

## NEW NEUTRON SIGNAL ACQUISITION AND PROCESSING PLATFORM FOR NUCLEAR SAFEGUARDS

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### Neutron Coincidence Counting (NCC)

CAEN designed a new platform of devices that addresses the current situation of limited availability of maintainable instrumentation and reflects the recent advances in microelectronics.



It is based on the on-board FPGA and ARM CPU, giving flexibility in the implementation of functionalities and integration.

It combines low power consumption and long-term reliability.

### CAEN R7771

32-input Neutron Pulse Train Recorder



Hardware features

- 10 ns time stamp resolution
- 10 ns of pulse pair resolution and minimum pulse width detection
- High power high voltage supply output (+2000 V @ 1 mA)
- High power low voltage supply output (+5 V @ 1.5 A)
- 10/100 Ethernet and USB 2.0 interfaces
- 32 GB of data storage

### CAEN R7780 - IAEA UDL1

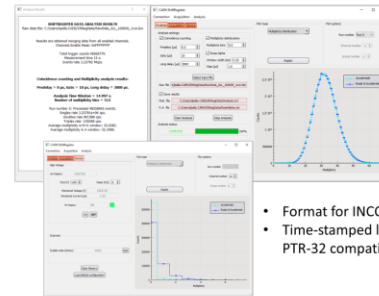
The R7780 is an 8-input complete readout system for NCC



Hardware features

- Fully remotely controllable by **Web Interface**
- **SDK** for integration
- Video output (**HDMI**) to externally monitor
- 10 ns time stamp resolution
- 10 ns pulse pair resolution and minimum pulse
- High voltage and low voltage outputs (+5V / +12V @ 1 A)
- 10/100 Ethernet and USB 2.0 interfaces
- Dual SD non-volatile memories for redundancy

### Software CAEN ShiftRegister



- Format for INCC software
- Time-stamped lists saved to PTR-32 compatible file

### R7780 test measurements at ENEA laboratories

JCC-15 Canberra detector  
JSR-14 Neutron Analysis shift register  
Pu Neutron sources



	Ref. Date	Pu-240 eq. (g)
BCMN61	20/06/98	5.667692
BCMN70	20/06/98	5.716722

Measurement time 300 s, UNATTENDED, MULTIPLICITY mode  
Predelay = 4.0 us, Gate= 64 us, LongDelay=4.096 ms

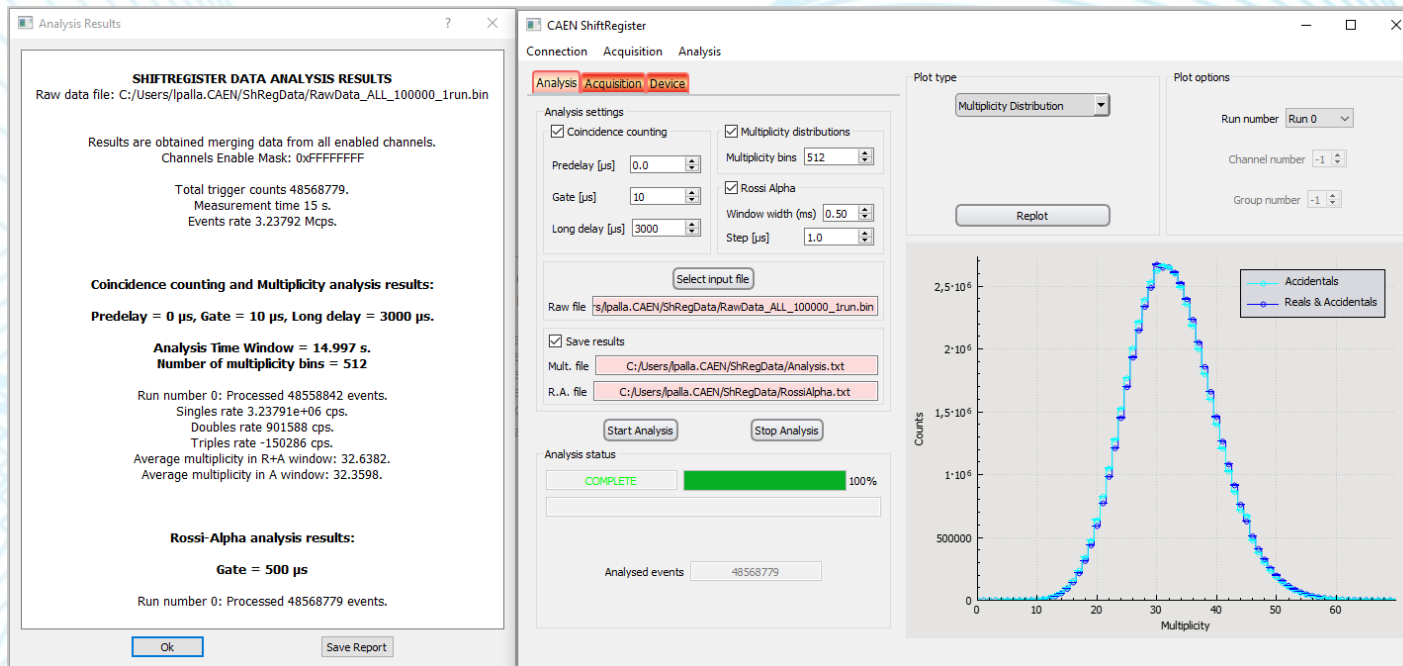
	Totals	Real+Accidental	Accidental	Singles (cps)	Doubles (cps)	Triples (cps)
R7780	653958	147524	91747	2179.8 ± 2	185.9 ± 1	20.0 ± 0.6
JSR14 run 1	652520	145505	90452	2175.1 ± 2	183.5 ± 1	20.3 ± 0.6
JSR14 run 2	654138	146875	90977	2180.5 ± 2	186.3 ± 1	21.6 ± 0.6

### Conclusion and Perspectives

- New platform for device for neutron counting and multiplicity analysis applications
- Good agreement with those obtained with current standards for Safeguards application
- New features in the devices non-volatile memory for data storage, web interface, digital video output
- Dedicated control software that also allows offline processing of raw timestamp lists
- Compatibility with commonly used software in the field and libraries for software integration
- Tests to be performed with nuclear material of higher activity

# Platform Elements

- 10 ns time stamp resolution
- High power high voltage supply
- High power low voltage supply
- **Web Interface**
- **SDK for integration**



- Multiplicity counting
- Pulse train recording
- INCC Software compatible



# Comparative Test and Conclusions

## Test Conditions

- JCC-15 Canberra detector
- JSR-14 Neutron Analysis shift register
- Neutron source of approx. 11 g Pu-240 eq.

Measurement time 300 s, UNATTENDED, MULTIPLICITY mode							
Predelay = 4.0 us, Gate= 64 us, LongDelay=4.096 ms							
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- Good agreement with those obtained with current standards for Safeguards application
- New features in the devices non-volatile memory for data storage, web interface, digital video output
- Dedicated control software and INCC compatibility