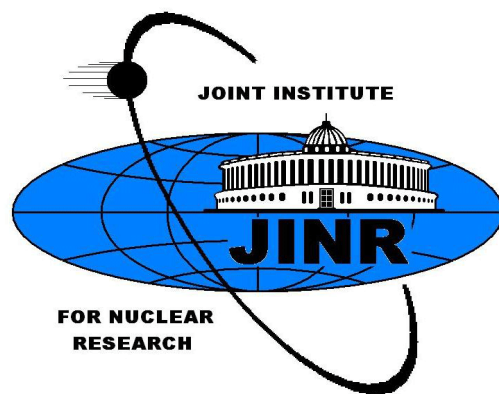


Local polarimetry with BBC at SPD

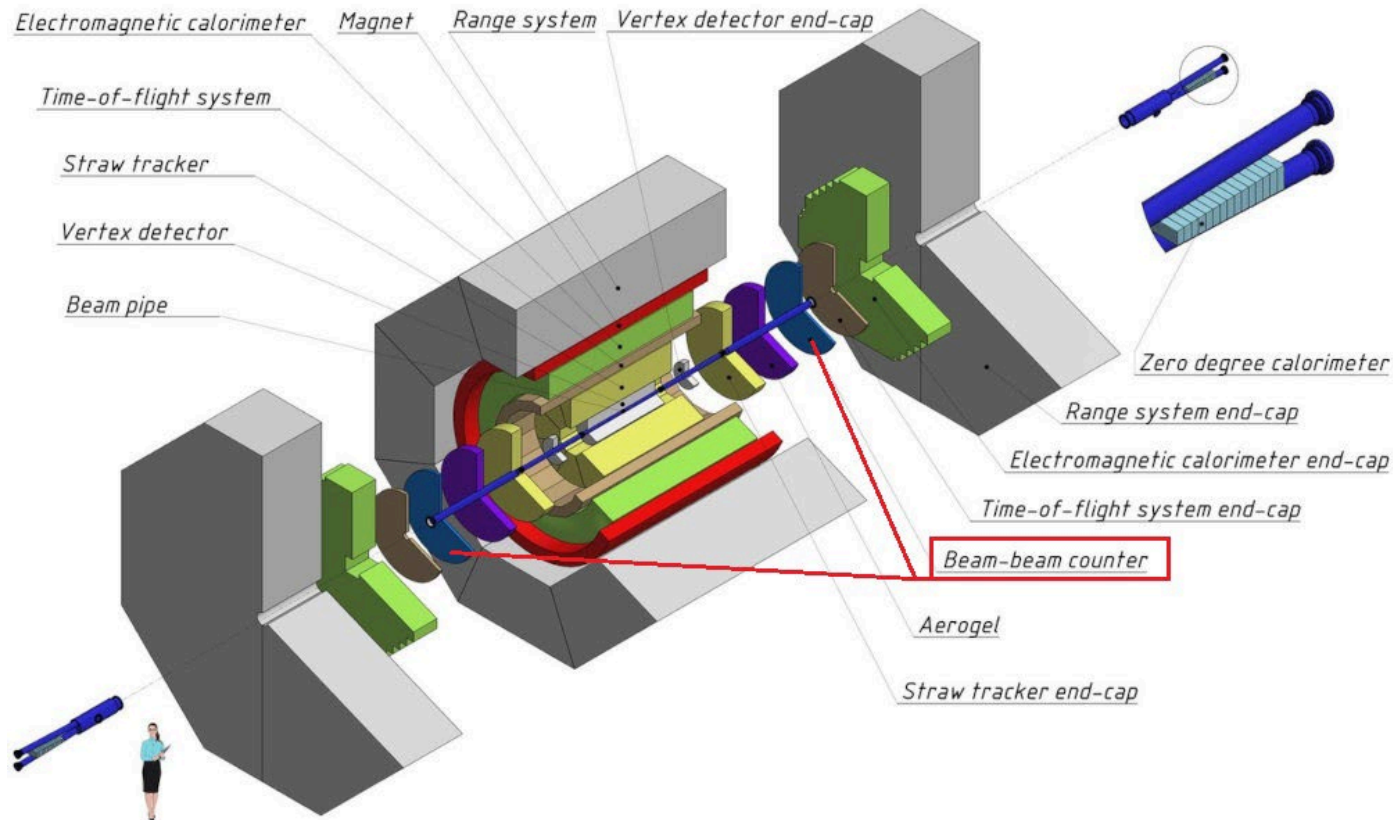
A.A Terekhin et al.

