kHz SLR Station Graz

Graz

kHz

LIDAR

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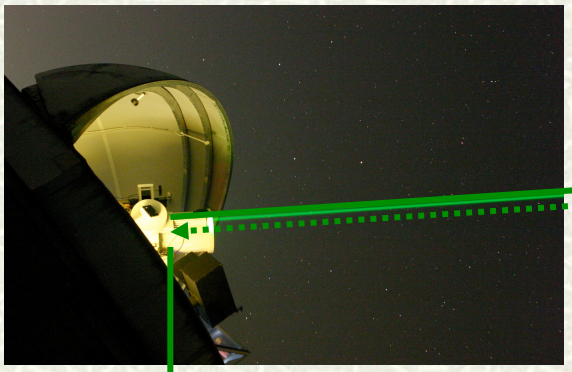
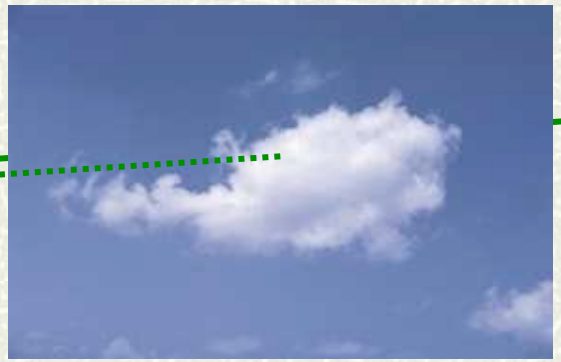
General Idea: How it works ....

- Herstmonceux published this idea in Canberra 2006; for 10 Hz SLR
- Graz now implemented a kHz LIDAR into the Graz kHz SLR station:
  - Laser Pulses are transmitted with 2 kHz;
  - Along each path, photons are backscattered (by clouds, layers ....)
  - Photons are detected with a SPCM (Single Photon Counting Module)
  - Epochs of these photons are filled into 100-ns-slots (15 m distance)
  - For each shot, up to 4096 slots are filled with photon events (> 60 km)
  - Up to 65000 shots can be accumulated / averaged for each slot
  - Number of events in each slot, Epoch Time, Az/El of mount are stored

