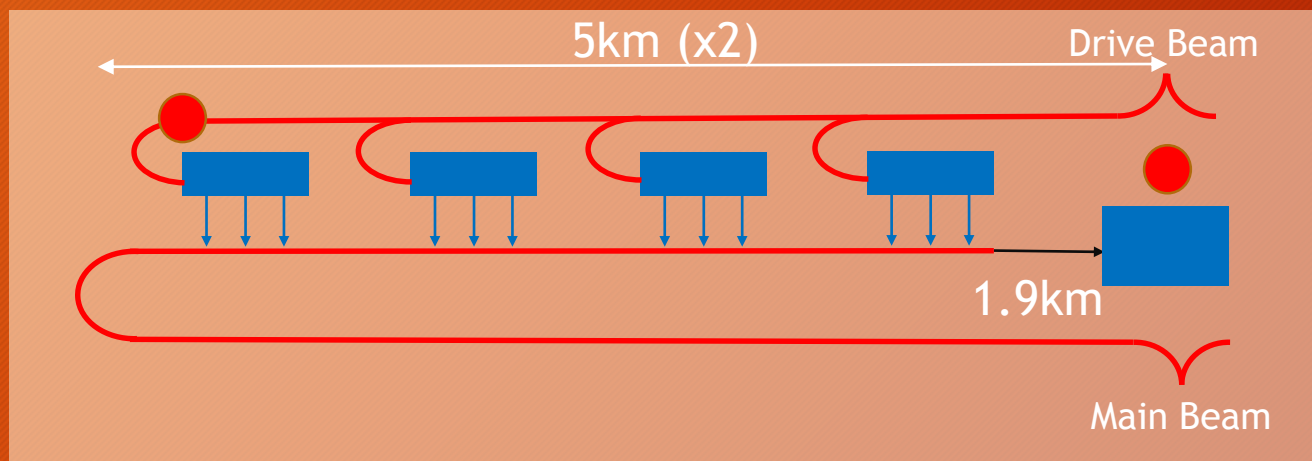
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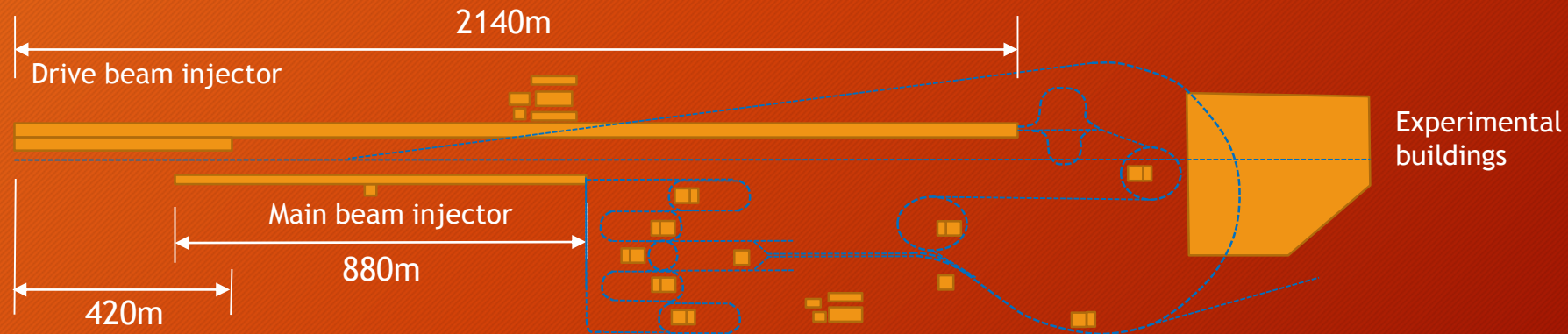
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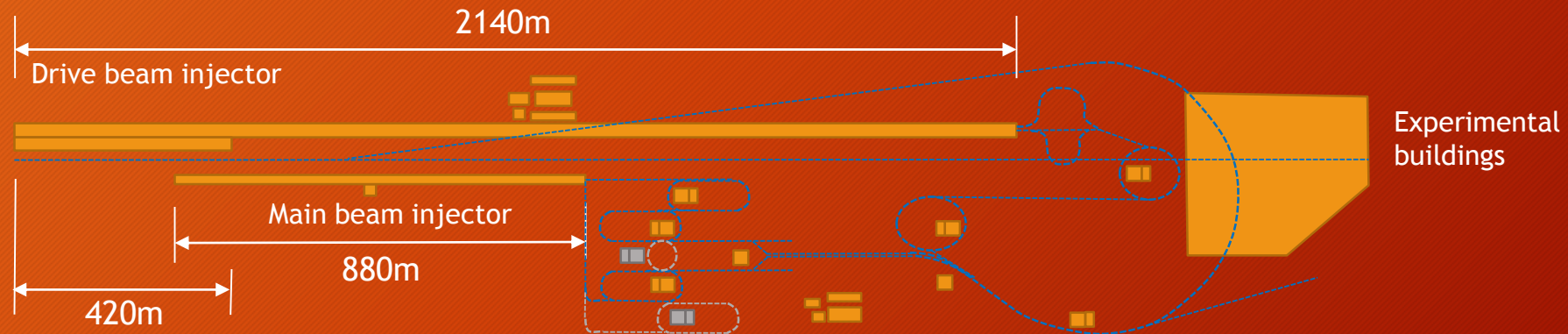
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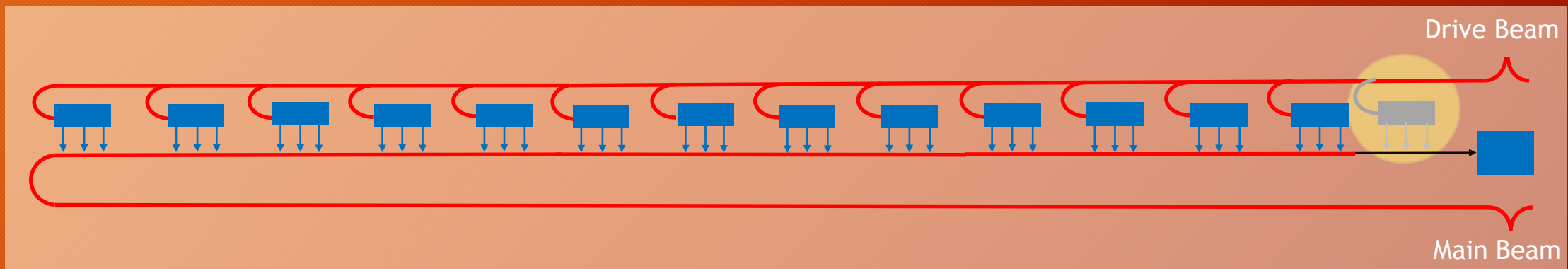
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1.5 TeV



