

Gamma-ray spectroscopy at the Bucharest Tandem accelerator

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Summary

- Gamma-ray detectors at IFIN-HH;
- Experimental setups;
- IFIN-HH Plunger;
- Future experimental setups at IFIN-HH;
- Conclusions.

Gamma-ray spectroscopy at Bucharest Tandem Accelerator

- Medium-high spin studies with heavy-ion fusion-evaporation reaction;
- Low-spin spectroscopy with proton and alpha particles induced reaction;
- Gamma-ray spectroscopy following beta decay;
- Cross-section measurements of astrophysical interest with the foil activation technique.

Current status of Bucharest FN Tandem Accelerator

- FN Tandem Accelerator with 9 MV max. accelerating voltage
- Upgrades in the last year:
 - Charging belt changed with Pelletron system;
 - New automated sputtering ion source;
 - α particle source;
 - New duo-plasmatron ion source; (upgrade to be done)
 - Beam pulsing system in nanoseconds range (already contracted with NEC, upgrade to be done).

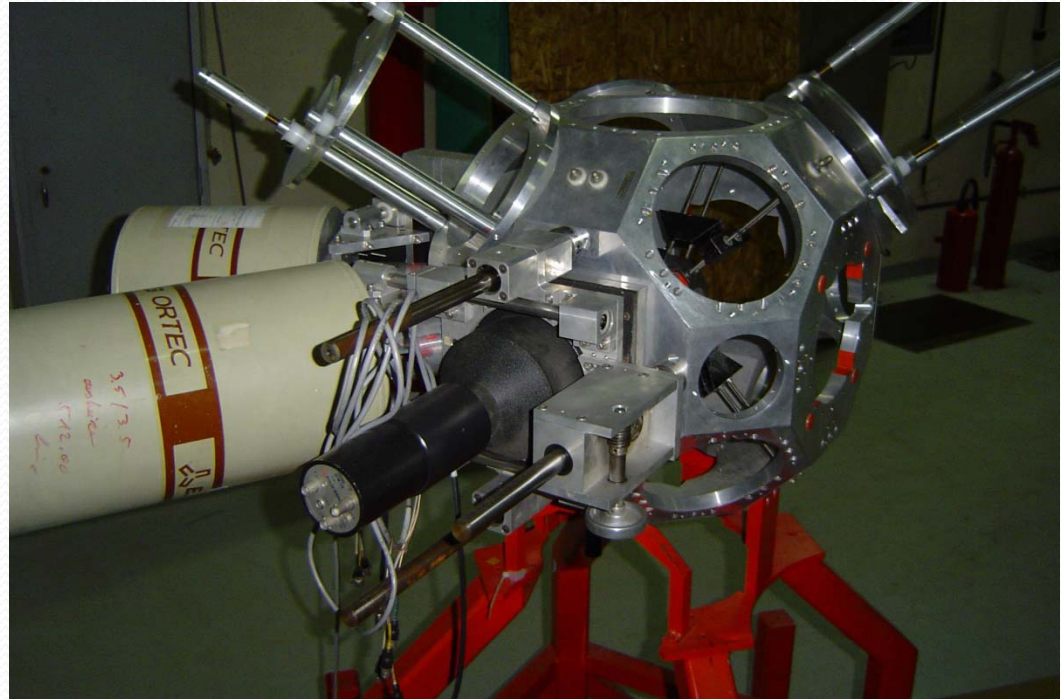
Results after upgrades: very stable intensity for the beam, wide variety of accelerated ions, high beam current.

Present detectors at Tandem Laboratory (IFIN-HH)

- Six new HPGe detectors with relative efficiency in the range of 35 to 55% and energy resolution around 1.7 keV at 1.3 MeV incident gamma radiation energy;
- Three HPGe detectors with 25% relative efficiency and energy resolution around 2.3 keV at 1.3 MeV incident gamma radiation energy;
- OSIRIS Array from IKP Köln with 6 HPGe detectors with a relative efficiency around 25%, with anti-Compton shields and energy resolution around 2.5 keV for 1.3 MeV incident gamma radiation energy;
- Three Ge planar detectors for low energy photons detection;
- Two neutron detectors.

