

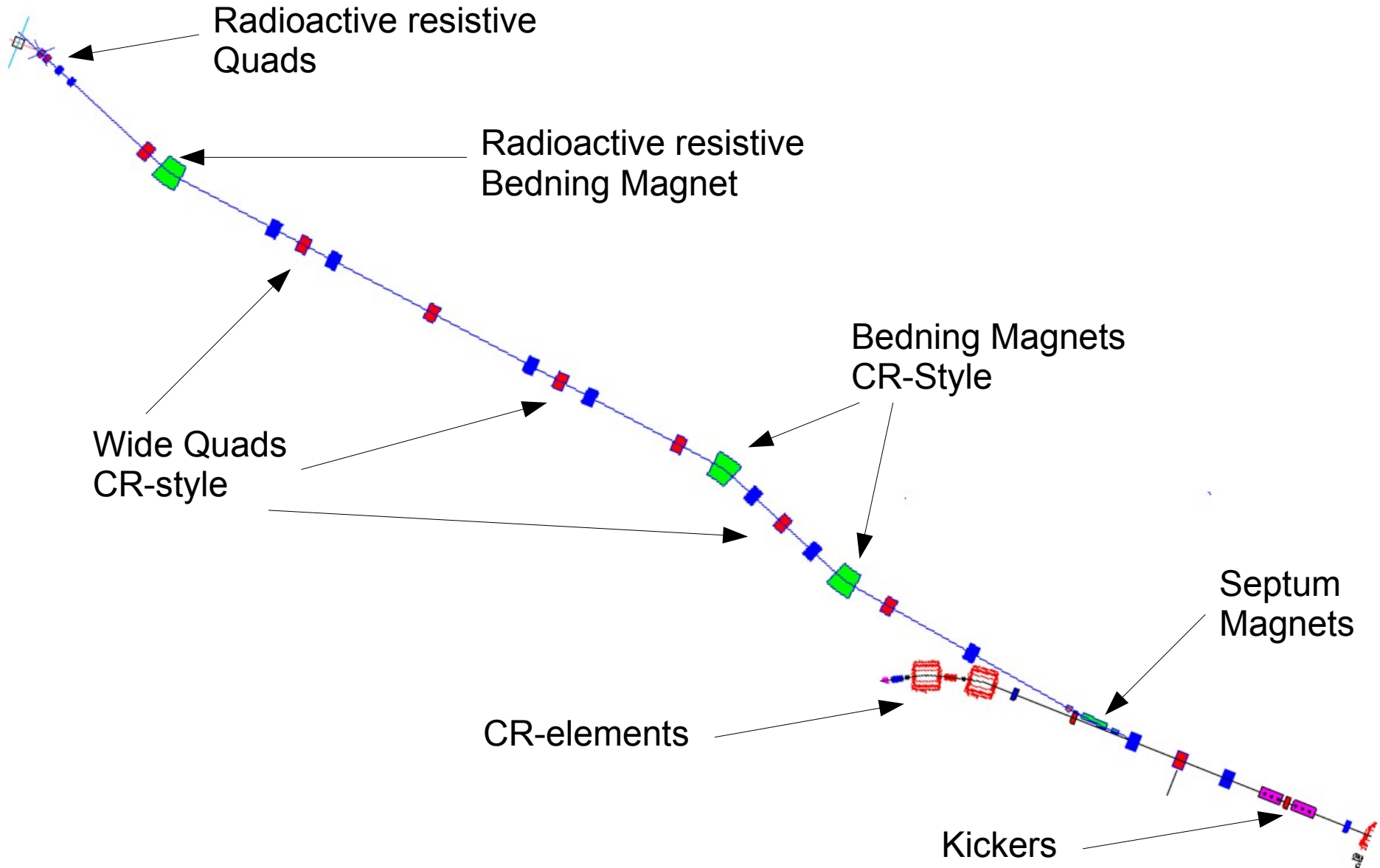
Injection: Concept & Devices

Dr. Petr Shatunov

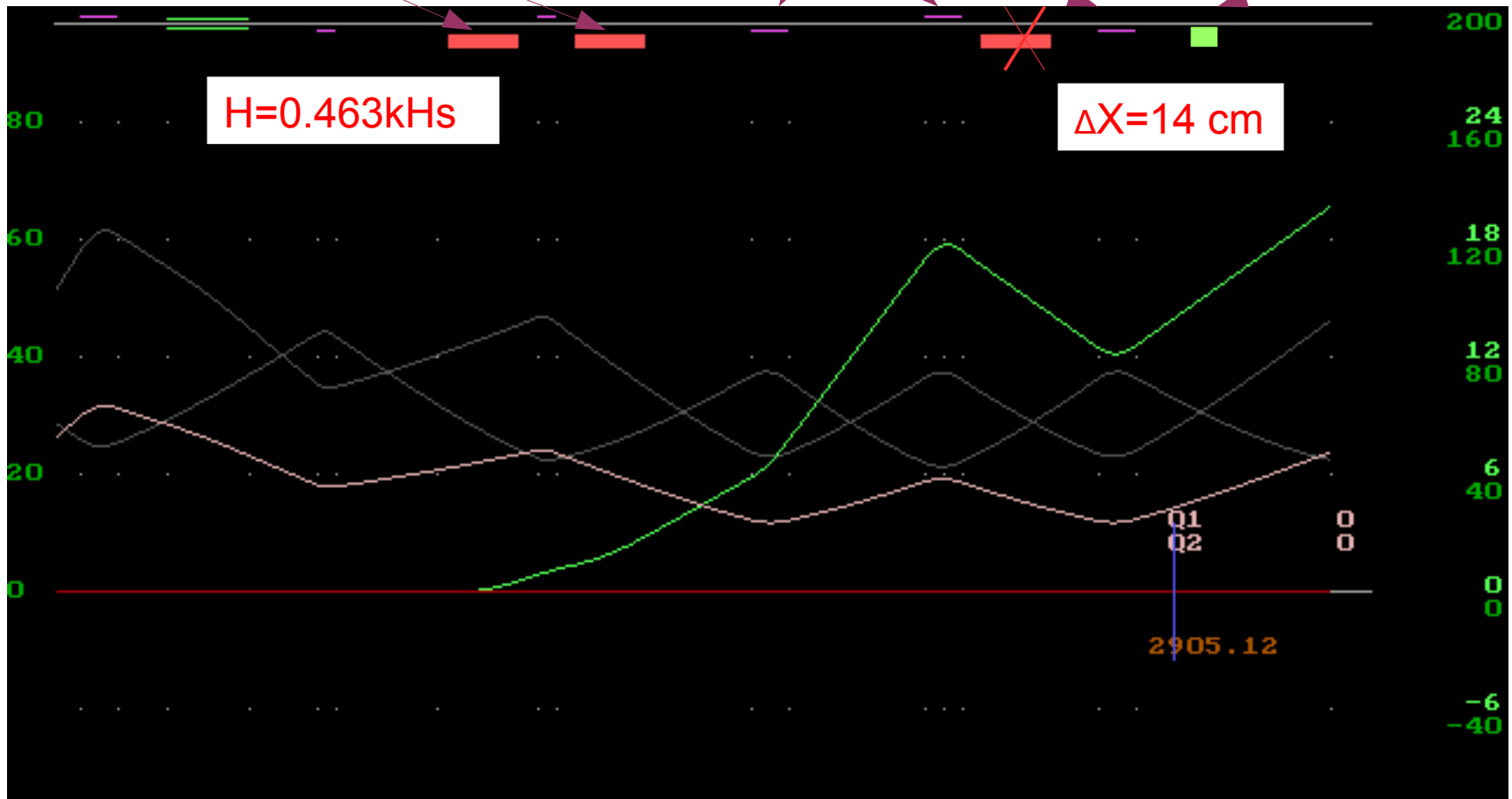
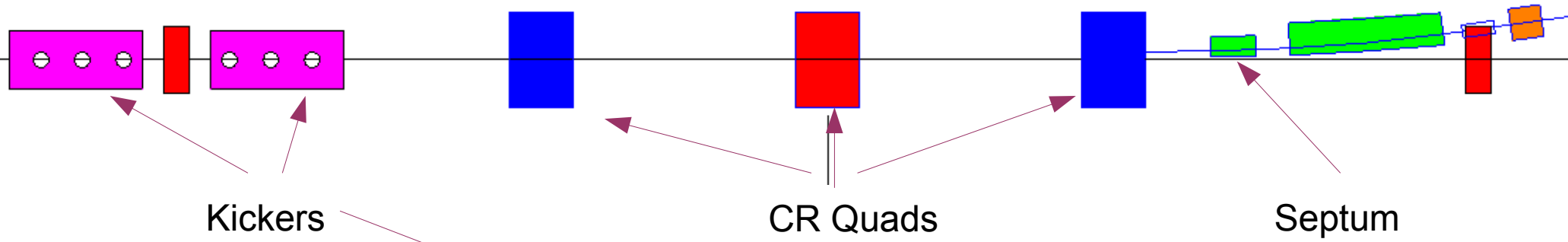
Darmstadt, December, 2014

