

Comparison among responses from L'Aquila (Italy) and Tohoku (Japan) Earthquakes

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April 2011

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L'Aquila Earthquake (Italy)

06 April 2009

M 5.8

AQV – WE

PGA $646.1 \text{ cm/s}^2 = 0.659 \text{ g}$

Tohoku Earthquake (Japan)

11 March 2011

M 9.0

MYG004 – NS

PGA $2647.8 \text{ cm/s}^2 = 2.699 \text{ g}$

INPUT $h(t) = \frac{1}{m\omega_d} e^{-\zeta\omega_l t} \sin(\omega_d t), \quad \omega_d = \omega_l \sqrt{1-\zeta^2}$ **OUTPUT**

$$u(t) = \int_{-\infty}^{+\infty} h(t-\tau) f(\tau) d\tau$$

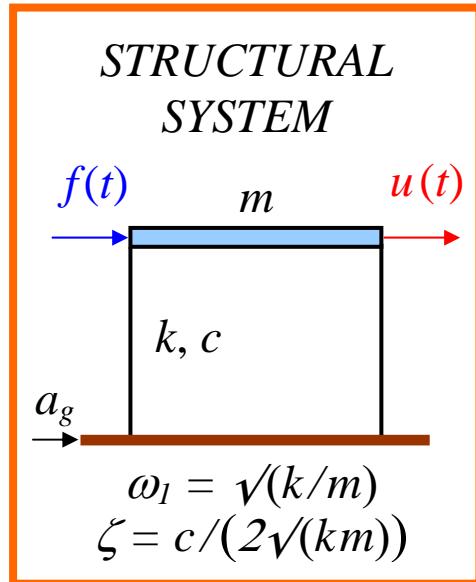
$$f(t) = -m a_g(t)$$

$$u(t)$$

**TIME
DOMAIN**

$$F(\omega) = \int_{-\infty}^{+\infty} f(t) e^{-i\omega t} dt$$

$$u(t) = \frac{1}{2\pi} \int_{-\infty}^{+\infty} U(\omega) e^{i\omega t} d\omega$$



$$F(\omega) = -m A_g(\omega)$$

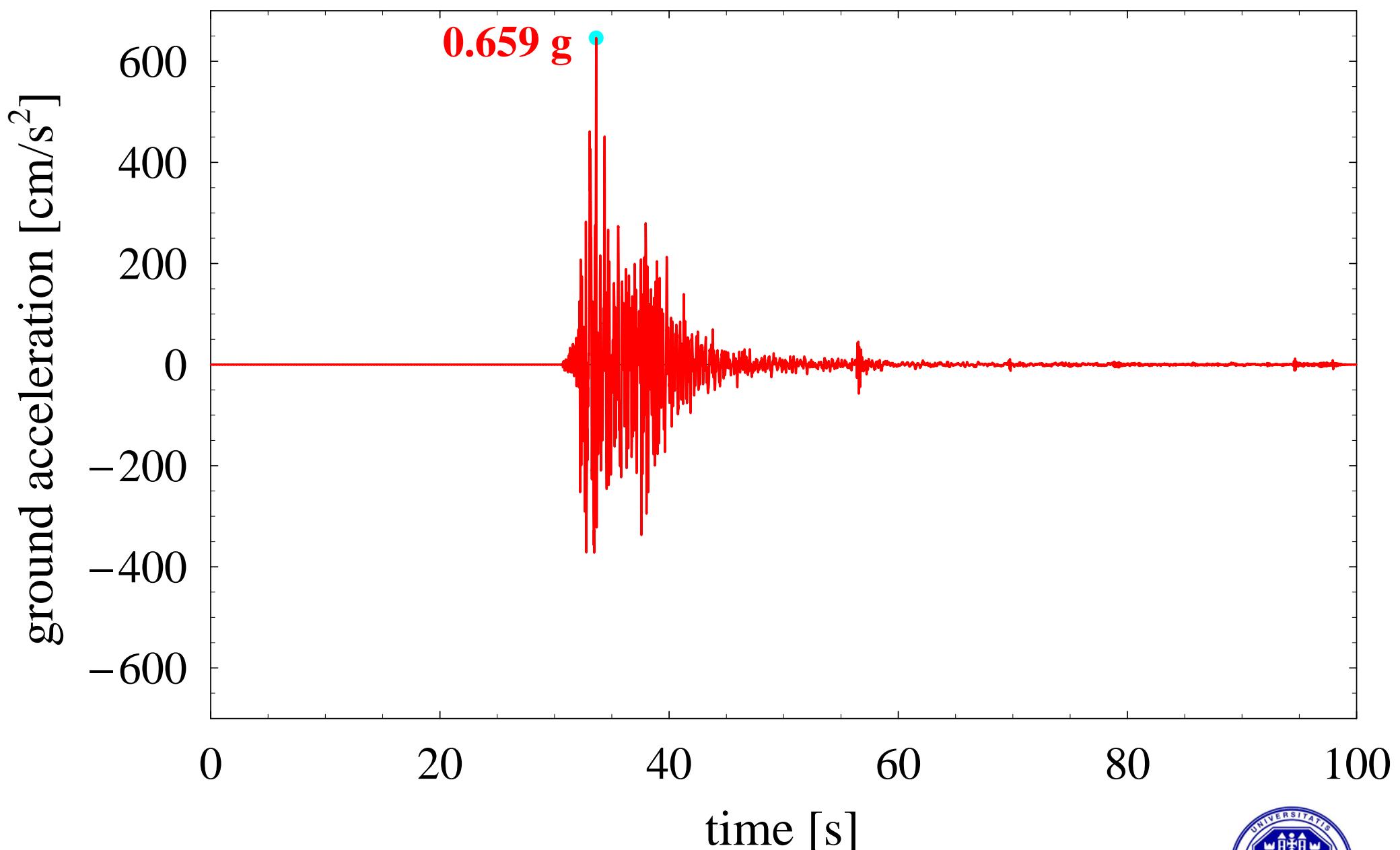
**FREQUENCY
DOMAIN**

$$U(\omega) = H(\omega) F(\omega)$$

$$H(\omega) = (k - \omega^2 m + i\omega c)^{-1} = m^{-1} (\omega_l^2 - \omega^2 + i2\zeta\omega_l\omega)^{-1}$$

