

TOF Hookup Scheme

Erik T. Everson

Last Update: 06 April, 2022

Created: 24 February, 2022

Summary: Overview

- ❑ Calculated lengths correspond to the MAX for each paddle.
- ❑ Actual number of cables needed is 4x each of the cable counts.
- ❑ Criteria for STD cables
 - $1.08 \leq \text{fractional margin} \leq 1.38$
 - $21.1 \text{ cm} \leq \text{length margin} \leq 57.6 \text{ cm}$

▪ Num. of STD Cables: 7

- **Note: Margin is enforced on MAX lengths so the shorter side could see significantly larger excess.**

- Readout and Trigger (RAT) box cable utilization:
 - 3 RATs use 3 STD cables
 - 14 RATs use 4 STD cables
 - 3 RATs use 5 STD cables

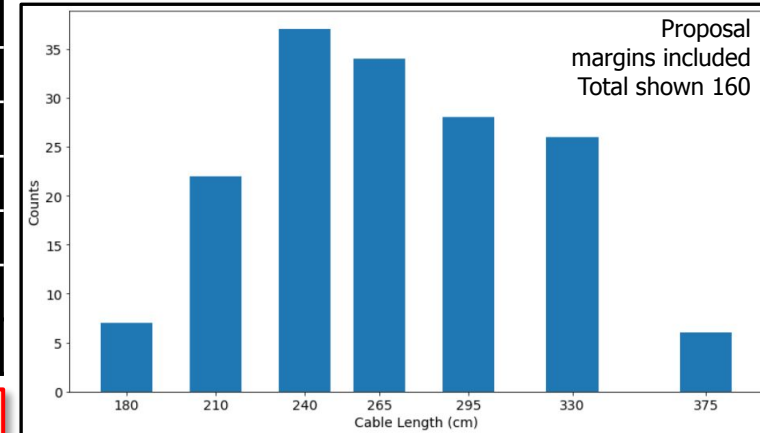
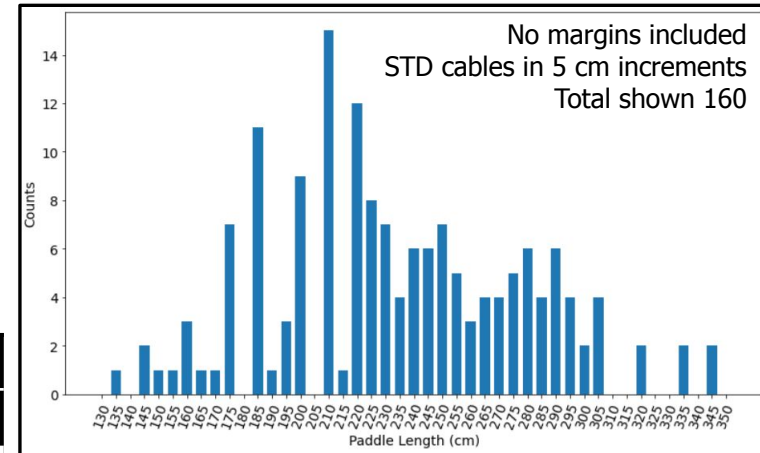
- Lengths:
 - Ave. = 267.88 cm
 - Extra over exact = 57 m

- Est. Connector Mass:
 - These are from GFP connectors and **NOT** flight versions purchased by the Italian group.
 - Amphenol RF 132235 (90deg) ~ 9.1 g
 - Ventev/TerraWave CON-18-200 ~ 4.53 g

