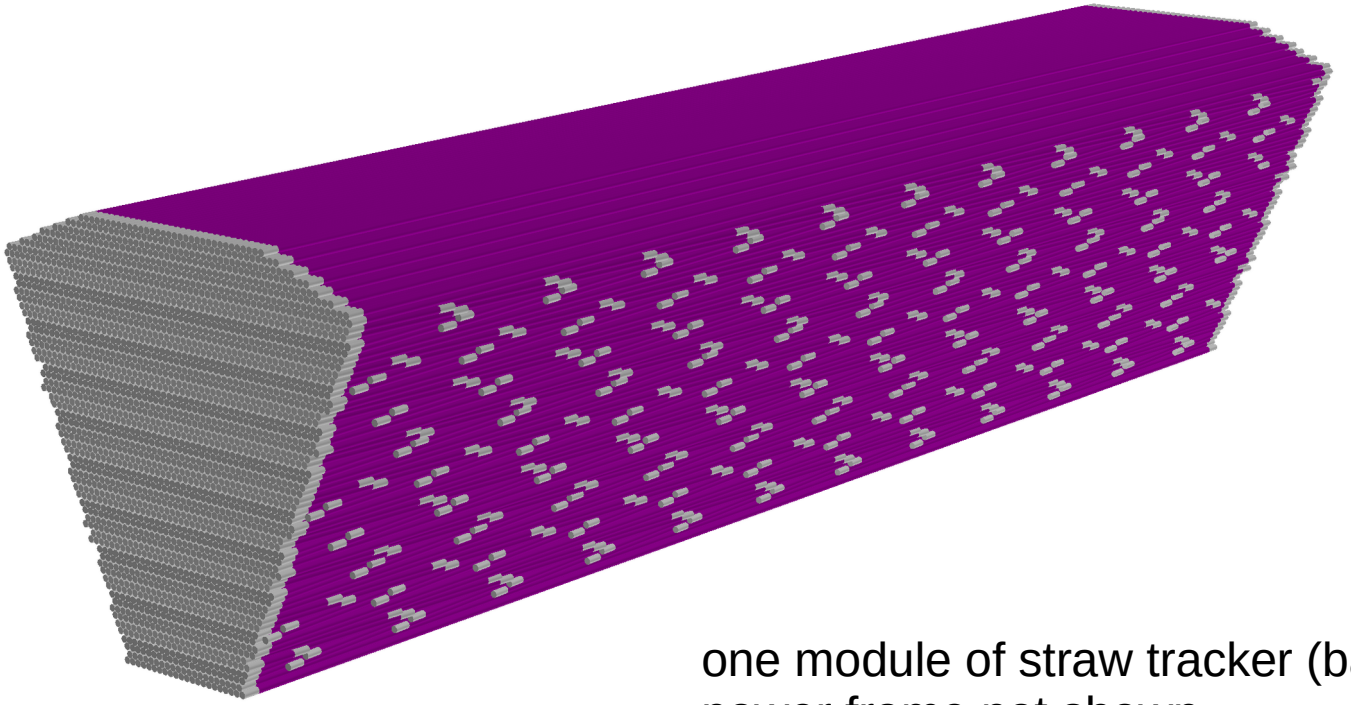
Sextant-based geometry of the straw tracker in SpdRoot

