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FEL Steering Magnet Model for the ELOP-code

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The VH5a steering magnet is the additional magnet for trajectory correction. There is VH5a on the left side of the bellow near the wiggler exit (Fig.1.)

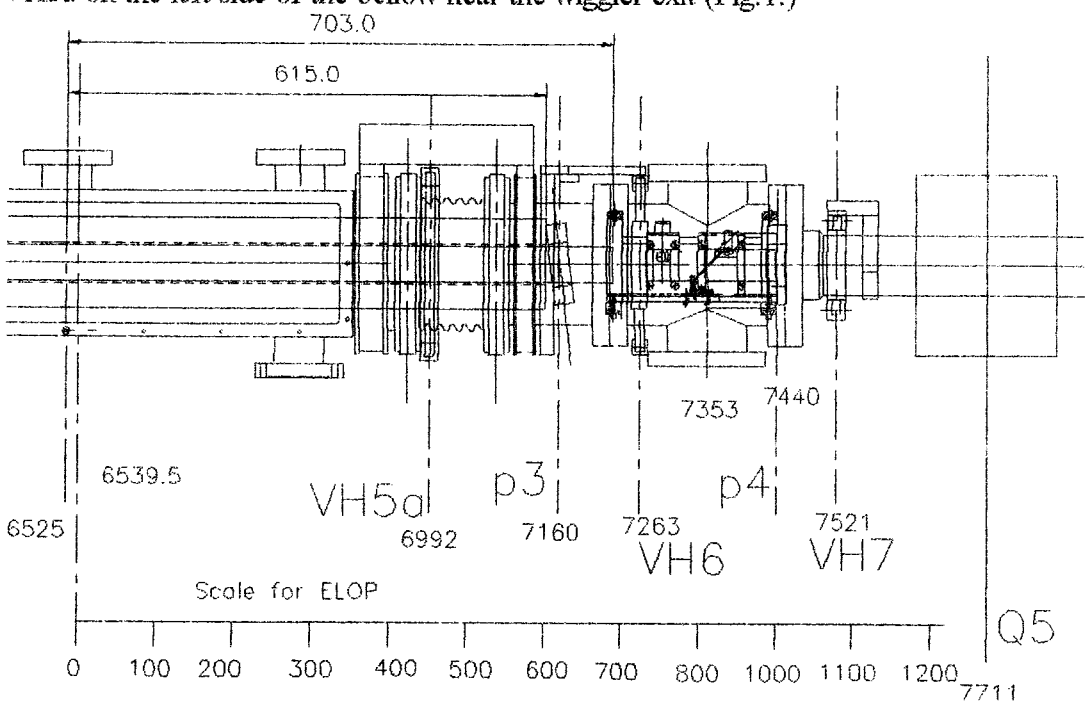

Fig.1. Region of the wiggler exit with steering magnet VH5a. Q5 - quadrupole, [p3, p4 - Pearson coils, numbers - distance from the cathode.

The field displacement along z-axis (direction of the acceleration) is shown on the Fig. 2.

