Progress of UV background analysis from EUSO-Balloon data

Simon Mackovjak[1], Andrii Neronov[1],

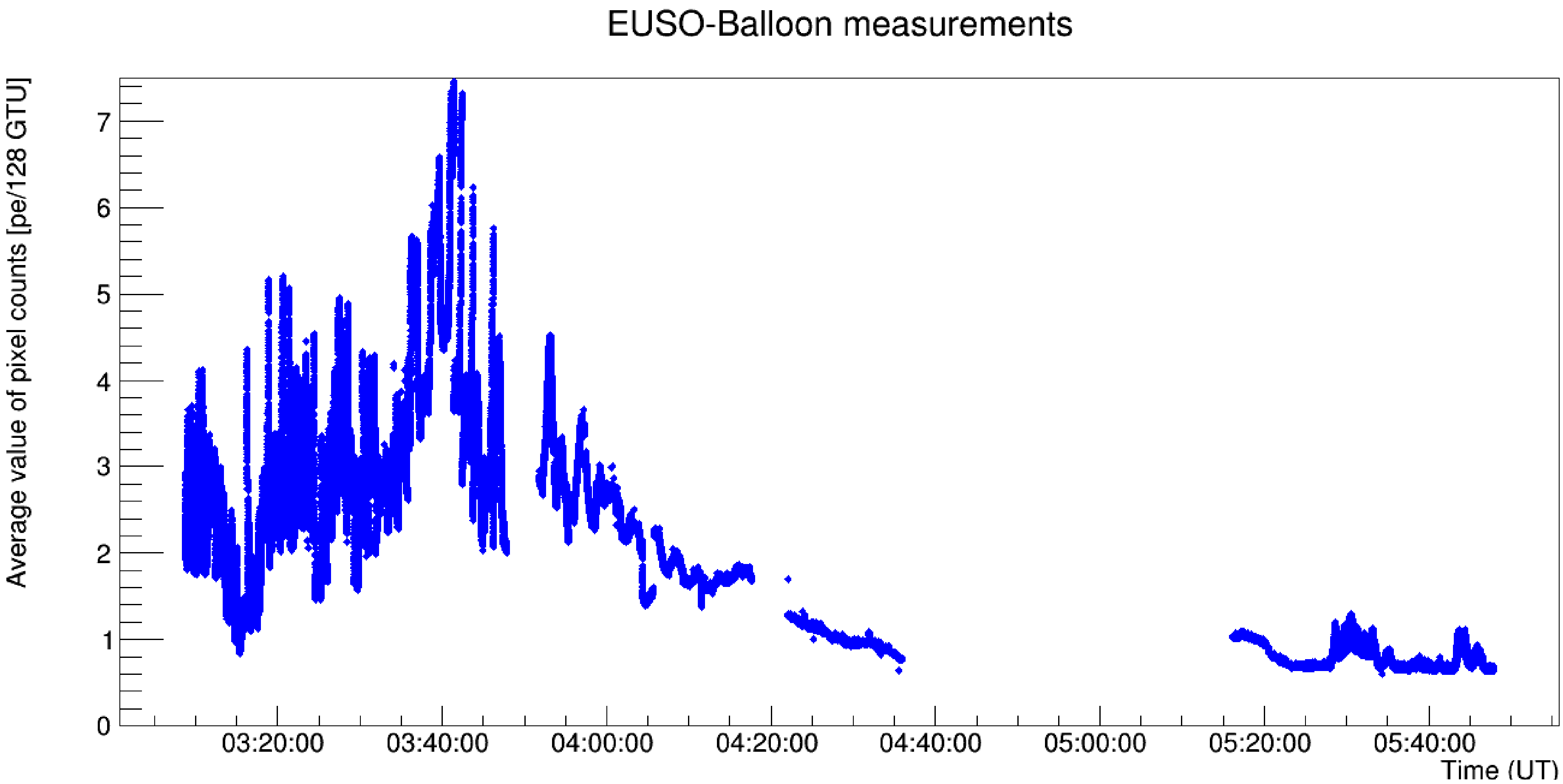
Pavol Bobík[2], Marián Putiš[2], Luis Del Peral[1]

