MAX-PLANCK-INSTITUT FÜR KERNPHYSIK

Further noise reduction and current state of signal characterization

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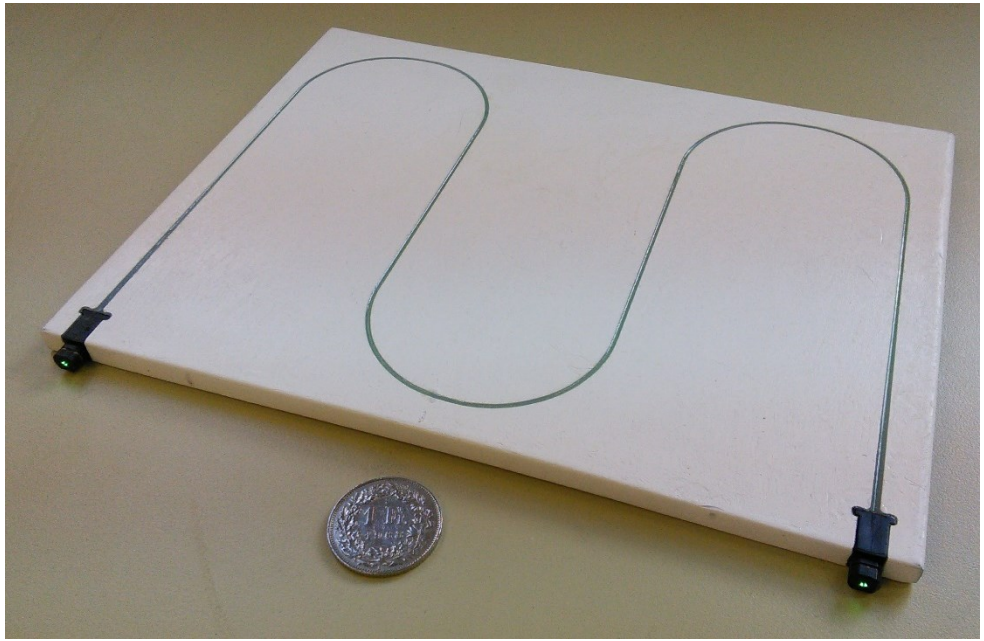
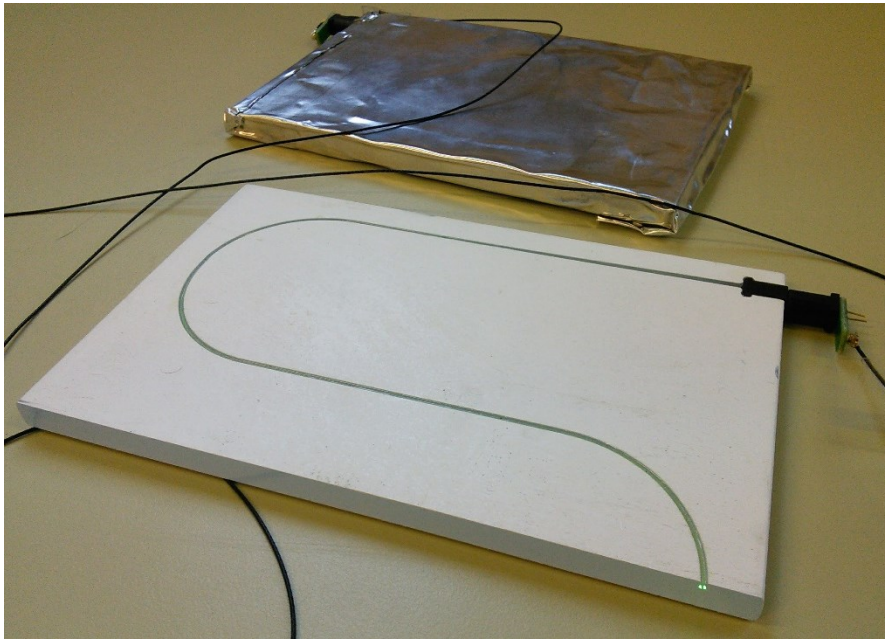
Pictures from the CosmicPi V1.5

