

## New external calibration target on 1824

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In the main astronomical observatory of the National Academy of Sciences of Ukraine, developed the new external calibration target by SLR 1824 team. There was some reasons:

- the target was destroyed by unknown persons twice ;
- The old target system has a systematic error;

This presentation demonstrates the real possibility of external calibration on telescopes TPL-1, real difficulties and ways of overcoming them.

New external calibration target used 2 years. This target are using for control internal target.

Part of the optical system of the telescope TPL-1 laser ranging station "Golosiiv-Kyiv" 1824 is schematically shown in Fig. 1. The full description given[1],[2].

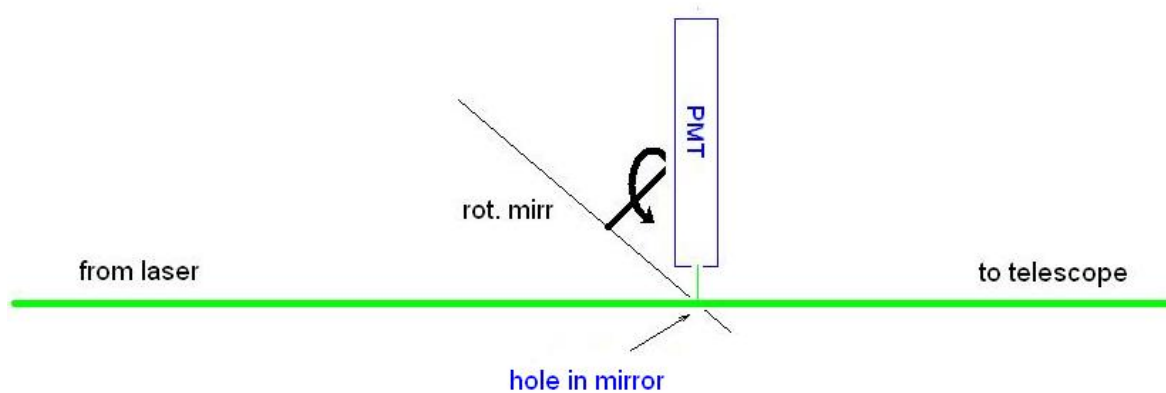


Fig.1

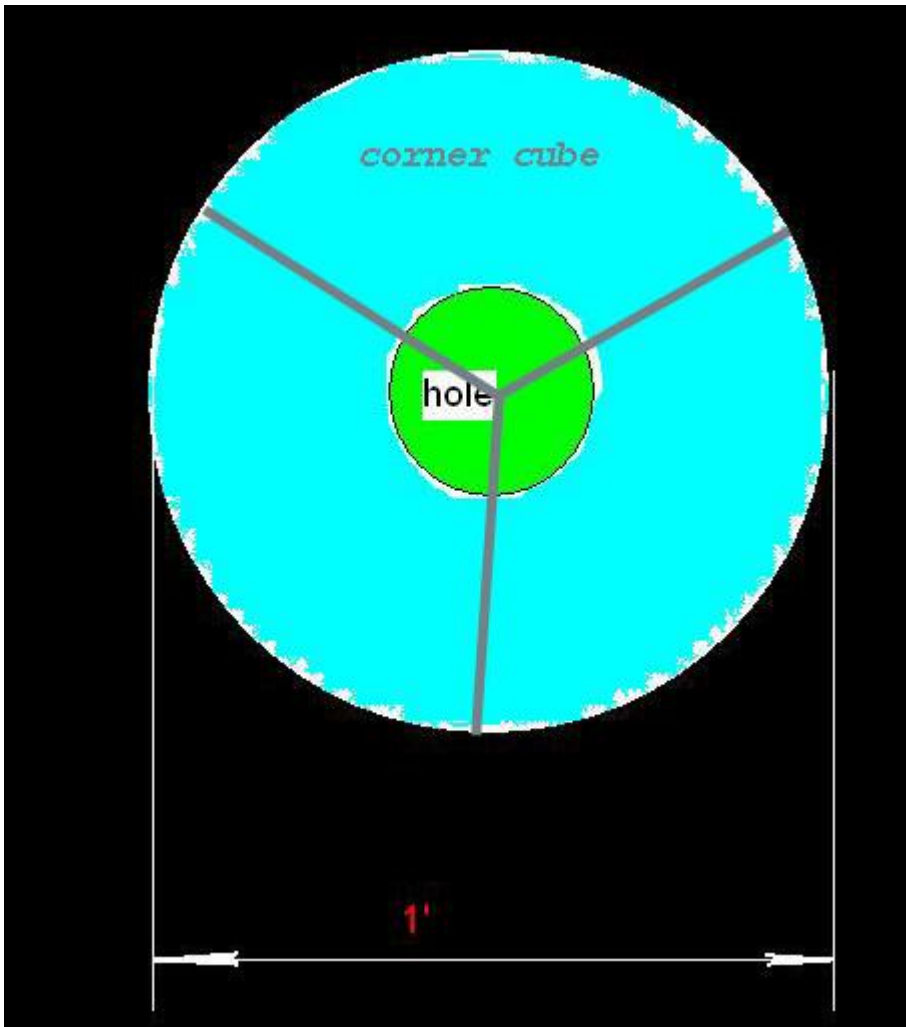


Fig.2

The field of view PMT looks like in Figure 2

This scheme allows for both external and internal calibration.

In Fig. 3 shows the PMT output signal without optics attenuation.

Yellow line shown the START signal, violet line shown the PMT signal.