Joint Institute for Nuclear Research, Dubna, Russia

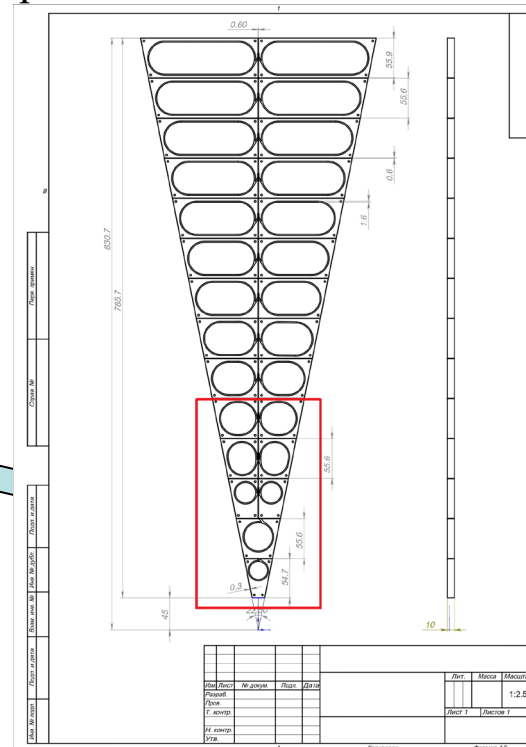
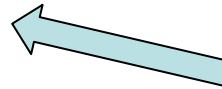


12.11.2025

BBC - detector

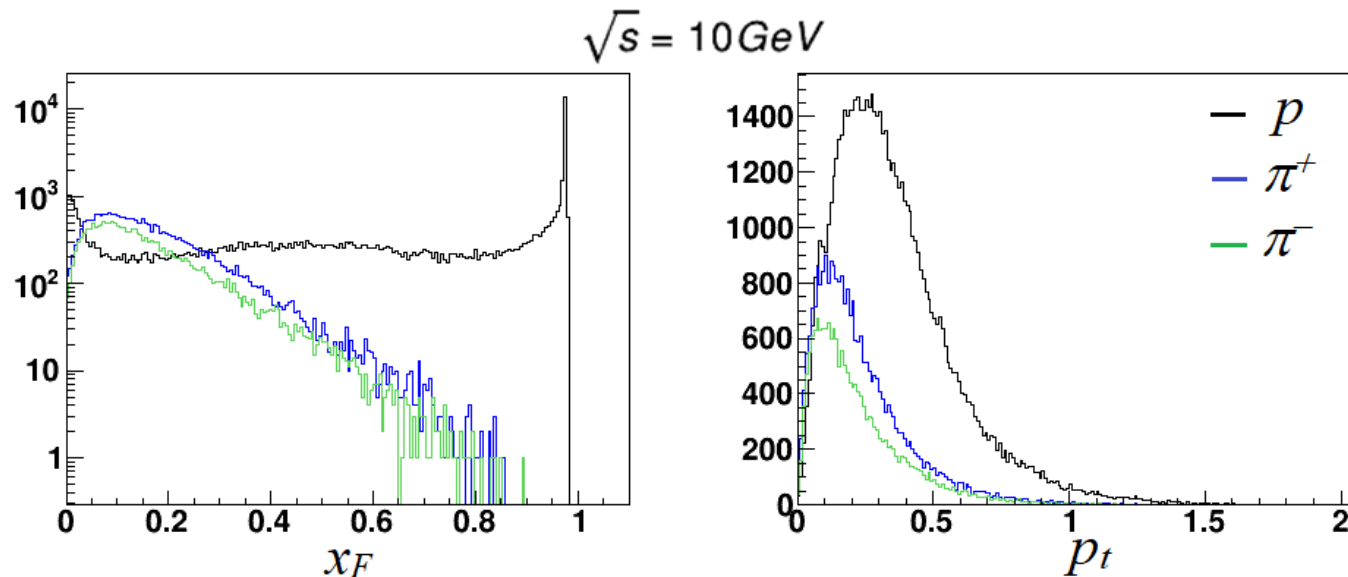


-



pp – scattering simulation for SPD BBC

- $\sqrt{s} = 6, 10$ and 27 GeV
- SPDRoot framework, FRITIOF, 10^5 events
- pp – **total** scattering simulation
 pp – **elastic** scattering simulation
 pp – **inelastic** scattering simulation
- For each BBC – layer:
 - N – events number
 - x_F – (Mean, RMS)
 - p_t – (Mean, RMS)