The Ring and the Channel

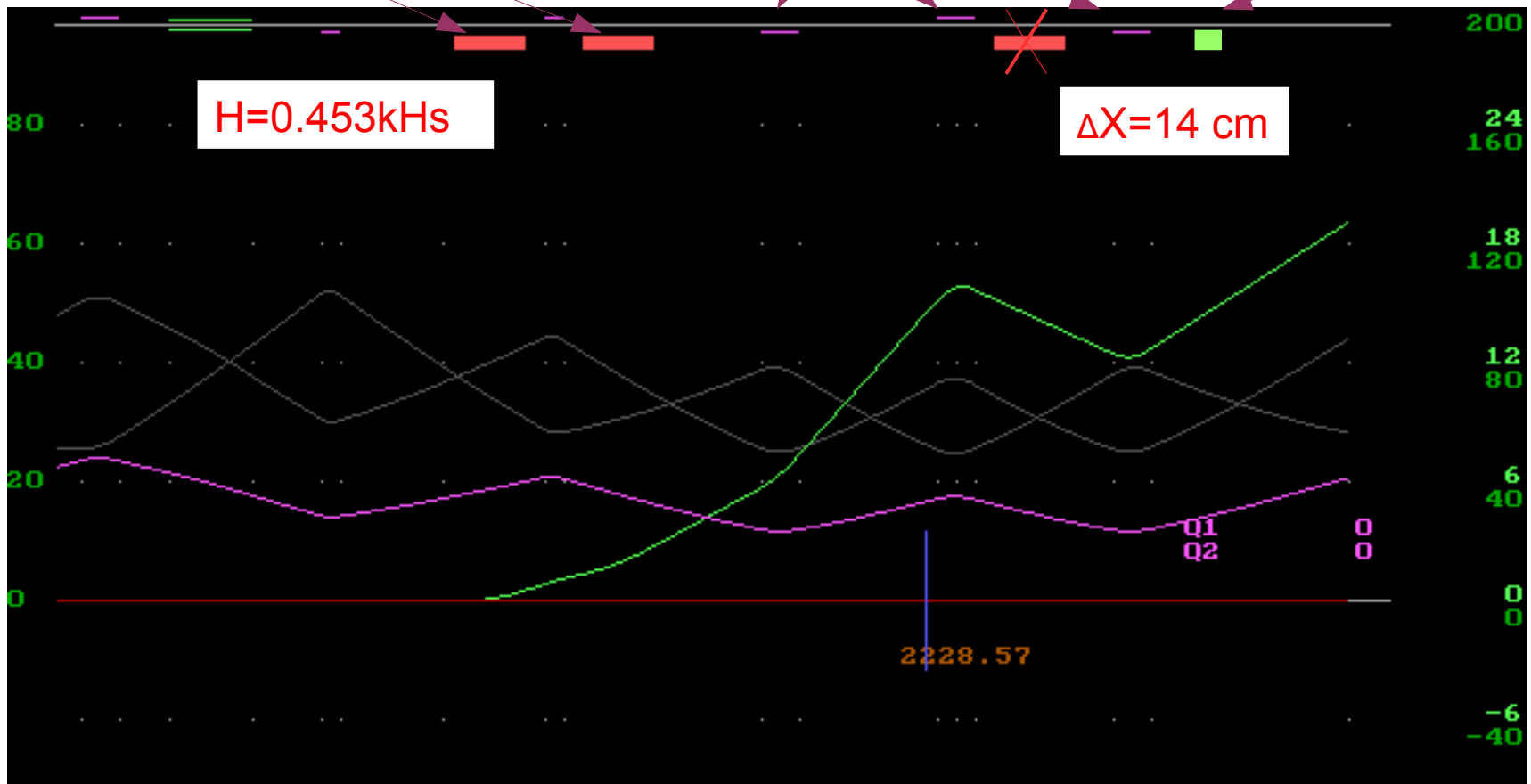
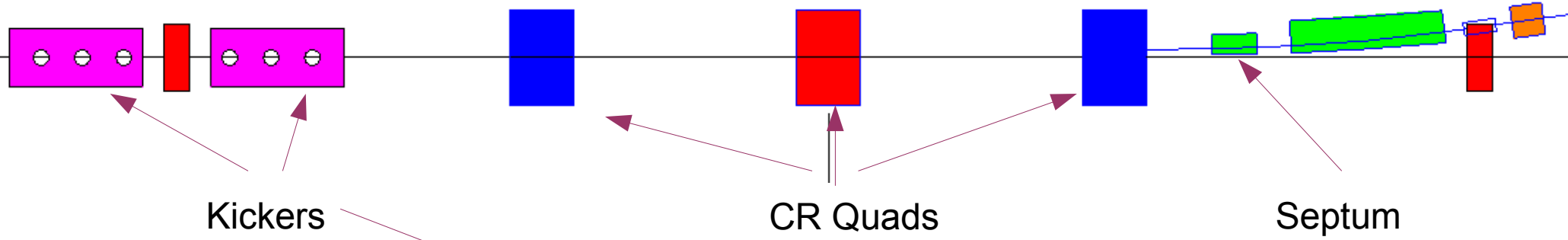
Pbar Target



