



Hollow e-lens circuits

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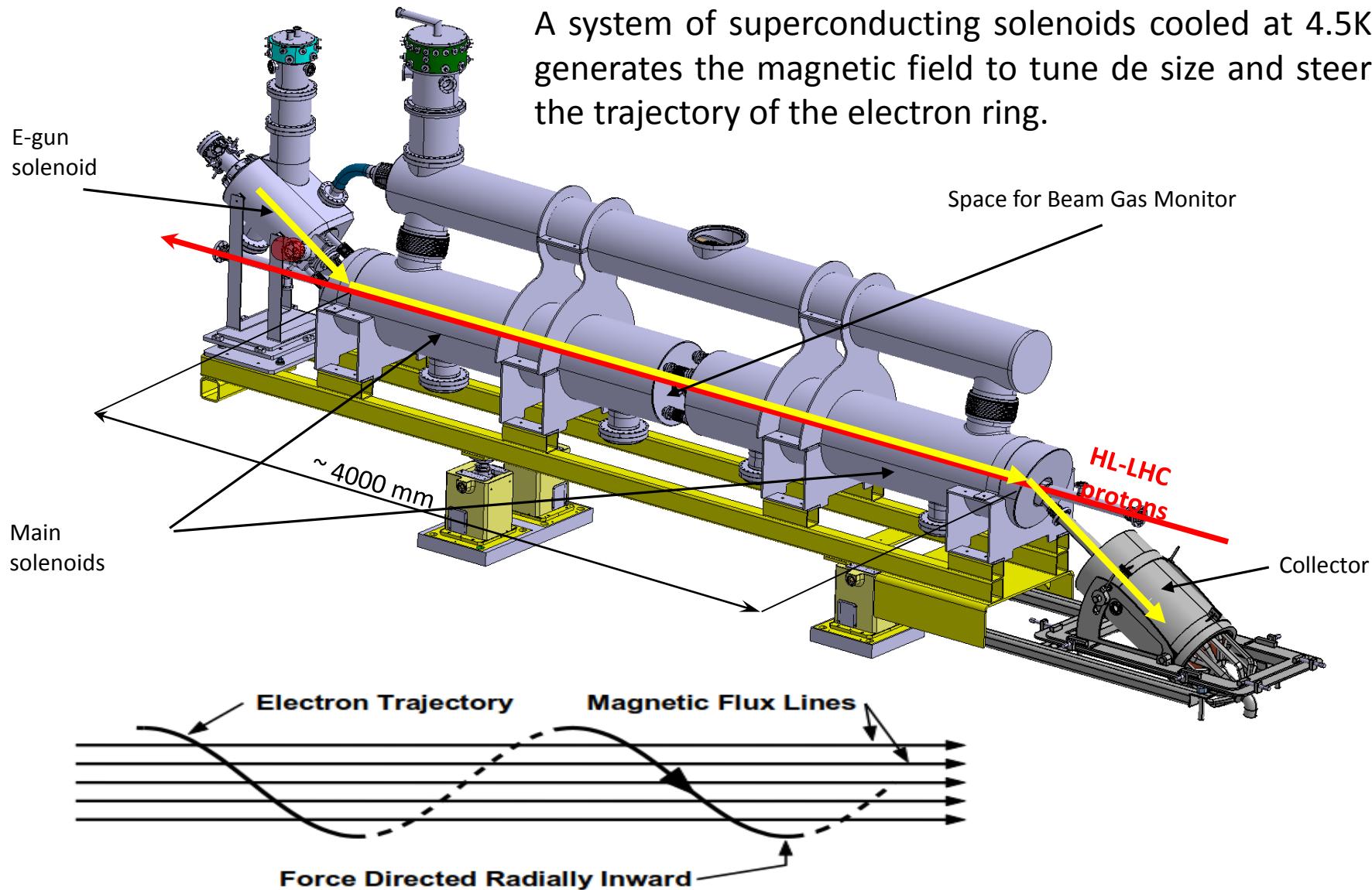
Outline

- ❑ Number of circuits. High current and low current.
- ❑ Circuits – Bus-bars and splices.
- ❑ Inductances – Quench protection.
- ❑ Conclusions.

