

# New particle position determination modules for Double Side Silicon Strip Detector at DGFRS

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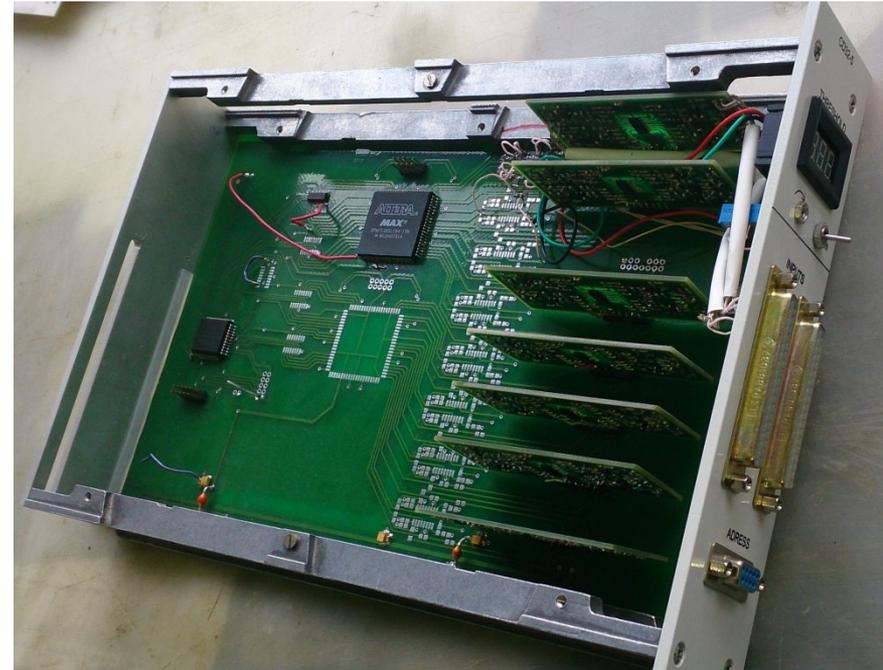
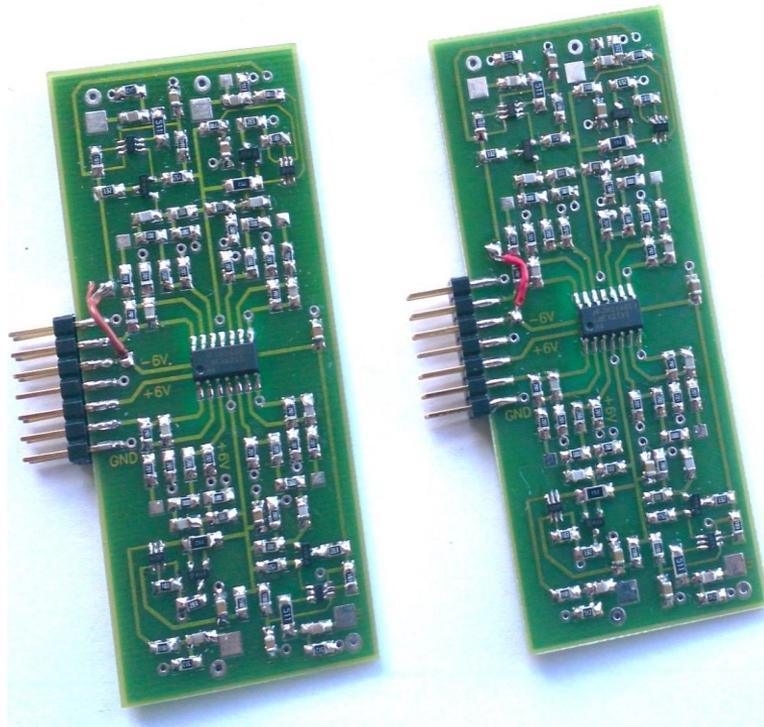
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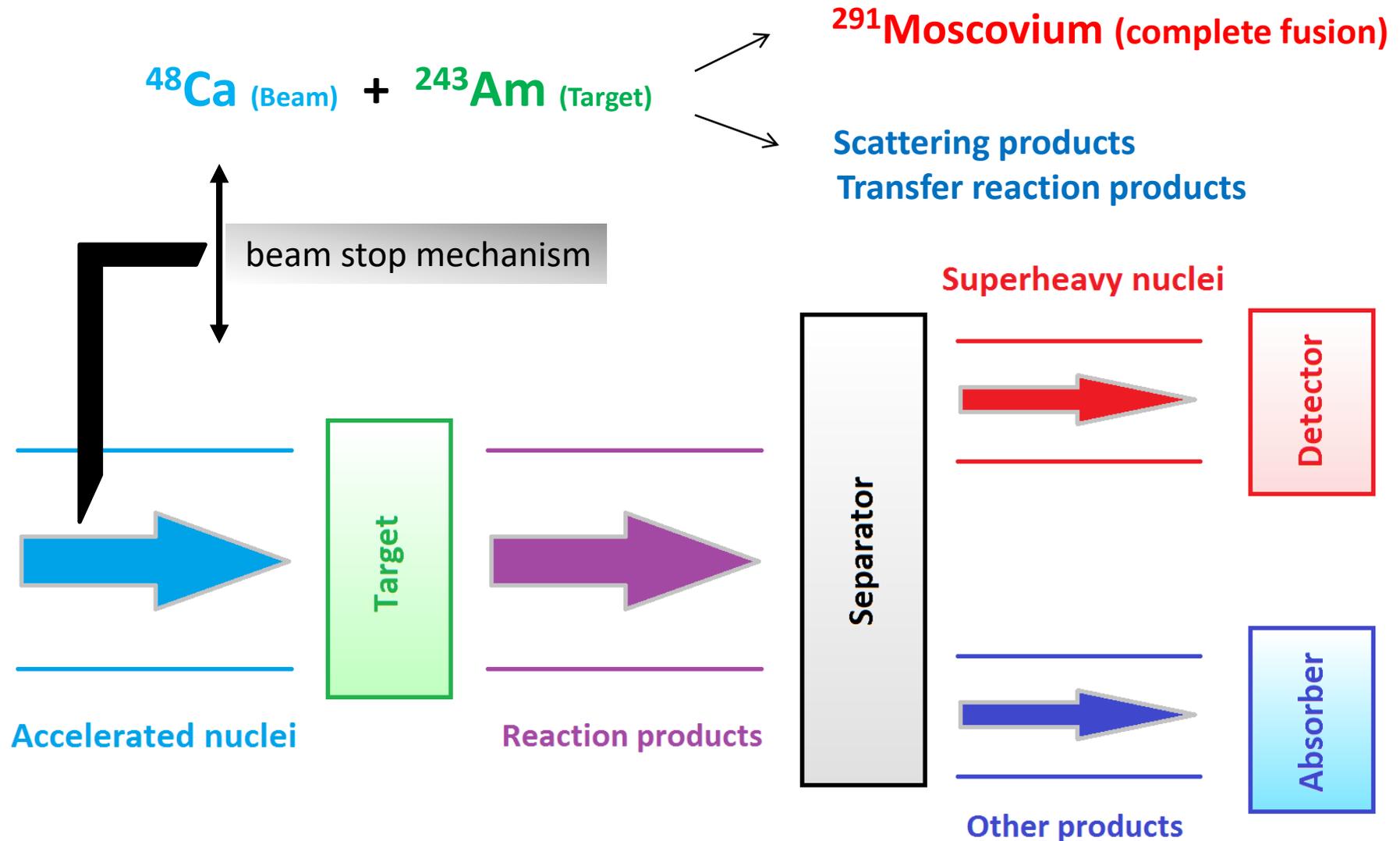
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# Outline