Ruslan Akhunzyanov
JINR

SPD Physics & MC Meeting
2025-02-19

Octant geometry

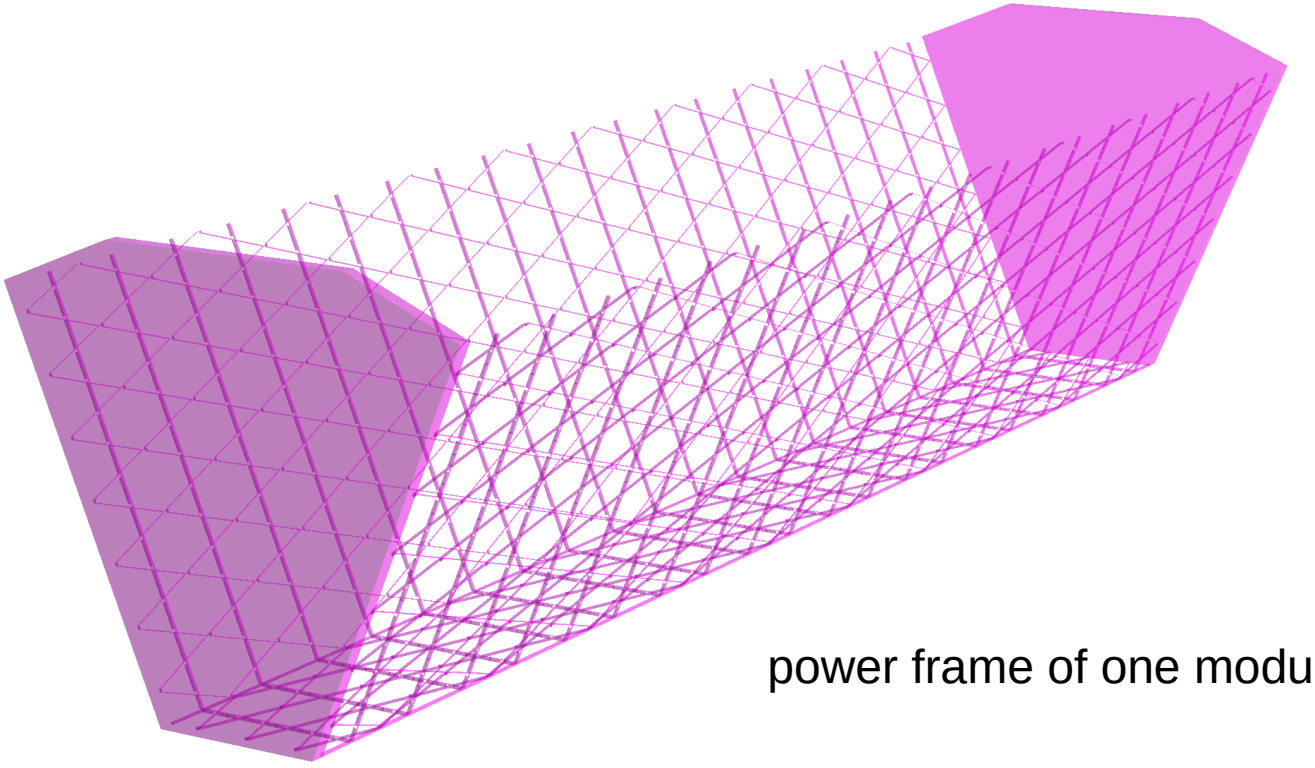
Current version of geometry in the `development` branch



one module of straw tracker (barrel);
power frame not shown

Octant geometry

Current version of geometry in the `development` branch

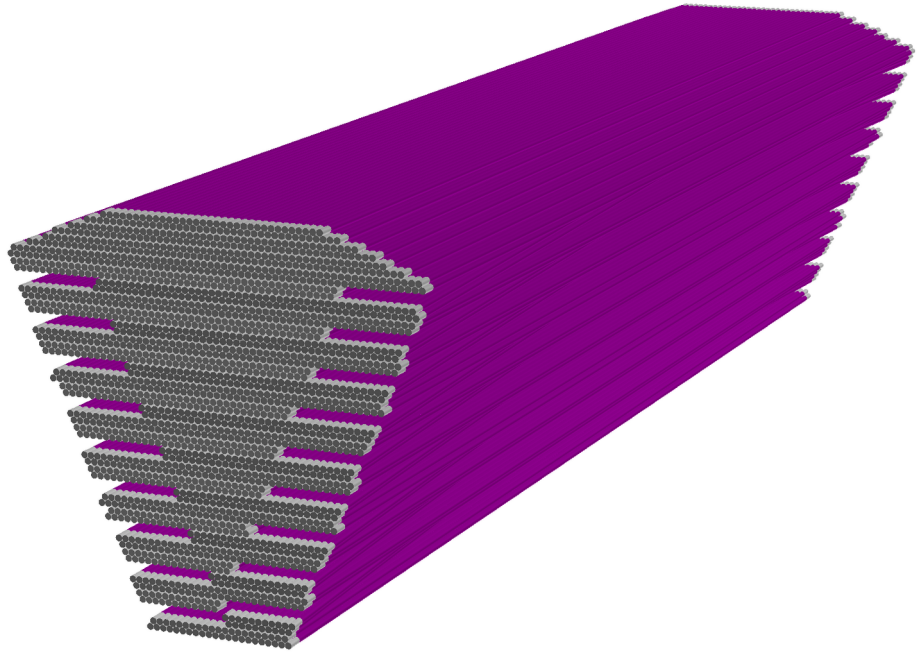


power frame of one module

Octant geometry: no short tubes

The tubes, one end of which comes out on the side of the module, will be **removed**, because no solution was found how to connect them to the gas system.

(see also my report at the SPD Physics & MC meeting in December).

