



Ground Motion & Magnet Alignment of J-PARC Main Ring

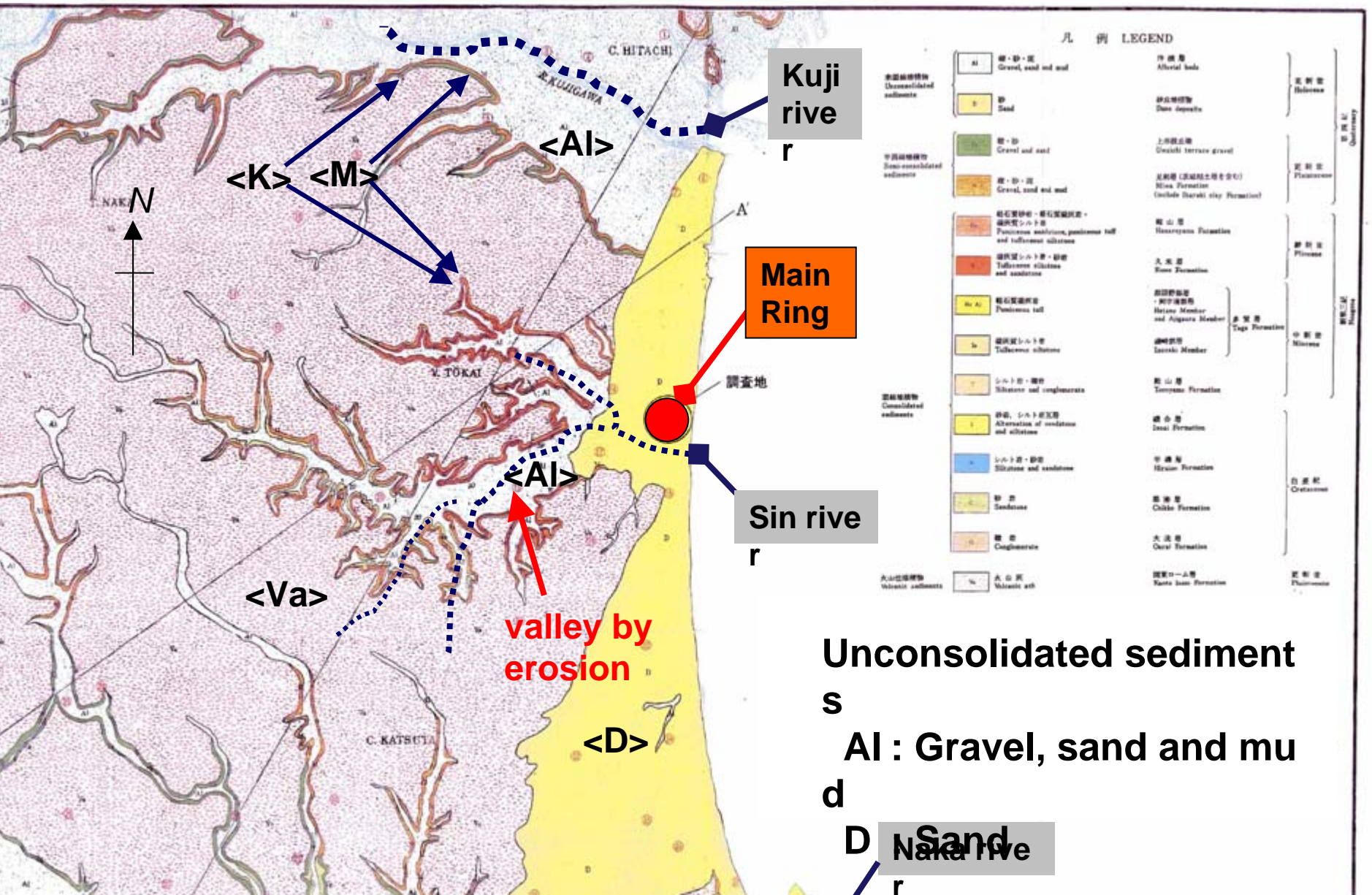
IWAA2008

Masashi Shirakata, KEK

J-PARC Site View



Stratum

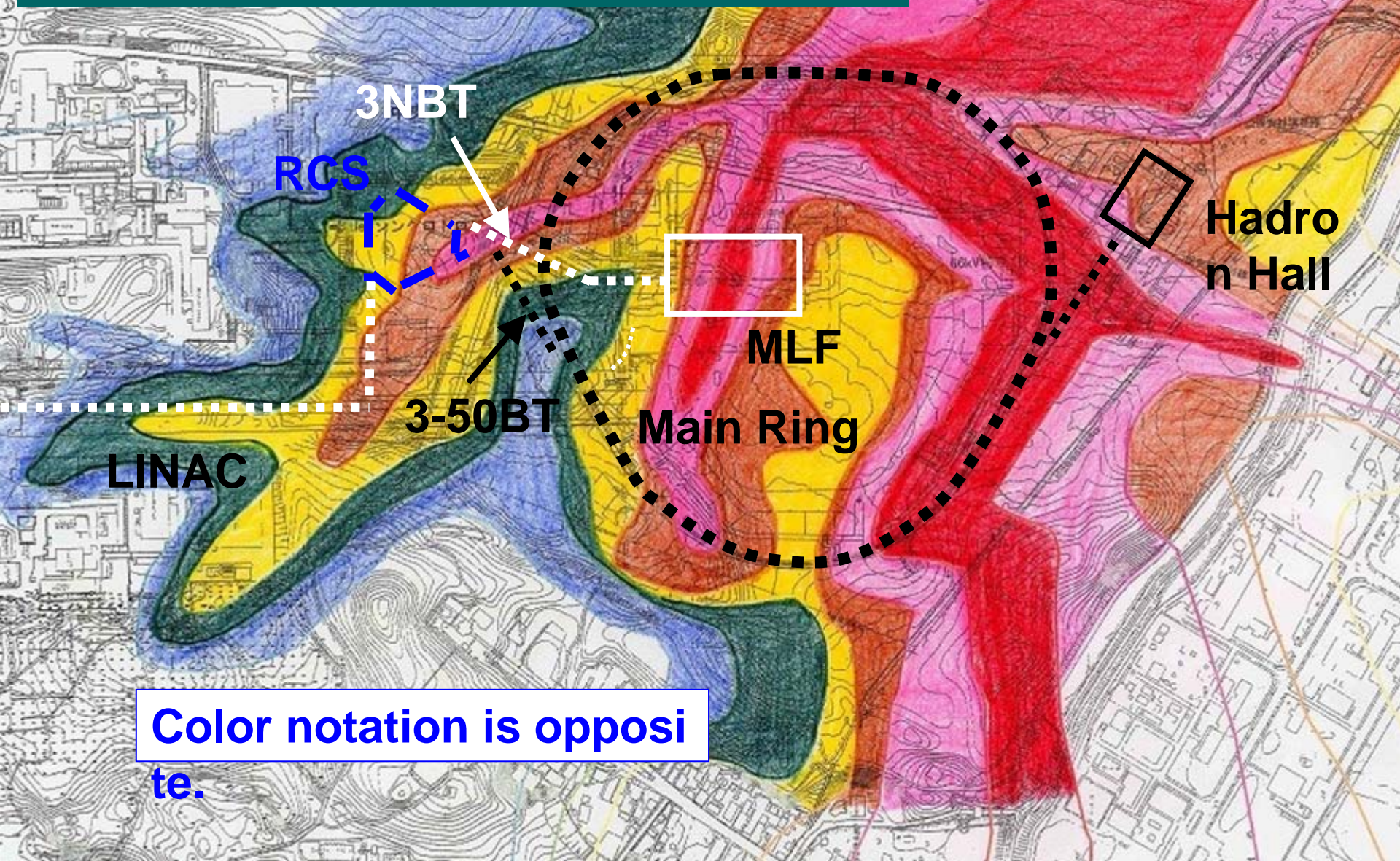


Unconsolidated sediment
s
Al : Gravel, sand and mud
d
D Sand
Naka River

Site Characteristics

- Very close to the sea
 - Ocean tide effect (site-wide inclination)
- Adjoining a river
 - Actually, it's just in the river.
 - There is a deep valley
- Not suitable for the storage ring
- Capable (we hope) for the cycling machine as J-PARC

Bedrock Contour of the South Area



3NBT

RCS

Hadron Hall

MLF

Main Ring

3-50BT

LINAC

Color notation is opposite.

Tunnel Construction



Battle with Water

● *We got much much water!*



● *How did we overcome difficulties in order to construct the main ring tunnel avoiding the water attack???*