[1] ISDC, Versoix, Switzerland
[2] IEP, Košice, Slovakia

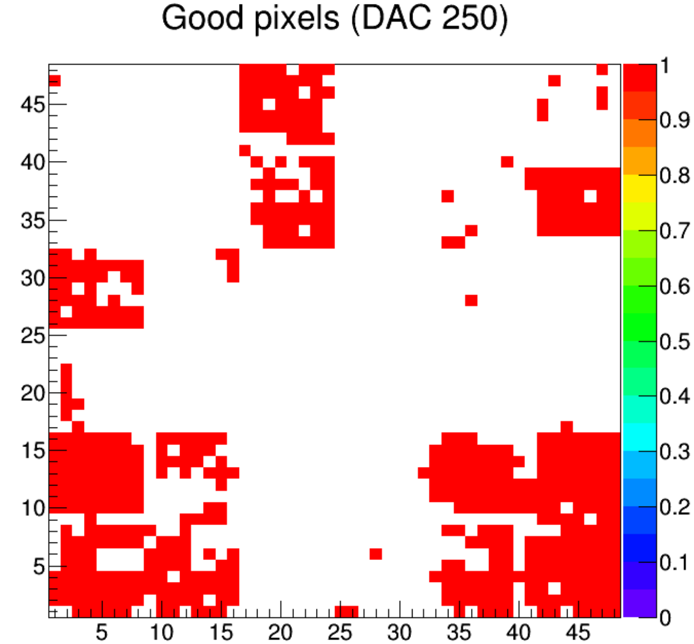
ISDC
DATA CENTRE FOR ASTROPHYSICS

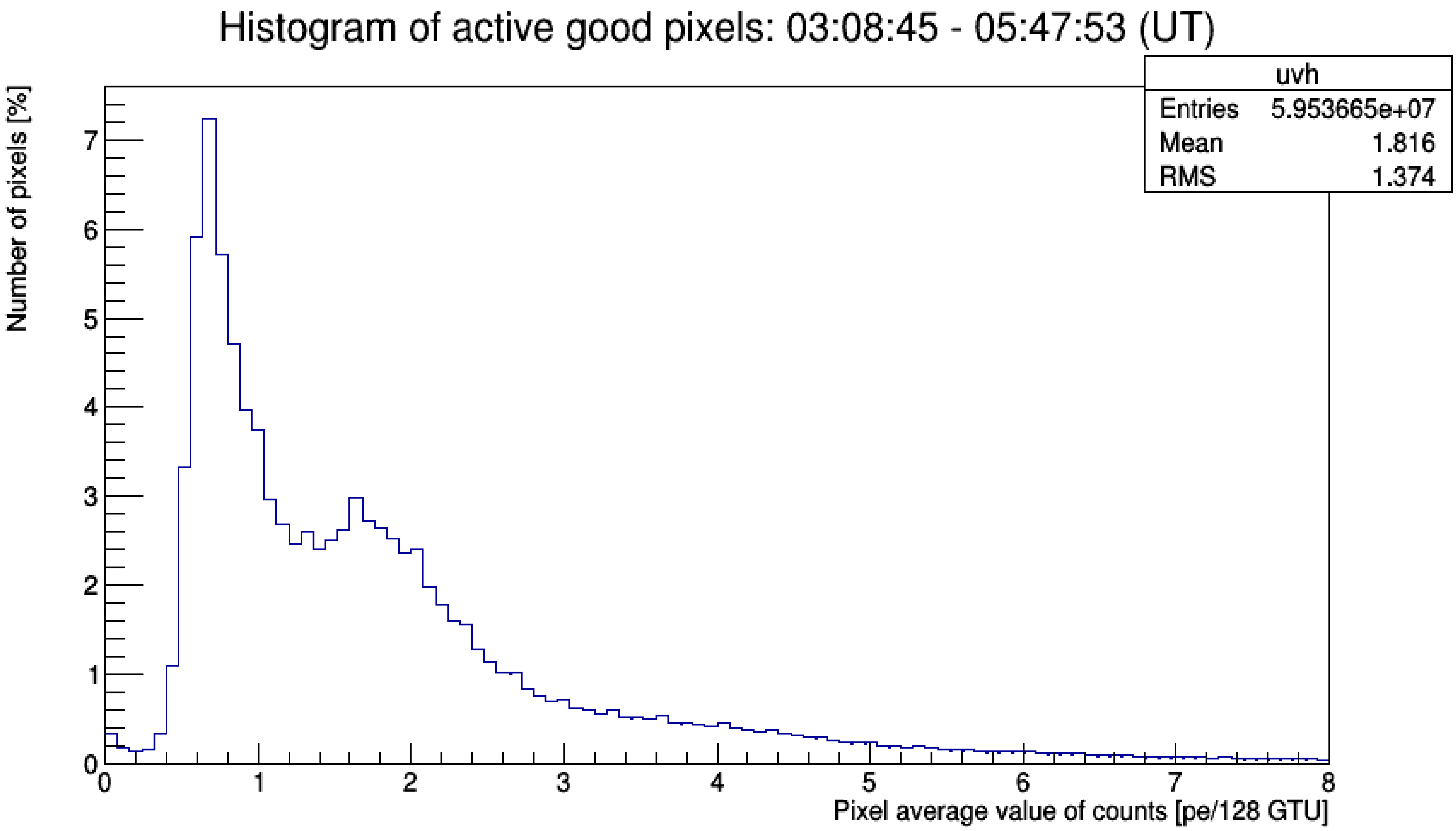
ÚEF
SAV

16th JEM-EUSO International Meeting, Moscow, Russia, 2 Dec 2014



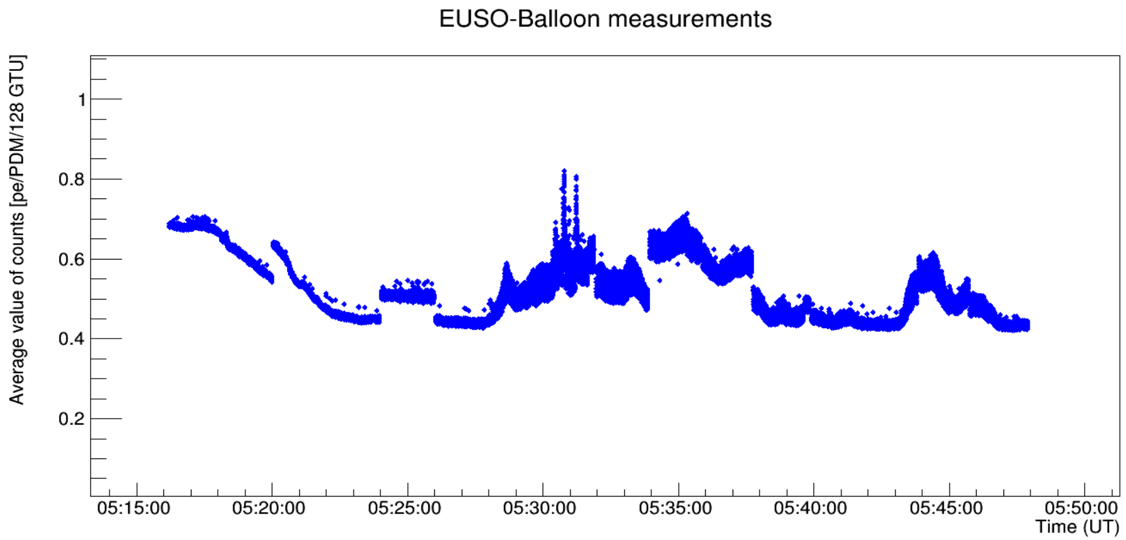
- using of CPU-TRIGGER data: "normal" acquisition mode
- 1 point ~ averaged value of counts per good active pixels of PDM per 128 GTUs
- Good pixels suggested by Camille Moretto (all pixels with low gain or with too high noise are rejected)



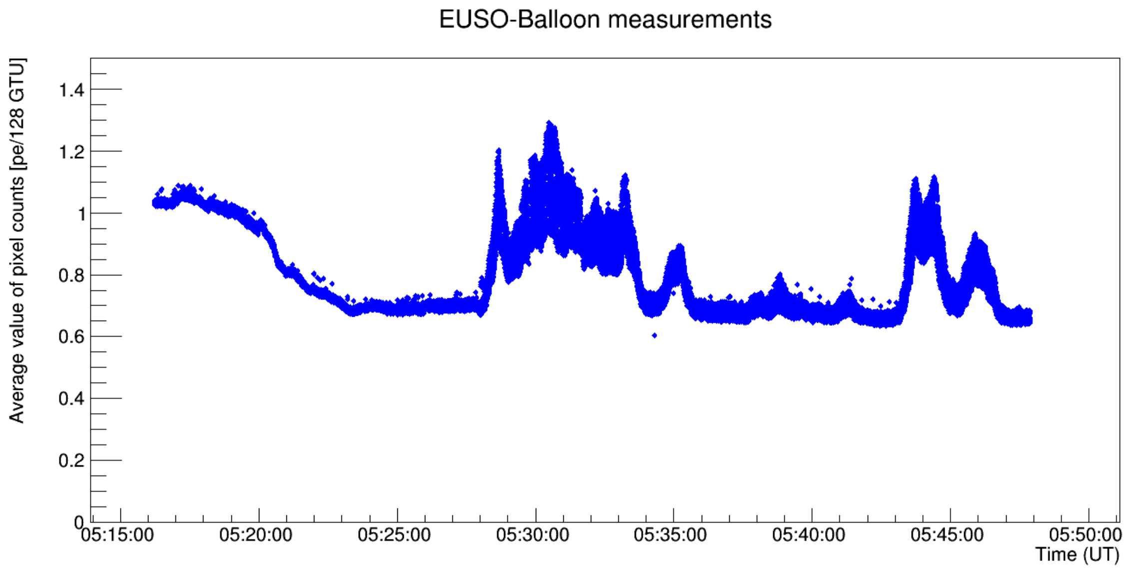


- Histogram of all active good pixels measurements

We have focused on measurements without city lights by Timmins –> 05:16:14 – 05:47:53 (UT)



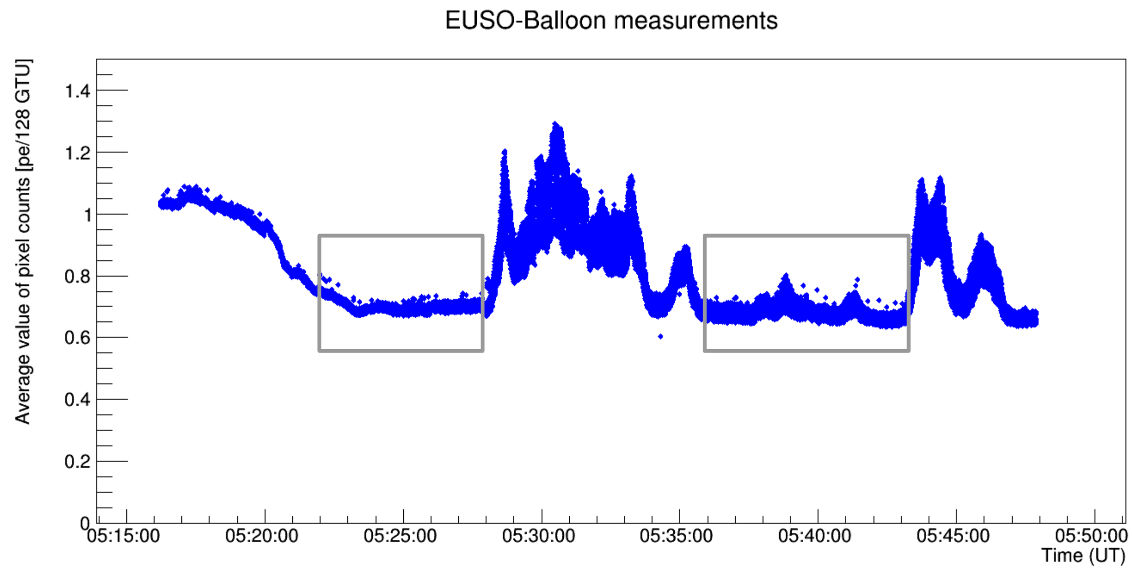
- Only “ACTIVE” PMTs are included to the averaged values per whole PDM

