Site Selection - Asian Site

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KEK

10 September 2007

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1. History

Before 2000

- **Site candidates had been studied by some members of JLC group**

Sep. 2000 - Aug. 2001

- **JLC Site Study Committee was organized**
- **Tolerances for the ground motion at the site were studied**
- **Checking items were listed up**

Sep. 2001 - March 2003

- **JLC Site Study Group was organized**
- **Picked up**
  - **9 sites of hard bed rock area (L > 20km), and**
  - **3 sites of Research Promoting Bases (A > 1000ha)**
  - **--> See the map on slide 5**

Sep. 2004 - March 2006

- **ILC Site Study Committee was organized**
- **Site candidates picked up were studied in detail by a member includig an expert of road tunnel construction and an expert of geology and groundwater**

I History (cont.)

Nov. 2005

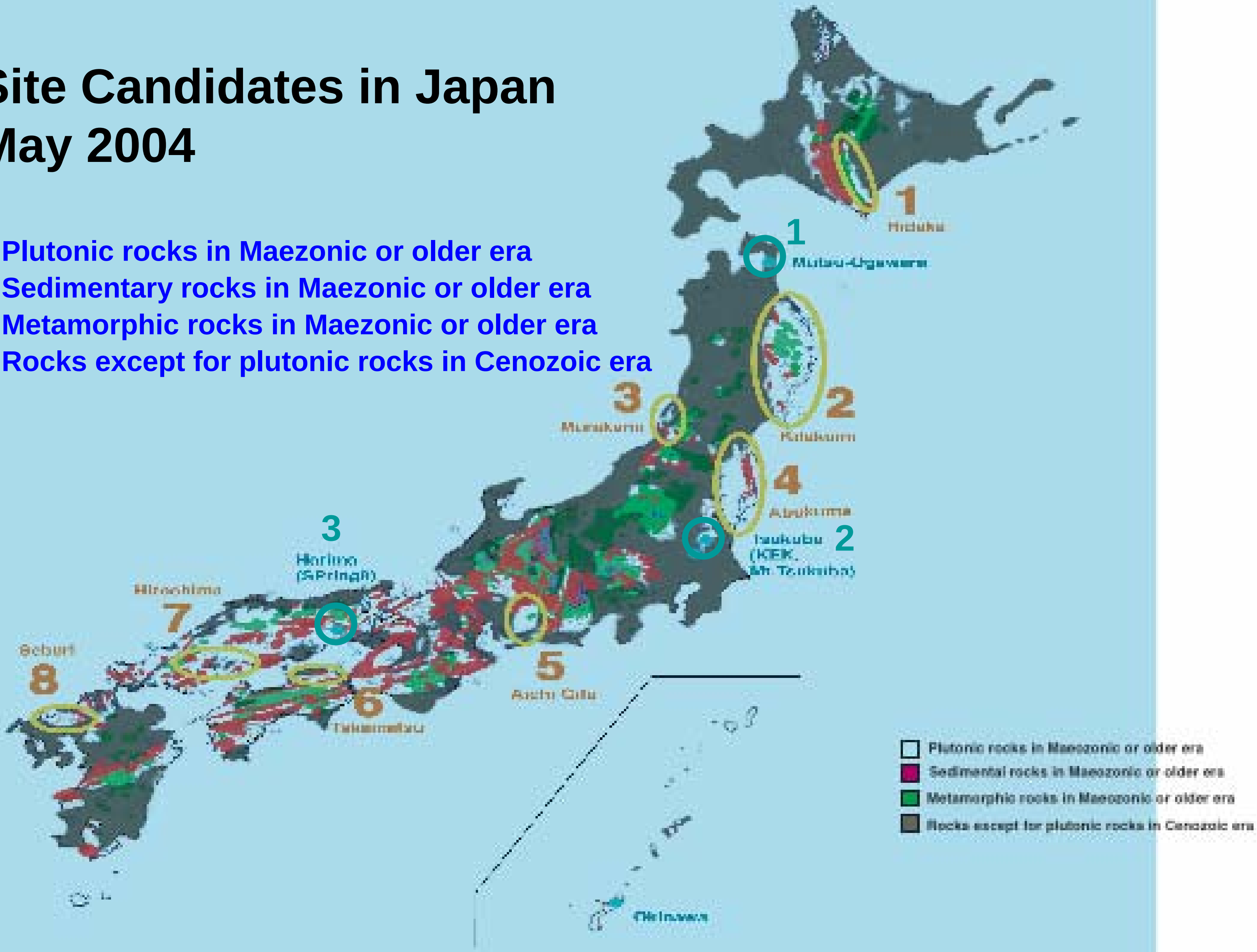
One site was chosen as a sample site, which was endosed as the Asian Sample Site at the 4th ILC-Asia Meeting.

April 2006 -

Site study has been continued under the cooperation of Japan Society of Civil Engineers

Site Candidates in Japan
May 2004

- Plutonic rocks in Maezonic or older era
- Sedimentary rocks in Maezonic or older era
- Metamorphic rocks in Maezonic or older era
- Rocks except for plutonic rocks in Cenozoic era

