Introduction to gun acoustic system at PITZ

- Set-up description
- System tests
- Preliminary data analysis
- Next steps

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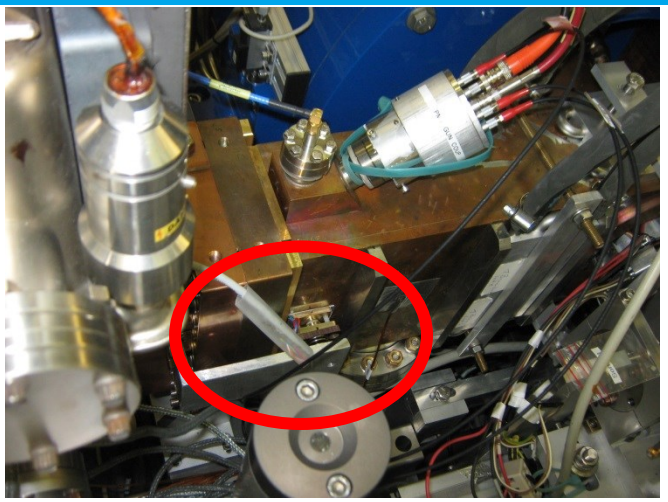
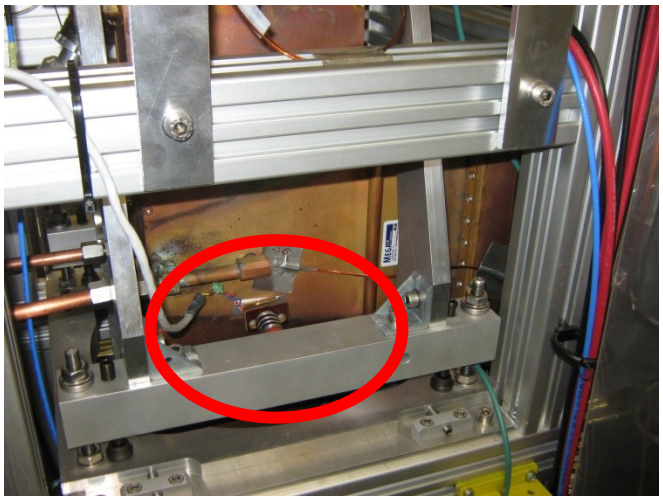
PPS, 09.06.2016