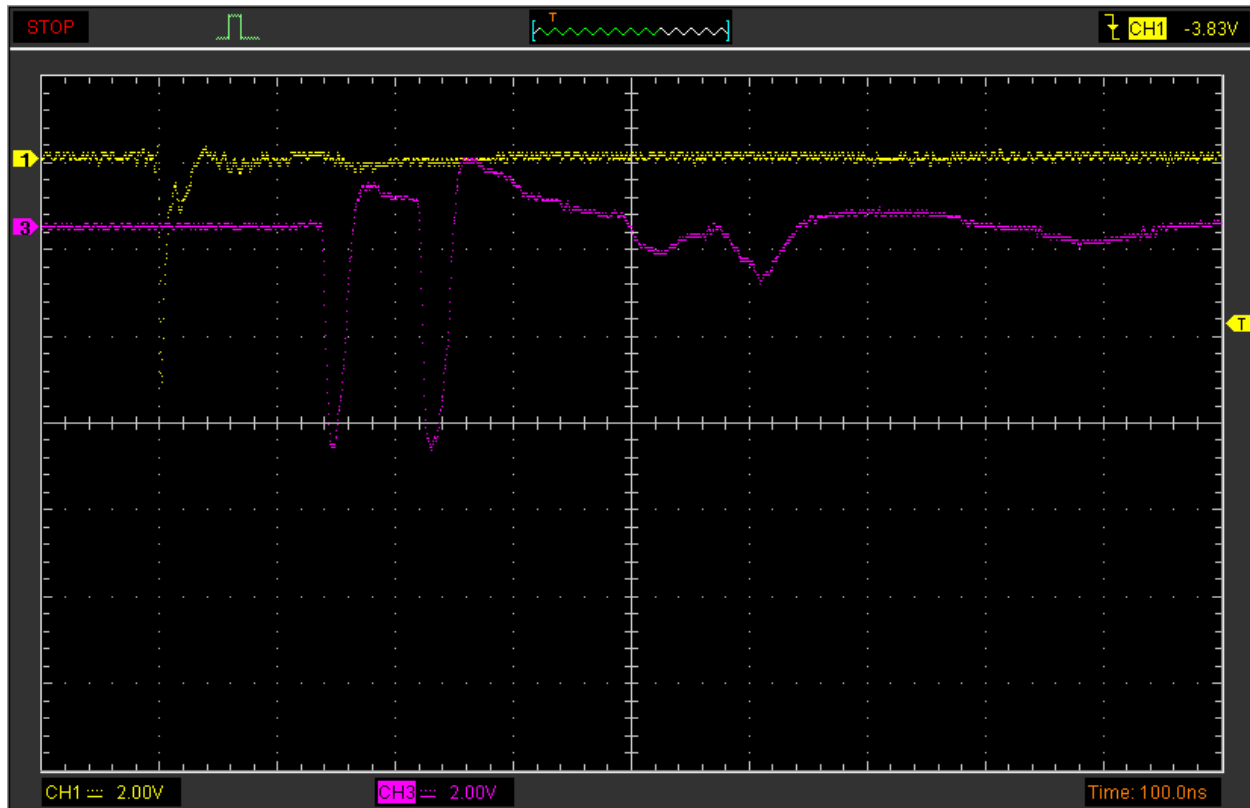


Fig.3 The PMT output signal without optics attenuation

As can be seen from the figure, the signal from the external target prior parasitic signal, which is the result of the scattering of the laser beam on the all optical surfaces of the telescope. This signal can be limited using the strobe time. However, it will impact on the analog part of the electronic system. It is understood that the passage of momentum for some time "remembered" for containers scheme. When used with CFD discriminator threshold will lead to the appearance of bias, which is impossible to determine hardware.

This effect clearly demonstrate the results of observation satellites , using the old system of external calibration (Fig. 4) and new (Fig. 6).

#	sat	site	date	time	dur	rb mm	error	sdelay
#	1824	= KIEV						
JAS2	1824		2012/12/14	15:35	3	-234	( 17 )	151735
GLO2	1824		2012/11/13	21:19	2	-99	( 27 )	151669
LARS	1824		2012/10/21	17:46	7	-99	( 11 )	151522
AJI1	1824		2012/10/22	00:32	3	-81	( 12 )	151520
LAG2	1824		2012/10/11	17:01	15	-99	( 31 )	151503
LARS	1824		2012/10/12	17:37	4	-108	( 21 )	151510
LAG2	1824		2012/09/20	21:01	2	-72	( 10 )	151653

Fig.4 The RB with old calibration target

The difference between the new and the old system of external calibration is that the old target was placed at a greater distance from the telescope. His signal intensity was significantly lower than the new.

With a much stronger signal from the target than parasitic. It can be attenuated by the neutral optic filter before PMP.

A in Fig.5 show PMT signal after attenuation.

You can see in Fig. 3 that the start signal from the target is raised relative to the zero line, as in Fig. 5 start pulse is at the zero line.