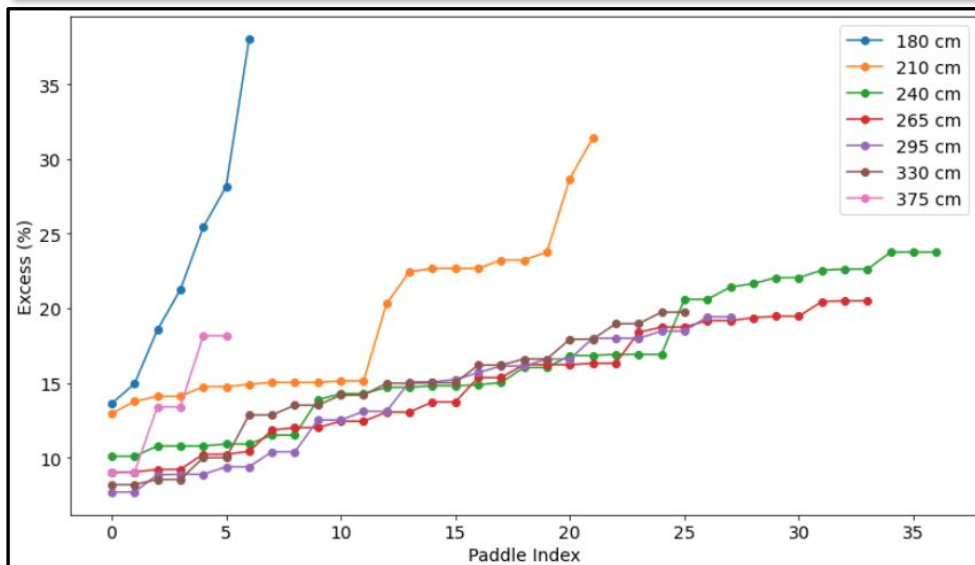
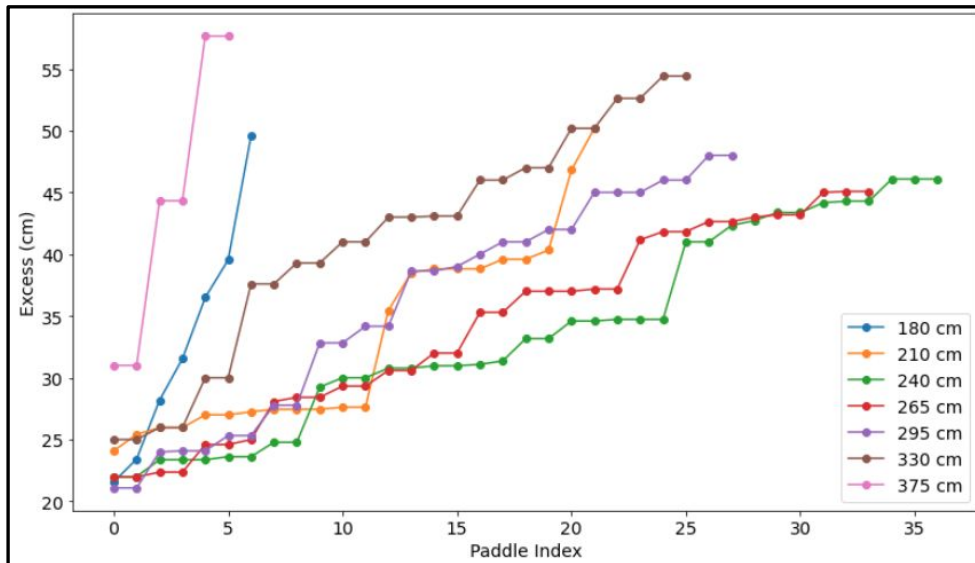
Lengths (cm)	QTY		
	Exact	Spares	TOTAL
180	28	3	31
210	88	9	97
240	148	15	163
265	136	14	150
295	112	12	124
330	104	11	115
375	24	3	27
	640	67	707

Mass:

- Est. connector = 8.7 kg
- Est. cable = 34 kg (w/ margin)
- **Est. Total = 42.7 kg**
- Budget = 48 kg



Summary: Margins



Lengths (cm)	MARGIN MIN		MARGIN MAX	
	cm	%	cm	%
180	21.6	13.6	49.6	38.0
210	24.1	12.0	50.2	31.4
240	22.0	10.1	46.1	23.8
265	22.0	9.0	45.1	20.5
295	21.1	7.7	48.0	19.4
330	25.0	8.2	54.4	19.7
375	31.0	9.0	57.6	18.2

Calculations performed with 'Cabling_histogram.ipynb'

