

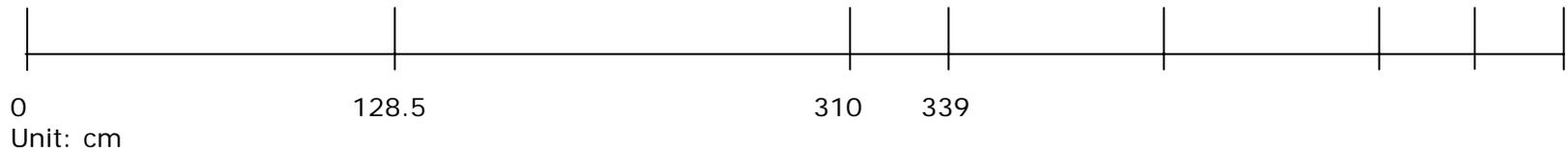
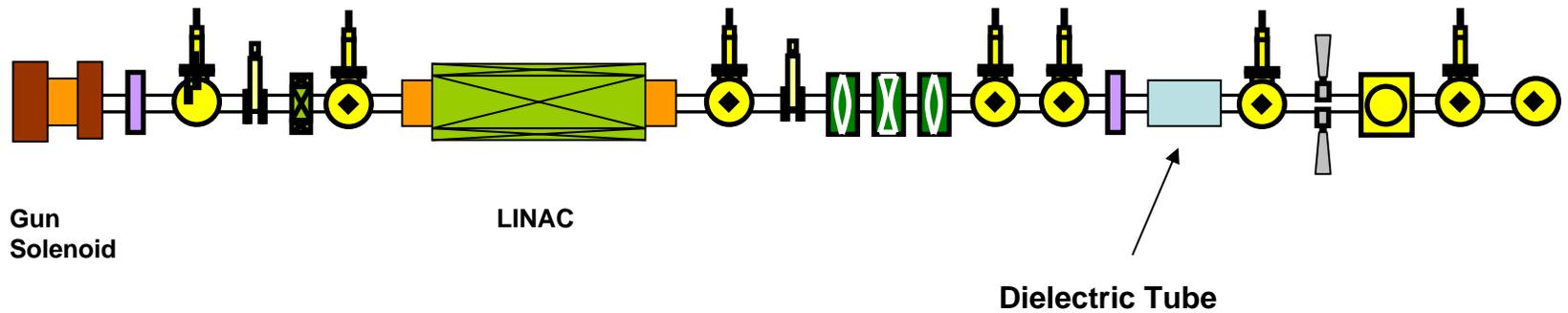
High-charge beam study for experiment of 15.6 GHz dielectric accelerating structure

