X3-087

On the IT Strong Motion Seismometer System for Buildings

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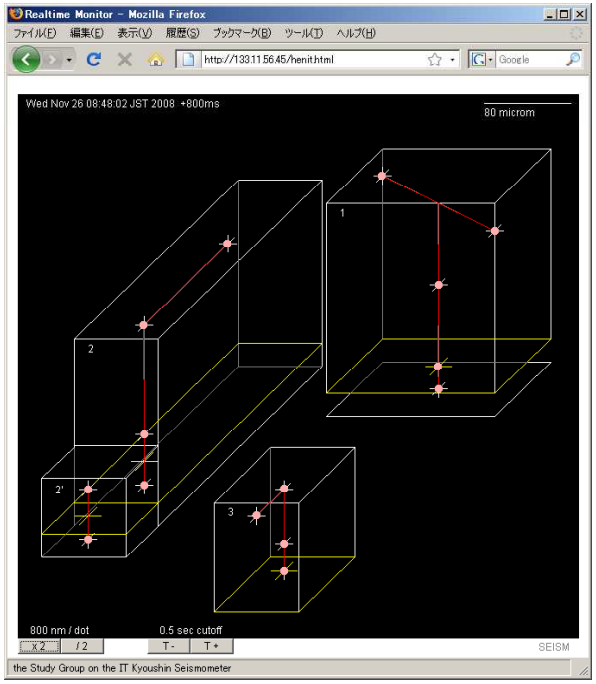
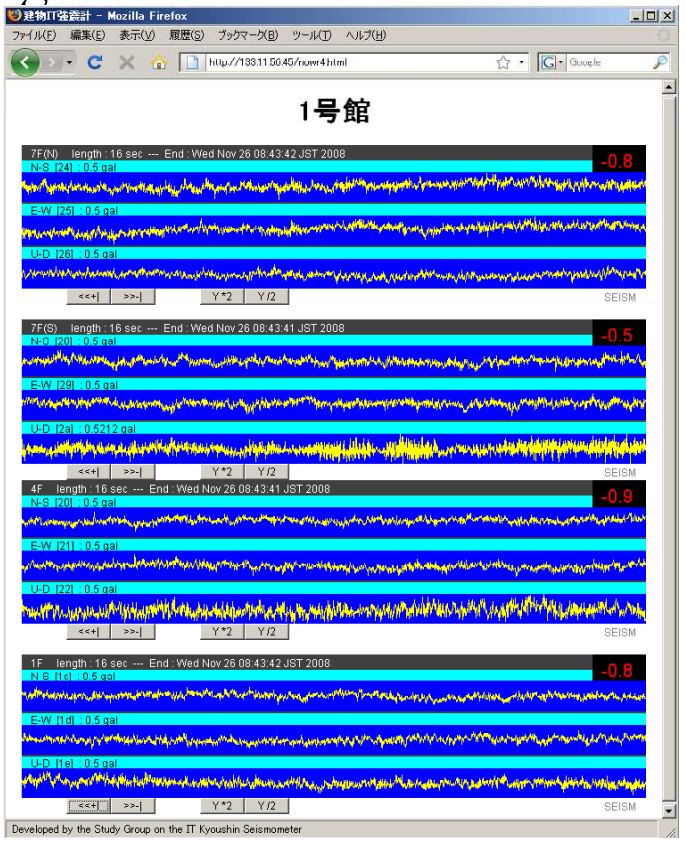
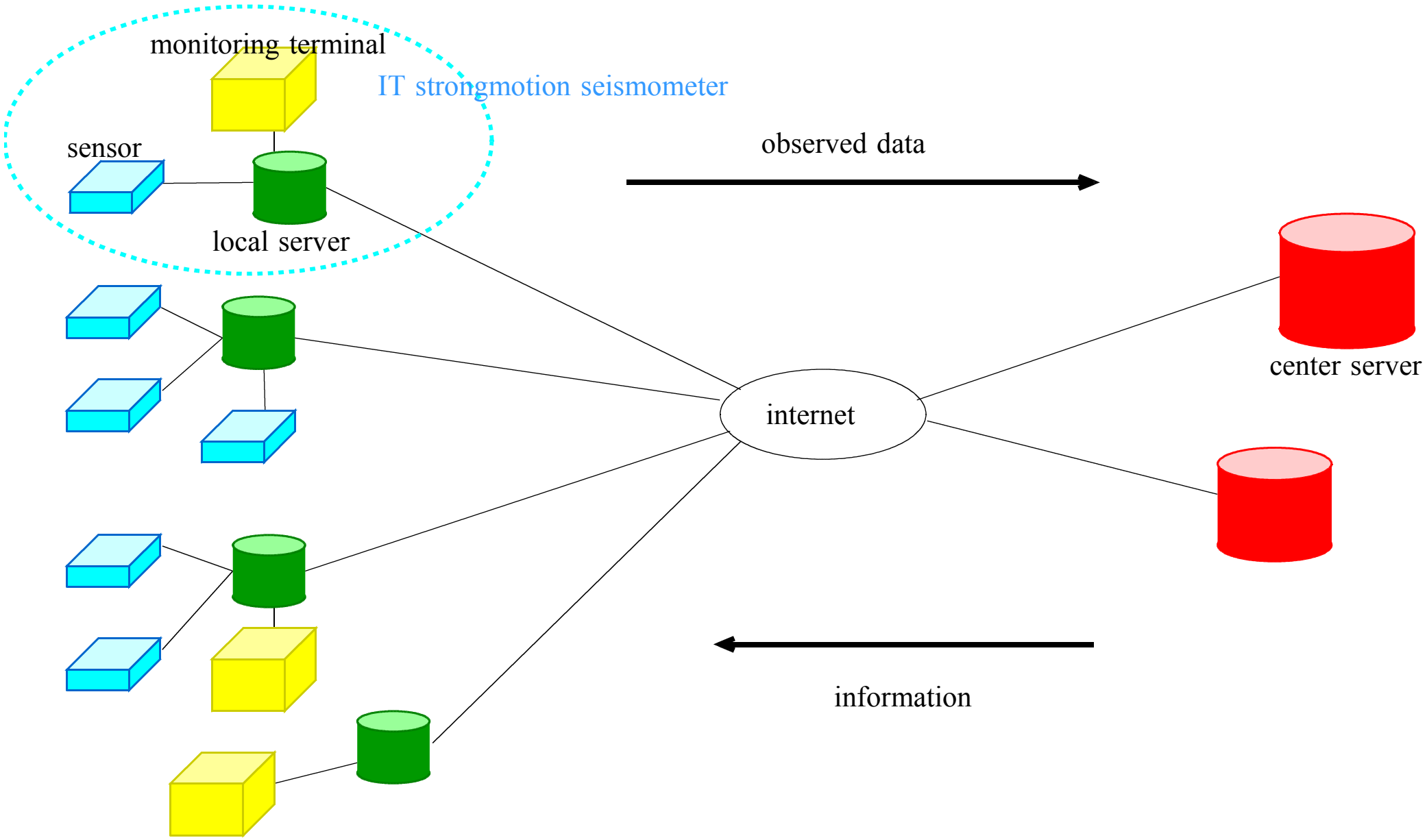
In order to reduce the seismic disaster, it seems to be the usefulness to investigate the seismic vibration of our familiar buildings such as housing, companies, schools, etc. in small earthquake, examine the weak point and improve the earthquake resistance of these building effectively. For this purpose, we devised IT strong motion seismometer as a new type self install strong motion seismometer. A trial manufacture system for structures is installed in several places including the Earthquake Research Institutes (ERI) buildings and operates. In addition, for the standardization of an apparatus and the protocol, IT strong motion seismometer consortium was established.

