From the ePIC.Interface Control Document for Services.052023:

Subsytem	Type	Item	Material	Quantity	Diameter (cm)	Cable Shape	Cross Area (cm^2)	+50% Packing for Bundles	+50% for MISC spacing needs	Available Space		
Red Path IP to pfRICH Inner face												
Vertex Silicon	Power	LV digital	Aluminium	12	0.8		6.03	9.05	13.57			
	Signal	Sensor Bias	Aluminium	34	0.2		1.07	1.60	2.40			
	Signal	Data *	Fibers?	204	0.6		57.68	86.52	129.78			
	Cooling	Cooling		12	0.3		0.85	1.27	1.91	147.66		
Sagita Silicon	Power	LV serial power	Aluminium	29	0.9		18.45	27.67	41.51			
	Signal	Signal Bias	Aluminium	771	0.3		54.50	81.75	122.62			
	Signal	Data *	Fibers?	771	0.2		24.22	36.33	54.50			
	Cooling	Cooling *		356	0.3		25.16	37.75	56.62	275.25		
Silicon Disks	Signal	Sensor Bias	Aluminium	1100	0.3		77.75	116.63	174.95			
	Cooling	cooling	tygon	550	0.63		171.45	257.17	385.76			
	Power	LV current	Aluminium	92	0.9		58.53	87.79	131.69			
	Signal	Data	Fibers?	1100	0.3		77.75	116.63	174.95	867.34		
Inner MPGD	Power	Hv	Copper	16	0.32		1.29	1.93	2.90			
	Power	LV		64	1.163		67.99	101.98	152.97			
	Cooling	Gas		32	0.4		4.02	6.03	9.05			
	Cooling	Cooling		128	0.625		39.27	58.90	88.36			
	Signal	Signal		64	1.1x0.2		0.44	0.66	0.99	254.26		
MPGD Disk	Power	Hv		16	0.32		1.29	1.93	2.90			
	Power	LV		32	0.9		20.36	30.54	45.80			
	Cooling	Gas		8	0.4		1.01	1.51	2.26			
	Cooling	Cooling		16	0.625		4.91	7.36	11.04			
	Singal	Signal	Ribbon	64	2x0.3		38.40	57.60	86.40			
	Signal	Fibers	Fibers	32	0.32		2.57	3.86	5.79	154.20		
AC LGAD TOF	Power	LV FEE		72	0.63		22.44	33.67	67.33			
	Power	HV FEE		144	0.15		2.54	3.82	7.63			
	Signal	Fiber *	Fiber	144	0.6		40.72	61.07	122.15	281.93		
	Cooling	Aluminum	Tygon	144	0.5		28.27	42.41	84.82	Available Space: Gap from CF tube to EEEMCAL is 71cm vs 67.3cm outer radii (dodecagon)		
Total				6007			848.96	1273.44	2178.71	2252.05	Used space:	96.74%

From the ePIC.Interface Control Document for Services.052023:

Subsytem	Type	Item	Material	Quantity	Diameter (cm)	Cable Shape	Cross Area (cm^2)	+50% Packing for Bundles	+50% for MISC spacing needs	Available Space		
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	Signal	Sensor Bias	Aluminium	34	0.2		1.07	1.60	2.40			
	Signal	Data *	Fibers?	204	0.6		57.68	86.52	129.78			
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	Cooling	Gas		32	0.4		4.02	6.03	9.05			
	Cooling	Cooling		128	0.625		39.27	58.90	88.36			
	Signal	Signal		64	1.1x0.2		0.44	0.66	0.99	254.26		
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	Power	LV		32	0.9		20.36	30.54	45.80			
	Cooling	Gas		8	0.4		1.01	1.51	2.26			
	Cooling	Cooling		16	0.625		4.91	7.36	11.04			
	Singal	Signal	Ribbon	64	2x0.3		38.40	57.60	86.40			
	Signal	Fibers	Fibers	32	0.32		2.57	3.86	5.79	154.20		
AC LGAD TOF	Power	LV FEE		72	0.63		22.44	33.67	67.33			
	Power	HV FEE		144	0.15		2.54	3.82	7.63			
	Signal	Fiber *	Fiber	144	0.6		40.72	61.07	122.15	281.93		
	Cooling	Aluminum	Tygon	144	0.5		28.27	42.41	84.82	Available Space: Gap from CF tube to EEEMCAL is 71cm vs 67.3cm outer radii (dodecagon)		
Total				6007			848.96	1273.44	2178.7	2252.05	Used space:	96.74%

