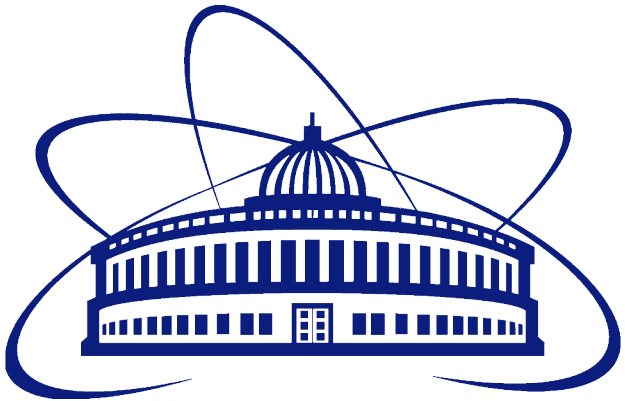


SVD description update

Review and recommendations

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Introduction

Silicon vertex detector (SVD) is responsible for precise determination of the primary interaction point and measurement of the secondary vertices from the decays of short-lived particles.

SVD is planned to be installed in the second stage of SPD operation.

It is assumed that it will be based on one of two technologies: MAPS (main) and DSSD (backup).

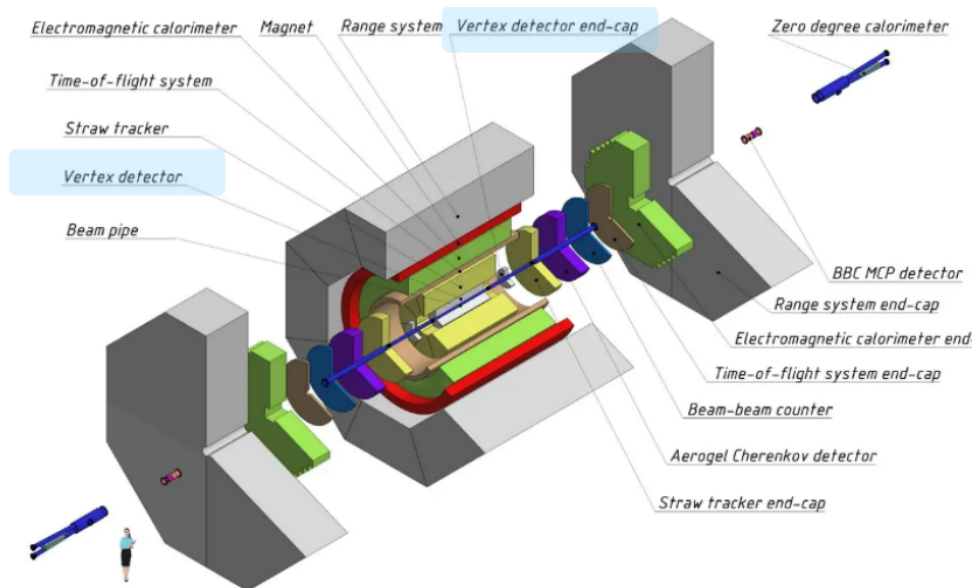
The main task:

Separate MAPS and DSSD description in SpdRoot source code;

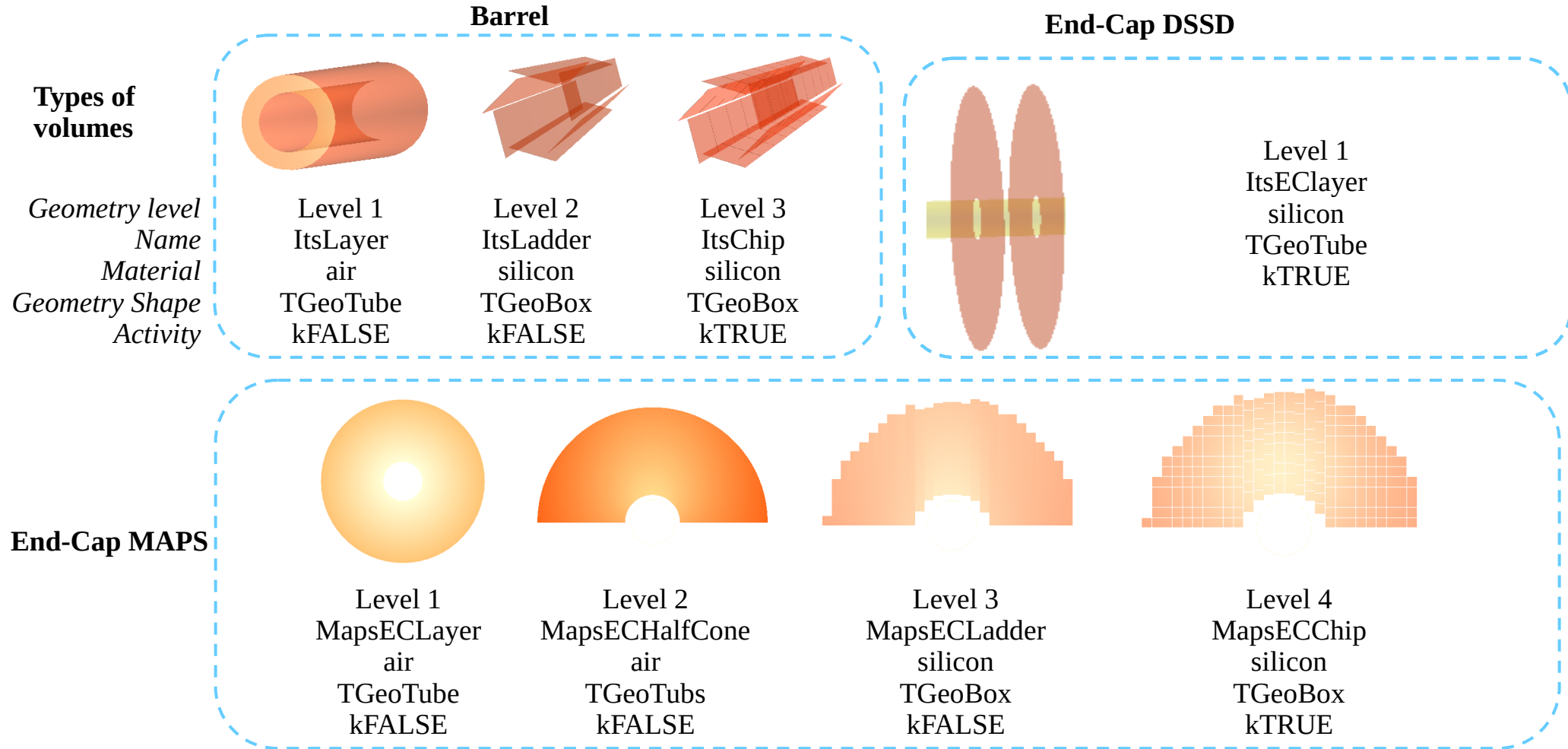
The changes are stored in the branch:

https://git.jinr.ru/avasyukov/spdroot/-/tree/devSVD_Vasyukov

- MAPS/DSSD separation
- End-Caps for SVD based on MAPS technology

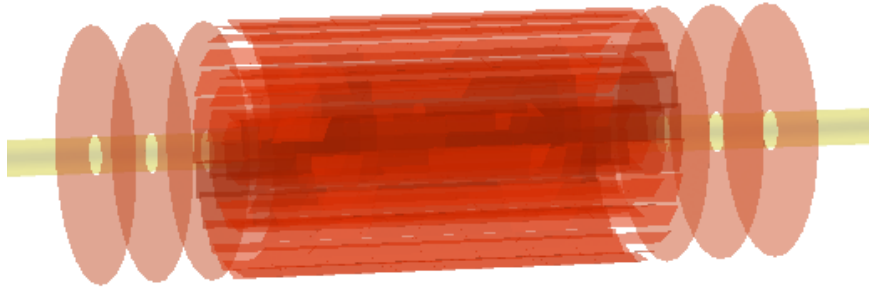


SVD in SpdRoot source code. Geometry model.

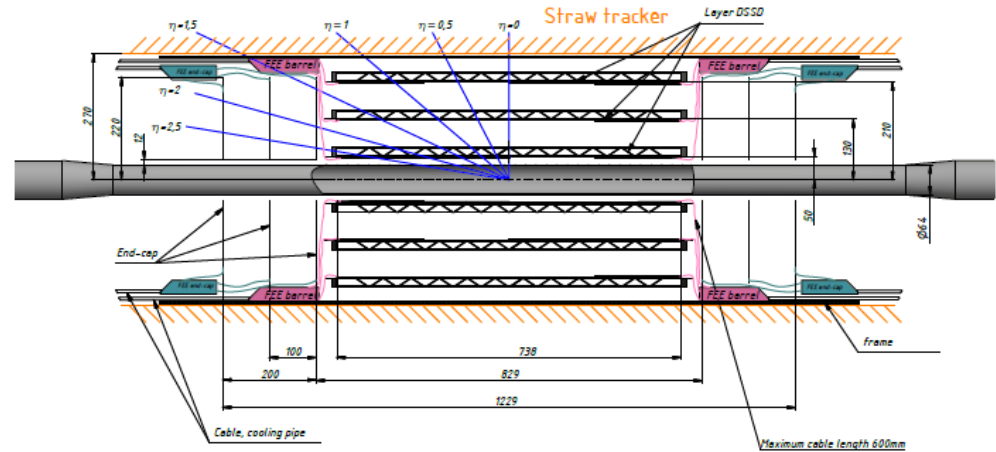


SVD in SpdRoot source code Dssd

SpdRoot



TDR



- Barrel layer thickness: 500 μm ;
- Local rotation angle for ladder: 15 grad;
- End-cap disk parameters:
 - Width: 300 μm ;
 - R_{min} : 3.5 cm; (TDR 3.2 cm)
 - R_{max} : 22 cm; (TDR)
- Positions of DSSD end-caps:
 - ± 41.45 cm; (TDR)
 - ± 51.45 cm; (TDR)
 - ± 61.45 cm; (TDR)

After separation 1 possible geotype:

```
SpdDssdGeoMapper::Instance() → SetGeometryPars(1);
```

