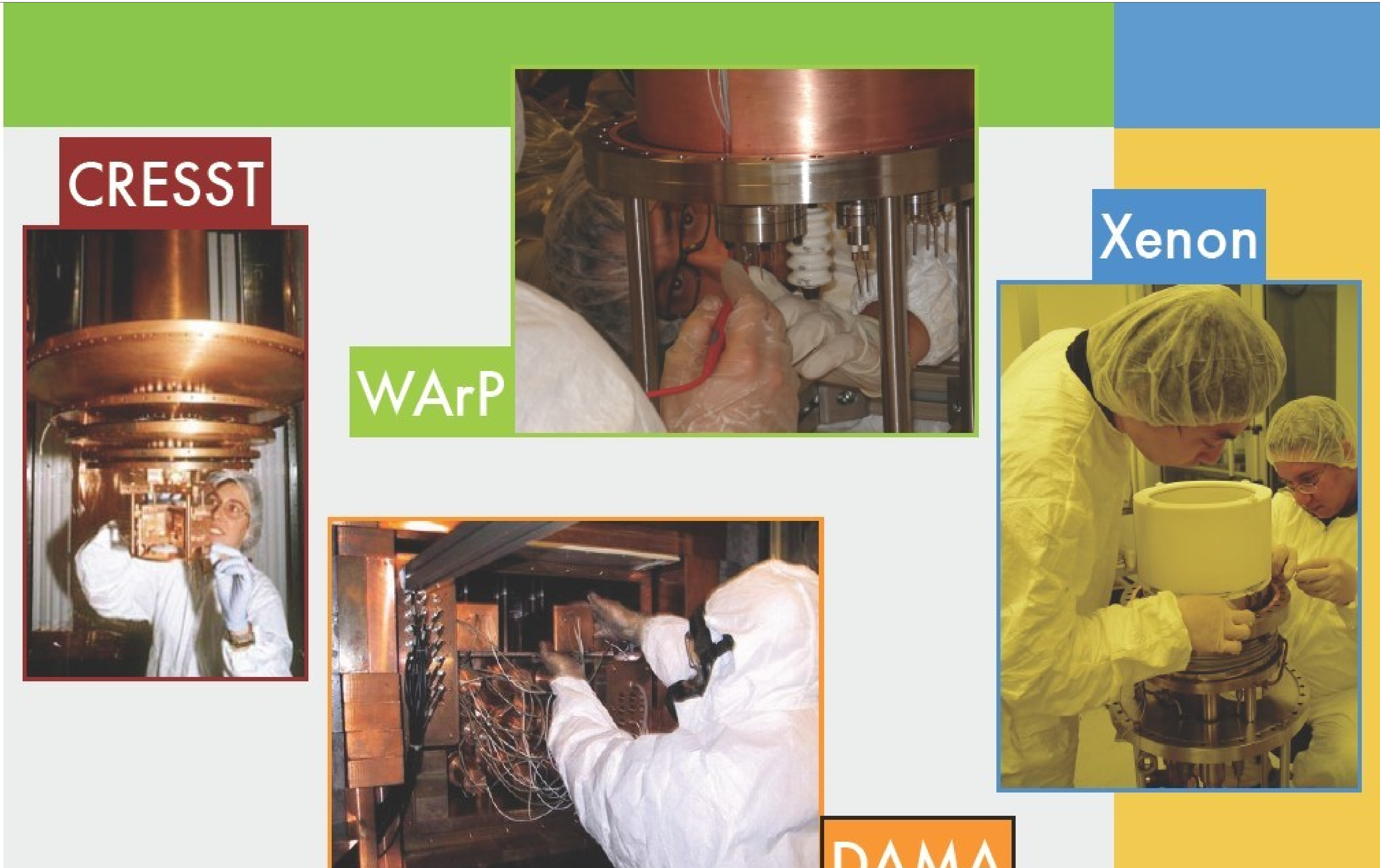
WARP DATABASE ORGANIZATION

Natalia Deniskina
Naples University "Federico II", INFN


World Wide Dark Matter Searches
Yangyang
KIMS
Homestake
LUX
SNOLAB
DEAP/CLEAN
PICASSO
Boulby
ZEPLIN
DRIFT
Kamioka
XMASS
Soudan
CDMS
Frejus/
Modane
EDELWEISS
Canfranc
ANAIS
NEXT
ArDM
Gran Sasso
CRESST
DAMA/LIBRA
WARP
XENON

Dark matter search, GranSasso



LNGS, Naples

What are we searching for?

Dark matter in the form of elementary particles:

- *not barionic (from nucleosynthesis);*
- *neutral (not interact electromagnetically);*
- *stable;*
- *cold*

We search WIMP weakly interacting massive particle that has all these characteristics

How are we searching WIMPs?

Dark matter & LAr

Direct detection of Dark Matter with noble gases liquified as target medium is one of the most promising line of development in experimental technology.

A particle interacting in noble liquid produce both atomic excitation and ionization inducing the emission of scintillation light.

Simultaneous measurements of free electron charge and light is at the basis of a strong discrimination power

Argon is an ideal medium for Dark Matter search and the feasibility of Ar-based detectors has been firmly proved by the WArP Collaboration [*Astropart. Phys. 28 (2008), 495*].

Why noble liquids?

- High scintillation Yield
- Simultaneous measurement of scintillation and ionization (particle discrimination)
- Potentiality to be extended to multi-ton volumes

Scintillator	NaI(Tl)	Liquid Argon	Liquid Xenon
Photon Yield [ph/MeV]	4.3×10^4	4.0×10^4	4.2×10^4
Fast Decay Time [ns]	-	6	2.2
Slow Decay Time [ns]	250	1200-1500	27

Why liquid Argon?

- Scintillation decay times very different ($\tau_f \approx 6$ ns , $\tau_s \approx 1200\text{-}1500$ ns) → Two independent discrimination tech. very efficient background reduction!
- Argon Technology fully operational
- Easily available (1% of atmosphere) → low cost

The WARP detection technique

"Identification of the nature of a particle interacting within a double phase Argon detector by means of the simultaneous measurement of the produced scintillation and ionization" **(WARP Letter of Intent 1999)**

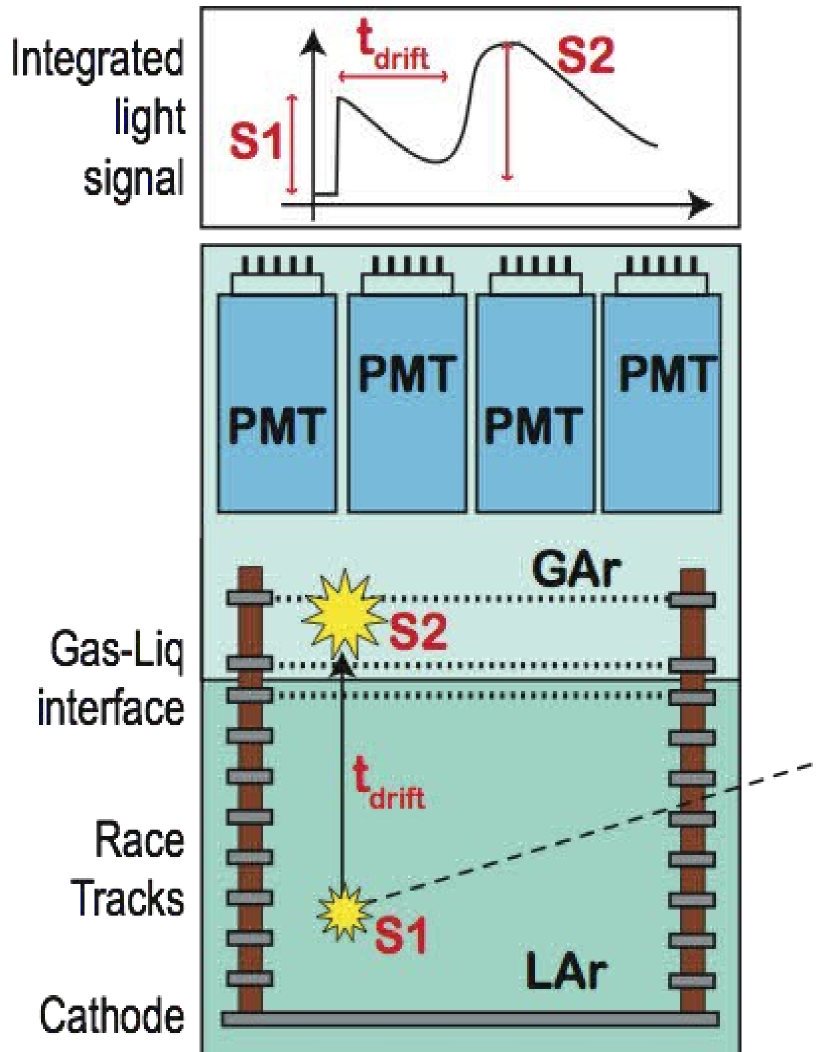
In liquid Argon for energy depositions in the range of interest for Dark Matter searches (20-100 keV) we have that

- the amplitude of the first signal (S1)
- the pulse shape of the first signal (S1)
- the amount of free electrons that drift toward the multiplication grids (S2)

strongly depend on the nature of the ionizing particle (Ar recoil, electron, heavy ion, etc)

⇓

These quantities can be used to characterize



So, we have the DATA.....

Data of WARP

1) experimental data of 100L detector;
2) experimental data of prototypes detectors;
3) Monte Carlo data;
4) PMT previous test data (Naples);
5) PMT manufacture data.

