Spin transparency mode at the NICA collider

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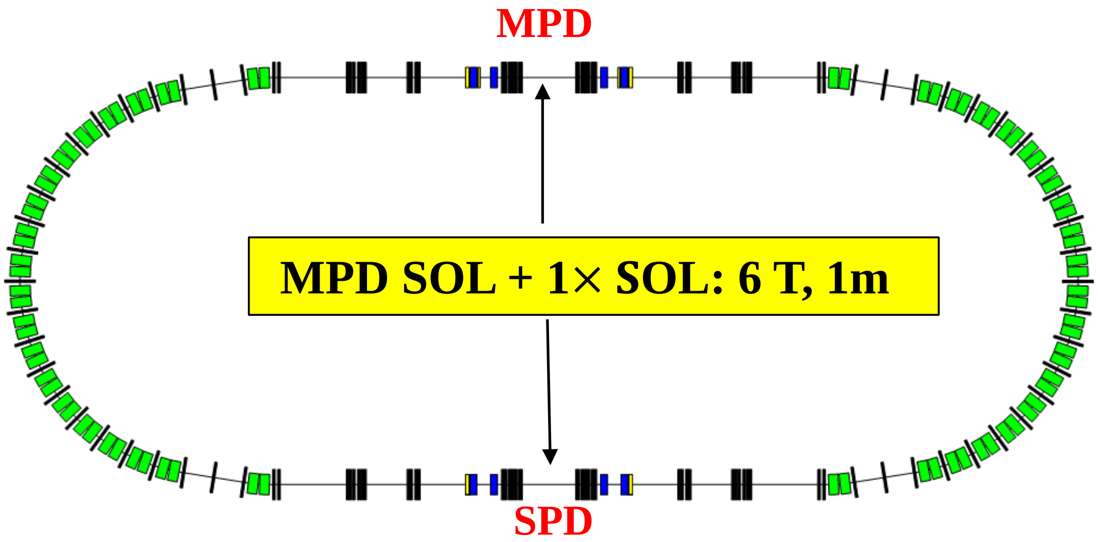
Outline

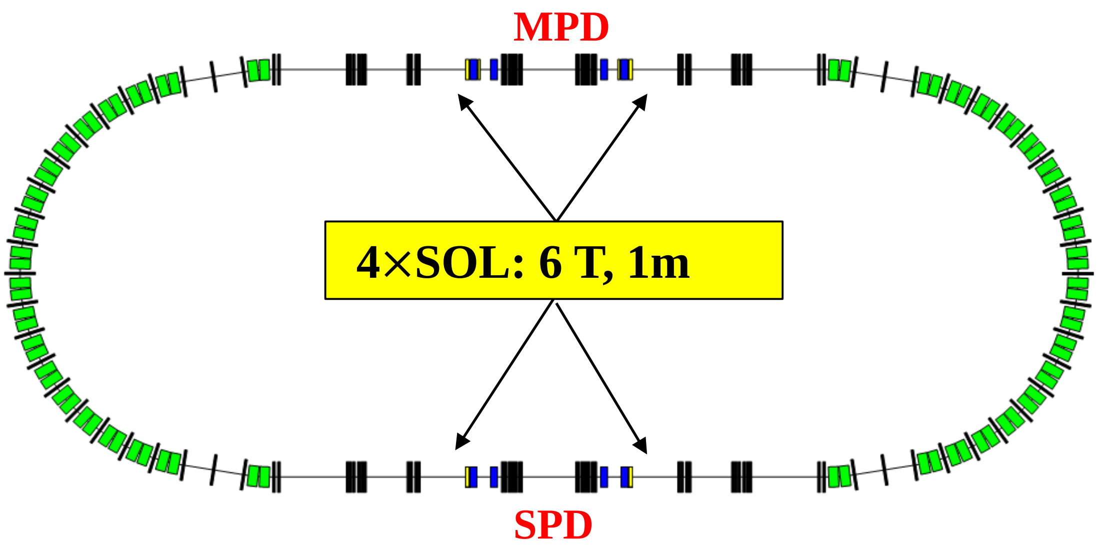
1. Spin Transparency mode in the NICA collider with solenoid snakes
2. Spin Transparency mode in the NICA collider at integer spin resonances
3. 3D spin navigators based on correcting dipoles
4. Conclusion