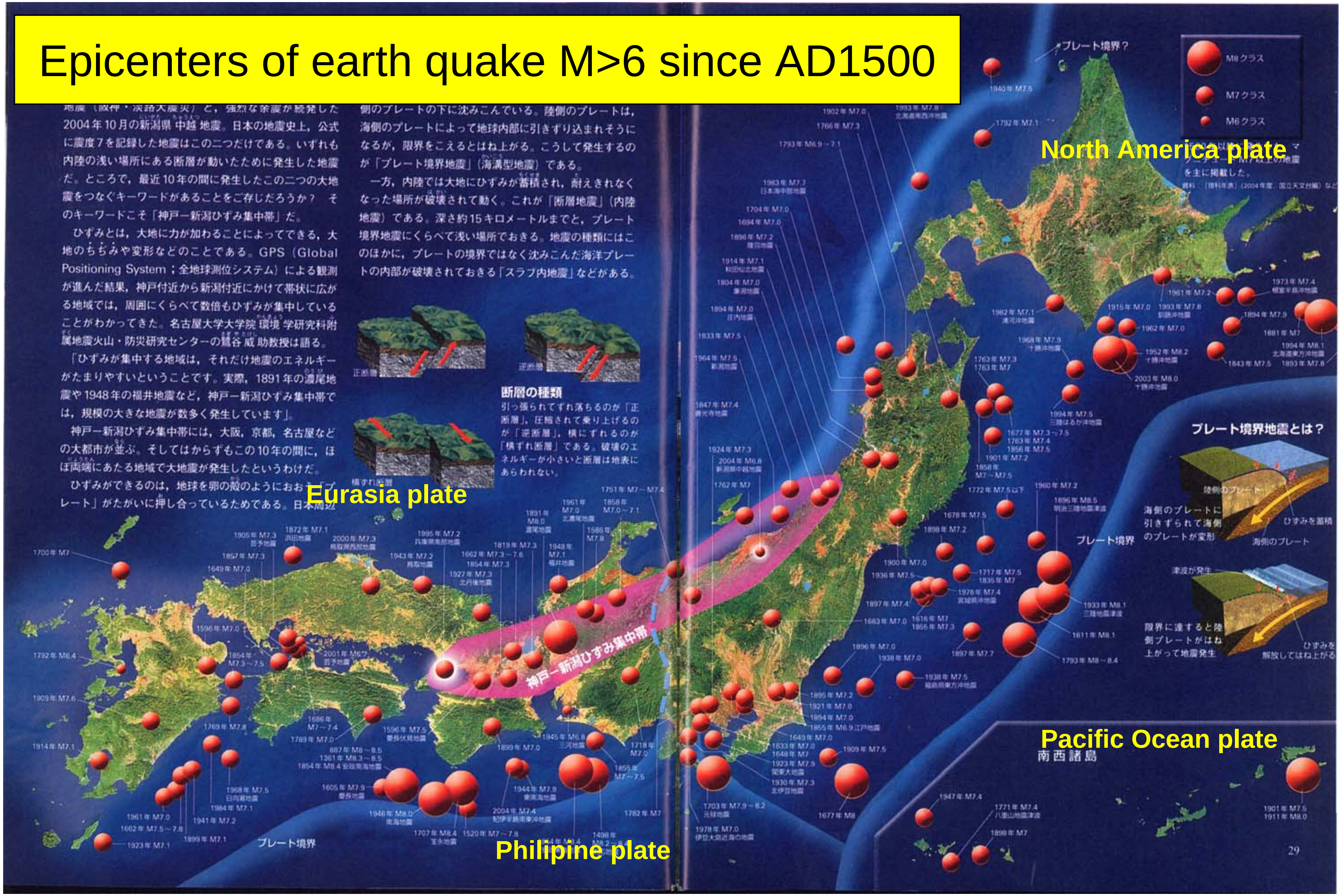


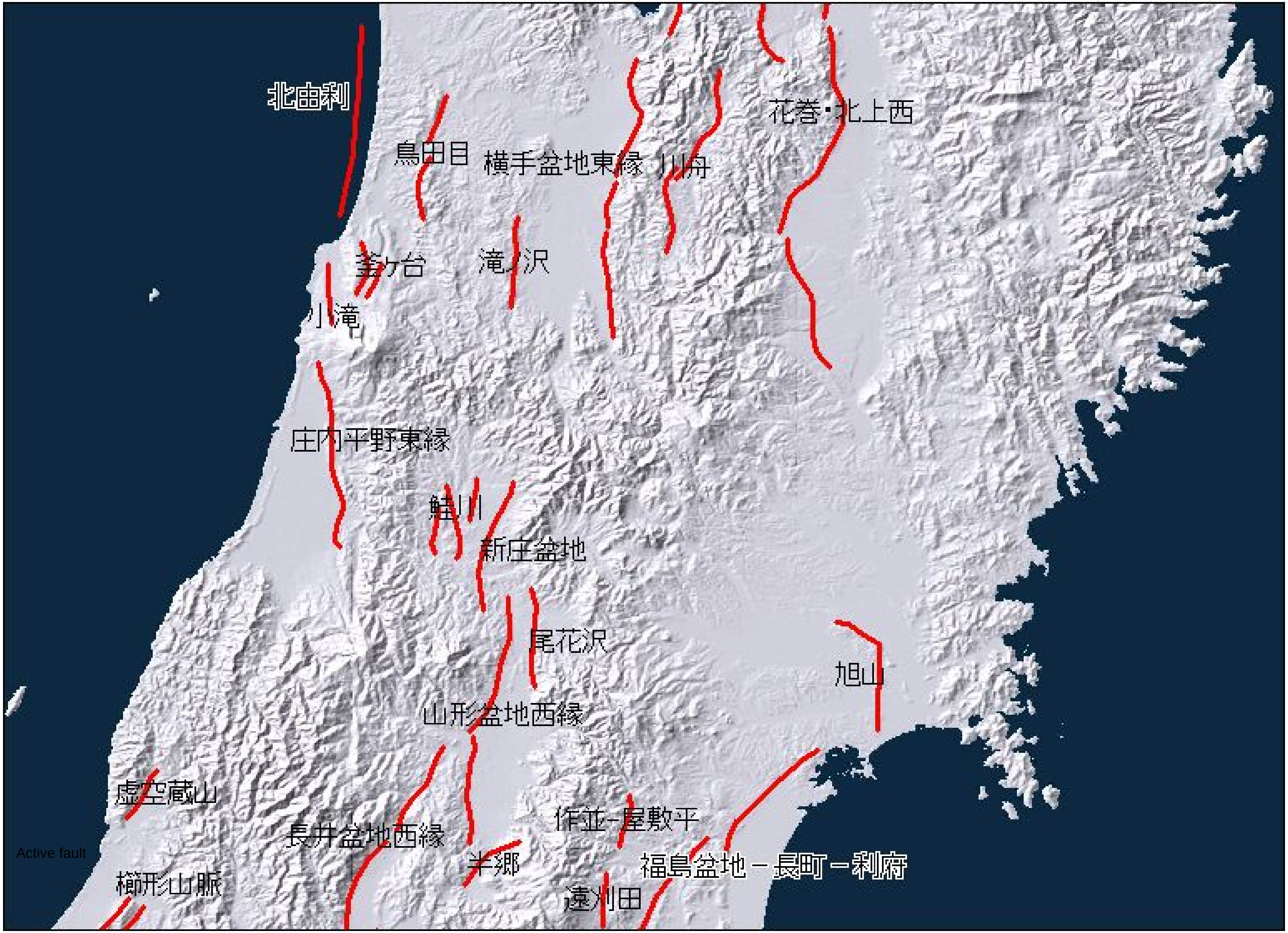
2. Conditions for site candidates

The site candidates should satisfy the following requirements:

- **Firm and uniform geology to ensure stable beam collision at the interaction point**
- **Sufficient length to accommodate straight tunnels spanning over 50 km**
- **Absence of any known active faults nearby**
  --> See slide 9, 10
- **Absence of epicenters of any known earthquakes exceeding M6 within 50 km from anywhere in the site since AD1500**
  --> See slide 8
- **Uniform altitude of the terrain so that the ILC tunnel depth is less than 600m throughout**
- **Availability of sufficient electrical power for ILC operation**
- **Existance of a practical construction plan for the underground tunnels and caverns**
- **Suitable environment, in terms of climate and access, for smooth machine operation**

Epicenters of earth quake M>6 since AD1500

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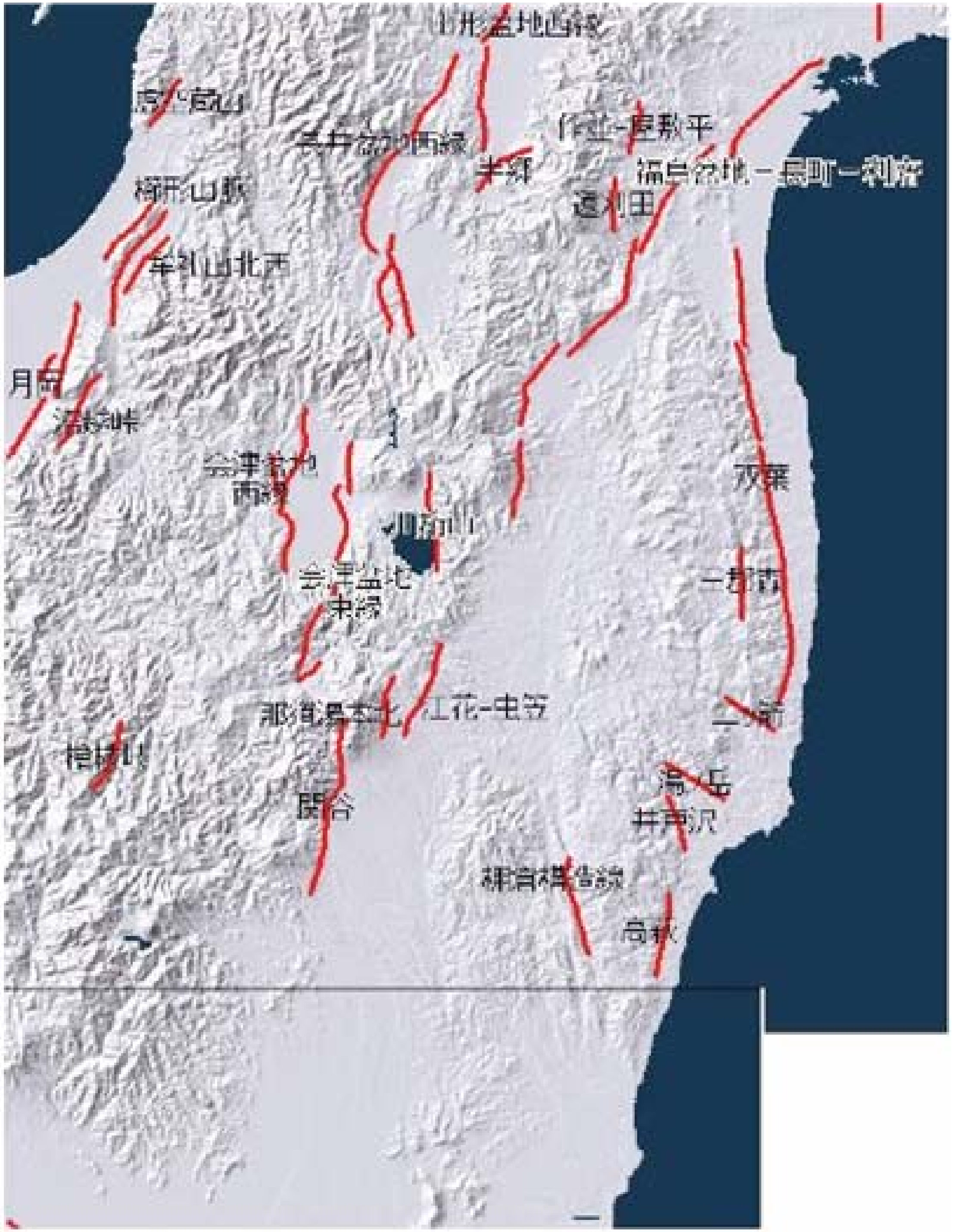
横手盆地東縁
川舟
花巻・北上西
釜ヶ台
滝ノ沢
小滝
庄内平野東縁
鮭川
新庄盆地
尾花沢
旭山
山形盆地西縁
虚空蔵山
長井盆地西縁
作並-屋敷平
半郷
福島盆地－長町－利府
遠刈田
Active fault
櫛形山脈


山形盆地西縁
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半郷
遠刈田
櫛形山脈
月岡
会津盆地
西縁
双葉
会津盆地
東縁
江花-屯笠
湯ノ岳
井戸沢
関谷
棚倉構造線
高萩

II Conditions for site candidates (more details)