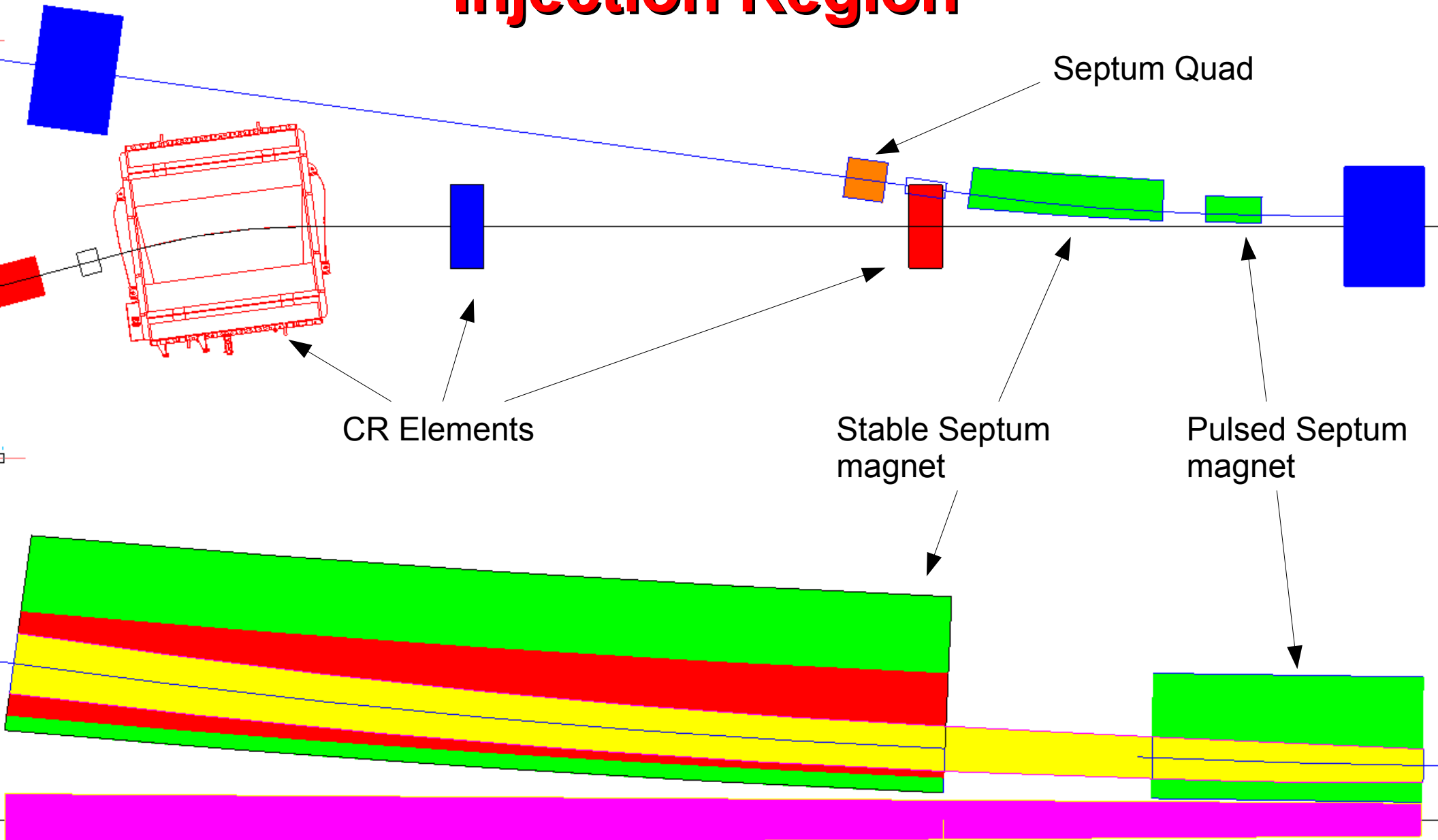
Injection: Pbars



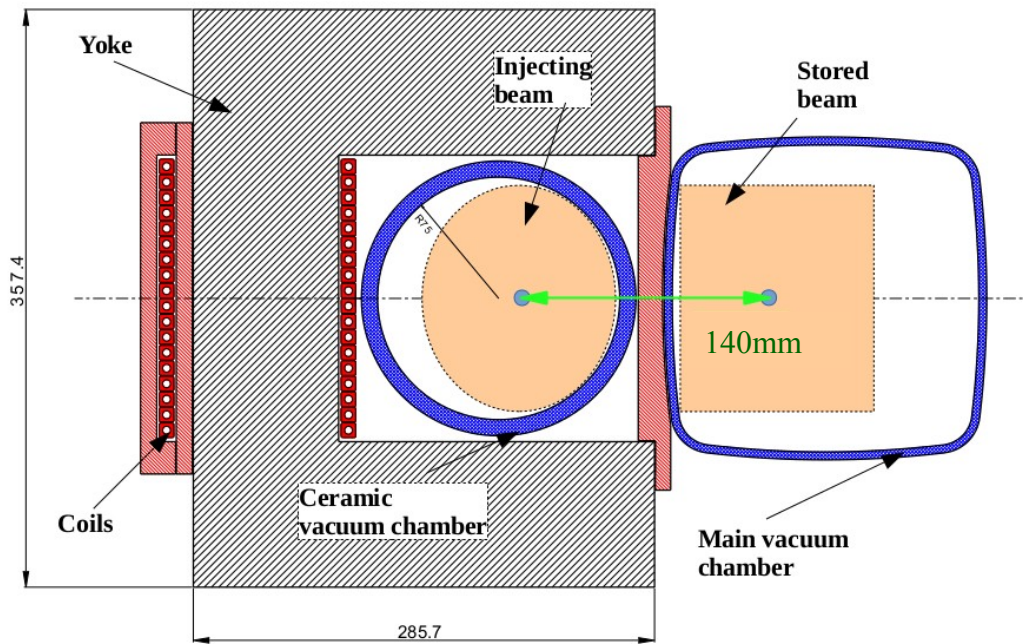
Injection: Ribs



Injection Region

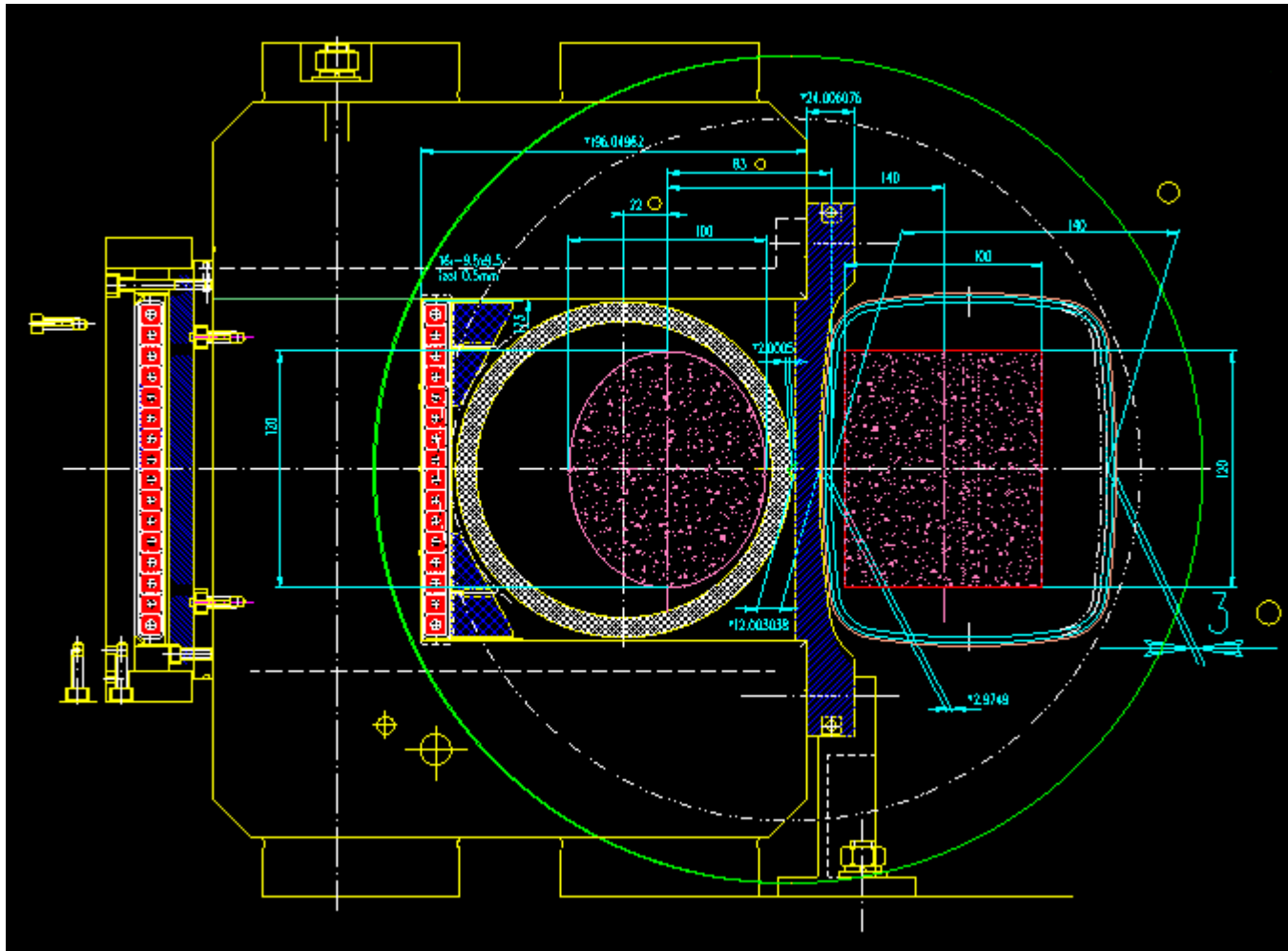


Injection Septum Magnet

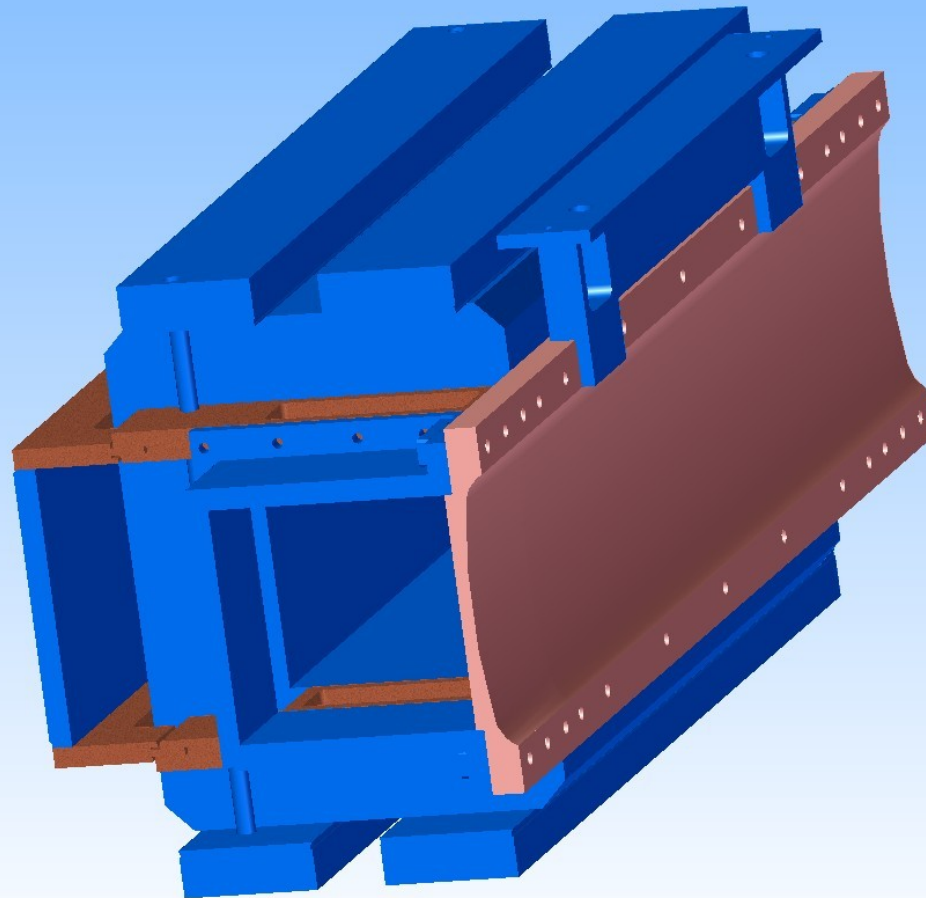


Width and height of the gap	w, h	200 , 175	mm
Magnetic field	B	0.5	T
The number of windings	n	18	
Effective length	l	0.78	m
Angle	α	0.03	r
Current	I	4000	A
Pulse duration, period	T	6	ms
Vacuum chamber thickness	δ	10	mm
Septum magnet thickness	Δ	< 15	mm

Pulsed septum magnet blueprint. The CR side cross section with flange.



