

Generator-level simulations of BBC performance for online polarimetry in the presence of magnetic field

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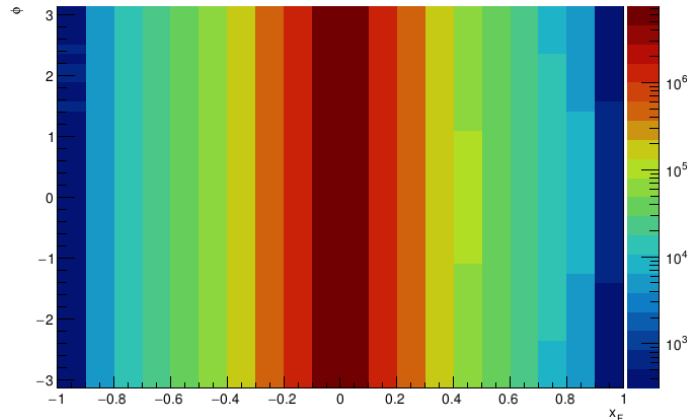
SPD Physics Weekly meeting
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Motivation

- We can expect magnetic field to smear polarization effect for BBC.
- For the time of study we didn't have event generator for collisions of polarized particles.
- Weighting procedure was used.
 - Approach 1: weight each track individually ($w = 1 + A_N(x_F) * \cos(\varphi)$) - will not take into account particle correlation in the event, **not discussed here**.
 - Approach 2: weight event (weight is given by a product of $(1 + A_N(x_F) * \cos(\varphi))$ for each track). Consistency check is required.
 - Weighting error is $\sigma^2 = (\text{sum } w)^2 / (\text{sum } w^2)$.
- Zhanibek has done such study in SpdRoot, but results seemed to have some artifacts.
- Here is generator-level investigation of possible reasons will be given.

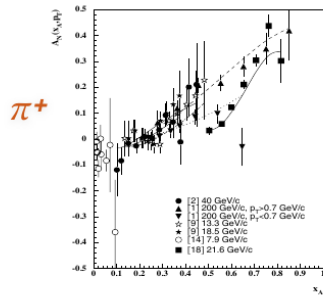
Simulation details

- Constant magnetic field of 1T, $\sqrt{s} = 27$ GeV.
- All tracks are analytically parameterized as helices.
- Rough geometry dimensions are used. Time $t = t(l, pz)$, the rotation angle is determined from $x(t)$ and $y(t)$. Track reaches BBC if when it paths trough BBC plane $r_{\min} < r < r_{\max}$ and $x_F > 0$.
- Two-dimensional histograms $x_F \times \varphi$ for generated particles and for particles in BBC are filled and analyzed.
- Only charged asymmetries of charged pions are considered (**no weight modification due to kaons or protons**)
- For extraction of asymmetries the φ distribution is fitted in each x_F bin.

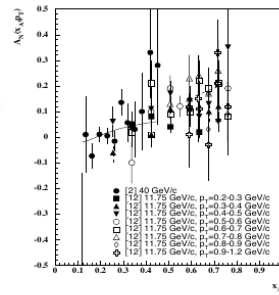


Measured asymmetries

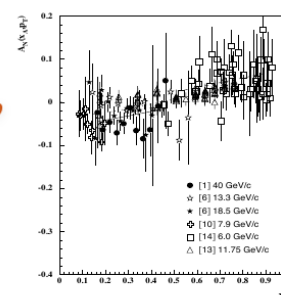
Fixed target experiments (Eur.Phys.J.C14(2000)427)



