PXI-compatible preamplifier, amplifier and single channel analyzer module for proportional gas counters

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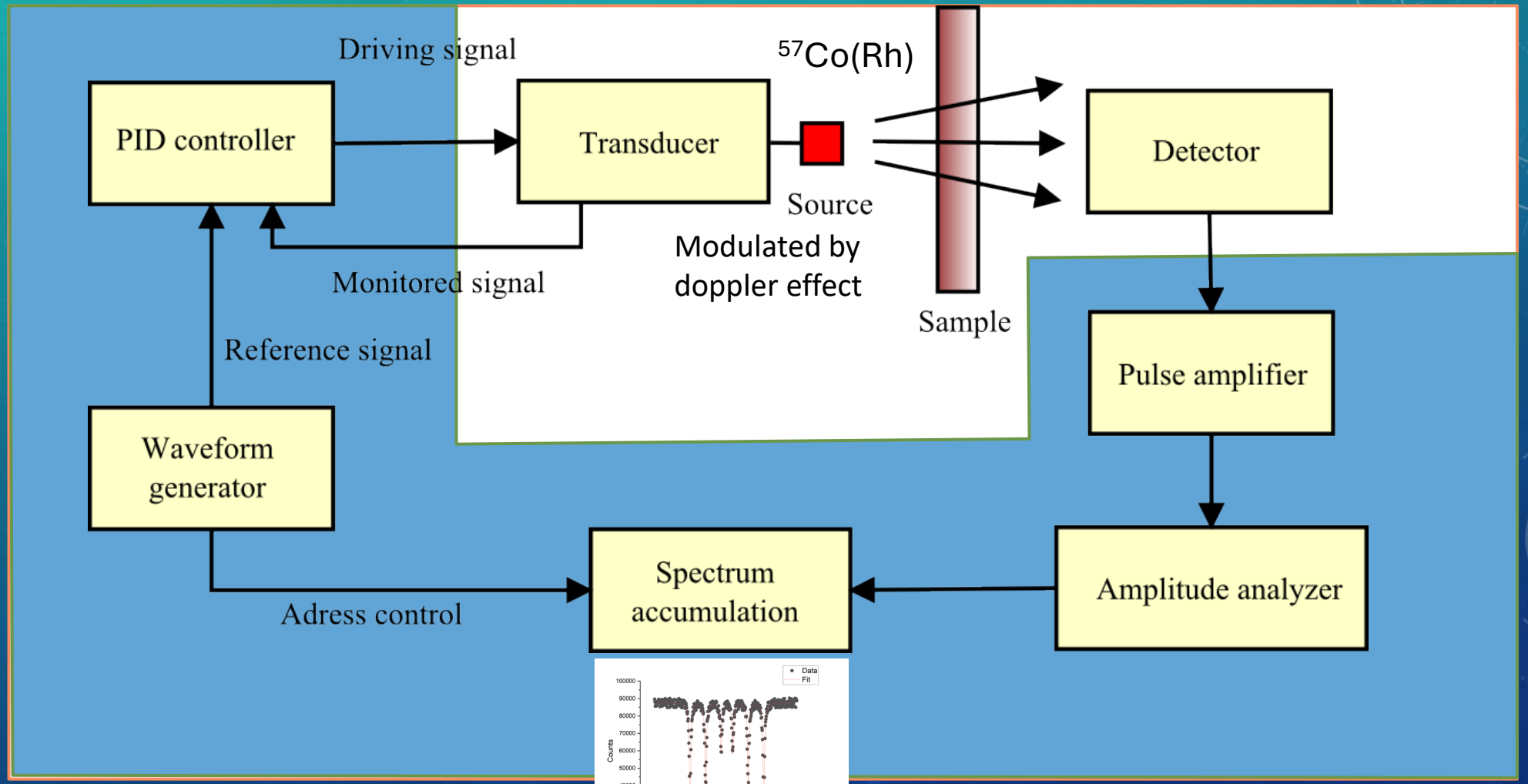
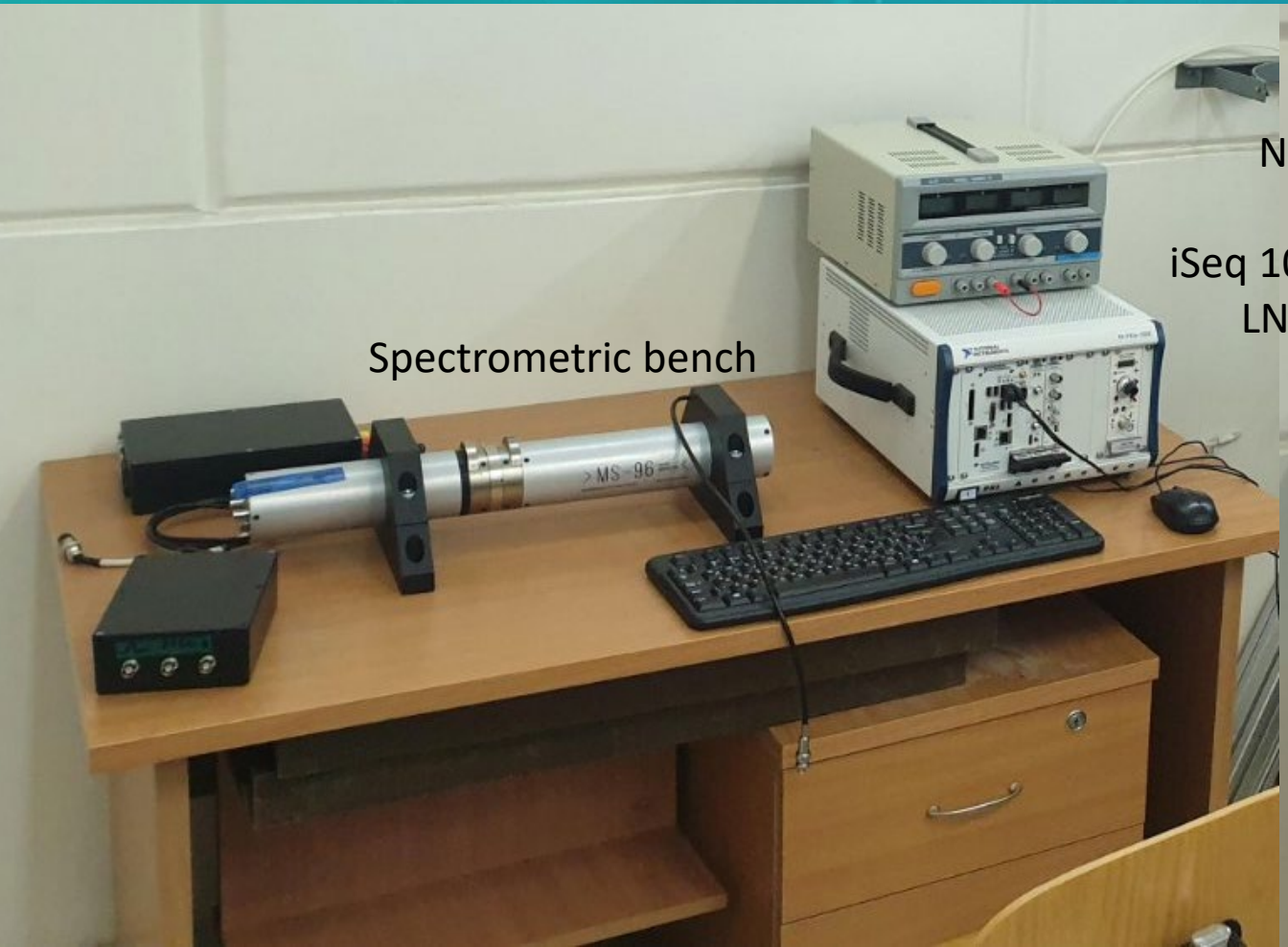
MÖSSBAUER SPECTROMETER

