FCC-hh – Layout and Optics for PL

Beam 2 injection and RF insertion

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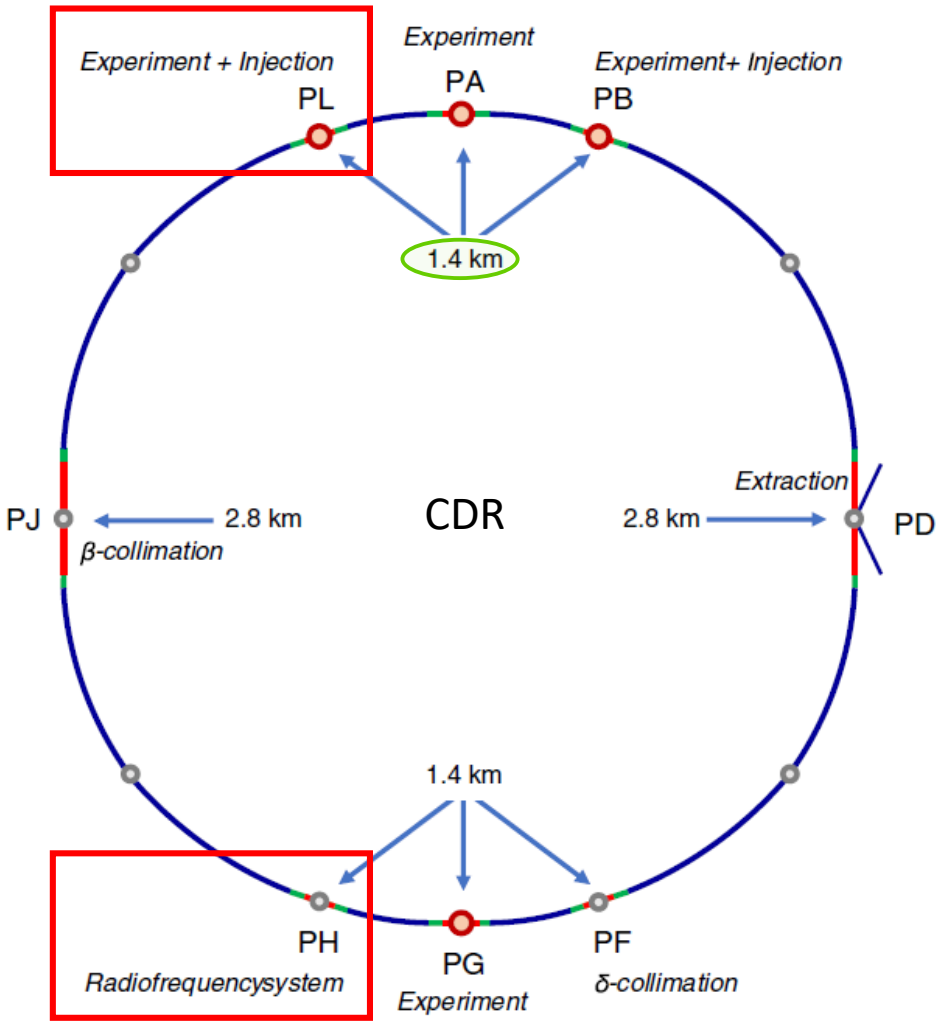