No.	Term	No.	Term	No.	Term
Tunnel route		**Accelerator construction and operation**		**Acquisition of land**	
1	Usable length (km)	13	Electric power supply (capacity of main power line distance)	34	Land for facility on the surface except for IP
2	Flexibility in adjusting tunnel routes	14	Accessibility to the entrance of the access tunnel	35	Land for IP facility
3	Within a single prefecture?	15	Access to the tunnel	36	Cost of land
		16	Snowfall	37	Inhabitants along the tunnel route
Geology		17	Dumping place for excavated material	38	Invitation from municipality
4	Type of rocks (layers)	18	Number of days per year with temperature above 30°C	39	Research and development project
5	Weathering	19	Source of cooling water		
6	Active dislocation	20	Average ambient temperature (= underground temperature)	**Environment for research**	
7	Dislocation nearby (W>0.5m)	21	Amount of underground water	40	Available airport
		22	Drainage in the tunnel	41	Available seaport
Geography and topography		23	Volcanoes (50km or closer)	42	Available railroads
8	Topography	24	Sources of earth quakes at M>6 and after 1600	43	Available main roads
9	Usage of surface	25	Thunderbolts	44	Distance from KEK
10	Depth of tunnel	26	Existing artificial vibrational noise	45	Universities and institutes nearby
11	Depth of IP	27	Hot springs		
12	Big rivers nearby	28	Quarries	**Living environment**	
				46	Cities and towns nearby
		Heritage		47	International school nearby
		29	National park	48	Cultural and recreational facilities
		30	Protected geology	49	Residence
		31	Biological sanctuary	50	Facilities for health and welfare
		32	Religious sanctuary	51	Facilities for safety and security
		33	Remains of early date		

These conditions were developed in detail in the GDE-CSF meeting, and about 100 items were listed up.

III Ground motion at various sites in Japan

(1) KEK site ..... soft ground

- Diluvium in Kanto plane
  (alternative layers of sand, gravels and clay)
- Measured on the ground surface and in the KEKB accelerator tunnel (10m deep underground)
- There is a main public road about 1km far from the measurement place.

(2) SPring-8 (8 GeV synchrotron light source lab.)

..... constructed on hard bedrock

- Kamigori metagabbro rock area
- Measured on the bedrock near to the accelerator ring

III Ground motion at various sites in Japan (cont.)

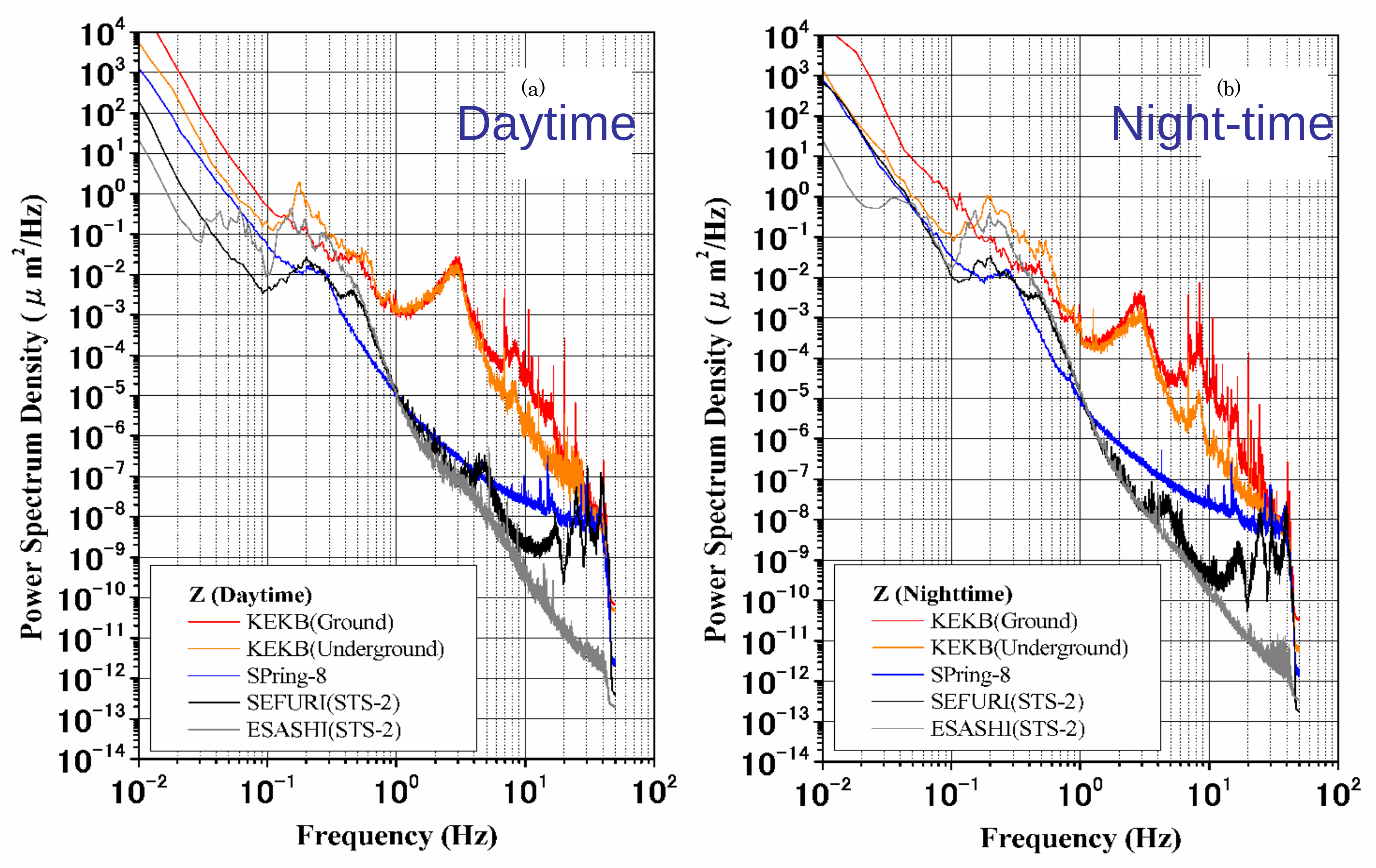
(3) Mitsuse road tunnel in **Sefri area** ..... granite rock area

- Penetrating Sefuri mountain chain (granite rock)
- Located in border between Fukuoka and Saga prefectures
- Measured at a point about 10m far from near edge of the road on the concrete floor in a shelter area, which is located about 800m inner from the entrance of the tunnel.