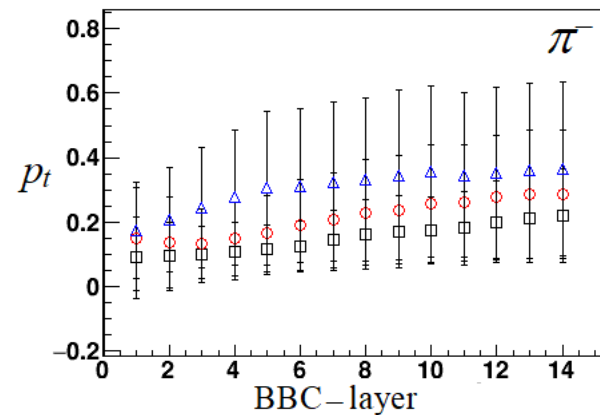
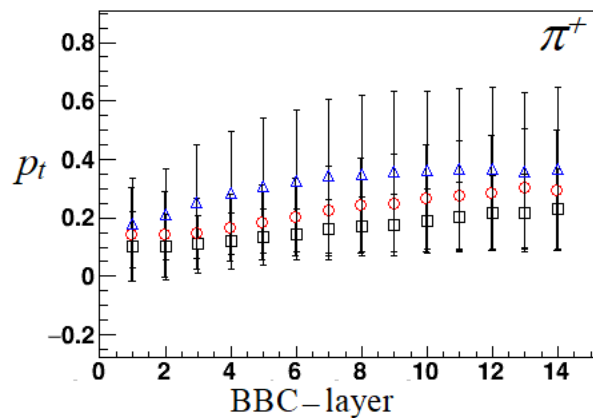
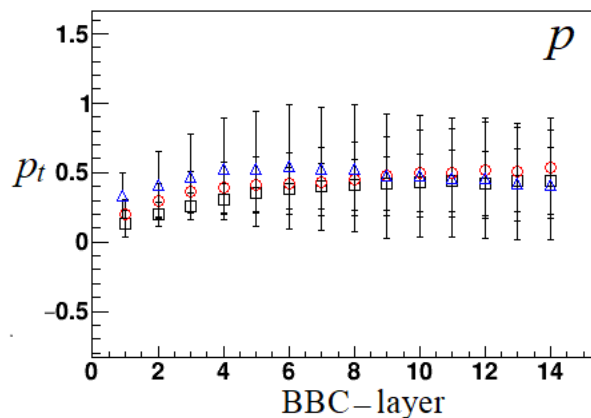
SPDRoot – simulation, FRITIOF, 10^5 events

p_t – distributions

□ -- $\sqrt{s} = 6$ GeV

○ -- $\sqrt{s} = 10$ GeV

△ -- $\sqrt{s} = 27$ GeV

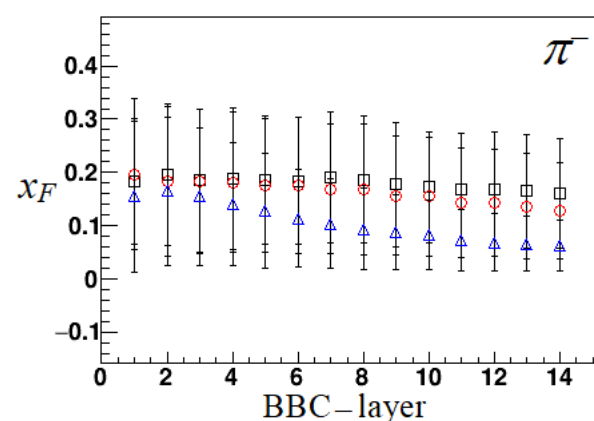
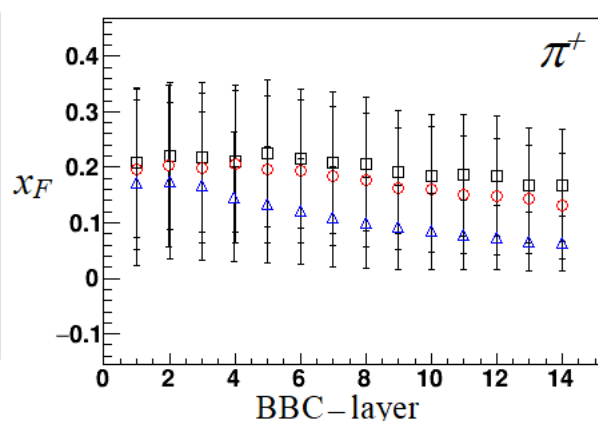
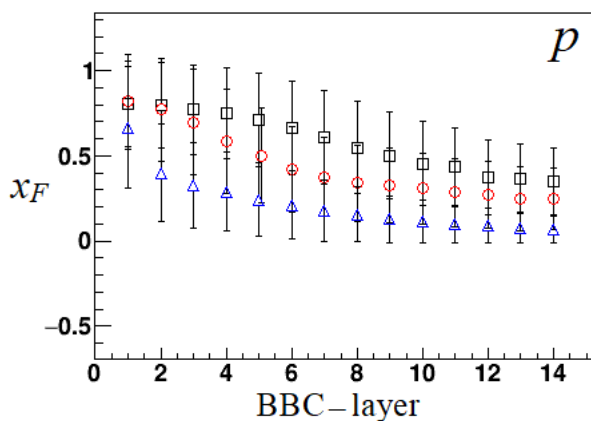