From the ePIC.Interface Control Document for Services.052023:

The area available for services in the pfRICH – EEEMCal tract is ~2,250 cm^2

The segmentation and shape need to be factored into what we do / need,

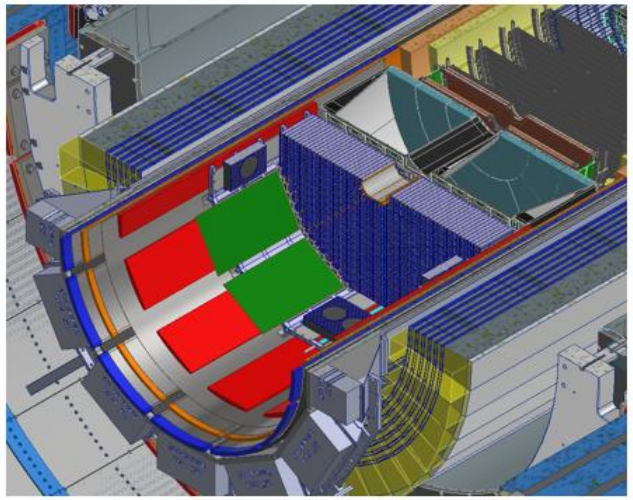
- a dodecagon with an outer radius of 67.3 cm has an apotherm of 67.3 cm x cos(15°) = 65.0 cm,
- Combined with the 71.0 cm radius of the CF tube, this leaves a maximum height of 6.0 cm (!) for the service trays,

One of Roland Wimmer's slides from the working meeting indicates that "trays" is indeed plural; the space is shared,

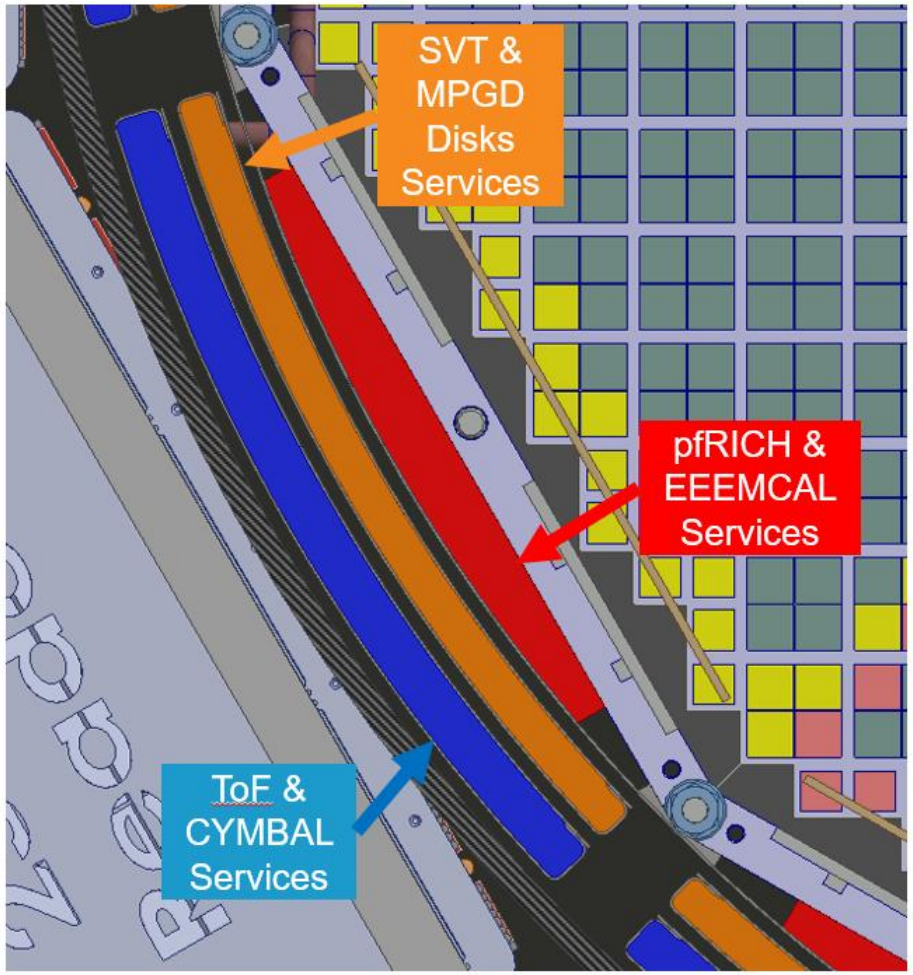
- His slide suggests that a more relevant maximum height is 71.0 – 67.3 cm = 3.7 cm (!),
- Note that this is still shared space:
  - ToF and Cymbal combined have a stated need of ~550 cm^2
  - SVT needs ~1,110 cm^2
  - The 1:2 ratio may imply that the relevant maximum height is 2.5 cm or less,
- *It is not a given that a 25mm / ~1-inch tube will fit even though the total area works out.*