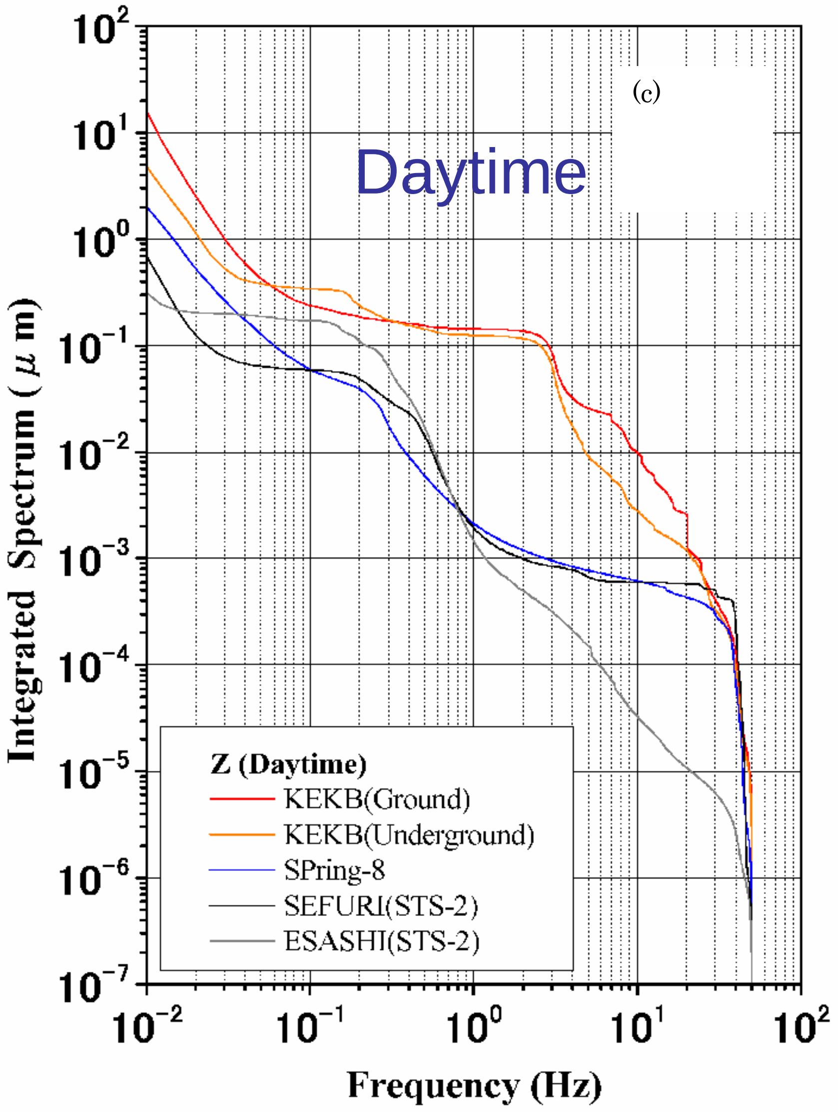
(4) Esashi area ..... granite rock area

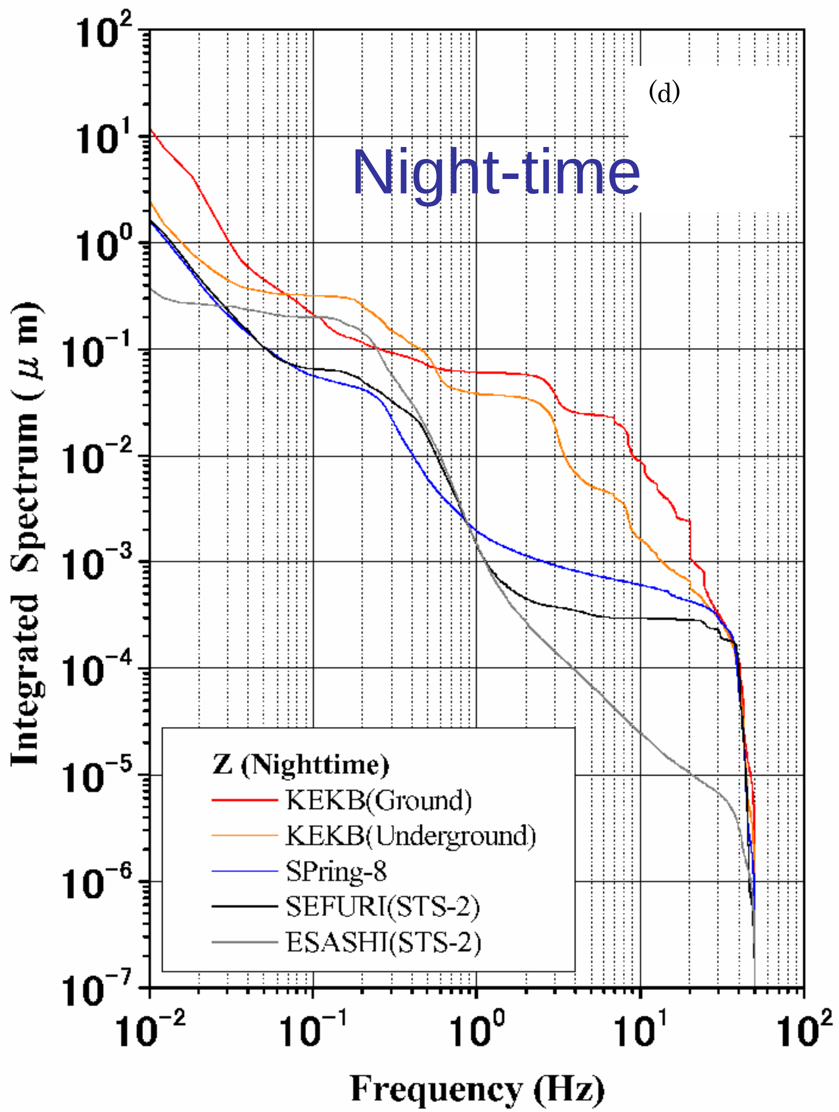
- Measured in Mizusawa Earth Tide Observatory
  About 150m long horizontal tunnel constructed in Abara mountain (granite rock)
- Measuremed on a granite base plate fixed on the bedrock.

