Radiation Monitor: Concepts, Simulation for an Advanced Read Out

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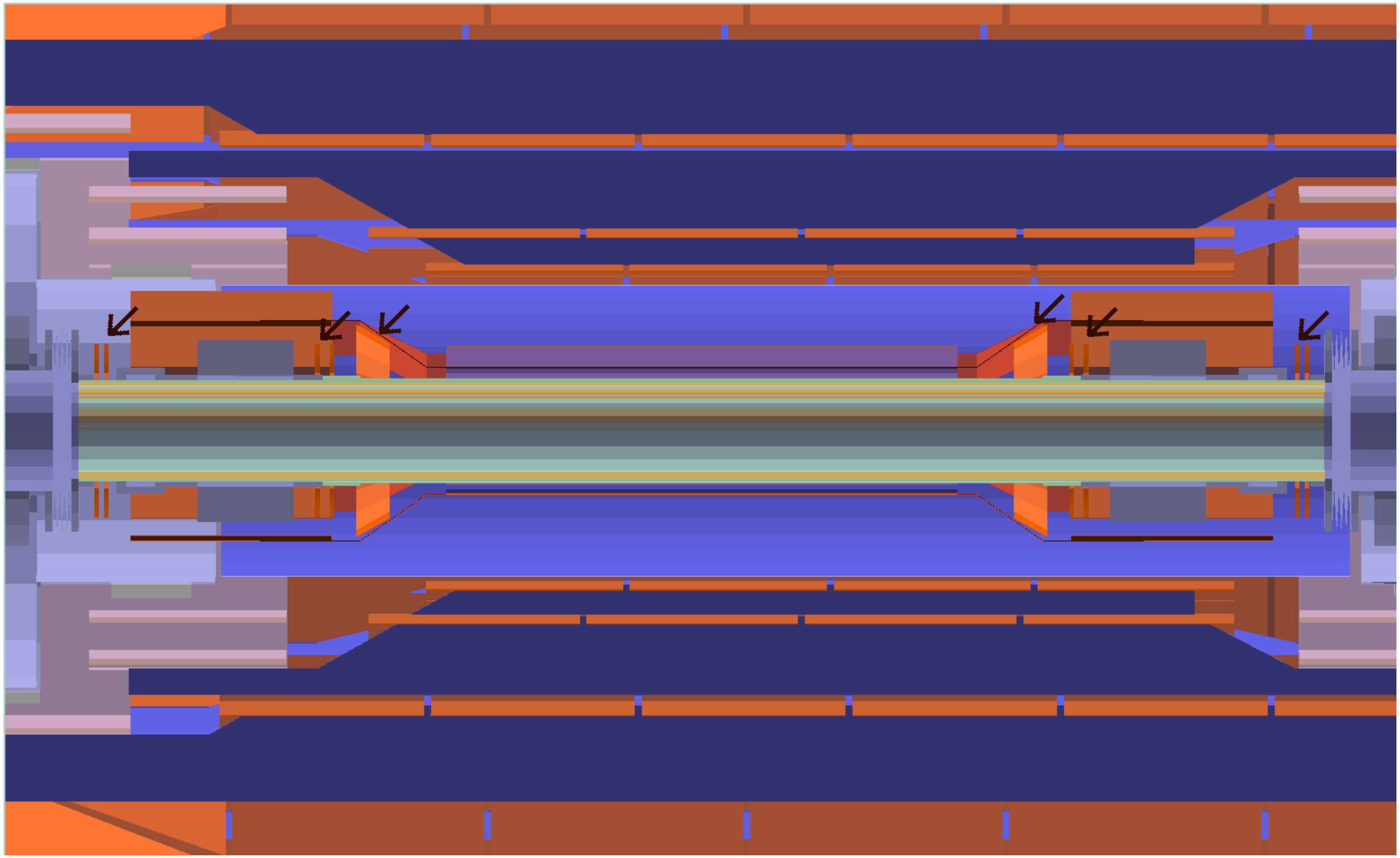
Pisa

Outline

- Location of the beam monitor in the Super-B detector.
- Test of a mono c. v.s. poly c. diamond detector with SiGe amplifier.
- Conclusions and future plans.