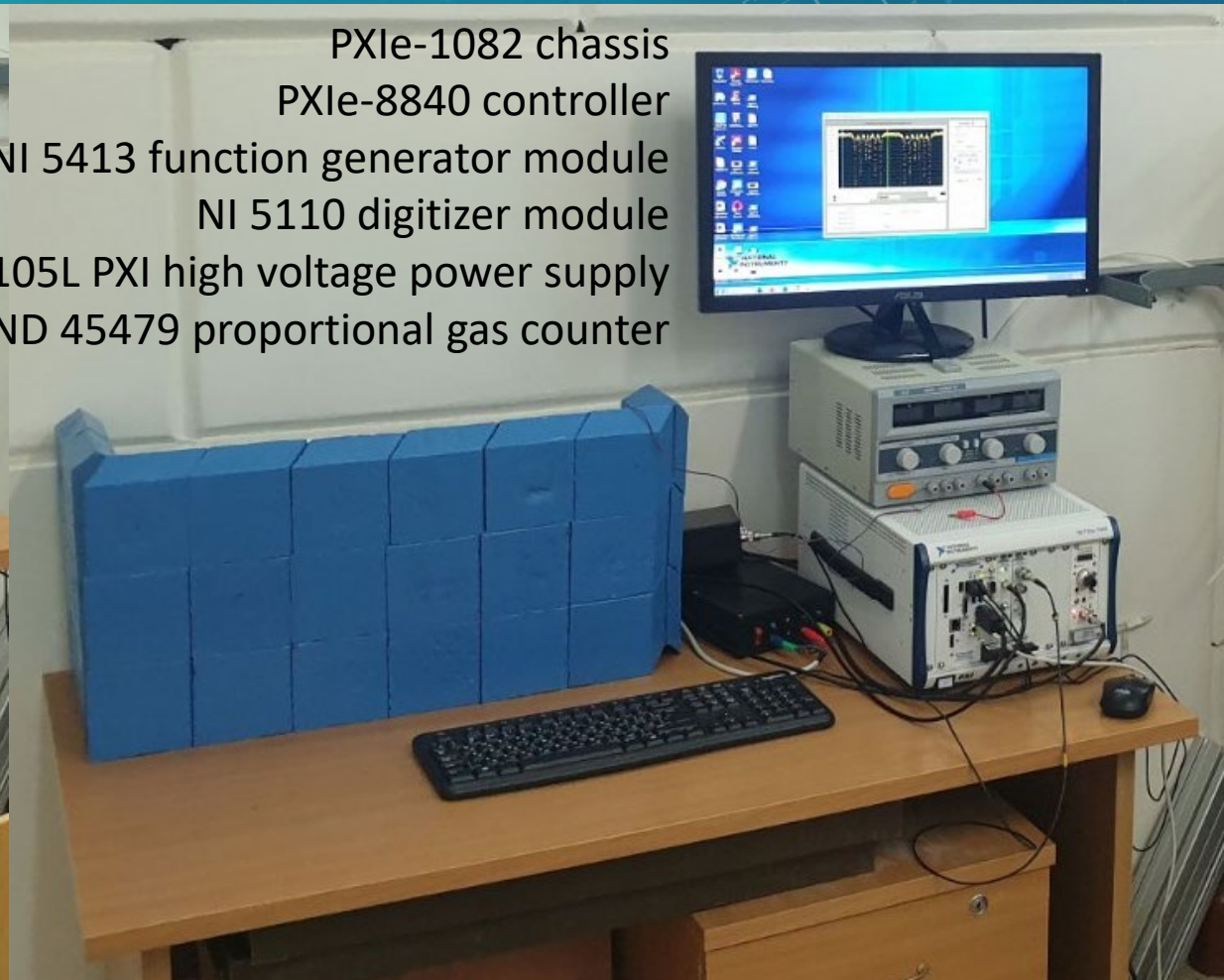
Hyperfine structure of nuclei



PXI POWERED MÖSSBAUER SPECTROMETER

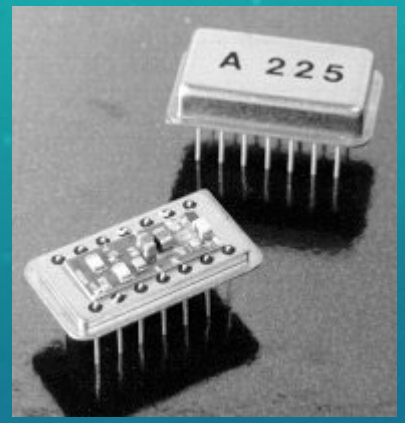


Spectrometric bench

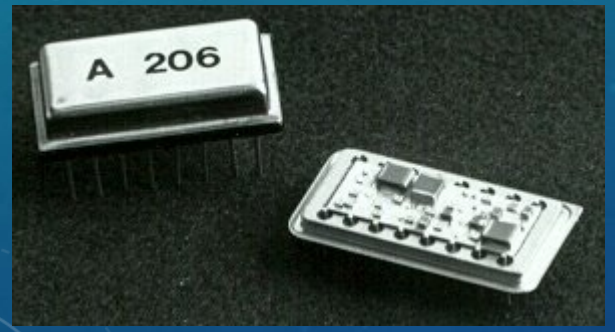


PXIe-1082 chassis
PXIe-8840 controller
NI 5413 function generator module
NI 5110 digitizer module
iSeq 105L PXI high voltage power supply
LND 45479 proportional gas counter

AMPTEK A225 - CHARGE SENSITIVE PREAMPLIFIER & SHAPING AMPLIFIER



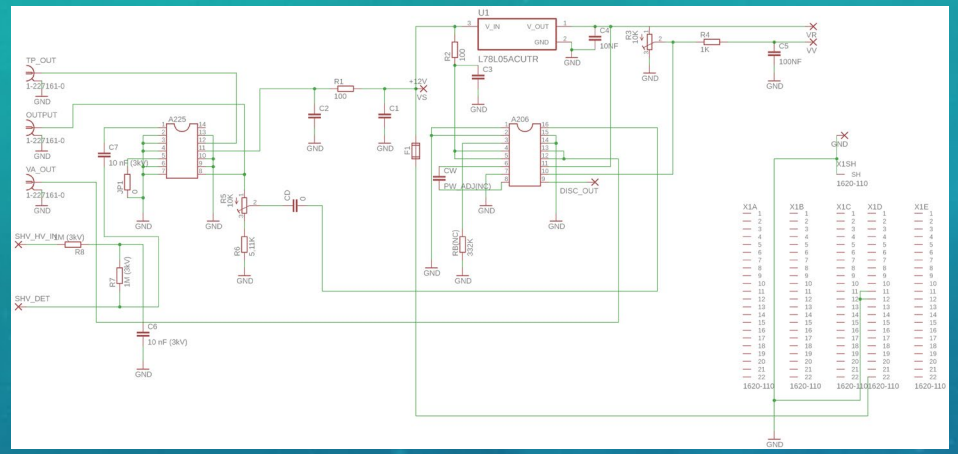
https://www.amptek.com/internal-products/a225-charge-sensitive-preamplifier-shaping-amplifier