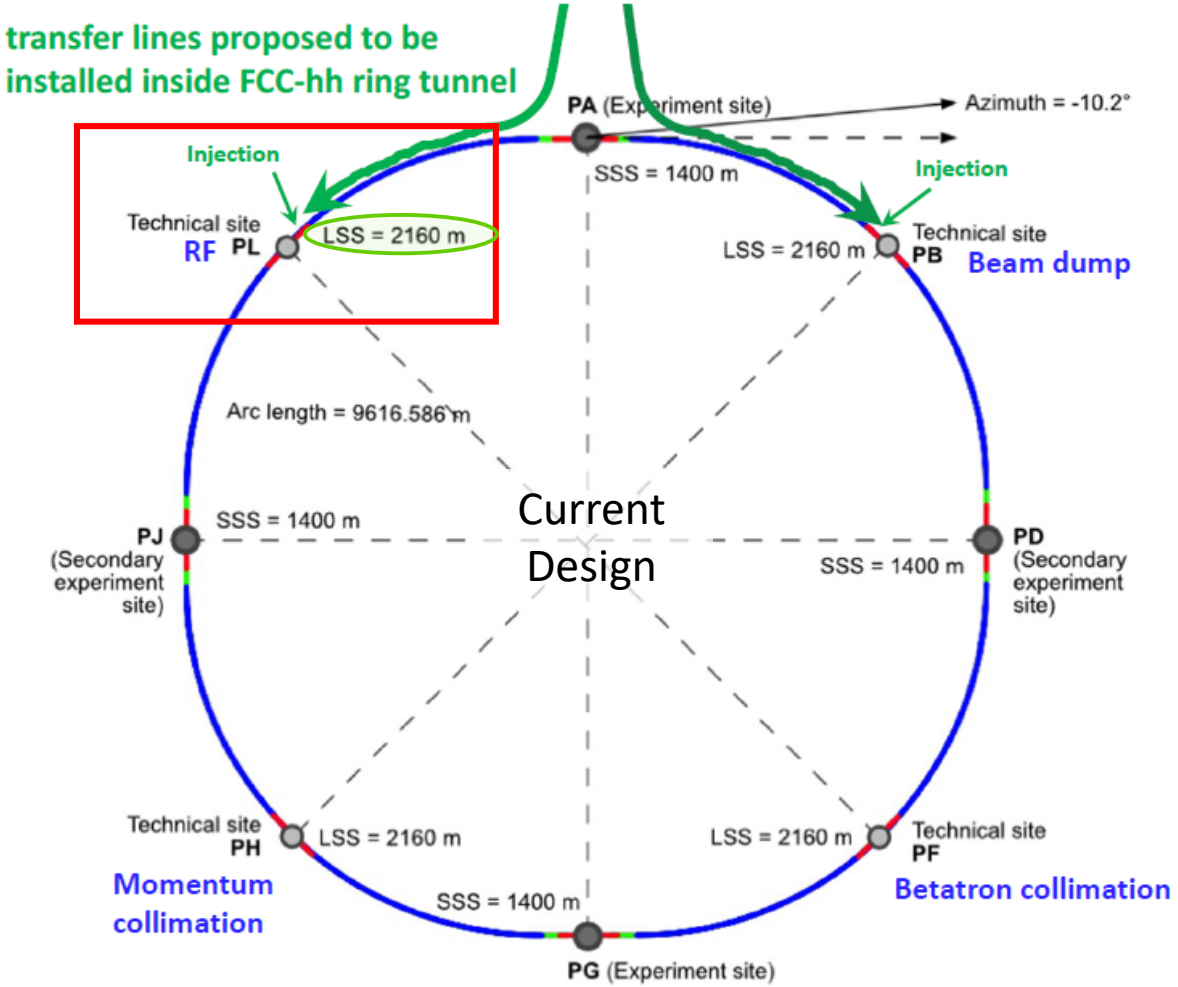
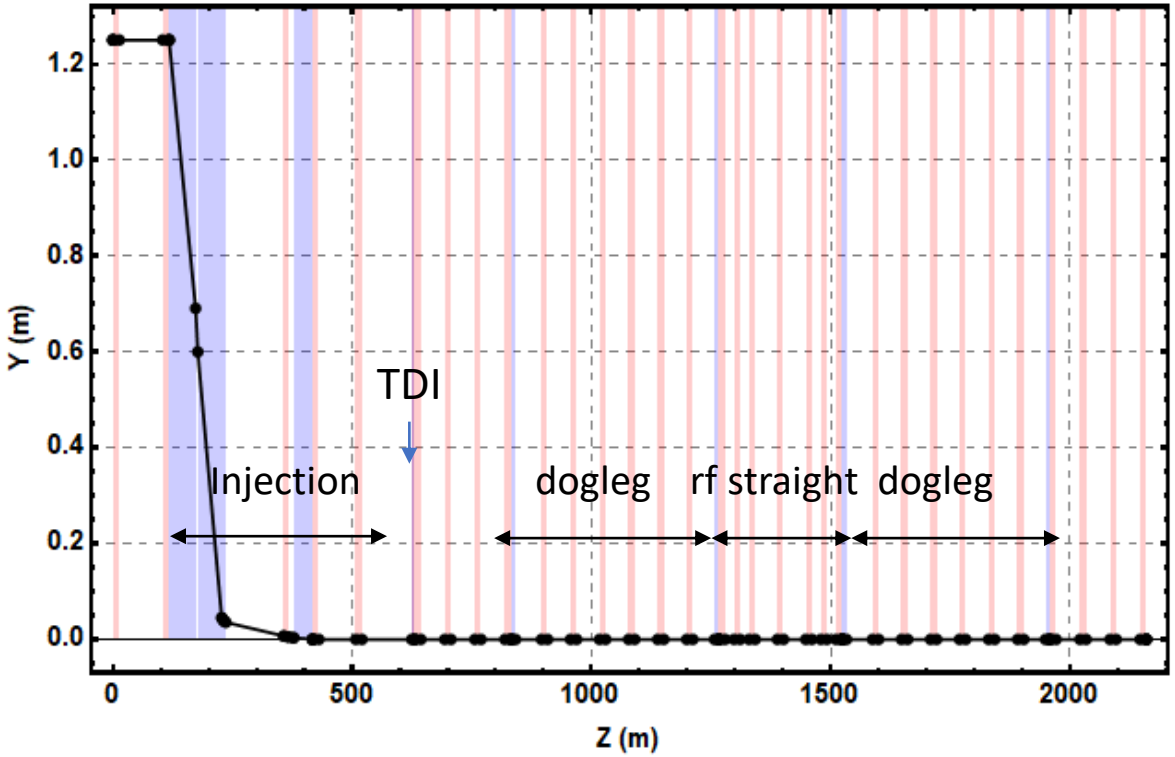
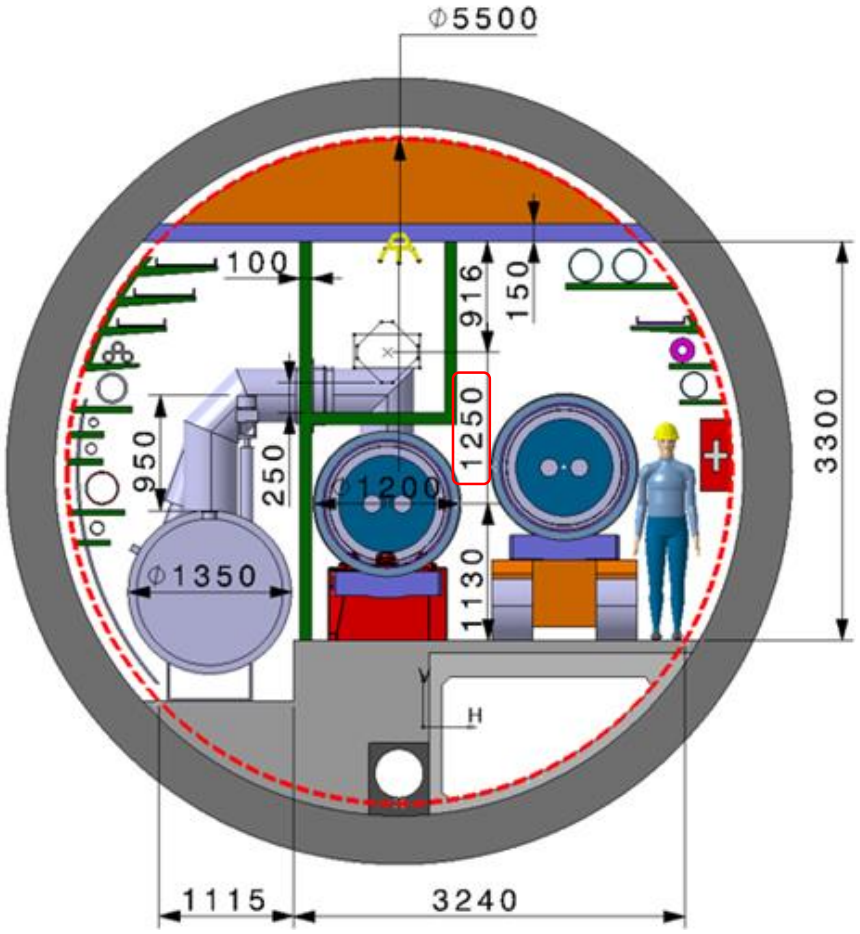
FCC layout


