1. Fiducialisation measur

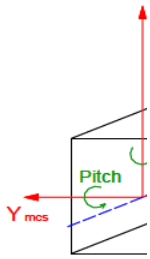
The magnetic field axis is described by deviation from the geometric axis.
During measuerement of magnetic field axis, quadrupole magnet has to be suspe
All dimensions taken at room temperature.

Input
Calculated

C. Omet
3/26/2014

Coordinate sy

Quadrupole, chamber, ...



mcs := r

Quadrupole D magnetic field axis

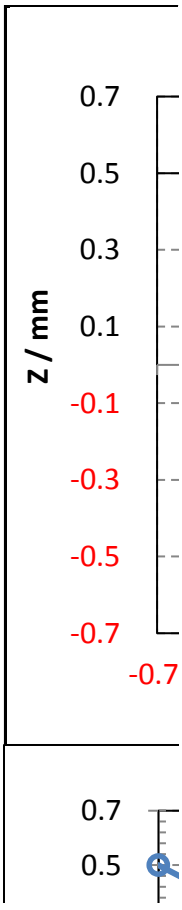
	X_D,E	0.00	**mm**
US Fiducial	**Y_D,E**	**-0.40**	**mm**
	Z_D,E	**0.50**	**mm**
	X_D,A	**1380.02**	**mm**
DS Fiducial	**Y_D,A**	**0.50**	**mm**
	Z_D,A	**-0.30**	**mm**
Roll	**γ_D**	**-1.00**	**mrad**
	X_D,M	690.01	mm
Center	Y_D,M	0.05	mm
	Z_D,M	0.10	mm
Length	L_D	1380.02	mm
Pitch	α_D	-0.58	mrad
Yaw	β_D	0.65	mrad

Quadrupol F magnetic field axis

	X_F,E	0.00	**mm**
US Fiducial	**Y_F,E**	**0.52**	**mm**
	Z_F,E	**0.50**	**mm**
	X_F,A	**1379.98**	**mm**
DS Fiducial	**Y_F,A**	**0.12**	**mm**
	Z_F,A	**0.30**	**mm**
Roll	**γ_F**	**1.50**	**mrad**
	X_F,M	689.99	mm
Center	Y_F,M	0.32	mm
	Z_F,M	0.40	mm
Length	L_F	1379.98	mm
Pitch	α_F	-0.14	mrad
Yaw	β_F	-0.29	mrad

Resulting absolute Position of Quadrupol F

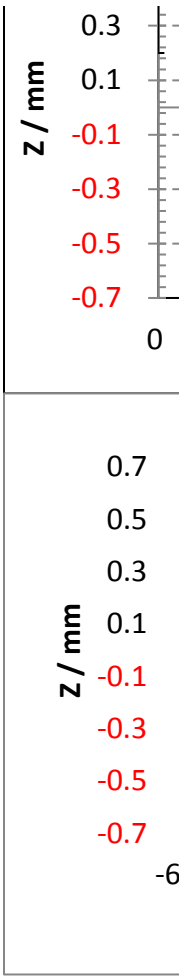
US Fiducial	X_F,E (abs)	2,607.80	mm
DS Fiducial	X_F,A (abs)	3,987.78	mm
Center	X_F,M (abs)	3,297.79	mm



EDMS **1533009 v.8** status **Released** access **Restricted**
Mounting_und_Alignment_QP_Units_TEMPLATE_xlsx_cpdf.pdf modified **2016-05-03 12:21**

Roll visualisation

Point	Y / mm	Z / mm
D left	-379.95	0.48
D center	0.05	0.10
D right	380.05	-0.28
F left	-379.68	-0.17
F center	0.32	0.40
F right	380.32	0.97

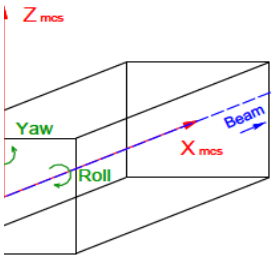


ement results

eded on the girder mounting points.

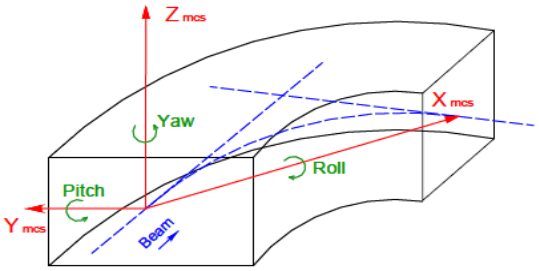
stem acc. to F-TG-3.68e:

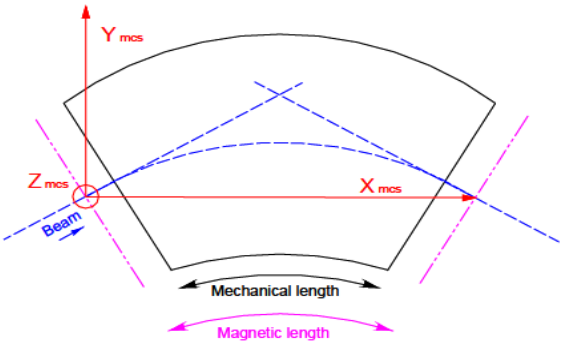
sextupole, diagnostic



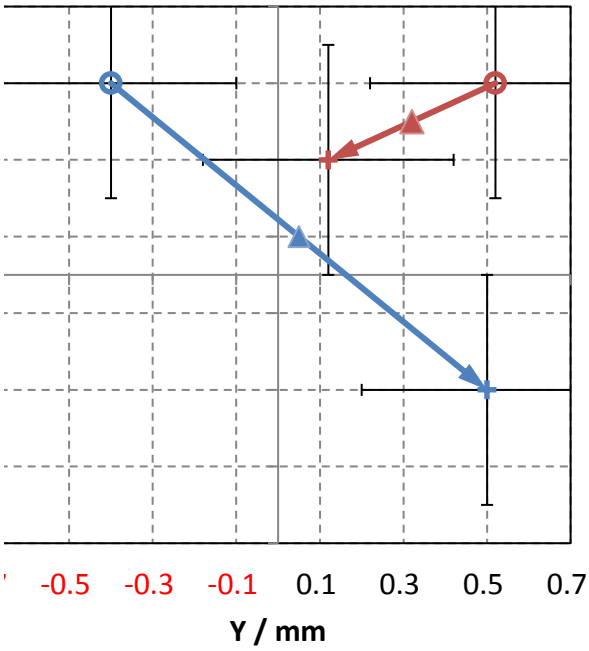
magnet coordinate system

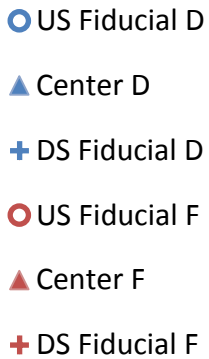
Dipoles

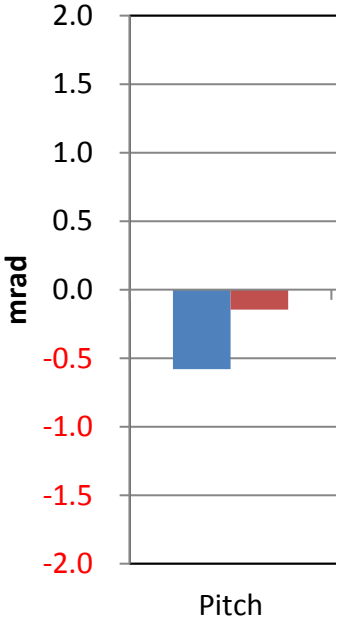




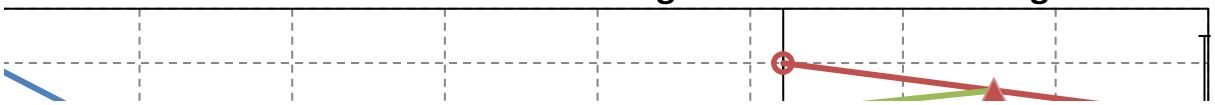
Measured magnetic axis

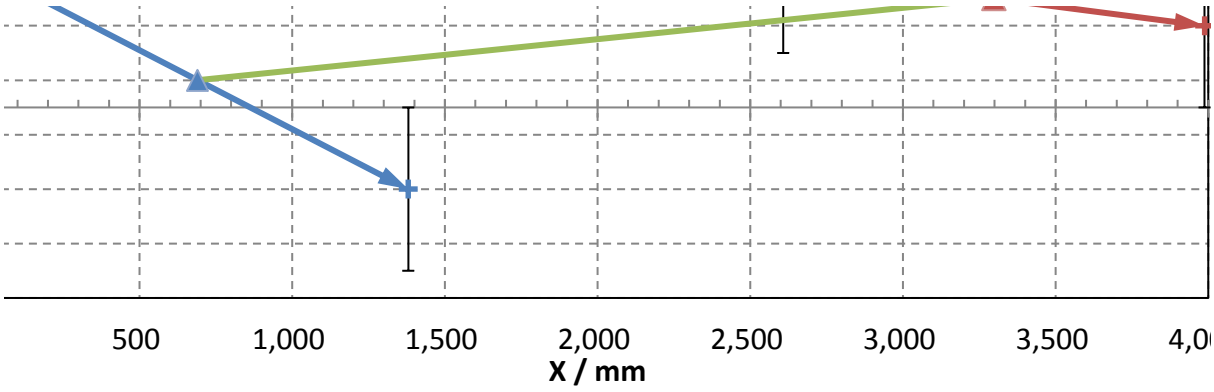


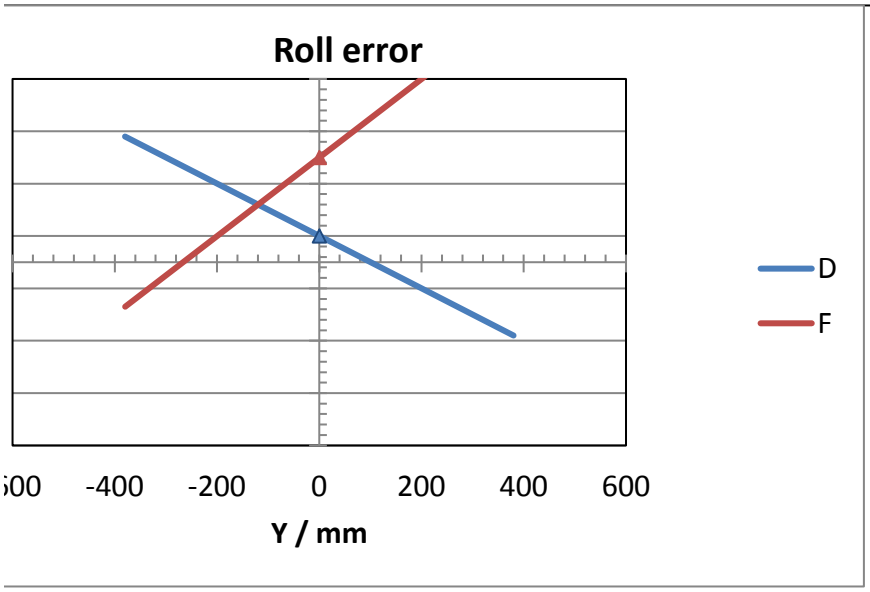


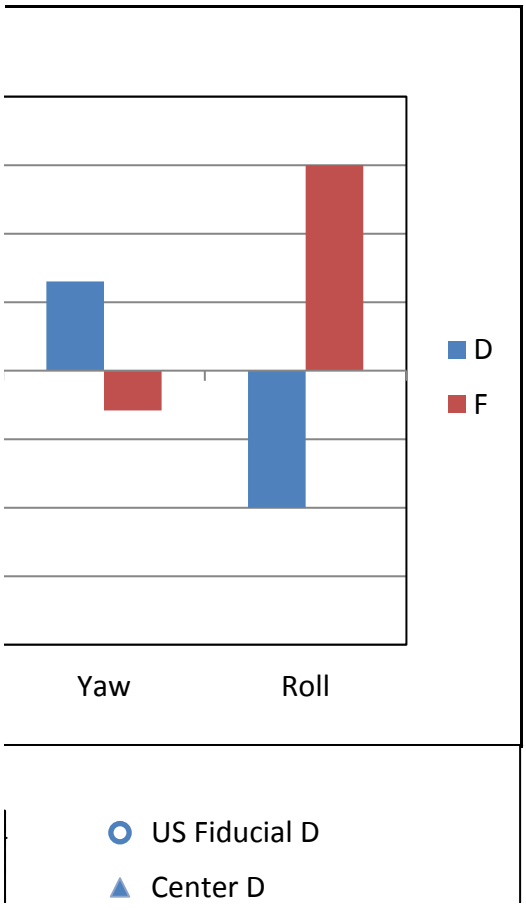


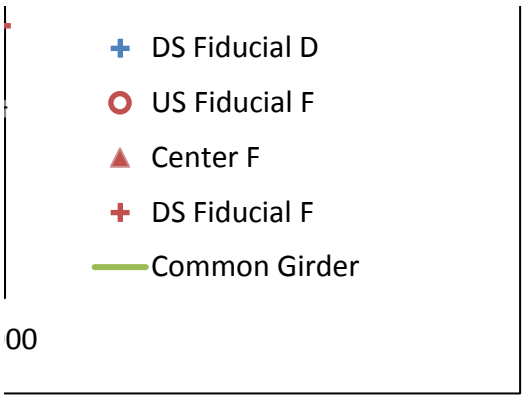
Measured magnetic axis on common girder




500
1,000
1,500
2,000
2,500
3,000
3,500
4,0
X / mm


Roll error
-400
-200
0
200
400
600
Y / mm
D
F


D
F
Yaw
Roll
US Fiducial D
Center D


DS Fiducial D
US Fiducial F
Center F
DS Fiducial F
Common Girder
00

2. Alignment

All dimensions taken at room temperature.

Y axis adjustment discretisation (foil thickness)	0.1	mm
Z axis adjustment discretisation (index bolt distance)	0.1	mm

Quadrupole D adjustments for offset and roll compensation

Distance fiducial from magnet center		ΔX_fiducial	690.01	mm
Roll adjustment		DZ,roll	0.19	mm
US left attachment	J1	Y1_D,E,Left	0.2	mm
		Z1_D,E,Left	-0.5	mm
US right attachment	J2	Y1_D,E,Right	0.8	mm
		Z1_D,E,Right	-0.1	mm
Center left attachment	J3	Y1_D,M,Left	0.6	mm
		Z1_D,M,Left	0.0	mm
Center right attachment	J4	Y1_D,M,Right	0.4	mm
		Z1_D,M,Right	0.0	mm