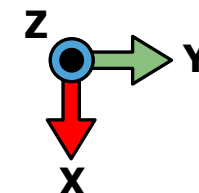
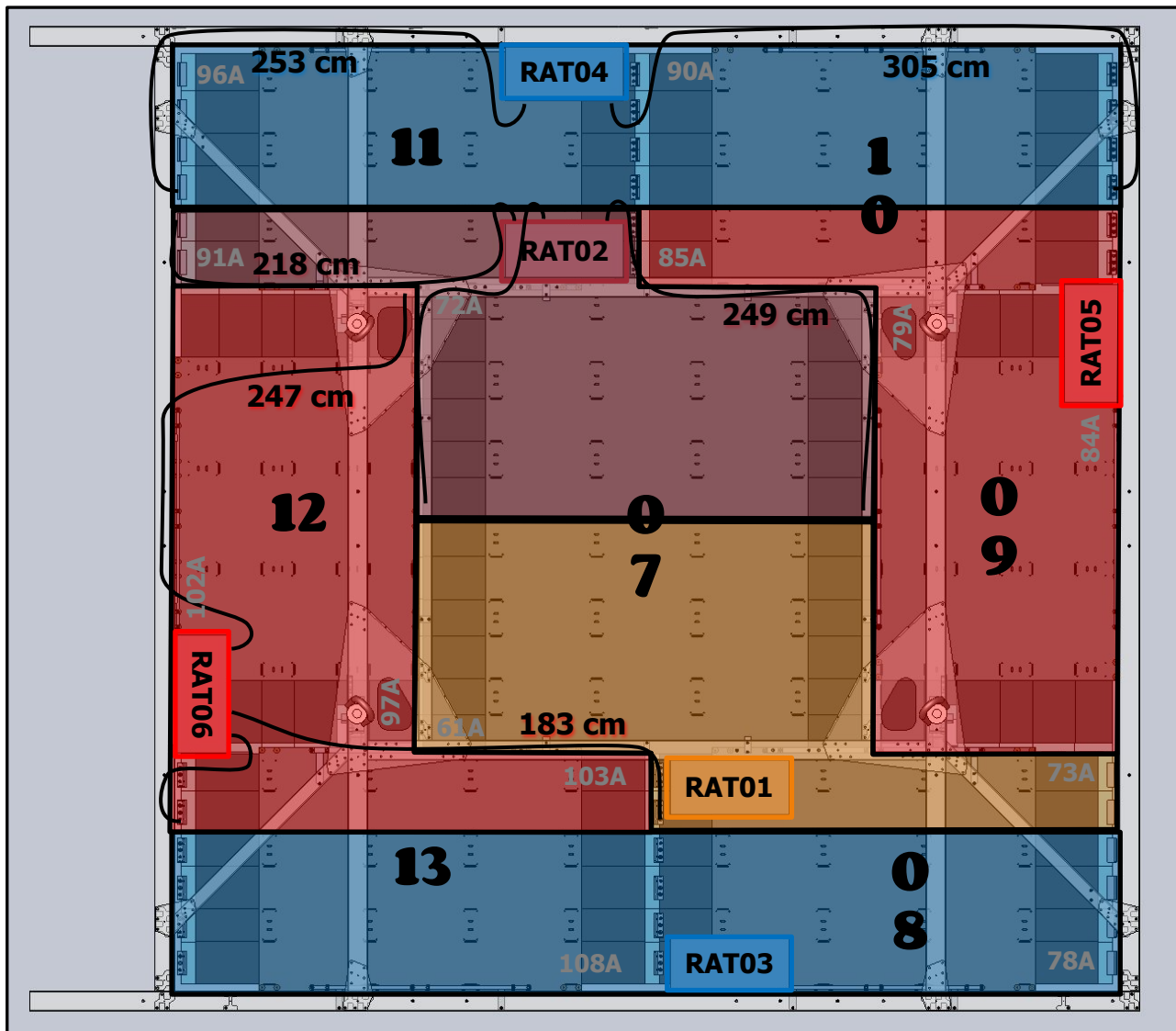


