Characterization of the Dihedron Pedestal

first results

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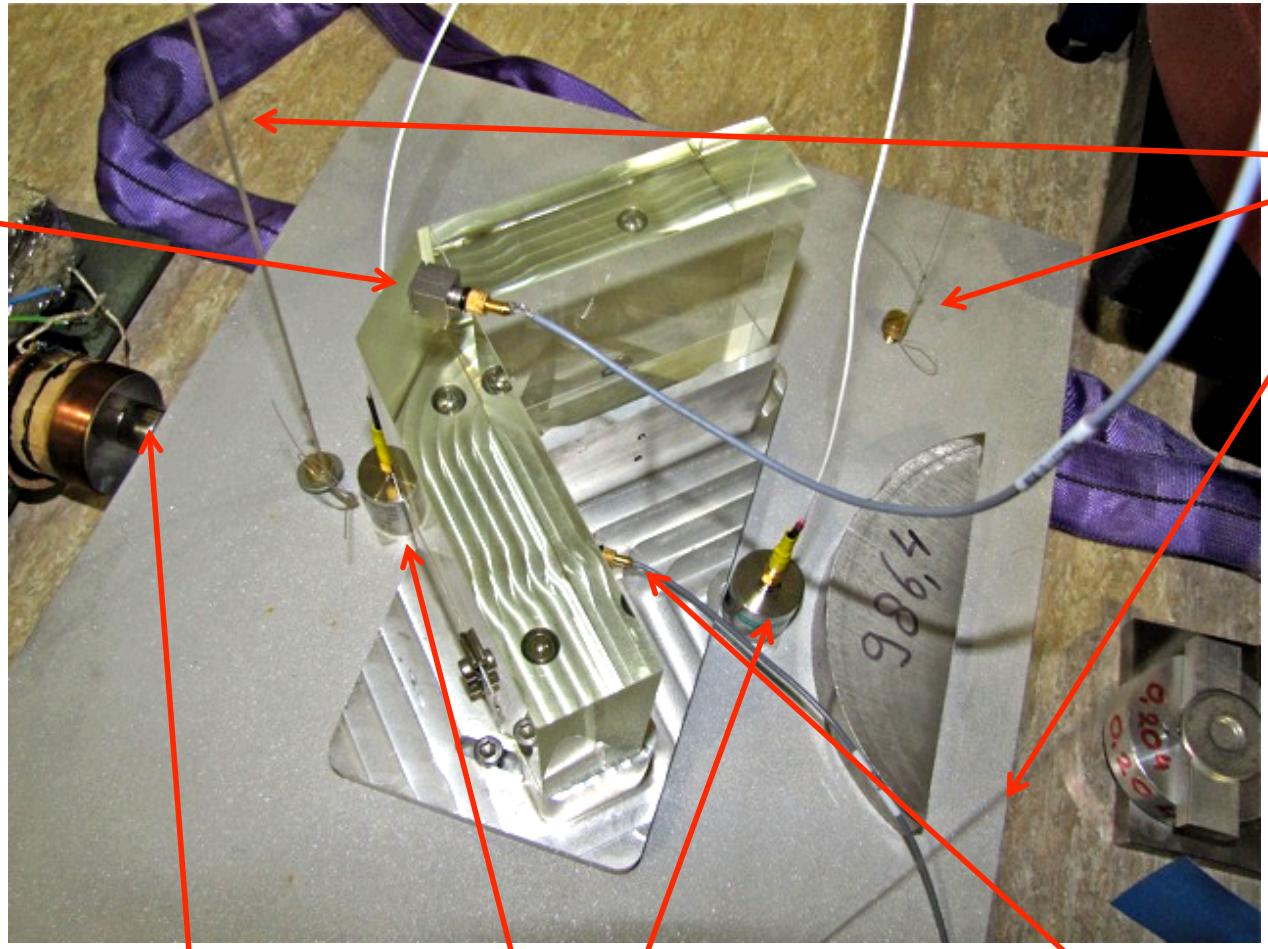
In the past, we tried different set-ups;
now we think we have found a way to *reliably* measure the TF between a pedestal and the dihedron itself.

Two essential ingredients:

1. we use a soft pendulum;
   a solid plate of ~ 9kg, 35 * 45 cm, 2 cm thick is suspended by 3 nylon strings of ~ 2m length;
   the plate can be excited horizontally by a coil-magnet device;
   the pedestal is bolted to the plate such that the longitudinal direction is parallel to the excitation of the pendulum plate.

2. two *vertical* sensors on both sides of the dihedron pedestal serve to understand non-horizontal movements of the pendulum plate.

We measure the *horizontal* response of the pedestal base plate, and on top of the dihedron.


horizontal sensor on dihedron
Nylon strings.
Magnet and coil for excitation
vertical sensors on pendulum plate
horizontal sensor on pedestal base

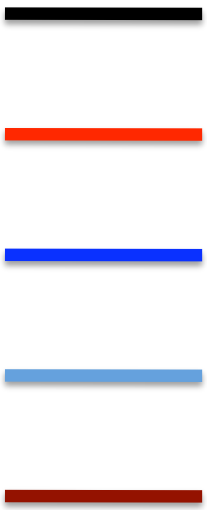
Three different contacts between pedestal and dihedron have been studied:

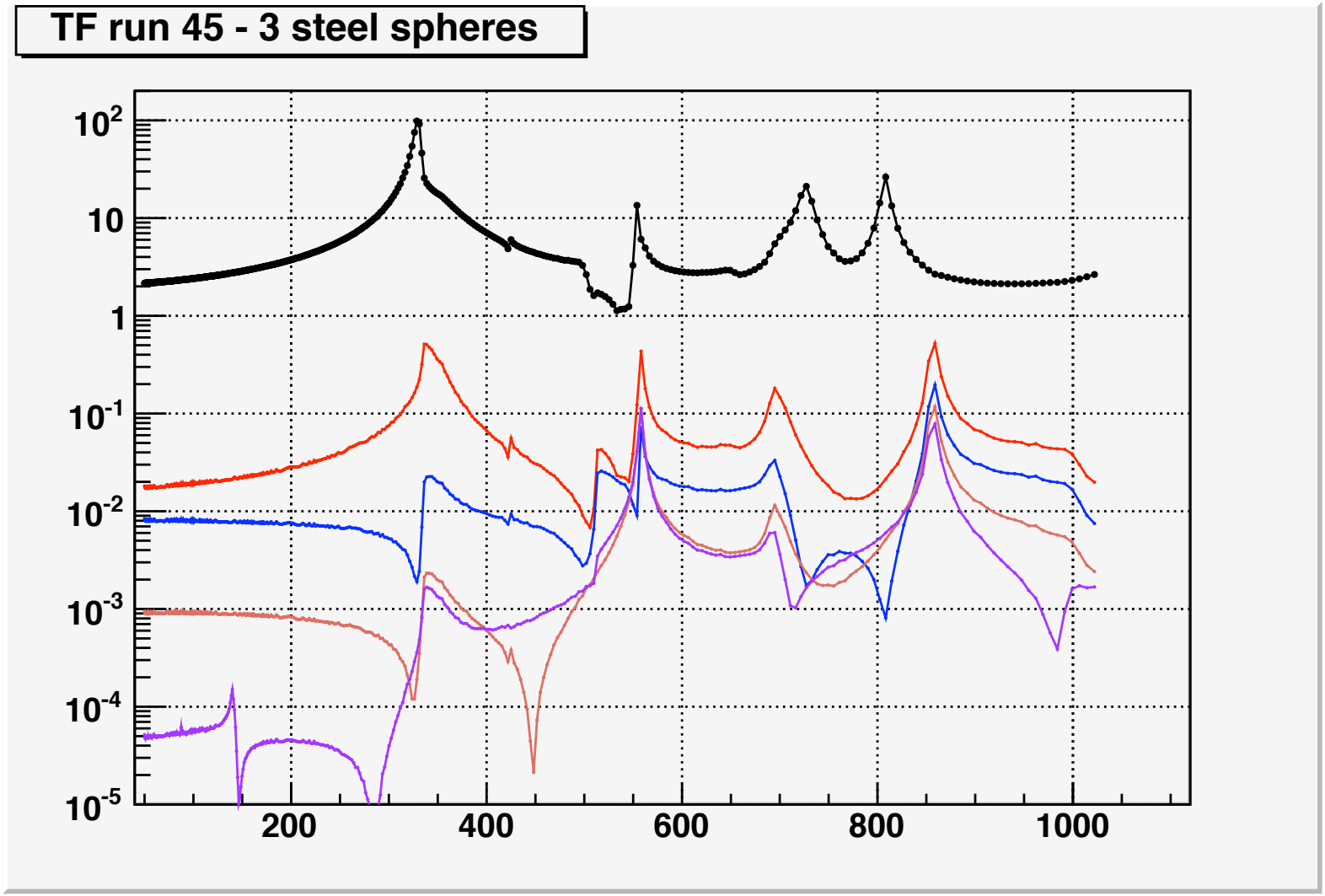
1. a completely flat surface;
2. three steel spheres to insure a 3-point contact;
3. three flat circular contact spots (diameter 5 mm).

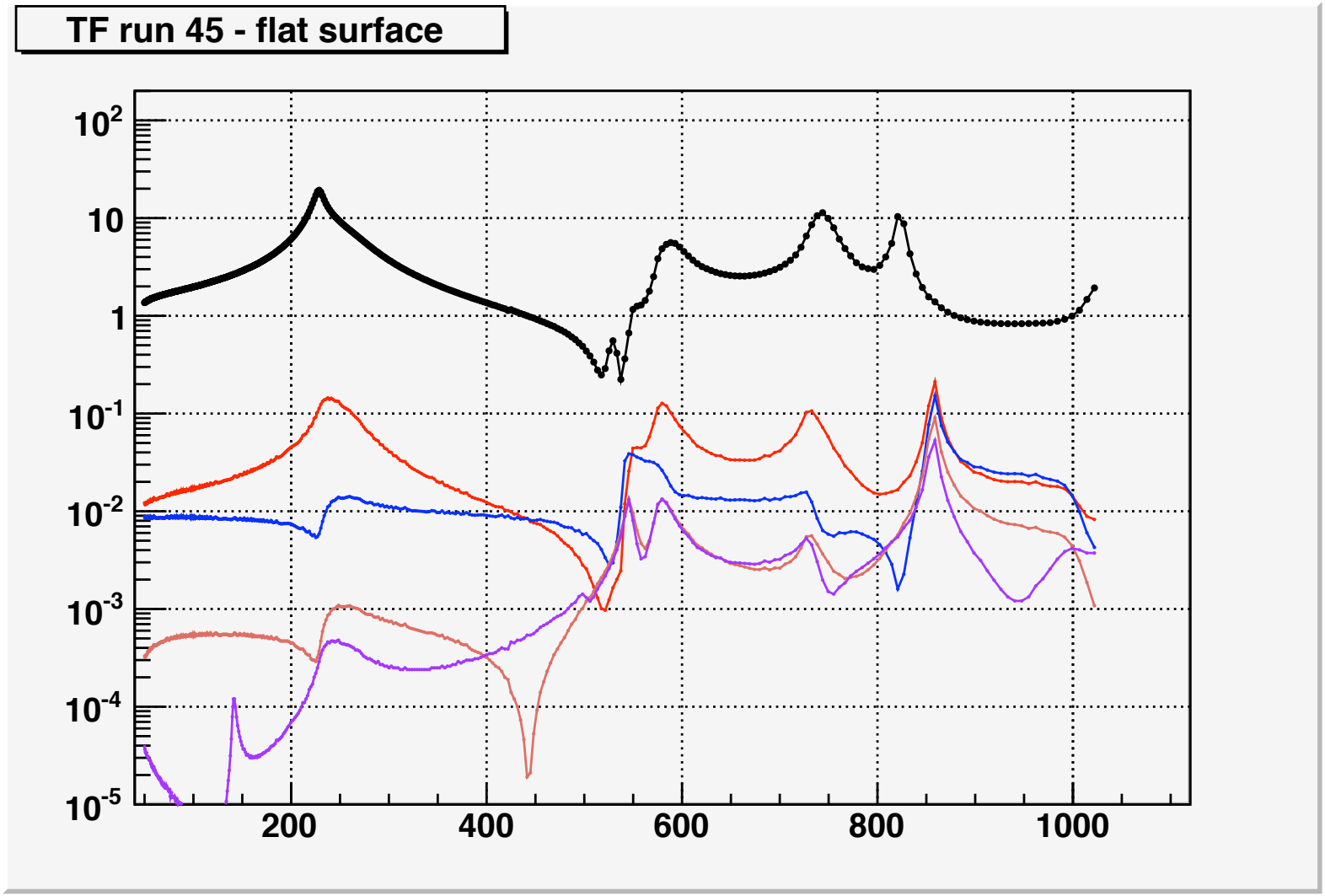
Note: for the case of a completely flat surface, it might be important to check both orientations of the dihedron, as only one surface is really flat.