Instead of

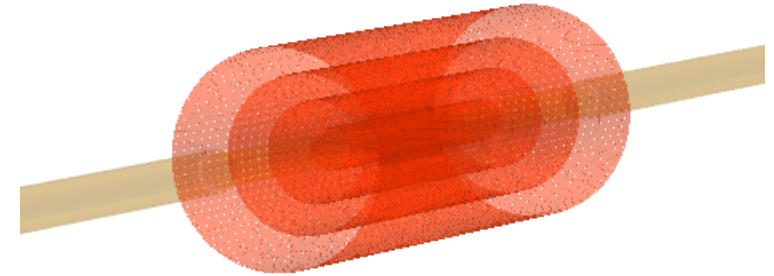
```
SpdItsGeoMapperX::Instance()->SetGeometryPars(3,2);
```

SVD in SpdRoot source code Maps

- Barrel layer thickness: 330 μm ($0.35\%X_0$);
- Radii of layers: 40 mm, 96 mm, 152 mm, 210 mm
- The lengths of layers are 762 mm, 889 mm, 1016 mm, 1270 mm;

- 1/2/3 layers;
- EC Ladder thickness: 290 μm ($0.3\%X_0$)
- EC Layer material budget: 290 + 290 μm of silicon
0.6% X_0 MFT Alice TDR;
- Distance between sensitive planes: 5 mm;
- Rmin: 5cm;
- Rmax: 21 cm (as for Barrel);
- Position 1 layer: ± 69 cm; (geotype 1, 2);
- Position 2 layer: ± 74 cm; (geotype 3, 4)
- Position 3 layer: ± 79 cm; (geotype 5, 6)

SpdRoot



After separation 6 possible geotypes (they differ in End-cap configurations):

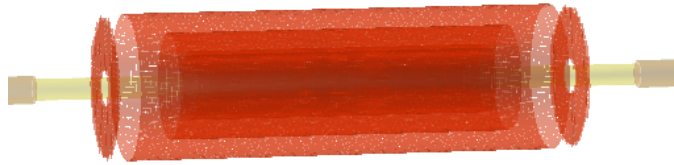
```
SpdMapsGeoMapper::Instance() → SetGeometryPars(1);  
SpdMapsGeoMapper::Instance() → EnableEndcaps(0);
```

Instead of

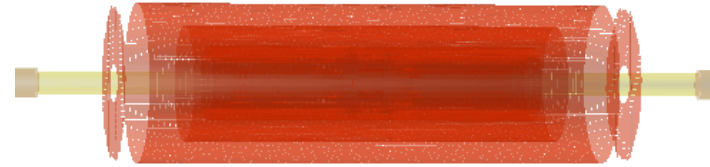
```
SpdItsGeoMapperX::Instance()->SetGeometryPars(1,1);
```

SVD in SpdRoot source code Maps. Geotypes.

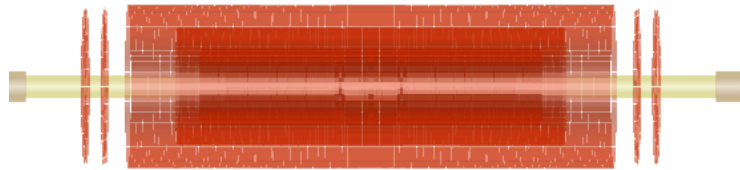
SpdMapsGeoMapper::Instance() → SetGeometryPars(1);



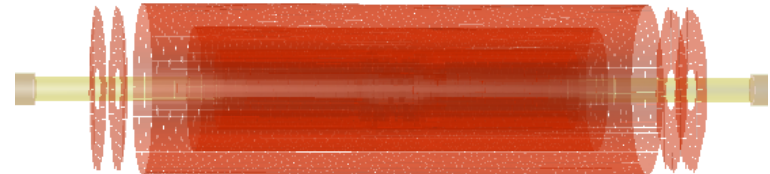
SpdMapsGeoMapper::Instance() → SetGeometryPars(2);



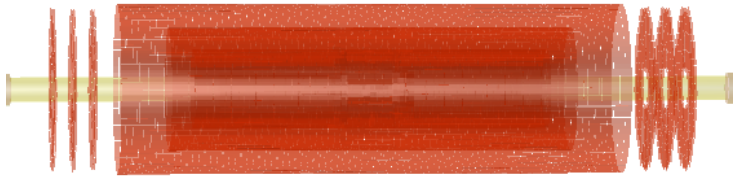
SpdMapsGeoMapper::Instance() → SetGeometryPars(3);



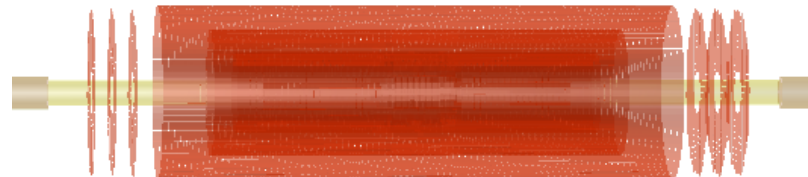
SpdMapsGeoMapper::Instance() → SetGeometryPars(4);



SpdMapsGeoMapper::Instance() → SetGeometryPars(5);



SpdMapsGeoMapper::Instance() → SetGeometryPars(6);



Workflow of adding SVD to simulation

1) Choose geotype:

```
SpdDssdGeoMapper::Instance() → SetGeometryPars(1);
```

```
SpdMapsGeoMapper::Instance() → SetGeometryPars(geotype);  
geotype = 1, 2, 3, 4, 5, 6
```

2) Customize the geometric model, if necessary (see next slide);

3) Create SpdDssd/SpdMaps object and add it to SpdRunSim;



All customization should be done before locking the geometry!