- SHE synthesis at DGFRS
- Current DGFRS particle detector
- Description of detector signal chain
- My contribution to particle detector DAQ subsystem
- Conclusion
- References

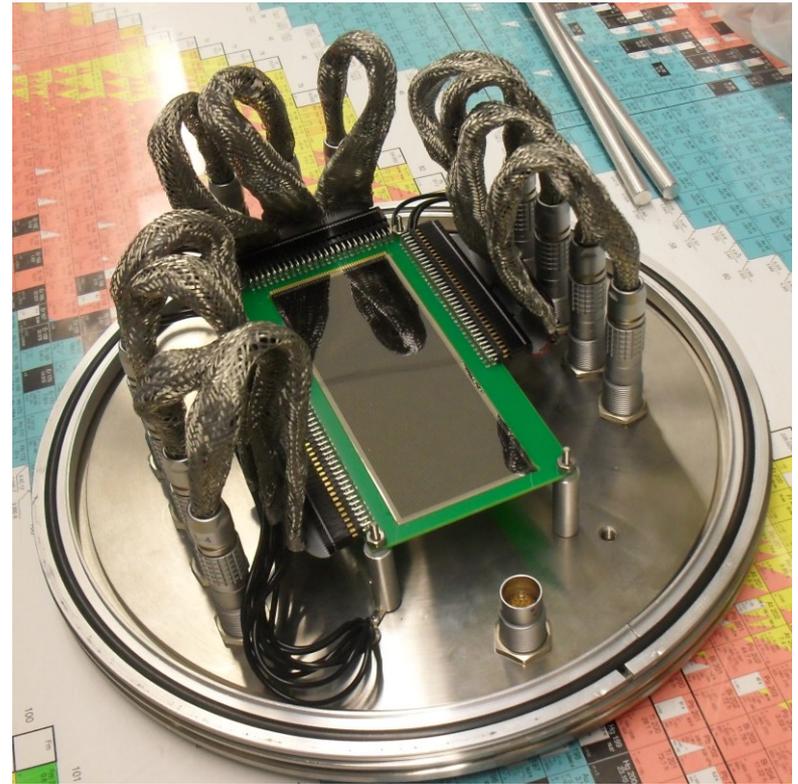
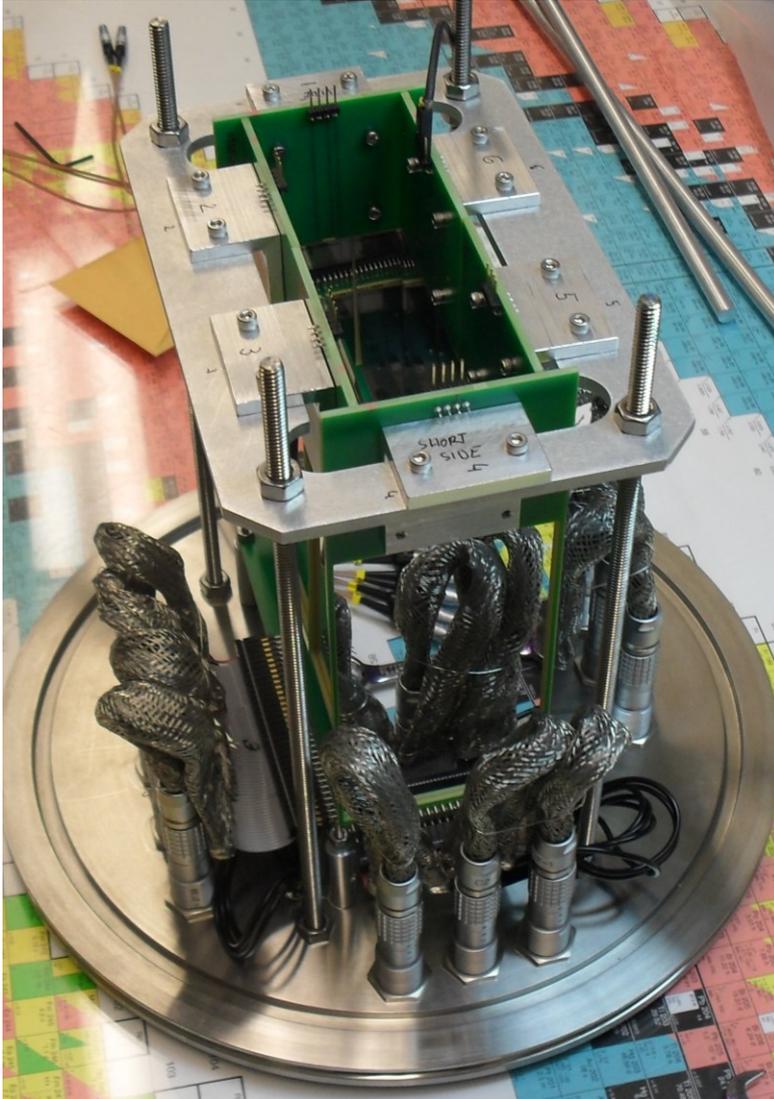


