Detector technologies for LRIs and applications

Day of Large Research Infrastructures 17 October 2022, Prague

Ivan Štekl

(Institute of Experimental and Applied Physics, CTU in Prague)

General remarks:

1) <u>Key role of LRIs</u>: needs of different types of detectors, huge detector's systems, harsh environment, long-term run,....

2) <u>Many types of detector technologies:</u> pixelated (monolithic, hybrid), strip detectors, scintillation detectors (different types), tracking (gas) detectors, Liquid Ar, Xe, HPGe, Si, GaAs, CdZnTe, PMT, SiPM, CCD.....

3) <u>Synergy with different R&D areas:</u> Electronics (readouts), SW (control of equipment, data processing), Data storage (computer centers), Data transfer (huge amount of data), Material science (radiation hardness, new types of sensors), Radiation safety and emergency preparedness, Forensic analysis....

4) International cooperation

5) Necessity to cooperate with industrial partners

Situation in Czech Republic (page 1):

1) <u>Czech institutions are included in several areas of detector technologies (in close cooperation with partners outside CR)</u>: pixelated (monolithic, hybrid), strip detectors, scintillation detectors, gas tracking detectors, Cherenkov type, semiconductor....

2) <u>Development of local research infrastructure</u>: clean rooms, automatic systems of calibration, wire-bonding, study radiation hardness.....

3) Strong industrial partners in CR:

ADVACAM – pixel detectors, spin-off company, Technological company of CR in 2021 NUVIA a.s. – scintillation detectors (subsidiary of VINCI) CRYTUR s r.o. – integrated crystal based solutions

4) <u>Fundamental research as well as applications:</u>
CERN – inner detector, forward physics, MoEDAL,.....
ESA - detectors on satelittes (even in open space), ISS (dosimetry)
Applications – medicine (FLASH therapy, imaging), biology, X-ray radiography, neutronography....

Automatic system for charging of samples for detectors (in radon-free atmosphere)



Situation in Czech Republic (page 2):

5) Possible oportunity to prepare and apply common "detection" project in OP TAK call:

- General R&D of technologies for fundamental research and applications (selected types of detectors, nuclear safety and emergency preparedness, detection techniques for ultra low-background conditions, radiation hardness e.g. for space....).
- The entire detection community of CR, opportunity in further construction of local RI (to support international cooperation – experts from abroad in CR)
- Use of direct contacts with Czech industrial partners (industrial impact): ADVACAM, CRYTUR, NUVIA....

Clean room (ISO 5) using anti-radon system in LSM (suppression of all types of radioactivity, including Rn, for production of detectors, chips to avoid surface contamination; biological studies)

High resolution X-ray radiography and tomography with counting detectors







5 mm CZT (Kromek) on Timepix3