Example

```
SpdRunSim* run = new SpdRunSim();  
// ..... //  
// choose geotype  
SpdMapsGeoMapper::Instance() → SetGeometryPars(4);  
// customize  
SpdMapsGeoMapper::Instance() → SetECLayerRmaxAll(30.); // Change max radii for all EC layers from 21 to 30 cm  
// Add Maps SVD to simulation  
SpdMaps* vxdet = new SpdMaps();  
run->AddModule(its);
```

SpdMapsGeoMapper usefull methods

- **void SpdMapsGeoMapper::EnableEndcaps(Bool_t on)**
By default End-Caps are enabled;
- **void SpdMapsGeoMapper::addECLayer(Double_t PosZ /*cm*/)**
That method creates additional EC layer in the PosZ position along z axis;
- **void SpdMapsGeoMapper::SetECLayerRmaxAll(Double_t Rmax/*cm*/)**
- changes the max radius of EC layers;
- **void SpdMapsGeoMapper::SetECLayerRminAll(Double_t Rmin/*cm*/)**
- changes the min radius of EC layers;
- **void SpdMapsGeoMapper::SetECLayerDzAll(Double_t Dz)**
- changes distance between sensor planes of EC layers;
- **void SpdMapsGeoMapper::SetECLayerNhalfConesAll(Double_t NhalfCones)**
NhalfCones = 2 — 1 sensor planes, 4 — 2 sensor planes;

(for all layers)

Note: if $NhalfCones = 2 \Rightarrow Dz = 0$;

Conclusion and plans

- The descriptions of the MAPS and DSSD detectors have been completely separated in source code;
- End-caps description for MAPS has been developed. Further optimization study is needed;

To do:

- Push updates in development branch of SpdRoot main repository.
- Realistic description of DSSD End-caps;
- Add option for different EC layers radii;

Thank you for your attention!

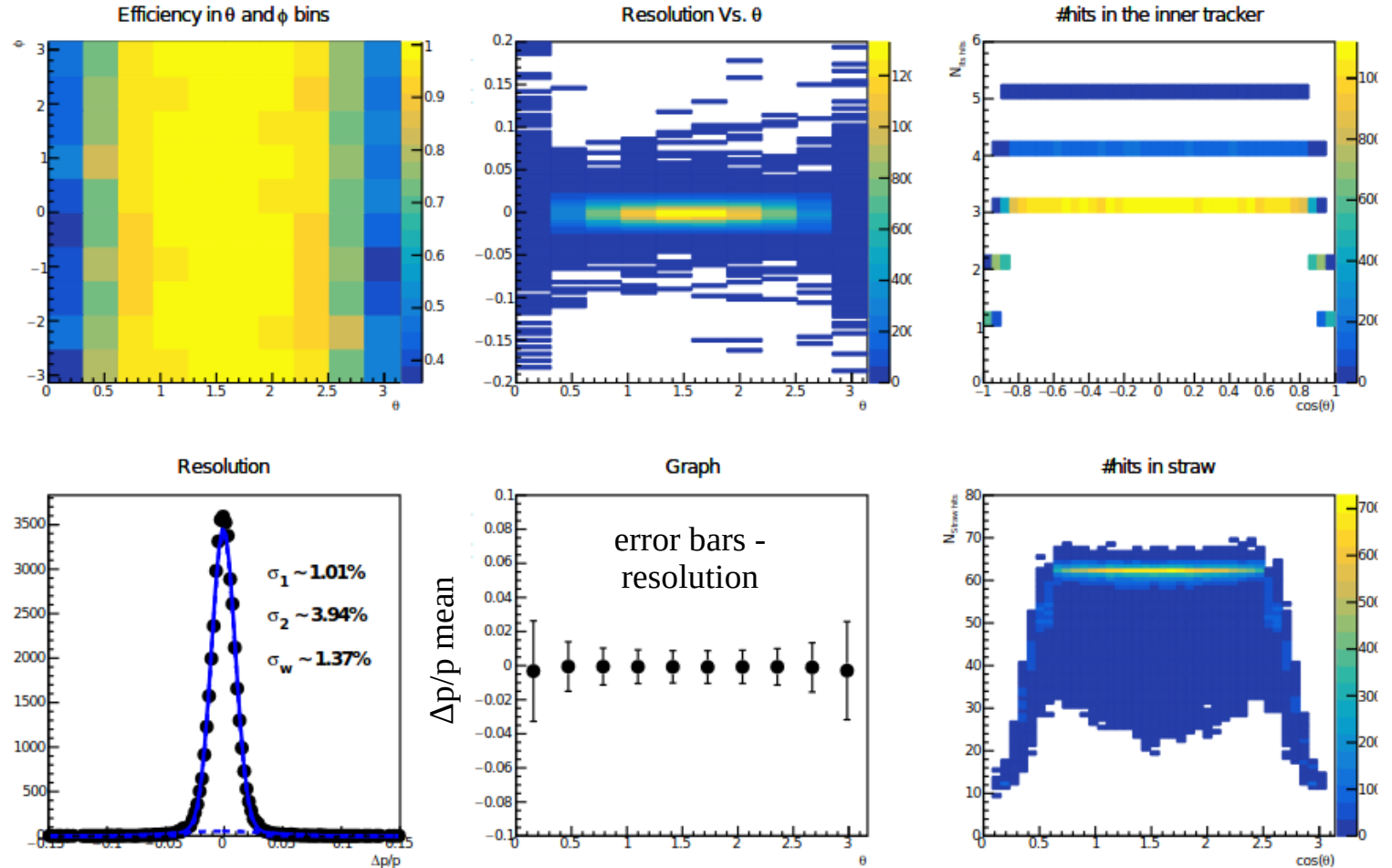
SVD performance test DSSD (no End-Caps)

