Analysis and visualization of the fake trigger events obtained by fast simulation code.

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JEM-EUSO International Meeting June 06-10 2011, Paris

Motivation and simulation conditions

ESAF .....

Standalone code written in C++ by Francesco Fenu

Source of background

Poisson distribution of average BG 500 ph/(m^2 s sr)

PDM

PTT algorithm 2nd Level 1 Hz/PDM

LTT algorithm 3rd Level 1mHz/PDM

40000 GTU/s

10^11 GTU/trigger

Code is fast, but since ton produce huge statistics we have to run parallel

Prepared and running on Kosice PC cluster

Computing facility – JEM-EUSO cluster

16 node Supermicro® SuperServer AS-1042G-MTF

Configuration of node :

- 4x Opteron 6134 (2,3GHz)

- 16GB RAM

- 600GB SATAII HDD (WD VelociRaptor)

2x master/disk server Supermicro® SuperServer AS-1042G-MTF

Configuration od server:

- 1x Opteron 6134 (2,3GHz)

- 16GB RAM

- 4x 2TB SATAII HDD (WD RE4)

All together:

CPU: 64 + 2 @ 2.3GHz

Cores: 512 + 16

RAM: 264 GB (4GB / CPU)

Disk space: 16x600GB + 8x2TB = 25,2TB

Computing facility – JEM-EUSO cluster

- full HW and OS/SW configuration ready on all nodes
- Fedora Core 14 1.2.5-2.fc14
- kernel 2.6.35.13-91.fc14.x86_64
- gcc 4.5.1-4
- disk space sharing by nfs
- ROOT 5.28/00, ESAF trunk, Geant4 9.4
- cluster ready for any user from JEM-EUSO collaboration

  - to have an account, simply write email to **bobik@saske.sk**

- **the infrastructure and computational facilities in Slovakia are supported by**
  26220120009, based on the supporting operational Research and developm
  European Regional Development Fund.

The statistics

The full simulated statistics was 110*1.e9 GTUs (110 jobs with 1.e9 GTU)

= 1.1e11 GTU's => 1.1e11*2.5e-6 s = 2.75e5 s

Among them in 16 runs LTT_THIRD_OUT appeared and the full numbers of LTT triggers in these files was 21500.

So the rate is 2.15e4/2.75e5 = 0.8e-1 Hz, which is not far from expected 0.1Hz

However, this result is for the integration threshold 145.

Calculated in 3 weeks on part of cluster

Has to be discussed with Mario, modified and prepared for massive simulations

Output

The information of accumulated LTT triggers stored to ascii file in the 4 column format:

row in EC (0-35) : column in EC (0-35) : time (0-30) : counts/pixel

1 LTT trigger = 36x36x31 lines

Average size of the LTT output : 250 MB/ 1.e9 Gtu's

We repro

	PTT (MB)	LTT (MB)	LTT lines	LTT triggers	ltt.ascii (MB)	ltt.root (MB)
Run.8	290	539	42988320	1070	828	48
Run.14	232	316	25150176	626	481	30
Run.25	322	135	10767168	268	204	13
Run.36	304	369	29408832	732	563	34
Run.37	246	185	14704416	366	280	18
Run.51	385	1417	107993088	2688	2246	116
Run.93	347	1281	97627680	2430	2026	105
Run.94	288	1281	97627680	2430	2026	105
Run.95	263	816	65085120	1620	1336	71
Run.100	285	898	71673984	1784	1476	78
Run.109	328	8554	651895776	16226	14000	682
Run.110	307	539	42988320	1070	828	48
Run.111	316	539	42988320	1070	828	48
Run.112	308	881	70308000	1750	1447	77
Run.114	232	539	42988320	1070	828	48
Run.116	298	172	13659840	340	260	16