Experiment + Injection
PL
Experiment
PA
Experiment+ Injection
PB
1.4 km
PJ
2.8 km
β-collimation
CDR
2.8 km
Extraction
PD
1.4 km
PH
Radiofrequencysystem
PG
Experiment
PF
δ-collimation


transfer lines proposed to be installed inside FCC-hh ring tunnel
PA (Experiment site)
Azimuth = -10.2°
Injection
SSS = 1400 m
Injection
Technical site
RF PL
LSS = 2160 m
LSS = 2160 m
Technical site
PB
Beam dump
Arc length = 9616.586 m
Current Design
PJ
(Secondary experiment site)
SSS = 1400 m
SSS = 1400 m
PD
(Secondary experiment site)
Technical site
PH
LSS = 2160 m
LSS = 2160 m
Technical site
PF
Momentum collimation
Betatron collimation
SSS = 1400 m
PG (Experiment site)

PL layout (from right)



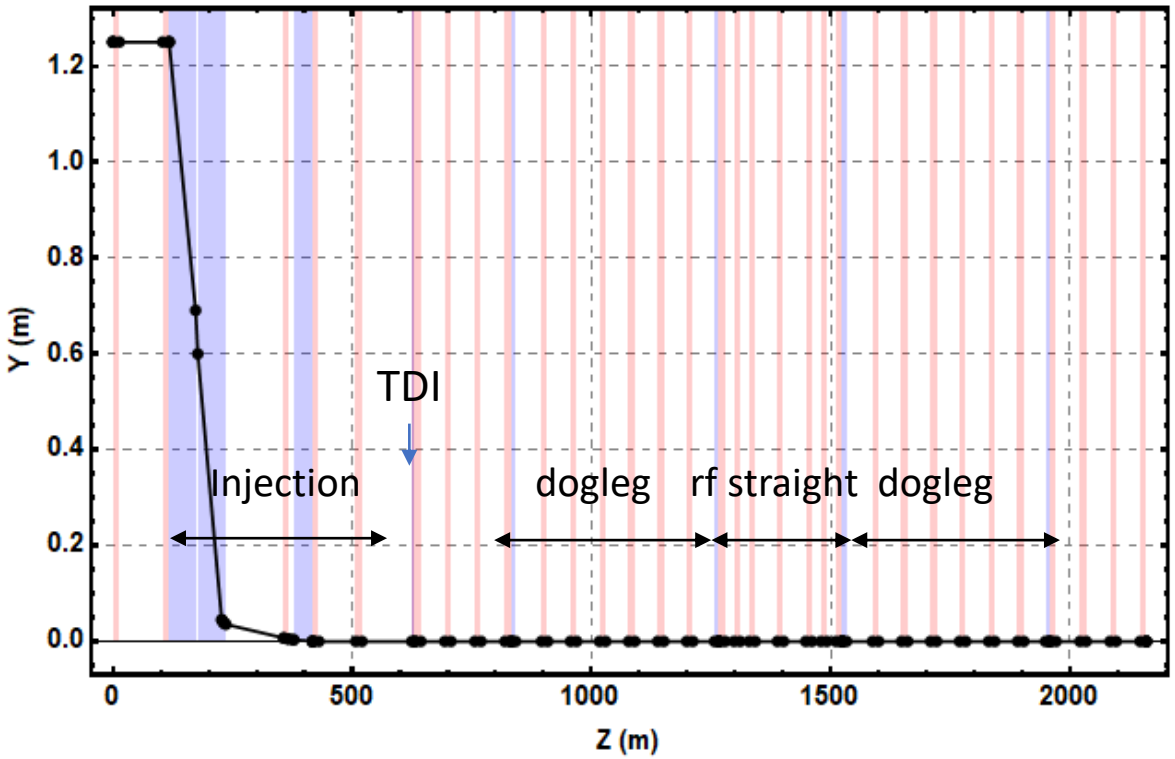


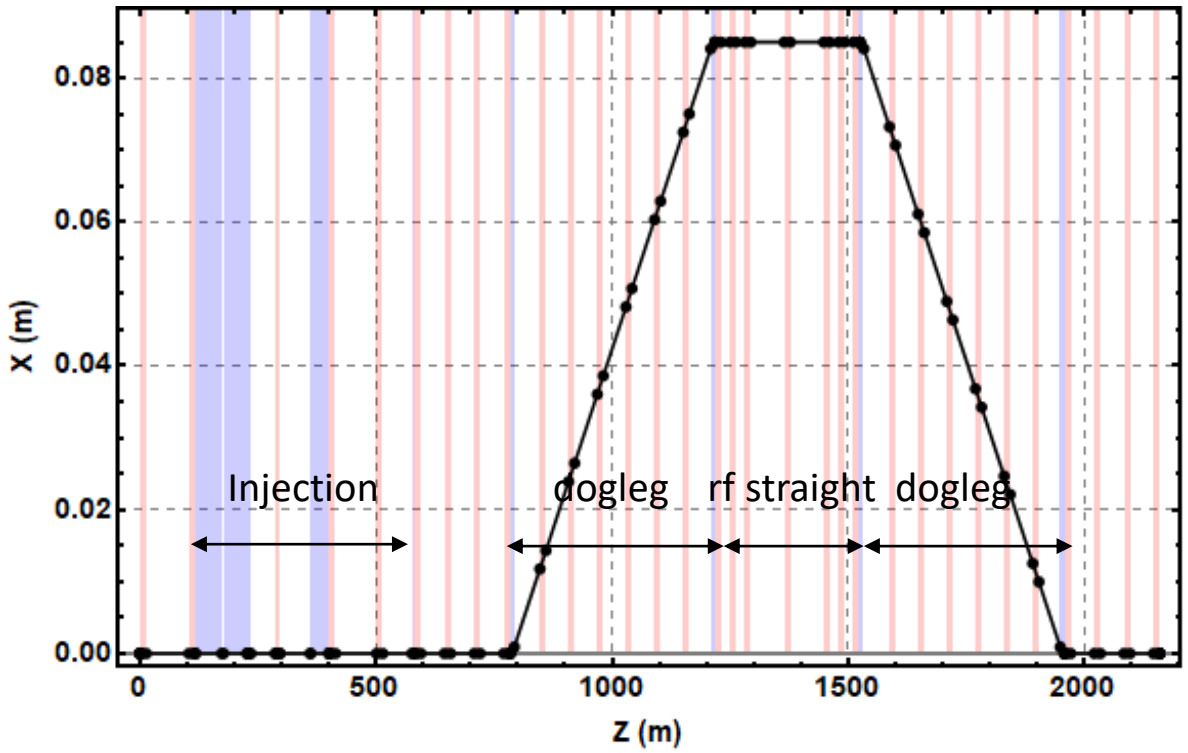
Dipole
Quadrupole

Vertical offset between injection and circulating planes: 1.25 m
Longitudinal dimension: 2160 m

PL layout (from right)