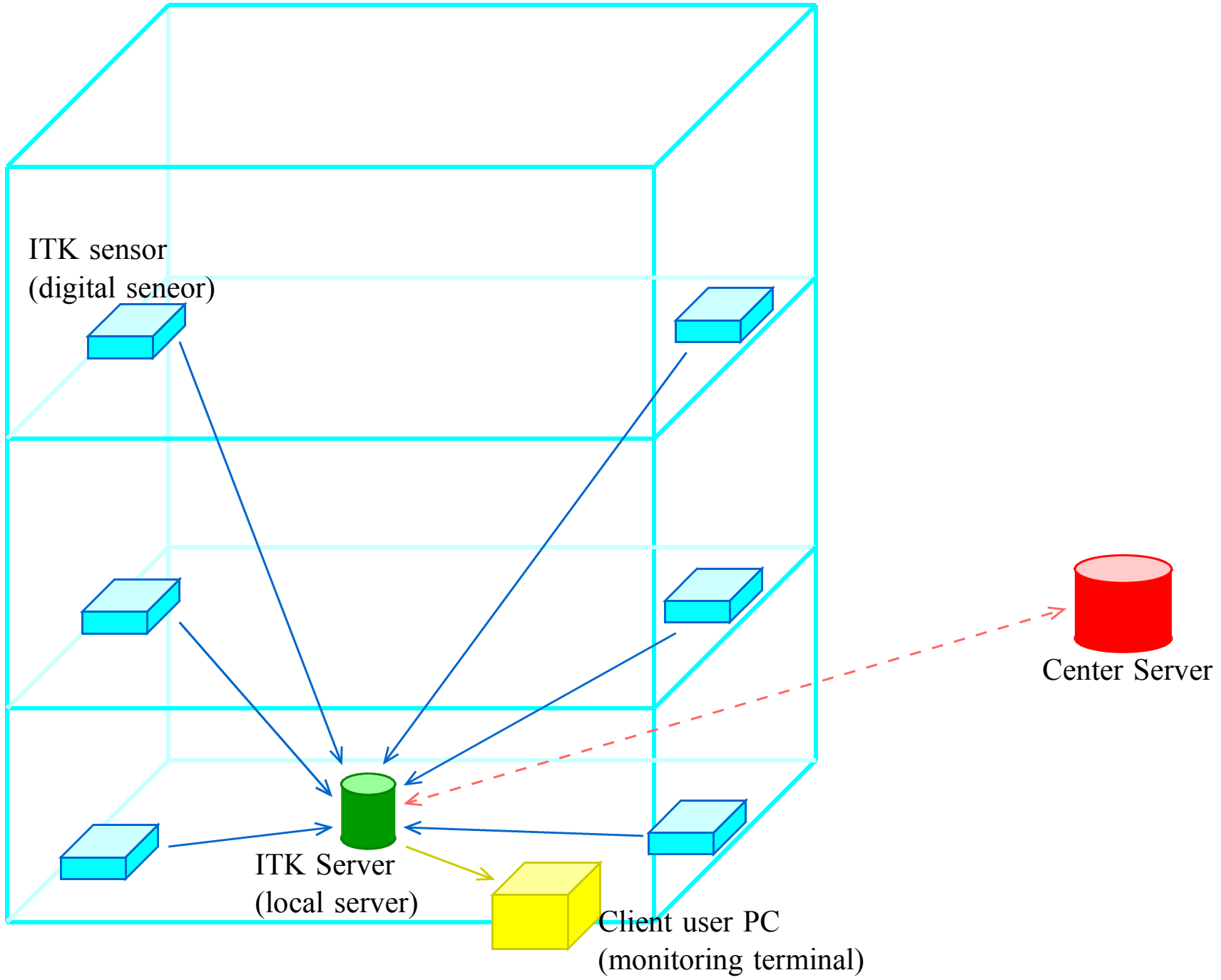




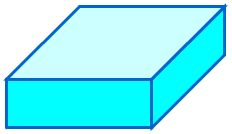
the network of IT strongmotion seismometer



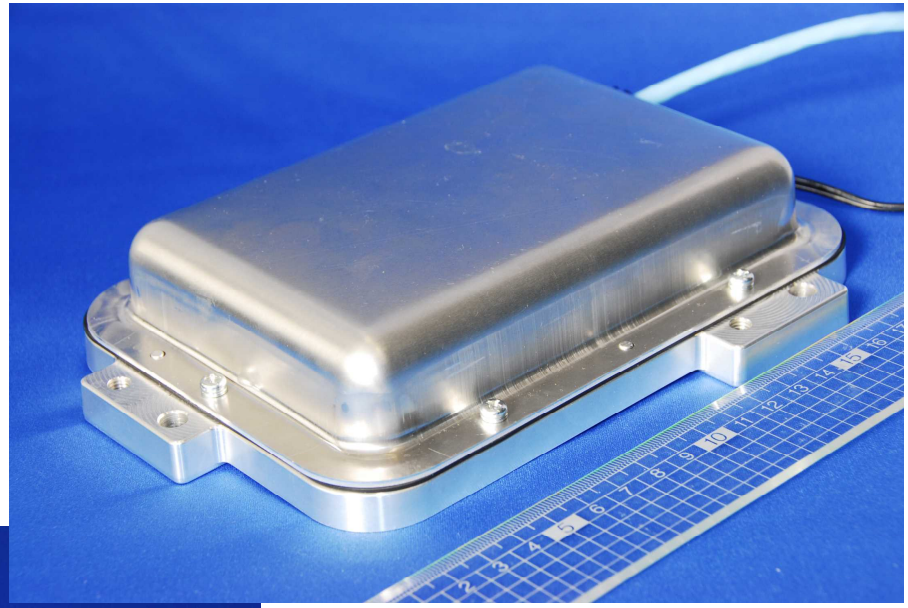
IT Strong Motion Seiemometer for Building