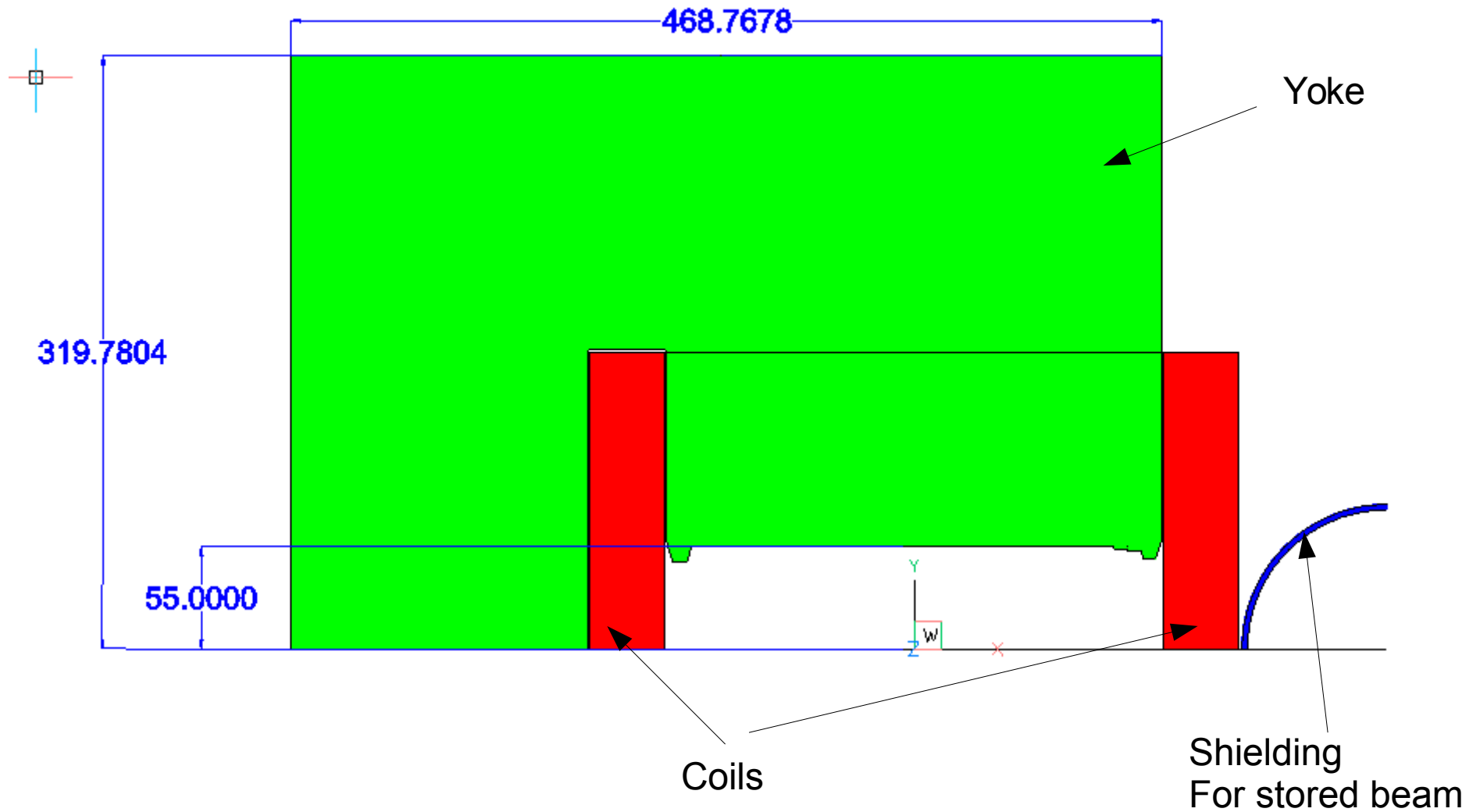
Pulsed septum 3D view



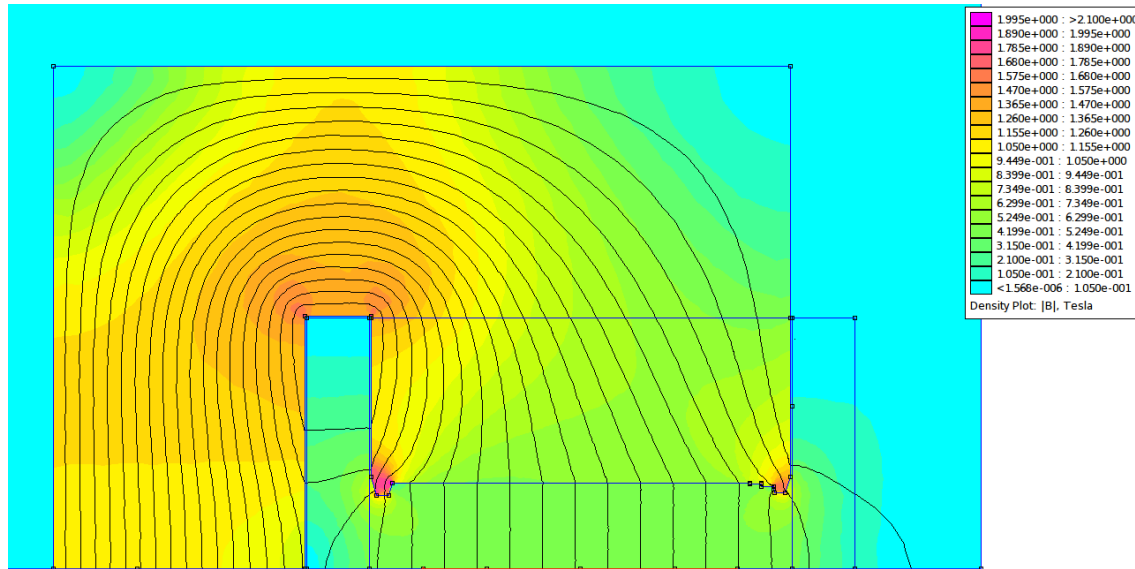
Long septum magnet parameters

Width and height of the gap	w, h	200 , 100	mm
Magnetic field	B	0.51	T
The septum sickness windings	δ	41	mm
Effective length	l	2.318	m
Angle	α	0.09353	r
Current	Matched with CR dipoles		