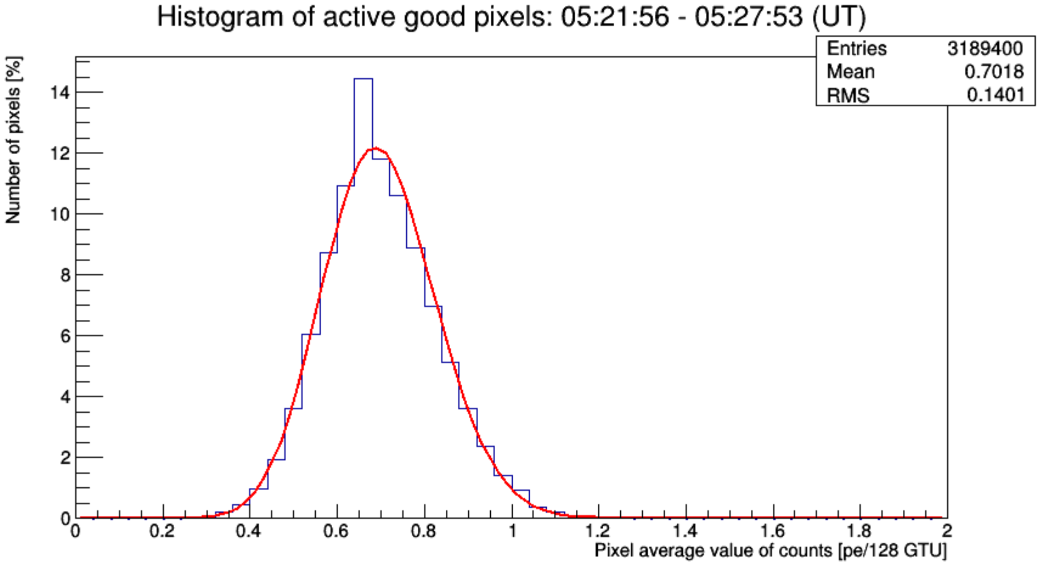


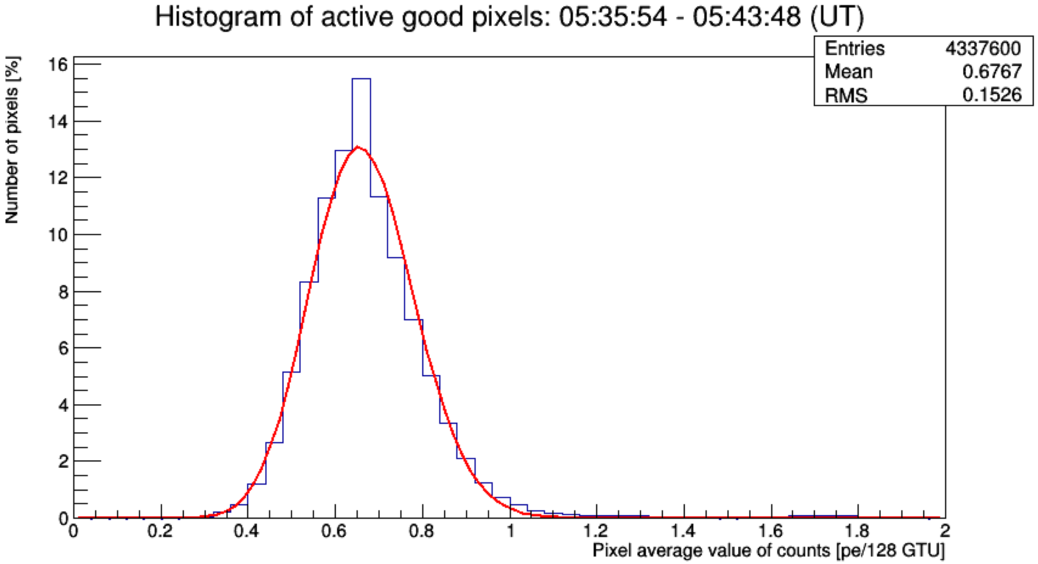
- Only “GOOD & ACTIVE” pixels are included to the averaged pixels values per all good & active pixels of PDM

  (all jumps disappeared)