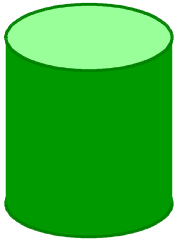
digital sensor



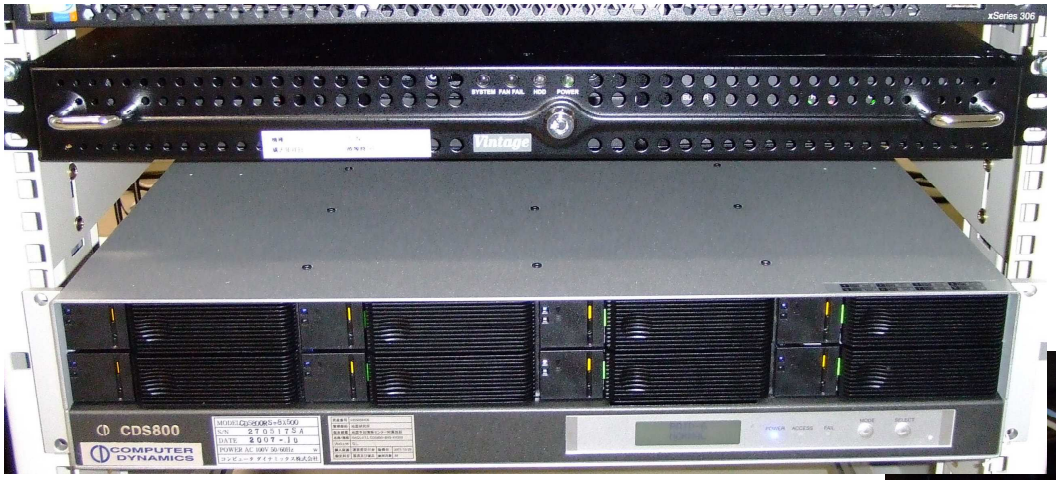
The digital sensor uses NTP(Network Time Protocol) for laying upon at the time of data, and a time stamp is attached for the data sent to a server by a digital sensor in correct time.



ITK server (local server)

