Discussion of the results and upgrade status

On going analyses:

Vasilii Plotnikov → plan for Preliminary
Yields of K^+, π^+ and their ratio in *argon - nucleus* interactions at 3.2 AGeV (ToF-400 data)

Lalyo Kovachev, Yuri Petukhov → plan for Preliminary
Yields of π, p, t, He^3, d/He^4 in *argon - nucleus* interactions at 3.2 AGeV (combination of ToF-400 and ToF-700)

Pavel Batyuk → plan for Preliminary
Yields of Λ hyperons in *argon - nucleus* interactions at 3.2 AGeV

Yuri Stepanenko, Ksenia Alishina → to get final results from Preliminary
Yields of Λ hyperons in *carbon - nucleus* interactions at 4 and 4.5 AGeV

Sergey Merts, Andrei Druck:
Nuclear fragments in carbon-hydrogen interactions with one prong, two prong tracks in proton arms (based on SRC data)
Sergey Merts + students of St Petersburg university:
Identification of π, p, t, He^3, d/He^4 (independent analysis of ToF-400,700 data)

Identified systematics:
- magnetic field outside the magnet pole at current 1250A is lower than the field extracted from the scaled map initially measured at current 900A
- energy measured in old ZDC in events with Λ hyperons in carbon-nucleus interactions is lower than predicted by model and ZDC simulation

Plan to start BM@N heavy ion program with a middle weight ion beams (Kr, Xe) in Spring 2022

► first need to trace beam through BMN and monitor its profile

► operate 1st stage of hybrid central tracker (3 Fwd Si + 7 GEM)

► maximal beam energy (up to 3.9-4.0 AGeV) , Targets: with weights closest to Kr, Xe: RbBr (Kr), CsI (Xe) or Cu, Sn (?)

Trigger: central + intermediate interactions, Min. bias events for monitoring, beam intensity: few 10^5 Hz, Event statistics per target, beam: ≥ 10^8 (?)

► Task force group is formed for more detailed simulation / reconstruction of Kr, Xe – nucleus interactions in BM@N central tracker and identification system

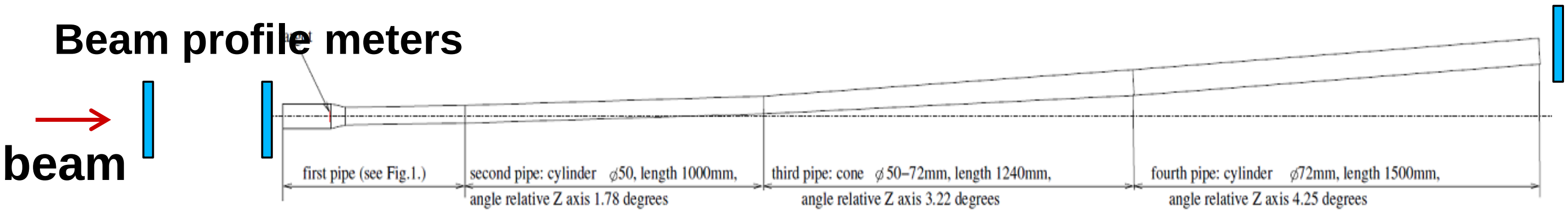
To prepare for measurements of collective flows:

► need more efforts to simulate / estimate EP resolution from charged particle data / neutron data to measure collective flows of mesons, protons, fragments, hyperons

► Need to develop a new neutron detector of high granularity to cover whole azimuthal range to measure single neutrons and finally → collective flow of neutrons

