

Performance Evaluation of FPCCD Vertex Detector

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Introduction

- Some results of tracking efficiency in using FPCCD will be shown in this presentation.

Simulation Setup

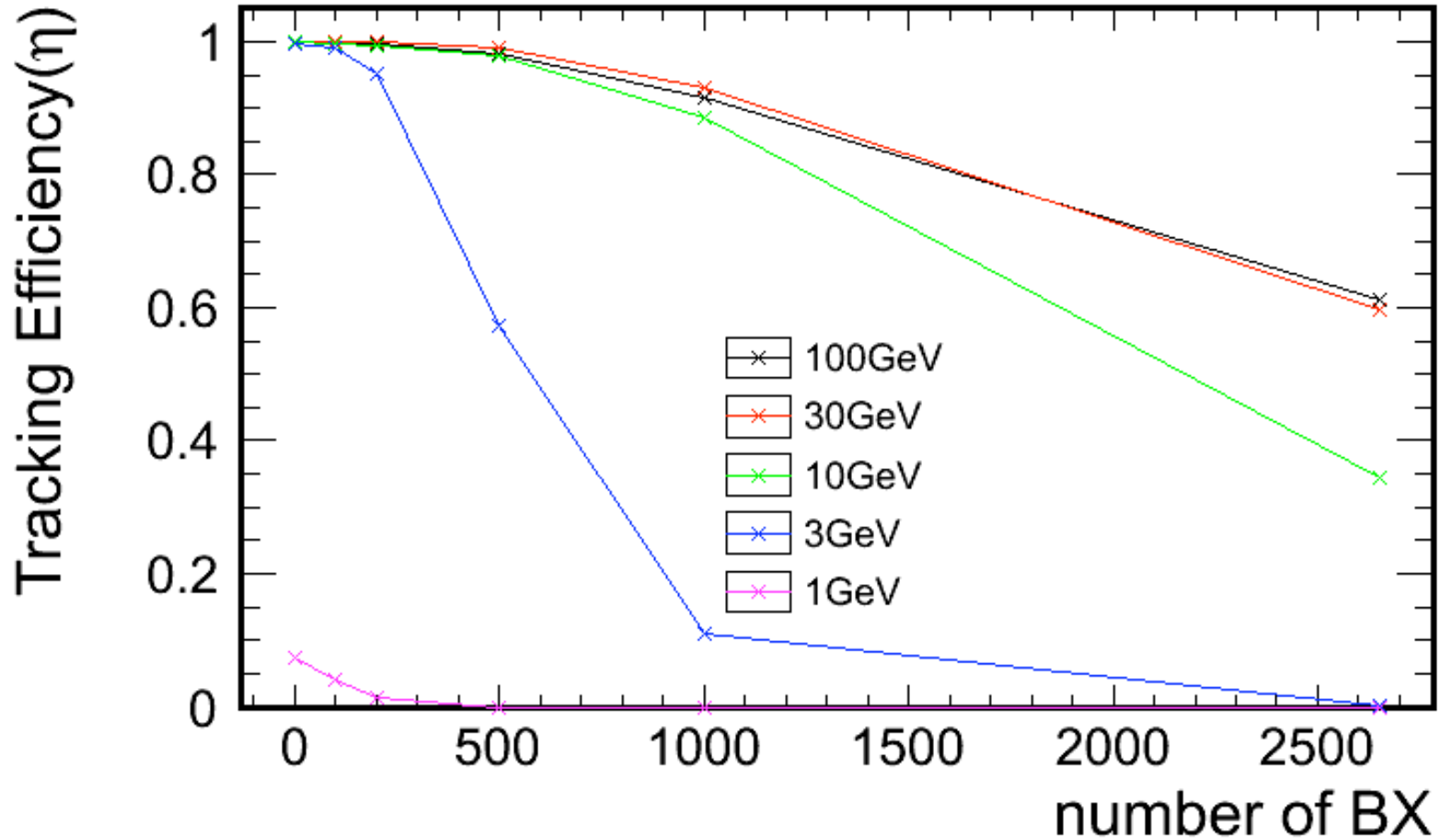
- Event: Single muon+ (whose MCParticles make more than one hit in each layer of VXD and SIT)
- Momentum: 100, 30, 10, 3 and 1GeV
- Angle of elevation: 85°(fixed)
- Azimuthal angle: [-120°, -60°] (uniformly smeared)
- Background: eepair and backscatter($E_{cm}=1\text{TeV}$)
- Bunch Crossing(from here, I'll write BX.):
0, 1, 100, 200, 500, 1000, and 2650BX
 - Only background, which exist -135° to -45° in azimuthal angle and 70° to 100° in angle of elevation from the origin, is left because the data volume not cut is so large that cpu and memory bursts.
- Tracking: SiliconTracking_MarlinTrk processor (Only Silicon Tracking is used.)

Definition of Tracking Efficiency

- Tracking Efficiency: $\eta = \text{Numerator}/\text{Denominator}$
- **Denominator**: the number of muon+
- **Numerator**: the number which satisfies all the followings. In tracking muon+,
 - VXD Hits ≥ 5 are used.
 - SIT Hits(in the sense of space points) ≥ 2 are used.

Tracking Efficiency VS # of BX

Silicon Tracking



Detail: Tracking Efficiency VS # of BX

SiTracks	# of BX	numerator	denominator	efficiency
100GeV	0	1664	1666	0.9988
	1	1666	1666	1.0000
	100	1664	1666	0.9988
	200	1662	1666	0.9976
	500	1637	1666	0.9826
	1000	1525	1666	0.9154
	2650	1017	1666	0.6104

SiTracks	# of BX	numerator	denominator	efficiency
30GeV	0	1661	1661	1.0000
	1	1661	1661	1.0000
	100	1660	1661	0.9994
	200	1660	1661	0.9994
	500	1647	1661	0.9916
	1000	1548	1661	0.9320
	2650	989	1661	0.5954

SiTracks	# of BX	numerator	denominator	efficiency
10GeV	0	1676	1679	0.9982
	1	1676	1679	0.9982
	100	1675	1679	0.9976
	200	1666	1679	0.9923
	500	1642	1679	0.9780
	1000	1489	1679	0.8868
	2650	580	1679	0.3454

SiTracks	# of BX	numerator	denominator	efficiency
3GeV	0	1642	1648	0.9964
	1	1642	1648	0.9964
	100	1632	1648	0.9903
	200	1568	1648	0.9515
	500	946	1648	0.5740
	1000	182	1648	0.1104
	2650	4	1648	0.0024

SiTra	# of BX	numerator	denominator	efficiency
1GeV	0	121	1655	0.0731
	1	121	1655	0.0731
	100	65	1655	0.0393
	200	22	1655	0.0133
	500	0	1655	0.0000
	1000	0	1655	0.0000
	2650	0	1655	0.0000

Consideration & Plan

- In the beam run of $E_{cm} = 1\text{TeV}$, FPCCD cannot endure tremendous background in the sense of the definition of tracking efficiency.
- But if a track uses the innermost hit, impact parameter may be small enough to satisfy the requirement of VXD, although I've not yet to check it.
- Now the dependency on angle of elevation is being checked. (But low angle muon may be unable to be evaluated because the processes are too complicated for cpu and memory to finish them in a few days or weeks.)
- As soon as the above is completed, should I start to prepare the beam test of fpccd?