Isotopic production of 1.5 GeV muons at (0, 0, 0) point

Detector subsystems:

- Dssd SVD
- Straw tracker (barrel + EC)

Magnetic field is on



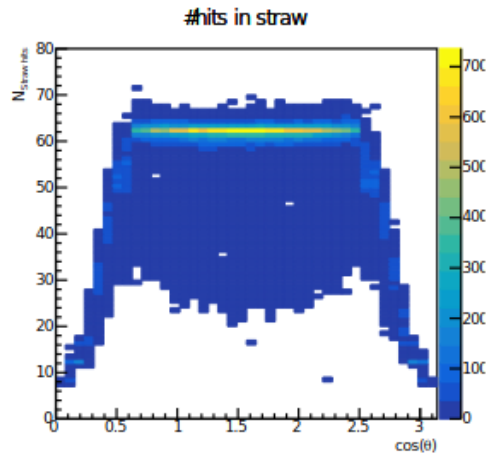
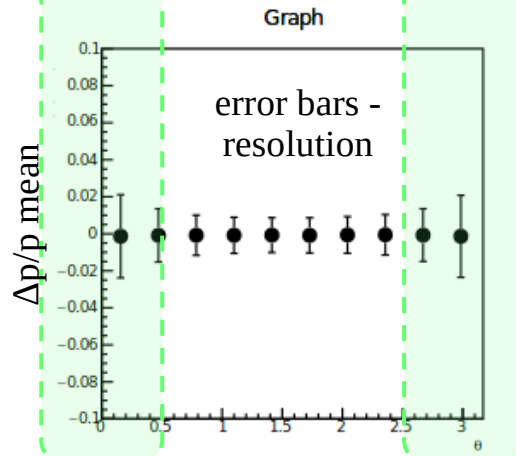
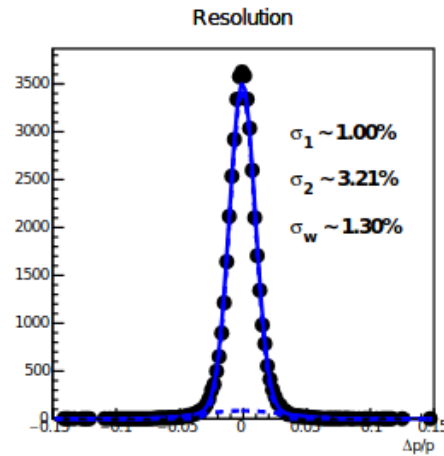
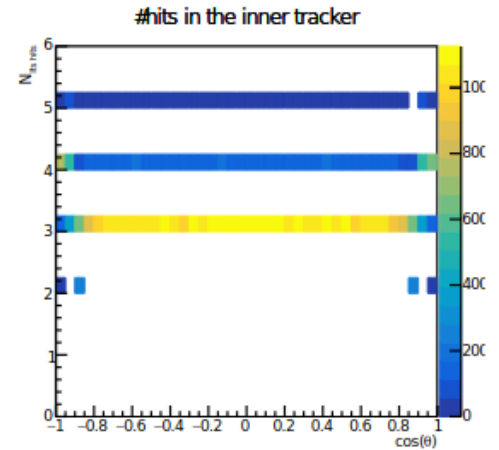
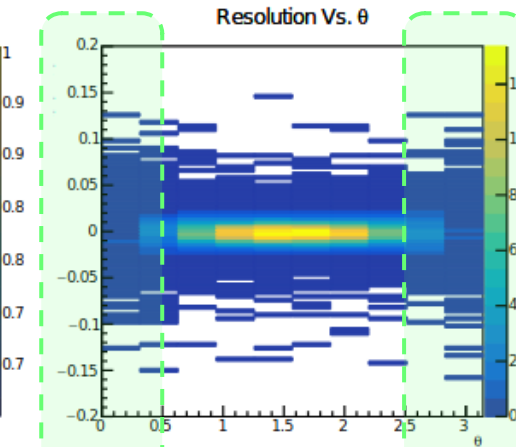
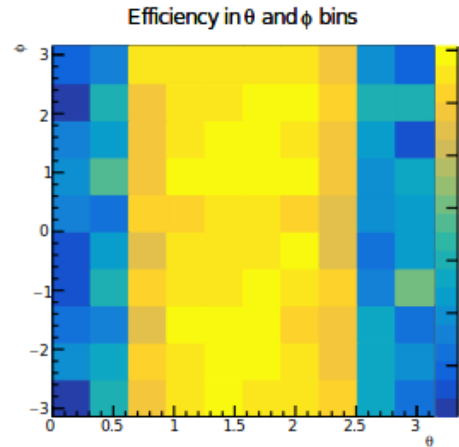
SVD performance test DSSD (with End-Caps)

Isotopic production of 1.5 GeV muons at (0, 0, 0) point

Detector subsystems:

- Dssd SVD
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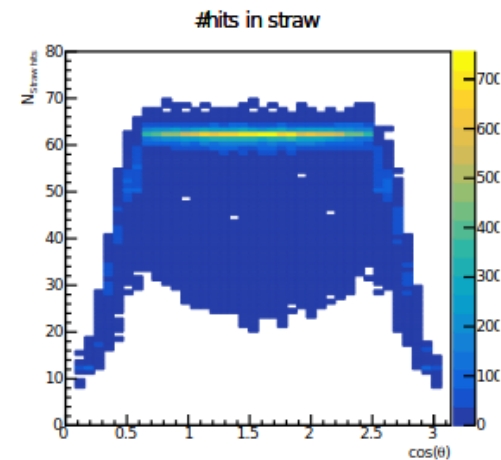
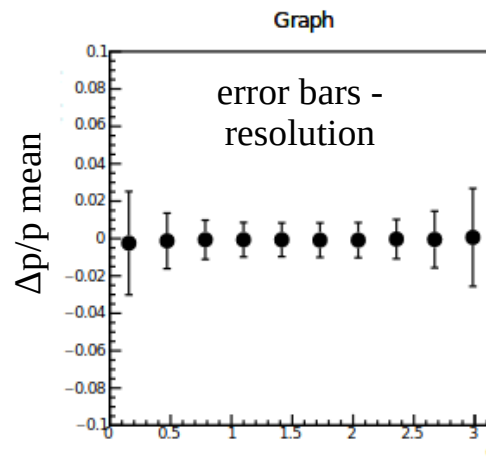
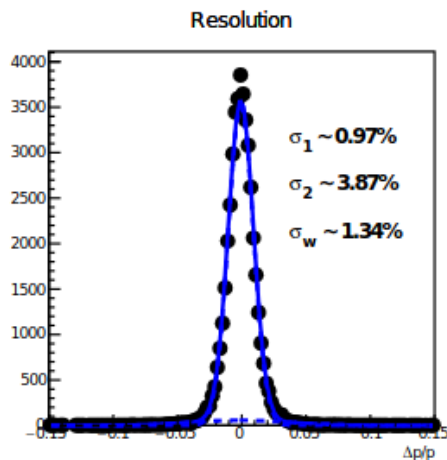
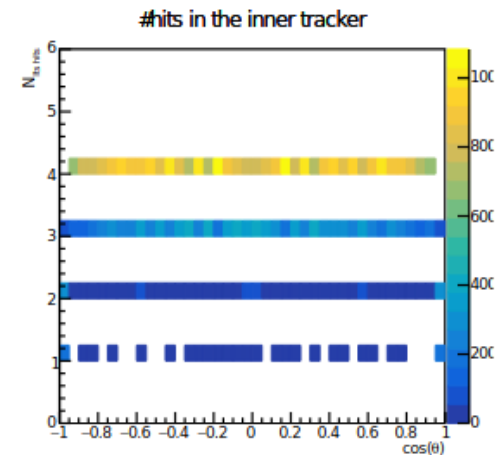
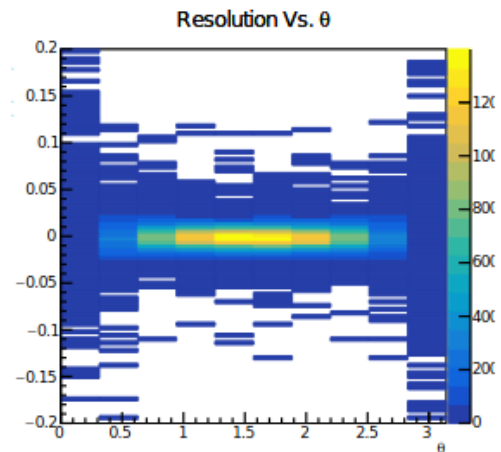
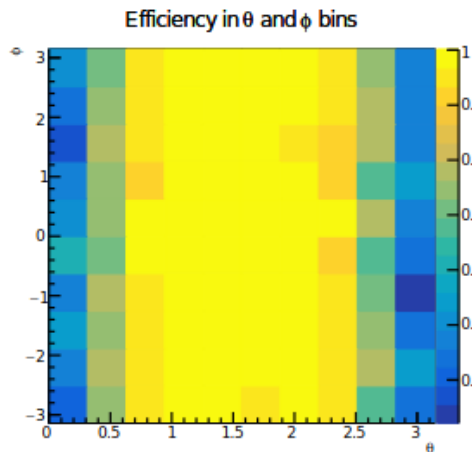
SVD performance test MAPS (no End-Caps)

Isotopic production of 1.5 GeV muons at (0, 0, 0) point

Detector subsystems:

- Dssd SVD
- Straw tracker (barrel + EC)