LNGS WARP Data

Event rate and size

*The main issue concerning data acquisition and storage is represented by the intrinsic radioactivity of Ar due to the 39Ar isotope. 39Ar undergo beta decay with an electron endpoint energy of 565 keV (mean electron energy is 219.8 keV). The specific activity of commercial grade lAr has been measured by the WARP collaboration to be **1 Bq/kg**. The expected event rate induced by 39Ar is thus expected to be **140 Hz.***

*The WARP detector is designed to discriminate between electrons and nuclear recoils with very high efficiency and it has been demonstrated that a smart data acquisition (digitizers + FPGA) could easily achieve an overall online rejection power for electron-like events **of about 98%**. The remaining 2% of events cannot be rejected by the online system and a more careful analysis must be performed in order to establish a possible DM signature. **Summarizing, the total event rate is estimated to be of 3 Hz.***

*The WARP inner volume is instrumented with 31 3" and 6 2" PMTs, for a **total of 37 readout channels.** The event is composed by 2 parts, **a prompt scintillation signal (S1)** followed by electron induced **scintillation in the gaseous phase (S2)**; the latter is delayed in time due to the time needed by primary ionization electrons to reach the multiplication grids (due to the inner detector geometry the maximum drift time is of about 400 μs).*

High speed digitizers (8 bits ADC @ 1Gs/s) acquire 15 μs for each of the two signals. The amount of data per PMT for one event is thus 30 μs × 1Gs/s × 1 byte/sample = 30000 bytes/PMT ev. This gives for 37 PMTs a total of 1 Mbyte/ev.

*It is reasonable to assume that a conservative 2:1 compression factor can be obtained by the online system itself by use of both zero suppression and an efficient bit packing algorithm. In the following we assume **0.5 Mbytes for one full event.***

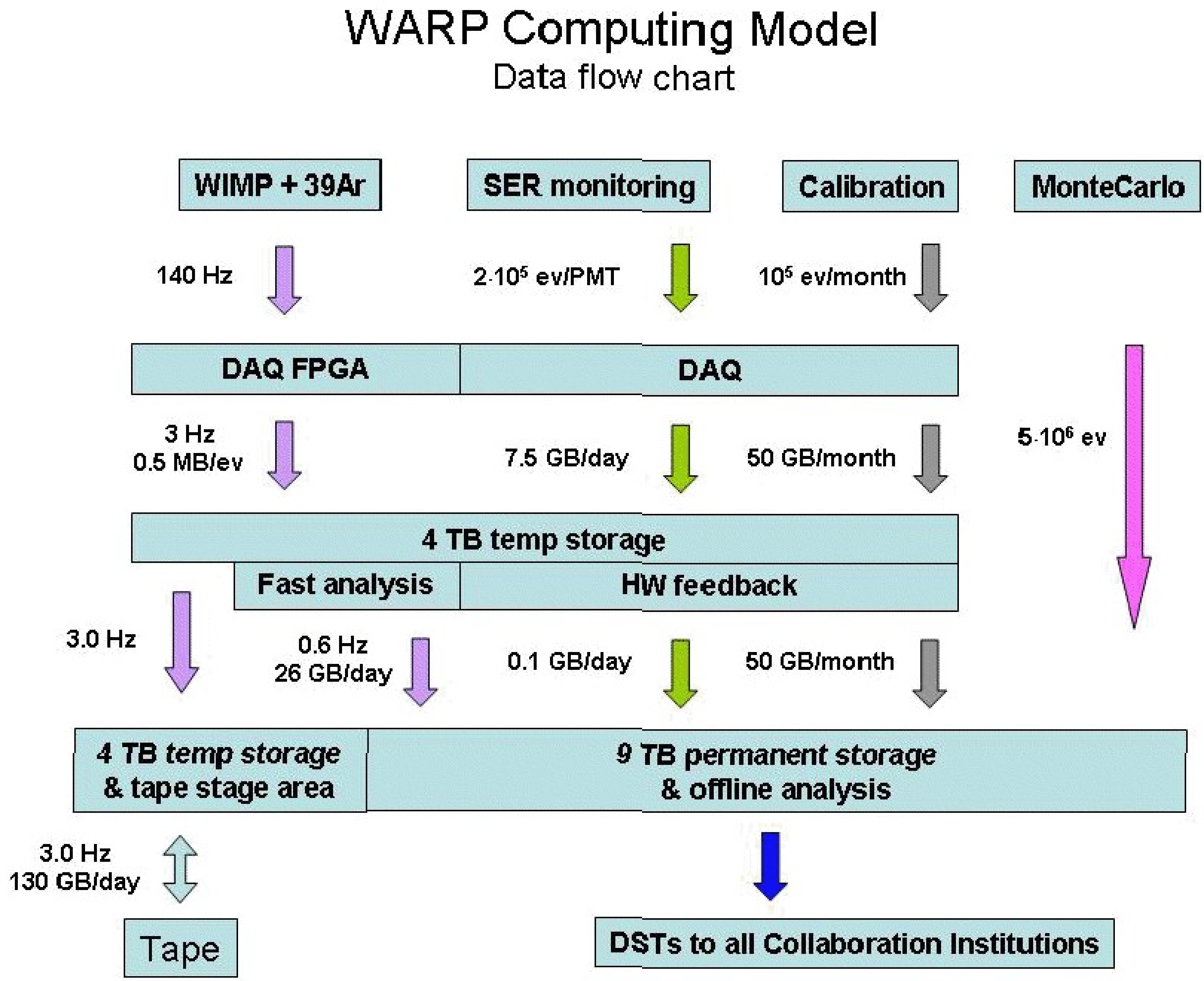

WARP Computing Model
Data flow chart
WIMP + 39Ar
SER monitoring
Calibration
MonteCarlo
140 Hz
2·10^5 ev/PMT
10^5 ev/month
DAQ FPGA
DAQ
3 Hz
0.5 MB/ev
7.5 GB/day
50 GB/month
5·10^6 ev
4 TB temp storage
Fast analysis
HW feedback
3.0 Hz
0.6 Hz
26 GB/day
0.1 GB/day
50 GB/month
4 TB temp storage
& tape stage area
9 TB permanent storage
& offline analysis
3.0 Hz
130 GB/day
Tape
DSTs to all Collaboration Institutions

Figure 1

1) **Underground: temporary storage and fast background rejection**

Given the 3 Hz event rate the total DAQ data throughput is of 130 GBytes/day. These events need to be stored at the detector location and a disk space buffer of 1.5 TBytes is required in order to face possible communication problems (up to 10 days) between underground and external labs (not less than 4 TBytes for safety reasons). The events in this buffer will follow two streams toward the external lab: a) all raw data will be saved on tape; this corresponds to 130 GBytes/day (1.5 Mbytes/s across the underground-external lab fibre connection); b) events will be analyzed by off-line algorithms in order to extract all meaningful reconstructed variables and safely further discard electron-like events. This first analysis step could reduce the amount of data by factor of 5; this corresponds to a total of 26 GBytes/day.

2) **External lab: permanent storage and data analysis**

The space required to hold one full year of data is of 9 Tbytes (plus an additional disk space of 4 TBytes).

3) **Calibrations**

Periodic detector calibrations have to be performed both during normal data taking and by the use of radioactive sources placed inside or nearby the detector. The PMTs gain monitoring belongs to the first type and is a crucial issue for the correct behaviour of the detector. Gain monitoring can be performed during normal data taking by enabling a dedicated trigger setting; a total of 105 SER events per PMT should be acquired at least twice a day. Event size in this case is about 1 μs. This correspond to 7.5 GBytes/day; this data will be processed and stored on tape.