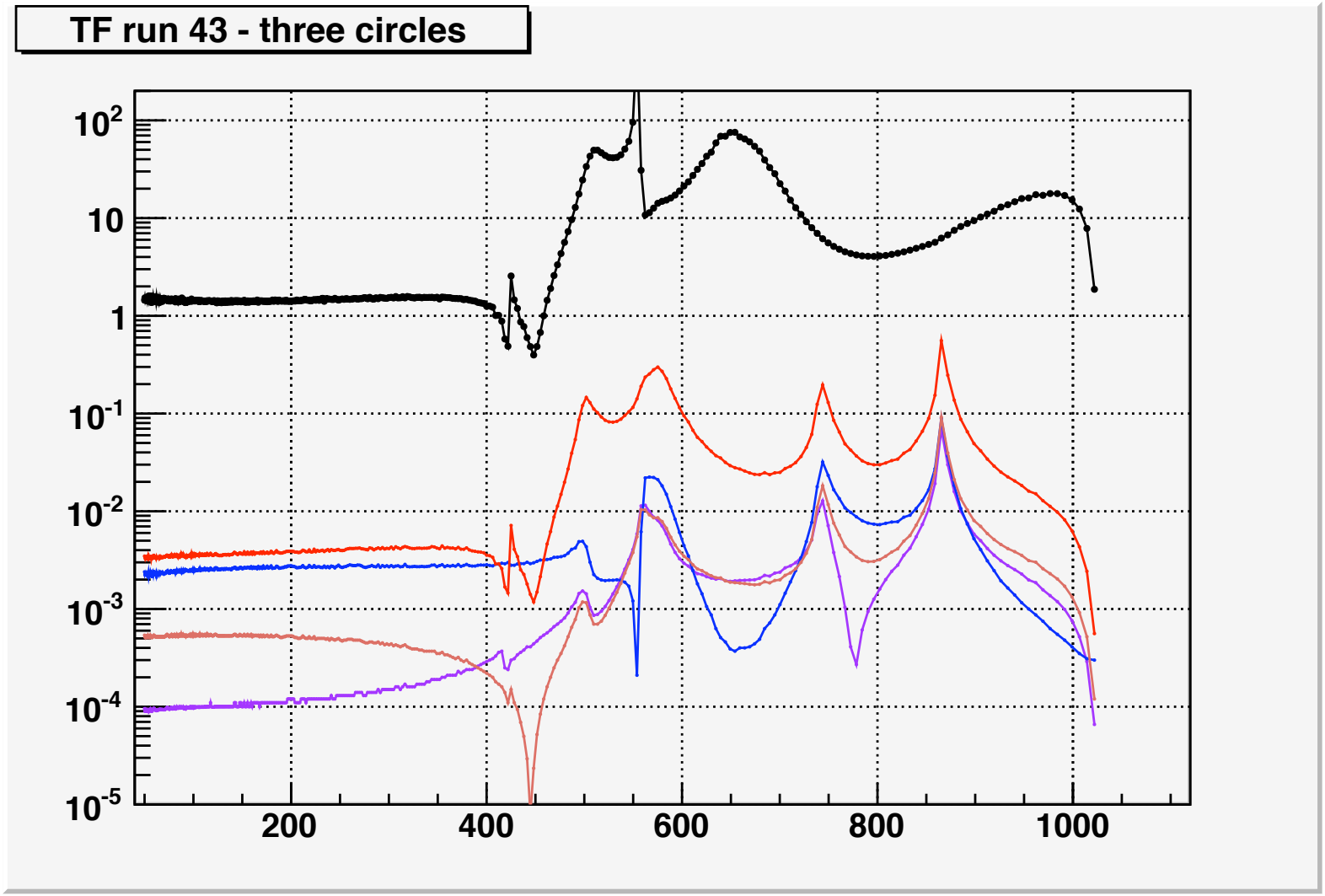
In the next section, we show

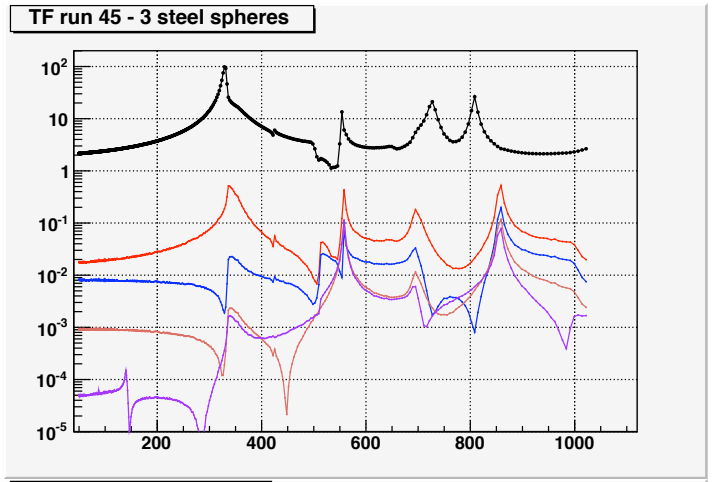
1. TF = top-dihe/base-pedestal;
2. top-dihe (longitudinal);
3. base-pedestal (longitudinal)
4. pendulum 1 (vertical)
5. pendulum 2 (vertical)




TF run 45 - 3 steel spheres
10^2
10
1
10^{-1}
10^{-2}
10^{-3}
10^{-4}
10^{-5}
200
400
600
800
1000


TF run 45 - flat surface
10^2
10
1
10^{-1}
10^{-2}
10^{-3}
10^{-4}
10^{-5}
200
400
600
800
1000

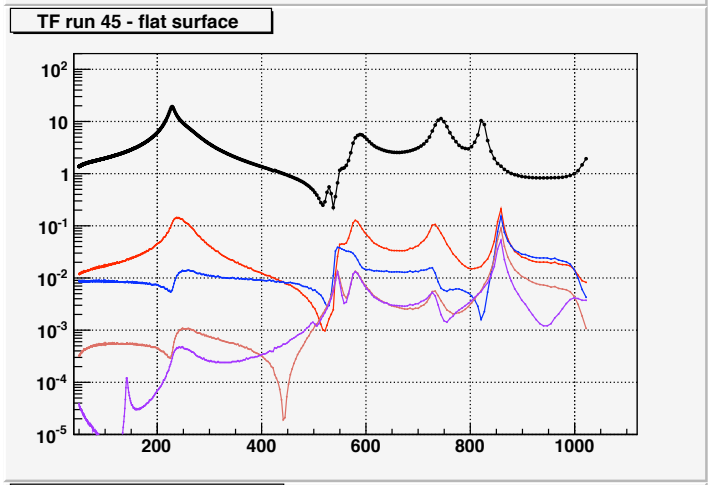

TF run 43 - three circles
10^{2}
10
1
10^{-1}
10^{-2}
10^{-3}
10^{-4}
10^{-5}
200
400
600
800
1000



3 steel spheres

lowest f : ~ 320 Hz

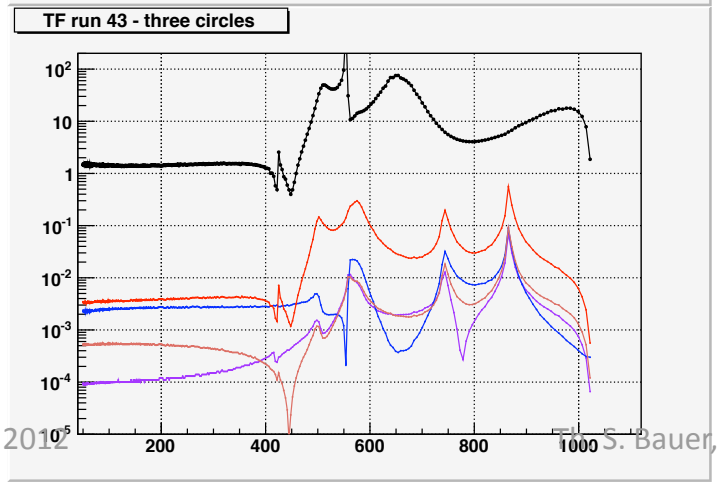
Q : ~ 100



flat surface

lowest f : ~ 220 Hz

Q : ~ 20



3 circular flats

lowest f : ~ 500 Hz ??

Q : ~ 100 ??

