



Proposed extension to ML tunnel (CR-0004)

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ILC@DESY project meeting

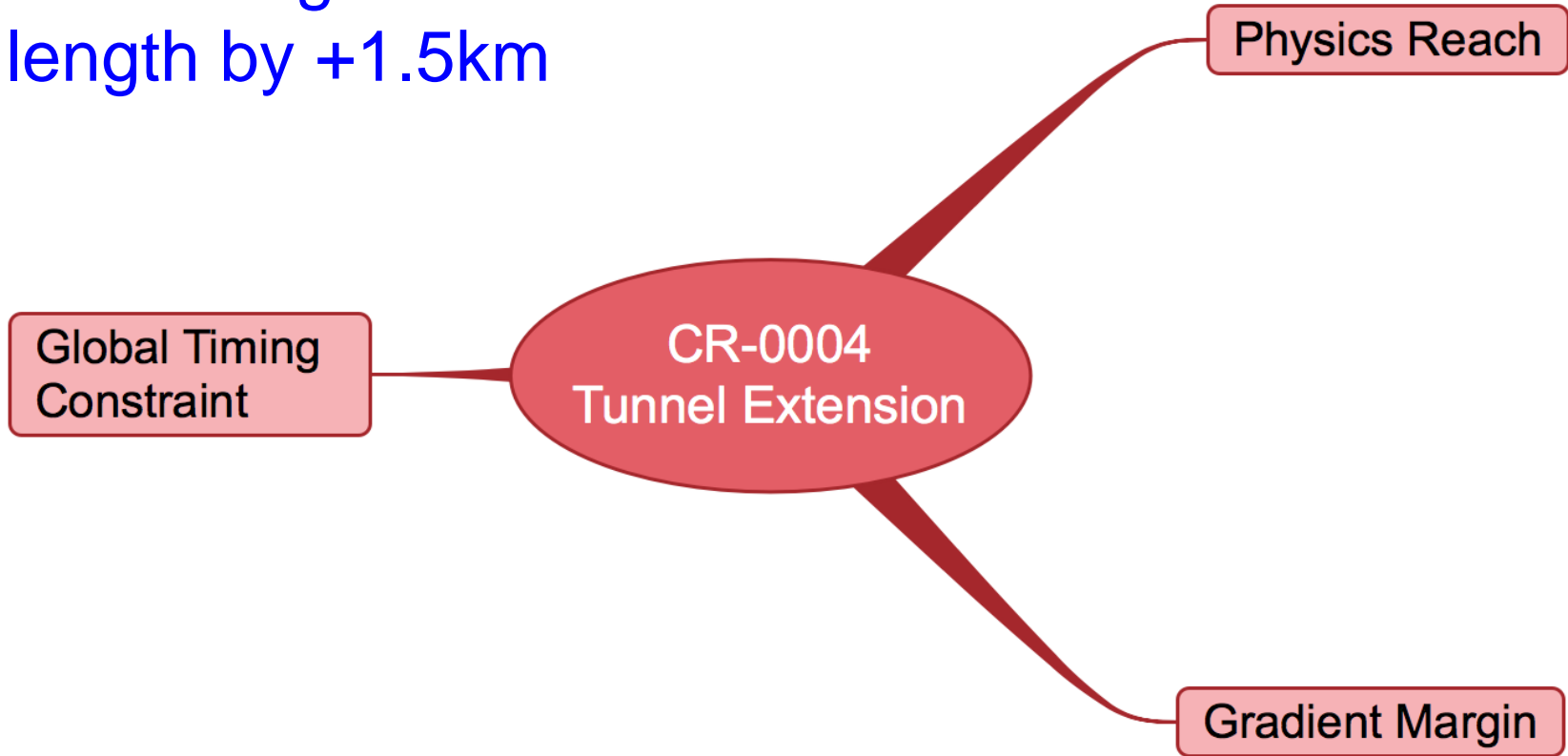
23.01.2015

A horizontal dotted line in a light yellow-green color is located at the bottom of the slide, mirroring the one at the top.



