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1 GeV リニアック検討資料

1 GeV LINAC DESIGN NOTE

題目 (TITLE) Parameters of JHP 200-MeV proton linac

著者 (AUTHOR) T. Kato

概要 (ABSTRACT)

200 MeV JHP 線型加速器のパラメーターをまとめた。これは各分野の設計用の基礎資料として使用する。今後の変更もあ
うる。

構成 RFQ (3 MeV) + DTL (50 MeV) + SDDL (203 MeV)

Total length 123 m

DTL length 28.56 m, SDDL length 92.4 m

Total rf power (30 mA) 27.4 MW

Number of klystron 15

KEY WORDS:

Ion source, RFQ, DTL, CCL, Magnet, Monitor, Beam Dynamics,
Transport, Vacuum, Cooling

Klystron, Low level rf, High power rf, Modulator

Control, Operation, Radiation, Others

Table * Parameters of the JHP proton linac.

	Total length (structure only)	93.0 m	(27.06 + 65.9)
	Total length (including drift space)	123.0 m	(28.56 + 2 + 92.4)
	Total rf driving power	21.4 MW	(3.95 + 17.4)
	Total rf power (30 mA)	27.4 MW	(1.42 + 4.6 + 21.4)
	Total rf power (60 mA)	33.4 MW	(2.84 + 9.2 + 21.4)
	Number of klystrons	15	(1 + 3 + 10 + 1)
	(includes for RFQ and debuncher)		
RFQ			
	Frequency	324	MHz
	Injection energy	50	keV
	Output energy	3	MeV
DTL			
	Frequency	324	MHz
	Injection energy	3	MeV
	Output energy	50.297	MeV
	Number of tank	3	
	number of cells	150	
	Total length	28.56	m
	Rf driving power (*)	3.95	MW
	Beam power (30mA)	1.42	MW
	Beam power (60mA)	2.84	MW
	Total power (30mA)	5.37	MW
	Total power (60mA)	6.79	MW
	Number of klystron	3	
	Transverse acceptance		
	Ax		
	Ay		
	Az		
	Focusing method	Equipartitioned focusing	
	Stabilization	Post-stabilized	

DTL

Tank number	1	2	3	
Injection energy	3.0	19.413	36.573	
Output energy	19.413	36.573	50.297	
Tank length	10.33	9.40	7.33	
Number of cells	80	43	27	
Rf driving power (*)	1.20	1.44	1.32	
Beam power (30mA)	0.49	0.52	0.41	
Beam power (60mA)	0.98	1.03	0.82	
Total power (30mA)	1.69	1.96	1.73	
Total power (60mA)	2.18	2.47	2.15	
Accelerating field	2.5	2.7	2.9	
Stable phase	-30	-26	-26	
Drift space	4	3	0	$\beta\lambda$
	0.741	0.753		m

* including a factor of 1.3

SDTL

Frequency	324	MHz
Injection energy	50.297	MeV
Output energy	202.777	MeV
Number of tank	31	
number of cells	155	
Structure length	65.9	m
Total length	92.4	m
Rf driving power (*)	17.4	MW
Beam power (30mA)	4.6	MW
Beam power (60mA)	9.2	MW
Total power (30mA)	22.0	MW
Total power (60mA)	26.6	MW
Number of klystron	10	
Accelerating field	3.86	MV/m
Energy gain	2.86 - 1.92	MeV/m
Drift space (**)	0.67-1.03	m
Transverse acceptance		
Ax		
Ay		
Az		

(*) including a factor of 1.2.

(**) shorter length is possible.

SUMMARY OF DTL LINAC

NT	ENERGY	BETA	CELL	TANK	PC*1.3	PBEAM	PTOT	DRIFT SPACE	STARTP	ENDP	START & END CELL
	3.000	.0798									
1	19.413	.2003	80	1033.560	1.195	.492	1.687	4	74.144	1107.703	1 80
2	36.573	.2713	43	940.458	1.442	.515	1.957	3	75.320	2123.482	81 123
3	50.297	.3149	27	732.830	1.316	.412	1.727	3	.000	2856.312	124 150
Total			150	2706.848	3.95	1.42	5.37	RFDRIVE=	3.04		