DS left attachment	J5	Y1_D,A,Left	0.9	mm
		Z1_D,A,Left	0.2	mm
DS right attachment	J6	Y1_D,A,Right	0.1	mm
		Z1_D,A,Right	0.5	mm

Common girder vertical misalignment (has to be compensated by adjustment feet on cryostat)

Overall pitch from QP D to QP F	α_DF	1.15E-04	mm/mm
		0.115	mrad
Offset of QP D US Fiducial		0.02	mm

Quadrupole F adjustments for offset and roll compensation

Distance fiducial from magnet center		ΔX_fiducial	689.99	mm
Roll adjustment		DZ,roll	-0.29	mm
US left attachment	J1	Y1_F,E,Left	0.9	mm
		Z1_F,E,Left	0.2	mm
US right attachment	J2	Y1_F,E,Right	0.1	mm
		Z1_F,E,Right	-0.4	mm
Center left attachment	J3	Y1_F,M,Left	0.8	mm
		Z1_F,M,Left	0.0	mm
Center right attachment	J4	Y1_F,M,Right	0.2	mm
		Z1_F,M,Right	0.0	mm
DS left attachment	J5	Y1_F,A,Left	0.6	mm
		Z1_F,A,Left	0.4	mm
DS right attachment	J6	Y1_F,A,Right	0.4	mm
		Z1_F,A,Right	-0.1	mm

Resulting Quadrupole D magnetic field axis

US Fiducial	**X_D,E**	0.00	**mm**
	Y_D,E	**0.01**	**mm**
	Z_D,E	**0.09**	**mm**
DS Fiducial	**X_D,A**	**1380.02**	**mm**
	Y_D,A	**-0.05**	**mm**
	Z_D,A	**0.18**	**mm**
Roll	**γ_D**	**-0.08**	**mrad**
Center	X_D,M	**690.01**	mm
	Y_D,M	**-0.02**	mm
	Z_D,M	**0.13**	mm
Length	L_D	**1380.02**	mm
Pitch	α_D	**0.07**	mrad
Yaw	β_D	**-0.05**	mrad

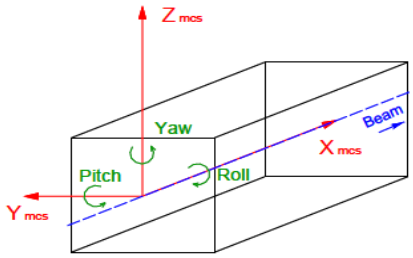
Resulting Quadrupol F magnetic field axis

