Seismic issues of ILD detector

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ILC Tokusui Workshop, KEK, 20 -21 Dec. 2012

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   - Seismic Actions on Structures

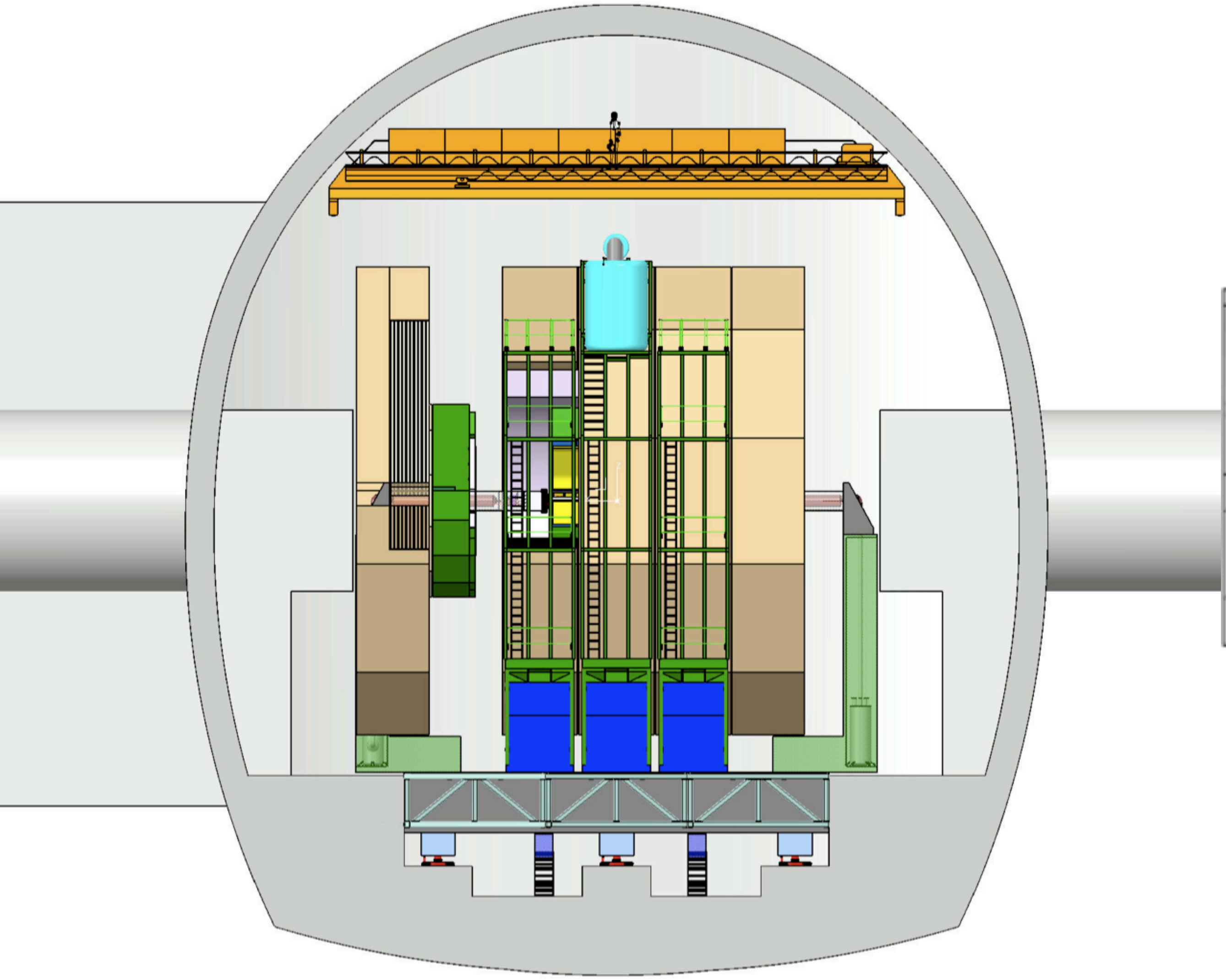
   to show the standard procedure for seismic analysis
6. Earthquake - 2011.3.11 : maximum acceleration in last 1,000 years
7. Allowable stress to be compared with the analysis results
8. FEM analysis of ND280 by H. Yamaoka
9. CLIC ILD seismic analysis by F.D.Ramos, H.Gerwig, M.Herdzina (LCWS2012)
10. Earthquake event on surface and -80m underground at KEK

    - amplification of acceleration on the surface
11. Summary

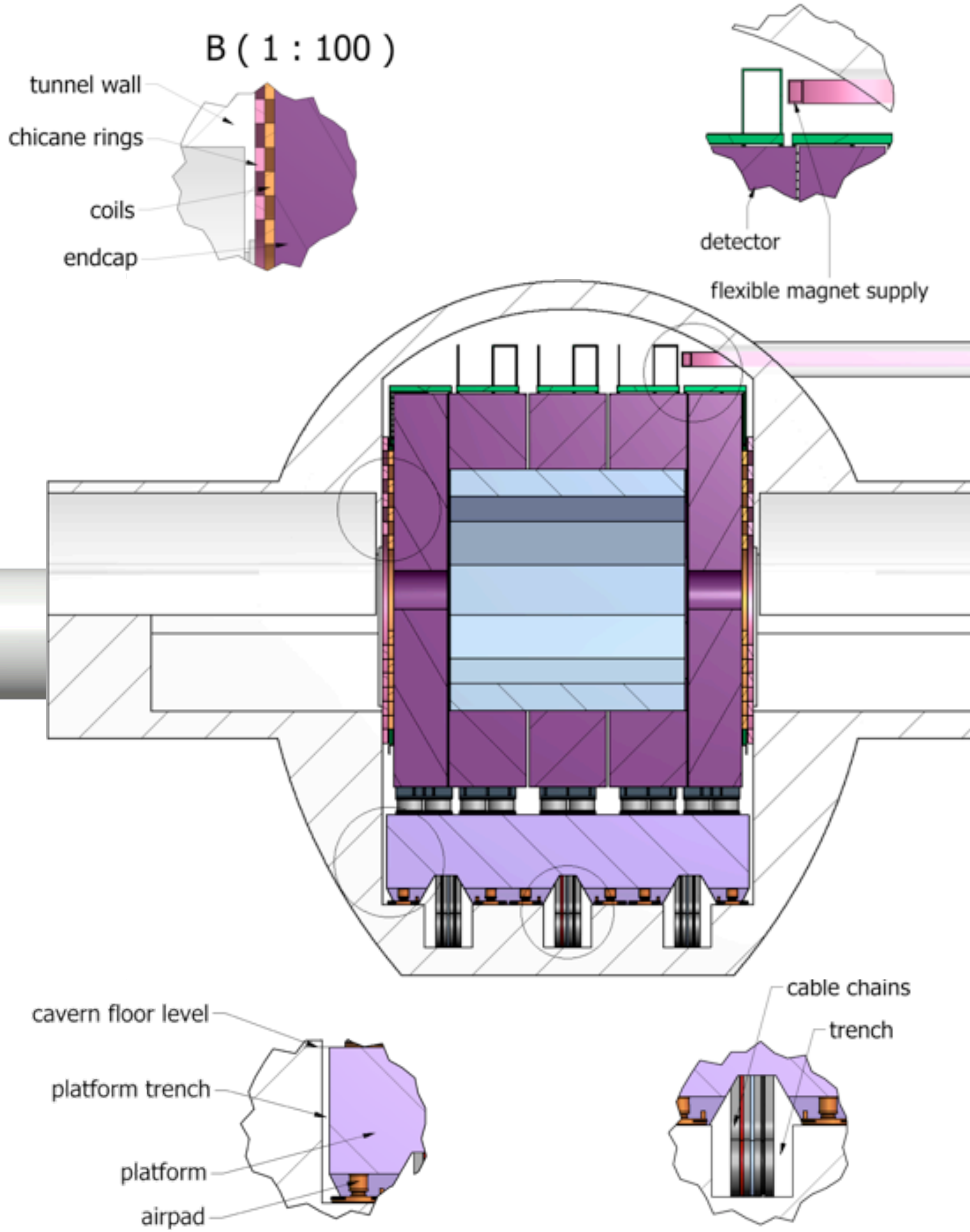
MDI Open Issues, draft, 31 October 2012

Priority	Task #	Description	Goal	Parties involved	Next Steps
10	1	**Push-pull** motion system	Platform design progress. There is substantial interest in the choice between rollers and airpads. Preliminary work is needed for door motion rail design; seismic restraints; and any tolerances for detector placement on the platform.	One egnineer from the participant Labs/Institute/Universities. In alternative an external contractor as ARUP or a direct contact to a supplier of roller- or airpad systems like Hillman or Konecranes	
11	2	**Cryogenic Distribution** system	Define the basic layout of the cryogenic distrubution scheme for the Solenoids, the FFS and the Crab Cavities	ILD, SID, Cryogroup at KEK	
12	3	**Surface Assembly Facilities**. Only a crude estimate of the space require for detector subsystem assembly was made.	The surface assembly for the flat site is better understood, being similar to the one developed for CMS. The surface assembly area for the mountain site has specific contraints because of the site topology. (The requirements for a mountain site are different from the flat site since the final installation from smaller pieces takes place in the underground hall.)	One engineer from Japan, having close ties with the CE group designing the Mountain site	Detectors must define a preassembly procedure
13	4	**Alignment of detector** to beamline after transport on platform. This presumably needs a coarse system covering the full range of motion, and an additional system with a conservative 1 mm tolerance measuring xyz and roll at both ends of the detector.	The external alignement system must be the same for the two detectors to align the detector with the integrated QD0´s with respect to the QF1`s and the beam axis	An alignment expert, possibly with deep knowledge of FSI or Rasnik. Alternativley a general alignement expert	Invite FSI Expert to give a seminar
20	5	**Detector Services** = umbilicals, interface, to CFS, routing in the Detector Hall	Revise the list of umbilcals for each detector. Define the routing in the detector hall and the interface with a CFS system	SID, ILD plus Japanese CFS contact	
22	6	**QD0 Prototyping**	Design and Testing of QD0. RF testing. Vibration testing	BNL	
25	7	**Sesimic** requirements and solution		ILD.SDI, CE exspert	Check the Japanses rules
28	8	**QD0 Integration**	Movers, FRWD, Beam Instrumentation	ILD, SID, BNL	
30	9	**Magnetic field leakage**	Compare the current field map with the the existing rules in Japan	ILD, SID with magnet expert from Japan	Check Japanese requirements
31	10	**Vibrations** analysis	Correlation measurements, cold box	ILD, SID, Expert, Cryogroup at KEK	
32	11	**Radiation shielding** properties of SID and ILD	Revise the worst conditions of radiation exposure like a beam loss. Compare it with the existing rules in Japan. Eventually reconsider the PACman design	ILD, SID with a radiation expert from Japan	Check Japanese requirements
35	12	**Beam Commissioning**	Define Physics Requirements for beam commissioning without detectors	ILD, SID, Machine expert	
35	13	**Detector internal alignement procedure**	Ideally the internal alignment system will be the same technology used for the external one. The two systems should be designed as an integrated systems. FSI pursued by SID shows good potentiality. Or a Rasnik system pursued by ILD.	ILD, SID plus alignement expert (FSI or Rasnik)	
40	14	**Local Control Rooms.** What is scope of permanent facilities associated with the experiment? Utilities. Machine shop.	Detectors will enumerate the list of the techncial rooms needed for the operation and maintenace of the detectors. CFS?)	To be implemented by the Civil engineering group in charge of the site layout (J-Power or ILC-CFS)	
50	15	**Vacuum** around the IP	Agree on the pressure distribution around IP	ILD, SID, Vacuum expert	

ILC

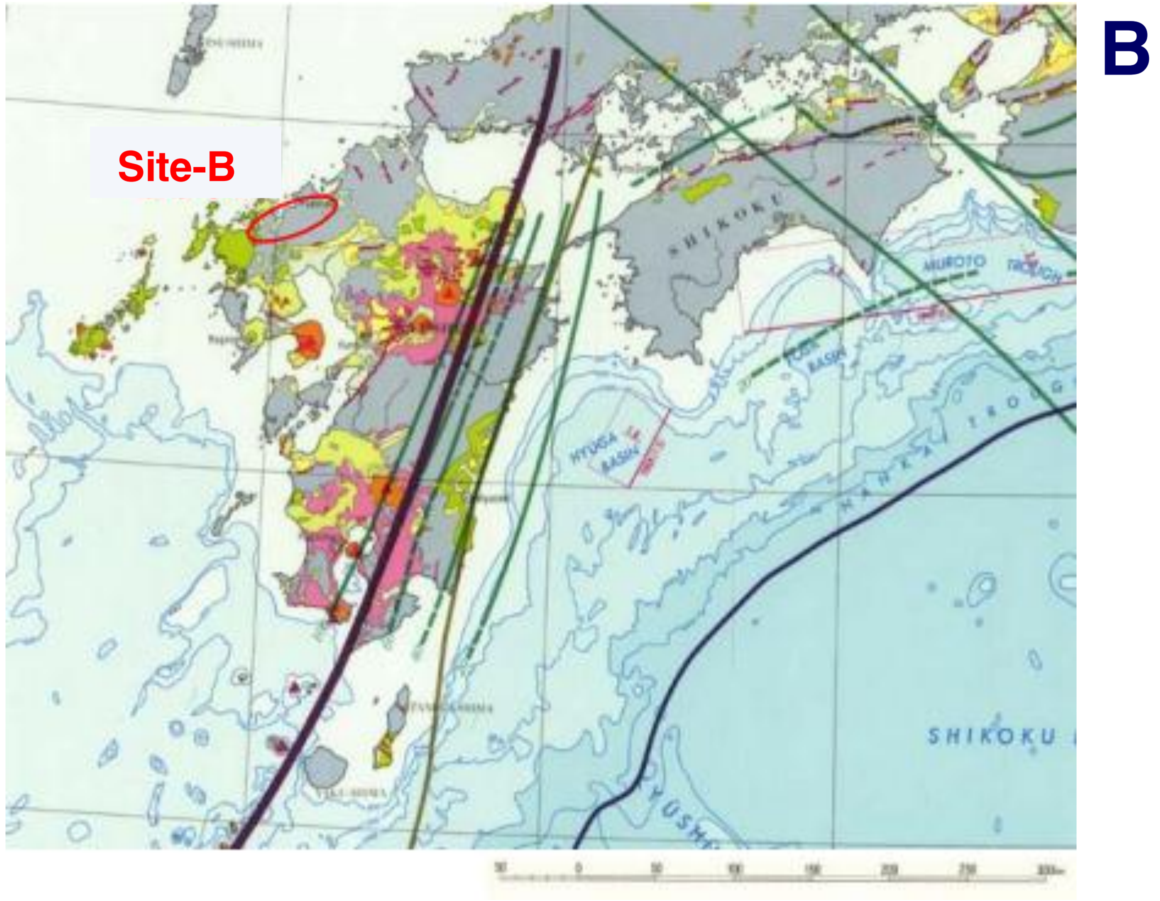


CLIC

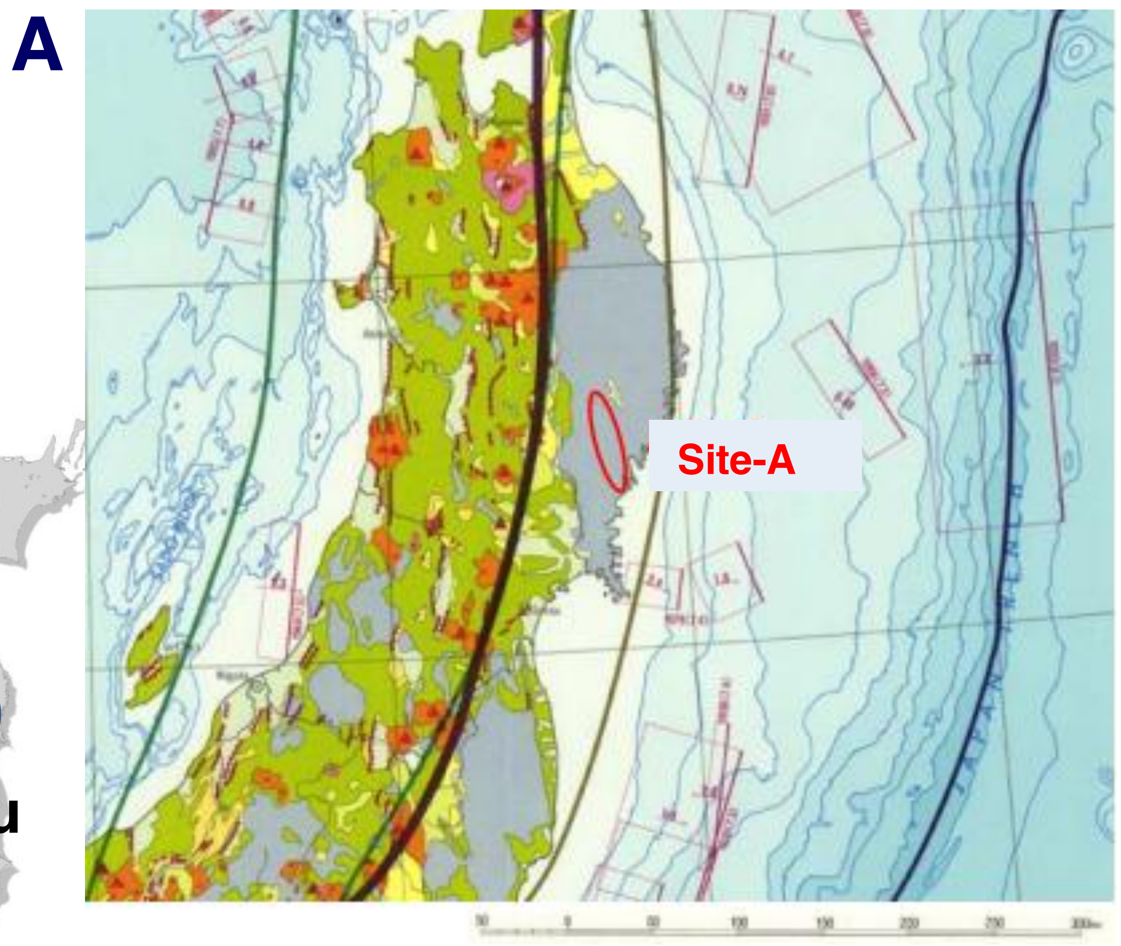

B (1 : 100)
tunnel wall
chicane rings
coils
endcap
detector
flexible magnet supply
cavern floor level
platform trench
platform
airpad
cable chains
trench

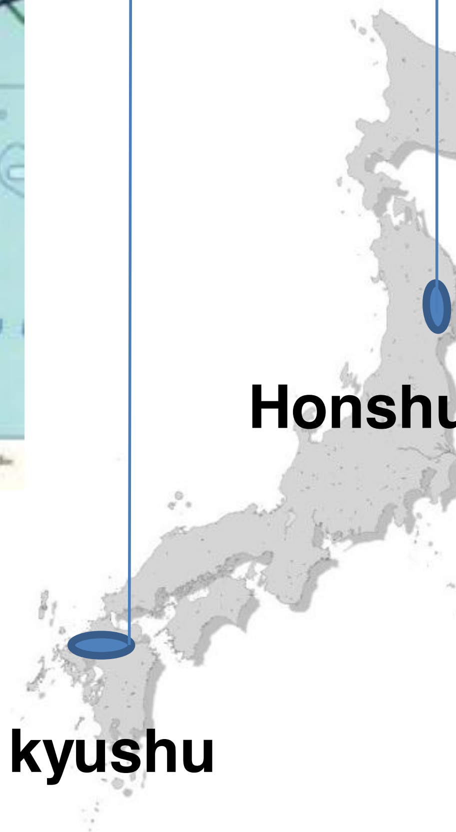
1. Outline about Two Candidate Sites in Japan

SEFURI-Site



KITAKAMI-Site





- Belong to FUKUOKA & SAGA Prefecture in KYUSHU District
- Located in stable Granite zone
- Have not Active Fault zone
- Separate from Volcano Front line
- Annual average Temperature:12℃
- Annual total Precipitation : 2,400mm