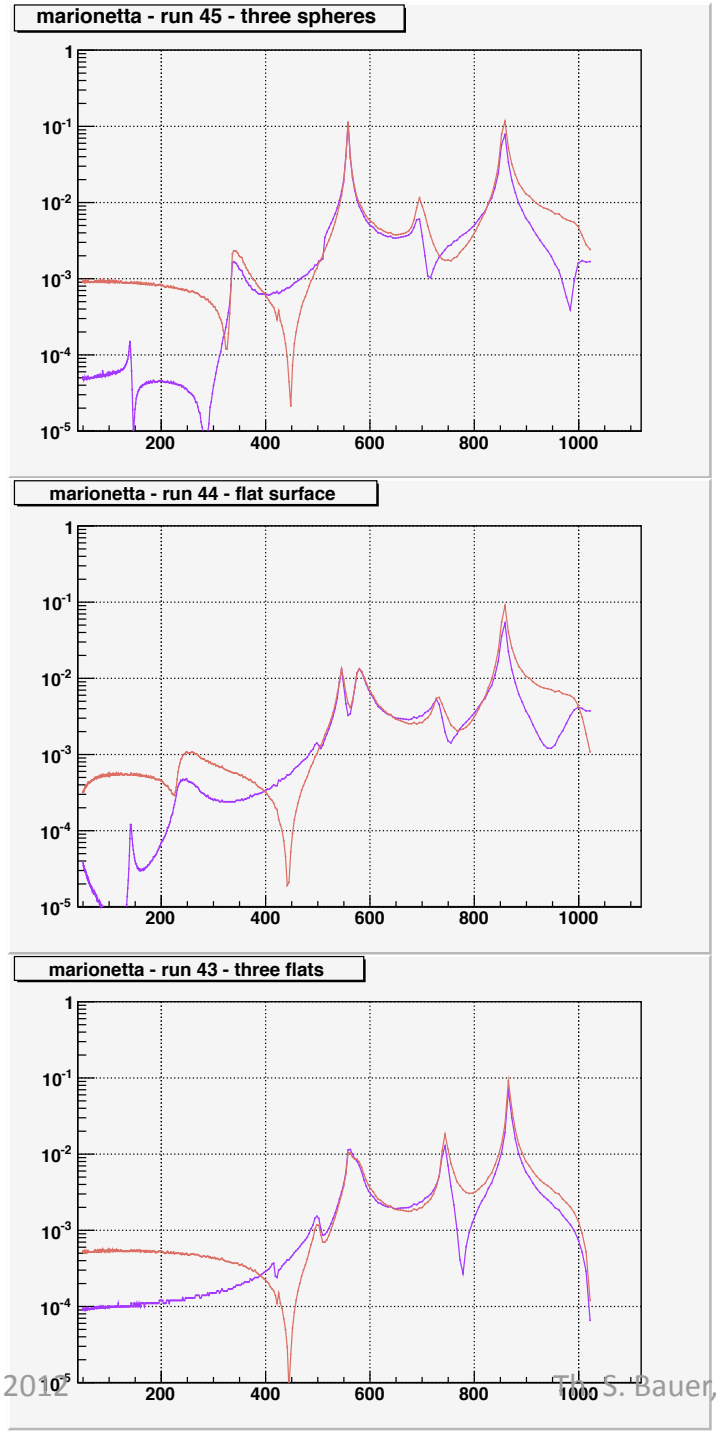
vertical movement of pendulum plate?

One sees a complex structure, but it seems as if

- 3-circular-flats have longer TF==1 (up to > 400 Hz);
- all 4 sensors have very similar structures above 500 Hz;
- notably, the V-sensors on pendulum plate are excited above 500 Hz.

In the next section, we concentrate on

1. pendulum 1 (vertical) 
2. pendulum 2 (vertical) 

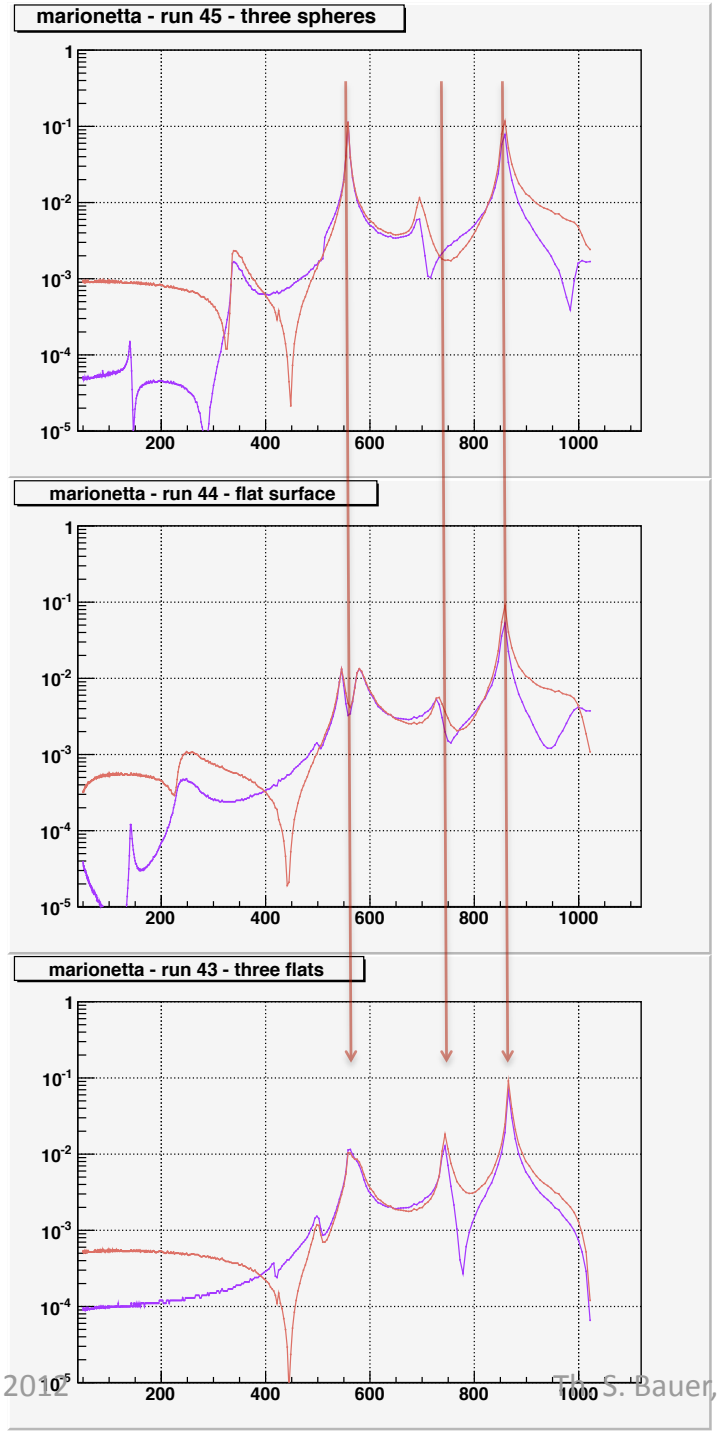


Marionetta movement

Setup is not entirely reproducible:

position of magnet wrt. coil depends on

- stretching of suspension wires,
- torsion,
- realignment after modifications.