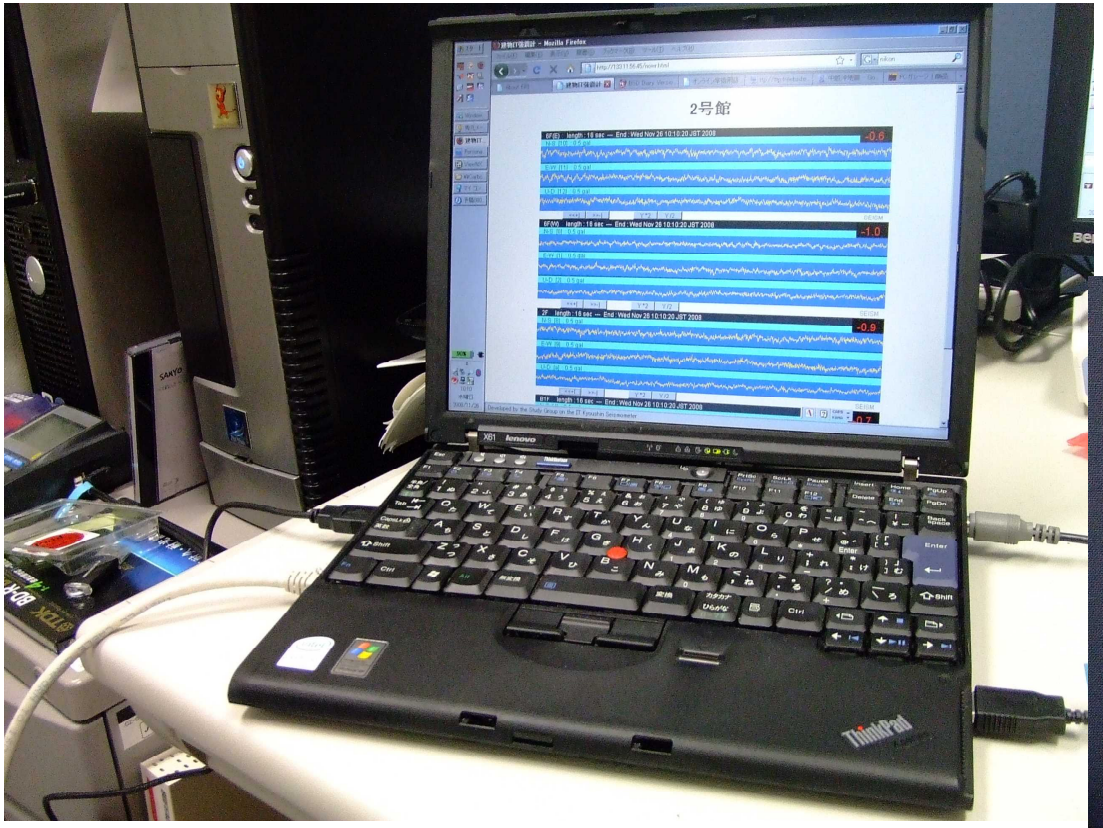


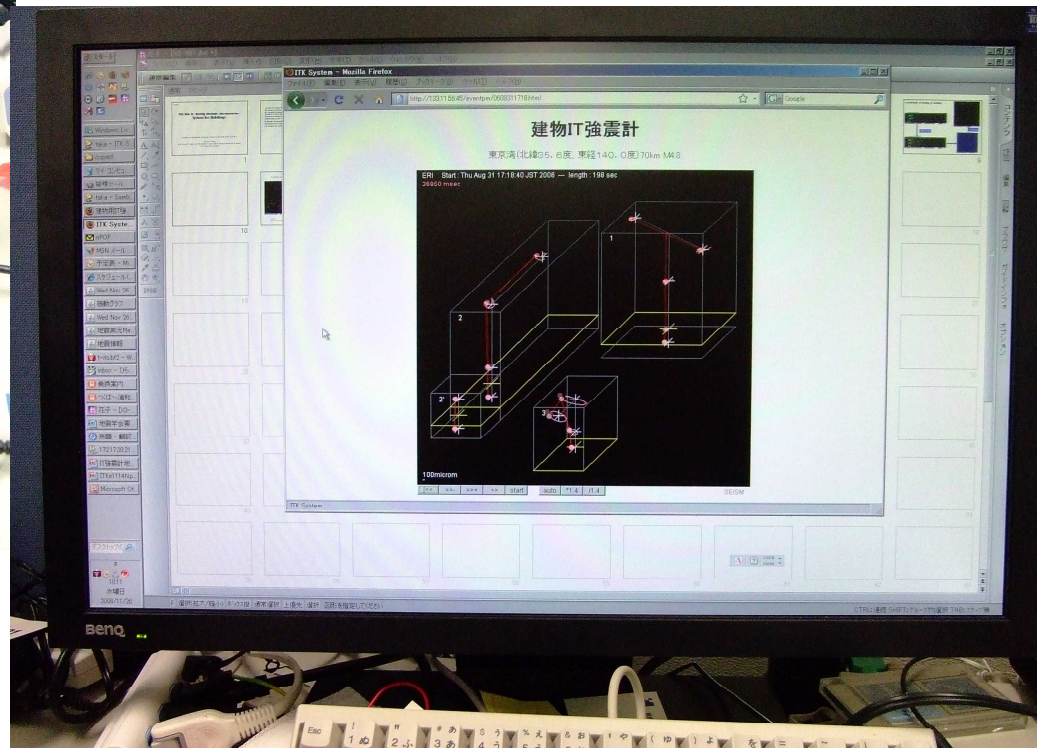
The local server collects the data from a sensor and performs consecutive waveform preservation, real-time operation, a trigger judgment. It changes the information for an outside server offers the data which own maintains.



monitoring terminal

The monitoring terminal notifies the users of the information that it got from a local server. Various displays by the Java applet are now realized with a normal PC as an monitoring terminal.



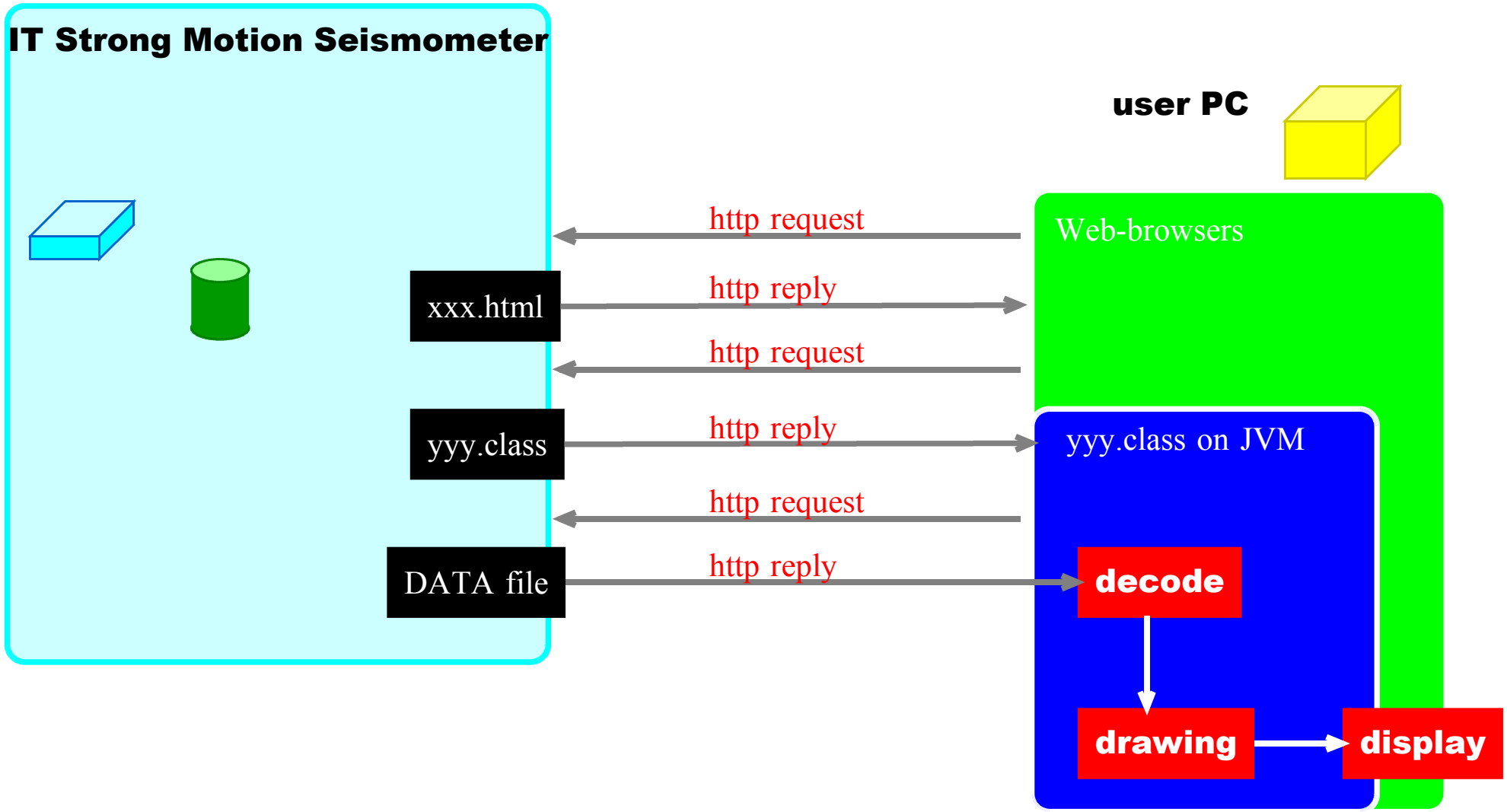


We can grasp effectively the behavior of the building at the time of the earthquake by arranging many sensor of the IT strong motion seismometer in the building. The point that consecutive waveform recorded in is superior to a case arranging a lot of strong motion seismometers of the simple trigger type. The reason is because it can get later the waveform record of the earthquake that trigger did not depend. Because the data are synchronized from the start at the time, the data set that was suitable for analyzing is provided. Because data collecting part is monas, and the wiring is an Ethernet, the expense of the systems construction is moderate.

The system at ERI started observation by current sensor placement from June, 2006. In the building where seismic reinforcement construction was performed in the meantime, it was confirmed that stiffness of the building was increased.