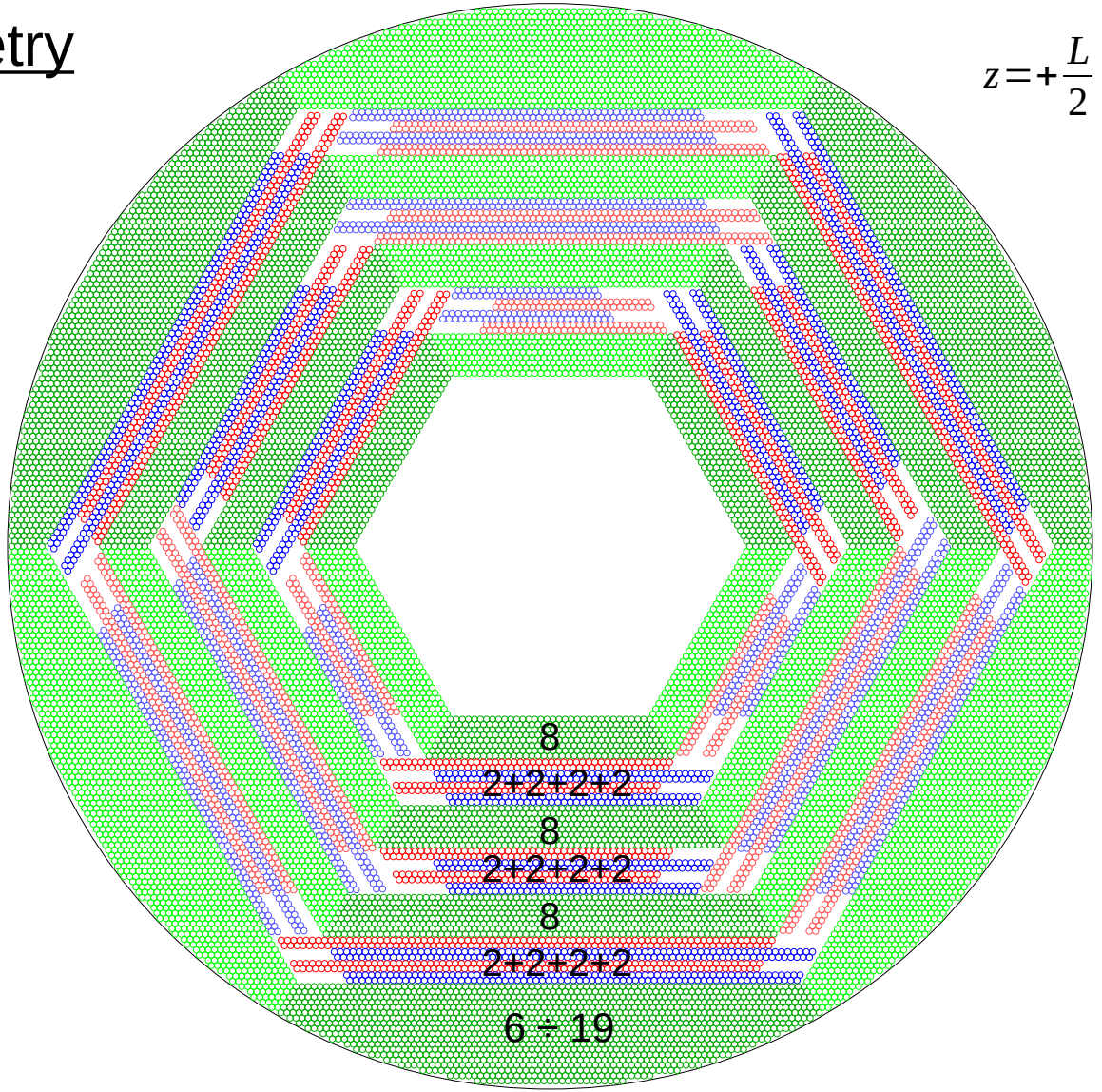


An option was added to SpdRoot code to implement this:

```
SpdTsTBGeoMapper *tsb_mapper = SpdTsTBGeoMapper::Instance();

tsb_mapper->MakeShortStraws(false);
```