Magnetic field is on



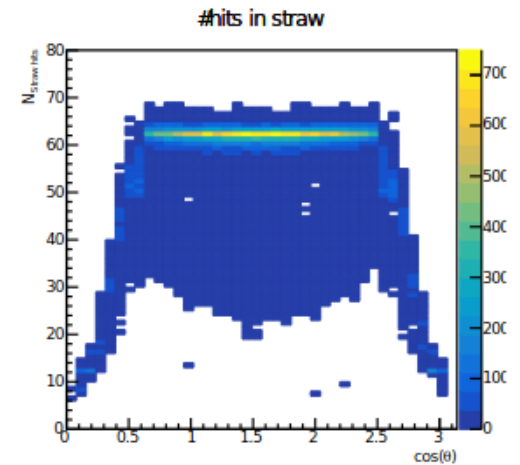
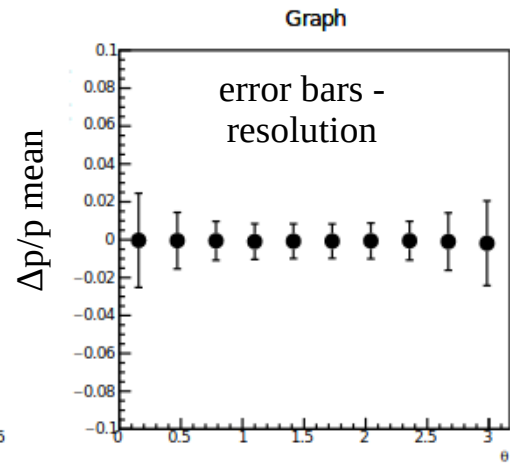
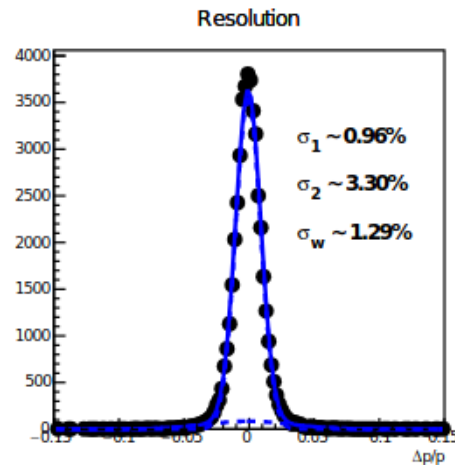
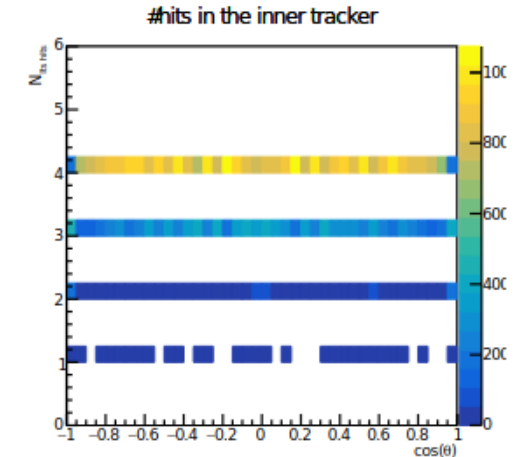
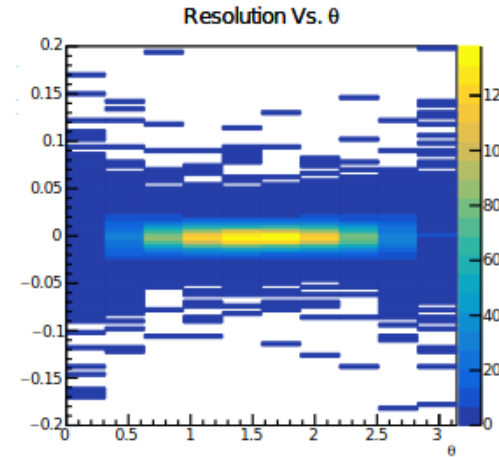
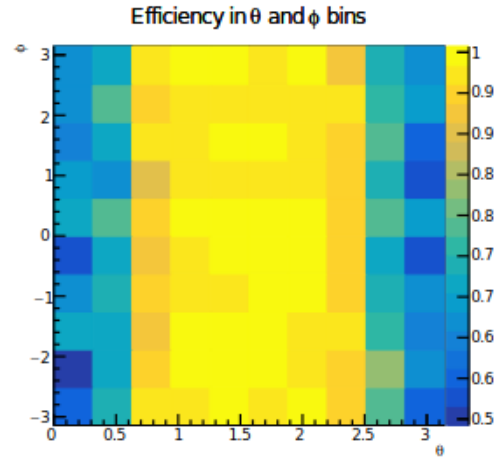
Performance test

