Status of SVD description in SPDroot source code

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Contents

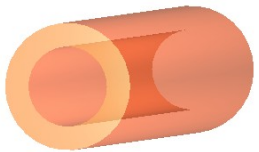
- Current status
- The study of unpredictable behavior in the test process
- End-cap suggestion for MAPS SVD

Previous report:
https://indico.jinr.ru/event/4598/#1-status-of-separating-maps-an

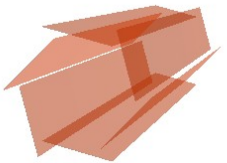
Current status

SVD geometry levels:

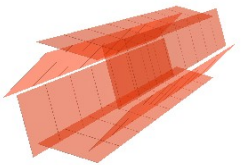
Level1 (layer)
Medium: air



Level2 (ladder)
Medium: silicon



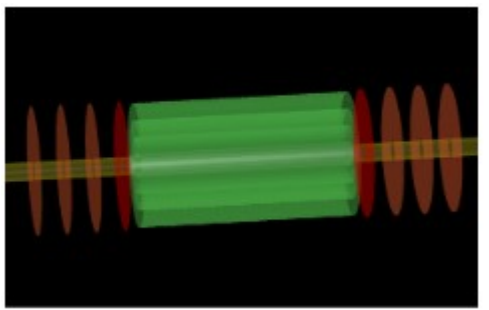
Level3 (chip)
Medium: silicon



MAPS and DSSD descriptions are separated in SPDroot source code

Problems preventing the merge with development branch:

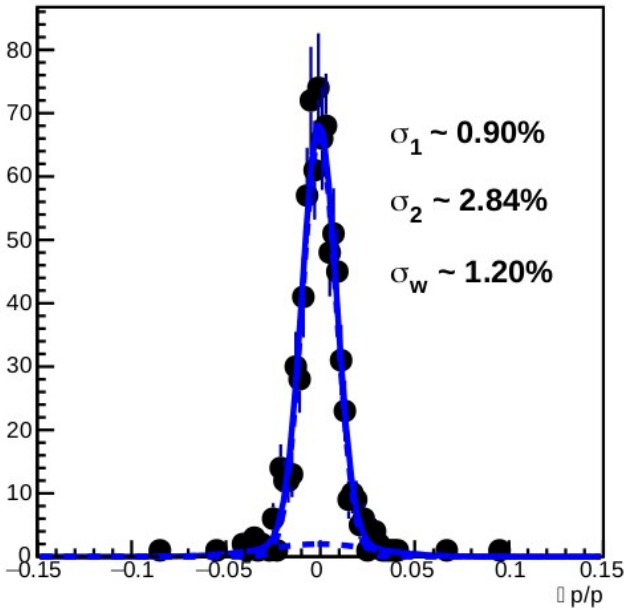
- Strange behavior during the tests
  dependence of the tracking results on the dimensions of the auxiliary geometry levels (layers);
- The description of End-cap for MAPS option is missing;

