A New Beam Monitor for the DESY Test Beam

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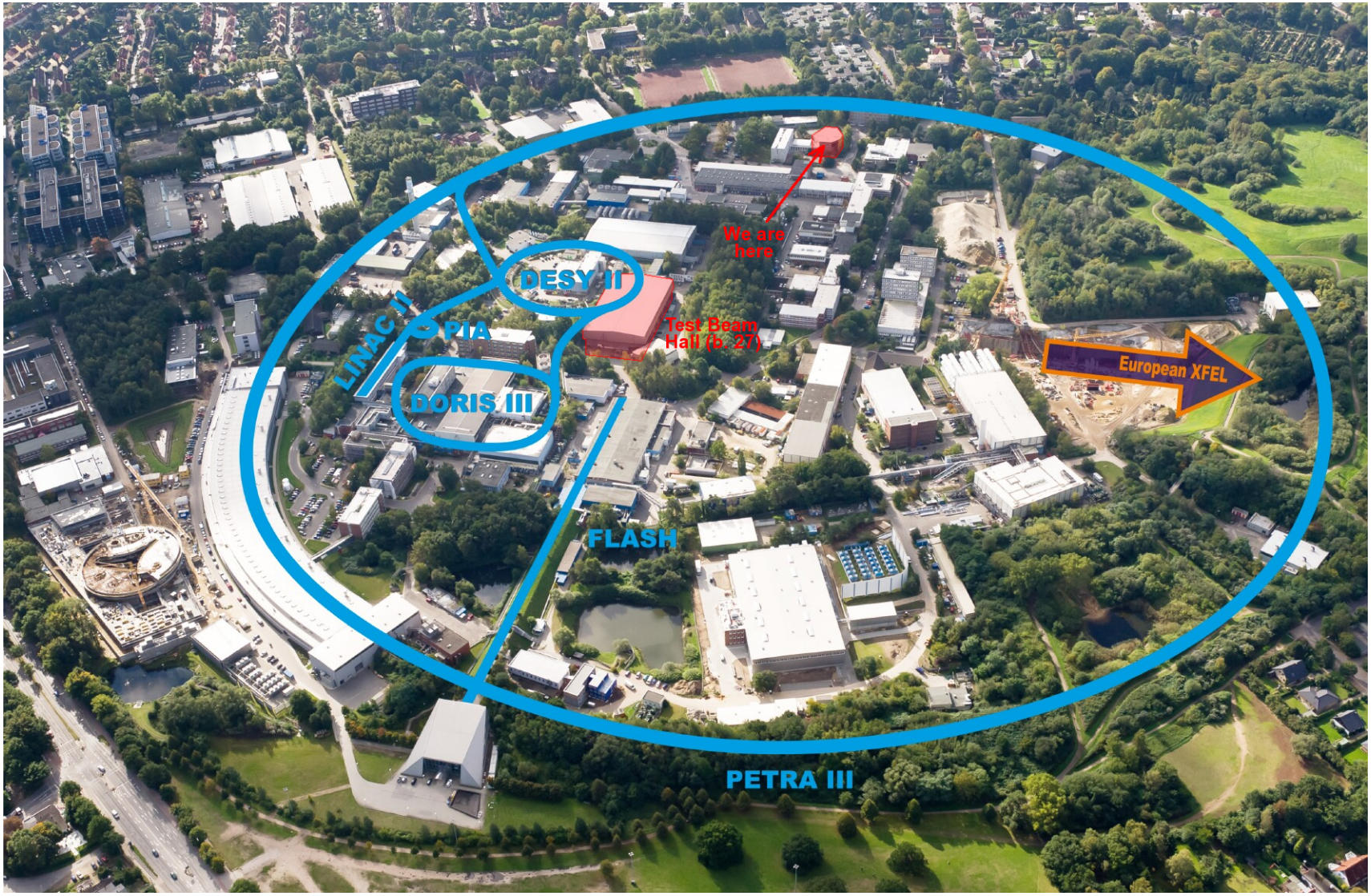
DESY, 2012-09-06

HELMHOLTZ ASSOCIATION

DESY

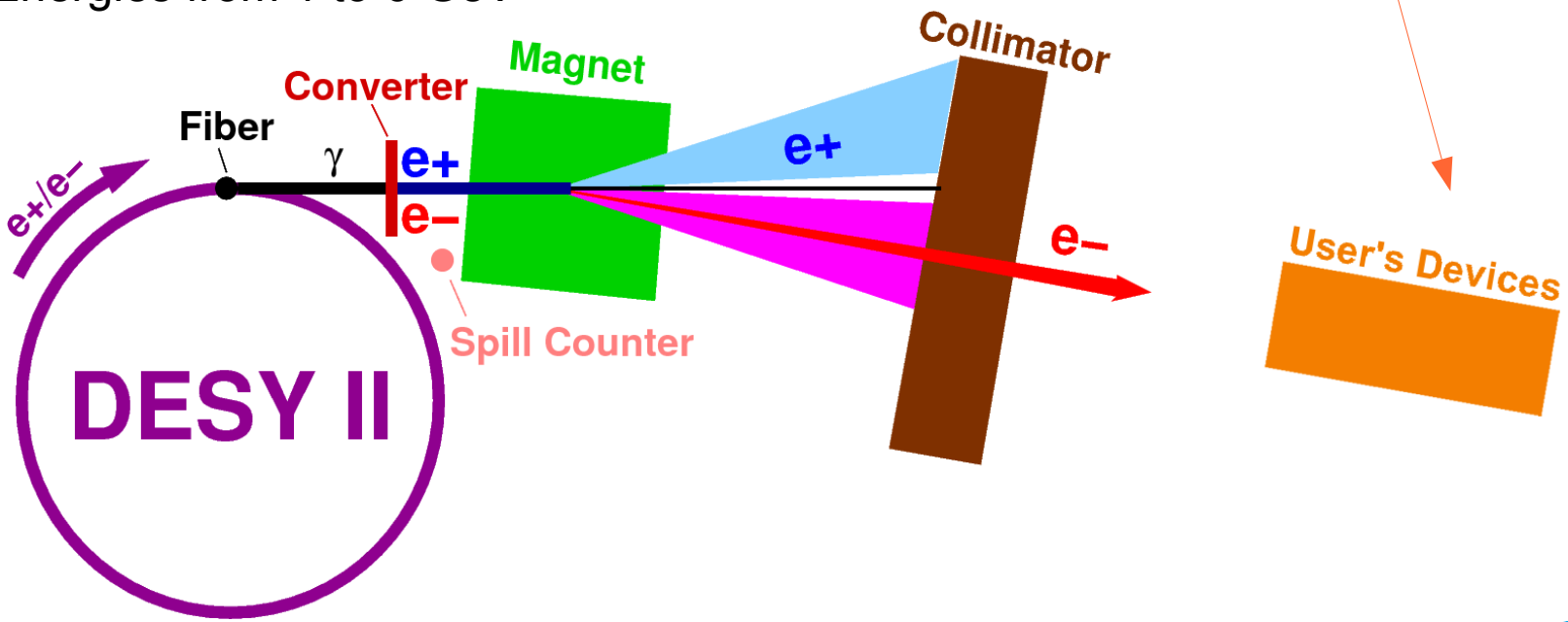
Test Beam at DESY



Test Beam at DESY

- Facility for testing detector prototypes
- Three electron/positron beam lines
- Converted bremsstrahlung

  from fibre targets in DESY II
- Typical flux around 1000 particles/cm²/second
- Energies from 1 to 6 GeV



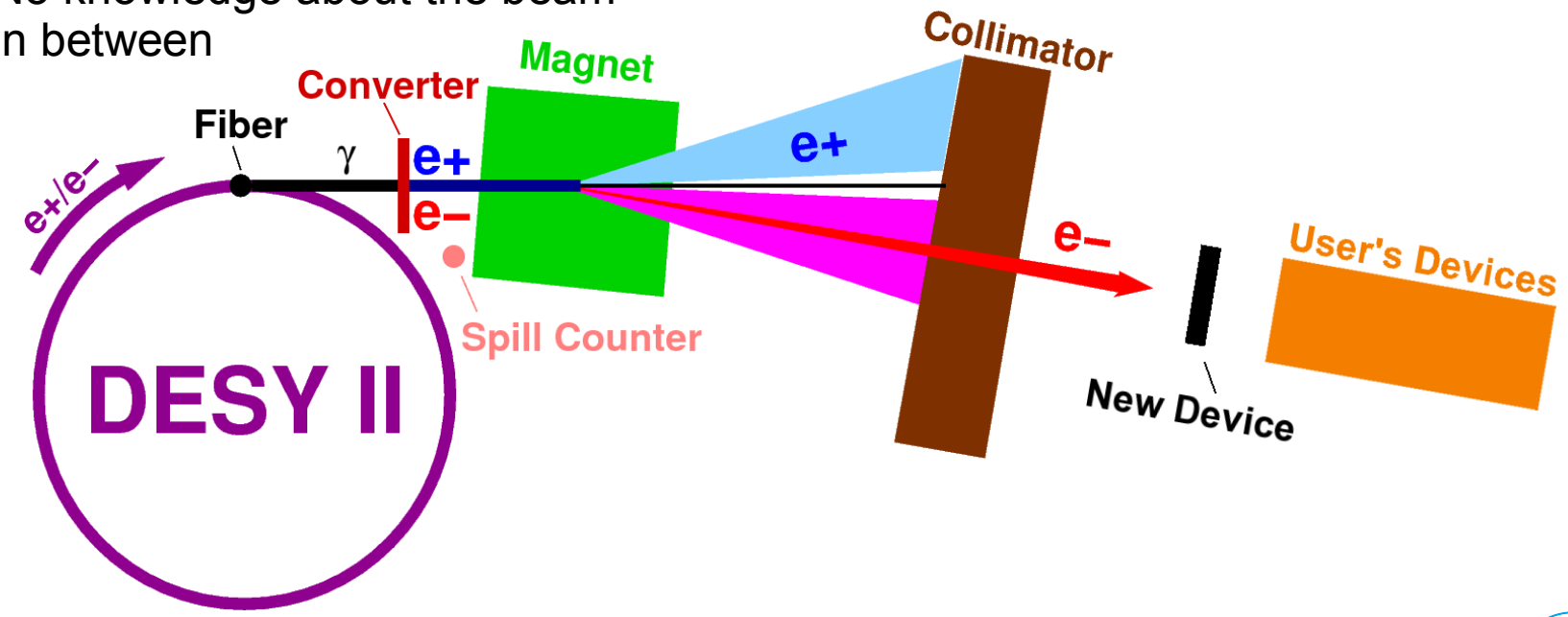
Purpose of the project

Problem:

- Difficult to establish beam presence
- Machine instrumentation before final collimator
- User tested devices in the area
- No knowledge about the beam in between

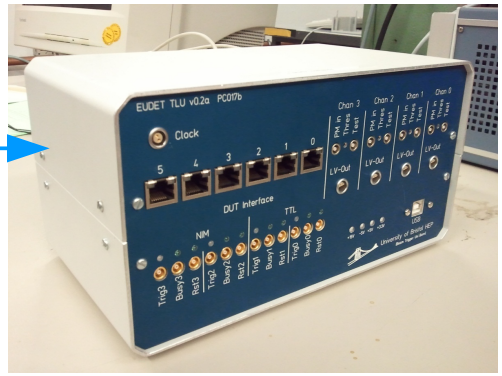
Solution:

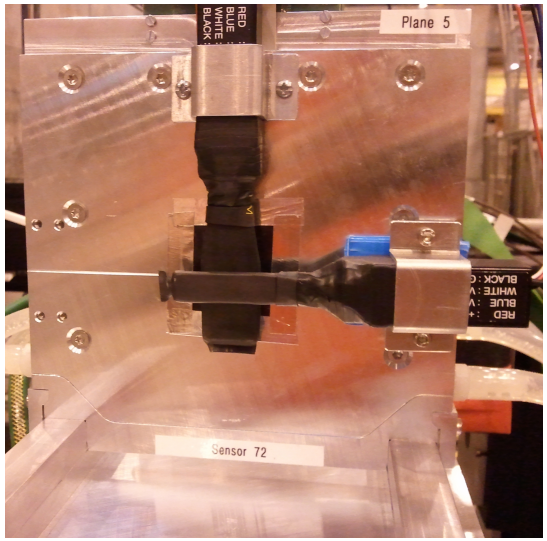
- Simple and reliable setup to measure flux after entry in the test beam area
- Remotely accessible real-time display
- Logging data for further analysis

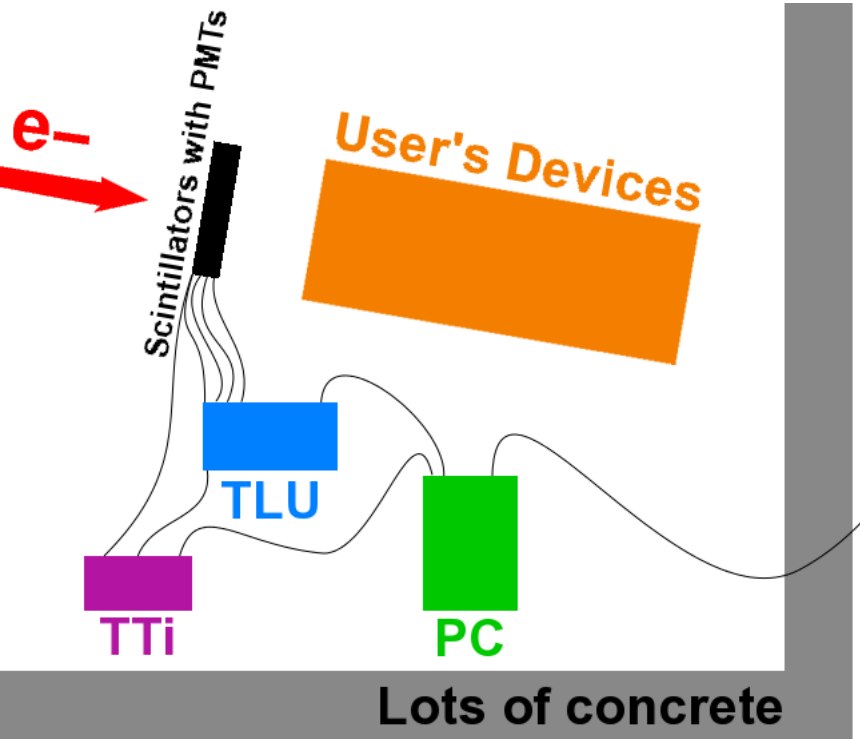


Hardware Setup

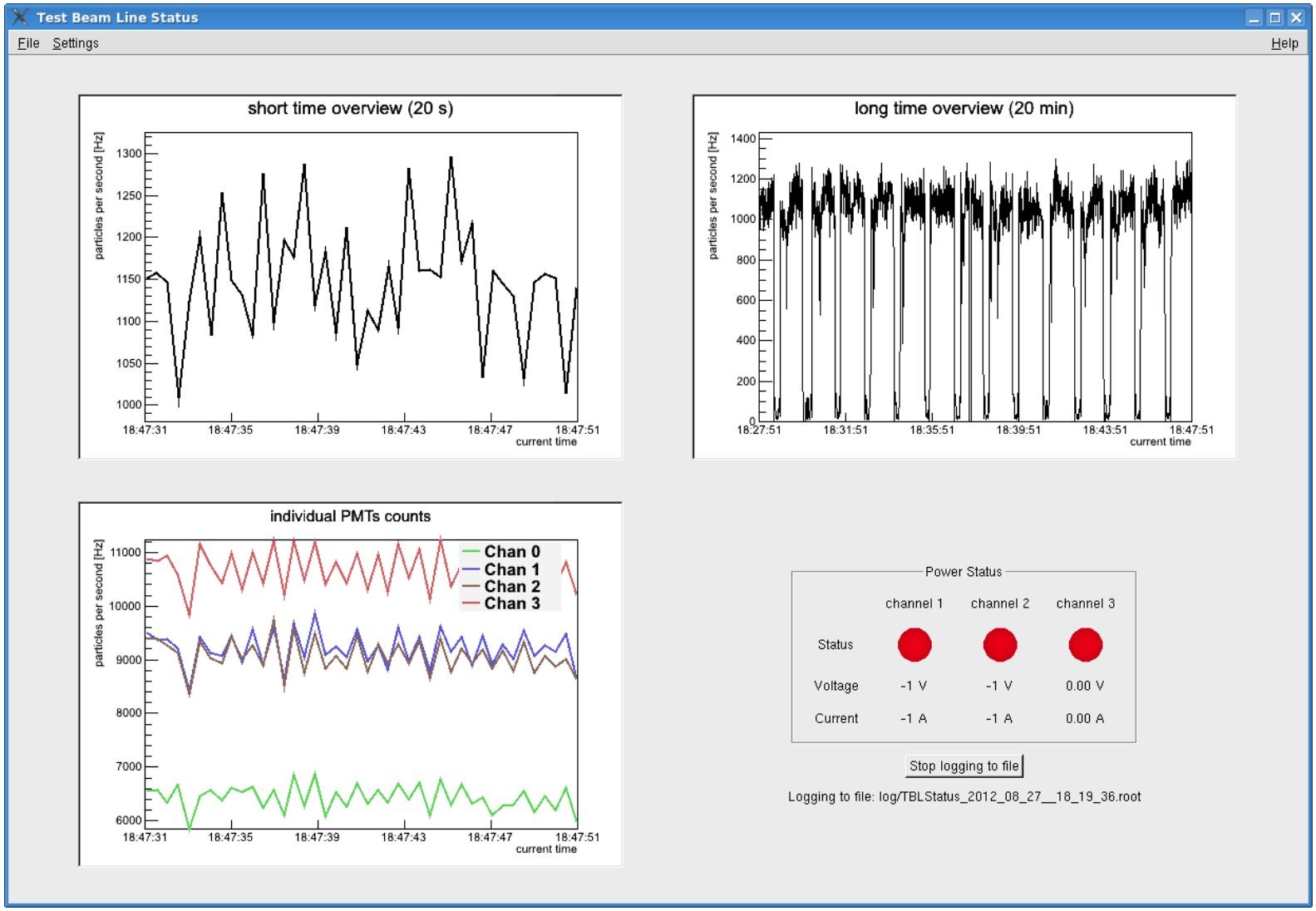
- Scintillators with PMTs (photomultiplier tubes)
- Trigger Logic Unit – TLU
- Power Supply - TTi
- PC running Linux