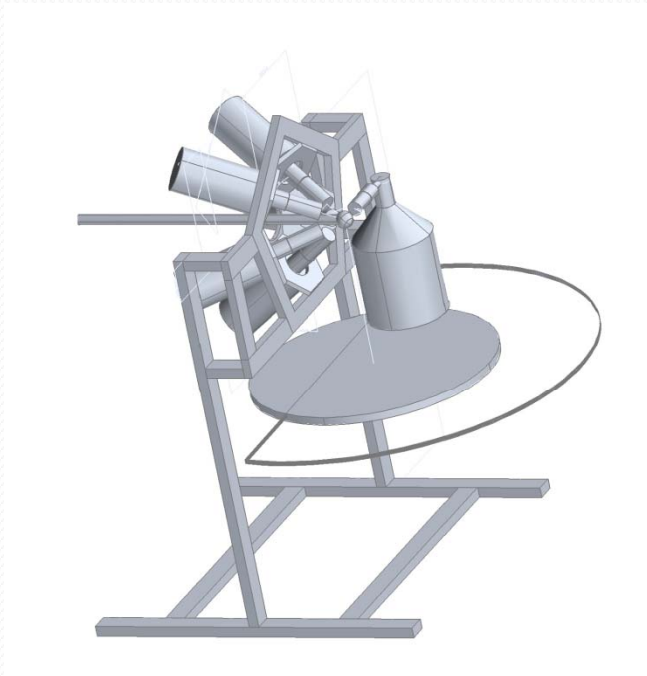
OSIRIS array

(collaboration with IKP Köln)



The present stage: detectors array to be mounted for in beam experiments.

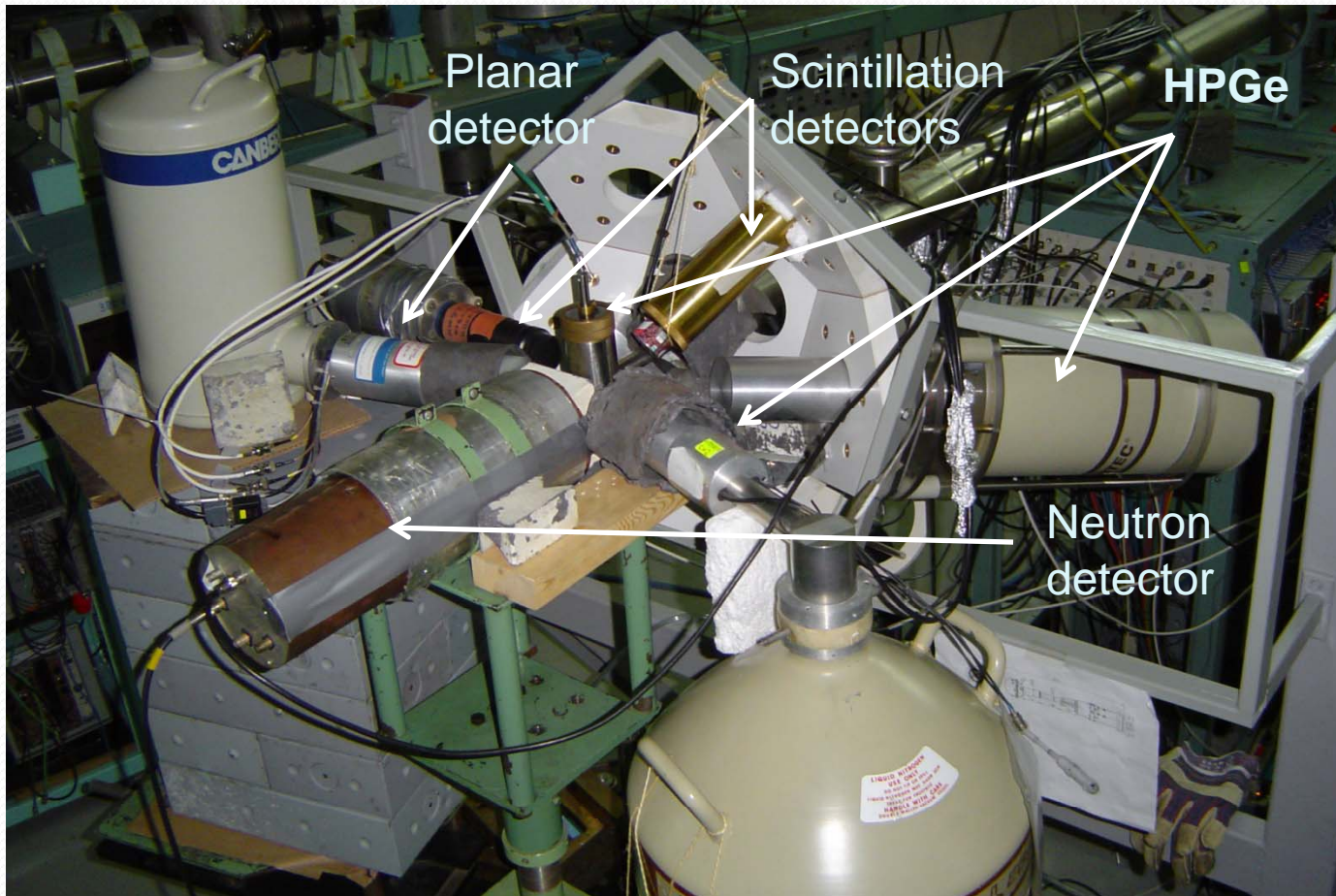
Frame for the HPGe detectors used in present in beam experiments



