



# COMMISSIONING AND INSTALLATION

S. Yamada (KEK)

# BASIC PLAN

## Test bench

- Readout test at test bench  
(Need to ask each sub-detector group to prepare )

## E-hut

- Fiber/patch panel installation

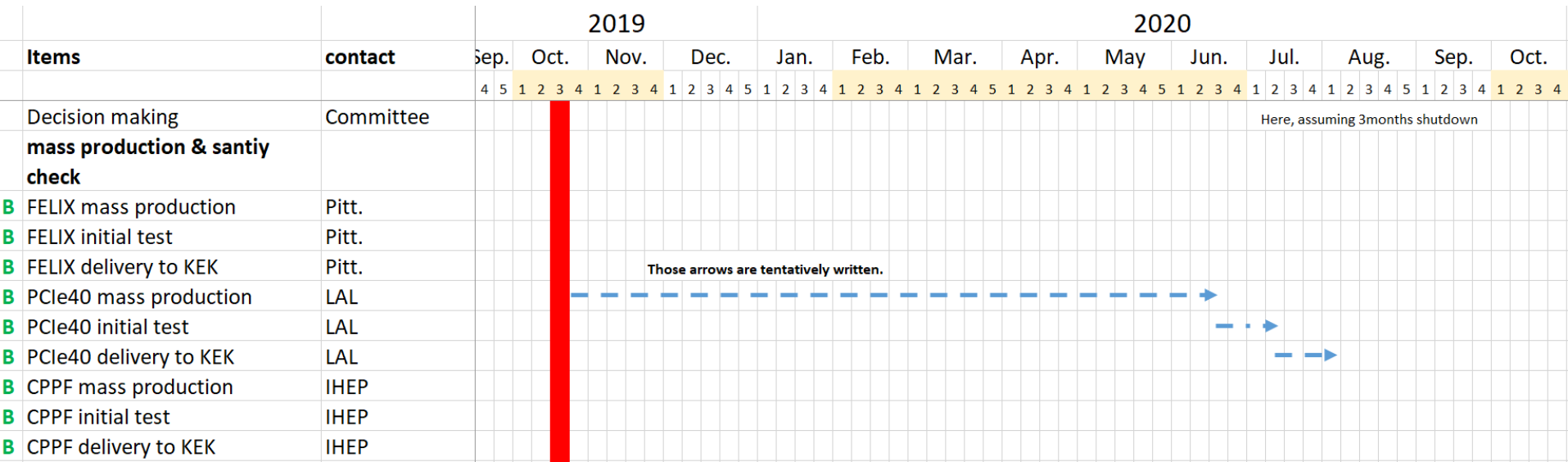
Delivery of new readout hardware

- Installation of ROPCs and new readout system

### SuperKEKB shutdown

- Connection between FEE and new RO
- Full-scale commissionng

# Mass production schedule (input from proponent)



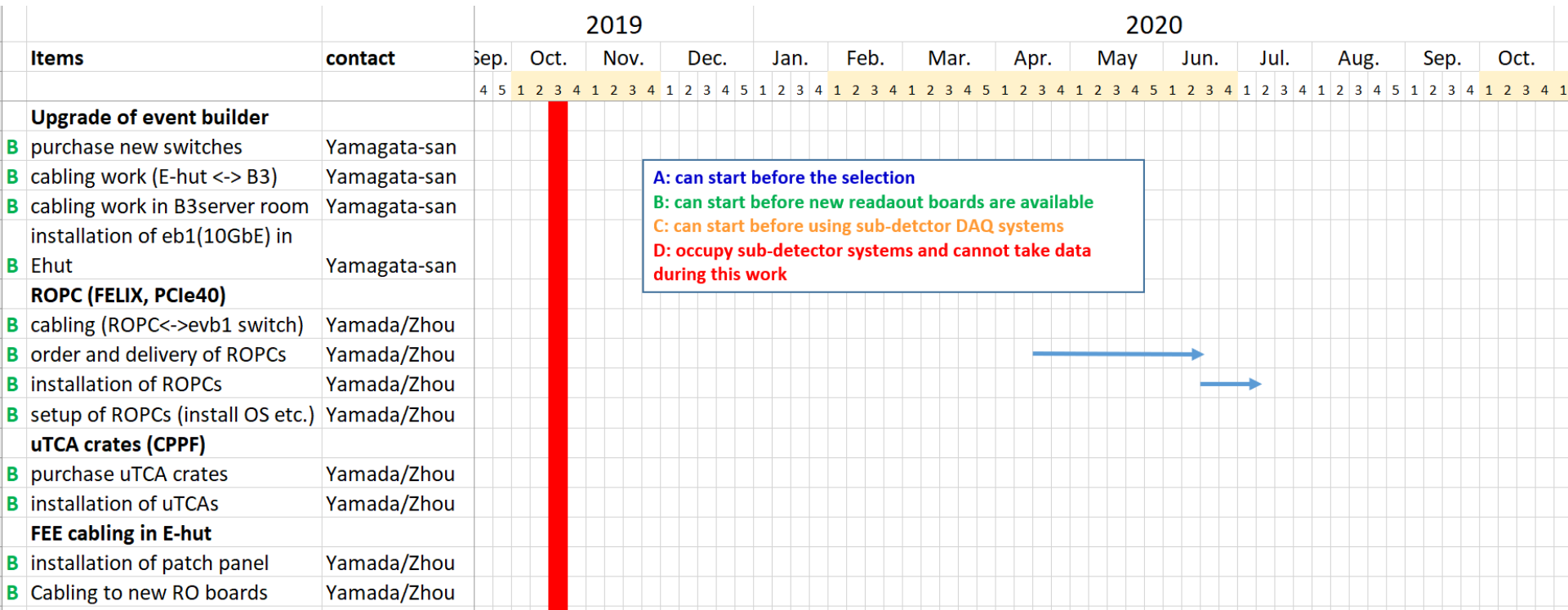
**A: can start before the selection**

**B: can start before new readaout boards are available**

**C: can start before using sub-detctor DAQ systems**

**D: occupy sub-detector systems and cannot take data during this work**

# Event-builder1, readout PCs etc. (Input from Yamagata-san and SY)



A: can start before the selection

B: can start before new readaout boards are available

C: can start before using sub-detctor DAQ systems

D: occupy sub-detector systems and cannot take data during this work

# Tasks during shutdown period(Input from Nakao-san etc. )

Shutdown period might be incorrect

		2019																2020															
Items	contact	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.																		