US Fiducial	**X_F,E**	0.00	**mm**
	Y_F,E	**-0.03**	**mm**
	Z_F,E	**0.36**	**mm**
DS Fiducial	**X_F,A**	**1379.98**	**mm**
	Y_F,A	**-0.02**	**mm**
	Z_F,A	**0.51**	**mm**
Roll	**γ_F**	**0.05**	**mrad**
Center	X_F,M	**689.99**	mm
	Y_F,M	**-0.02**	mm
	Z_F,M	**0.43**	mm
Length	L_F	**1379.98**	mm
Pitch	α_F	**0.11**	mrad
Yaw	β_F	**0.01**	mrad

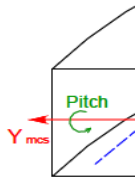
procedure for attachment points

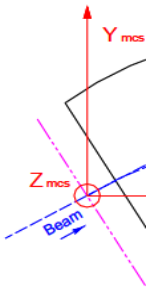
Coordinate system acc. to F-TG-3.68e:

Quadrupole, sextupole, diagnostic chamber, ...



Dipoles



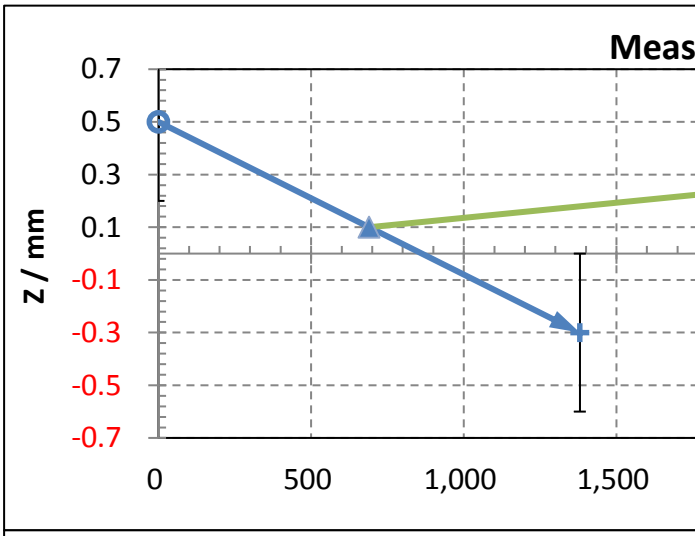


mcs := magnet coordinate system

spacer
tapped dowel pin
spacer
tapped dowel pin
spacer

spacer

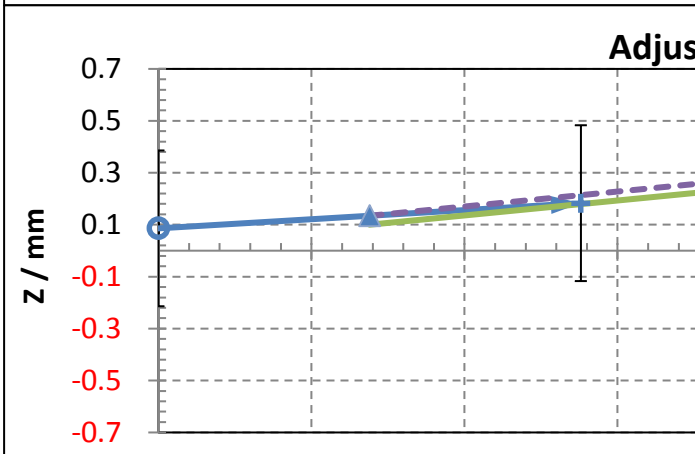
spacer
tapped dowel pin
spacer
tapped dowel pin