CR-0004 - Rationale

Increasing Main Linac tunnel length by +1.5km





CR-0004 - Rationale

Increasing Main Linac tunnel length by +1.5km

Fixes path length error

Global Timing Constraint

But other ways to do this

CR-0004
Tunnel Extension

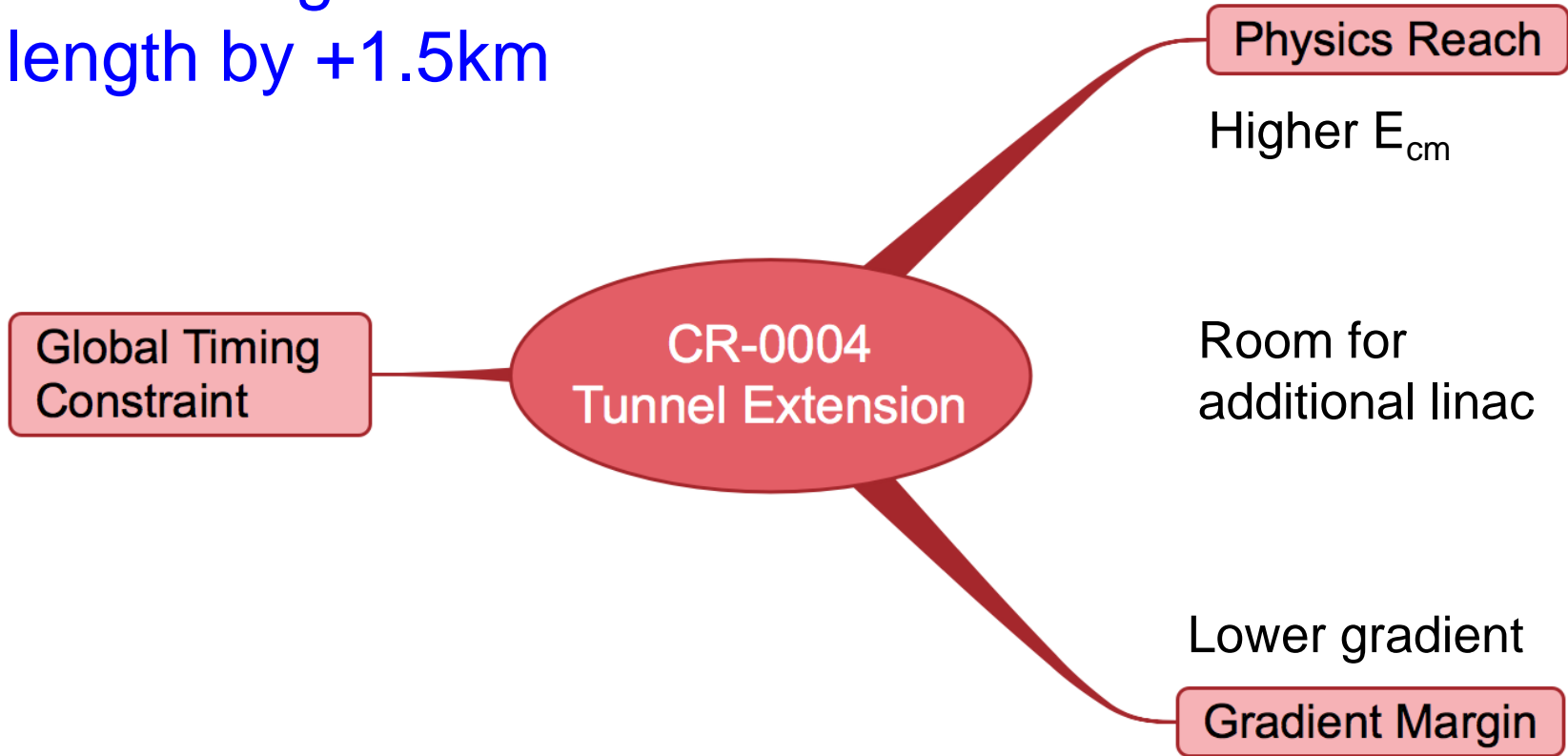
Physics Reach

Gradient Margin



CR-0004 - Rationale

Increasing Main Linac tunnel length by +1.5km



Physics Reach

Higher E_{cm}

Room for additional linac

Lower gradient

Gradient Margin