CAD Design



$\gamma - \gamma - n$ coincidence setup Isomeric Decay of ^{86}Y

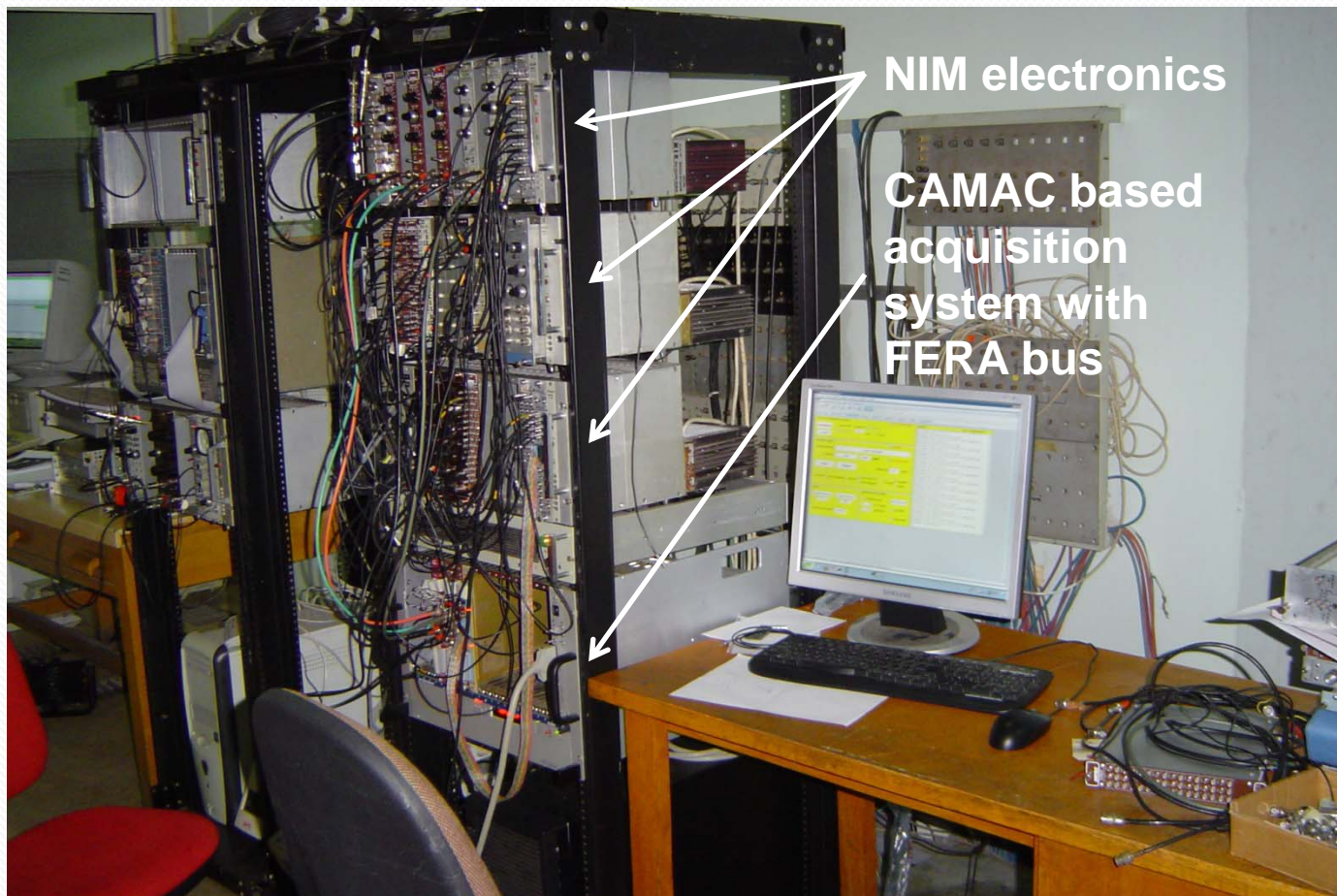




Electronic modules and acquisition systems at Tandem Laboratory (IFIN-HH)