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Introduction

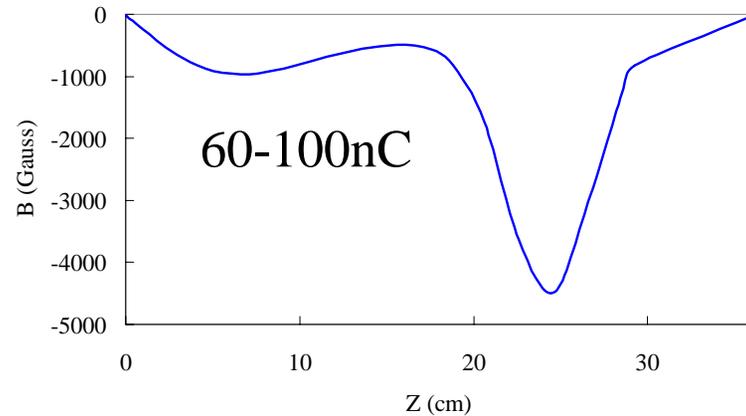
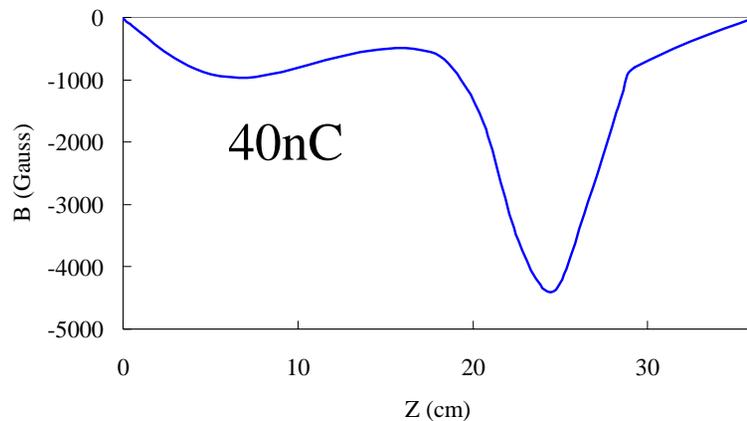
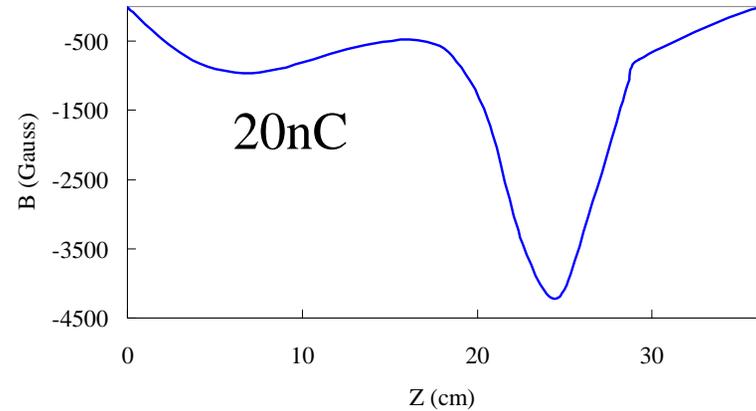
- The purpose of this study is to determine the installation position of 15.6 GHz dielectric accelerating structure in AWA new beamline, so that electron beam with as high charge as possible can pass through this structure. Beam dynamic was studied with the aids of PARMELA.
- The length of the structure is 19.5 cm, and the inner radius is 5mm.
- The initial beam parameters are that laser pulse length = 8ps (FWHM), radius of laser spot is 1cm, and beam charge varied from 20nC to 100nC. RF parameters for gun and Linac were adjusted to obtain beam energy gain 19MeV and 16MeV.