Example of UV BG measurements without additional light sources



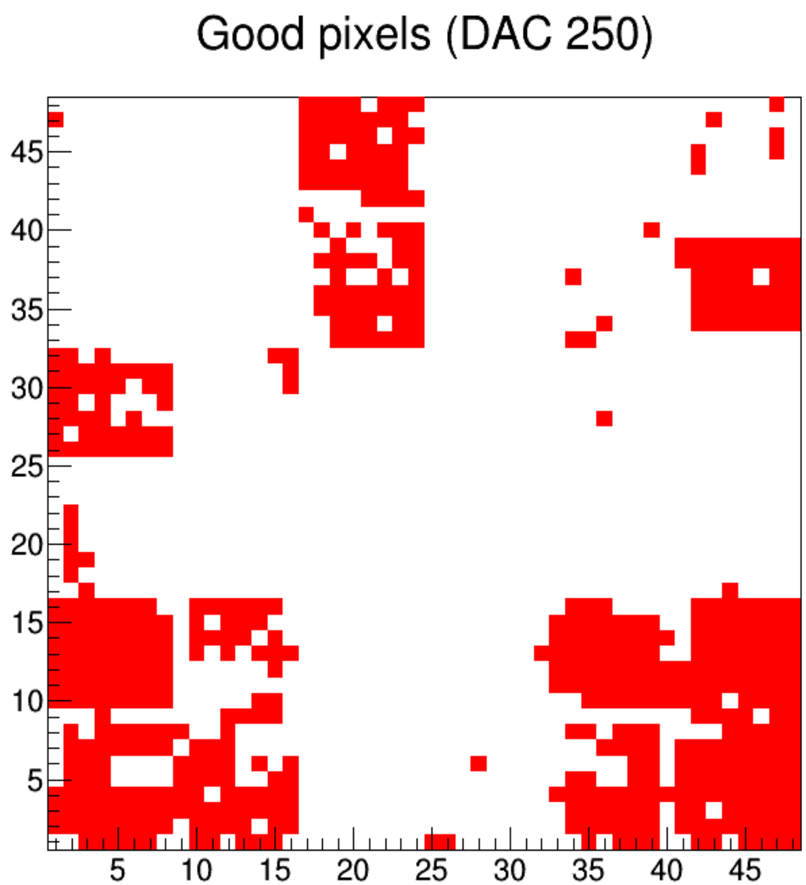


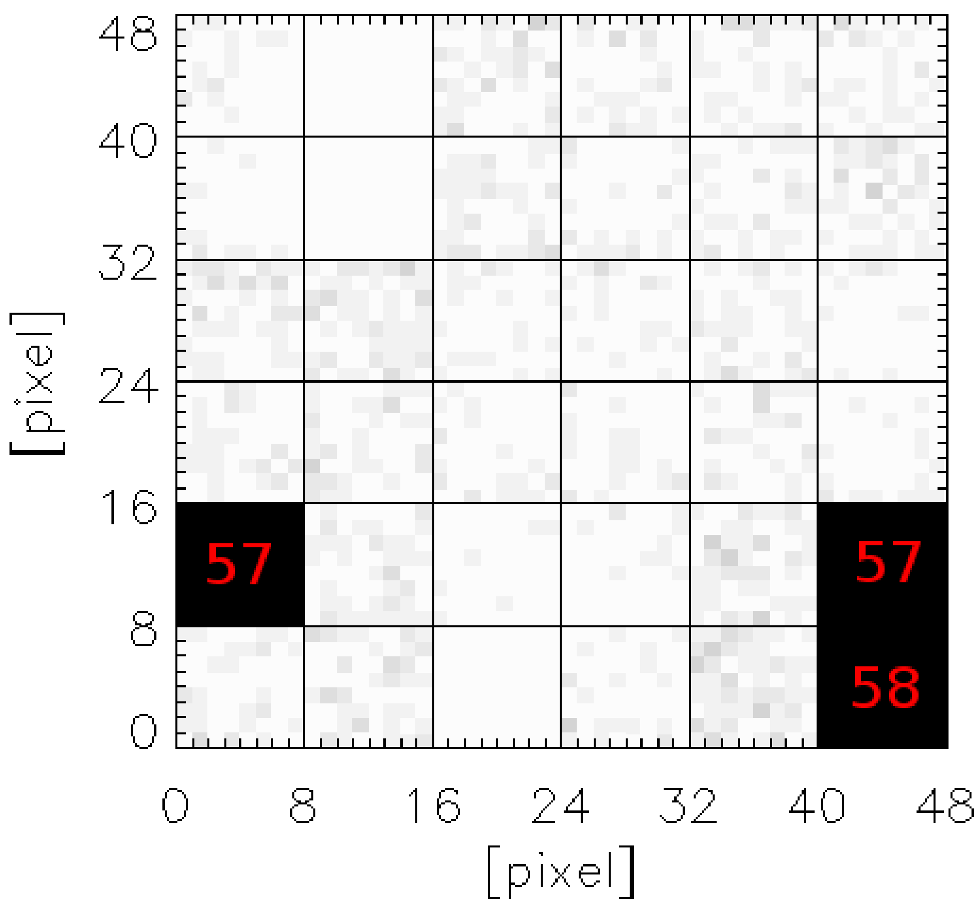


Fitted by Poisson distribution with $\lambda = 0.699$

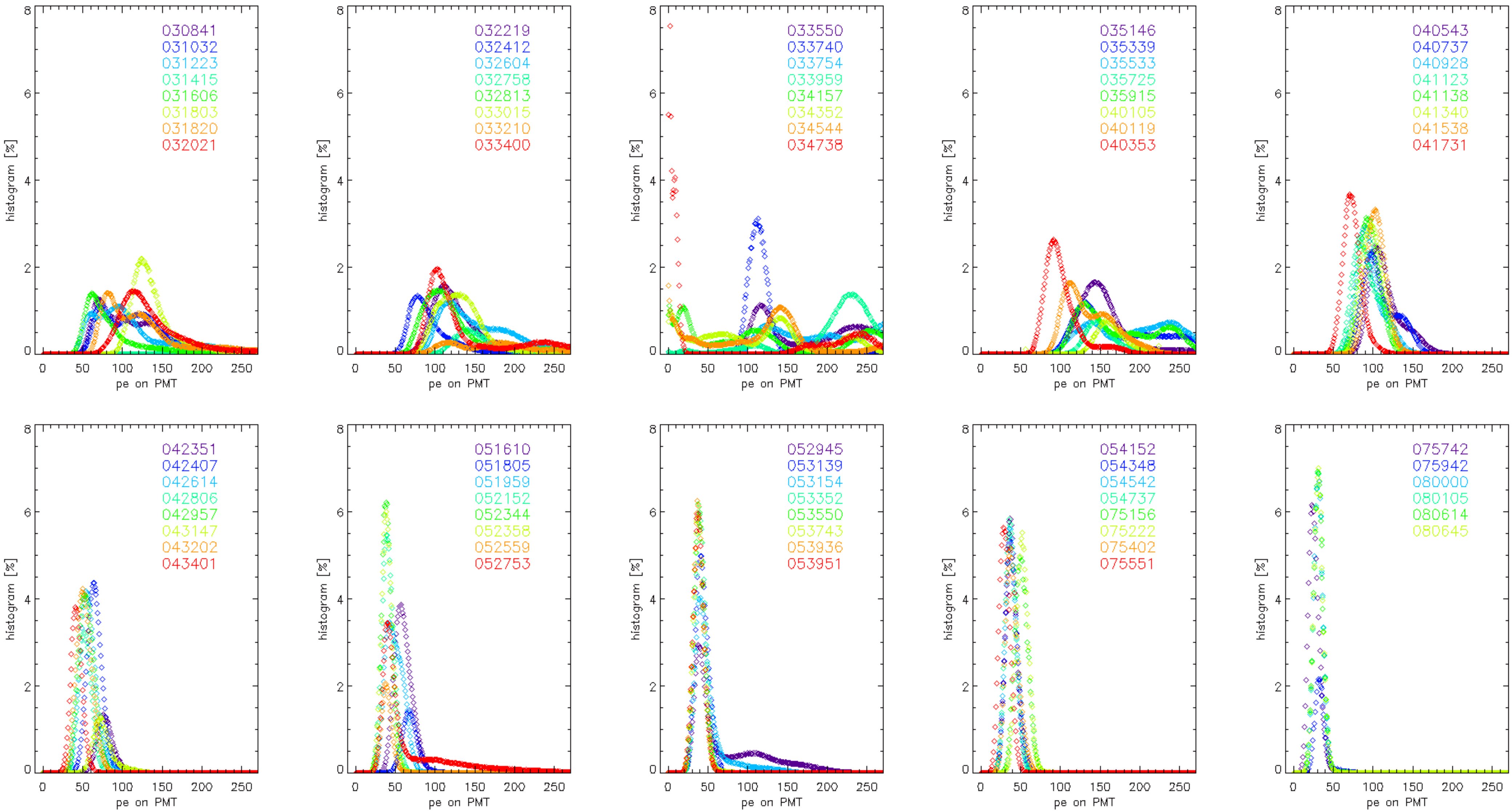
Fitted by Poisson distribution with $\lambda = 0.665$

The 3 best PMTs with the highest number of good pixels (with 57, 57 and 58 pixels) have been chosen from Camille Moretto map to crosscheck our results



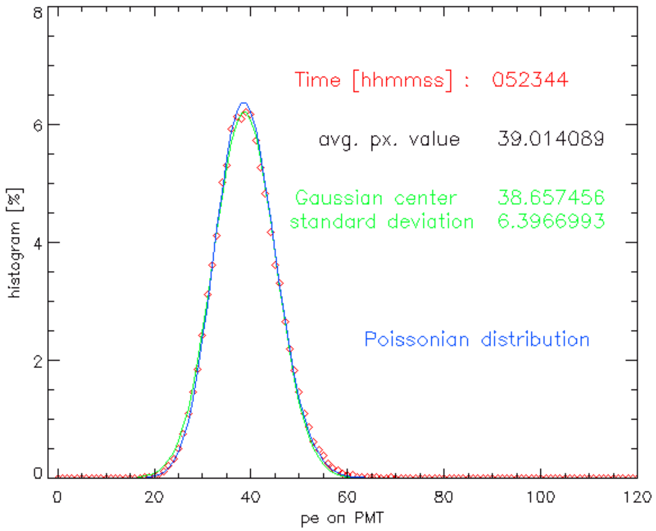


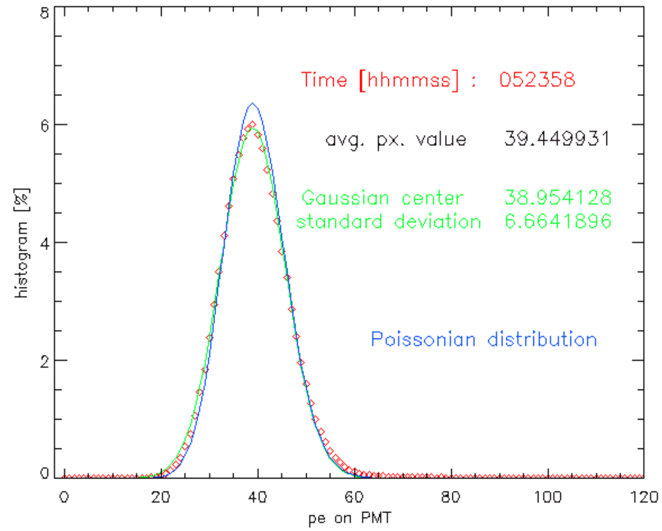
Time evolution - histograms of 3 best PMTs of particular .dat files

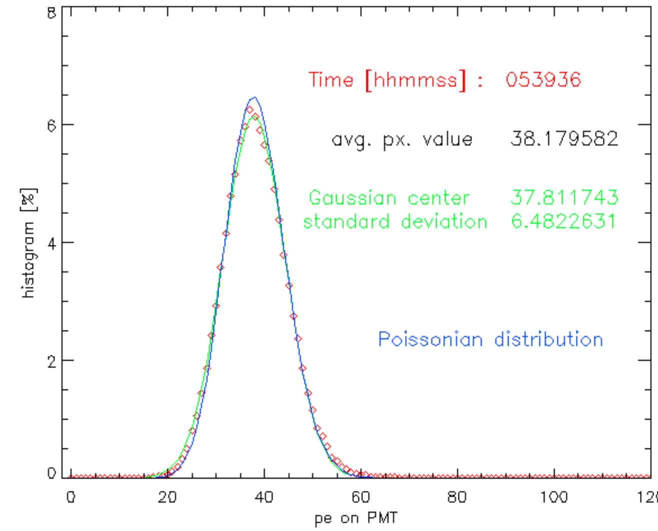


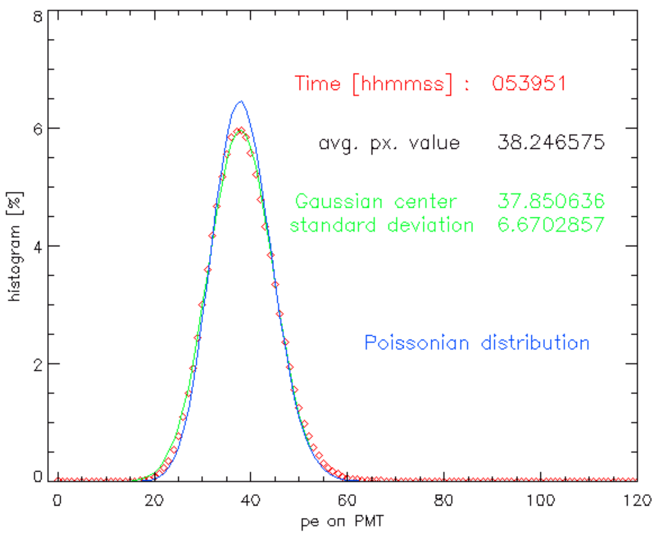
Example of UV BG measurements without additional light sources

