Annual teaching on cameras.
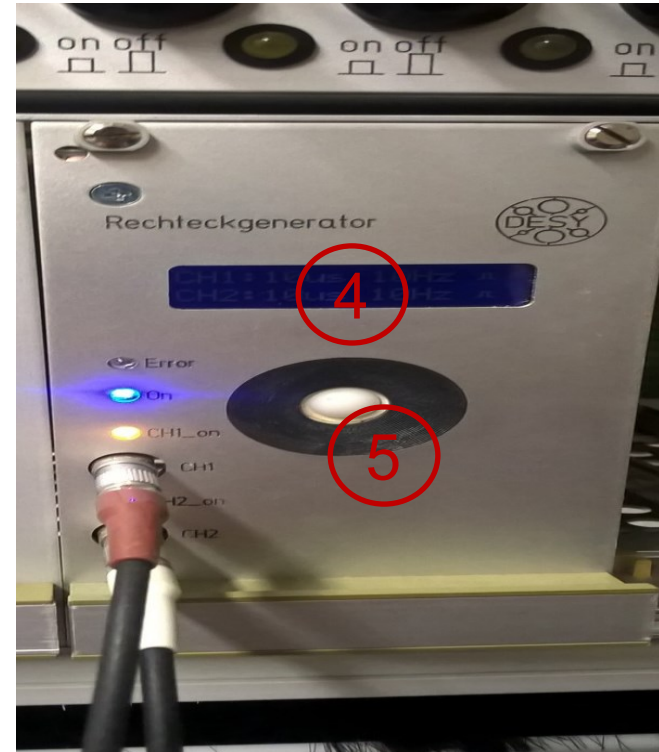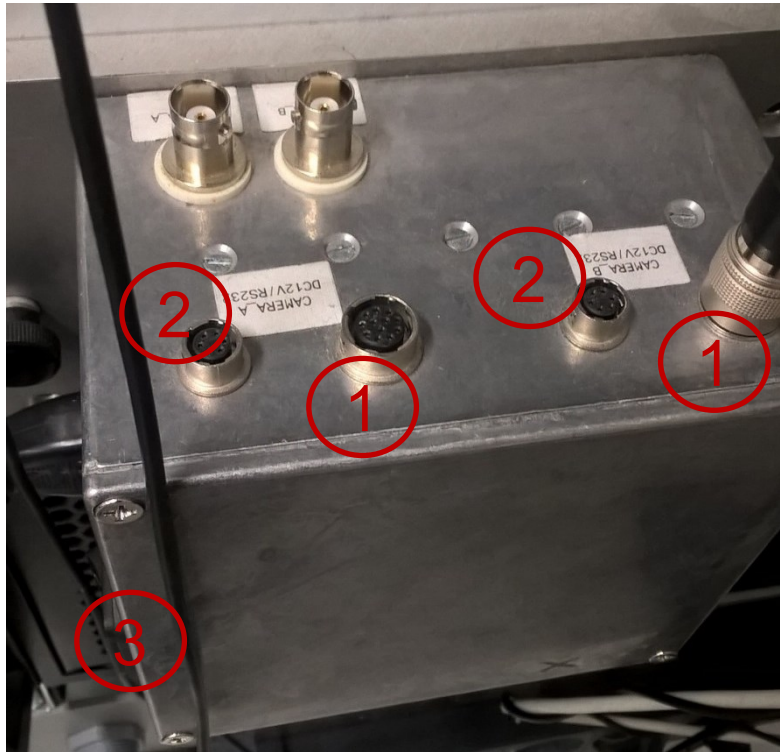
Grygorii Vashchenko
PITZ annual teaching
Zeuthen, 10.12.2015

HELMHOLTZ
| GEMEINSCHAFT

DESY
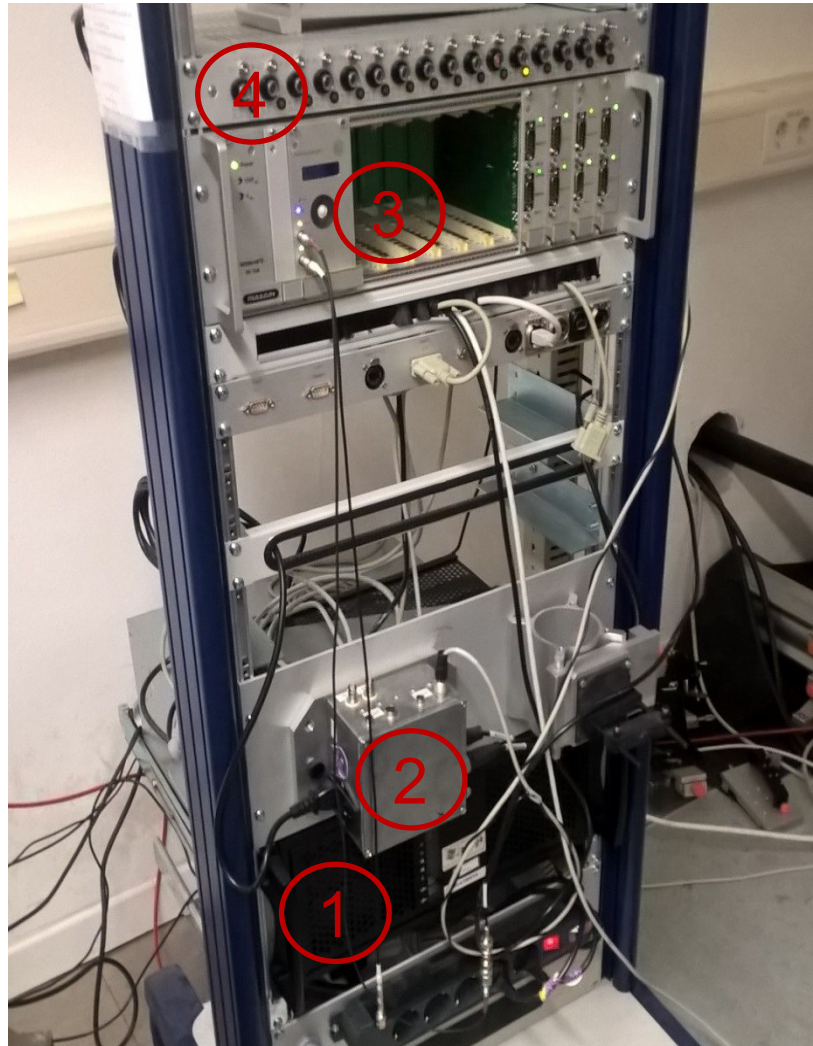
Overview

1. Server PC
2. Power box
3. Trigger generator
4. Power control

- Trigger box has two power outputs (1) and two trigger outputs* (2), power switch (3).
- It is recommended to use the trigger signal from the trigger generator as the power box always provides a certain signal which may not be suitable for some cameras while the trigger generator is controllable: trigger width and polarity can be set arbitrary.