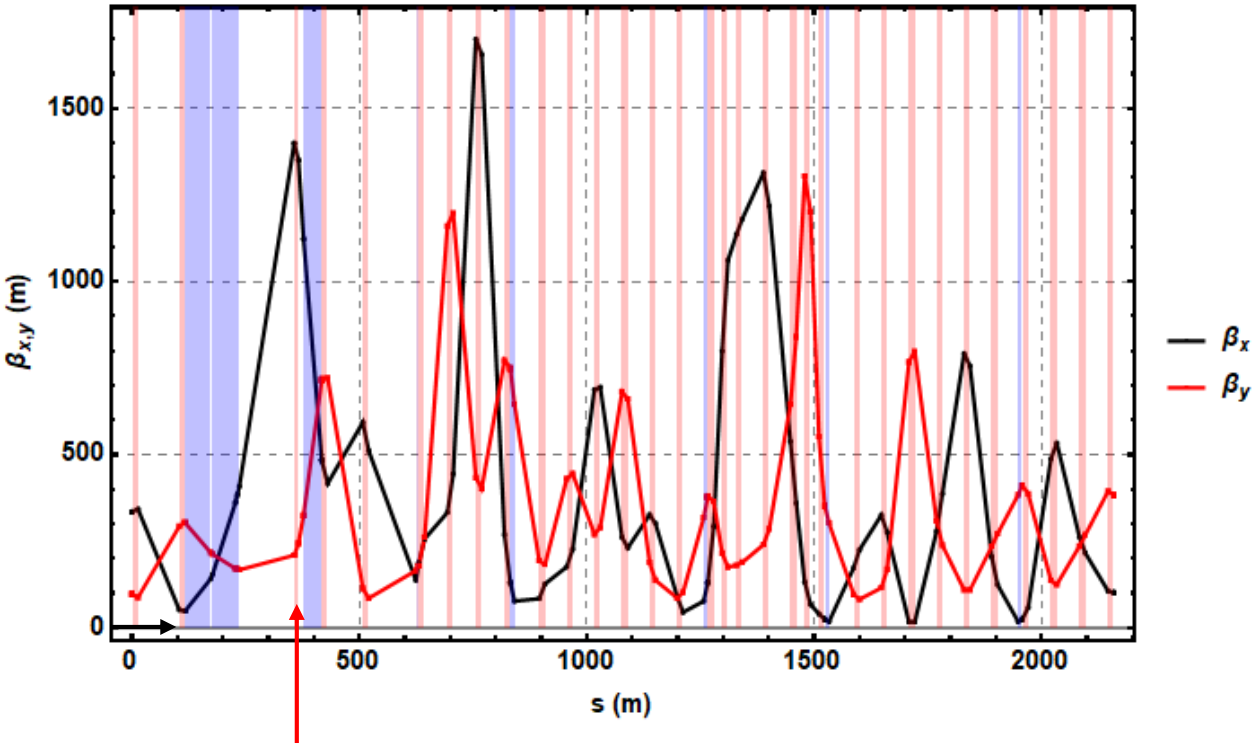
Dipole
Quadrupole



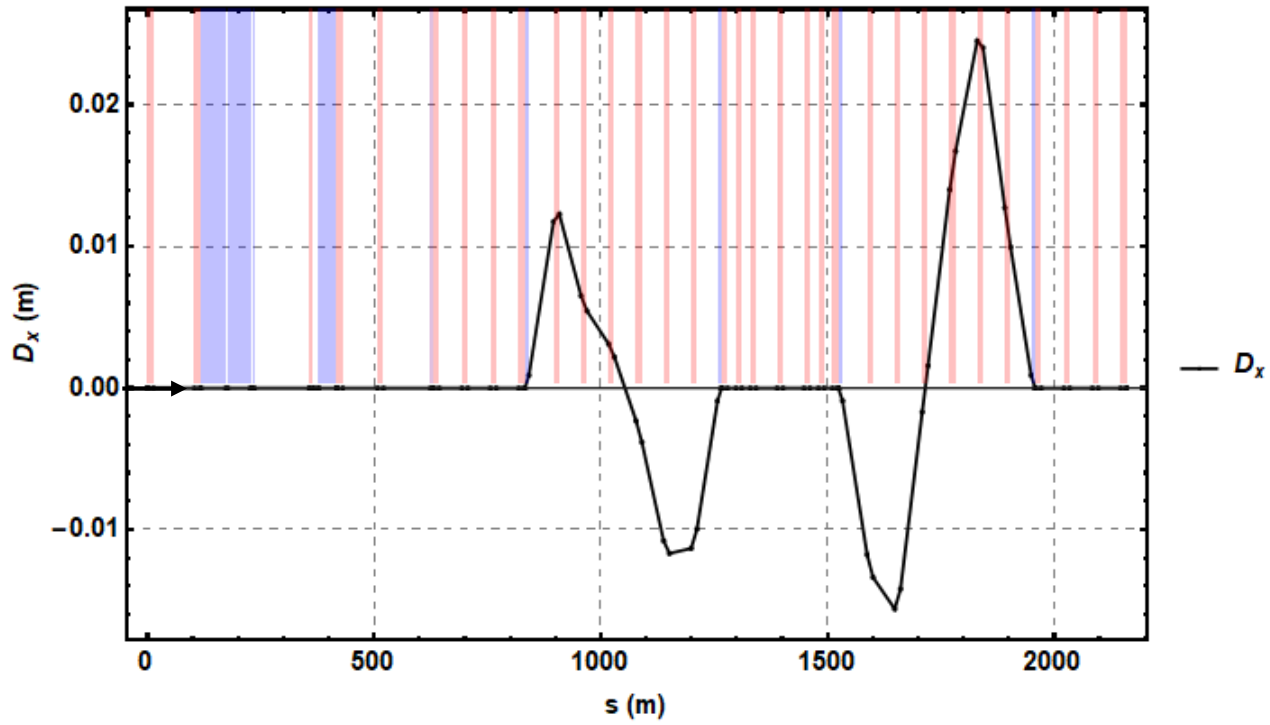


Vertical offset between injection and circulating planes: 1.25 m
Longitudinal dimension: 2160 m
Horizontal offset for RF: 0.085 m

IPL layout (From right)

