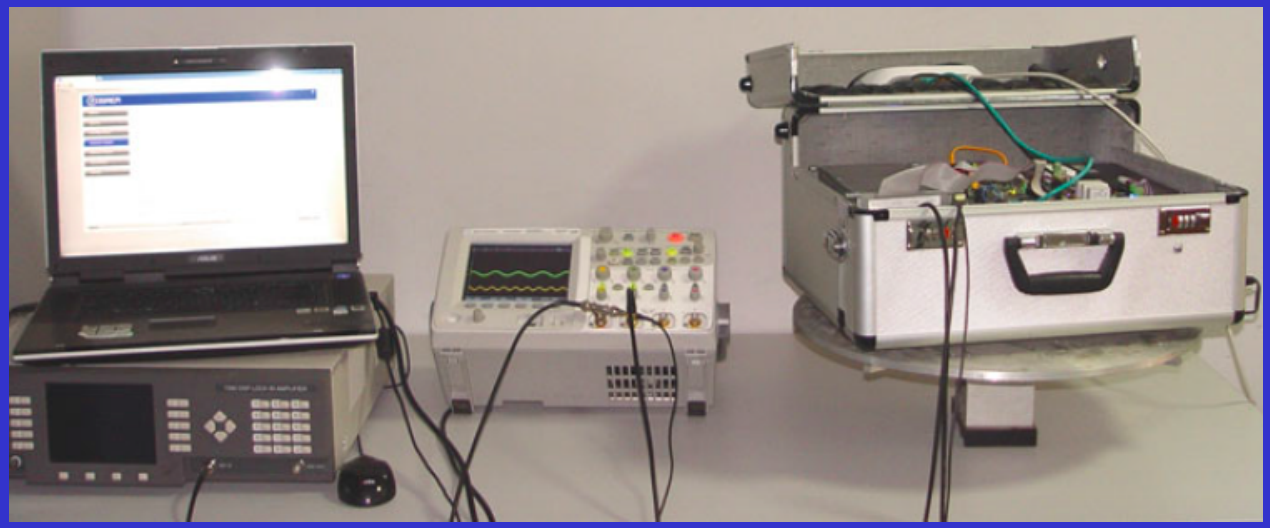
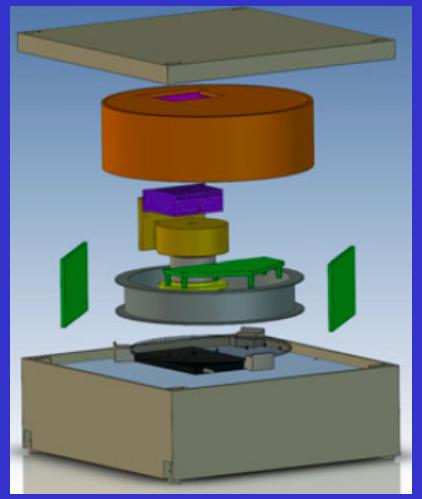
Teleseismic rotational measurements

Rotational sensor of Jaroszewicz et al. (2014)
Warsaw Military University

Sagnac effect in 15km long fiber glass

accuaracy 10^{-6} rad/s





Teleseismic rotational measurements

1) Cashmere Caverns, Christchurch, New Zealand (McLeod et al. 1998);
2) Wettzell, Germany (Schreiber et al. 2006);
3) Conway, Arkansas (Dunn et al. 2009);
4) Piñon Flat, California (Schreiber, Hautmann et al. 2009).