Not to be continued !

Very sorry! It's another story...

ANYWAY

- With wisdom and much efforts, the main ring tunnel was constructed successfully...

Constr. Area Map

大強度陽子加速器施設配置図 S=1/3,000



平成16年8月19日作成

Area B
Jun 2005

Completion of earthwork

Area C
Dec 2005

Hadron hall
Mar 2007

Area A
May 2005

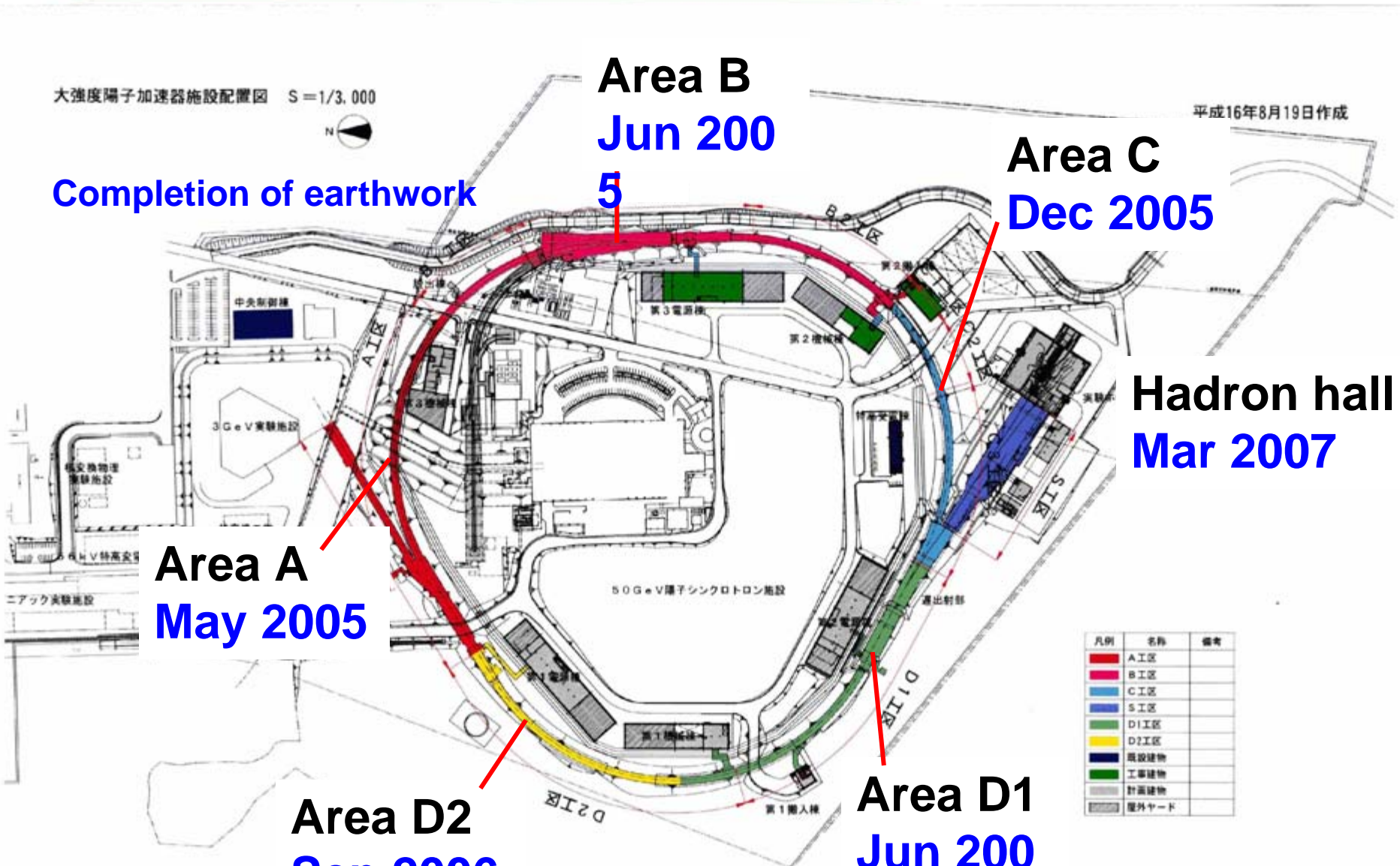
Area D2
Sep 2006

Area D1
Jun 2006

凡例	名称	備考
■	A工区	
■	B工区	
■	C工区	
■	S工区	
■	D1工区	
■	D2工区	
■	施設建物	
■	工事建物	
■	計画建物	
■	屋外ヤード	

地下水処理工法凡例

凡例	工法(案)
■	逆水壁工法(SMW)案



Alignment Started

- Magnet Alignment has started since March 2006.

During the same period...

- Construction of the middle area of the Neutrino beam line was done in summer 2006.
- Construction of the hadron experimental hall continued until March 2007.