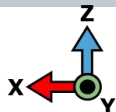
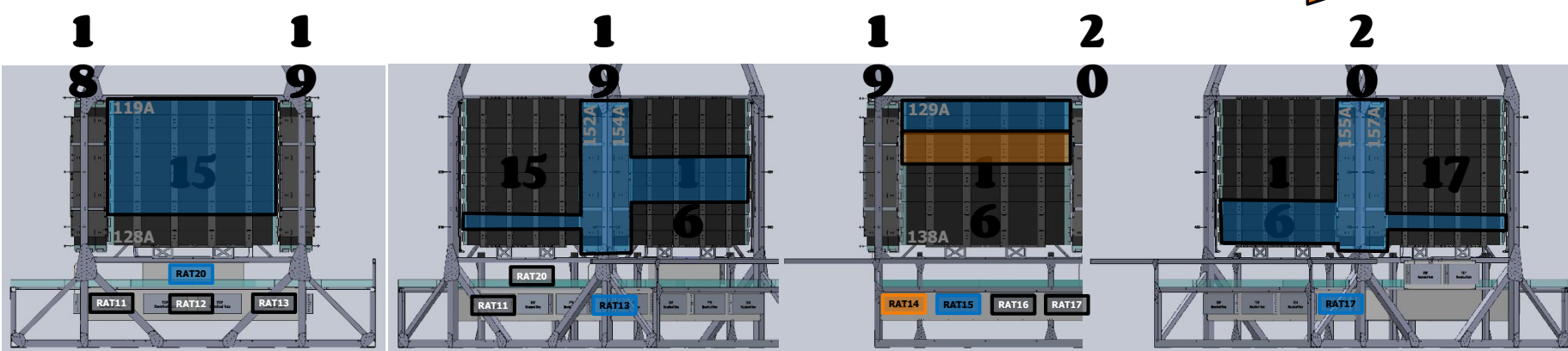
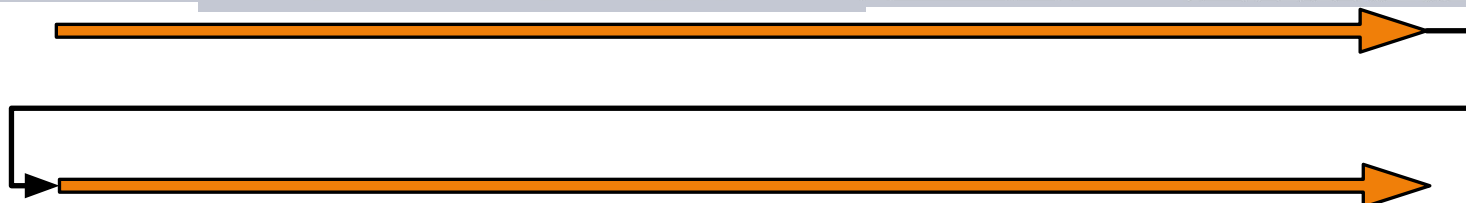
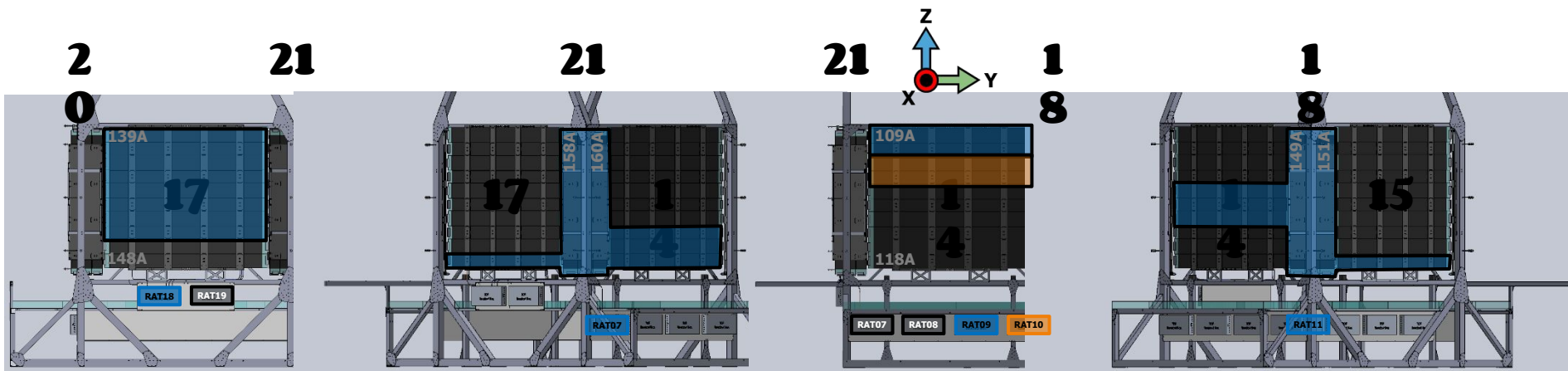
Length Chart

Panel ID	Panel Type	Major Zone	Location
01	12PP	CBE	Top
02	12PP	CBE	Bottom
03	08PP	CBE	+X
04	08PP	CBE	+Y
05	08PP	CBE	-X
06	08PP	CBE	-Y
07	12PP	UMB	Center
08	06PP	UMB	+X045
09	06PP	UMB	+Y
10	06PP	UMB	+X135
11	06PP	UMB	+X225
12	06PP	UMB	-Y
13	06PP	UMB	+X315
14	10PP	COR	+X
15	10PP	COR	+Y
16	10PP	COR	-X
17	10PP	COR	-Y
18	03PP	COR	+X045
19	03PP	COR	+X135
20	03PP	COR	+X225
21	03PP	COR	+X315