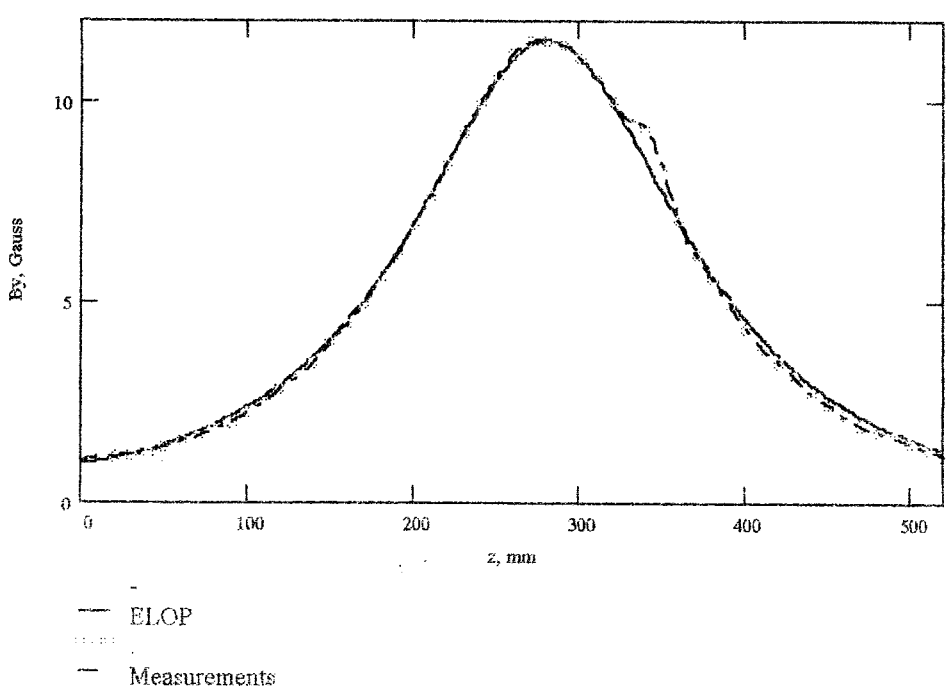

Fig.2. VH5a Steering magnet field. It has Place the perturbation of the measured data.

The parameters of the magnetic blocks to model VH5a steering magnet are led on the Table 1.

Table 1.

N	a, mm	b, mm	c, mm	x_m, mm	y_m, mm	z_m, mm	α, deg	β, deg	Bs /1 A	Type
33	12	208	12	104.5	0	452.5	0	0	7250	H5a
34	12	208	12	-104.5	0	452.5	0	0	7250	H5a
35	232	12	12	0	104.5	452.5	180	0	462	H5a
36	232	12	12	0	-104.5	452.5	180	0	462	H5a
37	232	12	12	104.5	0	452.5	0	-90	462	V5a
38	232	12	12	-104.5	0	452.5	0	-90	462	V5a
39	12	208	12	0	104.5	452.5	0	90	7250	V5a
40	12	208	12	0	-104.5	452.5	0	90	7250	V5a

Numbers of blocks N=1÷32 was used for steering magnets VH4, VH5,VH6,VH7.

Values of the Bs in the Table 1 are led to provide equivalent bending angles from magnet measurement data. Bending angle is equal 49.09 mrad for 1A steering magnet current. From data of measurements with exponential approximation of the field outwardly $\int Bsdz$=3021Gs mm for beam energy 1.4MeV. The maximum VH5a coil current is 3A and correspondingly maximum bending angle for drift space is 147.27mrad. The view of the central trajectory is led on the Fig.3 for I(H5a)=3A and initial trajectory parameters on the wiggler center x_0= -1.6376mm, x_0'=2.675mrad. On distance z=2000mm from wiggler center x=12.9mm, x'=8.8mrad, x(z=686mm - exit of the beam scrapper) =1.27mm.