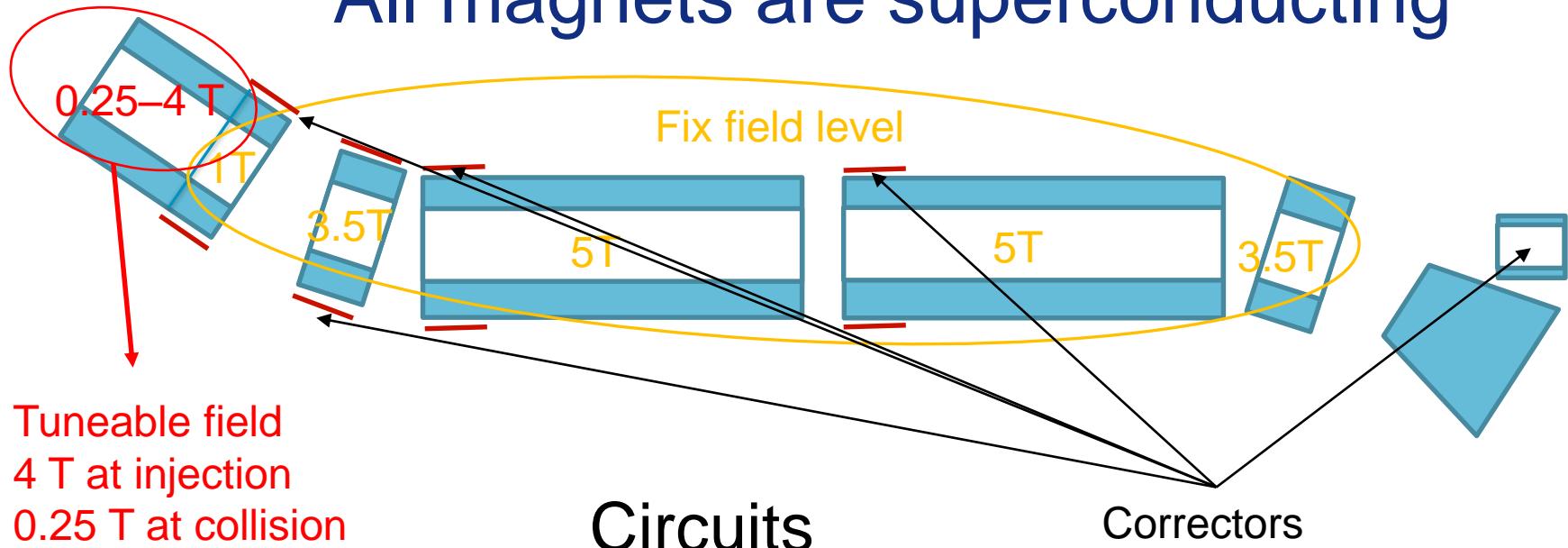
Work carried out under the WP5 HL study.

The system configuration

Electrons are produced by the cathode of an e-gun. A system of superconducting solenoids cooled at 4.5K generates the magnetic field to tune de size and steer the trajectory of the electron ring.