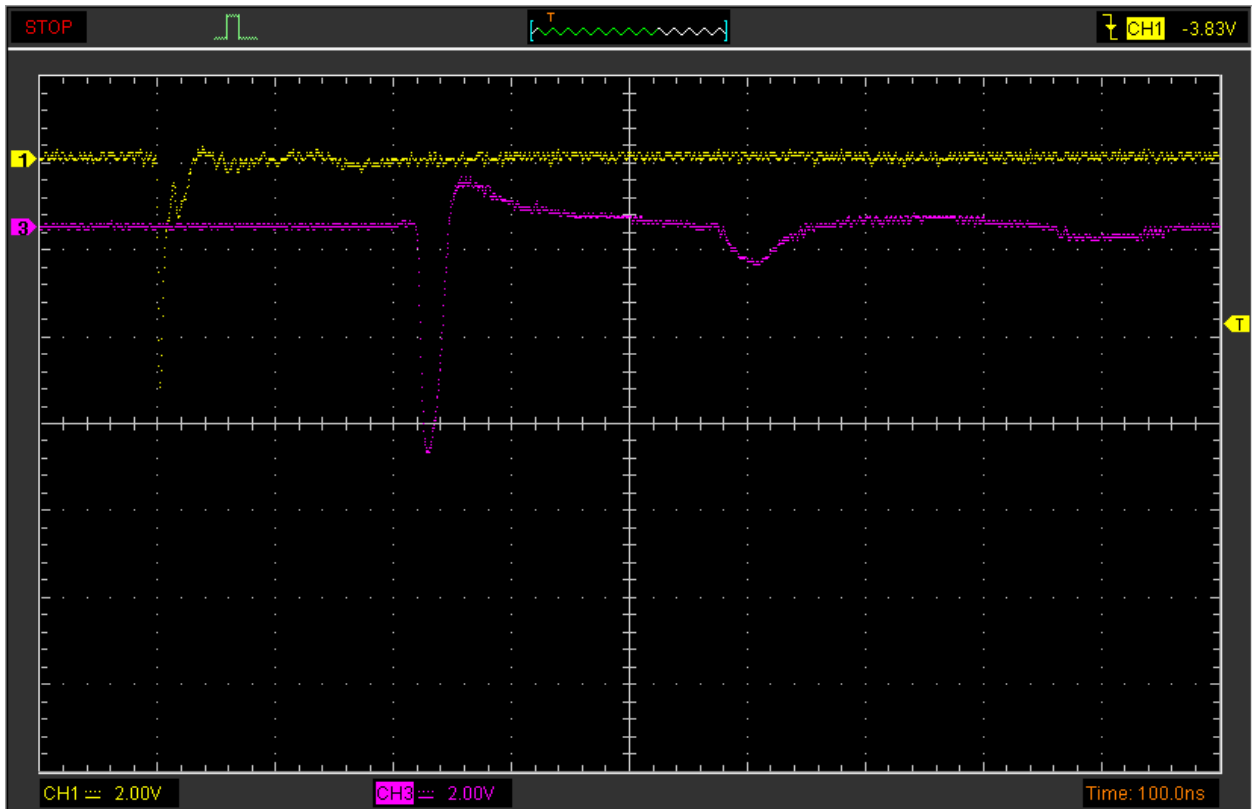


Fig.5 PMT output after optic attenuation

Figure 6 confirms that the new system of external calibration free from bias.

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#|
# 1824 = KIEV
# sat site      date      time dur      rb mm      error      delay
AJI1 1824 2016/09/08 00:01 0      19 ( 79 )      40208
STEL 1824 2016/09/08 00:04 0      -75 ( 104 )      40208
LAG2 1824 2016/09/08 01:14 6      -44 ( 166 )      40208
STEL 1824 2016/09/08 01:43 1      31 ( 0 )      40208
AJI1 1824 2016/09/08 01:56 3      35 ( 183 )      40208
LARS 1824 2016/09/08 02:07 0      9 ( 121 )      40208
LARS 1824 2016/09/08 18:58 5      -0 ( 21 )      40200
CRY2 1824 2016/09/08 20:02 0      -15 ( 177 )      40200
LAG1 1824 2016/09/08 20:28 11     7 ( 85 )      40200
JAS2 1824 2016/09/08 22:44 4      ----- ( ----- )      40200
AJI1 1824 2016/09/08 23:04 7      -36 ( 143 )      40200
LAG2 1824 2016/09/08 23:29 1      -23 ( ----- )      40213
LAG1 1824 2016/09/09 00:01 4      18 ( 5 )      40213
JAS2 1824 2016/09/09 00:38 1      -13 ( 4 )      40213
AJI1 1824 2016/09/09 01:10 2      1 ( 52 )      40213
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Fig.6

Reference.

1. O Bolotina, Yu Glushchenko, M Medvedskij, M Peretyatko, V Suberlak, D Yatskiv. "SLR station" Golosiiv-Kiev": current state and activity" 2003, Vol. 13, pp. 207-213. Journées 2001-systèmes de référence spatio-temporels.
2. OV Bolotina, Yu M Gluschenko, MM Medvedskij, NN Peretyatko, VR Suberlyak, D Ya Yatskiv. "Satellite laser ranging station" Holosiiv-Kyiv". Technical characteristics and results of 2001 observations" 2001/12, Kinematika i Fizika Nebesnykh Tel. Vol. 17. pp. 560-572