Graz kHz SLR LIDAR





„Austria“ Cloud ☺

SPCM

Laser

15 m

30 m

45 m

61440 m

Control Logic

Counter 1

Counter 2

Counter 3

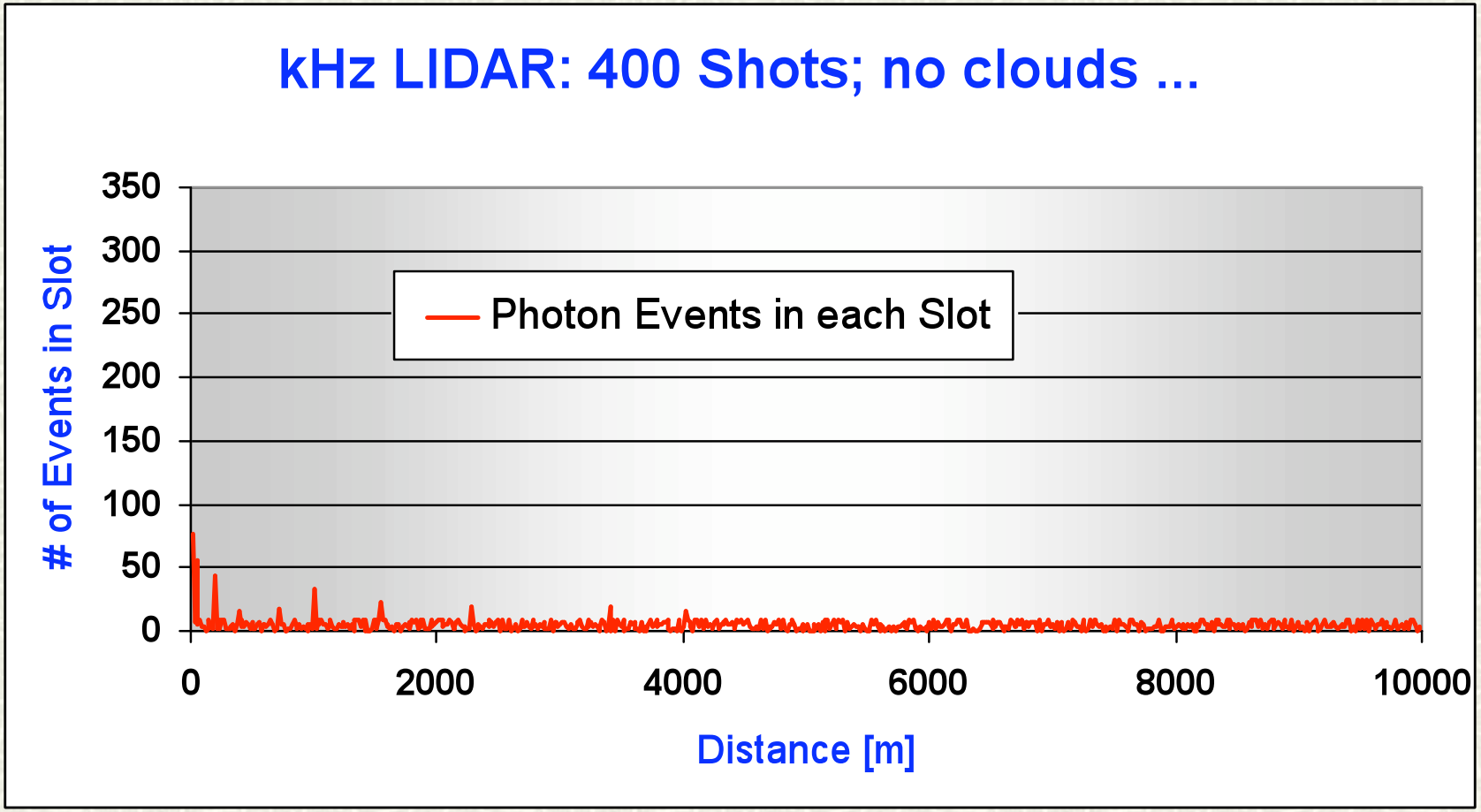
Counter 4096

Graz FPGA Card (ISA Card in PC)