Vacuum chamber thickness	δ	5	mm
Field quality		0.002	
Coil turns		32	

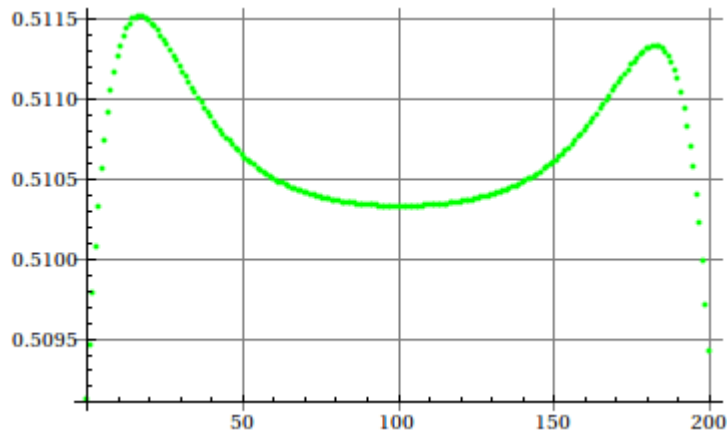
Long septum magnet: 2D model



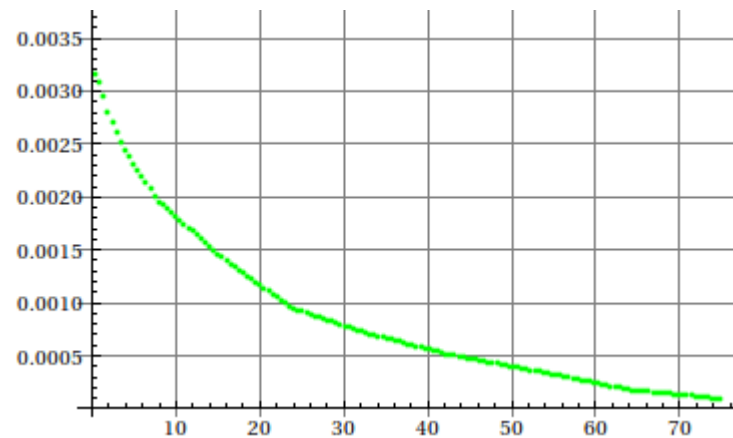
Long septum magnet: 2D model



The flux distribution

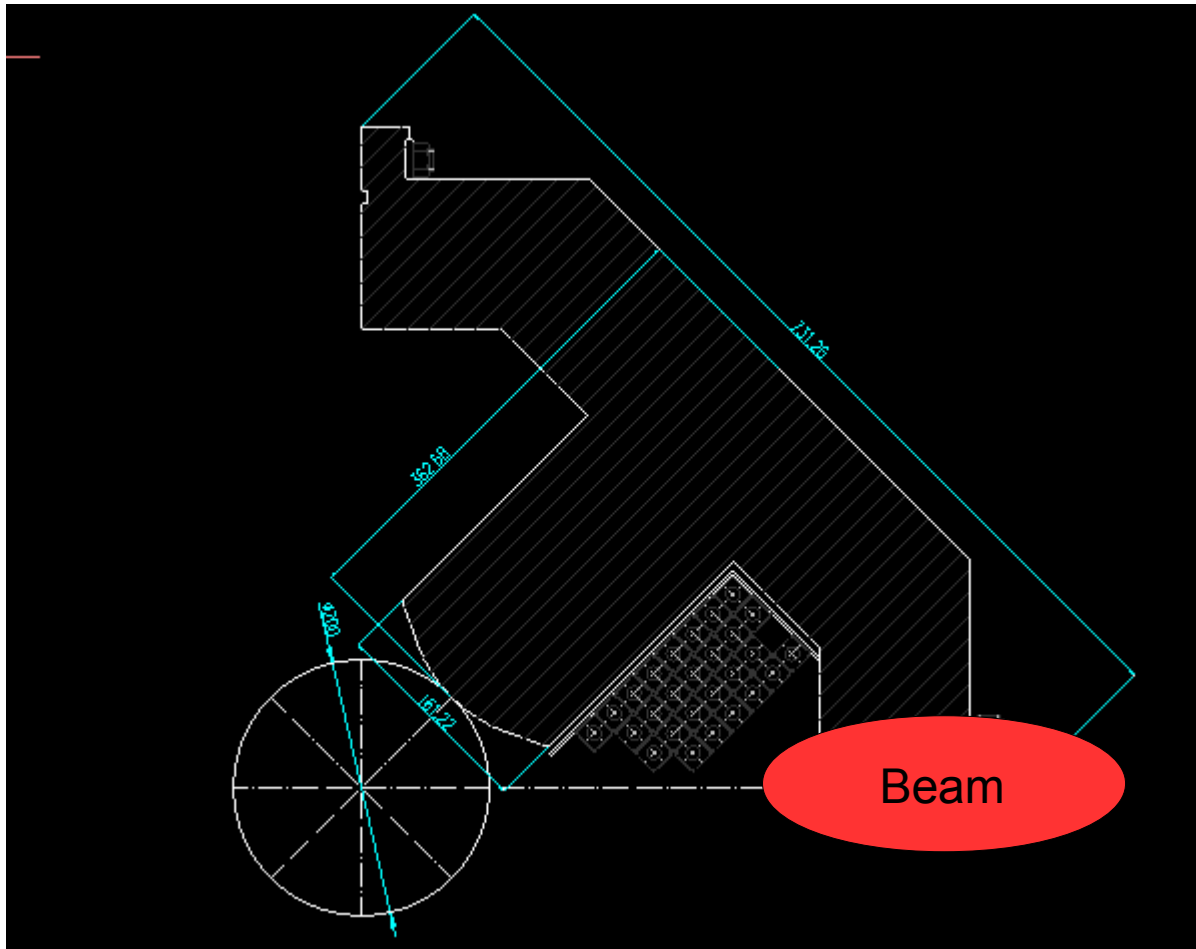


Vertical magnetic field in the aperture, (T)