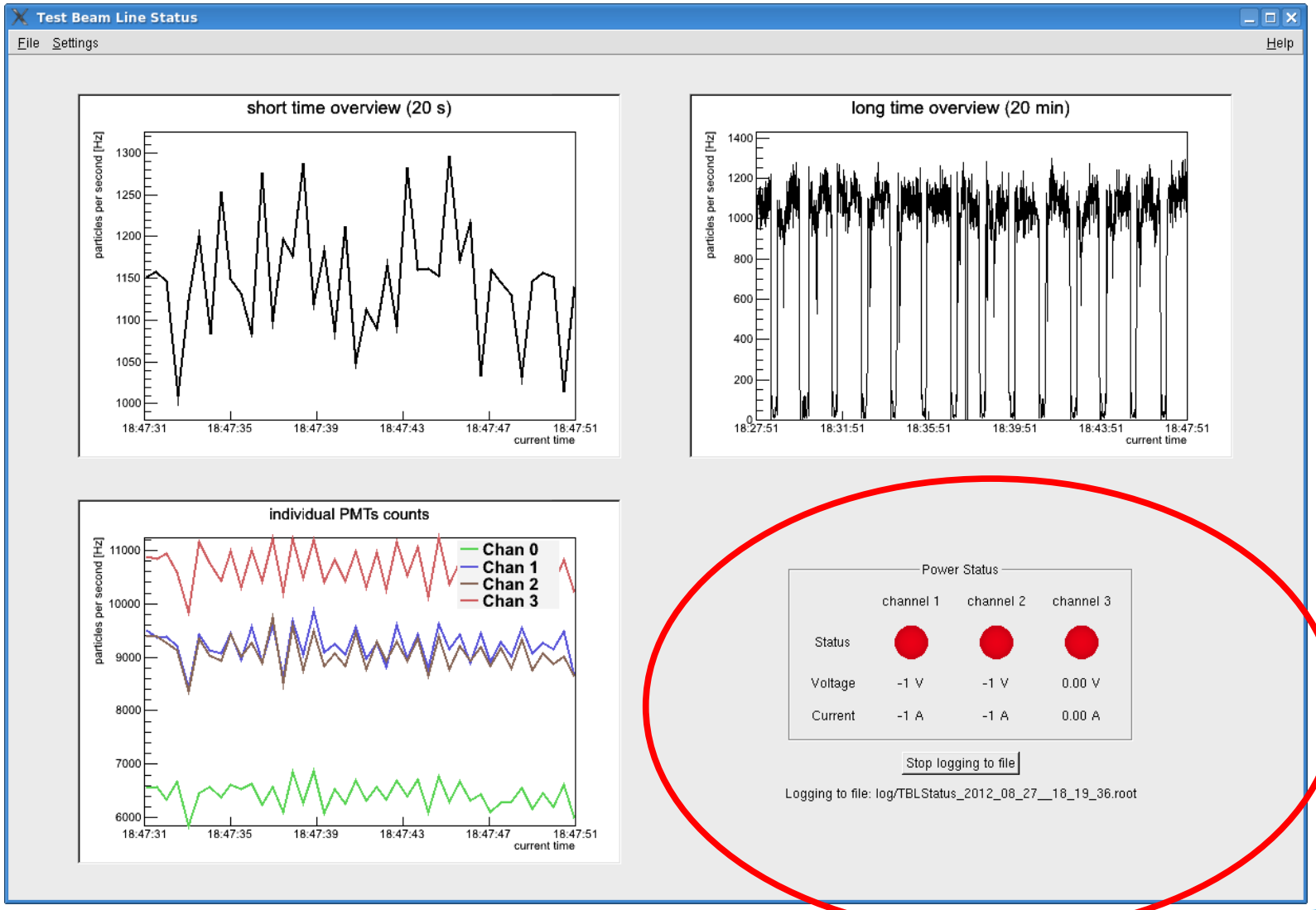




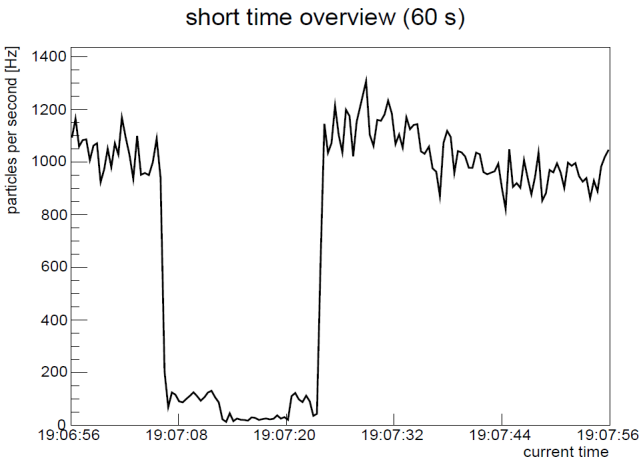
Application Overview – Main Window

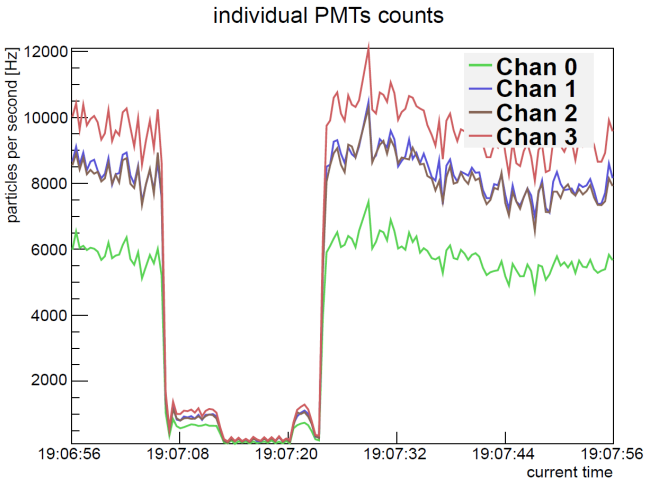


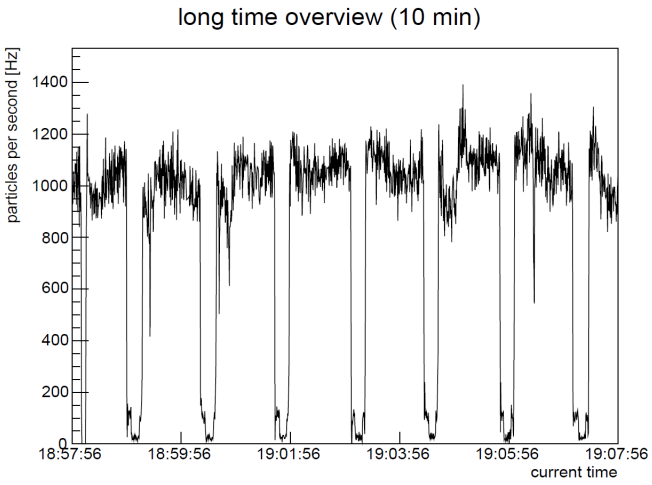
Application Overview - Voltage Monitoring