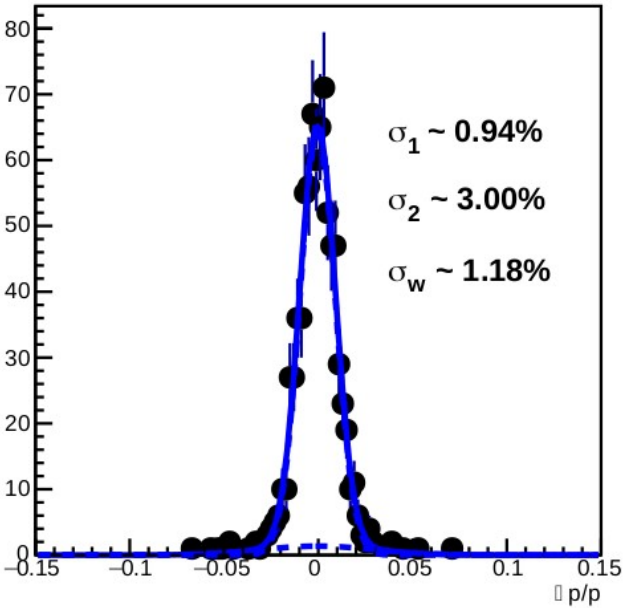


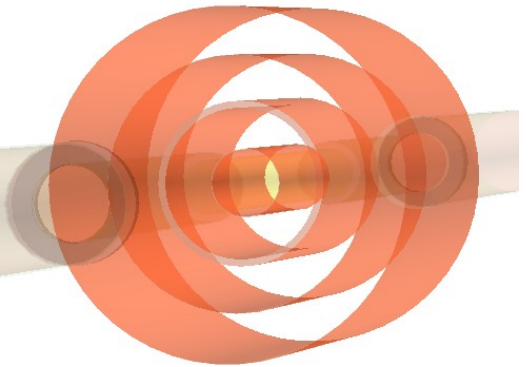
Amaresh Datta report
https://indico.jinr.ru/event/4633/#3-prospects-of-d0-tssa-measure

Unpredictable behavior study (test#1)

<SpdRoot dir>/macro/performance-tests/track-fitting/maps-straw







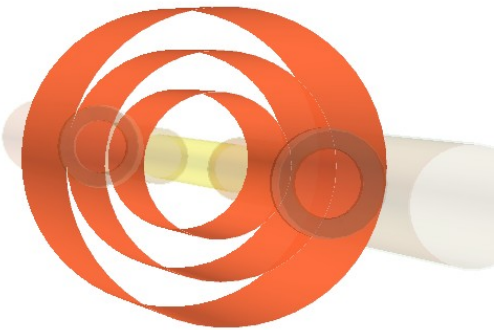
No overlaps

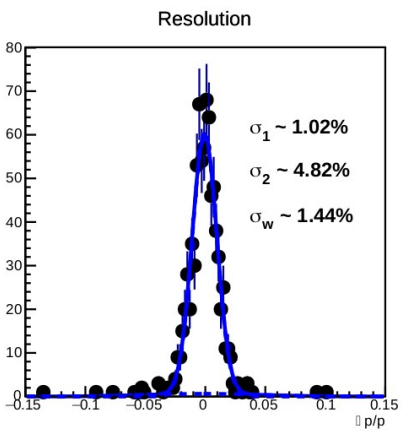
SpdItsGeoMapperX::Instance()->SetGeometryPars(1, 1)

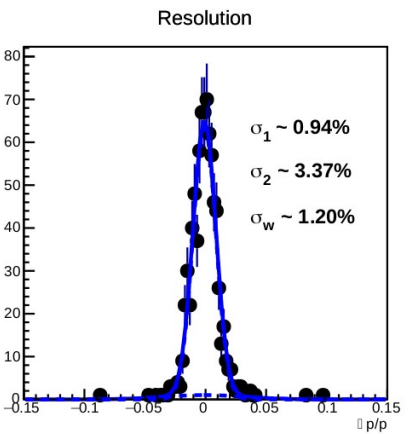
The same one, but
For 2nd layer Rmin = 9 instead of 9.7689

Unpredictable behavior study (test#2)

