



**Project no.043386**

**TRIGS**

**TRIGGERING INSTABILITIES IN MATERIALS AND GEOSYSTEMS**

**Sixth Framework Programme (FP6) - STREP**

**New and Emerging Science and Technology Pathfinder (NEST)**

Deliverable n. 1.2.1

Data sets of results from the granular shear experiment  
will be available for internal use through a web site

Due date of deliverable: 31-12-2008

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Start date of project: 1-1-2007

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Organisation name of lead contractor for this deliverable: CNR

Diffusion Level: PU

Revision: draft

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## Introduction

This deliverable requires the publication of data sets of results obtained from the granular shear experiment on a website for internal use by members of the TRIGS project.

The wiki platform (<http://trigs.artov.isc.cnr.it/>) already in use by TRIGS was deemed to be the most suitable location for the publication of the data; indeed as experiments have progressed, this group has been continuously making available sets of results, and their respective analyses on this platform.

The principal data sets are:

1. to investigate the effect of changing the normal pressure on the GM
  - <http://trigs.artov.isc.cnr.it/twiki/bin/view/TRIGS/Task12Expts070118>
2. to investigate the effect of changing the moments of inertia of the top plate
  - <http://trigs.artov.isc.cnr.it/twiki/bin/view/TRIGS/Task12Expts070403>
3. (\*) tests of the (granular) solid-on-solid experiment
  - <http://trigs.artov.isc.cnr.it/twiki/bin/view/TRIGS/Task12Expts070808>
4. (\*) to investigate the effect of different GM - 2mm and 1.5mm glass beads
  - <http://trigs.artov.isc.cnr.it/twiki/bin/view/TRIGS/Task12Expts0804>
5. to investigate the effect of vibration of the granular layer
  - <http://trigs.artov.isc.cnr.it/twiki/bin/view/TRIGS/Task12Expts0806>
6. (\*) to investigate 'granular' solid-on-solid behaviour
  - <http://trigs.artov.isc.cnr.it/twiki/bin/view/TRIGS/Task42Expts070927A>
7. (\*) to investigate the effect of changing the height of the granular bed
  - <http://trigs.artov.isc.cnr.it/twiki/bin/view/TRIGS/Task42Expts071002>

(\*) please see deliverable 4.2.1 and the associated synthesis report.

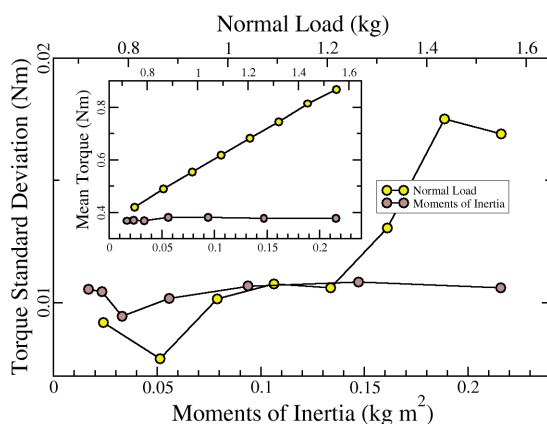


Fig. 1: The mean torque is proportional to the normal load but independent of the moments of inertia

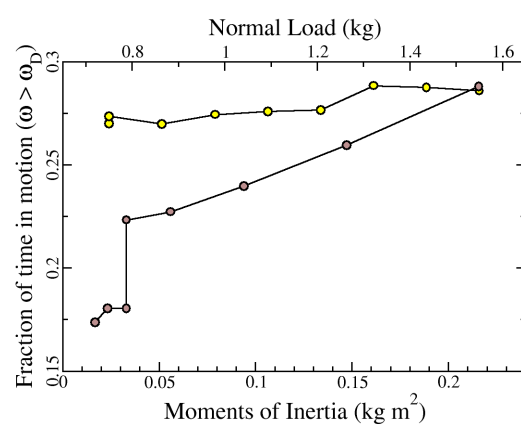


Fig. 2: The order parameter is independent of the normal load, and increases with the moments of inertia

1. The effect of changing the normal pressure on the GM. The principle effect of changing the normal load is to proportionally increase the mean torque subtended by the top plate, as expected by Coulomb's Law (fig. 1). However, we also see more complex secondary effects, such as an increasing duration of the slip events (fig. 3) even though the order parameter remains largely constant (fig. 2).
2. The effect of changing the moments of inertia of the top plate. In contrast, increasing the moments of inertia has no effect on the mean torque, while increasing the duration of the characteristic slip events, and the order parameter.

