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

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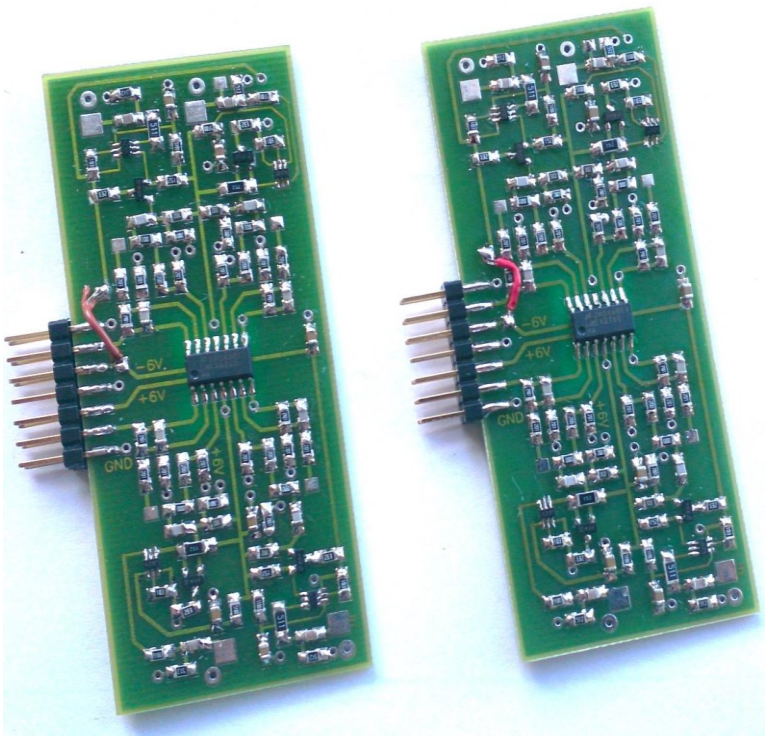
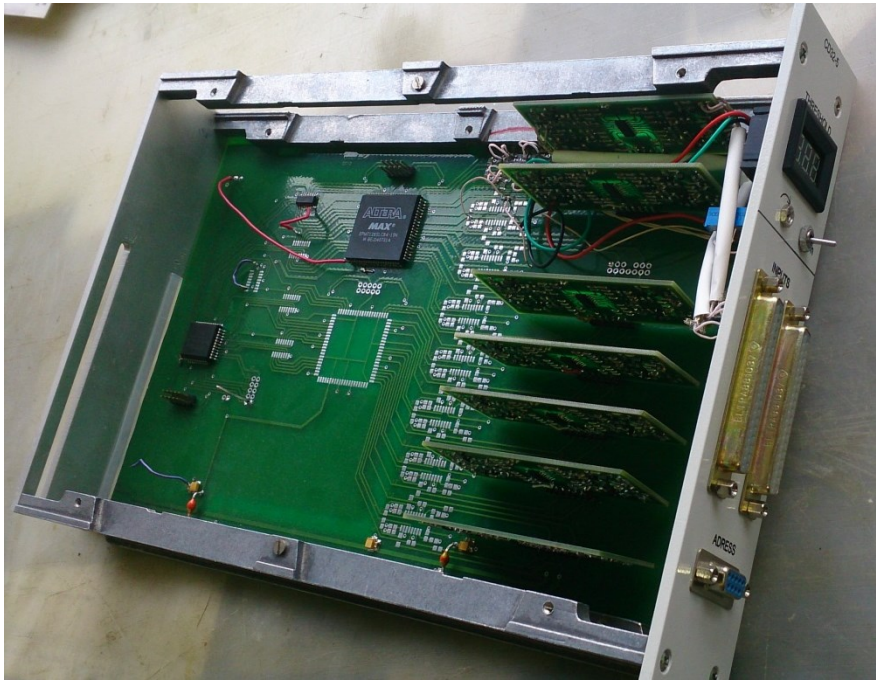
The XXI International Scientific Conference of Young Scientists and Specialists (AYSS-2017)