x_F – distributions

□ -- $\sqrt{s} = 6$ GeV

○ -- $\sqrt{s} = 10$ GeV

△ -- $\sqrt{s} = 27$ GeV

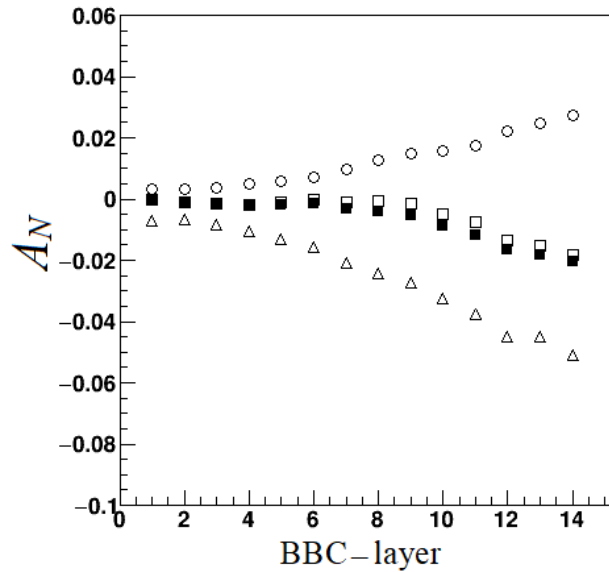


The single scattering asymmetry in the inclusive pp-interaction

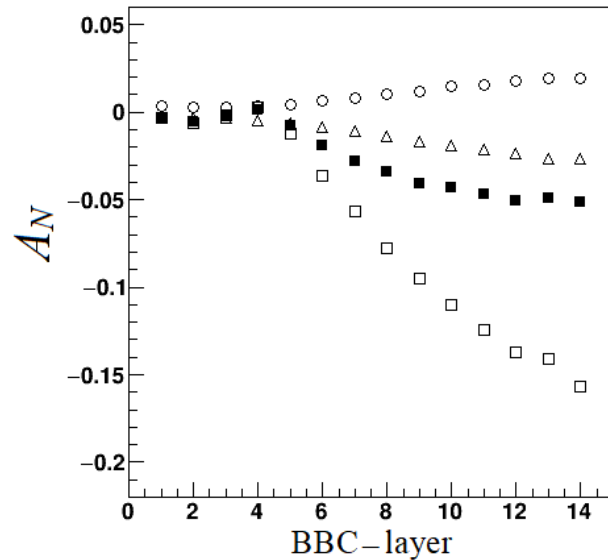
The analyzing powers A_N have been calculated by the Abramov V. V. [1] for inclusive reaction within the framework of the phenomenological model for chromomagnetic polarization of quarks (CPQ).

$$A_N^{eff} = \frac{A_N^p N_p + A_N^{\pi^+} N_{\pi^+} + A_N^{\pi^-} N_{\pi^-}}{N_p + N_{\pi^+} + N_{\pi^-}} \quad N_p, N_{\pi^+}, N_{\pi^-} - \text{number of the protons, } \pi^+, \text{ and } \pi^- \text{ in each concentric layer.}$$