Vertical magnetic field in the shield, (T)

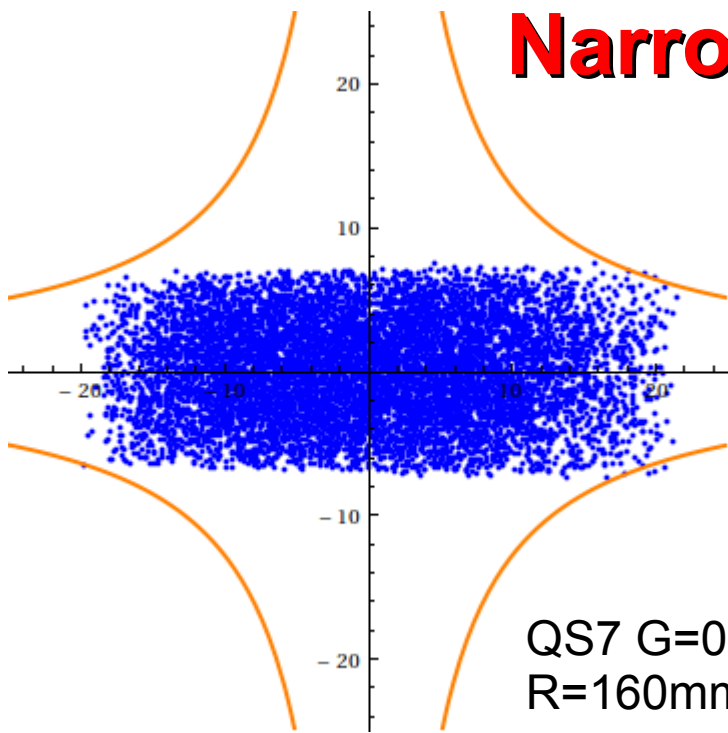
Quadrupole problem



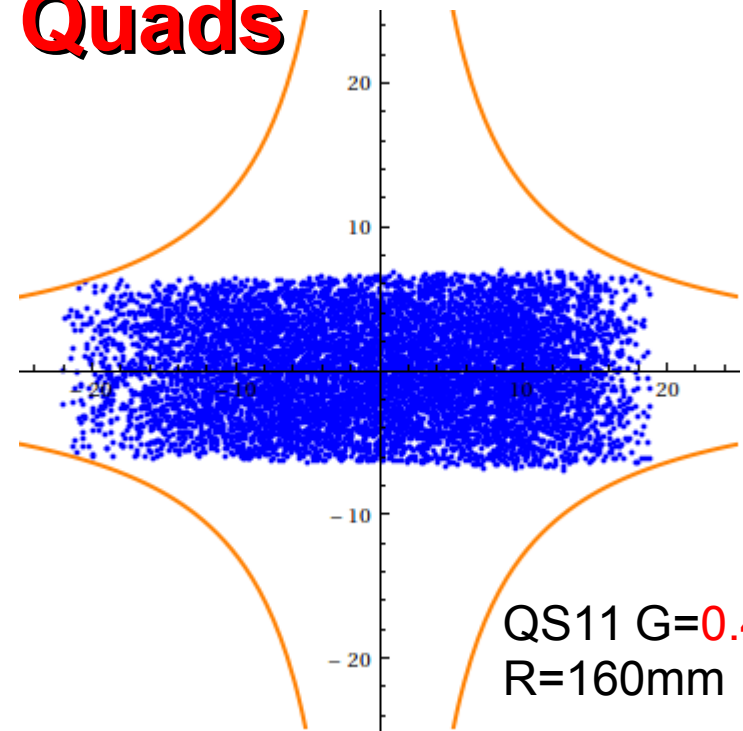
NQ Quad $G=0.42$ kGs/cm
 Septum Quad $G=0.45$ kGs/cm

PARAMETER	ед./unit	велич./value
Type of lens	Quadrupole	
Total magnet length	660	mm
Total magnet width	1040	mm
Total magnet height	1040	mm
Yoke length	420	mm
Yoke weight	1,6	to
Coils weight	0,55	to
Total weight	2,15	to
Aperture radius	100	mm
Maximal gradient	7	T/m
Effective magnet length	500	mm
Homogeneity value	0,0005	
Homogeneity area	A x B	mm
Wire size	20.1 x 20.1	mm
Cooling hole diameter	11	mm
Wire crossection	305	mm ²
Average turn length	1,85	m
Wire length in coil	49,95	m
Turns per coil	27	N
Turns per lens	108	N
Resistance	13,10	mΩ
Maximal current	1350	A
Maximal DC - voltage	17,69	V
Maximal dissipation power	23,88	kW
Low field inductance	11	mH
Maximal stored energy	10,02	kJ
Cooling water pressure	1,1	Bar
Cooling water velocity	131	cm/sec.
Cooling water requirements	30	l/min