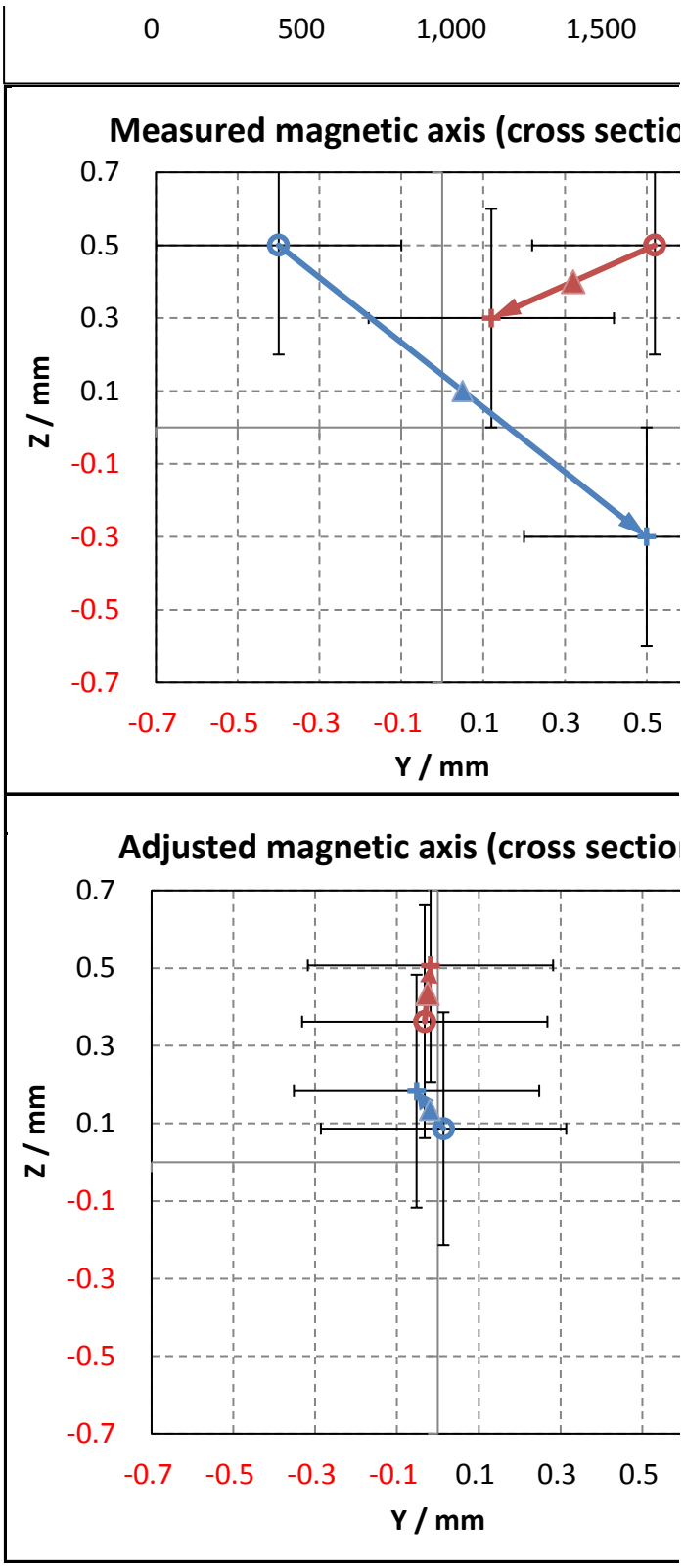


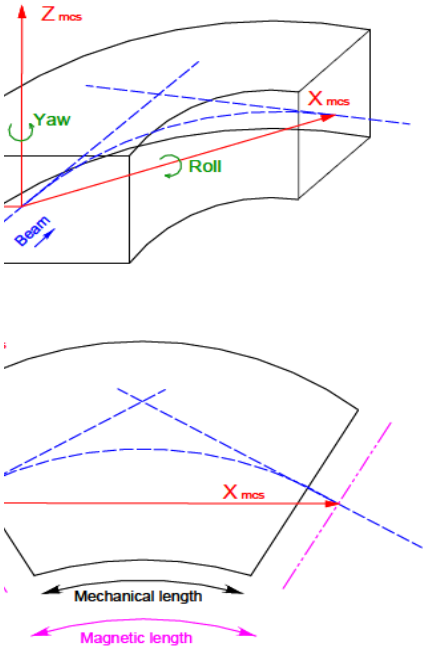
spacer
tapped dowel pin
spacer
tapped dowel pin
spacer

spacer

spacer
tapped dowel pin
spacer
tapped dowel pin



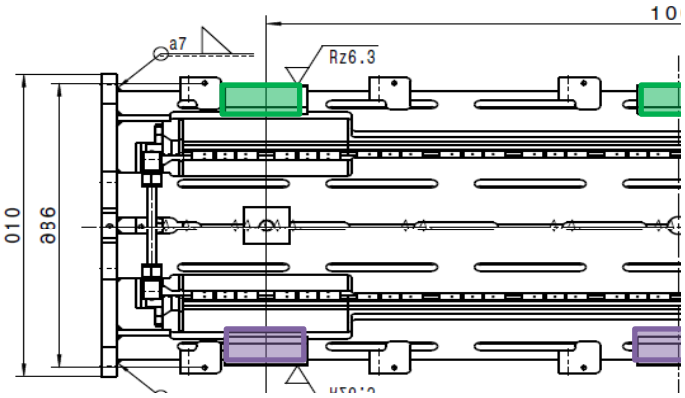

0
500
1,000
1,500
Measured magnetic axis (cross sectic
0.7
0.5
0.3
0.1
-0.1
-0.3
-0.5
-0.7
Z / mm
-0.7
-0.5
-0.3
-0.1
0.1
0.3
0.5
Y / mm
Adjusted magnetic axis (cross sectio
0.7
0.5
0.3
0.1
-0.1
-0.3
-0.5
-0.7
Z / mm
-0.7
-0.5
-0.3
-0.1
0.1
0.3
0.5
Y / mm



Drawing MAG-V15-C84.000.000 (top view)