Marionetta movement

However:

at $f > 500$ Hz, general structure identical;
whereas
at $f < 500$, some differences visible;

this indicates:

- *intrinsic excitation of marionetta* at higher frequencies,

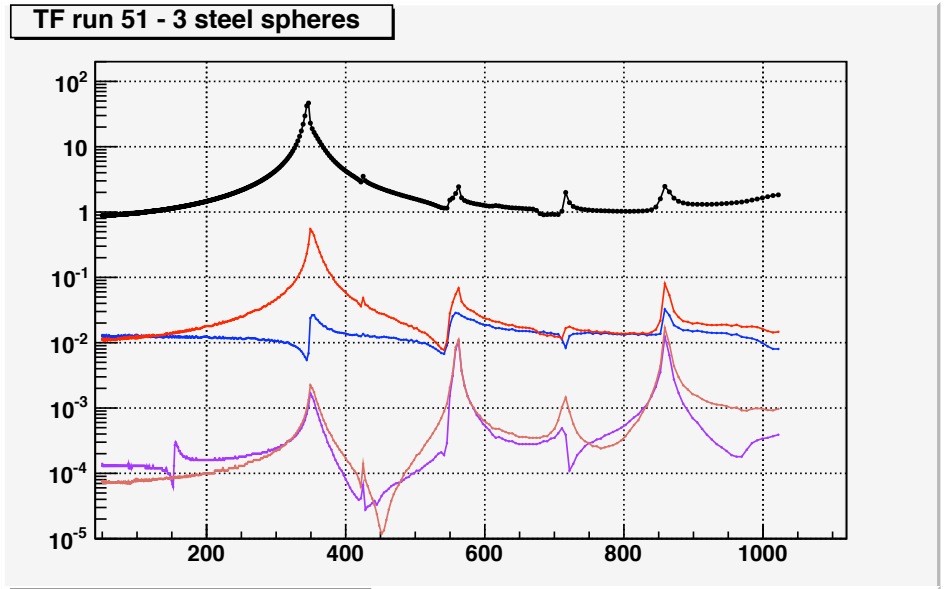
and

- coupled oscillations (i.e. *induced through the dihedron*) below ~ 500 Hz.

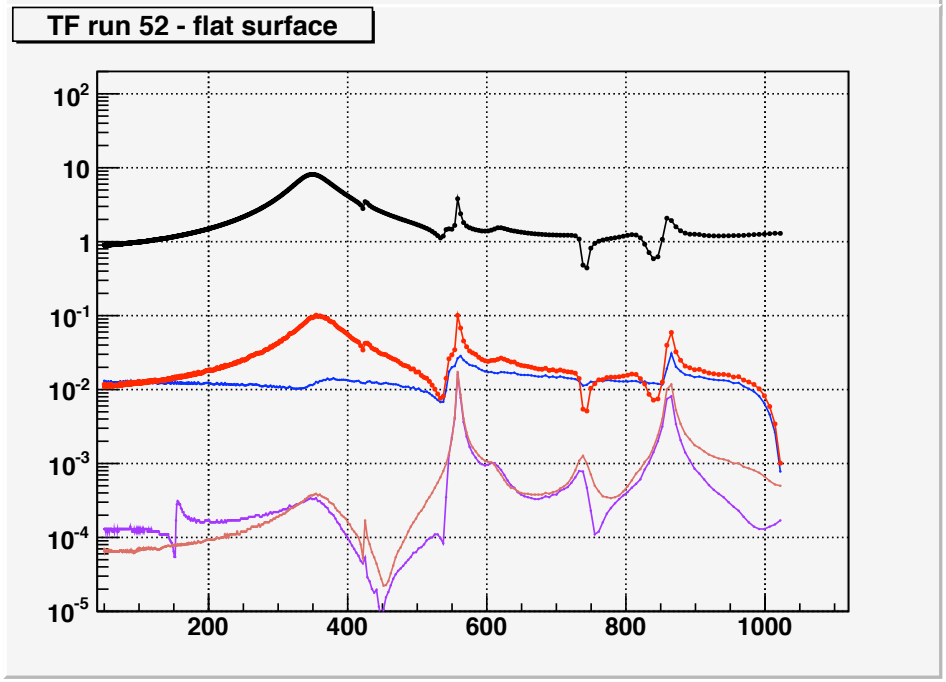
Reproducibility checks – here, the set-up was untouched for a longer stretch in time - resulted in better spectra.

This has probably to do with the fact that the position between magnet and coil is unchanged during the measurement, and possibly also well centered – which would eliminate torque, and thus vertical movement during the excitation.

In the following some pair-wise comparisons between different contact points.