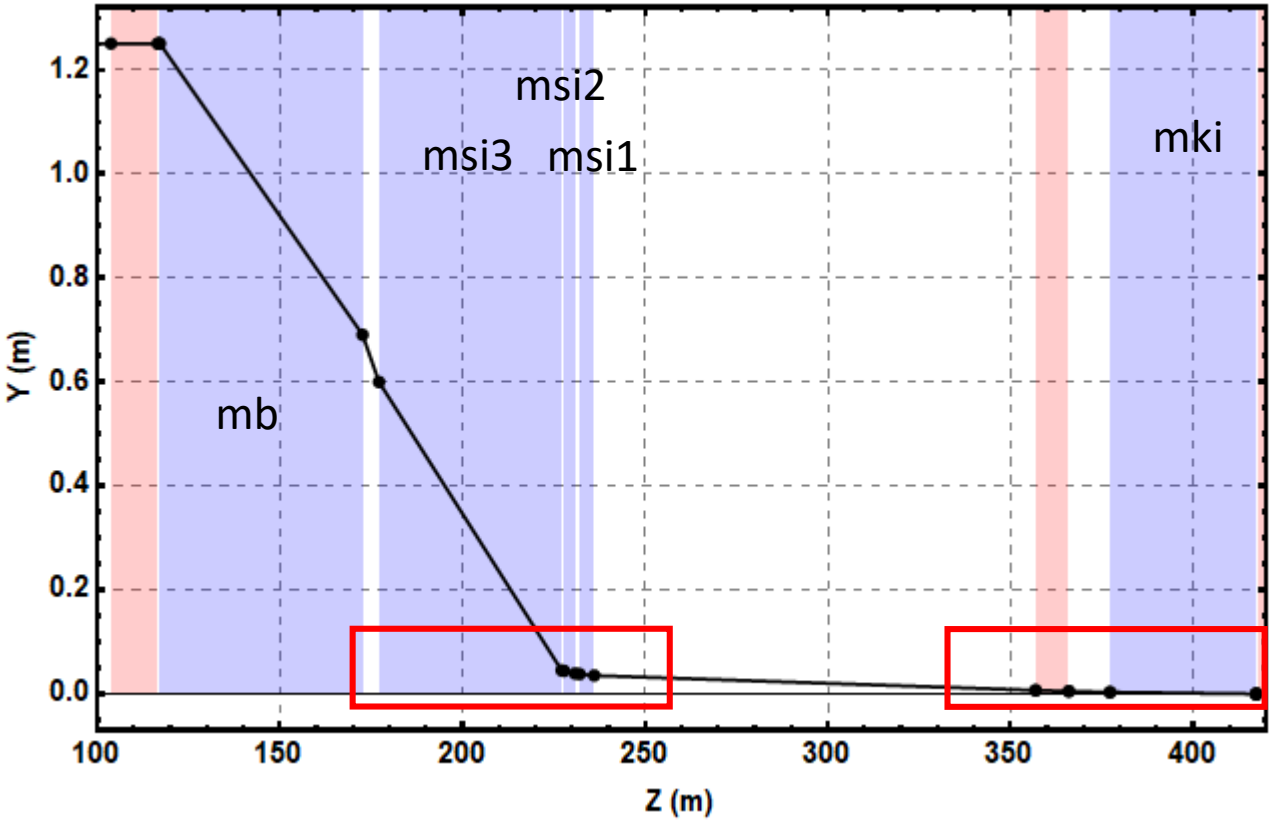


Strong focusing quadrupole after MSI to decrease strength requirement of MKI



Dispersion localized within rf doglegs

Injection geometry



mb: SBEND, l=55.48m, BField=1.2 T

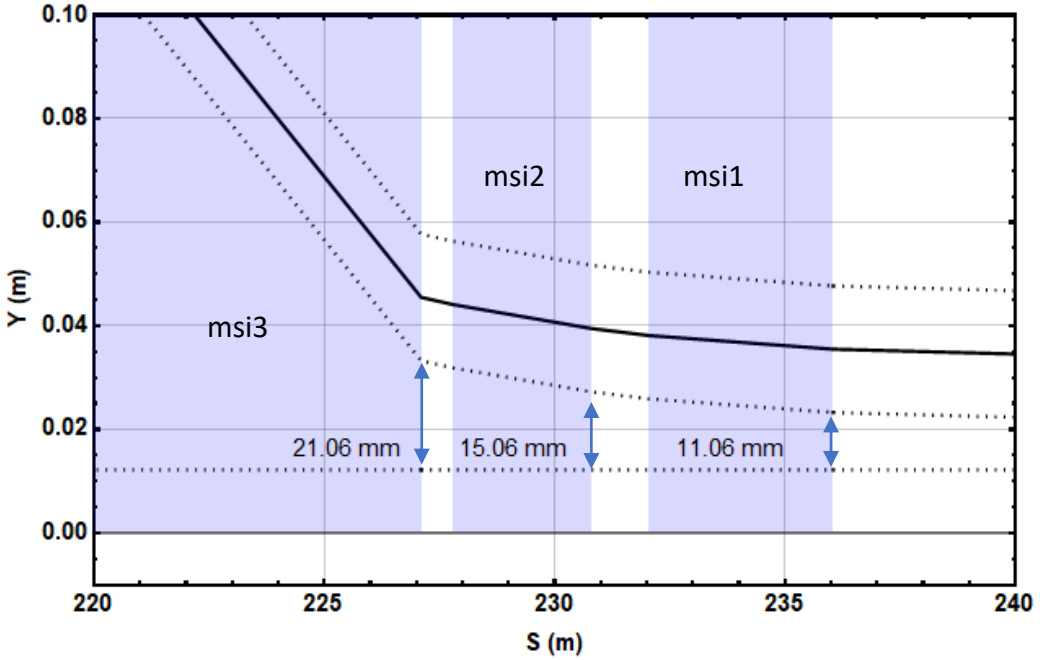
msi3: SBEND, l=50.0m, BField=1.2 T

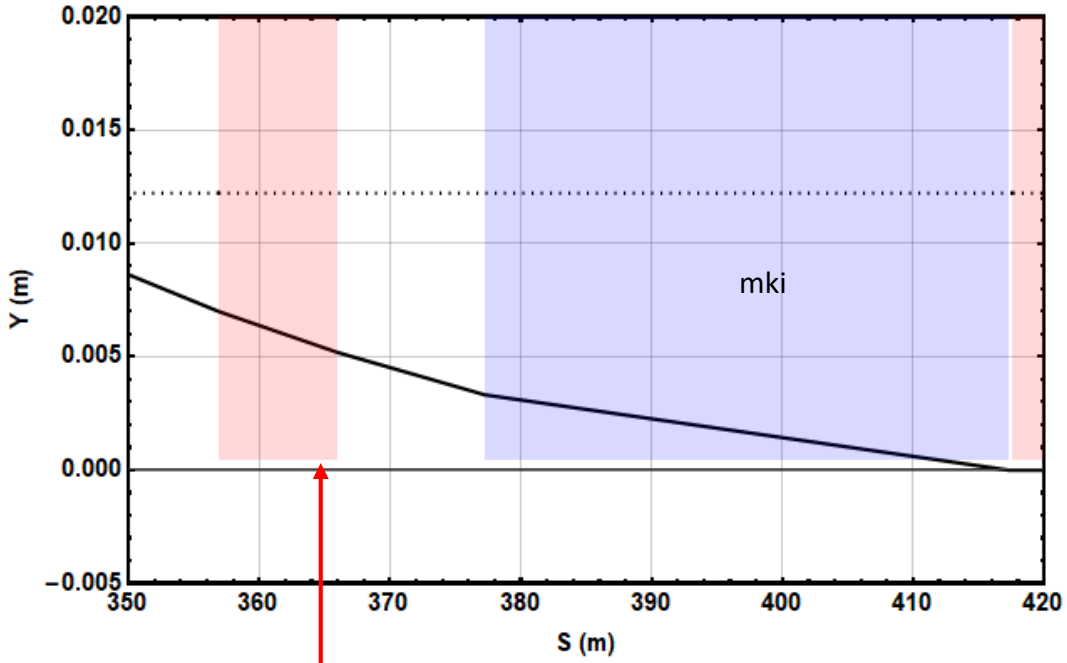
msi2: SBEND, l=3.0m, BField=1.0 T

msi1: SBEND, l=4.0m, BField=0.7 T