References

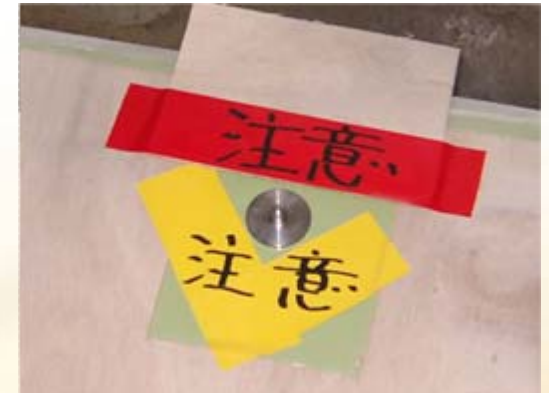
L-type wall base



O-type wall base



Floor level reference

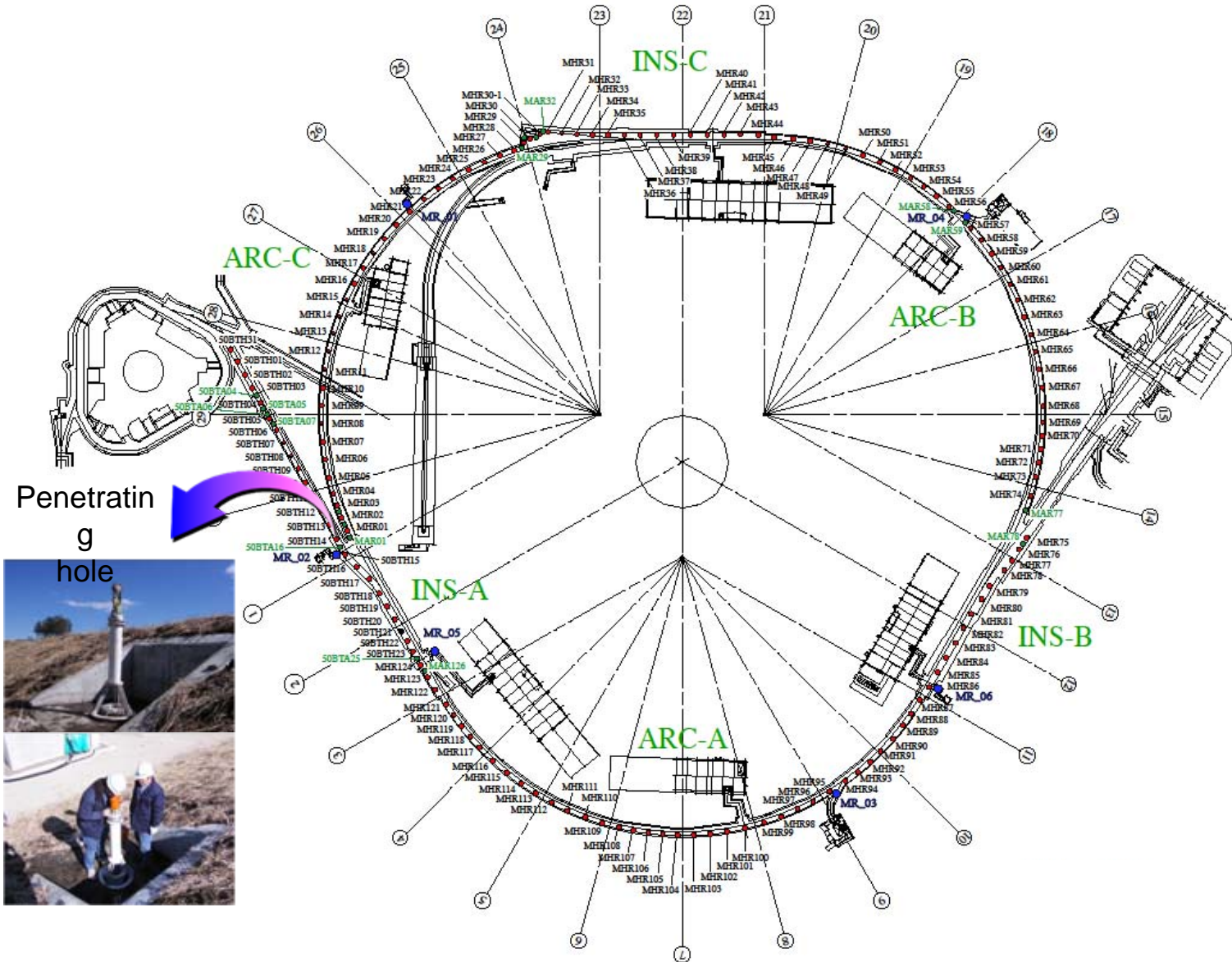


CCR of Laser Tracker

Measurement Points

- Floor level reference (FLR)
133 referenses on the MR floor
- L-type wall target base
136 target bases on the outer wall
- O-type wall target base
136 target bases on the inner wall
(After the magnet installation, the target bases on a magnet take a roll, instread.)