J6 **J4**

DS right cente

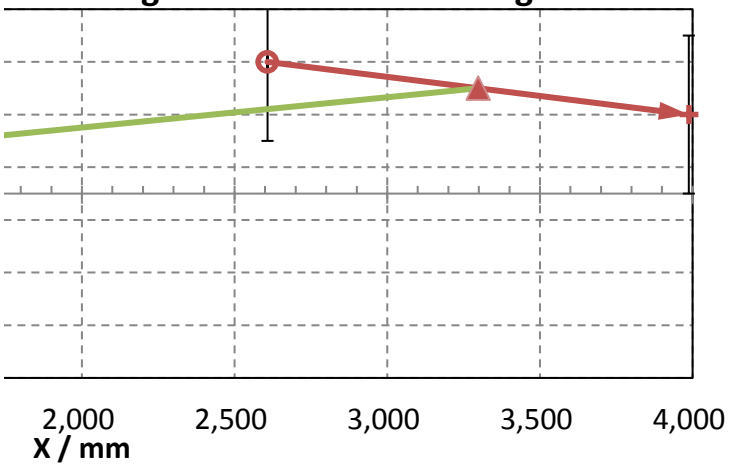


DS left cente

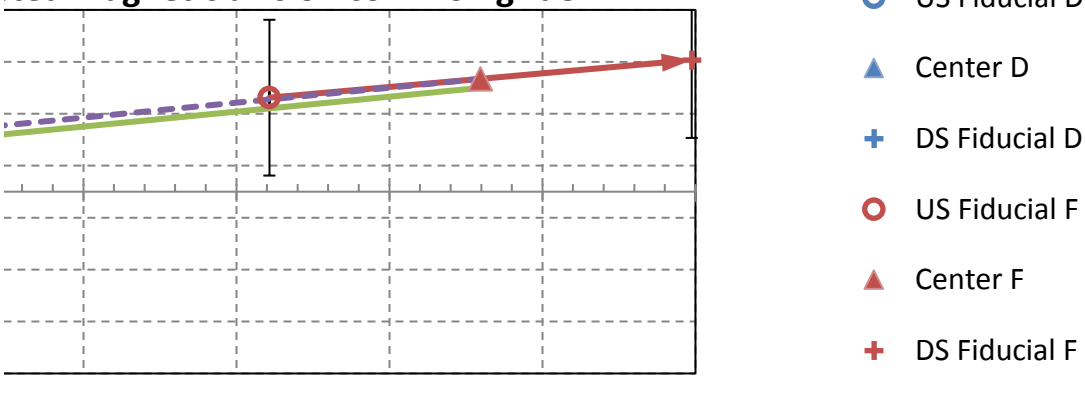
J5 **J3**

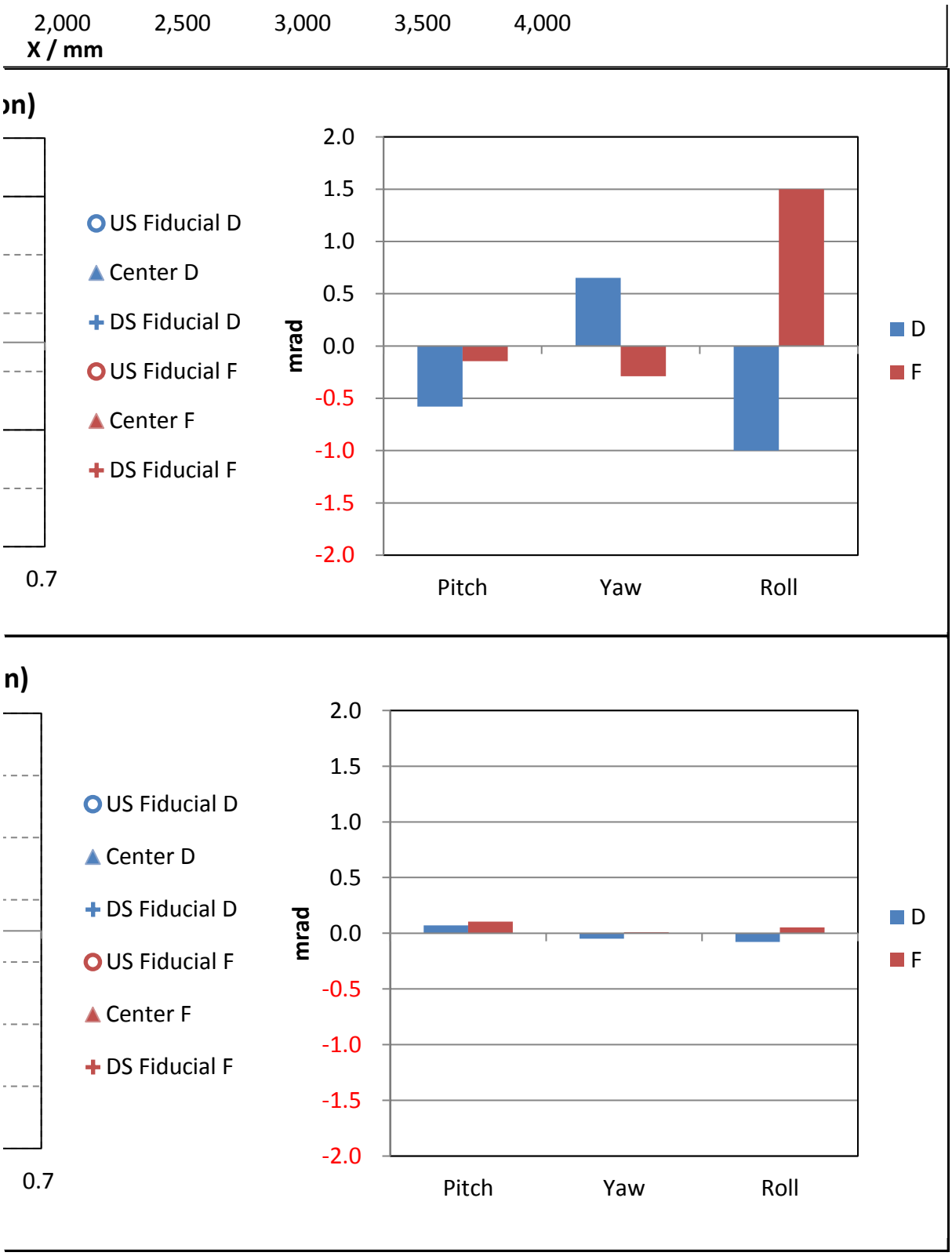
beam direction

ured magnetic axis on common girder



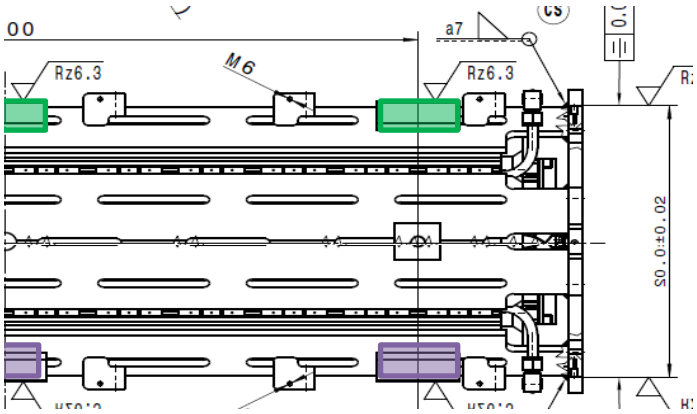
sted magnetic axis on common girder




2,000
2,500
3,000
3,500
4,000
X / mm
ɔn)
US Fiducial D
Center D
DS Fiducial D
US Fiducial F
Center F
DS Fiducial F
0.7
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
-2.0
mrad
Pitch
Yaw
Roll
D
F
n)
US Fiducial D
Center D
DS Fiducial D
US Fiducial F
Center F
DS Fiducial F
0.7
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
-2.0
mrad
Pitch
Yaw
Roll
D
F

J2

r right US right



r left US left

J1

Reference geometry of the

In reference geometry, geometric axis = magnetical axis.