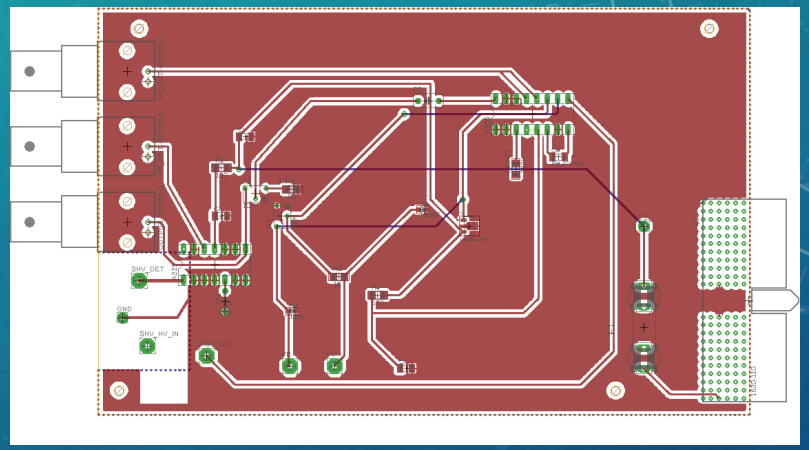


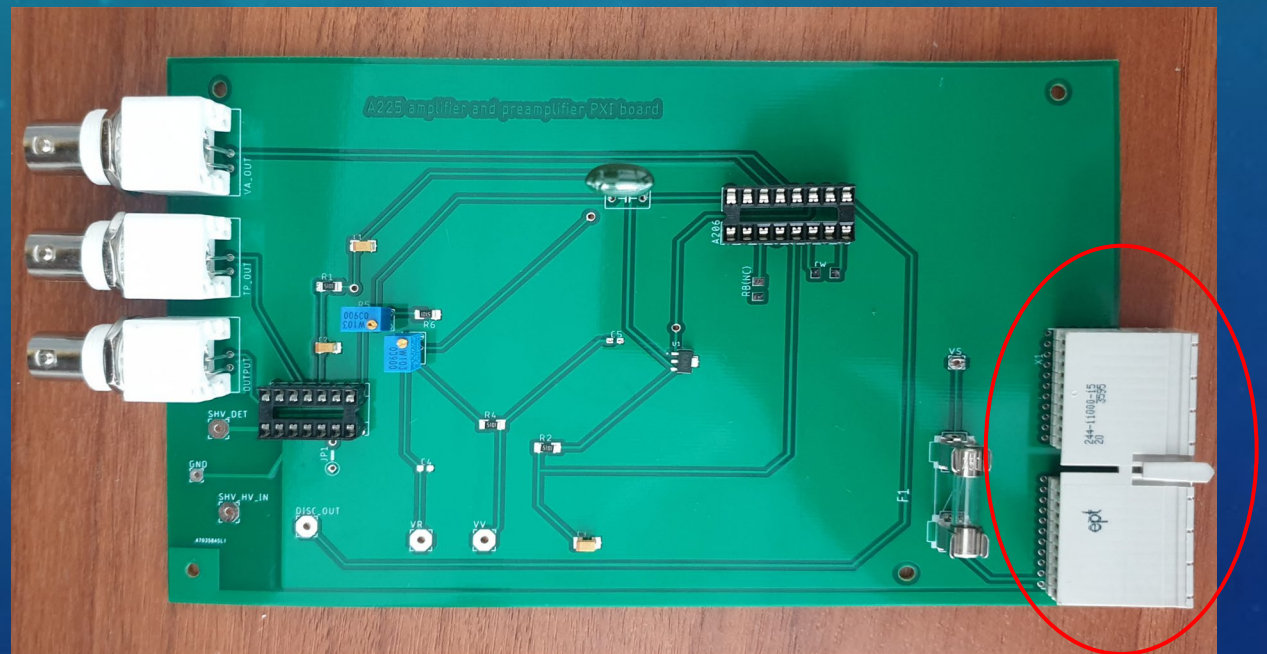
Amptek A206 Voltage Amplifier/Low Level Discriminator

https://www.amptek.com/internal-products/a206-voltage-amplifier-low-level-discriminator