accuaracy

10^{-8} rad/s to 10^{-9} rad/s

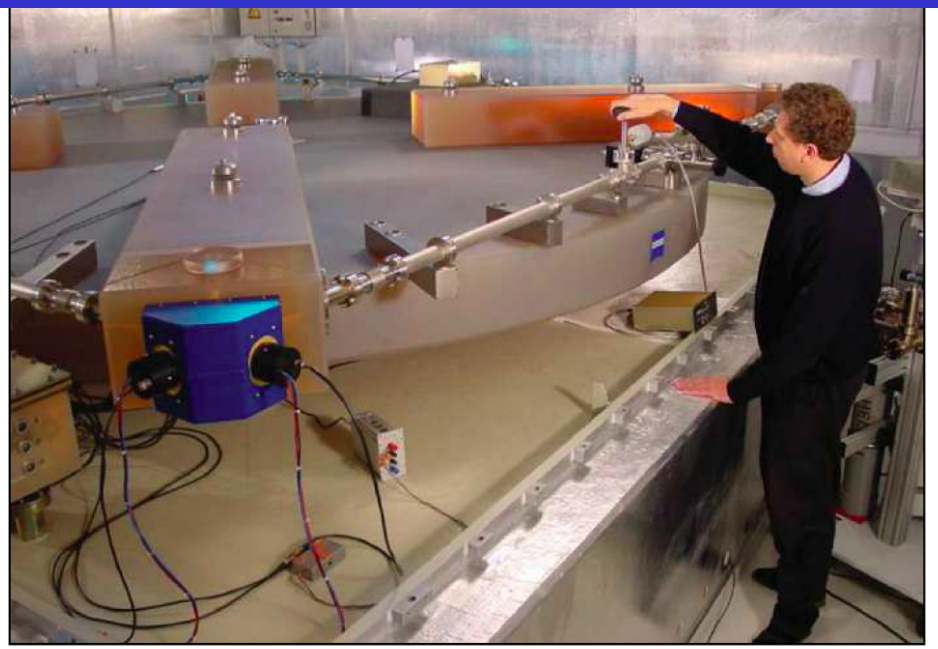


Figure 2.3 – G ring laser gyro at Wettzell Superstation, Germany, con Ulli Schreiber, its designer

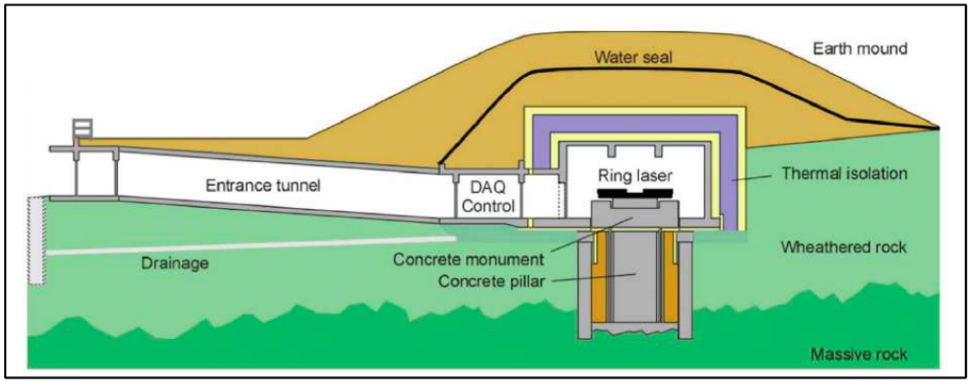


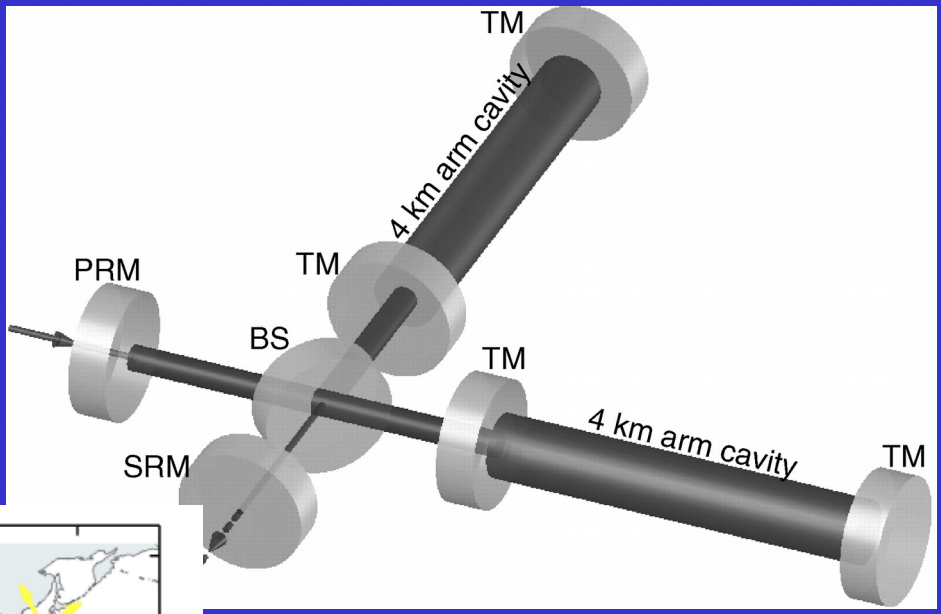
Figure 2.2 – G ring laser gyro at Wettzell Superstation, Germany, cross section view of the instrument site