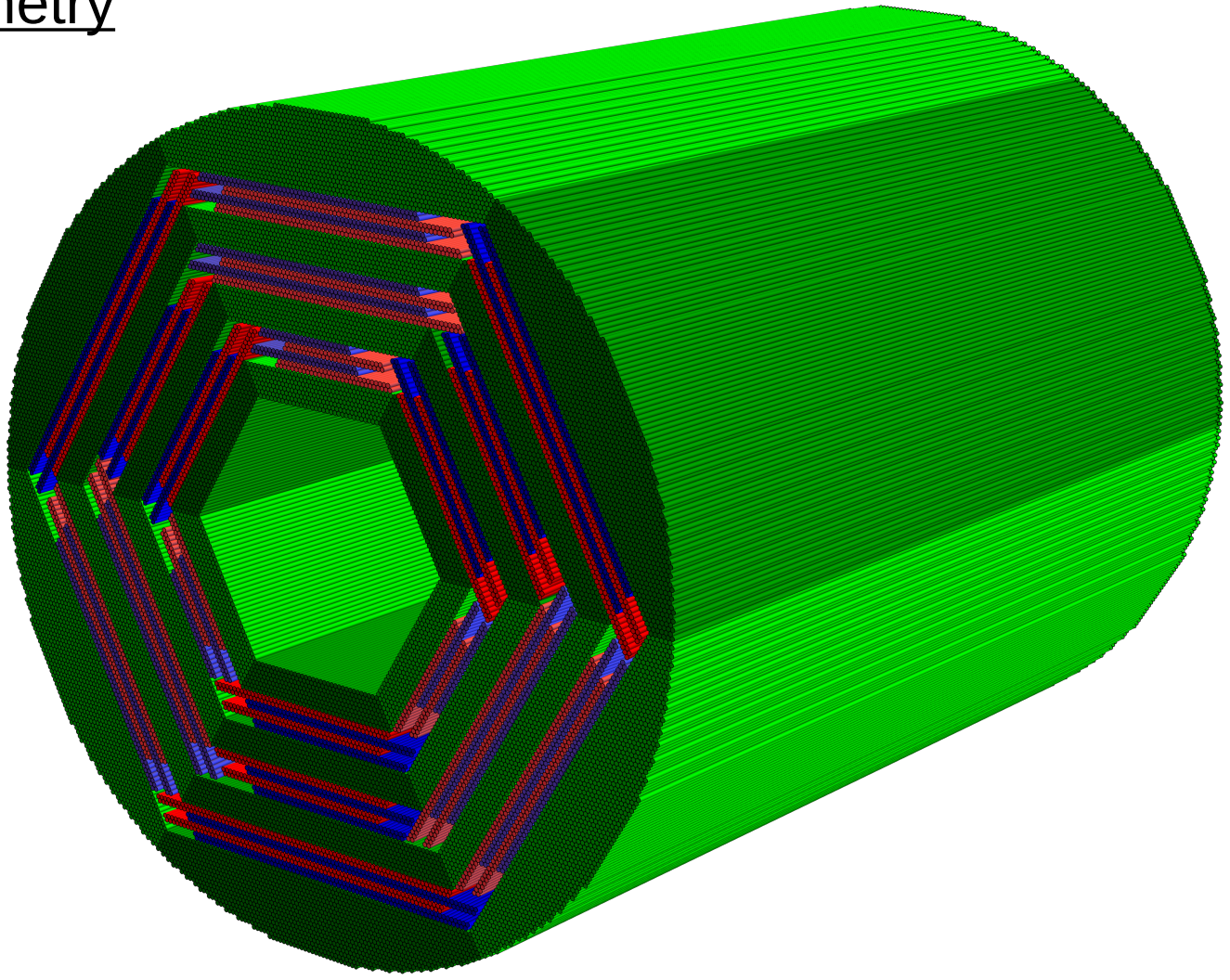
Sextant geometry

$z = +\frac{L}{2}$

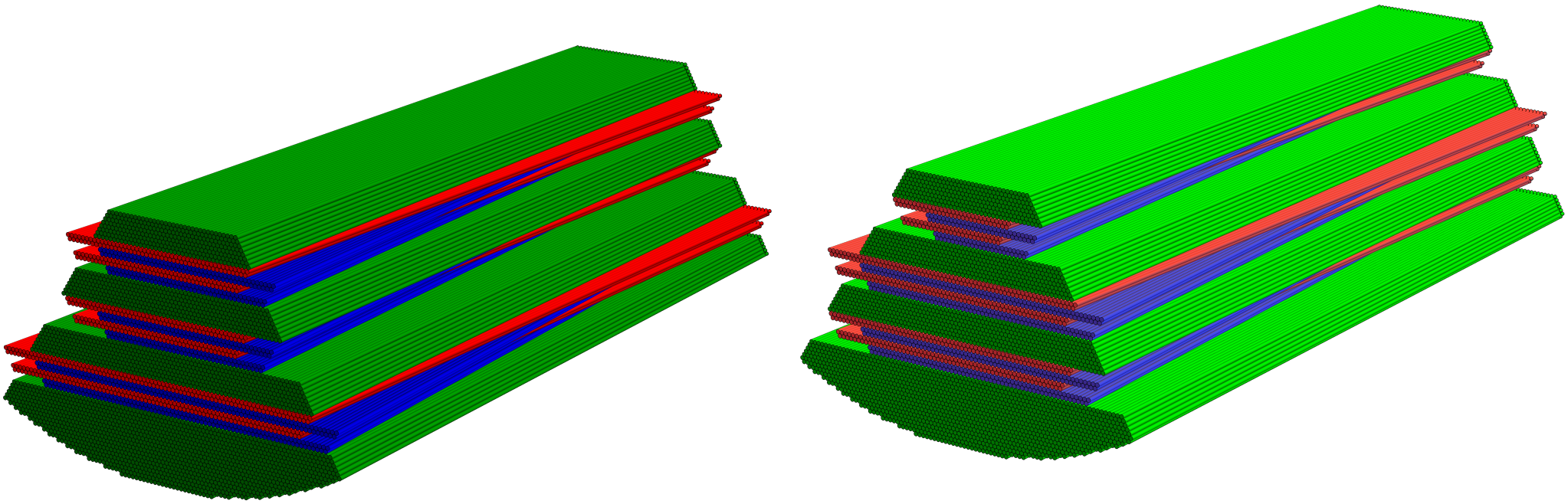


Two types of modules

Sextant geometry



Sextant geometry

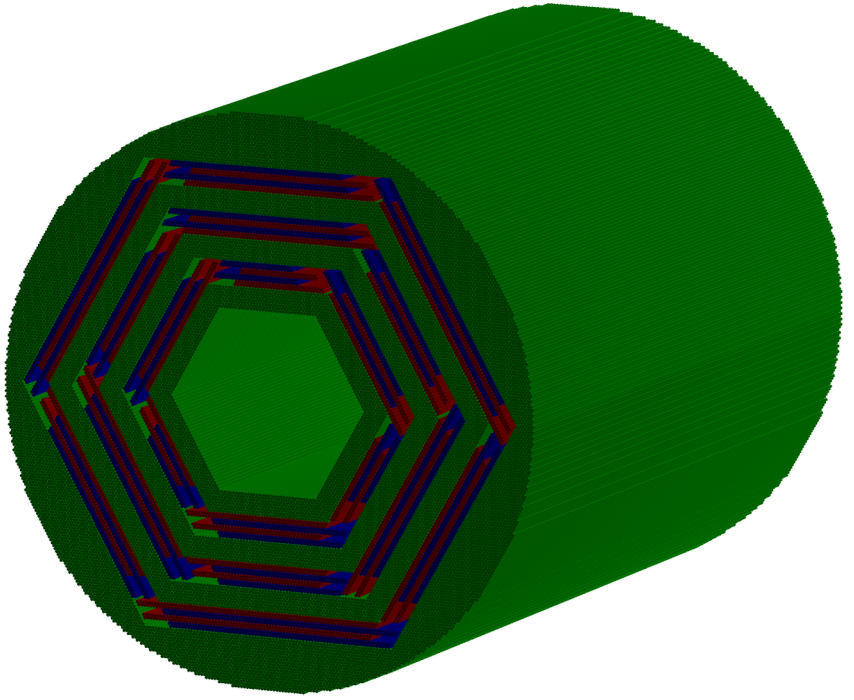


Two types of modules

Sextant geometry in SpdRoot