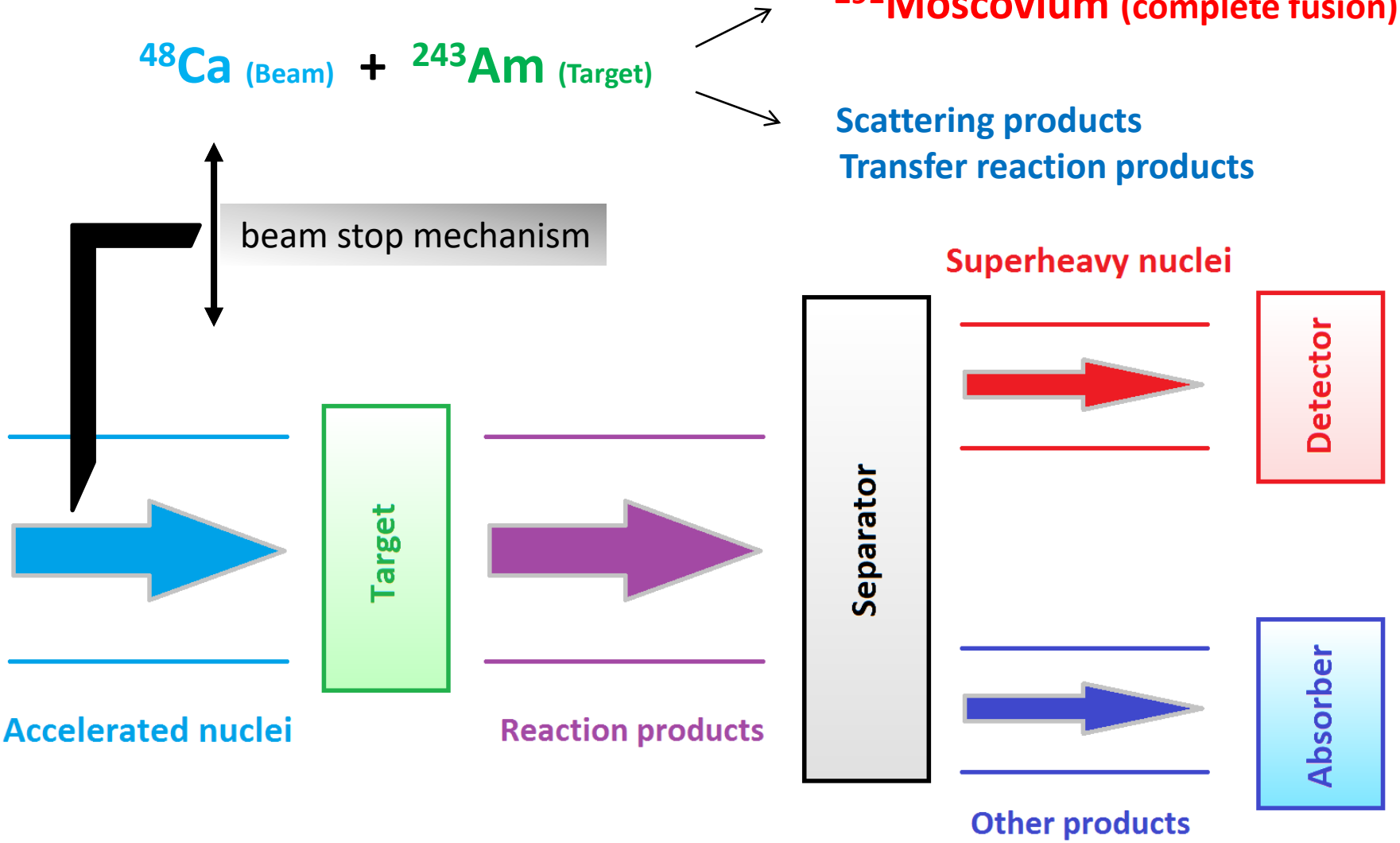
Outline

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





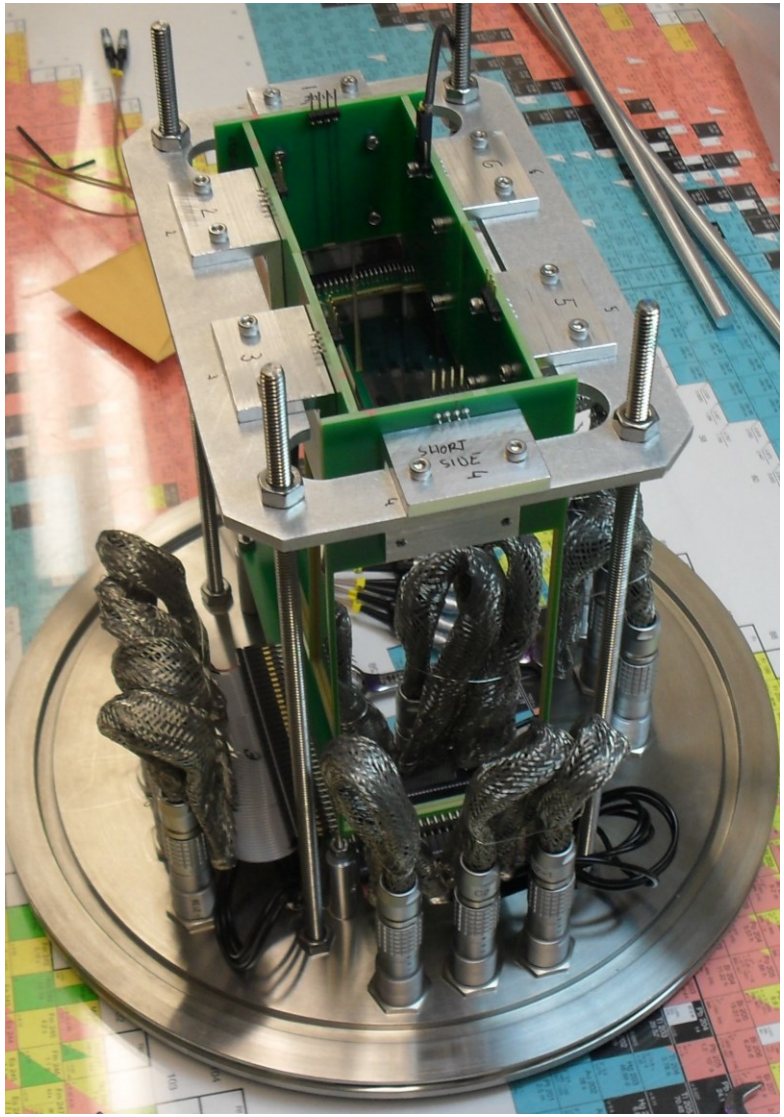
Synthesis of SHE using fixed target experiment followed by separation of Nuclear Reaction Products