- Belong to IWATE & MIYAGI Prefecture in TOHOKU District
- Located in stable Granite zone
- Have not Active Fault zone
- Separate from Volcano Front line
- Annual average Temperature:10℃
- Annual total Precipitation : 1,300mm

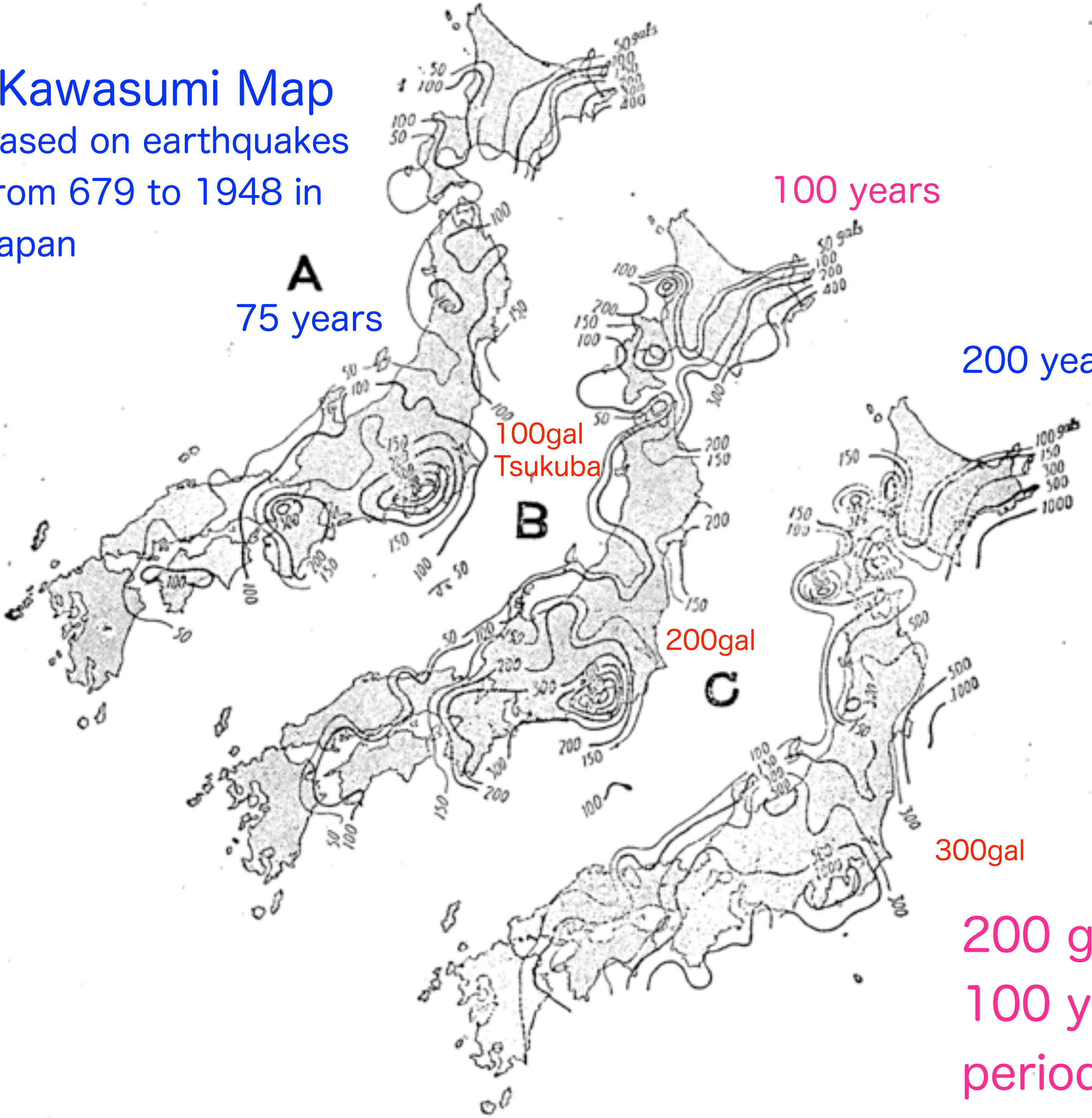
Hazard map in Japan

Maximum acceleration (gal) in the 100 years of recurrence intervals of earthquake

Regional constants of earthquake ground motions

Kawasumi Map

based on earthquakes from 679 to 1948 in Japan



75 years

100 years

200 years

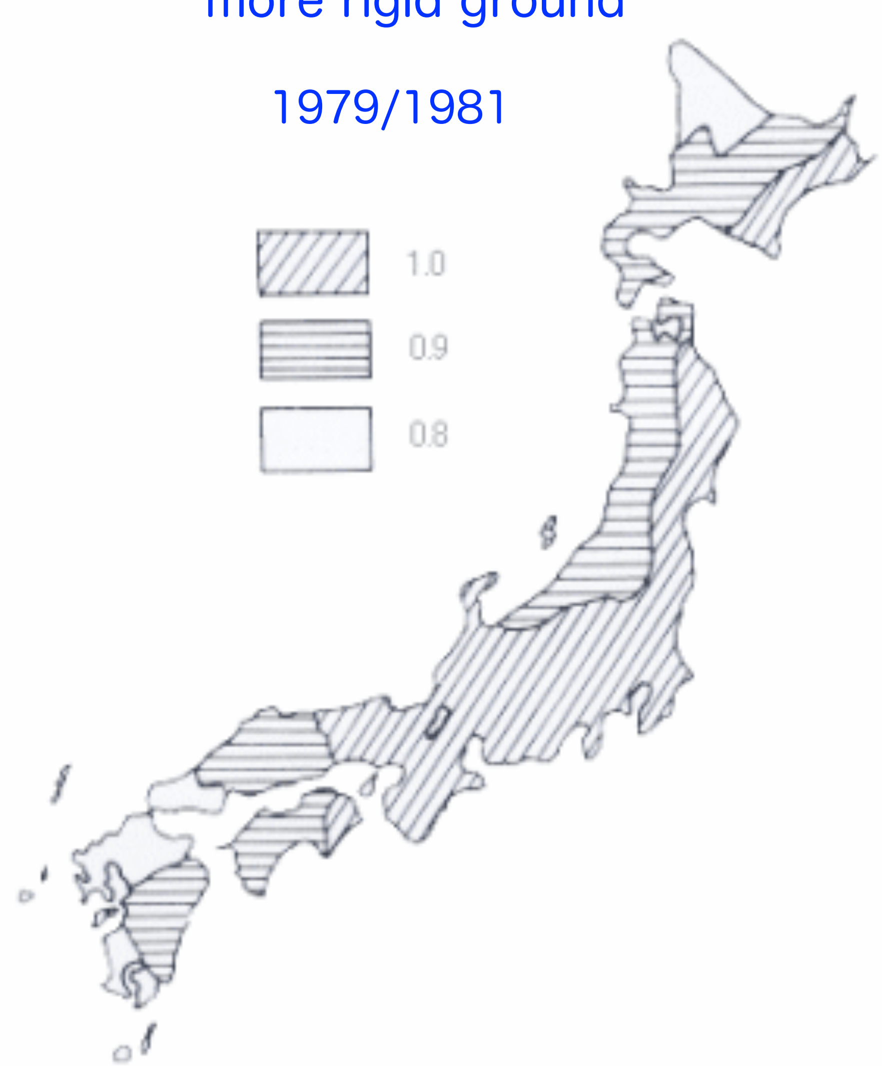
100gal
Tsukuba

200gal

300gal

small number means more rigid ground

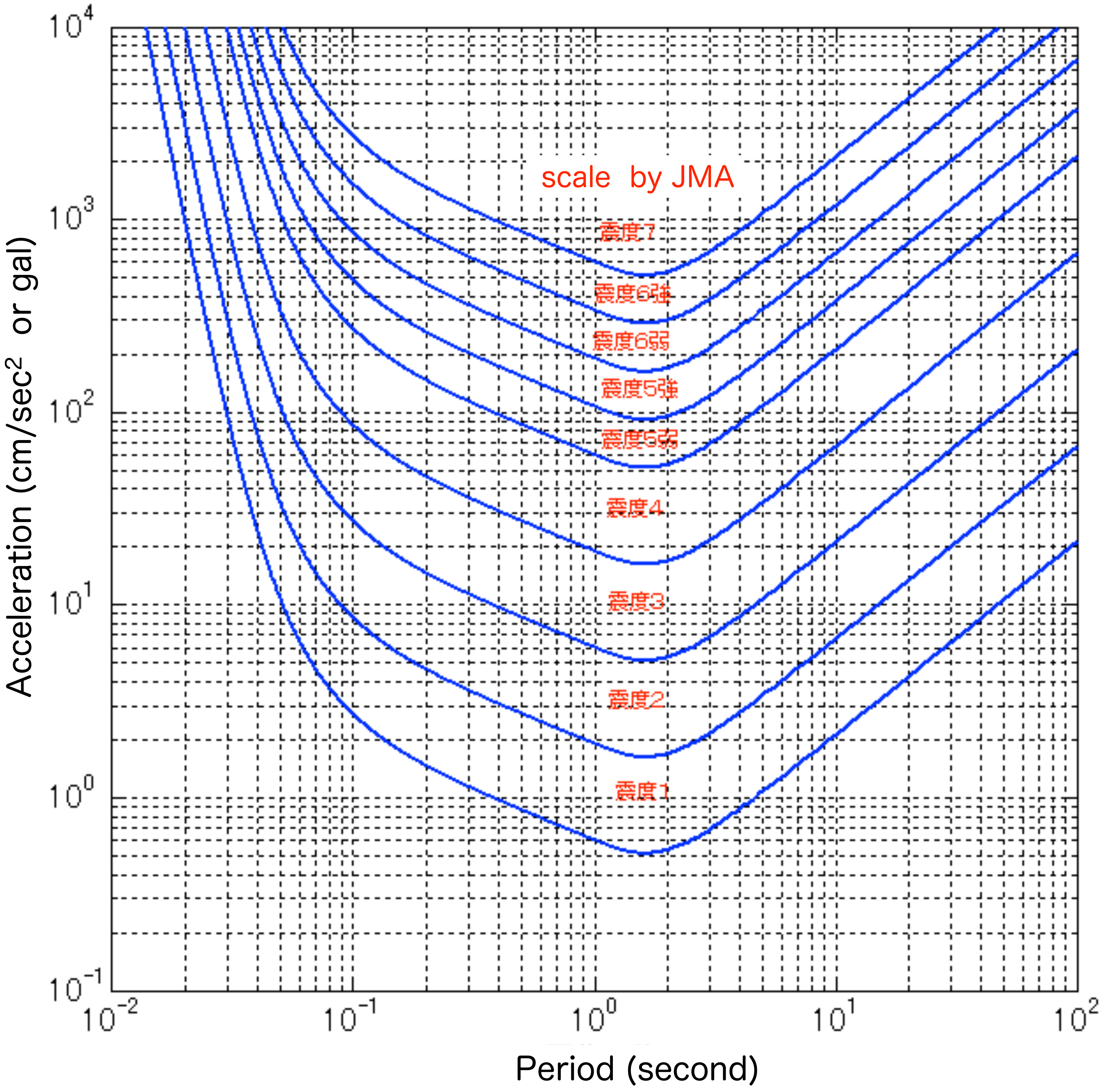
1979/1981



200 gal in Tsukuba for the 100 years endurance(return period)

JMA (Japan Meteorological Agency)				http://www.jma.go.jp/jma/kishou/know/shindo/explane.html	
Scale(m)	gal JMA lower end	Acc(cm/s^2) $0.45\times10^{m/2}$	**People**	**Indoor Situations**	**Outdoor Situations**
0			**Imperceptible to people.**		
1	**0.8**	**1.4**	**Felt by only some people in the building.**		
2	**2.5**	**4.5**	**Felt by most people in the building. Some people awake.**	**Hanging objects such as lamps swing slightly.**	
3	8	**14**	**Felt by most people in the building. Some people are frightened.**	**Dishes in a cupboard rattle occasionally.**	**Electric wires swing slightly.**
2012.12.7 (M7.3)@Tsukuba **4**	25	**45**	**Many people are frightened. Some people try to escape from danger. Most sleeping people awake.**	**Hanging objects swing considerably and dishes in a cupboard rattle. Unstable ornaments fall occasionally.**	**Electric wires swing considerably. People walking on a street and some people driving automobiles notice the tremor.**
5-Lower	80	**142**	**Most people try to escape from a danger. Some people find it difficult to move.**	**Hanging objects swing violently. Most Unstable ornaments fall. Occasionally, dishes in a cupboard and books on a bookshelf fall and furniture moves.**	**People notice electric-light poles swing. occasionally, windowpanes are broken and fall, un-reinforced concrete-block walls collapse, and roads suffer damage.**
5-Upper		**253**	**Many people are considerably frightened and find it difficult to move.**	**Most dishes in a cupboard and most books on a bookshelf fall. Occasionally, a TV set on a rack falls, heavy furniture such as a chest of drawers falls, sliding doors slip out of their groove and the deformation of a door frame makes it impossible to open the door.**	**In many cases , un-reinforced concrete-block walls collapse and tombstones overturn. Many automobiles stop because it becomes difficult to drive. Occasionally, poorly-installed vending machines fall.**
2011.3.11 (M9.0)@Tsukuba **6-Lower**	250	**450**	**Difficult to keep standing.**	**A lot of heavy and unfixed furniture moves and falls. It is impossible to open the door in many cases.**	**In some buildings, wall tiles and windowpanes are damaged and fall.**
6-Upper		**800**	**Impossible to keep standing and to move without crawling.**	**Most heavy and unfixed furniture moves and falls. Occasionally, sliding doors are thrown from their groove.**	**In many buildings, wall tiles and windowpanes are damaged and fall. Most un-reinforced concrete-block walls collapse.**
7	400	**1423**	**Thrown by the shaking and impossible to move at will.**	**Most furniture moves to a large extent and some jumps up.**	**In most buildings, wall tiles and windowpanes are damaged and fall. In some cases, reinforced concrete-block walls collapse.**

H. Yamaoka, “Magnet seismic analysis”, 10 July, 2007, KEK


scale by JMA
震度7
震度6強
震度6弱
震度5強
震度5弱
震度4
震度3
震度2
震度1
Acceleration (cm/sec^2 or gal)
10^4
10^3
10^2
10^1
10^0
10^{-1}
10^{-2}
10^{-1}
10^0
10^1
10^2
Period (second)

ISO3010

International Standard
Based for Design of Structures - Seismic Actions on Structures

2001

International Organization for Standardization

Normalized design response spectrum

The normalized design response spectrum can be interpreted as an acceleration response spectrum normalized by the maximum ground acceleration for design purpose.

It may be of the form

$k_R = 1$ for $T = 0$ (C.1)

Linear interpolation for $0 < T \leqslant T'_c$ (C.2)

$k_R = k_{Ro}$ for $T'_c < T \leqslant T_c$ (C.3)

$k_R = k_{Ro} \left(\frac{T_c}{T}\right)^{\eta}$ for $T > T_c$ (C.4)

where

k_R	is the ordinate of the normalized design response spectrum;
k_{Ro}	is a factor dependent on the soil profile and the characteristics of the structure, e.g. the damping of the structure; for a structure with a damping ratio of 0,05 resting on the average quality soil, k_{Ro} may be taken as 2 to 3;
T	is the fundamental natural period of the structure;
T_c and T'_c	are the corner periods as related to the soil condition, as illustrated in Figure C.1;
η	is an exponent that can vary between 1/3 and 1; when $\eta = 1$, the response velocity becomes constant as $\left(\frac{g}{2\pi} k_{Ro} T_c\right)$ for $T > T_c$, therefore, T_c is closely related to the response velocity;

T_c, T'_c and η are dependent on tectonic and geological conditions; T'_c may be taken as (1/5) to (1/2) of T_c.

For example, for horizontal motions T_c can be taken as

— 0,3 s to 0,5 s for stiff and hard soil conditions,

— 0,5 s to 0,8 s for intermediate soil conditions, and

— 0,8 s to 1,2 s for loose and soft soil conditions.

For the classification of soil conditions, the thickness of the soil layers should be taken into account.

The fundamental natural period, T, can be calculated from calibrated empirical formulae, from Rayleigh's approximation, or from an eigenvalue formulation. For the estimation of T, the reduction of stiffness of concrete elements due to cracking should be taken into account.

a) The structure should not collapse nor experience other similar forms of structural failure due to severe earthquake ground motions that could occur at the site
(ultimate limit state: ULS).

b) The structure should withstand moderate earthquake ground motions which may be expected to occur at the site during the service life of the structure with damage within accepted limits (serviceability limit state: SLS).

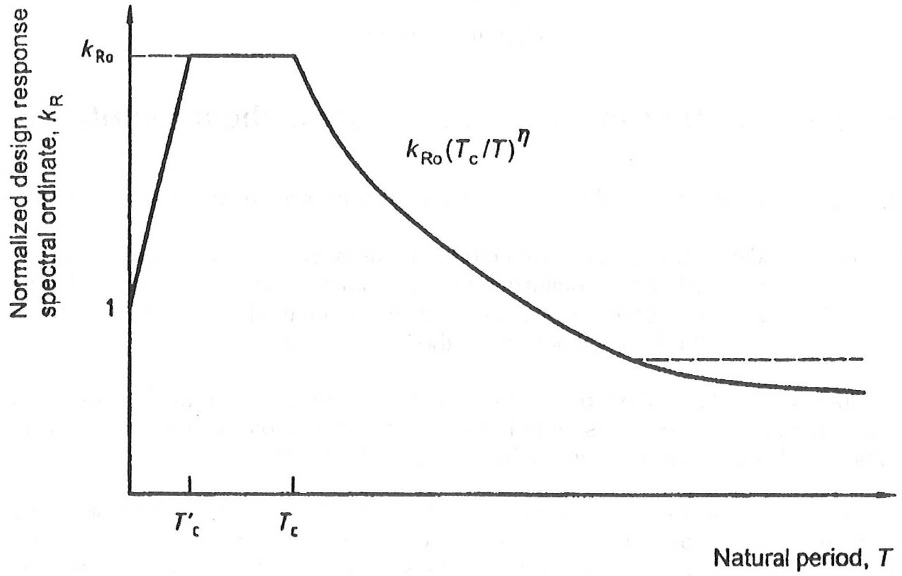


Figure C.1 — Normalized design response spectrum

Figure C.1 indicates that k_R is unity at $T = 0$ and linearly increases to k_{Ro} at $T = T'_c$. It is recommended, however, to use $k_R = k_{Ro}$ for $0 < T \leqslant T'_c$, as the dotted line of Figure C.1, because of the following reasons:

— uncertainty of ground motion characteristics in this range;

— low sensitivity of strong motion accelerometers in this range, and therefore a possibility of a higher value of k_R than the apparent one;

— possibility of an unconservative estimate of the structural factor k_D for short period structures.

For determination of forces at longer periods, it is recommended that a lower limit be considered as indicated by the dashed line in Figure C.1. The value of this level may be taken as 1/3 to 1/5 of k_{Ro}.

For determination of the displacements at longer periods, Figure C.1 becomes too conservative. For long periods, the response displacement becomes a function of the maximum displacement of earthquake ground motions. There is uncertainty about the ground displacement close to faults in very large magnitude earthquakes, therefore extrapolation of data from smaller earthquakes should be made with care.