A225 AND A206 PREAMPLIFIER AND AMPLIFIER BOARD



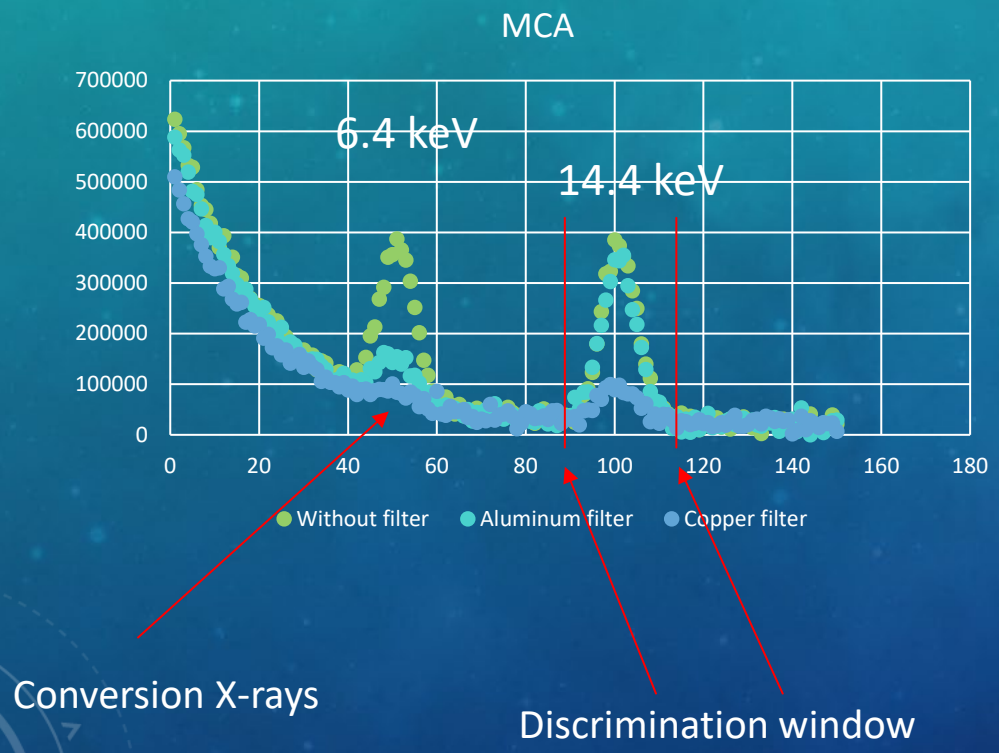


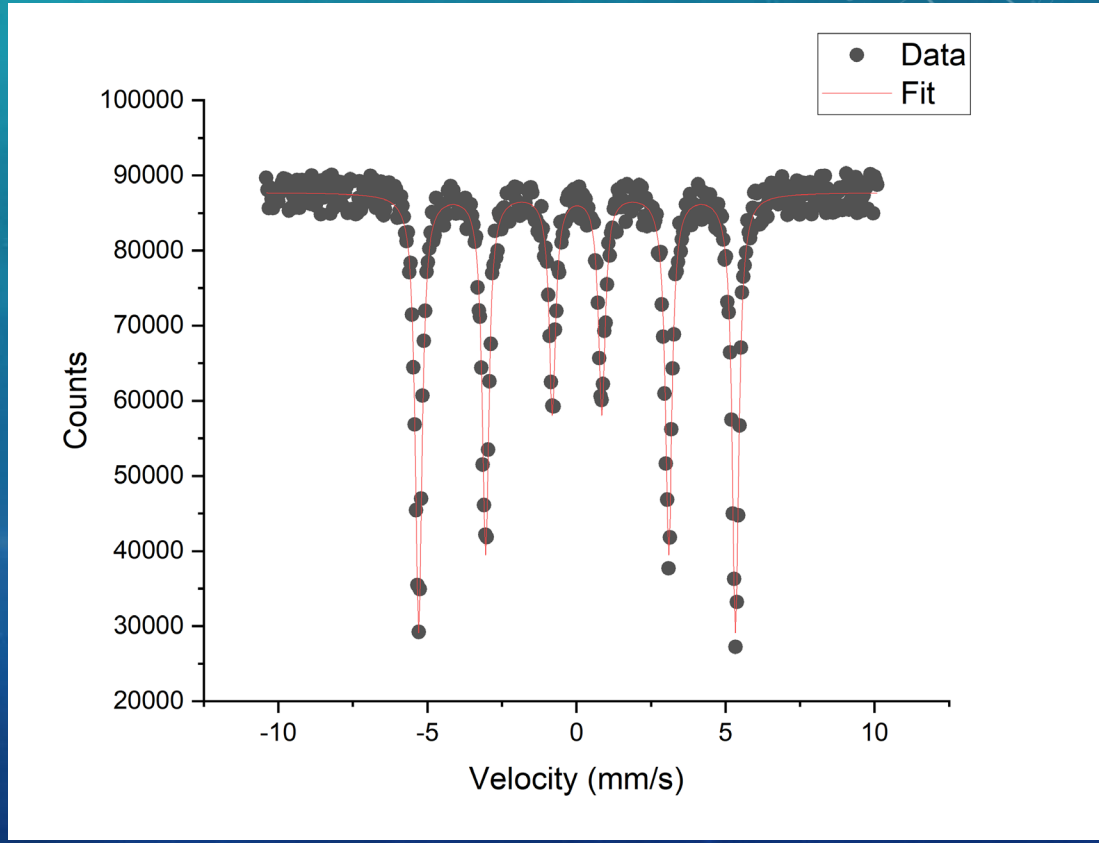


CompactPCI connector

Kohout, P., Kohoutová, A., Schlattauer, L. *et al.* PXI-Compatible Preamplifier and Amplifier for Proportional Gas Counters for Mössbauer Spectroscopy. *Phys. Part. Nuclei Lett.* **21**, 719–722 (2024). https://doi.org/10.1134/S1547477124701176

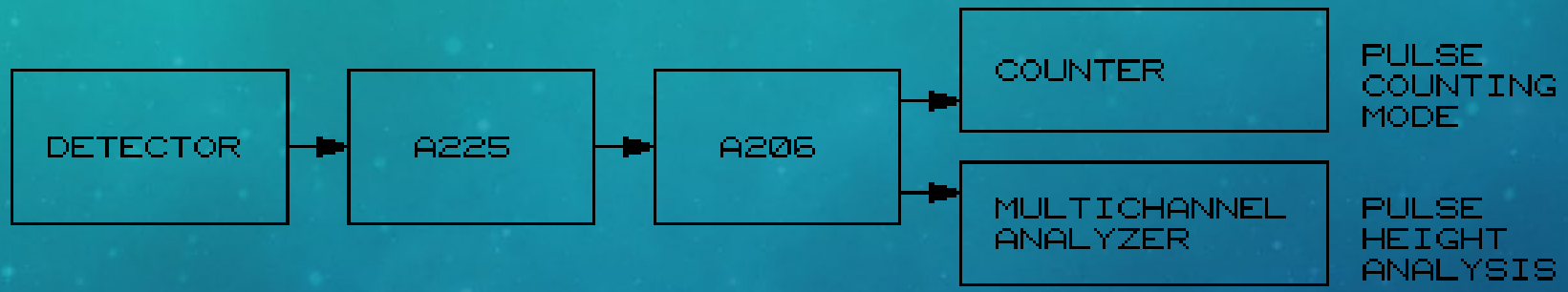
MEASUREMENTS WITH DEVELOPED BOARD

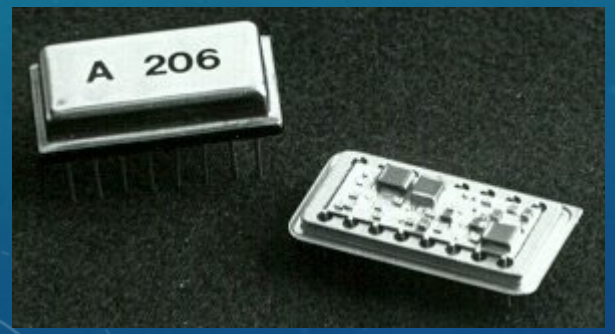




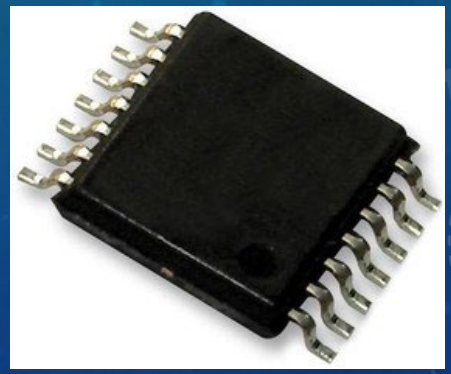
Callibration Mössbauer spectra of alpha iron