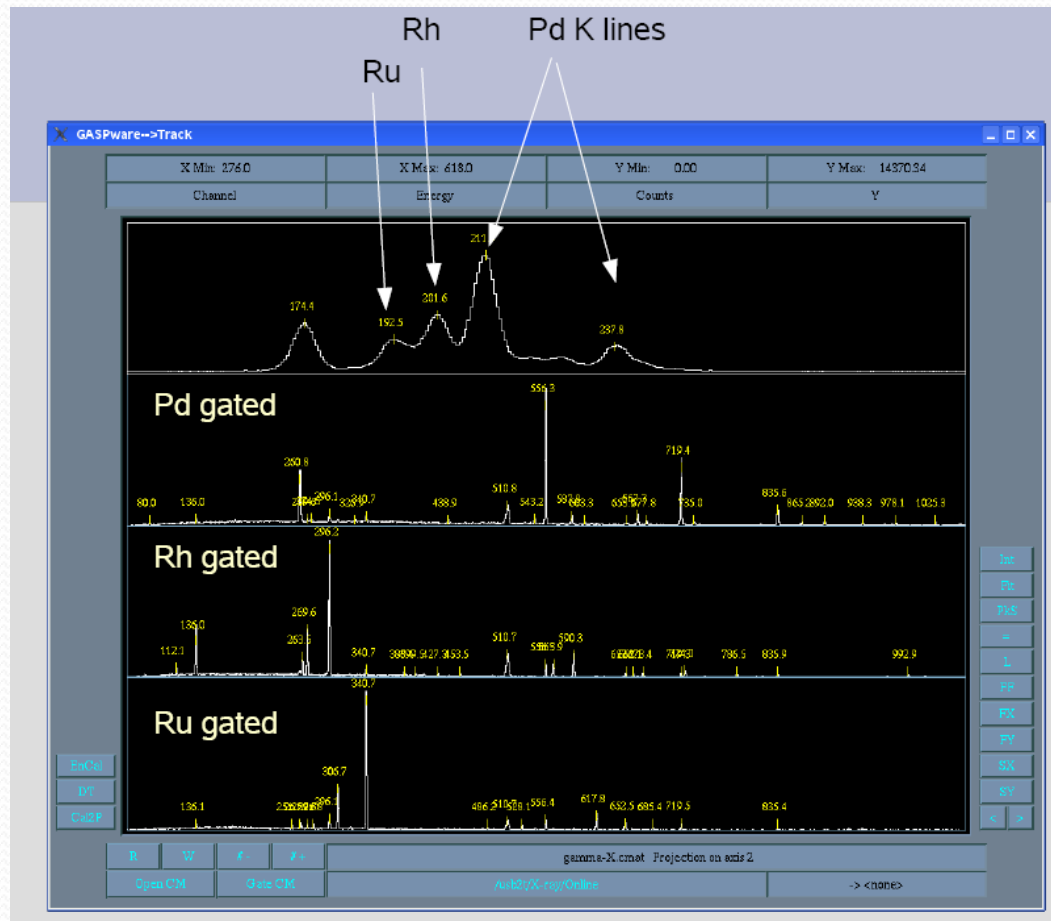
- NIM and CAMAC electronic modules;
- One acquisition system with FERA bus, with 24 ch. ADC and 16 ch. TDC;
- In progress 16 channels digital acquisition system (XIA - DGF).