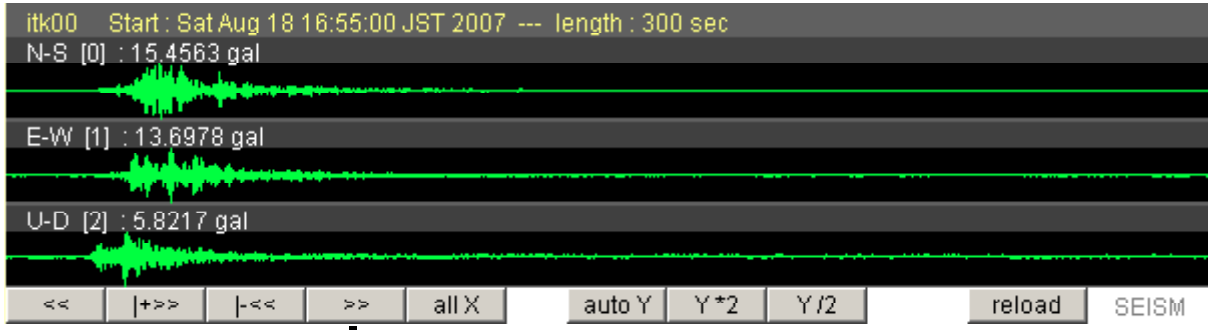
Display by the Java applet

We created a mechanism of display on a web browser for IT strong motion seismometer system. The display with the PC which is not special hereby comes true. For realization of real-time indication and animation display with low load, we developed the indication that it used Java applet.
Even if the acquired data are waveform data, it can easily visualize seismic ground motion because a animation displays as a particle motion. In addition, it can visualize the behavior of the building by making one which connected this particle motion on a single screen.


IT Strong Motion Seismometer
user PC
Web-browsers
http request
http reply
xxx.html
http request
yyy.class
http reply
yyy.class on JVM
http request
DATA file
http reply
decode
drawing
display

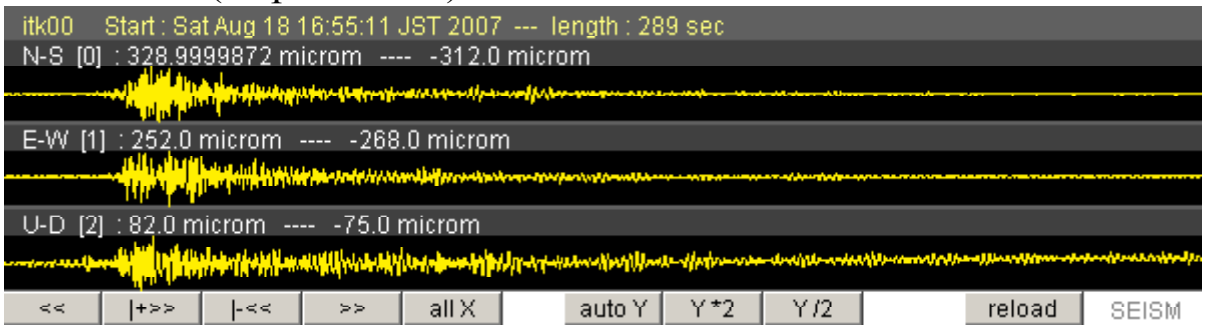
visualization of shaking on building

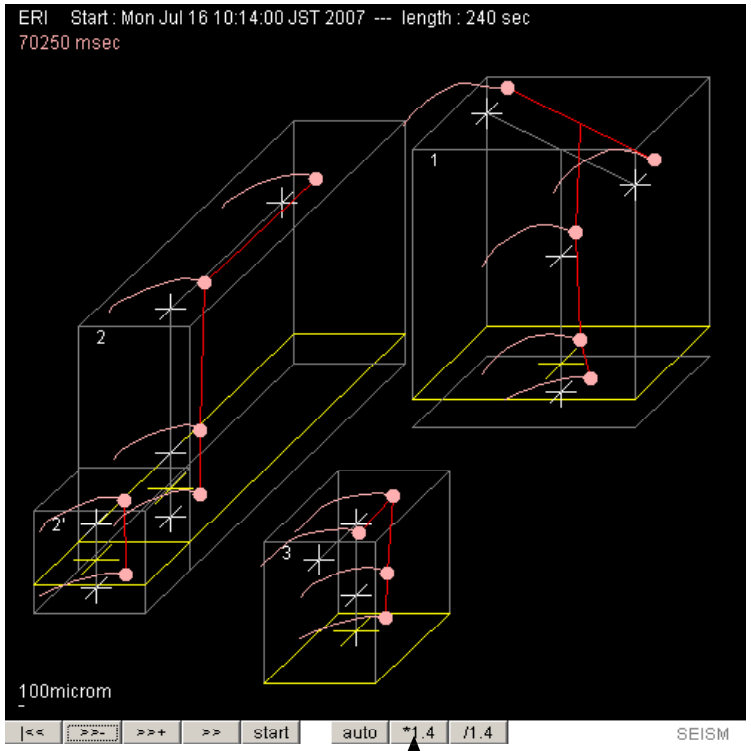
waveform(acceleration)



integration

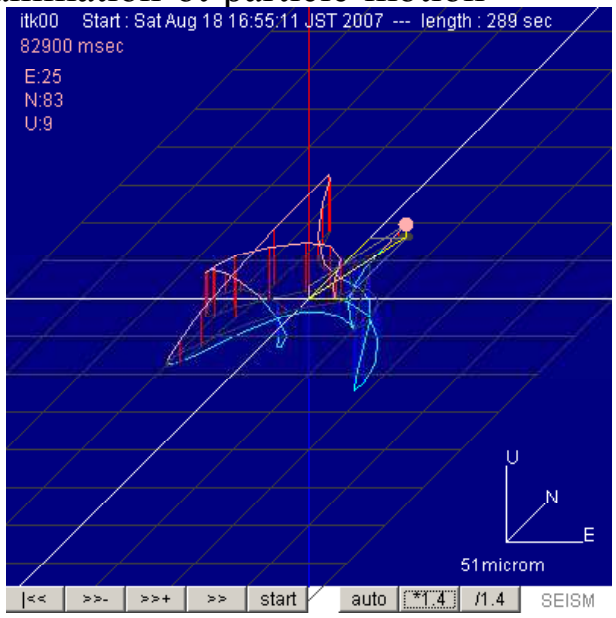
waveform(displacement)