RAT #	Major Zone	Panel ID	Sub-Paddles	Lengths (cm)			Notes
				MAX	5 th PAD MAX	MIN	
01	UMB	07	1-6	249			ORANGE same as RAT02-P07
	UMB	08	1-2	218			ORANGE same as RAT02-P11
02	UMB	07	7-12	249			
	UMB	11	1-2	218			
03	UMB	08	3-6	253			ORANGE same as RAT04-P11
	UMB	13	3-6	305			ORANGE same as RAT04-P10
04	UMB	10	3-6	305			
	UMB	11	3-6	253			
06	UMB	12	1-6	247			
	UMB	13	1-2	183			
05	UMB	09	1-6	247			ORANGE same as RAT06-P12
	UMB	10	1-2	183			ORANGE same as RAT06-P13
06	UMB	12	1-6	247			
	UMB	13	1-2	183			
07	COR	17	10	256	--	84	
	COR	21	1-3	250	--		
	COR	14	8-10	233	--		
	CBE	--	EDGE	199	--		
08	CBE	01	7-12	344			ORANGE same as RAT16-P01
	CBE	03	1-2	254			ORANGE same as RAT16-P05
09	CBE	03	3-8	228			ORANGE same as RAT15-P05
	COR	14	1-2	284	--		
10	CBE	02	7-12	283			ORANGE same as RAT14-P02
	COR	14	3-4	300	--		
11	COR	14	5-7	287	--		
	COR	18	1-3	289	--		
	COR	15	10	240	--		
	CBE	--	EDGE	210	--		BLUE +10cm buffer to RAT07-EDGE for OHP interference
12	CBE	04	1-8	228			
13	COR	15	9	255	--		BLUE +15 cm shift from RAT11-P15
	COR	19	1-3	289	--		ORANGE same as RAT11-P18
	COR	16	5-7	287	--		ORANGE same as RAT11-P14
	CBE	--	EDGE	210	--		BLUE +10cm buffer to RAT07-EDGE for OHP interference
14	CBE	02	1-6	283			
	COR	16	3-4	300	--		ORANGE same as RAT10-P14
15	CBE	05	3-8	228			BLUE est. from RAT16-P05 max L & sub. 12.95cm paddle delta
	COR	16	1-2	284	--		ORANGE same as RAT09-P14
16	CBE	01	1-6	344			
	CBE	05	1-2	254			
17	COR	16	8-10	233	--		ORANGE same as RAT07-P14
	COR	20	1-3	250	--		ORANGE same as RAT07-P21
	COR	17	9	271	--		BLUE +15 cm shift from RAT07-P17
	CBE	---	EDGE	199	--		ORANGE same as RAT07-EDGE
18	COR	17	1-8	250	196	98	BLUE -56 cm from long side version, box is 28cm off-center
19	CBE	06	1-8	220	169		BLUE -51 cm is measured Delta between paddle 1 and 5
20	COR	15	1-8	222	168	126	BLUE from RB18-P17 but account for the 28 cm that centers RB20

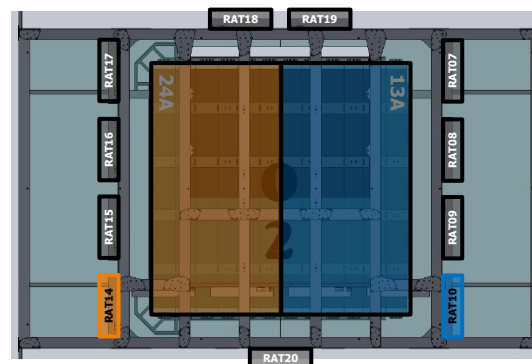
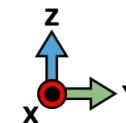
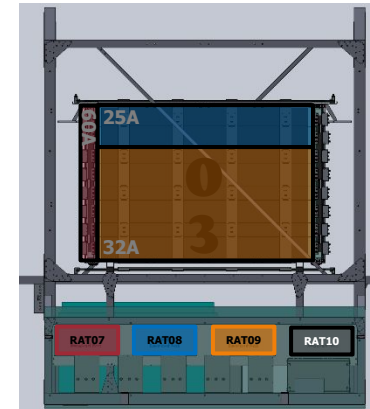
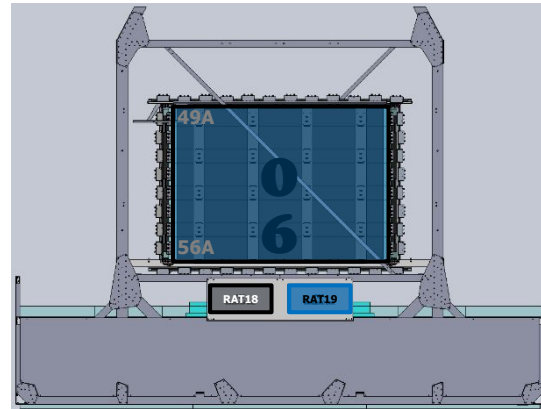
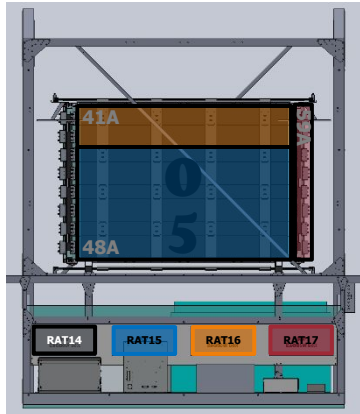
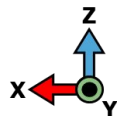
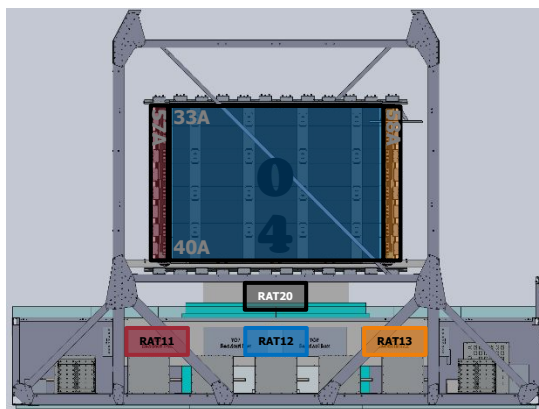
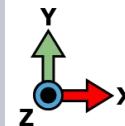
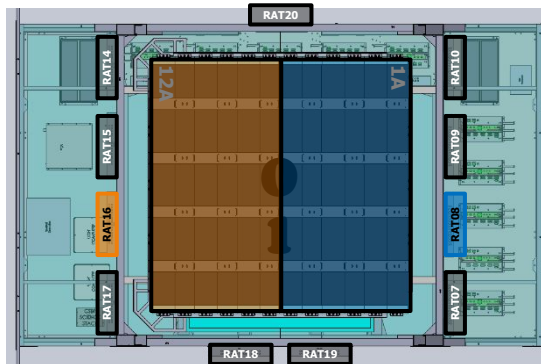
**PANEL
ID**