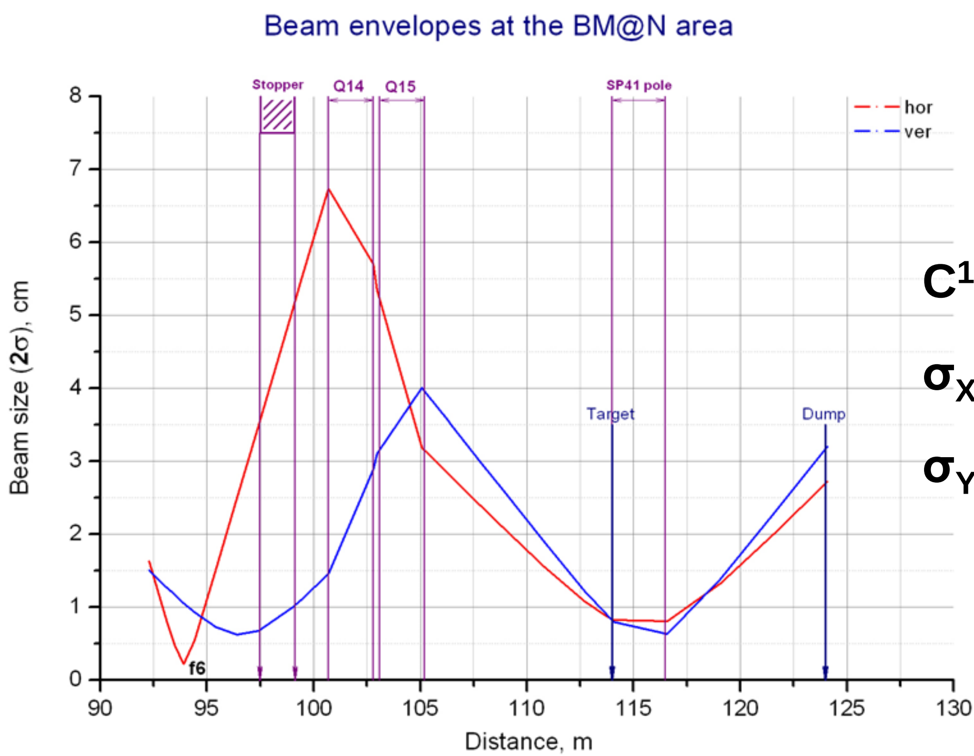
► Up to now only measurements of neutron flow have been done in GSI in Au+Au at 0.4 and 1 AGeV. BM@N can extend measurement of neutron collective flow to higher energies (baryon densities)

Beam tracing through BMN beam pipe and profile monitoring



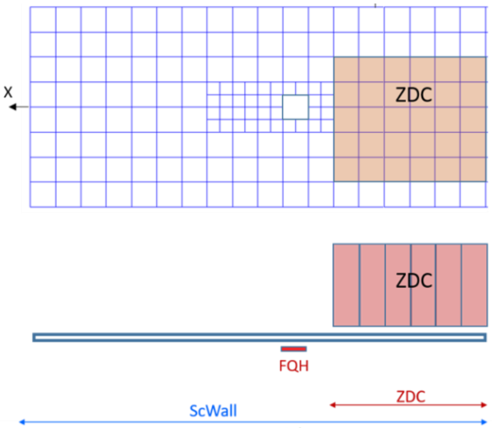
Additional beam profile meter

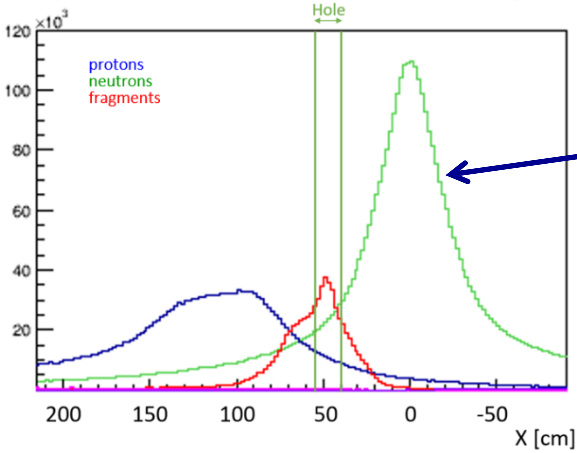
First task of the next run → trace beam and monitor its profile in the end of the setup (try to find optimal trajectory to reduce background)