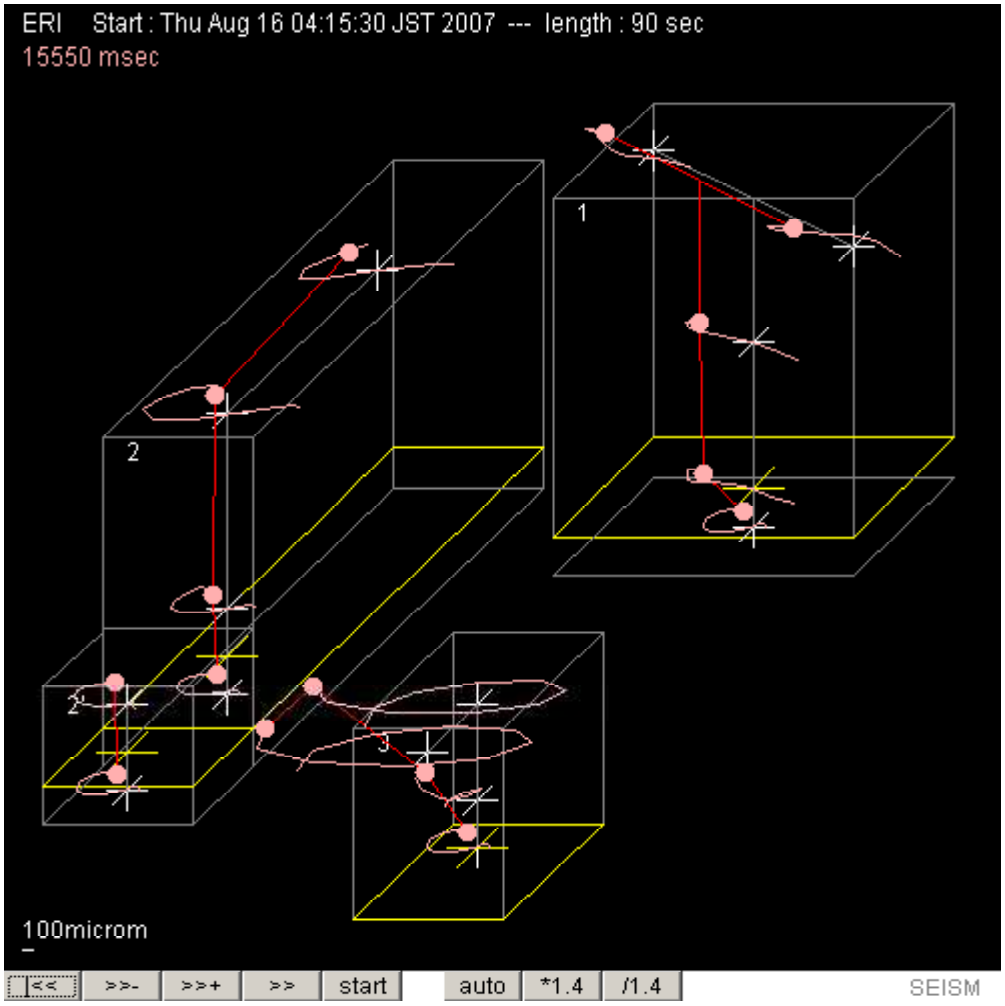


connect

animation ot particle motion



The earthquake that is not big of the magnitude that occurred near

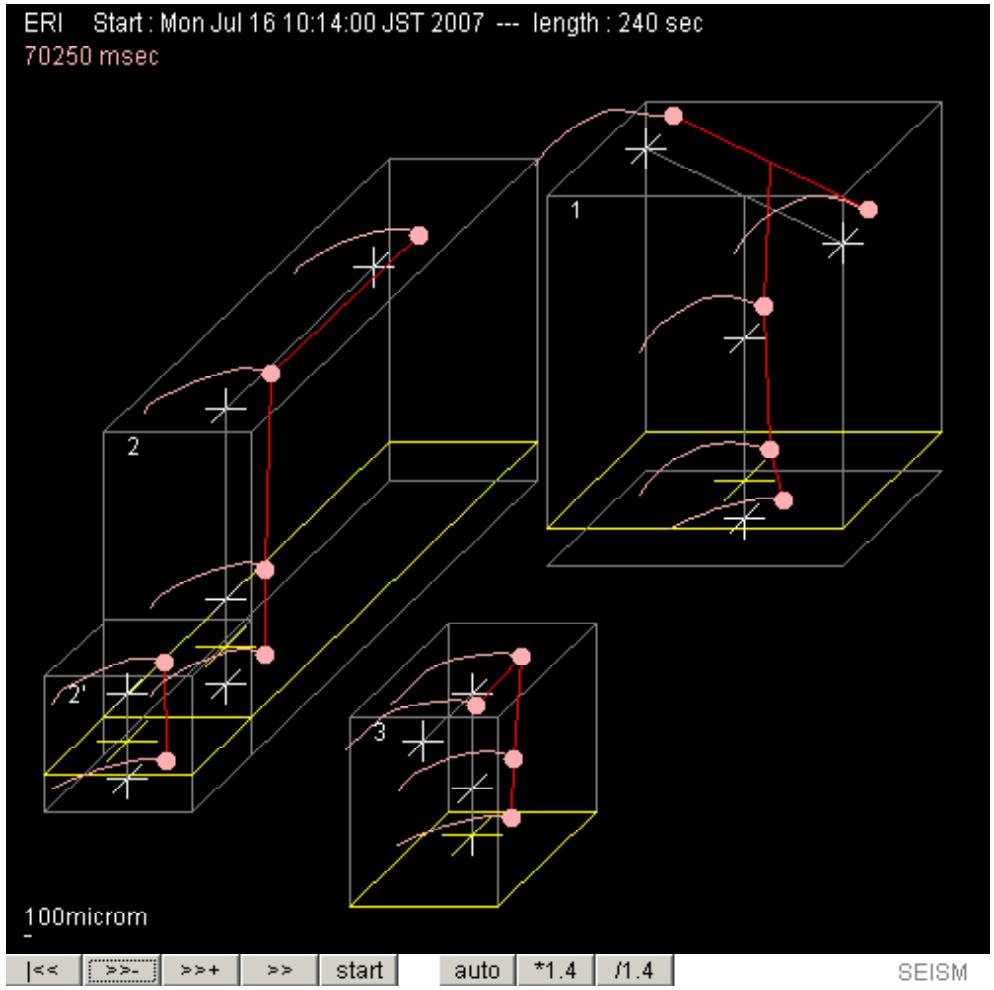


A building of the steel structure shakes greatly on its natural period

A building of the base isolation shows the big amplitude in long-term displacement