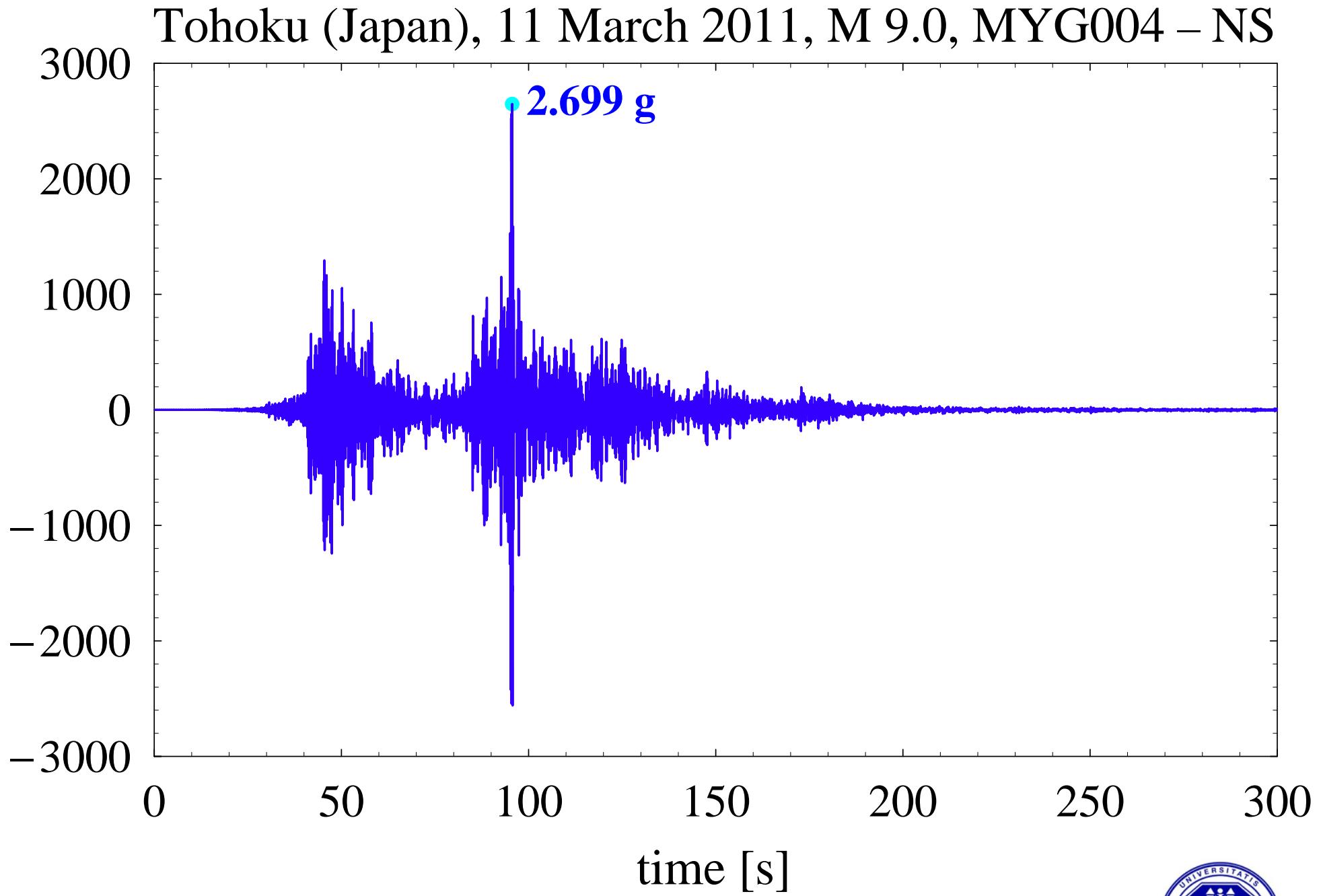
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L'Aquila (Italy), 06 April 2009, M 5.8, AQV – WE



Tohoku (Japan), 11 March 2011, M 9.0, MYG004 – NS

ground acceleration [cm/s²]