		4 5 1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4 5	1 2 3 4	1 2 3 4 1	2 3 4 5	1 2 3 4	1 2 3 4 5	1 2 3 4	1 2 3 4 5	1 2 3 4	1 2 3 4 5	1 2 3 4	1 2 3 4 5	1 2 3 4	1 2 3 4 5	1 2 3 4	1 2 3 4 5	1 2 3 4	1 2 3 4 5	1 2 3 4	1 2 3 4 5	1 2 3 4	1 2 3 4 5							
FTSW																																	
install COPPER FTSWs in a VME																																	
D rack near new new boards	Nakao-san																																
D cabling between FTSWs	Nakao-san																																
D Modifying ttaddr program	Nakao-san																																
Commissioning																																	
Reconnection of fibers(SVD,CDC,TOP,ARI,ECL, KLM, TRG)	Yamada/Zhou-san																																
D comissioning with full-SVD	Yamada/Zhou-san/proponent																																
D comissioning with full-CDC	Yamada/Zhou-san/proponent																																
D comissioning with full-TOP	Yamada/Zhou-san/proponent																																
D comissioning with full-ARICH	Yamada/Zhou-san/proponent																																
D comissioning with full-ECL	Yamada/Zhou-san/proponent																																
D comissioning with full-KLM	Yamada/Zhou-san/proponent																																
D comissioning with full-TRG	Yamada/Zhou-san/proponent																																