# Synthesis of SHE using fixed target experiment followed by separation of Nuclear Reaction Products



## Detector chamber at DGFRS

consists of double-sided silicon strip detector + side detectors

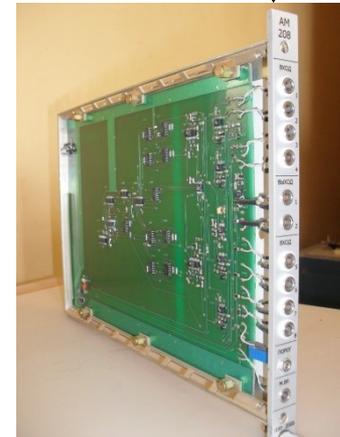
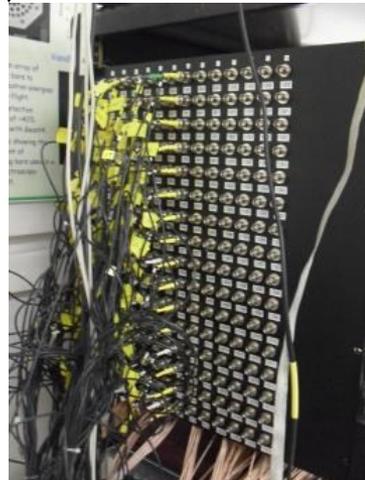
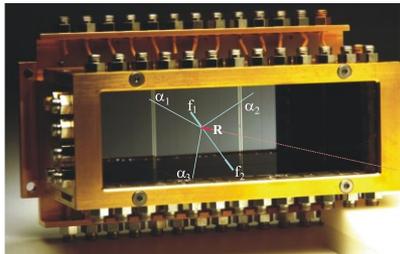
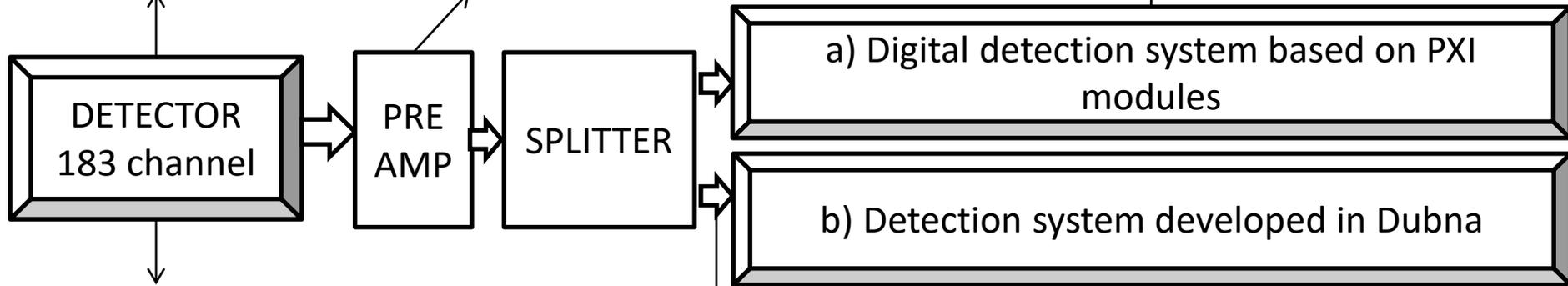


