On SPD inner tracker for the first stage

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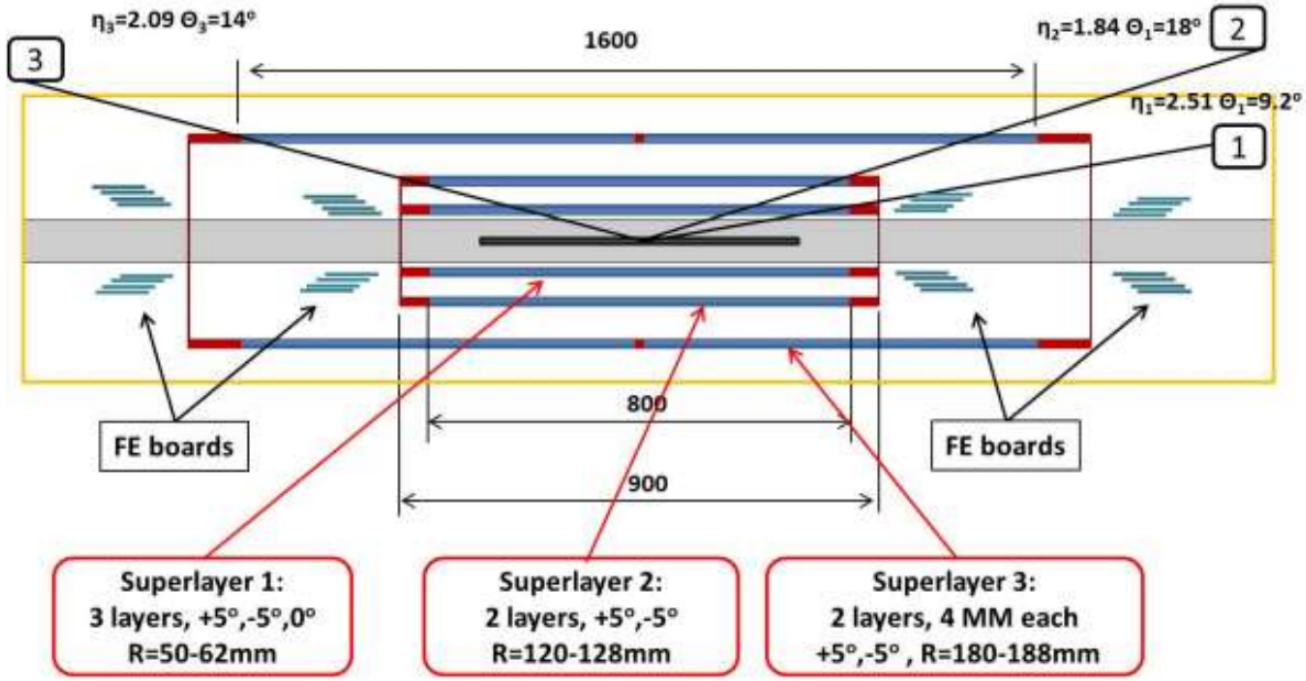
The **actual work** is performed by:

- Vladimir Andreev
- Artur Tkachenko
- Dmitry Dedovich

Motivation

- At the first stage of operation MAPS or DSSD vertex detector will not be installed.
- The absence of the tracker close to the beam pipe leads to dramatic worsening of momentum resolution.
- An inner tracker based on Micromegas technology is proposed for the 1-st stage running. Its cost is estimated to be less than 10% of the silicon detector.
- The design of the inner tracker has suggested by Dmitry Dedovich, described in SpdRoot by Artur Tkachenko, and its impact on momentum resolution has been estimated by Vladimir Andreev.

Suggested set-up



- MM single layer: strips, resolution of ~150μ
- radiation sickness of each layer – 0.4%

For details see talk by Dmitry at the last CM!