FLR Distribution

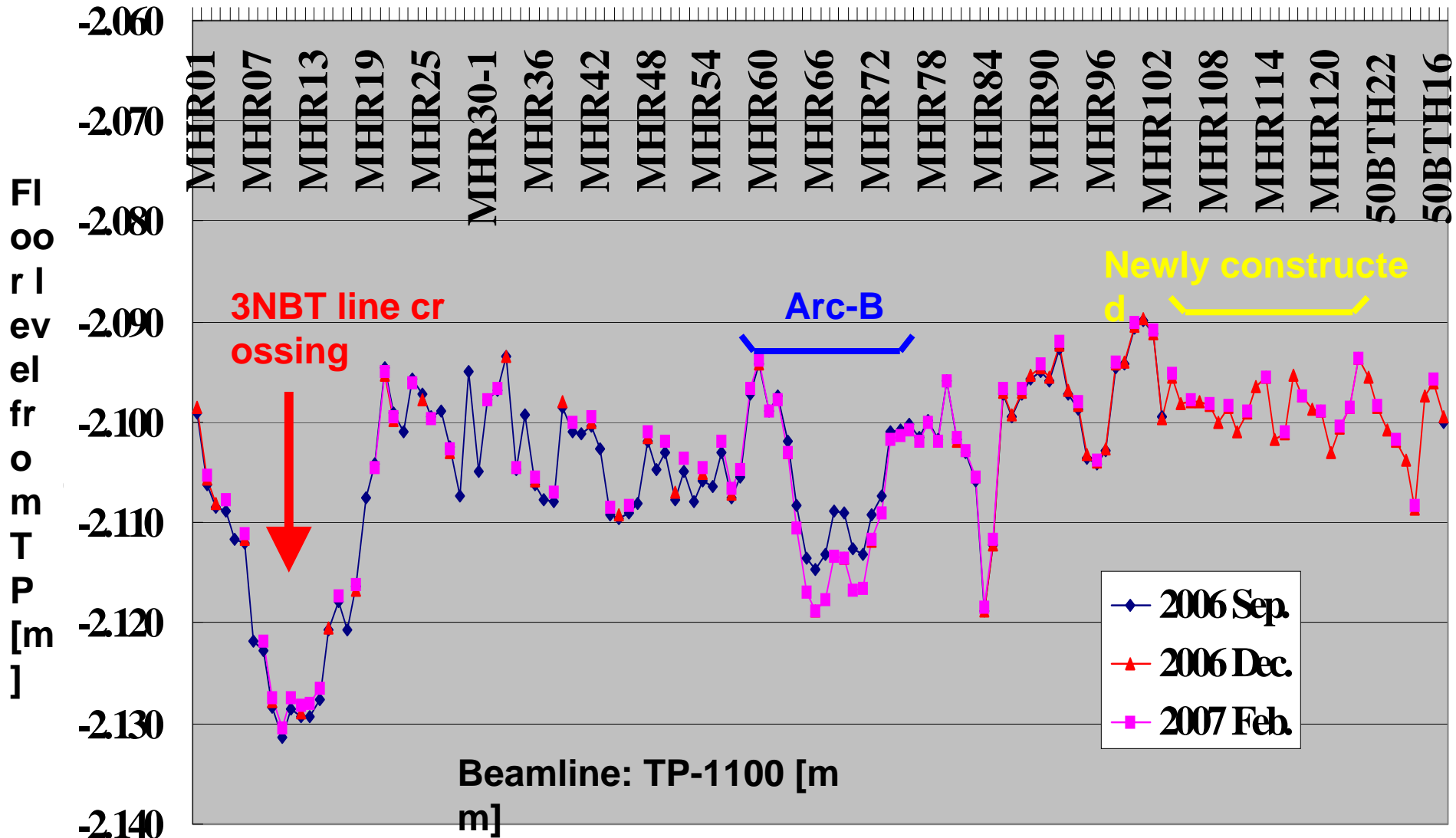


Coordinate System

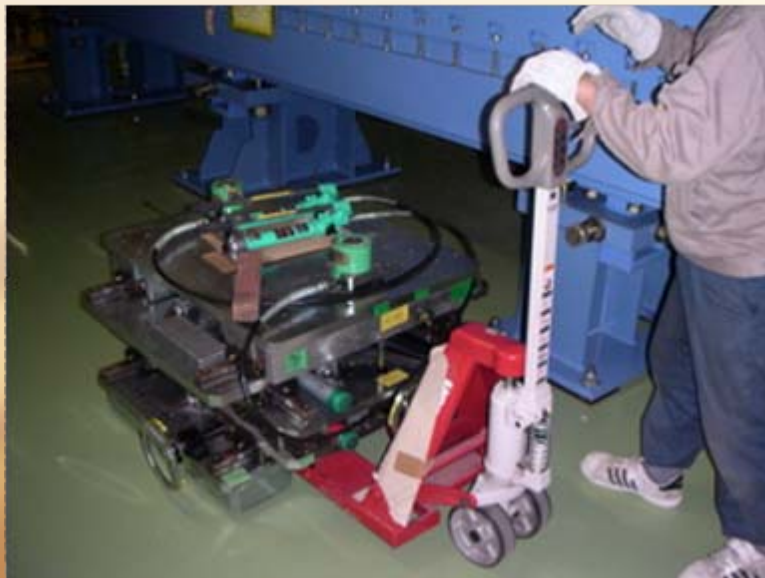
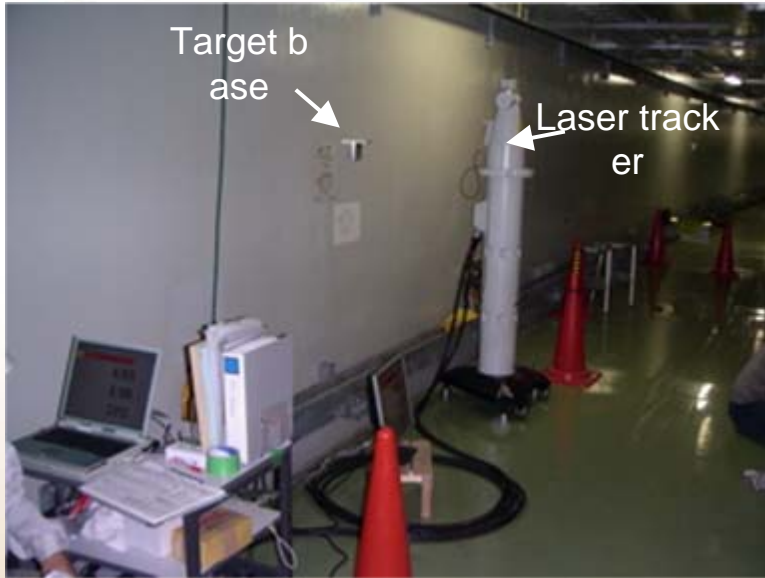
KEK_J-PARC Coordinate system

- Origin: the center of RCS
- x-axis: Parallel to the INS-C line of the MR
- Height of beamline: TP-1100 [mm]