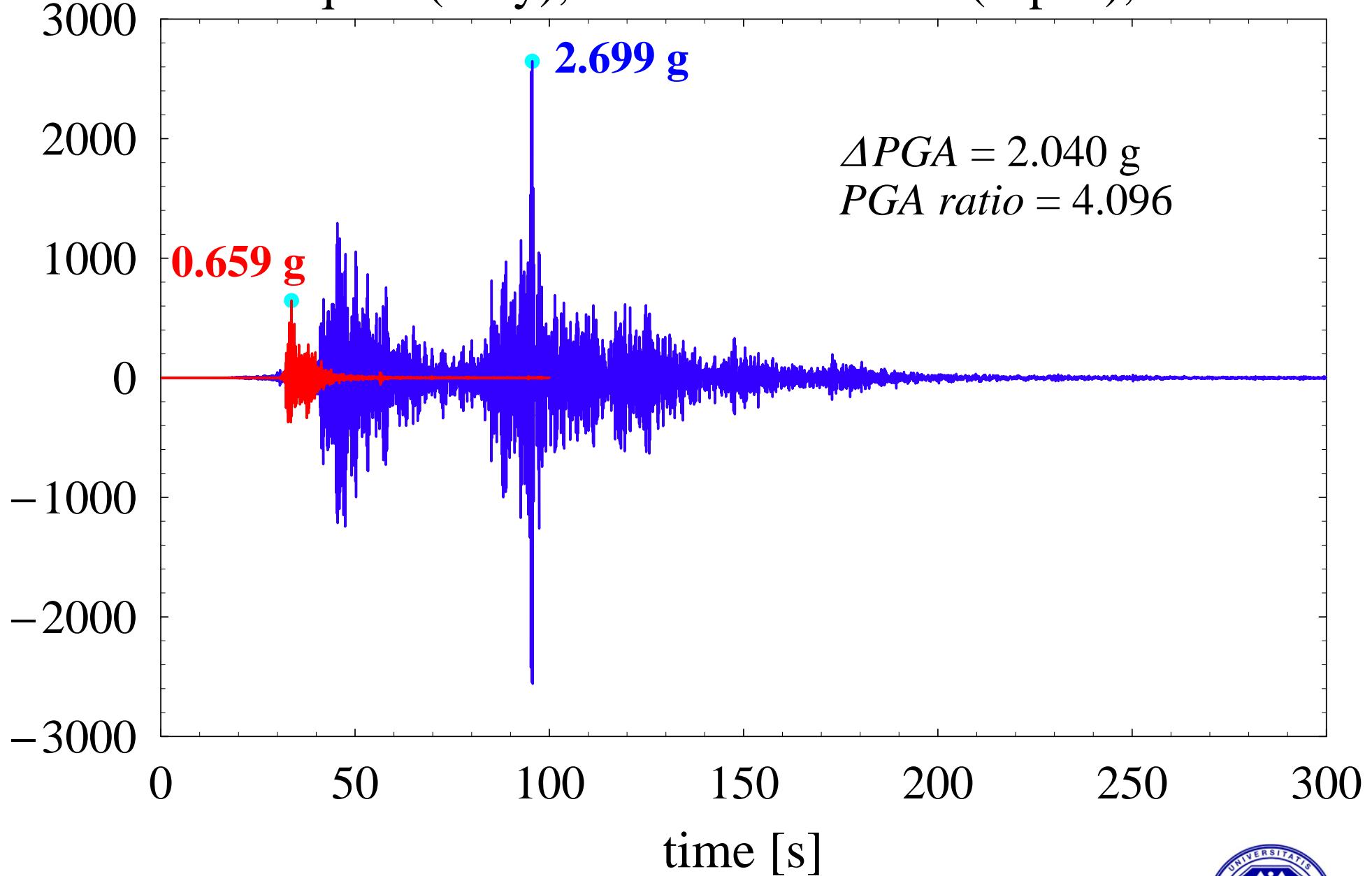


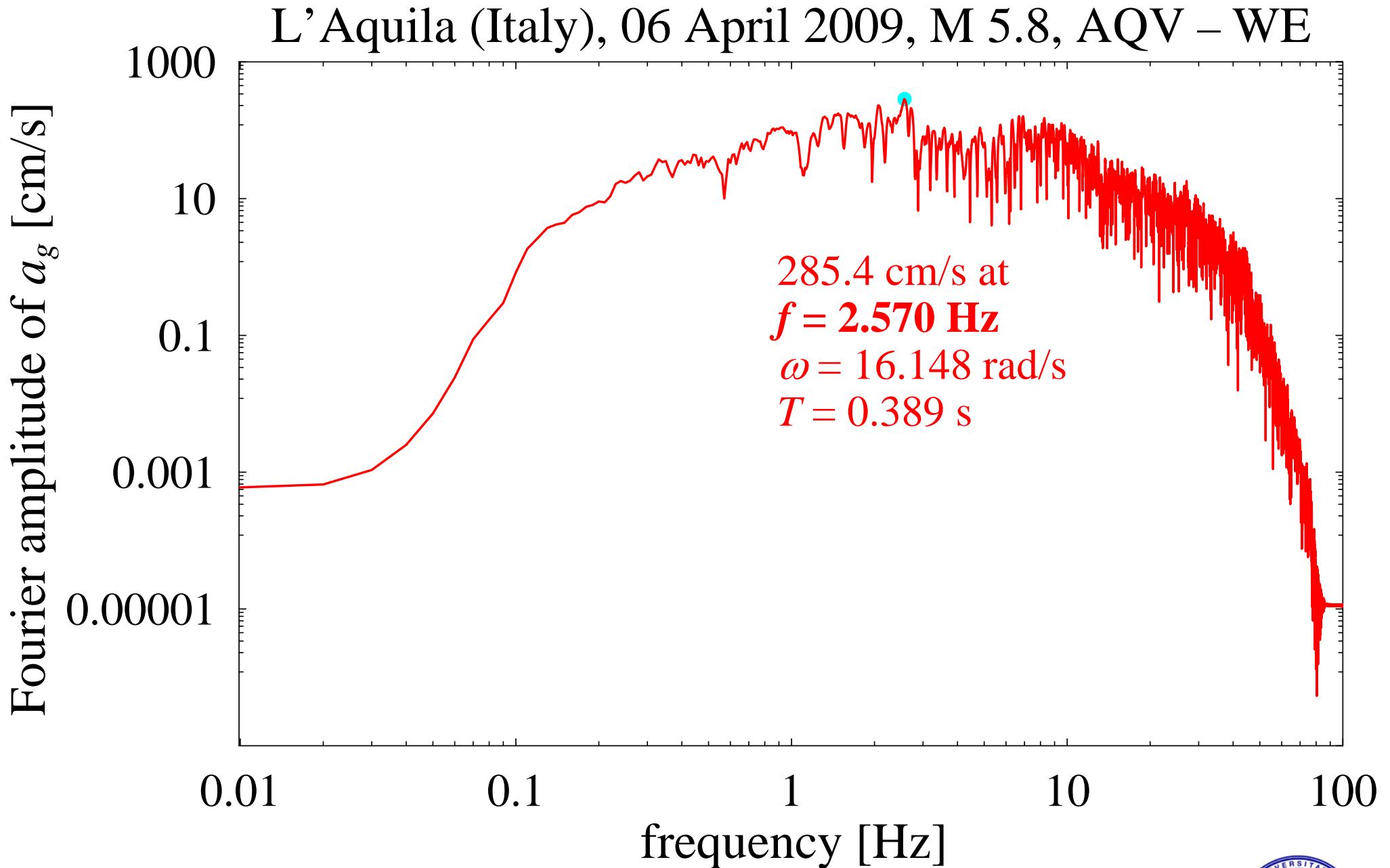
time [s]

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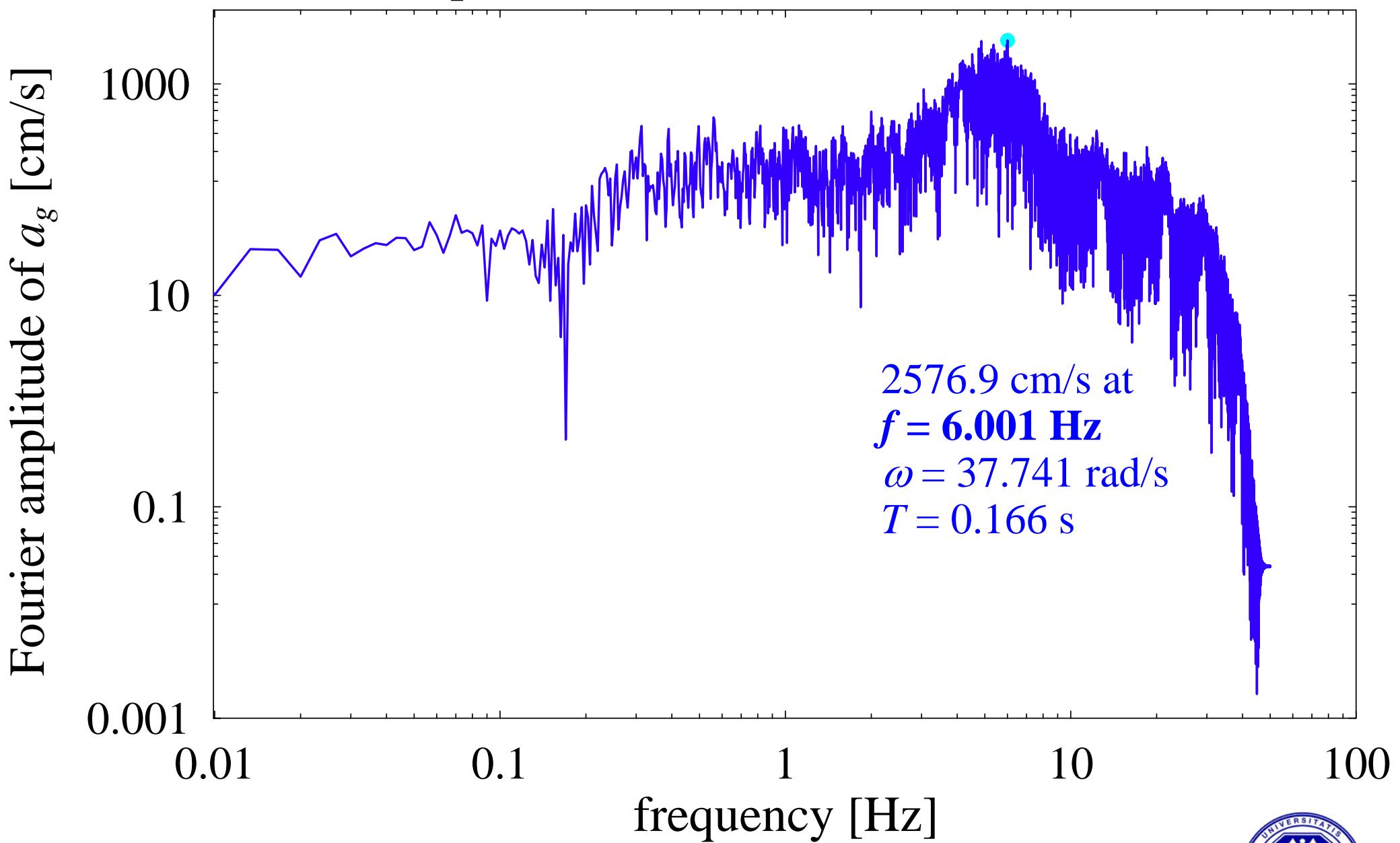
L'Aquila (Italy), M 5.8 vs. Tohoku (Japan), M 9.0

ground acceleration [cm/s²]