Electronics and data acquisition system with FERA bus



Gamma spectroscopy following beta decay

Example of γ -X coincidence measurements at Buchatest FN Tandem



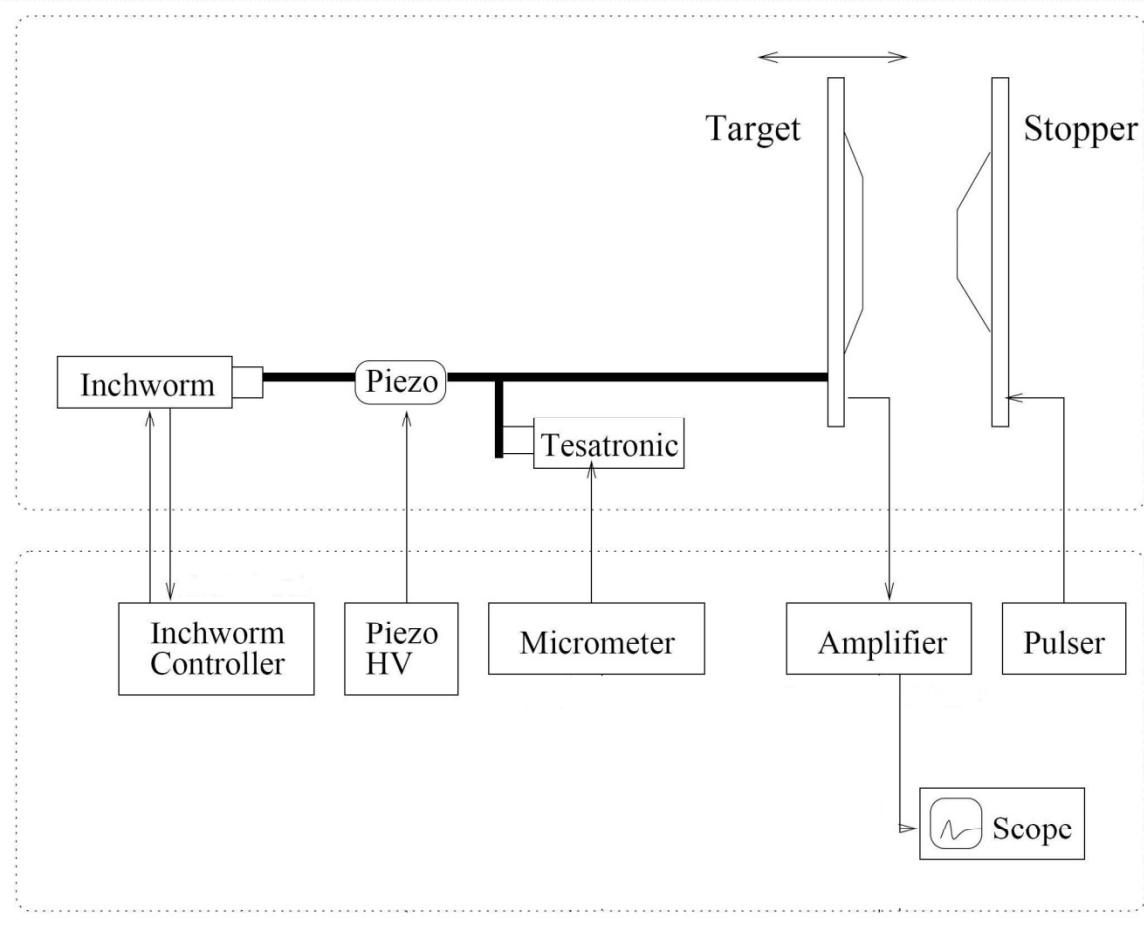
$^{12}\text{C}(56 \text{ MeV}) + ^{94}\text{Mo}$