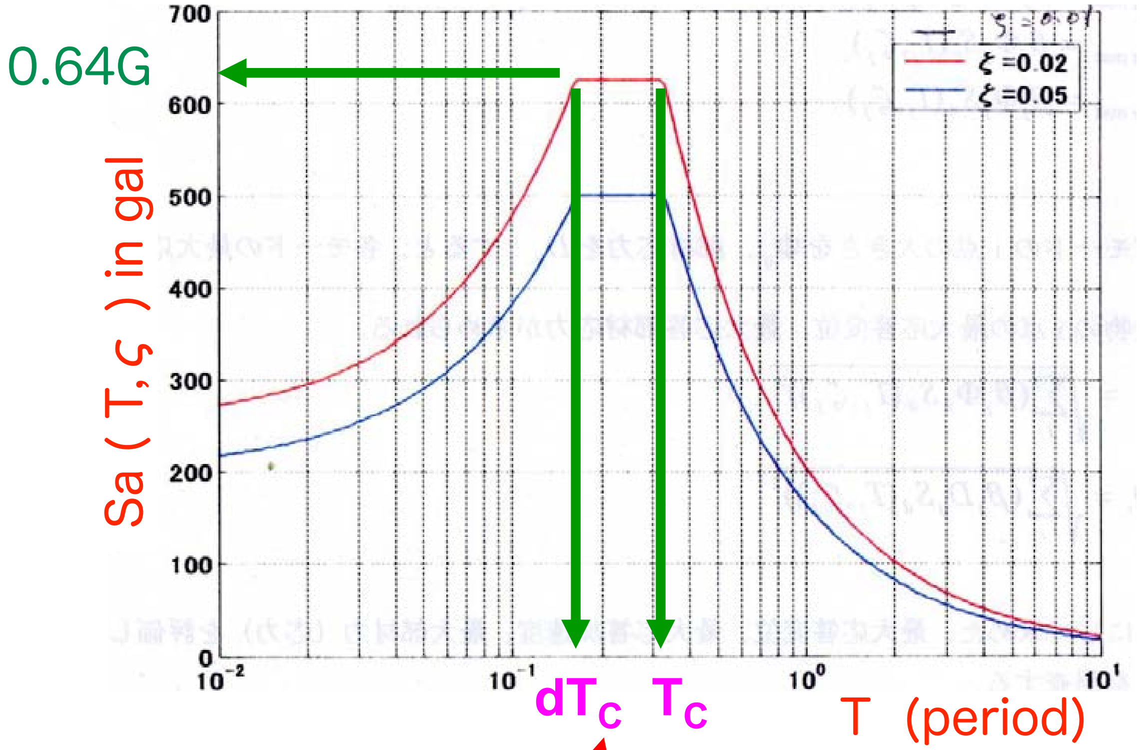
An equivalent linearlization approach may also be used for estimating the maximum deformations of structural systems. In this approach, a system involving hysteretic behaviour is replaced with a linear system having an equivalent natural period and an equivalent viscous damping ratio. The maximum deformation of the hysteretic system is estimated as that of the equivalent linear system. A number of proposals are available for determining the equivalent natural period and viscous damping ratio, which are primarily specified as a function of the expected ductility factor. In recent years, design concepts based upon displacement analysis have been advanced, and the equivalent linearlization approach is often used for determining the required strength for a given maximum deformation.

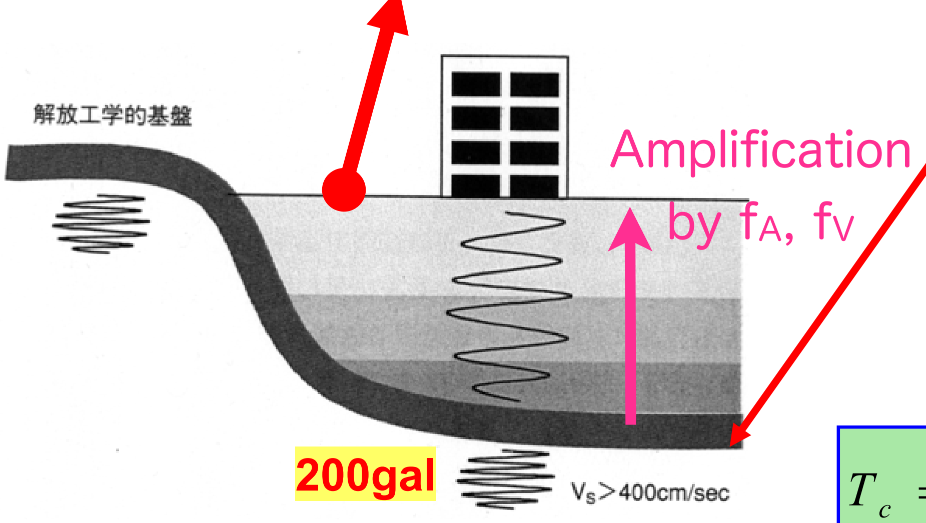
ISO3010, geology (class-1, rigid), on the surface

Seismic analysis

Steel structure : ς =0.02

Acceleration response spectrum





$0 \le T \le dT_C$

$$S_a = \left(1 - \frac{f_A - 1}{d} \cdot \frac{T}{T_C}\right) \cdot F_h \cdot G_A \cdot R_A \cdot \boxed{A_0}$$

$dT_c \le T \le T_C$

$$S_a = f_{A\cdot} F_h \cdot G_A \cdot R_A \cdot \boxed{A_0}$$

$T_C \le T$: Velo = const.

$$S_a = \frac{2\pi \cdot f_V \cdot F_h \cdot G_V \cdot R_V \cdot V_0}{T}$$

rigid $A_0 = 15V_0$

A_0=200gal: *representative value of earthquake*

In case of *hard soil*, rigid

f_A=2.5, f_V=2.0, d=0.5, R_A=1.0, R_V=1.0,
G_A=1.0, G_V=1.0, T_C=0.33

$$F_h = \frac{1.5}{1 + 10\varsigma}$$

ζ(Damping ratio) =0.02 → F_h=1.25

$$T_c = \frac{2\pi f_V \cdot G_V \cdot R_V \cdot V_0}{f_A \cdot G_A \cdot R_A \cdot A_0} = \frac{2\pi \cdot 2 \cdot 1 \cdot 1 \cdot A_0/15}{2.5 \cdot 1 \cdot 1 \cdot A_0} = 0.33 \text{ sec}$$

$dT_c \le T \le T_C$

$$S_a = f_{A\cdot} F_h \cdot G_A \cdot R_A \cdot A_0$$
$$= 2.5 \cdot 1.25 \cdot 1.0 \cdot 1.0 \cdot 200 \;.= \boxed{625\ (gal)}$$

T_c=0.33sec= *3Hz*

dT_c=0.16sec= *6.3Hz*

H. Yamaoka, “Magnet seismic analysis”, 10 July, 2007, KEK

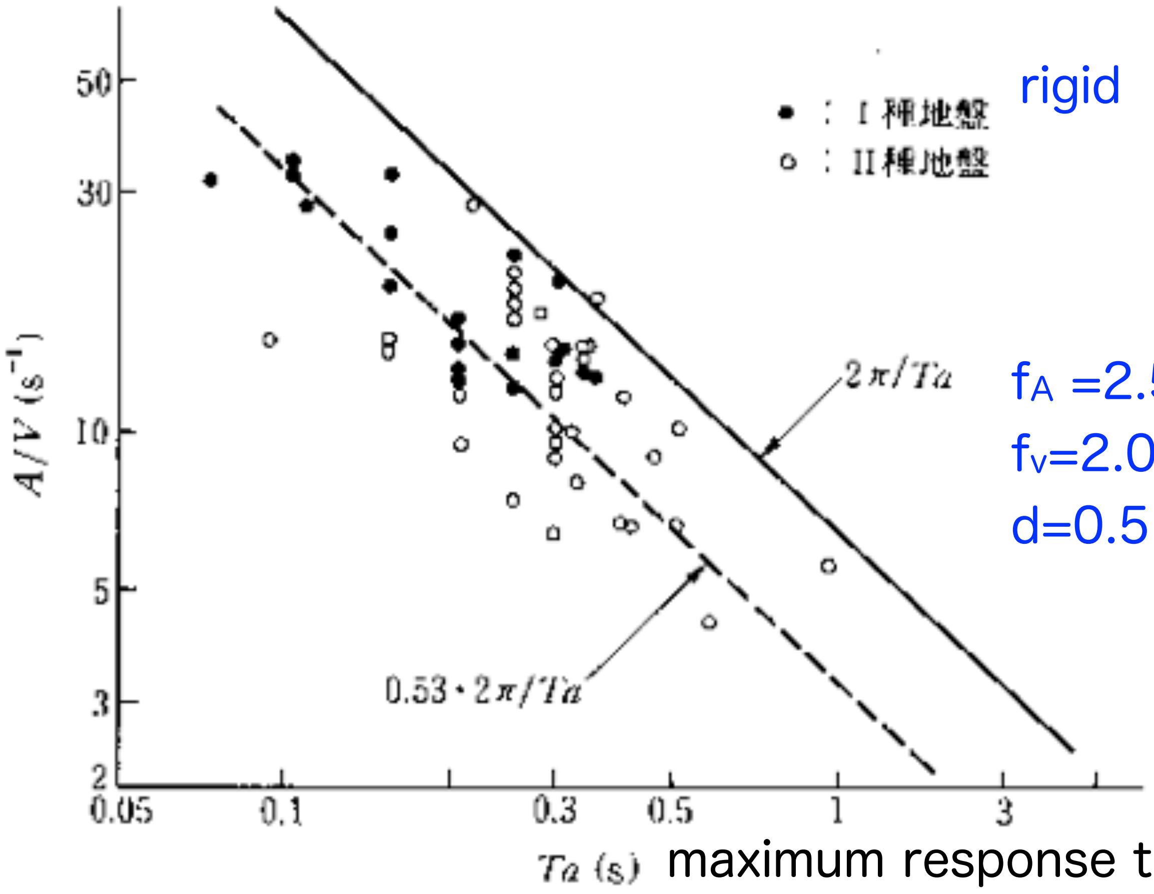
f_A : ratio of $G_A R_A A_0$ of $S_a(T,0.05)$ in $dT_c<T<T_c$, amplification factor
f_V : ratio of $G_V R_V V_0$ of $S_V(T,0.05)= S_a(T,0.05)T/2\pi$ in $T_c<T$, amplification factor
d : dT_c/T_c, ratio of lower bound of period (dT_c) relative to the upper one (T_c) in the constant $S_a(T,\varsigma)$
F_h : Correction factor of damping constant, $1.5/(1+10\varsigma)$
A_0 : Basic maximum acceleration of ground motion
V_0 : Basic maximum velocity of ground motion
R_A : conversion coefficient of recurrence intervals of the maximum acceleration
R_V : conversion coefficient of recurrence intervals of the maximum velocity
G_A : site-dependen correction factor of the maximum acceleration
G_V : site-dependen correction factor of the maximum velocity

Natural vibration analysis of structures

Calculation of eigen frequencies, own natural periods, eigen angular frequencies, natural vibration modes, impulse constants, effective masses then,

Estimation of maximum displacement, maximum response acceleration, and maximum stress to be reviewed if it is less than the allowable stress.

Response time of acceleration/velocity



rigid

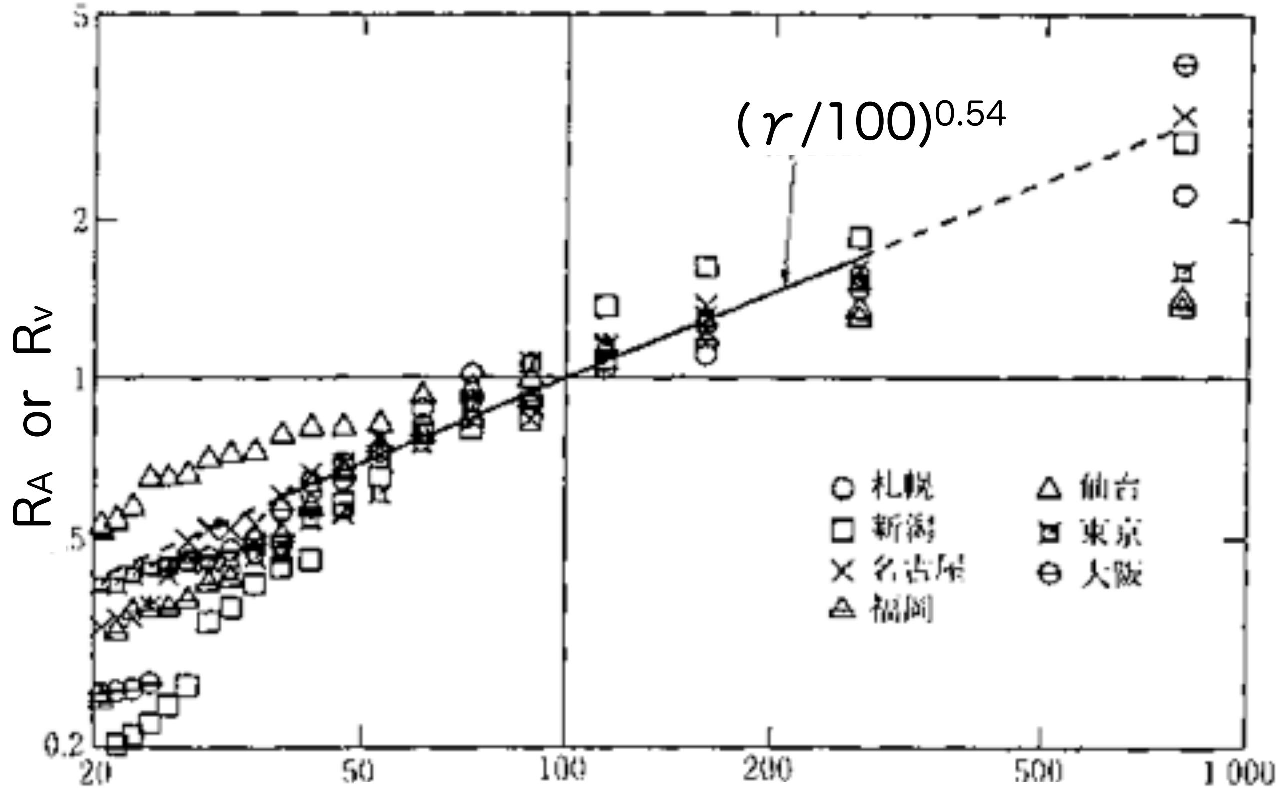
$f_A = 2.5$

$f_V = 2.0$

$d = 0.5$

maximum response time

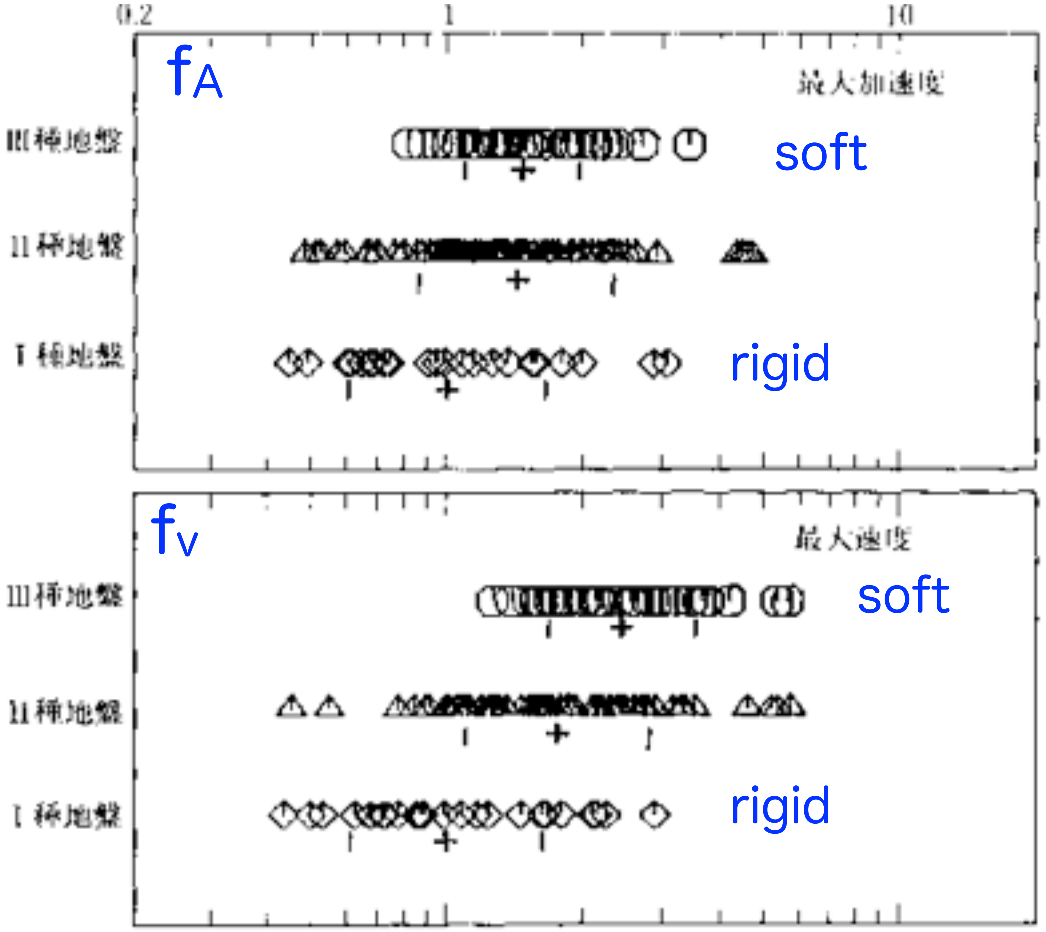
R_A or R_V



$(\gamma/100)^{0.54}$

recurrence interval γ (year)

Amplification (千葉県東方沖地震,1987)



f_A

soft

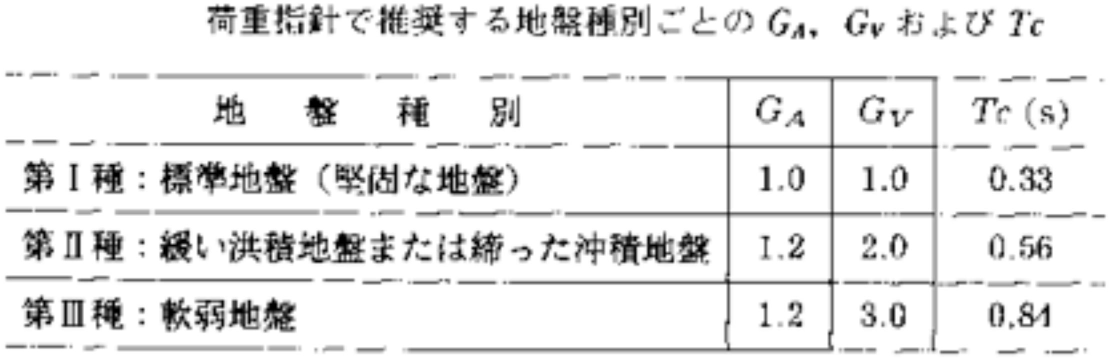
rigid

f_V

soft

rigid

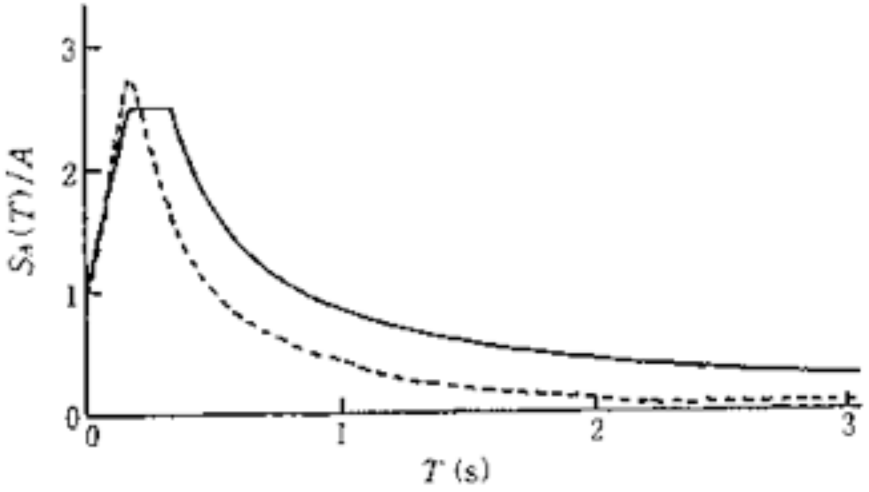
荷重指針で推奨する地盤種別ごとの G_A, G_V および Tc



地　盤　種　別	G_A	G_V	Tc (s)
第 I 種：標準地盤（堅固な地盤）	1.0	1.0	0.33
第 II 種：緩い洪積地盤または締った沖積地盤	1.2	2.0	0.56
第 III 種：軟弱地盤	1.2	3.0	0.84