Location of the detectors

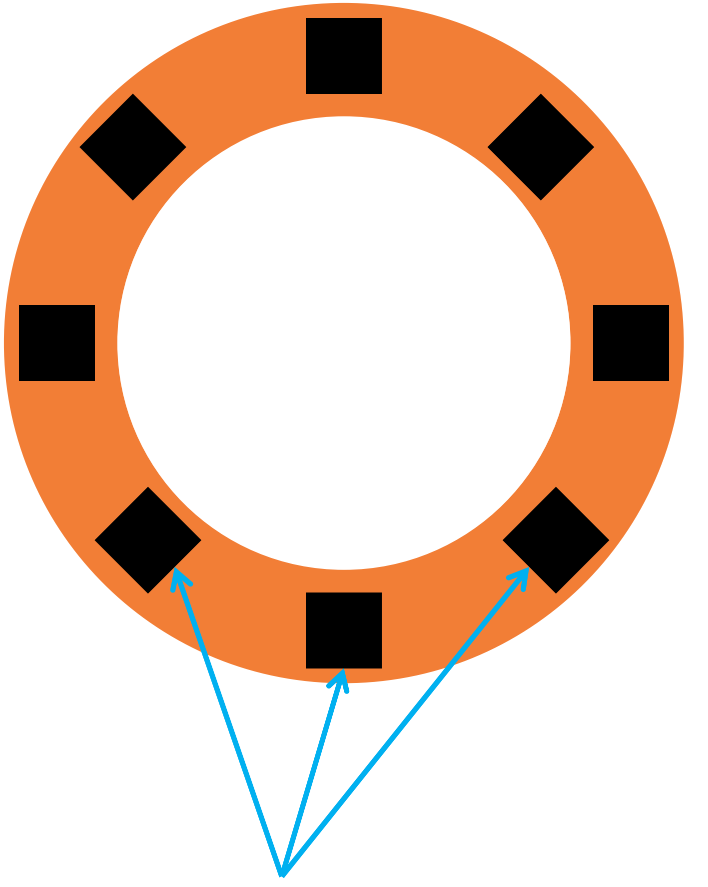


geometry of the detector

feature

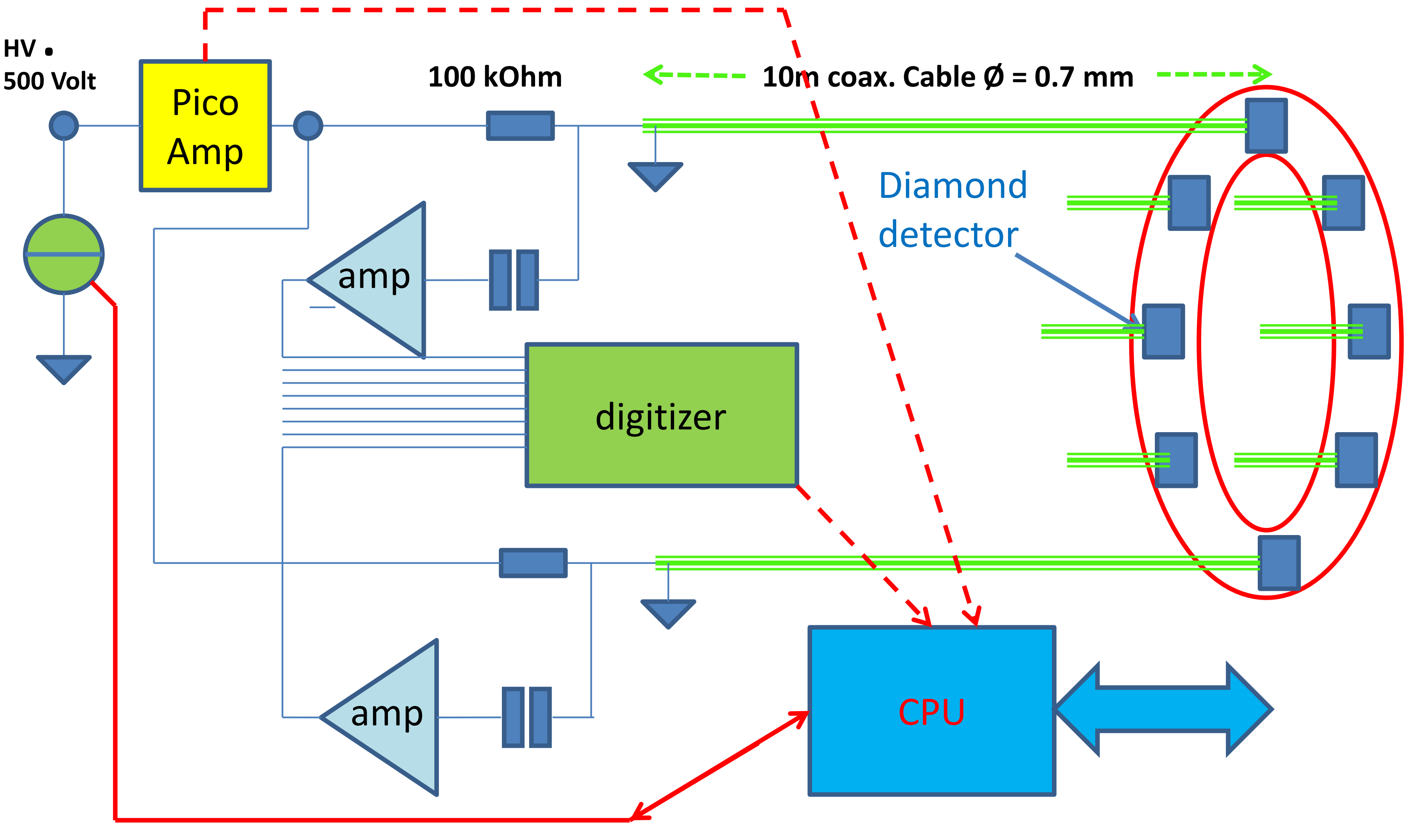
detector size	8 X16 mm^2
leakage current	$80x10^{-10}$ A
Ionization current	$6.7x10^{-10}$ A
hits rate	130KHz
Transit time	20 ns
Integration time	30 ns
Electric resistance	10^{11} Ωcm
energy threshold	150KeV