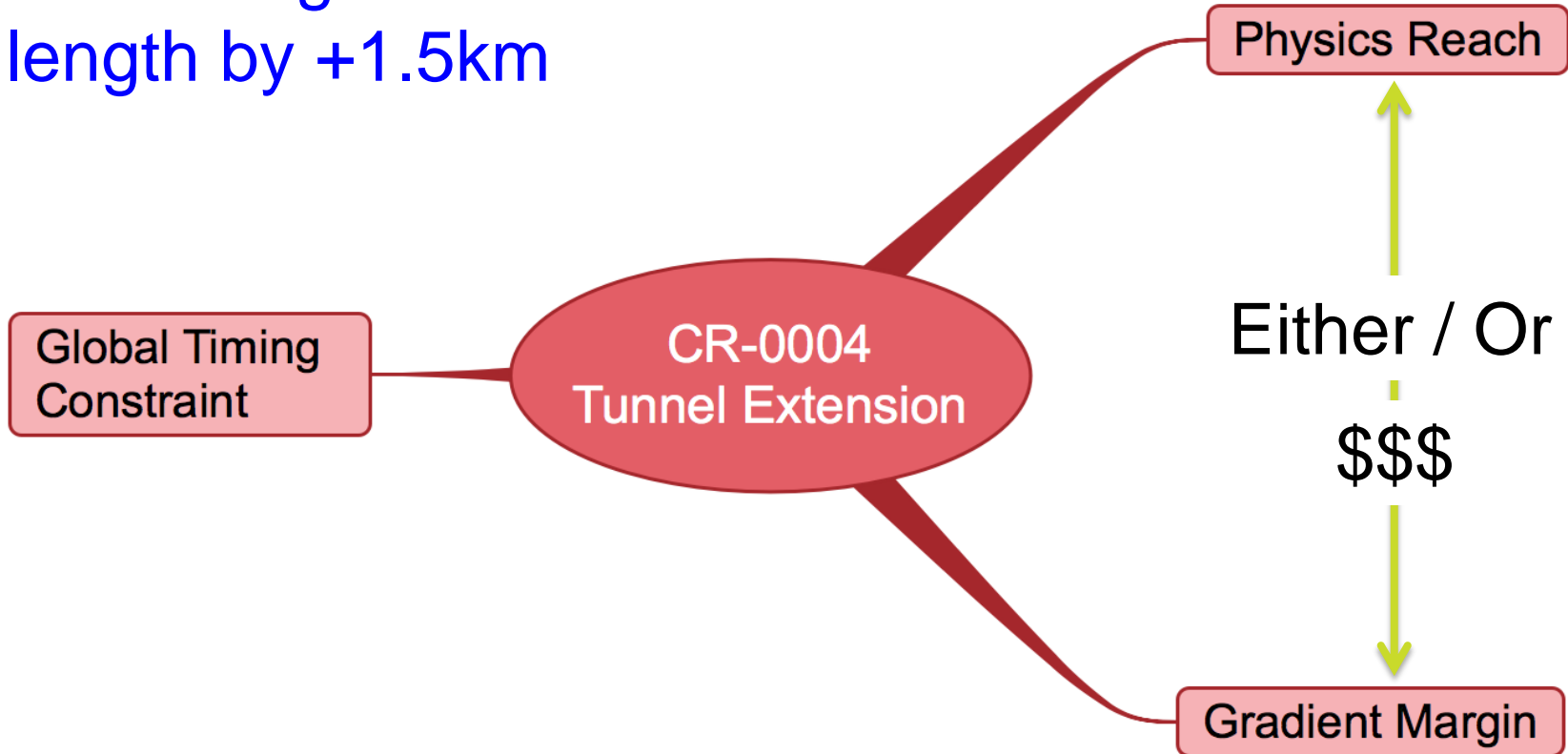
Global Timing Constraint

CR-0004
Tunnel Extension



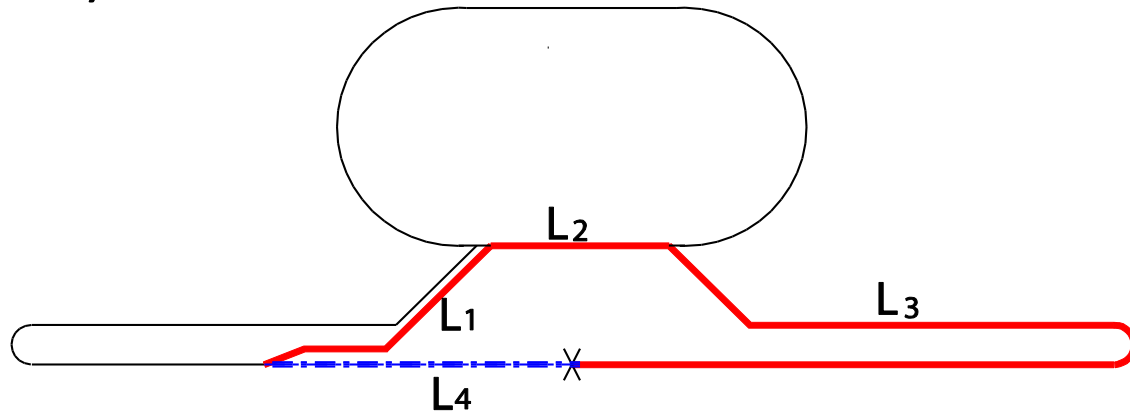
CR-0004 - Rationale

Increasing Main Linac tunnel length by +1.5km



Timing Issue

- $(L_1 + L_2 + L_3) - L_4 = n \times C_{DR}$



- TDR values give
 $(L_1 + L_2 + L_3) - L_4 = 9 \times C_{DR} + 294\text{m}$
- It is possible to adjust the value either by
 - Shortening the BDS by $\sim 150\text{m}$or by
 - Expanding the DR circumference by $\sim 30\text{m}$
- This will nearly keep the TDR layout
- But no margin for 500GeV, no way to reach 550GeV



Global Numbers (Round Trip)

B. List: Global timing

Section	Length		
PLTR	355.753		
DR injection to z=0	112.6		
- BDS: branch-off to IP	-427.751		
Total delay up to z=0	40.6		
DR z=0 to extraction	107.5		
E+ RTML, total	16003.136		
E+ Main Linac (incl. MPSCOL), KCS	11026.866		
E+ BDS	2253.532		
Sum	29431.6		
DR Circumference	3238.681		
9*DR	29148.1	10*DR	32387
Mismatch	-283.5		+2955
ML change:	-141.7 m		+1478m