Trigger settings display (4)
Trigger settings control wheel (5)

* Trigger outputs are not working in the optics lab, only in tunnel

Power control unit – refer to the documentation attached on the rack for details

AVT (former Prosilica) camera connected to Ethernet and power/trigger cable

Important:

All the cameras which are used at PITZ have a so-called "Hirose" power/trigger connector. Nevertheless for different cameras pinning inside of the connector is different.

Always ensure that you use proper cable otherwise you can burn the camera.

1. S. Weisse is you friend
2. Ensure that the trigger box power switch is off
3. Take the camera you want to connect and find the corresponding cables (in one of the shelves)
4. Connect the camera to one of the outputs of trigger box and to trigger generator, connect the Ethernet cable
5. Set the proper trigger pulse form at trigger generator (refer to camera users guide)
6. Power the trigger box with a corresponding button at power control unit
7. Power the camera with a trigger box power switch

Camera should start normally within several seconds; indication of the normal start differs for different cameras. Example: for AVT GC-1350 green LED should be permanently on, orange LED should blink showing the data transfer.

Preparation of the camera for the video system

- Depending on the camera type different software (provided by camera manufacturer) is required. Nevertheless, steps to be performed are similar for all cameras and will be described on the example of AVT GC-1350 camera.
- All the information about camera has to be filled to camera list located at: \\win.desy.de\zn-groups\zn_pitz\controls\VideoSystem\documentation\cameralist\Complete_Cameralist.xls; Description how to fill the camera list can be found there as well.
- Start the IP configurator from "Start" => "All programs" => "Allied Vision Technologies" => "IPConfig (64 bit)"
- Press "Change" button

Preparation of the camera for the video system
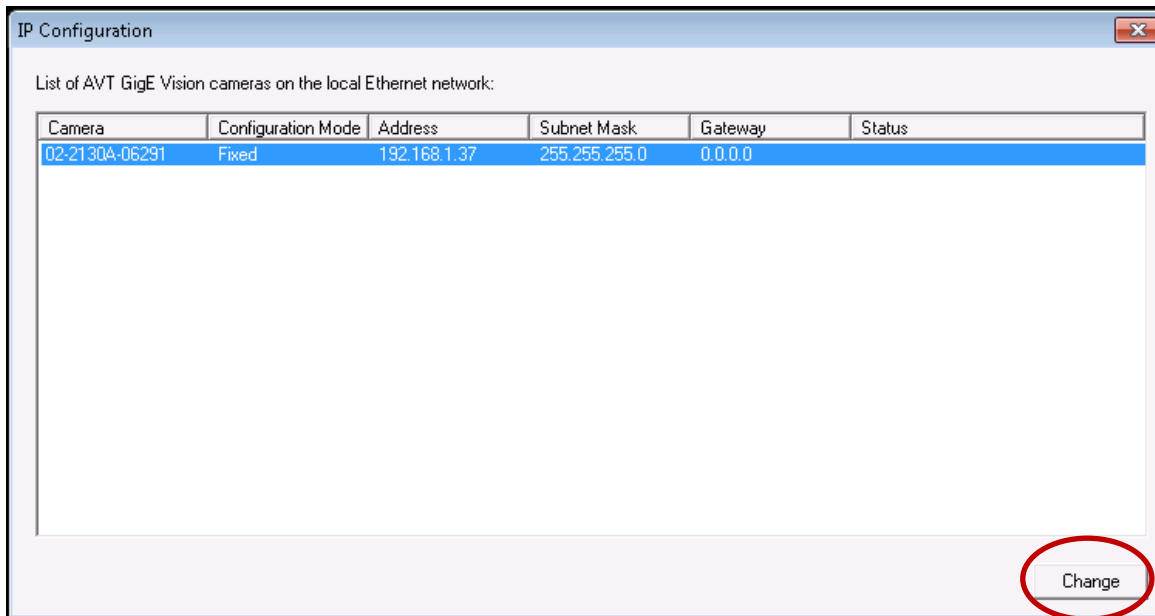
- Refer to "Camera list" to set the proper IP address (for new cameras must be 192.168.241.??? where ??? is a free number from the list)
- Subnet mask must be 255.255.255.0
- Gateway must be 0.0.0.0

S. Weisse has to be informed when the new IP is issued and the camera list is filled (in order to register the new IP in the IT department)

Preparation of the camera for the video system

- Start the IP configurator from "Start" => "All programs" => "Allied Vision Technologies" => "SampleViewer (64 bit)"
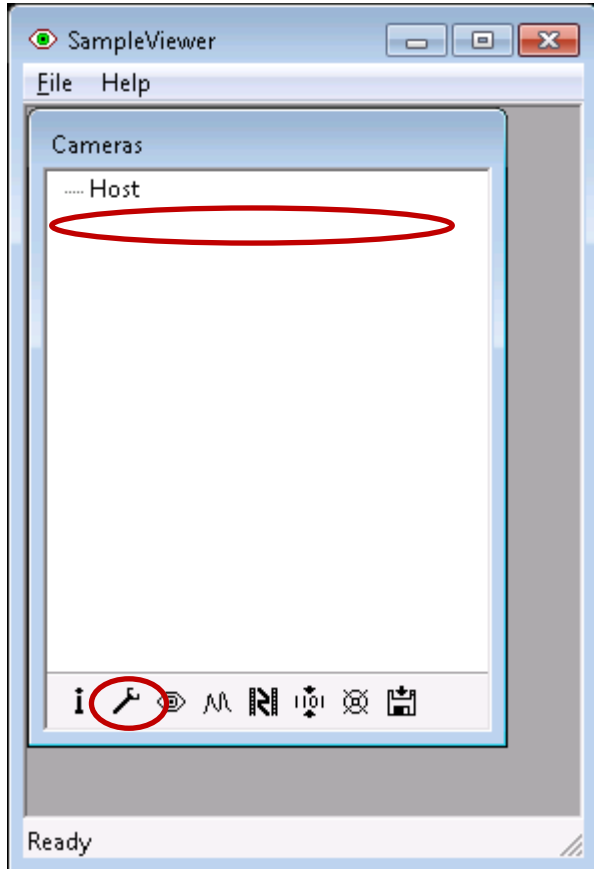
- In the opened window choose the connected camera and press the wrench button on bottom. Additional window with all camera information will be opened. Fill the required information to "Camera list".
- Close the tool when you are done in order to release connection to the camera.