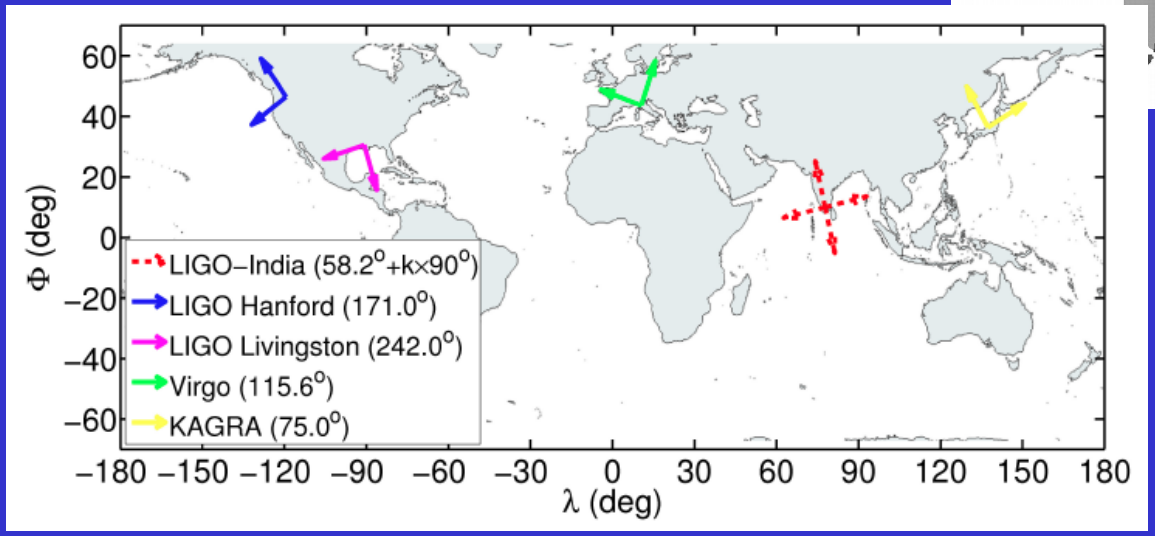
Advanced LIGO for gravitational waves detection

LIGO=Laser Interferometer Gravitational-Wave Observatory

(Modified Michelson effect)

strain measured 10^{-21}





required accuracy of rotation 10^{-11} rad

Questions:

<u>How about strong, rotational ground motion?</u>

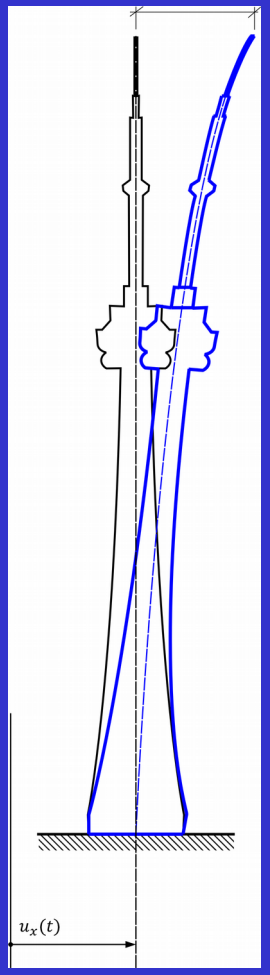
When will we acquire the rotation corresponding to seismic damaging intensity?

Questions … :

What would be the maximum proportion of PGA to PGA_{rot} for particular earthquake (e.g. in epicenter)?