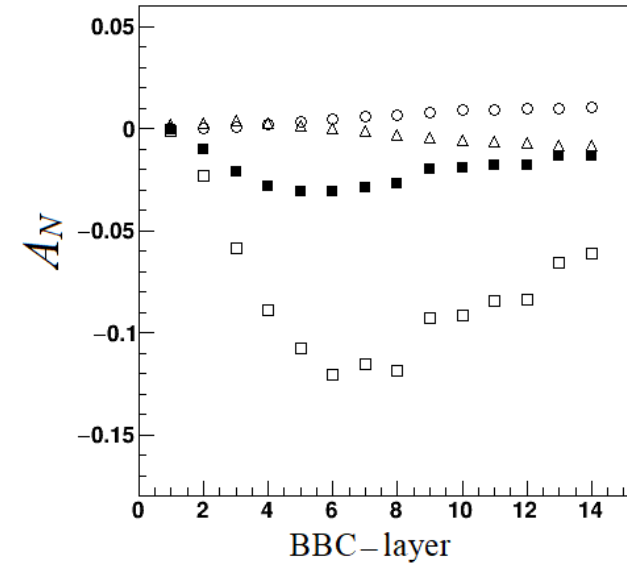
$\sqrt{s} = 6 \text{ GeV}$



$\sqrt{s} = 10 \text{ GeV}$



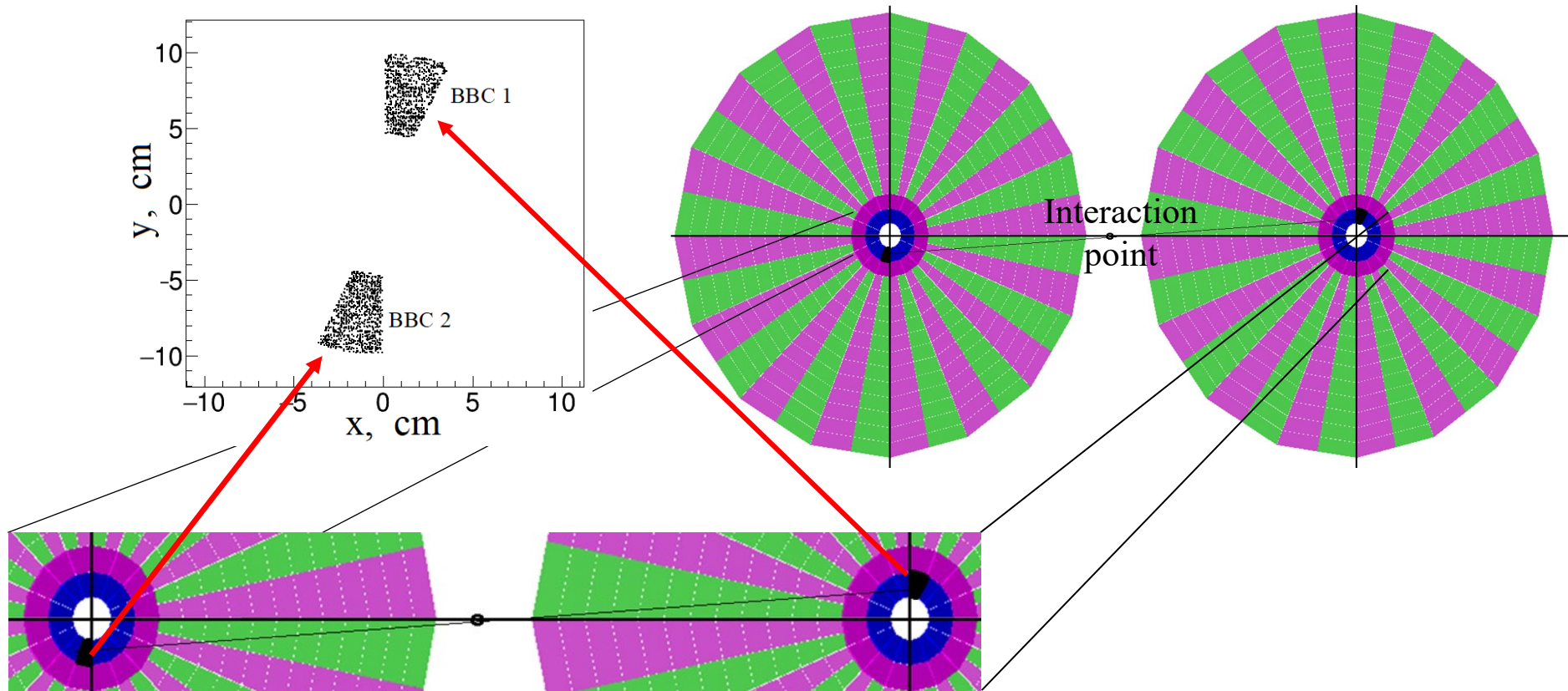
$\sqrt{s} = 27 \text{ GeV}$



- \square — A_N^p
- \triangle — $A_N^{\pi^+}$
- \circ — $A_N^{\pi^-}$
- \blacksquare — A_N^{eff}