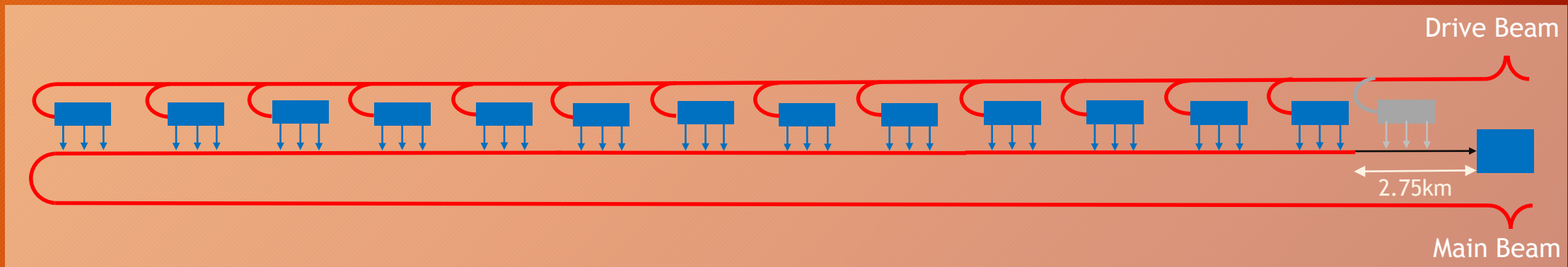
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- 2.75 km Beam Delivery System
- Total length of 27km
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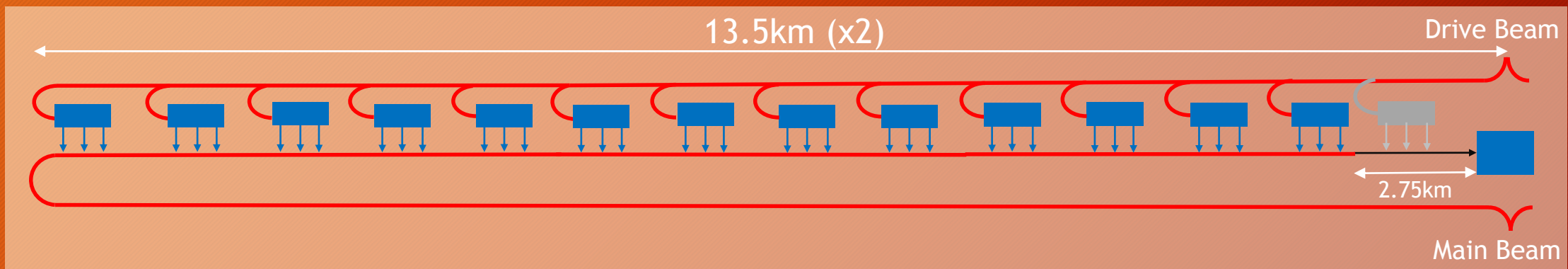
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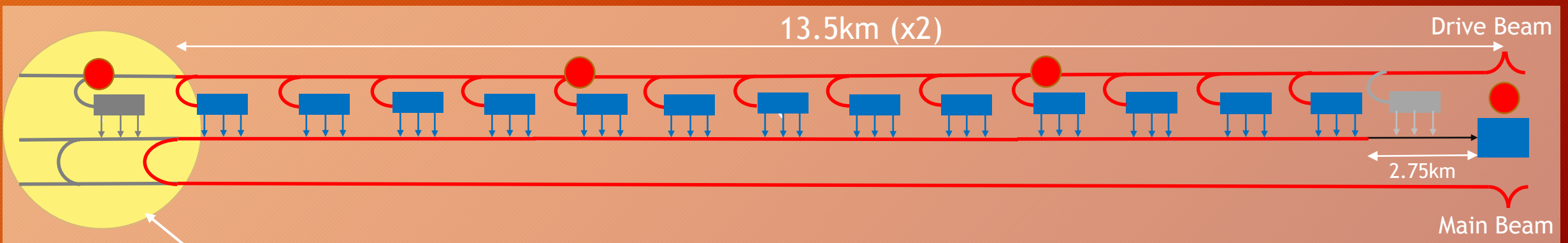
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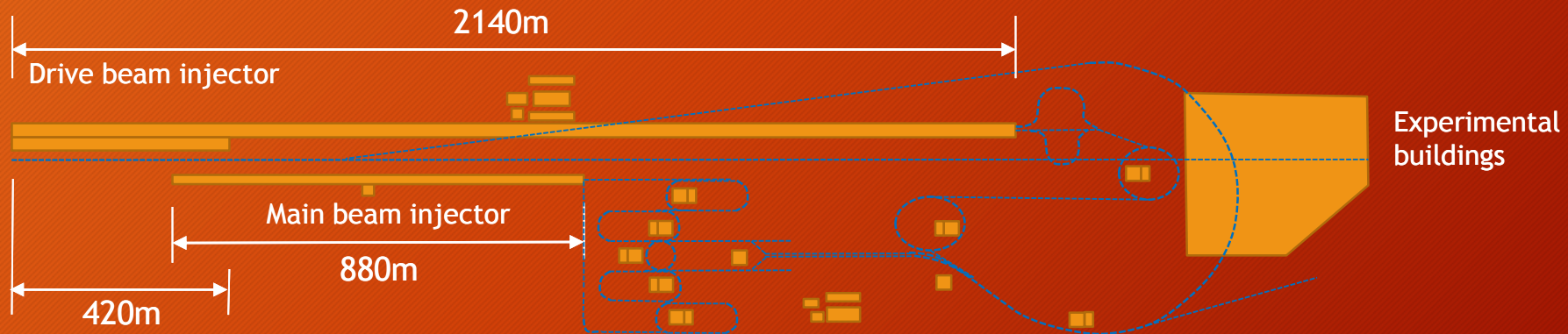


Potentially construct tunnel to shaft 7 and approx. 100m past at second stage.

1.5 TeV



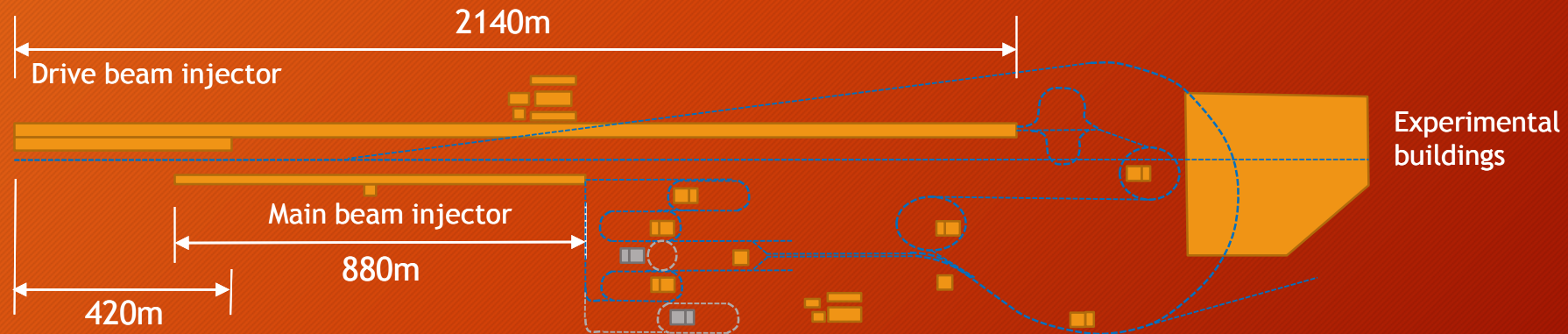
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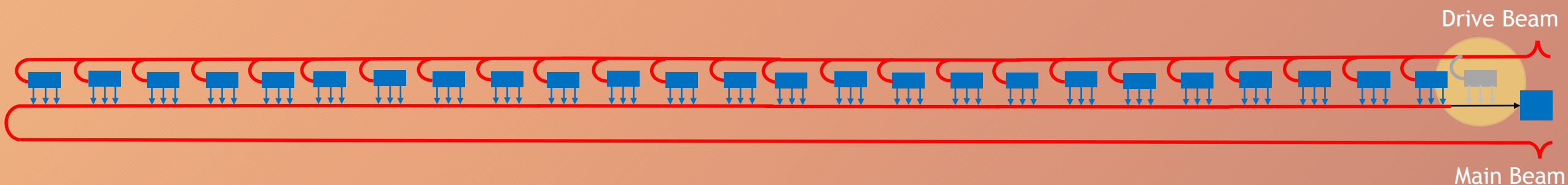
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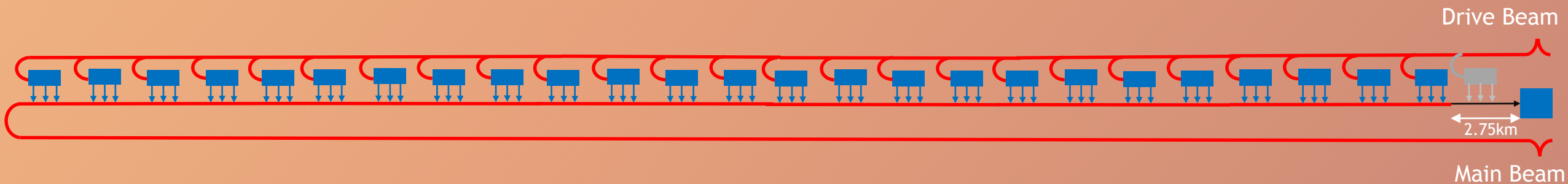
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- 2.75 km Beam Delivery System
- Total length of 48km
- Shafts every 5km
- Central Injector Complex - Located on CERN land two drive beam injectors.