Argonne Wakefield Accelerator Beamline

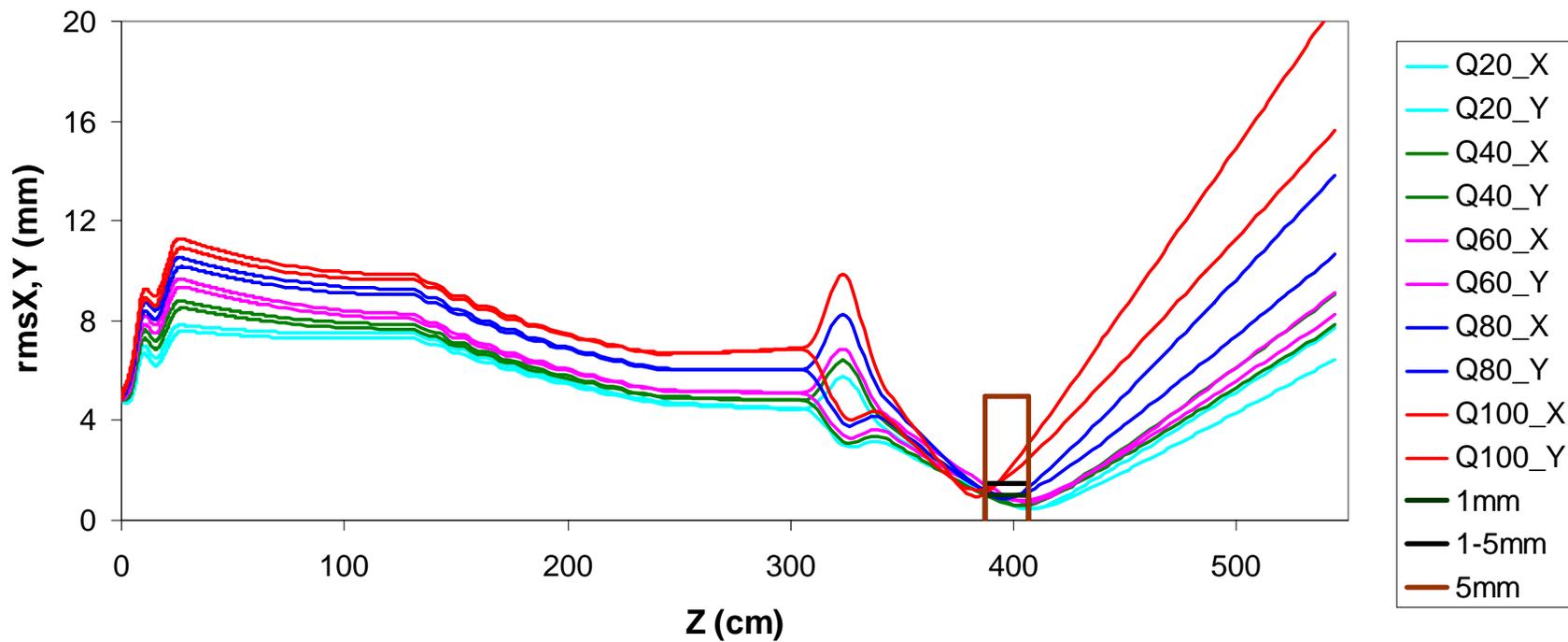


Solenoid field maps along central axis (maximum gun gradient=80MV/m)

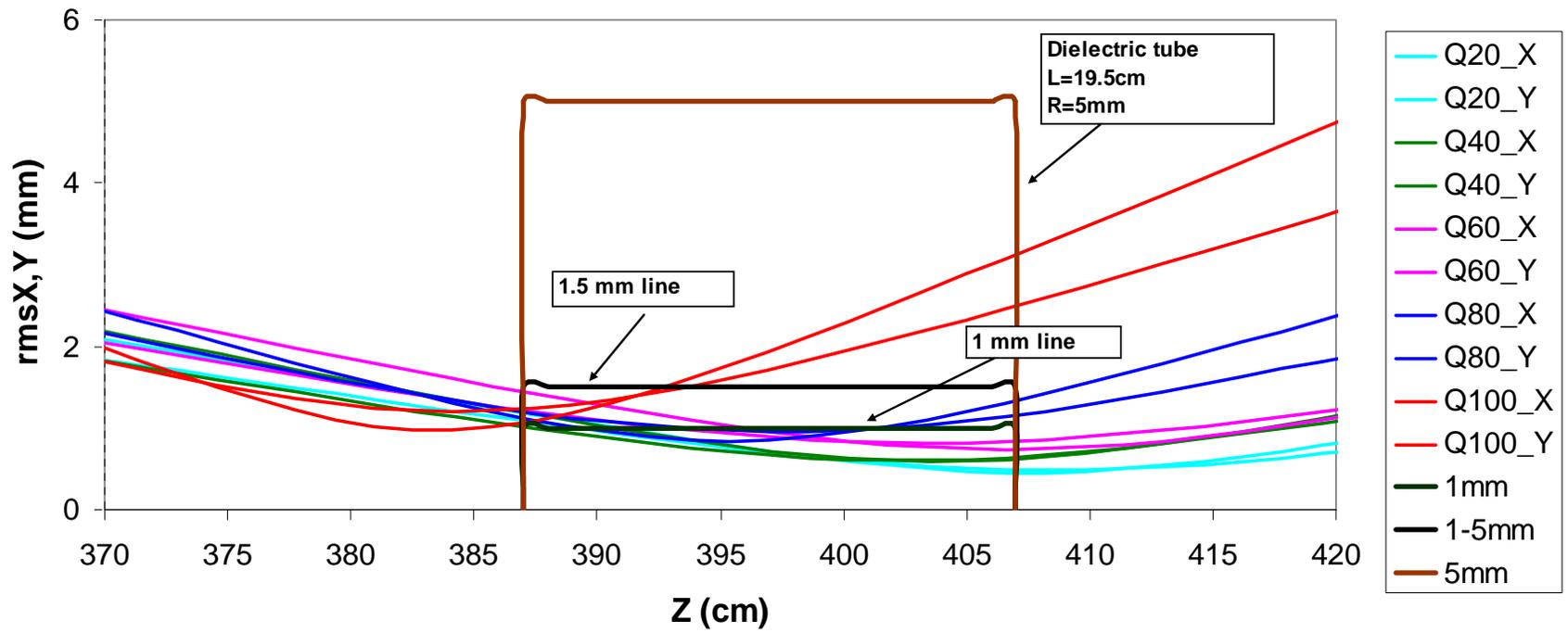
$I_{\text{bucking}}=427\text{A}$,
 $I_{\text{focusing}}=427\text{A}$,
 $I_{\text{matching}}=303\text{A}$ (20nC),
316A (40nC),
322A (60,80,100nC).