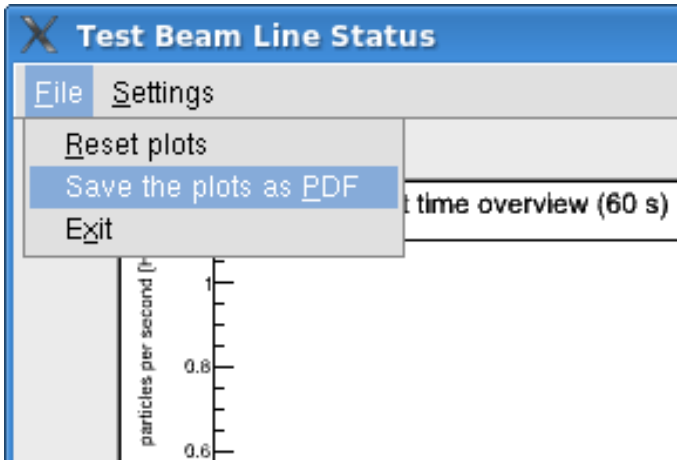


Application Overview – Saving Plots

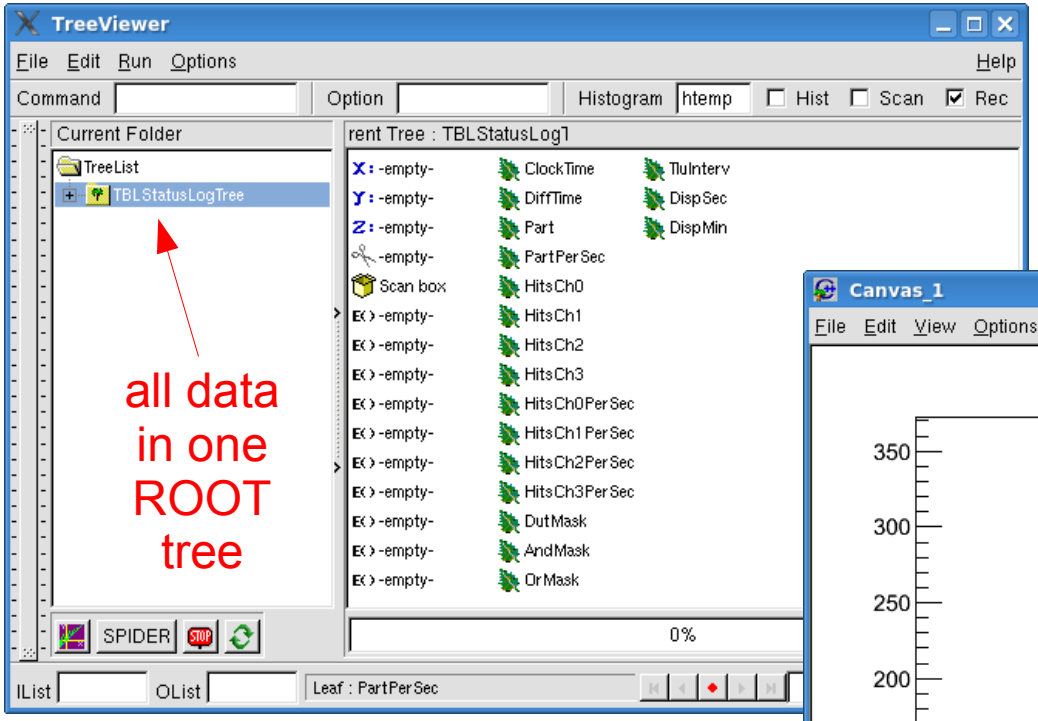






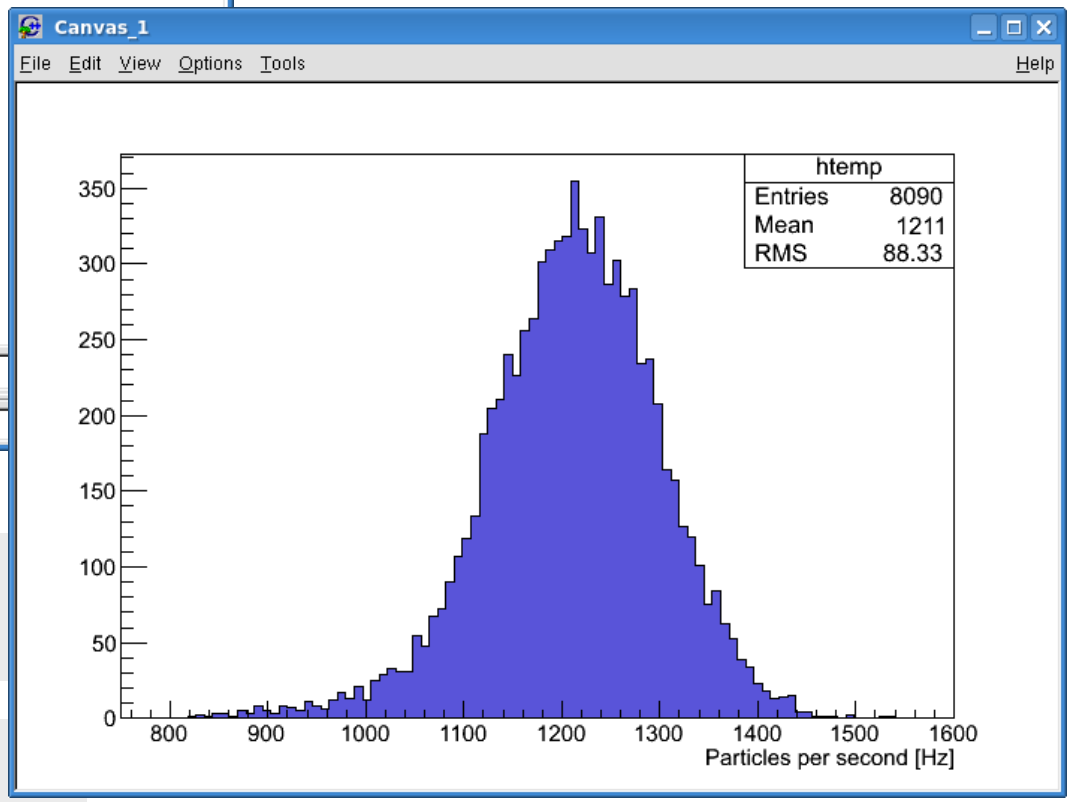


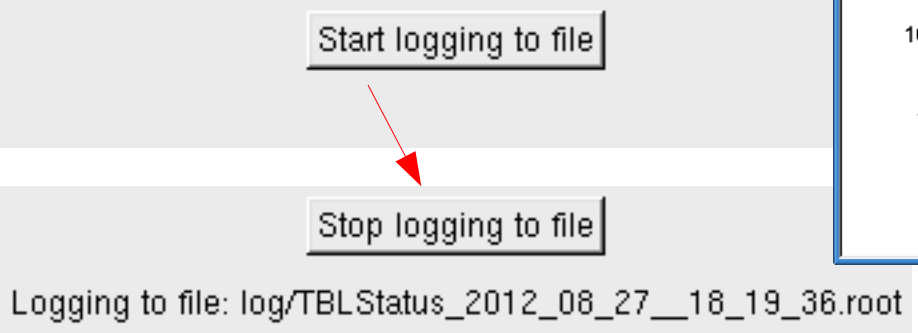
Application Overview - Logging



all data in one ROOT tree

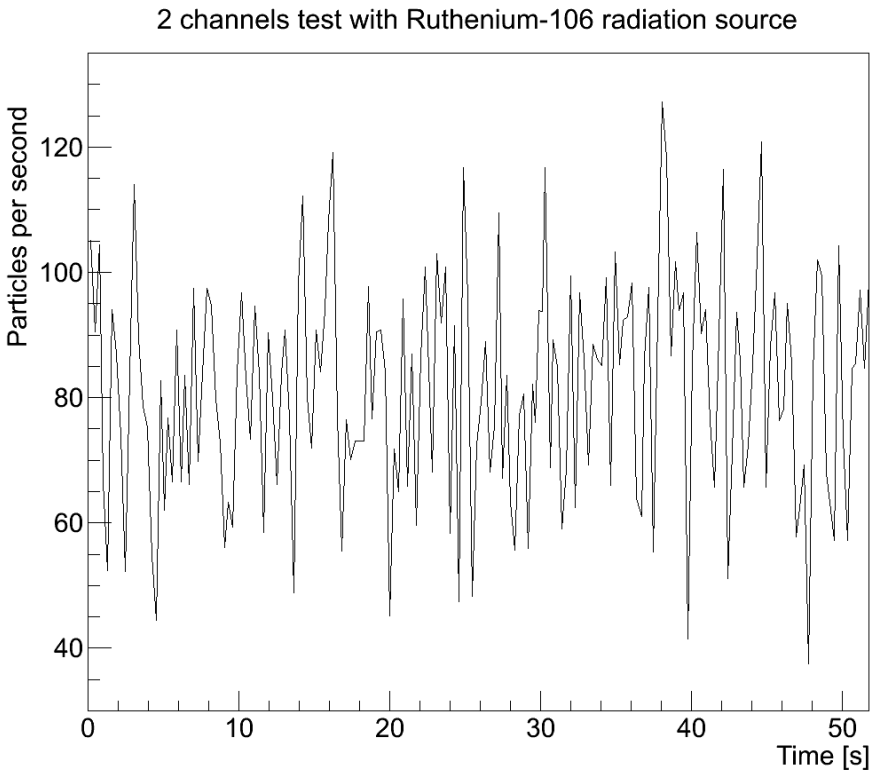