PP – elastic scattering selection

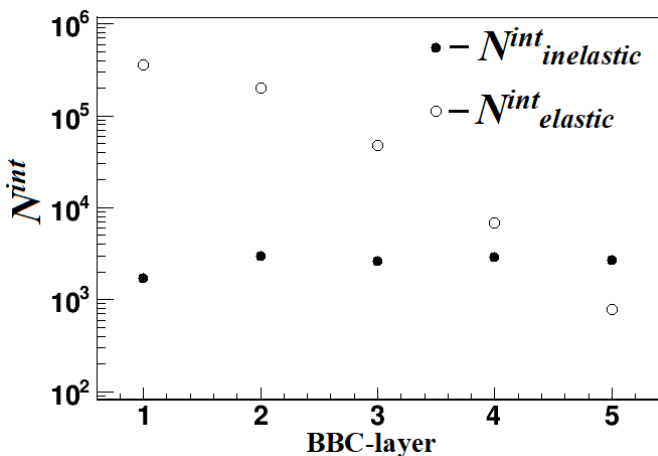
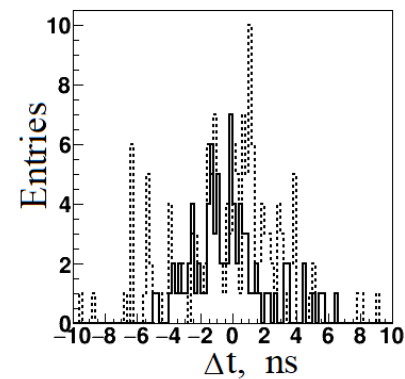
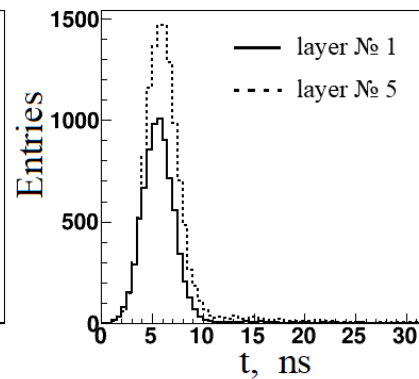
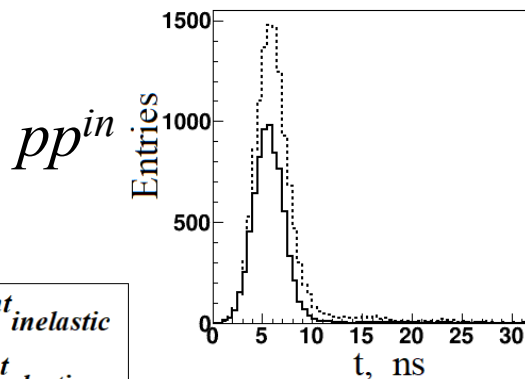
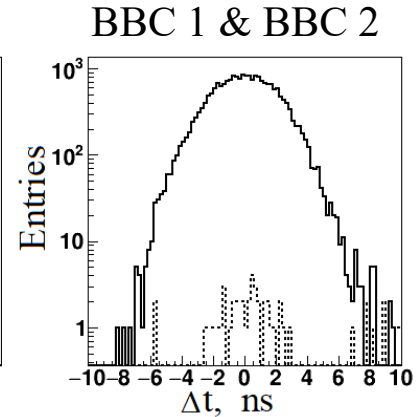
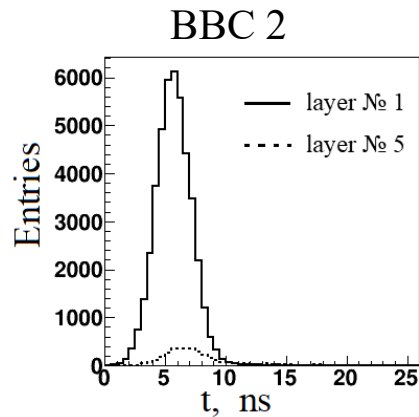
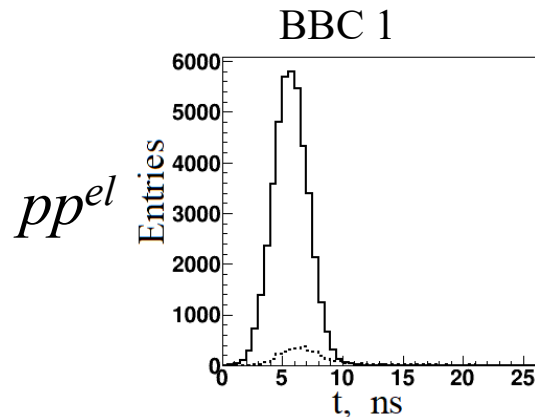
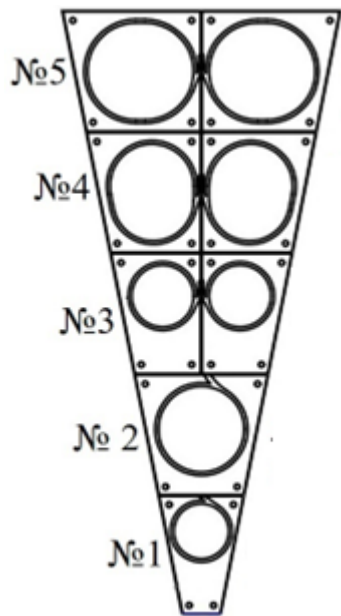
Elastic scattering events can be pre-selected by using the time information of the hits which are observed simultaneously in the both BBCs.



***PP* – elastic scattering selection**

FRITIOF generator, $\sqrt{s} = 10$ GeV, 10^6 events

The simulation of the *pp*-elastic scattering only and *pp*-inelastic scattering only.