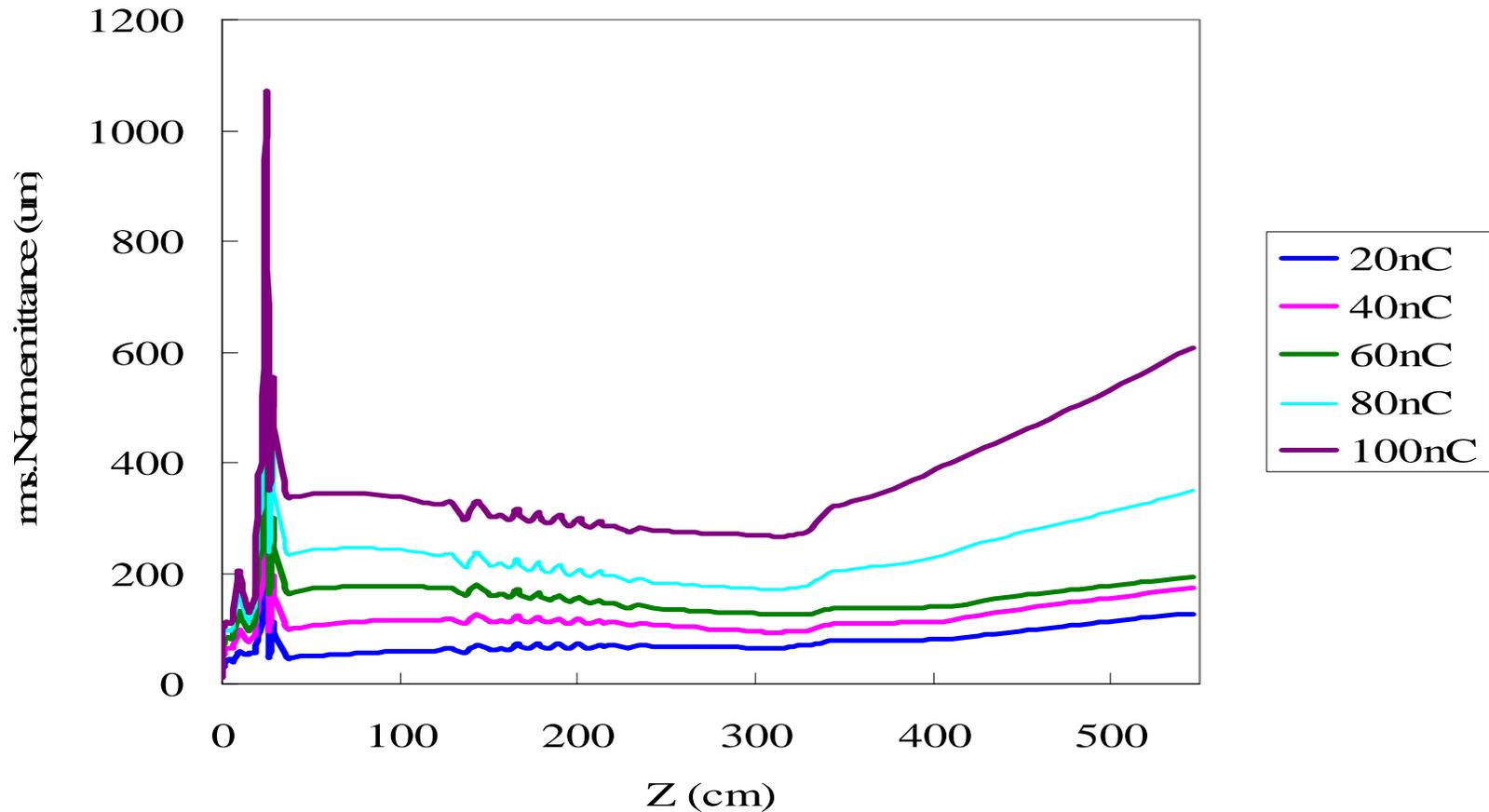
rms. Beam Envelop
(Charge=20--100nC, Beam energy=19MeV)