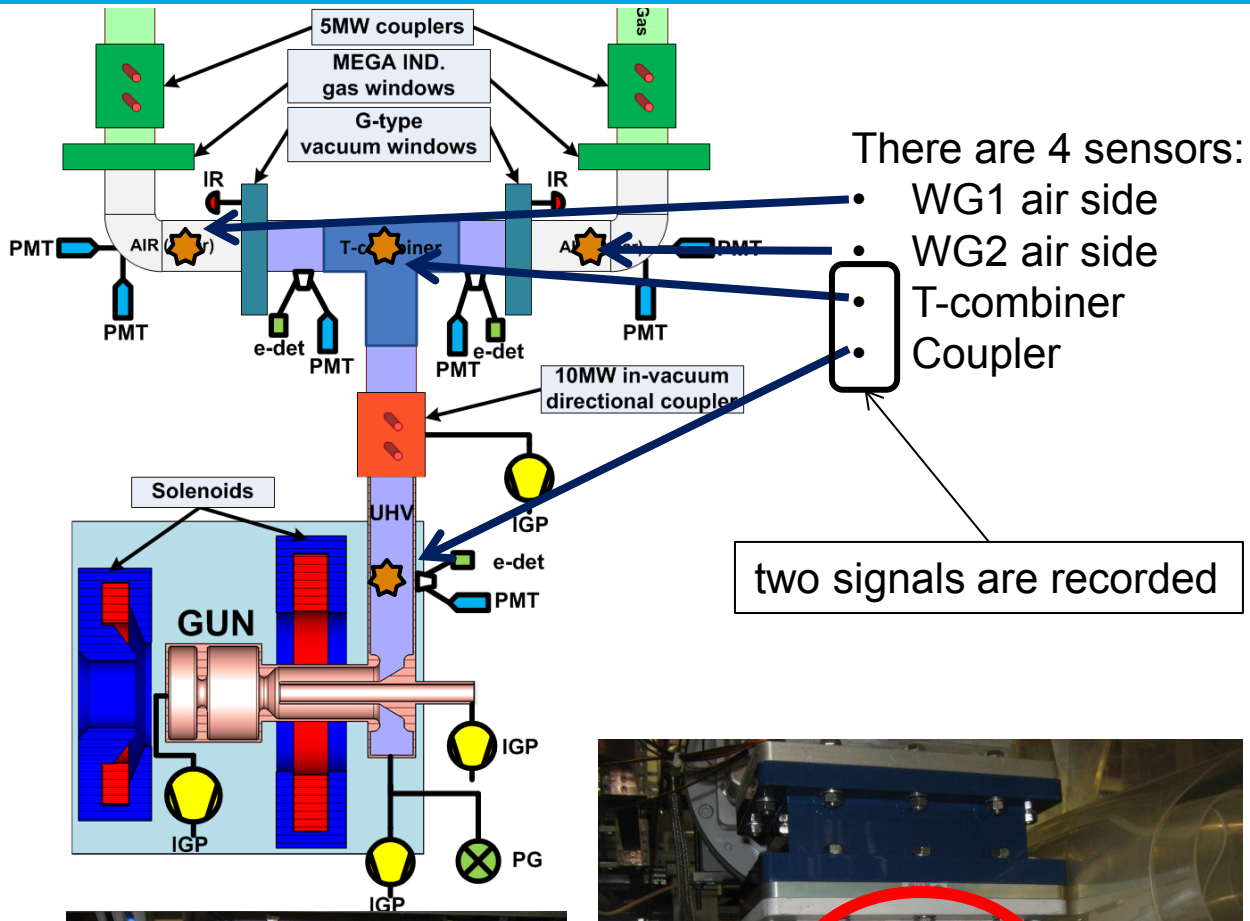
HELMHOLTZ ASSOCIATION

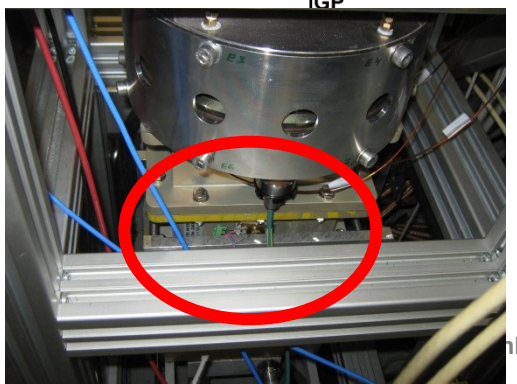
DESY

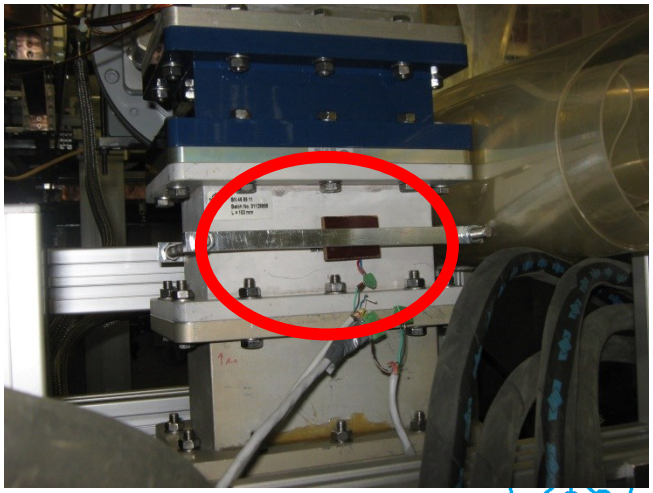
Set-up

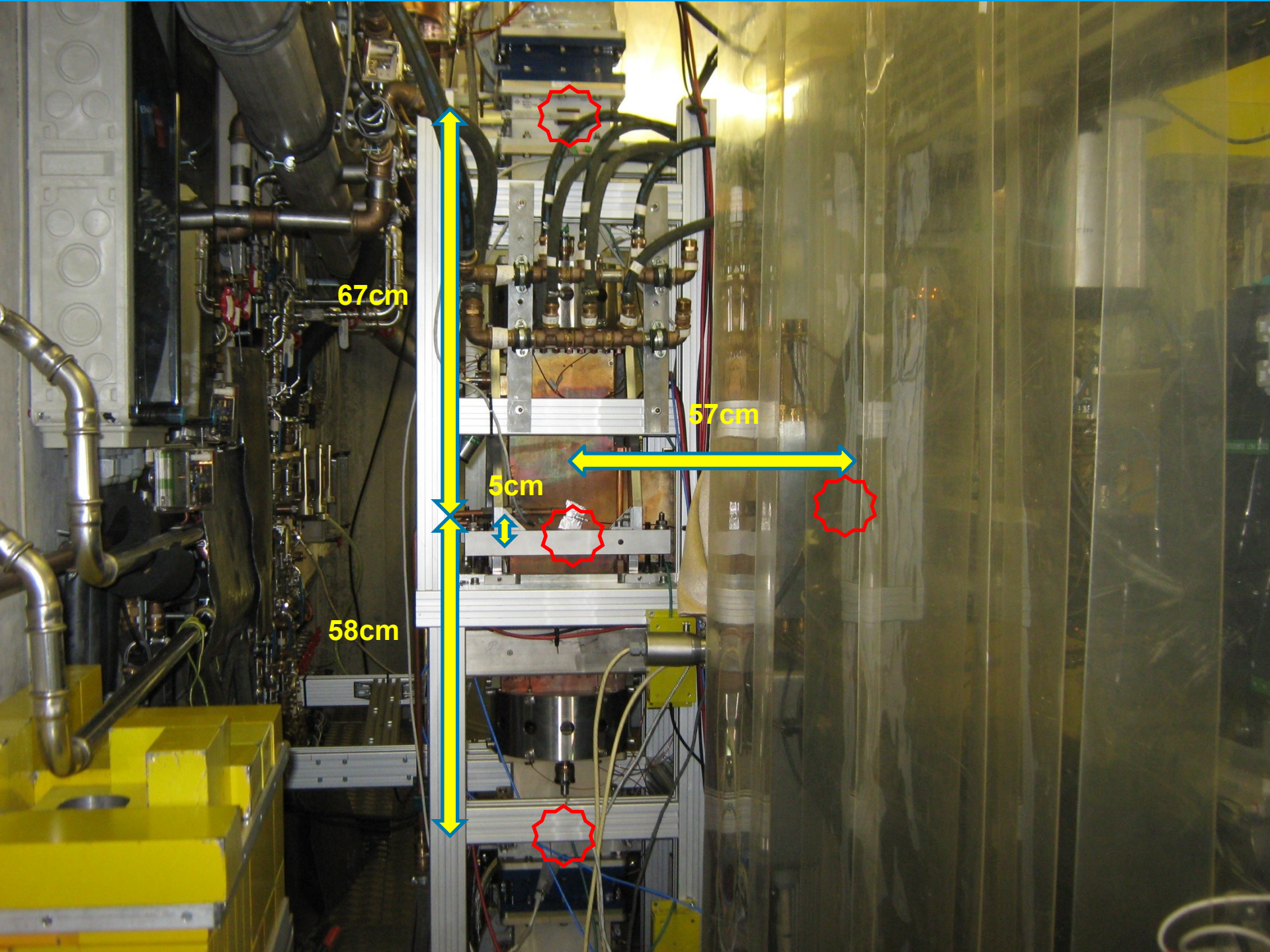





5MW couplers
MEGA IND. gas windows
G-type vacuum windows
IR
IR
PMT
PMT
PMT
PMT
e-det
e-det
PMT
PMT
10MW in-vacuum directional coupler
Solenoids
UHV
IGP
e-det
PMT
GUN
IGP
IGP
PG
IGP
There are 4 sensors:
WG1 air side
WG2 air side
T-combiner
Coupler
two signals are recorded



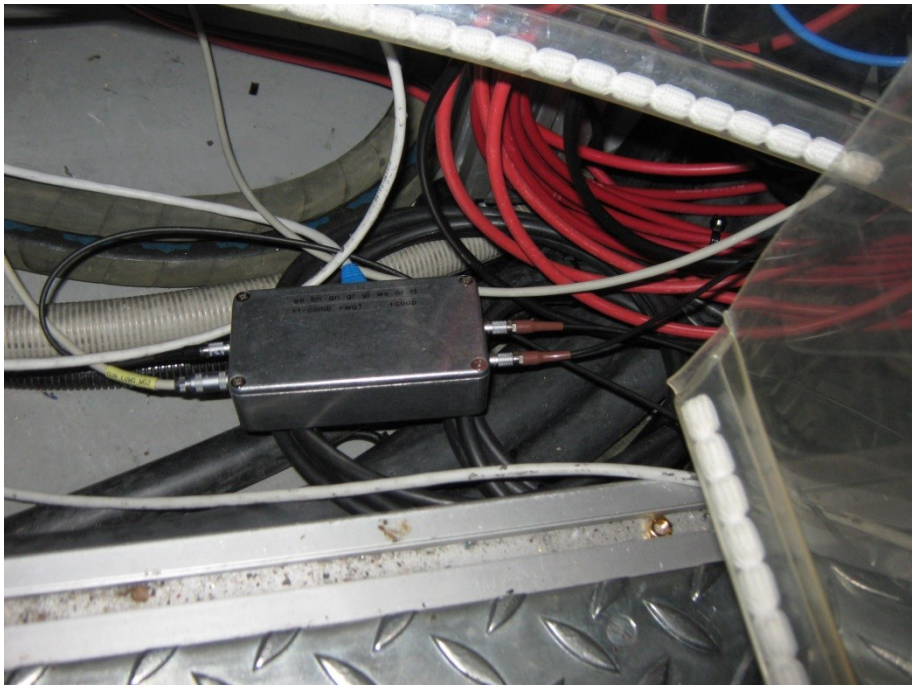



67cm
57cm
5cm
58cm

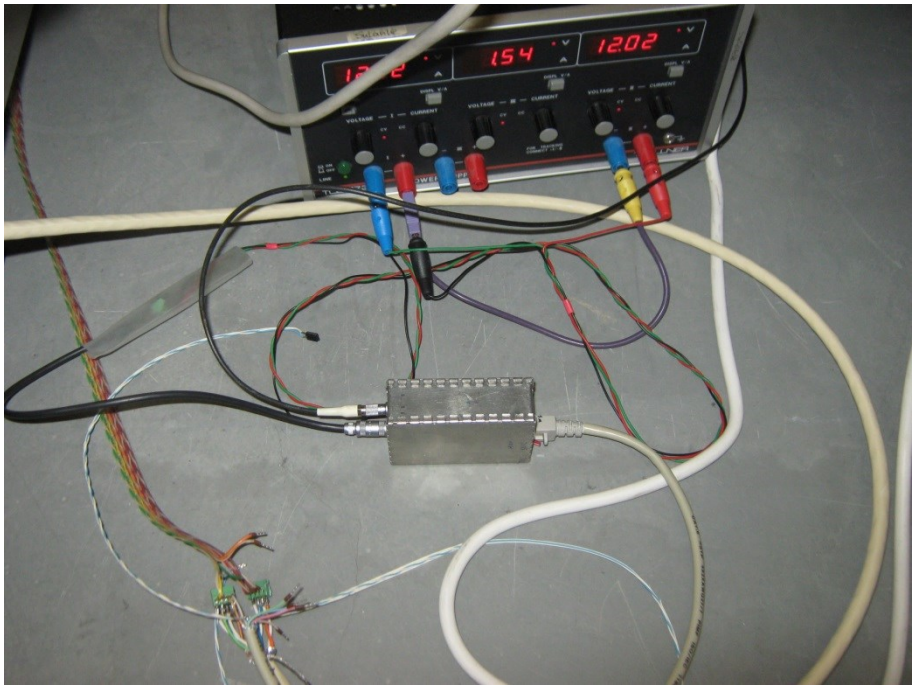
Set-up. Amplifiers.

Amplifier in the tunnel deliver better sound !

Amplifier in the tunnel



Amplifier in the rack room



Set-up

BURR - BROWN®

INA114

Precision INSTRUMENTATION AMPLIFIER

FEATURES

- LOW OFFSET VOLTAGE: 50µV max
- LOW DRIFT: 0.25µV/°C max
- LOW INPUT BIAS CURRENT: 2nA max
- HIGH COMMON-MODE REJECTION: 115dB min
- INPUT OVER-VOLTAGE PROTECTION: ±40V
- WIDE SUPPLY RANGE: ±2.25 to ±18V
- LOW QUIESCENT CURRENT: 3mA max
- 8-PIN PLASTIC AND SOL-16

APPLICATIONS

- BRIDGE AMPLIFIER
- THERMOCOUPLE AMPLIFIER
- RTD SENSOR AMPLIFIER
- MEDICAL INSTRUMENTATION
- DATA ACQUISITION

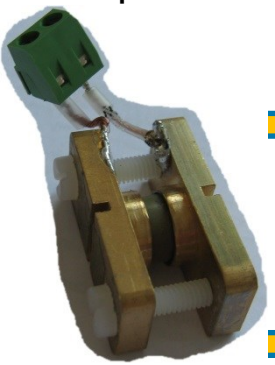
DESCRIPTION

The INA114 is a low cost, general purpose instrumentation amplifier offering excellent accuracy. Its versatile 3-op amp design and small size make it ideal for a wide range of applications.

