Electrostatic Deflector Development

Dr. Kirill Grigoryev
Institute for Nuclear Physics (IKP)
for JEDI collaboration

MOTIVATION

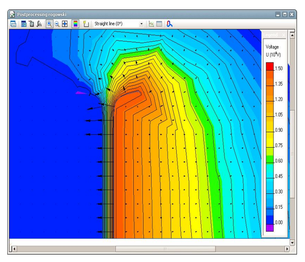
Precision experiments like, search for the permanent electric dipole moments (EDM) with polarized protons or deuterons, require a dedicated electrostatic or combined electro-magnetic storage ring. High field electrostatic bending elements are necessary to achieve high sensitivity of the beam position.

STORAGE RING EXPERIMENTAL REQUIREMENTS

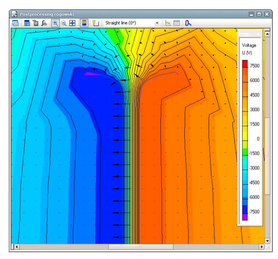
Particle	p (MeV/c)	E (MV/m)	B (T)
Proton	701	16.79	0.000
Deuteron	1000	-3.98	0.160
^{3}He	1285	17.16	-0.051

SIMULATIONS

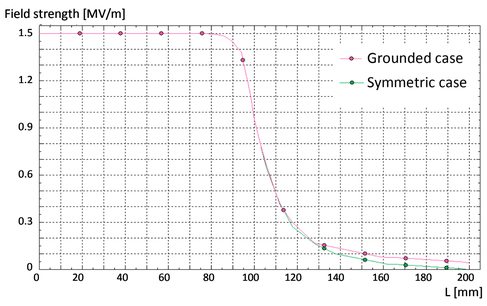
SYMMETRIC POWER SUPPLIES OR GROUNDED CASE



Grounded : U1 = 0, U2 = 2U

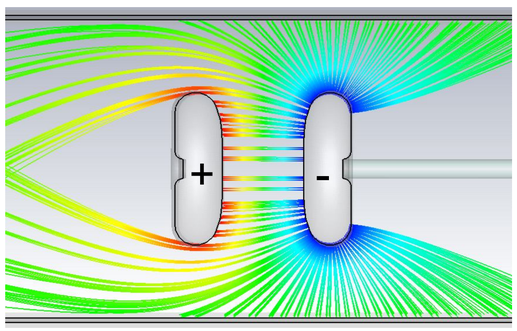


Symmetric : U1 = -U2 = U

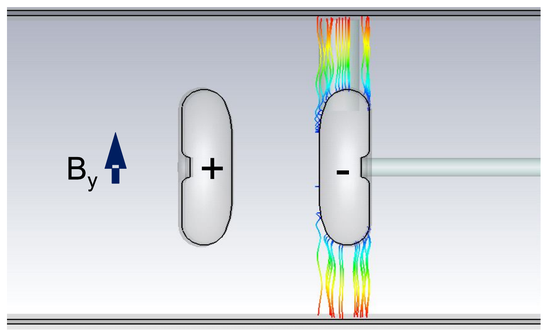


ELECTRONS EMISSION