C^{12} 2017	Ar 2018	Kr 2018
σ_X = 6 mm	5 mm	5.3 mm
σ_Y = 4.9 mm	5 mm	3.2 mm

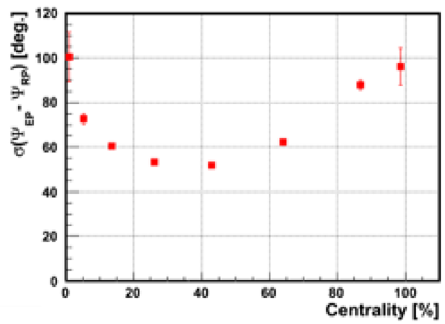
EP reconstruction with FHCAL , Scint Wall and FQH



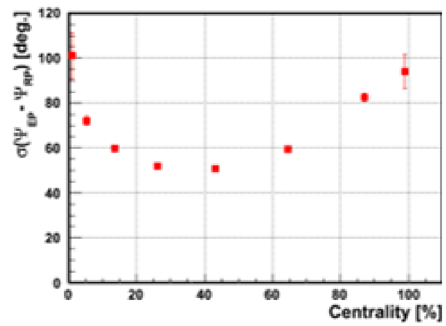


Event Plane resolution

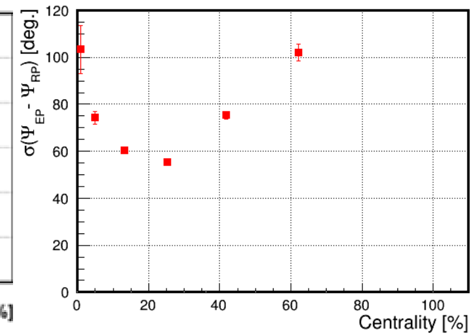
ZDC (all particles)



ZDC (only neutrons)



ScWall (charged fragments)



Neutron profile in front of ZDC

To measure neutron collective flow need:

►EP from identified protons and fragments

►granular neutron detector to measure single neutrons

Expected statistics of hyperons to be collected per second and for 2200 hours (3 months) of data taking. We foresee 2000-3000 hours of data taking per year. We assume the parallel operation of the Booster-Nuclotron for the BM@N experiment during data acquisition in the MPD experiment at the NICA collider.

Numbers are based on estimations of Peter Senger 4 A GeV min. bias Au+Au collisions, multiplicities from statistical model,
Reaction rate 10^4/s, accelerator duty factor = 0.25

Hyper-nucleus	Yield / 2200 hours
${}_{\Lambda}^{3}H$	$1 \cdot 10^6$
${}_{\Lambda\Lambda}^{5}H$	100

Particle	E_{thr}NN GeV	M central	M m.bias	ε %	Yield/s m. bias	Yield / 2200 hours m. Bias
Ξ^-	3.7	$1 \cdot 10^{-1}$	$2.5 \cdot 10^{-2}$	1	2.5	$5 \cdot 10^6$
Ω^-	6.9	$2 \cdot 10^{-3}$	$5 \cdot 10^{-4}$	1	$5 \cdot 10^{-2}$	$1 \cdot 10^5$
Anti-Λ	7.1	$2 \cdot 10^{-4}$	$5 \cdot 10^{-5}$	3	$1.5 \cdot 10^{-2}$	$3 \cdot 10^4$
Ξ^+	9.0	$6 \cdot 10^{-5}$	$1.5 \cdot 10^{-5}$	1	$1.5 \cdot 10^{-3}$	$3 \cdot 10^3$
Ω^+	12.7	$1 \cdot 10^{-5}$	$2.5 \cdot 10^{-6}$	1	$2.5 \cdot 10^{-4}$	$5 \cdot 10^2$