A single external resistor sets any gain from 1 to 10,000. Internal input protection can withstand up to ±40V without damage.

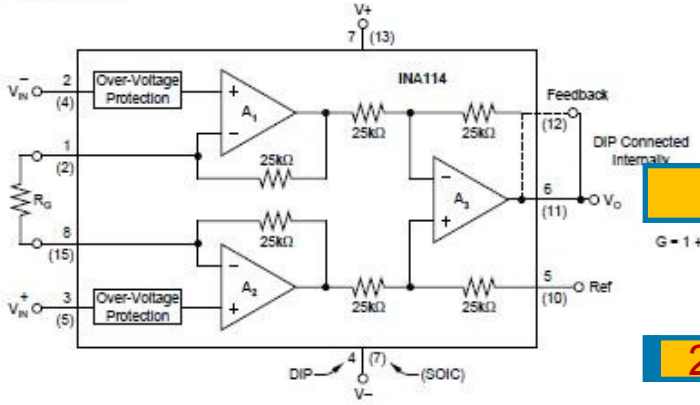
The INA114 is laser trimmed for very low offset voltage (50µV), drift (0.25µV/°C) and high common-mode rejection (115dB at G = 1000). It operates with power supplies as low as ±2.25V, allowing use in battery operated and single 5V supply systems. Quiescent current is 3mA maximum.

The INA114 is available in 8-pin plastic and SOL-16 surface-mount packages. Both are specified for the –40°C to +85°C temperature range.



piezzo

gain



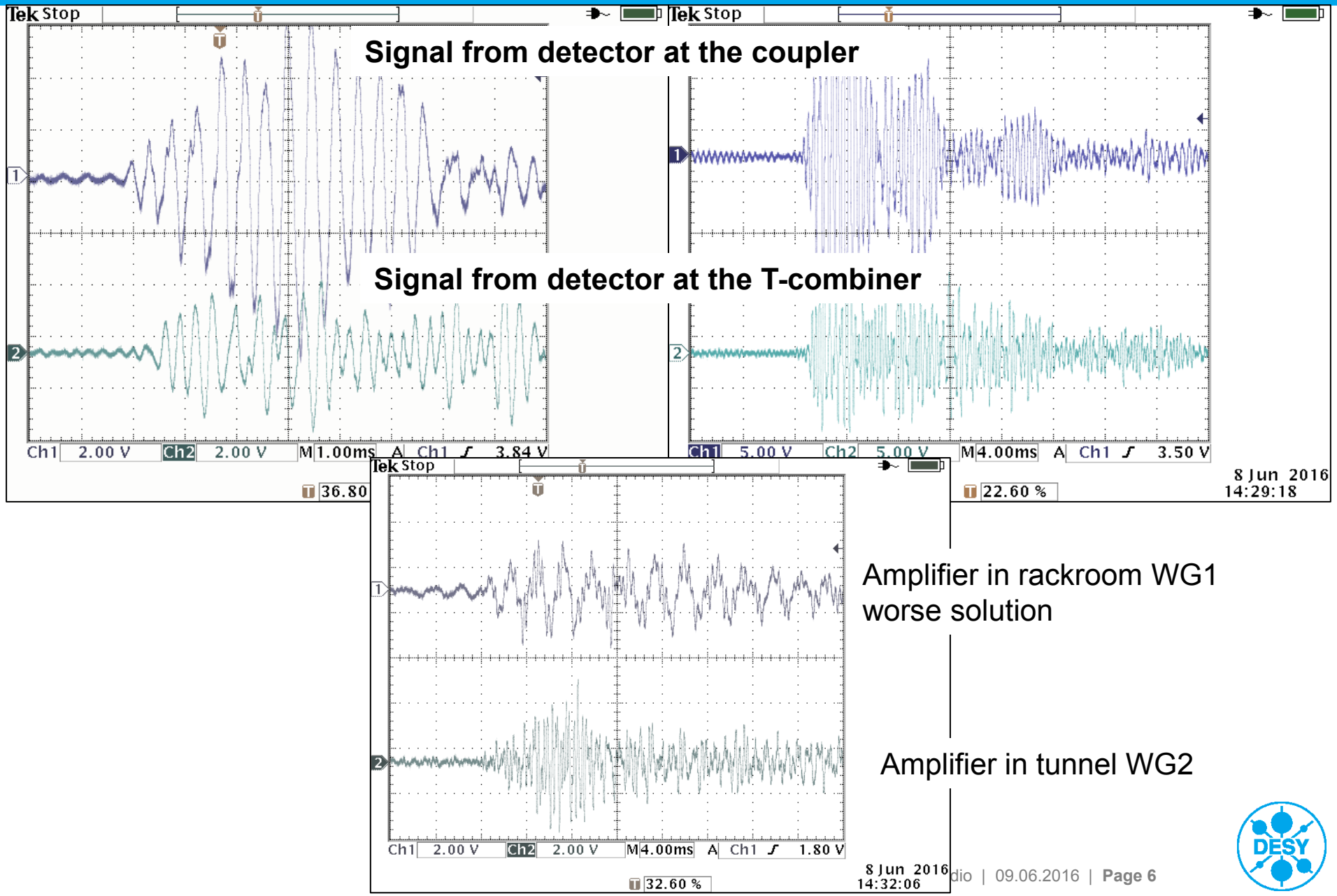
4 ch_to ADCs

2 ch_to audio input

1 right
2 left

Voltage divider 5:1

Scope readings



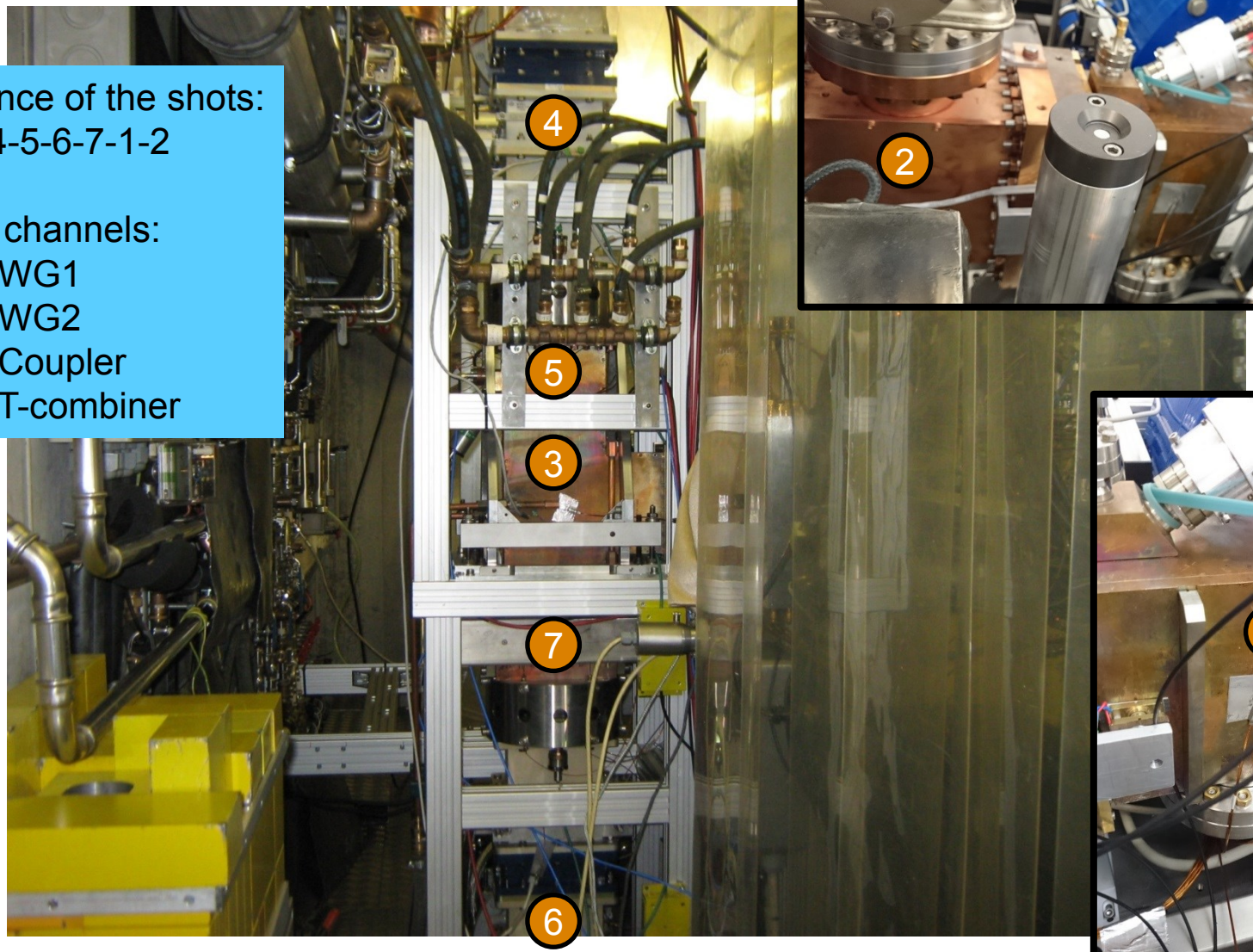
Amplifier in rackroom WG1
worse solution