Automatic backup every 10 minutes

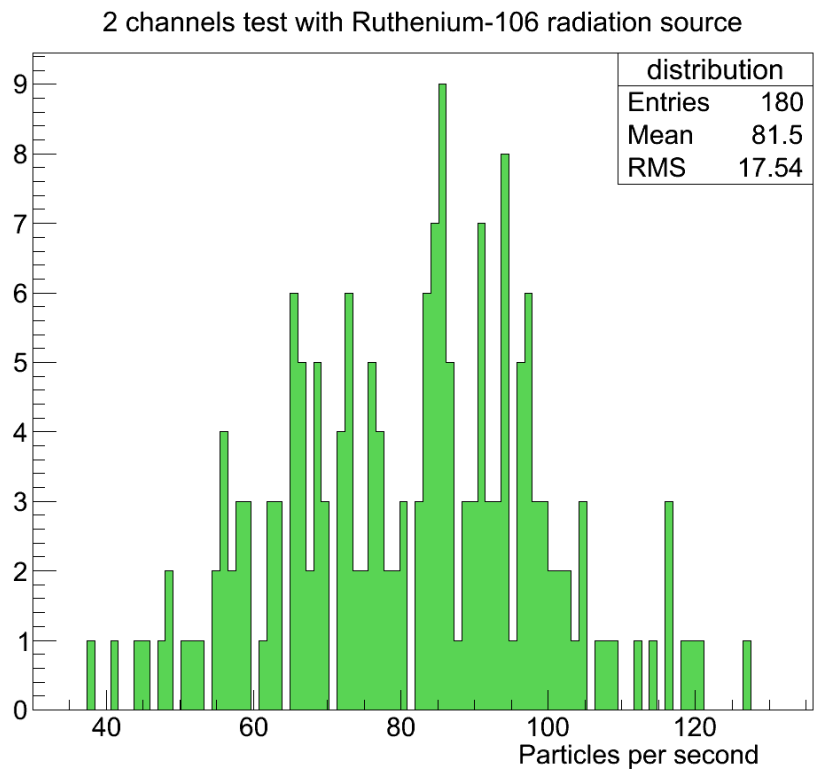




Testing – Radiation Source

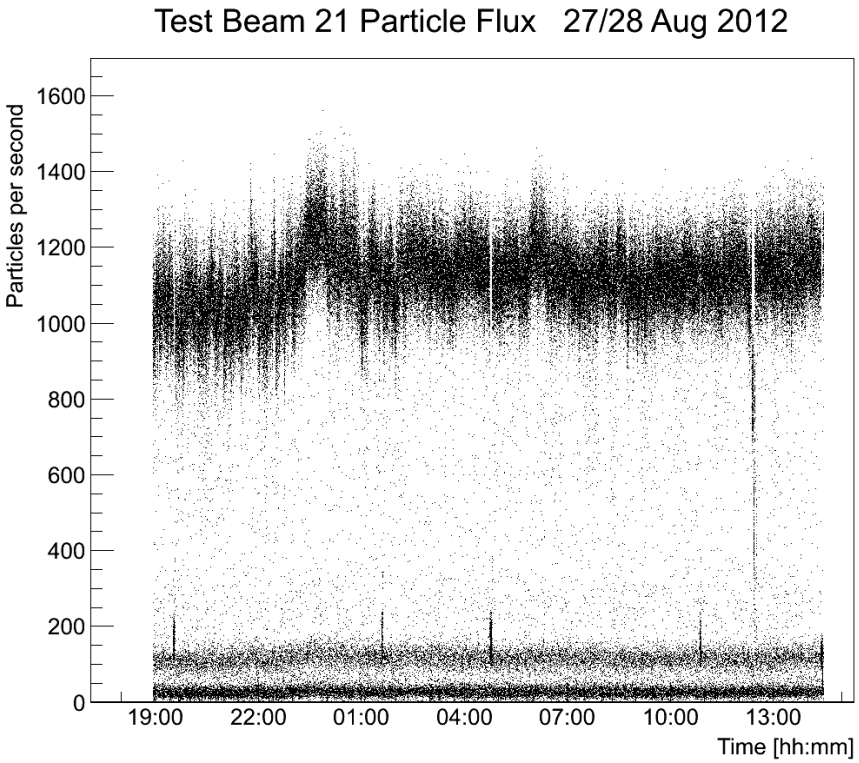
- Beta minus decay
- Max energy ~ 3.5 MeV

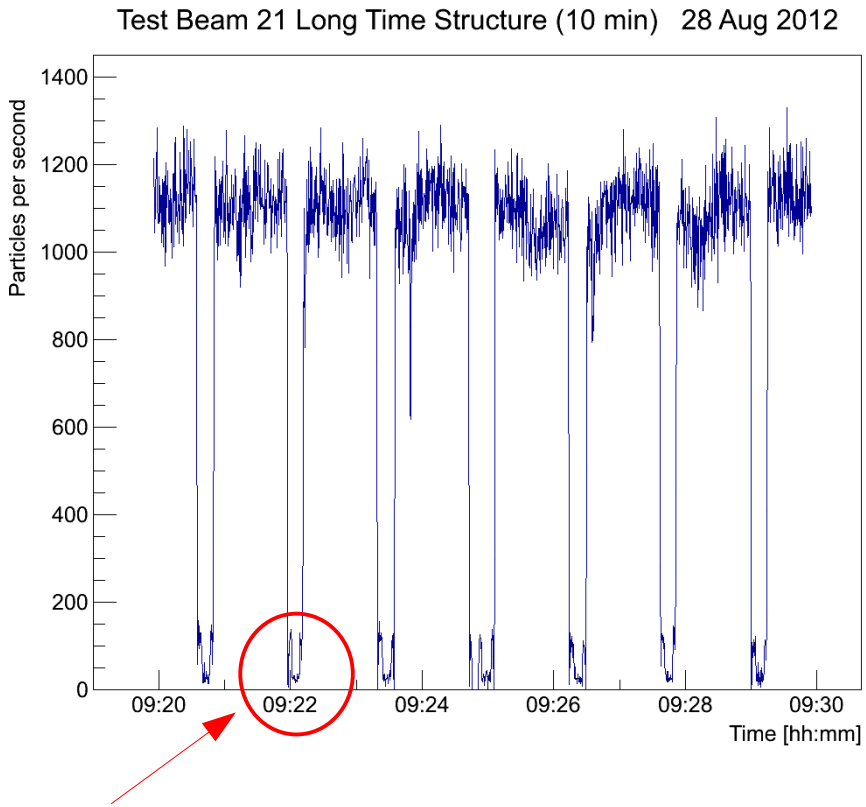




Testing – Test Beam

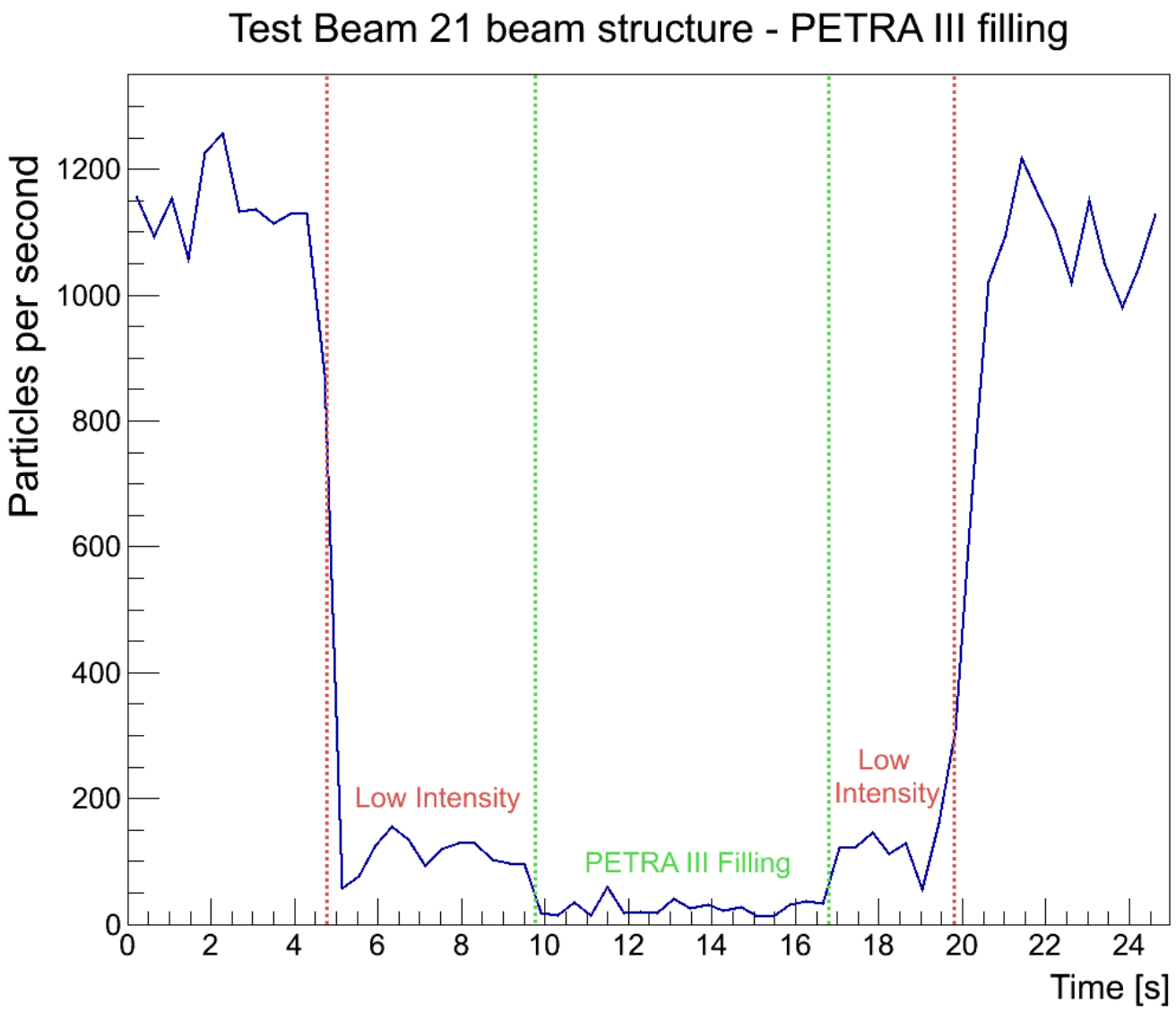
- Background: only 3 particles in 22 hours!