All dimensions taken at room temperature.

Input
Calculated

C. Omet

4/23/2014

Quadrupole D Reference

US Fiducial	**X0_D,E**	**0.0**	**mm**
	Y0_D,E	**0.0**	**mm**
	Z0_D,E	**0.0**	**mm**
DS Fiducial	**X0_D,A**	**1,380.0**	**mm**
	Y0_D,A	**0.0**	**mm**
	Z0_D,A	**0.0**	**mm**
Roll	**γ0_D**	**0.0**	**rad**
Center	X0_D,M	690.0	mm
	Y0_D,M	0.0	mm
	Z0_D,M	0.0	mm
Length	L0_D	1,380.0	mm
Pitch	α0_D	0.0	rad
Yaw	β0_D	0.0	rad

Distance attachment from magnet center	ΔX_attach	500	mm
Distance attachment from magnet center	ΔY_attach	380	mm
Absolute position of US attachment	X_attach_D, US	190.0	mm
Absolute position of DS attachment	X_attach_D, DS	1,190.0	mm
Absolute position of US attachment	X_attach_D, US	2,107.8	mm
Absolute position of DS attachment	X_attach_D, DS	3,107.8	mm

Quadrupol F Reference

Drawing Cold Mass MG-1007850-A-000

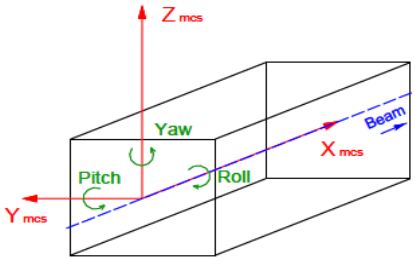
Distance Center QP F to Center QP D	ΔX0_D/F	2,607.8	mm
US Fiducial	**X0_F,E**	**1,917.8**	**mm**
	Y0_F,E	**0.0**	**mm**
	Z0_F,E	**0.0**	**mm**
DS Fiducial	**X0_F,A**	**3,297.8**	**mm**
	Y0_F,A	**0.0**	**mm**
	Z0_F,A	**0.0**	**mm**
Roll	**γ0_F**	**0.0**	**rad**
Center	X0_F,M	2,607.8	mm
	Y0_F,M	0.0	mm
	Z0_F,M	0.0	mm
Length	L0_F	1,380.0	mm

Pitch	$\alpha 0_F$	0.0	rad
Yaw	$\beta 0_F$	0.0	rad

quadrupole module

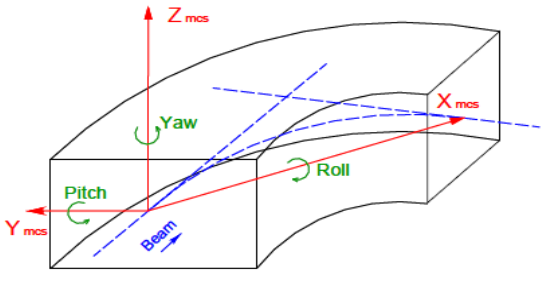
Coordinate system acc. to F-TG-3.68e:

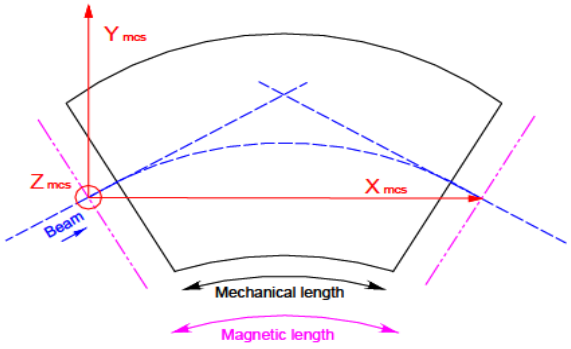
Quadrupole, sextupole, diagnostic chamber, ...