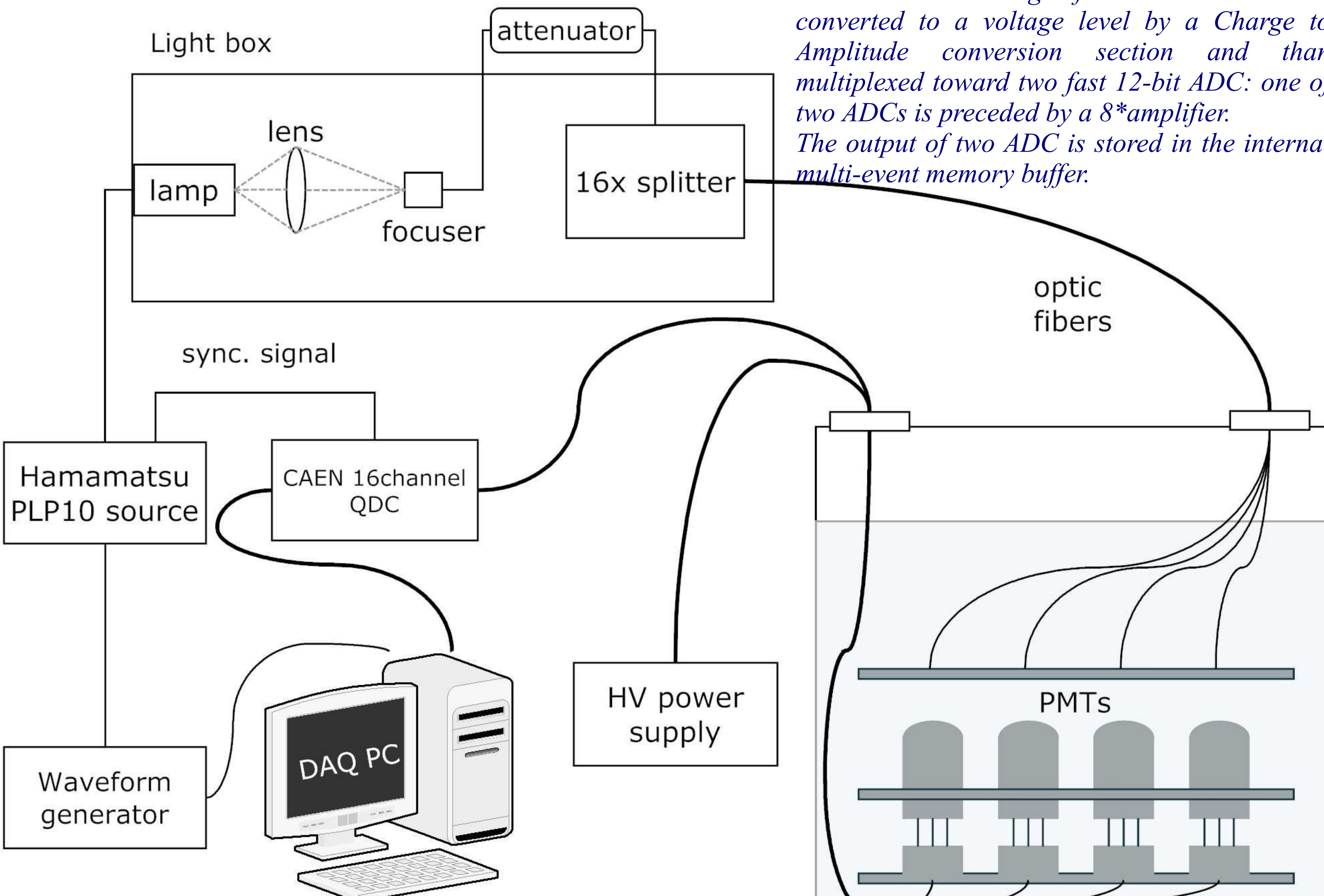
5) **MonteCarlo**

MonteCarlo event production is of crucial importance in order to evaluate selection efficiency and to tune reconstruction algorithms. For the WIMP search analysis an adequate amount of fully simulated electron-like and recoil-like events is foreseen. Due to the amount of electron-like events expected to survive online reduction a sample of at least 5·106 fully simulated MonteCarlo events is envisaged. MonteCarlo simulation is also needed for calibration performed during data taking with neutrons and radioactive sources as well as to check background induced by neutrons.

Naples test Data

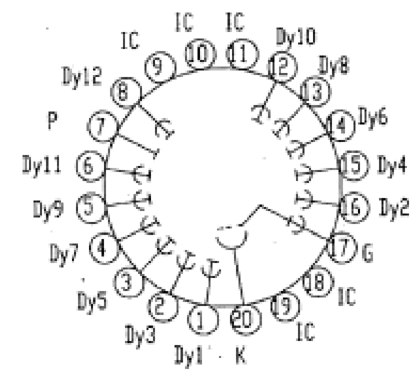
Scheme of the test

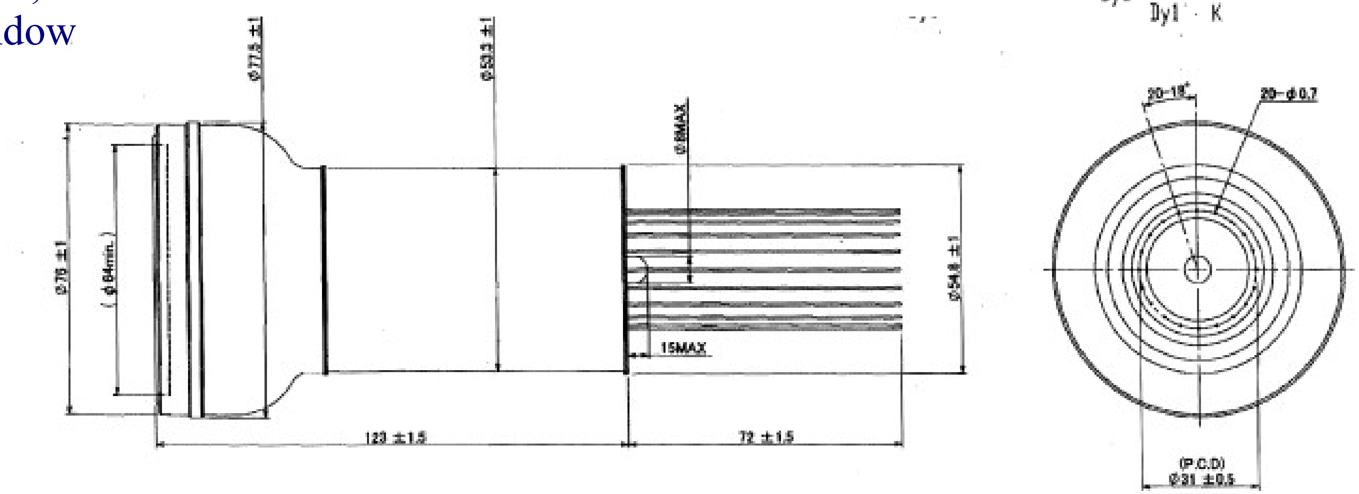
*PMT signals are directly feed into QDC (CAEN). QDC integrates the charge received in a time window defined by GATE (we used 60ns). The collected charge for each channel is converted to a voltage level by a Charge to Amplitude conversion section and than multiplexed toward two fast 12-bit ADC: one of two ADCs is preceded by a 8*amplifier.*
The output of two ADC is stored in the internal multi-event memory buffer.



R11065, Hamamatsu

Special Bialkali photocathode
 Low radioctivity (about 75mBq/PMT)
Low temperature operation down to -186'C
3 Inch
12 stage, linear focus
Synthetic Silica/Metal
Supply voltage 1750 V
Rise Time 10 ns,
quartz flat window





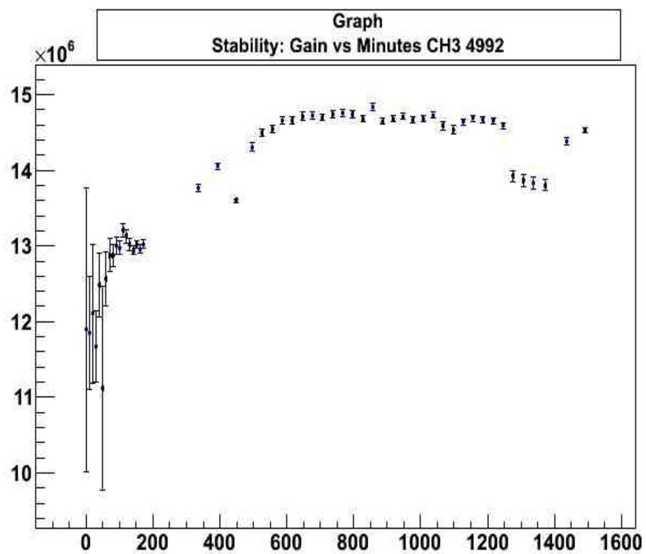
According to particular requirements to PMTs imposed by WARP experimental conditions the main objects of our test were:

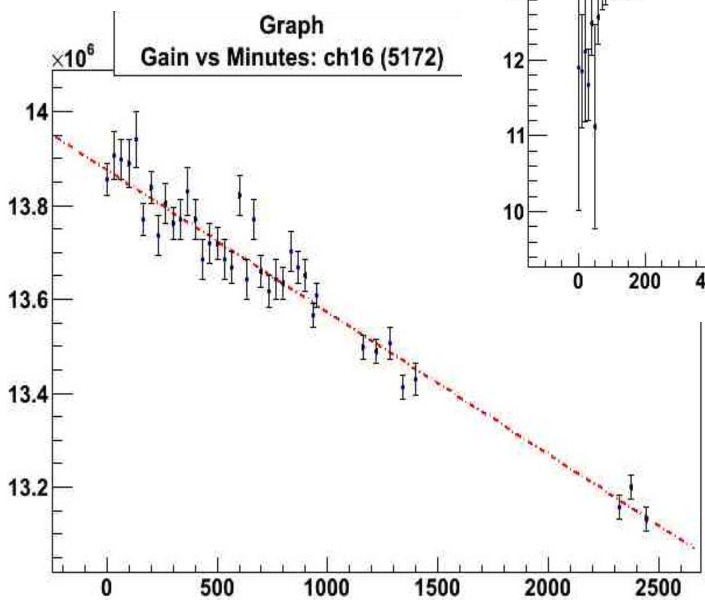
- *check of capability of thermal shock (mechanical endurance) and monitoring of long term operation stability at liquid nitrogen temperatures;*
- *study of behavior of basic characteristics (SER, gain, signal to noise ratio, charge resolution, dark spectrum and dark rate) at cryogenic temperatures.*

