TID Stability Test

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Aim

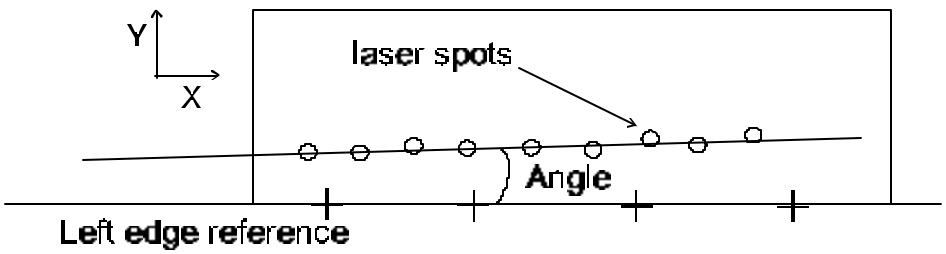
Such a test has been performed in order to determine the stability of the whole TID + target chamber system. The test consists in marking a material plate with 20 dots separated by 8 mm along the Z direction (manipulator moving downwards). The idea of this test is to compare two different situations: One fast (20 dots in 20 minutes considered as stable situation) and one slow (20 dots over 11 days where the system could move). Then by comparing the distribution (longitudinal and transversal), a conclusion could be made.

Setup

An octagonal target of 20-cm height was used for this test. One face of the target was set perpendicular to the plasma axis using He-Ne and cross wire across the chamber flanges.
A first trial showed that Stainless Steal was the most appropriated material to perform this test as the sputtering was less than with lead allowing defining the center of the crater more easily using an optical microscope.
An octagonal Target with two stainless steal plates mounted with care parallel to the support left edge was set up. The 1st shot was done with the target at its upper position and then it was moved downwards by 8 mm every shot. The slow test has been finished after11 days. Then, rotating the target by 45 degrees allowed us do the fast test on the second face without opening the chamber. However, filling the chamber with Nitrogen up to 250-mbar partial pressure was necessary to allow lifting the target back up. Fast test over 30 minutes was then done after pumping down to 10^{-6} mbar.

Measurements

The positions of the laser spots were recorded using a optical microscope equipped with an X-Y table. The resolution of the table along X (longitudinal) was 10 µm and 1 µm along Y (transverse). Also we recorded few points on the left edge in order to get a reference axis.



Results (see page3-4)

	Fast test (HF)	Slow test (LF)
X average	8.14 mm	8.15 mm
X deviation	0.09 mm	0.11 mm
Y average	0.00 mm	0.00 mm
Y deviation	0.07 mm	0.05 mm
Angle	3 mrad	-0.3 mrad

