Performance of BEBE-prototype: A BEam-BEam counter prototype for the MPD-NICA experiment at JINR

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Outline

Quark-Gluon Plasma to Hadron state

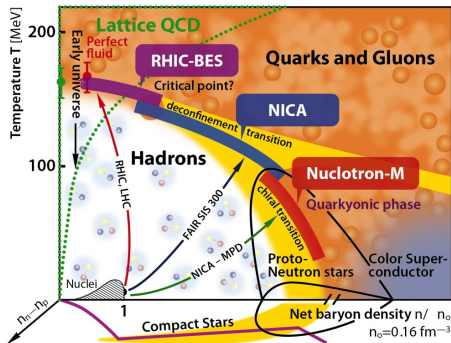Figure: Phase diagram: Critical point location.

Through: Dilepton study, stranges particles.
SPS (CERN) studies: NICA covers the gap.

Nuclotron-based Ion Collider fAcility (NICA)

Located in Dubna, Russia.

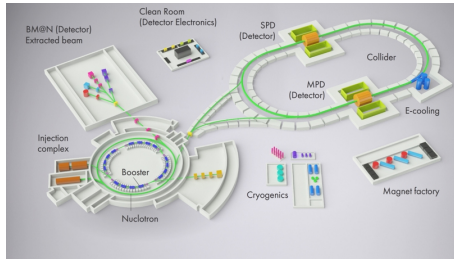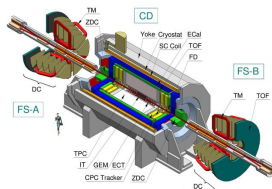Figure: NICA complex.

- The Baryonic Matter at Nuclotron (BM@N).
- The Spin Physics Detector (SPD).
- **The Multi-Purpose Detector (MPD).**

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The MPD complex

- Time Projection Chamber (TPC).
- Inner Tracker (IT).
- Time of Flight (TOF).
- Electromagnetic Calorimeter.
- Zero Degree Calorimeter.
- Fast Forward Detector (FFD).
- Magnetic solenoid.

# BEam-BEam counter detector (BEBE or Beam Monitoring Detector (BMD))

The BMD: An ambitious detector:

- Scintillator detector: Bc404.
- Increase the pseudorapidity region: $1.69 \leq |\eta_{BMD}| \leq 4.36$.
- Optimization of events: Plane resolution.
- Centrality and Interaction point location..
- Multiplicity reference estimator.
- Trigger system.
- Beam monitoring.
- Discriminate centrality events from background and beam-gas interaction.
- Determinate the absolute cross section of reaction process.
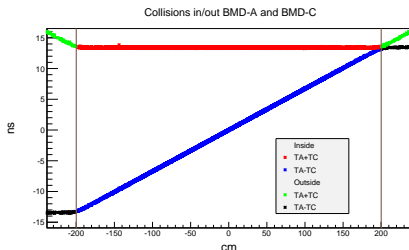- **Time resolution: 50 ps** (arrival time scintillator-photons + electronic time).

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BEam-BEam counter detector (BEBE or Beam Monitoring Detector (BMD))

The BMD: An ambitious detector:
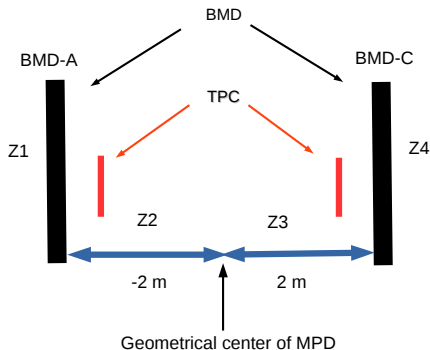
Location of the interaction point

The goal of this work is to find the arrival time distribution and resolution.

Figure: Relation between the arrival time (T_A and T_C) to **BMD** with **interaction point position**.

Arrival time resolution: $\Delta\sigma = |\sigma_A - \sigma_C| = 57.982 \pm 0.509$ **ps.**

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Finding the geometry to obtain 50 ps
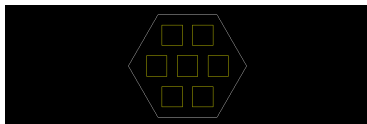
Geant4 simulation (yellow square = APD):

a)

Figure: Size: 10 cm high. 133.579 ± 21.803 **ps** $\leq \Delta\sigma \leq 226.409 \pm 37.821$ **ps.**

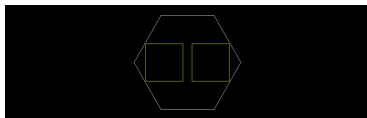**b)**

Figure: Size: 5 cm high. $\Delta\sigma = 12.908 \pm 4.762$ **ps.**

We are close!

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Conclusions

- BMD will be an important detector for MPD.
- BMD will be able to find the point interaction location.
- The geometry to obtain the 50 ps will be found it in few time.

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- Dra. Isabel Domínguez.