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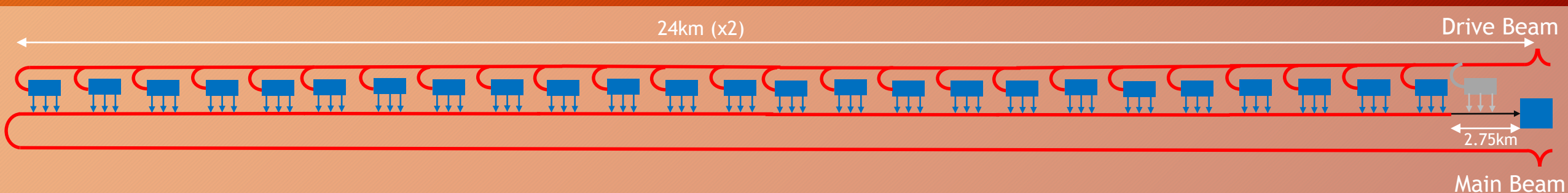
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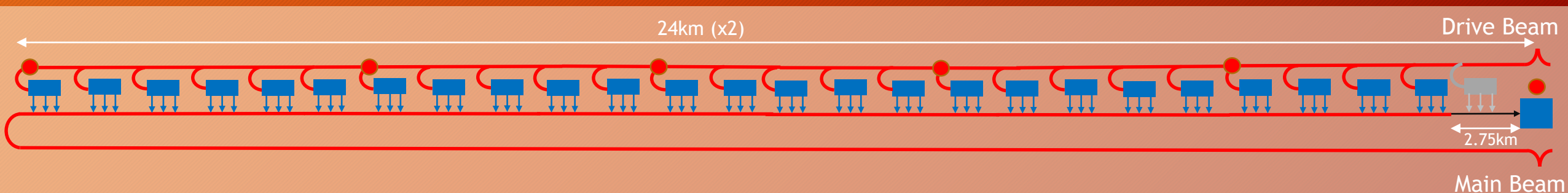
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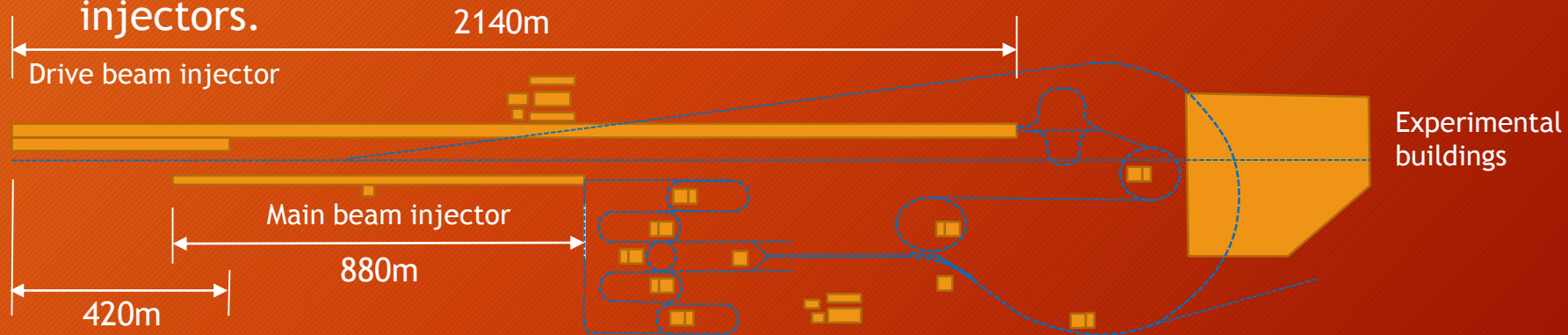
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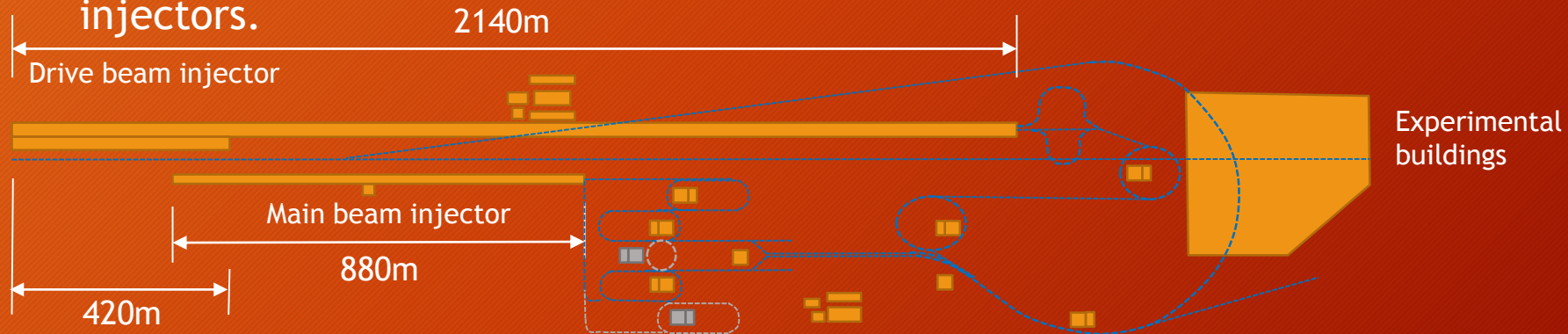
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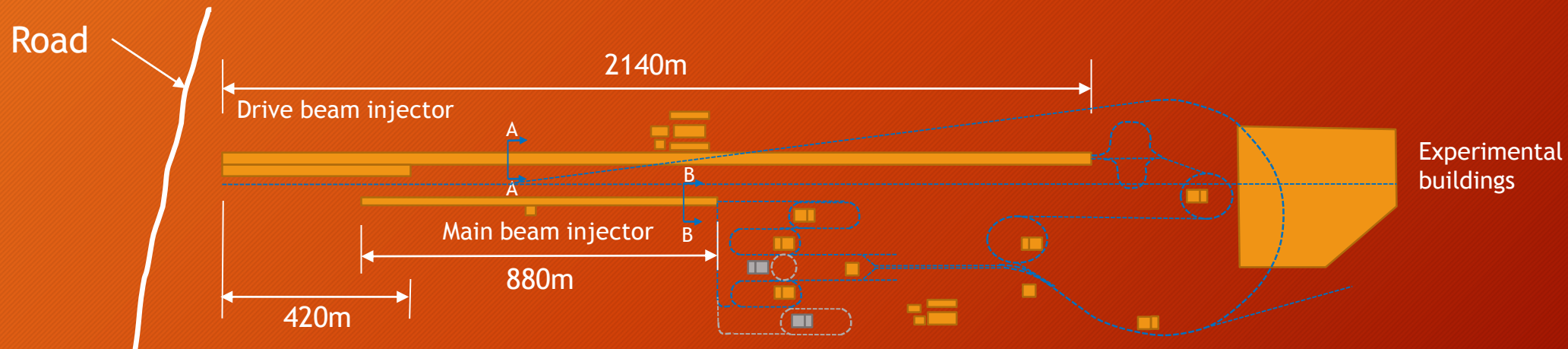
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Central Injector Complex



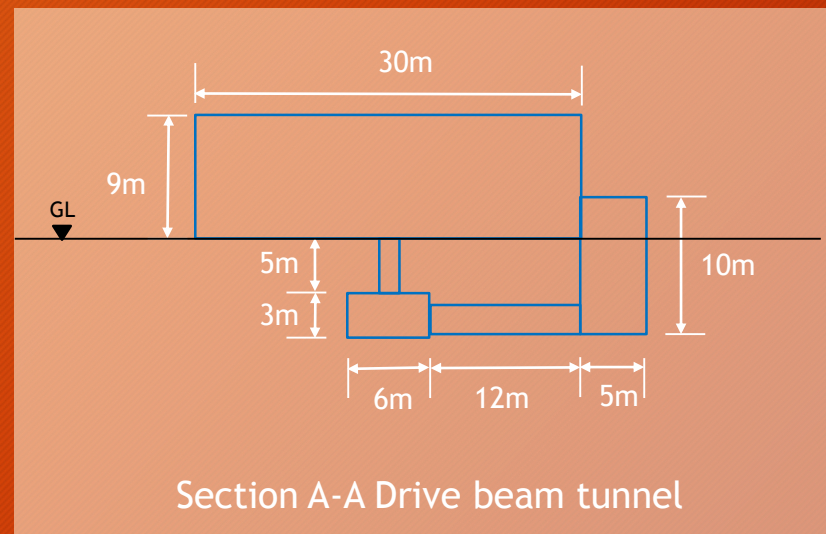
- Consists of 3 main parts - Drive beam injector, main beam injector and experimental buildings.
- Section A-A: Cross sectional geometry of the drive beam injector
- Section B-B: Cross sectional geometry of the main beam injector