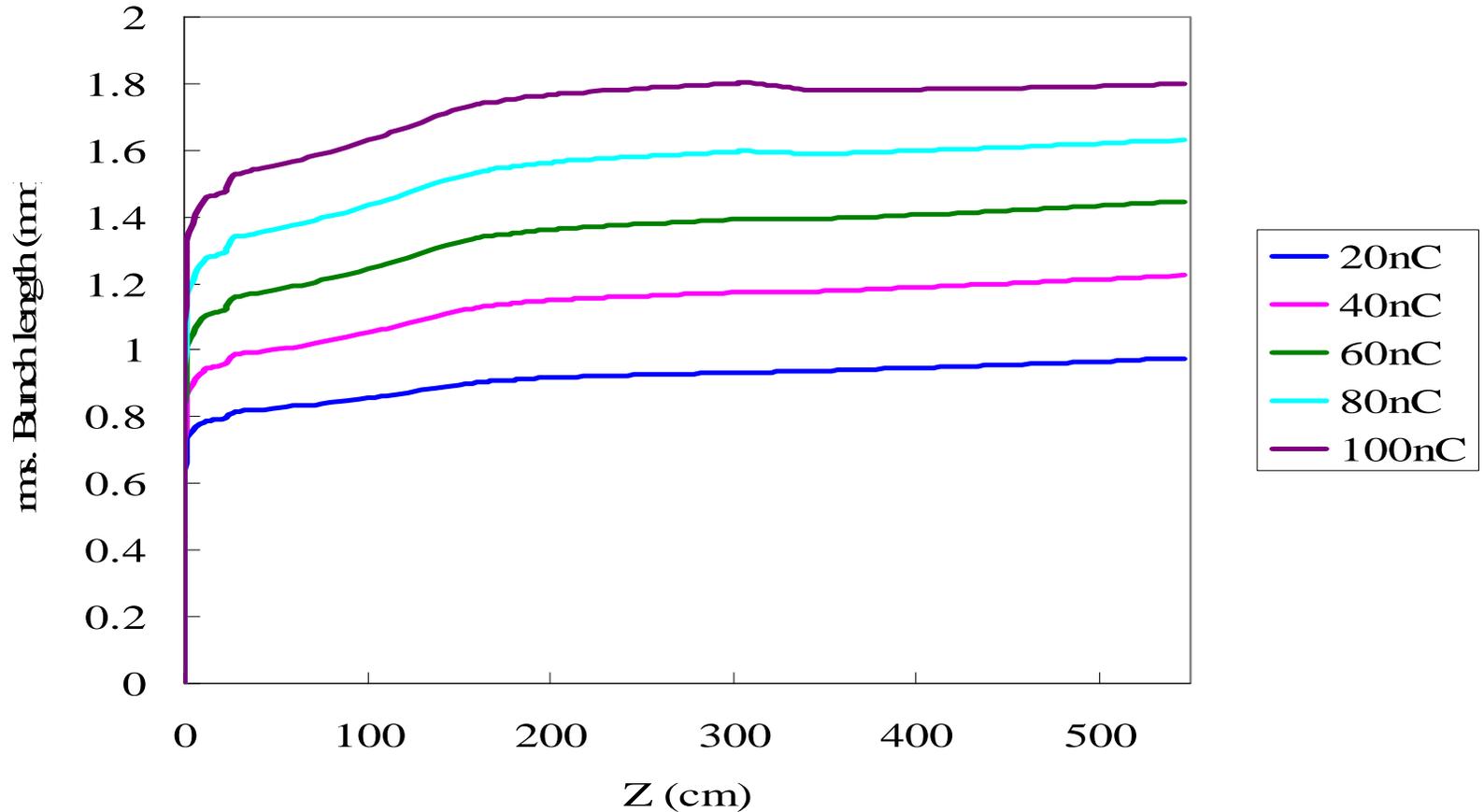
rms. Beam Envelop (Charge=20--100nC, Beam energy=19MeV)