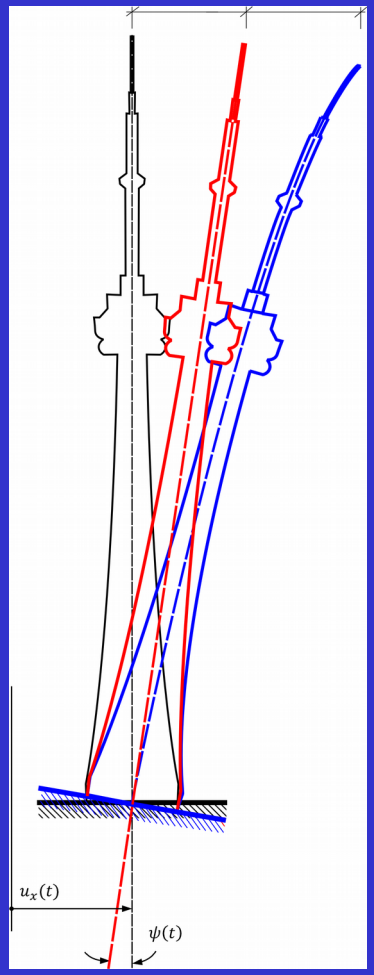
How would it depend on epicentral intensity?

Actual design model
(lateral effects only)



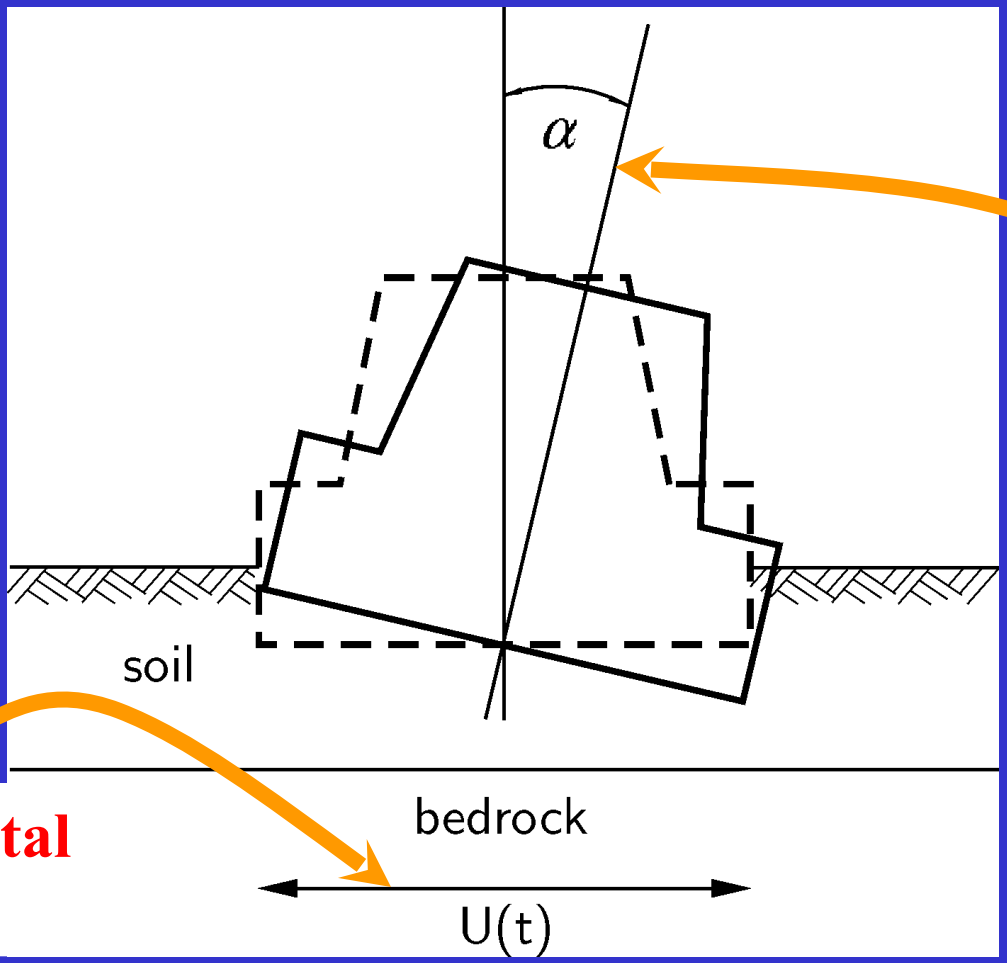
Rotation could be a game changer

future design model
(combined,
lateral-rocking effects)