Mj=5.3
Kujukuri Coast, Boso Peninsula

A big earthquake of the magnitude that occurred in the distance

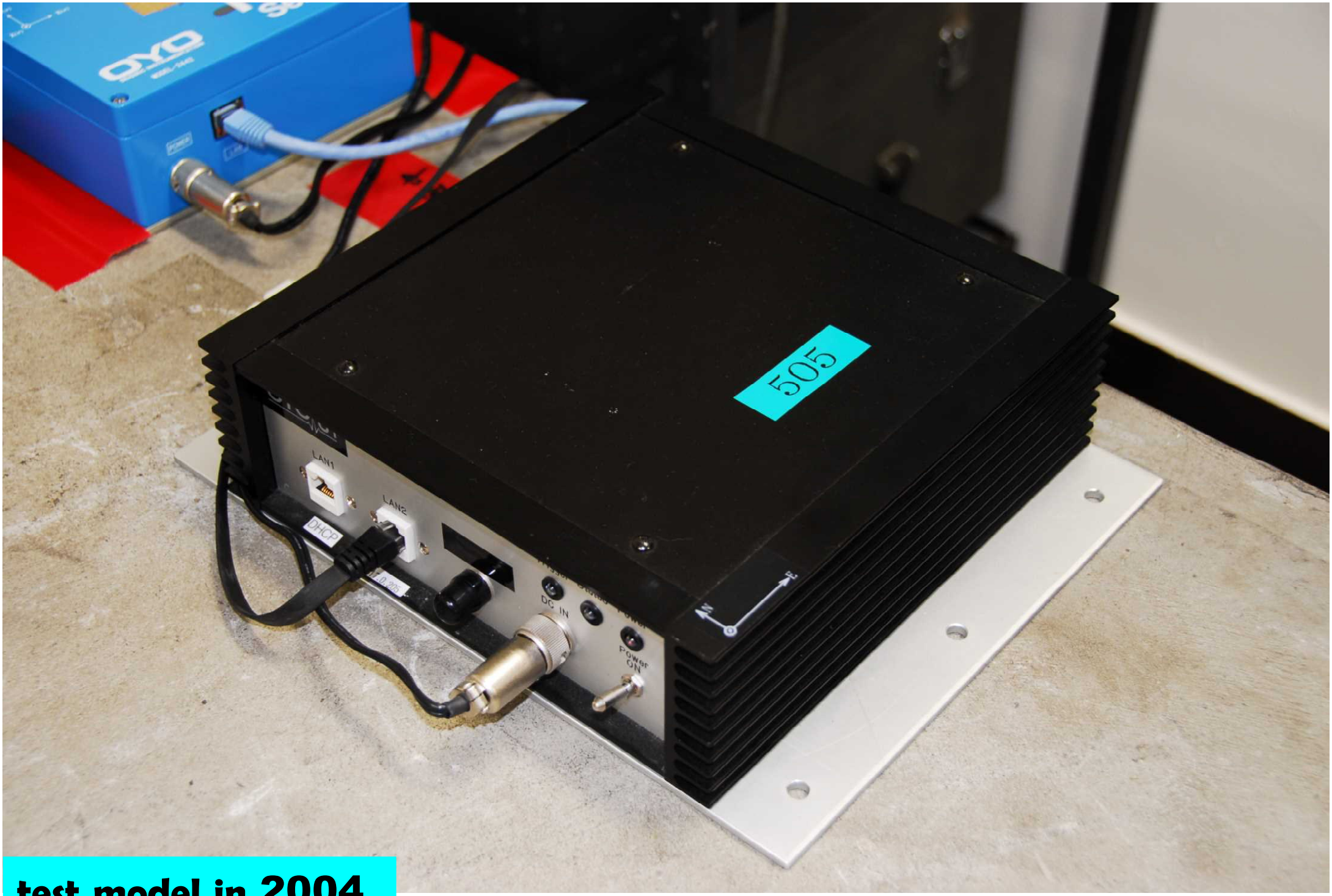


All points do a translation

↑

long-period seismic wave

The Niigataken Chuetsu-oki Earthquake in 2007



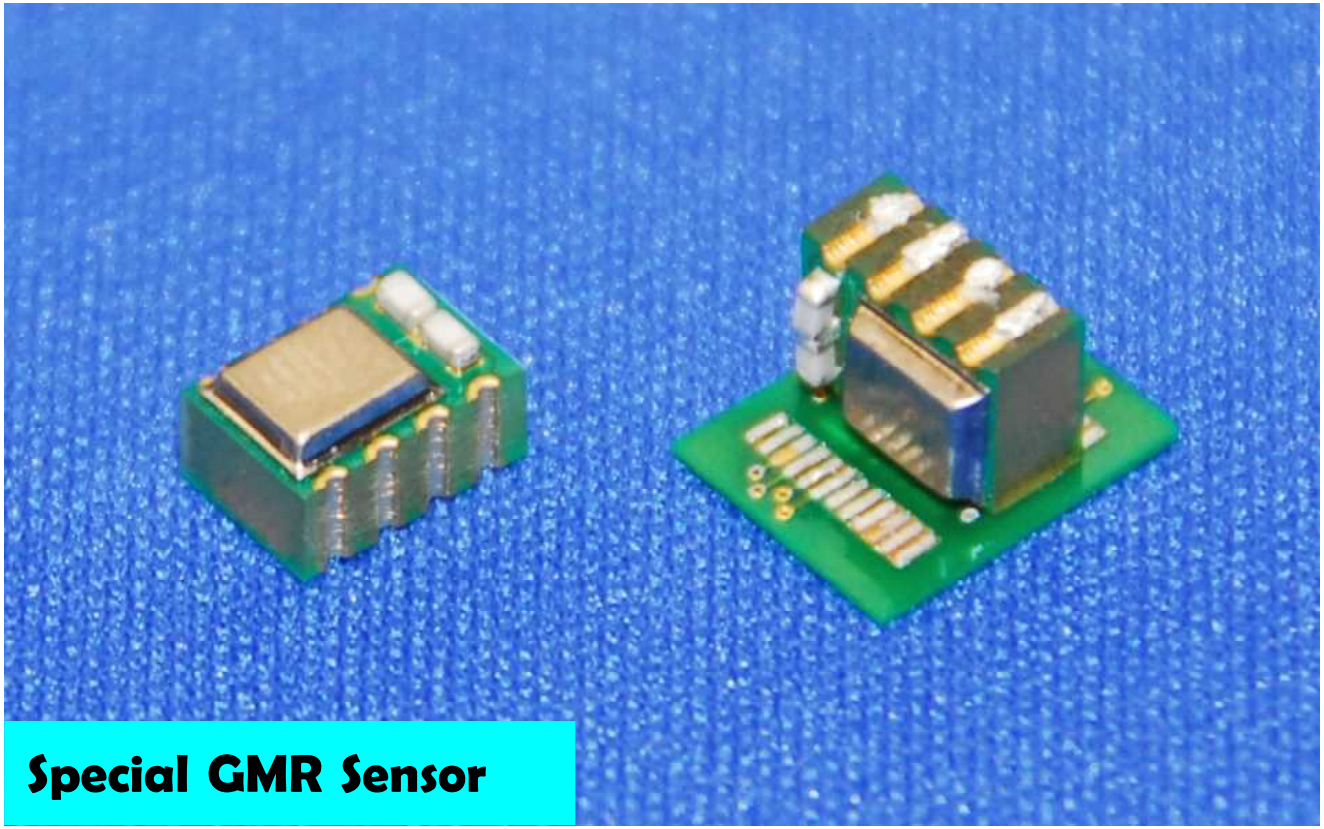
test model in 2004

¥600000

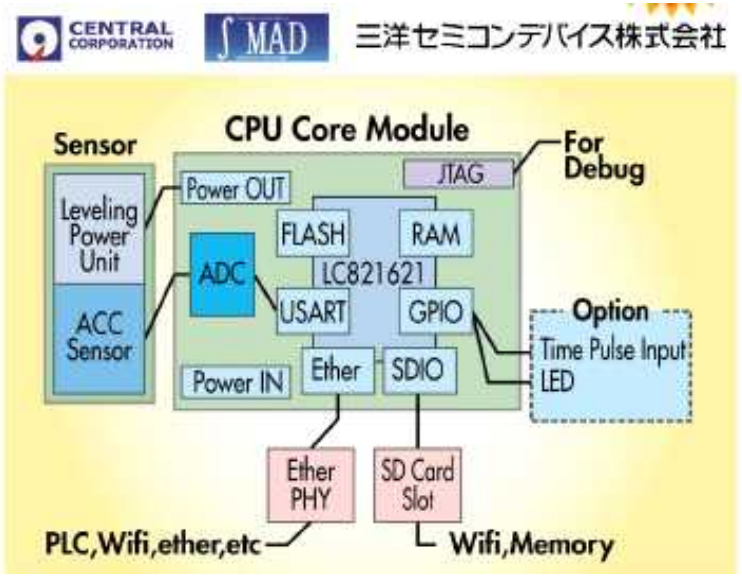
capacitance type in 2005

¥200000

The IT strong motion seismometer system can realize improvement of the