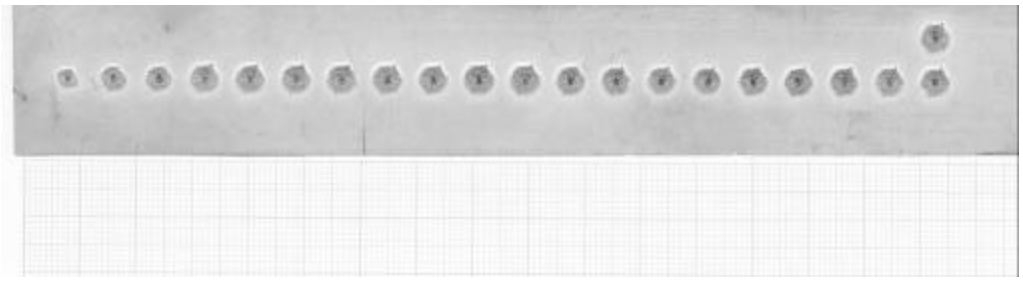
Conclusion

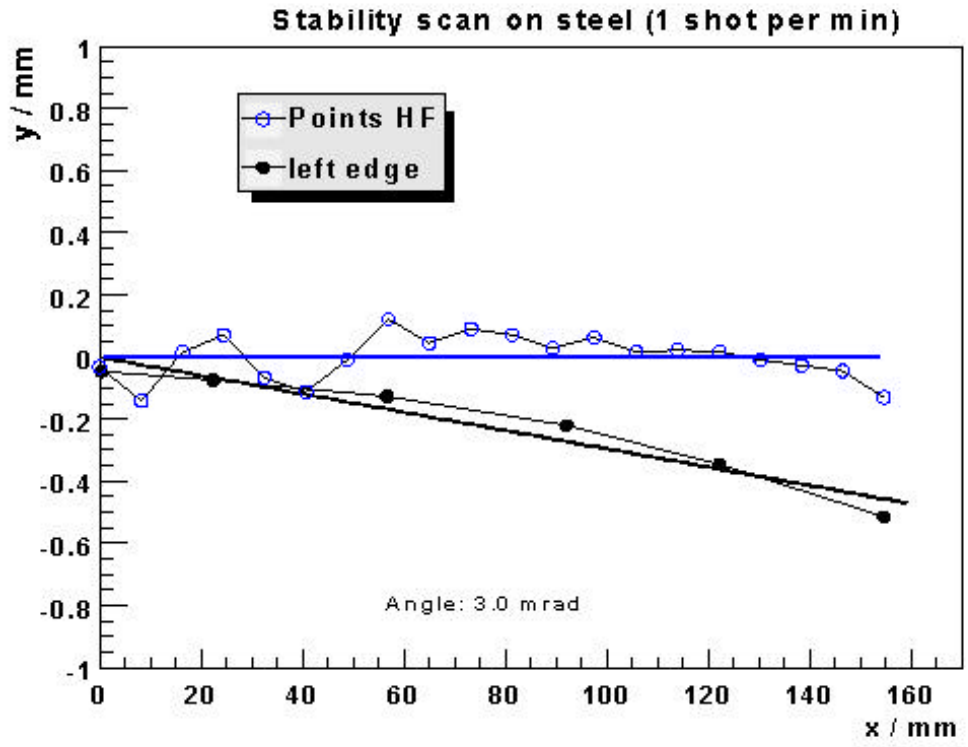
Considering:

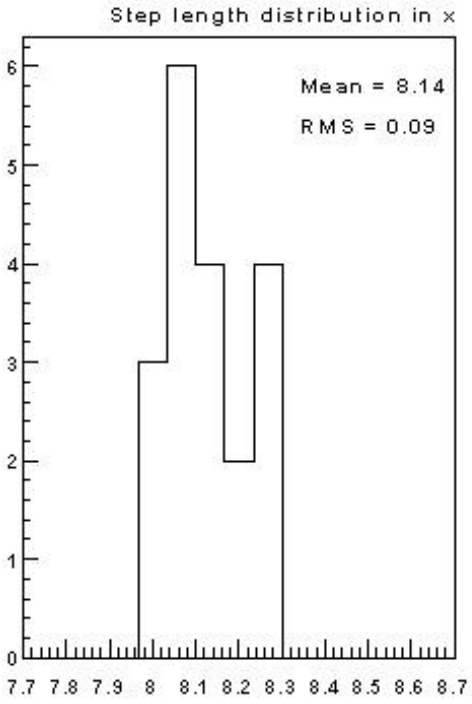
1. The resolution of the manipulator (+/- 15 µm) and the resolution of the X-Y table (10 µm along X, 1 µm along Y)
2. The reproducibility in defining the center of crater (100 µm Longitudinally and 50 µm transversally).
3. The stability of the laser photon path (0.05 mrad per Month).
4. The result of the slow (LF) and fast.(HF) test

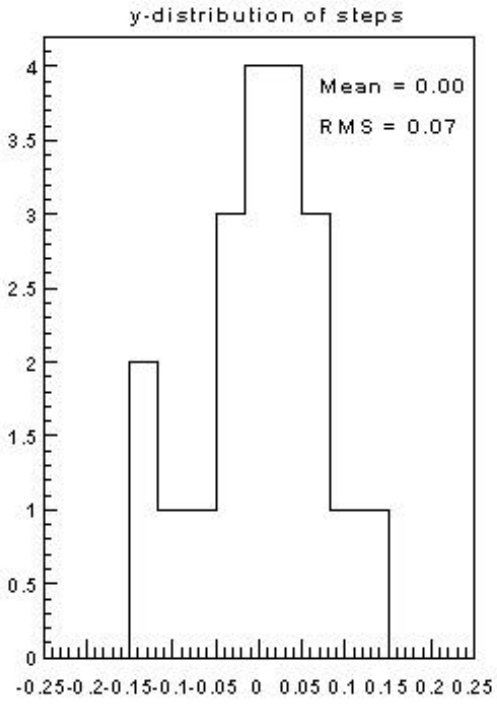
We can say that we could not distinguish evident signs of any instability greater than 100 µm at the target surface.