Amplifier in tunnel WG2

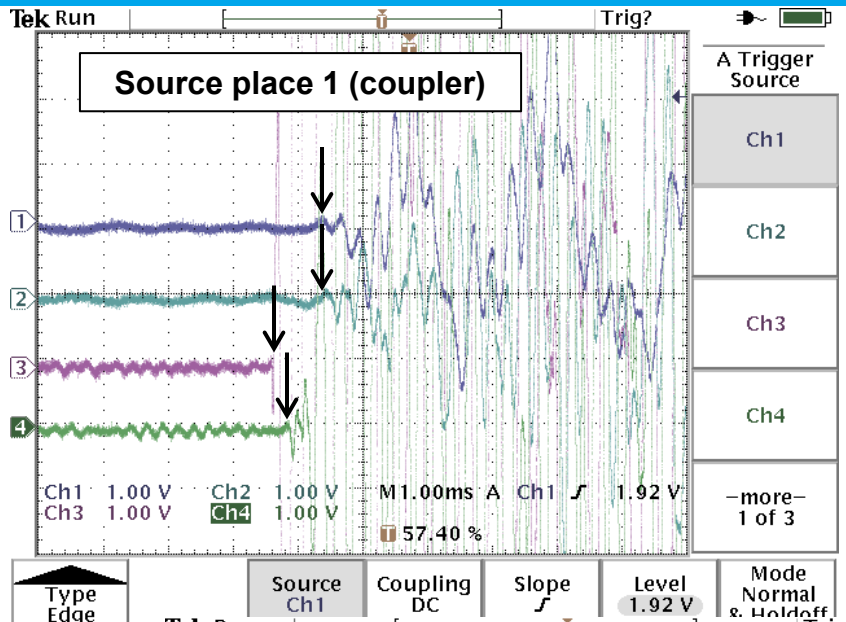
System tests

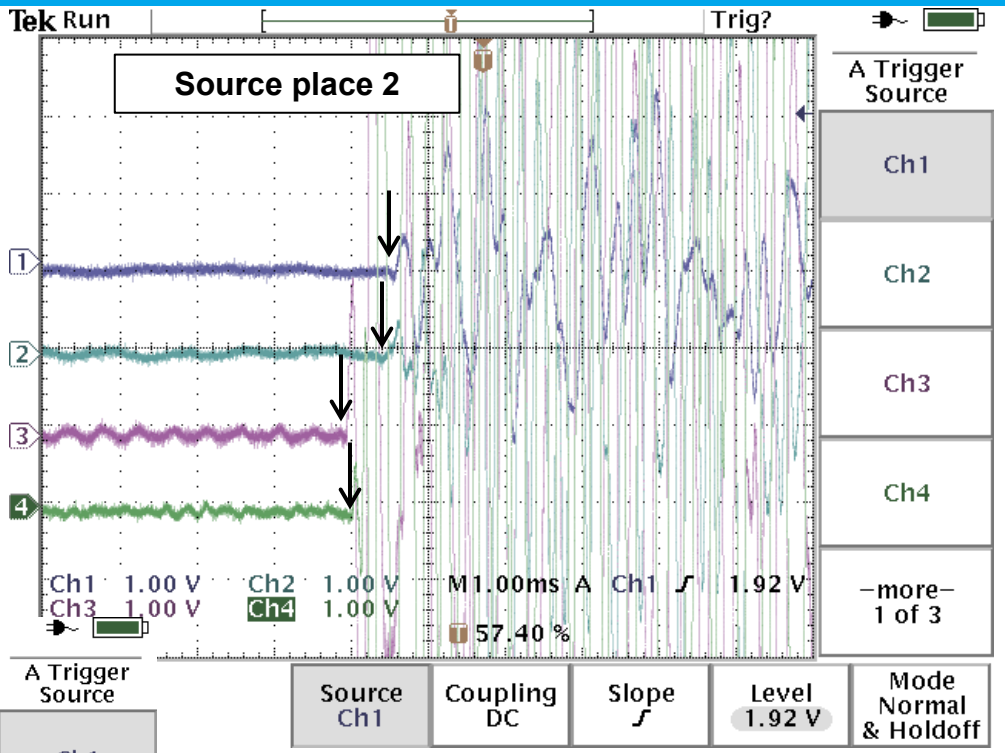
Sequence of the shots:
1-2-3-4-5-6-7-1-2

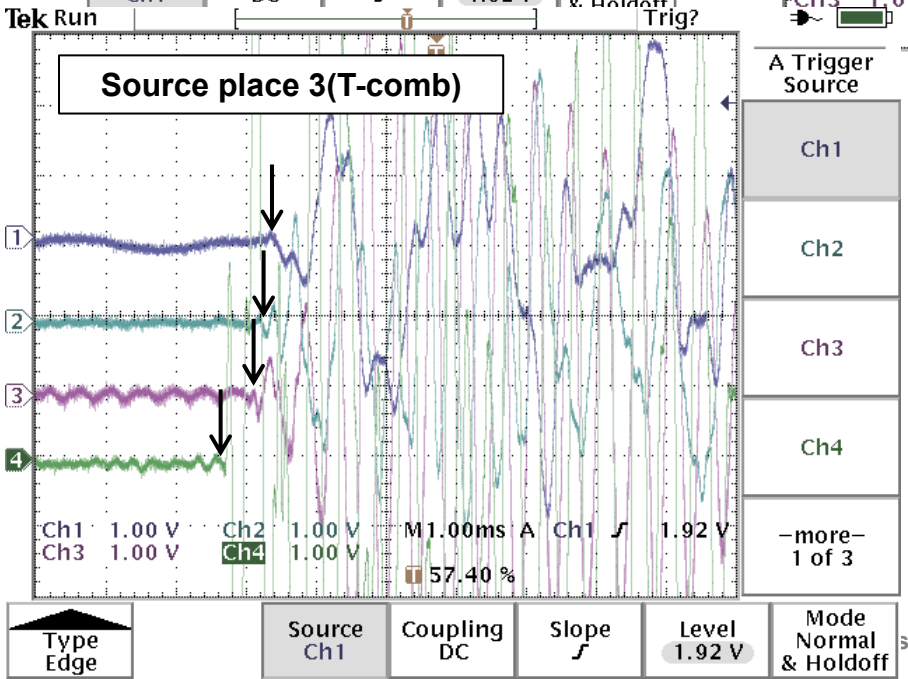
Scope channels:
Ch1 – WG1
Ch2 – WG2
Ch3 – Coupler
Ch4 – T-combiner