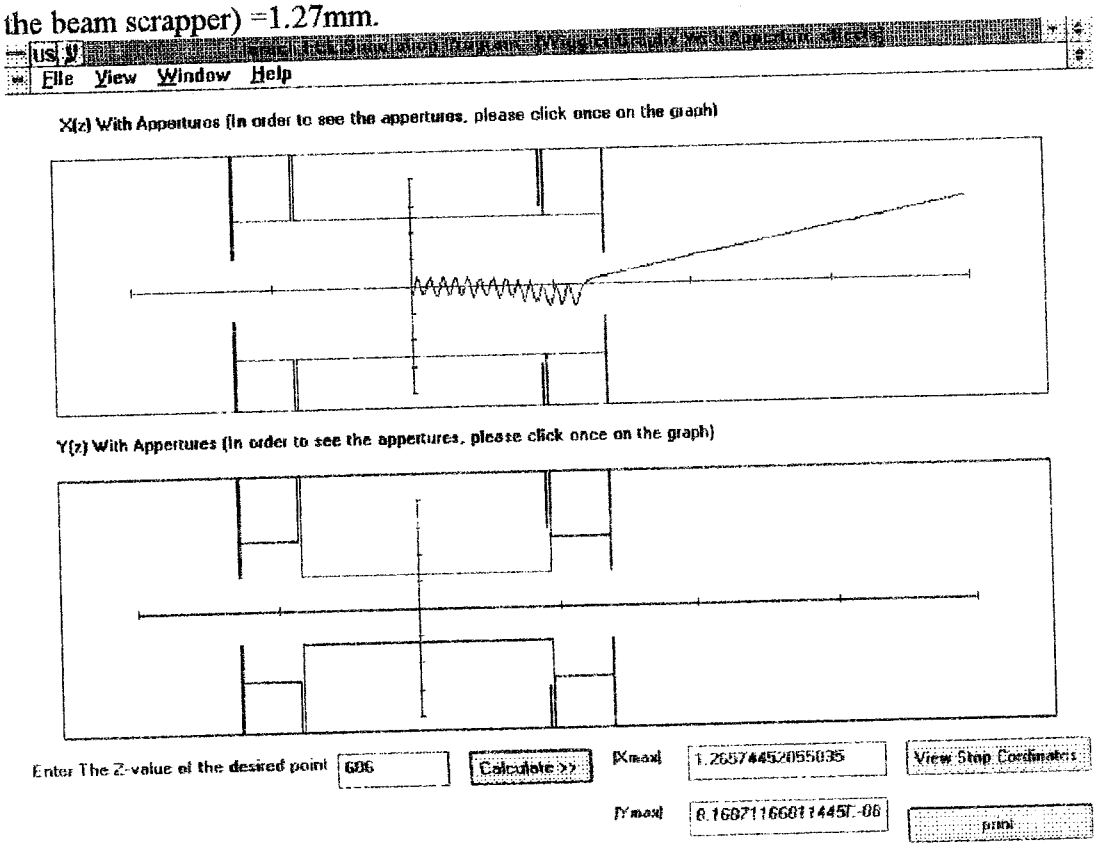

Fig.3. Central beam trajectory for I(H5a)=3A.

The trajectory for I= -3A are led on the Fig. 4. On this case x(z=2000mm) = -13.58mm, x'(z=2000mm)=-9.56mrad, x(z=686mm)= -0.85mm.

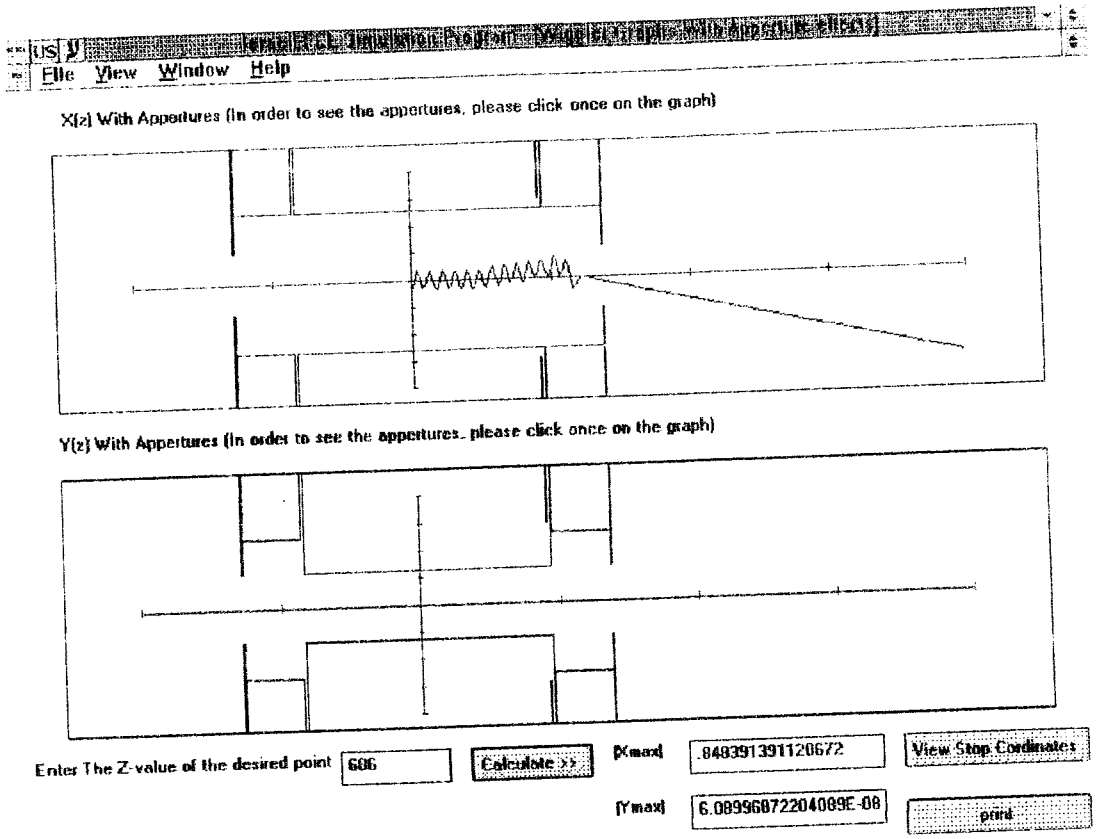

Fig.4. Central trajectory for I(H5a)= -3A.

Conclusion: The model of the steering magnet VH5a for ELOP code is completed on correspondence of the experimental data of steering field displacement along z-axis. Some estimates of the VH5a effectively for maximum currents are led.