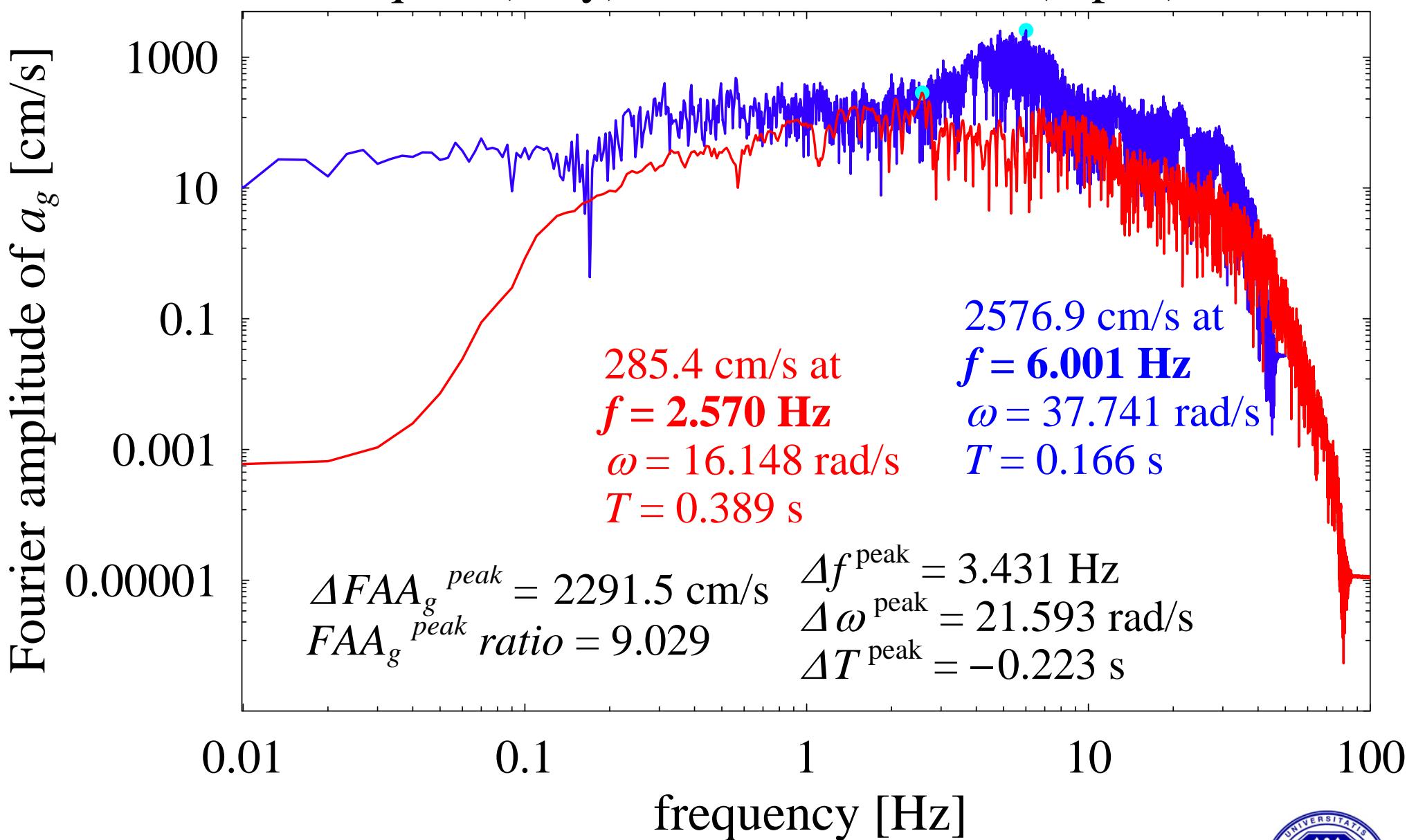




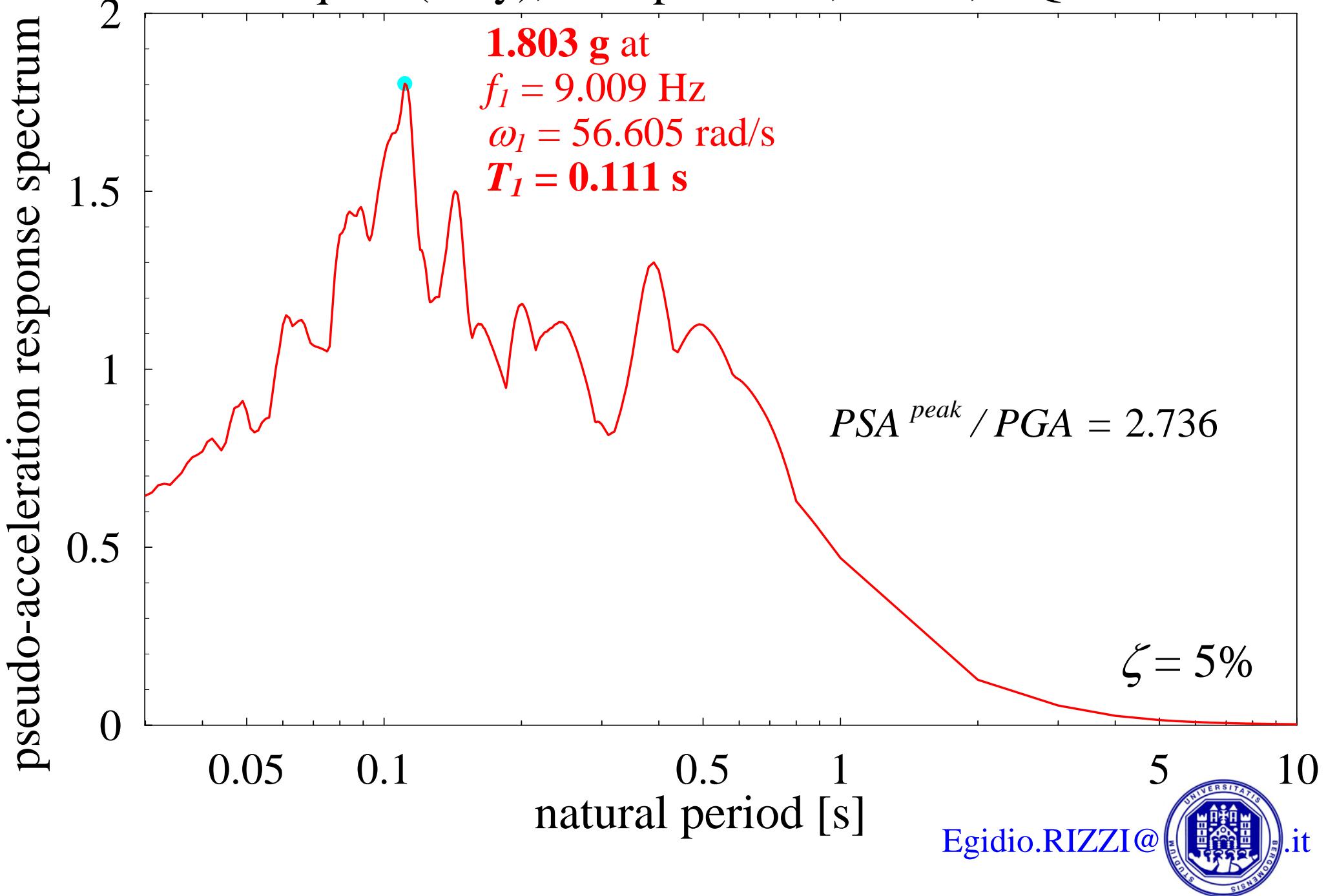
Tohoku (Japan), 11 March 2011, M 9.0, MYG004 – NS