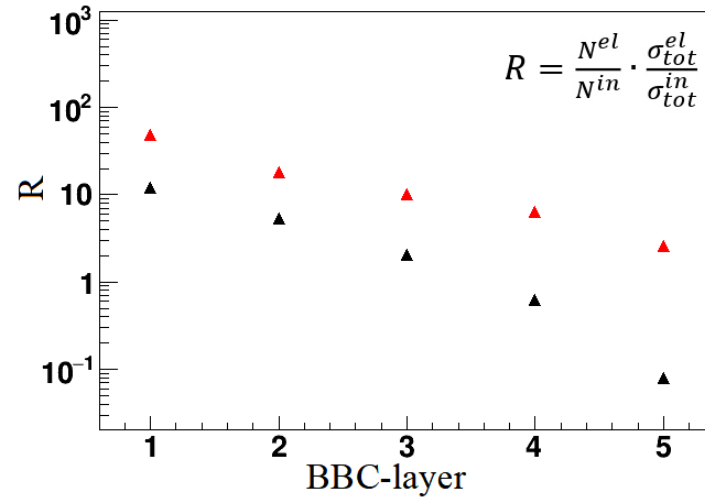
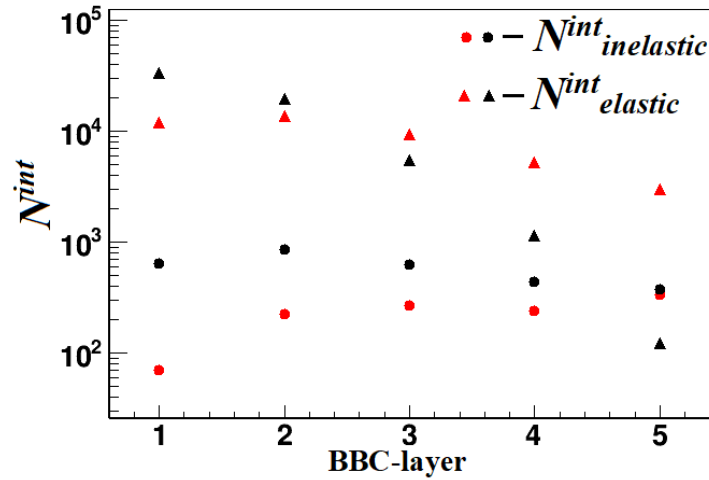


N^{int} – total selected
events in the *i*-layer, *i* = 1...5

PP – elastic scattering selection

FRITIOFF generator, $\sqrt{s} = 6$ and 10 GeV

Black - $\sqrt{s} = 10$ GeV **Red** - $\sqrt{s} = 6$ GeV



$\sqrt{s} = 10$ GeV

BBC-layer	Signal %	Background %
1	92.5	7.5
2	84.4	15.6
3	67.2	32.8
4	38.0	62.0
5	7.3	92.6