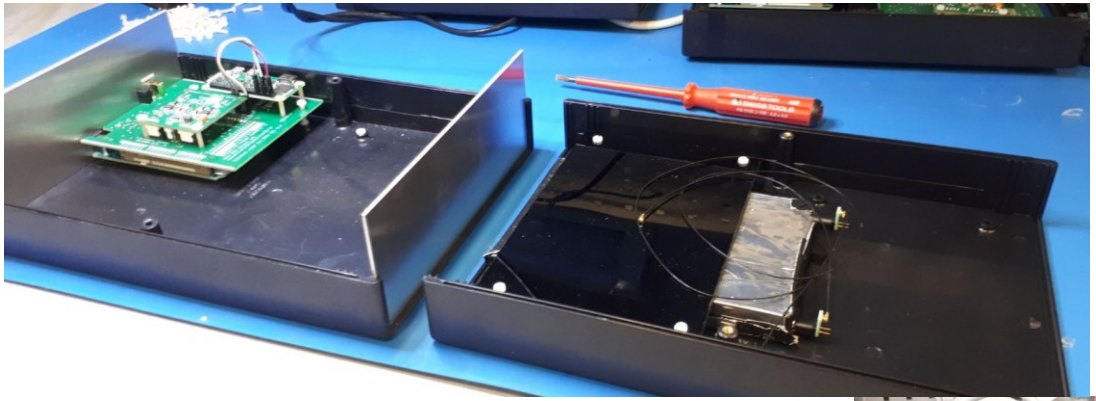


CosmicPi V1.5 scintillator; Extruded plastic
with light-shifting lightguide



CosmicPi V1.5 cut scintillator with SiPM's attached;
Wrapped in industrial aluminium foil.
Dimensions after cutting: 200x160x6 mm

Pictures from the CosmicPi V1.5



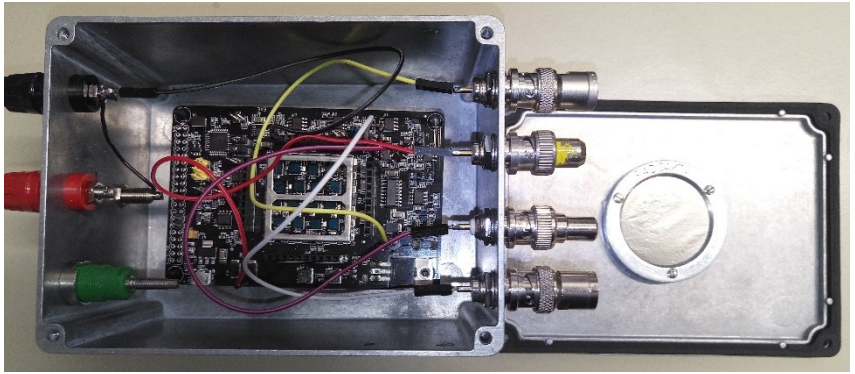
Open V1.5 unit; On the left: Lower part with electronics; On the right: Upper part with the scintillators and SiPMs

Stack of V1.5 units; Partially open;