Central Injector Complex



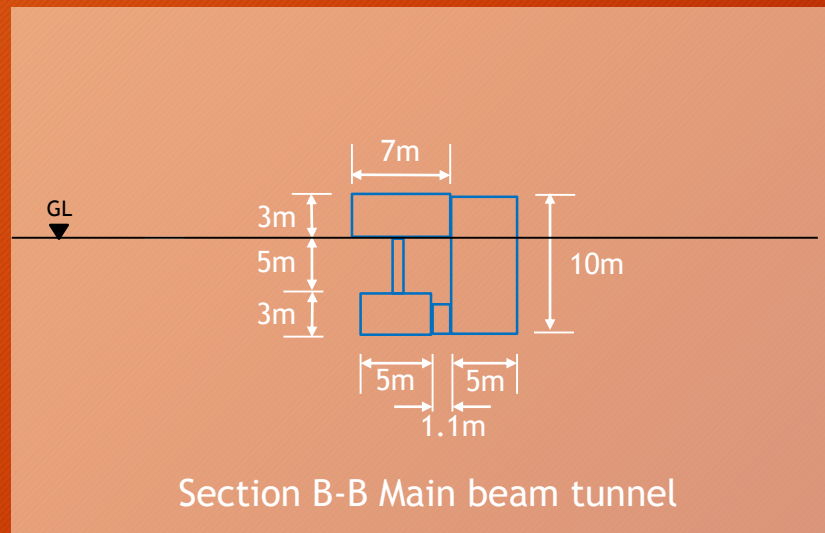
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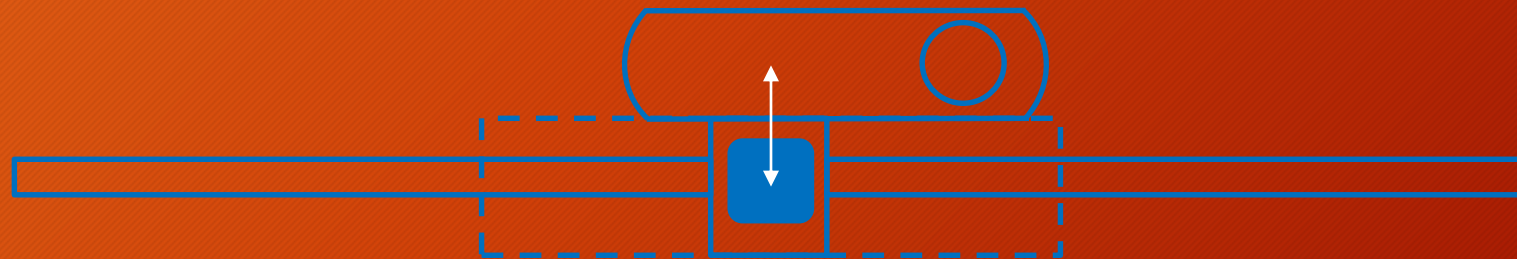
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Interaction Region



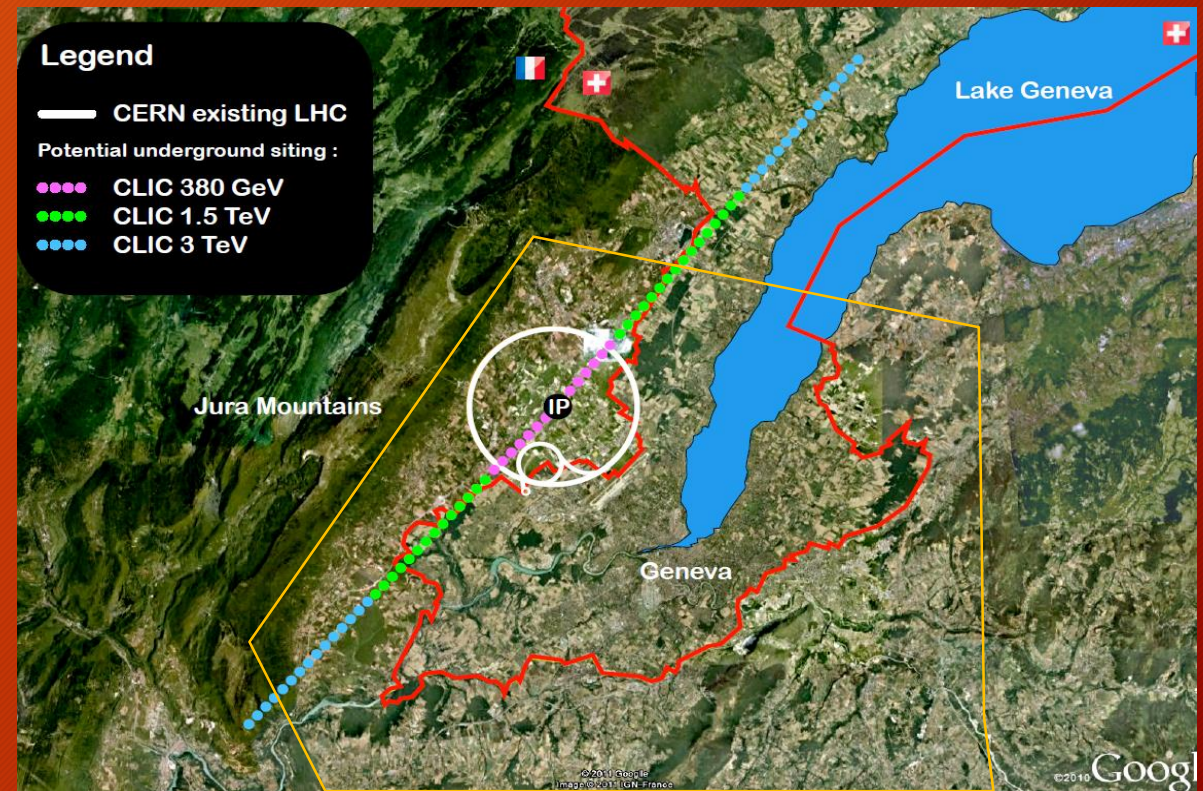
- Access shaft for detector and machine ?
- What to do with the proposed escape tunnel?
- Thickness of shielding wall?
- Moveable detector - garage position available.



CLIC-TOT



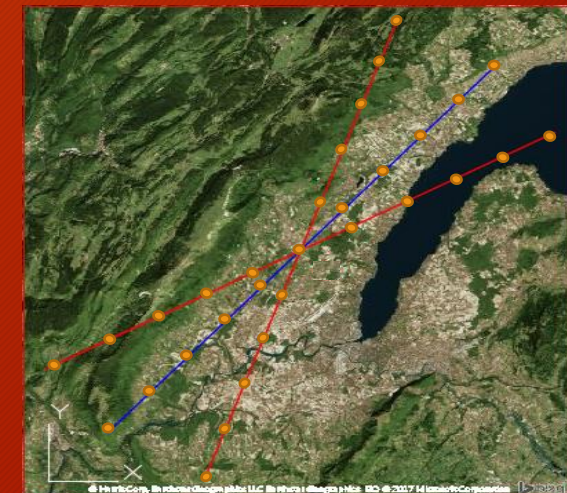
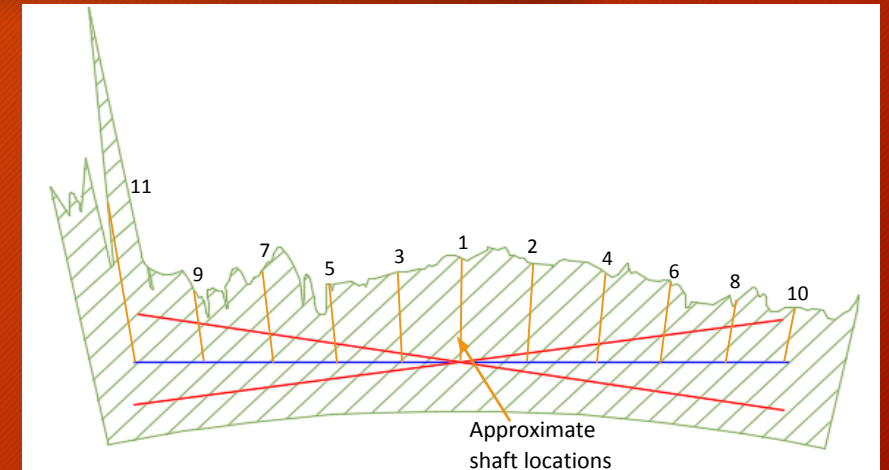
- Optimise the Position of the CLIC for the three energy stages.
- Optimise the depth
- Optimise the angle of the tunnels
- Optimise the position of the IR
- Production of Tool including user inputs and outputs has been agreed
- Geological data required outside of the FCC study area. (Meeting with local geologists 22 May).