Branch `straw-sextant-geometry`

New class `SpdTsB`



In simulation script:

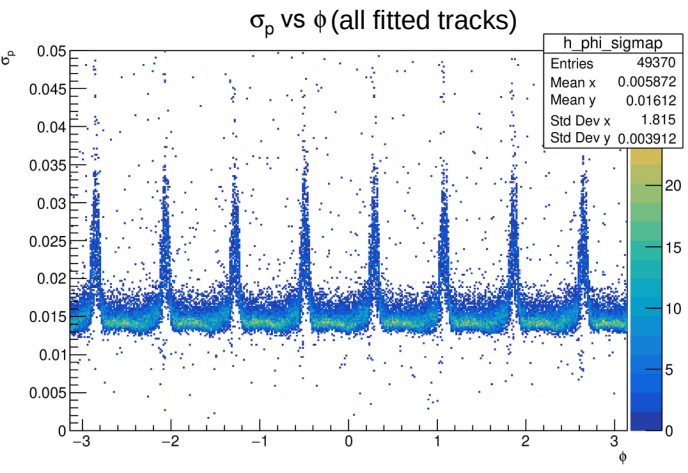
```
SpdTsB *ts_barrel = new SpdTsB()

run->AddModule(ts_barrel);
```

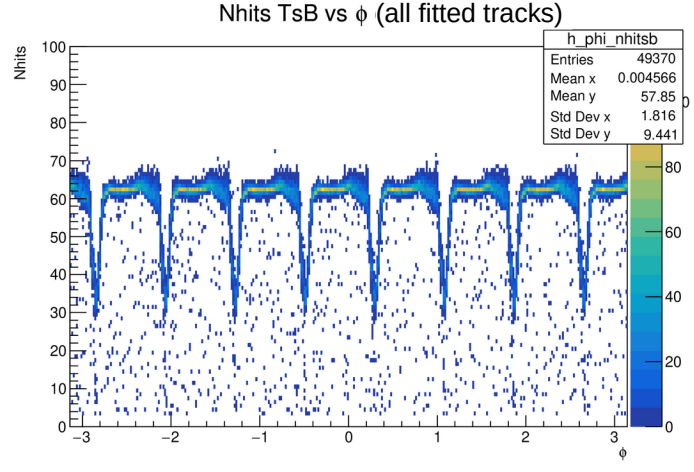
The octant version is available as `SpdTsTB`, as before.