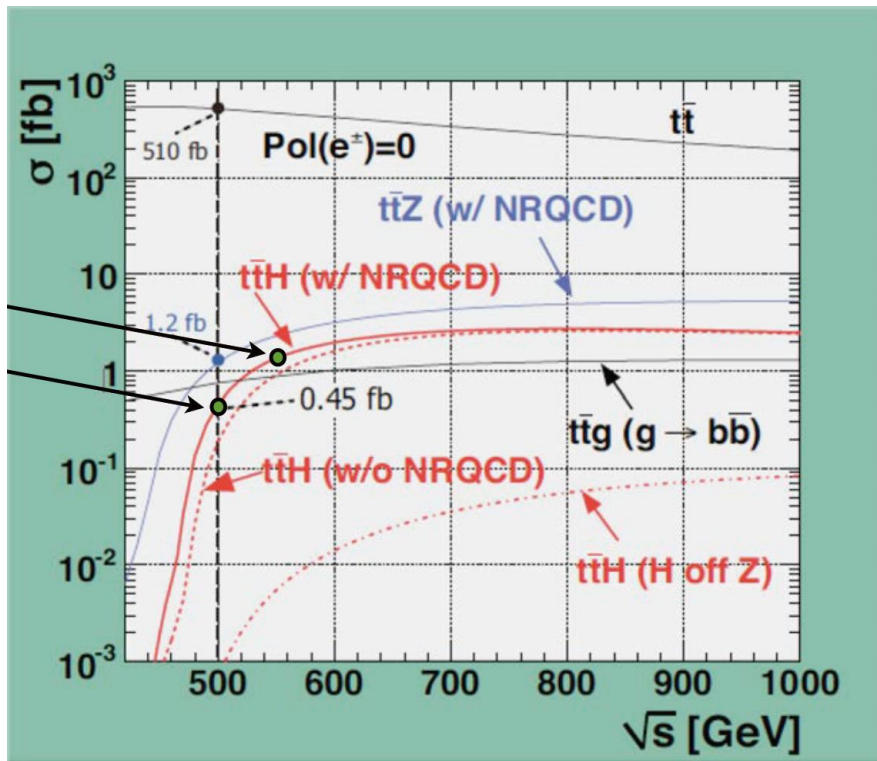


Gradient Margin

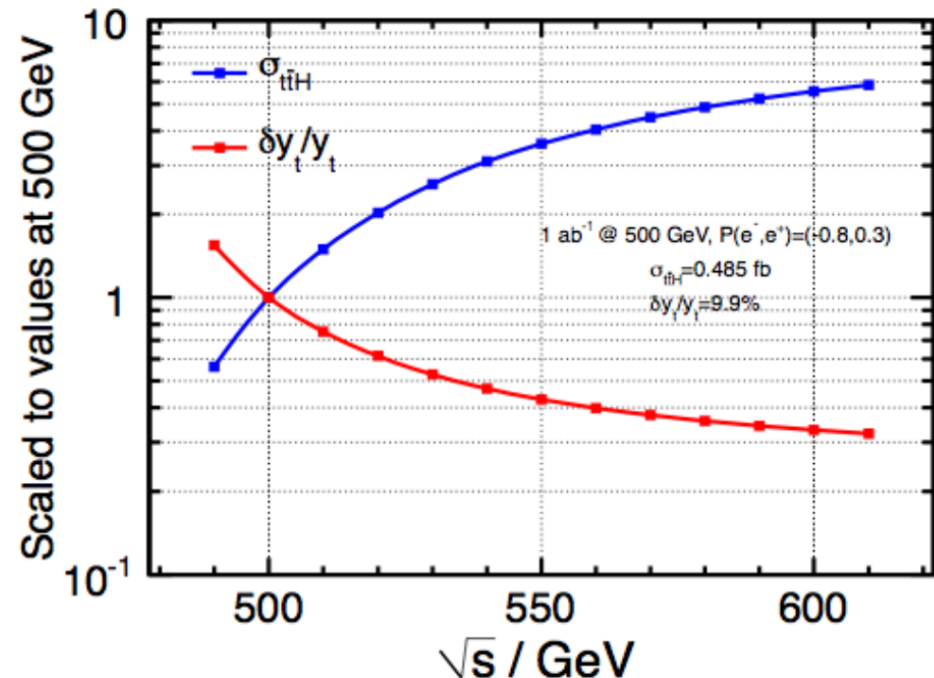
- Room for an additional 12 cryostrings
 - **9x12 cryomodules @ 31.5 MV/m ~ 30.6 GeV**
- TDR layout $E_{\text{beam,max}} = 254 \text{ GeV} \rightarrow 284 \text{ GeV}$
- $E_{\text{cm}} = 568 \text{ GeV}$ (13.6% additional overhead)
- Would allow $\langle G \rangle = 27.8 \text{ MV/m}$ to achieve $E_{\text{cm}} = 568 \text{ GeV}$
- Current XFEL average: 27 MV/m
 - **Impact of WG distribution and controls overhead not included**