Floor Level of MR



Magnet Alignment

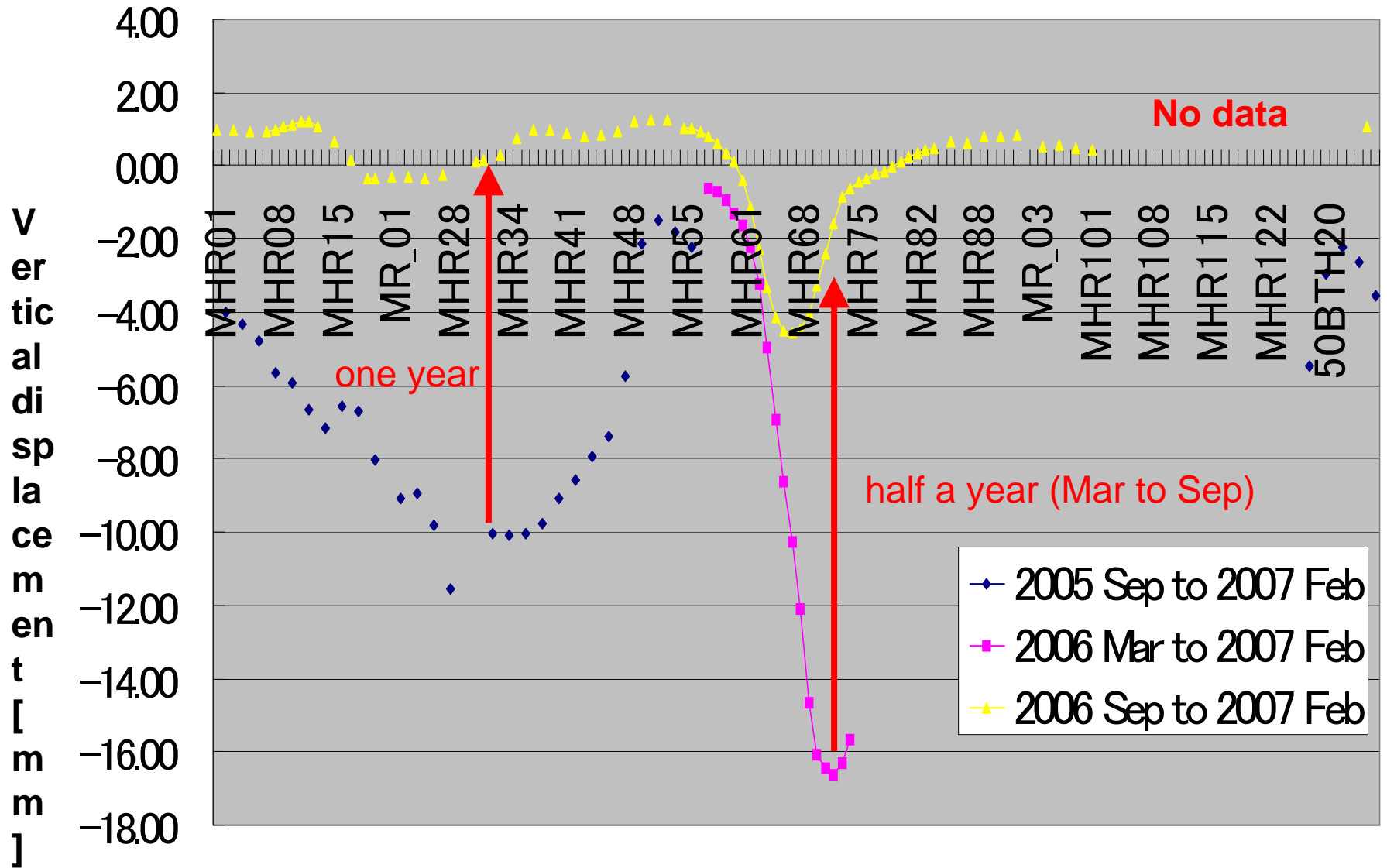


Spacer Insertion



Spacer insertion in order to compensate the large floor up-down

Displacement of FL



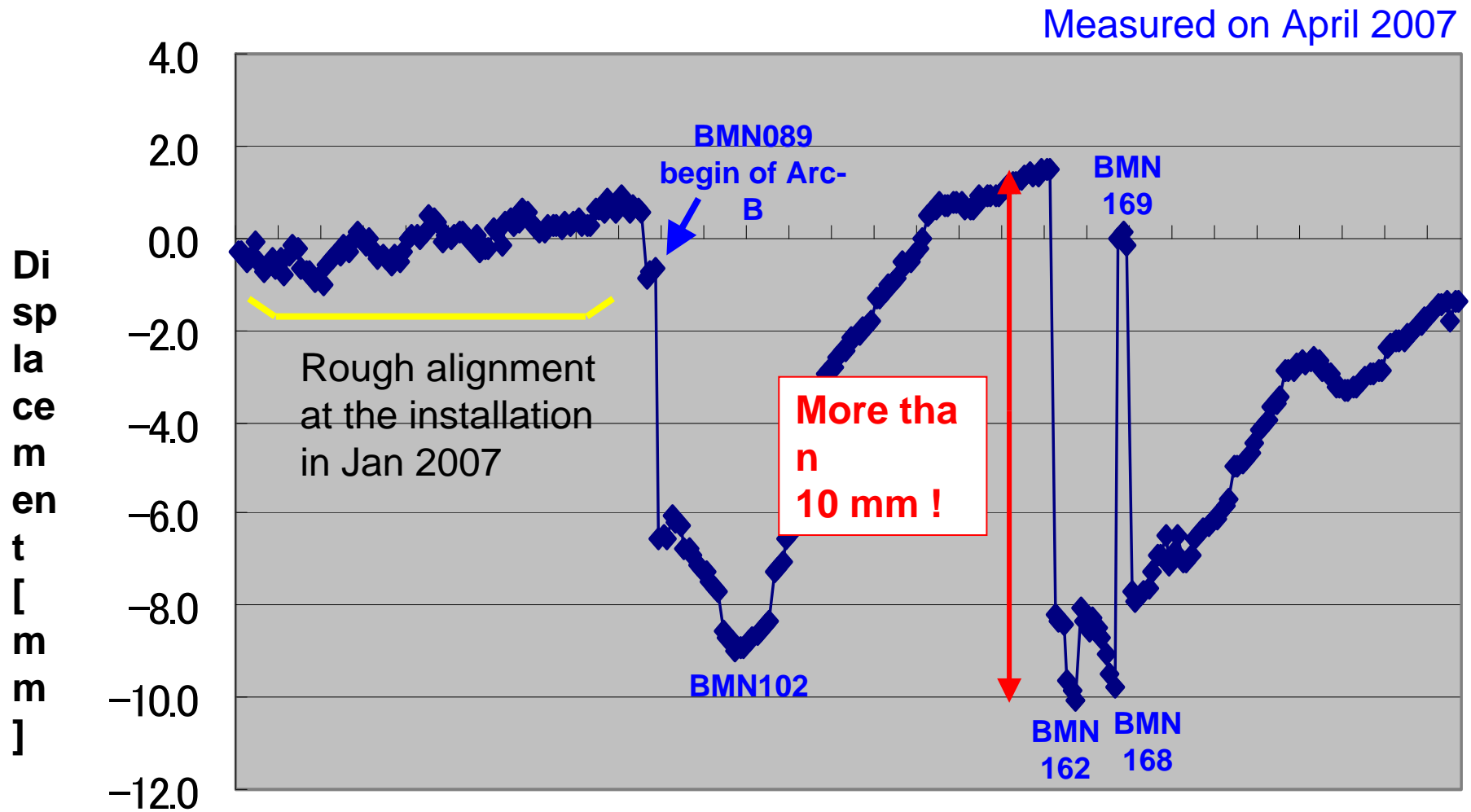
Important Facts

- Floor level displacement is terribly large in a year before September 2006.