Tool Functionality



- Allows rotation of the tunnel in the vertical plane shown here.
- Gives an optimised depth and most suitable shaft positions.
- Reduce average depth of tunnel to decrease cost and schedule.
- Rotation of the Tunnel in the horizontal plane shown here.
- Provide a Geological cross section of the tunnel.
- Allow positioning of inclined tunnel access and provide geological data for the inclined tunnels.



TOT Timeline



The proposed programme task completion dates are as follows, assuming a project commencement at the end of April 2017:

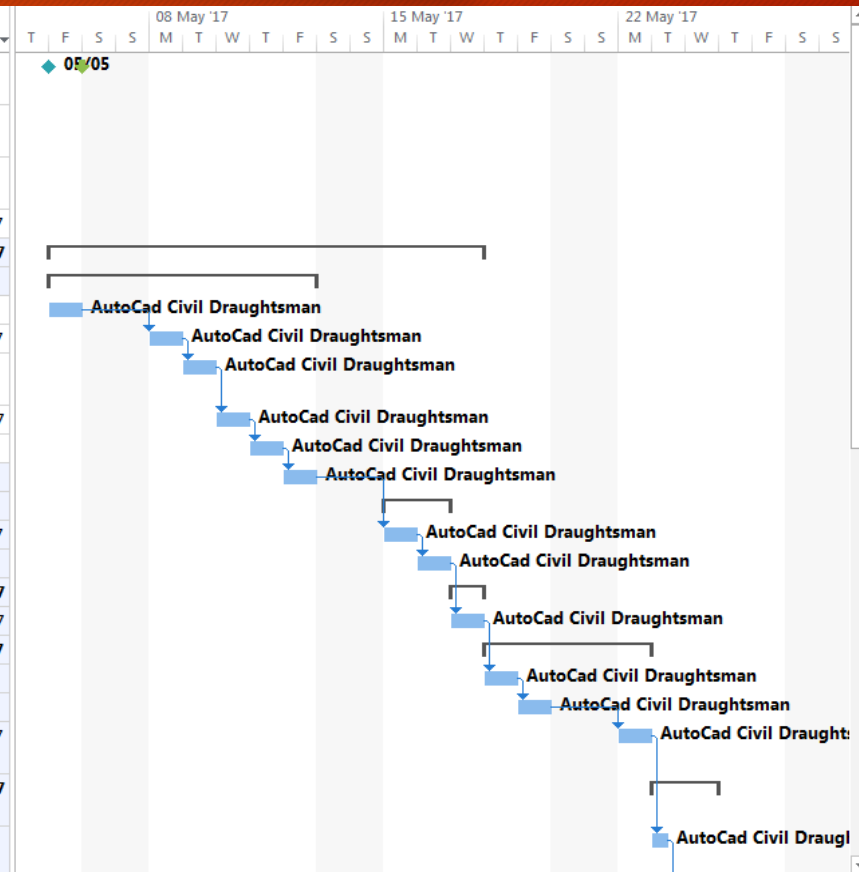
Task 1	Establish Project Setup and Technical Basis	June (mid)
Task 2	Data and Functionality Prioritisation	June (end)
Task 3	Specifications and TOT-CLIC architecting/wireframing (Concept Stage)	July (mid)
Task 4	Data Integration and TOT-CLIC (beta) development	July (mid)
Task 5	Finalised TOT-CLIC Development	Sept (end)
Task 6	Troubleshooting and Technical Support	-

Civil Engineering Drawings



- Existing Civil Drawings to be updated where required.
- New drawings for Klystron Design will be required.
- Full 3D schematic required for entire length.
- 3D schematic required for IR.
- Schedule for Drawings to be agreed with Civil Draughtsmen.

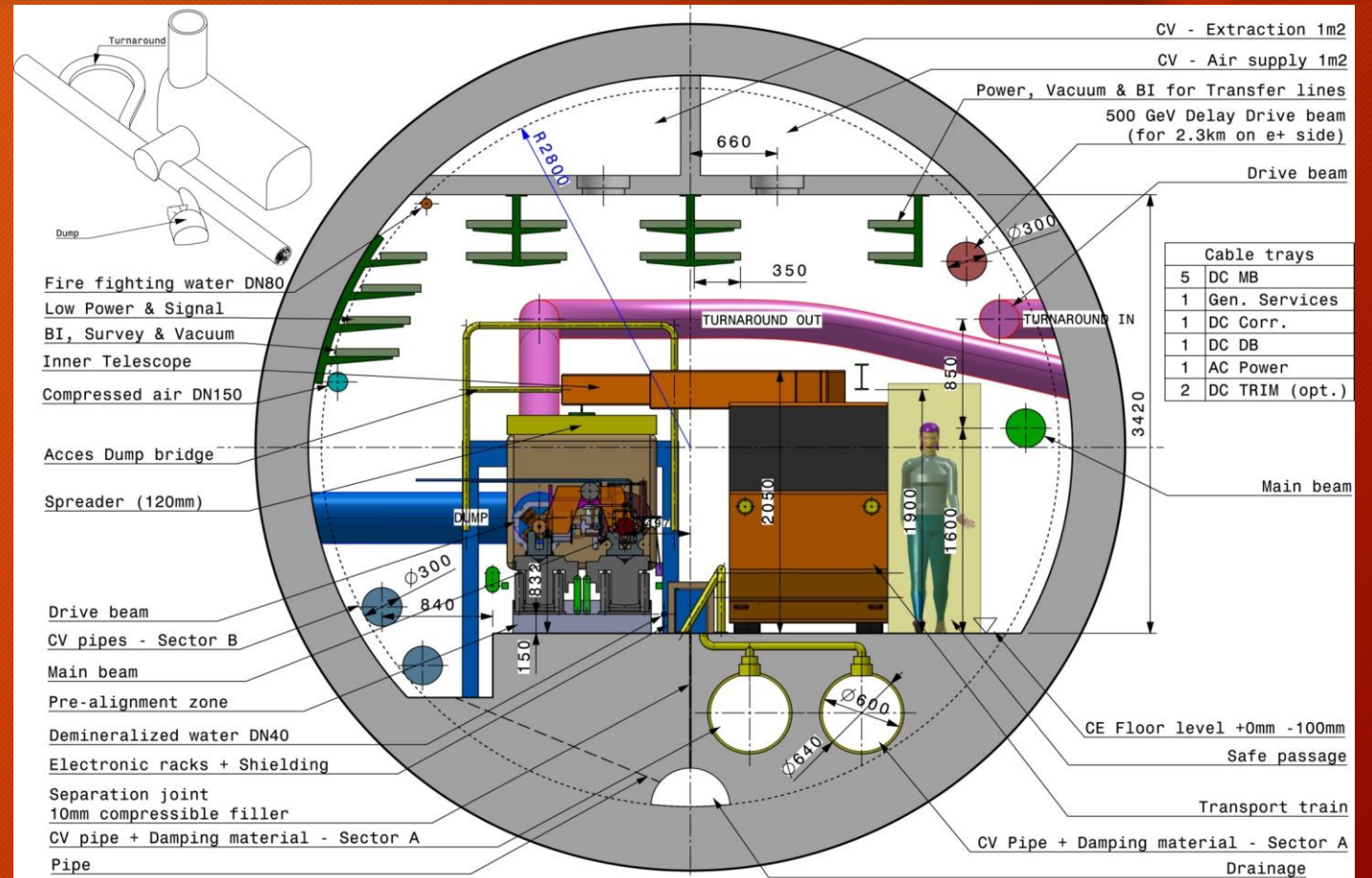
Task Mode	Task Name	Duration	Start	Finish
	CEIS Working Group Meeting 05/05/2017	0 days	Fri 05/05/17	Fri 05/05/17
	CEIS Working Group Meeting 16/06/2017	0 days	Fri 16/06/17	Fri 16/06/17
	CEIS Working Group Meeting 21/07/2017	0 days	Fri 21/07/17	Fri 21/07/17
	CLIC Week	0 days	Mon 21/08/17	Mon 21/08/17
	Proposed Tunnel Layout	9 days	Fri 05/05/17	Wed 17/05/17
	11km Tunnel Layout	6 days	Fri 05/05/17	Fri 12/05/17
	Detector Cavern Layout	1 day	Fri 05/05/17	Fri 05/05/17
	BDS Layout	1 day	Mon 08/05/17	Mon 08/05/17
	General Tunnel and caverns	1 day	Tue 09/05/17	Tue 09/05/17
	Beam Dump Layout	1 day	Wed 10/05/17	Wed 10/05/17
	Turnaround Layout	1 day	Thu 11/05/17	Thu 11/05/17
	Drive Beam Return Loop	1 day	Fri 12/05/17	Fri 12/05/17
	29km Tunnel Layout	2 days	Mon 15/05/17	Tue 16/05/17
	Tunnel Extension	1 day	Mon 15/05/17	Mon 15/05/17
	BDS Layout extension	1 day	Tue 16/05/17	Tue 16/05/17
	55km Tunnel Layout	1 day	Wed 17/05/17	Wed 17/05/17
	Tunnel Extension	1 day	Wed 17/05/17	Wed 17/05/17
	Klystron Layouts	3 days	Thu 18/05/17	Mon 22/05/17
	11km Single Tunnel	1 day	Thu 18/05/17	Thu 18/05/17
	11km Double Tunnel	1 day	Fri 19/05/17	Fri 19/05/17
	Cross section of Klystron single and double tunnel	1 day	Mon 22/05/17	Mon 22/05/17
	Detail 01 (plan and Cross-Sections)	2 days	Tue 23/05/17	Wed 24/05/17
	Detail plan of beam dump, turnaround, shaft and main	0.5 days	Tue 23/05/17	Tue 23/05/17