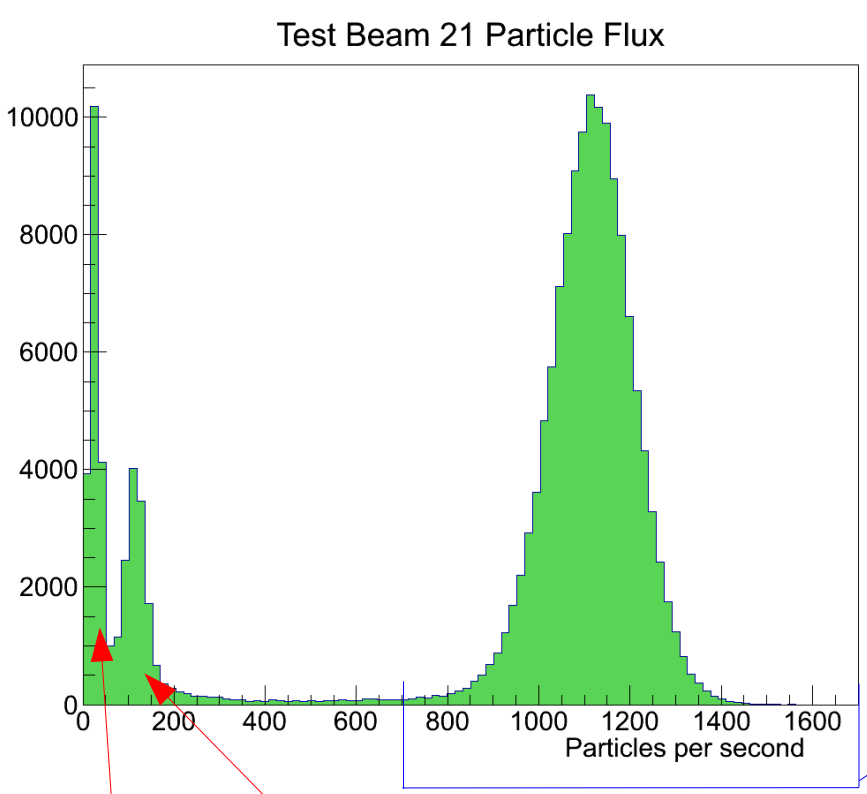


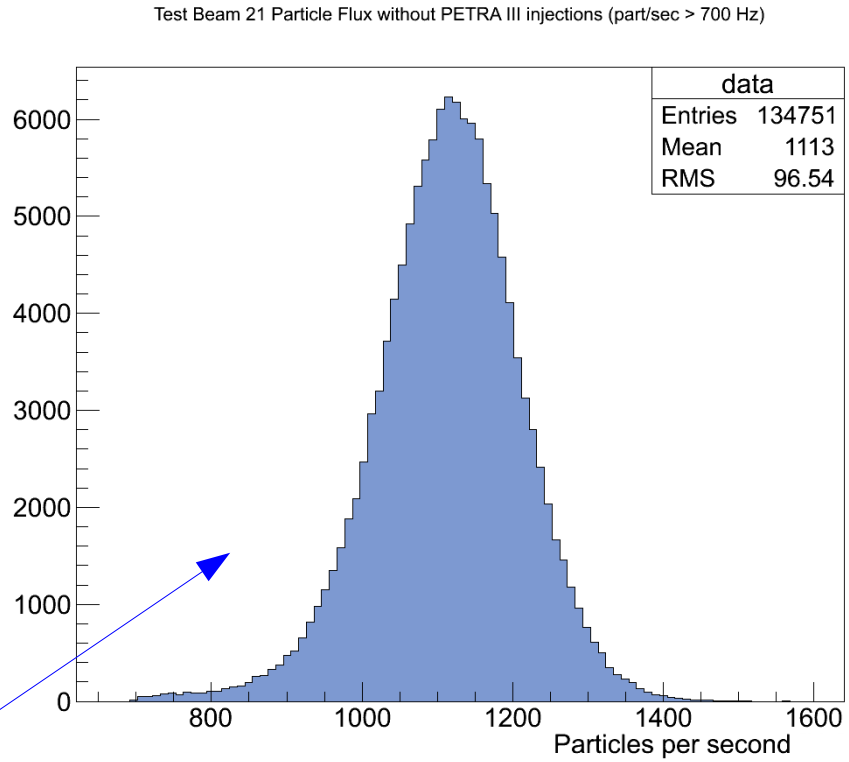
PETRA III injections

Testing – Test Beam



Testing – Test Beam

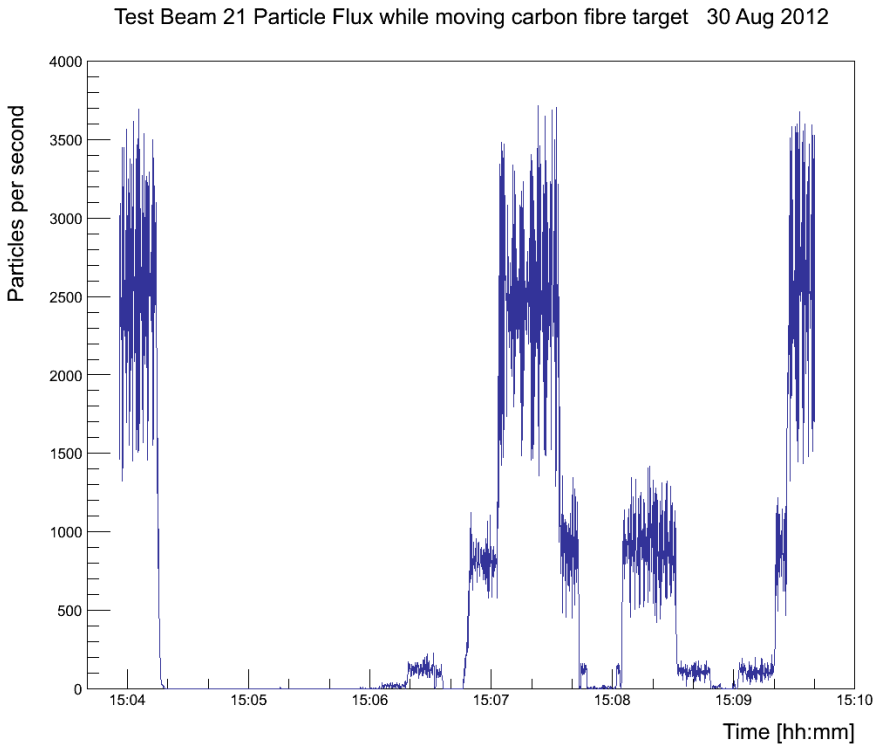


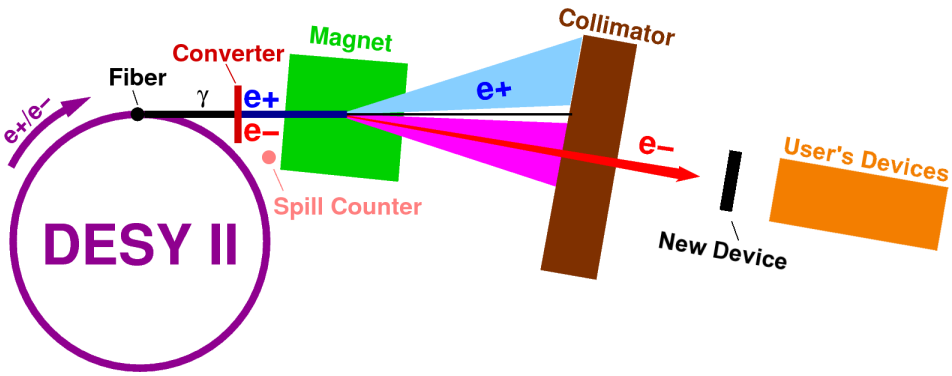


PETRA III injections

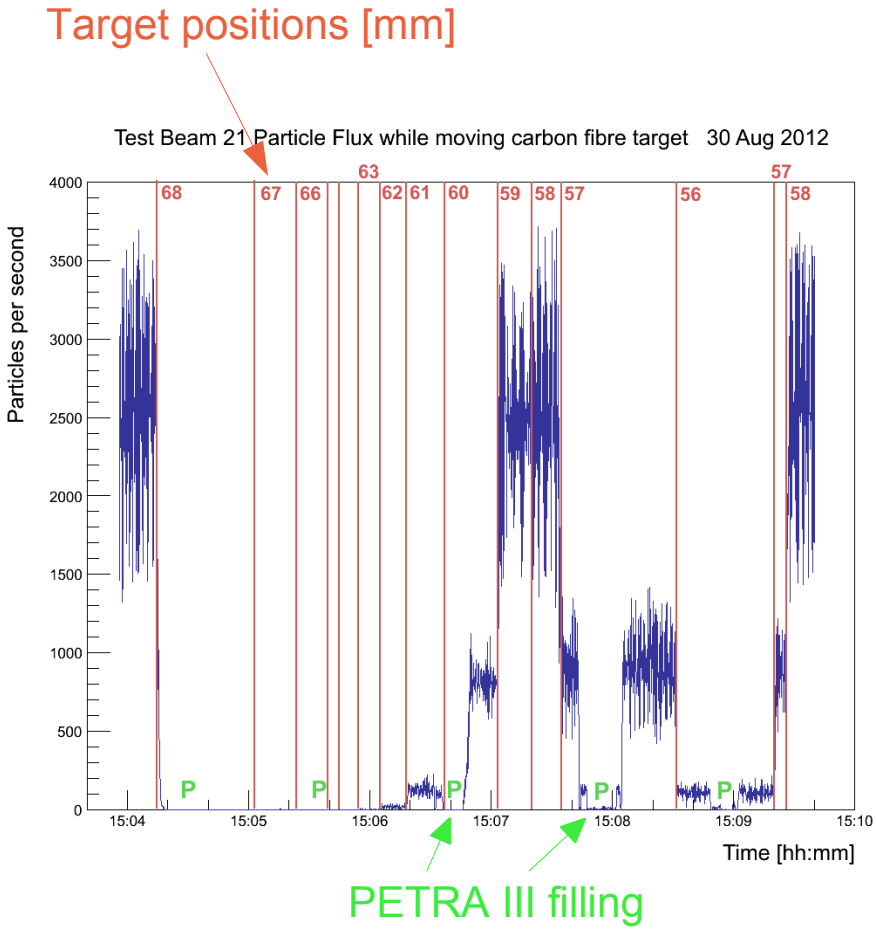
lowered intensity

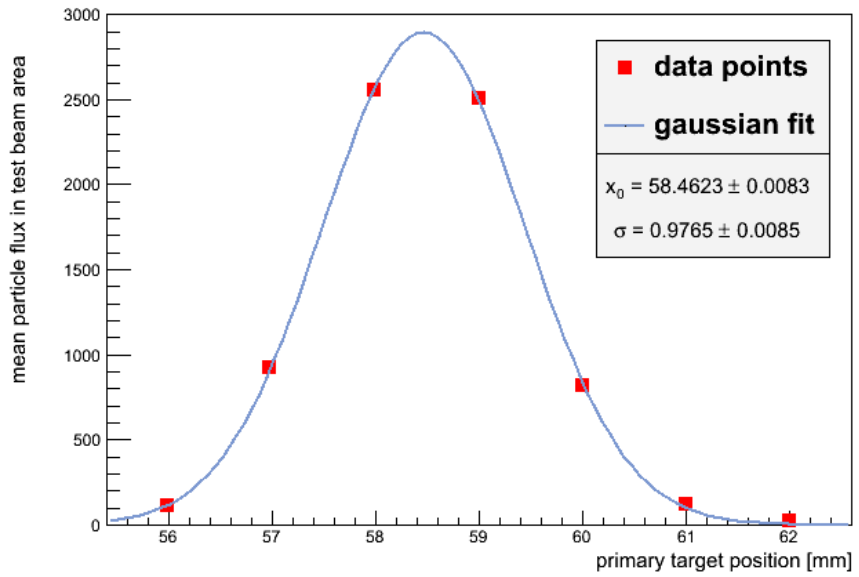
Application at work - Monitoring movement of primary target