PC

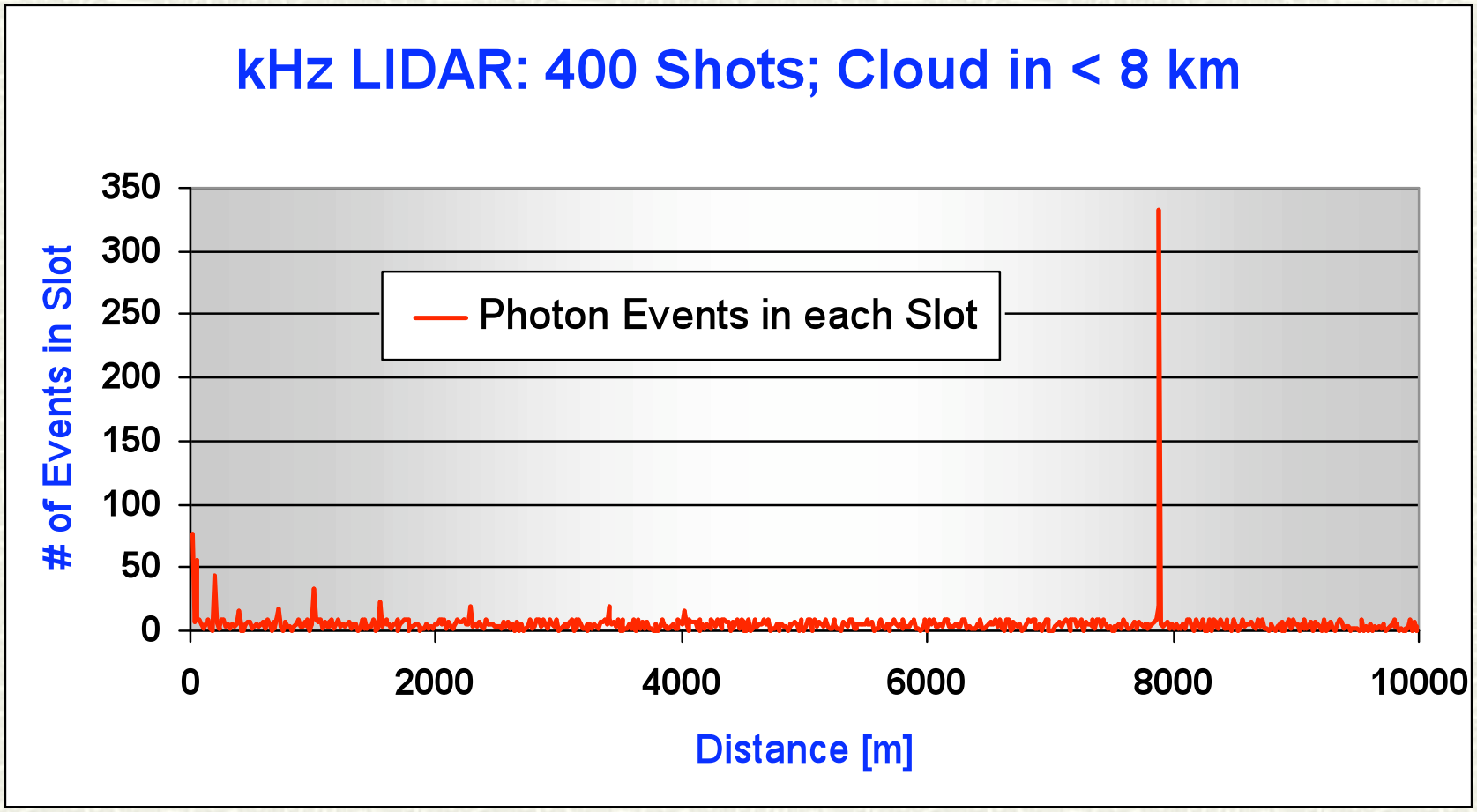
- Each Counter: 16 Bit, up to 65 k events
- Integration time selectable for each cycle
- PC stores all counter values, Time, Az, El ...

No Clouds: No reflections ..