*Dark current rate, cold, (gain 6*10^6)*

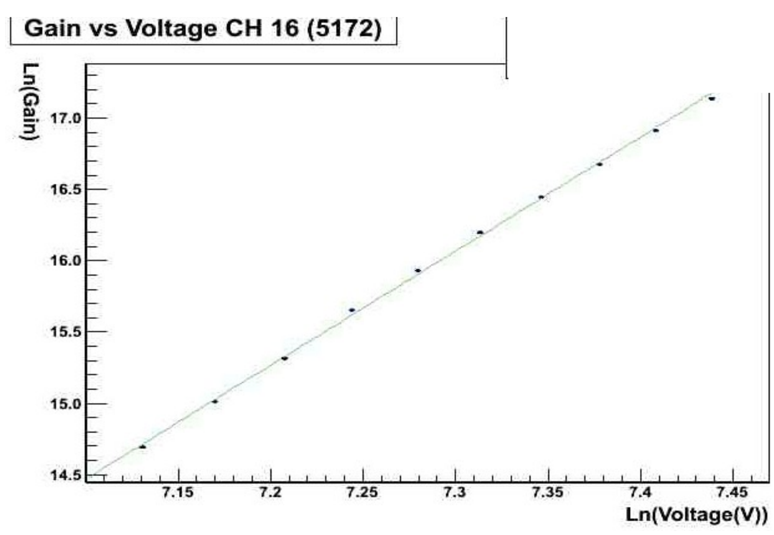
zk4992	1530V	330Hz
zk4983	1500V	389Hz
zk5006	1400V	525Hz
zk5172	1530V	500Hz

Stability in "cold"





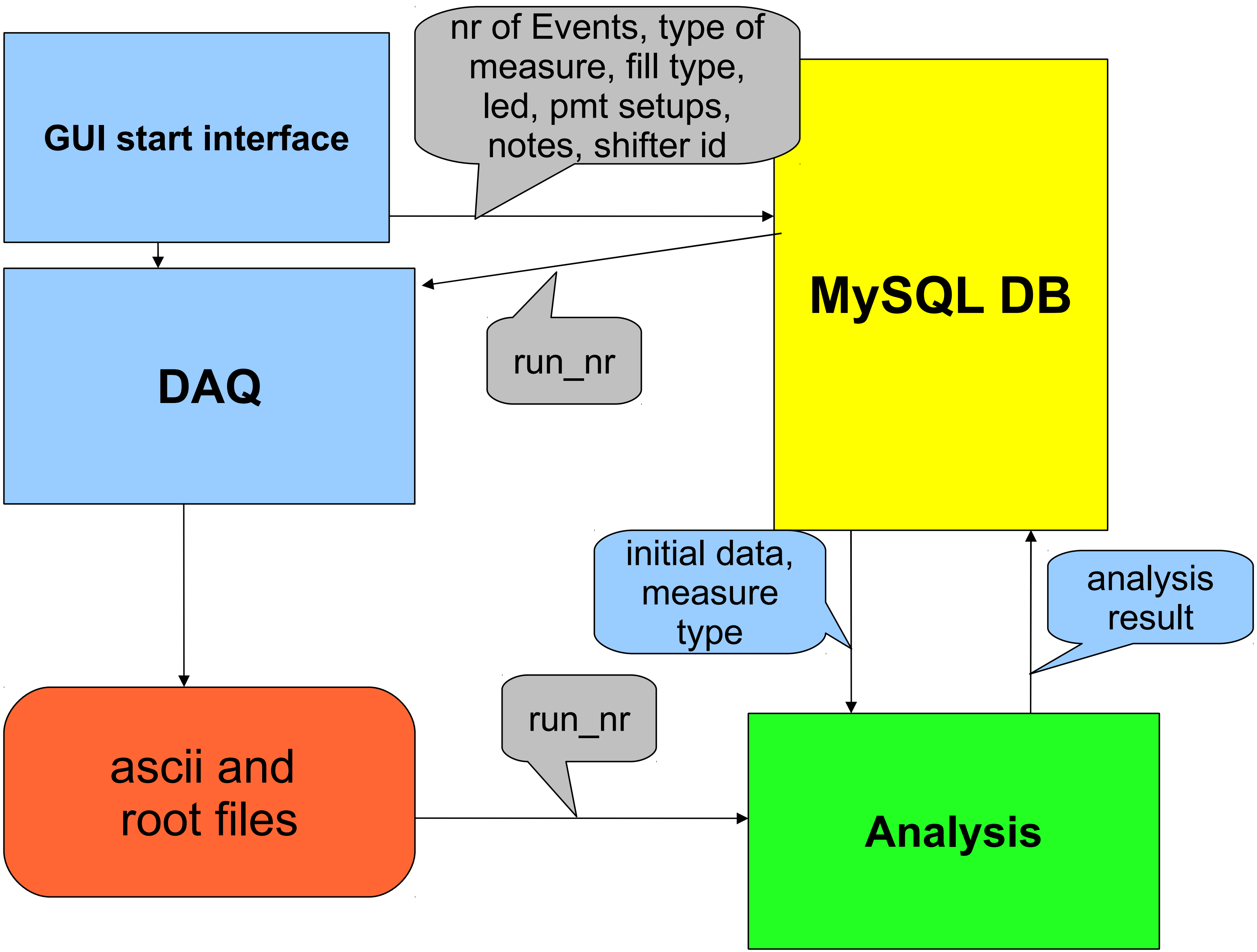
Gain versus voltage in cold



Database of PMT (mysql), Naples

All the data (manufacture information and test data) of WARP PMT's are conserved in Naples database which is available for WARP collaboration.

The software scheme



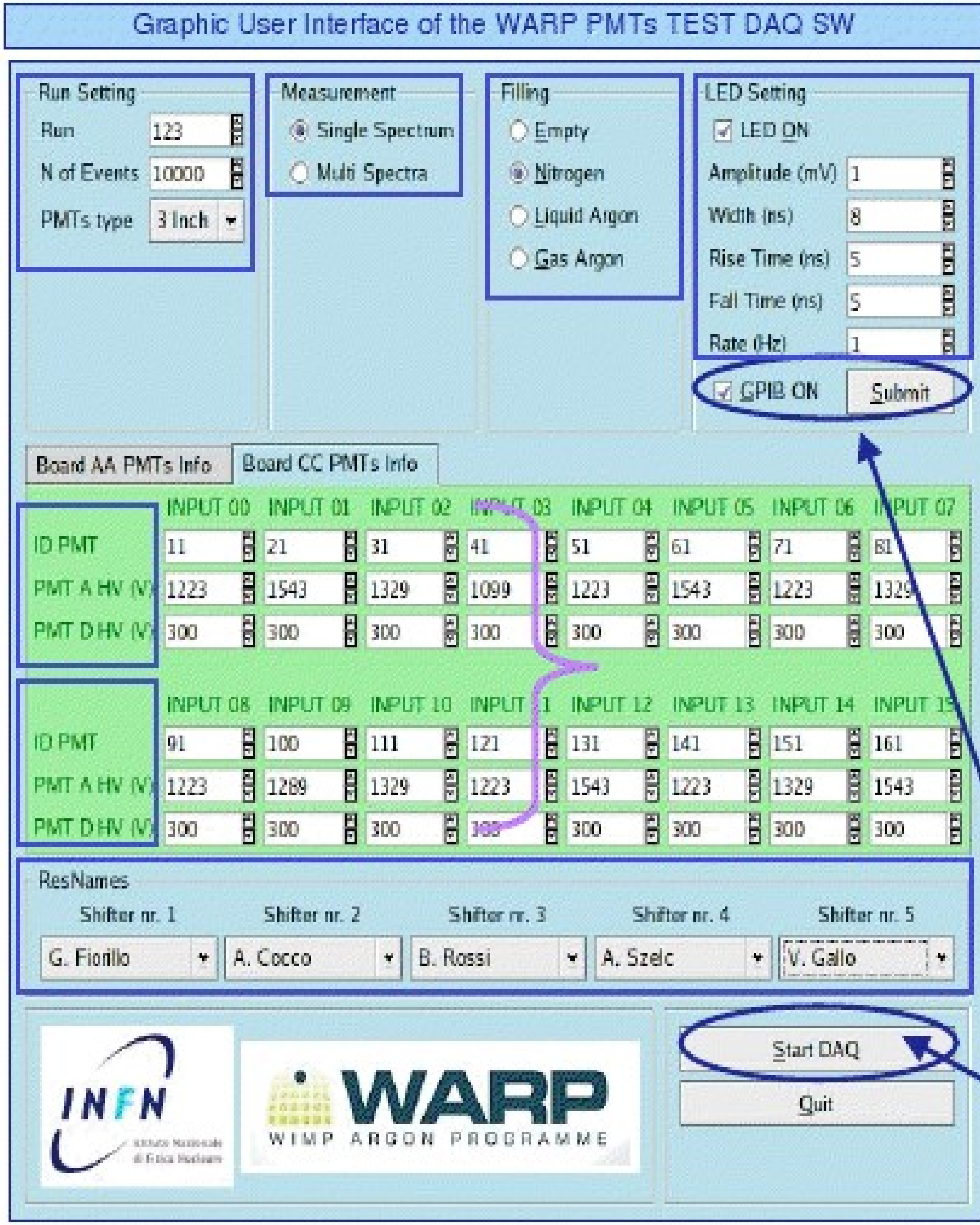
Software and DataBase.

The software is comprised of 2 separate parts and a Database:

- The DAQ software is connected to a GUI used to enter run parameters. It is possible to monitor the data online.

- The analysis software takes the data-files created by the DAQ and writes the results of the fit into the DB.

- the DB is powered by the MySQL engine



G.U.I. is connected to the DATABASE

One can set:

- Run number
- Numebr of events and PMTs type
- Measurement(Single or multi spectrum)
- the Filling (empty, nitrogen,LAr..)
- the names of the shifters
- PMTs details (ID, Anodic HV, Dinodic HV)
- The LED pulse properties

GUI is not only a Database interface but is also a real-time controller

For example:

one can control the light pulser (via a GPIB parallel port) and set the output pulse properties clicking on "**GPIB ON**" button

or STORE the data into the database and START the DAQ clicking on "**Start DAQ**" button

Graphic User Interface

Analysis software: DB structure

table: main

***run_nr*,**
ev_set (number of events),
m_type (analysis),
f_type (run conditions),
led_on (0),
led_set up,
PMT batch id,
fitflag (channels used)
shifter,
ev_act (actual nr of evts),
notes.

table: led_set

***led_setup id* ,**
width,
rise, fall, rate,height

table pmt_set:

batch id,
input channel id,
***pmt name*,,**
pmt high volt.,
pmt1 dynode volt.