Single chip 128 x 48mm active area  
128 strips vertical  
48 horizontal cells

This is equal to 6144 single detectors  
with space resolution  $\approx 1\text{mm}^2$

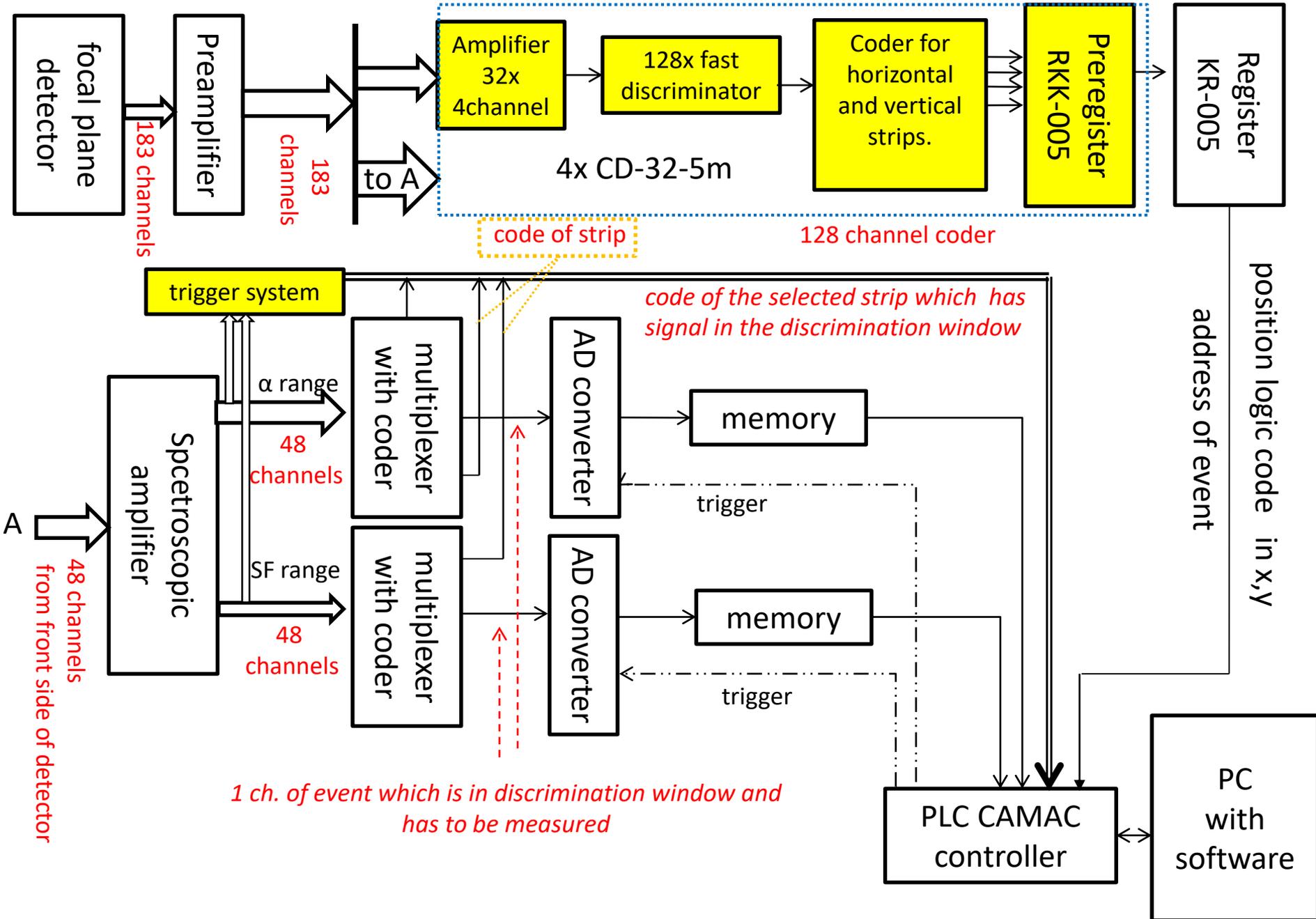
Ref. [2,3]

# Detector signal chain



Ref. [2,3]