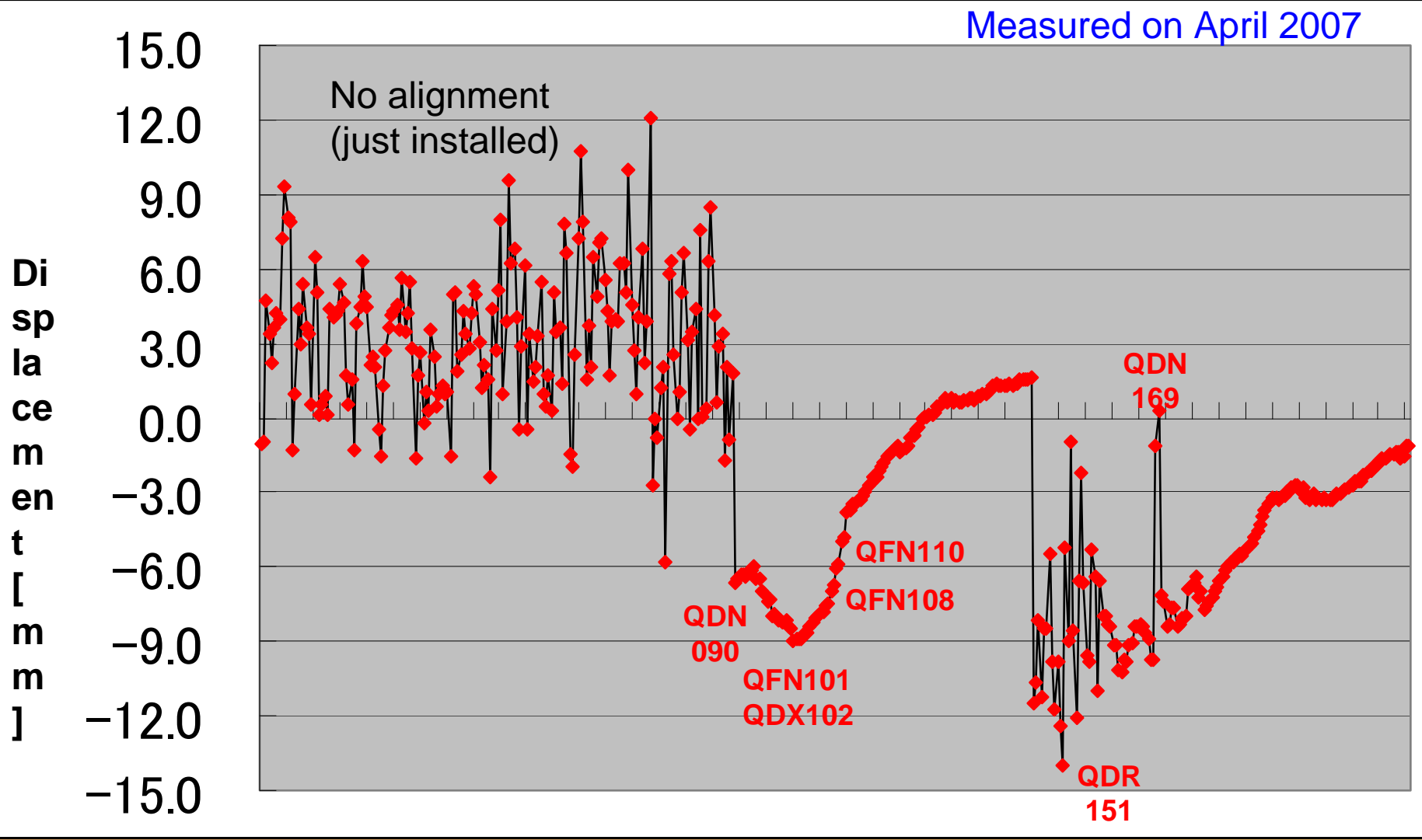
- Effect from the earthwork? **Yes.**
- Underground structure:
steep slope & deep valley? **Yes.**

Dipole Height



Absolute values are based on MAR02 measured on February 2007

Quadrupole Height



Absolute values are based on MAR02 measured on February 2007

Re-alignment

- Magnet alignment was restarted based on the result measured in April 2007.
- It spent about five months until the end of October.

Dipole: 96

Quadrupole: 216

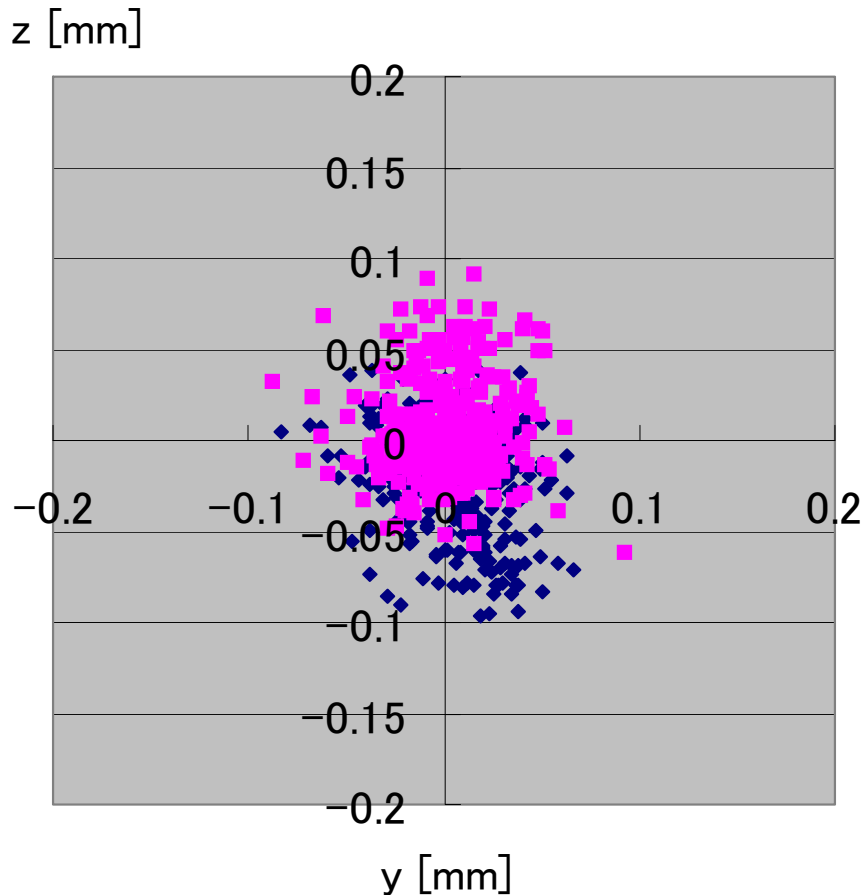
Sextupole: 80

After everything has done...