8 diamond detectors for each ring

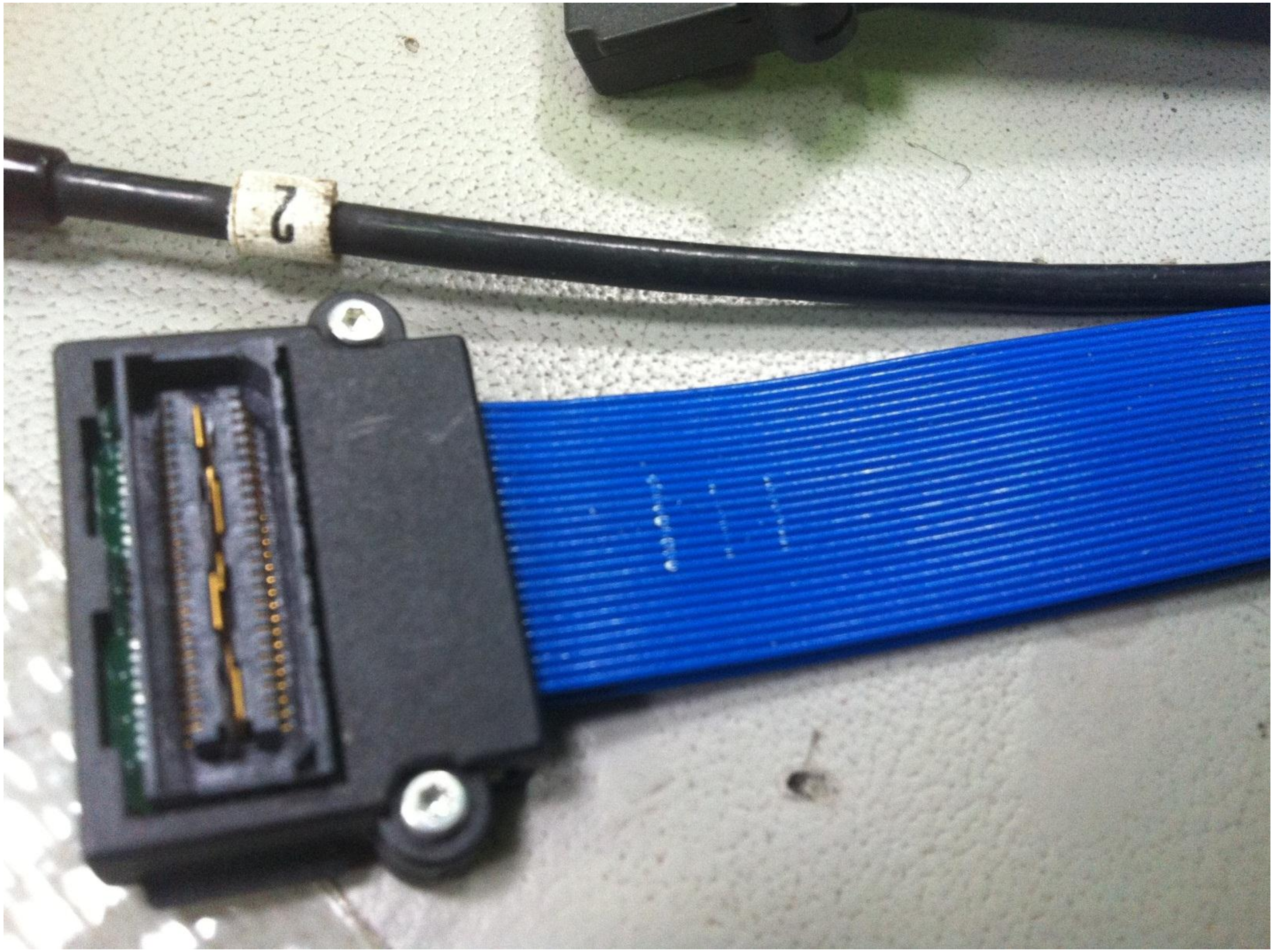


Diamond detectors
4mm x 4mm

Tentative electronics diagram



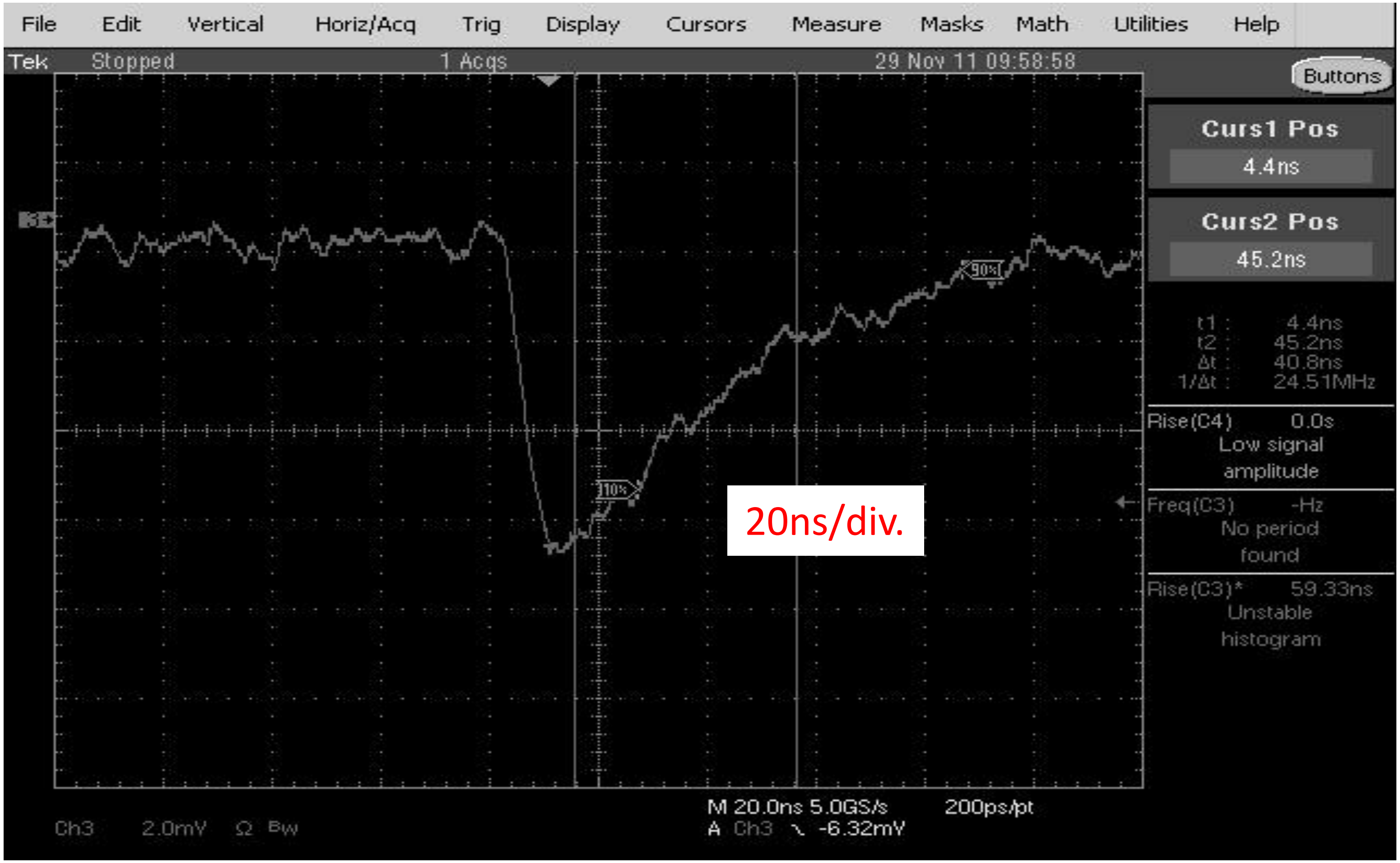