Magnetic field configuration. All magnets are superconducting

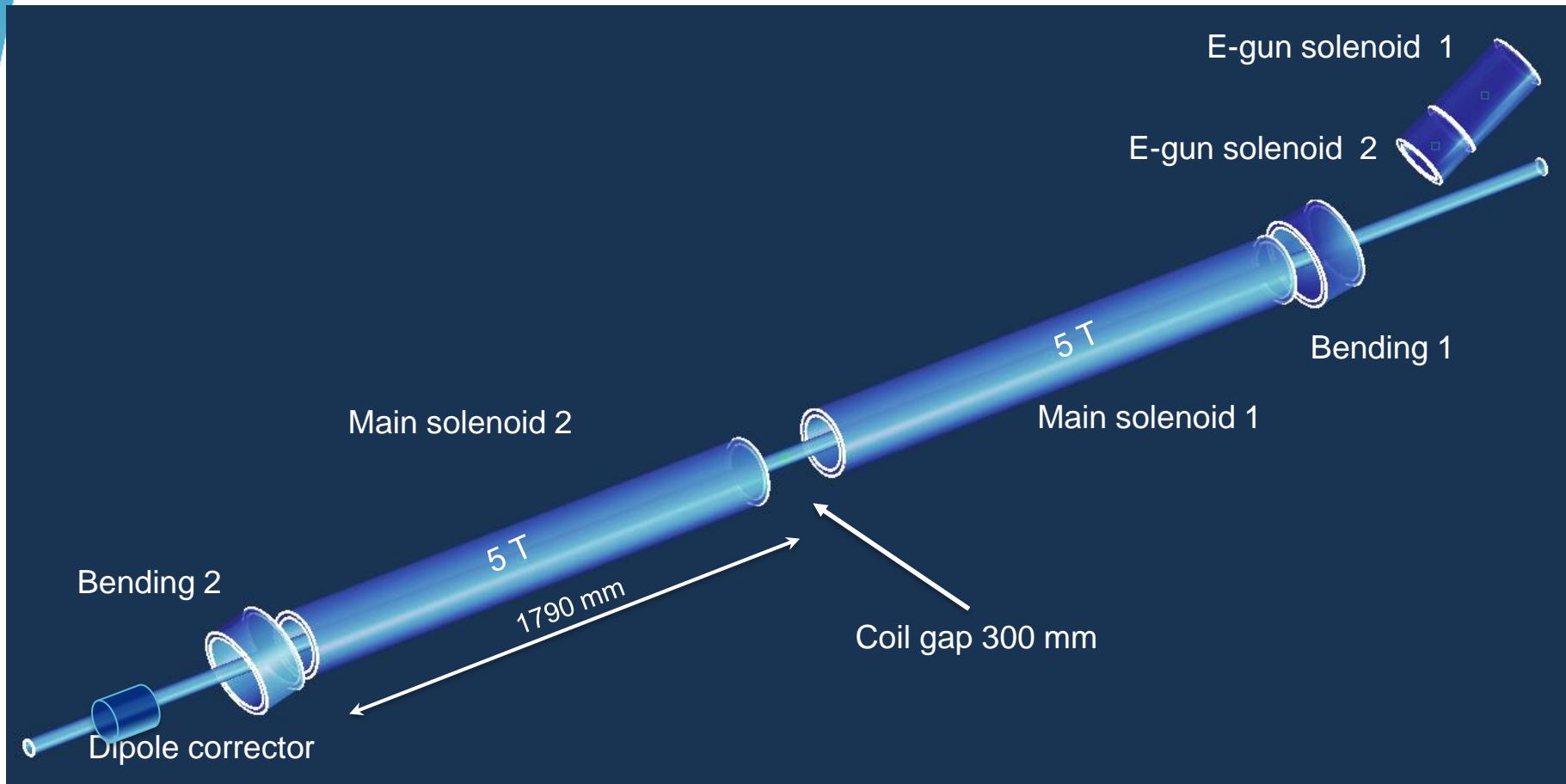


2 solenoids e-gun
1 bending solenoids
2 main solenoids

1 Dipole V e-gun
1 Dipole H e-gun
2 Dipole V main
2 Dipole H main
1 Dipole V at the exit (in series with the bending)
1 Dipole V, 1 Dipole H, 2 Quadrupoles, bending 1