mki: SBEND, l=40.0m, angle=0.000166
CDR value: <0.00018

Septum and Kicker apertures



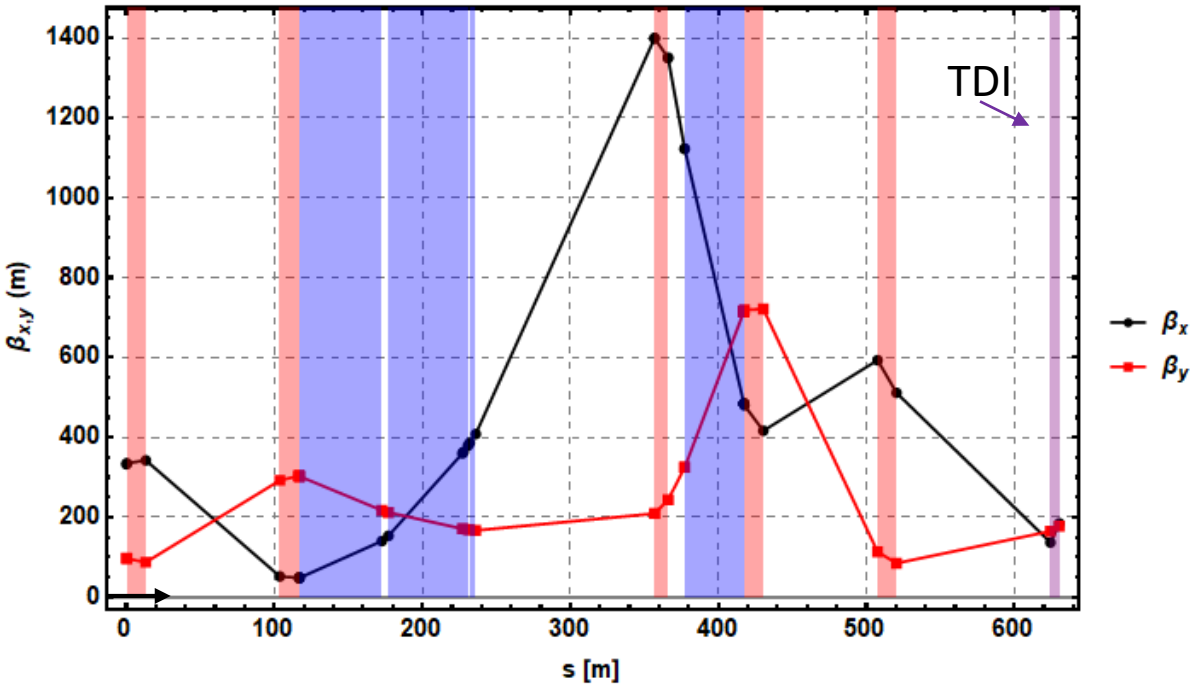


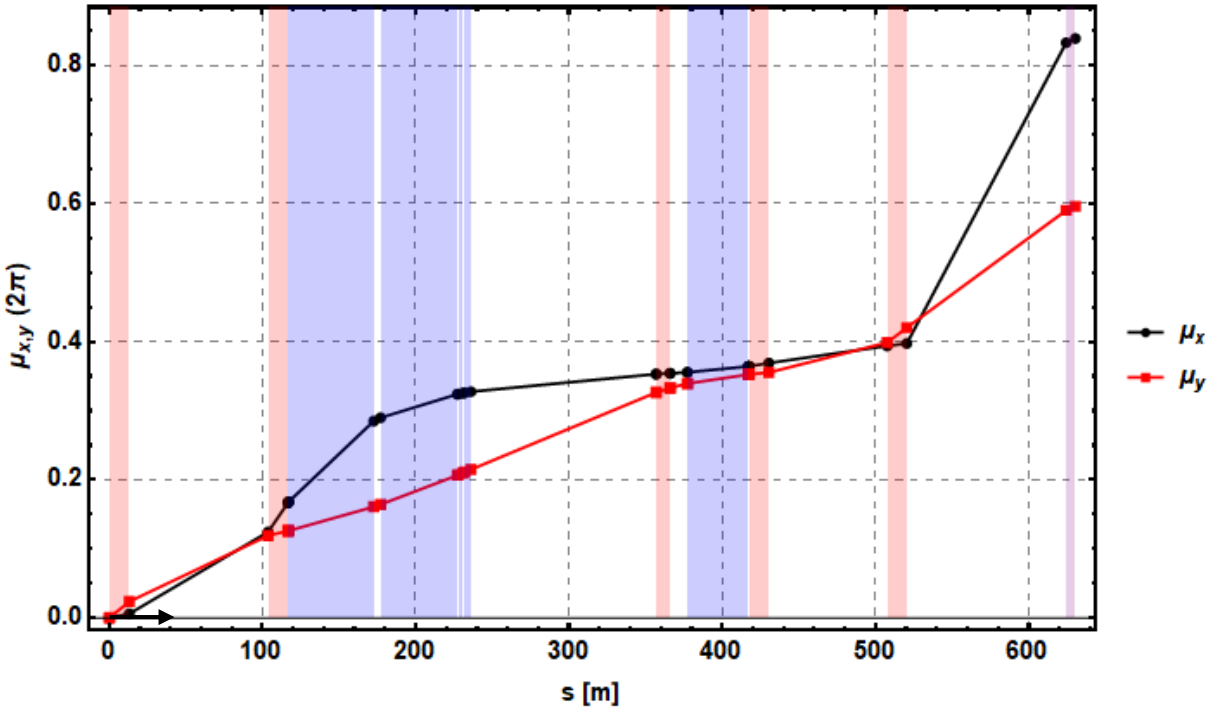
	Septum field (T)	Septum thickness (mm)
msi1	0.7	> 8.0
msi2	1.0	> 12.0
msi3	1.2	> 18.0

(CDR specifications)

Strong focusing quadrupole after MSI to decrease strength requirement of MKI.
Limited by aperture constraints.