* At the moment I have no possibility to connect the camera, but the newly opened window with camera properties is simple and intuitive

# Camera list: Complete_Cameralist.xls

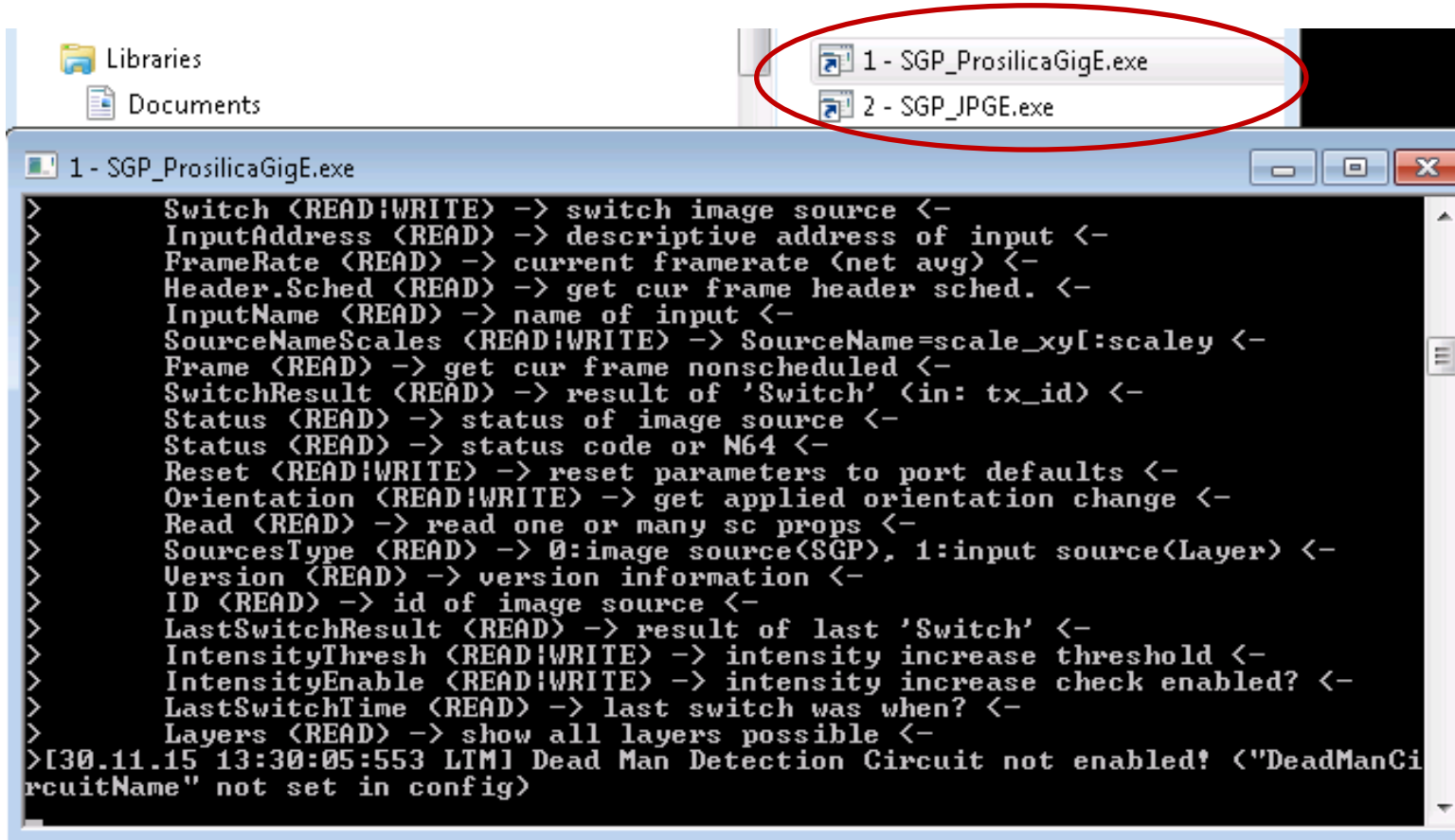|												
06/11/2015	PST.Scr3	100929	22/12/2008	02-2130A-06230	mounted	1906448	192.168.241.32	255.255.255.0	0.0.0.0	00-0f-31-01-8a-41	GC-1350	13
06/11/2015	PST.Scr4	100930	22/12/2008	02-2130A-06231	mounted	1906415	192.168.241.43	255.255.255.0	0.0.0.0	00-0f-31-01-8a-42	GC-1350	14
09/01/2012	Control Room	34233	10/02/2009	02-2130A-06233	spare camera	1906508	192.168.241.34	255.255.255.0	0.0.0.0	00-0f-31-00-85-b9	GC-1350	16
17/11/2015	Lab	100932	10/02/2009	02-2130A-06234	only for laser tests	1906509	192.168.241.35	255.255.255.0	0.0.0.0	00-0f-31-01-8a-44	GC-1350	17
18/11/2015	1K04	102469	28/05/2009	02-2130A-06272	UV-Test	1906613	192.168.241.40	255.255.255.0	0.0.0.0	00-0f-31-01-90-45	GC-1350	21
06/11/2015	PST.Scr2	102651	28/05/2009	02-2130A-06287	mounted	1906615	192.168.241.42	255.255.255.0	0.0.0.0	00-0f-31-01-90-fb	GC-1350	23
07/10/2015	Tunnel N2	102716	28/05/2009	02-2130A-06290	defective	1906612	192.168.1.38	255.255.255.0	192.168.1.1	00-0f-31-01-91-3c	GC-1350	19
1.6.2015	Lab	102717	28/05/2009	02-2130A-06291	Only for software tests	1906610	192.168.1.37	255.255.255.0	0.0.0.0	00-0f-31-01-91-3d	GC-1350	18
06/11/2015	PST.Scr5	102718	28/05/2009	02-2130A-06292	mounted	1906614	192.168.241.41	255.255.255.0	0.0.0.0	00-0f-31-01-91-3e	GC-1350	22
09.07.2015	A.Oppelt	102739	28/05/2009	02-2130A-06295	only for laser tests	1906611	192.168.1.39	255.255.255.0	0.0.0.0	00-0f-31-01-91-53	GC-1350	20
09.07.2015	A.Oppelt	114637	21/01/2011	02-2130A-06704	Zum Verschrotten	1907277	192.168.1.45	255.255.255.0	192.168.1.1	00-0f-31-01-bf-cd	GC-1350	25
12/05/2015	Low.Scr1	115291	20/12/2010	02-2130A-06746	mounted	1904262	192.168.241.44	255.255.255.0	0.0.0.0	00-0f-31-01-c2-5b	GC-1350	24
09/11/2015	Lab	118685	21/01/2011	02-2130A-06882	probably defective, to be tested	1907270	192.168.241.46	255.255.255.0	0.0.0.0	00-0f-31-01-cf-9d	GC-1350	26
06/11/2015	PST.Scr1_YAG	118686	21/01/2011	02-2130A-06883	mounted	1907098	192.168.241.47	255.255.255.0	0.0.0.0	00-0f-31-01-cf-9e	GC-1350	27
18/11/2015	1K04	119814	21/01/2011	02-2130A-06890	for laser tests only	1907273	192.168.241.48	255.255.255.0	0.0.0.0	00-0f-31-01-d4-06	GC-1350	28
06/11/2015	Low.Scr2	119817	21/01/2011	02-2130A-06893	mounted	1907272	192.168.241.49	255.255.255.0	0.0.0.0	00-0f-31-01-d4-09	GC-1350	29
04/11/2015	High1.Scr5	127389	15/12/2011	02-2130		1907447	192.168.241.55	255.255.255.0	0.0.0.0	00-0f-31-01-f1-9d	GC-1350	30
09.07.2015	Lab	127390	15/12/2011	02-2130		1907448	192.168.241.56	255.255.255.0	0.0.0.0	00-0f-31-01-f1-9e	GC-1350	31
09.07.2015	A.Oppelt	129140	15/12/2011	02-2130		1907450	192.168.1.57	255.255.255.0	192.168.1.1	00-0f-31-01-f8-74	GC-1350	32