- a batch of PMTs is saved with a unique number (batch id). Through this number it is then referenced from the main table.
- same idea is used for the light pulser settings.
- fitflag tells which channels are actually connected to pmts.
- in linearity mode an Asymmetric gaussian is fitted.

Analysis Results

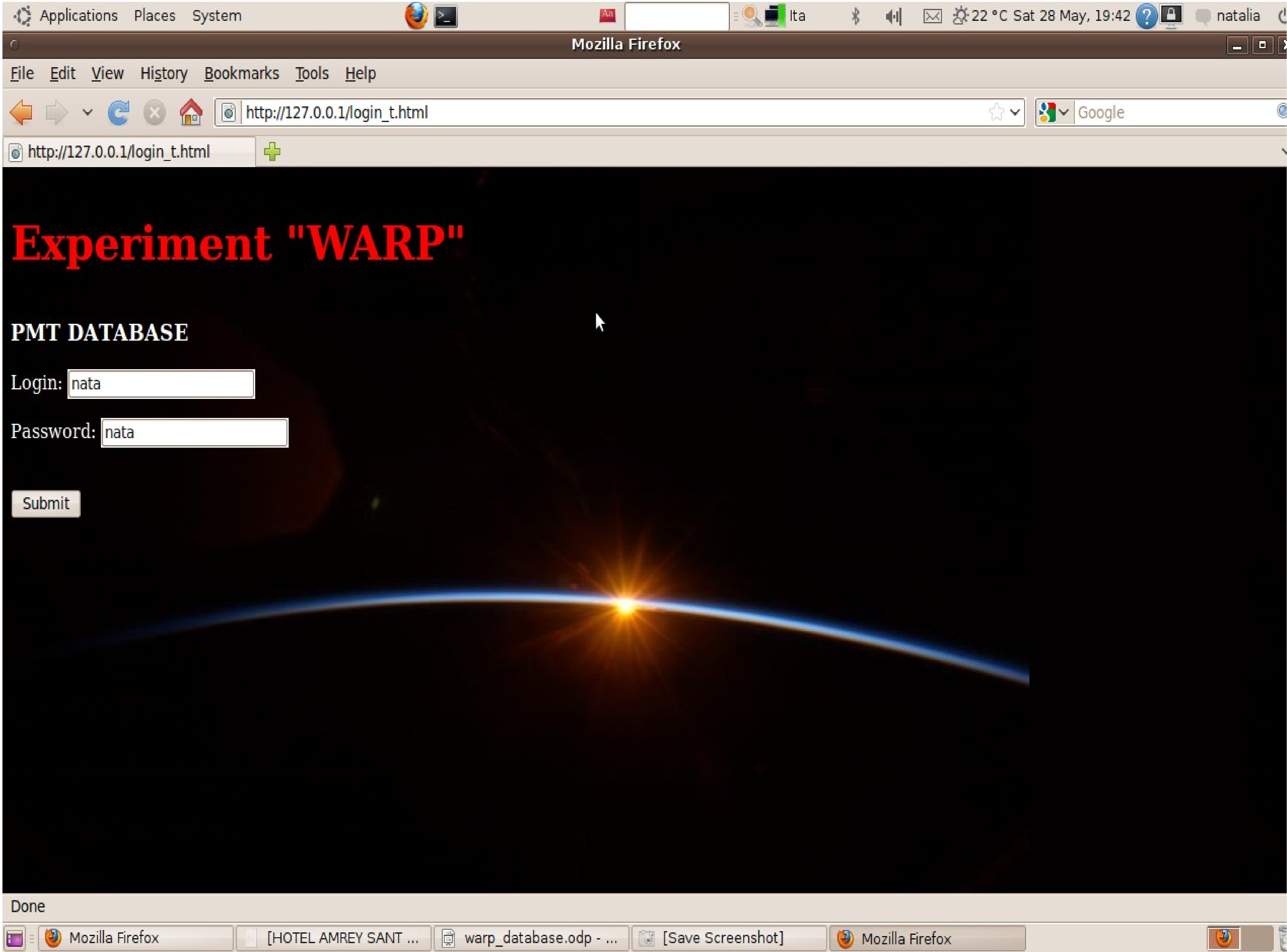
pedestal values:
run_nr,
input chan.
pdst h. gain
pdst l. gain

SER:
run nr,
input chan,
peak pos.,
sigma,
valley pos.
peak ov. val.
Dark Curr.
Chi square

stability:
run nr,
input chan,
peak pos.,
sigma,
valley pos.
peak ov. val.
Dark Curr.
Chi square

linearity:
run nr,
input chan.,
peak pos.,
sigma right
sigma left
peak
Chi Square
(both for hg and lg)

Legend:
bold – not a null value,
italic – primary key,
color – foreign key,
(x) – default value.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22 °C Sat 28 May, 19:42
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Mozilla Firefox
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http://127.0.0.1/login_t.html
Google
http://127.0.0.1/login_t.html
Experiment "WARP"
PMT DATABASE
Login: nata
Password: nata
Submit
Done
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warp_database.odp - ...
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Google
http://127.0....password=nata
http://127.0.0...ge3_test.html
1. The schemes of WARP detector
The schemes of WARP detector. Cabling, pmt positions. The pictures of all schemes. (Without search)
2. PMTs of active veto
2a. The schemes of pmt position in active veto, TOP
2b. The schemes of pmt position in active veto, BOTTOM
3. PMTs of inner detector
3. The schemes of pmt position in inner detector
4. Search of PMTs with the same plate (signal_flange, signal_cable, hv_flange, hv_connector, hv_cable, hv_board, caen_ch)
Active veto cabling, all positions in one table
By typing the number of plate, (or signal_flange, signal_cable, hv_flange, hv_connector, hv_cable, hv_board, caen_ch) inside the window of "pmt_actv_veto_cabling_position" it is possible to have the list of all pmts on this plate (or signal_flange, signal_cable, hv_flange, hv_connector, hv_cable, hv_board, caen_ch)
5. Search of the position of pmt (with known pmt_id) in the inner detector
By typing PMT_ID inside the window you can receive the position (if exists) and cabling information of PMT in the inner detector.
10502
Send
6. Search of the position of pmt (with known pmt_id) in the active veto
By typing PMT_ID inside the window you can receive the position (if exists) and cabling information of PMT in the active veto.
Send
Done
Mozilla Firefox
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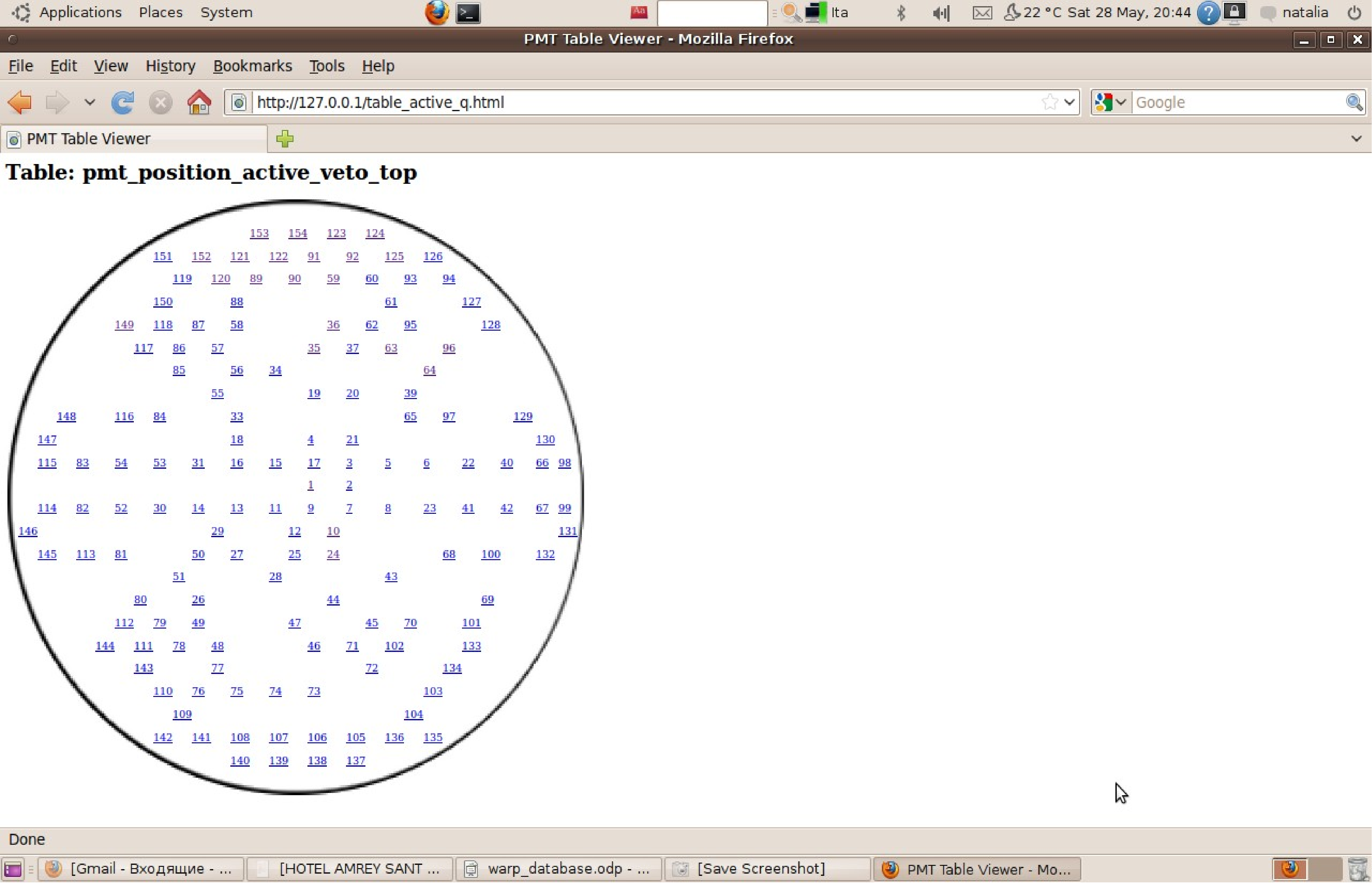
warp_database.odp - ...
Mozilla Firefox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PMT Table Viewer - Mozilla Firefox
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http://127.0.0.1/table_active_q.html
Google
PMT Table Viewer
Table: pmt_position_active_veto_top
153 154 123 124
151 152 121 122 91 92 125 126
119 120 89 90 59 60 93 94
150 88 61 127
149 118 87 58 36 62 95 128
117 86 57 35 37 63 96
85 56 34 64
55 19 20 39
148 116 84 33 65 97 129
147 18 4 21 130
115 83 54 53 31 16 15 17 3 5 6 22 40 66 98
1 2
114 82 52 30 14 13 11 9 7 8 23 41 42 67 99
146 29 12 10 131
145 113 81 50 27 25 24 68 100 132
51 28 43
80 26 44 69
112 79 49 47 45 70 101
144 111 78 48 46 71 102 133
143 77 72 134
110 76 75 74 73 103
109 104
142 141 108 107 106 105 136 135
140 139 138 137
Done
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warp_database.odp - ...
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PMT Table Viewer - Mozilla Firefox