**PANEL
ID**

CBE Hookup



Backup / Support



Length Chart

Panel ID	Panel Type	Major Zone	Location
01	12PP	CBE	Top
02	12PP	CBE	Bottom
03	08PP	CBE	+X
04	08PP	CBE	+Y
05	08PP	CBE	-X
06	08PP	CBE	-Y
07	12PP	UMB	Center
08	06PP	UMB	+X045
09	06PP	UMB	+Y
10	06PP	UMB	+X135
11	06PP	UMB	+X225
12	06PP	UMB	-Y
13	06PP	UMB	+X315
14	10PP	COR	+X
15	10PP	COR	+Y
16	10PP	COR	-X
17	10PP	COR	-Y
18	03PP	COR	+X045
19	03PP	COR	+X135
20	03PP	COR	+X225
21	03PP	COR	+X315

RAT #	Major Zone	Panel ID	Sub-Paddles	Lengths (cm)			Notes
				MAX	5 th PAD MAX	MIN	
01	UMB	07	1-6	249			
	UMB	11	5-6	218			
02	UMB	07	1-6	249			ORANGE same as RAT01-P07
	UMB	08	5-6	218			ORANGE same as RAT01-P11
03	UMB	12	1-6	247			
	UMB	13	1-2	183			
04	UMB	09	1-6	247			ORANGE same as RAT03-P12
	UMB	10	5-6	183			ORANGE same as RAT03-P13
05	UMB	10	1-4	305			
	UMB	11	1-4	253			
06	UMB	08	3-6	253			ORANGE same as RAT05-P11
	UMB	13	3-6	305			ORANGE same as RAT05-P10
07	COR	17	10	256	--	84	
	COR	21	1-3	250	--		
	COR	14	8-10	233	--		
	CBE	--	EDGE	199	--		
08	CBE	01	7-12	344			ORANGE same as RAT16-P01
	CBE	03	1-2	254			ORANGE same as RAT16-P05
09	CBE	03	3-8	228			ORANGE same as RAT15-P05
10	COR	14	1-2	284	--		
11	CBE	02	7-12	287	--		ORANGE same as RAT14-P02
12	COR	14	3-4	300	--		
13	COR	14	5-7	287	--		
14	COR	18	1-3	255	--		
15	COR	15	1-2	284	--		
16	CBE	--	EDGE	210	--		BLUE +10cm buffer to RAT07-EDGE for OHP interference
12	CBE	04	1-8	228			
13	COR	15	9	255	--		BLUE +15 cm shift from RAT11-P15
	COR	19	1-3	289	--		ORANGE same as RAT11-P18
	COR	16	5-7	287	--		ORANGE same as RAT11-P14
	CBE	--	EDGE	210	--		BLUE +10cm buffer to RAT07-EDGE for OHP interference
14	CBE	02	1-6	283			
	COR	16	3-4	300	--		ORANGE same as RAT10-P14
15	CBE	05	3-8	228			BLUE est. from RAT16-P05 max L & sub. 12.95cm paddle delta
	COR	16	1-2	284	--		ORANGE same as RAT09-P14
16	CBE	01	1-6	344			
	CBE	05	1-2	254			
17	COR	16	8-10	233	--		ORANGE same as RAT07-P14
	COR	20	1-3	250	--		ORANGE same as RAT07-P21
	COR	17	9	271	--		BLUE +15 cm shift from RAT07-P17
	CBE	---	EDGE	199	--		ORANGE same as RAT07-EDGE
18	COR	17	1-8	250	196	98	BLUE -56 cm from long side version, box is 28cm off-center
19	CBE	06	1-8	220	169		BLUE -51 cm is measured Delta between paddle 1 and 5
20	COR	15	1-8	222	168	126	BLUE from RB18-P17 but account for the 28 cm that centers RB20