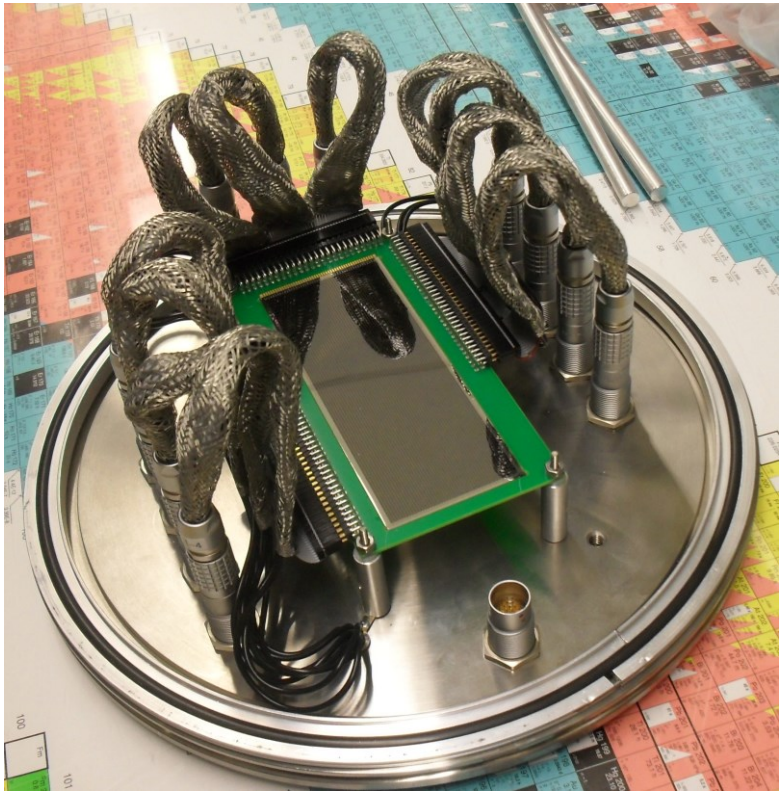


Ref. [1,2,3]

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 ≈1mm^2

Ref. [2,3]

Detector signal chain

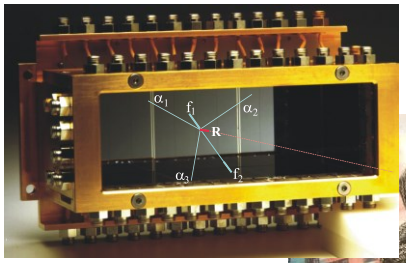
DETECTOR
183 channel

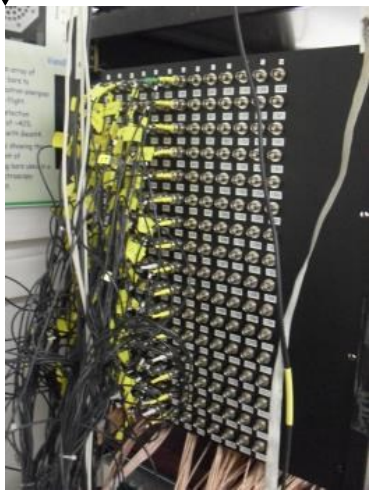
PRE
AMP

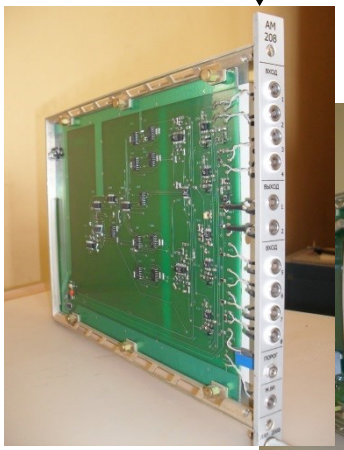
SPLITTER

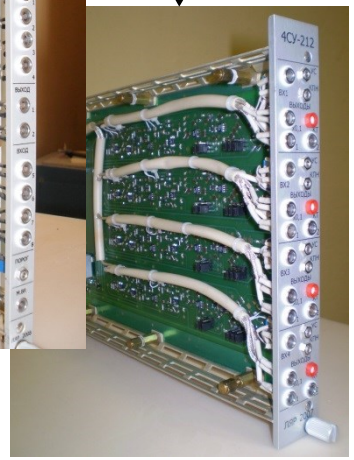
a) Digital detection system based on PXI modules