# Block Diagram of Analog Detection System being Developed in Dubna



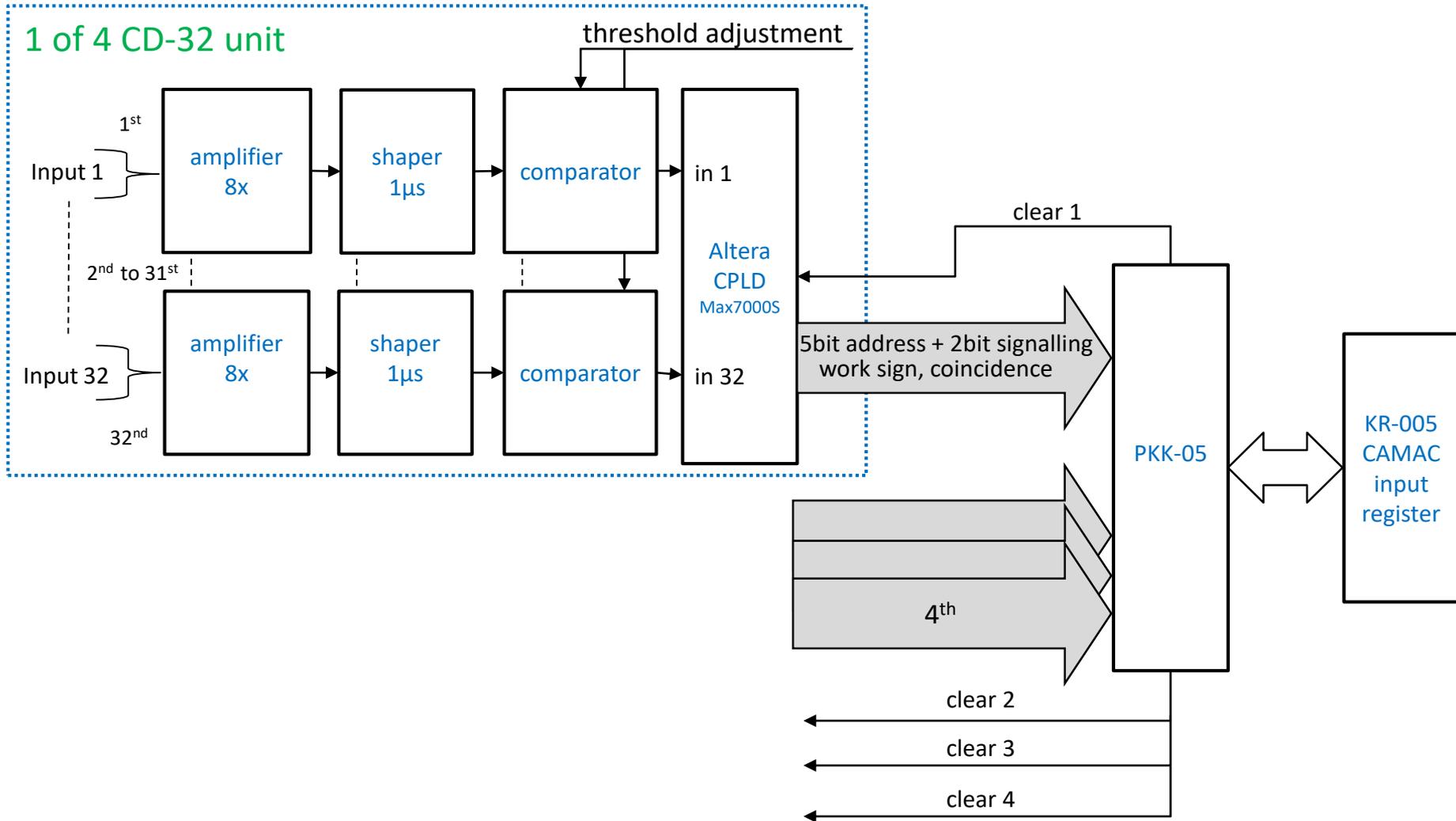
# The subsystem description

- Subsystem is looking for alpha particles over the pre-set threshold which are present during event.
- Its necessary to analyze signals in parallel from detector in realtime.
- Signals from detector goes to DAQ for data analysis and also going to introduced subsystem which consists of:
  1. 128 amplifiers with shapers
  2. 128 single channel discriminators
  3. Logic code creation for channel identification
  4. Logic for CAMAC bus interconnection
  5. Software