Physics Issue

- TDR Design : Maximum energy $E_{CM}=500\text{GeV}$
 - ✓ Decided before the discovery of Higgs at $\sim 125\text{GeV}$
- 500GeV is close to the threshold of $e^+ e^- \rightarrow t \bar{t} H$ at $E_{CM}=475\text{GeV}$
- $E_{CM} \sim 550\text{GeV}$ is preferable for measuring top-Yukawa coupling
 - The crosssection at 550GeV is factor ~ 4 larger than at 500GeV



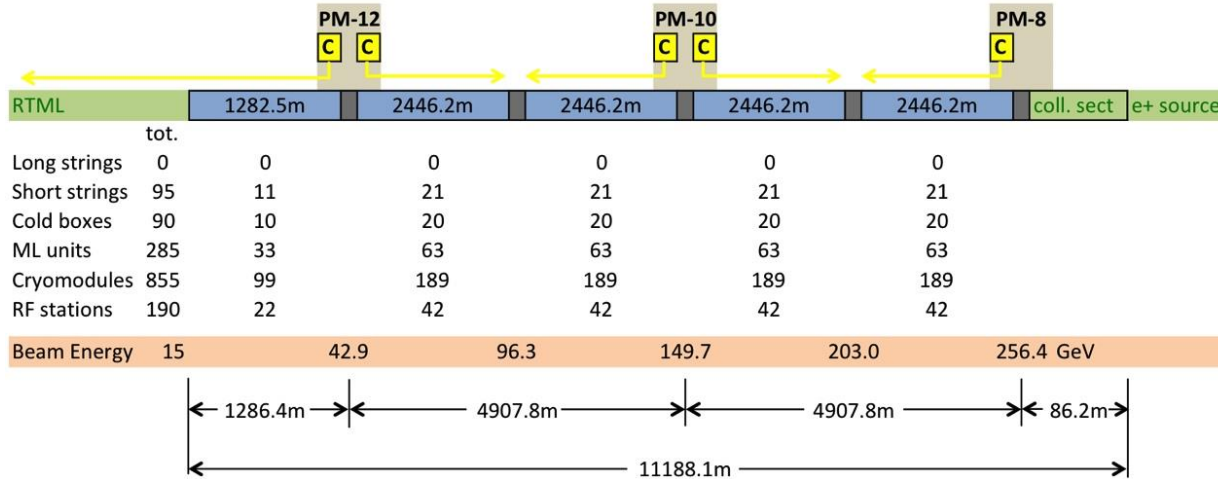
2014/12/4 ADI-CFS Yokoya



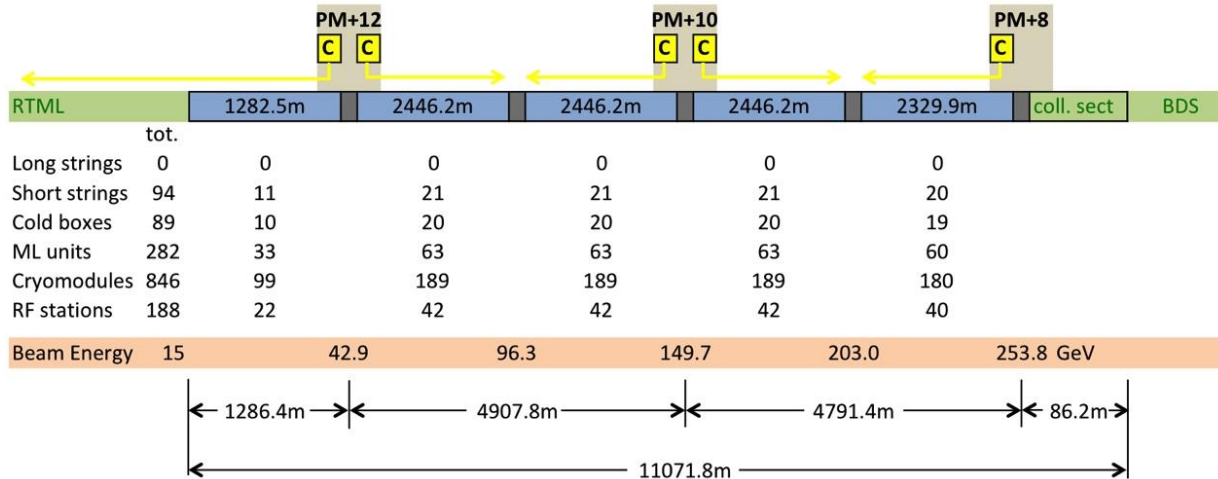
Parameter Group report (Oct.2014)