rigid

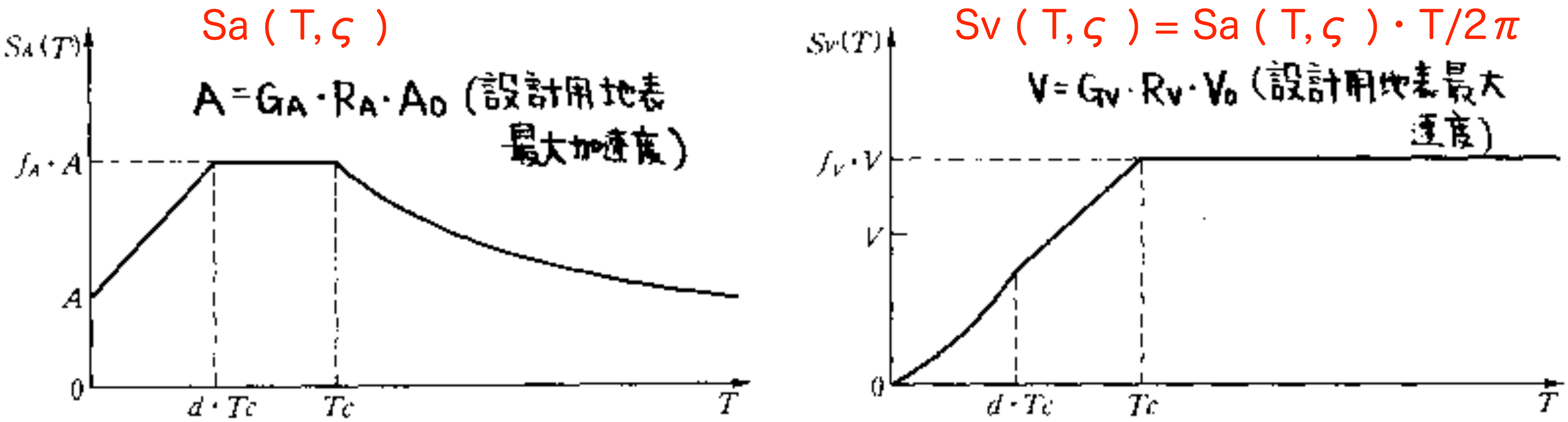
soft



(a)　第 I 種地盤（破線は1種）

rigid

Acceleration/Velocity response spectrum

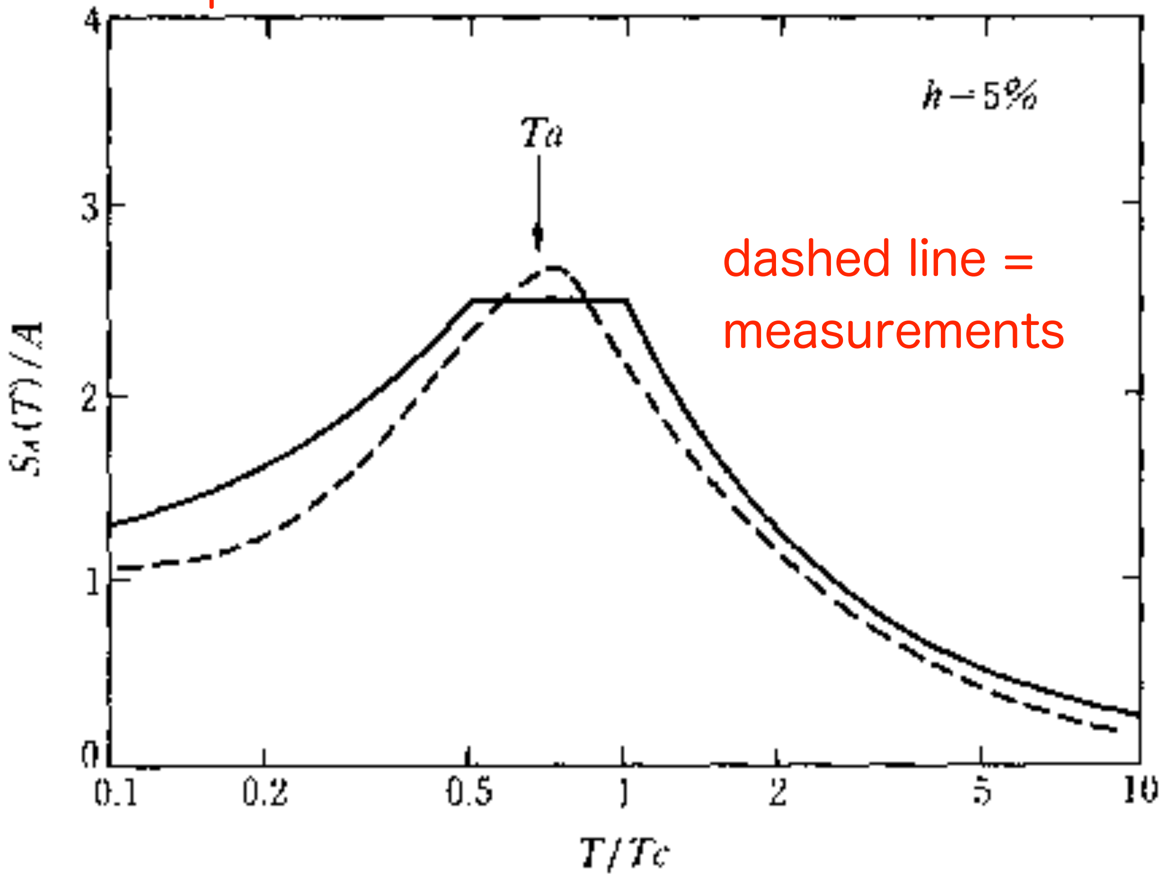


(a) 加速度応答スペクトル

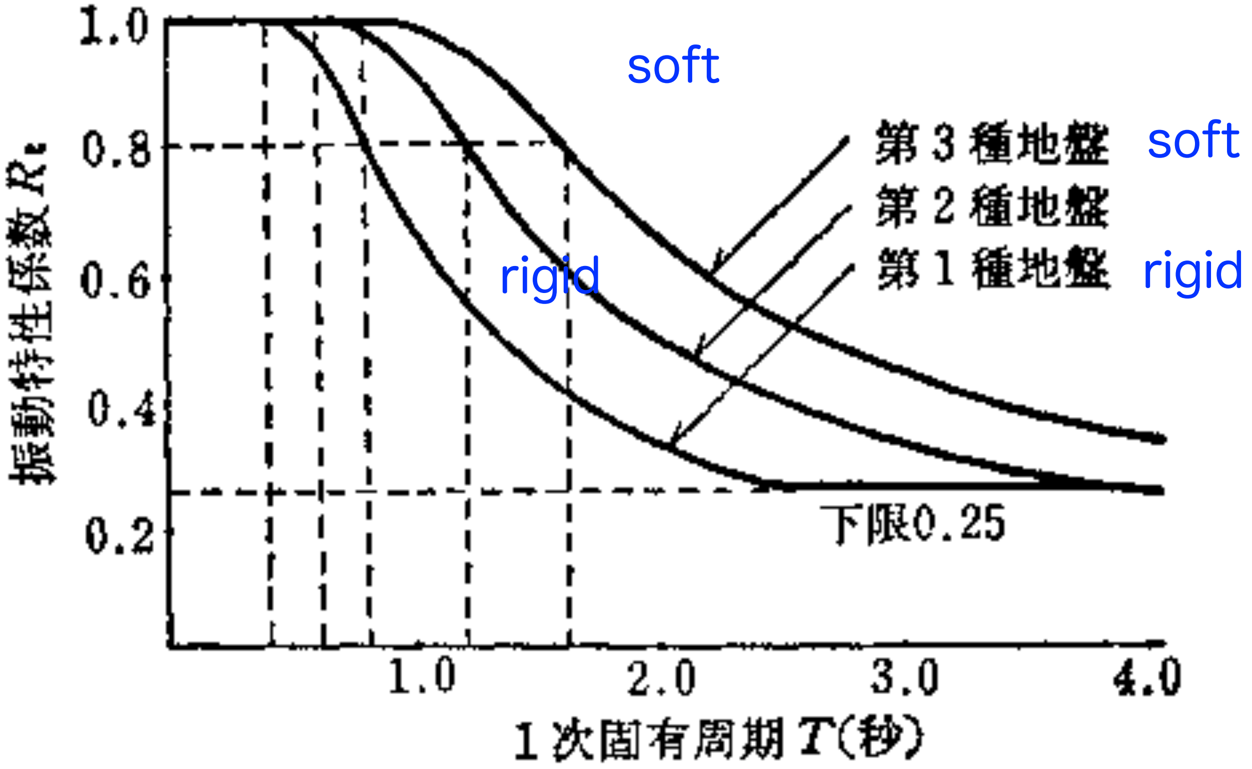
(b) 速度応答スペクトル ($S_A(T) \cdot T/2\pi$)

図 7.2.1 本文 (7.2) 式による応答スペクトルの模式図

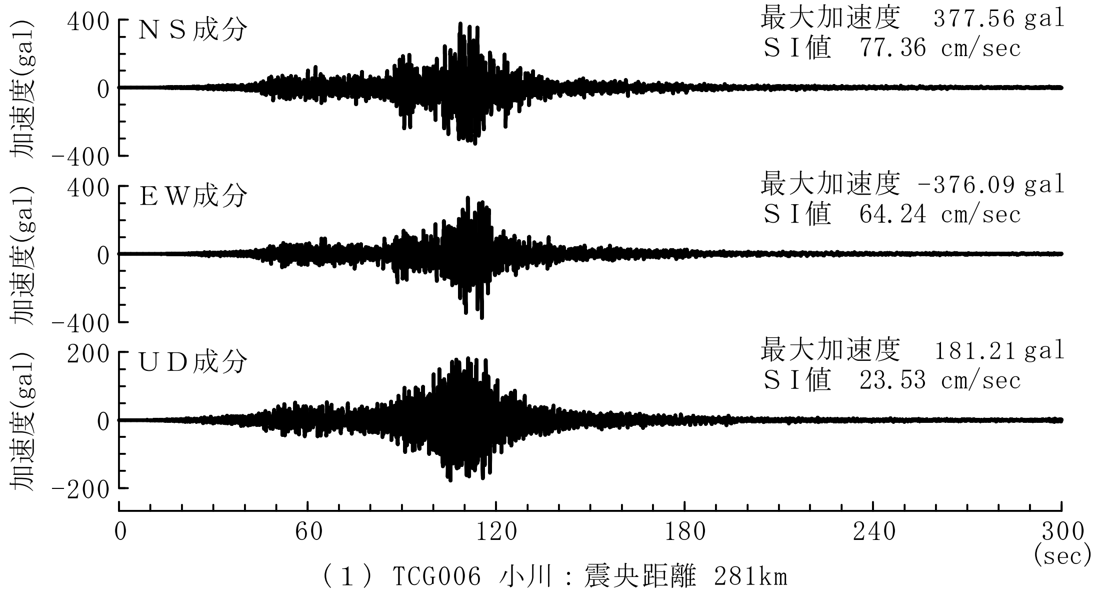
Amplification factor at surface



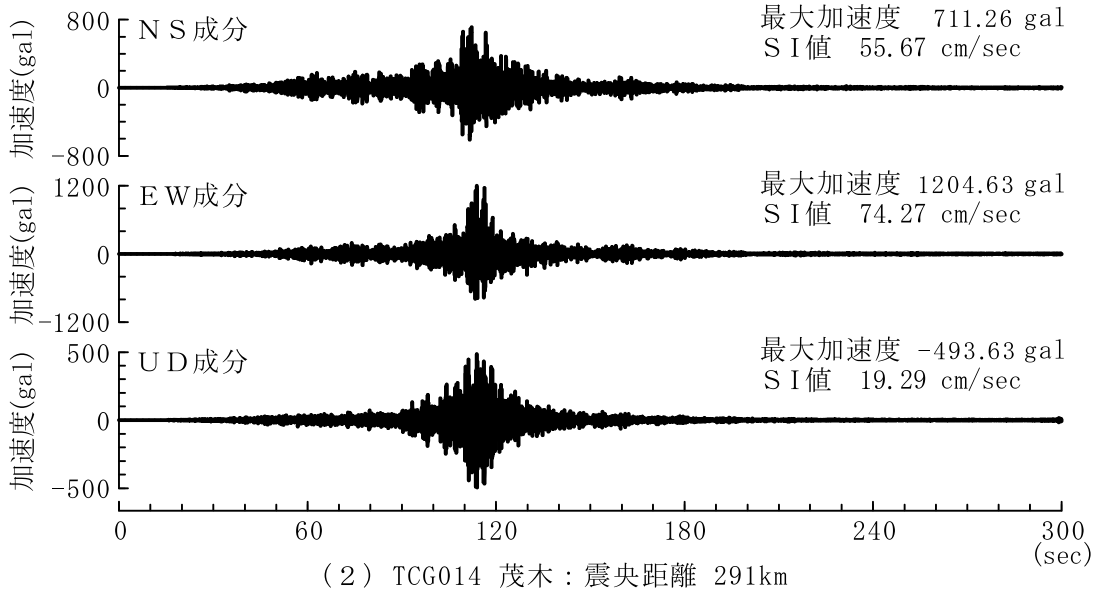
Vibration characteristic constant at surface



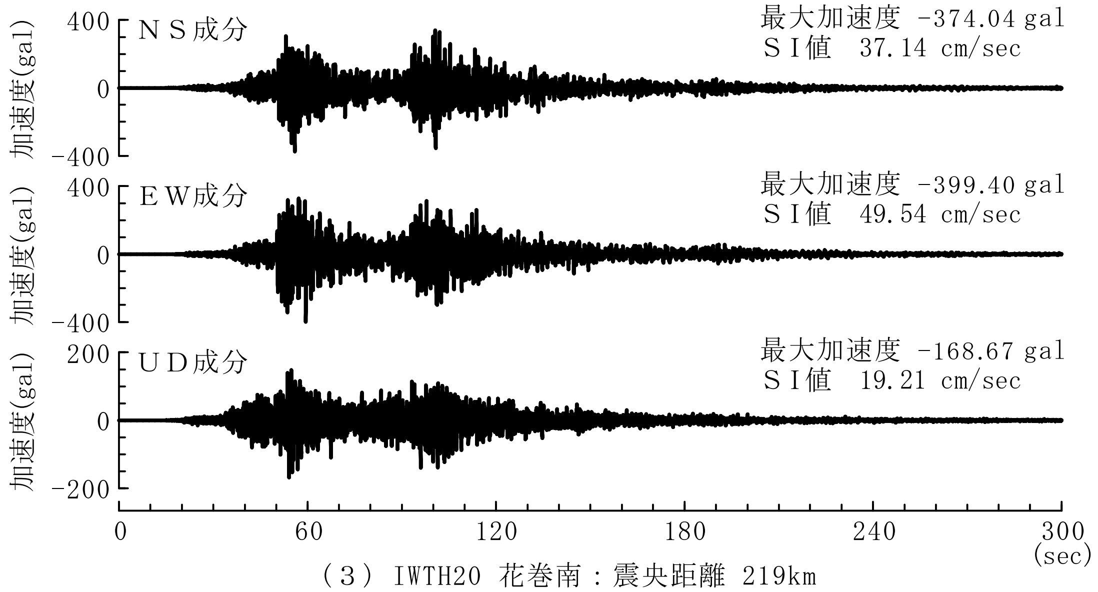
3.11



（１） TCG006 小川：震央距離 281km

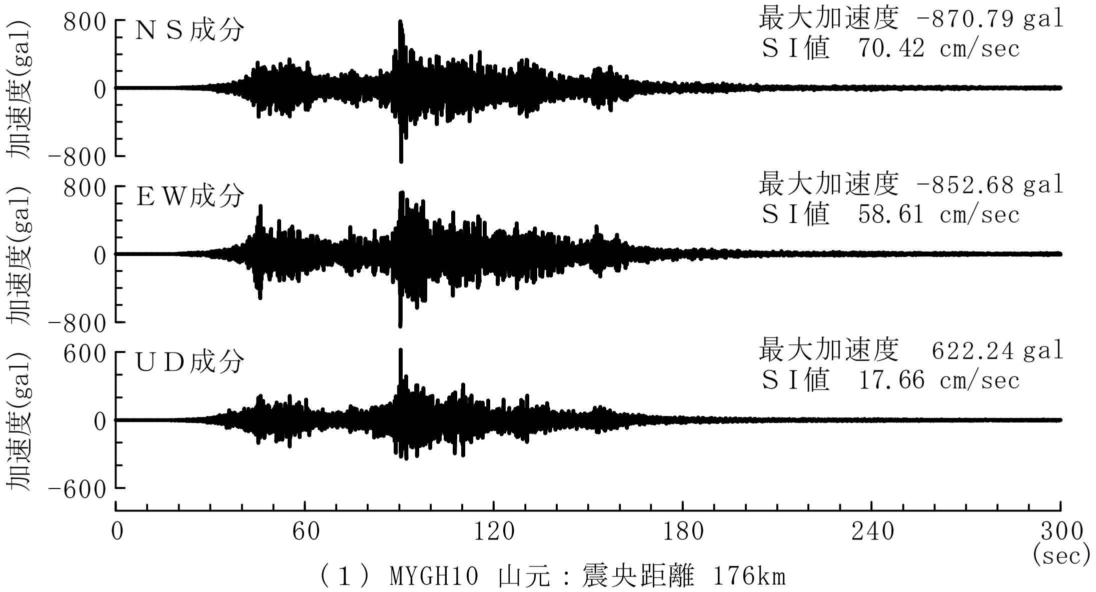


（２） TCG014 茂木：震央距離 291km

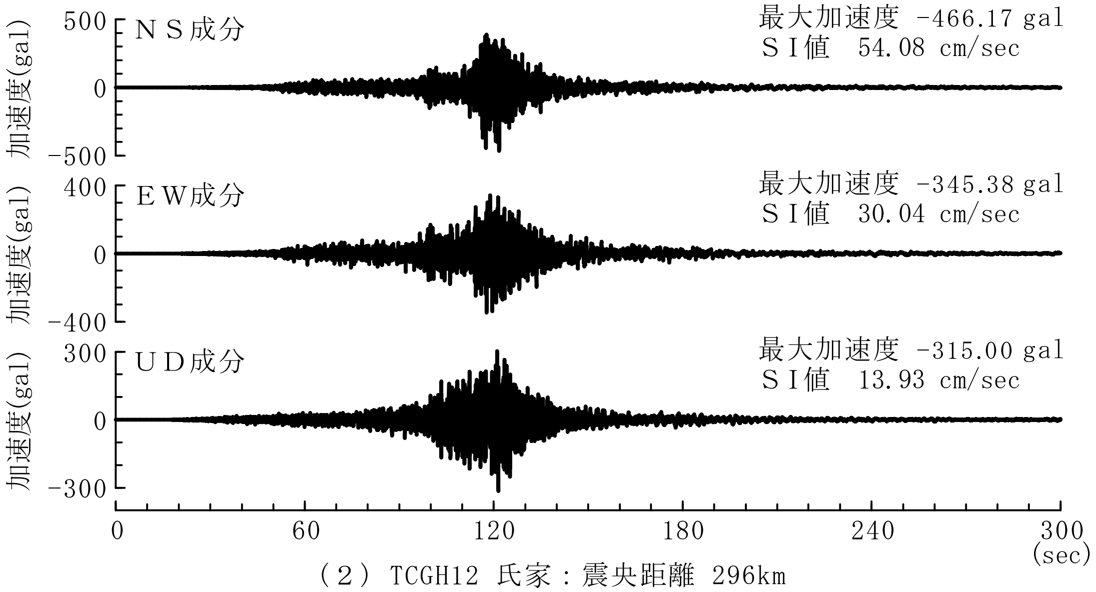


（３） IWTH20 花巻南：震央距離 219km

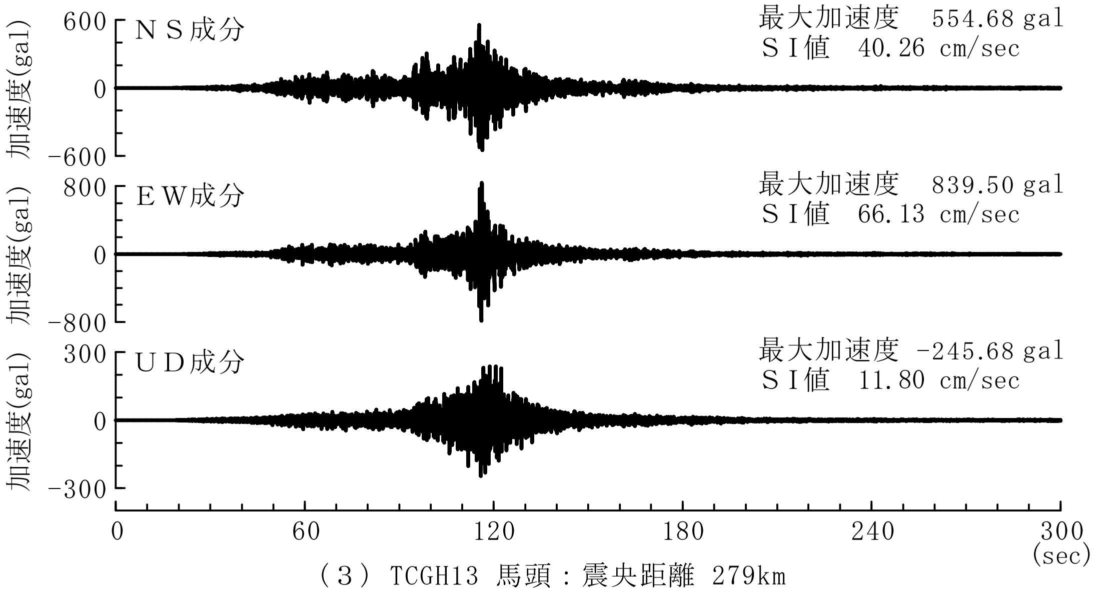
図　－　（２）2011.03.11 14:47 東北地方太平洋沖地震（M9.0, 深さ24km）
の加速度波形（防災科学技術研究所K-NET,KiK-netによる）Ｉ種地盤