System tests

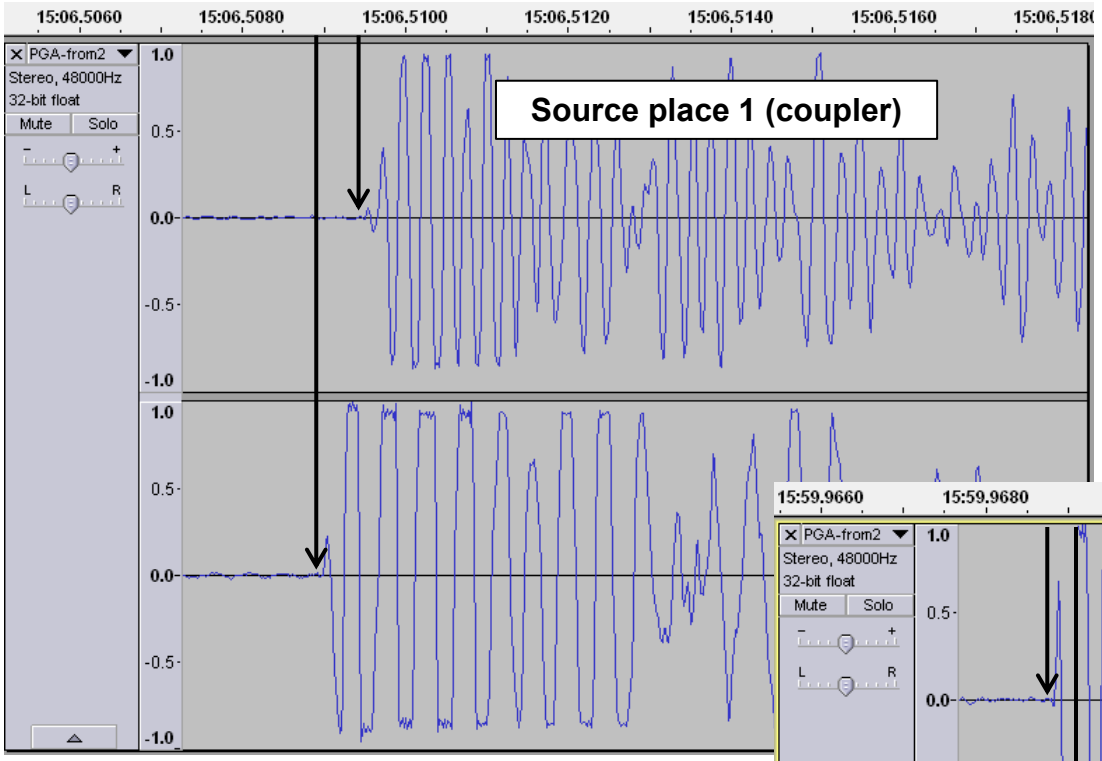


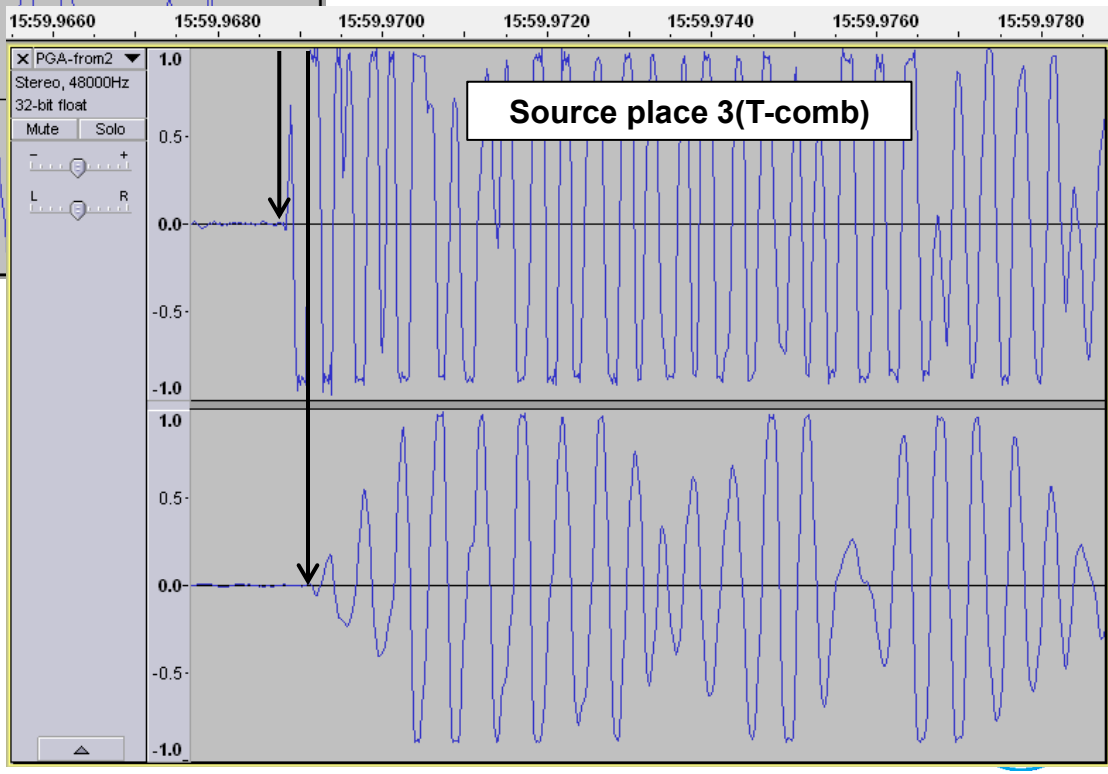




Scope channels:
Ch1 – WG1
Ch2 – WG2
Ch3 – Coupler
Ch4 – T-combiner

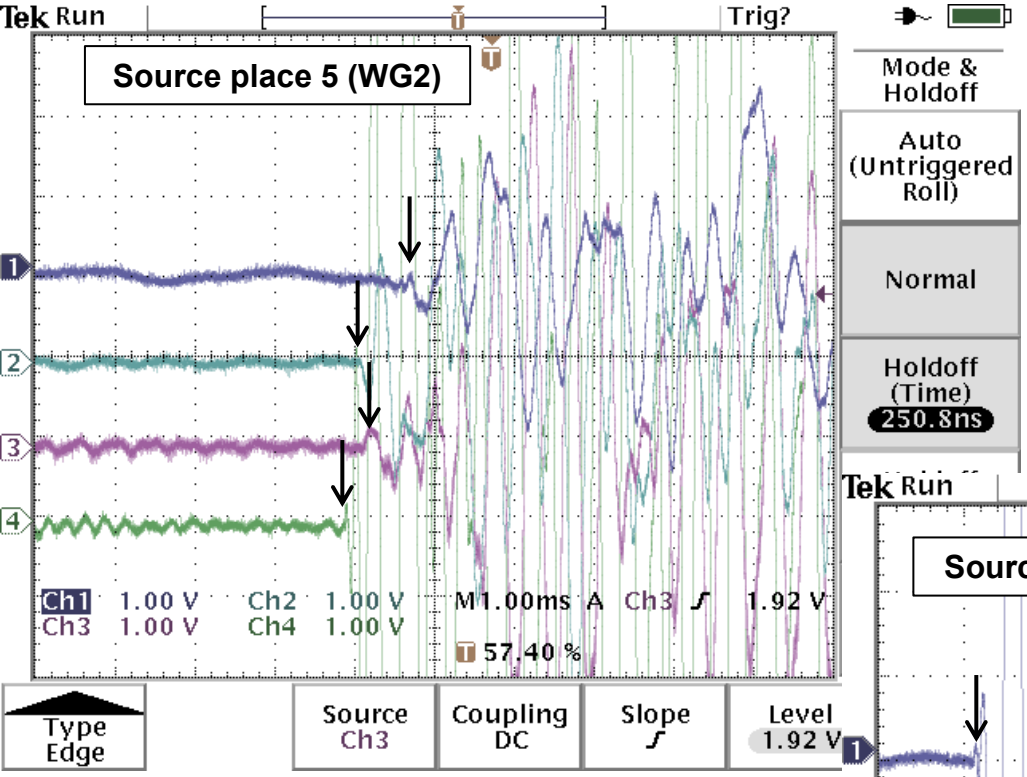
System tests. Recorded data.