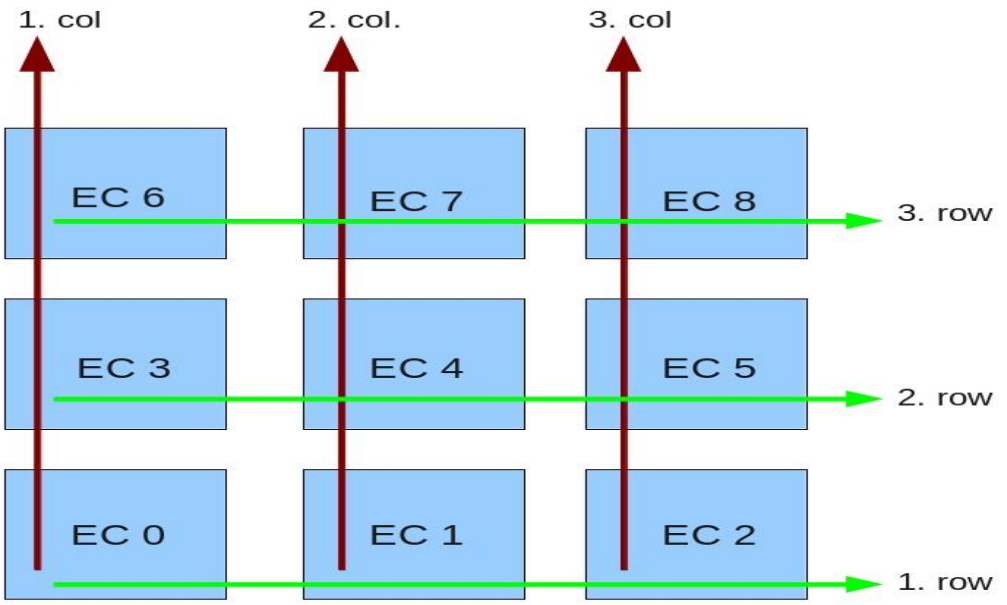
Configuration

M36

BG = 2.1 ph/pix/GTU

PTT_integr = 43

LTT integration = 145

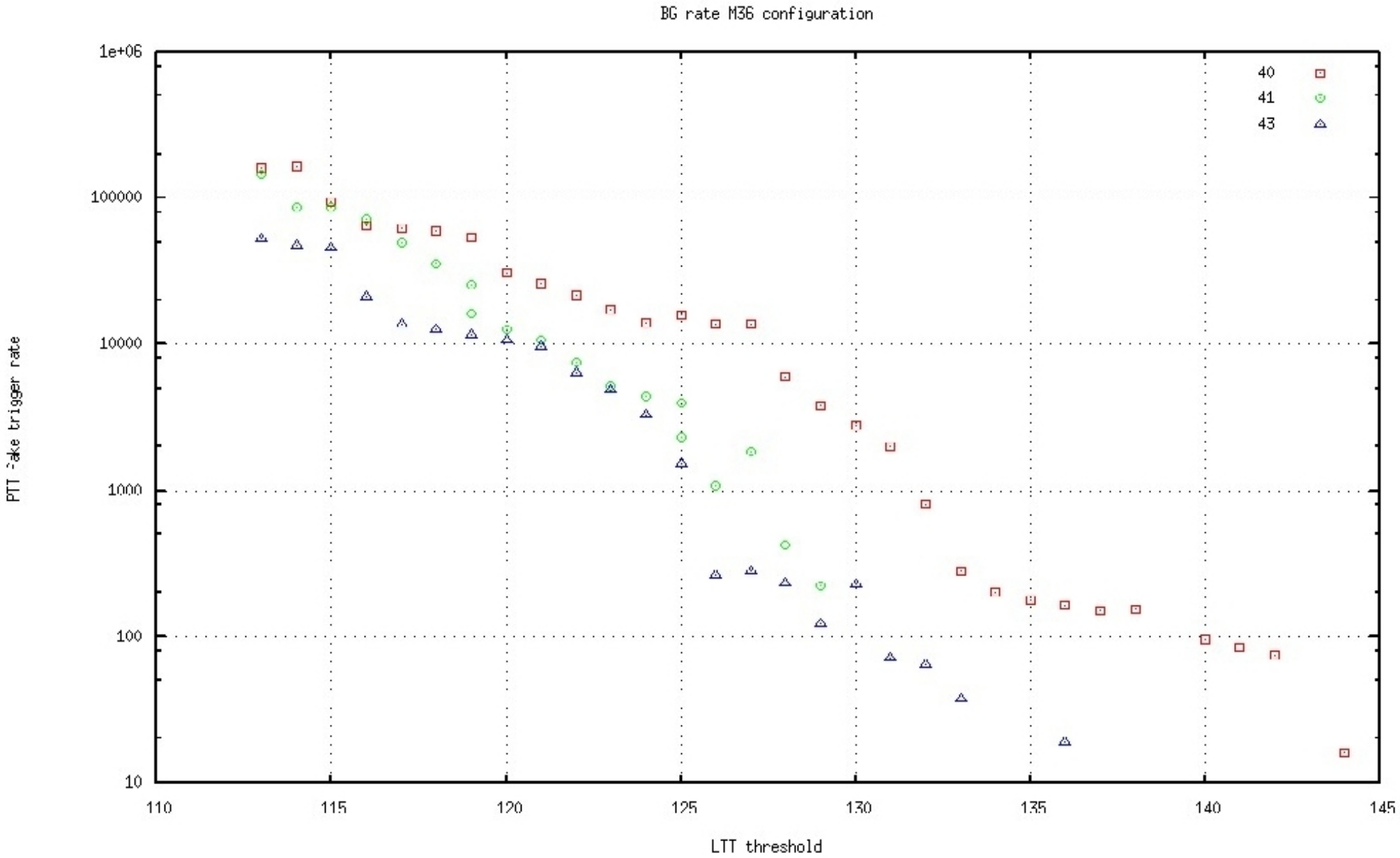


1 PDM = 9 EC = 1296 pixel