$\sqrt{s} = 6$ GeV

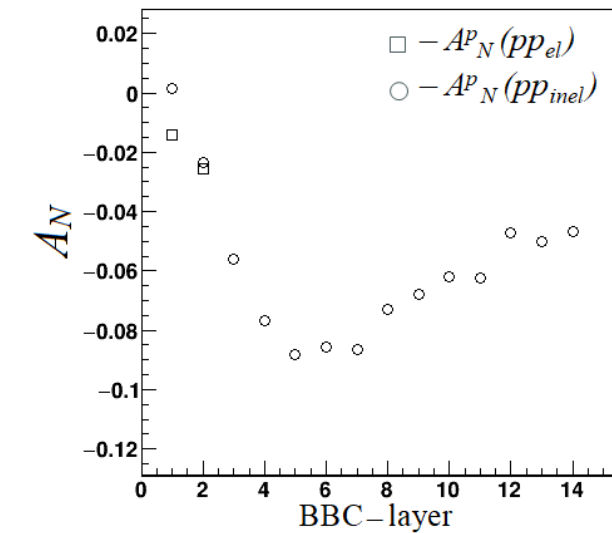
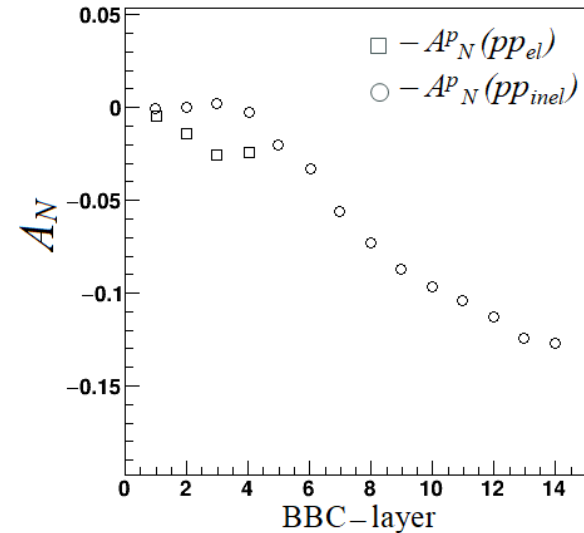
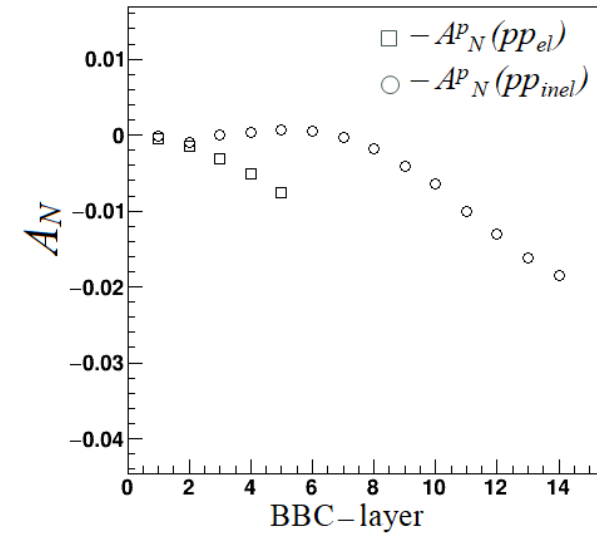
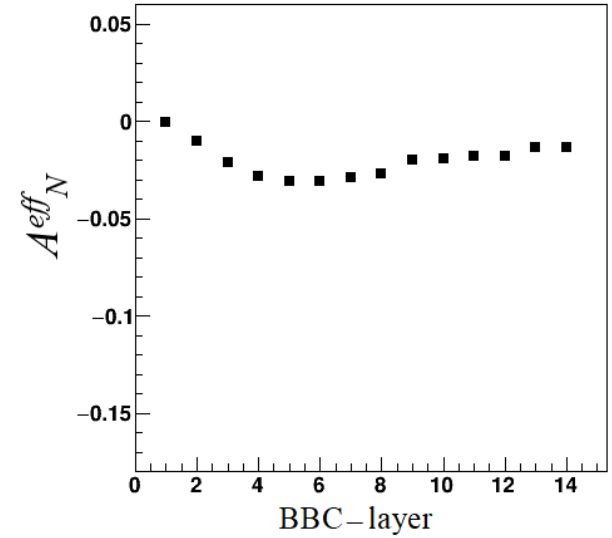
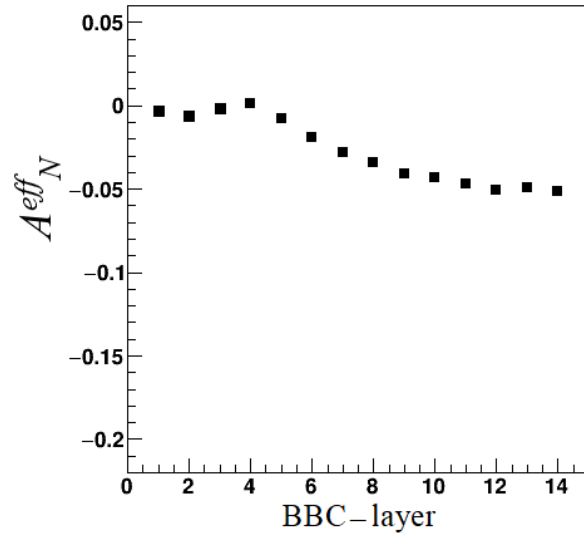
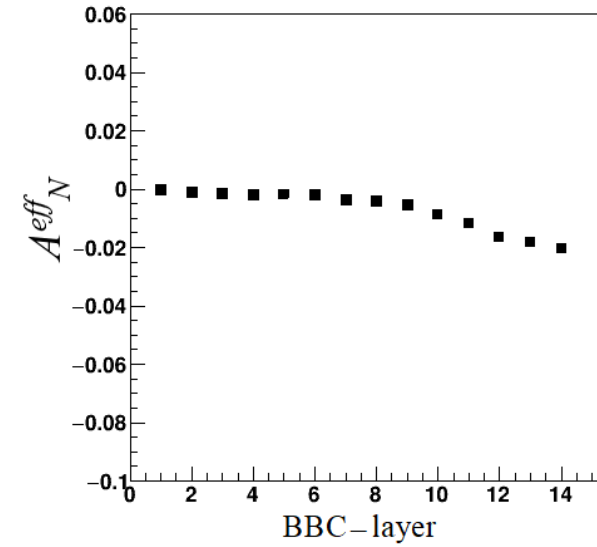
BBC-layer	Signal %	Background %
1	98.0	2.0
2	94.7	5.3
3	90.9	9.1
4	84.4	15.6
5	61.5	38.5

The single scattering asymmetry in the inclusive pp-interaction

$\sqrt{s} = 6 \text{ GeV}$

$\sqrt{s} = 10 \text{ GeV}$

$\sqrt{s} = 27 \text{ GeV}$



Conclusion

- The simulation of the pp – scattering at energies $\sqrt{s} < 27$ GeV has been performed for SPD BBC using the FRITIOF generator within SPDroot framework.
- The efficient analyzing powers A_N have been estimated for pp – interaction at $\sqrt{s} = 6, 10$ and 27 GeV within the framework of the phenomenological model chromomagnetic polarization of quarks. The proton asymmetry gives the leading contribution in to efficient analyzing power A_N^{eff} .
- The role of the pp-elastic scattering has been studied. Is shown that the elastic channel gives the significant contribution to the effective asymmetry at the energies $\sqrt{s} < 10$ GeV. The inelastic channel, on the contrary, gives the significant contribution at the energies $\sqrt{s} > 10$ GeV.
- The significant role of the pp-elastic scattering at energies 10 GeV for first five BBC-layers allows to use the BBC-prototype in the SPD - zero phase.

Thank you for attention!

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