b) Detection system developed in Dubna



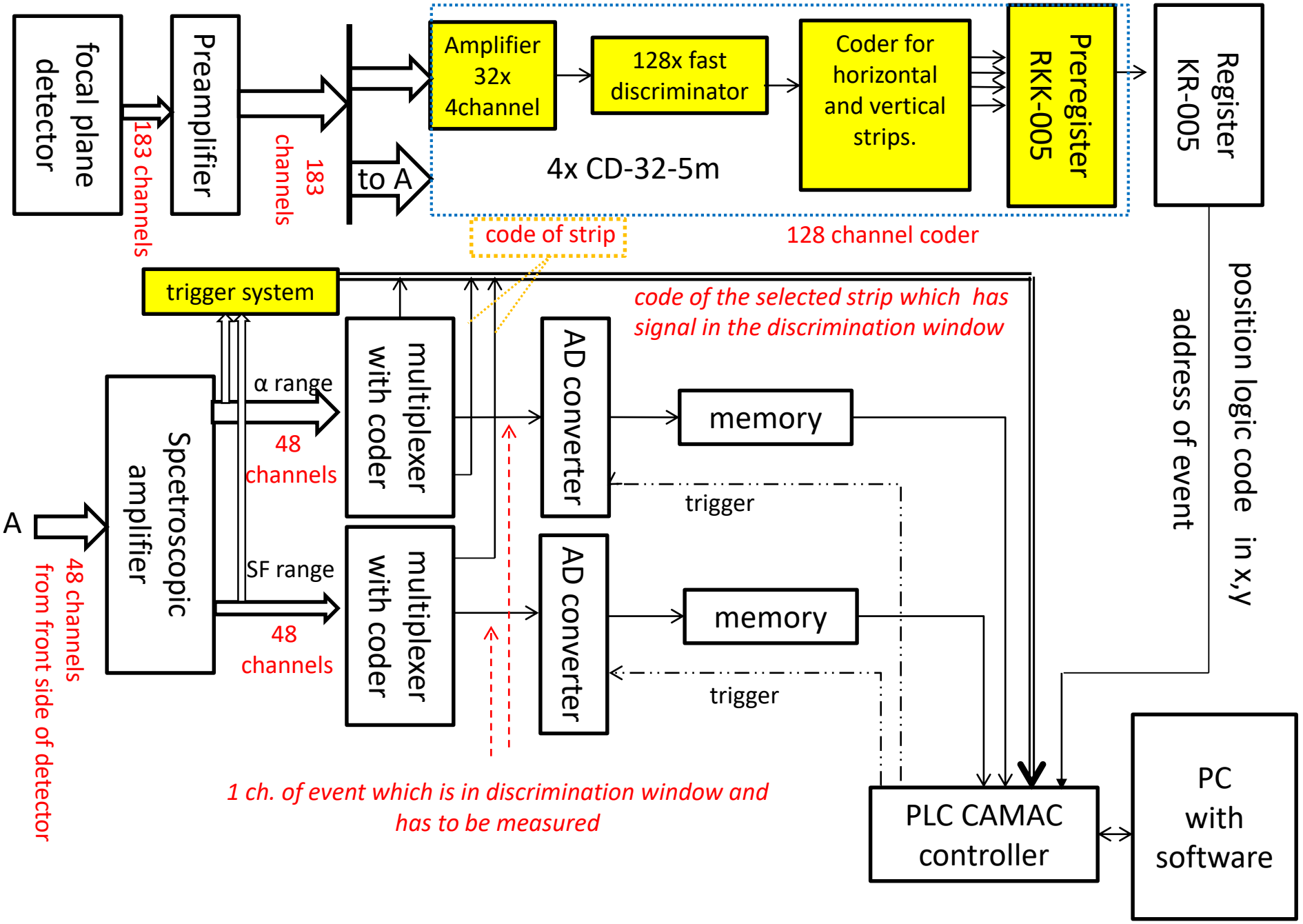






Ref. [2,3]

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 1µs

  32x single channel discriminator with adjustable threshold

  detection of multichannel event

  -> 5bit output code of the active channel

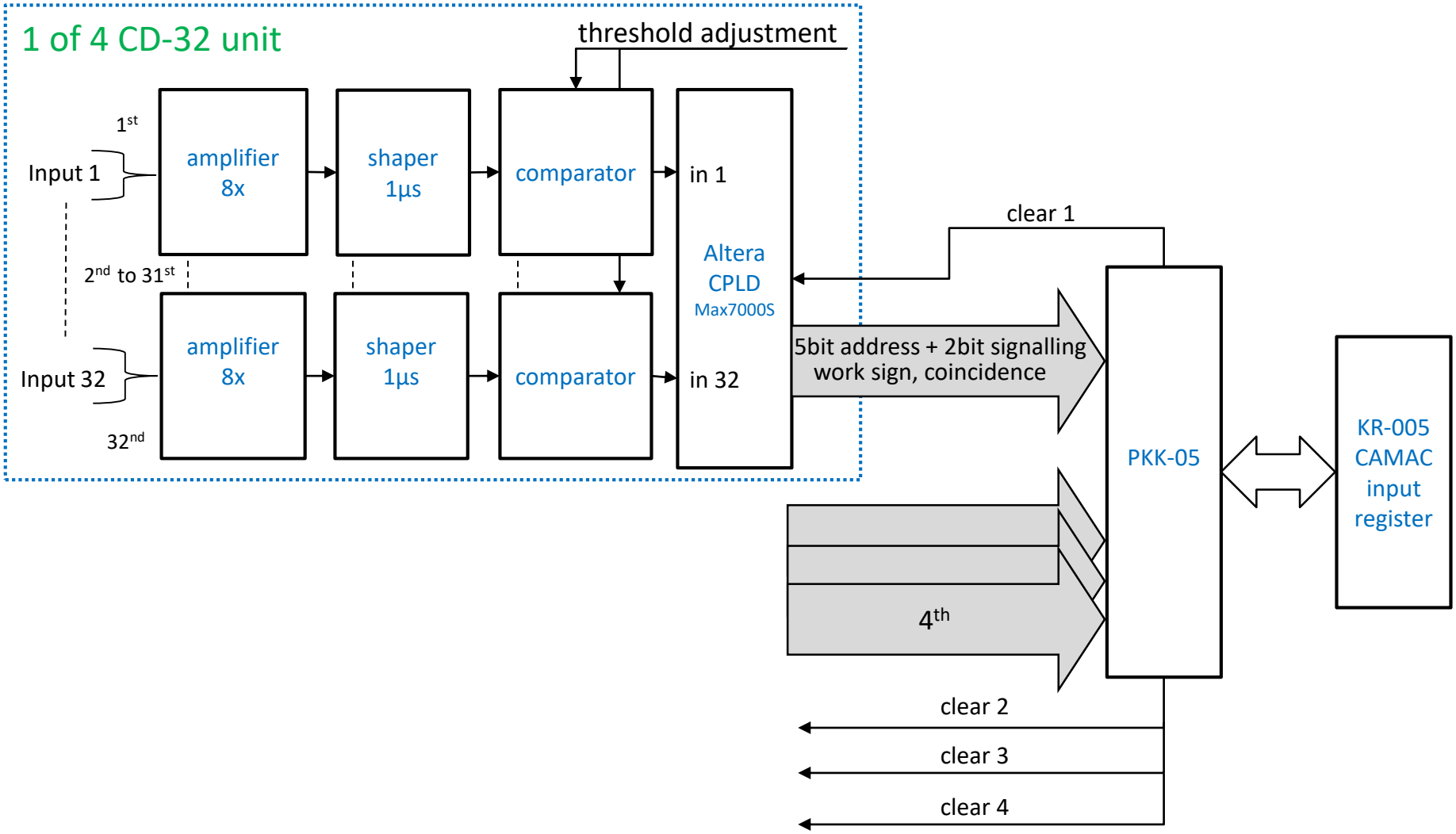
- 1x PKK-05 (finished, functional prototype)