1 EC = 4 x PMT = 144 pixel

1 PMT = M 36 = 36 pixel (6 x 6)

Background rate for M36 configuration



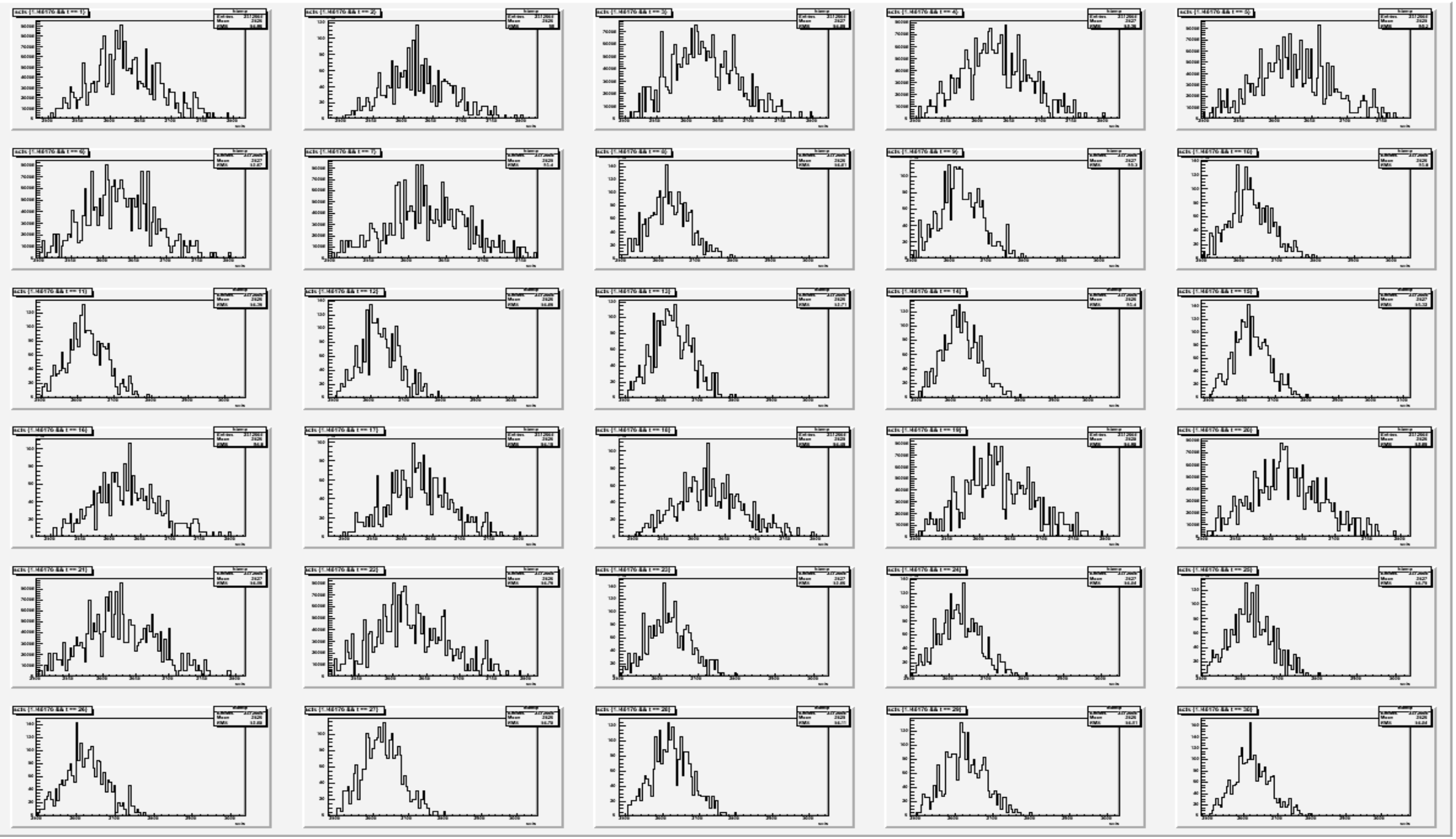
Visualization

Two SW approaches to analyze results:

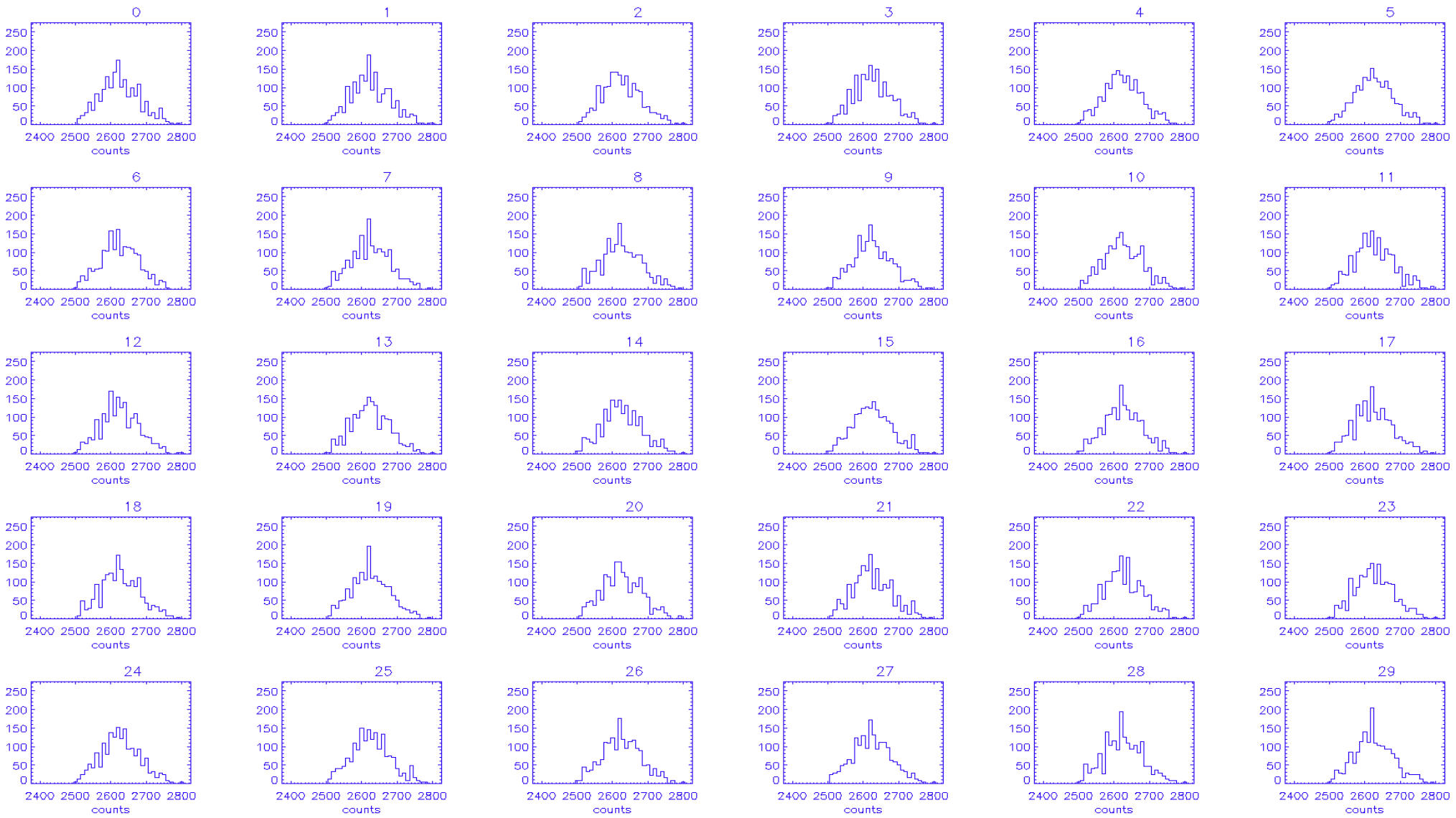
- IDL 8.1

- ROOT

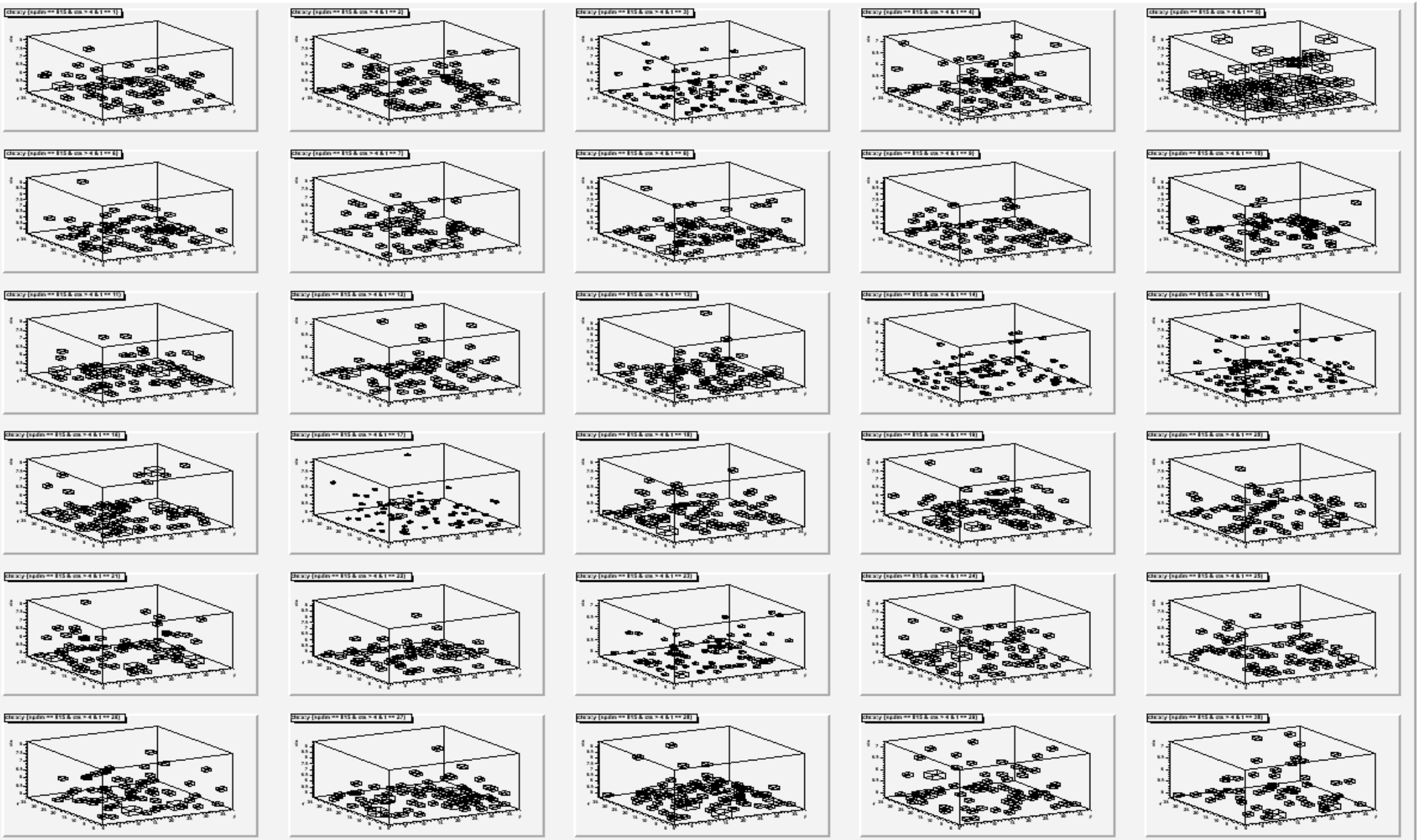
Plots of summary counts on all PDMs for 