β-source for testing

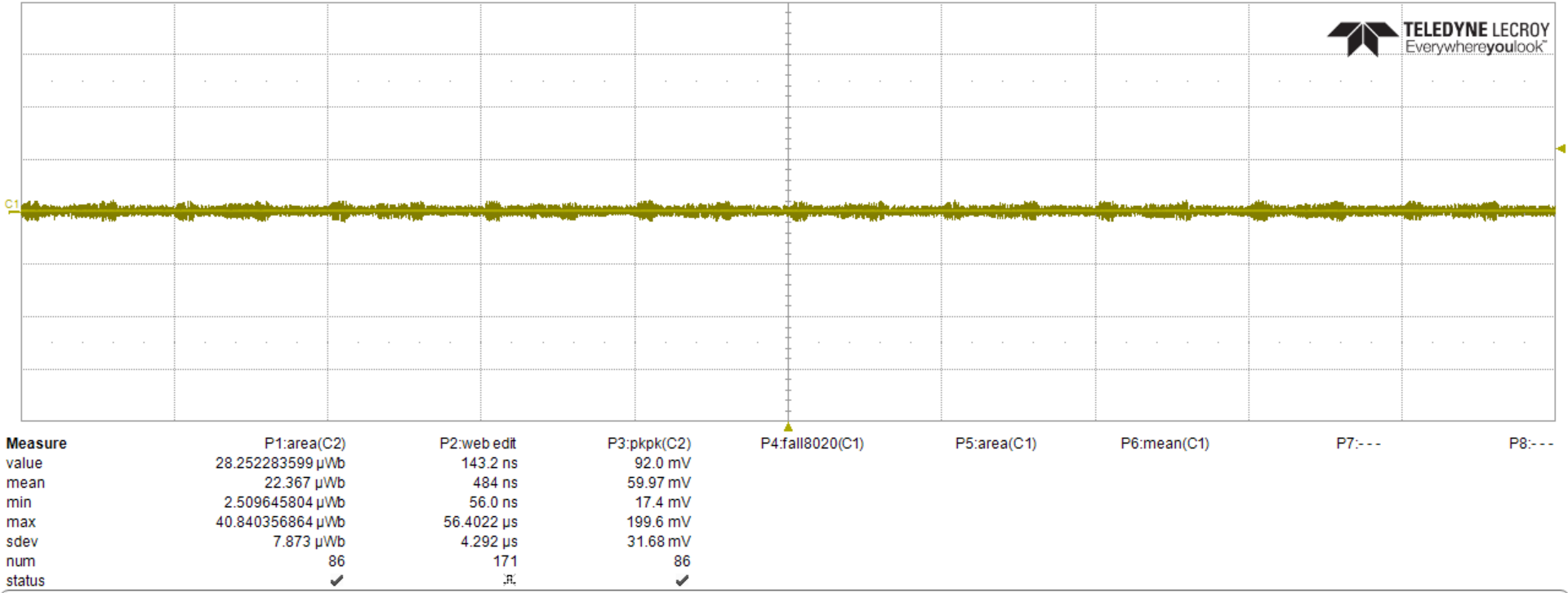
Supplied by Ralph Lackner

- **Sr90**
  - Halflife: ~29 y
  - Energy: 0.546 MeV
  - Estimated activity: ~250 Bq
  - Decay product: 100% Y90
- Y90
  - Halflife: ~64 h
  - Energy: 2.28 MeV
  - Estimated activity: ~250 Bq