Drive Beam Tunnel



- 5.6m Internal Diameter
- Turnaround with 10m turning radius to exit and enter main tunnel.
- Beam dump cavern required at each turnaround.

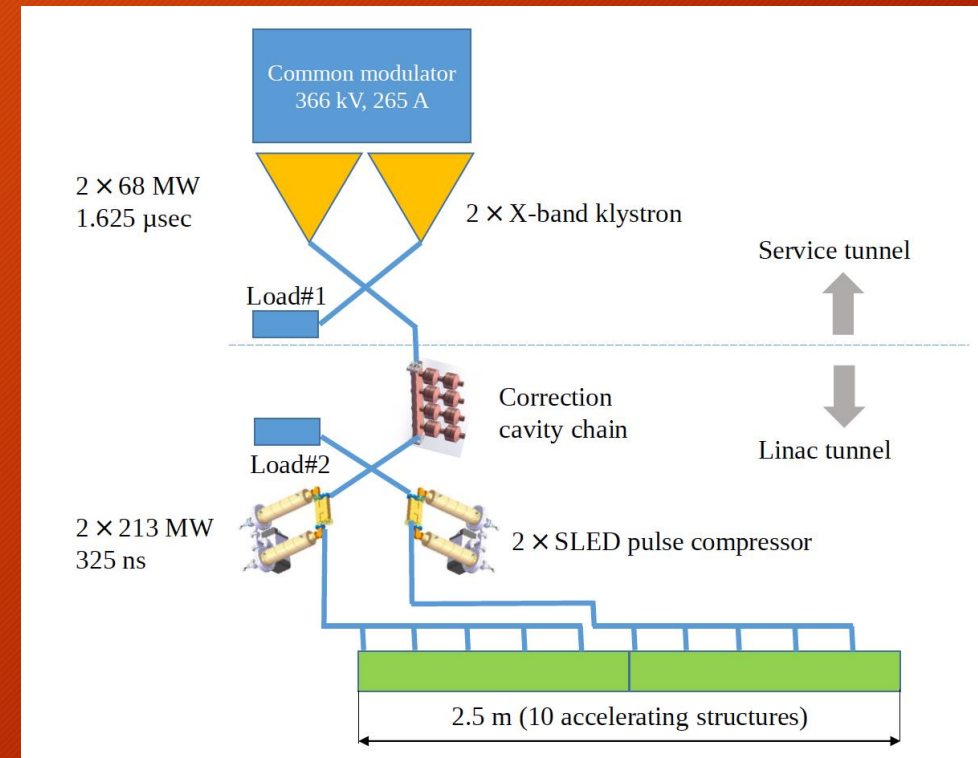


CLIC - Typical Cross Section - Diameter 5600mm - Junction with Turnaround - 1:25
Draft - J.Osborne / A.Kosmicki - August 9th 2010

Low energy Klystron



- The ideal scenario would be to have the same tunnel design for the drive beam and for the klystron accelerator.
- The first energy stage design should be consistent with the previously proposed drive beam design allowing consideration for an upgrade
- Ensure that it is compatible with an energy upgrade if it is decided that energy upgrades will be powered by klystrons.

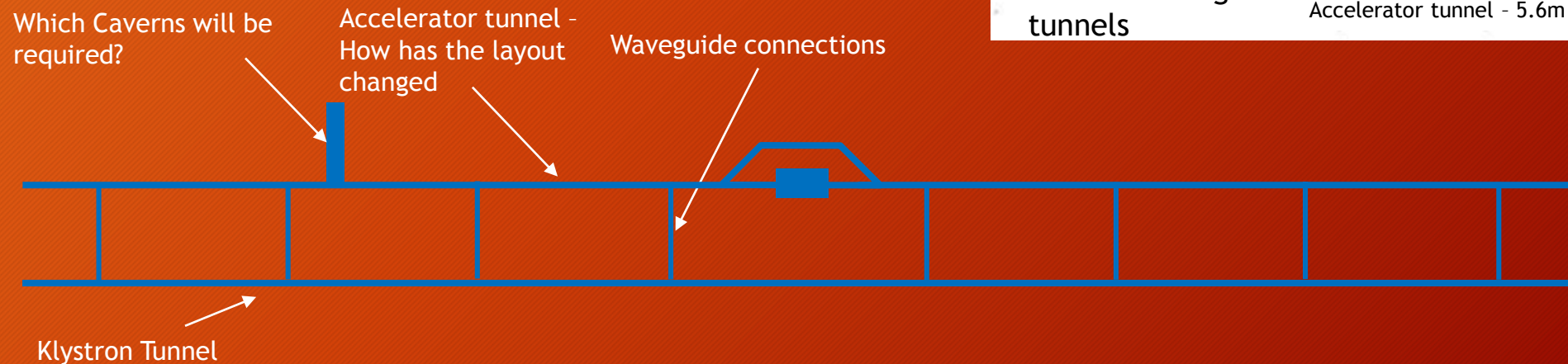
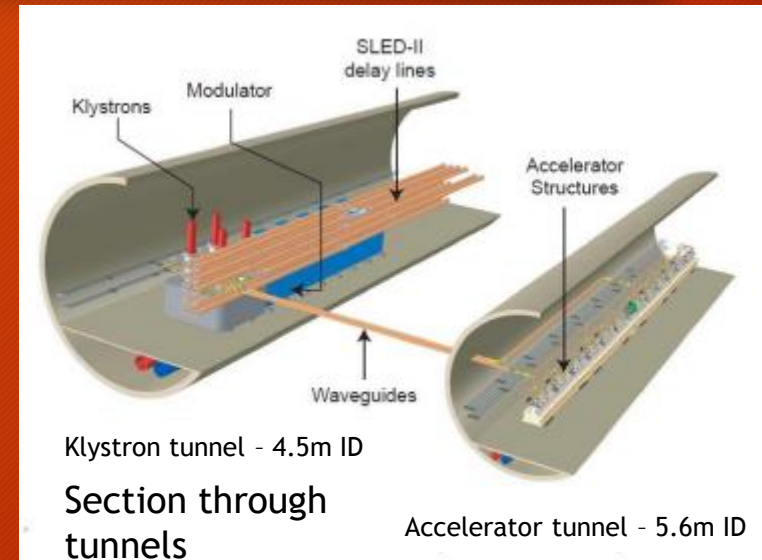