IV Ground motion at various sites in Japan (cont.)
PSD (Power Spectrum Density)



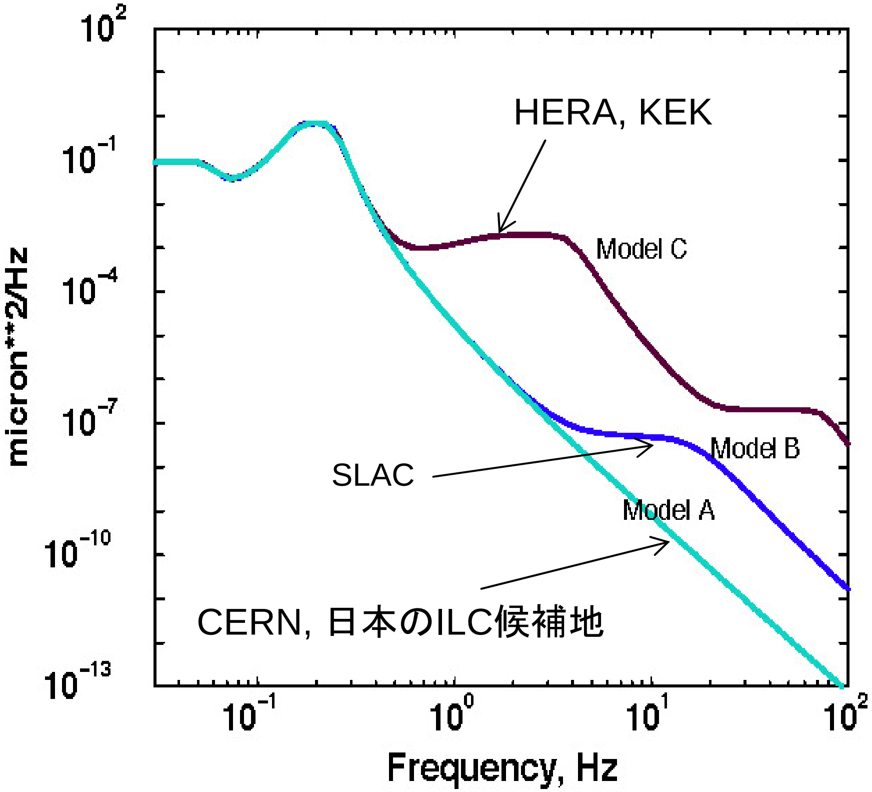
III Ground motion at various sites in Japan (cont.)
Integrated PSD



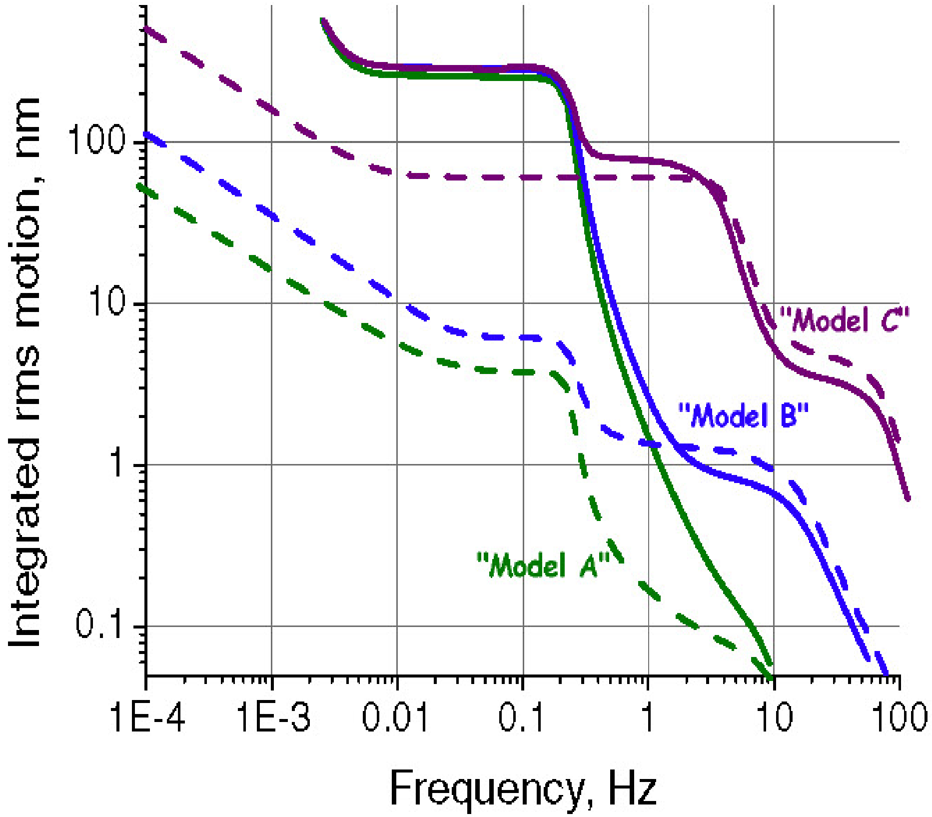


III Tolerances on Ground Motion (from TESLA TDR)