  - Decay product: 100% Zr90 (stable)
- Activity visible with the CosMo detector (has an aluminum shielding)
- Still no activity visible at the PIN-Diodes



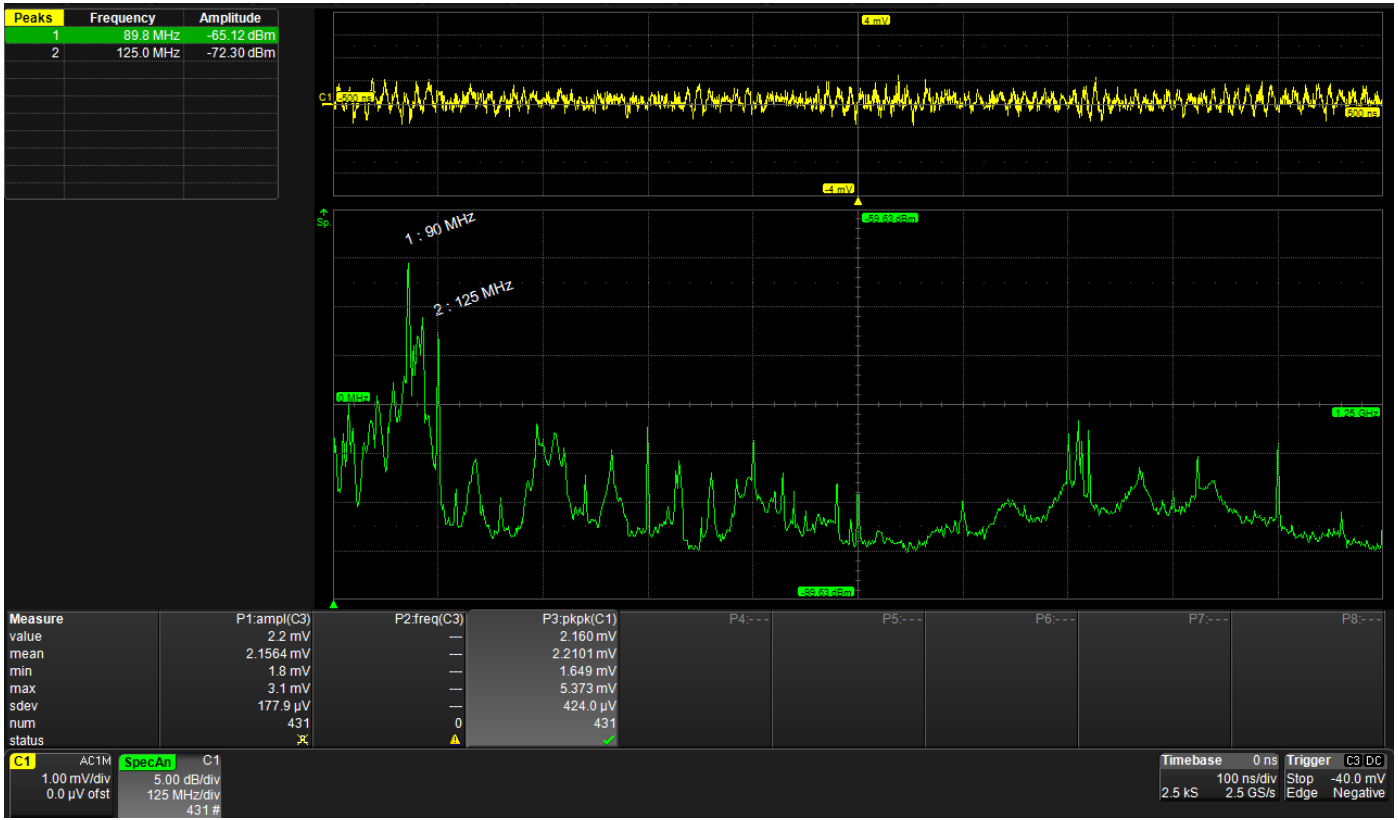
Current setup of the uTelescope; Sr90 source is mounted onto the electrical shielding

