58th session of the PAC PP, 21 June 2023

BM@N experiment online data processing and QA system.

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NICA complex

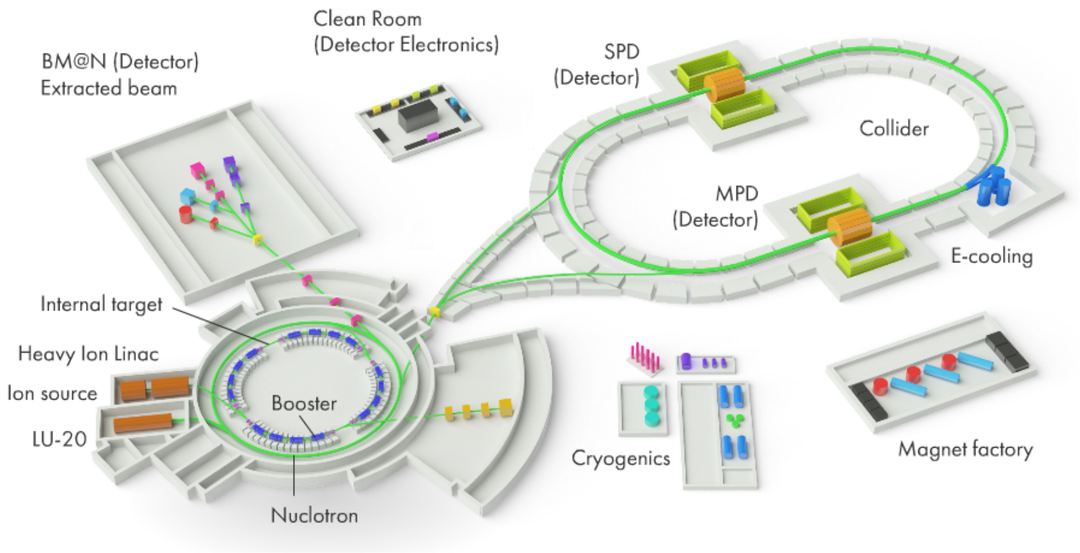


Figure 1: NICA complex

The new acceleration complex - NICA [1,2] being built in the JINR is aimed to study heavy ion (up to Au-Au) collisions at maximum baryon density in order to explore equation of state and properties of phase transition between baryonic matter and quark-gluon ”plasma”.

The experimental conditions being reached on the facility are close to the ones in the neutron stars and existed in the Quark epoch of the Universe.