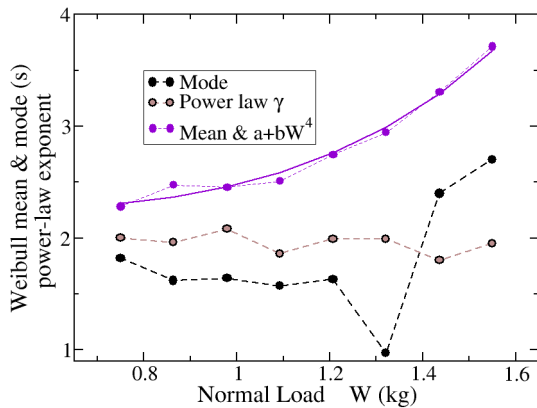


Fig. 3: The characteristic event duration increased as the 4th power of the normal load. This indicates that there is a greater granular friction and that the top plate drags more material when the normal load is higher. On the contrary, the power-law exponent for short events remains almost constant

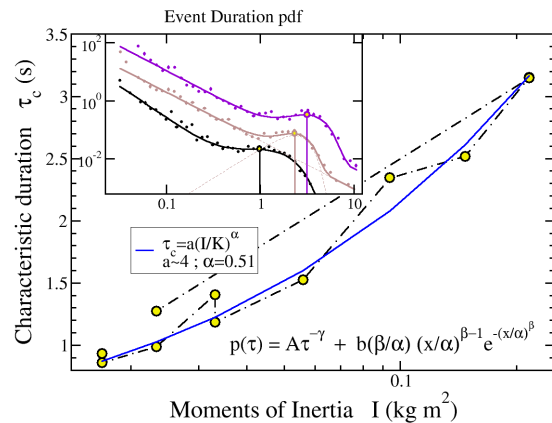
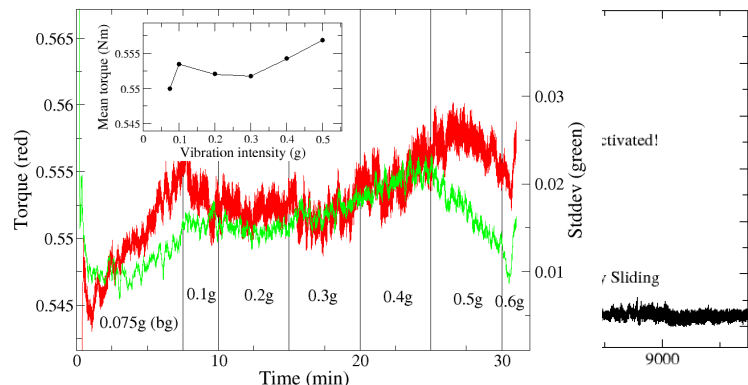


Fig. 4: The event duration distribution is characterised by a power-law superimposed on a Weibull distributed characteristic event. Though the power-law exponent remains constant for changes in the moments of inertia, the characteristic event increases as the square root of inertia, as expected

5. The effect of vibration of the granular layer. The circular channel in which the top plate moves was mounted on a Type 4809 Bruel & Kjaer Vibration Excitor. The vibration had a clear effect on the overall dynamics of the system as illustrated in fig. 5 – the top plate changed from clear quasi-periodic stick-slip to a noisy steady sliding. Fig. 6, however, illustrates that the vibration does not have such a clear effect on the mean torque – note in particular that the change from the background signal of 0.075g (rms) to 0.1g (rms) is small. It was not possible to experiment further as the vibrator is not capable of greater vibration intensity, and the vibrations caused problems with the alignment of the encoder discs rendering any longer-term results unreliable.



on the mean torque than on the dynamic behaviour