β/ε decay in the region of ^{102}Pd

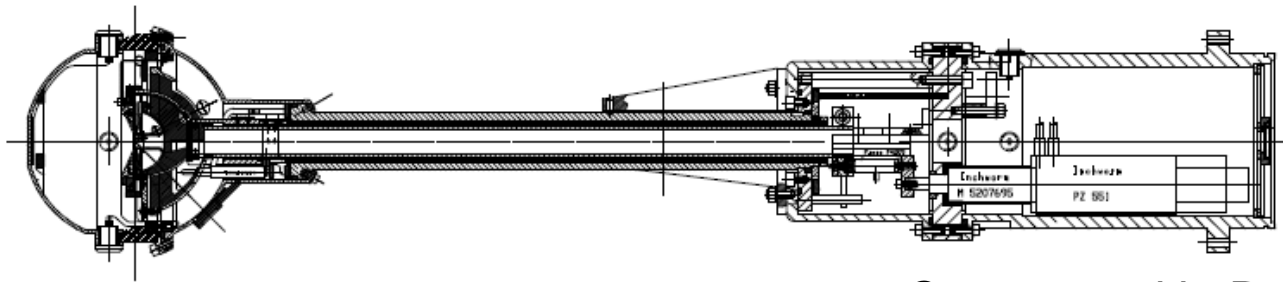
15 minutes activation and

15 minutes acquisition time

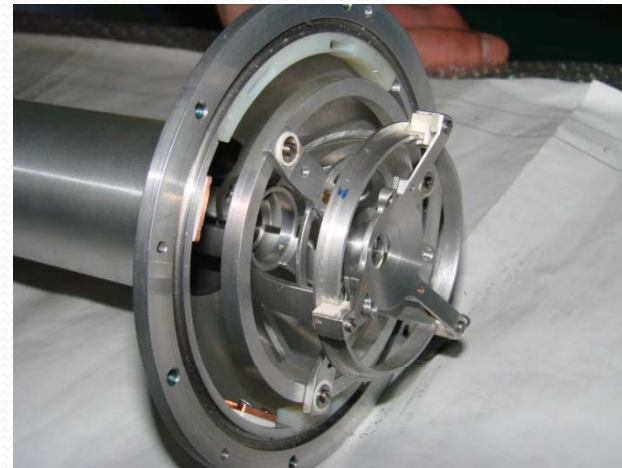
IFIN-HH Plunger – block diagram