The first layer was replaced with a passive volume of air

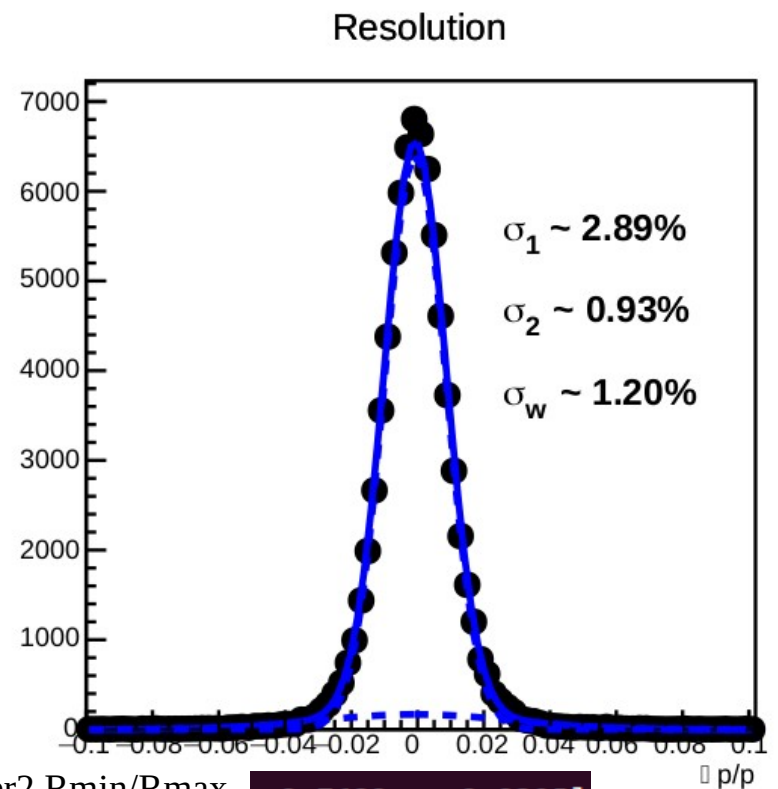


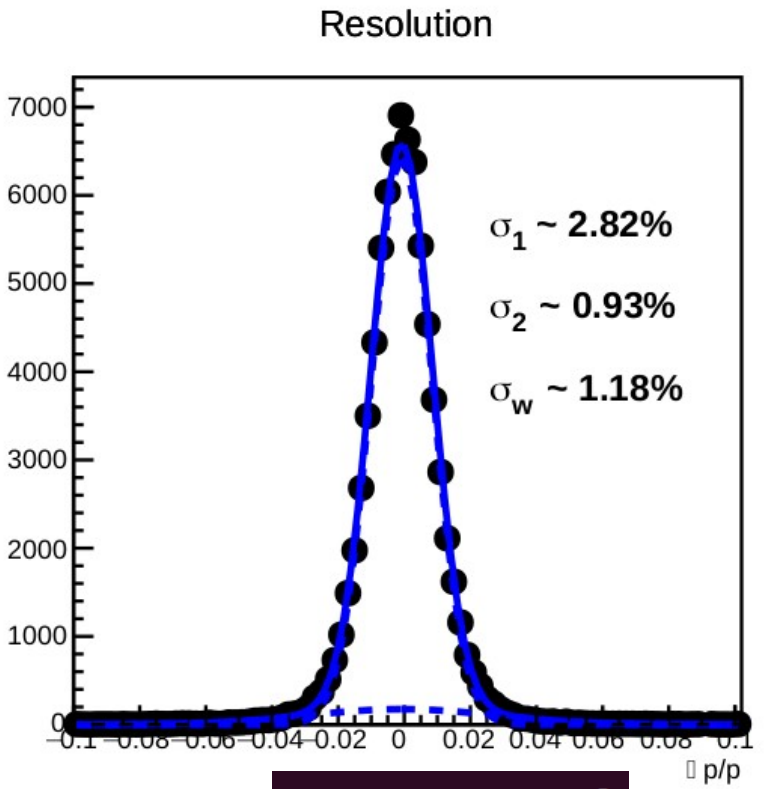




Unpredictable behavior study (test#3) Increasing statistics

100000 events





Layer2 Rmin/Rmax	9.7689	9.8305]
Layer3 Rmin/Rmax	15.2666	15.3180]
Layer4 Rmin/Rmax	20.9995	21.0459]

	9.7647	9.8305]
	15.2625	15.3180]
	20.9954	21.0459]