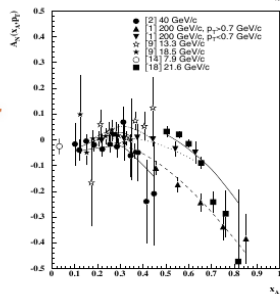
K^+



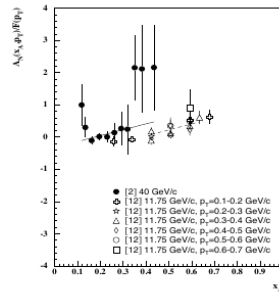
p



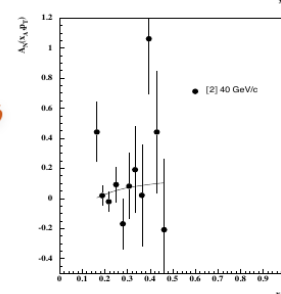
π^-



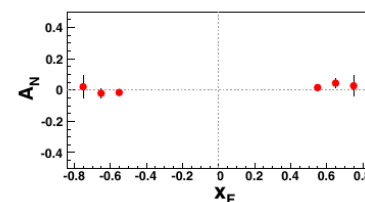
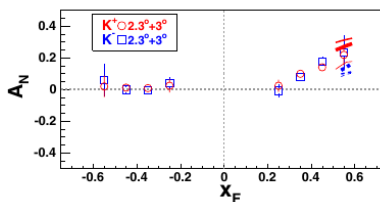
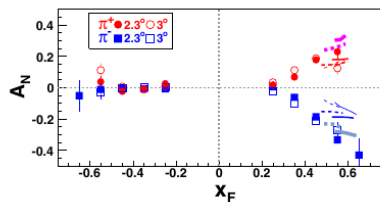
K^-



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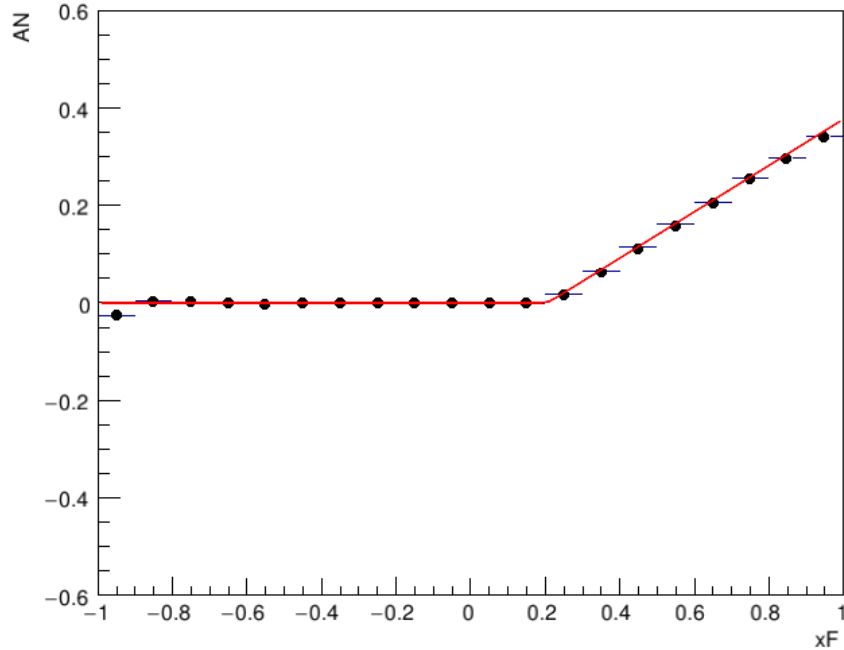


Collider experiment BRAHMS (Phys.Rev.Lett.101(2008)042001)