1-st stage of operating with polarized beams in the ST mode



First configuration:
ST mode with the
MPD and 6T-solenoid

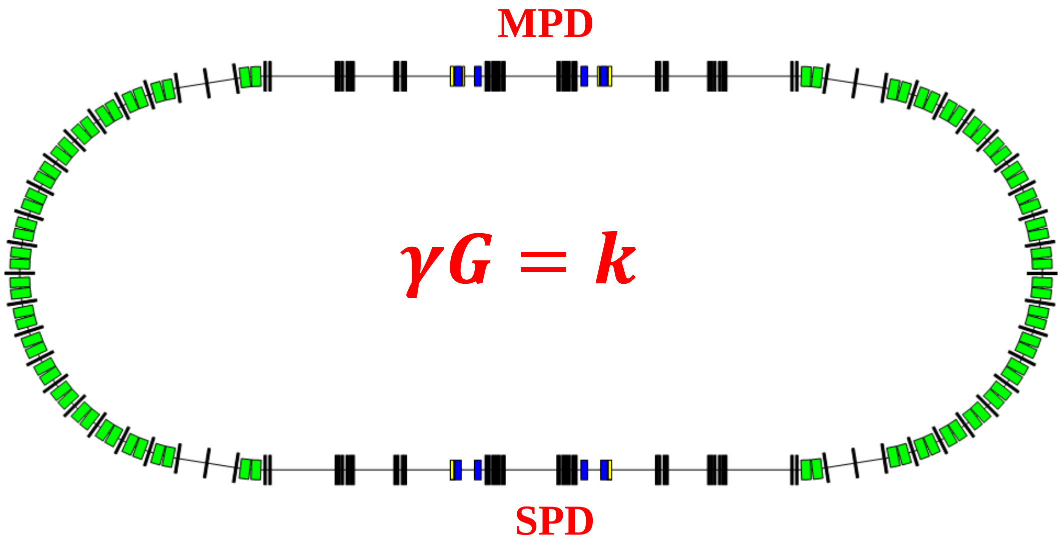
p **up to 1.60 GeV/c**
d **up to 0.49 GeV/c**
He^3 up to 3.66 GeV/c