Thank you for your attention

A massive structure on a compliant soil



RESPONSE, not excitations

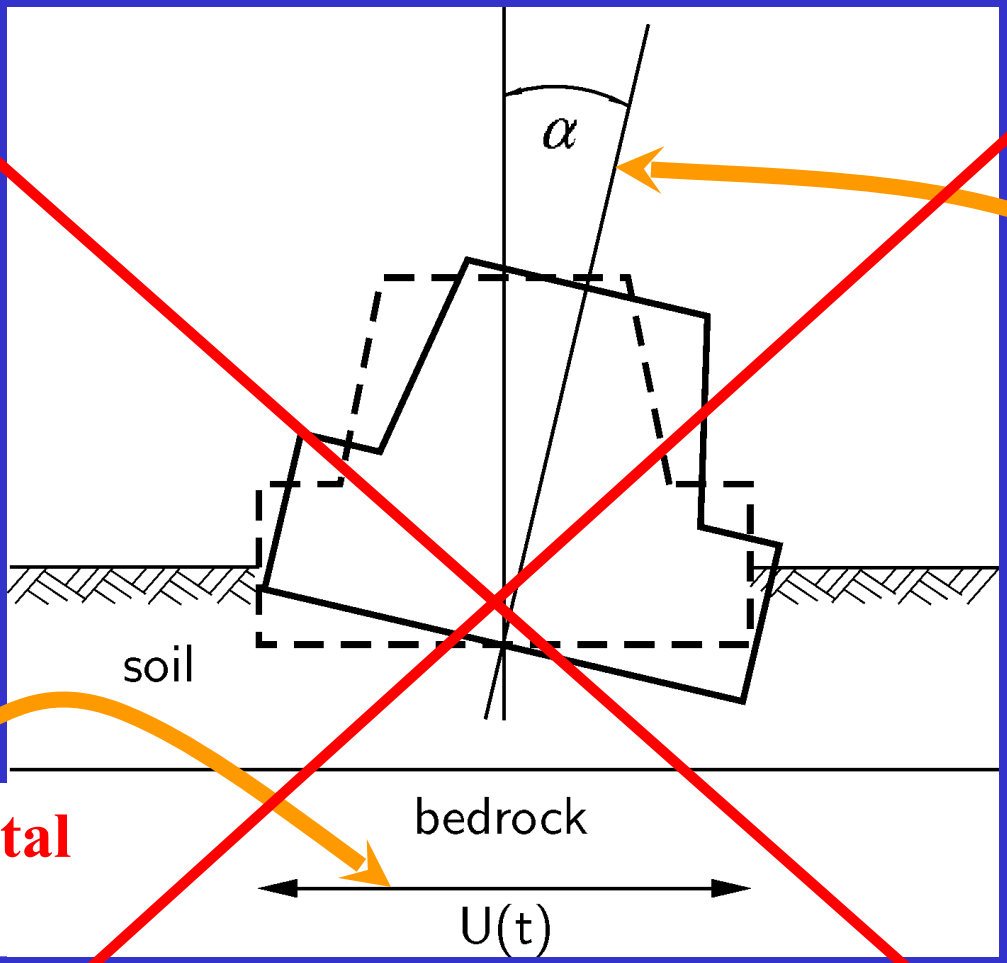
SSI effects

ONLY horizontal excitations

Some times such (response) rotations from very complaint (weak) soil and strong horizontal excitations can be very serious

Photograph taken after Kocaeli (1999) earthquake in Turkey

A massive structure on a compliant soil



RESPONSE, not excitations

SSI effects

ONLY horizontal excitations

This is not what we consider by seismic rotational load

Conclusion:

Except for the structures founded directly on rock the **structural response due to rotational <u>excitations</u>** should be combined with rocking effects from soil compliance (or even SSI)