USING BUILT-IN LL-DISCRIMINATOR



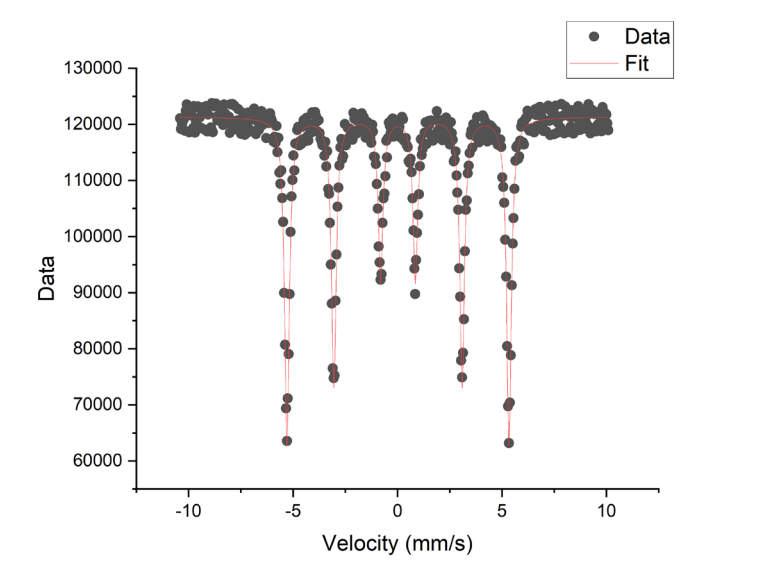


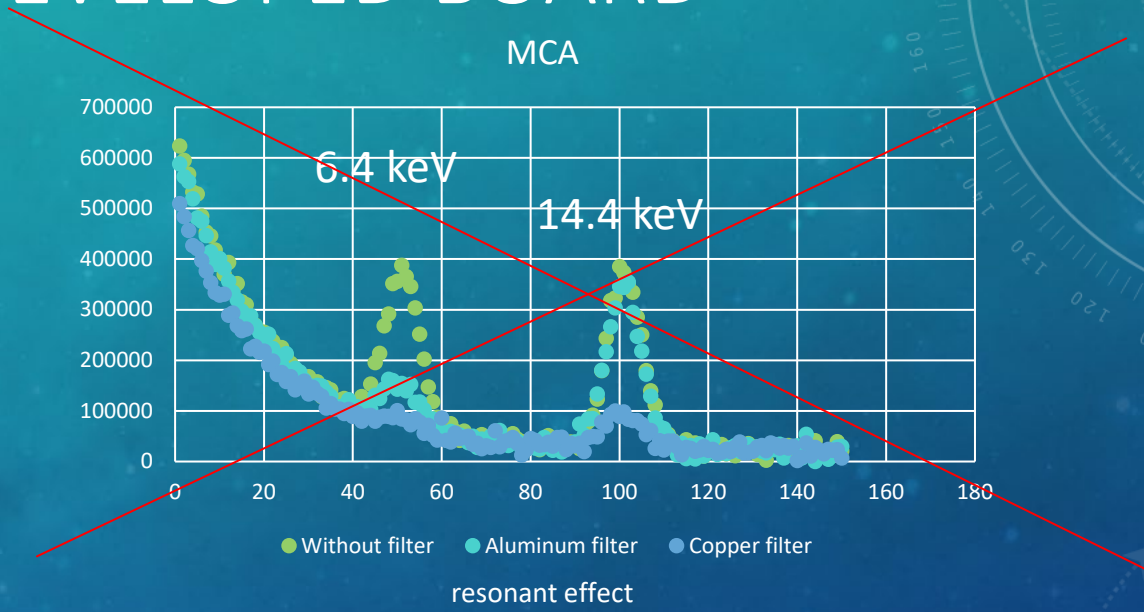
- built-in low level discriminator
- Level can be set by potentiometer
- produces TTL pulses



AD5252
Dual digital potentiometer

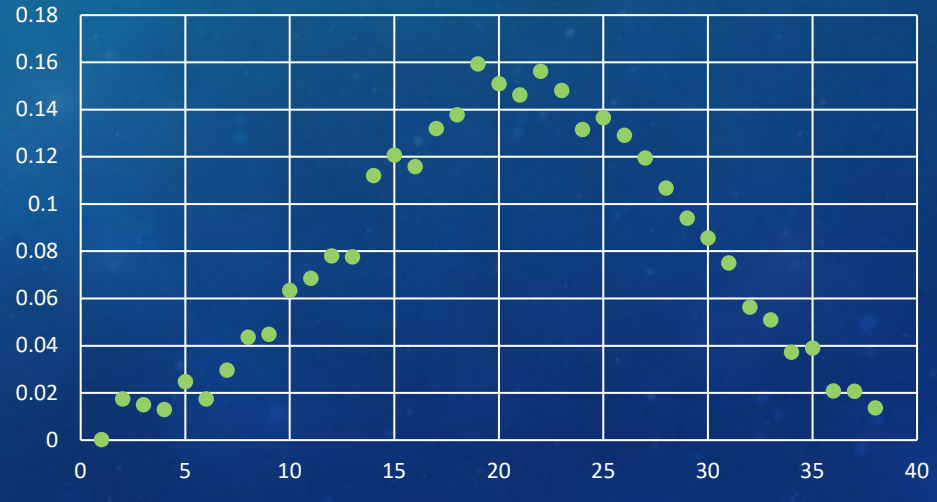
MEASUREMENTS WITH DEVELOPED BOARD



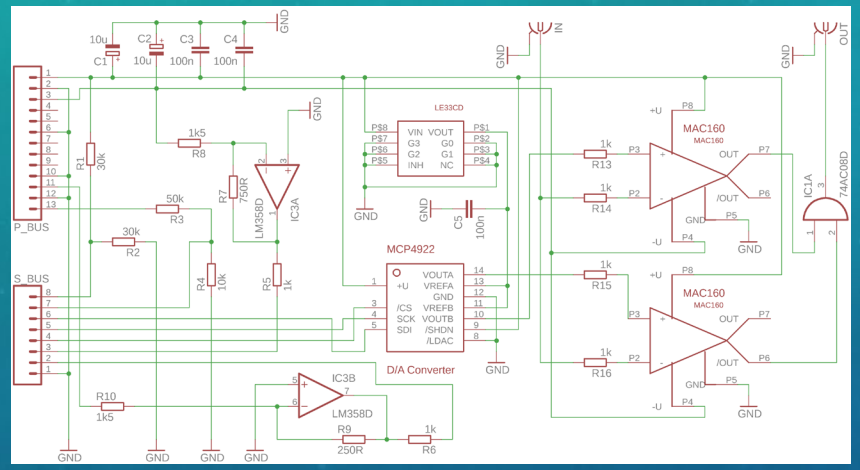


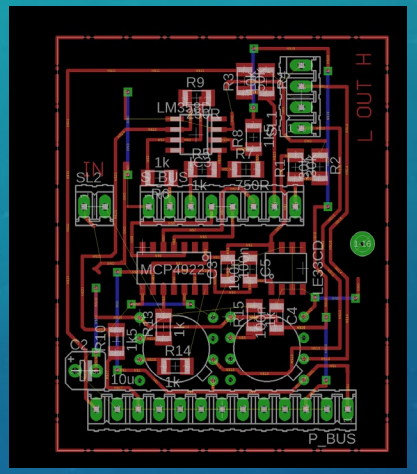
$$\varepsilon = \frac{|N(\infty) - N(0)|}{N(\infty)};$$