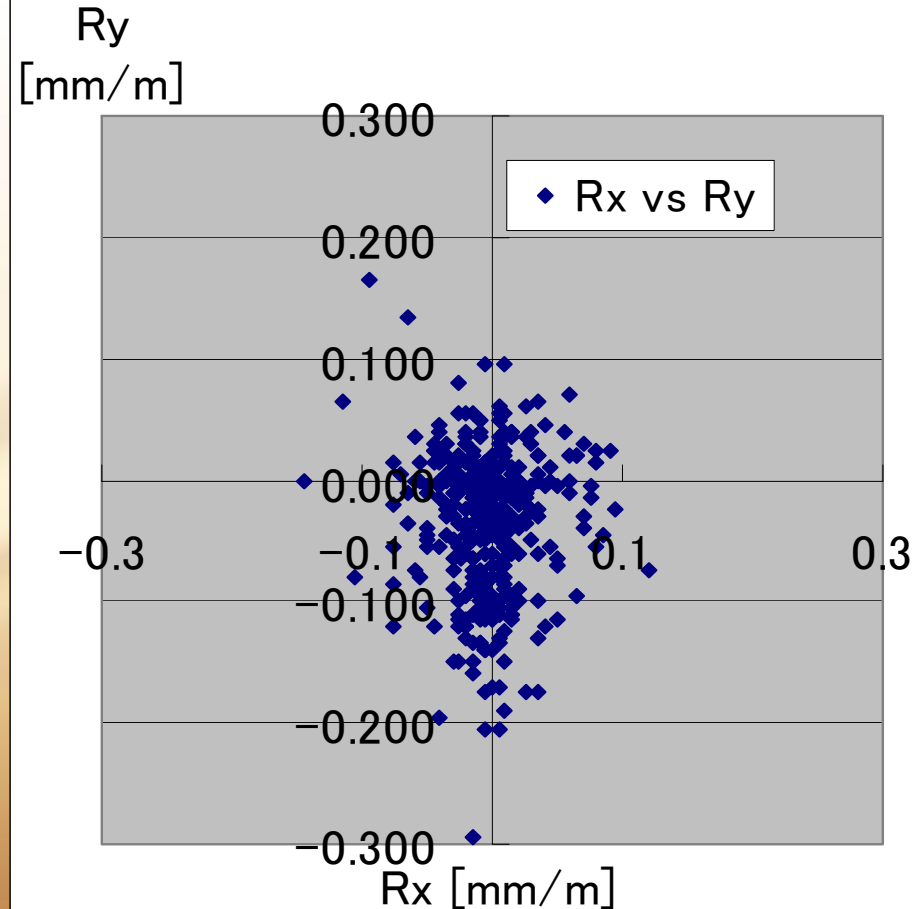
Alignment Status

All the magnets are aligned very well.