20230125 ... charts before repositioning RATs 1-6

Summary - 20220406

- ☐ Calculated lengths correspond to the MAX for each paddle.
- ☐ Actual number of cables needed is 4x each of the cable counts.

☐ Criteria for STD cables

- $1.08 \leq \text{margin} \leq 1.38$
- $21.1 \text{ cm} \leq \text{margin} \leq 57.6 \text{ cm}$
- For cables $< 250 \text{ cm}$ the margin was kept to $\leq 30 \text{ cm}$, but was slowly extended as the cable lengths increased.

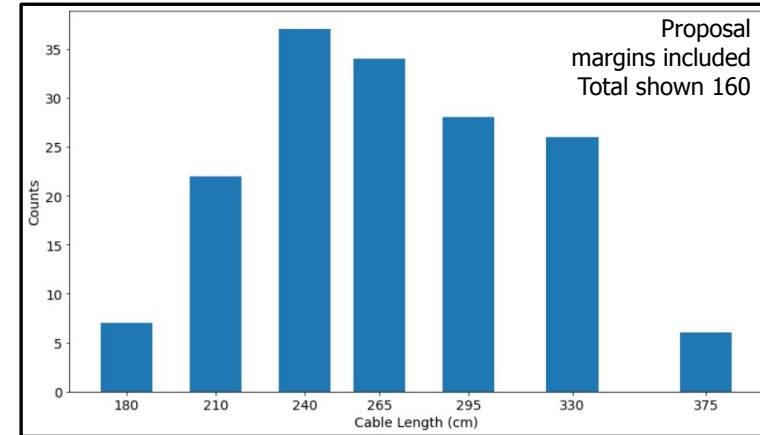
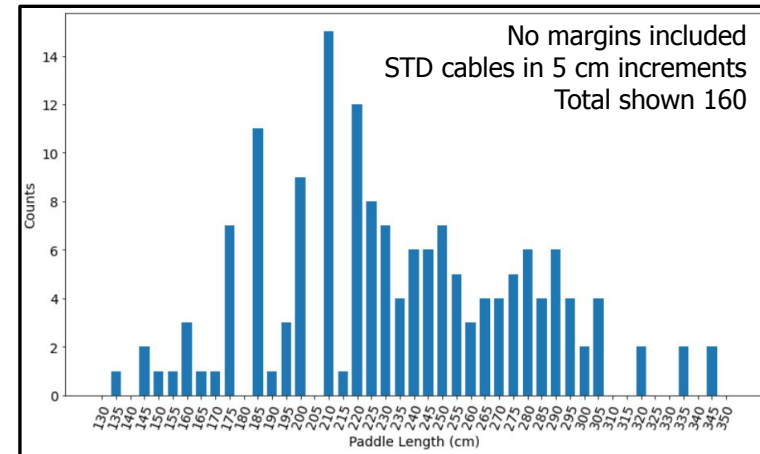
▪ Num. of STD Cables: 7

- **Note: Margin is enforced on MAX lengths so the shorter side could see significantly larger excess.**

▪ Readout and Trigger (RAT) box cable utilization:

- 3 RATs use 3 STD cables
- 14 RATs use 4 STD cables
- 3 RATs use 5 STD cables
- Ave. Lengths = 267.88 cm
- Est. SMA mass = 34 kg (w/ margin)
- Budget SMA mass = 48 kg
- Extra L over exact = 57 m
- Extra mass over exact = 1.26 kg

Lengths (cm)	QTY		
	Exact	Spares	TOTAL
180	28	3	31
210	88	9	97
240	148	15	163
265	136	14	150
295	112	12	124
330	104	11	115
375	24	3	27
	640	67	707



Summary - 20220401

- ☐ Calculated lengths correspond to the MAX for each paddle.
- ☐ Actual number of cables needed is 4x each of the cable counts.