30 times run No. 100 (ROOT)



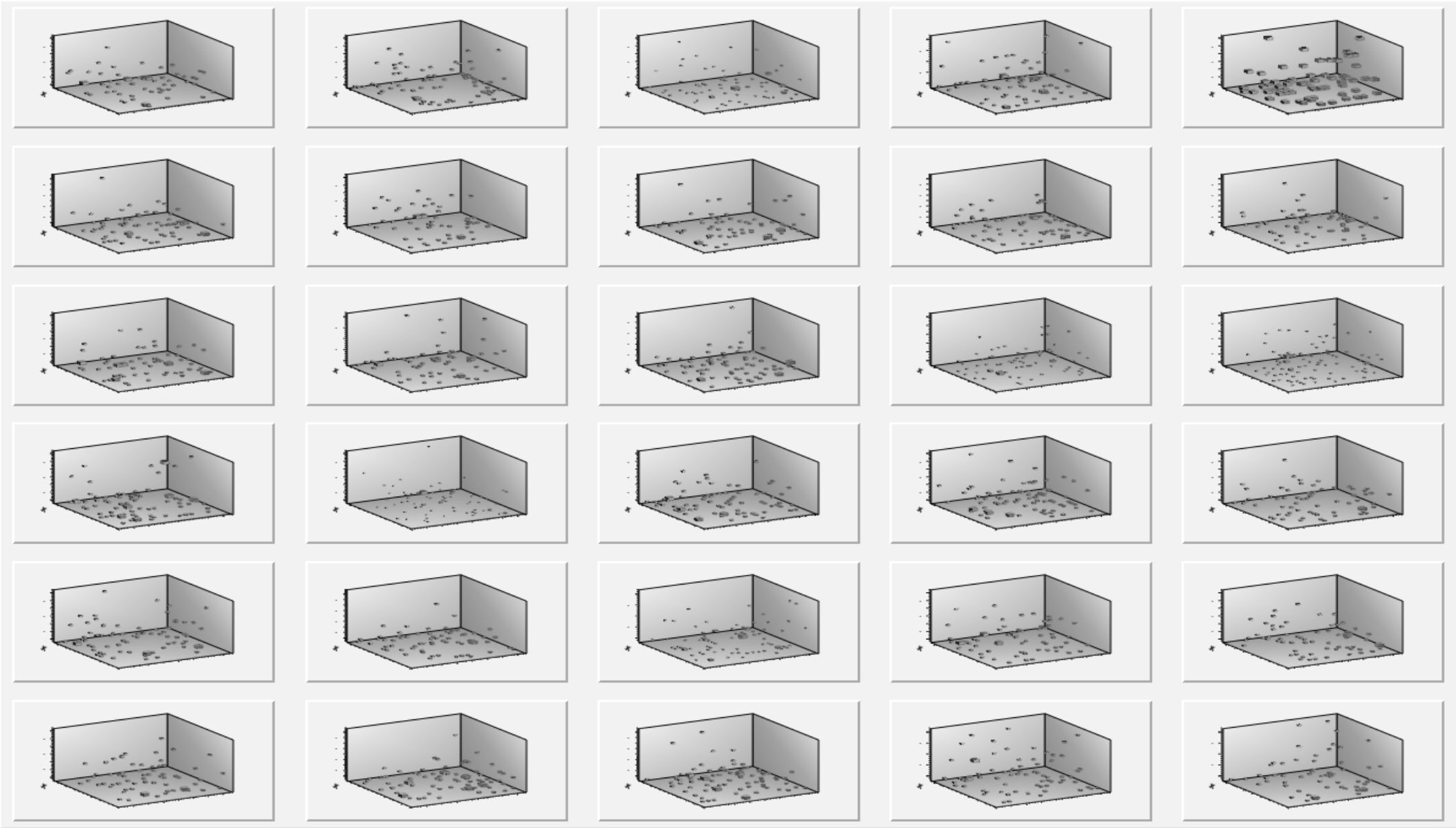
Plots of summary counts on all PDMs for 30 times run No.100 (IDL)