  combine four 5 bit codes to one 7 bit output code

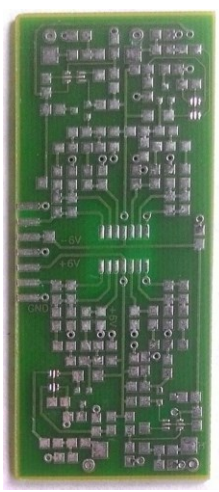
  detection of multiblock event

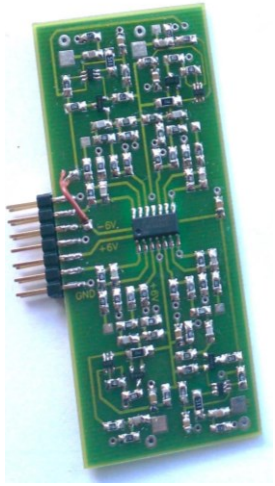
  detection of multistrip coincidence

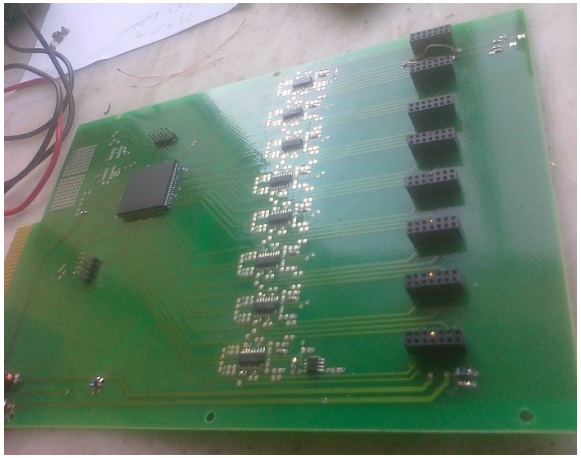
One CD-32 unit block diagram

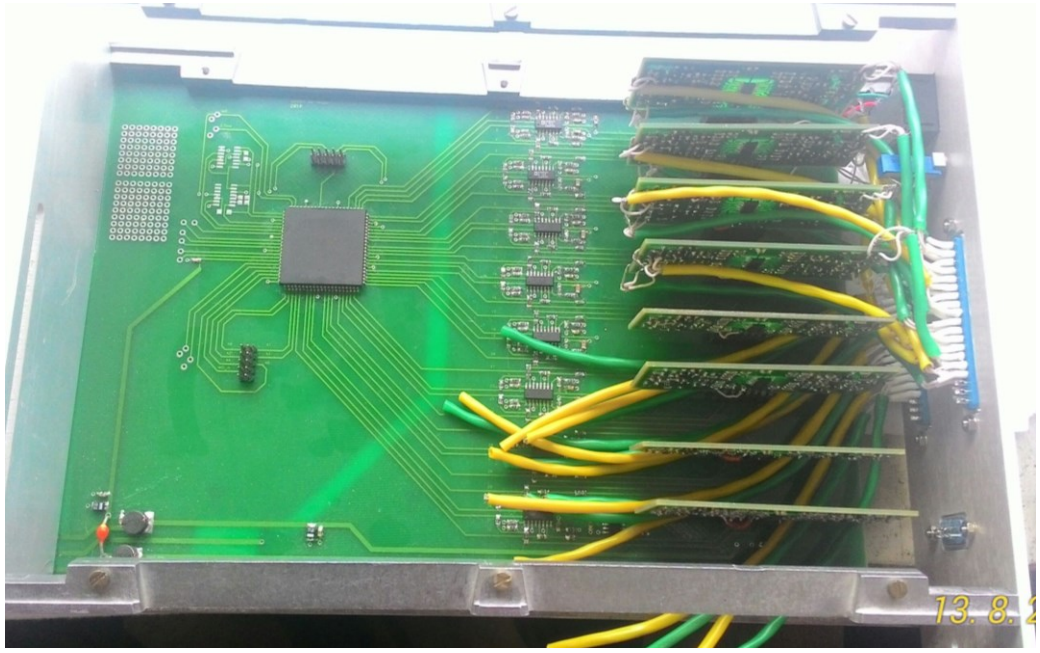