☐ Criteria for STD cables

- $1.08 \leq \text{margin} \leq 1.25$
- $11.5 \text{ cm} \leq \text{margin} \leq 48 \text{ cm}$
- For cables $< 250 \text{ cm}$ the margin was kept to $\leq 30 \text{ cm}$, but was slowly extended as the cable lengths increased.

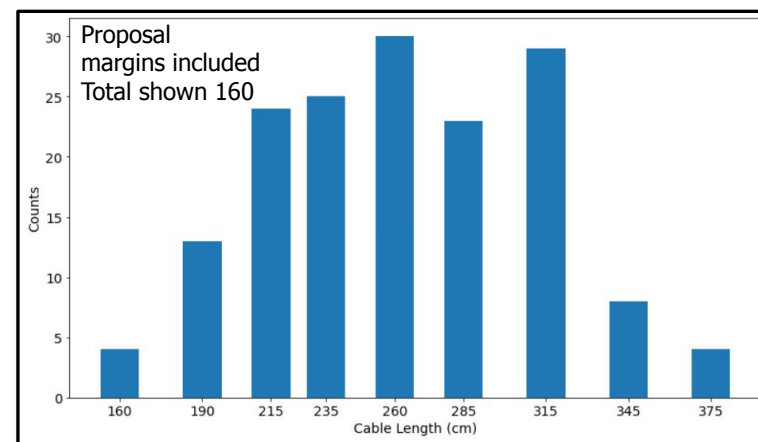
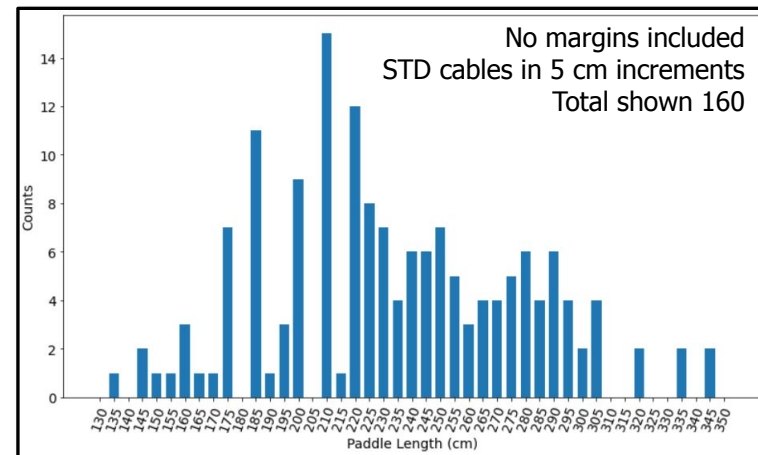
▪ Num. of STD Cables: 9

- **Note: Margin is enforced on MAX lengths so the shorter side could see significantly larger excess.**

▪ Priority: Mitigate excess margin over the number of STD cables.

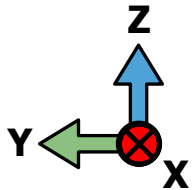
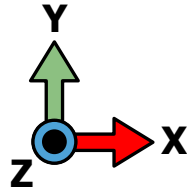
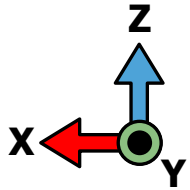
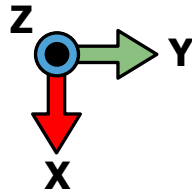
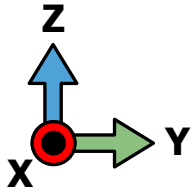
- All Readout and Trigger (RAT) boxes will utilize 4 or 5 STD cables.
- Ave. Lengths = 261.84 cm
- Est. SMA mass = 33.8 kg (with margin)
- Budget SMA mass = 48 kg
- Extra L over exact = 47 m
- Extra mass over exact = 1.04 kg

Lengths (cm)	QTY	Spares (?)
160	16	
190	52	
215	96	
235	100	
260	120	
285	92	
315	116	
345	32	
375	16	



Calculations performed with 'Cabling_histogram.ipynb'

**PANEL
ID**



LTB	(01)	(02)	(03)	(04)	(05)	(06)	(07)	(08)	(09)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
RB1	(01)	(02)	(03)	(04)	(05)	(06)	(07)	(08)								
RB2	(09)	(10)	(11)	(12)	(13)	(14)	(15)	(16)								
PB	(02)	(04)	(06)	(08)	(10)	(12)	(14)	(16)								
	(01)	(03)	(05)	(07)	(09)	(11)	(13)	(15)								