Backward Direction Cable Trays

- Cables trays around the EEEMCAL and pfRICH will be broken up into 3 separate trays
- Innermost trays will house services from the pfRICH and EEEMCAL
- Middle trays are for SVT and MPGD disks
- Outermost trays are for CYMBAL and ToF



Trays are not Proportional



For the ePIC.Interface Control Document for Services.052023 update:

Subsytem	Type	Item	Material	Cable Specifics	Quantity	Diameter (cm)	Cross Area (cm^2)	Notes
Inner Barrel	Power	LV	Multi-Conductor Cable	4 Al conductors, 18AWG	16	0.9	NA	All on the hadron side; none on the electron side
	Signal	Data	144 Fiber Cable		4	0.89	NA	All on the hadron side; none on the electron side;harnesses TBD
	Cooling	cooling	Air		2	2.54	NA	All on the hadron side; none on the electron side
	Cooling	Exhaust	Air				40.54	Preliminary estimate, **not subject to packing**
Outer Barrel	Power	LV	Multi-Conductor Cable	4 Al conductors, 18AWG	93	0.9	59.16	
	Signal	Data	144 Fiber Cable		6	0.89	3.73	
	Cooling	cooling	Air		8	2.54	40.54	
	Cooling	Exhaust	Air				162.15	Preliminary estimate, **not subject to packing**
Disks	Power	LV	Multi-Conductor Cable	4 Al conductors, 18AWG	185	0.9	117.69	
	Signal	Data	144 Fiber Cable		12	0.89	7.47	
	Cooling	Cooling	Air		10	2.54	50.65	
	Cooling	Exhaust	Air				202.60	Preliminary estimate, **not subject to packing**
Outer Barrel / Disks FIB	Signal	Read out Fibers			NA	NA	NA	part of the fiber counts above (OB, disks) insofar external
	Power	Ext Current Source			NA	NA	NA	powered by CB (i.e. internal services, but not external)
	Cooling	cooling	Air / convection		NA	NA	NA	VTRx+ can be cooled convectively per its manual
Outer Barrel / Disks CB	Signal	Slow Control Fibers FIB	144 Fiber Cable		1	0.89	0.62	
	Signal	Slow Control Fibers FPC	144 Fiber Cable		1	0.89	0.62	
	Power	Ext Voltage Source		4 Al conductors, 18AWG	26	0.9	16.54	16 OB control boards, 36 disk control boards
	Cooling	Cooling	Water		28	0.63	8.73	Approx. 1.3 kW to be cooled
Inner Barrel SCB	Signal	Control Fibers	144 Fiber Cable		1	0.89	NA	All on the hadron side; none on the electron side;harnesses TBD
	Cooling	Cooling	Water		4	0.63	NA	All on the hadron side; none on the electron side
Inner Barrel DPB	Signal	Control Fiber	144 Fiber Cable		1	0.89	NA	All on the hadron side; none on the electron side;harnesses TBD
	Power	Bulk Power	Multi-Conductor Cable	4 Al conductors, 18AWG	16	0.9	NA	All on the hadron side; none on the electron side
	Cooling	Cooling	Water		4	0.63	NA	All on the hadron side; none on the electron side
Ground(s)							0.70	Preliminary estimate
Interlocks							4.00	Preliminary estimate; more of a "space allocation"
Environmental sensors							4.00	Preliminary estimate; more of a "space allocation"

- Values listed are for the electron side of the SVT

- Only services leaving the SVT Envelope are shown

Total ~700 cm^2 for SVT electrical, optical, and air-inlet services (incl. packing and misc.)

~400 cm^2 for air exhaust (no packing and misc.)