convenience and reduction of the cost by utilizing network technology. However, the sensors having practical performance are expensive now, and limiting on spreading IT strong motion seismometers. On this account we are developing a new acceleration sensor for IT strong motion seismometers.

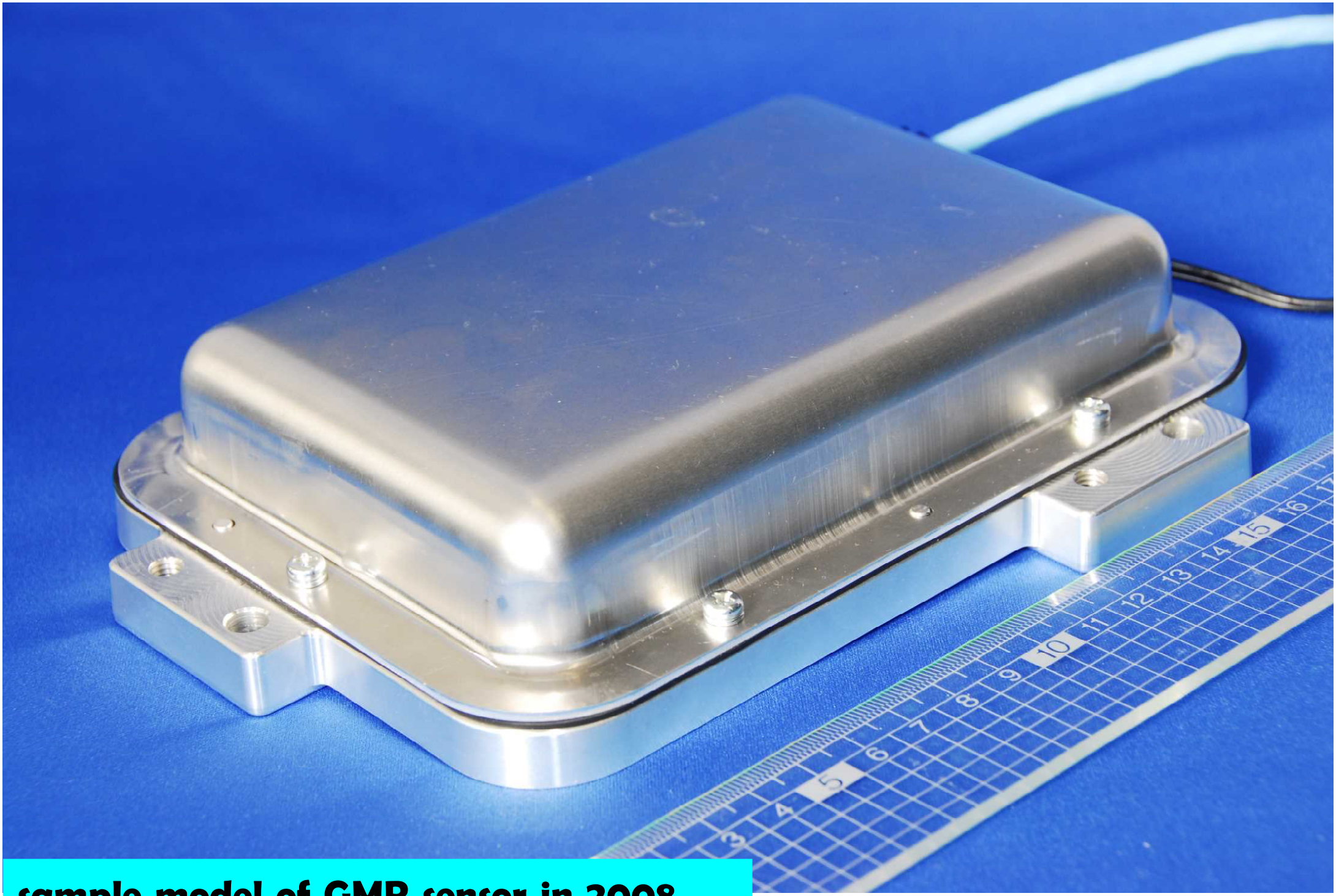


Special GMR Sensor



test model of GMR sensor in 2008

GMR : giant magnetoresistance effect



sample model of GMR sensor in 2008

¥30000