Comparing straw geometries

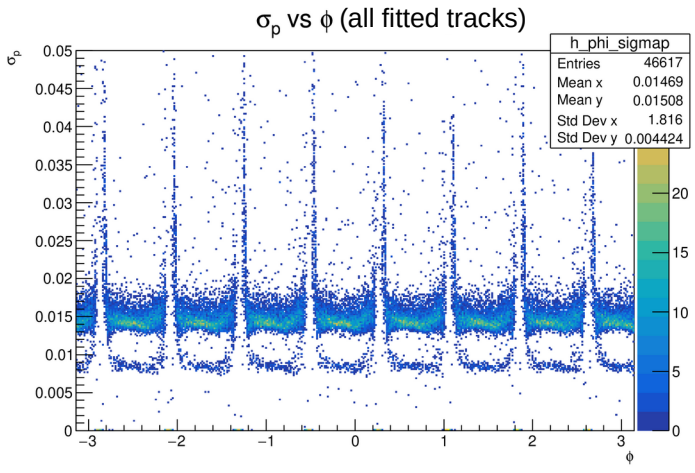
- Tracking detectors: only straw tracker
- Artificial sample kinematics:
  $P = 1$ GeV/c,
  $\theta = \pi/2$,
  $\phi \sim U(-\pi,\pi)$,
  $Z_0 \sim Gaus(0, 30\ cm)$

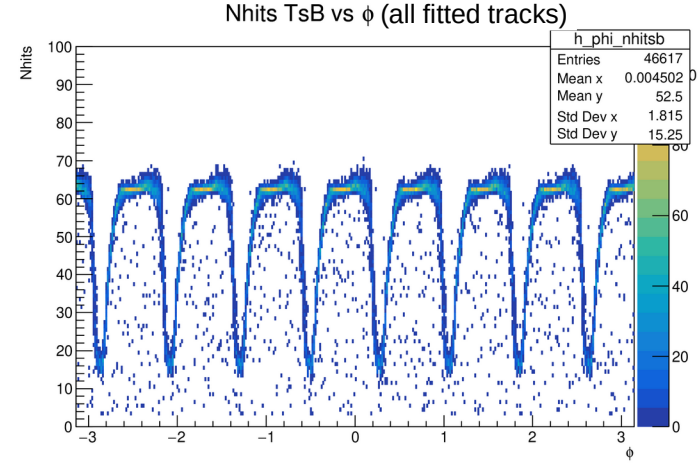
Octant geometry, α = 3°, with short straws