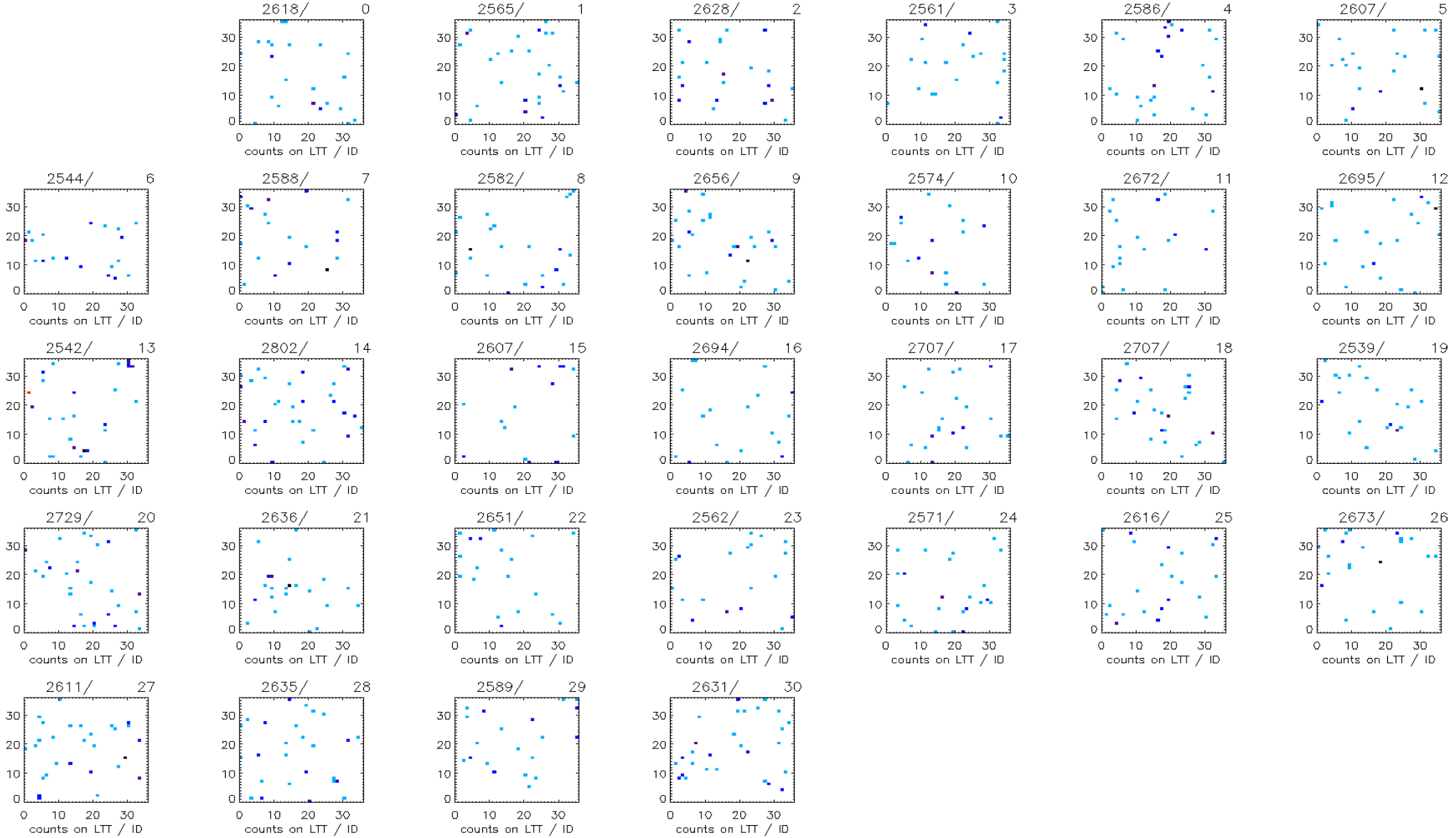
Counts on PDM with highest sum counts from counts/pixel > 4 for 30 times – run No.100 (ROOT)