07/10/2015	Tunnel N2	129141	15/12/2011	02-2130A-17131	defective	1907451	192.168.1.58	255.255.255.0	192.168.1.1	00-0f-31-01-f8-75	GC-1350	33
06/11/2015	HIGH1.Scr2	129142	15/12/2011	02-2130A-17132	mounted	1907449	192.168.241.59	255.255.255.0	0.0.0.0	00-0f-31-01-f8-76	GC-1350	34
06/11/2015	High1.Scr4	129143	15/12/2011	02-2130A-17133	mounted	1907438	192.168.241.60	255.255.255.0	0.0.0.0	00-0f-31-01-f8-77	GC-1350	35
06/11/2015	Disp3.Scr1_c1	129144	15/12/2011	02-2130A-17134	mounted	1907439	192.168.241.61	255.255.255.0	0.0.0.0	00-0f-31-01-f8-78	GC-1350	36
07/02/2012	M.Sachwitz	129145	15/12/2011	02-2130A-17135	ready for use	1907440	192.168.1.62	255.255.255.0	192.168.1.1	00-0f-31-01-f8-79	GC-1350	37
06/11/2015	Disp2.Scr1	129146	15/12/2011	02-2130A-17136	mounted	1907441	192.168.241.63	255.255.255.0	0.0.0.0	00-0f-31-01-f8-7a	GC-1350	38
09/11/2015	Lab	129147	15/12/2011	02-2130A-17137	ready for use	1907442	192.168.241.64	255.255.255.0	0.0.0.0	00-0f-31-01-f8-7b	GC-1350	39
06/11/2015	High2.Scr2	129148	15/12/2011	02-2130A-17138	mounted	1907443	192.168.241.65	255.255.255.0	0.0.0.0	00-0f-31-01-f8-7C	GC-1350	40
06/11/2015	Disp1.Scr1	129149	15/12/2011	02-2130A-17139	mounted	1907444	192.168.241.66	255.255.255.0	0.0.0.0	00-0f-31-01-f8-7D	GC-1350	41
06/11/2015	High1.Scr1	129150	15/12/2011	02-2130A-17140	mounted	1907445	192.168.241.67	255.255.255.0	0.0.0.0	00-0f-31-01-f8-7e	GC-1350	42
06/11/2015	Low.Scr3	129151	15/12/2011	02-2130A-17141	mounted	1907446	192.168.241.68	255.255.255.0	0.0.0.0	00-0f-31-01-f8-7F	GC-1350	43
12/02/2015	Laser 1K05	170922	end of 2014	02-2130A-38143	ready for use	1908237	192.168.241.69	255.255.255.0	0.0.0.0	00-0f-31-02-9B-AA	GC-1350	44
17/03/2015	Laser 1K05	170923	end of 2014	02-2130A-38144	ready for use	1908238	192.168.241.70	255.255.255.0	0.0.0.0	00-0f-31-02-9B-AB	GC-1350	45
19/11/2015	1L18	182634	16/11/2015	02-2130A-17736	ready for use	1908396	192.168.241.72	255.255.255.0	0.0.0.0	00-0F-31-02-C9-6A	GC-1350	46
19/11/2015	1L18	182635	16/11/2015	02-2130A-17737	ready for use	1908397	192.168.241.73	255.255.255.0	0.0.0.0	00-0F-31-02-C9-6B	GC-1350	47
19/11/2015	1L18	182636	16/11/2015	02-2130A-17738	ready for use	1908398	192.168.241.74	255.255.255.0	0.0.0.0	00-0F-31-02-C9-6C	GC-1350	48
19/11/2015	1L18	182637	16/11/2015	02-2130A-17739	ready for use	1908399	192.168.241.75	255.255.255.0	0.0.0.0	00-0F-31-02-C9-6D	GC-1350	49
19/11/2015	1L18	182638	16/11/2015	02-2130A-17740	ready for use	1908400	192.168.241.76	255.255.255.0	0.0.0.0	00-0F-31-02-C9-6E	GC-1350	50
19/11/2015	1L18	182639	16/11/2015	02-2130A-17741	ready for use	1908401	192.168.241.77	255.255.255.0	0.0.0.0	00-0F-31-02-C9-6F	GC-1350	51
19/11/2015	1L18	182640	16/11/2015	02-2130A-17742	ready for use	1908402	192.168.241.78	255.255.255.0	0.0.0.0	00-0F-31-02-C9-70	GC-1350	52
19/11/2015	1L18	182641	16/11/2015	02-2130A-17743	ready for use	1908403	192.168.241.79	255.255.255.0	0.0.0.0	00-0F-31-02-C9-71	GC-1350	53