L'Aquila (Italy), M 5.8 vs. Tohoku (Japan), M 9.0

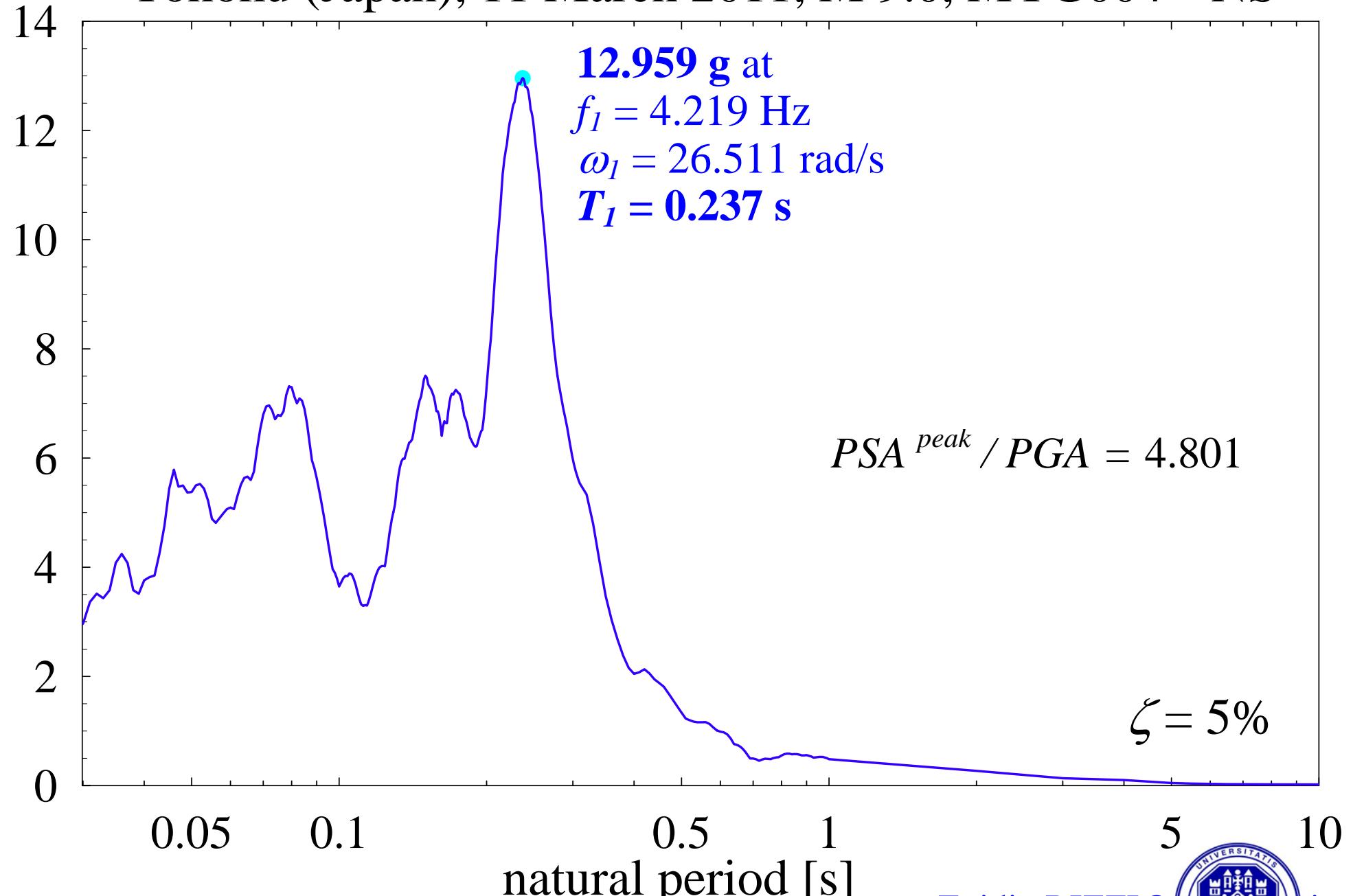


L'Aquila (Italy), 06 April 2009, M 5.8, AQV – WE



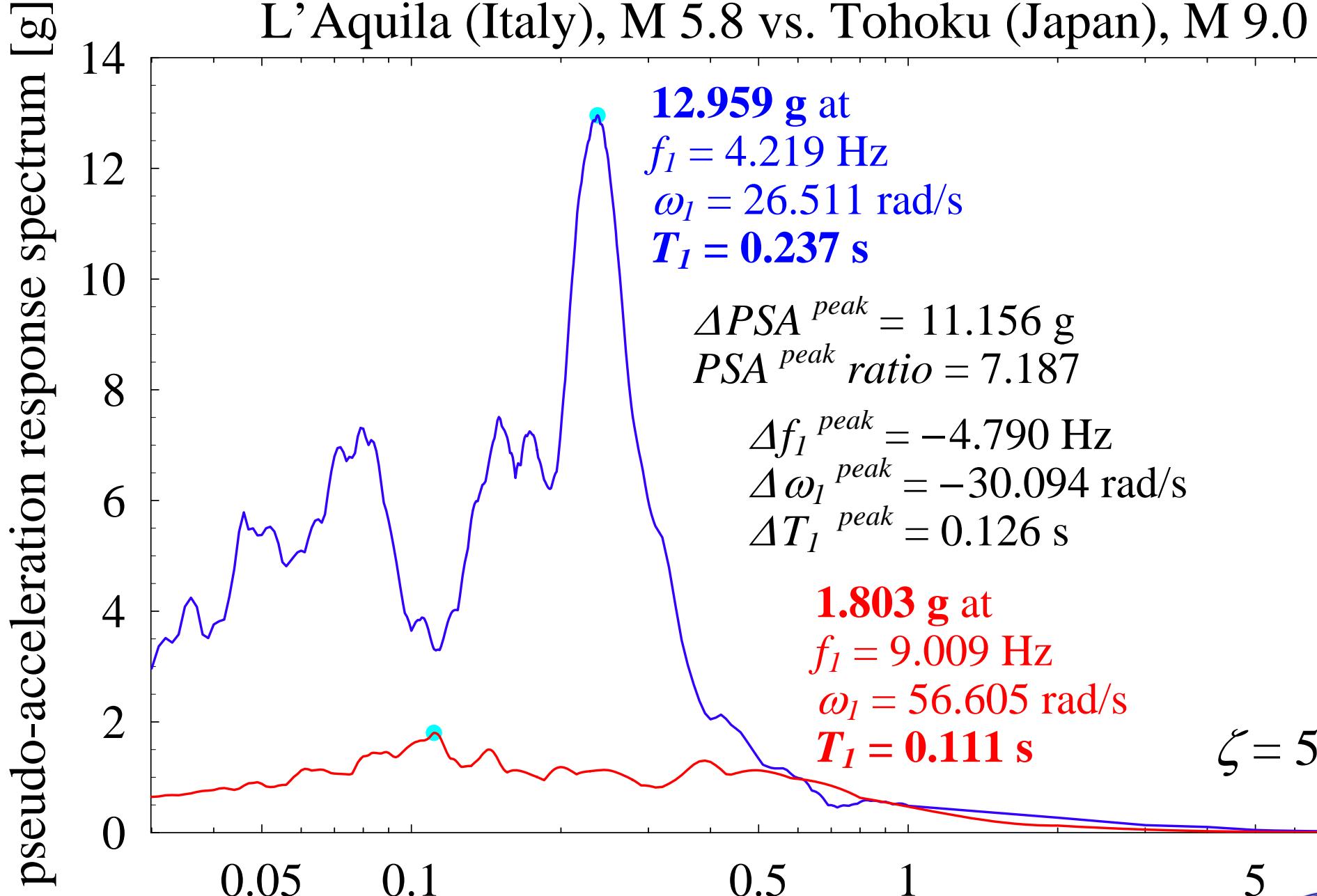
pseudo-acceleration response spectrum [g]