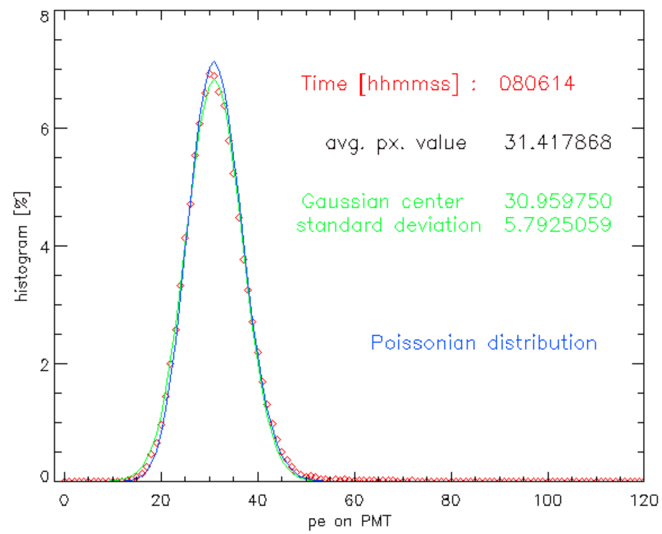
-> best single peak histograms









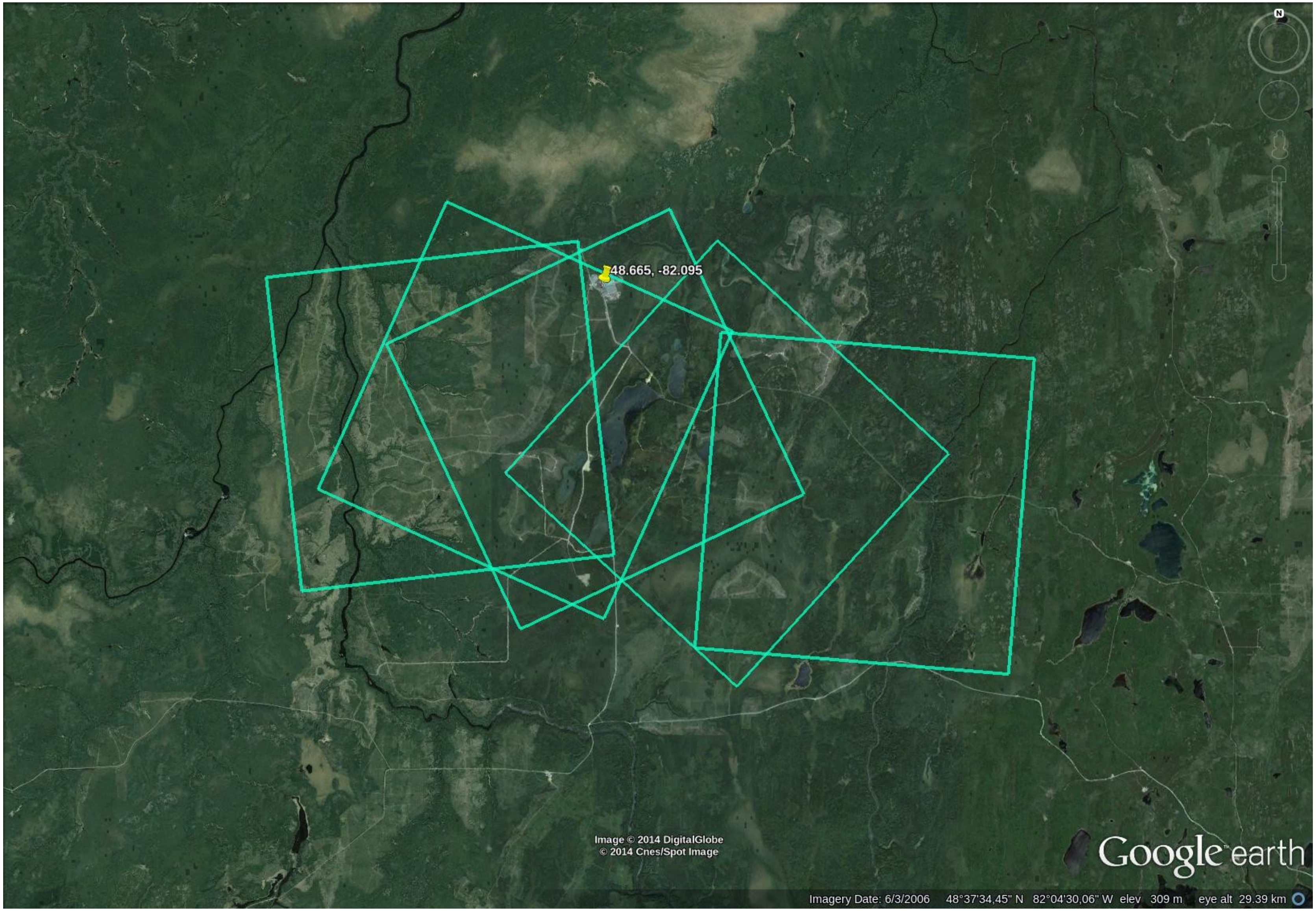


Fitted by Poisson distribution

with λ ~ 38.8 for PMT

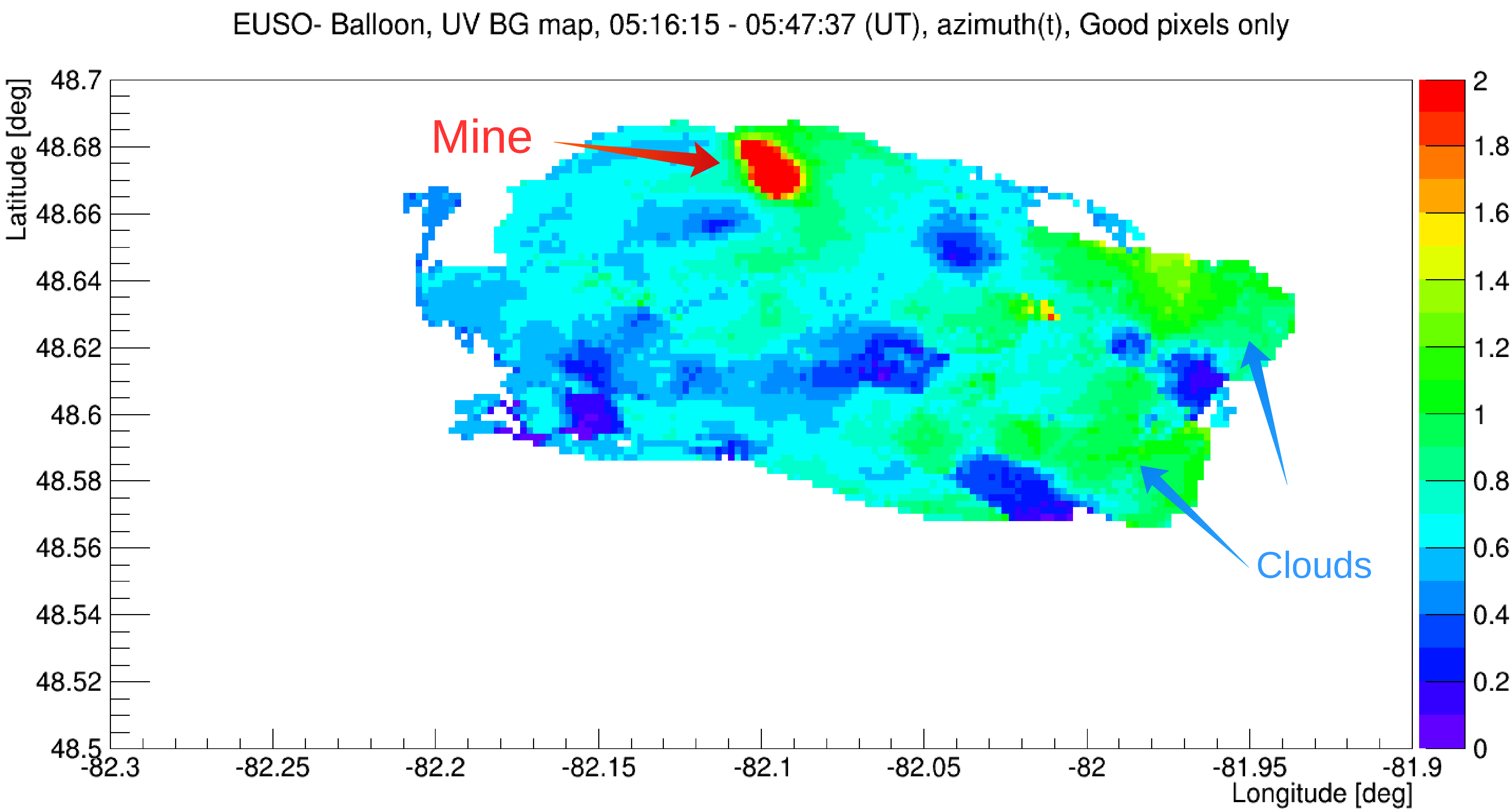
→ λ ~ 0.67 for pixel

Investigation of PDM observed structures (ground, clouds, light sources, ...) is crucial for UV BG analysis