Unpredictable behavior study (test#4)

```
-I- <SpdPrimaryGenerator::ReadEvent> Event: 143   Particles: 1   Vertex: (-0.1, 0.1, 25.8)
-I- SpdMaps::ProcessHits fVVolume name: MAPS_512x512-I- SpdMaps::ProcessHits CurrentVolName name:       MapsChip1
-I- SpdMaps::ProcessHits CurrentVolPath path:   /cave_1/MapsLayer1_1/MapsLadder1_16/MapsChip1_45
-I- SpdMaps::ProcessHits Is track inside??      0
-I- SpdMaps::ProcessHits TrackPid()     13
2.644327        3.018467        29.470598
-I- SpdMaps::ProcessHits CurrentVolName name:   MapsChip1
-I- SpdMaps::ProcessHits CurrentVolPath path:   /cave_1/MapsLayer1_1/MapsLadder1_16/MapsChip1_45
-I- SpdMaps::ProcessHits Is track inside??      0
-I- SpdMaps::ProcessHits TrackPid()     13
2.667260        3.042215        29.500671
-I- SpdMaps::ProcessHits fVVolume name: MAPS_512x512-I- SpdMaps::ProcessHits CurrentVolName name:       MapsChip1
-I- SpdMaps::ProcessHits CurrentVolPath path:   /cave_1/MapsLayer2_1/MapsLadder2_37/MapsChip1_187
-I- SpdMaps::ProcessHits Is track inside??      0
-I- SpdMaps::ProcessHits TrackPid()     13
6.685591        7.123810        34.714143
-I- SpdMaps::ProcessHits CurrentVolName name:   MapsChip1
-I- SpdMaps::ProcessHits CurrentVolPath path:   /cave_1/MapsLayer2_1/MapsLadder2_37/MapsChip1_187
-I- SpdMaps::ProcessHits Is track inside??      0
-I- SpdMaps::ProcessHits TrackPid()     13
6.708975        7.147106        34.744190
-I- SpdMaps::ProcessHits fVVolume name: MAPS_512x512-I- SpdMaps::ProcessHits CurrentVolName name:       MapsChip1
-I- SpdMaps::ProcessHits CurrentVolPath path:   /cave_1/MapsLayer4_1/MapsLadder4_78/MapsChip1_122
-I- SpdMaps::ProcessHits Is track inside??      0
-I- SpdMaps::ProcessHits TrackPid()     13
14.795958       14.901857       44.958970
-I- SpdMaps::ProcessHits CurrentVolName name:   MapsChip1
-I- SpdMaps::ProcessHits CurrentVolPath path:   /cave_1/MapsLayer4_1/MapsLadder4_78/MapsChip1_122
-I- SpdMaps::ProcessHits Is track inside??      0
-I- SpdMaps::ProcessHits TrackPid()     13
14.802265       14.907686       44.966800
```

```
-I- <SpdPrimaryGenerator::ReadEvent> Event: 143   Particles: 1   Vertex: (-0.1, 0.1, 25.8)
-I- SpdMaps::ProcessHits fVVolume name: MAPS_512x512-I- SpdMaps::ProcessHits CurrentVolName name:       MapsChip1
-I- SpdMaps::ProcessHits CurrentVolPath path:   /cave_1/MapsLayer1_1/MapsLadder1_16/MapsChip1_45
-I- SpdMaps::ProcessHits Is track inside??      0
-I- SpdMaps::ProcessHits TrackPid()     13
2.645204        3.017668        29.468907
-I- SpdMaps::ProcessHits CurrentVolName name:   MapsChip1
-I- SpdMaps::ProcessHits CurrentVolPath path:   /cave_1/MapsLayer1_1/MapsLadder1_16/MapsChip1_45
-I- SpdMaps::ProcessHits Is track inside??      0
-I- SpdMaps::ProcessHits TrackPid()     13
2.668169        3.041386        29.498913
-I- SpdMaps::ProcessHits fVVolume name: MAPS_512x512-I- SpdMaps::ProcessHits CurrentVolName name:       MapsChip1
-I- SpdMaps::ProcessHits CurrentVolPath path:   /cave_1/MapsLayer2_1/MapsLadder2_37/MapsChip1_187
-I- SpdMaps::ProcessHits Is track inside??      0
-I- SpdMaps::ProcessHits TrackPid()     13
6.689562        7.119988        34.705375
-I- SpdMaps::ProcessHits CurrentVolName name:   MapsChip1
-I- SpdMaps::ProcessHits CurrentVolPath path:   /cave_1/MapsLayer2_1/MapsLadder2_37/MapsChip1_187
-I- SpdMaps::ProcessHits Is track inside??      0
-I- SpdMaps::ProcessHits TrackPid()     13
6.712965        7.143266        34.735376
-I- SpdMaps::ProcessHits fVVolume name: MAPS_512x512-I- SpdMaps::ProcessHits CurrentVolName name:       MapsChip1
-I- SpdMaps::ProcessHits CurrentVolPath path:   /cave_1/MapsLayer3_1/MapsLadder3_57/MapsChip1_253
-I- SpdMaps::ProcessHits Is track inside??      0
-I- SpdMaps::ProcessHits TrackPid()     13
10.625687       10.964547       39.705041
-I- SpdMaps::ProcessHits CurrentVolName name:   MapsChip1
-I- SpdMaps::ProcessHits CurrentVolPath path:   /cave_1/MapsLayer3_1/MapsLadder3_57/MapsChip1_253
-I- SpdMaps::ProcessHits Is track inside??      0
-I- SpdMaps::ProcessHits TrackPid()     13
10.635028       10.973501       39.716800
-I- SpdMaps::ProcessHits fVVolume name: MAPS_512x512-I- SpdMaps::ProcessHits CurrentVolName name:       MapsChip1
-I- SpdMaps::ProcessHits CurrentVolPath path:   /cave_1/MapsLayer4_1/MapsLadder4_78/MapsChip1_122
-I- SpdMaps::ProcessHits Is track inside??      0
-I- SpdMaps::ProcessHits TrackPid()     13
14.809578       14.888238       44.928626
-I- SpdMaps::ProcessHits CurrentVolName name:   MapsChip1
-I- SpdMaps::ProcessHits CurrentVolPath path:   /cave_1/MapsLayer4_1/MapsLadder4_78/MapsChip1_122
-I- SpdMaps::ProcessHits Is track inside??      0
-I- SpdMaps::ProcessHits TrackPid()     13
14.833892       14.910593       44.958700
```

