





#### HLR week, DESY, Hamburg

# Silicon Tracking Algorithms vs VXD designs

Yorgos Voutsinas

09/07/15

#### **Addressed question**

- We have 3 options for silicon tracking (DBD, FPCCD, mini-vectors)
- We have a number of candidate VXDs
- Which algorithm should one use?

### Mini – vectors & VXD specifications

- Mini-vector approach motivated by the possibility to combine spatial & time information
- Makes more sense to be used in VXD concepts featuring alternating fast precise layers
  - CMOS or CMOS-like designs
- Use of mini-vectors might be detrimental when both layers have high occupancy
  - e.g. In DBD VXD, FPCCD seems to perform better
  - Can't apply mini-vector formation in FPCCD VXD
- Where in VXD parametrisation space it makes sense to move from a spacepoint based track following approach to a mini-vector cellular automaton?

	CMOS 1		CMOS 2		CMOS 3		CMOS 4		CMOS 5	
layer	σ <sub>sp</sub> (μm)	σ <sub>time</sub> (μs)	σ <sub>sp</sub> (μm)	$\sigma_{_{time}}(\mu s)$						
L1 / L2	3/6	50 / 2	5 / 5	8/8	3/5	50 / 8	4/4	4/4	3/3	1/1
L3 / L4	4 / 10	100 / 7	5/5	16 / 16	5/5	16 / 16	4/4	8/8	3/3	2/2
L5 X L6	4 / 10	100 / 7	5/5	16 / 16	5/5	16 / 16	4 / 4	8/8	3/3	2/2

#### 6 fermions – no pair bkg

- Examined subsample: all MCParticles
  - Originate from inside the beam pipe
  - $\cos\theta < 0.95$
  - Difference from previous study
    - Particles that have been decayed inside tracker vol. are accounted
- MCParticle is considered found if
  - 75% of the track's hit are stemming from the dominanant MC particle
  - $\geq 4$  hits in silicon (difference from DBD)
- All reconstructed tracks inside applied geometrical acceptance ( $\cos\theta < 0.95$ ) that are not matched with an <u>examined</u> MCParticle are considered as bad (not very proper definition...)

#### 6 fermions – no pair bkg: performance



## Missing high $P_{T}$ particles

- Efficiency ~ 99% for  $P_{T} > 1 \text{ GeV}$
- Why we can't find this ~1% of tracks?
- Typical case of lost track, MC particle  $P_T = 21$ GeV
- Particle doesn't create hits to all layers, in L4 and L6 crosses the insensitive electronic band
  - > Can form mini vectors only in inner layer
  - Need > 1 mini vector to reconstruct a track...
- Marginal(?) effect in tracking but...



### Conclusion

- Can be mini vector or FPCCD tracking part of stdreco chain?
  - Need validation with physics studies
  - Mini vector tracking strongly depends on VXD
- Mini vectors appears to be promising for some studies, e.g. Higgsino, vertex charge
- Importand for VXD R&D and definition of its parameters