TDI





Larger $\sqrt{\beta_x \beta_y}$ at TDI reduces material stress

$\beta_{x,\mathrm{TDI}} = 184\mathrm{m}$ $\beta_{y,\mathrm{TDI}} = 178\mathrm{m}$ $\sqrt{\beta_x\, \beta_y} = 181.4\mathrm{m}$

CDR values:

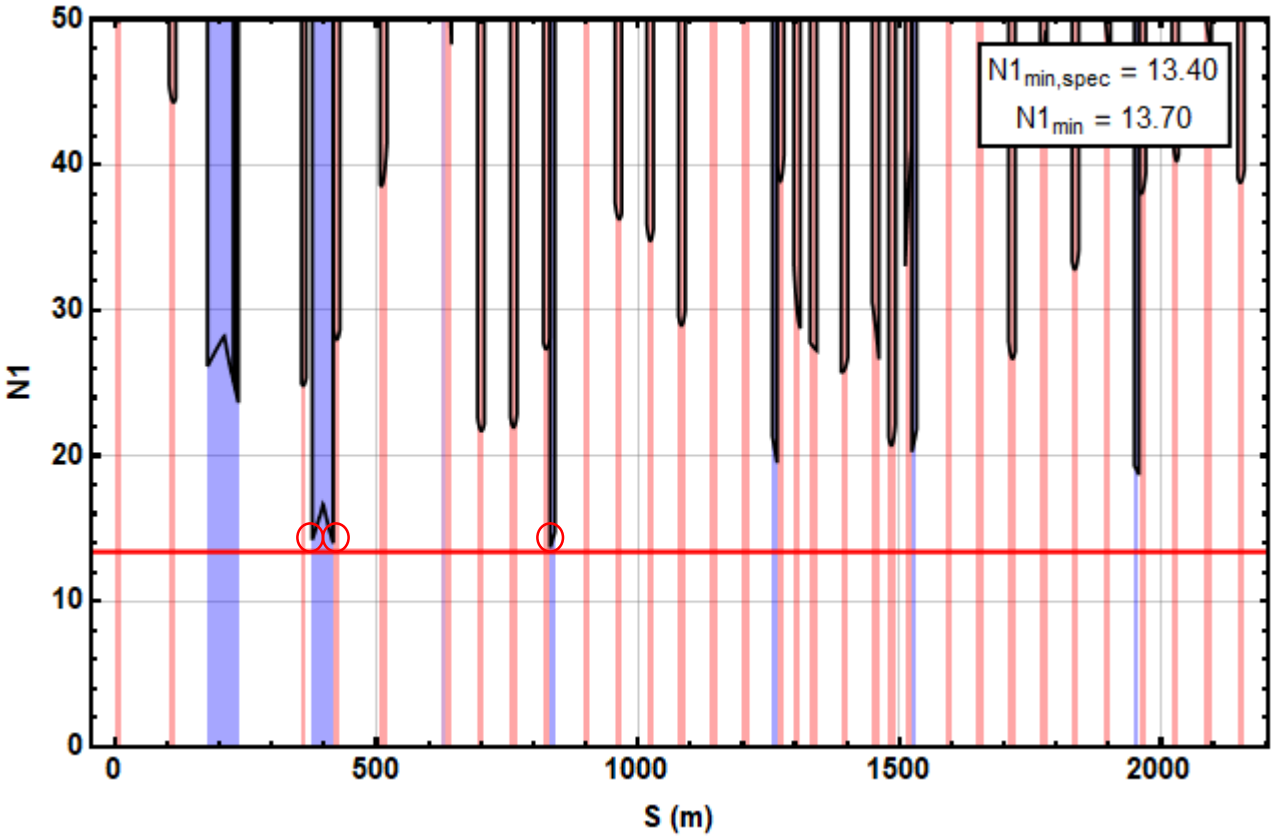
$\beta_{x,\mathrm{TDI}} = 37\mathrm{m}$ $\beta_{y,\mathrm{TDI}} = 932\mathrm{m}$ $\sqrt{\beta_x \beta_y} = 185.7\mathrm{m}$