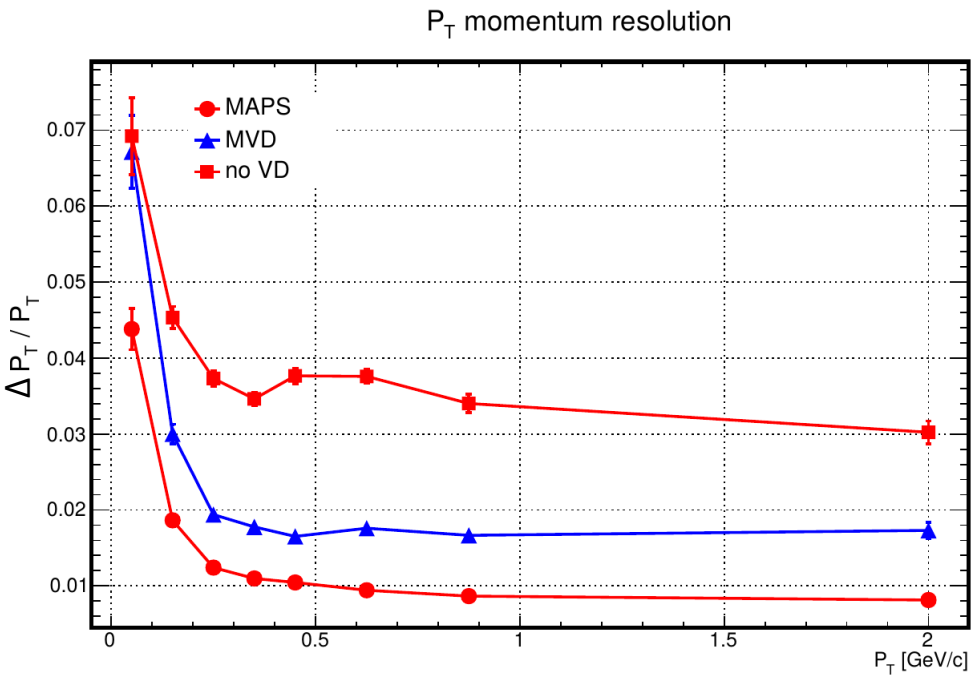
Is it an optimal set-up?

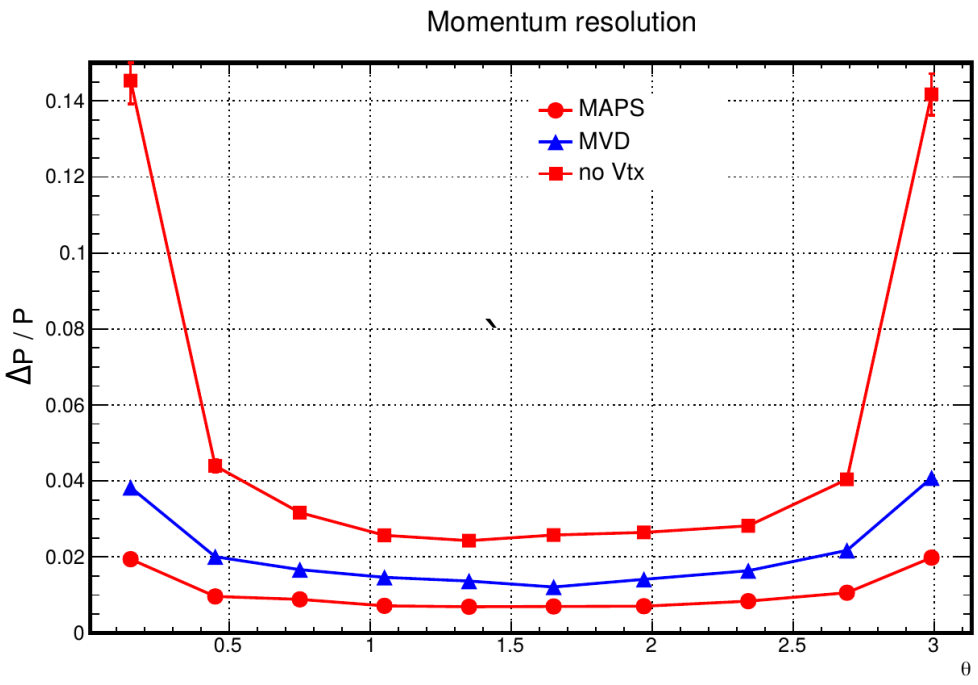
- Considering momentum resolution only one layer set-up might be better.
- But the final decision should also take into account
  - pattern recognition,
  - performance for small p_T tracks,
  - stability with respect to unknown yet beam conditions.
- For the following the shown set-up is adopted.