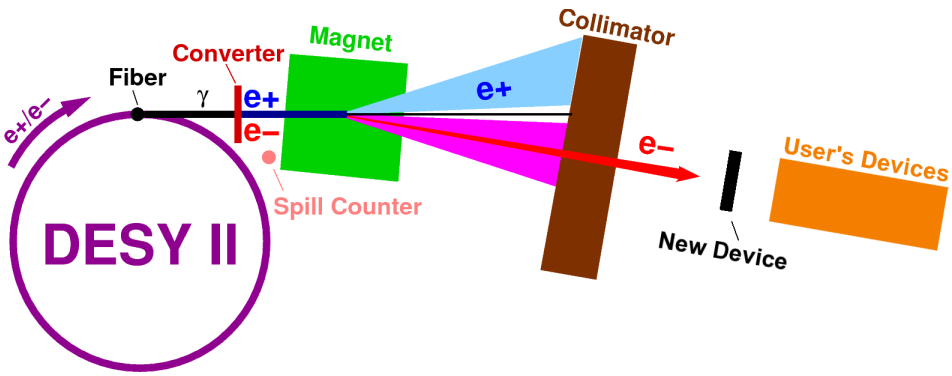




Application at work - Monitoring movement of primary target



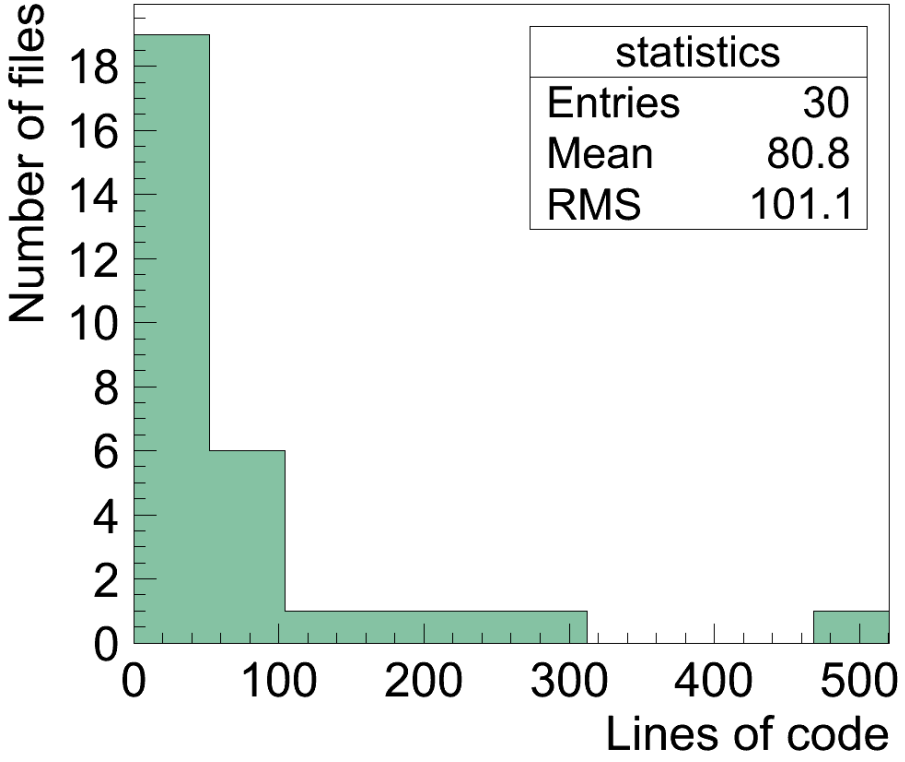




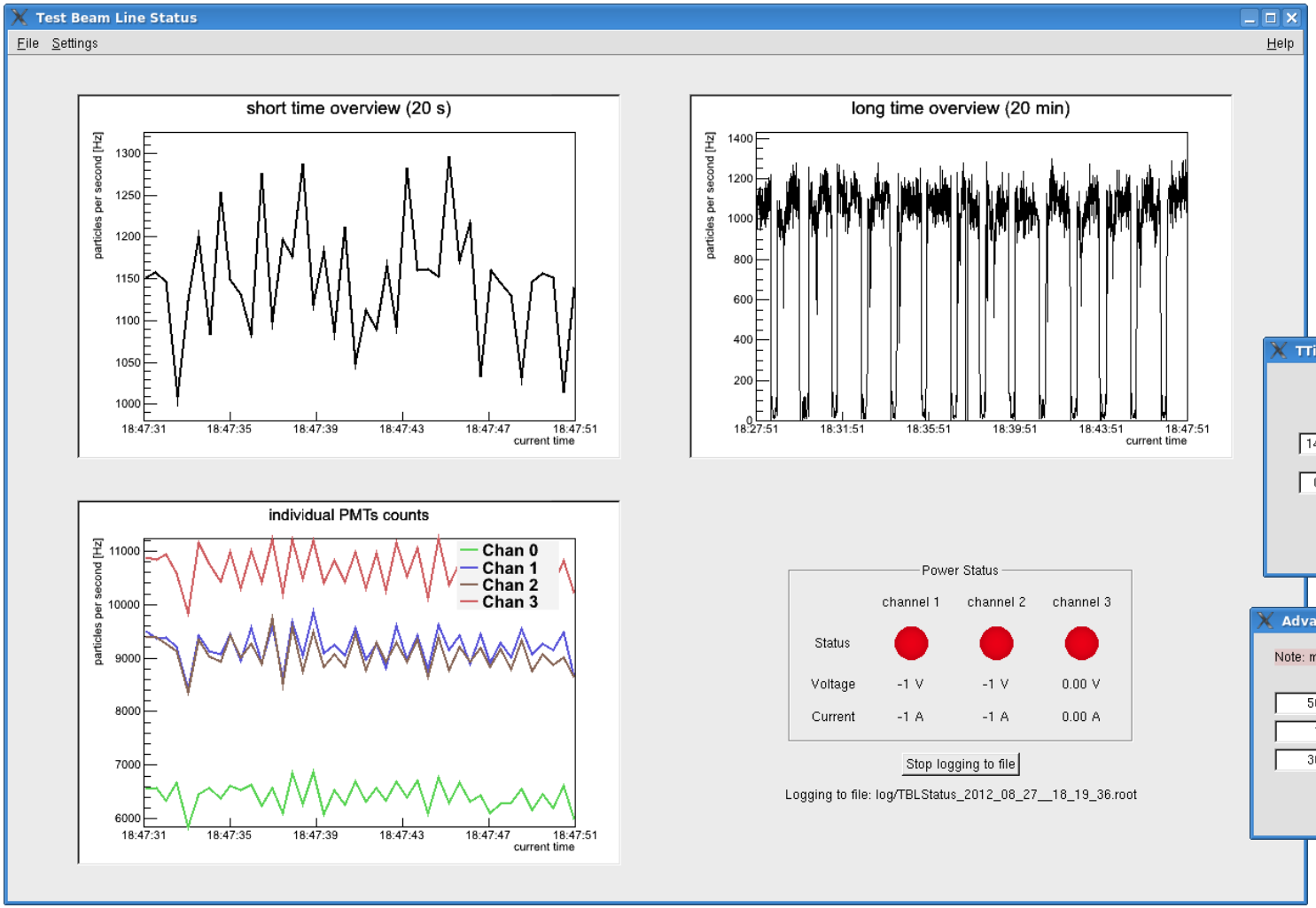
Project Statistics

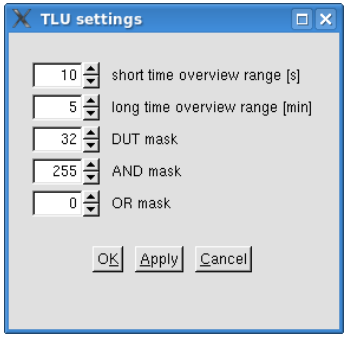
- 6 weeks
- A few liters of coffee
- ~2500 lines of final code
- Tens of impossible-to-find bugs
- Hundreds of swears