Low energy Klystron



Klystron Layout

- Double tunnel - one for the accelerator and one for the klystrons.
- Accelerator tunnel - How does this change?
- Are the connections between the tunnels compatible with the current design?
- ID of the accelerator to be 5.6m not 3m

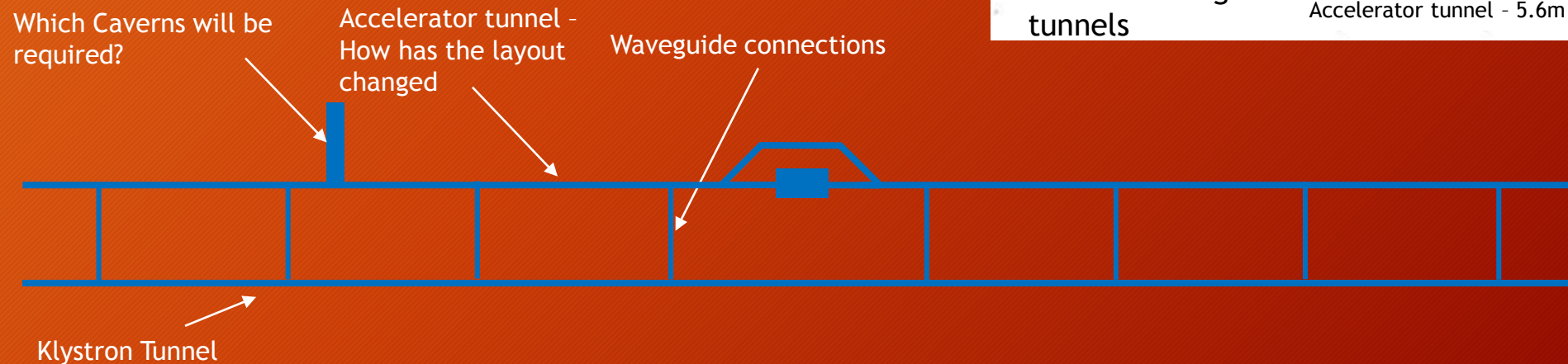
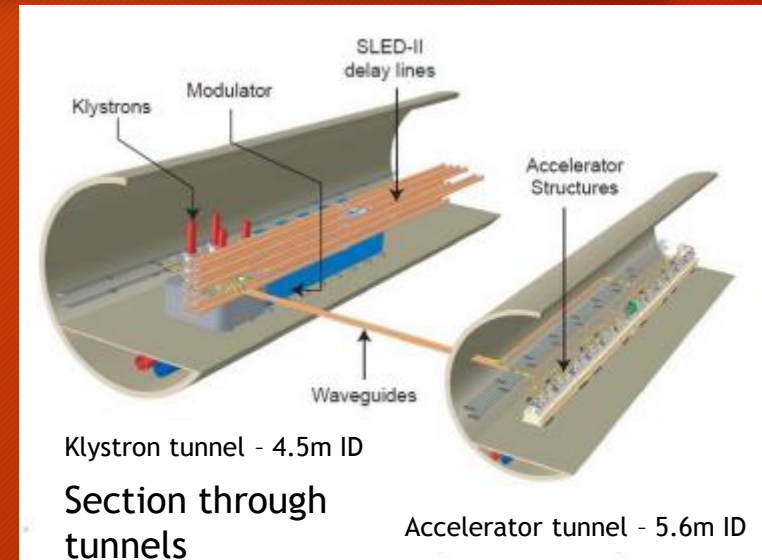


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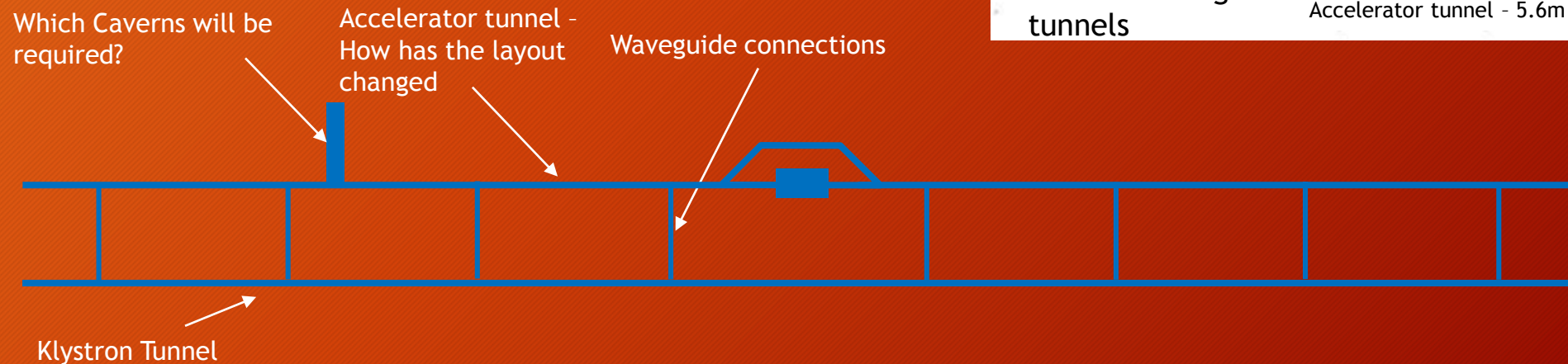
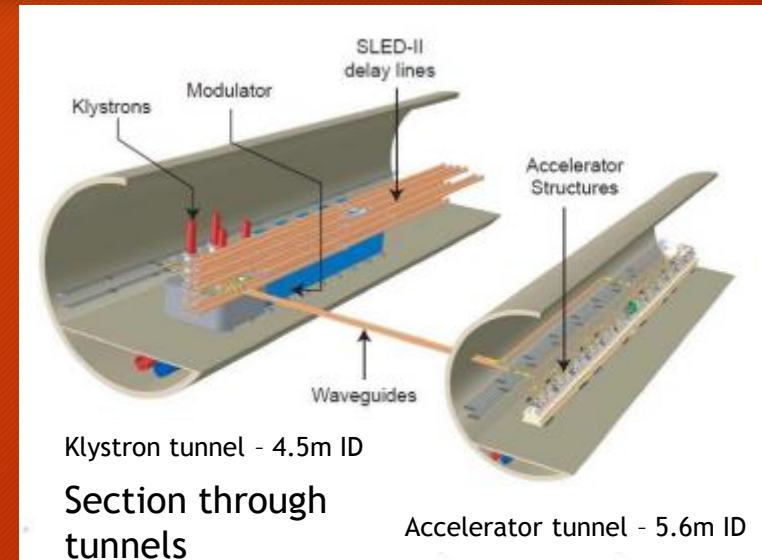


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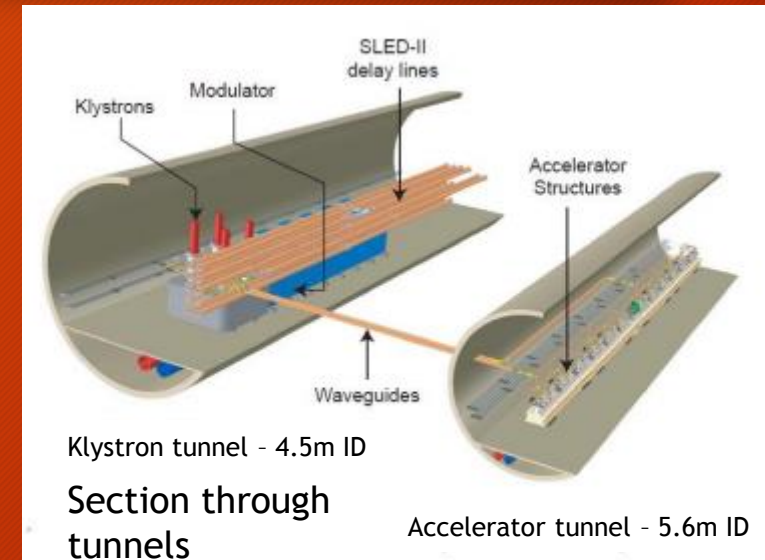