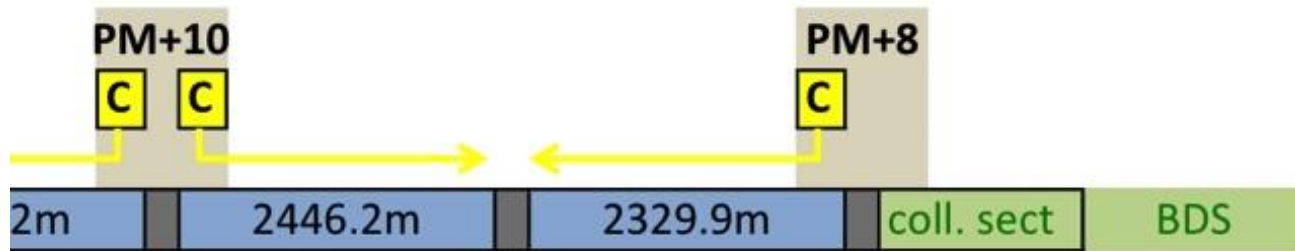


Electron Linac

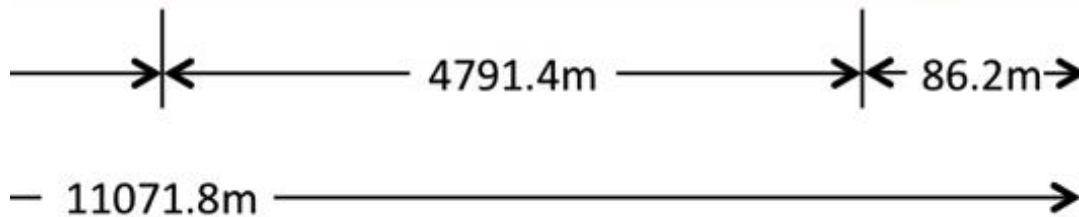


Positron Linac

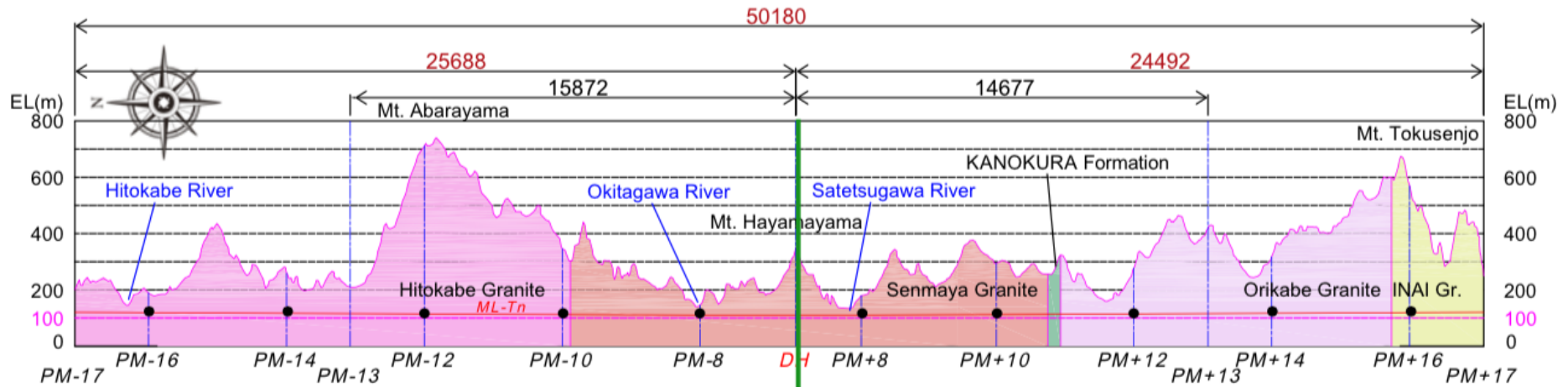




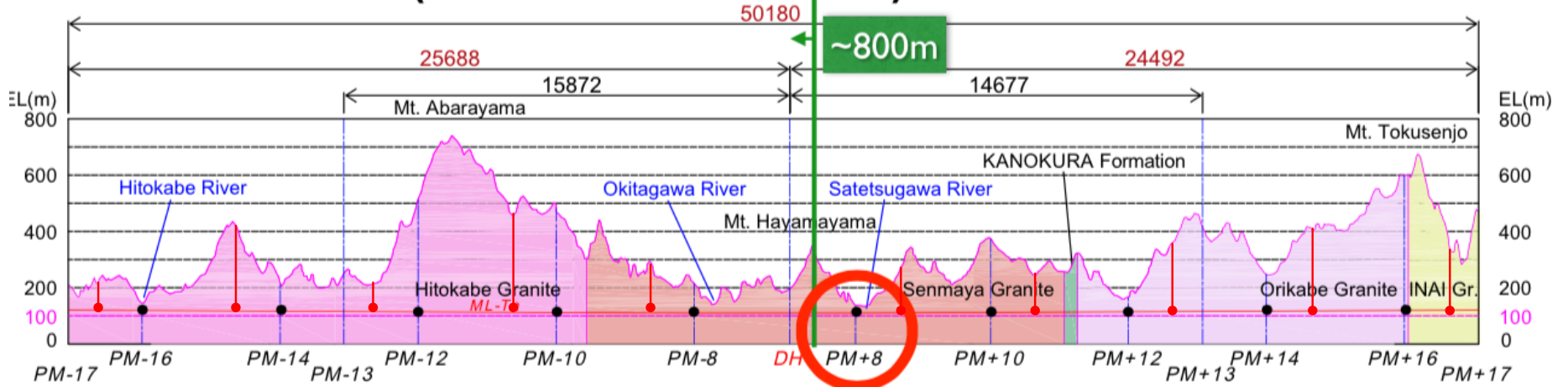
	0	0
	21	20
	20	19
	63	60
)	189	180
	42	40



TDR (Horizontal Access)



Vertical Access (shift ML to the North)



In Summary

- CR-004 has formally been submitted to CMB
- Proposes ~1.5km extension to both Main Linac tunnels
 - **simple warm beam transfer line**
- Rationale:
 - **Corrects global timing path length for $10 \times C_{DR}$**
 - **Allows room for extension to main linacs (up to 14%)**
 - **Facilitates margin for reduced gradient or**
 - **Higher E_{cm} capability**

→ *Guarantee min 500 GeV performance*

- CMB to form Change Review Panel
 - **meeting today**
- Request to “attempt cost neutrality”
 - **Estimated cost increase ~100 kILCU**
 - **Impact on horizontal tunnel accesses to be accessed**
- Attempt to conclude by April LC meeting (KEK)
 - **Milestone for fixing tunnel length and CFS layout.**