Data processing flow

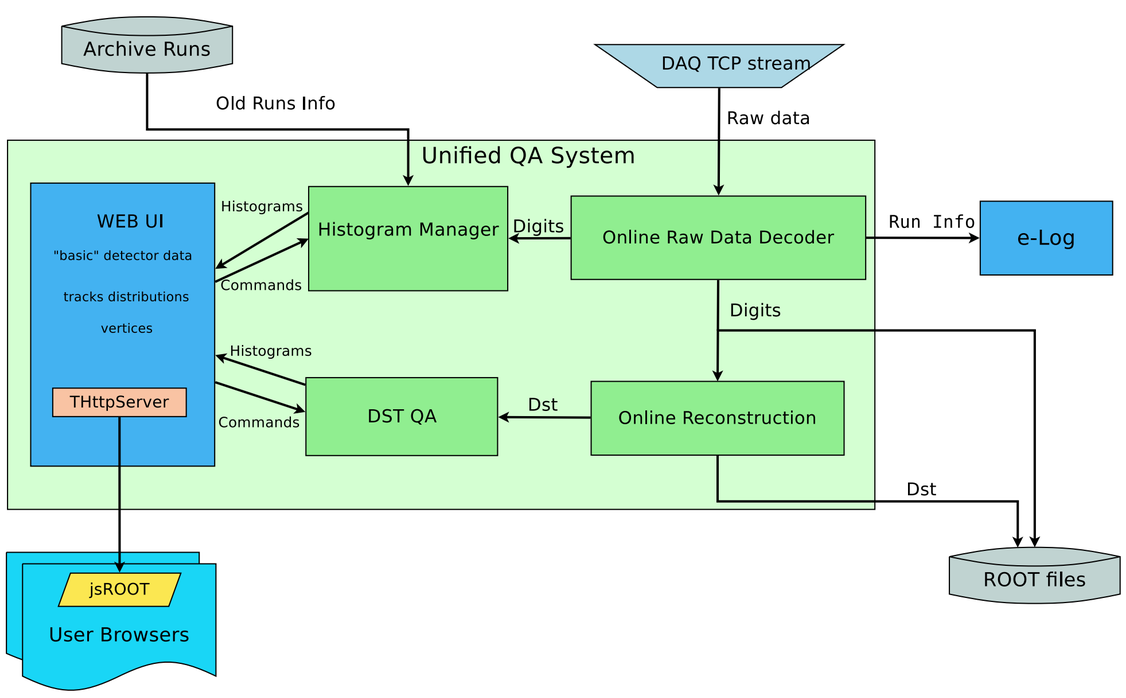


Figure 2: Data processing workflow for the next run in 2022

The decoding workflow includes filtration, executing noise reduction, applying the channel-strip mapping and making preparation for a subsequent physical analysis. The processed data of each event is then sent to the monitoring and reconstruction processes via the ZeroMQ [3,4] pub socket. Lighttpd [5] web server is used on a frontend where jsROOT[6,7] library finally draws object in the browser. The more detailed description of the system is done in [8,9].

BmnRoot QA structure

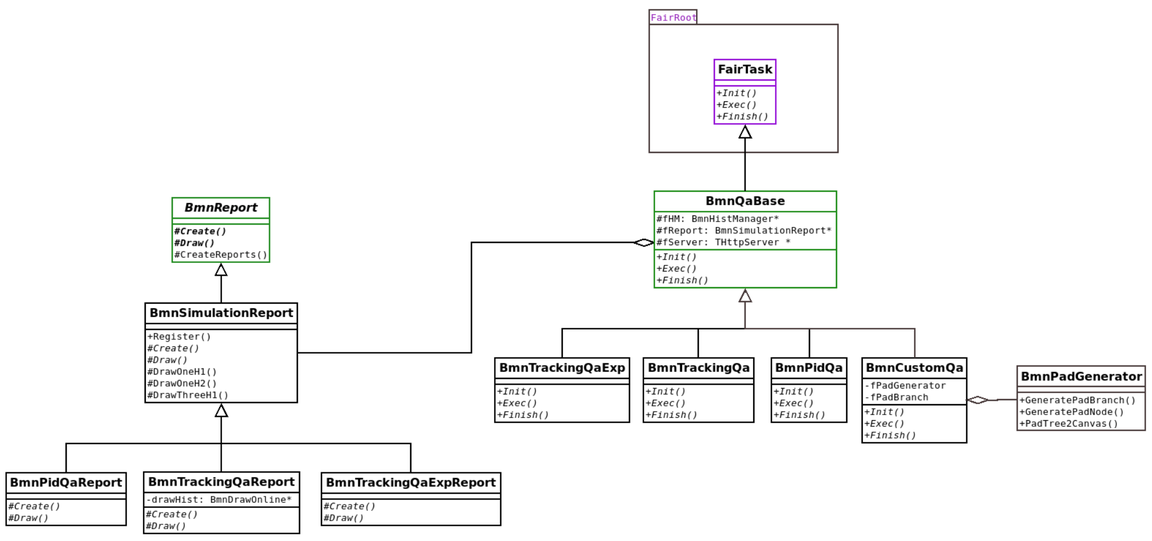


Figure 3: QA main classes (including online)