Tohoku (Japan), 11 March 2011, M 9.0, MYG004 – NS



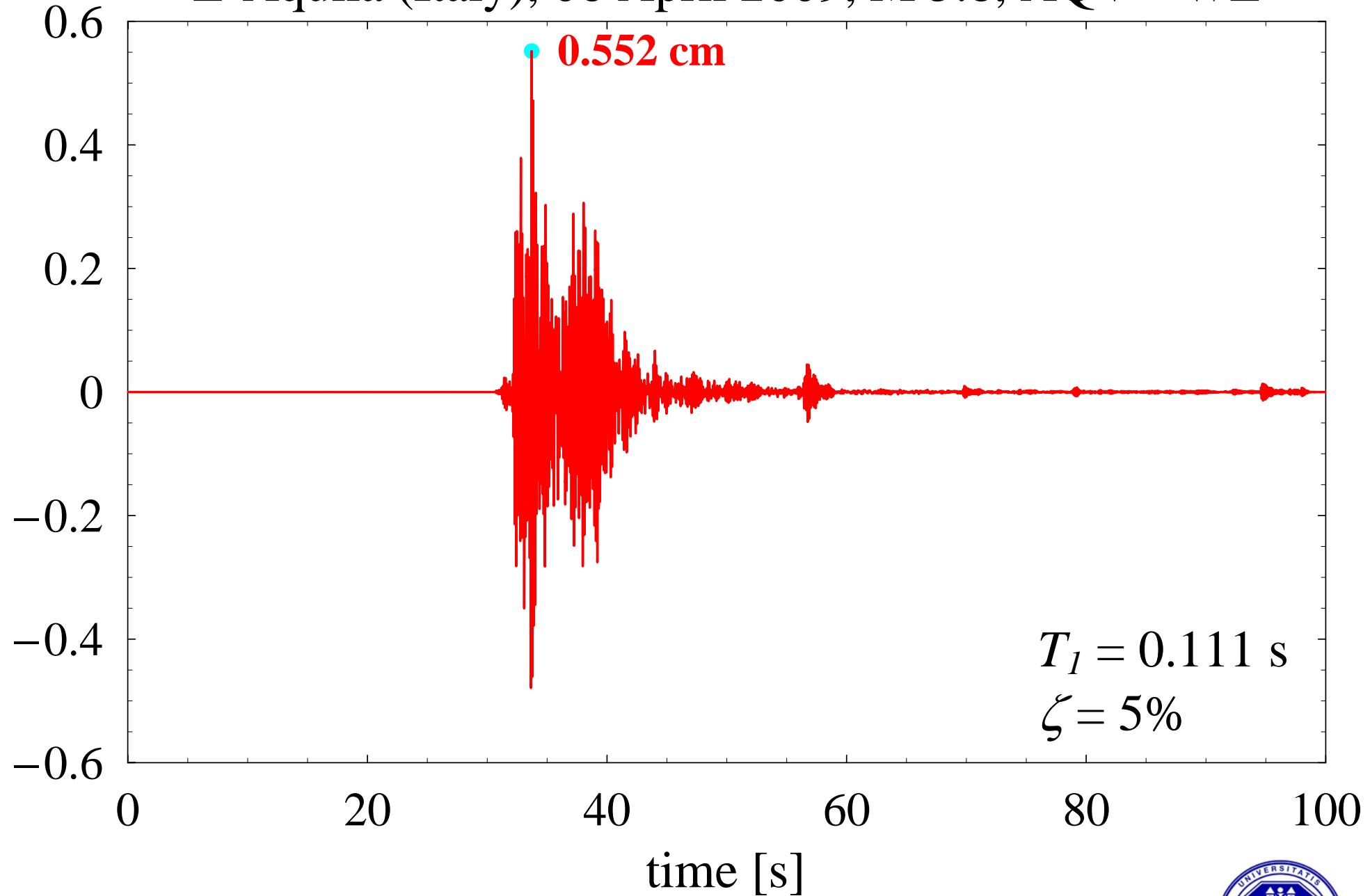
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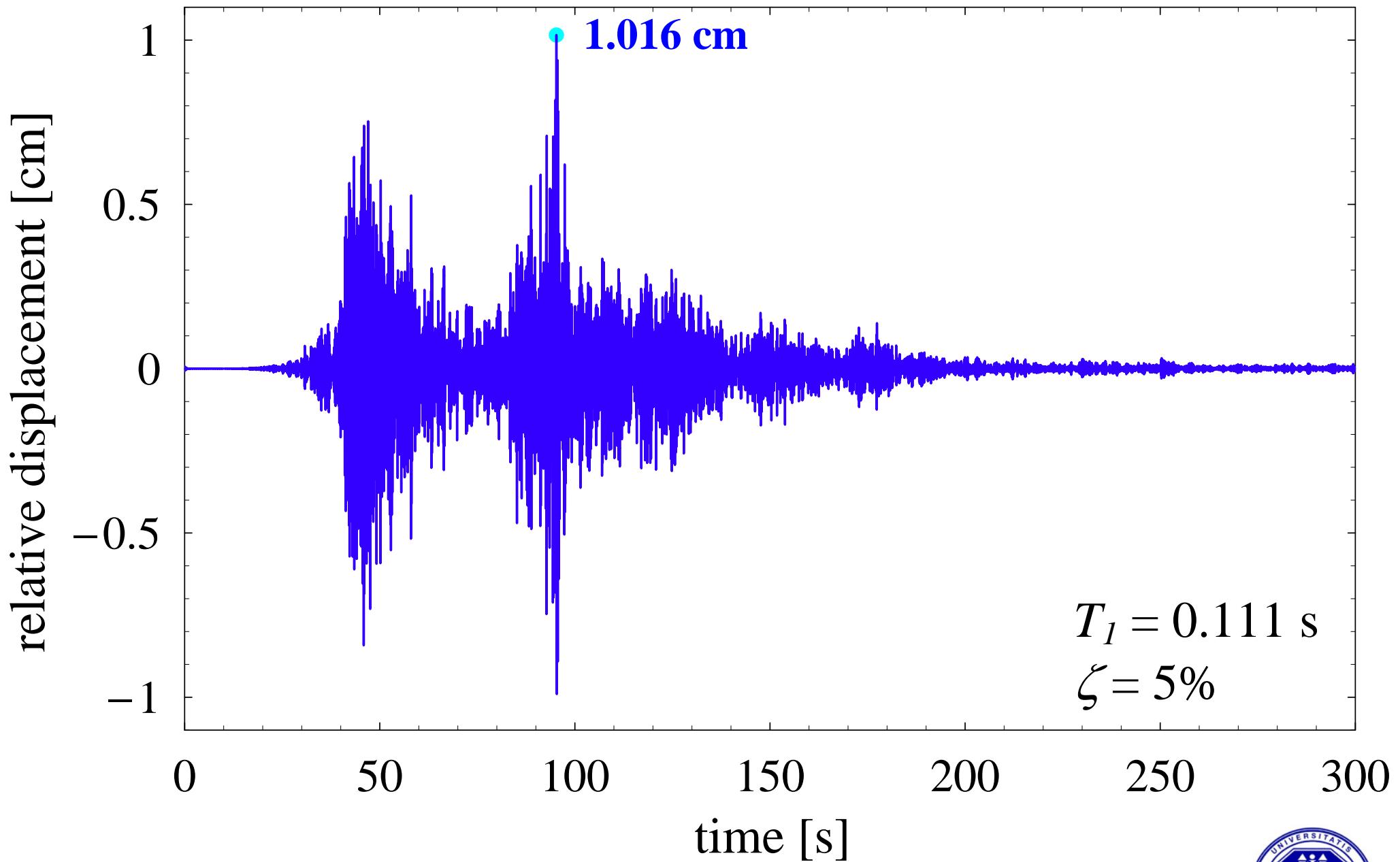
L'Aquila (Italy), 06 April 2009, M 5.8, AQV – WE