90° phase advance in the kick plane between kicker and absorber TDI to protect from kicks of circulating beam and missed kicks of injected beam.

$$\mu_{y,\mathrm{TDI}} - \mu_{y,\mathrm{mki}} = 90°$$

Values from: FCC-hh protection absorbers and the dump - FCC Week 2018

Beam aperture

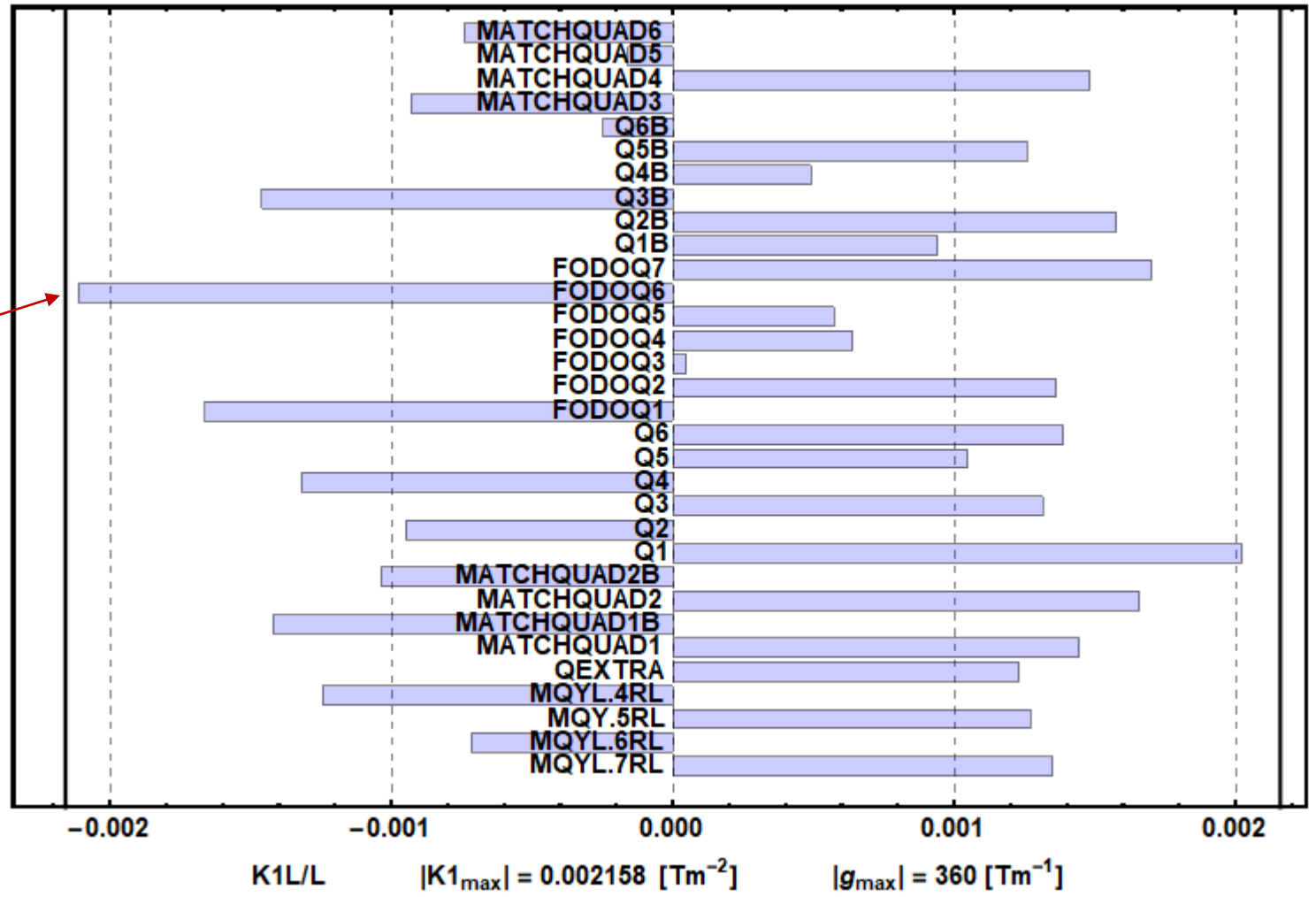


Close calls:

- Large β_x at MKI entry
- Large β_y at MKI exit
- Large β_y at first RF separation dipole

Quadrupole strengths

~ 2% margin



*working names