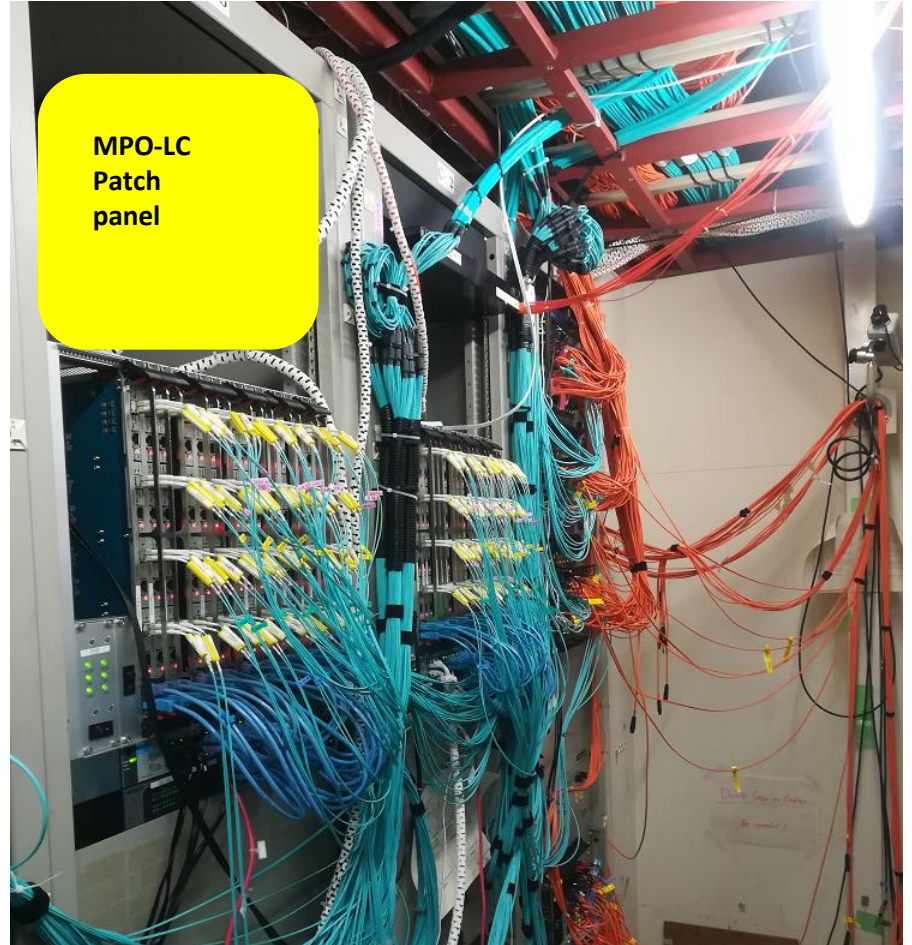
## SVD

MPO-LC  
Patch  
panel



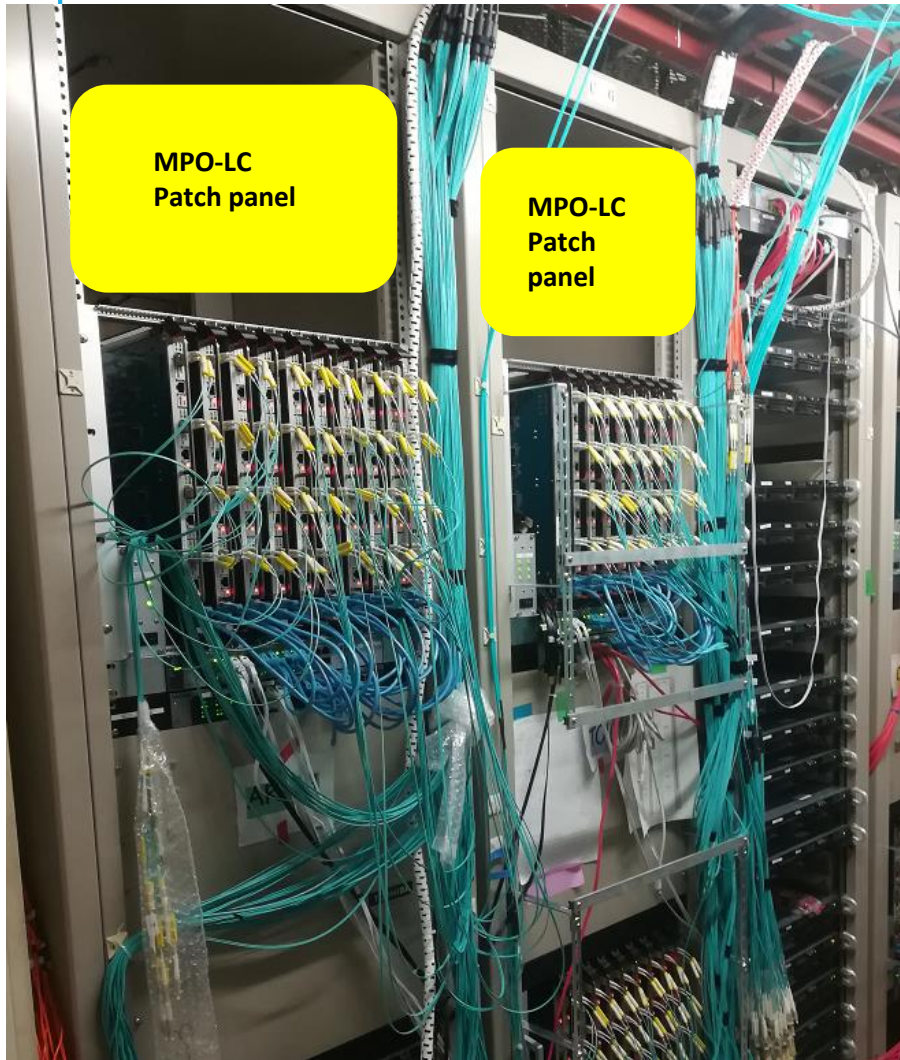
## CDC

MPO-LC  
Patch  
panel





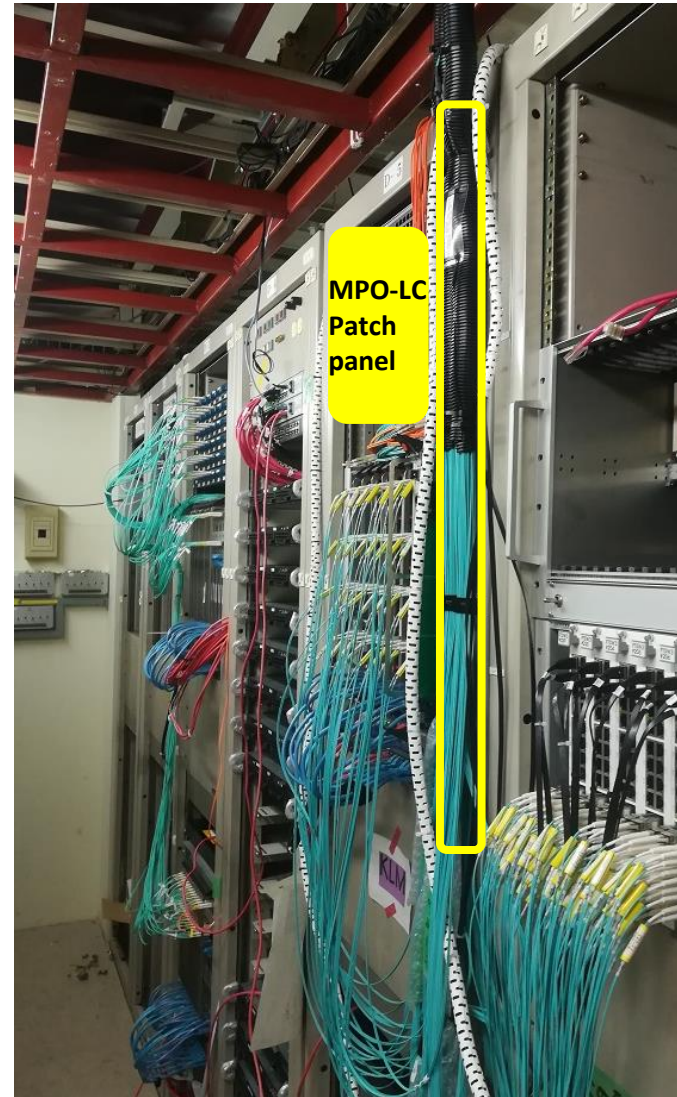
# TOP, ARICH



## ECL

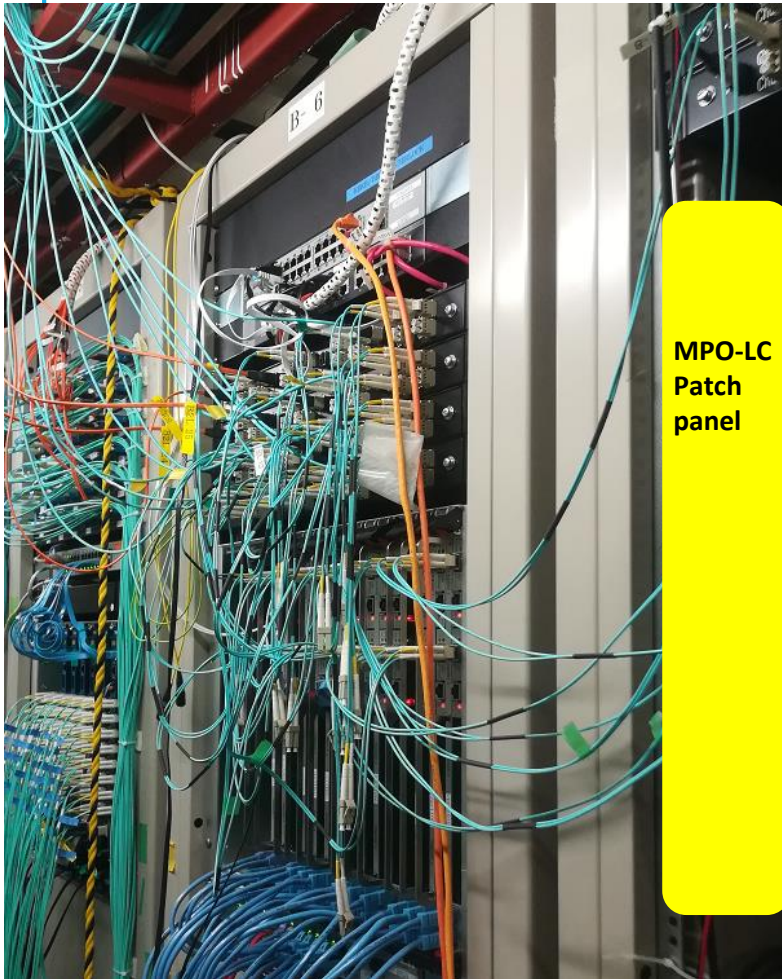


## KLM





## TRG



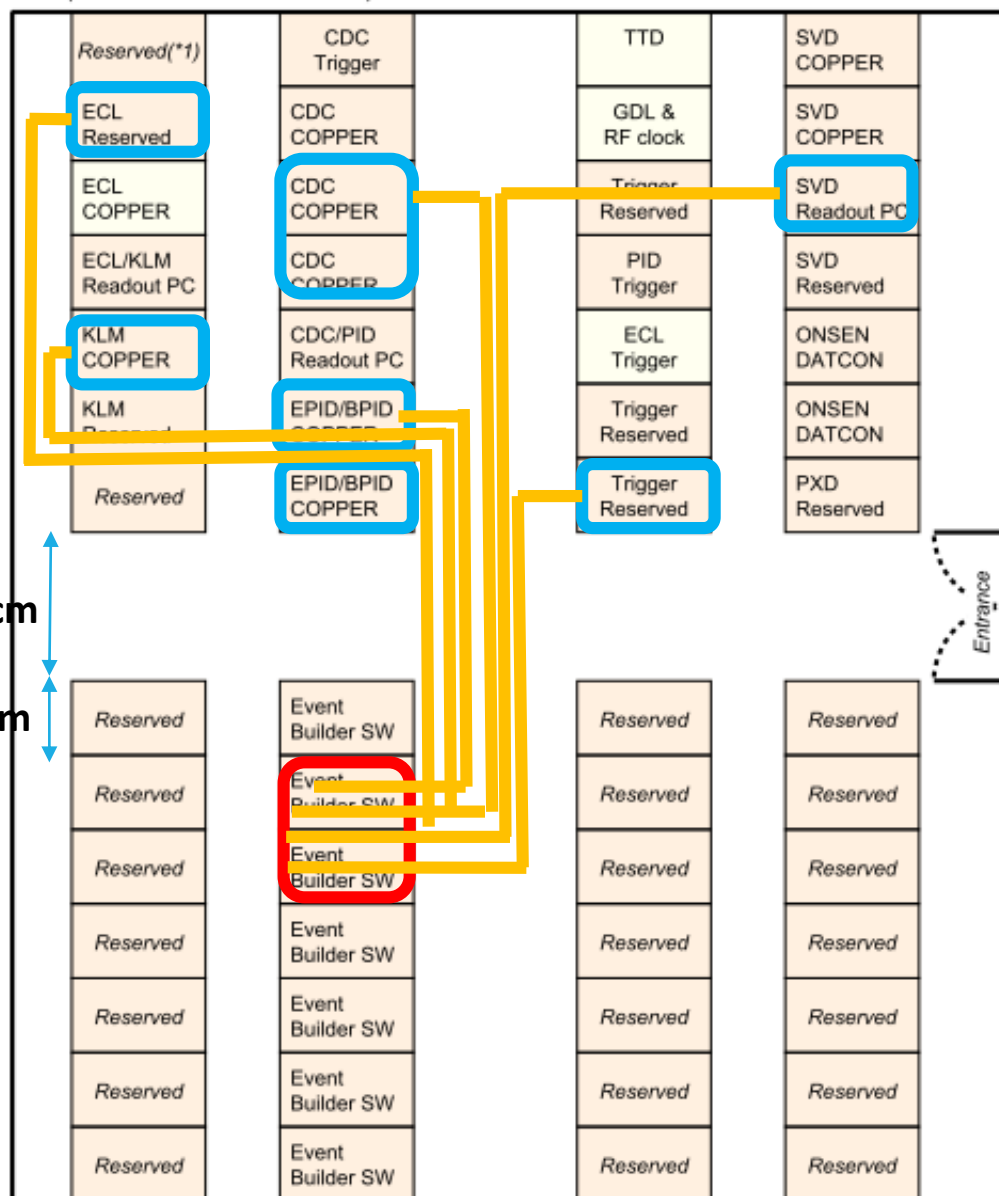
## ROPC



130cm      235cm (82.5+70+82.5)

2014.2.8 version (Kuzmin/Iwasaki/Itoh/Nakao)

1F (all racks reserved for TRG/DAQ)



	N-S [m]	E-W [m]	vertical [m]	total [m]	Round off [m]	+2m [m]
SVD	6.8	4.47	3	14.27	14	16