Preparation of the camera for the video system

- Open the folder with video system tools placed on the Desktop
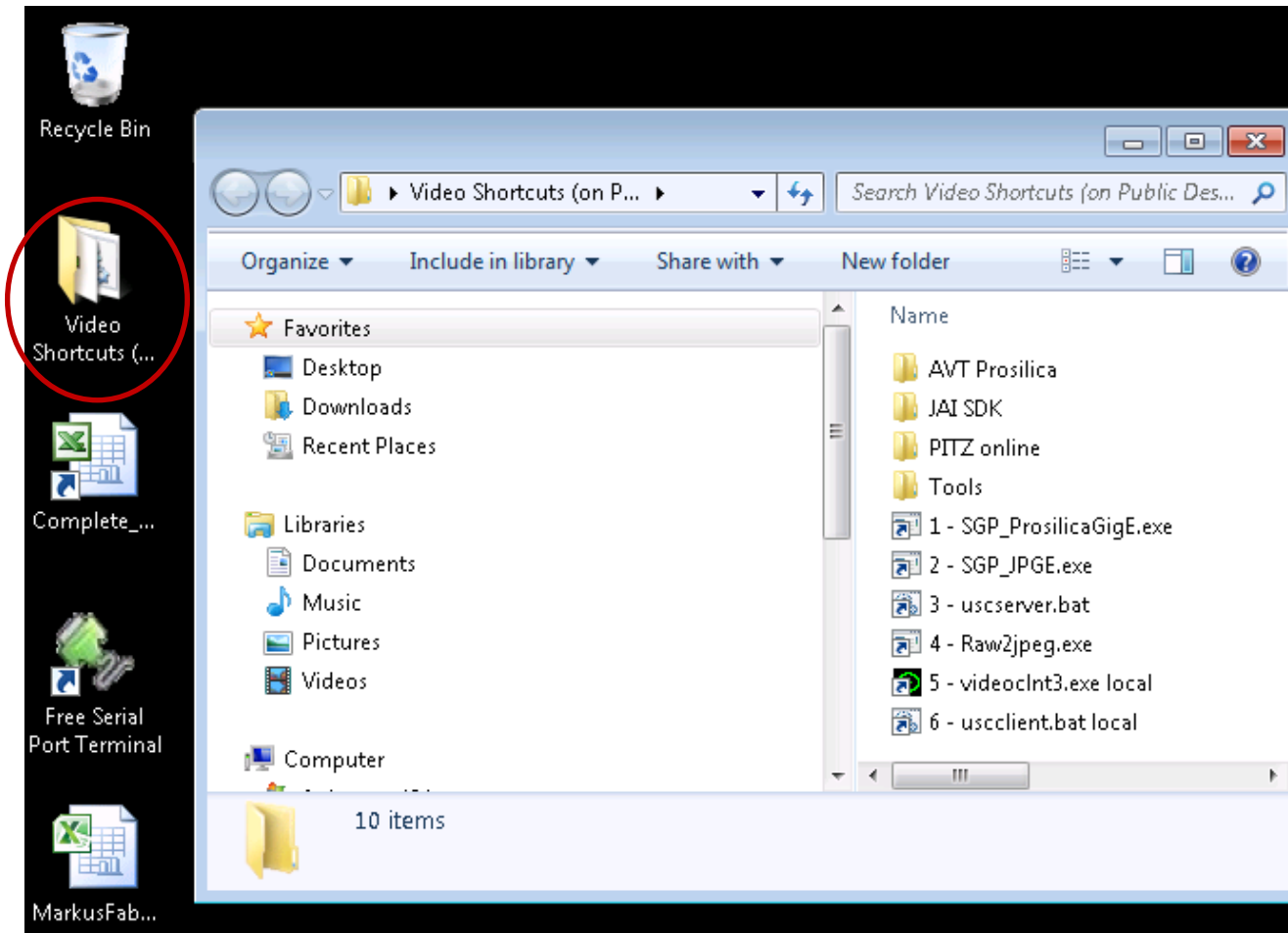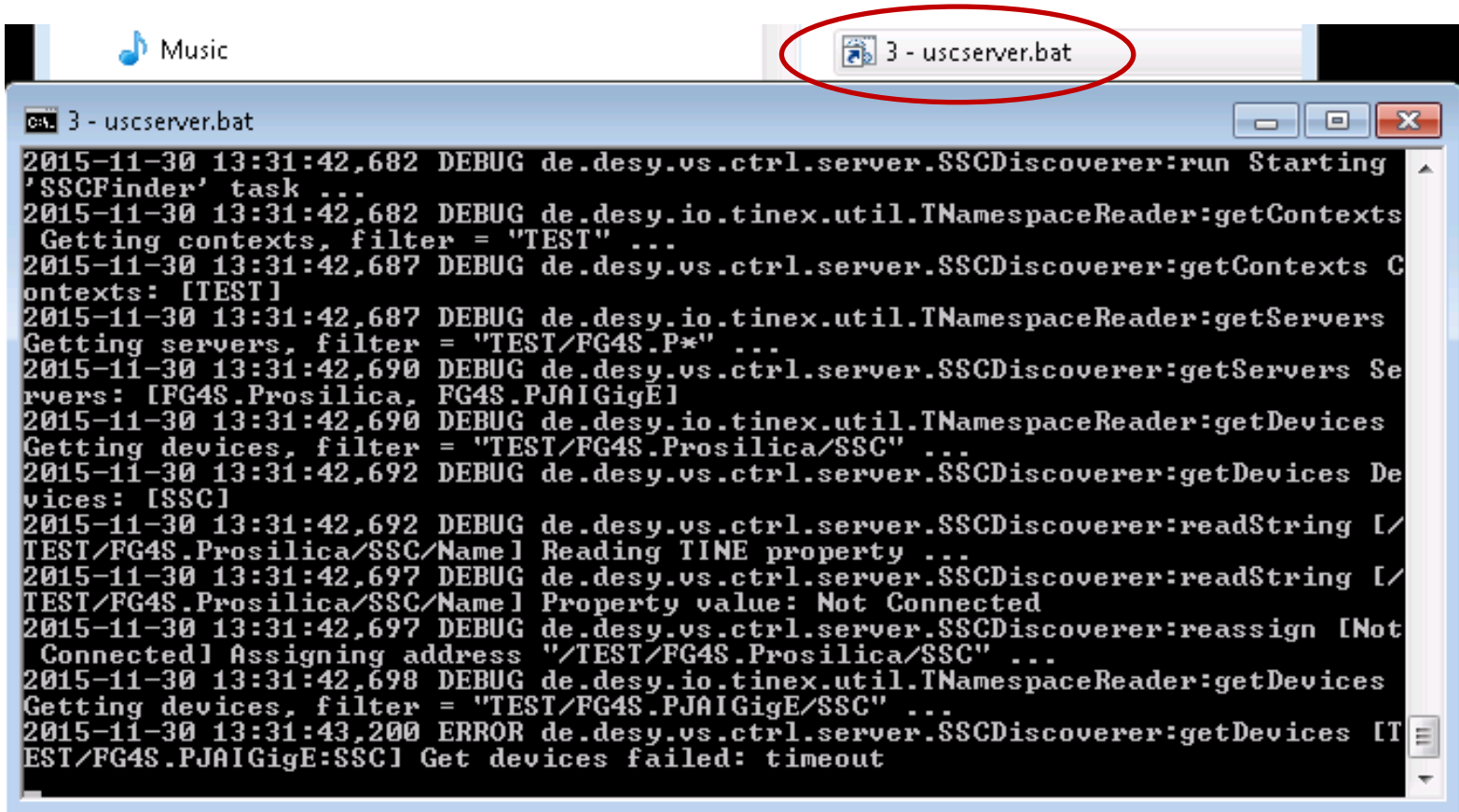
- Run "1 – SGP_ProsilicaGigE.exe" to start video system server (for JAI cameras run "2 – SGP_JPGE.exe")