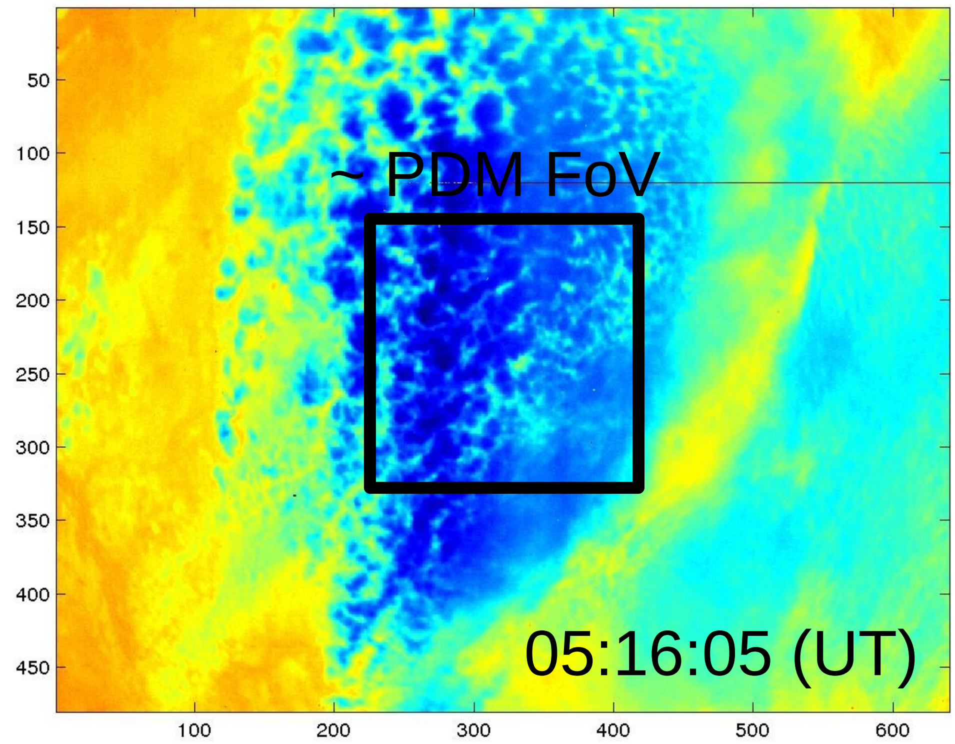


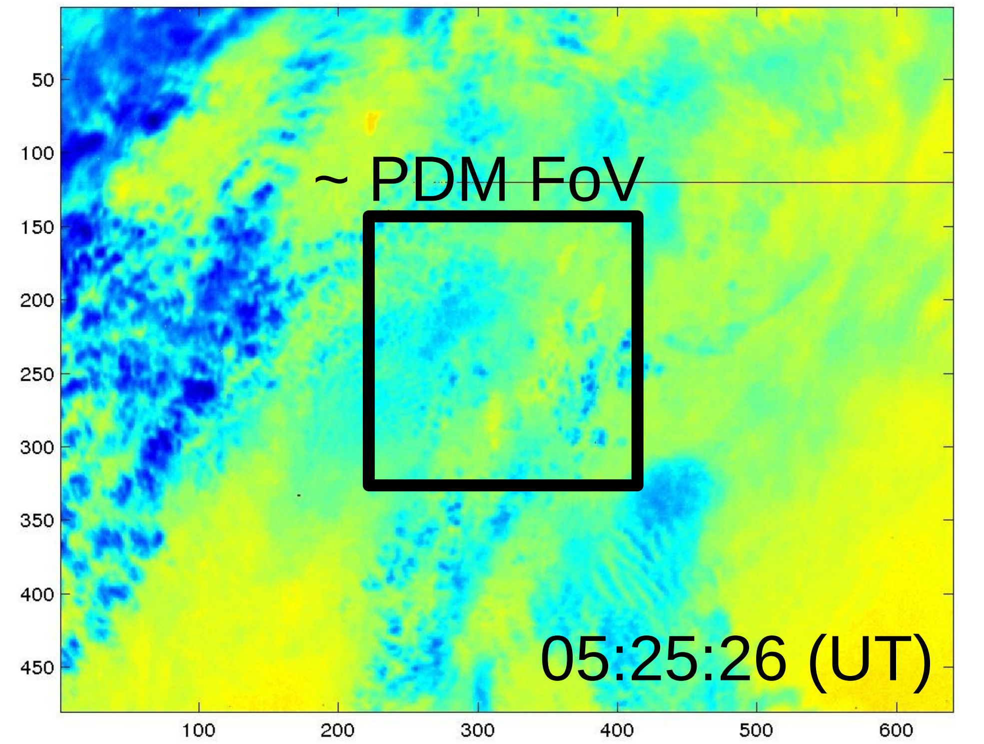
- PDM FoV – 05:16 - 05:48 (each 8 min)
- PDM side projection ~ 8.4 km, azimuth reconstructed by Camille Catalano

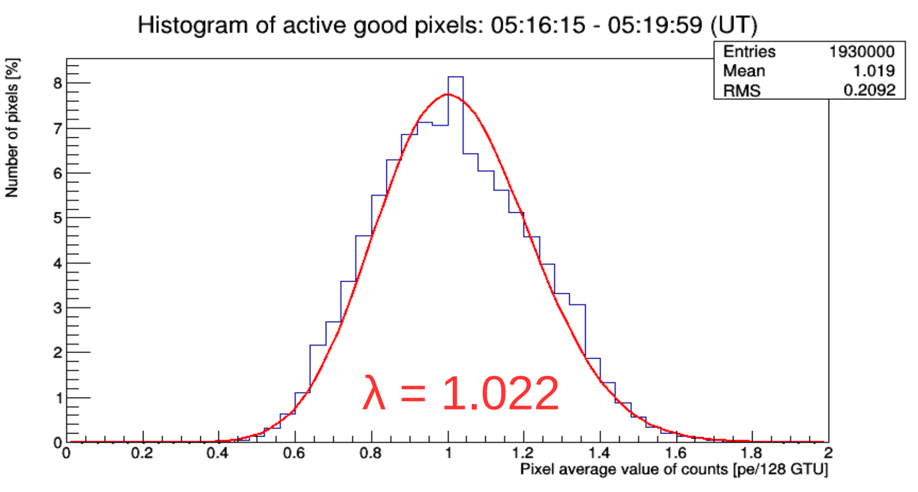
UV background map - each observed value of PDM pixel was associated with its calculated ground position

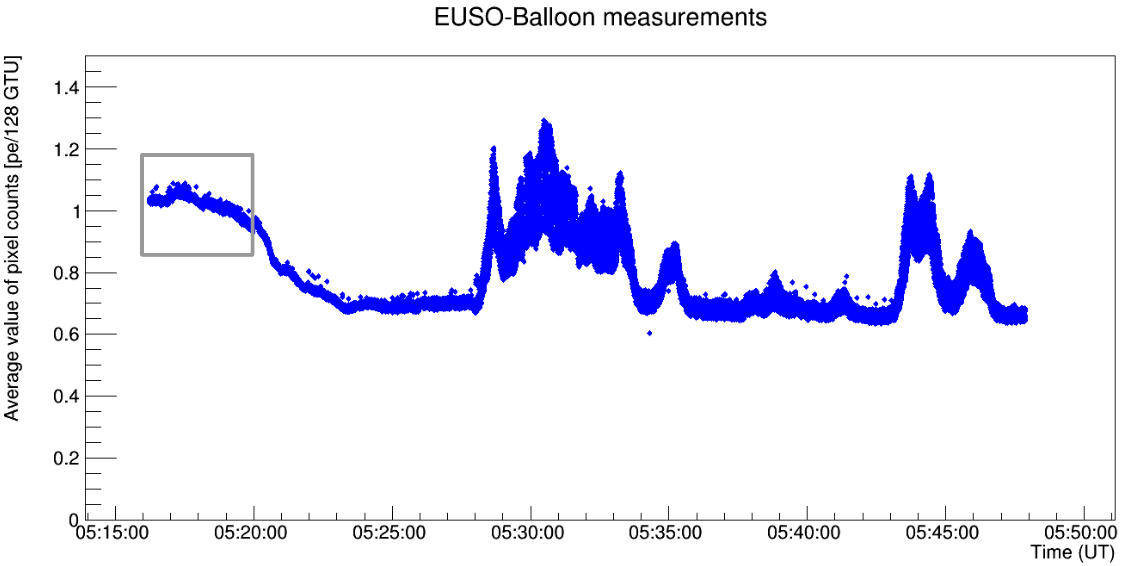


Clouds could change UV intensity (due to higher albedo)