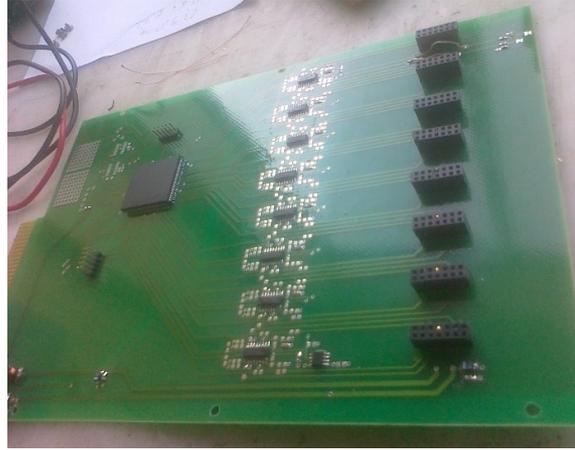
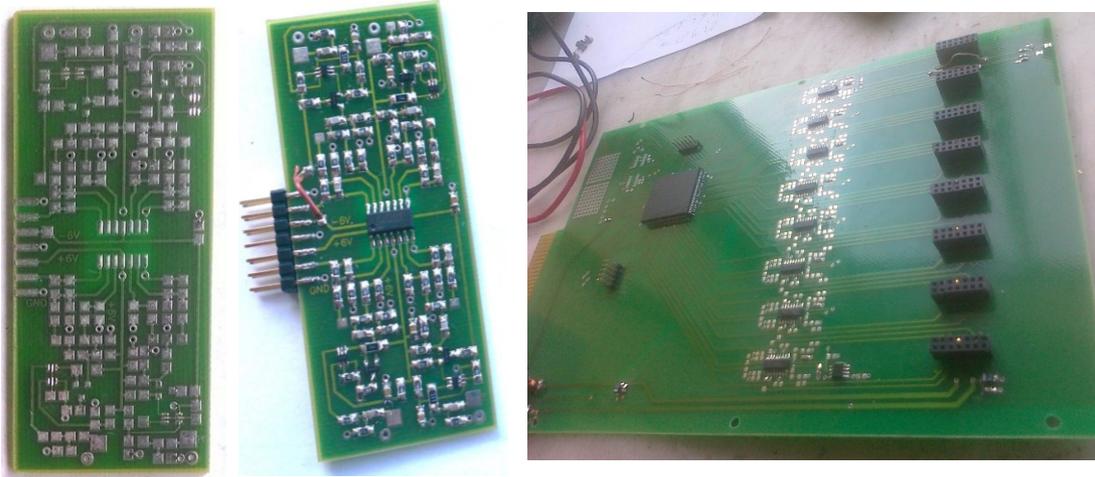
# Realization of the subsystem

- 4x CD32 (finished four, functional prototypes)
  - 32x signal amplifier with factor 8x
  - 32x pulse shaper 1 $\mu$ s
  - 32x single channel discriminator with adjustable threshold
  - detection of multichannel event
  - > 5bit output code of the active channel
- 1x PKK-05 (finished, functional prototype)
  - combine four 5 bit codes to one 7 bit output code
  - detection of multiblock event
  - detection of multistrip coincidence