Preparation of the camera for the video system

- Run "3 – uscserver.bat" to start universal slow control server which allows to control camera properties like gain and exposure time
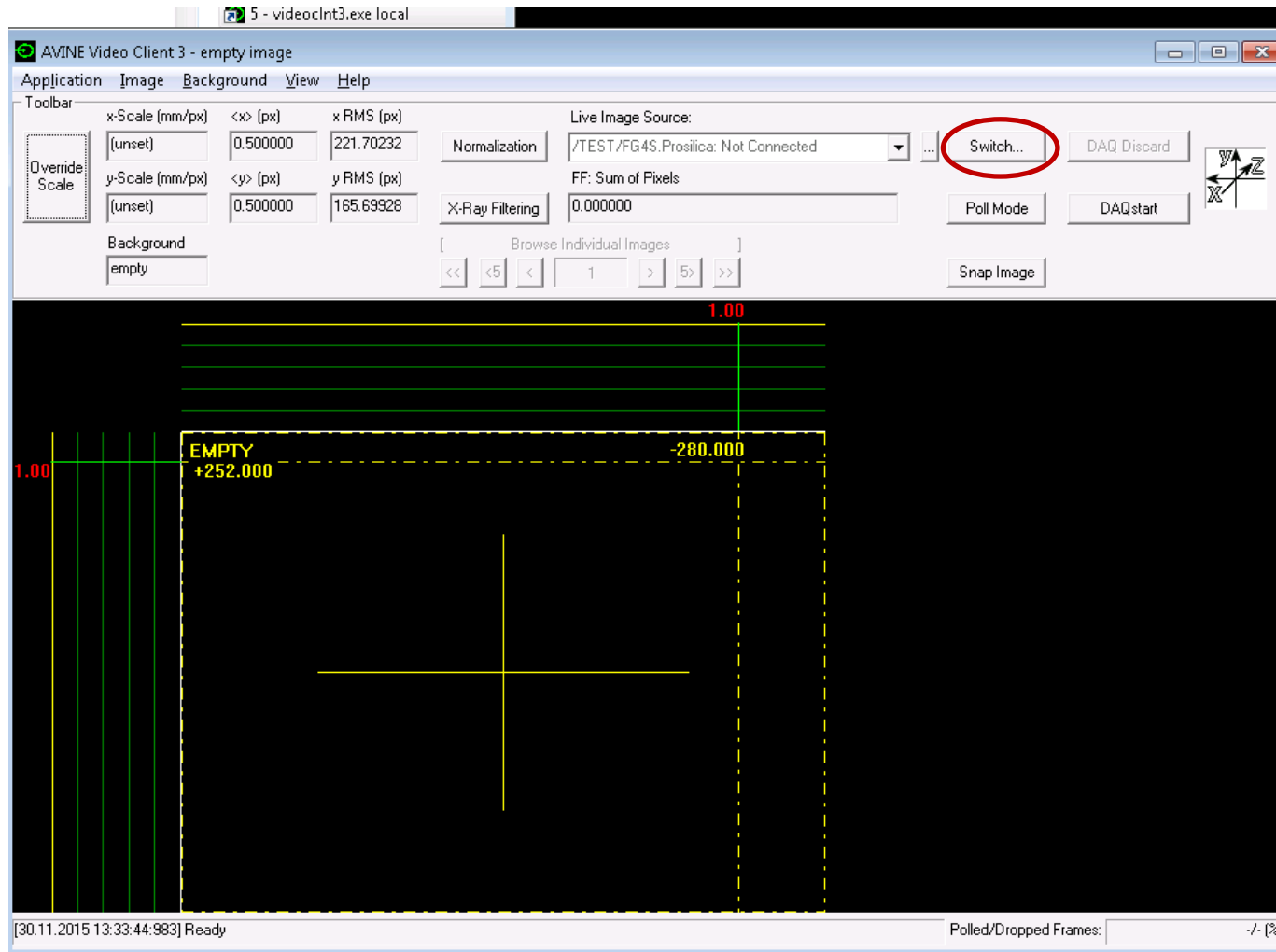
- Run "5 – videoclnt3.exe local" to start video client. Press "Switch…" button in order to change the camera connection mode.
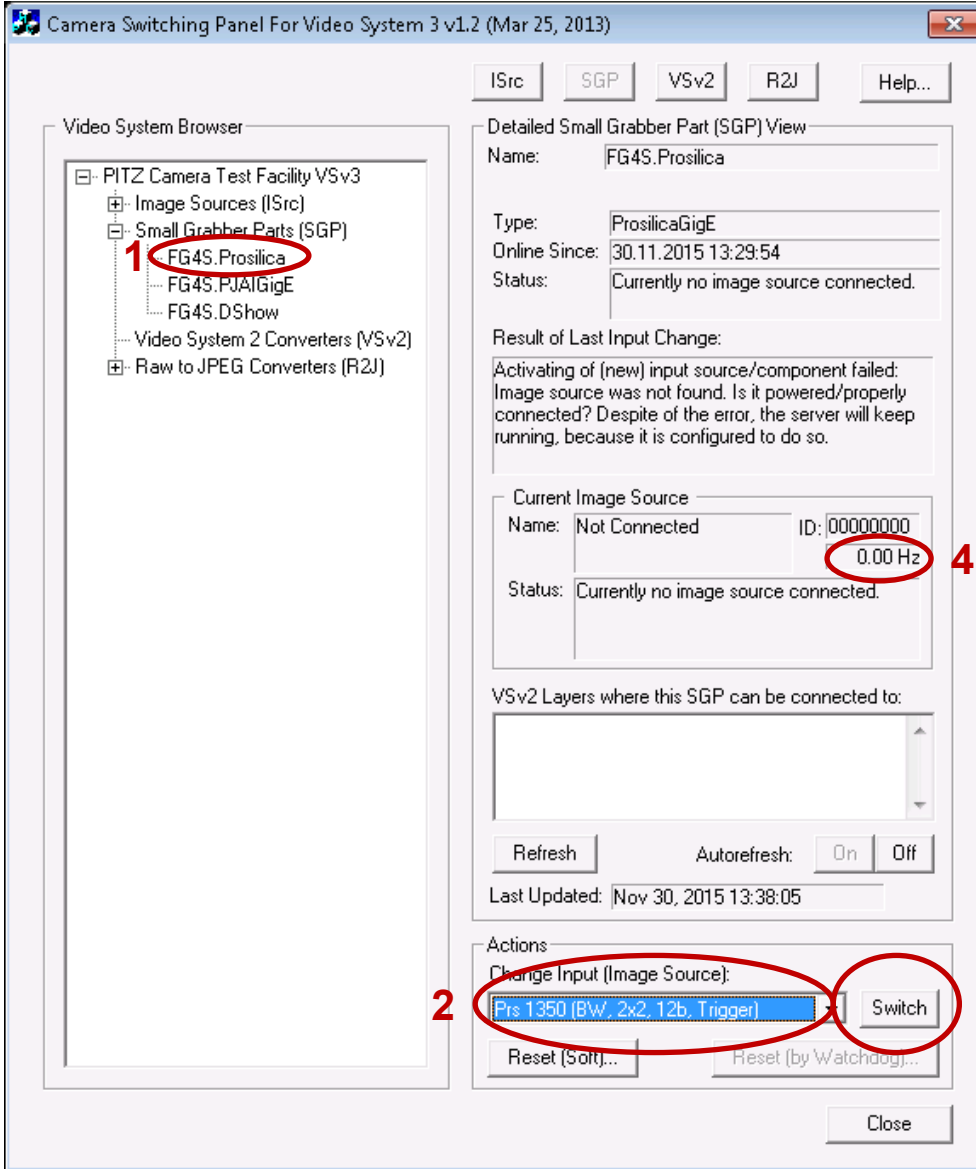
- Choose Prosilica camera in triggered mode and press switch button. Camera frame rate has to ramp to 10 Hz within several seconds (not a case on the presented snapshot)