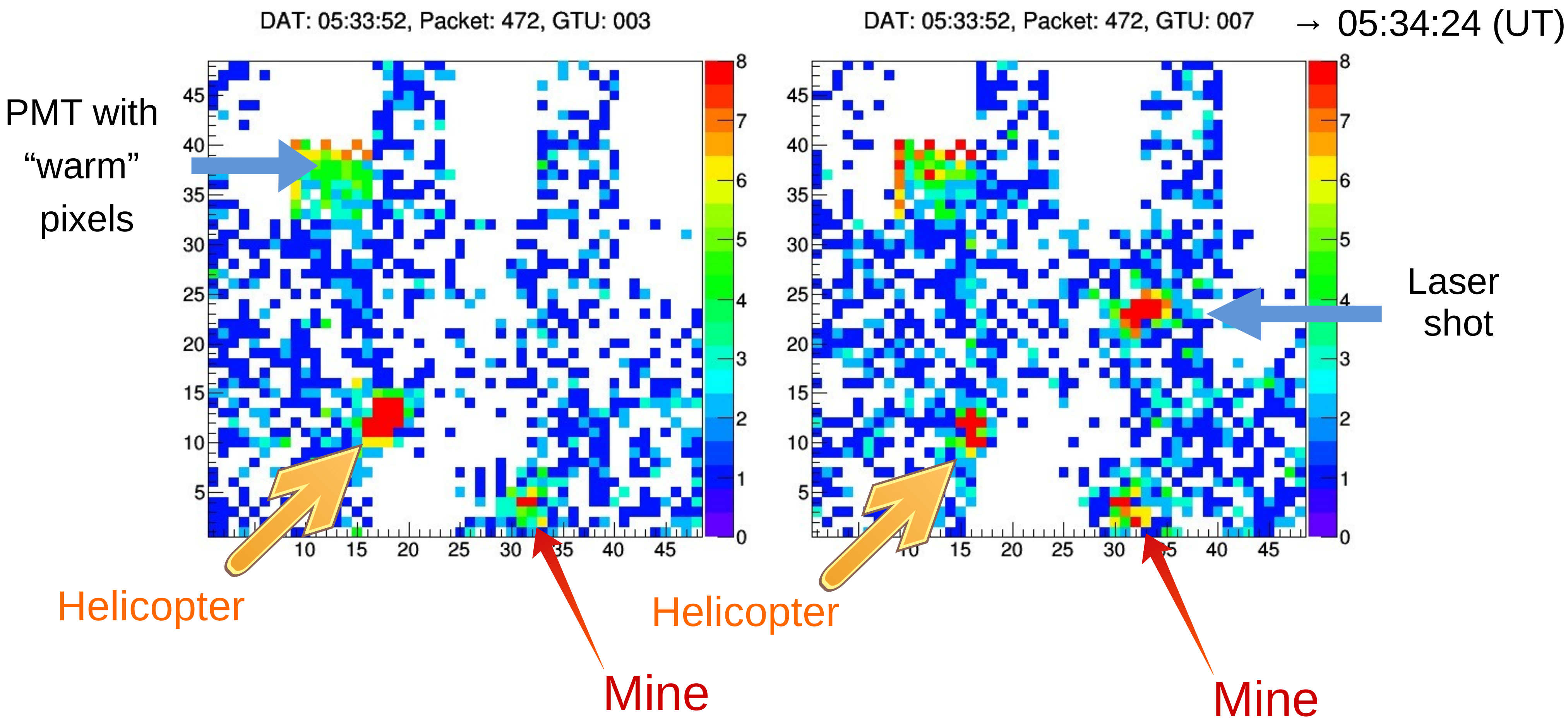






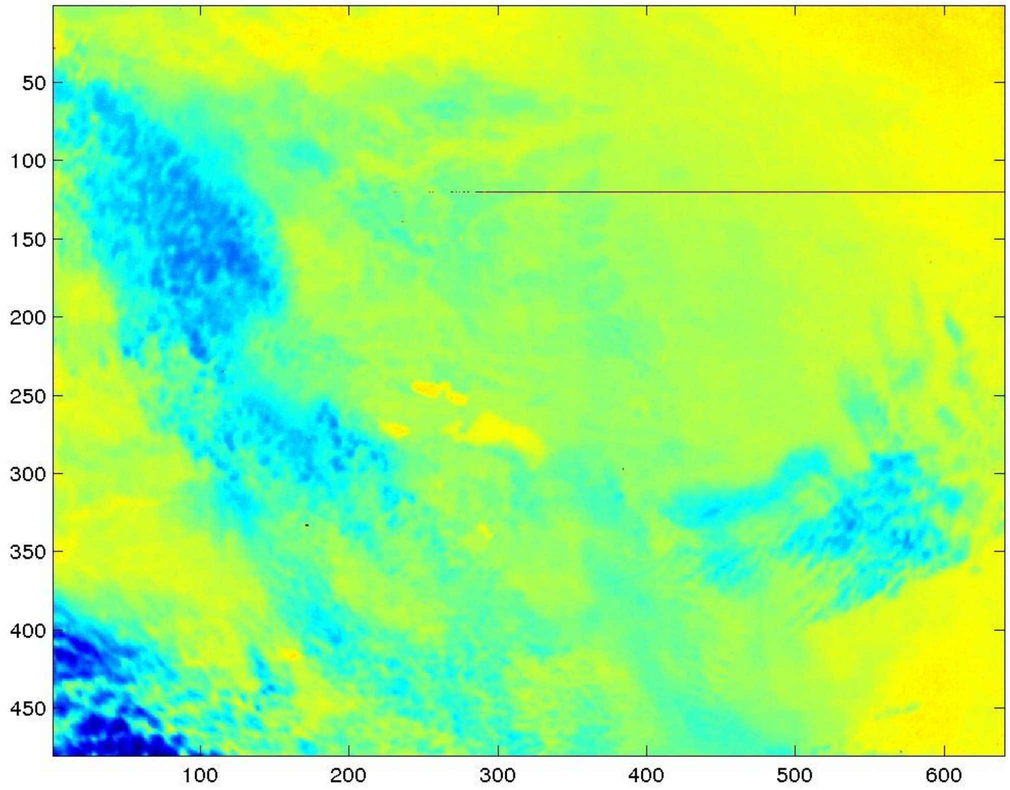
A few notes to PDM - IR CAM - Google Earth referencing

- we found light source from Helicopter in PDM data



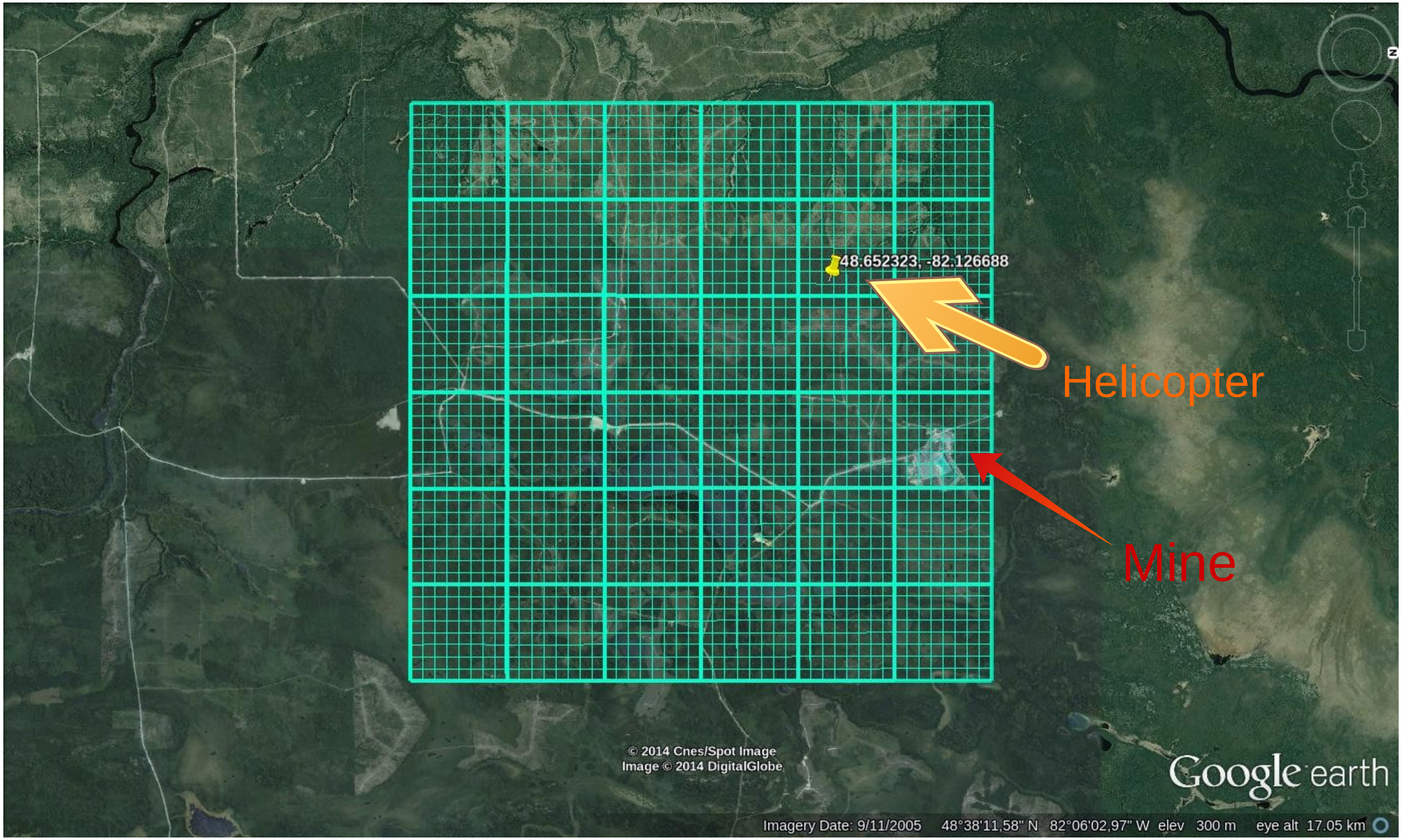
- we used table from Mario Bertina and Gregorio Suino (INFN)

- we found IR camera image with nearest time and associated it with Google Earth



- IR image: 206 → 05:34:48 (UT)
- Azimuth ~ 267.45° (in correspondence with azimuth reconstruction by Camille Catalano)