Low energy Klystron



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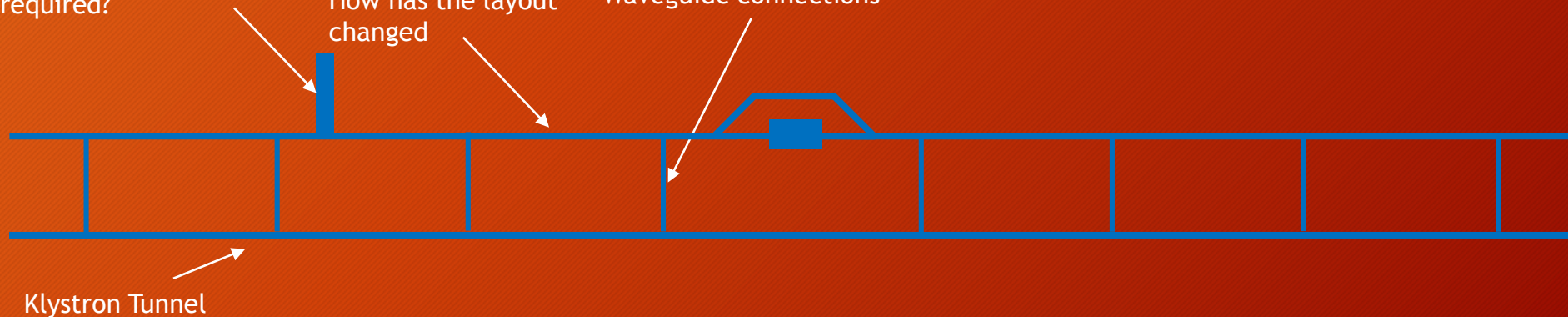
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Which Caverns will be required?

Accelerator tunnel - How has the layout changed

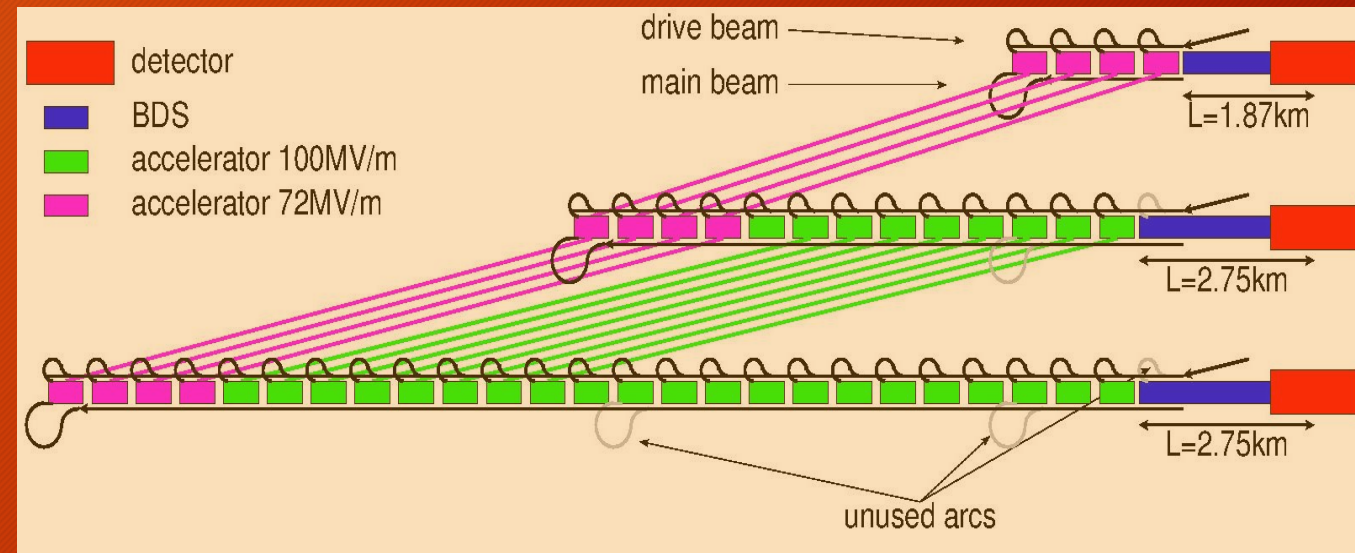
Waveguide connections



Summary



- 3 different energy stages: 10km, 27km and 48km
- 380 GeV Klystron design compatible with upgrades. Double tunnel or single tunnel required.
- Tunnel Optimisation Tool kick off meeting to be held on the 22nd of May
- Civil Drawings are to be produced by Civil Draughtsmen - new drawings to be produced for the Klystron design and existing drive beam design drawings to be changed.
- Next meeting on the 16th of June.



Thank You For Your Attention

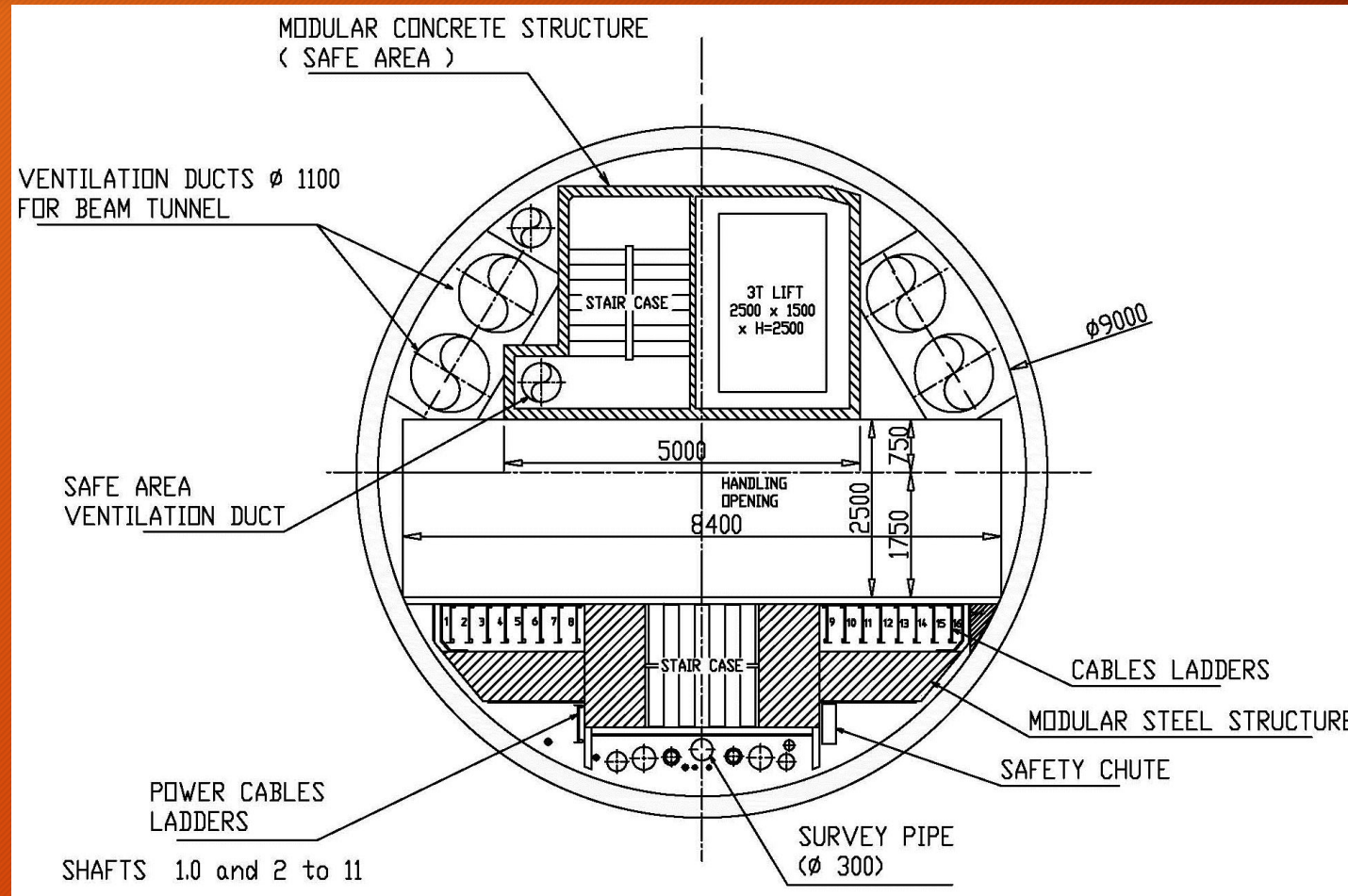


Thank you to all contributors
(John Osborne, Daniel Schulte, Steinar Stapnes etc..)

Extra Slides



Shaft Layout



Original CLIC



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