Online beam control

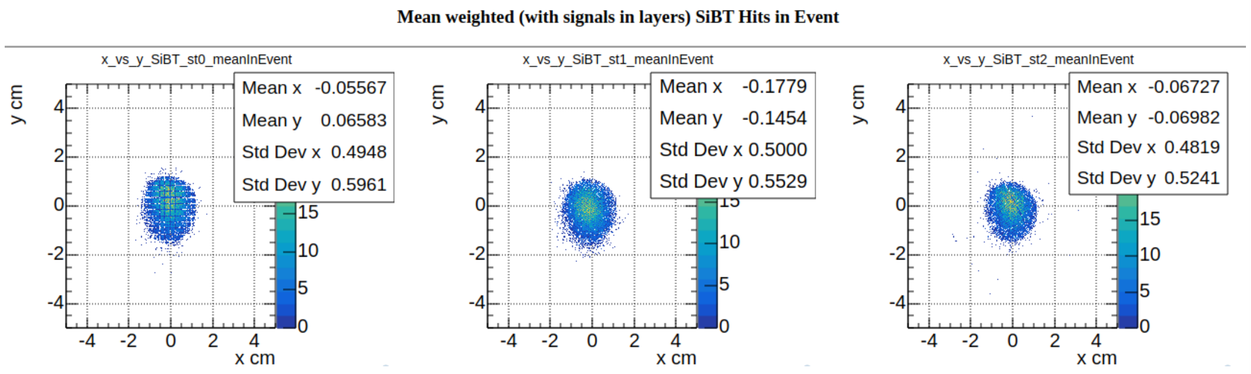


Figure 4: Si beam tracker hits

BM@N experiment

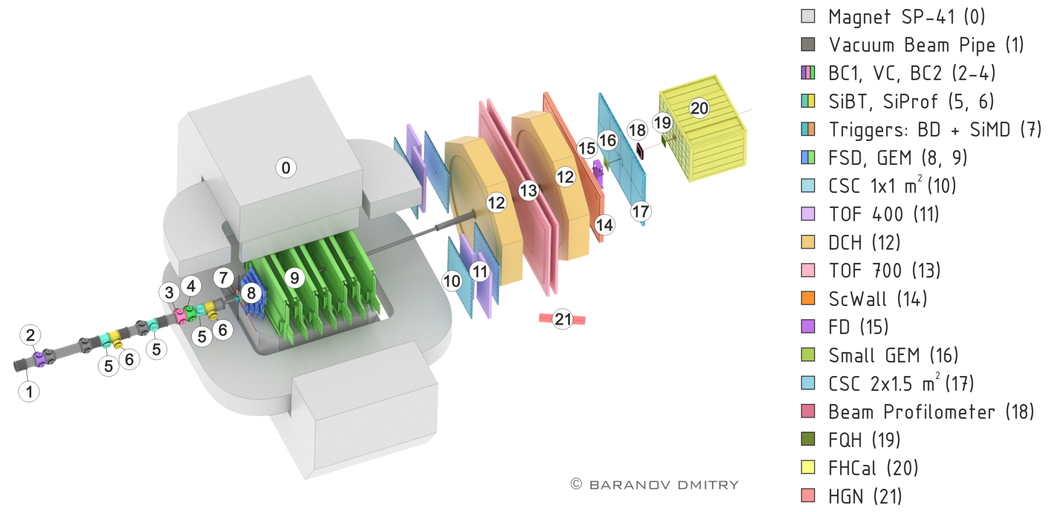


Figure 5: BM@N detector Xe run configuration

The BM@N experiment is designed to study heavy ion collisions with energy range **2 – 3.8 *AGeV***. It is built as the first stage of the NICA project. One of the indications of deconfinement phase transition is the enhanced yield of strange particles. Thus one of the main requirements for the BM@N tracker system is the ability to reconstruct decays of hyperons and hypernuclei.