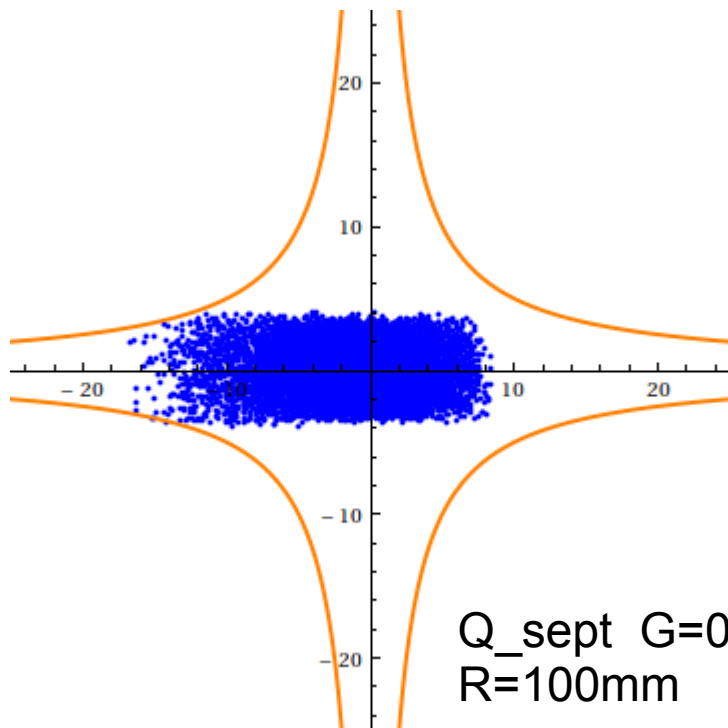
Narrow places, Quads



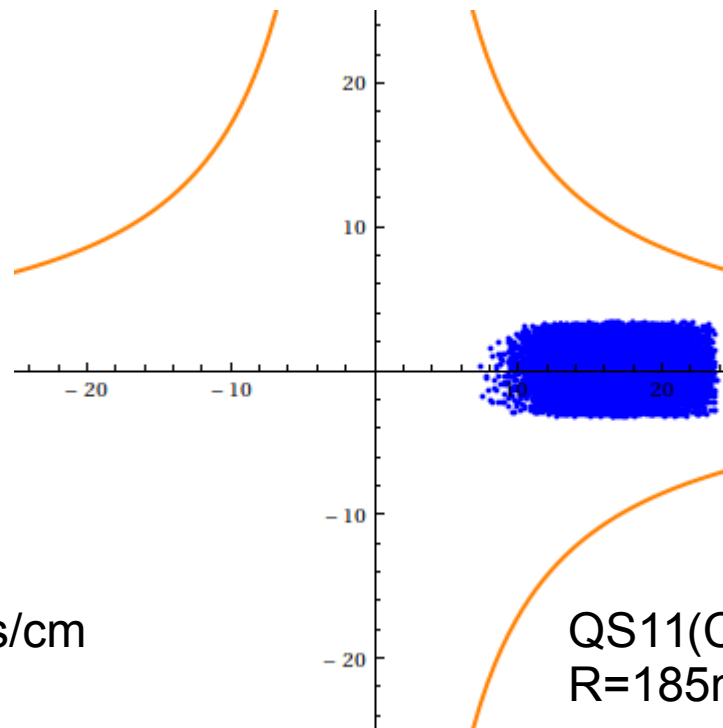
QS7 $G=0.43\text{kGs/cm}$
 $R=160\text{mm}$



QS11 $G=0.46\text{kGs/cm}$
 $R=160\text{mm}$

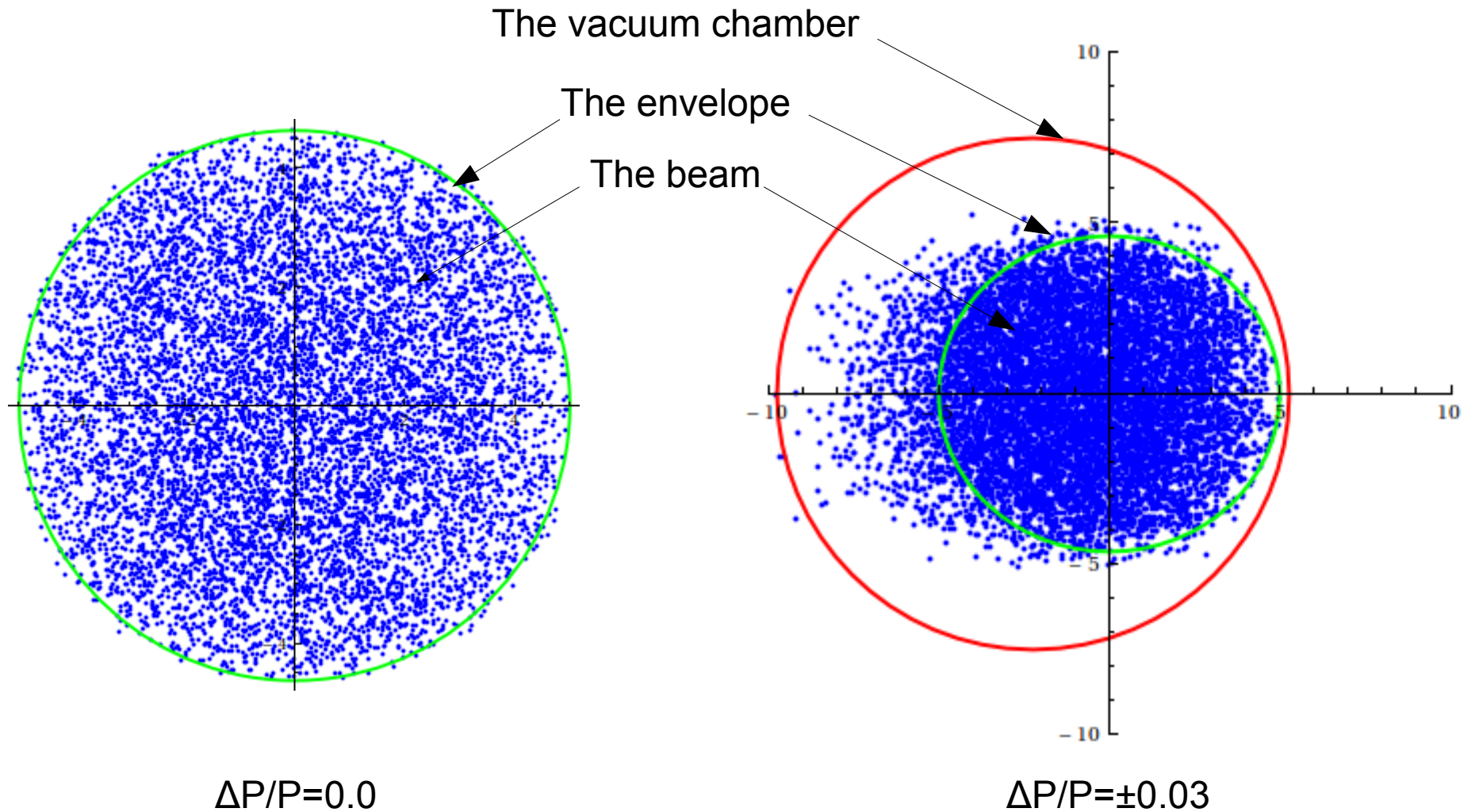


Q_sept $G=0.45\text{ kGs/cm}$
 $R=100\text{mm}$



QS11(CR) $G=0.3\text{ kGs/cm}$
 $R=185\text{mm}$

Narrow places, Septum Magnet



Transversal distributions
Beam sizes: X=5.1cm Y=4.9cm

Thank you!