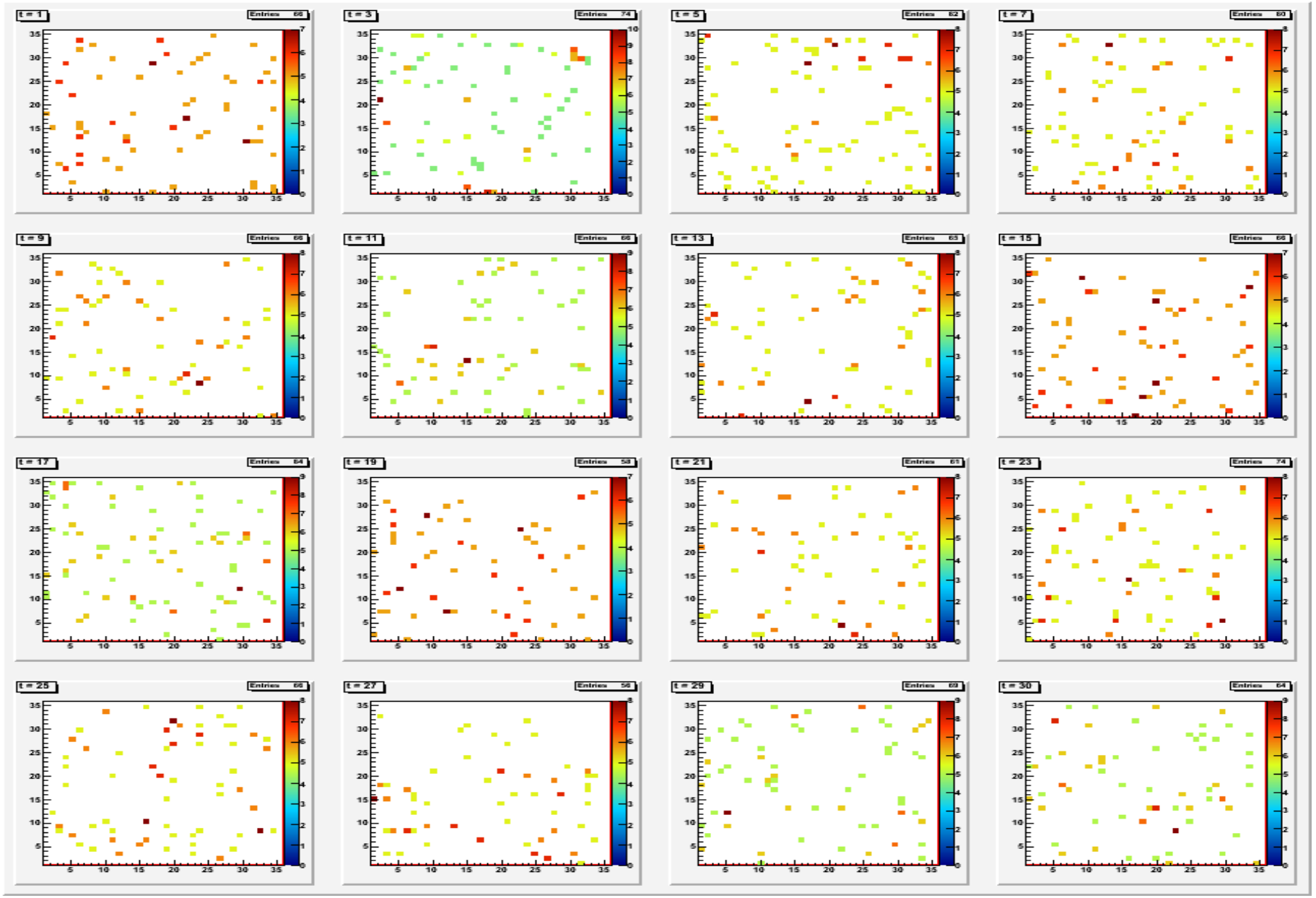
Counts on PDM with highest sum counts from counts/pixel > 4 for 30 times – run No.100 (ROOT, glb)