ε... value of resonant effect
N(0)…counts at spectral line
N(∞)…baseline counts



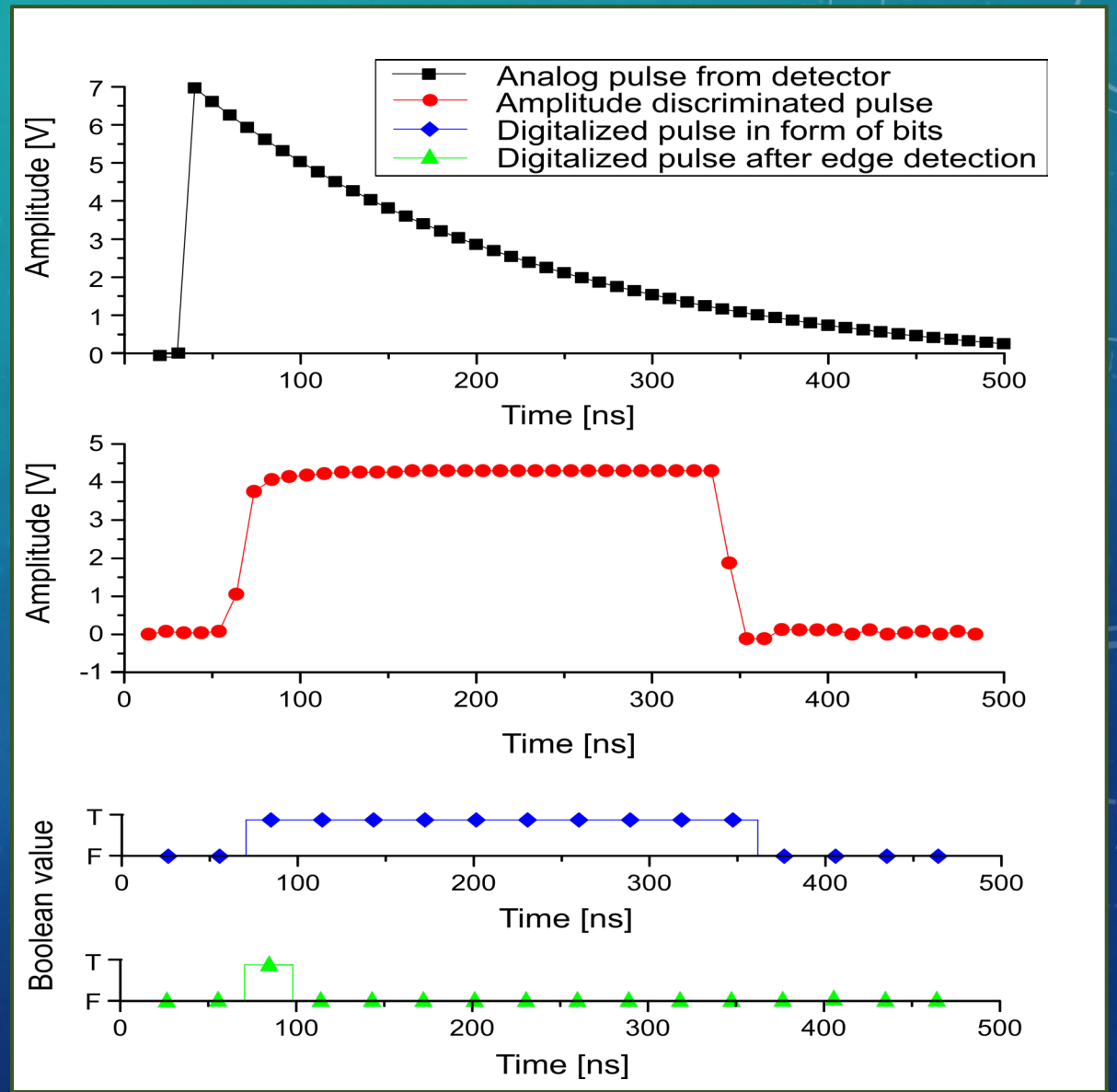
DEVELOPMENT OF SCA ADDON BOARD



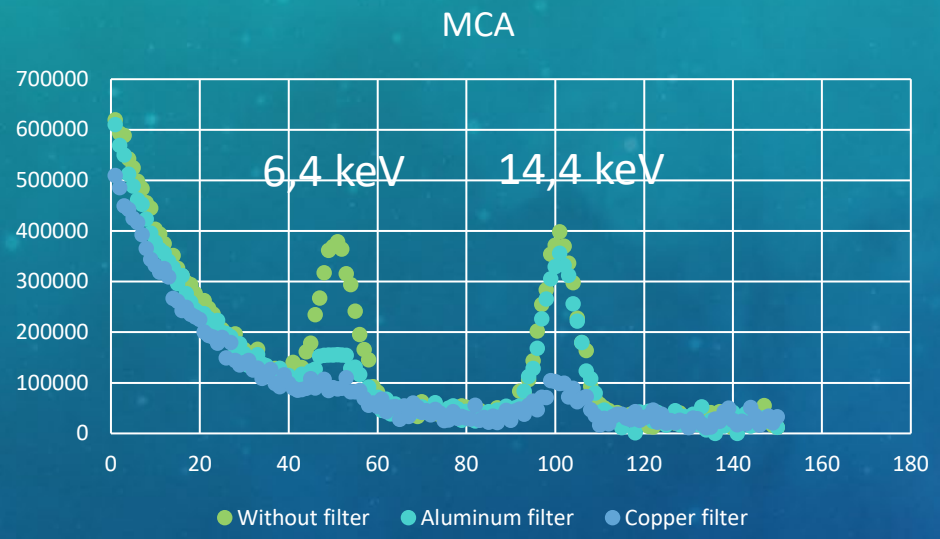


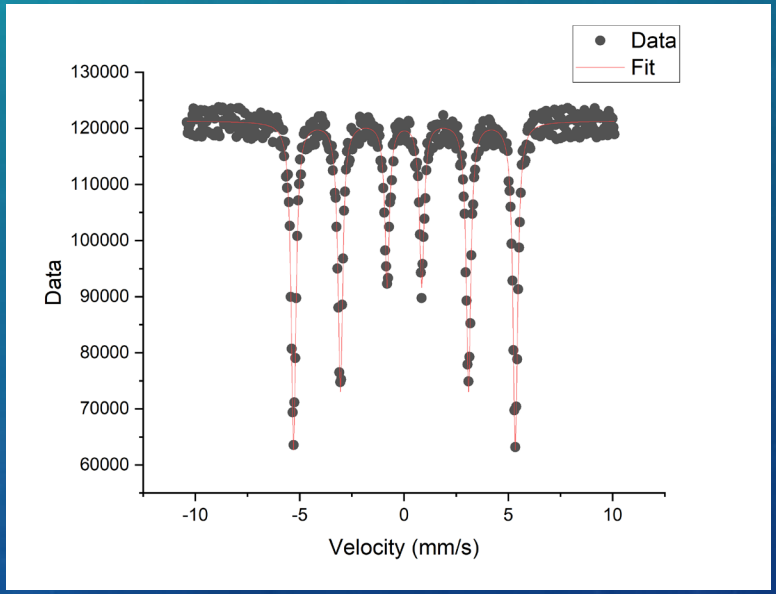
DETECTOR DATA ACQUISITION

- Single channel analyzer
- MCA via SCA multiple scanning
- Data acquisition using fast digital input