Second configuration:
ST mode with four
6T-solenoid

p **up to 3.20 GeV/c**
d **up to 0.98 GeV/c**
He^3 up to 7.32 GeV/c

ST mode at integer spin resonances for protons



Protons

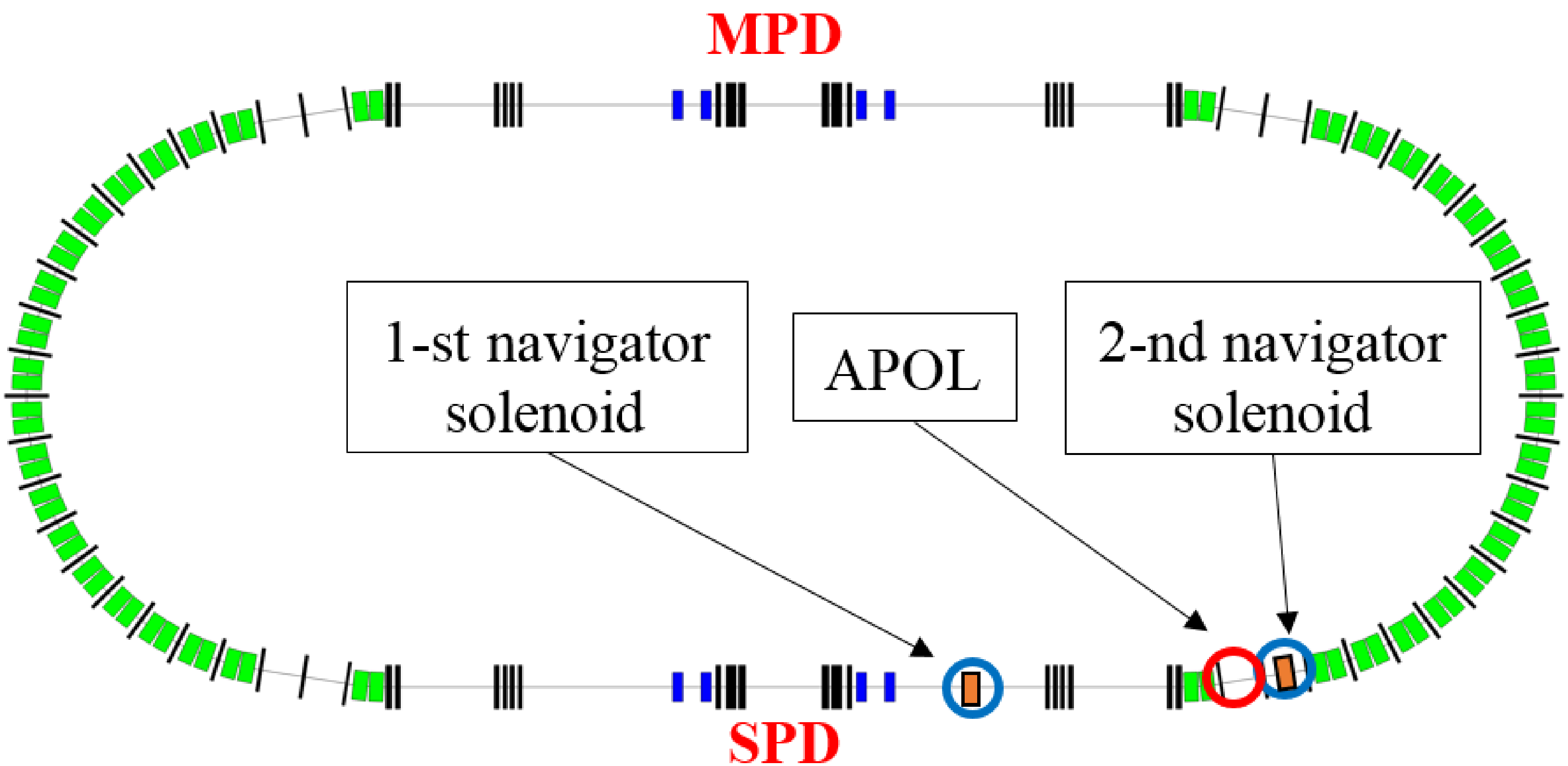
$$pc > 3.2\ \text{GeV}$$

Energy step

$$\Delta E \approx 523\ \text{MeV}$$

- Synchrotron oscillations lead to a series of satellite resonances
- The number and strengths of satellite resonances increases with energy
- The problem of delivering of a polarized beam to the ST-resonance region
- It is required to develop spin navigators taking into account synchrotron oscillations