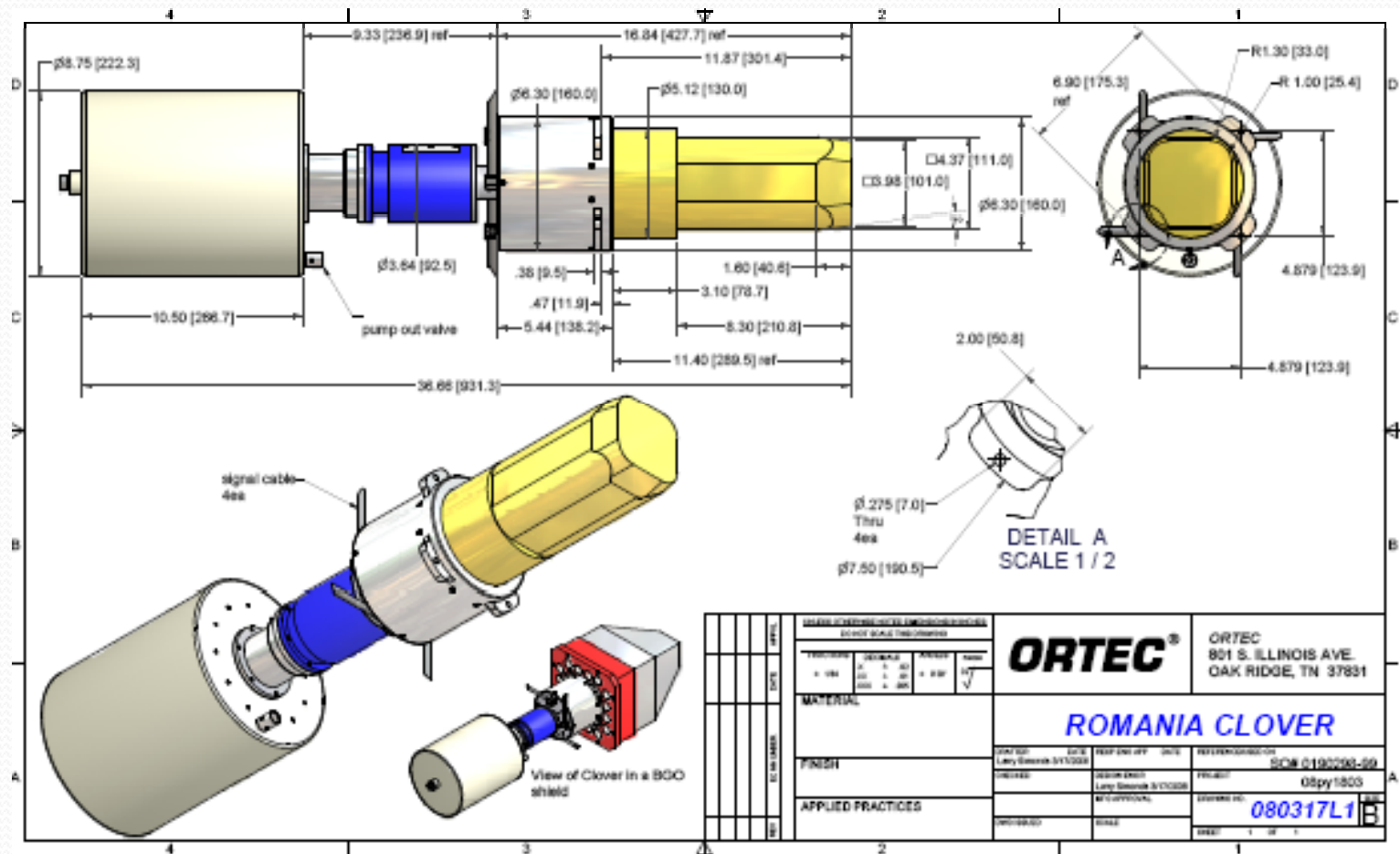
IFIN-HH Plunger



Constructed in Romania
following the latest Köln design

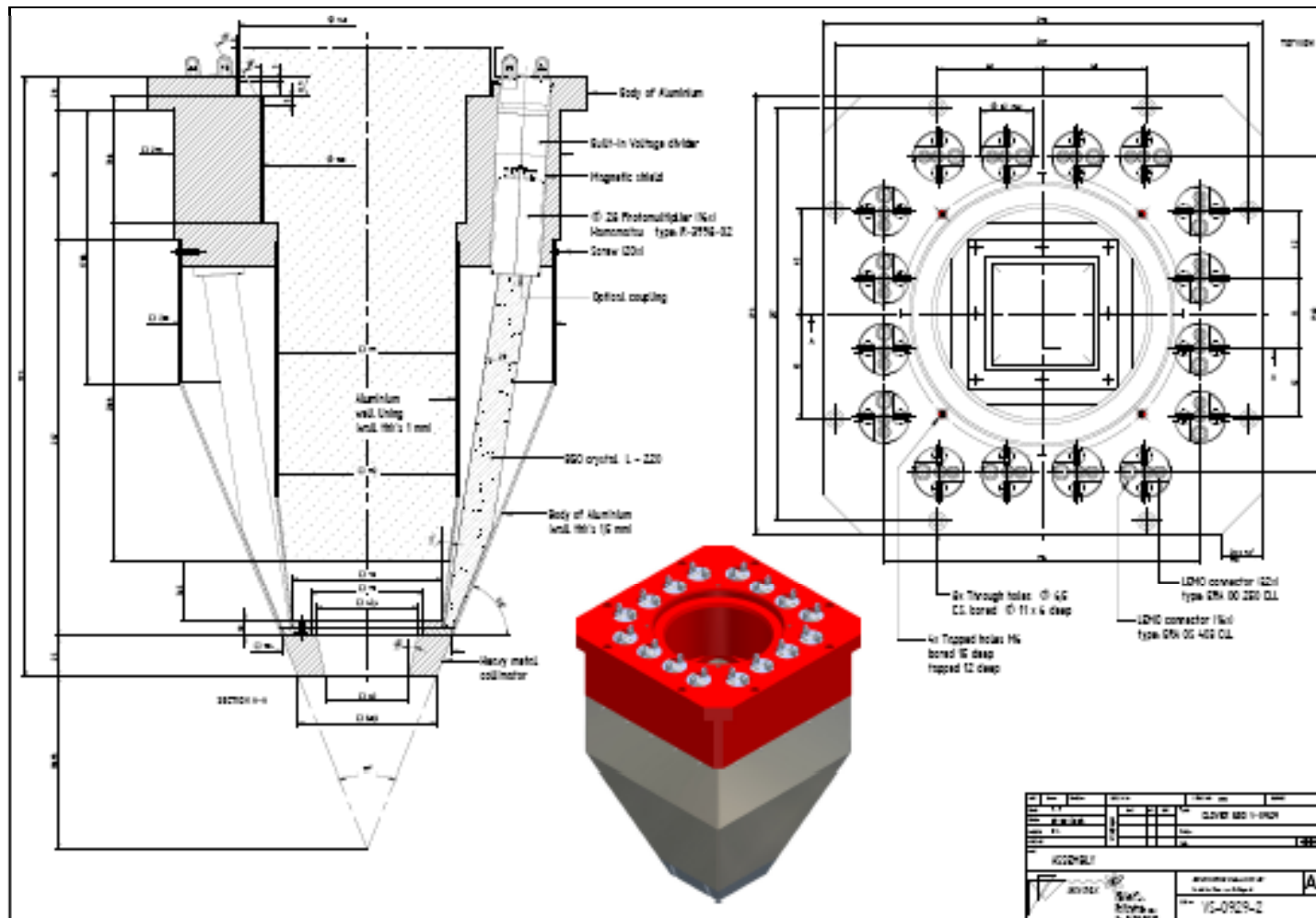


TWO ORTEC CLOVER DETECTORS already in development for IFIN-HH (120% rel. eff.)