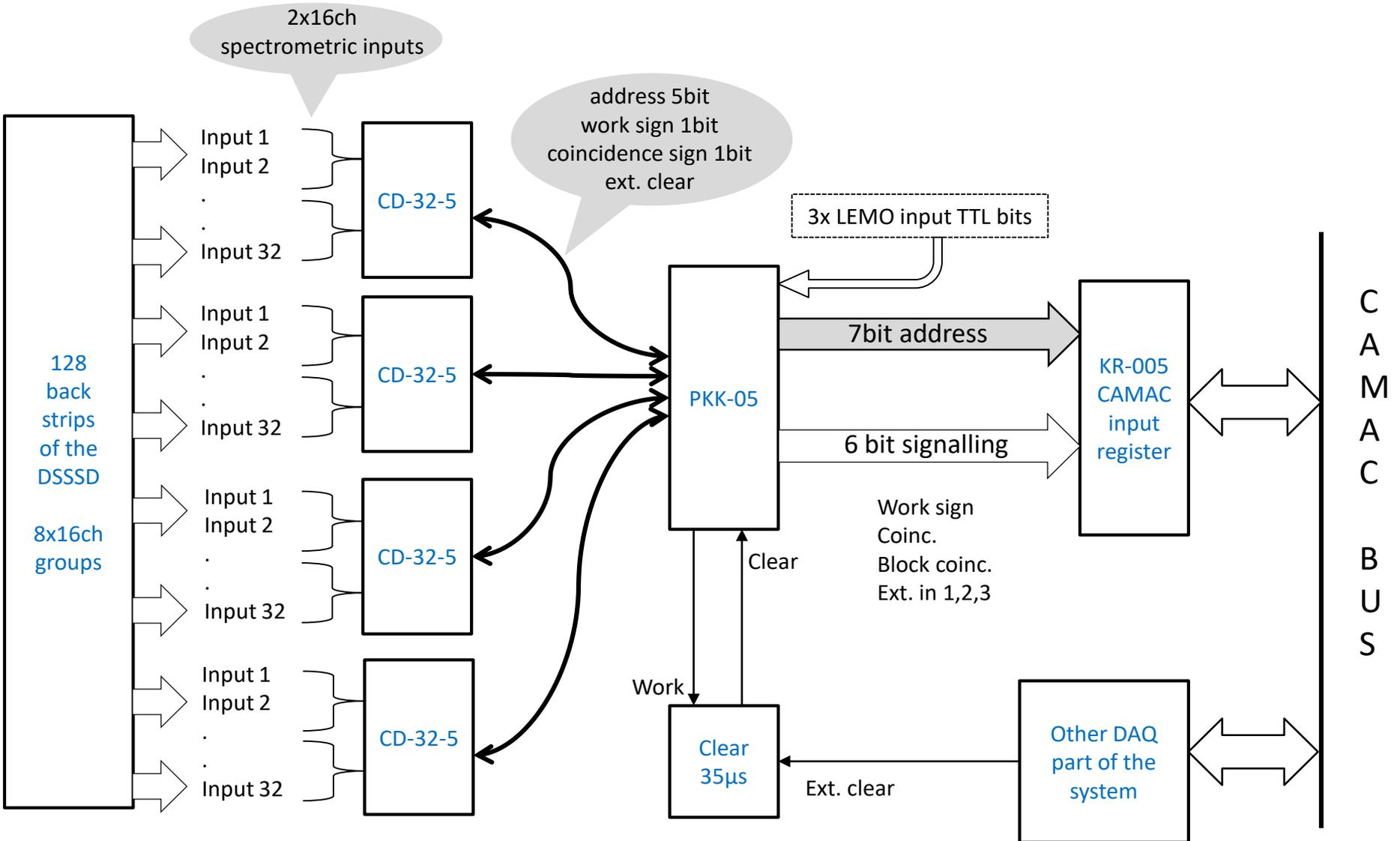
# One CD-32 unit block diagram



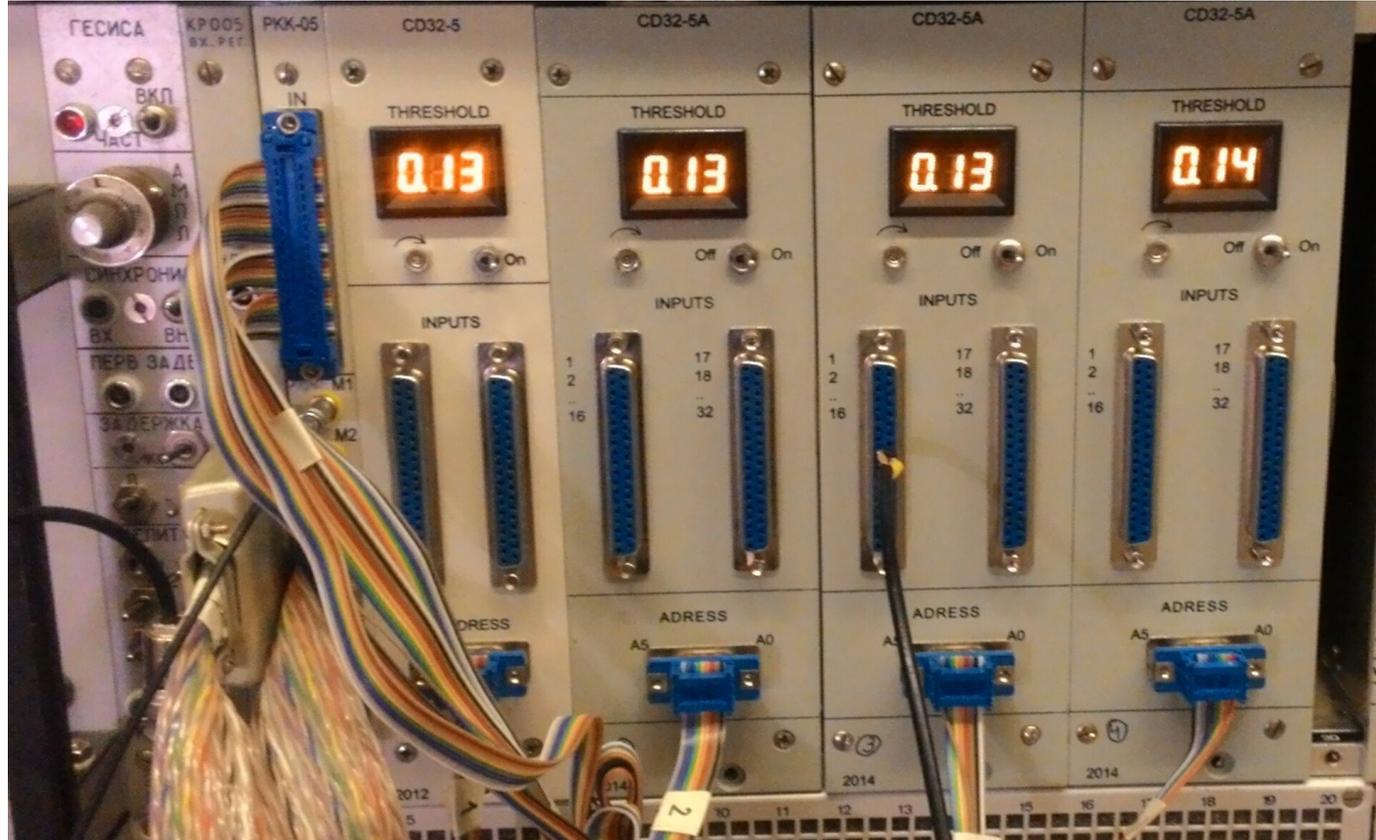
# Realization of four CD-32 units



# Subsystem block diagram

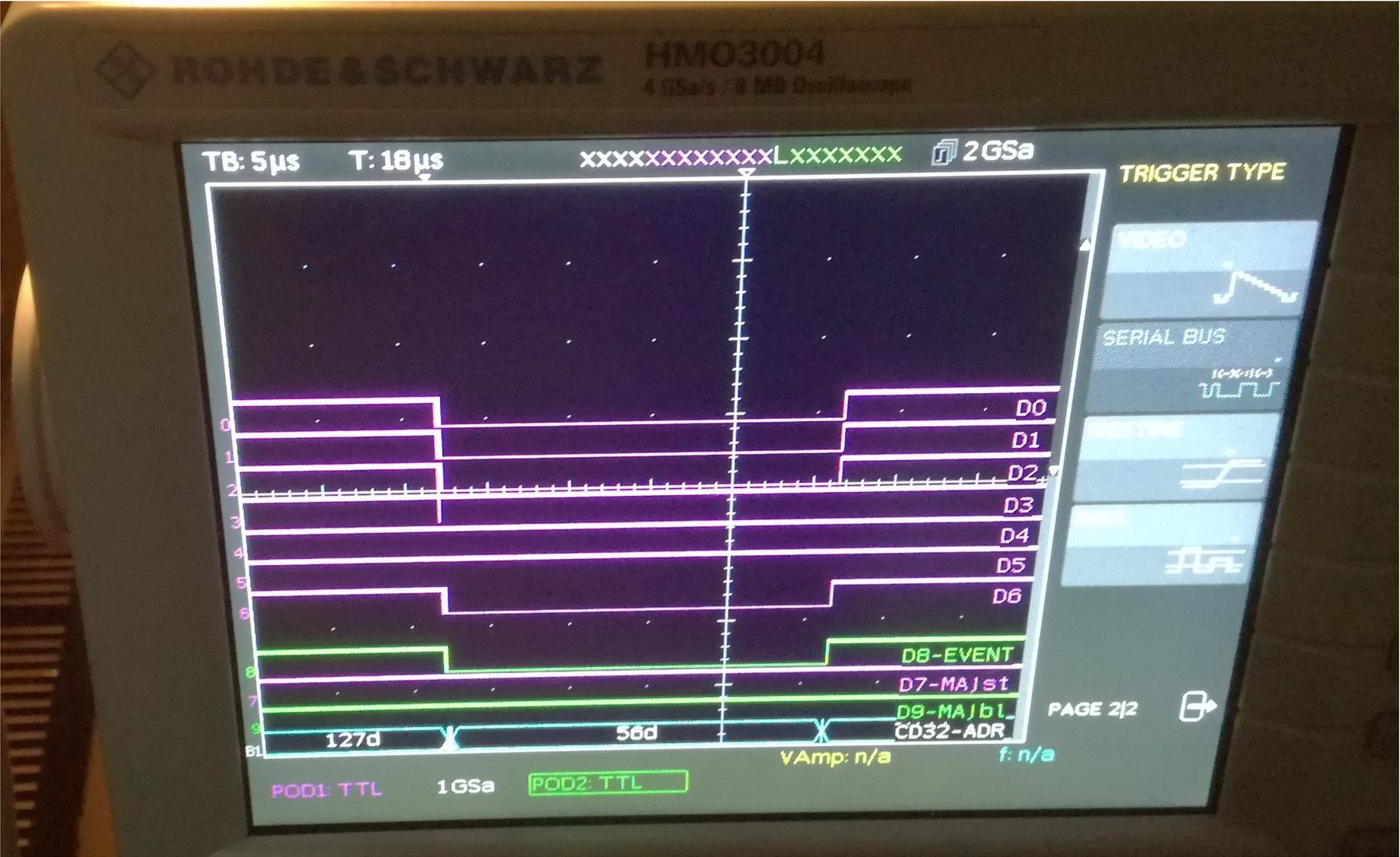


# Finished position determination subsystem prototype



- ✓ Address system for 128 back strips of the Double Sided Silicon Strip Detecor
- ✓ Input impulse threshold level: 5mV to 300mV+ of input signal
- ✓ Using 7mV/MeV detector preamps it goes to thresholds (1,2MeV - 4,5MeV+)
- ✓ Changable polarity of inputs
- ✓ Internal shaping time  $1\mu\text{s}$  + 8x amplification
- ✓ Coincidence window 25ns between strips, 25ns between blocks

# Final data ready to transfer to camac input register



# Conclusion

- Developed subsystem provides information about:
  - ✓ Event over-threshold sign
  - ✓ Coincidence sign between strips
  - ✓ Coincidence sign between coder units
  - ✓ Address code of back strips of DSSSD used in detector chamber
- Developed subsystem will reduce dead time of the system by  $7\mu\text{s}$  (8 stations to read  $\rightarrow$  1 st.)
- The design is all SMD plus using Altera MAX7000S CPLDs for easy optimization based on request
- First prototype of the system was tested successfully. There are ongoing implementations.
- This subsystem will be one of main parts of my Ph.D. thesis.

# References

- [1] Yu. S. Tsyganov, V. G. Subbotin, A. N. Polyakov, et al., Nucl. Instrum. Methods Phys. Res., Sect. A **392**, 197 (1997)
- [2] Yu. Ts. Oganessian, V. K. Utyonkov, Super-heavy element research, Rep. Prog. Phys. **78**, 036301 (2015)
- [3] V. K. Utyonkov et al., “Experiments on the synthesis of super-heavy nuclei  $^{284}\text{Fl}$  and  $^{285}\text{Fl}$  in the  $^{239, 240}\text{Pu} + ^{48}\text{Ca}$  reactions,” Phys. Rev. C **92**, 034609 (2015)
- [4] Subbotin, V.G., Zubareva, A.M., Voinov, A. N. Zubarev, **L. Schlattauer**, New analog electronics for the new challenges in the synthesis of superheavy elements, Phys. Part. Nuclei Lett. (2016)



# Thank you for your attention

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