Multi-Coaxial Cable Ø = 0.7 mm



Amplifier, AC, (BJT SiGe, BFP740)

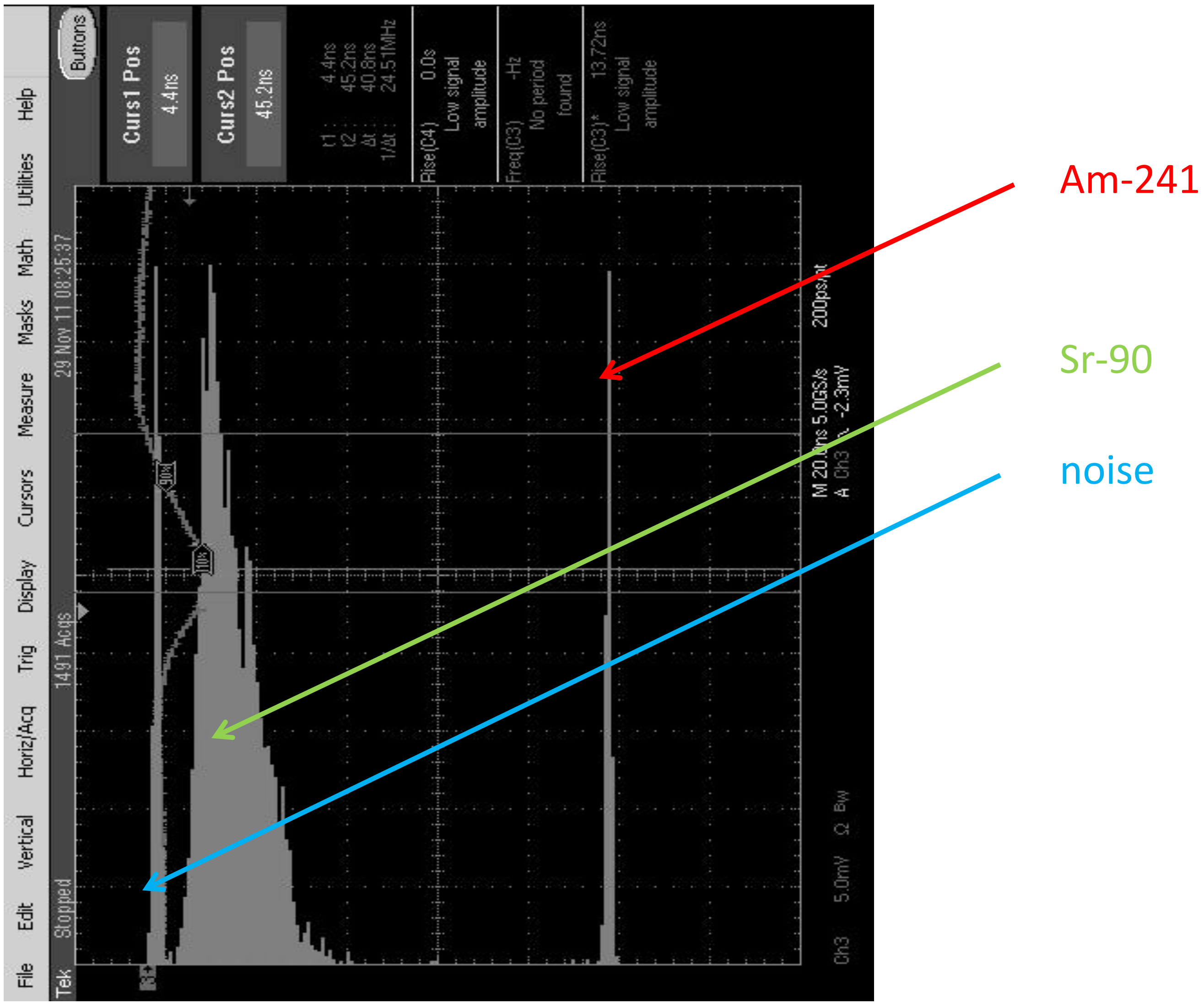
- Voltage supply 5 Volt
- Sensitivity 6 mV/fC
- noise 500 e^- RMS
- Input impedance 50 Ohm
- B.W. 30 MHz
- Power consumption 10 mW/ch
- Low cost 2 – 3 eur./ch
- Radiation hardness 50 Mrad, 10^{15} n cm^{-2}