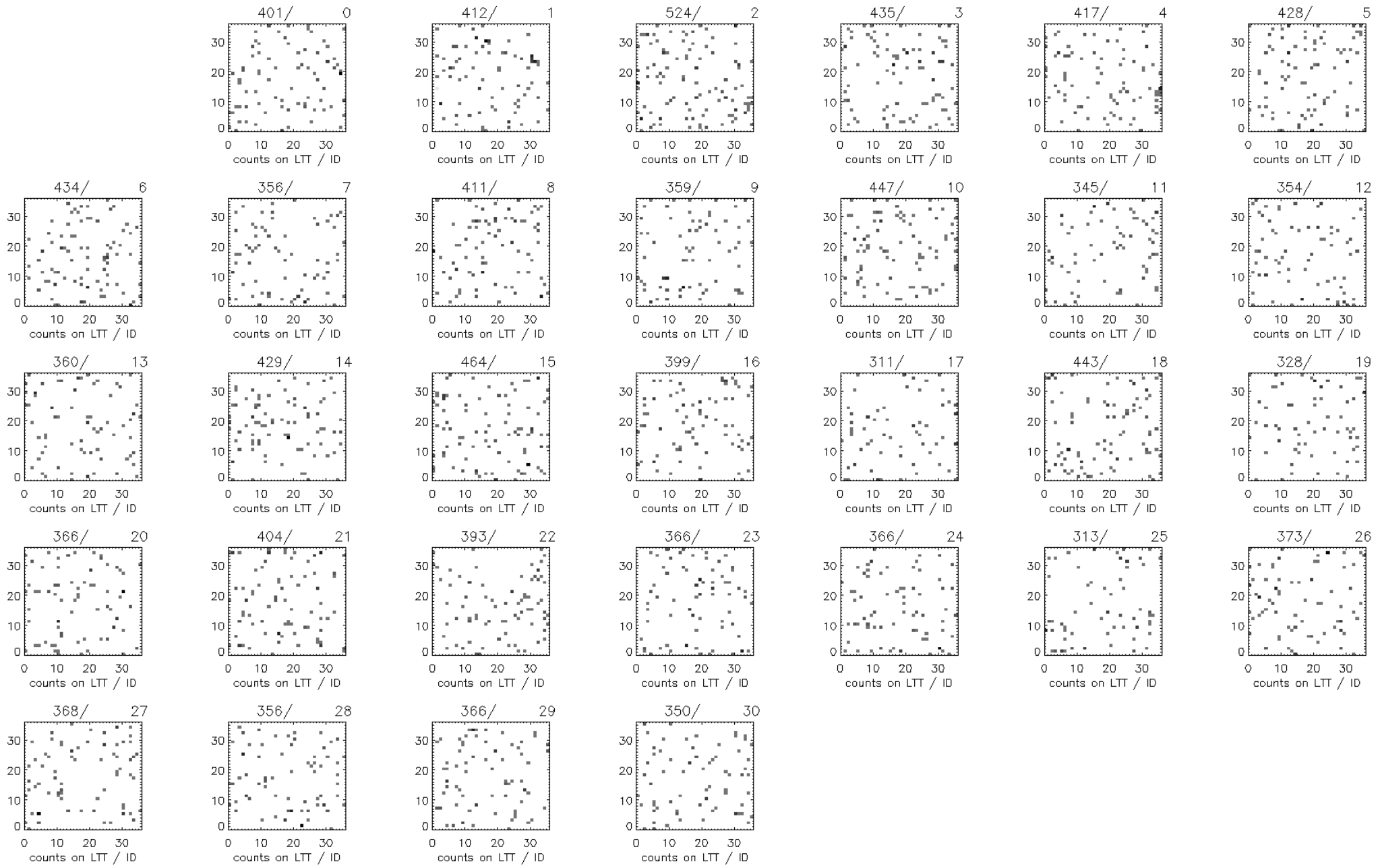
Counts on PDM with highest sum counts from counts/pixel > 4 for 30 times – run No.100 (IDL)



Plots from events, where sum counts of only counts/pixel > 4 were the highest - run No.100 (ROOT)



Plots from events, where sum counts of only counts/pixel > 4 were the highest - run No.100 (IDL)



Summary

- Checked trigger rates obtained from the code are compatible with expectation
- Visualisation of the output don't show structures at present level of analysis
- Significant problems with rnd generation

Open questions & Todo

- Continue analyse obtained LTT triggers
  - suggestions how to check light curves for only pixels contributed to LTT
- Investigate random number generator
  - rndm = rndm1 + 10^-6*rndm2 produce increased LTT rate
- Perform calculations for M64 configuration
  - agree and fix PTT and LTT integration thresholds
- Compare ESAF and fast code results
  - what is actual rate of computations speeds