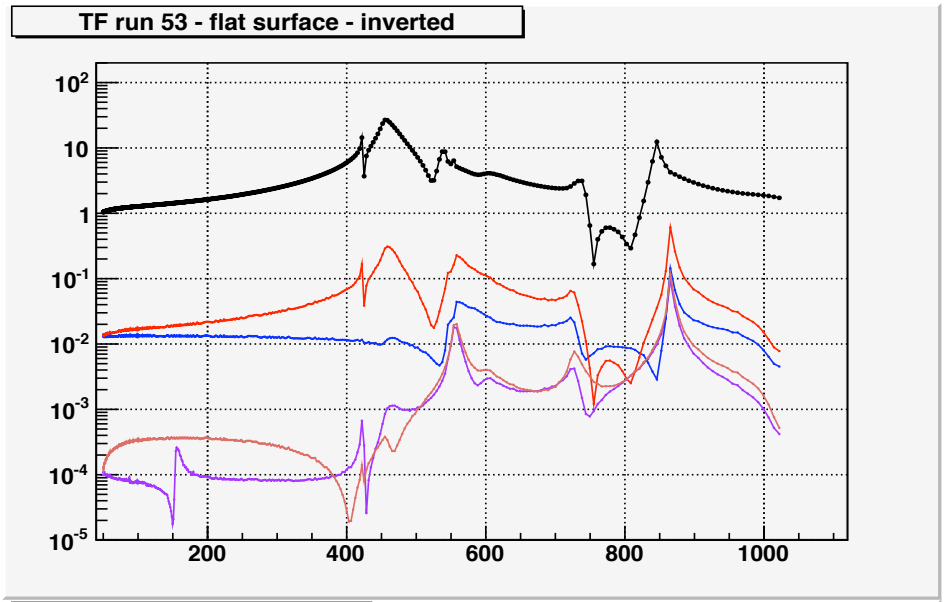


3 steel spheres

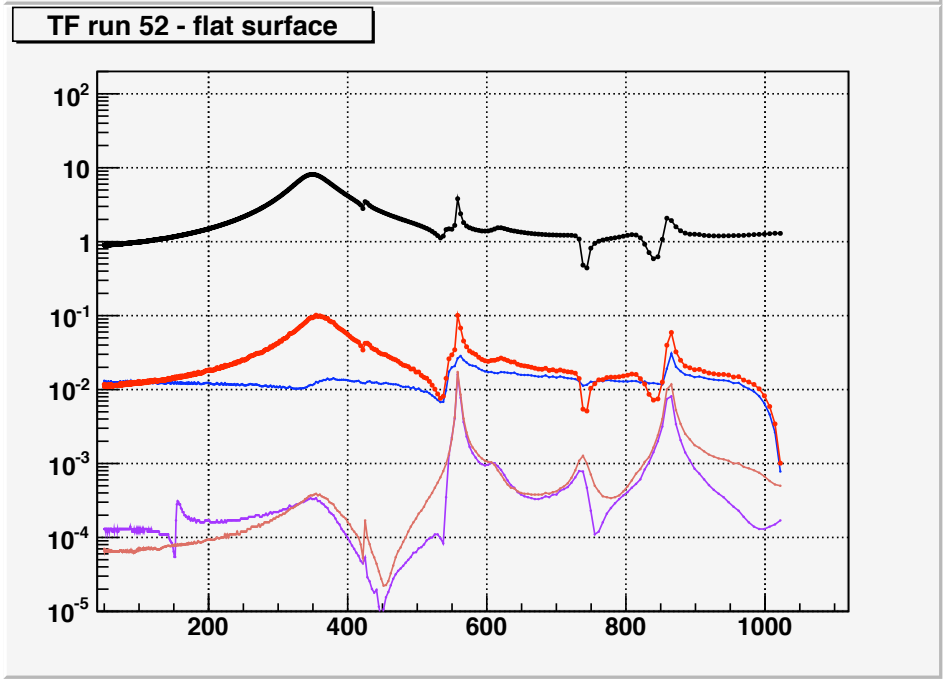


flat surface

rather similar, but higher Q for 3 steel spheres.