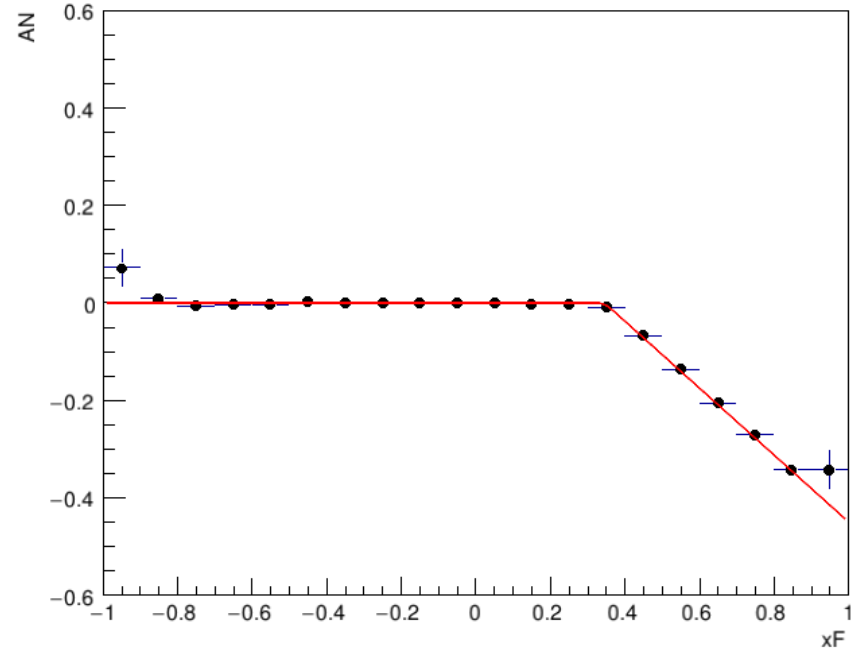


Consistency check for pions

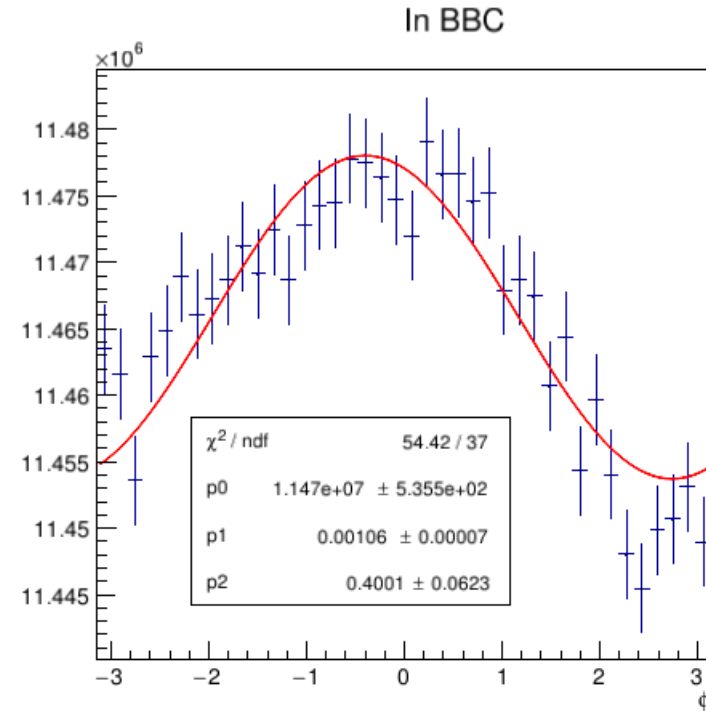
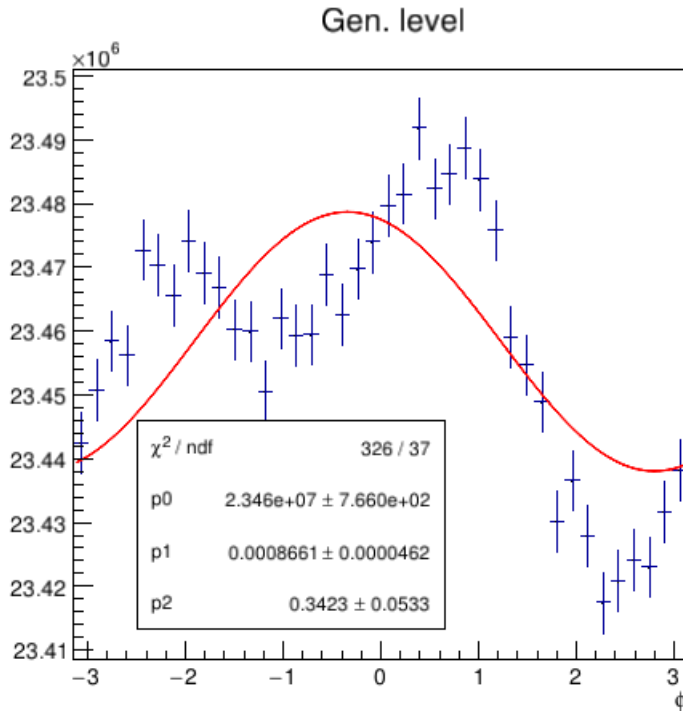
A_N for π^+