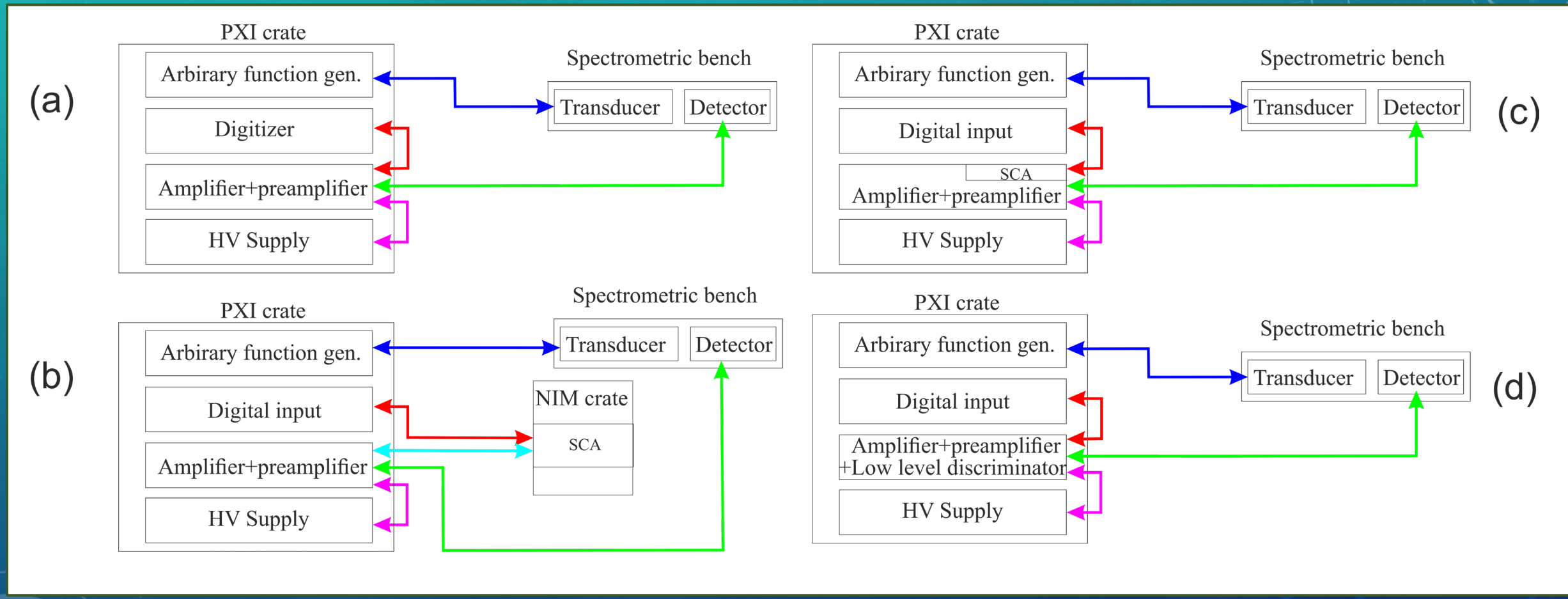


MEASUREMENTS WITH DEVELOPED BOARD



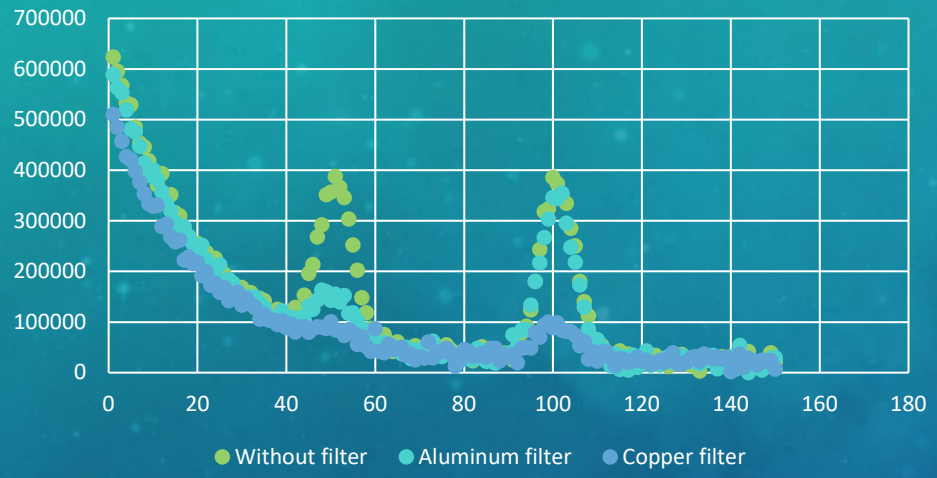


COMPARISON

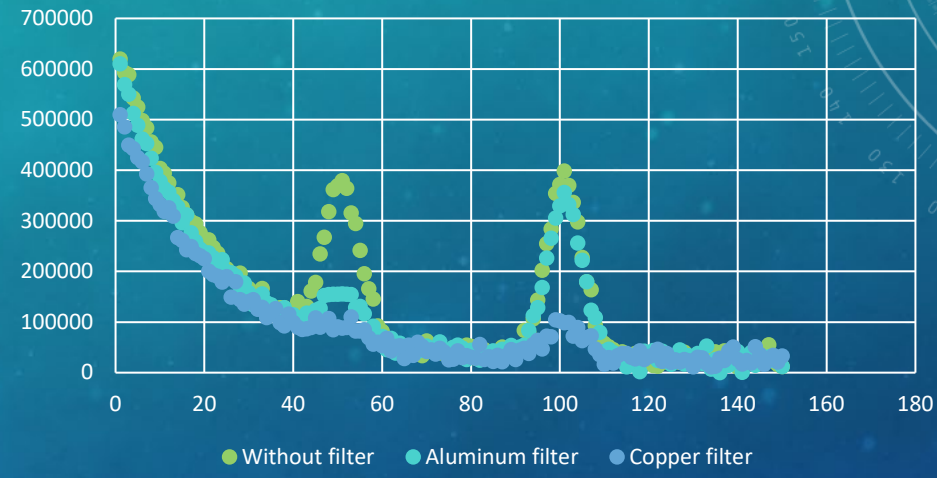

(a)
PXI crate
Arbirary function gen.
Digitizer
Amplifier+preamplifier
HV Supply
Spectrometric bench
Transducer
Detector
(b)
PXI crate
Arbirary function gen.
Digital input
Amplifier+preamplifier
HV Supply
Spectrometric bench
Transducer
Detector
NIM crate
SCA
(c)
PXI crate
Arbirary function gen.
Digital input
SCA
Amplifier+preamplifier
HV Supply
Spectrometric bench
Transducer
Detector
(d)
PXI crate
Arbirary function gen.
Digital input
Amplifier+preamplifier
+Low level discriminator
HV Supply
Spectrometric bench
Transducer
Detector

COMPARISON (MCA)