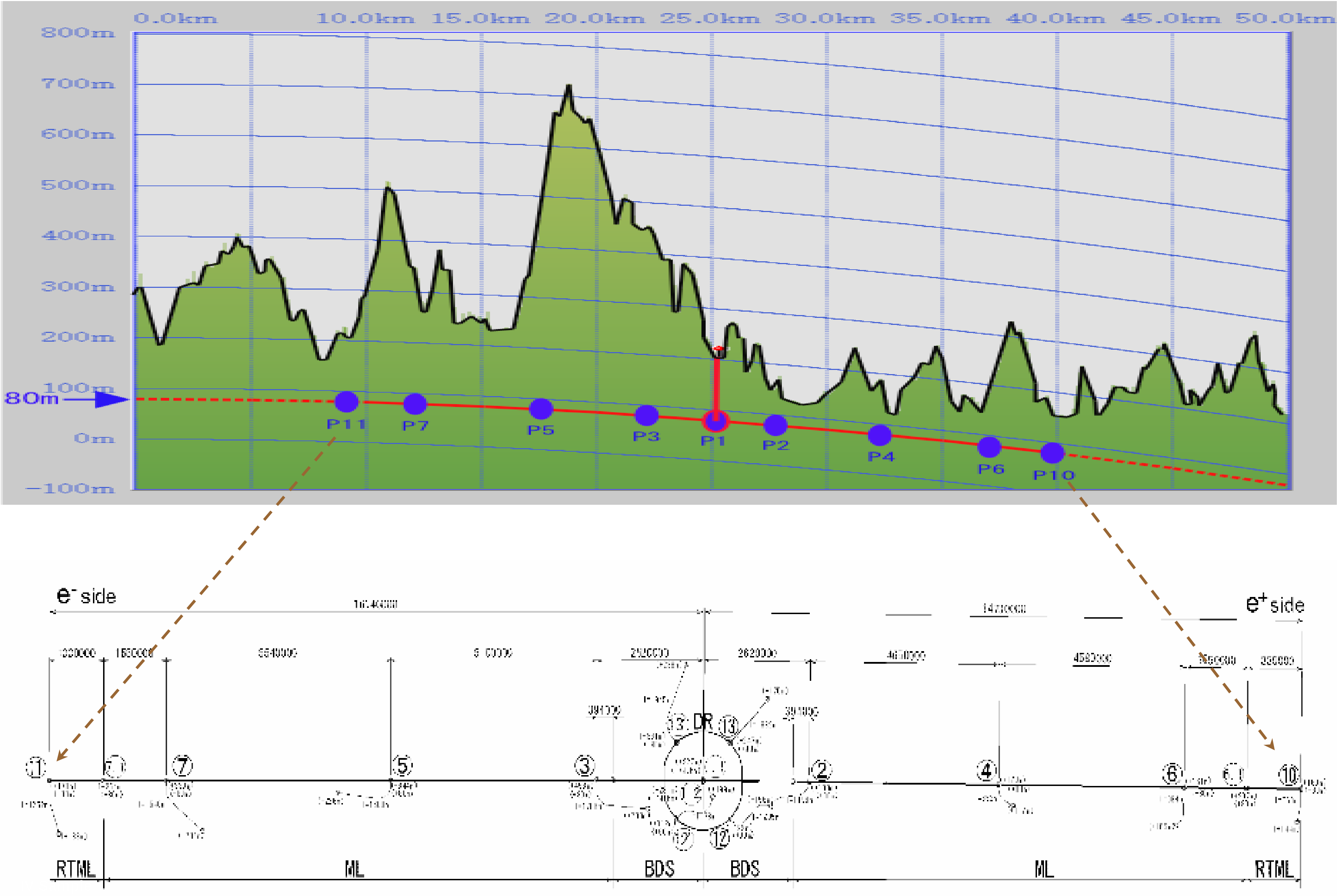
PSD



Inegrated PSD



IV Asian Sample Site
Cross sectional view



V Asian Sample Site (cont.)
Features

Location

- The Asian site is located in a moderate plateau area (low mountains) in uniform solid rock
- It is within 10 to 20 km from cities which provide a living environment with reasonable quality of life. The neighboring cities are connected to an international airport within several hours by both bullet train and highway.

Land Features

- The site surface is dominated by woods and is partly occupied by an agricultural area which is crossed by occasional local paved roads
- Only a few local residences exist along the tunnel route.
- There are no major high-ways or streets with heavy traffic and no large river systems which cross the tunnel route
- Hence, very few sources of natural or human-made vibrations exist
- An adequate flat surface area is available to accommodate surface facilities
- Existing local roads can be utilized as access routes to entrances of the tunnel

IV Asian Sample Site (cont.)

Climate

- The climate is mild. There is snowfall in winter but only for a short period. It is not too hot in summer.
- There is no recorded history of major typhoons

Geology and Tunnel Structure

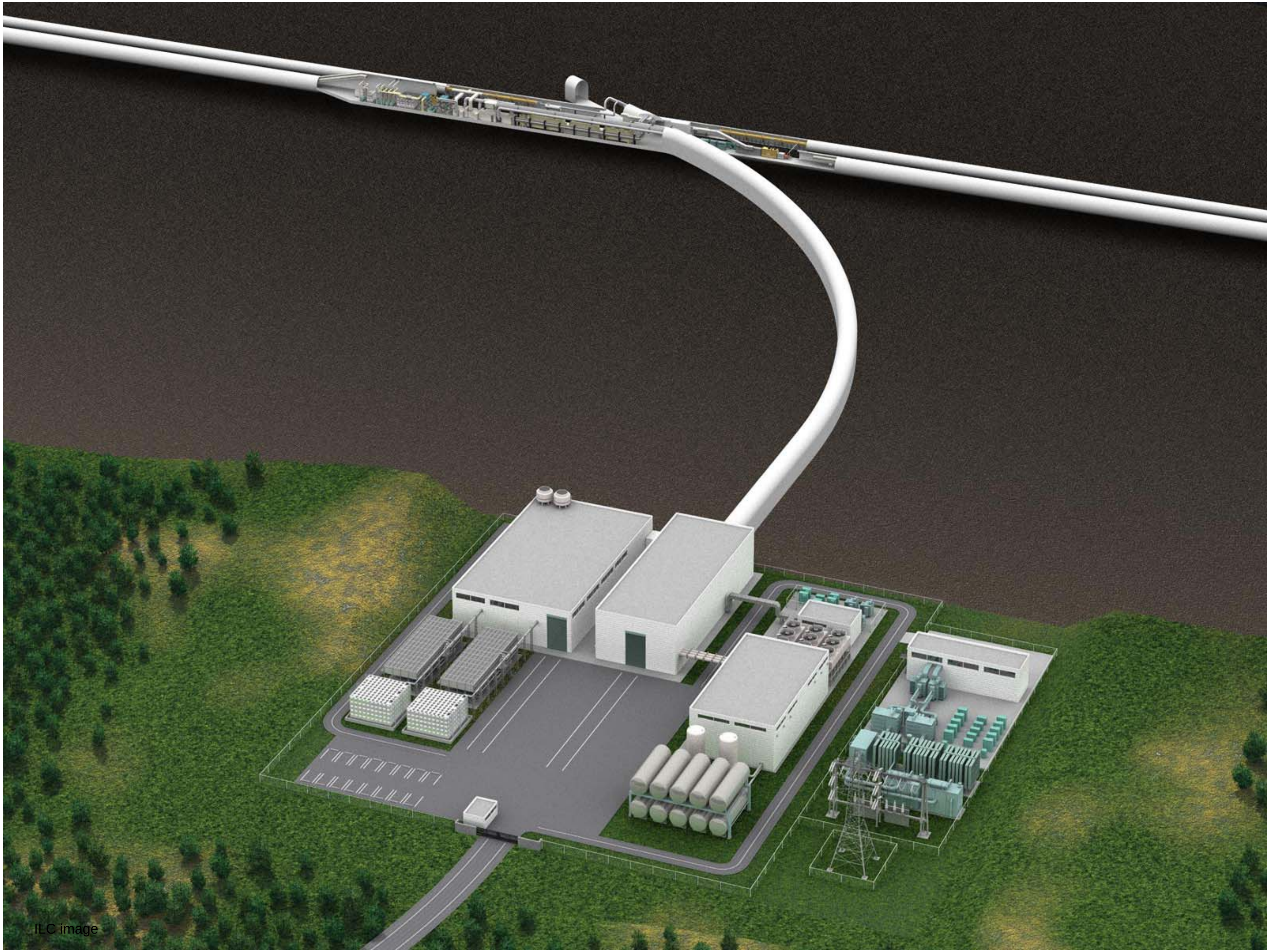
- The 31 km ILC tunnels for the first project phase can be constructed within solid hard rock
- In the second project phase, when the tunnels are extended to 50 km, one side of the main linac tunnel will pass through an area with sedimentary rock, but this geology is also solid.
- The depth of the tunnels, which will be built in a low mountainous part of the site, is in the range between 40 m and 600 m. Most of the access to the tunnel is provided by sloped ramps
- An exception is the access to the interaction region which has a vertical shaft approximately 112 m deep.