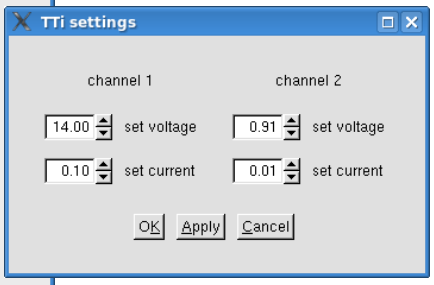
  at ROOT developers

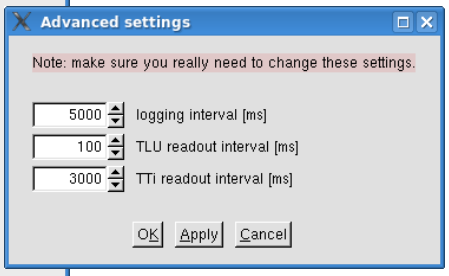


Questions


Test Beam Line Status
File Settings Help
short time overview (20 s)
particles per second [Hz]
current time
long time overview (20 min)
particles per second [Hz]
current time
individual PMTs counts
particles per second [Hz]
Chan 0
Chan 1
Chan 2
Chan 3
current time
Power Status
channel 1 channel 2 channel 3
Status
Voltage -1 V -1 V 0.00 V
Current -1 A -1 A 0.00 A
Stop logging to file
Logging to file: log/TBLStatus_2012_08_27__18_19_36.root

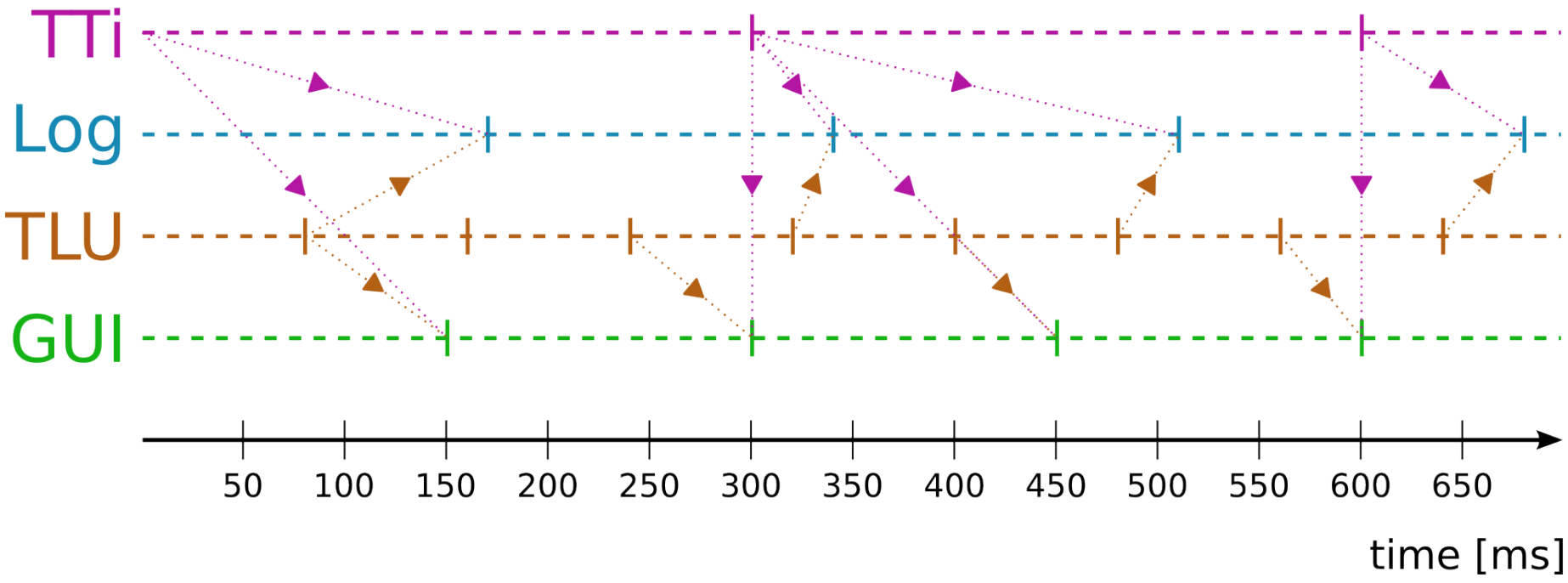

TLU settings
10 short time overview range [s]
5 long time overview range [min]
32 DUT mask
255 AND mask
0 OR mask
OK Apply Cancel


TTi settings
channel 1 channel 2
14.00 set voltage
0.91 set voltage
0.10 set current
0.01 set current
OK Apply Cancel

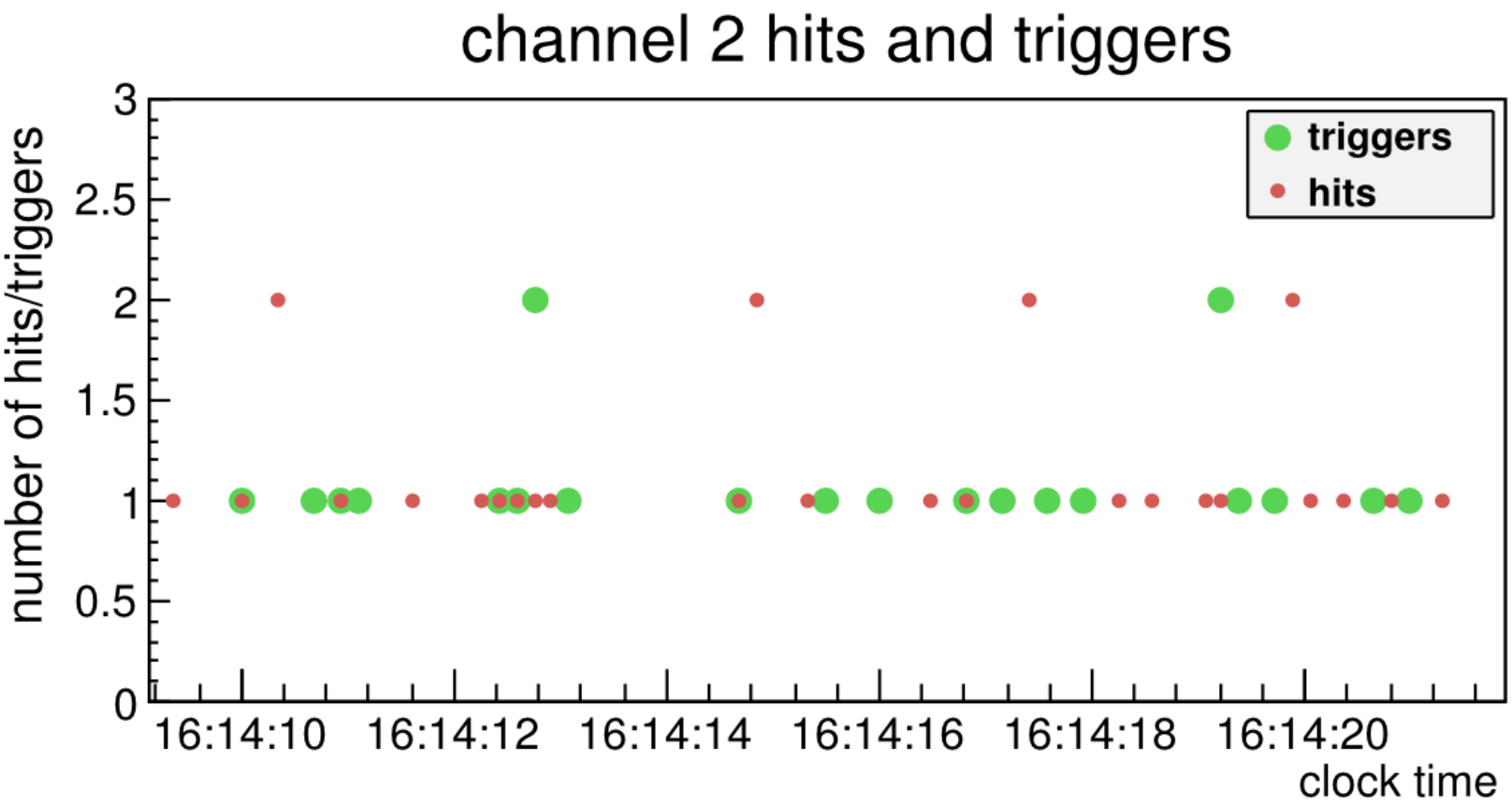

Advanced settings
Note: make sure you really need to change these settings.
5000 logging interval [ms]
100 TLU readout interval [ms]
3000 TTi readout interval [ms]
OK Apply Cancel

Application Timing

- Multithreaded: 4 main threads
- Asynchronous



Testing - Background



- 51-minutes 2-channels test
- 95% CL that coincidence rate is lower than 0.42 Hz