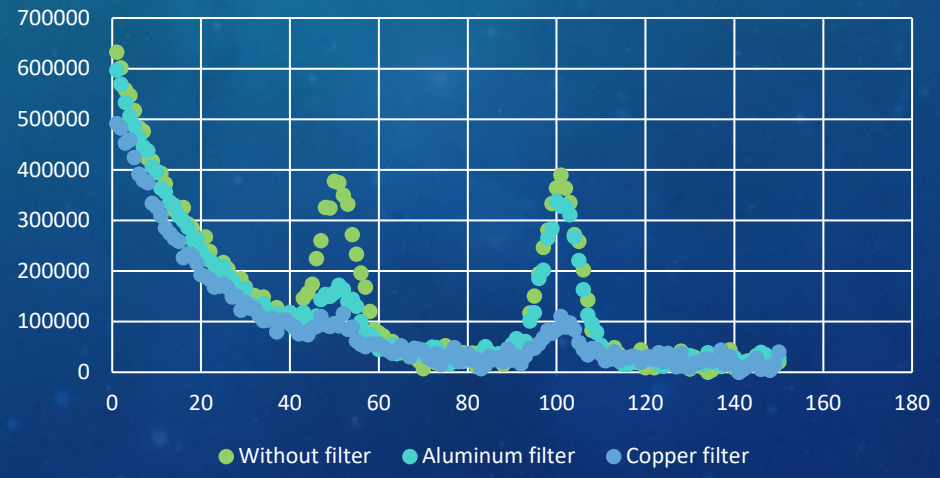
MCA with digitizer



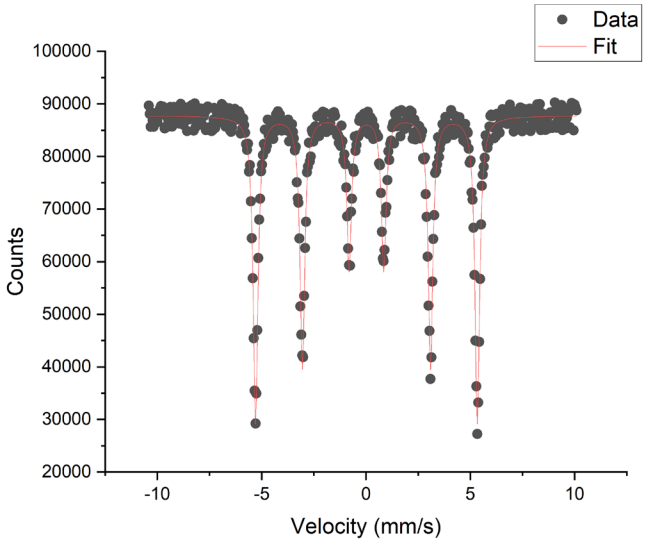
MCA made by scanning of SCA board

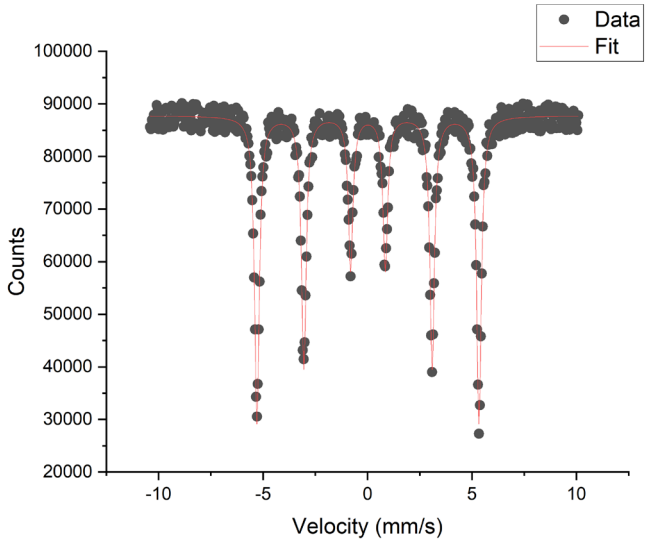


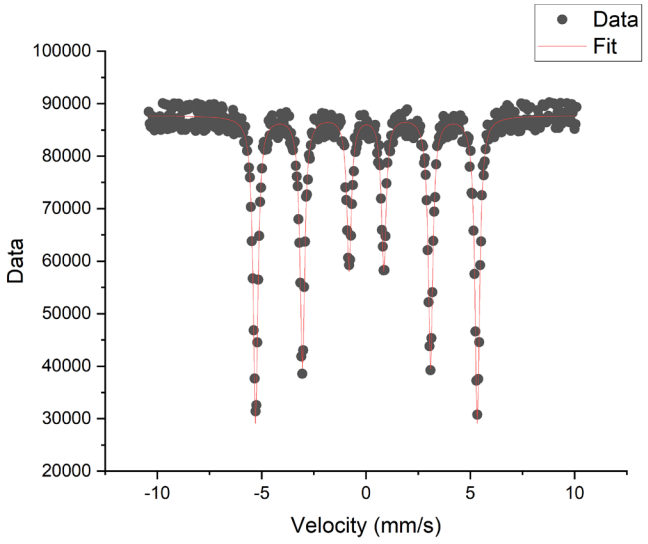
MCA made by scanning of ORTEC SCA

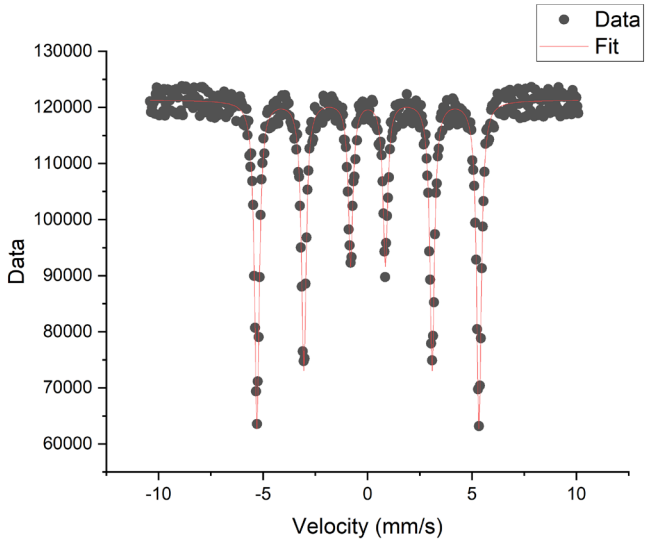


COMPARISON (MS)









COMPARISON (TABLE)

	N(0)	N(∞)	ε (%)	Q	FWHM (mm/s)
Digitizer + MCA	59751	87127	31.4 ± 0.5	3716 ± 29	0.305 ± 0.001
Ortec SCA	59418	87615	32.2 ± 0.5	3908 ± 45	0.304 ± 0.001
Custom SCA board	59871	87150	31.3 ± 0.6	3691 ± 31	0.306 ± 0.001
Only LL discriminator	99189	121219	18.2 ± 0.5	1835 ± 27	0.306 ± 0.001

$$\varepsilon = \frac{|N(\infty) - N(0)|}{N(\infty)};$$

$$Q = \frac{\varepsilon^2}{\varepsilon + 2} N(\infty),$$

ε... value of resonant effect
N(0)…counts at spectral line
N(∞)…baseline counts
Q…statistical quality of spectra

THANK YOU FOR YOUR ATTENTION!