Realization of four CD-32 units



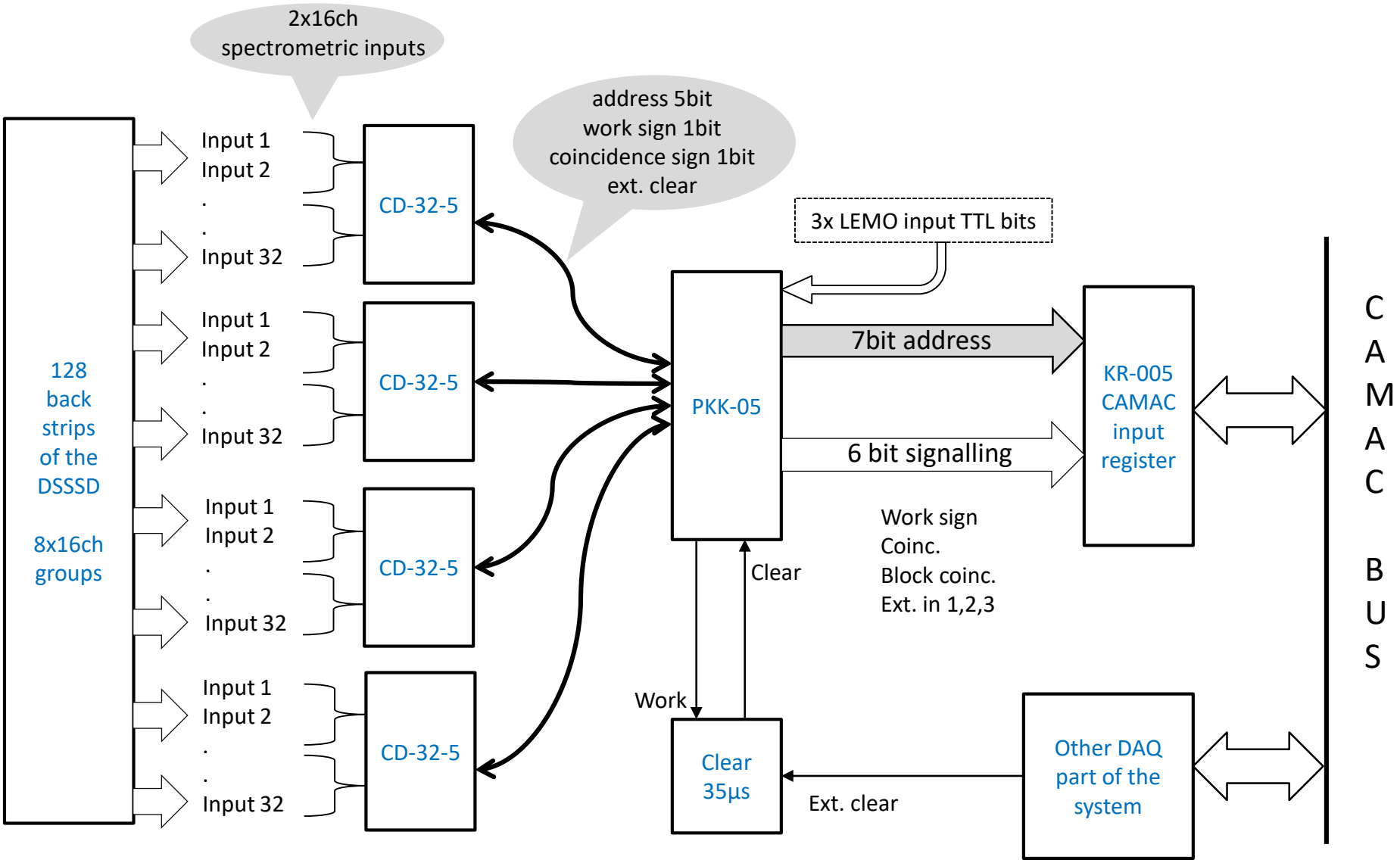






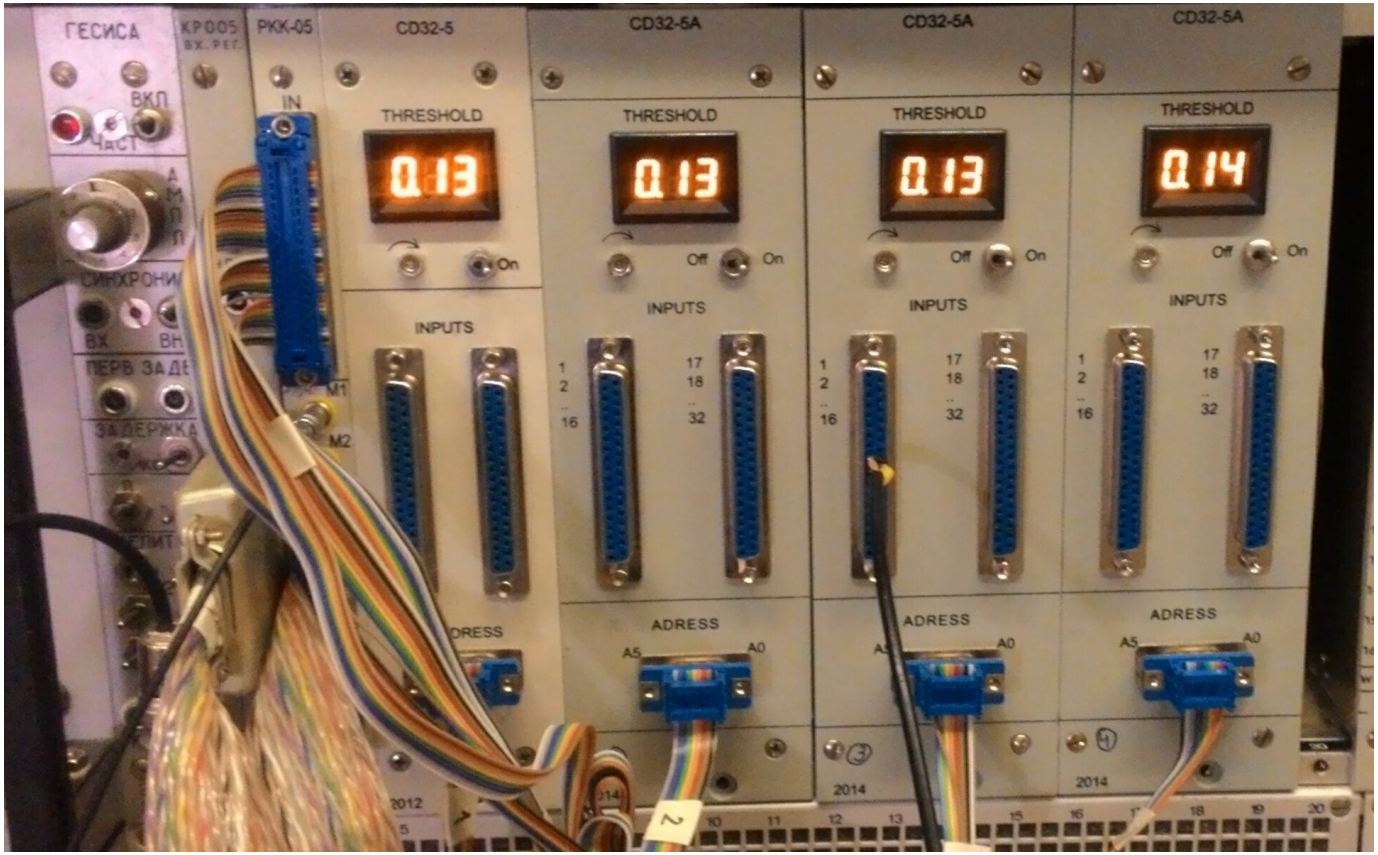
Ref. [4]

Subsystem block diagram



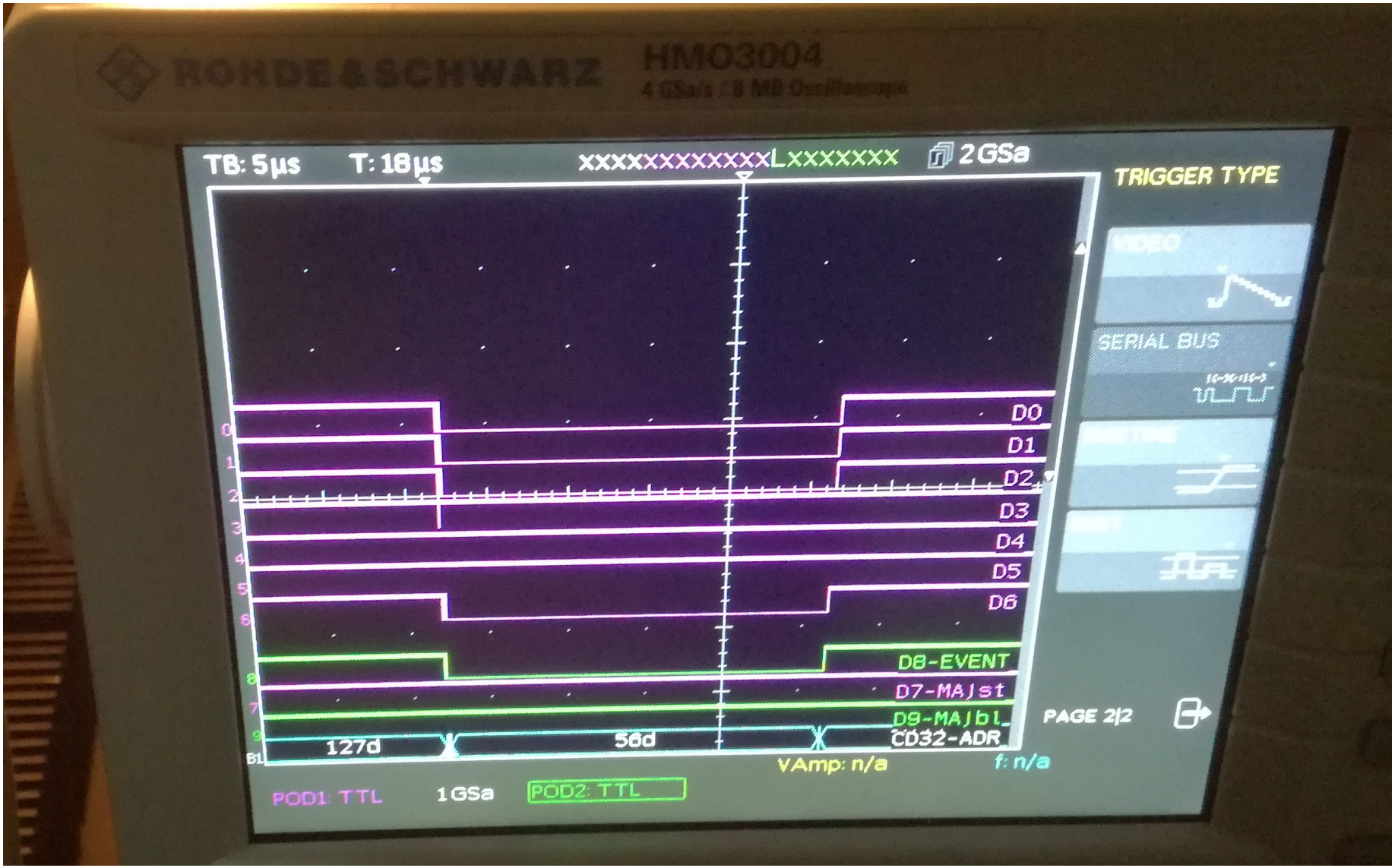
Ref. [4]

Finished position determination subsystem prototype



- ✓ Adress 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 1µs + 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-treshold sign
  - ✓ Coincidence sign between strips
  - ✓ Coincidence sign between coder units
  - ✓ Adress code of back strips of DSSSD used in detector chamber

- Developed subsystem will reduce dead time of the system by 7µs (8 stations to read ->1 st.)