（１） MYGH10 山元：震央距離 176km



（２） TCGH12 氏家：震央距離 296km



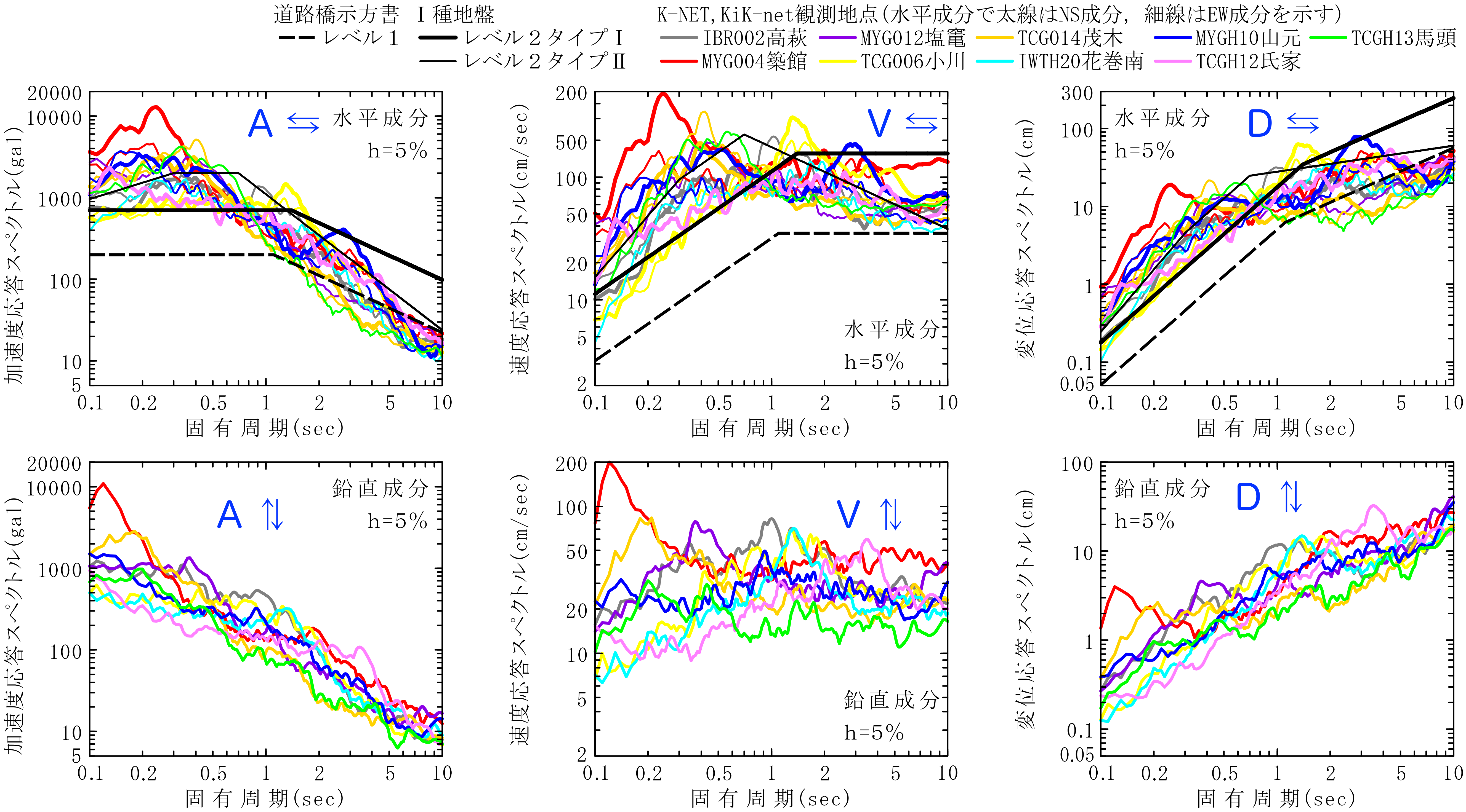
（３） TCGH13 馬頭：震央距離 279km

図　－　（３）2011.03.11 14:47 東北地方太平洋沖地震（M9.0, 深さ24km）
の加速度波形（防災科学技術研究所K-NET,KiK-netによる）Ｉ種地盤

2012年 12月 21日 金曜日

Acceleration/Velocity/Displacement response spectrum

3.11



（１）加速度応答スペクトル

Acceleration : shear force

（２）速度応答スペクトル

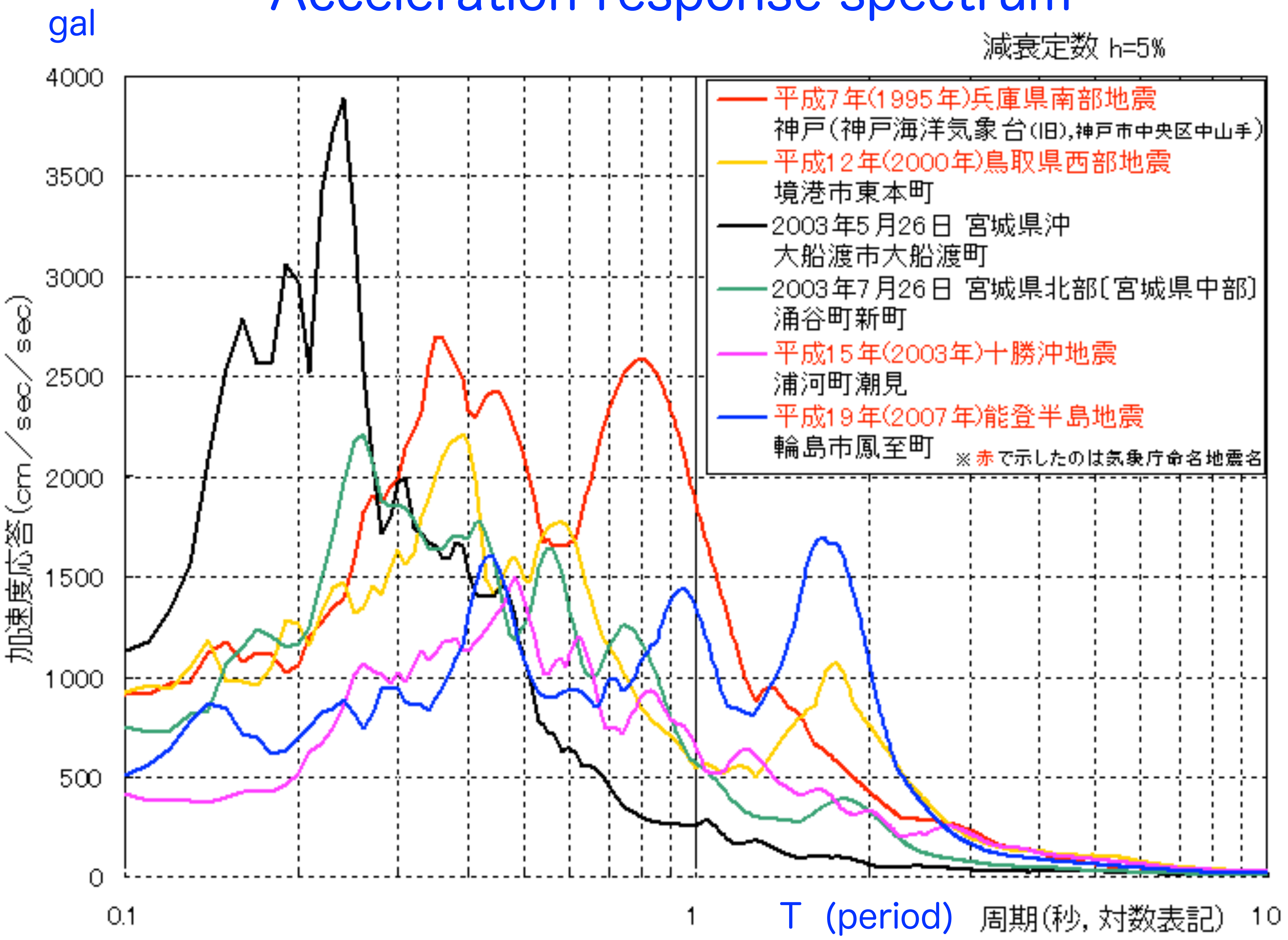
Velocity : kinetic energy

（３）変位応答スペクトル

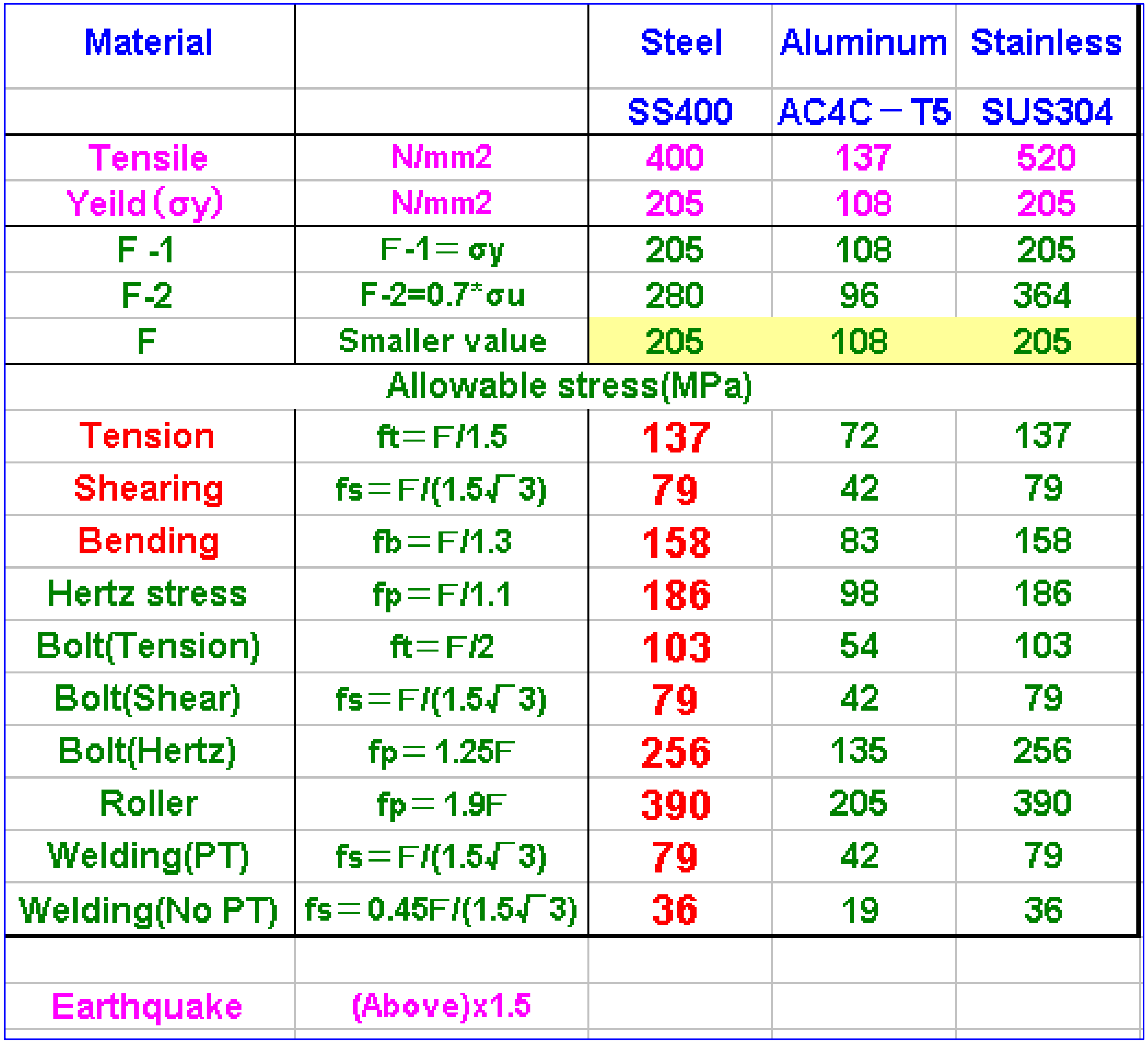
Displacement : strain

図 ー　2011.03.11 14:47 東北地方太平洋沖地震(M9.0, 深さ24km)の応答スペクトル

Acceleration response spectrum



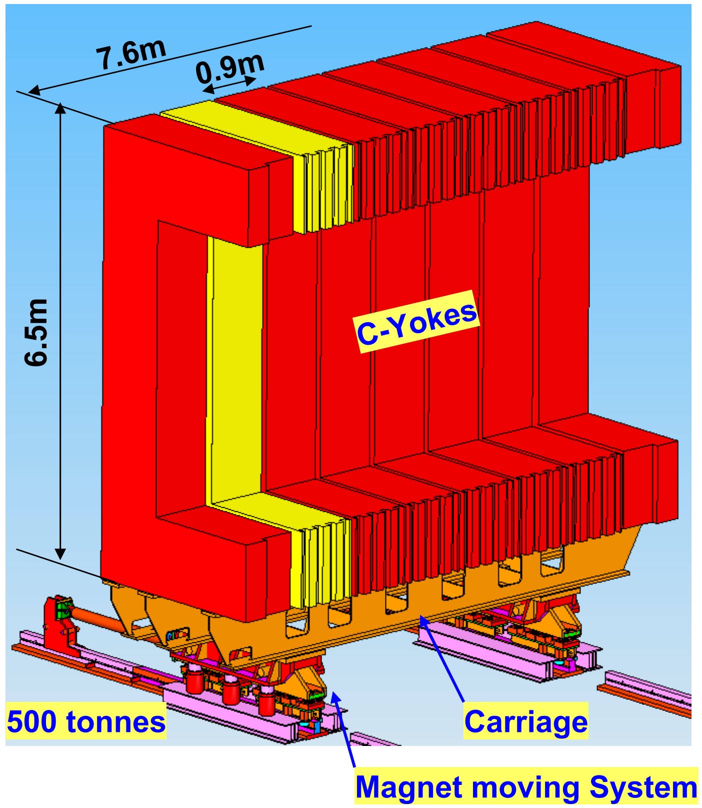
Allowable stress



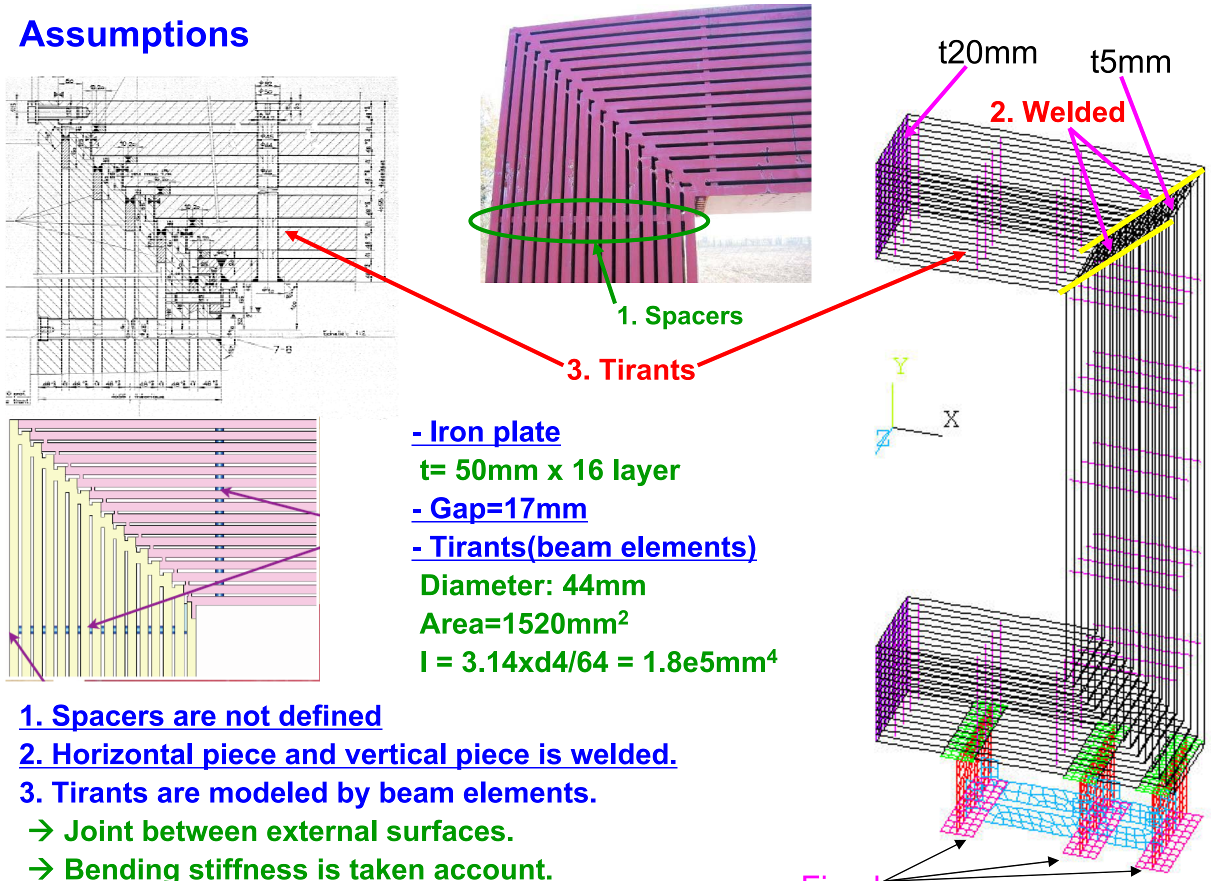
Material		Steel	Aluminum	Stainless
		SS400	AC4C－T5	SUS304
Tensile	N/mm2	400	137	520
Yeild (σy)	N/mm2	205	108	205
F -1	F -1＝σy	205	108	205
F-2	F-2=0.7*σu	280	96	364
F	Smaller value	205	108	205
Allowable stress(MPa)				
Tension	ft＝F/1.5	137	72	137
Shearing	fs＝F/(1.5√3)	79	42	79
Bending	fb＝F/1.3	158	83	158
Hertz stress	fp＝F/1.1	186	98	186
Bolt(Tension)	ft＝F/2	103	54	103
Bolt(Shear)	fs＝F/(1.5√3)	79	42	79
Bolt(Hertz)	fp＝1.25F	256	135	256
Roller	fp＝1.9F	390	205	390
Welding(PT)	fs＝F/(1.5√3)	79	42	79
Welding(No PT)	fs＝0.45F/(1.5√3)	36	19	36
Earthquake	(Above)x1.5			

H. Yamaoka, “Magnet seismic analysis”, 10 July, 2007, KEK

FEM calculation for the Magnet system



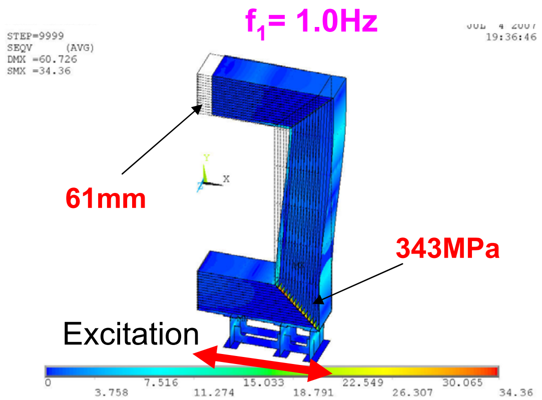
Assumptions



- Iron plate
  t= 50mm x 16 layer
- Gap=17mm
- Tirants(beam elements)
  Diameter: 44mm
  Area=1520mm^2
  I = 3.14xd4/64 = 1.8e5mm^4

1. Spacers are not defined
2. Horizontal piece and vertical piece is welded.
3. Tirants are modeled by beam elements.
 → Joint between external surfaces.
 → Bending stiffness is taken account.
 → Gap between Tirants and iron plate(0.5mm) is taken into account by CP command.