Signal from a minimum ionizing particle

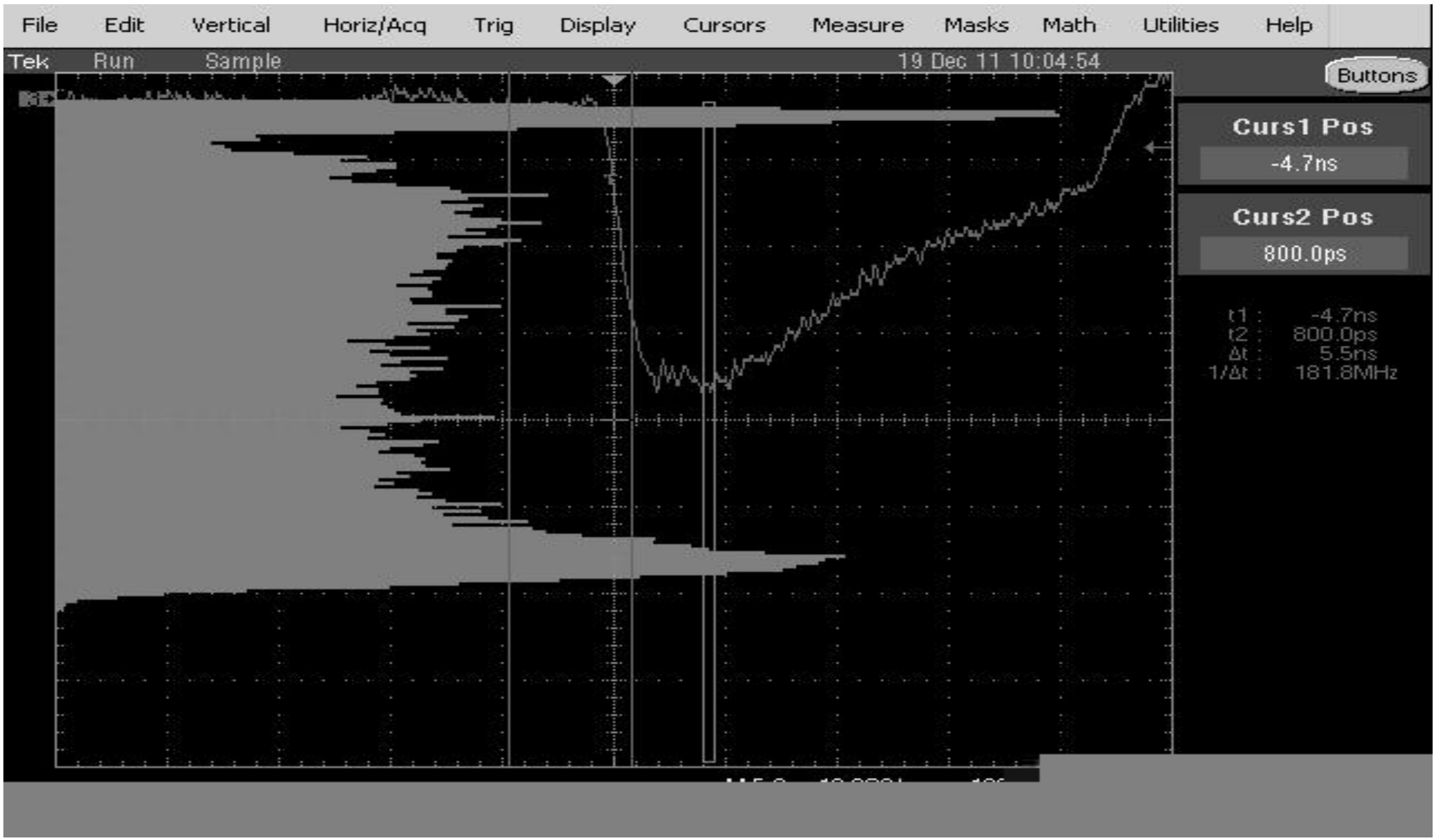


20ns/div.