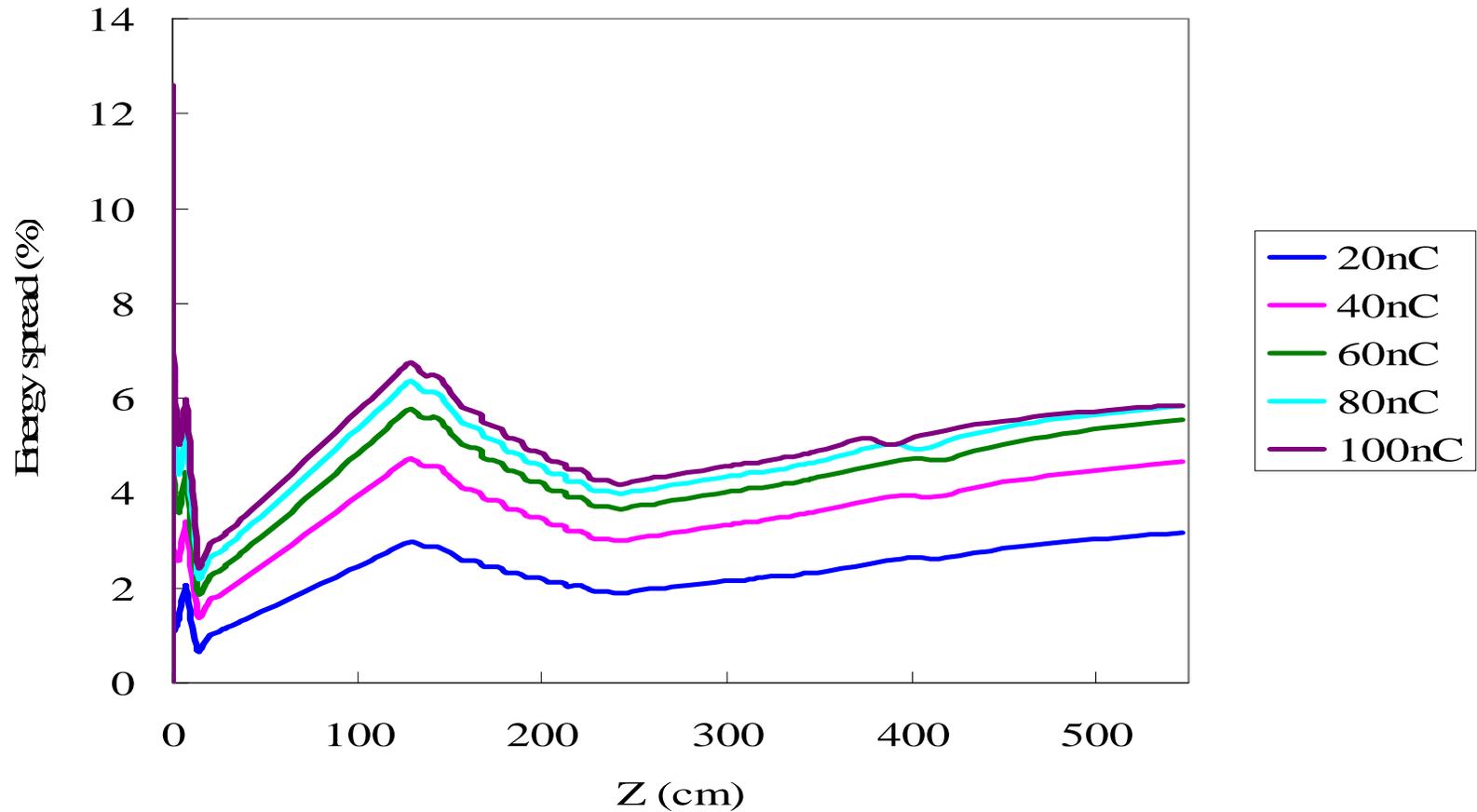
Rms. Norm. emittance at horizontal direction (Beam energy = 19MeV)