ORTEC® ORTEC 801 S. ILLINOIS AVE. OAK RIDGE, TN 37831	
ROMANIA CLOVER	
PROJECT: SC# 0190796-59 DRAWING: OSpy1803	DATE: 08/03/17 SCALE: 1 OF 1
APPLIED PRACTICES	080317L1

SCIONIX anti-Compton shields for CLOVER DETECTORS already in development for IFIN-HH

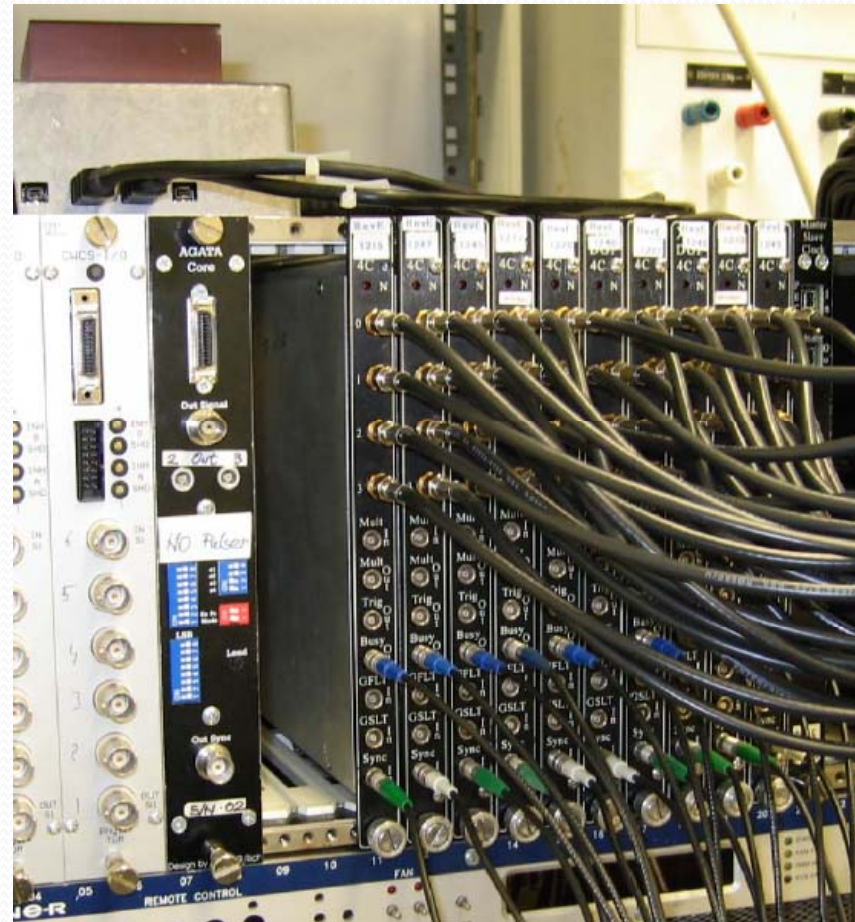


DGF system from XIA

Digital acquisition system
(XIA-DGF Rev. 4F) in
development.

Collaboration with IKP Köln
(Dr. G. Pascovici).

Self triggered on each
channel.



Picture from IKP-Köln (DGF Rev.4C)

In development at Tandem Laboratory

- New detector array including the two CLOVER DETECTORS and other 3 already contracted HPGe detectors (55% rel. eff.);
- Applied for another two CLOVER detectors (national funds);
- LaBr₃(Ce) detectors to be coupled to the experimental setups;
- Plunger campaigns in the 2008-2009 Bucharest FN Tandem beam time.



Conclusions

- Significant investments in the last years
- New experimental setups in construction
- Tandem Laboratory: well equipped national laboratory for nuclear physics



Collaborators

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