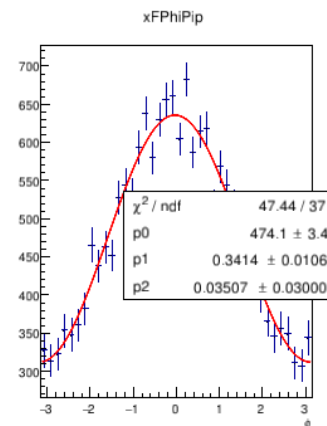
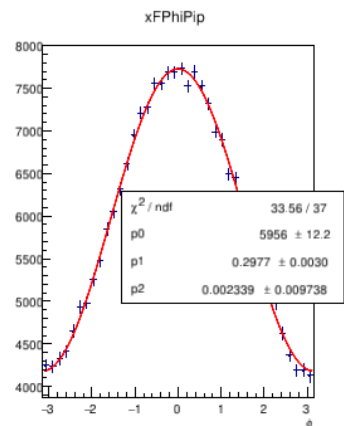
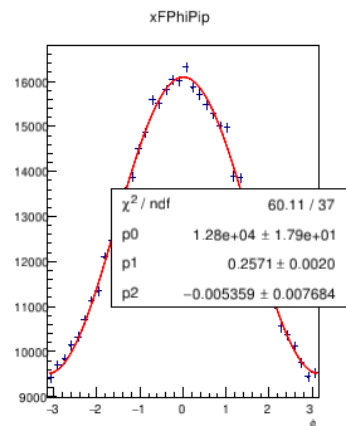
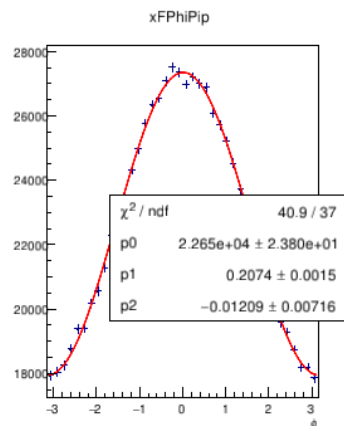
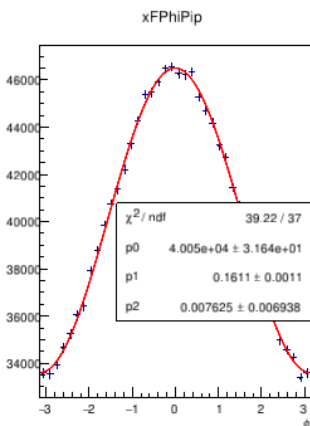
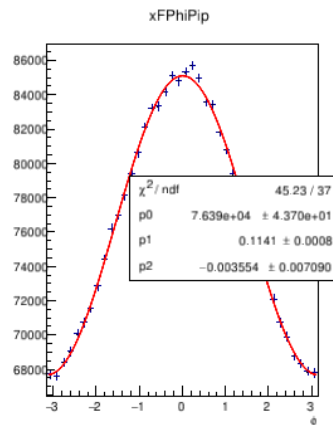
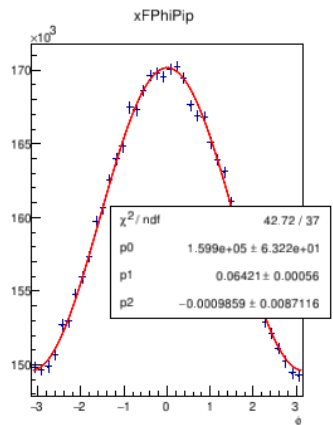
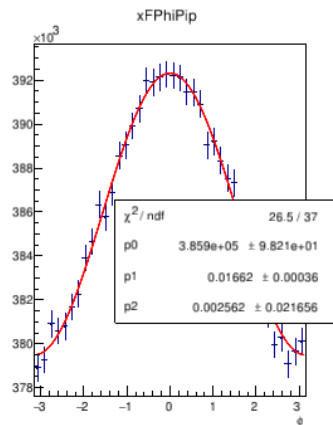
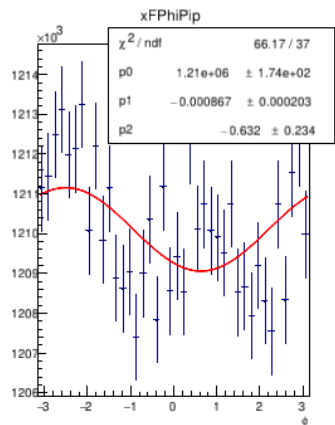
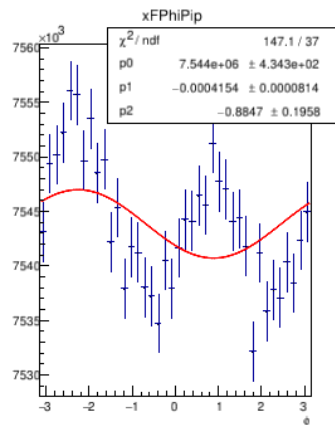
A_N for π^-