NTK	N1	N2	NC	WIN MeV	BETAIN	CLENG cm	TANKLENG cm	DRIFT cm	RF MWX1.20	PBEAM MW	ZS MOHM/m	WGAIN MeV	PHI DEG	PTOT MW	EZERO MV/m	WG/m MeV/m
1	1	5	5	50.300	.3149	29.24	148.44	90.74	.351	.127	75.827	4.2466	-26.00	.479	3.86	2.86
2	6	10	5	54.547	.3269	30.35	153.92	93.99	.367	.131	75.203	4.3530	-26.00	.498	3.86	2.83
3	11	15	5	58.900	.3386	31.43	159.26	97.15	.383	.134	74.594	4.4506	-26.00	.516	3.86	2.79
4	16	20	5	63.350	.3500	32.48	164.46	66.82	.398	.136	74.024	4.5353	-26.00	.534	3.86	2.76
5	21	25	5	67.886	.3611	33.50	169.53	68.82	.414	.138	73.473	4.6138	-26.00	.552	3.86	2.72
6	26	30	5	72.499	.3719	34.50	174.46	70.77	.429	.141	72.938	4.6867	-26.00	.570	3.86	2.69
7	31	35	5	77.186	.3824	35.47	179.26	72.66	.444	.143	72.416	4.7537	-26.00	.586	3.86	2.65
8	36	40	5	81.940	.3927	36.42	183.93	74.51	.459	.144	71.891	4.8099	-26.00	.603	3.86	2.62
9	41	45	5	86.750	.4026	37.34	188.47	76.30	.474	.146	71.365	4.8597	-26.00	.619	3.86	2.58
10	46	50	5	91.609	.4123	38.23	192.89	78.04	.488	.147	70.853	4.9051	-26.00	.635	3.86	2.54
11	51	55	5	96.514	.4217	39.10	197.18	79.73	.502	.148	70.356	4.9459	-26.00	.651	3.86	2.51
12	56	60	5	101.460	.4309	39.94	201.36	81.38	.517	.149	69.874	4.9777	-26.00	.666	3.86	2.47
13	61	65	5	106.438	.4398	40.76	205.41	82.98	.531	.150	69.408	5.0040	-26.00	.681	3.86	2.44
14	66	70	5	111.442	.4484	41.56	209.35	84.53	.544	.151	68.956	5.0268	-26.00	.695	3.86	2.40
15	71	75	5	116.469	.4568	42.33	213.18	86.04	.558	.151	68.516	5.0462	-26.00	.709	3.86	2.37
16	76	80	5	121.515	.4649	43.08	216.90	87.51	.571	.152	68.089	5.0627	-26.00	.723	3.86	2.33
17	81	85	5	126.578	.4729	43.82	220.51	88.93	.584	.152	67.674	5.0763	-26.00	.736	3.86	2.30
18	86	90	5	131.654	.4806	44.53	224.03	90.32	.597	.153	67.270	5.0873	-26.00	.749	3.86	2.27
19	91	95	5	136.741	.4881	45.22	227.45	91.67	.609	.153	66.877	5.0959	-26.00	.762	3.86	2.24
20	96	100	5	141.837	.4954	45.89	230.78	92.98	.622	.153	66.495	5.1023	-26.00	.775	3.86	2.21
21	101	105	5	146.939	.5025	46.55	234.01	94.26	.634	.153	66.124	5.1063	-26.00	.787	3.86	2.18
22	106	110	5	152.046	.5094	47.18	237.16	95.50	.646	.153	65.772	5.1052	-26.00	.799	3.86	2.15
23	111	115	5	157.151	.5161	47.80	240.23	96.71	.658	.153	65.441	5.1016	-26.00	.811	3.86	2.12
24	116	120	5	162.253	.5226	48.41	243.21	97.89	.669	.153	65.119	5.0964	-26.00	.822	3.86	2.10
25	121	125	5	167.349	.5290	48.99	246.11	99.04	.680	.153	64.805	5.0897	-26.00	.833	3.86	2.07
26	126	130	5	172.439	.5352	49.56	248.94	100.15	.691	.152	64.500	5.0817	-26.00	.844	3.86	2.04
27	131	135	5	177.520	.5412	50.12	251.69	101.24	.702	.152	64.203	5.0724	-26.00	.854	3.86	2.02
28	136	140	5	182.593	.5471	50.66	254.37	102.29	.713	.152	63.914	5.0620	-26.00	.865	3.86	1.99
29	141	145	5	187.655	.5528	51.19	256.98	103.32	.723	.152	63.632	5.0506	-26.00	.875	3.86	1.97
30	146	150	5	192.705	.5583	51.70	259.52	104.33	.734	.151	63.357	5.0382	-26.00	.885	3.86	1.94
31	151	155	5	197.744	.5638	52.20	262.00	.00	.743	.151	63.090	5.0333	-26.00	.894	3.86	1.92

Peak current is .0300 A Pc+Pbeam power is 22.0096 MW
Pc power is 17.4353 MW

Pbeam power is 4.5743 MW
 TANK length without drift space is 6594.95068 cm
 TANK length with drift space is 9245.58113 cm
 Number of klystrons is 10
 No of klystron and rf power 1 2.027 MW
 No of klystron and rf power 2 2.311 MW
 No of klystron and rf power 3 2.571 MW
 No of klystron and rf power 4 2.085 MW
 No of klystron and rf power 5 2.209 MW
 No of klystron and rf power 6 2.325 MW
 No of klystron and rf power 7 2.432 MW
 No of klystron and rf power 8 2.531 MW
 No of klystron and rf power 9 2.624 MW
 No of klystron and rf power 10 .894 MW

Location 30 - 50 m downstream of the linac

Voltage 0.8 - 1.2 MV , depending upon location