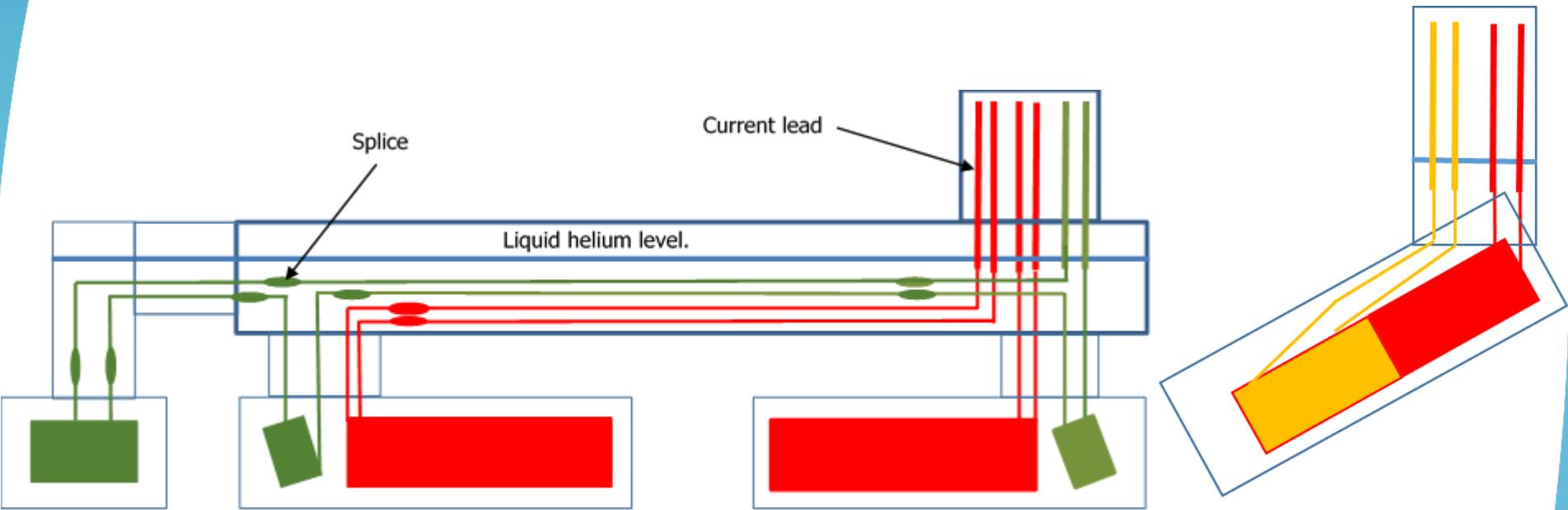
Tot: 5 circuits with current < 450 A, 10 circuits with current < 50 A

Circuits – main parameters. EDMS 2036694



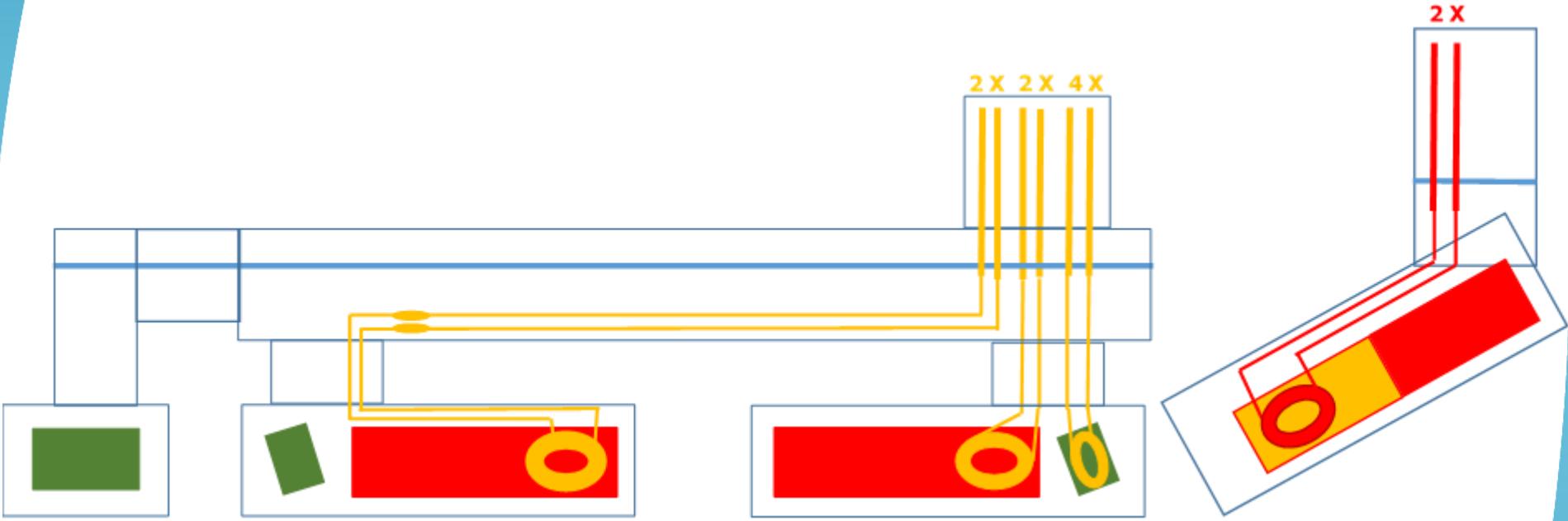
All the magnets are wound with the same cable. The size is 1.65 mm x 1.05 mm (insulated). The Cu – NbTi ratio is 4:1. The minimum critical current is 750 A at 5T.

