BEAM DYNAMICS SIMULATION FOR LINAC-100 – HEAVY ION "DRIVER" FOR DERICA PROJECT

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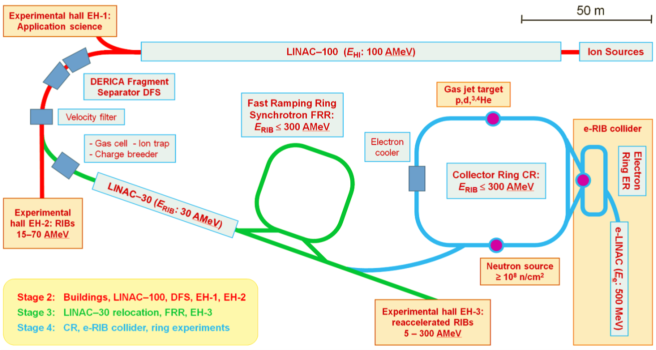
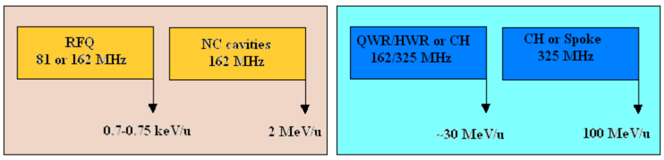
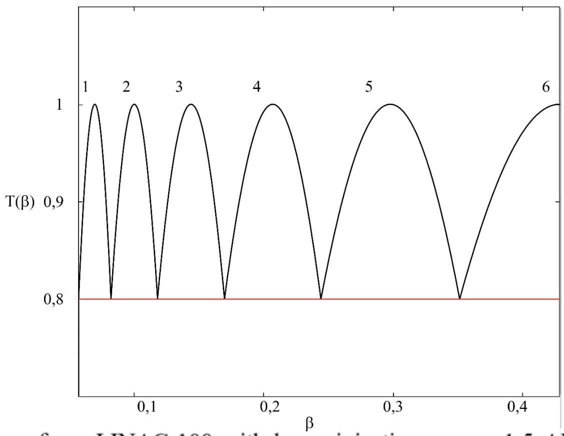
R&D on new Dubna Electron Radioactive Ion Collider fAcility (DERICA) implies the development of two heavy ion linear accelerators LINAC-100 and LINAC-30 each capable of accelerating ions with wide range of mass/charge ratios A/Z. LINAC-100 will accelerate intensive CW primary stable isotope beams (from B 11 to U 238 with A/Z) with beam currents up to10 puA for radioactive isotope production using fragmentation method. As a concept for LINAC-100 modular system of independently phased SC cavities with NC CW RFQ section in injector part is proposed. In order to obtain maximum range of secondary ions acceleration up to 50 AMeV for U 238 and 100 AMeV for «light» ions should be provided. Moreover, to enlarge flexibility in radioactive ion production conditions and expand using of LINAC-100 on applied physics it is desirable to have three modes of accelerator operation: with maximum «light» ion energies of 50, 75 and 100 AMeV. DERICA general concept and first results of LINAC-100 modular part layout are being presented.



DERICA project general layout

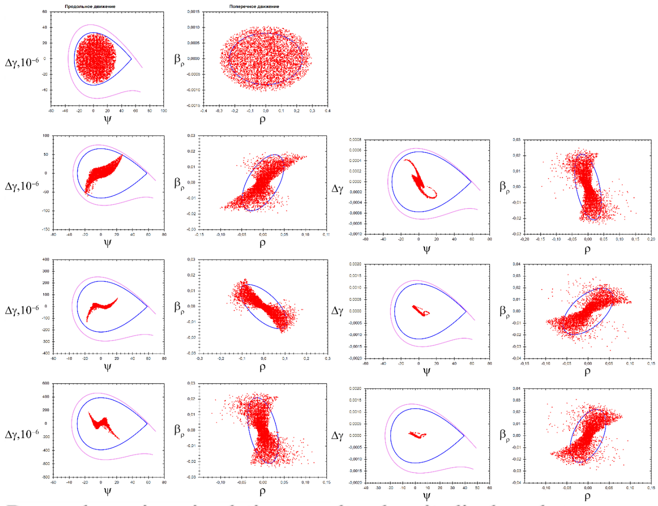


LINAC-100 initial layout



β_g-map for a LINAC-100 with beam injection energy 1,5 AMeV and output energy 100 AMeV for slipping factor T=20%. SC part of linac includes 5 groups of cavities, total 156 cavities, total length ~140 m

Conventionally, modular part of SC linear accelerator can be composed of independently phased QWR and HWR cavities for 1-3 sections, and CH- or Spoke for sections 4-6 with focusing elements placed between the cavities. Such period structures as C-S, C-FD-C and C-F-C-D, where C stands for cavity, S- solenoid, F and D- focusing and defocusing quadrupole respectively.



Beam dynamics simulation results: longitudinal and transverse phase portraits on the start of LINAC-100 SC part and after each group of cavities.

General layout of LINAC-100 SC part

Group	1	2	3	4	5	6
W_{in}, MeV/u	1.5	3.16	6.59	13.78	29.24	63.8
β_{in}	0.056	0.08	0.12	0.170	0.244	0.351
β_g	0.069	0.01	0.144	0.207	0.298	0.428
W_{out}, MeV/u	3.16	6.59	13.78	29.24	63.8	100.0
β_{out}	0.082	0.12	0.170	0.244	0.351	0.428
T, %	20	20	20	20	20	20
f, MHz	162	162	162	324	324	324
φ_{inj}, deg	–30	–30	–30	–30	–27	-20
U, MV	0.52	1.5	2.7	3.0	6.0	9.5
E, kV/cm	2	4	5.1	7.83	10.9	11.93
N_{gap}	4	4	4	4	4	4
L_{cav}, m	0.257	0.37	0.532	0.383	0.551	0.796
B_{sol}, T	3.1	4.5	5.5	6	7	7.5
L_{sol}, m	0.2	0.2	0.2	0.2	0.2	0.2
L_{per}, m	0.657	0.77	0.932	0.783	0.951	1.196
N_{per}	22	16	18	36	40	24
K_T, %	100	100	100	100	100	100