End-cap suggestion for MAPS SVD

https://cds.cern.ch/record/1981898
Technical Design Report for the Muon Forward Tracker

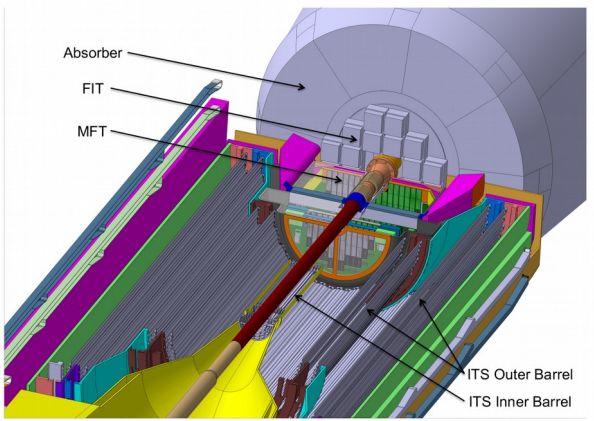
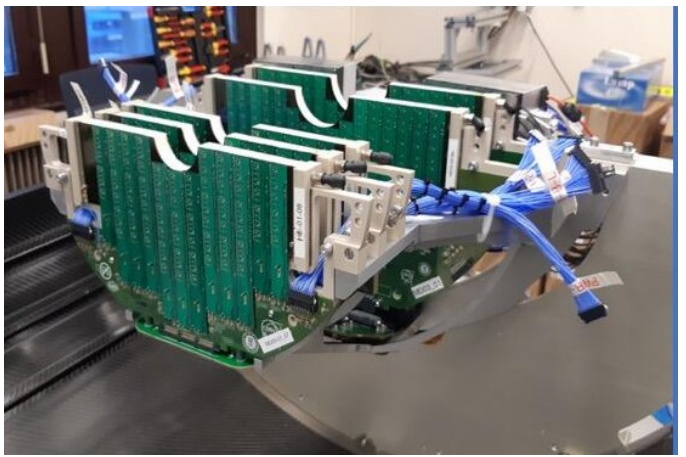


Figure 1.1: Layout of the MFT detector in ALICE.