CDC	6.8	2.12	3	11.92	12	14
TOP	4.85	2.12	3	9.97	10	12
ARICH	4.2	2.12	3	9.32	9	11
ECL	7.45	4.47	3	14.92	15	17
KLM	5.5	4.47	3	12.97	13	15
TRG	4.2	2.12	3	9.32	9	11

# MoU: Replacement timescale

- This schedule doesn't reflect long summer shut-down in 2020 (TOP MCP-PMT replacement, other work)**

Year	2018	2018	2018-2020	2020	2020	2021	2021	2022	2022	2023
Month	Jul.16	Oct.31	Apr/18 Mar/20	Apr.	July-Sep.	Jan.	July-Sep.	Jan.	July-Sep.	Jan.
	Proposal deadline	Decision								
Proto typing										
Mass Production										
COPPER-replacement										
Comment										

The diagram includes several annotations on the timeline:

- A pink arrow points from the 'Decision' cell (2018 Oct.31) to the 'Proto typing' row.
- A blue double-headed arrow is in the 'Proto typing' row, spanning from the 'Apr/18 Mar/20' cell to the 'Apr.' cell.
- A green dashed box with red border contains the text: "Could be shortened depending on budgetary situation and integration results". It is positioned over the 'July-Sep.' cells for 2020 and 2021.
- A large red double-headed arrow spans from the 'Apr.' cell (2020) to the 'Jan.' cell (2022) in the 'Mass Production' row.
- In the 'COPPER-replacement' row, blue double-headed arrows labeled 'repl. 1', 'repl. 2', and 'repl. 3' are placed over the 'July-Sep.' periods of 2020, 2021, and 2022 respectively. Red double-headed arrows labeled 'spare' are placed over the 'Jan.' periods of 2020, 2021, and 2022.
- A yellow box in the 'Comment' row contains the text:
  - COPPERs are replaced detector by detector during summer shutdown period in 2020, 2021, and 2022.
  - Short winter shutdown might be utilized for additional work.