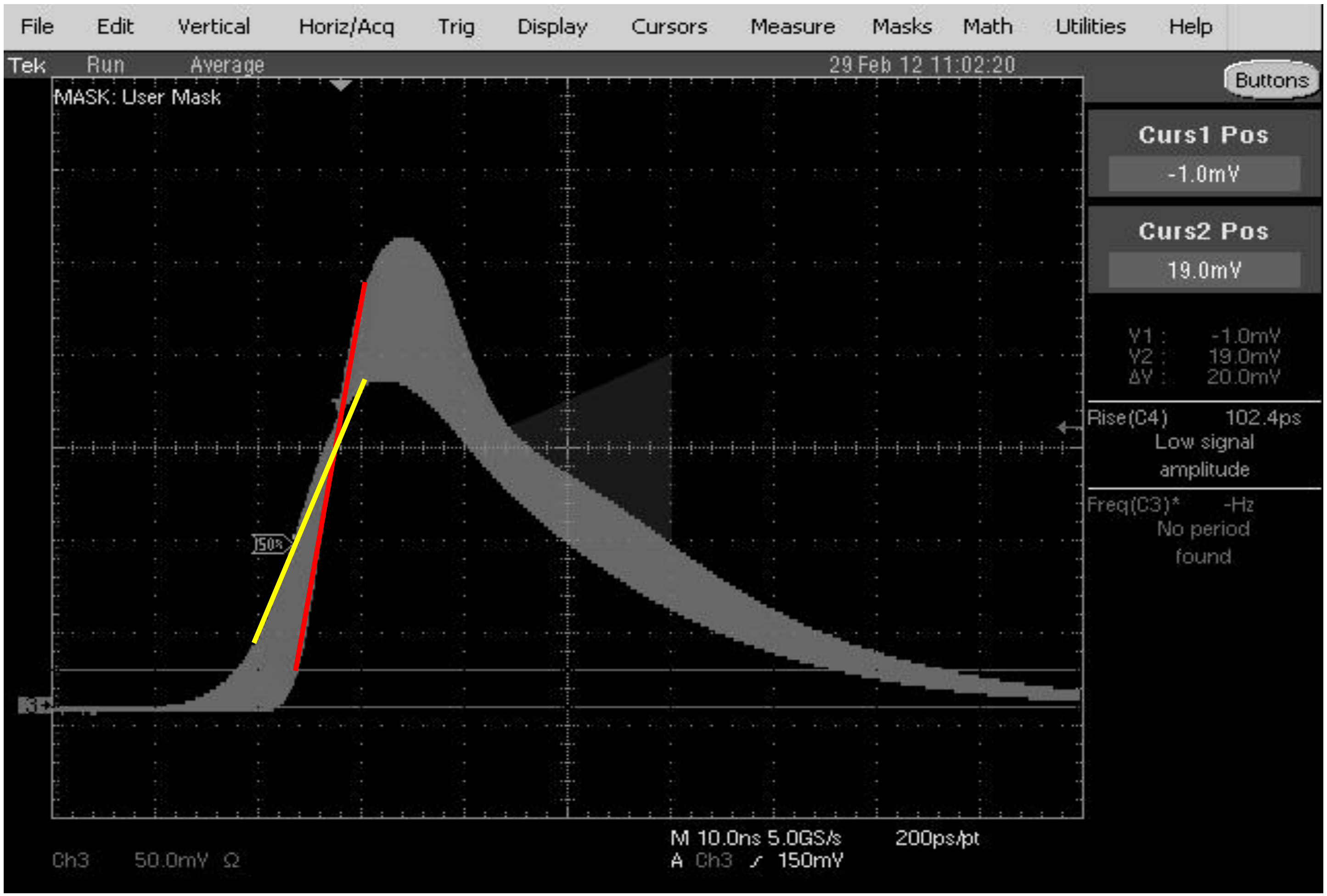
Americium-241 + Sr-90



Polycrystal diamond: alfa source (log scale)