Further plans

- To determine the reason for the dependence of the tracking results on the dimensions of the auxiliary geometry levels;
- Push the changes to the upstream SpdRoot repository + wiki page
- Add End-Caps for MAPS

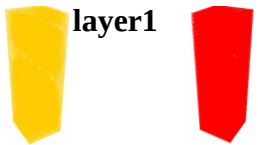
Thank you for your attention!

Appendix

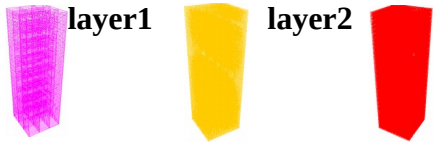
Ap1 The advantages of having multiple geometry levels

Model 1 (D = 1 + 80000 = 80001):

Model 2 (D = 1 + 8000 + 10 = 8011):

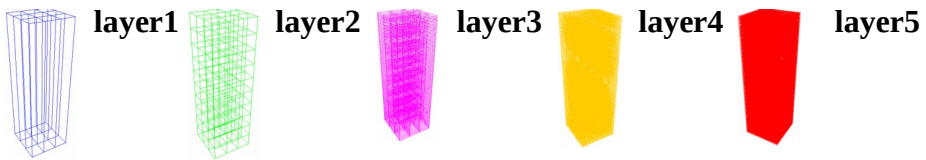


Model 3 (D = 1 + 800 + 10 + 10 = 821):



Model 4 (D = 1 + 80 + 10 + 10 + 10 = 111):

Model 5 (D = 1 + 8 + 10 + 10 + 10 + 10 = 49):

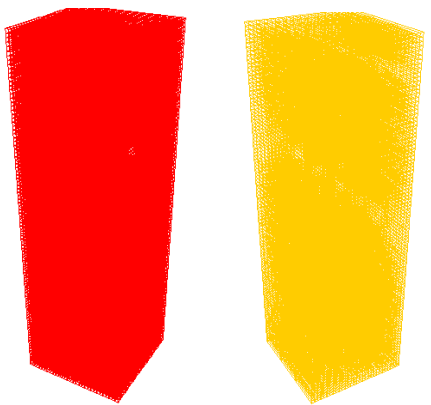


Volume types:

- Master volume (8 Board) — size 200*200*500
- Board (10 Box1) — size 40*40*400
- Box1 (10 Plate) — size 40*40*40
- Plate (10 Panel) — size 40*40*4
- Panel (10 Box2) — size 4*40*4
- Box2 — 4*4*4

The difficulty of finding volumes:

$$D = \sum_{i=0}^{N_{layers}} n_{volumes}^{i}$$



Ap1 The advantages of having multiple geometry levels

```
LogDuration *navtimer = new LogDuration("navtimer");

Float_t avnsteps = 0;
Int_t nevents = 100000;

for(Int_t i(0); i < nevents; i++)
{
   Int_t nsteps = 0.;
   geoman->SetCurrentPoint(0., 0., 0.);
   geoman->SetCurrentDirection(gRandom->Gaus(0., 1.), gRandom->Gaus(0., 1.), gRandom->Gaus(0., 1.));
   geoman->InitTrack(geoman->GetCurrentPoint(), geoman->GetCurrentDirection());

   while(!geoman→IsOutside())
   {
      geoman->FindNextBoundaryAndStep(0.1, kTRUE);
      nsteps++;
   }
   avnsteps += (Float_t)nsteps / nevents;
}

cout << "Average number of steps:\t" << avnsteps << endl;

delete navtimer;
```

Ap1 The advantages of having multiple geometry levels

100000 tracks:

№ Model	1	2	3	4	5
D	80001	8011	821	111	49
time, ms	1118495	54033	14601	10068	10863
‹N_{steps}›	1219.7	1219.7	1219.7	1219.7	1219.7

D < O(1000) there is no significant acceleration of the code