- Run "5 – uscclient.bat local" to start USC client. Choose the corresponding camera from the list

First tests

- Check the picture quality attaching some telescope lens from the shelve.
- Check that camera runs stable (stable frame rate, no dropped frames)
- Check for adequate reaction of the camera on the change of its gain and exposure time
- Leave the camera for approximately 30 minutes to heat up and repeat the tests
- Close the camera cap and save so-called black frames for fixed to 10 us exposure time and different camera gains from 0 to 24 dB in step of 2 or 4 (required for camera noise analysis)
- Use "caman" tool to evaluate the camera noise pattern quality and compare it to other cameras. See next slide for details.

Black frames analysis

- Black frames must be saved in advance to the proper location:
  /doocs/measure/Cameras/Tests/YYYY/YYYYddMM/Camera-Serial-Number

```
[ 15-11-30 16:07   wgs13 ] /doocs/measure/Cameras/Tests/2015/20151120 $ ll
total 31
drwxrwx--- 2 gryvash  pitz   2048 Nov 25 16:44 02-2130A-17736
drwxrwx--- 2 gryvash  pitz   2048 Nov 25 16:47 02-2130A-17737
drwxrwx--- 2 gryvash  pitz   2048 Nov 25 16:51 02-2130A-17738
drwxrwx--- 2 gryvash  pitz   2048 Nov 25 17:06 02-2130A-17739
drwxrwx--- 2 gryvash  pitz   2048 Nov 26 12:05 02-2130A-17740
drwxrwx--- 2 gryvash  pitz   2048 Nov 26 12:10 02-2130A-17741
drwxrwx--- 2 gryvash  pitz   2048 Nov 26 12:14 02-2130A-17742
drwxrwx--- 2 gryvash  pitz   2048 Nov 26 12:18 02-2130A-17743
drwxrwx--- 2 gryvash  pitz   2048 Nov 26 12:22 02-2130A-17744
drwxrwx--- 2 gryvash  pitz   2048 Nov 26 12:29 02-2130A-17745
-rw-rw-rw- 1 zhaoquan pitz 10642 Nov 26 12:30 results.xlsx
[ 15-11-30 16:07   wgs13 ] /doocs/measure/Cameras/Tests/2015/20151120 $ cd 02-2130A-17736
[ 15-11-30 16:07   wgs13 ] /doocs/measure/Cameras/Tests/2015/20151120/02-2130A-17736 $ ll
total 28978
-rwxrw---- 1 gryvash pitz  696328 Nov 24 13:34 BF_10us_gain0.bkg
-rwxrw---- 1 gryvash pitz 2932974 Nov 24 13:34 BF_10us_gain0.imc
-rw-rw---- 1 gryvash pitz    8018 Nov 25 16:38 BF_10us_gain0.imc.eps
-rwxrw---- 1 gryvash pitz  696328 Nov 24 13:34 BF_10us_gain12.bkg
-rwxrw---- 1 gryvash pitz 3867502 Nov 24 13:34 BF_10us_gain12.imc
-rw-rw---- 1 gryvash pitz    9014 Nov 25 16:43 BF_10us_gain12.imc.eps
-rwxrw---- 1 gryvash pitz  696328 Nov 24 13:34 BF_10us_gain16.bkg
-rwxrw---- 1 gryvash pitz 3941225 Nov 24 13:34 BF_10us_gain16.imc
-rw-rw---- 1 gryvash pitz   10279 Nov 25 16:43 BF_10us_gain16.imc.eps
-rwxrw---- 1 gryvash pitz  696328 Nov 24 13:34 BF_10us_gain20.bkg
-rwxrw---- 1 gryvash pitz 3642567 Nov 24 13:34 BF_10us_gain20.imc
-rw-rw---- 1 gryvash pitz    9589 Nov 25 16:44 BF_10us_gain20.imc.eps
-rwxrw---- 1 gryvash pitz  696328 Nov 24 13:34 BF_10us_gain24.bkg