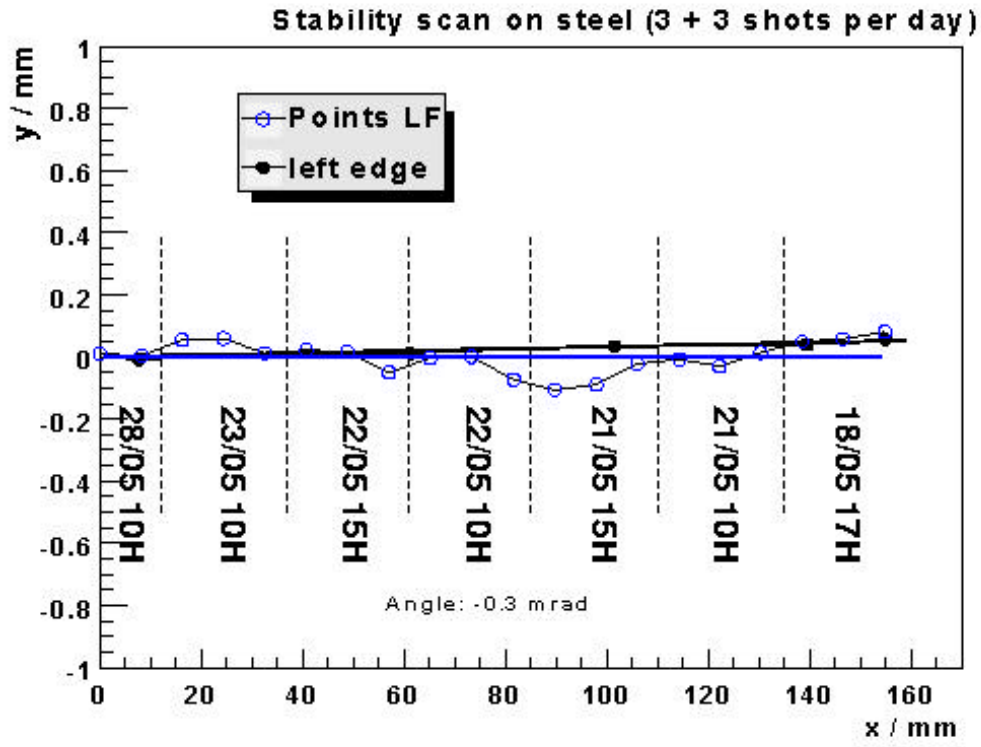
Note that the angle of 3 mrad max obtained on the fast test is of the order of the precision achieved when positioning the plate on its support. It then does not reveal any tendency of motion of the whole TID + target chamber motion.

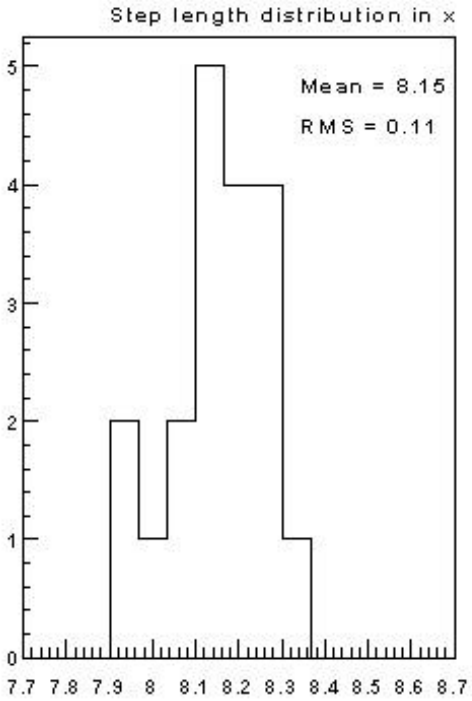


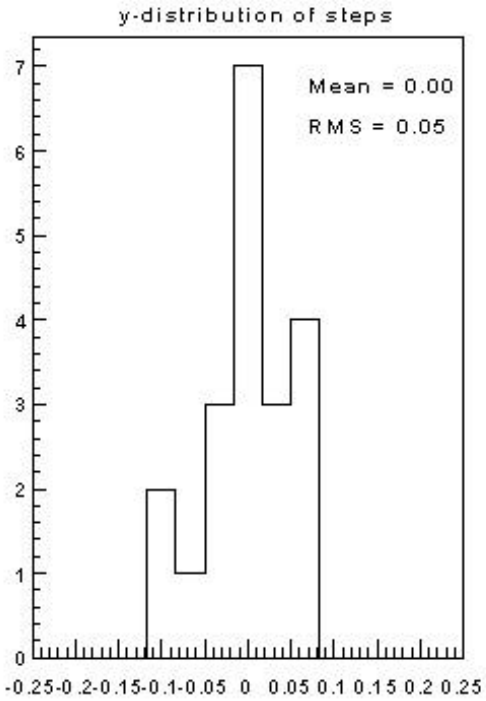

Stability scan on steel (1 shot per min)
Points HF
left edge
Angle: 3.0 mrad
y / mm
x / mm


Step length distribution in x
Mean = 8.14
RMS = 0.09


y-distribution of steps
Mean = 0.00
RMS = 0.07


Stability scan on steel (3 + 3 shots per day)
y / mm
x / mm
Points LF
left edge
28/05 10H
23/05 10H
22/05 15H
22/05 10H
21/05 15H
21/05 10H
18/05 17H
Angle: -0.3 mrad


Step length distribution in x
Mean = 8.15
RMS = 0.11


y-distribution of steps
Mean = 0.00
RMS = 0.05