- The design is all SMD plus using Altera MAX7000S CPLDs for easy optimalization based on request

- First prototype of the system was tested sucessfuly. There are ongoing implementations.

- This subsystem will be one of main parts of my Ph.D. thesis.

References

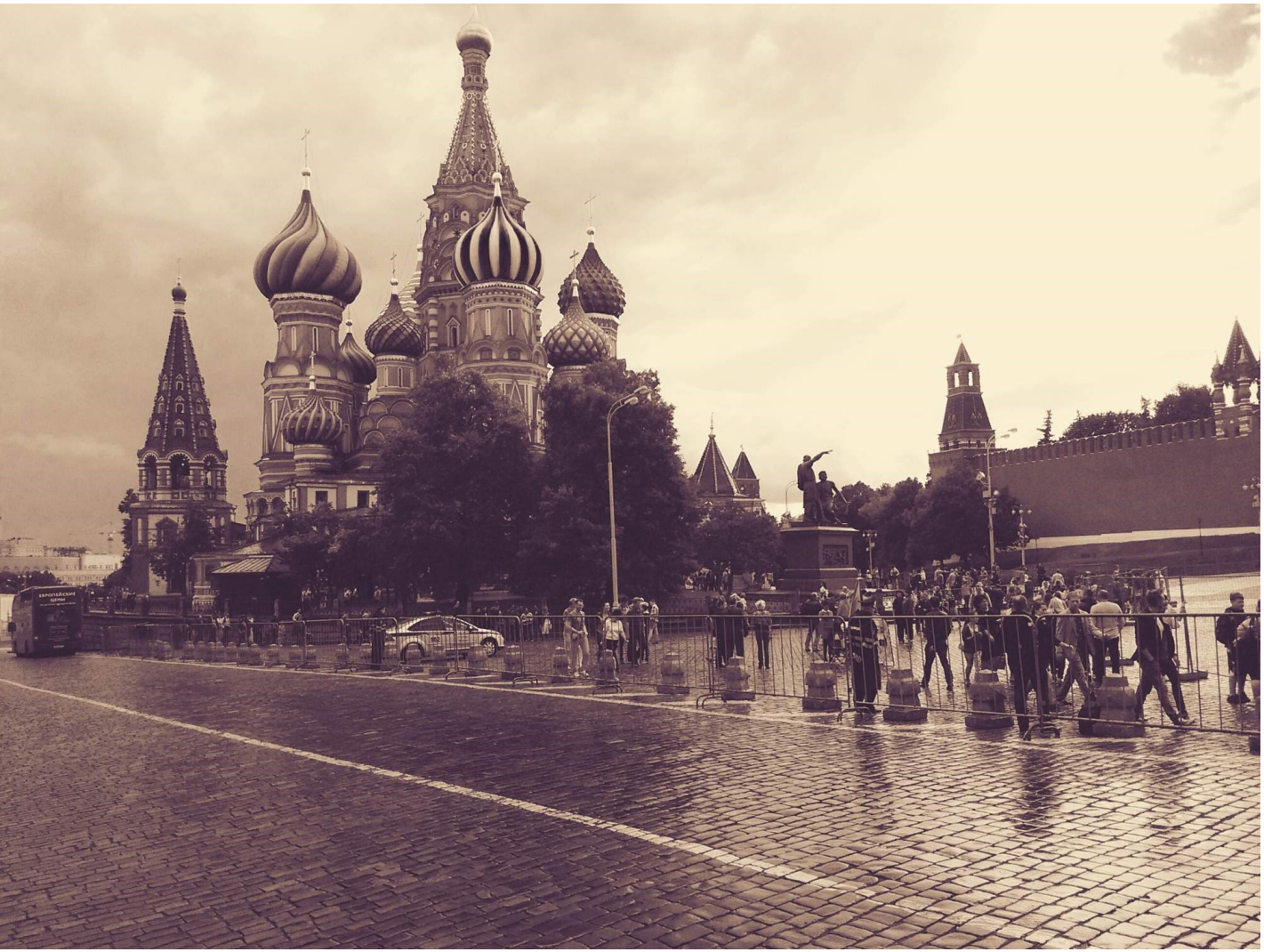
[1] Yu. S. Tsyganov, V. G. Subbotin, A. N. Polyakov, et al., Nucl. Instrum. Methods Phys. Res., Sect. A **392**, 197 (1997)

[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 284Fl and 285Fl in the 239, 240Pu + 48Ca 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



And special thanks to:

A. Voinov
Y. Tsuganov
V. Utenkov

FLNR JINR
Russian Federation

J. Pechoušek
M. Mašláň
Palacký University
Czech Republic

I. Štekl
UTEF CVUT Prague CZ

A. Kovalík
UJF AS CZ, JINR Dubna