- Implies requirement for concurrent operation**

# SCHEDULE (MOU RELATED)

- It seems that 3months shutdown is not enough for full replacement
  - readout test at test bench for all-subdetector might be also difficult, if delivery of new hardware will be near the summer shutdown in FY2020.
  - So, support for installation/commission length will be extended to JFY2021.
  - But, anyway some sub-systems should be replaced in FY2020 (which subsystem ? TOP+SVD+CDC ? )
    - Co-exists with the current COPPER system
    - Then, In my idea, the longer shutdown can be used for the replacement of the rest of sub-detectors.



# # OF NEW READOUT BOARDS

In requirements document,  
<https://confluence.desy.de/display/BI/Requirements+Document+for+DAQ+upgrade>

unit (kBytes/event)	BBbar generator for SVD,CDC, TOP, bKLM estimation	BHwide generator (example of low multiplicity event) for SVD,CDC, TOP, bKLM estimation	# of links	
SVD	20.4	19.4	48	
CDC	22.4	17.3	299	
TOP	8.6	5.5	64	
ARICH	14.5	14.5	72	
ECL	27.7	27.7	52	
bKLM	4.5	4.3	16	
eKLM	0.8	0.8	16	
TRG	N.A.	N.A.	22	
total	98.9	89.5	589	

(Note: those estimation is event size after processing data on readout PC by adding header and trailer)

In Katsuro-san's talk at this workshop

Expected SVD data size				
	SVD data size [kB/event]	SVD data rate @ 15kHz [MB/s]	SVD data rate @ 30kHz [MB/s]	Limit on data rate [MB/s]
COPPER	max. ~ 2.3	max. ~ 35	max. ~ 70	~ 85
ROPC	max. ~ 11	max. ~ 170	max. ~ 350	~ 250
EB1	~ 84	~ 1200	~ 2500	~ 2500 (sum of all subsystems except PXD) Could be double with final HLT system
		HLT rate ~2.5kHz	HLT rate ~5.0kHz	
HLT/ Storage	~ 84	~ 210	~ 420	~ 1800(*) (sum of all subsystems)

- Evaluated data rates are assuming 3% layer-3 occupancy, which is at the SVD operation limit due to tracking performance.
- Operation at 15kHz trigger rate should be OK, while operation at 30kHz can require future reinforcement of ROPC
  - SVD data reduction with 3-sample instead of 6-sample
  - Increase the number of ROPCs or output network ports
  - COPPER upgrade project

(\*) limit due to data transfer to KEKCC

$$20.4\text{kB/ev} \times 30\text{kHz} = 612\text{MB/s}$$



Throughput @30kHz : 2500MB/s

# LIAISON WITH DAQ-UPGRADE PROJECT

- The impact of modification is minimize in sub-detector side.
  - use belle2link -> no update for FEE firmware
  - update of SLC software -> previous talk.
- But, as for commission, we need to work together with sub-detector DAQ experts.
  - Building a test bench ( KEK or home-institute ?)
  - How to configure FEEs

	Candidates	Test bench
SVD	Katsuro-san ?	Tsukuba B4
CDC	Nanae-san ?	Tsukuba B4
TOP	Oskar/Martin ?	Tsukuba B4, Hawaii
ARICH	Yun-tsung ?	KEK ? Kitasato ?
ECL	Mikhail ?	
KLM	New UH post-doc ?	Hawaii

FTSW preparation	Nakao-san/Kunigo-san?	
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# SUMMARY

- Commissioning for each sub-system will be done
  - first at test bench
  - large-scale test during SuperKEKB shutdown
- Schedule (My idea)
  - “1<sup>st</sup>” installation for some sub-systems
  - The rest will be installed in longer shutdown for PXD and TOP
  - Still we can see how the preparation goes to finalize the schedule but longer installation period needs to be noticed in MoU
- Work with sub-detector DAQ experts again
  - Assigning liaison
    - Test and commissioning will be the main work.