Momentum resolution for 1 GeV muons (%) in the barrel					
Angle (deg)	Straw	Straw + MVD1	Straw + MVD2	Straw + MVD3	Straw + MAPS
45	2.56	1.52	1.54	1.45	0.76
90	2.50	1.34	1.39	1.30	0.67

Inner tracker set-up:
- MVD1 – described at the prev. slide
- MVD2 – two superlayers, 3 MM layers in each
- MVD3 – one superlayers, with 3 MM layers

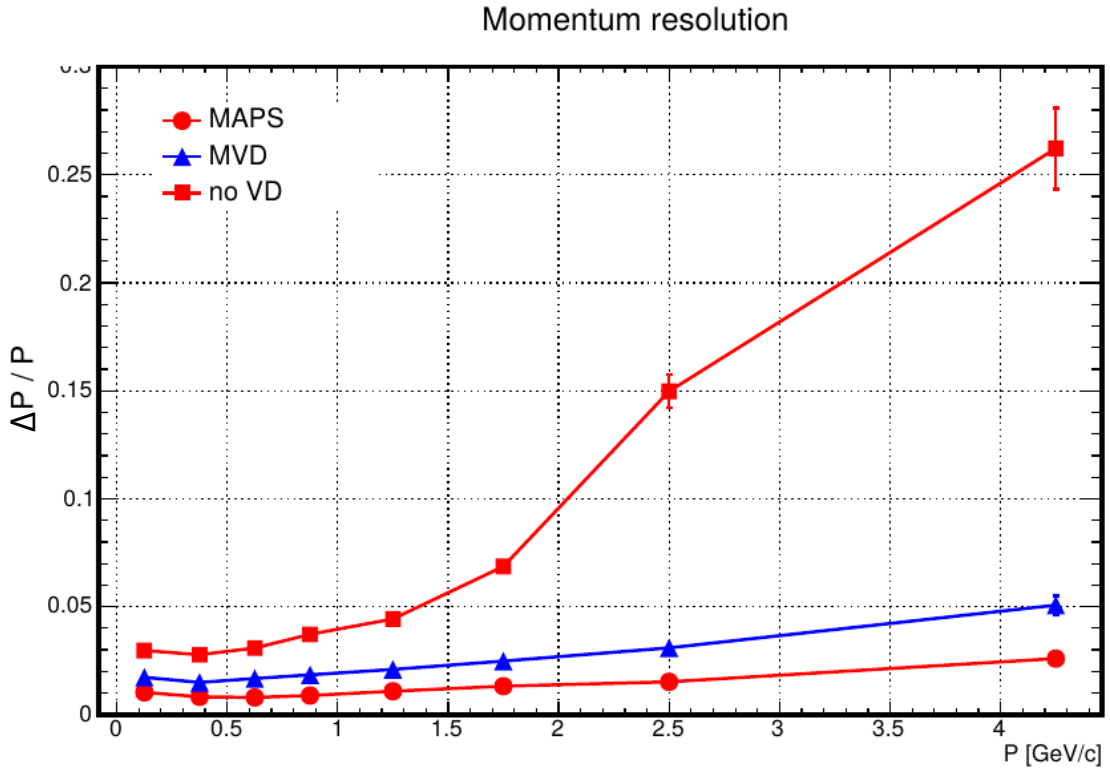
Impact on momentum resolution





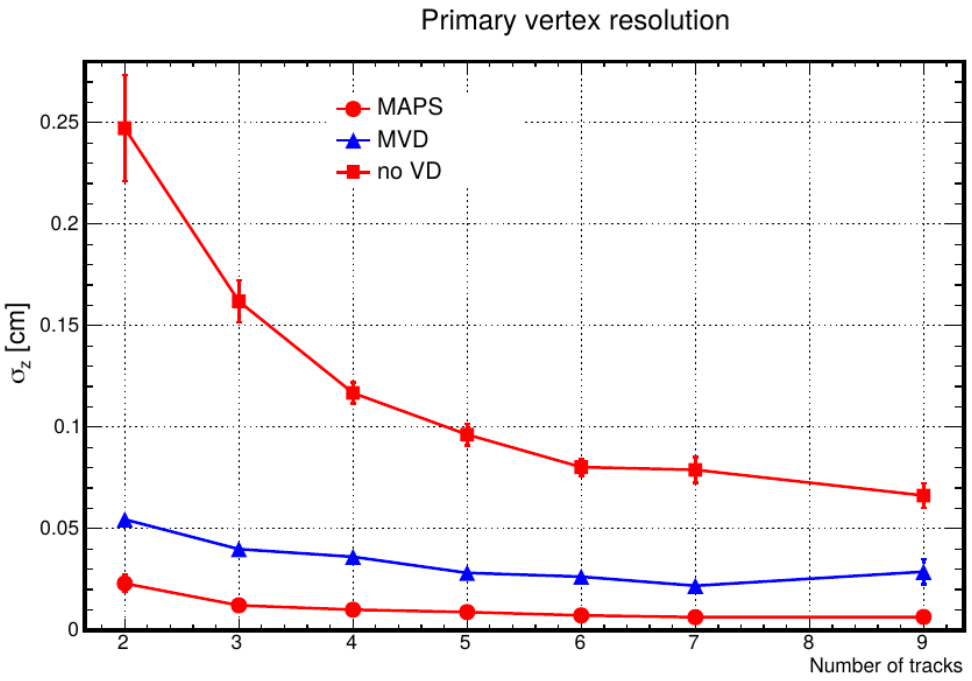
Sample: Pythia8 minimum bias at 10 GeV.

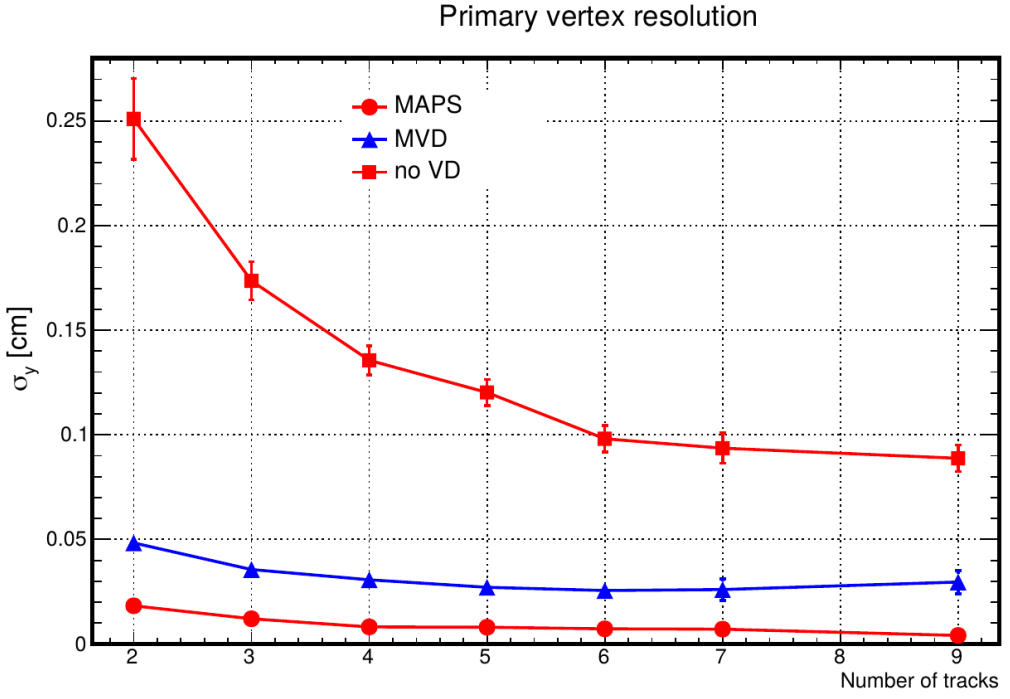
Impact on momentum resolution



Sample: Pythia8 minimum bias at 10 GeV.

Impact on vertexing





Sample: Pythia8 minimum bias at 10 GeV.

Important for reconstruction of K_S and Λ at low energies.

Summary

- The absence of the tracker close to the beam pipe results in dramatic degradation of momentum resolution (especially in specific kinematic regions).
- This problem can be solved with inner tracker based on Micromegas technology, which is affordable for the 1-st stage running.
- The final design of IT should be chosen based on several arguments (momentum resolution, efficiency of low-p_T tracks reconstruction, impact pattern recognition, stability with respect to beam conditions). The shown configuration seems to be the safest choice.
- The macro for simulation with this configuration will released with the new SpdRoot release.
- Thanks to all involved!