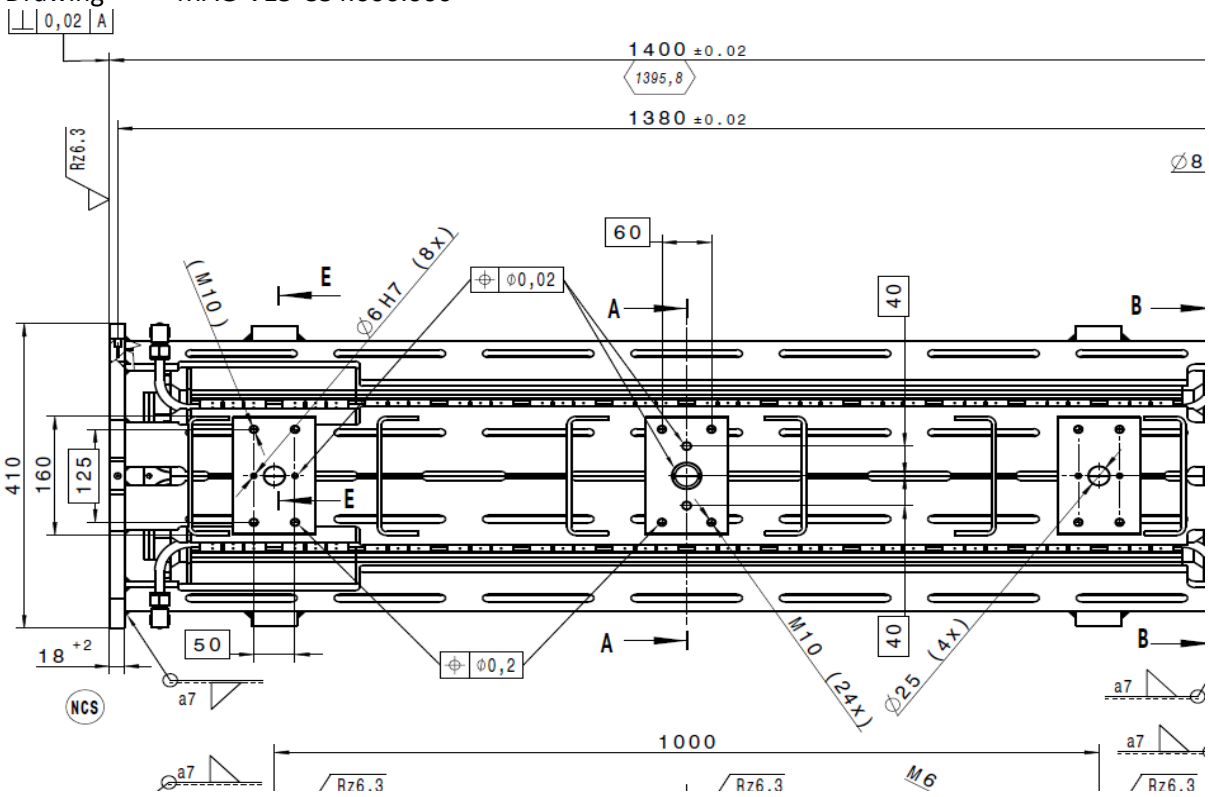
mcs := magnet coordinate system

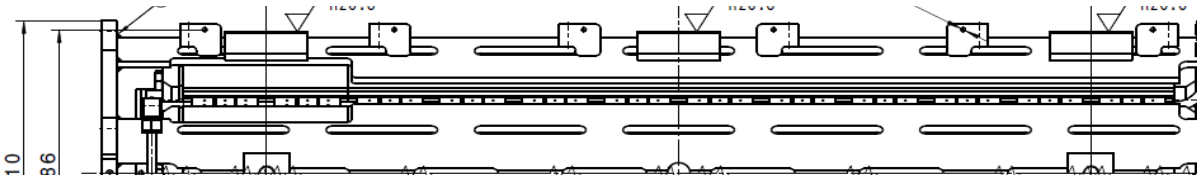
Dipoles

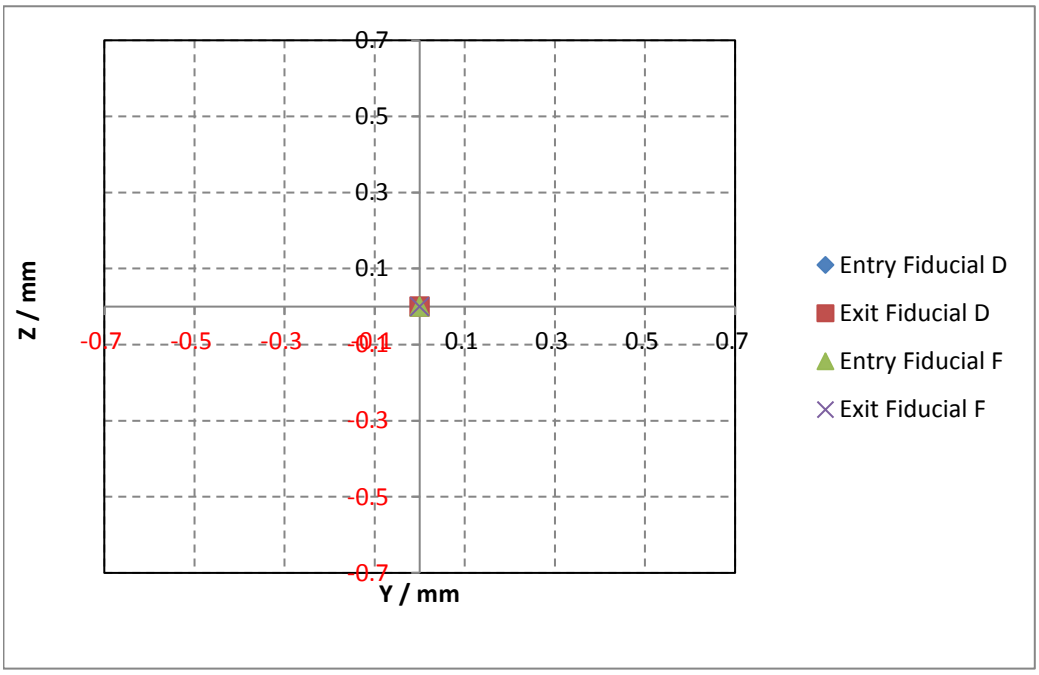


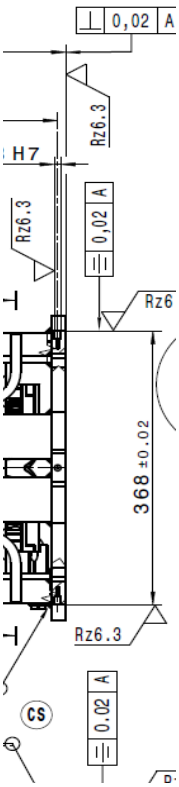


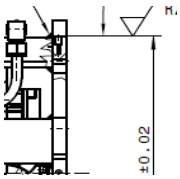
Drawing MAG-V15-C84.000.000




10
36


0.7
0.5
0.3
0.1
-0.7
-0.5
-0.3
-0.1
0.1
0.3
0.5
0.7
-0.3
-0.5
-0.7
z / mm
Y / mm
Entry Fiducial D
Exit Fiducial D
Entry Fiducial F
Exit Fiducial F


0,02 A
Rz6.3
H7
Rz6.3
0,02 A
Rz6
368 ±0.02
Rz6.3
CS
0.02 A


±0.02