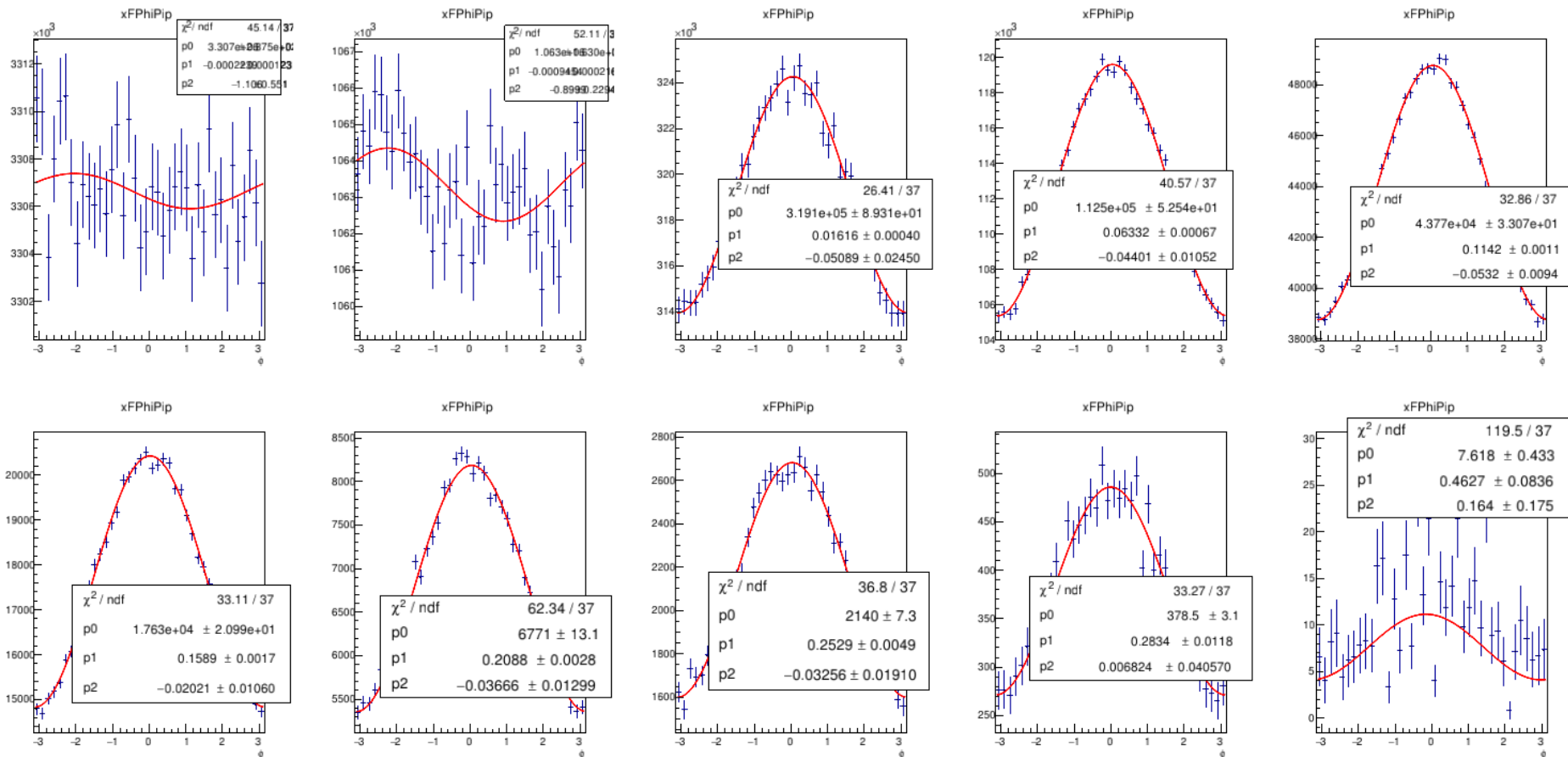
Integral distributions of generated events and tracks in BBC



Generated tracks in x_F bins



Tracks in BBC in x_F bins



- A simple model and weighting procedure are studied at $\sqrt{s} = 27 \text{ GeV}$:
 - There are **notable artifacts** of the weighting procedure in the regions with no asymmetry ($0 < x_F < 0.2$).
 - The asymmetry for $x_F > 0.2$ is almost the same for BBC and generated events.
 - Considering that we do not expect asymmetry in the region where we have artifacts, BBC should perform well in the magnetic field.
- Studies with generators like SPHINX should allow us to get a clear conclusion.
- What about lower energies?