http://127.0.0.1/test_q_a.php?table=pmt_actv_veto_cabling_position&position=154

PMT_id=10157

Cabling

position	inches	pmt_id	plate	signal_flange	signal_cable	hv_flange	hv_connector	hv_cable	hv_board	caen_ch	dark_test	gain_res	vacuum_test	notes
154	"3"""	10157	1	4	27	4	1	12	12	12	"OK"	"mid"	"OK"	
154	"3"""	10157	1	4	27	4	1	12	12	12	"OK"	"mid"	"OK"	

Manufactory characteristics

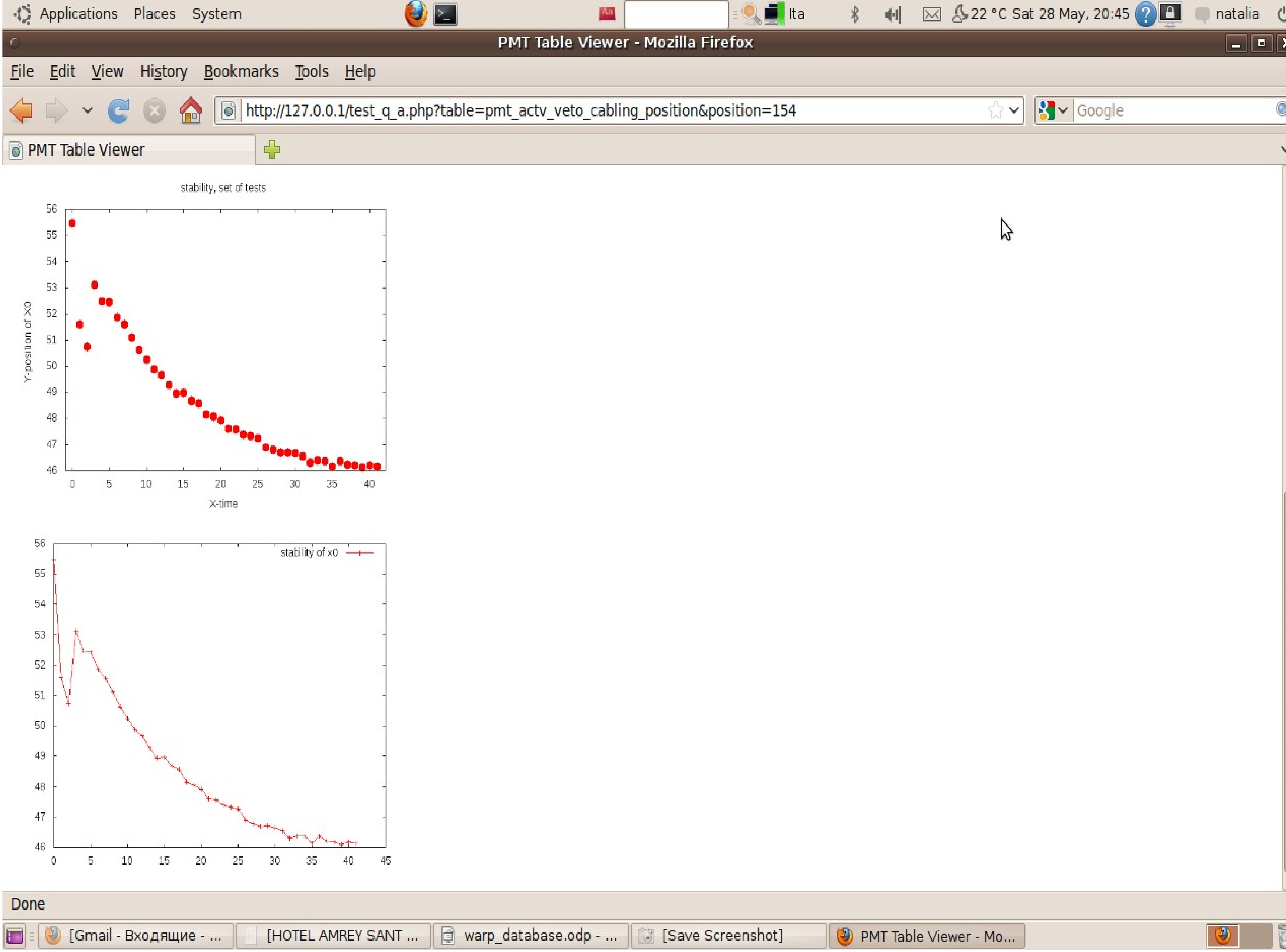
type	inches	CB	CR	D1	Volts_500	Dark_Current	Volts_2000	Volt_3r	location	serial_int	ser_pv	gain_1e7	dcts	qe_peak
D750UKFLA	3	8	0.9	8.1	1466	1.1		1295	LNGS	539766	3.7	1430	228	18.07

pressure	cold_qe_test	rate_eff_test	despatch_date	hot_cold	cured	tripped	turned_on
Pass	Pass	Pass	01/19/2007		0	0	5

The results of SER investigation

run_nr	input	xo	sig	val	pov	dcurr	chi_sq	f_num	time	pmt_hv	m_type	f_type	led_on
5019	5	49.16	14.16	18.73	2.94	1581.36	1.07	0	1995-07-27 10:22:32	1295.00	1	0	1
3055	5	298.01	86.82	103.45	2.64	751.00	1.03	0	2007-03-30 18:20:33	1295.00	1	1	0
3056	5	513.10	145.54	197.23	2.74	473.19	0.71	0	2007-03-30 20:04:48	1295.00	1	1	0
3057	5	416.76	116.79	136.88	3.20	92.16	1.23	0	2007-04-03 15:23:41	1295.00	1	0	0
5037	11	58.38	15.02	20.69	3.24	12512.37	4.10	0	2007-04-12 19:27:24	1295.00	1	1	1
5039	11	56.36	15.01	19.32	3.13	11551.11	1.32	1	2007-04-12 20:17:10	1295.00	1	1	1
5040	11	50.75	14.34	15.86	3.21	12014.39	1.32	2	2007-04-12 21:35:48	1295.00	3	1	1
3068	11	464.09	118.99	174.24	2.96	82.42	0.65	0	2007-04-13 10:42:59	1295.00	1	1	0
5042	11	47.72	12.14	18.47	3.05	24292.92	1.23	0	2007-04-13 11:53:44	1295.00	1	1	1
5044	11	49.59	12.11	20.32	2.96	23851.54	2.49	0	2007-04-13 12:17:53	1295.00	1	1	1
5134	0	46.15	12.59	16.54	2.85	23336.81	0.87	39	2007-11-03 10:12:11	1295.00	3	1	1

Done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PMT Table Viewer - Mozilla Firefox
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http://127.0.0.1/test_q_a.php?table=pmt_actv_veto_cabling_position&position=154
Google
PMT Table Viewer
stability, set of tests
Y-position of X0
X-time
stability of x0
Done
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warp_database.odp - ...
[Save Screenshot]
PMT Table Viewer - Mo...