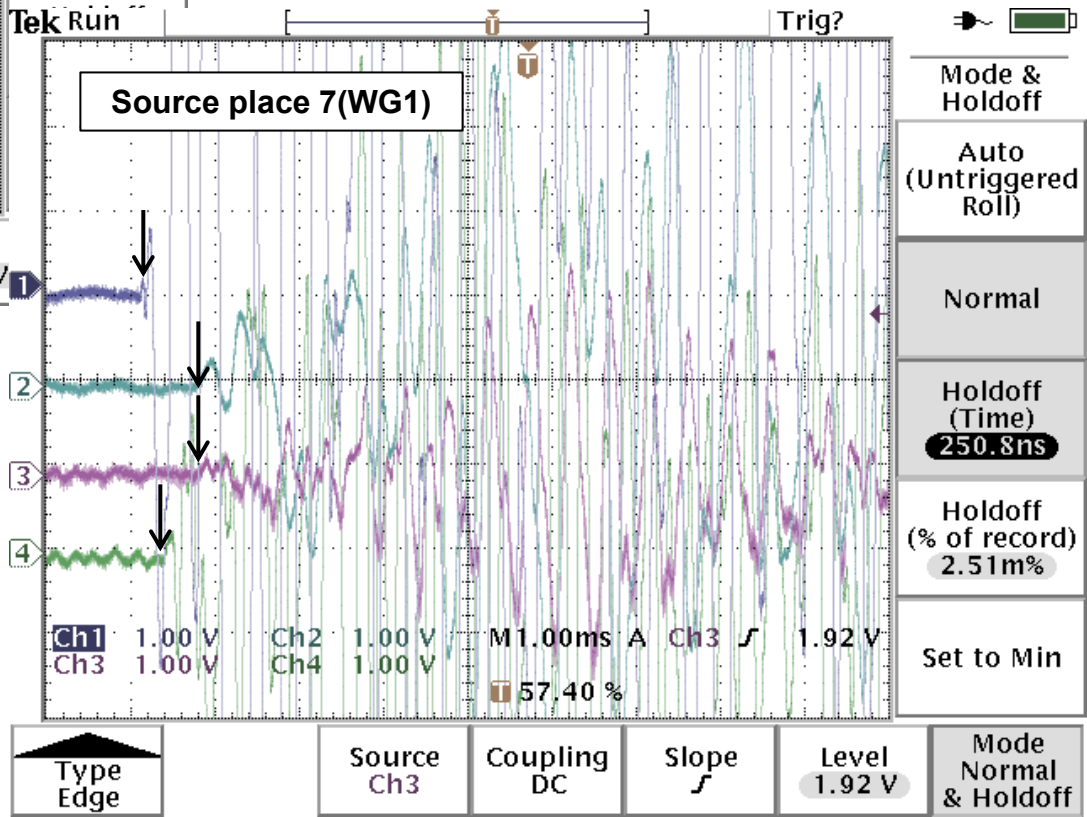




Audio input channels:
Ch1(top) – T-combiner
Ch2(bottom) – Coupler

System tests





Scope channels:
Ch1 – WG1
Ch2 – WG2
Ch3 – Coupler
Ch4 – T-combiner

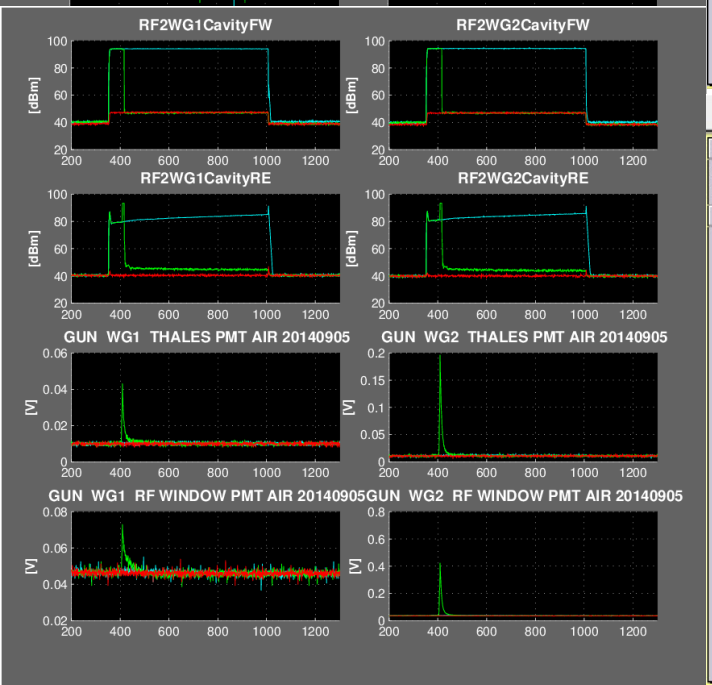
Data recordings info

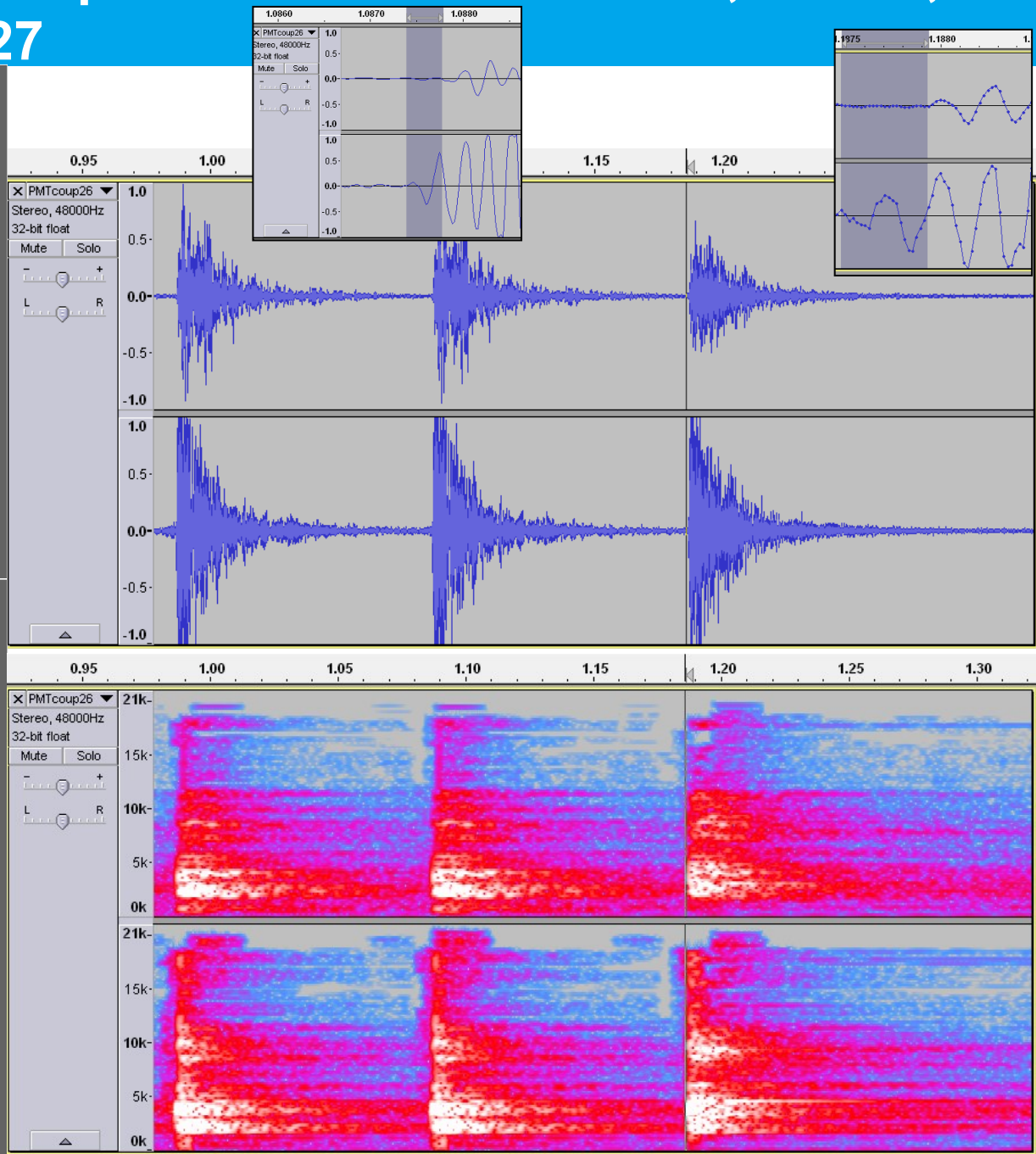
- Data is recorded via standard computer audio card (input channel / microphone)
- Data is stored in mp3 files in the folder:

  n:\4groups\zn_pitz\NFS\Data\AudioGun\incoming\
- 1 hour = 1file, with 1 minute overlap
- Files older than 8 days are deleted
- There are two links for start and stop recording service in zngremlin24->desktop->PITZ Gun Audio links
- Files could be open via audio player (e.g. WinAmp) or editor (e.g. Audacity)
- Signals spectra could be observed on ADC :

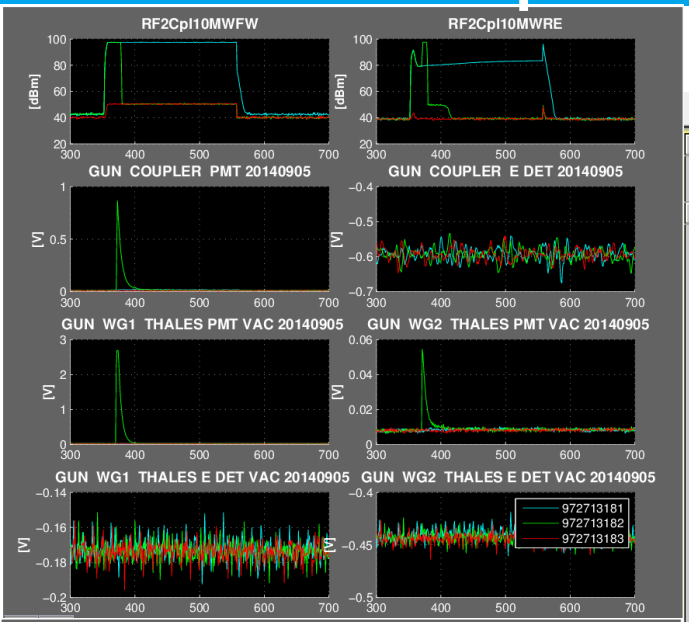
  PITZ.WSCANNER/ADCSCOPE/WS.ADC0/CH00 - CH 03