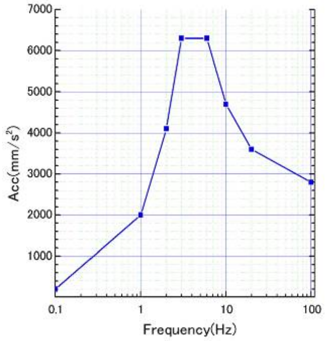
Spectrum Calc. (X direction)



Allowable stress:
σ_a= 237MPa
(158MPa x1.5)

- Reaction stress is too high
- Resonant frequency is lower than the earthquake resonance.

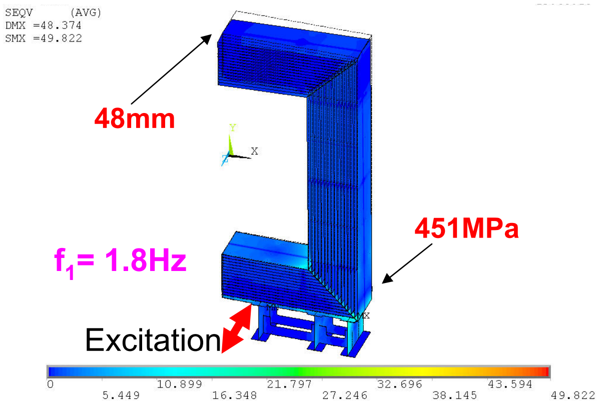
630gal for 3 -6 Hz



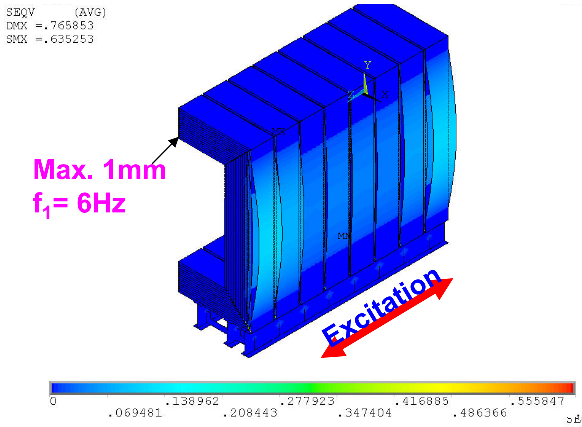
Freq(Hz)	Acc(mm/s^2)	Disp(mm)
0.1	200	3183.
1	2000	318.
2	4100	163.
3	6300	111.
6	6300	28.
10	4700	7.5
20	3600	1.4
100	2800	0.04

Disp=Acc/(2xπxfreq)^2

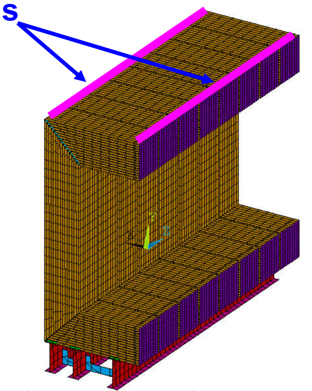
Spectrum Calc. (Z direction)



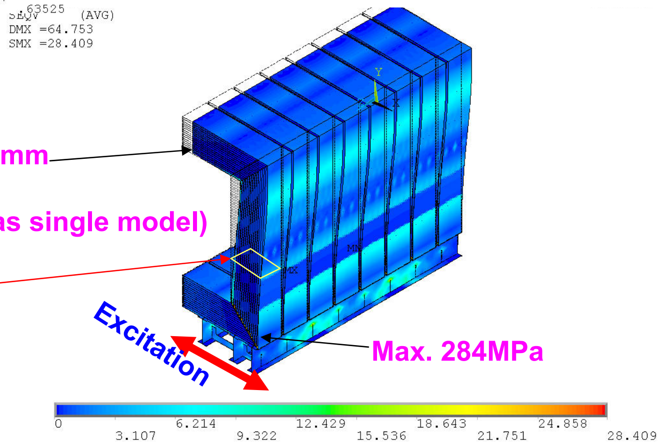
Spectrum Calc. (Z direction)



Rigid beams
(Defined by CP)
ux, uy,uz



Spectrum Calc. (X direction)



Bending stiffness: D
D=E x I
E: Young's modulus
I: Moment of Inertia
Moment of Inertia is determined by cross-section of vertical piece.

→ It is difficult to improve the stiffness against seismic force.

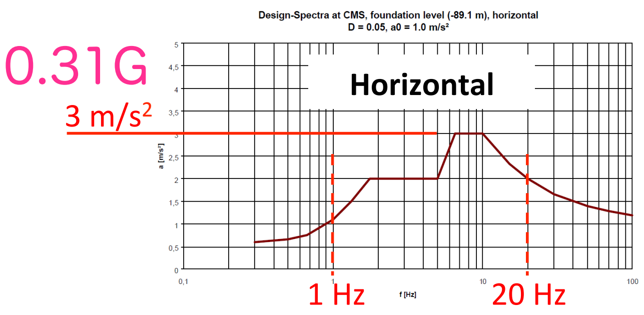
H. Yamaoka, “Magnet seismic analysis”, 10 July, 2007, KEK

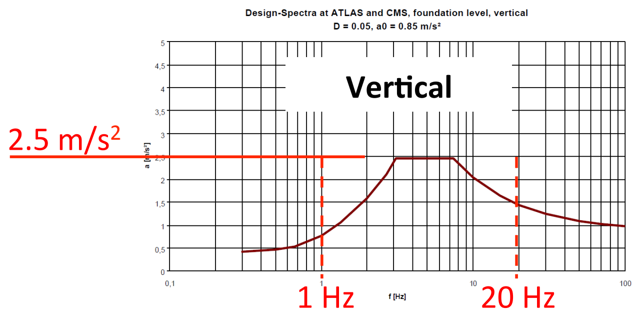
Seismic action at CERN

- CERN is within a “moderate seismicity” zone;
- Nominal earthquake:

Period	Epicentral distance	Magnitude (Richter)	Duration
60-75 years	15 km	5.5-6.1	15 s

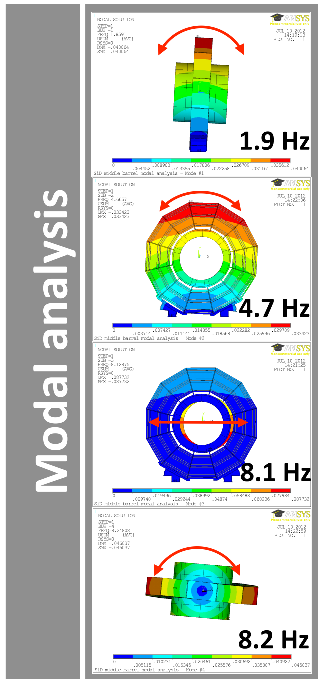
- French/Swiss/European regulations enforced;

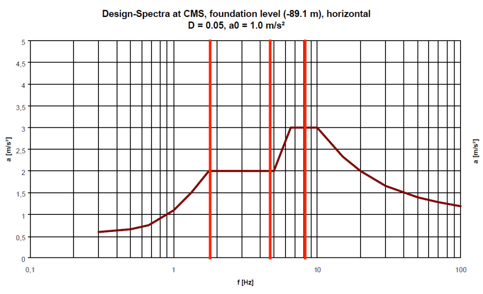


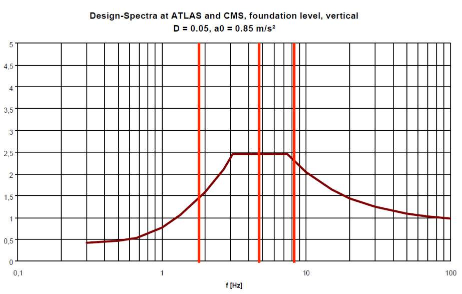


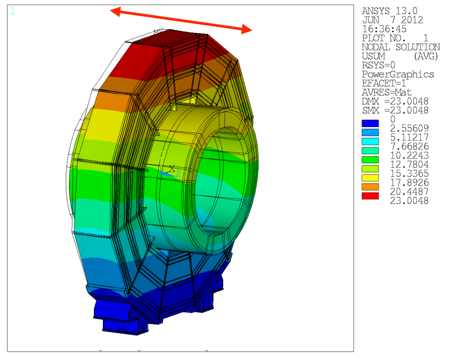
G. Benincasa and R. Schmidt, “Seismic design spectra for ATLAS and CMS”, March 2000

CLIC_ILD yoke – Garage

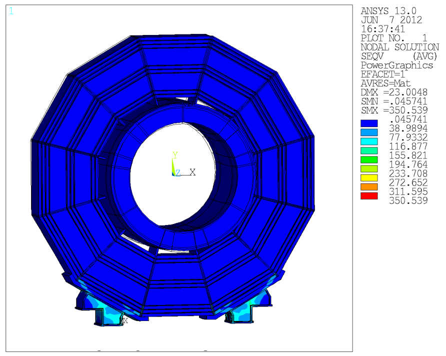






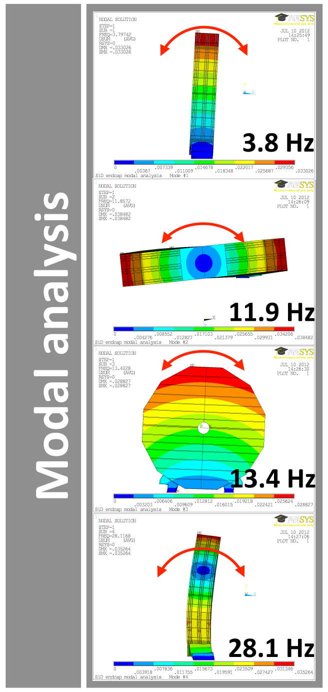


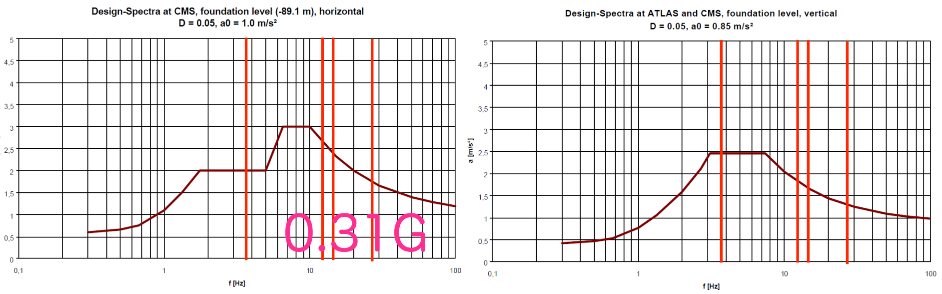
Maximum deformation: **23 mm**

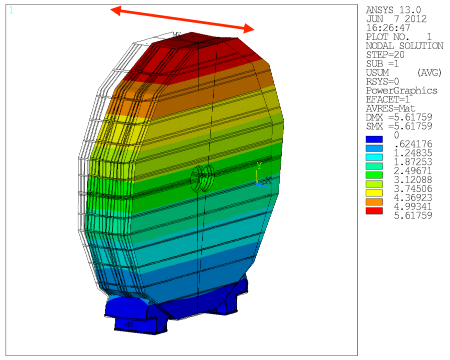


Maximum v. Mises stress: **350 MPa**

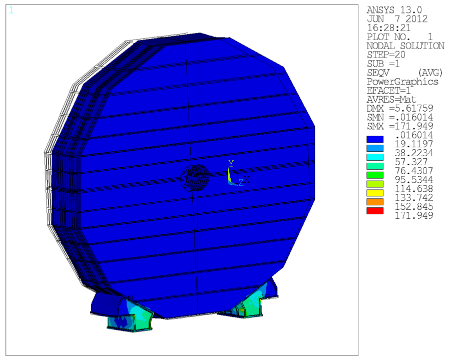
CLIC_ILD yoke – Garage







Maximum deformation: **5.6 mm**



Maximum v. Mises stress: **172 MPa**

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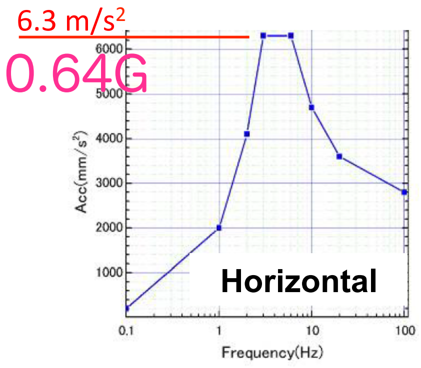
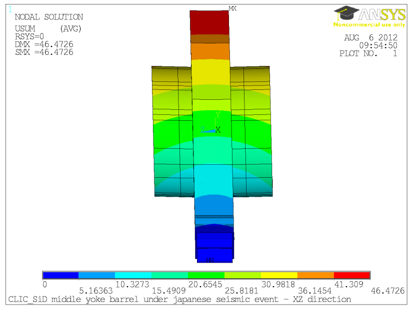
note: on the surface

CLIC_ILD yoke – J-PARC spectrum

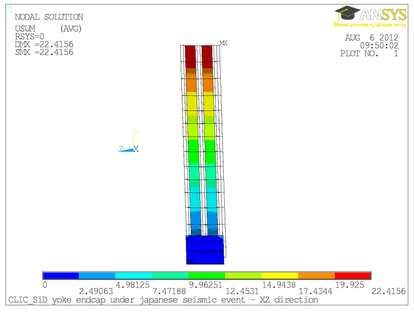


J-PARC - ND280 magnet system spectrum
Courtesy: T. Tauchi (KEK)

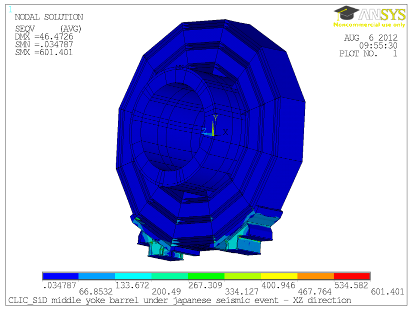
Rigid strategy **not feasible** in high seismicity locations



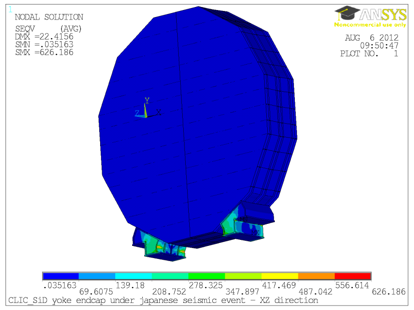
Maximum deformation: **46.4 mm**



Maximum deformation: **22.4 mm**



Maximum v. Mises stress: **601 MPa**

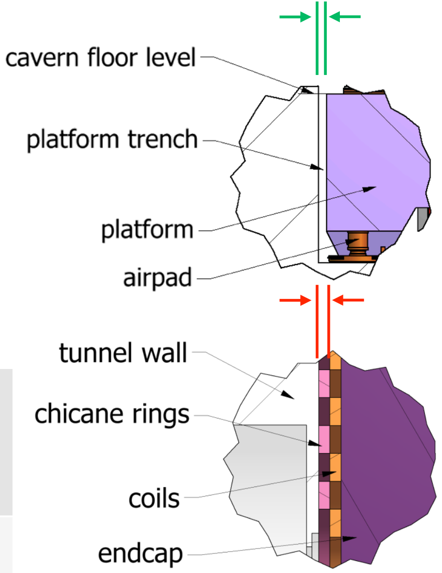


Maximum v. Mises stress: **626 MPa**

Seismic isolation strategies

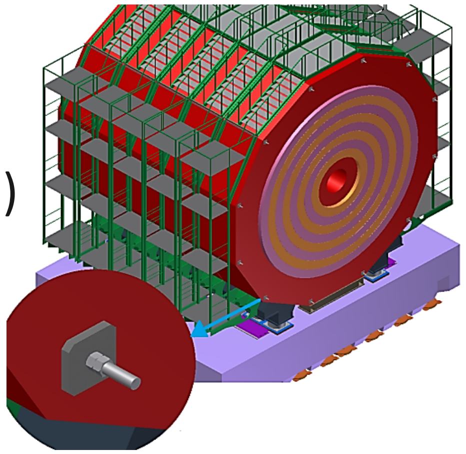
- Rigid detector support;
- Isolation under platform;
  - Using airpads;
  - Using friction pendulum isolators;
- Isolation above platform;

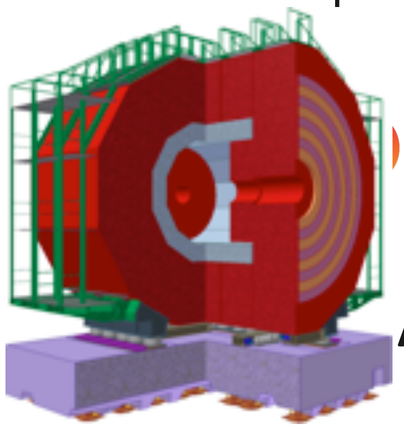
Pros	• Isolation during assembly and maintenance;
Cons	• Possible impacts with cavern walls;
Feasibility	✓



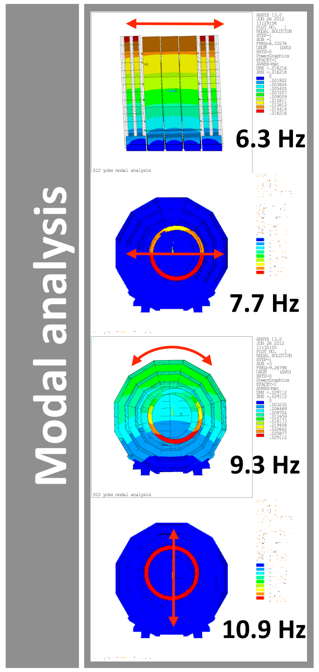
Rigid detector support

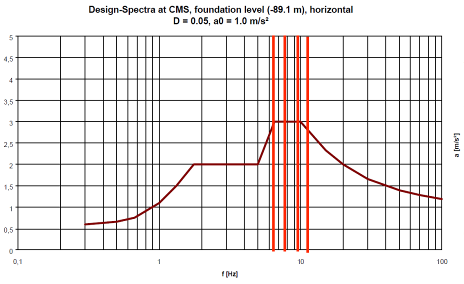
- Detector must withstand moderate seismic events;
- Tie-rods and magnetic forces maintain detector closed when in data-taking position;
- Integrity of all detector components must be maintained in garage (opened) and data-taking (closed) position;