relative displacement [cm]

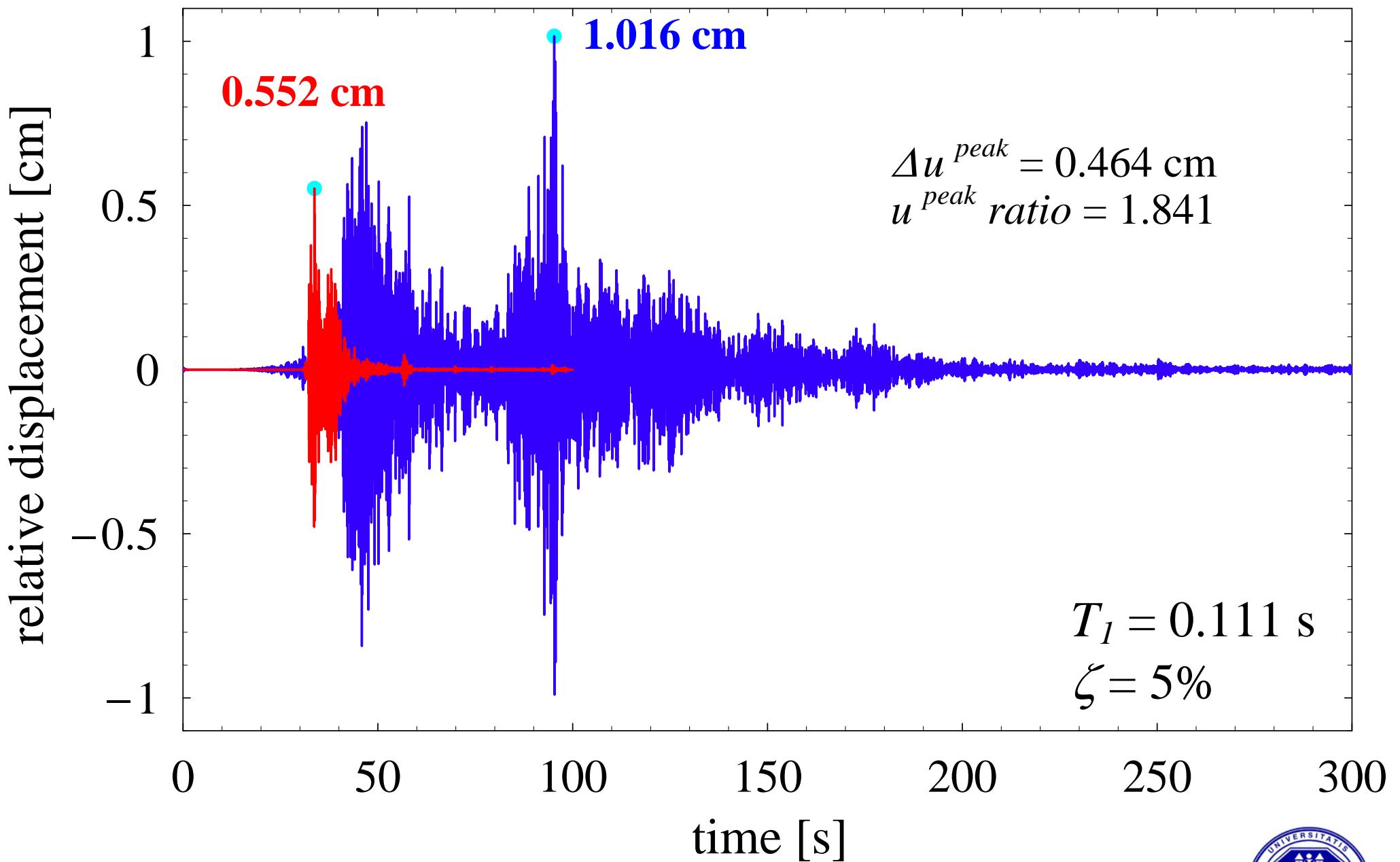


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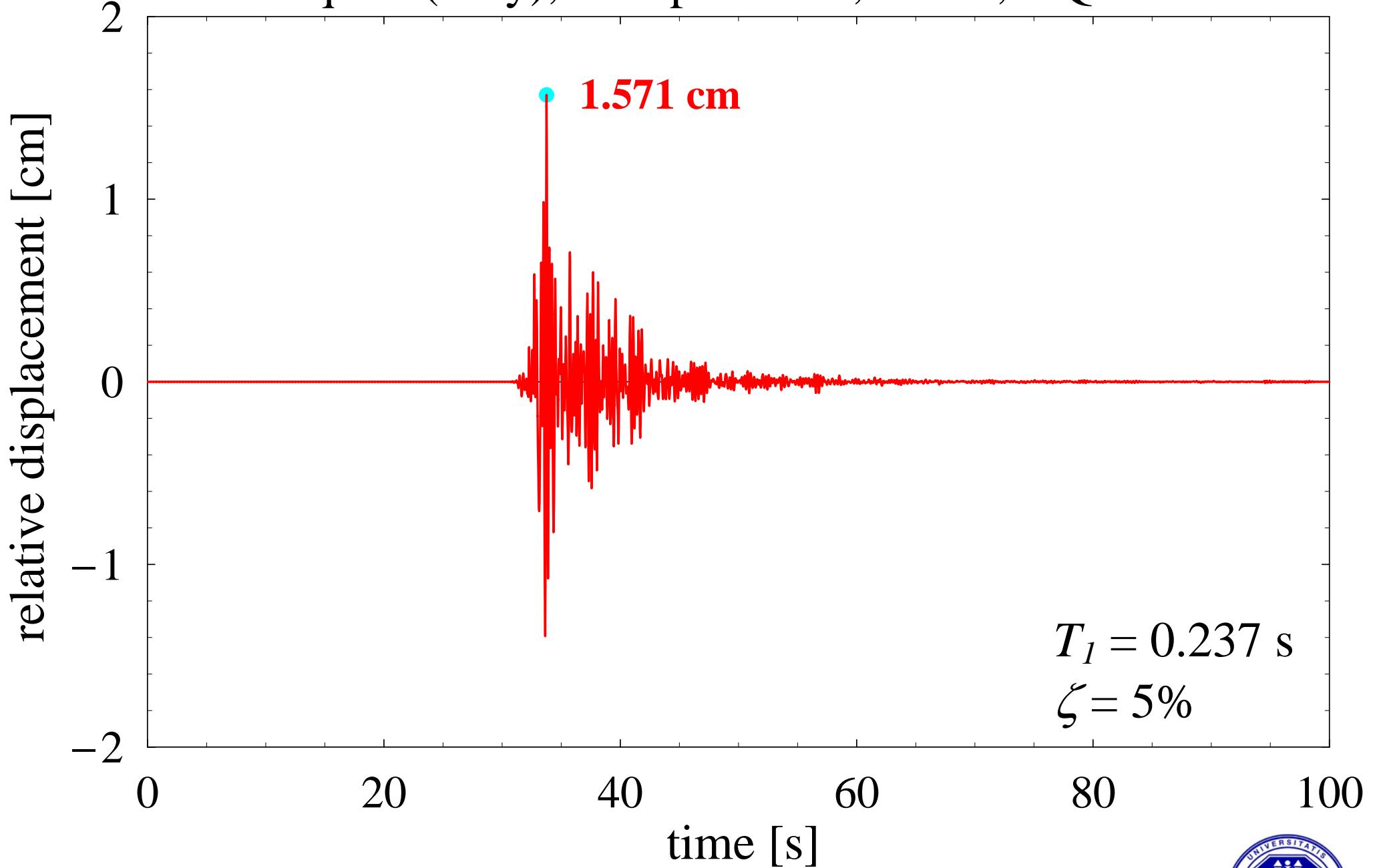
Tohoku (Japan), 11 March 2011, M 9.0, MYG004 – NS



L'Aquila (Italy), M 5.8 vs. Tohoku (Japan), M 9.0