High current circuits. $I=350$ A



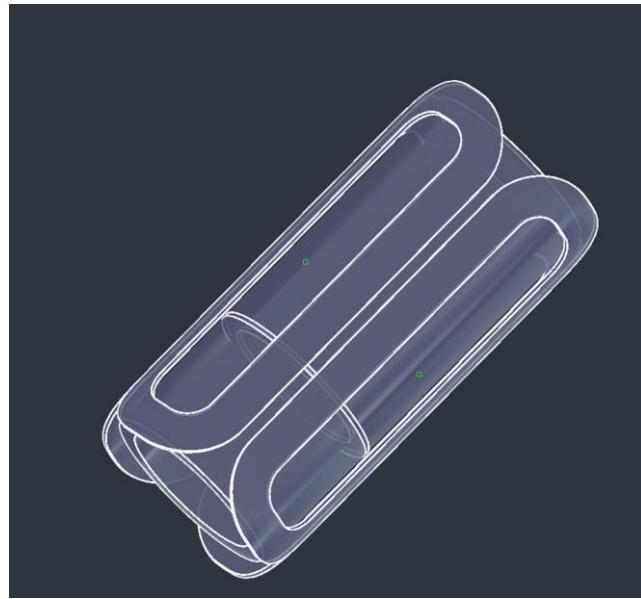
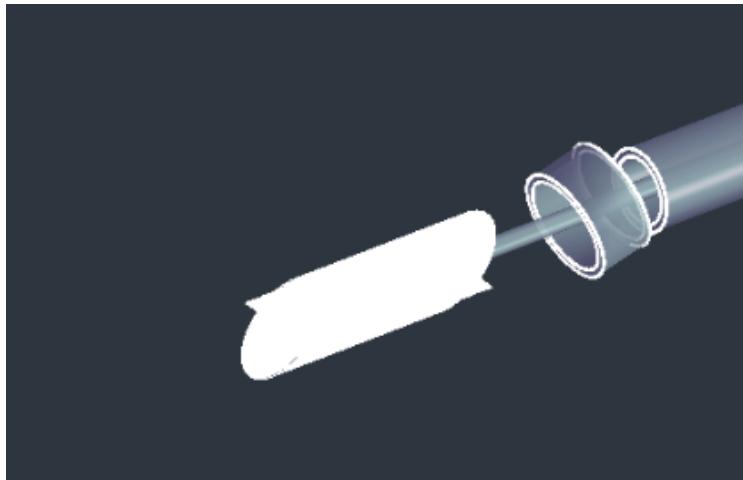
	Nominal current [A]	Inductance [mH]	Inner bore diameter [mm]	Length [mm]	Number of turns	Cable size L [mm] x h [mm]
Main solenoid 1	350	9380	180	1790	21700	1.65 x 1.05
Main solenoid 2	350	9380	180	1790	21700	1.65 x 1.05
Bending 1	350	850	258	150	1820	1.65 x 1.05
Bending 2	350	850	258	150	1820	1.65 x 1.05
Dipole corrector	350	1011	180	CCT dip.	CCT dip.	1.65 x 1.05
e-gun solenoid 1	0-350	851	152	300	3458	1.65 x 1.05
e-gun solenoid 2	350	329	152	145	1672	1.65 x 1.05

Low current circuits. $I_{MAX}=50$ A



	Maximum current [A]	Inductance [mH]	Cable size L [mm] x h [mm]
M. Sol. 1 – vert. dipole	50	57	1.65 x 1.05
M. Sol. 1 – hor. dipole	50	57	1.65 x 1.05
M. Sol. 2 – vert. dipole	50	57	1.65 x 1.05
M. Sol. 2 – hor. dipole	50	57	1.65 x 1.05
Bend. 1 - quadrupole	50	120	1.65 x 1.05
Bend. 1 – skew quad.	50	120	1.65 x 1.05
Bend. 1 – vert. dipole	50	57	1.65 x 1.05
Bend. 1 – hor. dipole	50	57	1.65 x 1.05
e-gun 2 – vert. dipole	50	109	1.65 x 1.05
e-gun 2 – hor. dipole	50	109	1.65 x 1.05