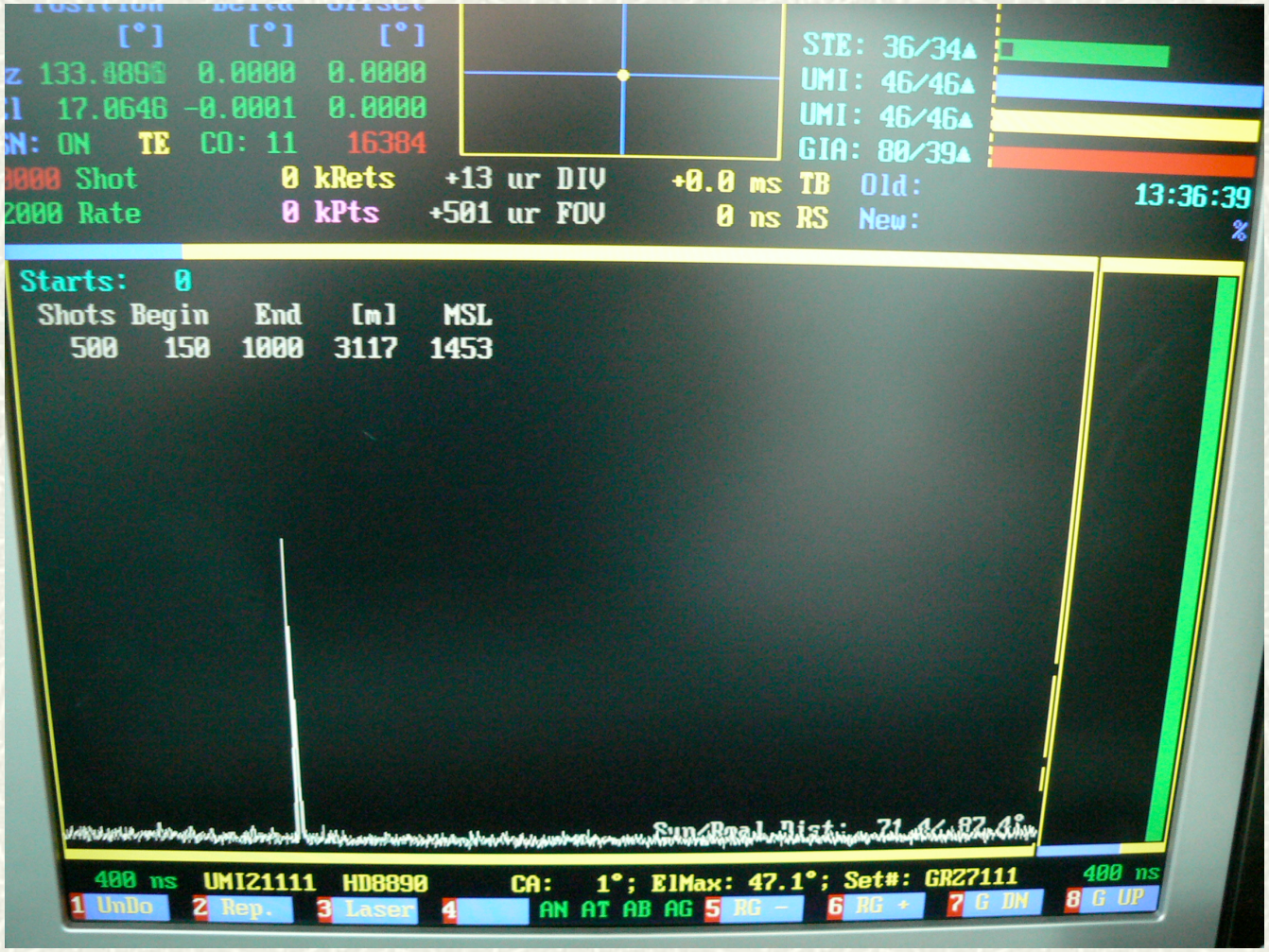
If there are NO clouds or other reflecting things along the laser beam path:
=> No reflections detected ....

The kHz LIDAR easily detects clouds …



The SPCM / FPGA can „see“ these reflections: Here in a distance of 7890 m:
In this 15-m slot, 335 out of 400 shots detected the cloud in full daylight