Isotopic production of 1.5 GeV muons at (0, 0, 0) point

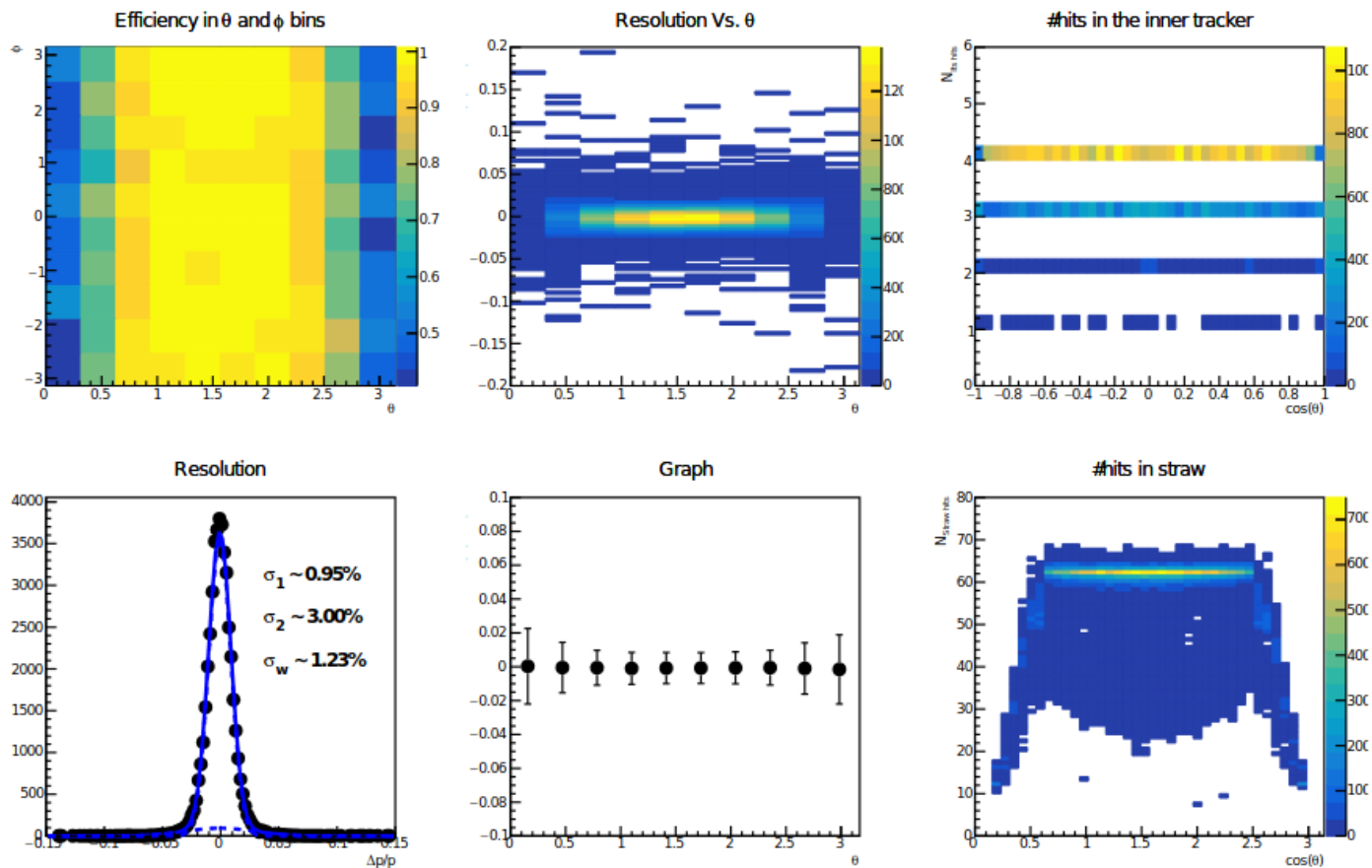
Detector subsystems:

- Dssd SVD
- Straw tracker (barrel + EC)

Magnetic field is on

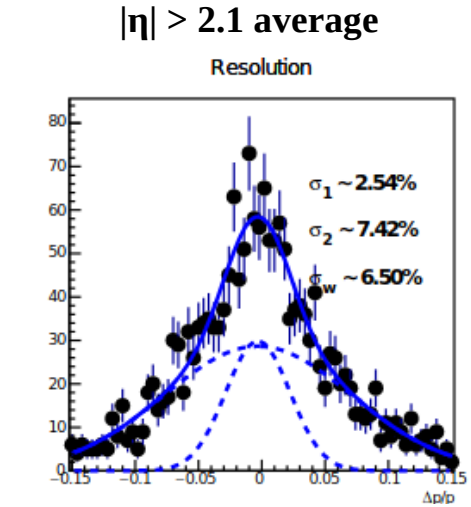
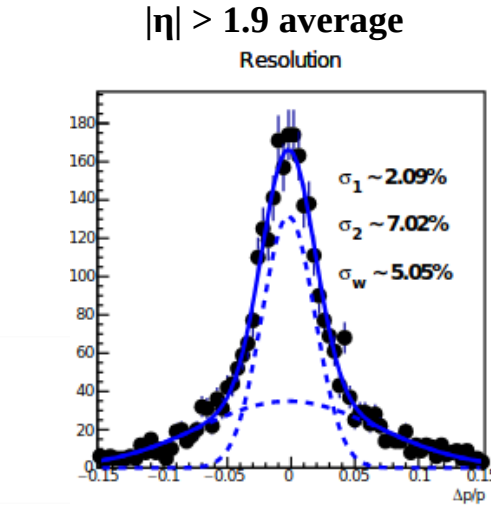
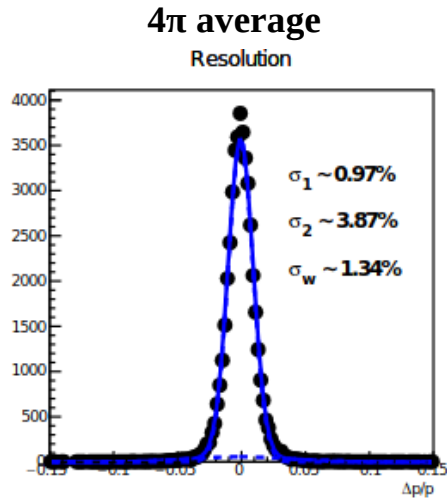


Performance test $|\eta| < 2.5$



Performance test comparing with no Ens-cap MAPS option

no EC



With EC