Spin navigator based on two weak solenoids



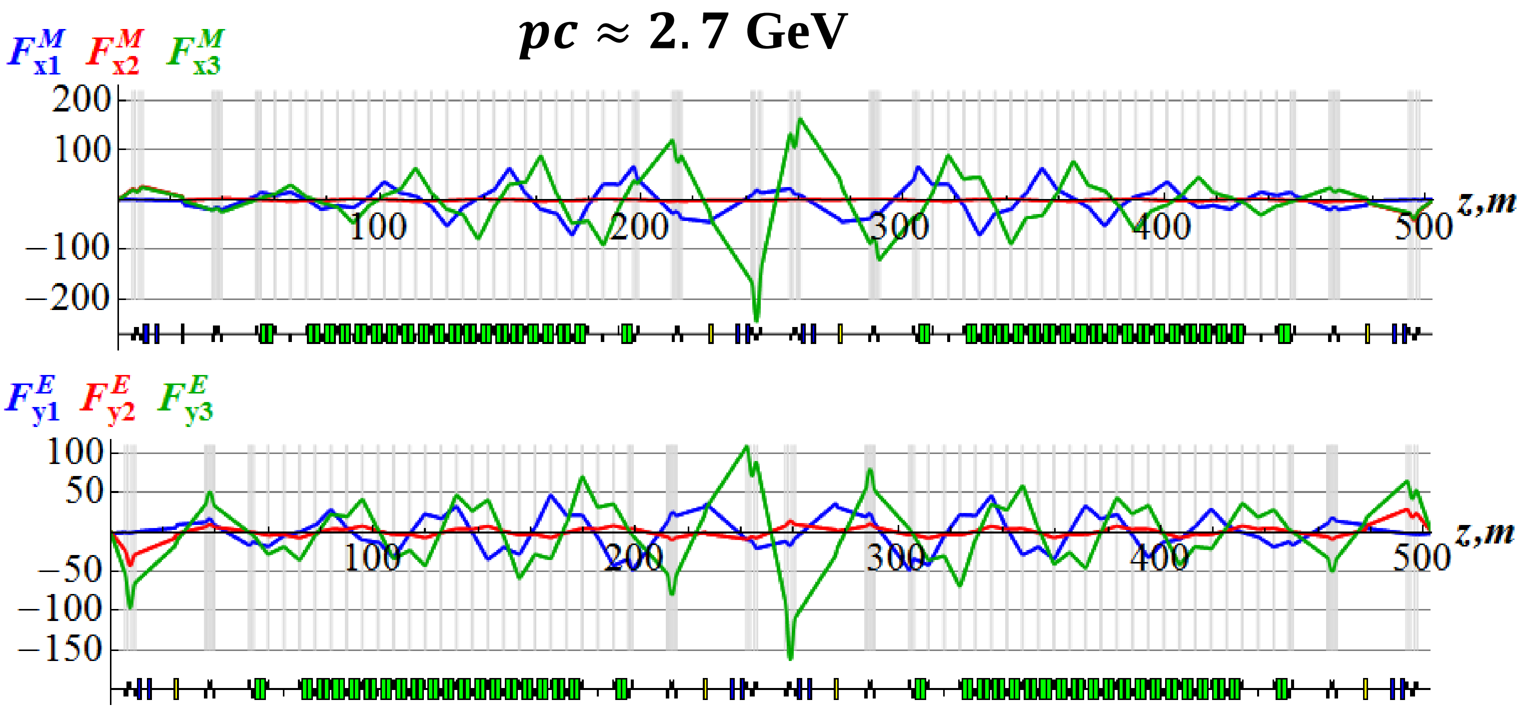
APOL: polarization control in the collider plane
(radial and longitudinal polarization)

3D spin navigator based on correcting dipoles

$$\nu_{nav} n_i = \frac{1}{2\pi} \int_0^L \left[\frac{b_x}{B\rho} F_{xi} + \frac{b_y}{B\rho} F_{yi} \right] dz$$

b_x, b_y are navigator's dipoles (existing correcting dipole)
F_{xi}, F_{yi} are radial and vertical spin response functions

$\vec{S} = \vec{n}$



Field integrals of $b_{\perp} L \sim 10\ mT \cdot m$ are sufficient to provide ν_{nav}=0.01

Spin navigators based on solenoids and dipoles

Navigator fields	additional solenoids	existing correcting dipoles
Polarization control	2D-navigator	3D-navigator
Distortion of the closed orbit	No	Yes
Momentum dependence	$(BL)_{nav}$ is proportional to the beam momentum	$(BL)_{nav}$ is weakly dependent on the beam momentum
$\nu_{nav} = 0.01$ **at 13.5 GeV/c**	$(BL)_{nav} \sim 0.5$ T·m	$(BL)_{nav} \sim 0.01$ T·m
Compensation of the ST-resonance strength	partial compensation	complete compensation

Conclusion

It is required:

- to analyze the influence of synchrotron oscillations on polarization in the region of integer spin resonances
- to develop 3D spin navigators based on correcting dipoles
- to provide simultaneous measurement of the radial and vertical polarization components

Thank you for your attention!