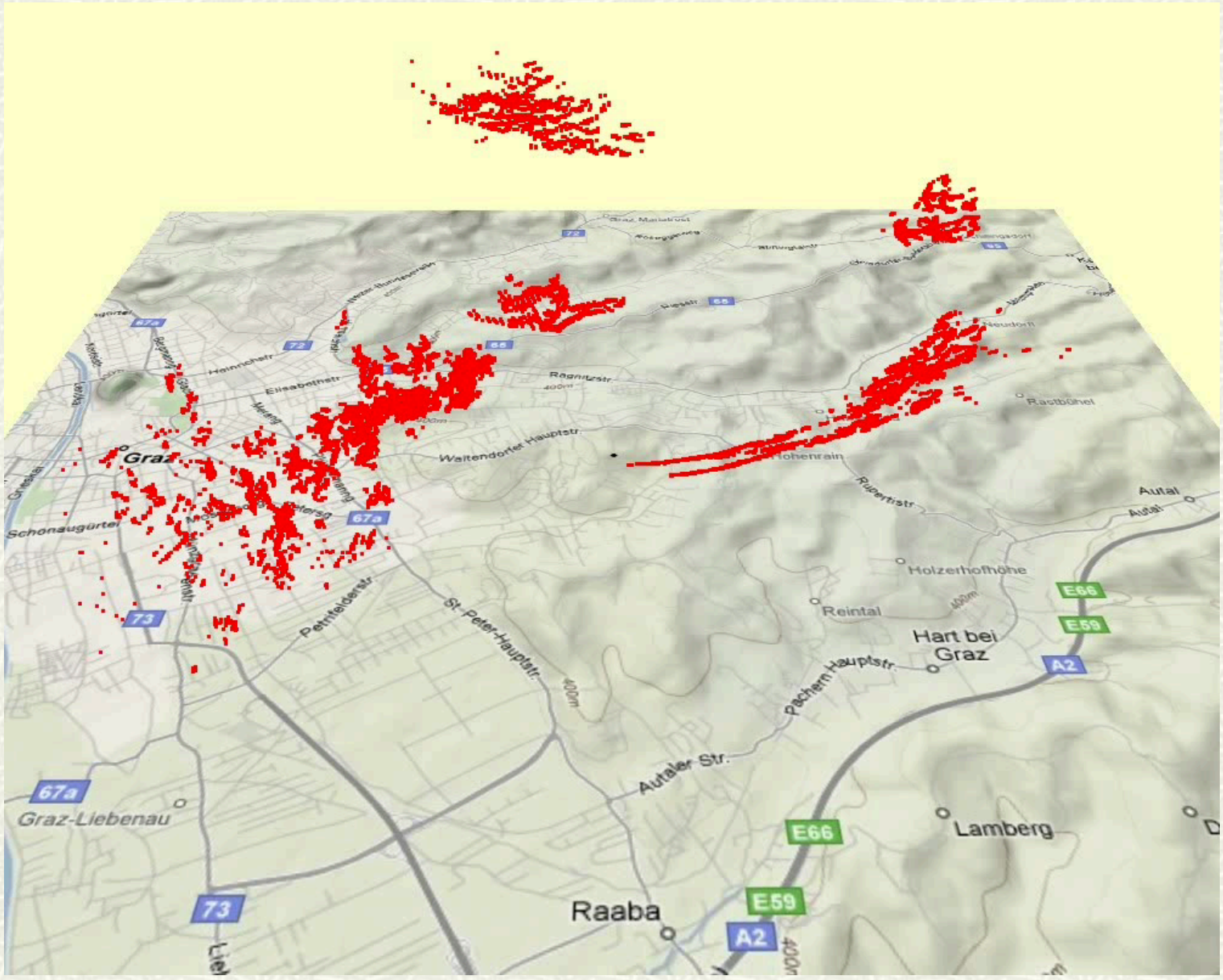
kHz LIDAR: Real Time Display



kHz LIDAR example:

- Full daylight;
- Low Noise, Clear signal
- Cloud in 3117 m dist.;
- 500 Shots averaged;
- @ 2 kHz: 4 meas./s
- Az/El/Time/Dist. Record

Lidar scan of some cloudy area ...



Main LIDAR Goals:

Collecting data for atmospheric research in the Graz basin:

- kHz SLR LIDAR will run automatically day and night during SLR;
- It will run in parallel to all SLR activities;
- This will collect data sets (3-D-coordinates, 15 m resolution) of:
  - Clouds, Layers, Inversions, Cirrus clouds etc.
  - Aircraft Vapor Trails; possibly wind speeds in altitudes
  - Correlation between SLR Return Rate and atmospheric backscatter
  - ???
- In addition, dedicated scans can be initiated to:
  - map dimensions and growing of Cumulo-Nimbus clouds
  - Measure altitudes of clouds, top levels of CBs etc. etc.

Conclusions

- kHz SLR is also a nice and efficient LIDAR system ☺
- Runs in parallel and automatically with SLR
- Day & Night operation
- Simple and low-cost add-on to collect atmospheric data
- Maybe useful also for 10 Hz stations ...

"Do not look into the laser beam with your remaining eye !"

Thank you ☺

Slowly scanning through such a sky ...

… results in these records