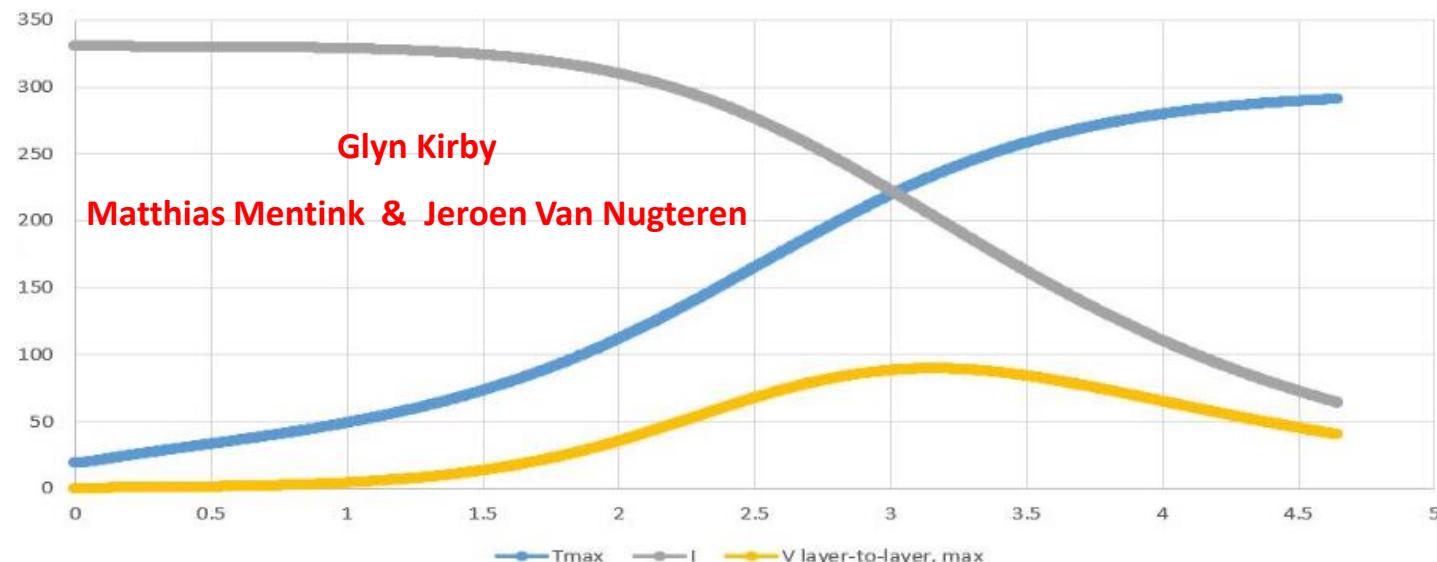
Correctors



Inductances

	Main solenoid 1	Main solenoid 2	Bending 1	Bending 2	Dipole corrector	e-gun solenoid 1	e-gun solenoid 2
Main solenoid 1	9380	36	100	1	0	3.5	3
Main solenoid 2	36	9380	1	100	1	0	0
Bending 1	100	1	850	0	0	4	5
Bending 2	1	100	0	850	3	0	0
Dipole corrector	0	1	0	3	1011	0	0
e-gun solenoid 1	3.5	0	4	0	0	851	83
e-gun solenoid 2	3	0	5	0	0	83	329

5T , 1.5m HEL solenoid
Quench with no extraction



First computations. Natural quench no extraction 5T -1.5m coil.
300 K hot spot too high. 100 V voltage ok.

With Aluminium quench propagation strips the hot spot temperature is ~ 240 K.

These magnets requires quench detection and energy extraction systems. This is what we have today in the design and in the price estimations.



Conclusions

- Circuits are defined. EDMS 2036694
- The 5 T solenoids need energy extraction.
- Final computations and analysis are going on.
Discussed with WP7



Thank you for your attention