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22 °C Sat 28 May, 21:49
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Mozilla Firefox
File Edit View History Bookmarks Tools Help
http://127.0.0.1/page0_test.html?login=nata&password=nata
Google
http://127.0....password=nata
http://127.0.0...ge3_test.html
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10502
Send
6. Search of the position of pmt (with known pmt_id) in the active veto
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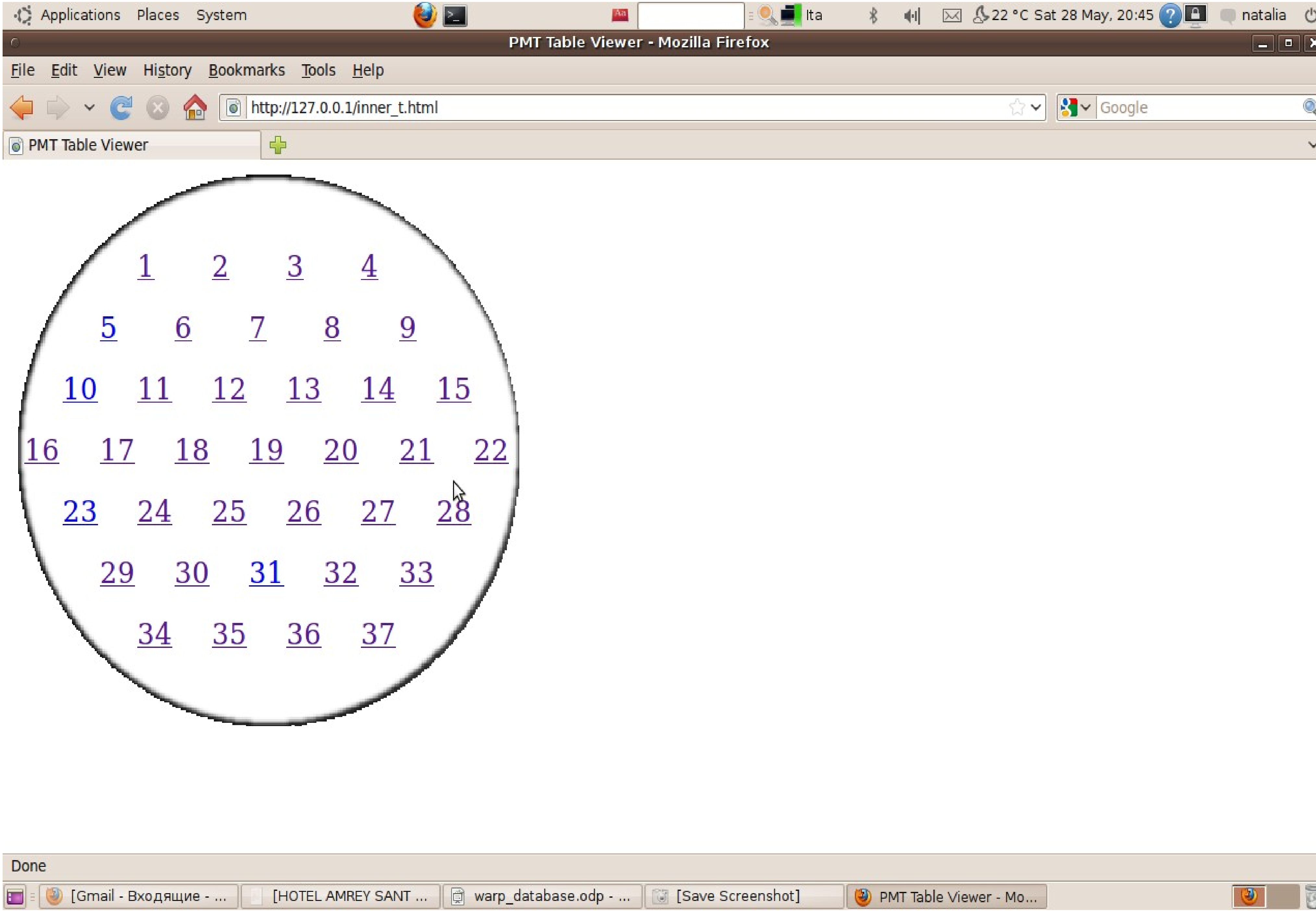
Send
Done
Mozilla Firefox
[HOTEL AMREY SANT ...
warp_database.odp - ...
Mozilla Firefox


Applications Places System
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22 °C Sat 28 May, 20:45
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PMT Table Viewer - Mozilla Firefox
File Edit View History Bookmarks Tools Help
http://127.0.0.1/inner_t.html
Google
PMT Table Viewer
1 2 3 4
5 6 7 8 9
10 11 12 13 14 15
16 17 18 19 20 21 22
23 24 25 26 27 28
29 30 31 32 33
34 35 36 37
Done
[Gmail - Входящие - ...
[HOTEL AMREY SANT ...
warp_database.odp - ...
[Save Screenshot]
PMT Table Viewer - Mo...

PMT Table Viewer - Mozilla Firefox

http://127.0.0.1/test_q.php?table=pmt_inner_detector_cabling_position&position=13

PMT_id=10435

Cabling

position	inches	pmt_id	plate	signal_flange	signal_cable	hv_flange	hv_connector	hv_cable	hv_board	caen_ch	dark_test	gain_res	vacuum_test
13	"3"""	10435	0	2	13	1	1	13	0	11	"OK"	"mid"	"OK"

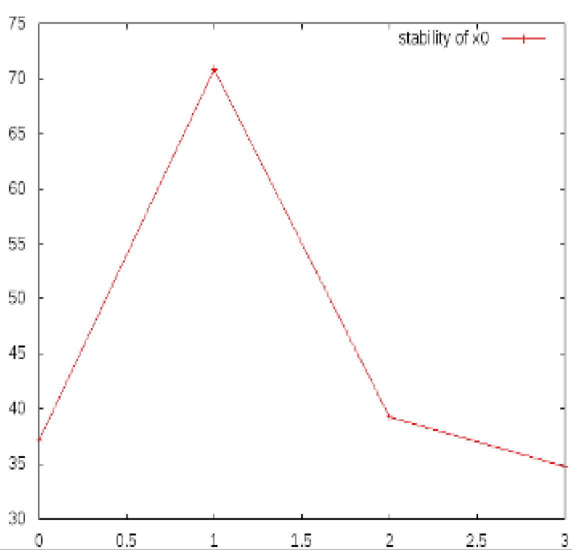
Manufactory characteristics

type	inches	CB	CR	D1	Volts_500	Dark_Current	Volts_2000	Volt_3r	location	serial_int	ser_pv	gain_1e7	dcts	qe_peak
D750UKFLA		9.4	3.1	7.7	1474	10.4		1380	LNGS	570776	3.4	1520	656	20.63

pressure	cold_qe_test	rate_eff_test	despatch_date	hot_cold	cured	tripped	turned_on
Pass	Pass	Pass	06/20/2007		0	0	2

The results of SER investigation

run_nr	input	xo	sig	val	pov	dcurr	chi_sq	f_num	time	pmt_hv	m_type	f_type	led_on
5085	1	37.13	13.27	6.99	3.47	42402.12	0.83	0	2007-07-03 18:22:35	1380.00	1	0	1
5086	1	70.89	19.50	3.13	317.16	65550.16	788.68	30	2007-07-04 09:42:06	1380.00	3	0	1
5088	1	39.29	12.58	8.57	3.45	37099.74	1.02	6	2007-07-05 19:21:19	1380.00	3	1	1
5158	1	34.81	11.67	8.21	3.61	38644.71	1.03	46	2007-11-15 11:32:56	1380.00	3	1	1



Done


Applications Places System
Ita
22 °C Sat 28 May, 21:49
natalia
Mozilla Firefox
File Edit View History Bookmarks Tools Help
http://127.0.0.1/page0_test.html?login=nata&password=nata
Google
http://127.0....password=nata
http://127.0.0...ge3_test.html
1. The schemes of WARP detector
The schemes of WARP detector. Cabling, pmt positions. The pictures of all schemes. (Without search)
2. PMTs of active veto
2a. The schemes of pmt position in active veto, TOP
2b. The schemes of pmt position in active veto, BOTTOM
3. PMTs of inner detector
3. The schemes of pmt position in inner detector
4. Search of PMTs with the same plate (signal_flange, signal_cable, hv_flange, hv_connector, hv_cable, hv_board, caen_ch)
Active veto cabling, all positions in one table
By typing the number of plate, (or signal_flange, signal_cable, hv_flange, hv_connector, hv_cable, hv_board, caen_ch) inside the window of "pmt_actv_veto_cabling_position" it is possible to have the list of all pmts on this plate (or signal_flange, signal_cable, hv_flange, hv_connector, hv_cable, hv_board, caen_ch)
5. Search of the position of pmt (with known pmt_id) in the inner detector
By typing PMT_ID inside the window you can receive the position (if exists) and cabling information of PMT in the inner detector.
10502
Send
6. Search of the position of pmt (with known pmt_id) in the active veto
By typing PMT_ID inside the window you can receive the position (if exists) and cabling information of PMT in the active veto.
Send
Done
Mozilla Firefox
[HOTEL AMREY SANT ...
warp_database.odp - ...
Mozilla Firefox

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PMT Table Viewer - Mozilla Firefox