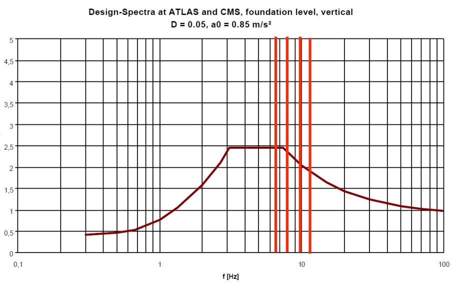


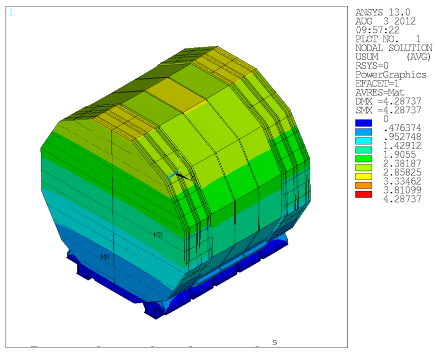


CLIC_ILD yoke – Data-taking

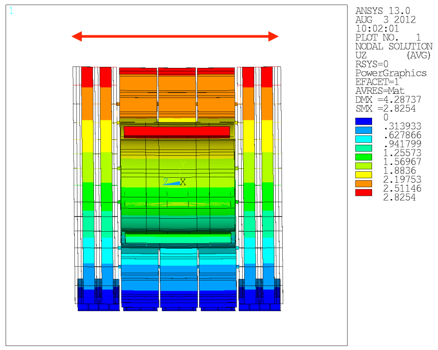






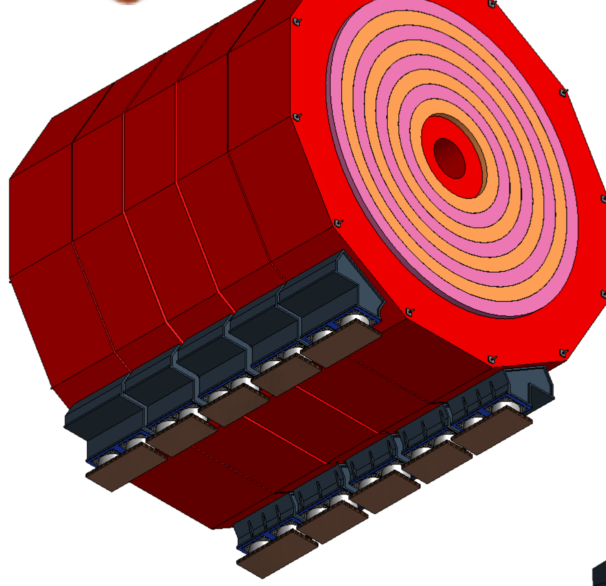


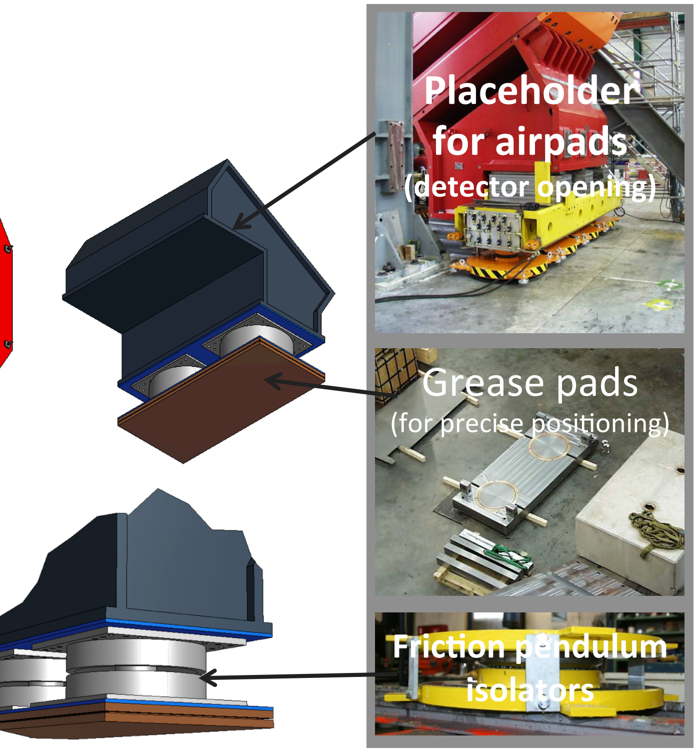
Maximum deformation: **4.3 mm**



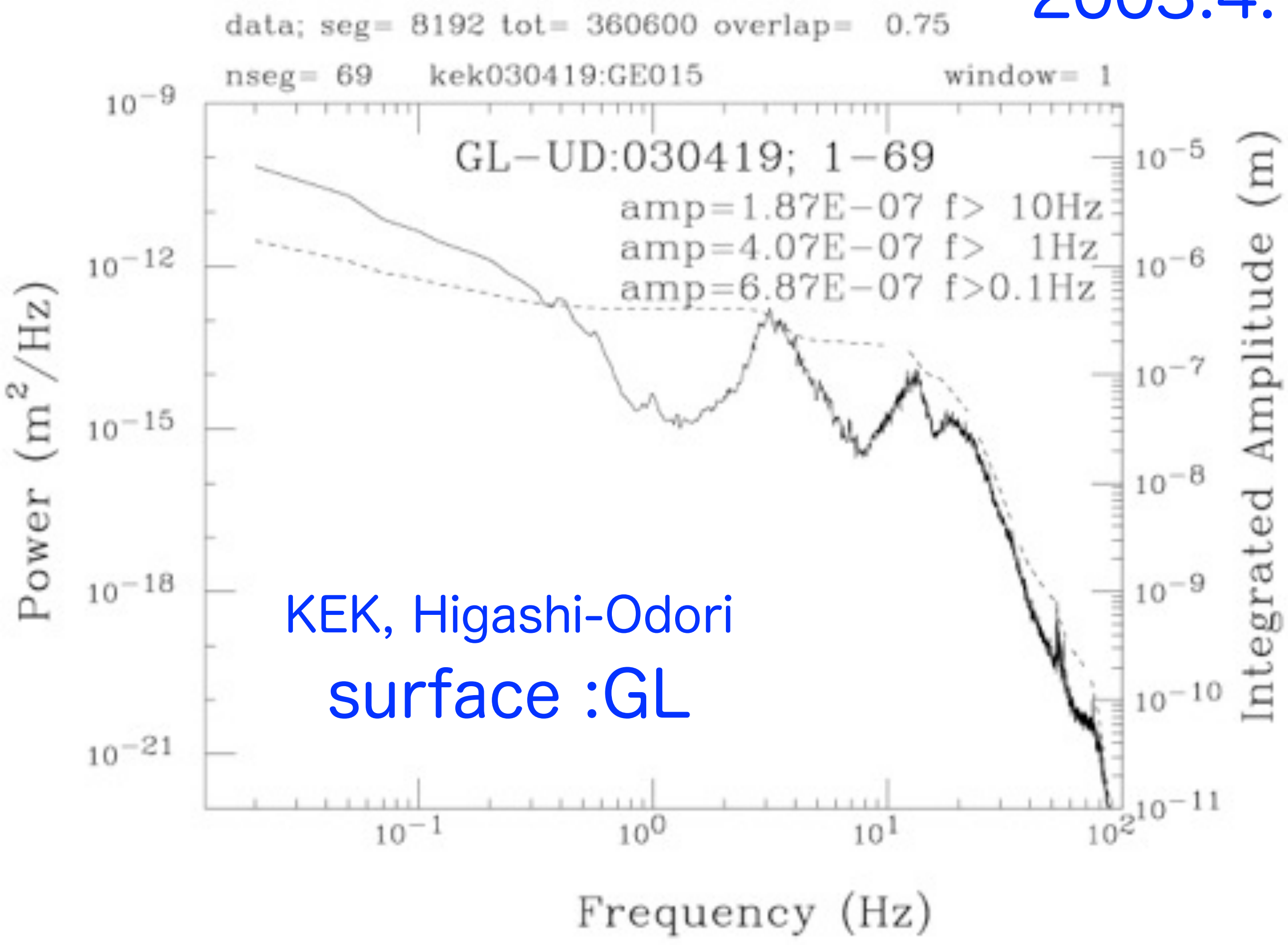
Deformation along beam axis: **2.8 mm**

Above platform isolation



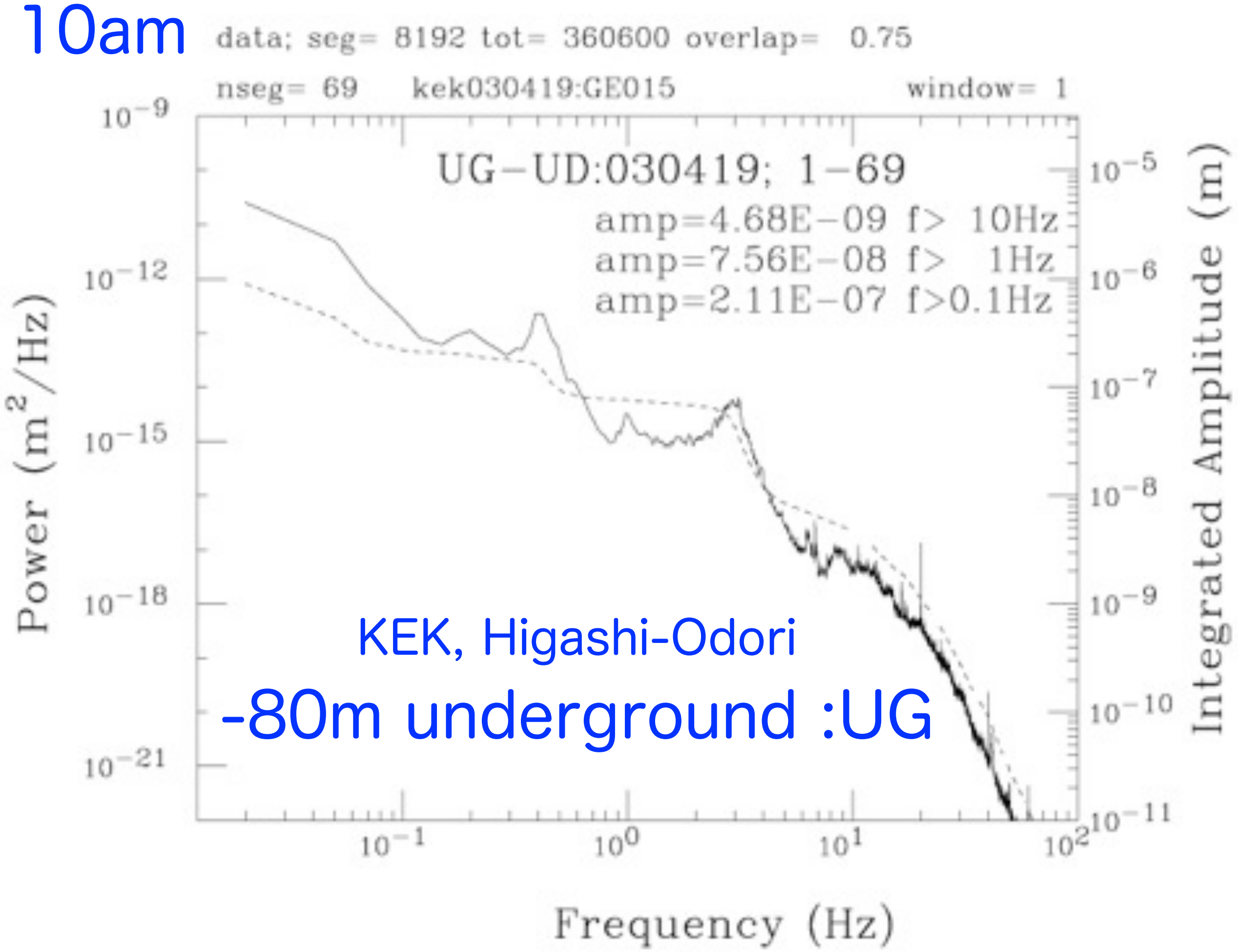


2003.4.19, 10am



KEK, Higashi-Odori

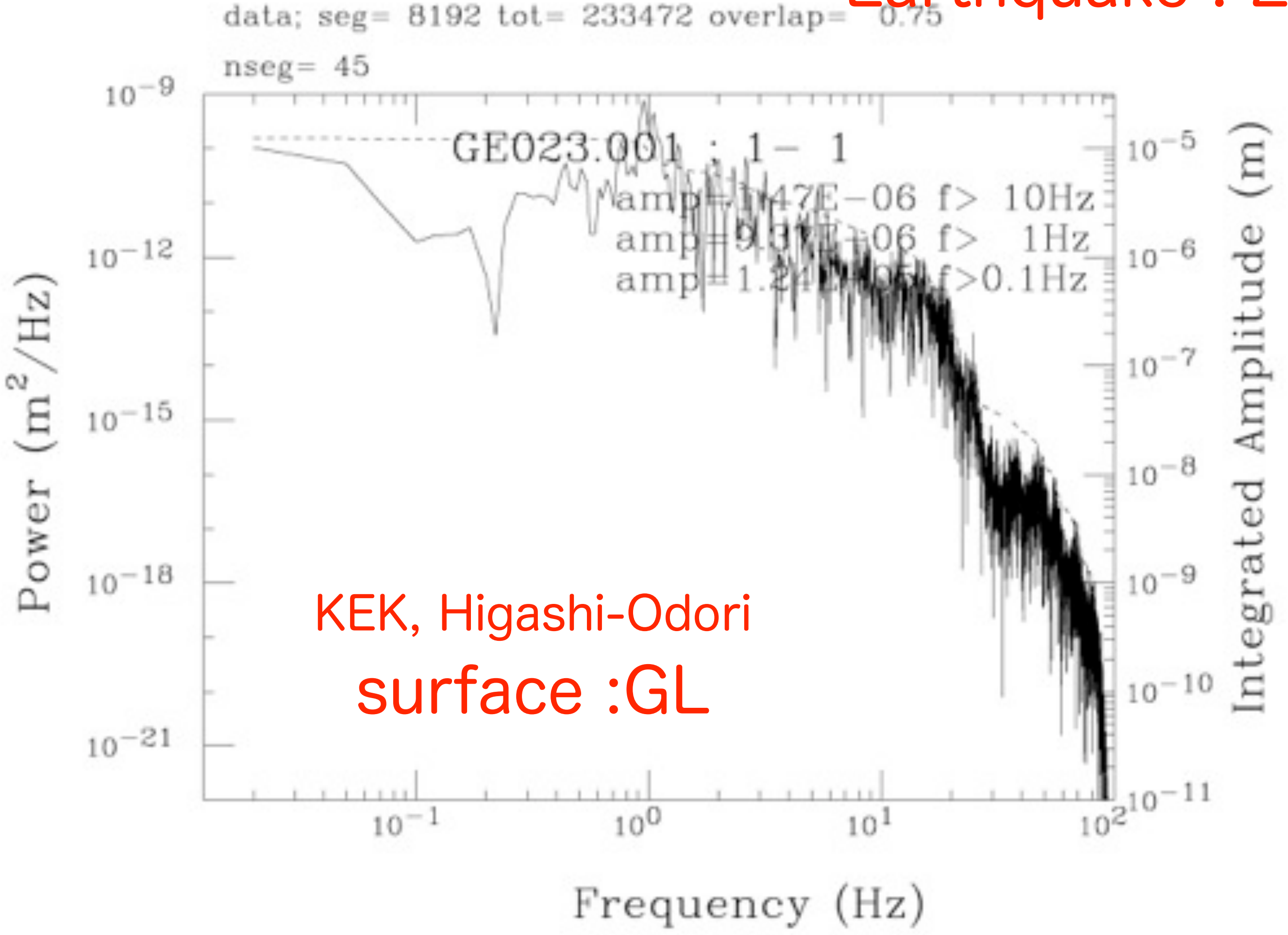
surface :GL



KEK, Higashi-Odori

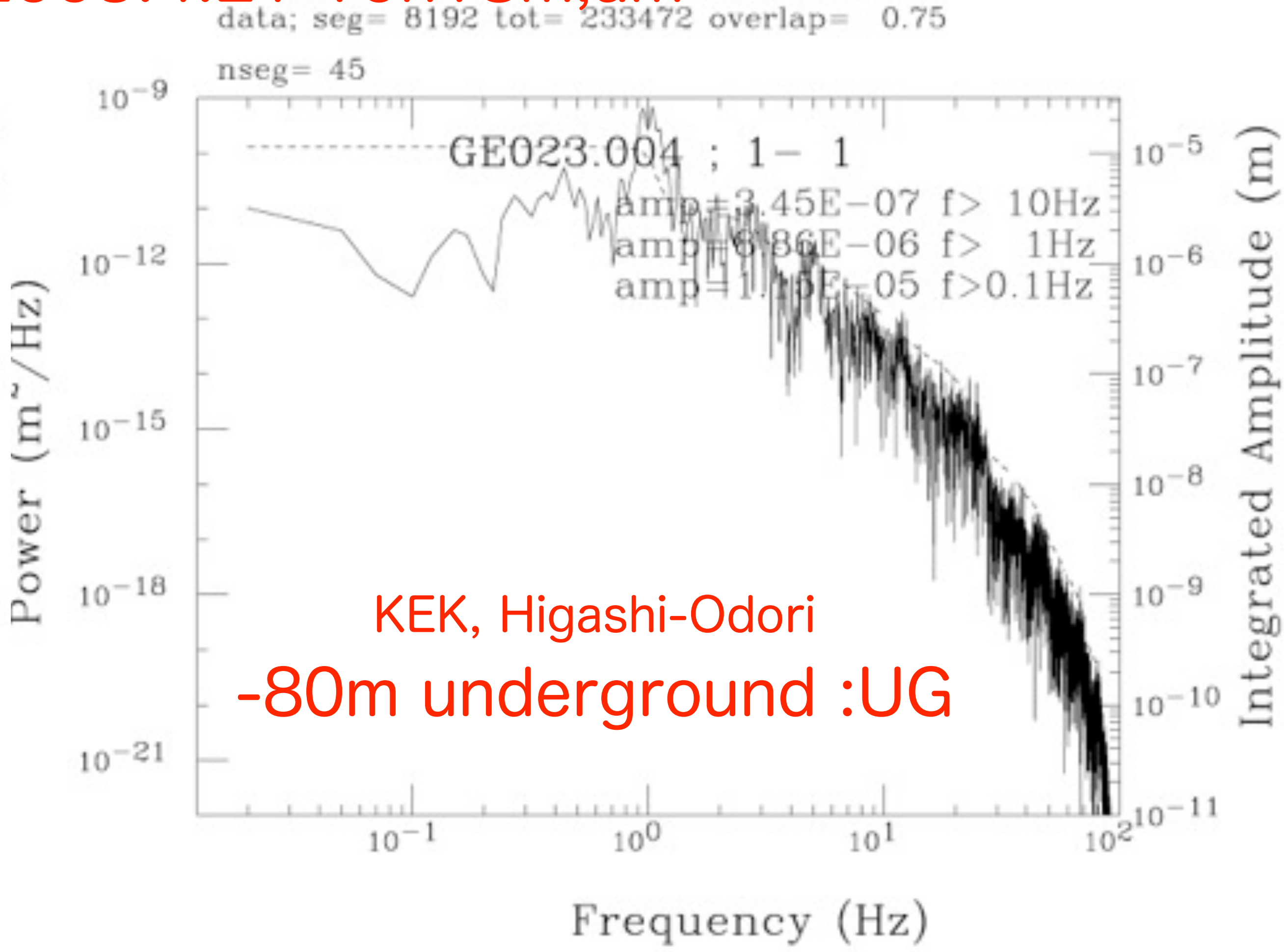
-80m underground :UG

Earthquake : 2003.4.21 10h18m,am



KEK, Higashi-Odori

surface :GL

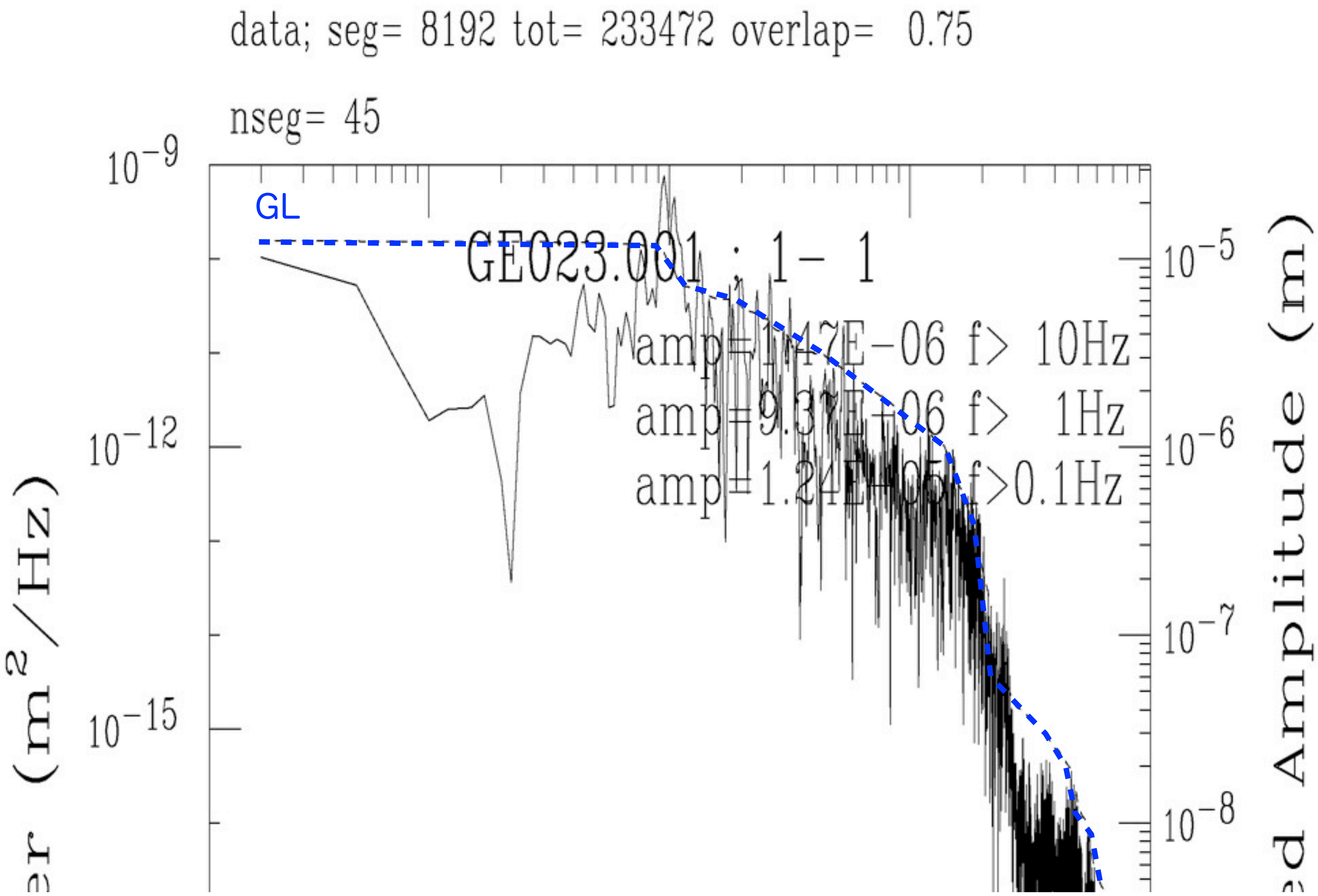


KEK, Higashi-Odori