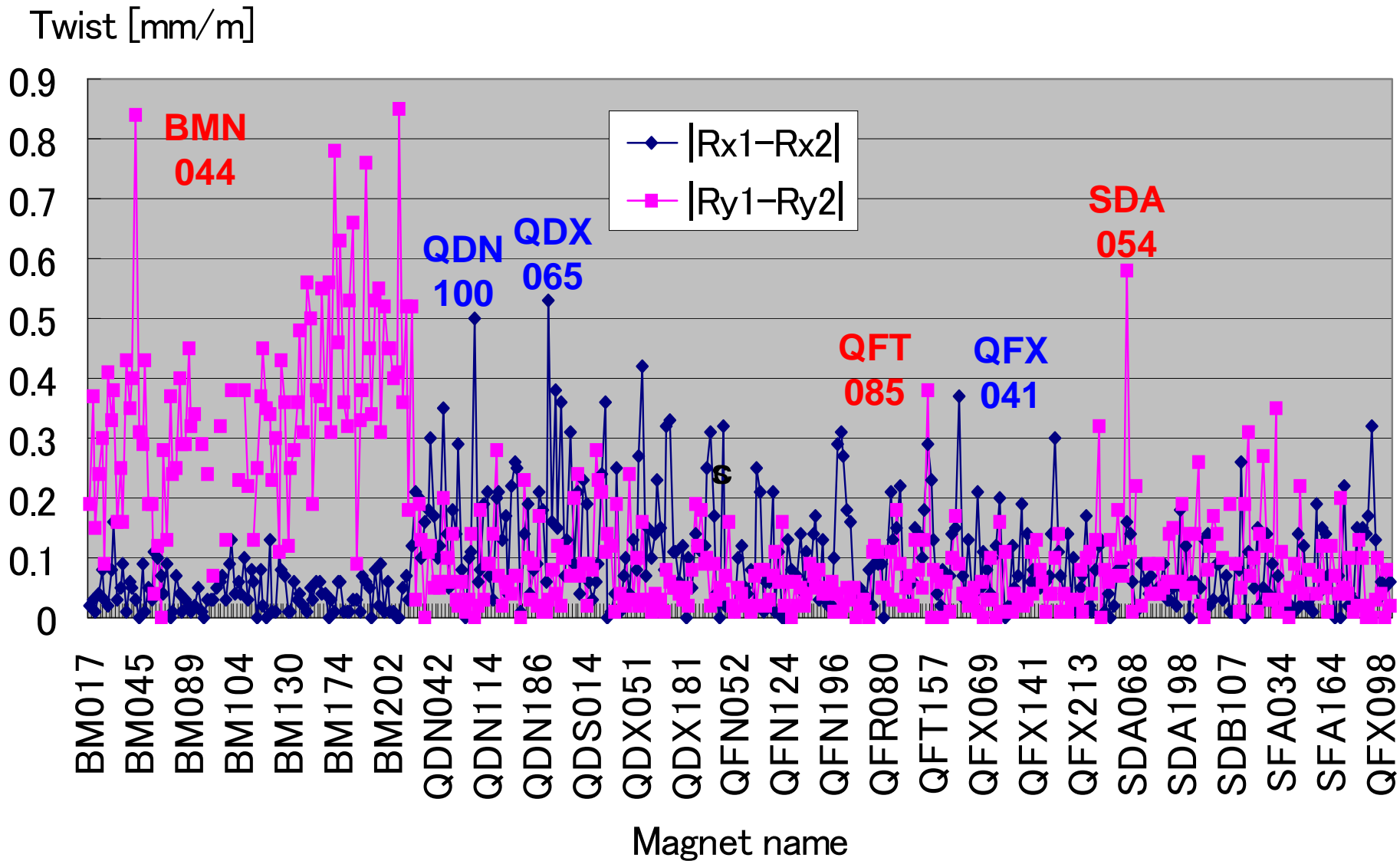
Displacement



Rotation

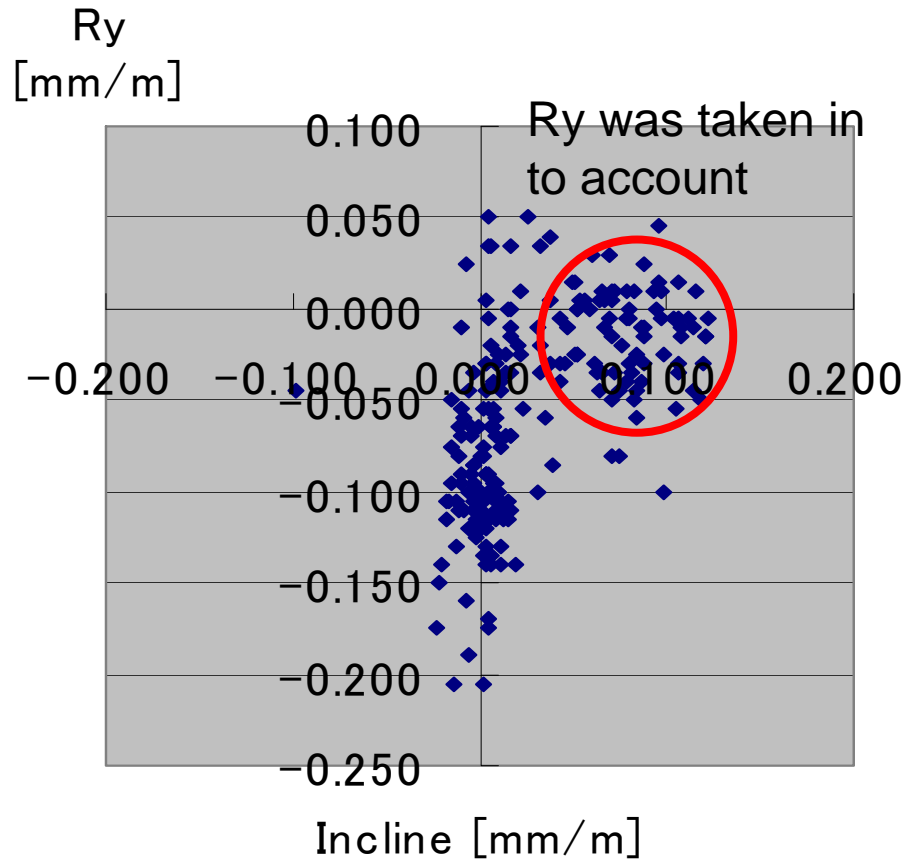


Twist of Magnets

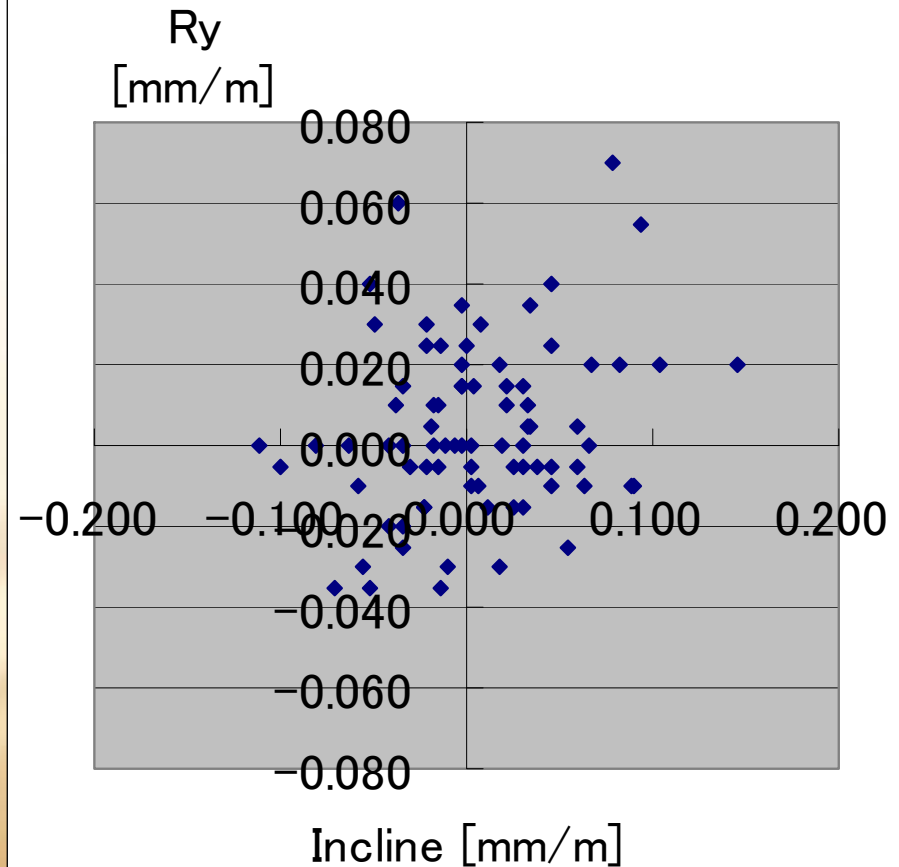


Magnet Baseplate

Quadrupole



Sextupole



$$\text{Incline} = (z2 - z1)/\text{dist}$$

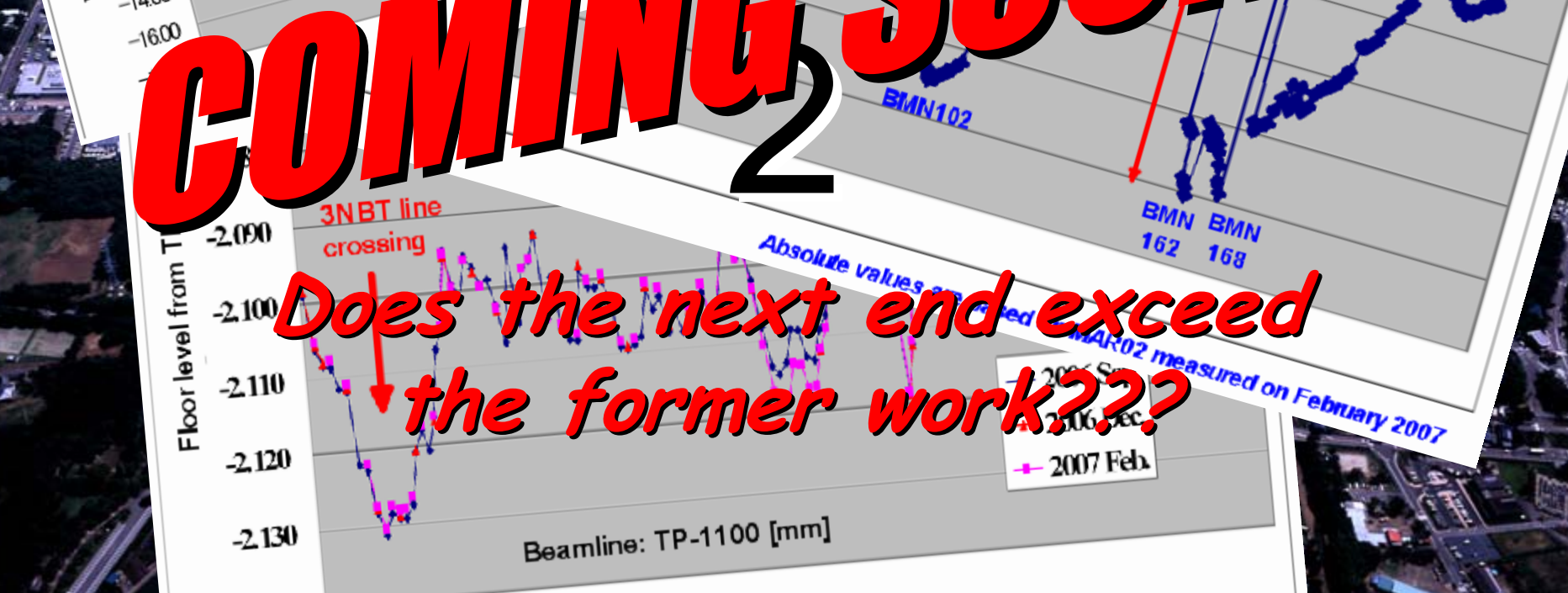
Summary

- *Unfortunately, the ground level in J-PARC site is unstable.*
- *After all, all the magnets have been aligned to satisfy the requirements, though we still have anxieties on ground motion.*
- *Next magnet measurement is planned in July 2008 after the first beam in May.*
- *Re-alignment will be carried out in autumn if it is needed.*

J-PARC Main ring

Magnet Measurement

COMING SOON!!!



Does the next end exceed the former work???