-rwxrw---- 1 gryvash pitz 3400895 Nov 24 13:34 BF_10us_gain24.imc
-rw-rw---- 1 gryvash pitz    9841 Nov 25 16:44 BF_10us_gain24.imc.eps
-rwxrw---- 1 gryvash pitz  696328 Nov 24 13:34 BF_10us_gain4.bkg
-rwxrw---- 1 gryvash pitz 3305676 Nov 24 13:34 BF_10us_gain4.imc
-rw-rw---- 1 gryvash pitz    8183 Nov 25 16:42 BF_10us_gain4.imc.eps
-rwxrw---- 1 gryvash pitz  696328 Nov 24 13:34 BF_10us_gain8.bkg
-rwxrw---- 1 gryvash pitz 3630101 Nov 24 13:34 BF_10us_gain8.imc
-rw-rw---- 1 gryvash pitz    9170 Nov 25 16:43 BF_10us_gain8.imc.eps
[ 15-11-30 16:07   wgs13 ] /doocs/measure/Cameras/Tests/2015/20151120/02-2130A-17736 $
```
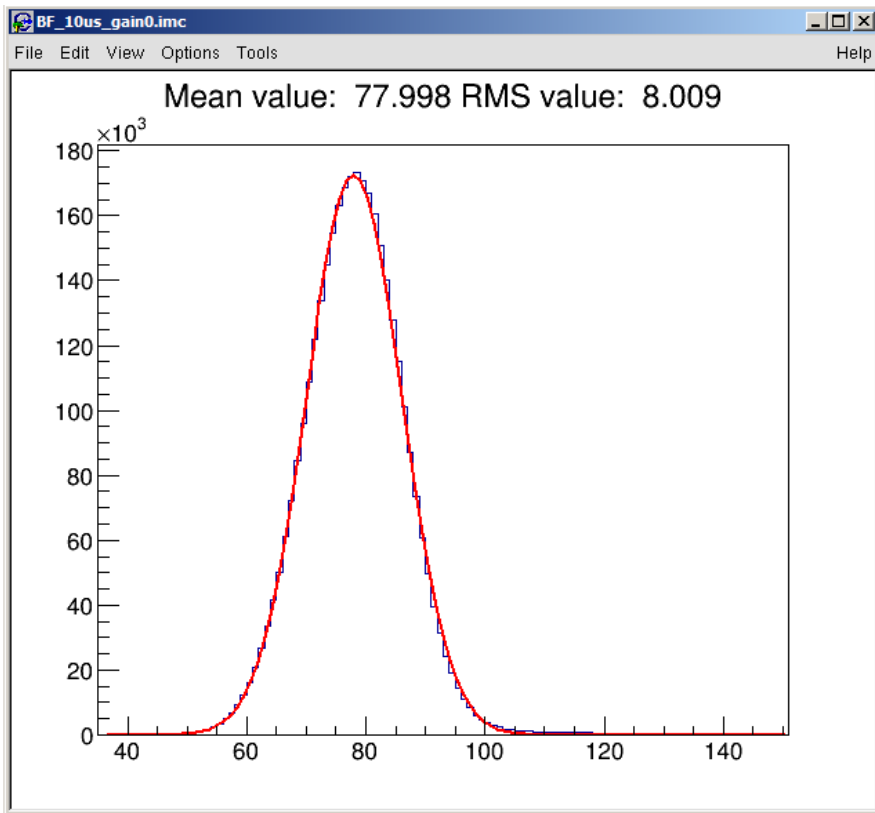
caman – how to use:

- Go to any of PITZ workgroup servers
- Execute the following command in the shell: "module add devtoolset/2" – it will invoke the newer C++ compiler and libraries. The tool is compiled using gcc 4.8.2 20140120 and CERN ROOT 6.02. In general tool will start even with an old compiler but will produce a lot of warnings during the work.
- Go to the directory with saved files, e.g. /doocs/measure/Cameras/Tests/2015/20151120/02-2130A-17736
- Execute the following command: "caman filename.imc". See example on the next slide.

Warnings produced without devtoolset/2:


```
[pi4-vm1] /doocs/measure/Cameras/Tests/2015/20151120/02-2130A-17736 % caman BF_10us_gain0.imc
cc1plus: error: unrecognized command line option "-std=c++11"
cc1plus: error: unrecognized command line option "-std=c++11"
cc1plus: warning: unrecognized command line option "-Wno-maybe-uninitialized"
Warning in cling::CIFactory::createCI():
  Possible C++ standard library mismatch, compiled with __GLIBCXX__ v20140120 but extraction of runtime stan
Invoking:
    echo '#include <vector>' | c++ -pipe -m64 -Wall -W -Woverloaded-virtual -fPIC -pthread -std=c++11 -Wno-
Wno-comment -std=c++11 -ffunction-sections -fdata-sections -fno-common -Woverloaded-virtual -Wcast-qual -fno
results in
cc1plus: error: unrecognized command line option "-std=c++11"
cc1plus: error: unrecognized command line option "-std=c++11"
cc1plus: warning: unrecognized command line option "-Wno-maybe-uninitialized"
with exit code 0
BF_10us_gain0.imc is loaded
```

caman

Mean value: 77.998 RMS value: 8.009

- caman produces some output to the shell:
  - Effective BPP of the camera
  - Height of the camera in pixels
  - Width of the casmera in pixels
  - Number of frames in the loaded file
  - Gaussian fit parameters applied to the noise histogram
- caman will display the histogram of the noise distribution together with a Gaussian fit
- caman will save the displayed figure as eps file for further usage
- To exit the program just close the figure

Histogram represents the distribution of values of all pixels over all frames.