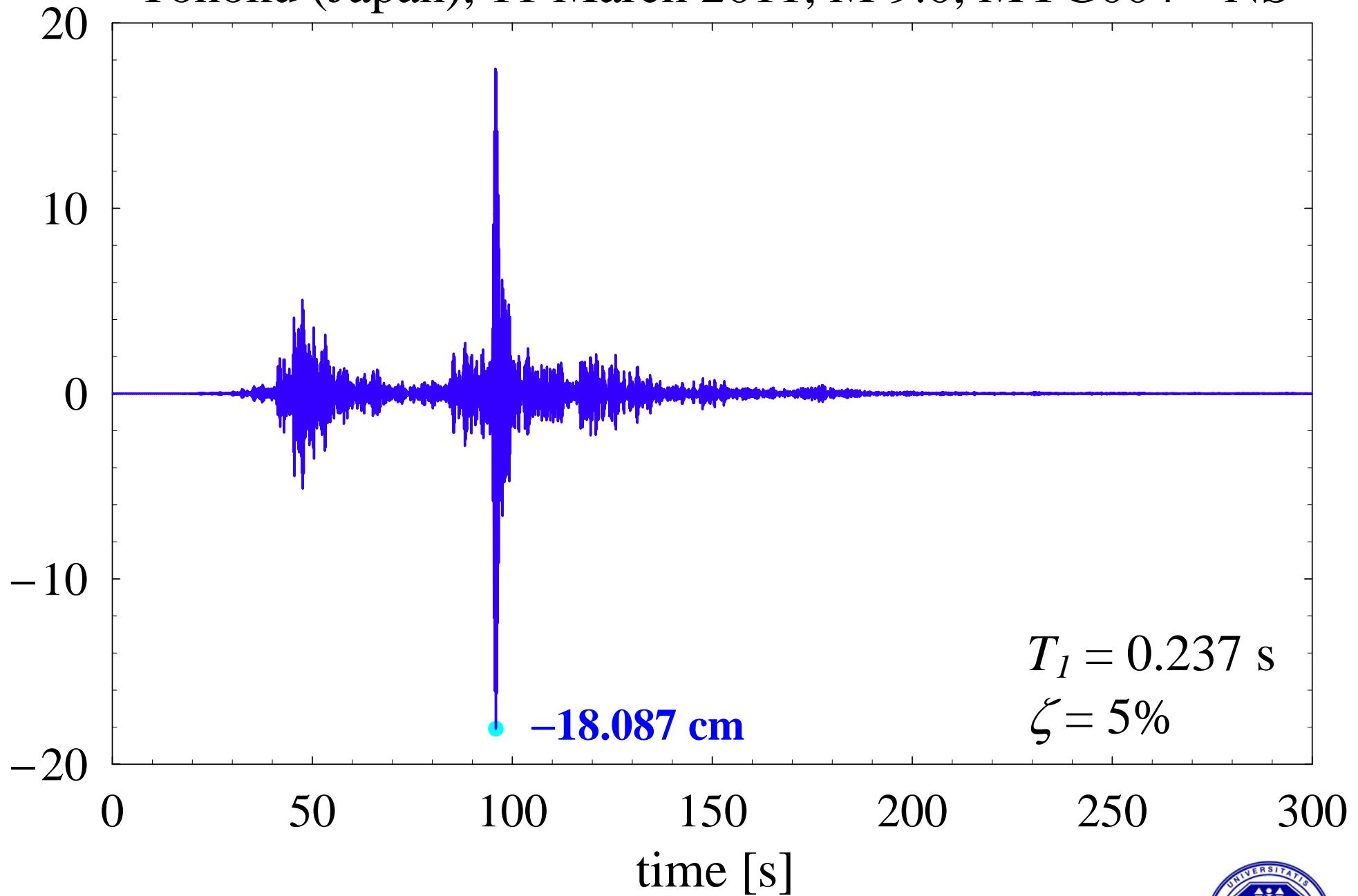


L'Aquila (Italy), 06 April 2009, M 5.8, AQV – WE



Tohoku (Japan), 11 March 2011, M 9.0, MYG004 – NS

relative displacement [cm]



L'Aquila (Italy), M 5.8 vs. Tohoku (Japan), M 9.0

relative displacement [cm]