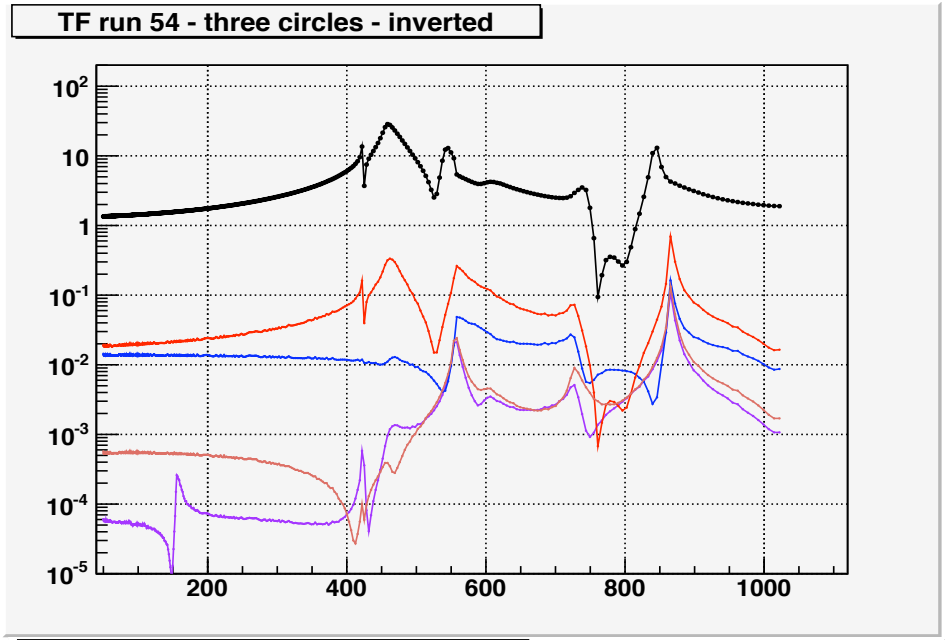


flat surface, inverted dihedron

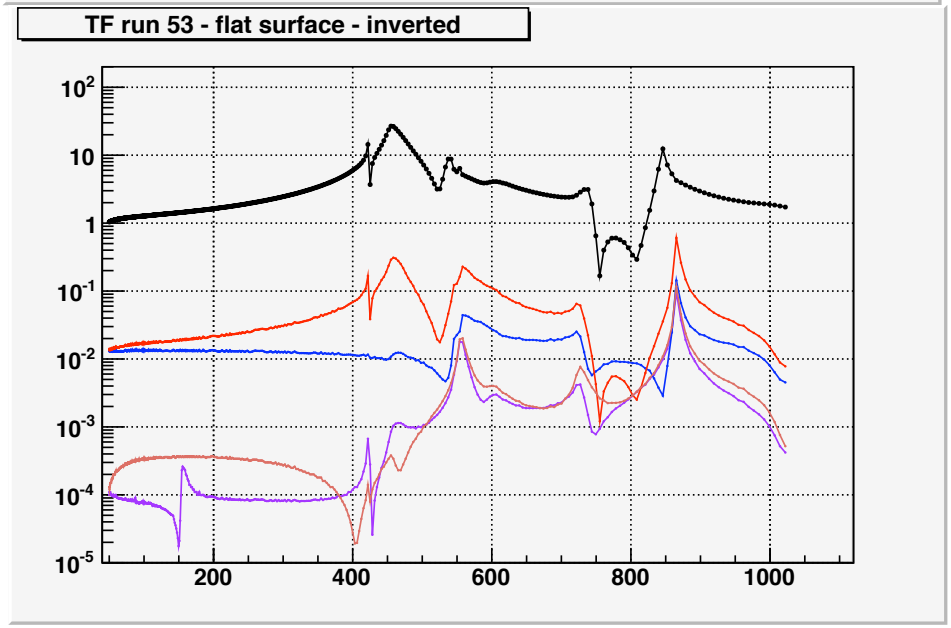


flat surface

rather similar, but higher f for inverted pendulum. This indicates different contact points!



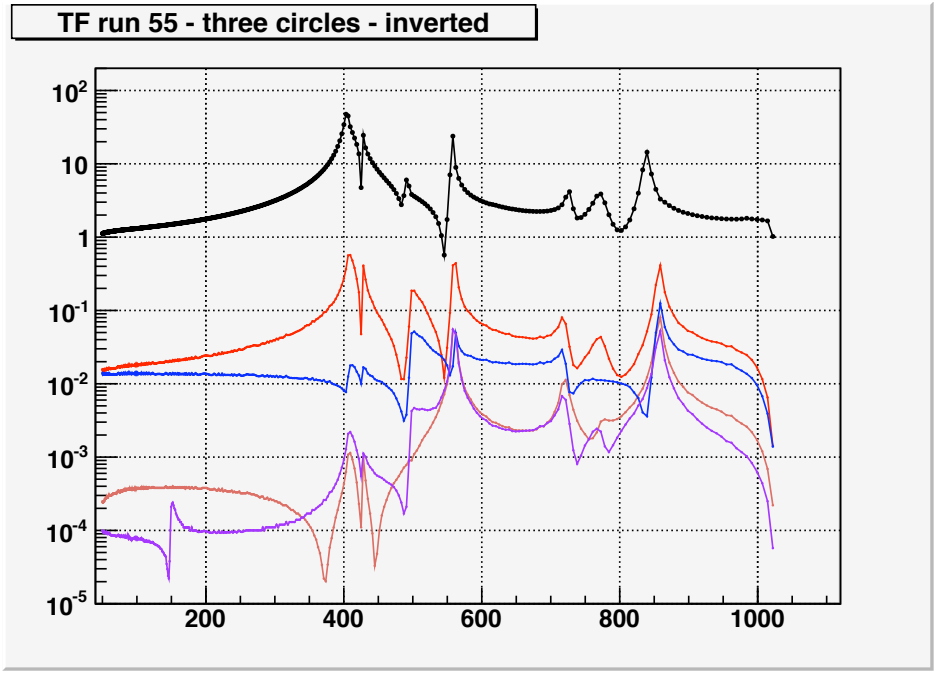
flat surface, inverted dihedron
(title of plot is wrong)



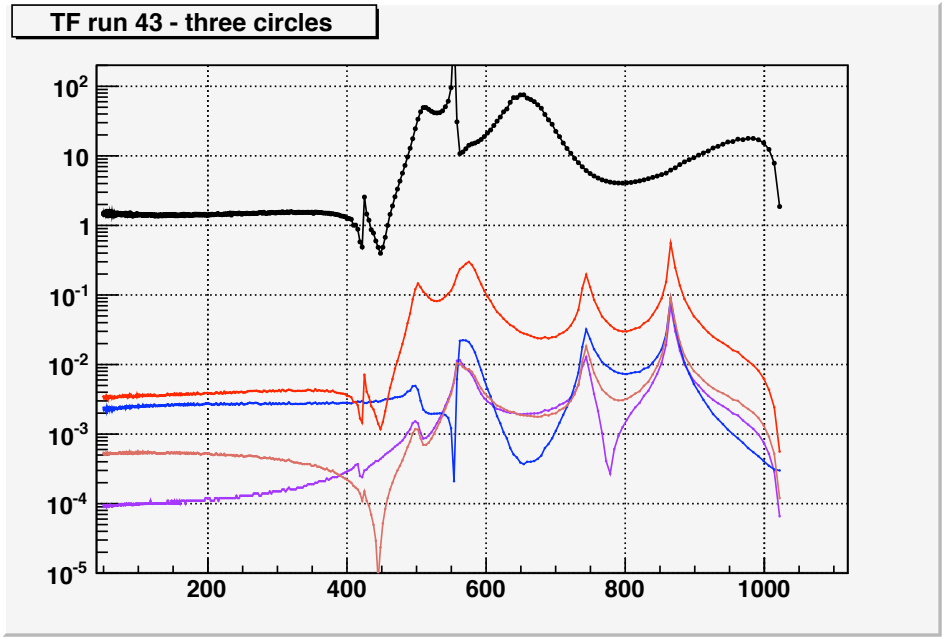
flat surface, inverted dihedron

exact repetition in order to see whether differences between inverted and non-inverted dihedron persist.

dihedron has definitely a lower and an upper side.



3 circular flats, inverted dihedron



3 circular flats

Differences due to inversion of dihedron!
Note that here “inverted dihedron” is similar to the other contacts!!

Conclusions:

1. Work in progress.

2. Pendulum is good set-up for characterization measurements.

3. Vertical movement of pendulum plate is important, and plays important role above ~ 500 Hz;

4. At present, a “3 circular flats 5 mm Ø” seems best; should be optimized and symmetrized.

5. Final results soon available. Notably, need to confirm the TFs of the “three circular flats”.