Frontend view

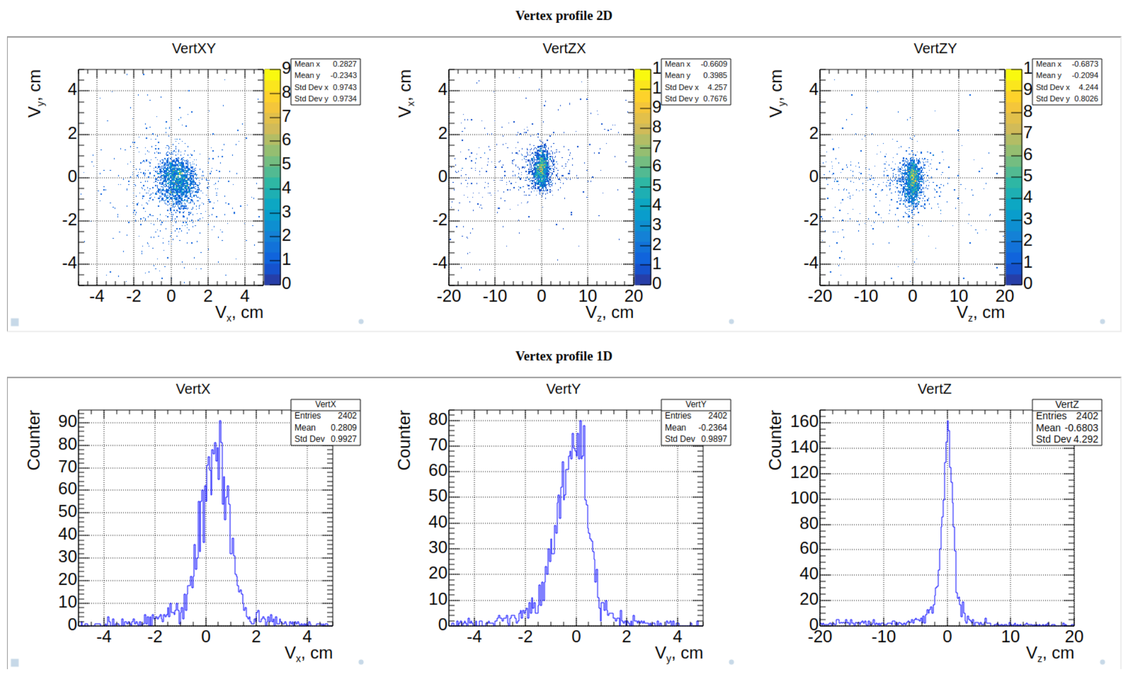
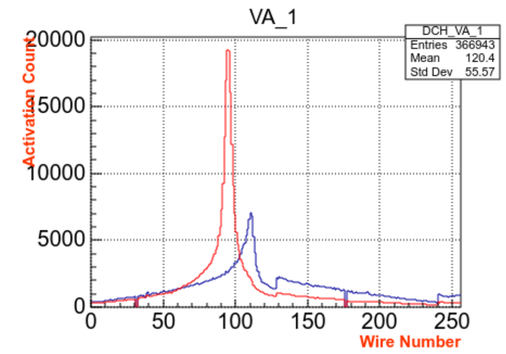


Figure 6: Primary Vertex online reconstruction

The system is capable of providing a detailed information about every detector subsystem.

And allows users to select reference run from past runs and impose it on the current run in order to detect possible deviations in the histogram form as can be seen in Fig. 1 for the Drift Chambers time distribution.

- ✓ Ref run imposition
- ✓ Autoselection of similar runs



No code histogramming (in development)

JSON scheme:

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        "Title": "Vertex XY",
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            -5,
            5
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        "Name": "VZ",
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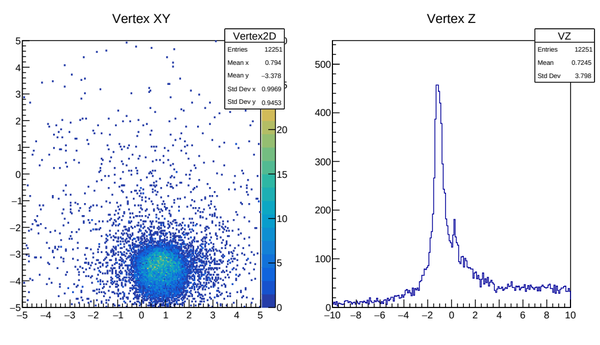
            -10,
            10
        ]
    }
]
}
```

Canvas structure:



Conclusion

The BmnRoot software package developed for BM@N-NICA experiment includes raw data decoder, QA, database management and physics analysis tools. The online QA system implements data decoding and full event reconstruction chain including primary vertex. The system is flexible by design and capable of providing online relevant and detailed information about each detector subsystem and the data quality checking.

Contacts

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