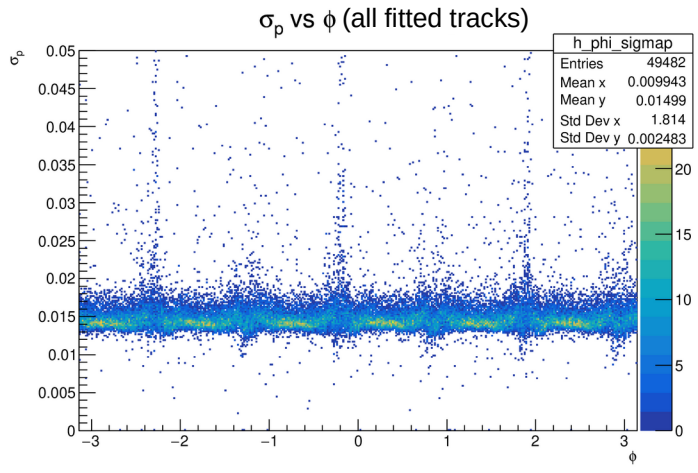


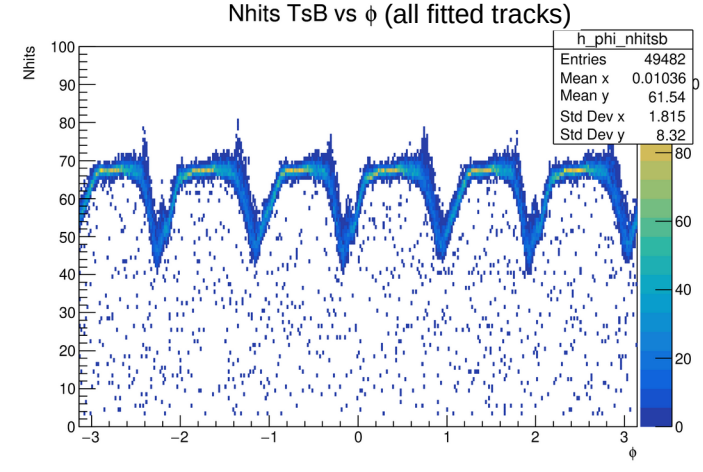
Octant geometry, α = 2°, no short straws





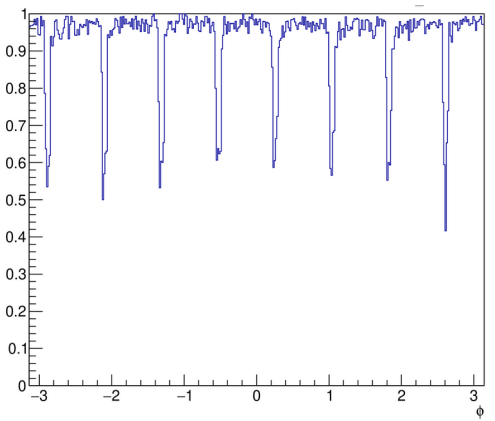
Sextant geometry, α = 2°





	Octant geometry, α = 3°, with short straws	Octant geometry, α = 2°, no short straws	Sextant geometry, α = 2°
Primary particles	100,0%	100,0%	100,0%
Tracks	98,8%	98,8%	99,1%
Tracks with fit pars	98,7%	93,2%	99,0%
Tracks, convergency == 1	96,6%	82,6%	90,2%