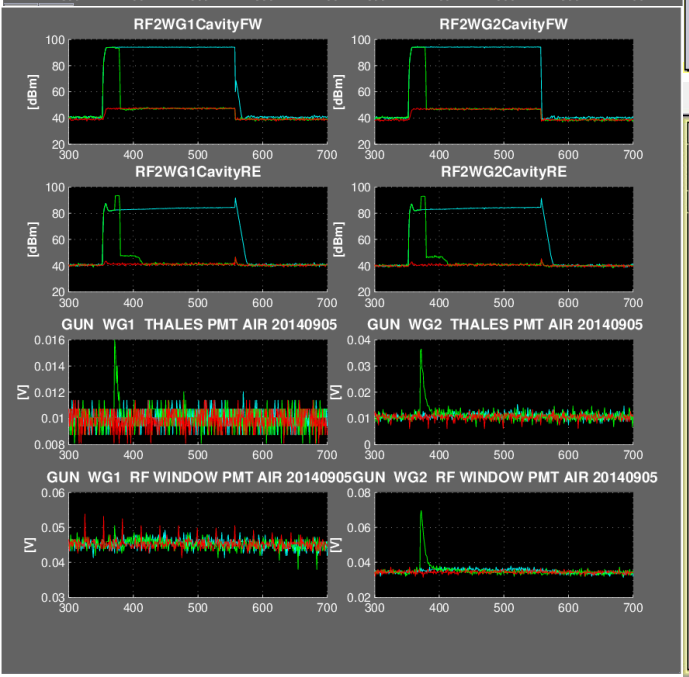
Data analysis. PMT coupler IL after 1.5h at 650us, 5.5MW, on 26.05.2016 at 21:27

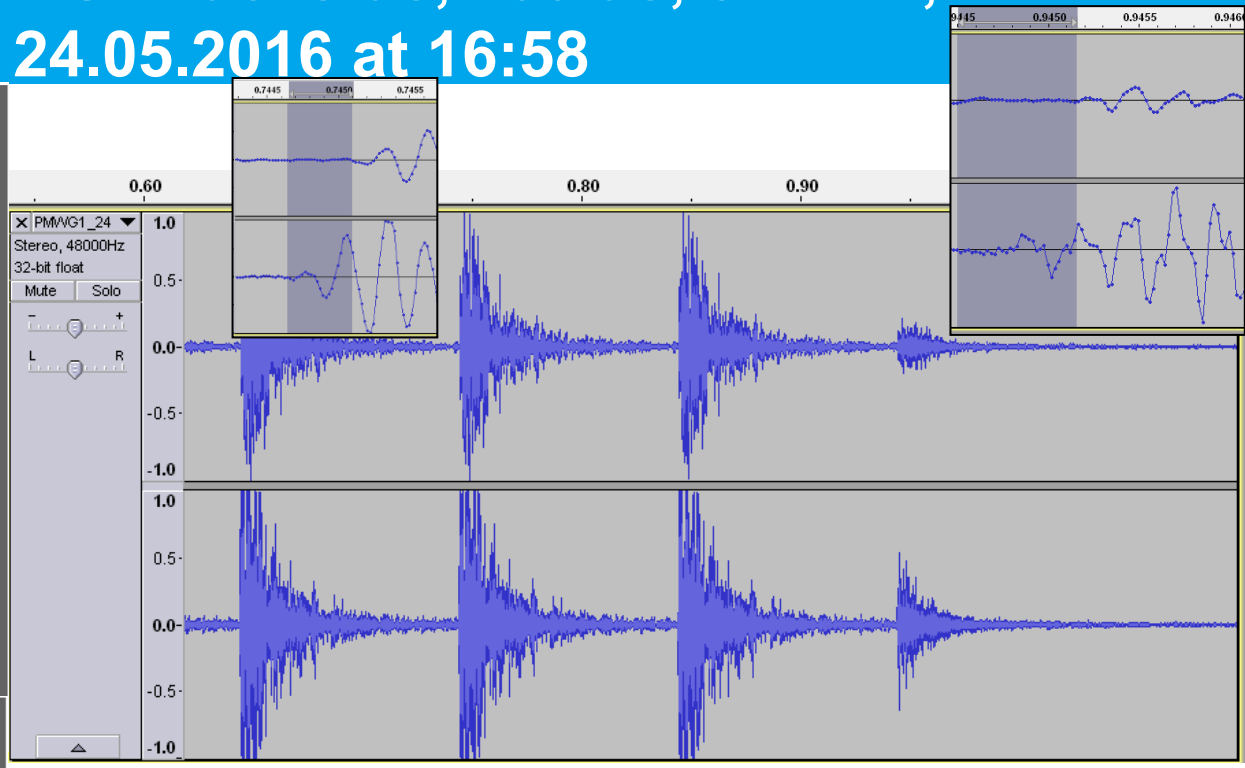


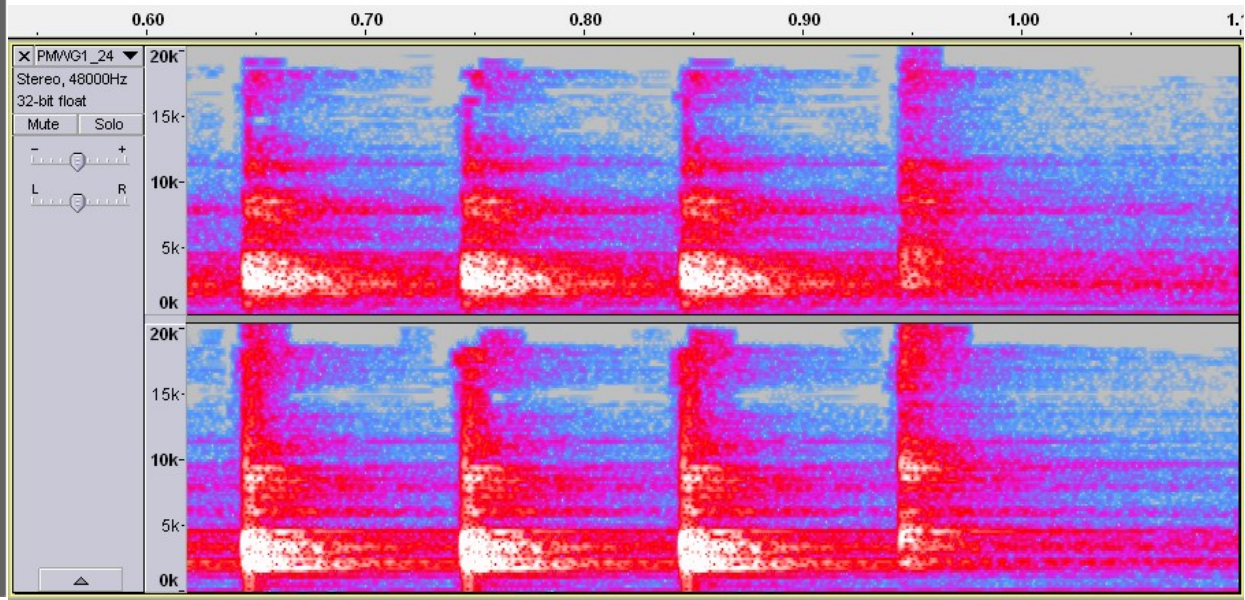


Data analysis. PMT WG1 vac. side, 200 us, 5.4 MW, solenoids swept on 24.05.2016 at 16:58