- we calculated position of each pixel of PDM for this time and azimuth, and plot Helicopter position

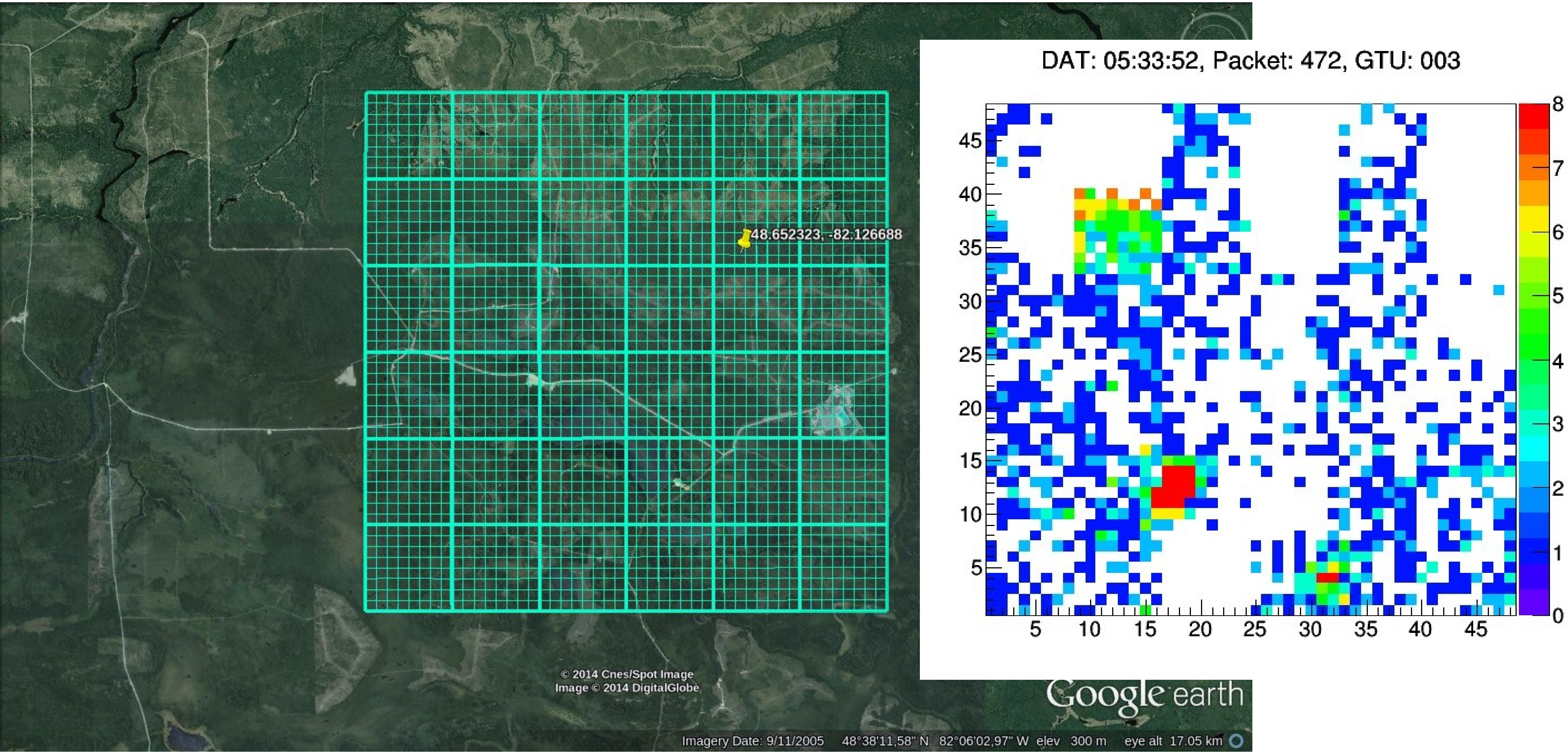


- Time: 05:34:24 (UT)
- Azimuth ~ 267.45°

EB center Lat: 48.6366°
EB center Lon: -82.1063°

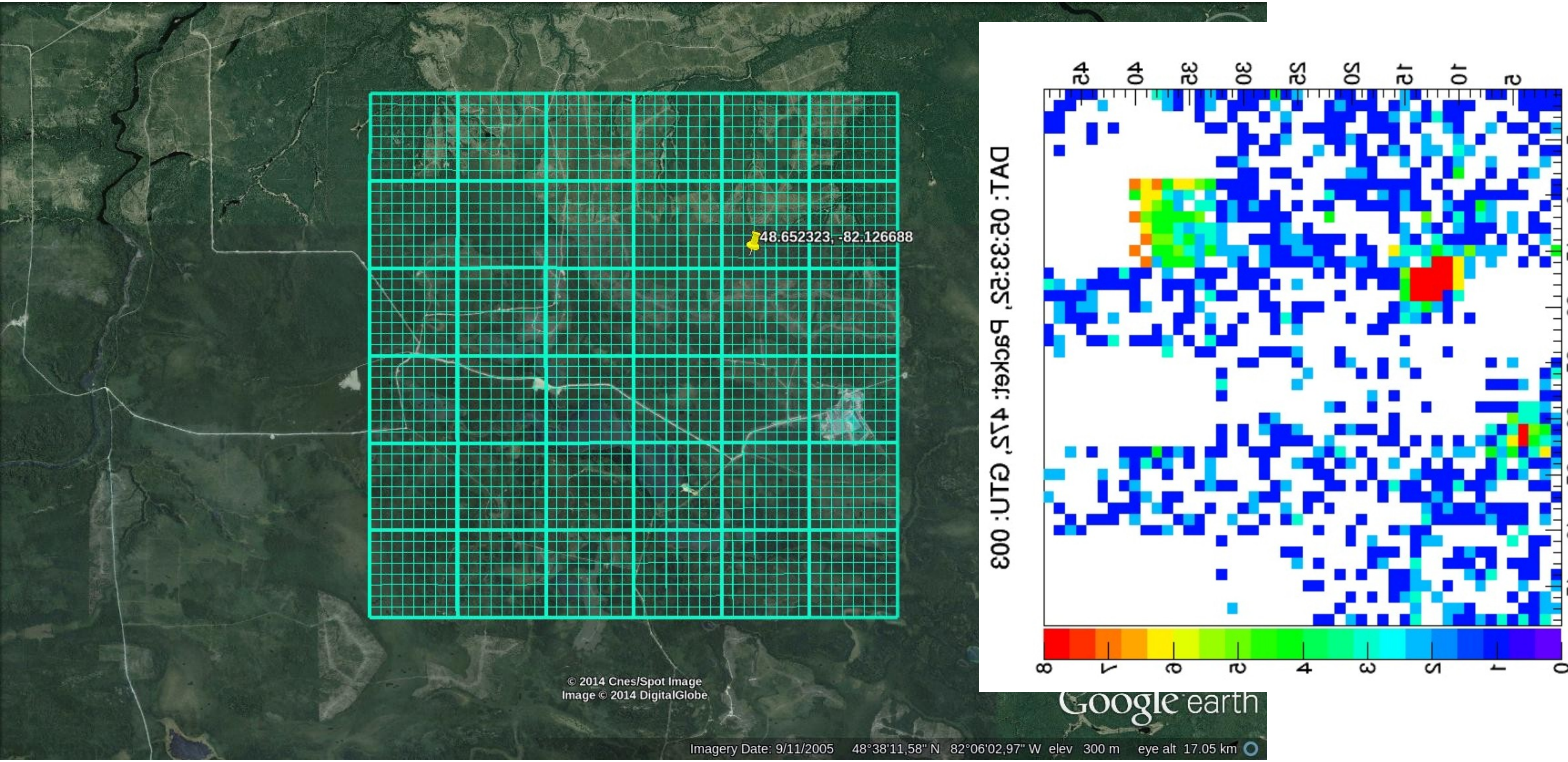
Helicopter Lat: 48.6523°
Helicopter Lon: -82.1267°

• we compared position of PDM with its observation



NO geographical correspondence for standard PDM mapping!

• we proposed correct orientation of PDM



GOOD correspondence for vertical flipped and + 90° turned PDM

→ vertical flip could be due to optics or due to side from which you look on PDM

→ rotation + 90° is due to fact that X axis points geographical North
when the azimuth is 0°

Conclusions

- We have estimated value of UV background

  ~ 0.68 pe counts of pixel
- We have created UV background map which is needed for complex investigation of UV BG
- Clouds which are visible in IR could increase intensity in UV range
- Correct orientation of PDM should be taken into account

my e-mail: simon.mackovjak@gmail.com

Future plans

- Preparation of UV Background map for whole EB flight from the PDM measurements
- Study of cloud effects on UV intensity
- Investigation of UV BG changes during the night
- Comparison of results with AURIC model
- Production of complex UV background map (for 24 Aug 2014) anchored to balloon results

my e-mail: simon.mackovjak@gmail.com