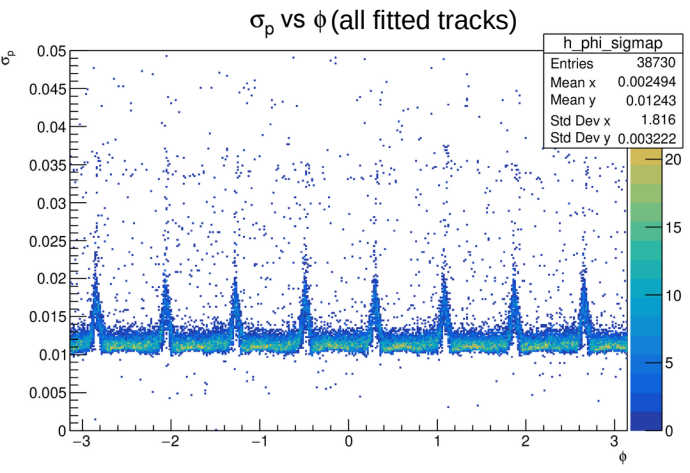
fraction of fitted tracks

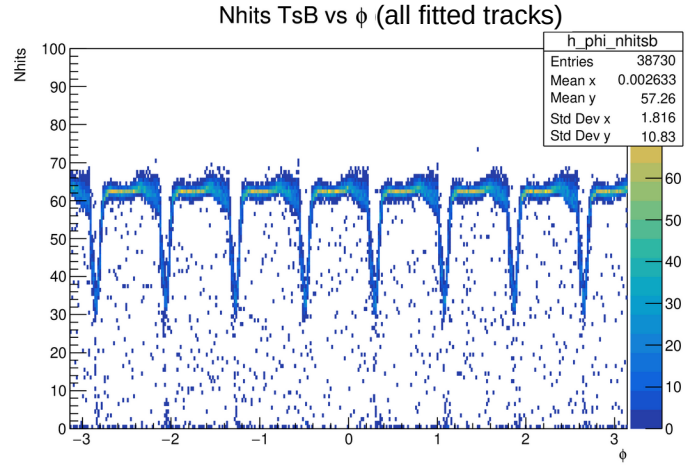


Comparing straw geometries

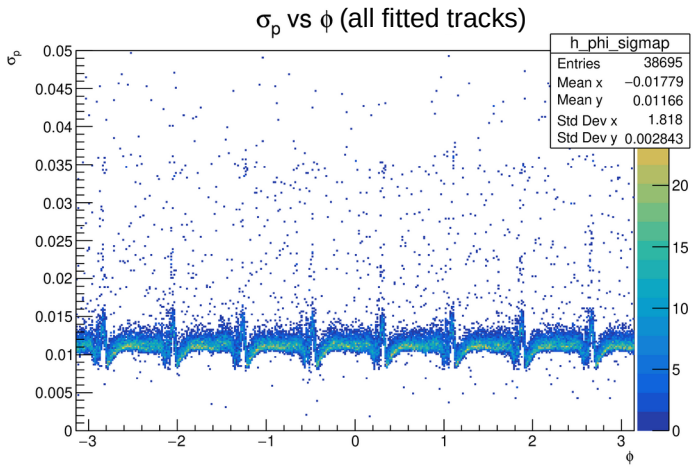
- Tracking detectors: DSSD + straw tracker
- At least 1 hit in DSSD is required for track.
- Artificial sample kinematics:
  $P = 1$ GeV/c,
  $\theta = \pi/2$,
  $\phi \sim U(-\pi,\pi)$,
  $Z_0 \sim Gaus(0, 30\ cm)$

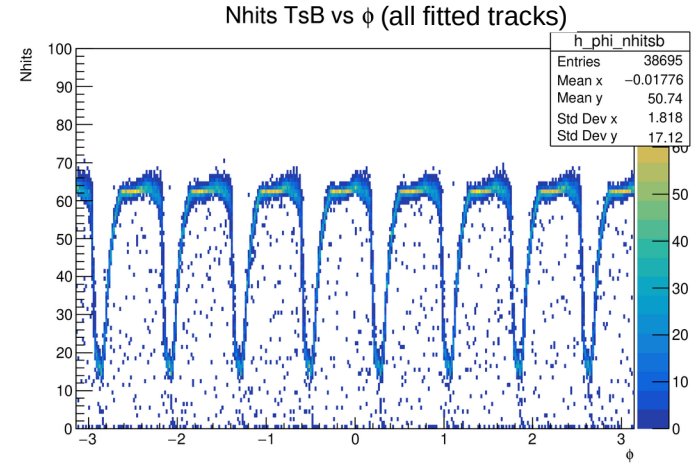
Octant geometry, α = 3°, with short straws



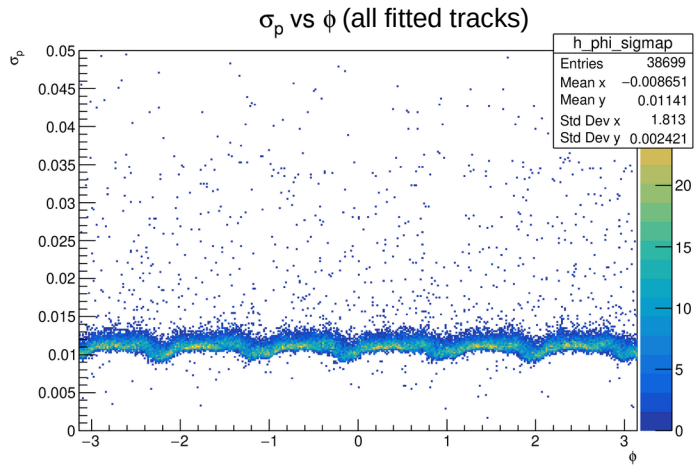


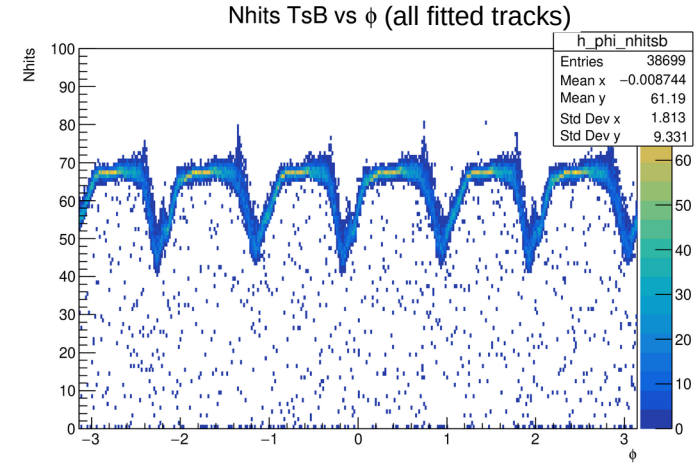
Octant geometry, α = 2°, no short straws





Sextant geometry, α = 2°





	Octant geometry, α = 3°, with short straws	**Octant geometry, α = 2°, no short straws**	**Sextant geometry, α = 2°**
Primary particles	100,0%	100,0%	100,0%
Tracks	77,5%	77,4%	77,4%
Tracks with fit pars	77,5%	77,4%	77,4%
Tracks, convergency == 1	75,9%	76,0%	75,8%

Conclusions

- New sextant-based version of straw tracker geometry was implemented in SpdRoot (see `straw-sextant-geometry` branch).
- First tests show that sextant geometry gives better track fitting performance than octant version without short tubes.