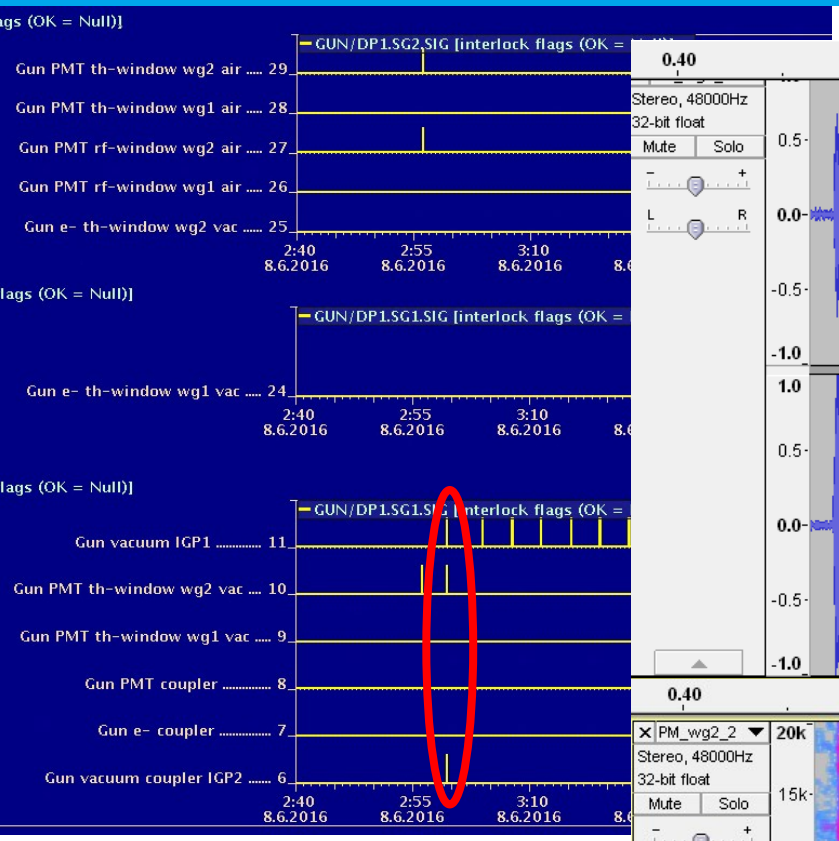


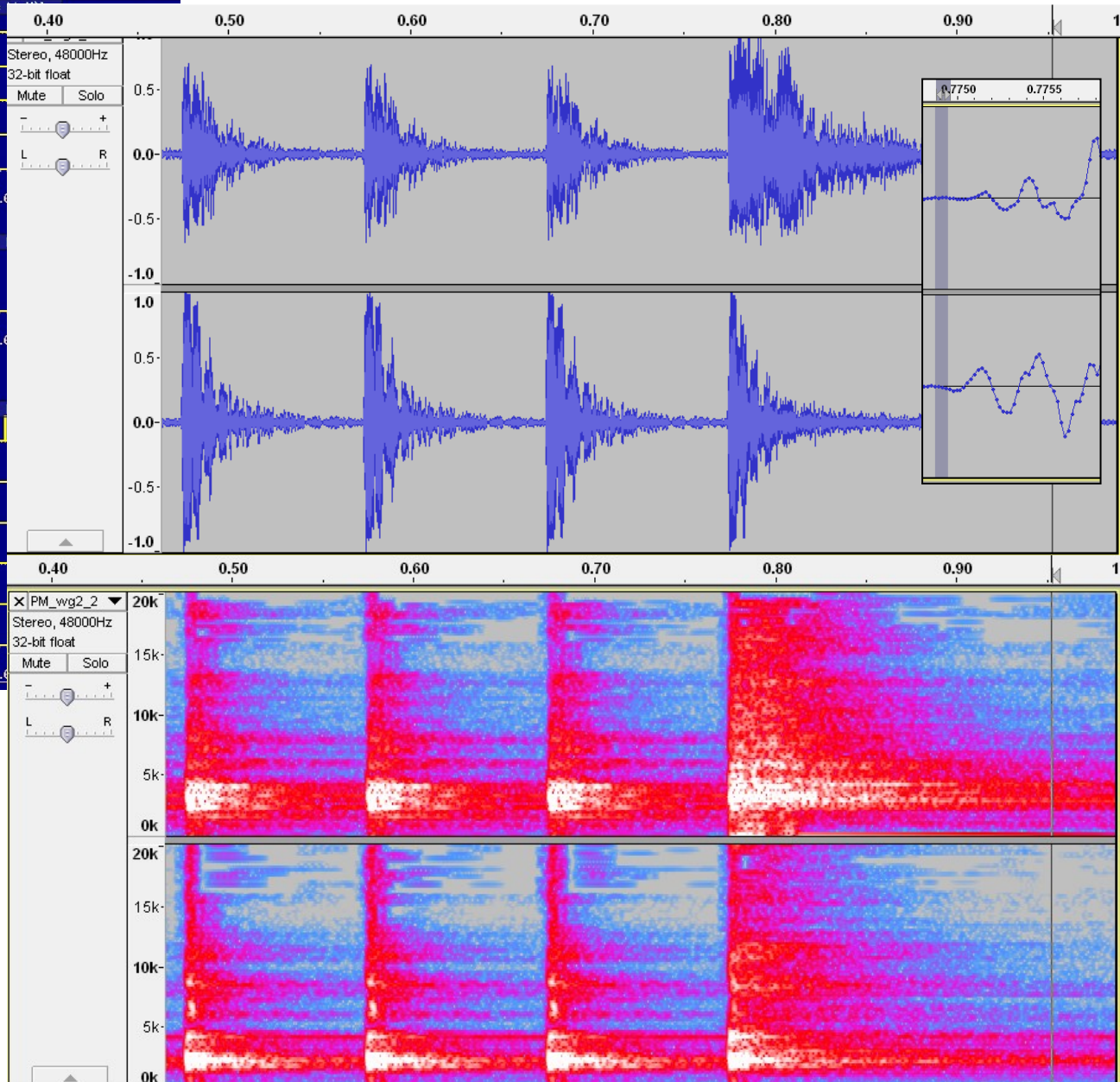






Data analysis. PMT WG2 vac. Side +IGP1 + IGP2 on 08.06.2016 at 16:58

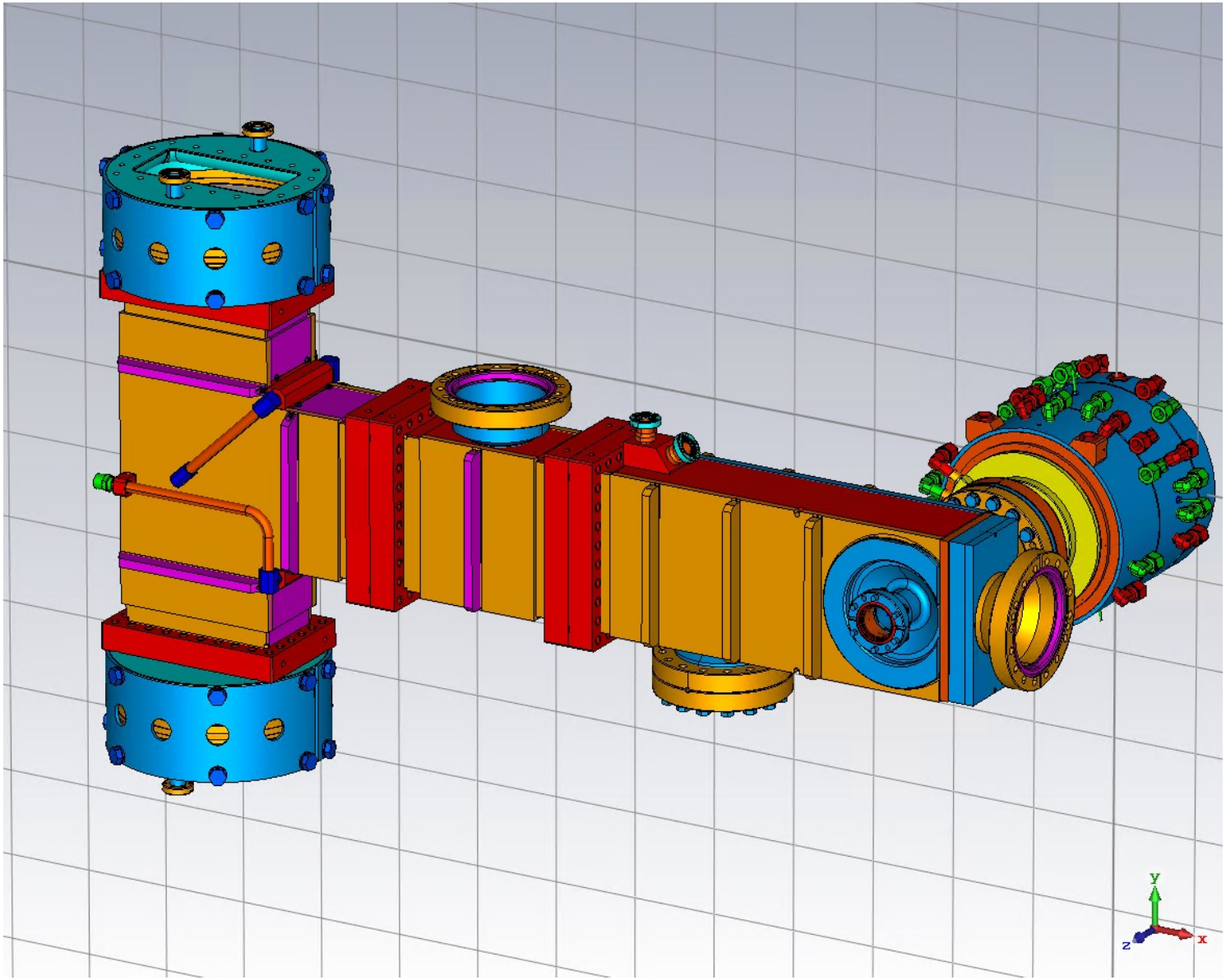




Next steps

- More detailed and careful data analysis for different IL types with MATLAB
- FLAC (lossless format) vs MP3 comparison (try to increase rate recording >48kHz)
- Recording of all 4 channels (in 1 file or in 4 files)
- ADCs adjustments
- Implementation of data storing in DAQ
- Simulations of acoustic wave propagation in the waveguide distribution system

Thank you for your attention.


y
z
x

- 16 samples / 48kHz = 0.33e-3 sec 0.57m/0.33e-3sec = 1727m/sec
- 23 samples / 48kHz = 0.48e-3 sec 0.57m/0.48e-3sec = 1188m/sec

- Acoustic **wave** speed in **copper**: longitudinal waves **4720 m/s**, longitudinal waves in a thin pivot **3790 m/s**, (4700, 3700, 3560, 3570)