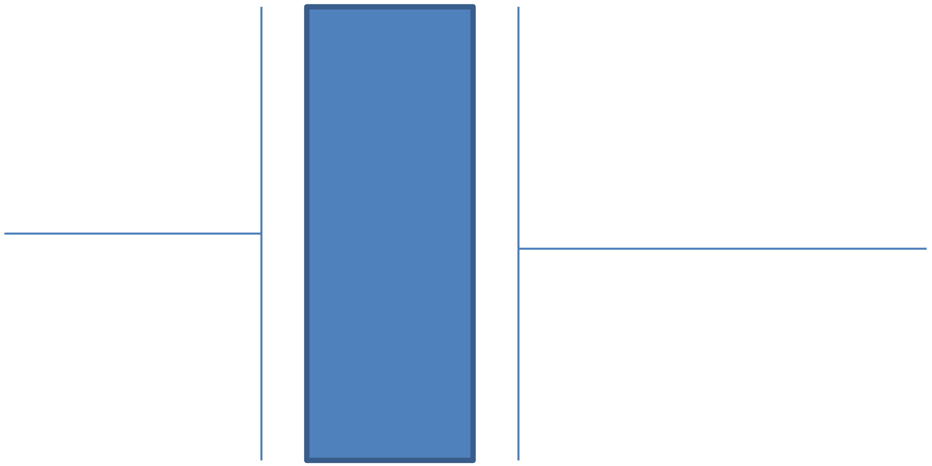
Drift of the monocrystal diamond



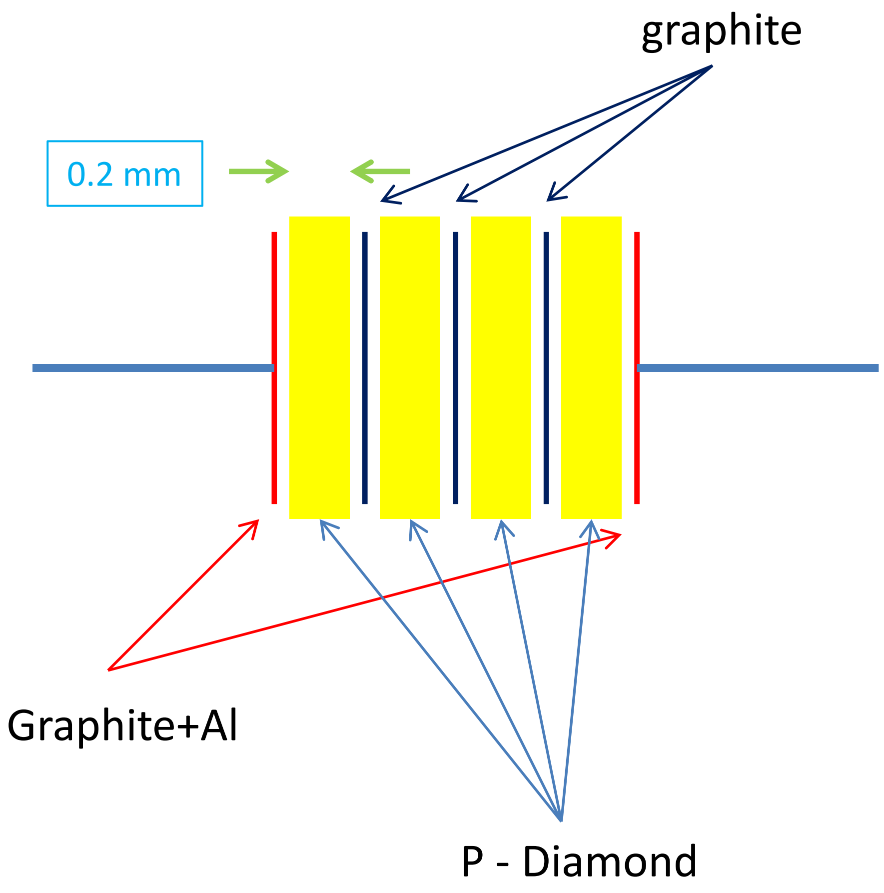
Problems of standard diamont detectors

- Monocrystal is unstable.
- Polycrystal has low charge collection efficiency.

Standard diamond detector



New detector concept



Conclusions

- The background of the detector has been simulated.
- The developement of FE electronics is in progress.
- A new structure of diamond detector has been proposed to solve the main problems of the present ones.

Future plans for 2013

- Test at H8 (CERN) with muon beam.
- Test of the new detectors.
- Test of the final layout.
- Developement of a full custom FE electronics in SiGe technology.