Reduction of electrical noise



Noise after first shielding; peak to peak voltage: ~20 mV

Reduction of electrical noise

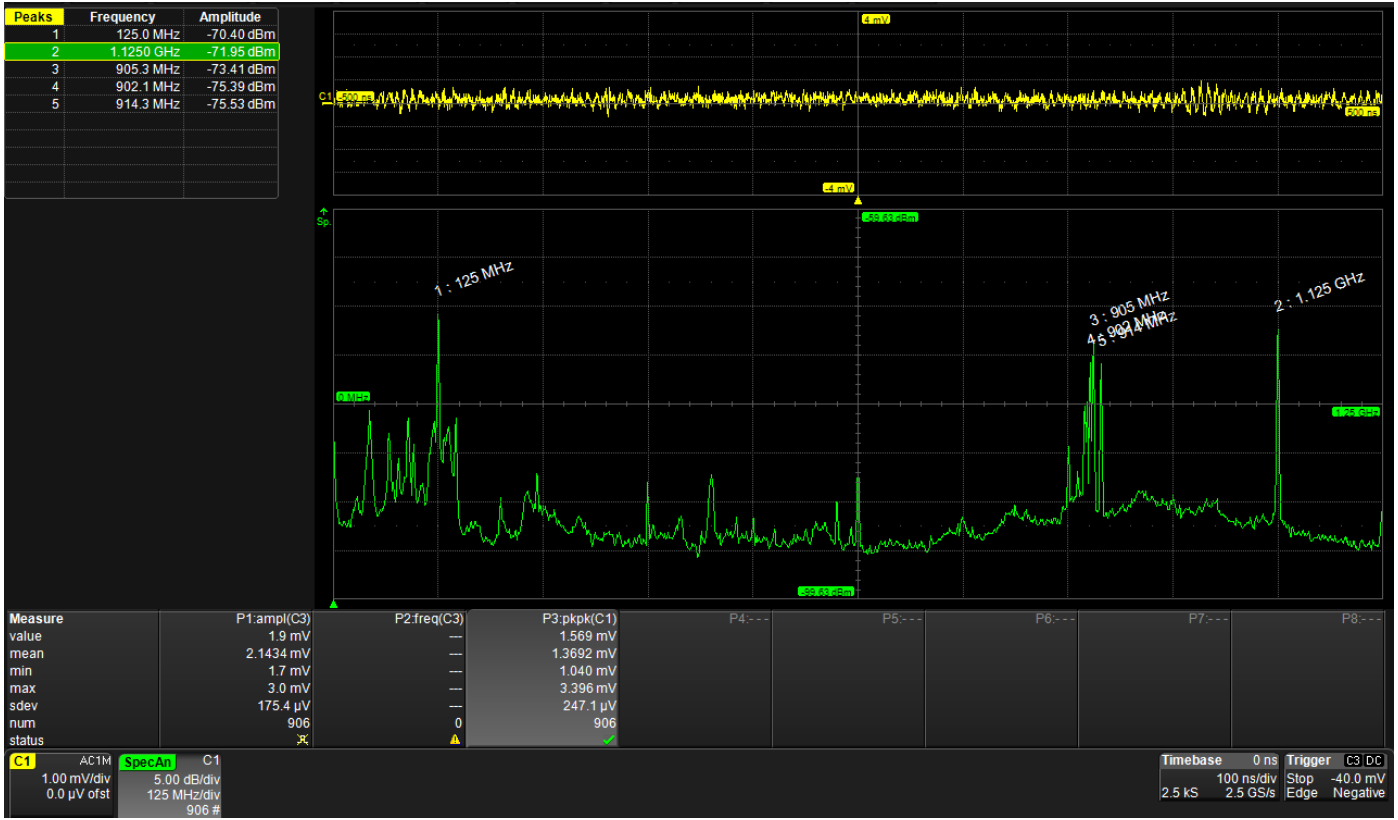


- Additional grounding was applied
- Peak to Peak voltage: ~2.2 mV

Prominent Noise:

- 90 MHz (UKW-Radio)
- 125 MHz (Aircraft traffic control)

Reduction of electrical noise



- Replaced BNC connectors
- Improved grounding
- Peak to Peak voltage: ~1.4 mV

Prominent Noise:

- 125 MHz (Aircraft traffic control)
- 890~915 MHz (GSM)
- 960~1164 MHz (Flight-navigation)

- Noise minimum from the Oscilloscope: PkPk:~1,1mV

Theoretical assumptions for directly measuring signals with the oscilloscope

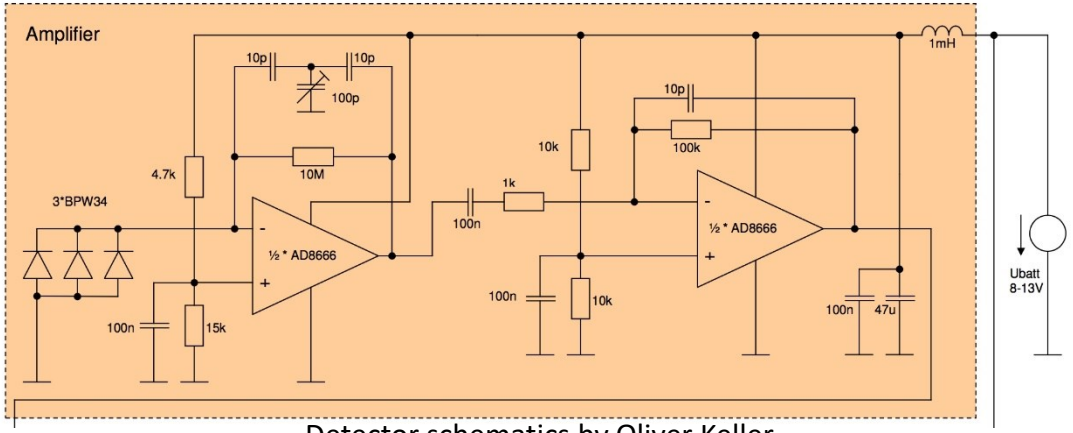
- Oscilloscope impedance: 1MΩ
- Diode capacitance: 25 pF
  - ➢ Pulse length:
- Diode thickness: 0.3 mm
- Deposited energy from e^-: ~100 keV
- Freed e^- : ~12000
  - ➢ Induced voltage: ~0,1 mV

With the current setup it is unlikely to measure any pulse directly at the PIN-Diodes.

- ➢ Pre-amplification is required

Testing with a reference design

- Designed and tested by Oliver Keller
- Uses low noise op-amps for integrating amplification
- Easily reproduceable
  - PIN-diodes are available
  - Capacitors and resistors available at the electronics workshop



Detector schematics by Oliver Keller

Next steps

- Signal recording after pre-amplification, using:
  - Design by Oliver Keller
  - Further up the amplification chain on the Telescope
- Further noise reduction of the signal may be needed