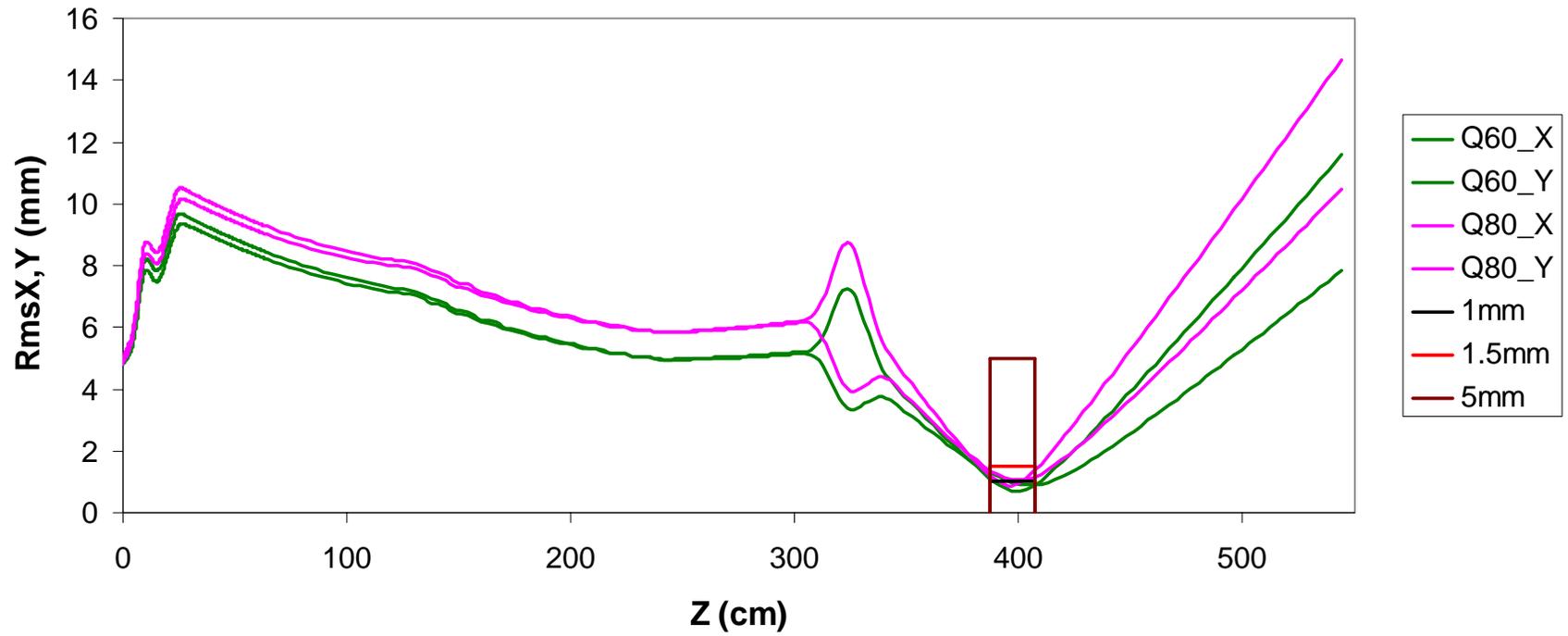
Rms. Bunch length (Beam energy = 19MeV)