-80m underground :UG

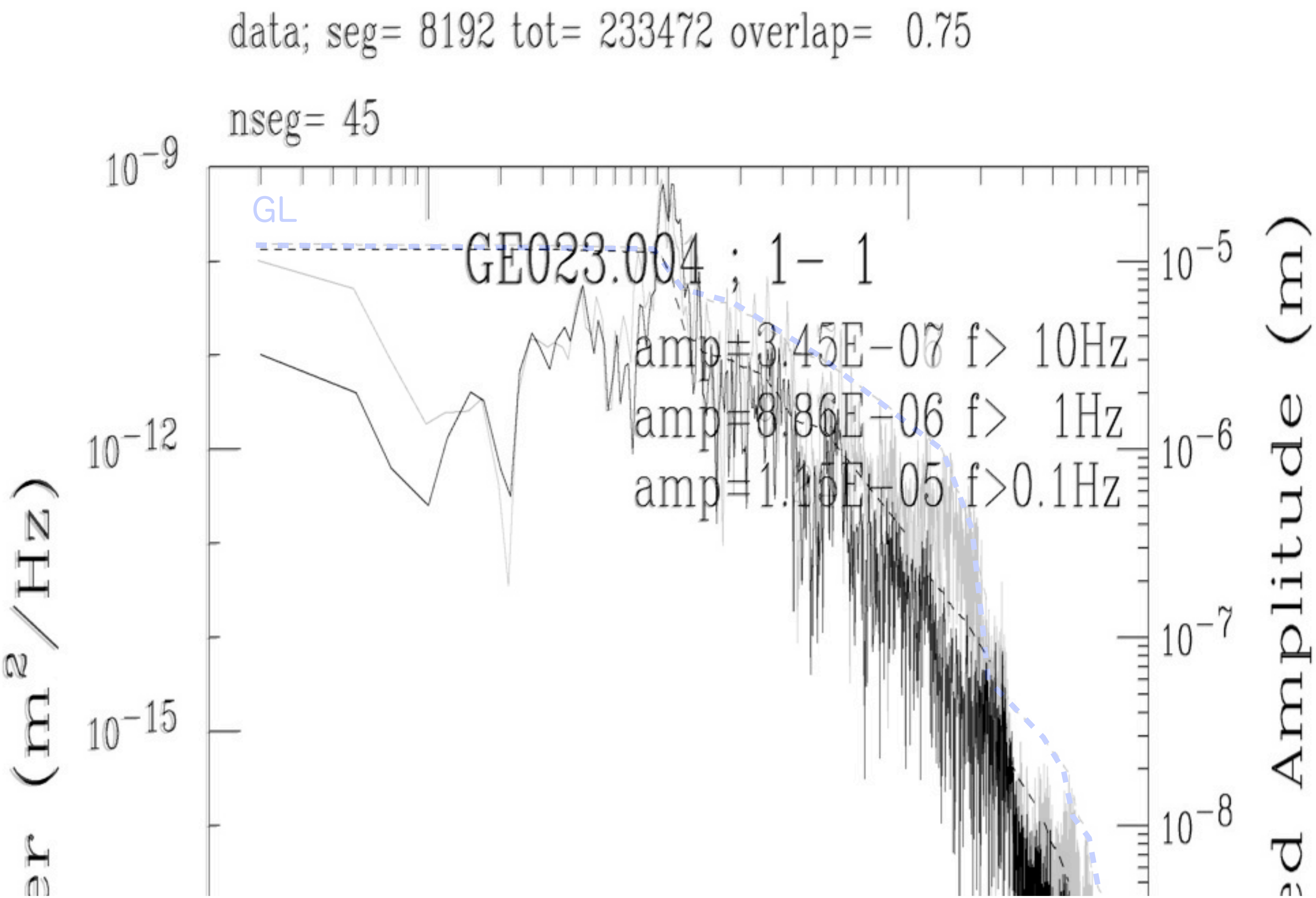
Observation of Earth Quake

2003.4.21 10h18m,am

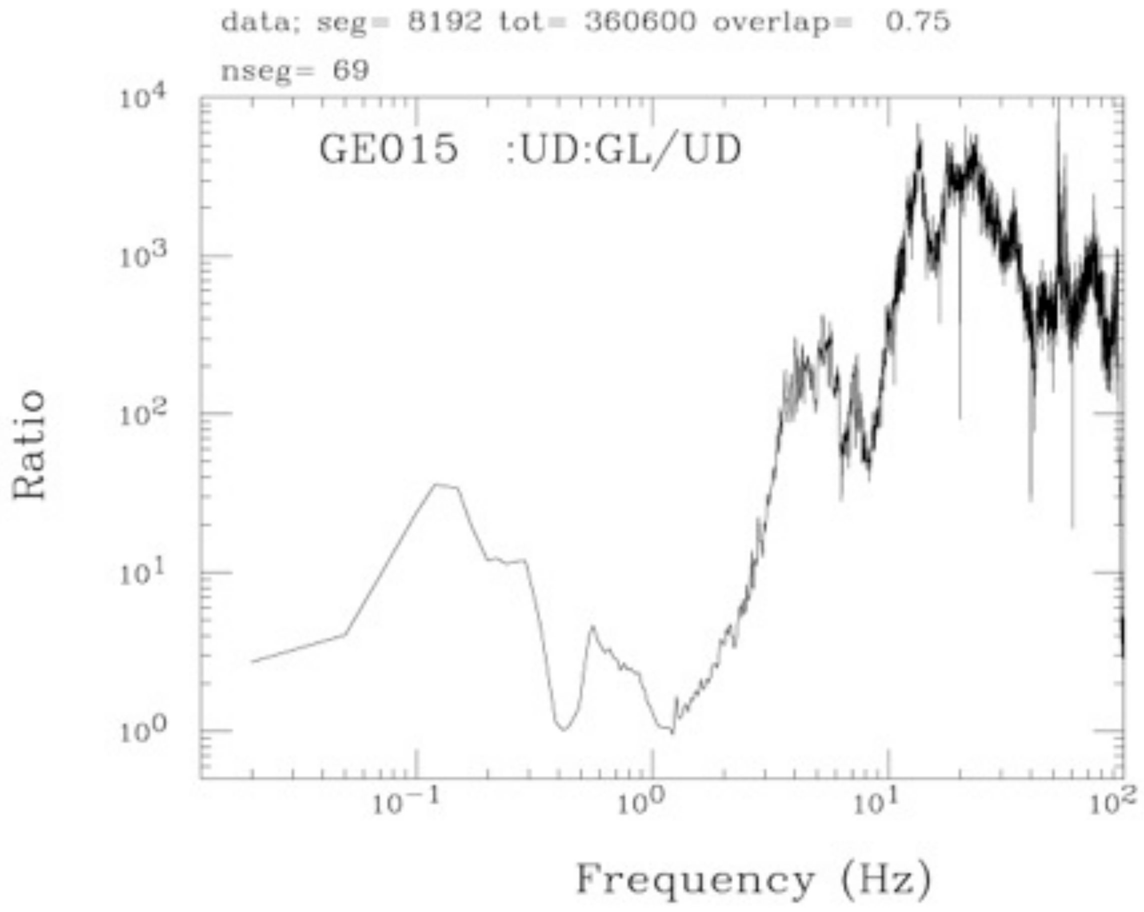


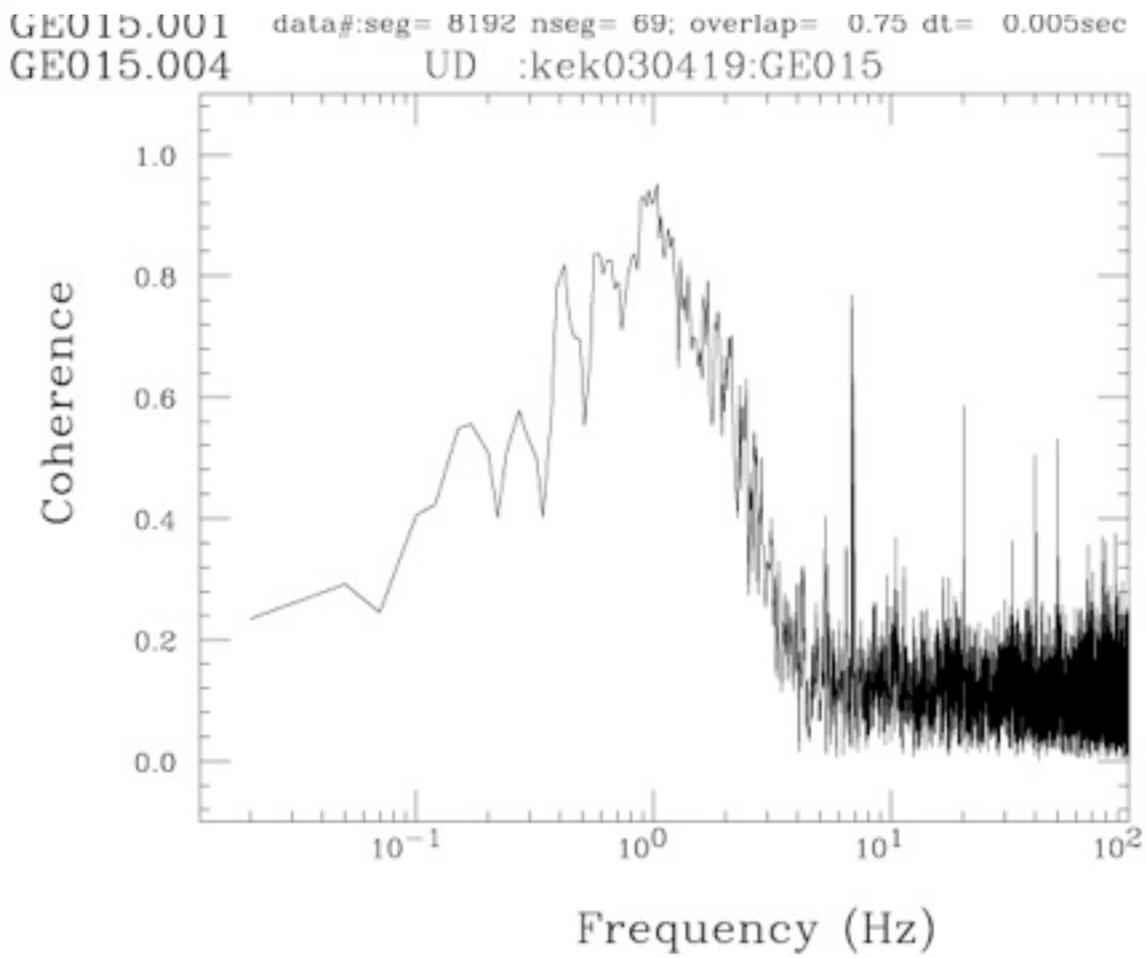
Observation of Earth Quake

2003.4.21 10h18m,am

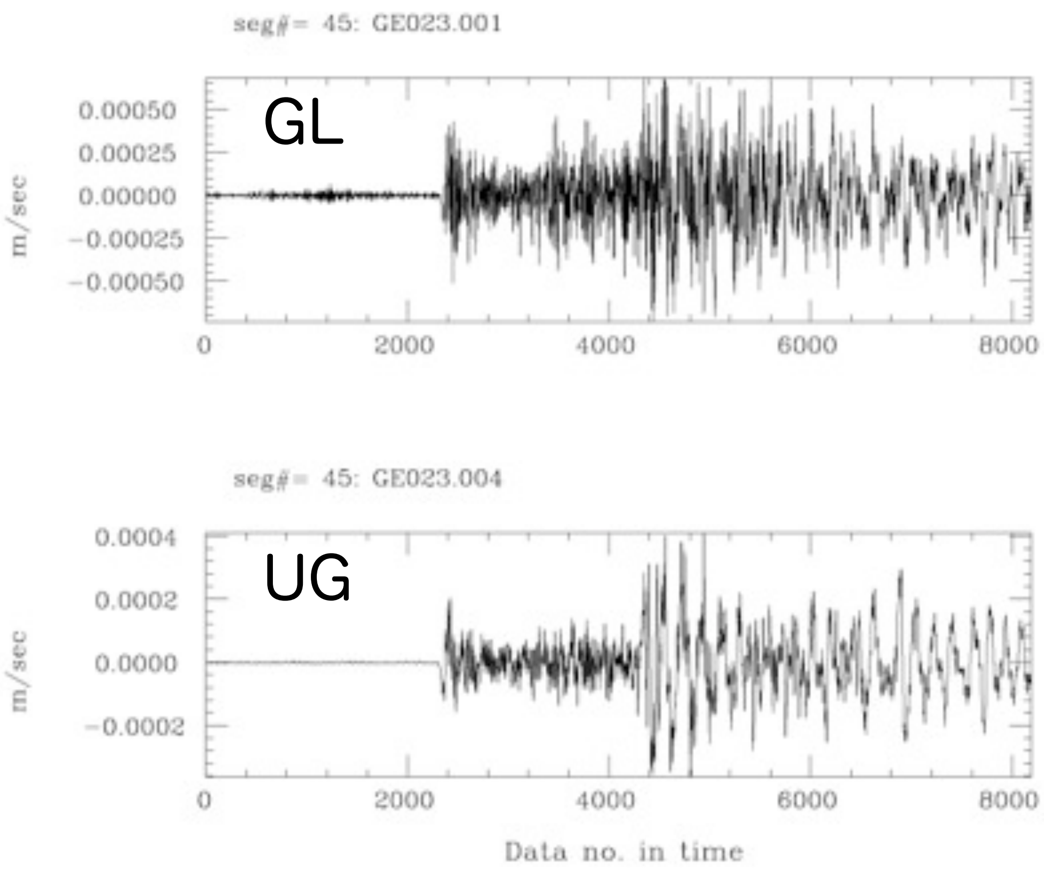


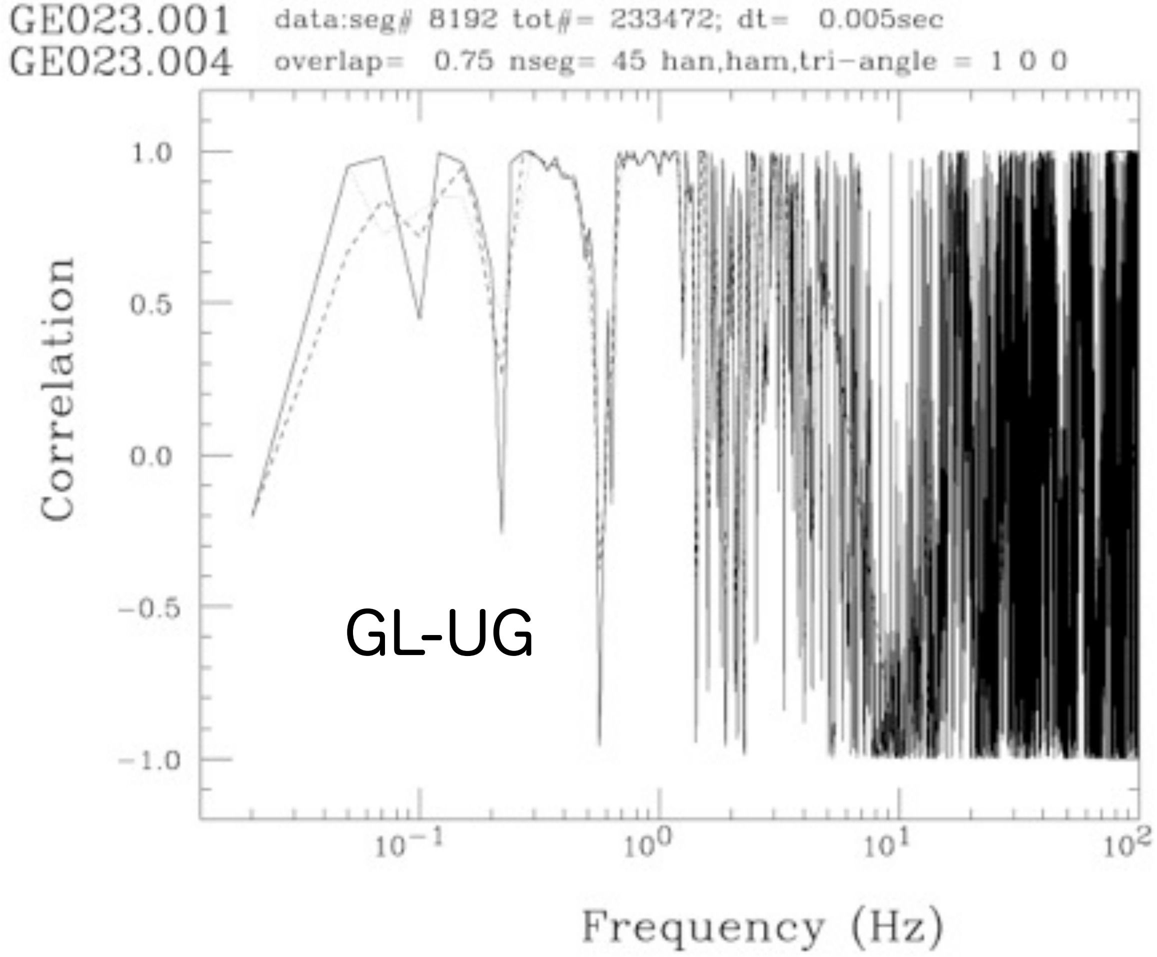
2003.4.19, 10am





Earthquake : 2003.4.21 10h18m,am





Summary

1. Earthquake protection will follow the ISO3010.

2. The protection of CLIC ILD has been investigated.
   - OK at the CERN site, but NO at J_PARC
   - Rigid detector support
   - Above platform isolation

3. We would like to analyze it at the Japanese sites.
   - Rigidness of ILD detector
   - Isolation method with respect to the platform and detailed layout needed