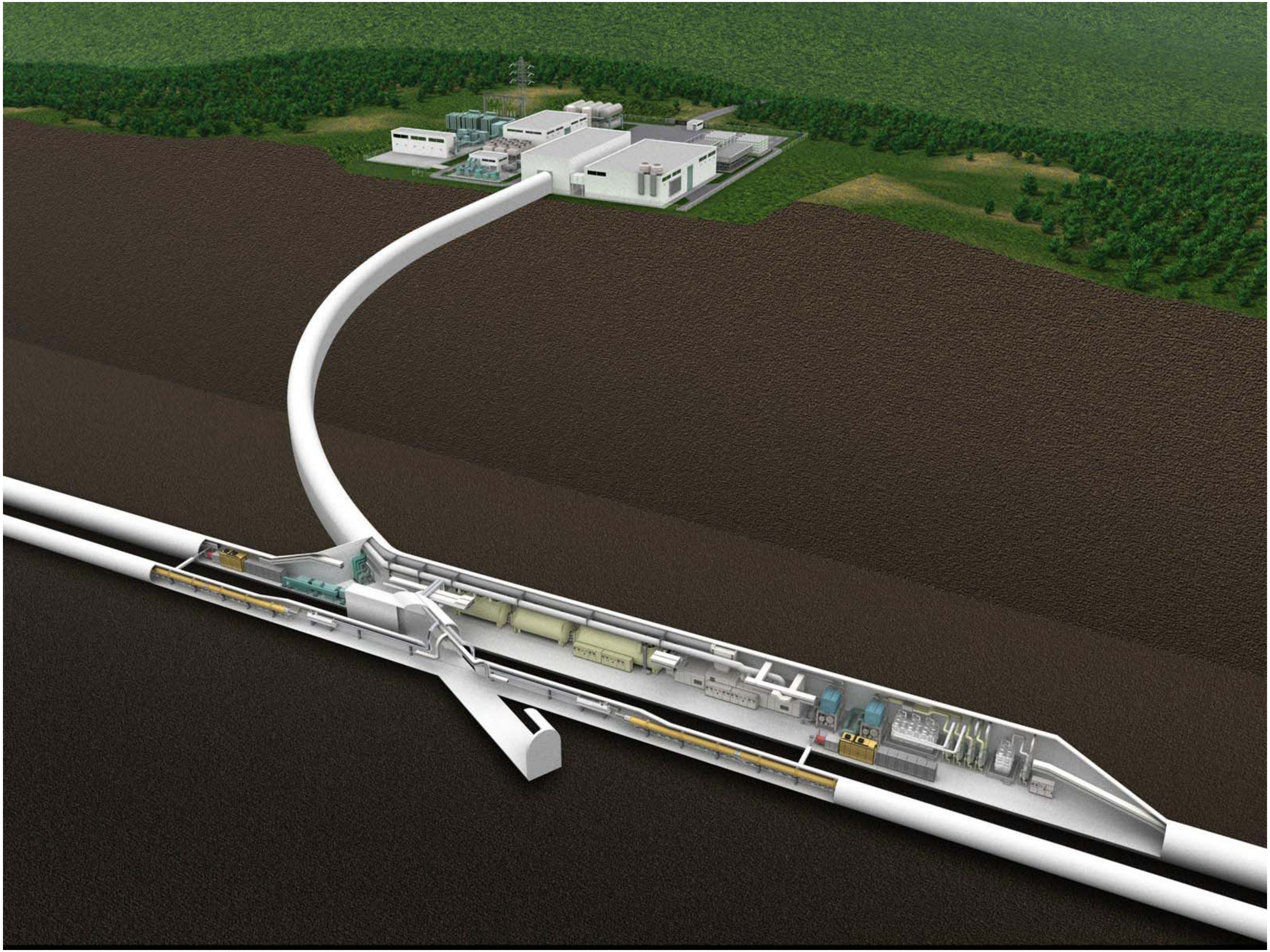
IV Asian Sample Site (cont.)

- **Past experience with Japanese construction projects indicates that the uniform granite has sufficient strength that the tunnels and caverns do not require reinforcement by rock bolts or concrete lining**
- **Shotcrete is used to cover the inner surfaces of the tunnels**
- **Excavation of very large caverns, such as the experimental hall, may require reinforcement by rock bolts**

Power Distribution System

- **The site is located in the neighborhood of an existing 275 kV power grid. It is considered to be reasonably straightforward to supply the power of 240 MW required for the 500 GeV ILC.**
- **Power failures in Japan are very rare, and even if they occur, the system average interruption duration index (SAIDI) has been only 13 minutes, according to the statistics of the Ministry of Economy, Trade and Industry of Japan.**


ILC image



Summary

- **Several good site candidates have been found in Japan**
- **More investigations, such as geological assessment and environmental assessmet, are needed**
- **Site candidates are all wide granite areas**
- **We will investigate sedimentary rock areas**