File Edit View History Bookmarks Tools Help

http://127.0.0.1/test_query.php?table=pmt_actv_veto_cabling_position

PMT Table Viewer

Table: pmt_actv_veto_cabling_position

position	pmt_size_inches	pmt_id	plate	signal_flange	signal_cable	hv_flange	hv_connector	hv_cable	hv_board	caen_ch	dark_test	gain_res	vacuum_test	notes
1	2	222	0	2	60	1	2	62	2	9	"OK"	"mid"	"OK"	
2	2	201	0	2	52	1	2	54	2	2	"OK"	"mid"	"OK"	
3	2	191	0	2	53	1	2	55	2	1	"OK"	"mid"	"OK"	
4	2	190	0	2	54	1	2	56	2	5	"OK"	"mid"	"OK"	
5	2	176	0	2	55	1	2	57	2	4	"OK"	"mid"	"OK"	
6	2	225	0	2	56	1	2	58	2	14	"OK"	"mid"	"OK"	
7	2	175	0	2	57	1	2	59	2	7	"OK"	"mid"	"OK"	
8	2	157	0	2	58	1	2	60	2	6	"OK"	"mid"	"OK"	
9	2	206	0	2	59	1	2	61	2	10	"OK"	"mid"	"OK"	
10	2	186	0	2	51	1	2	53	2	3	"OK"	"mid"	"OK"	
11	2	171	0	2	61	1	2	63	2	13	"OK"	"mid"	"OK"	
12	2	192	0	2	62	1	2	64	2	12	"OK"	"mid"	"OK"	
13	2	174	0	2	63	1	2	65	2	11	"OK"	"mid"	"OK"	
14	2	194	0	2	64	1	2	66	2	15	"OK"	"mid"	"OK"	
15	2	189	0	2	65	1	2	67	2	8	"OK"	"mid"	"OK"	
16	2	179	0	2	66	1	2	68	2	18	"OK"	"mid"	"OK"	
17	2	211	0	2	67	1	2	69	2	17	"OK"	"mid"	"OK"	
18	2	208	0	2	68	1	2	70	2	16	"OK"	"mid"	"OK"	
19	3	10313	142	2	70	1	2	72	2	19	"OK"	"mid"	"OK"	
20	3	10307	73	2	71	1	2	74	2	23	"OK"	"low"	"OK"	
21	3	10347	108	2	72	1	2	75	2	22	"OK"	"low"	"OK"	
22	3	10302	107	2	73	1	2	76	2	21	"NOSIG"	"mid"	"OK"	
23	3	10329	105	2	74	1	2	77	2	25	"OK"	"mid"	"OK"	
24	3	10312	106	2	75	1	2	79	2	24	"OK"	"mid"	"OK"	
25	3	10326	140	2	76	1	2	80	2	28	"OK"	"low"	"OK"	
26	3	10317	104	2	77	1	2	81	2	27	"OK"	"low"	"OK"	
27	3	10320	144	2	78	1	2	82	2	26	"OK"	"mid"	"OK"	
28	3	10343	145	2	79	1	2	83	2	30	"OK"	"mid"	"OK"	

Done

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PMT Table Viewer - Mozilla Firefox

File Edit View History Bookmarks Tools Help

http://127.0.0.1/p_q_i.php?pmt_id=10502

PMT Table Viewer

PMT_ID: 10502

position	inches	pmt_id	plate	signal_flange	signal_cable	hv_flange	hv_connector	hv_cable	hv_board	caen_ch	dark_test	gain_res	vacuum_test
9	"3"""	10502	0	2	9	1	1	9	0	10	"OK"	"mid"	"OK"

Done

[Gmail - Входящие - ... [HOTEL AMREY SANT ... warp_database.odp - ... [Save Screenshot] PMT Table Viewer - Mo...

The interface between AstroGrid and S.Co.P.E.-GRID

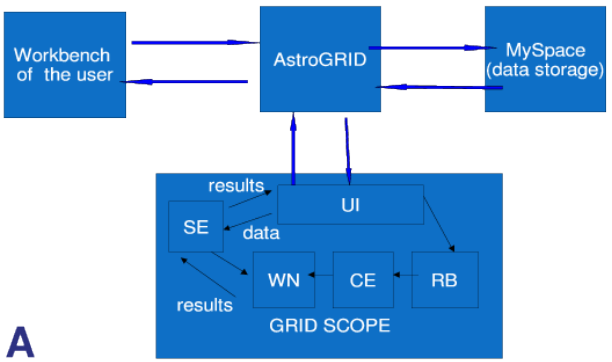
Abstract

The goal of the work was to create interface between the ASTROGRID and GRID infrastructures. Our interface allows a ASTROGRID user (who has an ASTROGRID certificate but no GRID certificate) to start computational tasks on the Grid from the ASTROGRID Workbench. "Grid_launcher" has been implemented and tested on :
VONeural_MLP (supervised clustering),
VONeural_SVM (supervised clustering),
SExtractor (extraction of object-catalogs from astronomical images),
SWARP (resample and co-add FITS images using any arbitrary astrometric projection defined in the WCS standard).
All these programs are registered inside CEC of ASTROGRID.

GRID-launcher work-flow:

A - schema, B - the work-flow from AG to WN, C – the work-flow from WN to AG.

GRID-Launcher work-flow



A

The workflow of the job is following:

1. "Grid_launcher"
   a) takes the user input from the Workbench of Astrogrid;
   b) collects all the needed files, tabs and programs;
   c) wraps them in an archive and sends it to the Scope-GRID UI. (The Authentication on Scope is done by means of public keys exchange).

2. The Scope UI receives data and programs from "GRID_launcher", unpacks them and translates them to Grid job format.

3. Once the GRID job jdl file is ready, "GRID_launcher" starts it in Grid (from an AstroGrid node); periodically checks the status; and then (when job is finished) retrieves the results.

4. "GRID_launcher" receives the data archive, unpacks it and puts the results into the "MySpace" data storage of AstroGRID.

The workflow of the job is following:

1. "Grid_launcher" a) takes the user input from the Workbench of Astrogrid; b) collects all the needed files, tabs and programs; c) wraps them in an archive and sends it to the Scope-GRID UI.
2. The Scope UI receives data and programs from "GRID_launcher", unpacks them and translates them to Grid job format.
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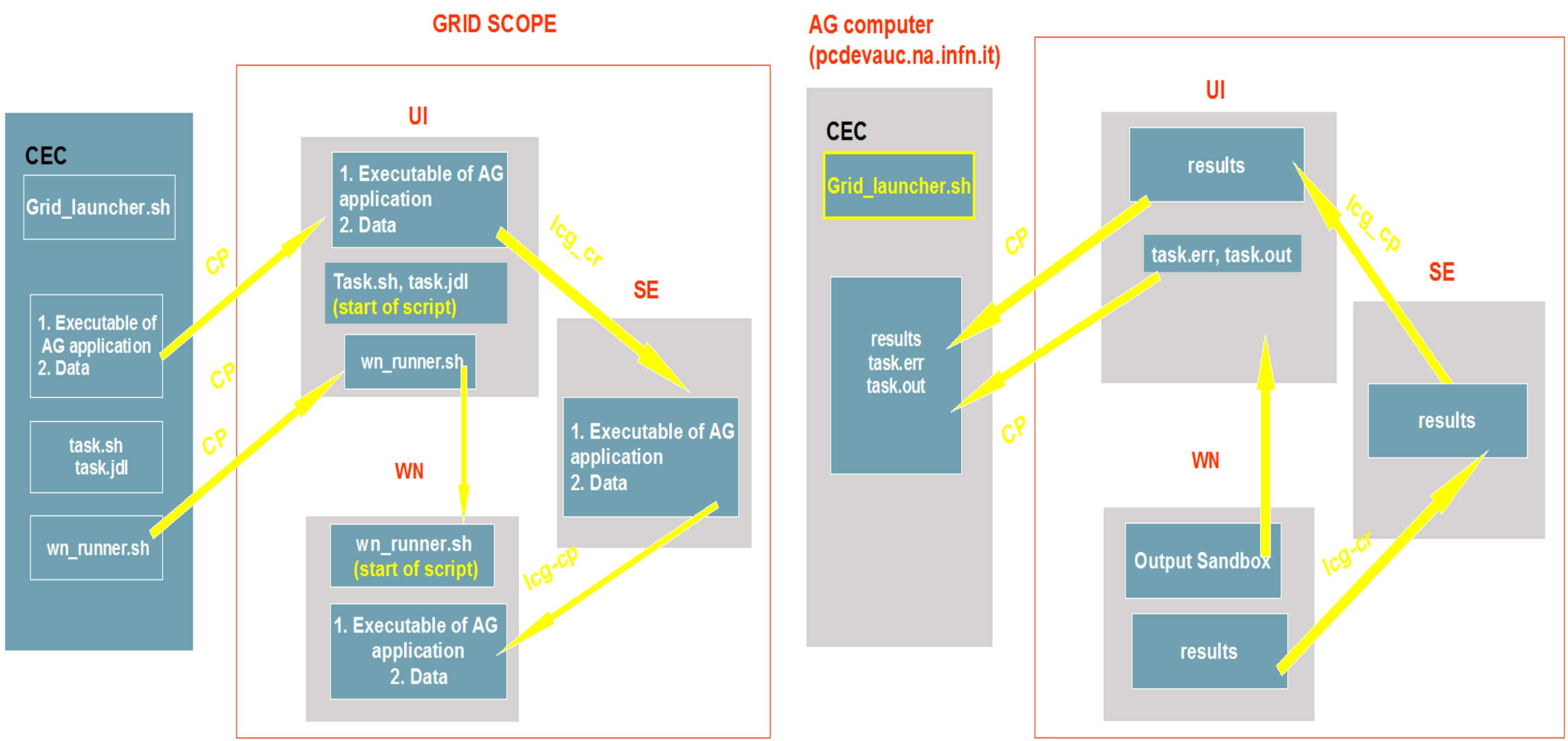
4. "GRID_launcher" receives the data archive, unpacks it and puts the results into the "MySpace"data storage of AstroGRID.



Thank you!