Electrons initial energy: 50 eV, Voltage: ±100 kV → 4MV/m



B-field: 0 T

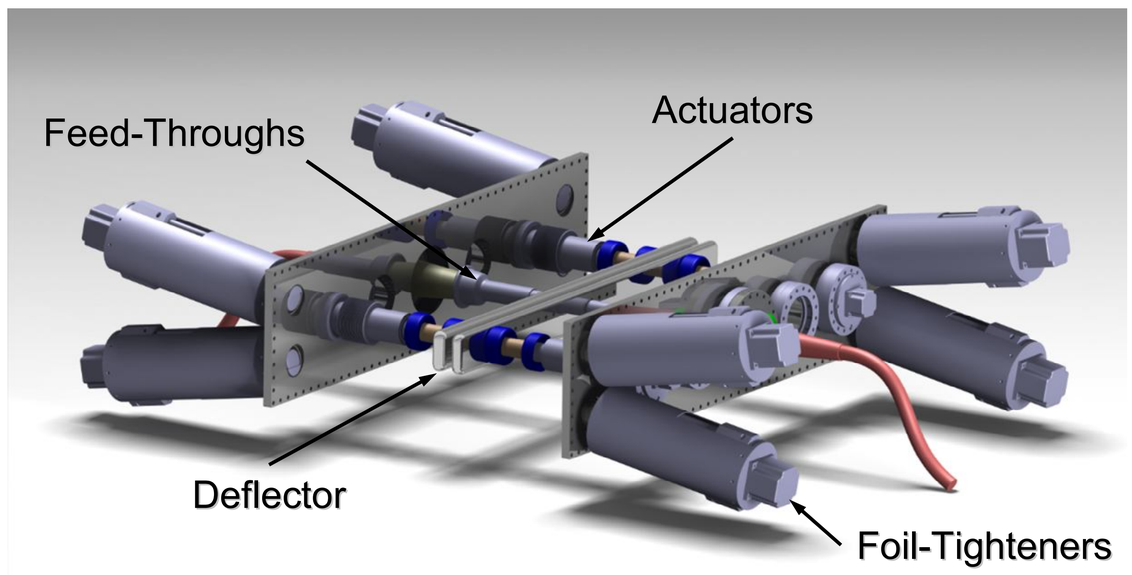


B-field: 0.15 T

SMALL SCALE SETUP

Setup with few centimeters deflectors
- less weight - simplify support;
- easy to machine and prepare the surface;
- conventional high-voltage devises;
- minimal safety restrictions.

LARGE SCALE SETUP

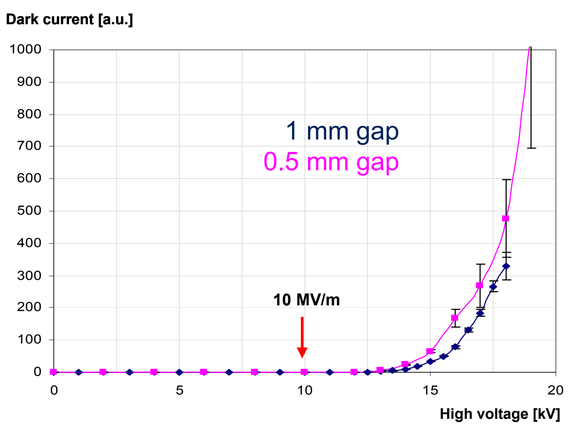


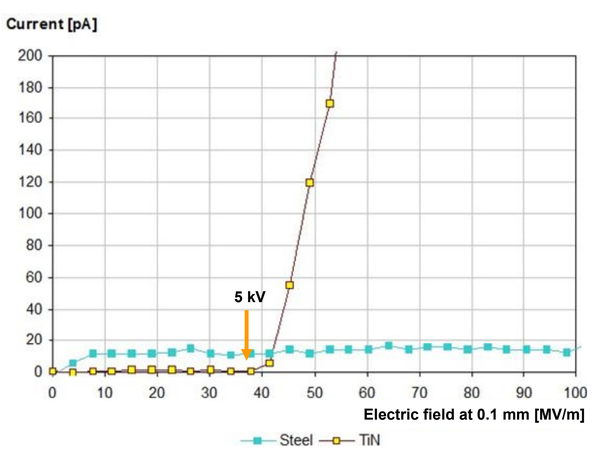
PARAMETERS

Electrode length	=	1020 mm
Electrode height	=	90 mm
Electrode spacing	=	20 – 80 mm
Maximum e-field	=	± 200 MV on each electrode
Material / coating	=	TiN coated Aluminum

RESULTS

DARK CURRENT MEASUREMENTS





Polished stainless steel
- 240 MV/m measured at 0.05 mm with half-sphere vs. flat surface
- 17 MV/m with 17 kV at 1 mm two small half-spheres

Polished aluminum
- 30 MV/m measured at 0.1 mm two small half-spheres

TiN coating
- smaller breakdown voltage
- zero dark current