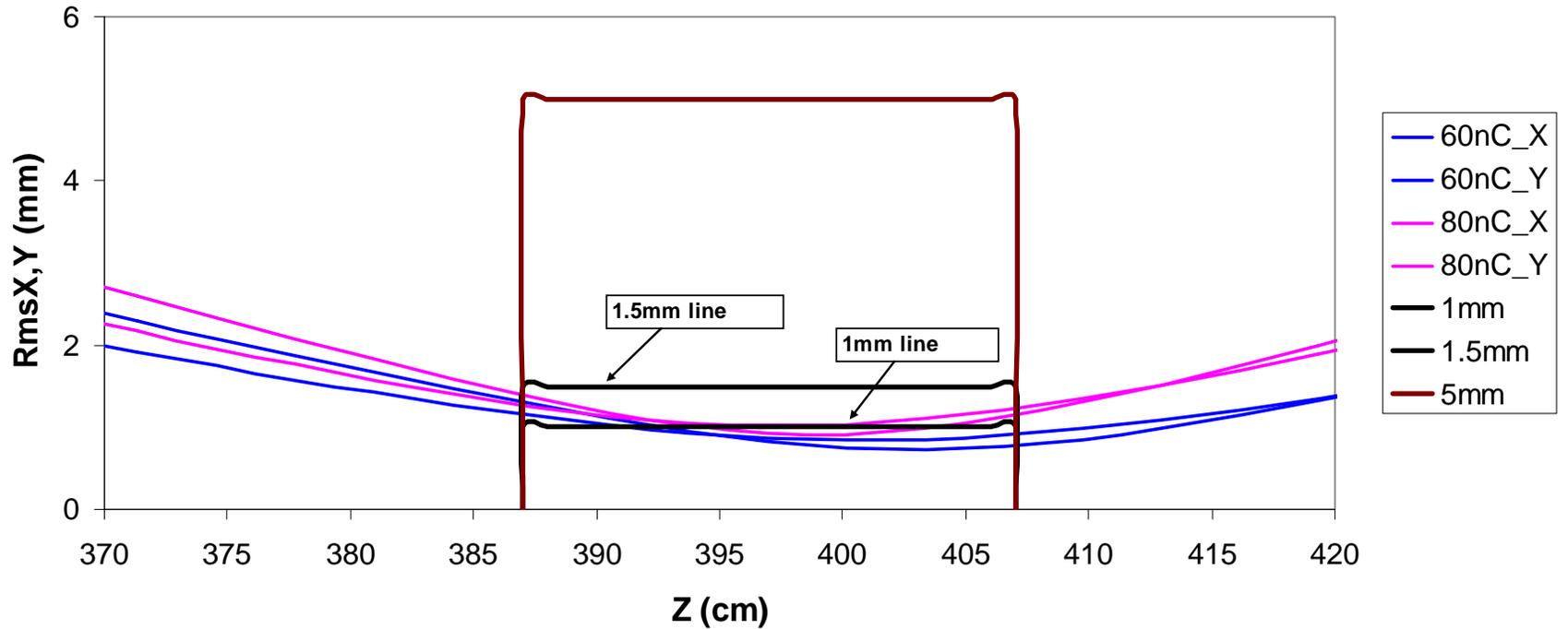
Energy spread (Beam energy = 19MeV)



Rms. Beam Envelop (Charge=60, 80nC Beam energy=16MeV)



Rms. Beam Envelop (Charge=60, 80nC Beam energy=16MeV)



Summary

- For both 19MeV and 16MeV beam energy, 60nC beam can pass through the dielectric accelerating structure if we limited $\sigma_r < 1\text{mm}$. The initial position of the structure is $Z = 391\text{cm}$.
- 80nC beam can pass through the structure with the limitation $\sigma_r < 1.5\text{mm}$. The initial position of the structure is $Z = 387\text{cm}$.
- Enough space for a diagnosis cross between Quadruples and dielectric accelerating structure.