

Track reconstruction efficiency

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<http://www-d0.fnal.gov/~rakitin/tex/2006.Jan.26.Tralgo/tr.pdf>



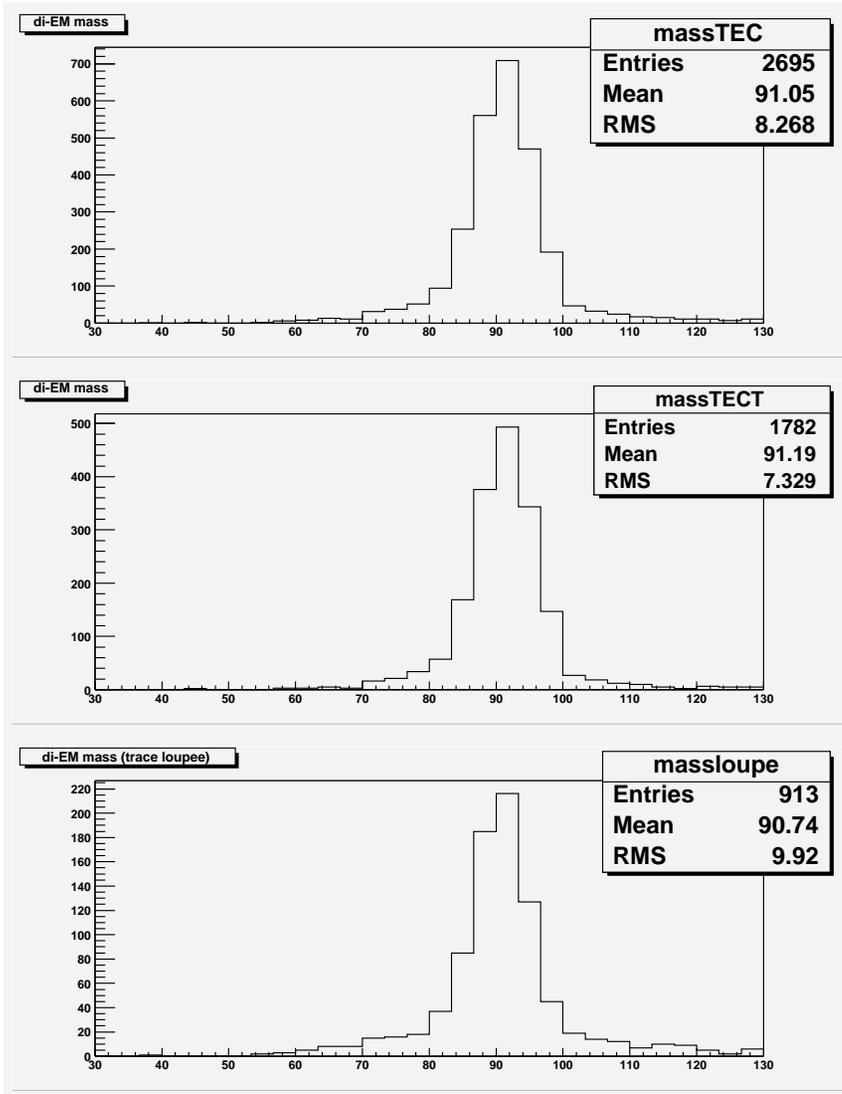
Tracking efficiency study:

I use Jan Stark's data sample $Z \rightarrow e^+e^-$:

- 117 pb⁻¹ taken Sep 2002 - Jun 2003
- Cuts:
 - iso < 0.15
 - emfrac > 0.9
 - $p_t > 25$ GeV/c
 - $m(ee) > 30$ GeV/c²
- Fire at least one of cal. triggers: 2EM_2MD12, 2EM_2MD7, EM_HI
- No track triggers – to avoid bias
- One EM cluster in CC (“tag electron”) – must have matching track
- Another EM cluster in end-caps (“probe electron”) – does not have to have matching track



Tracking efficiency study:



The plots of di-EM mass (©Jan Stark):

- Upper: all events
- Middle: probe electron has matching track (~66%)
- Lower: probe electron has no matching track (~34%)

Question: why the matching track is not reconstructed for probe electron in one-third cases?



Investigation:

- Shoot an imaginary track from PV to EM cluster
- See which detector elements it crosses
- See if these elements have hits
 - within 5 mm from track for SMT
 - within 3σ from track for CFT
- Understand why these hits did not produce a track



Results:

- All the tracks having 3+ hits in SMT Barrels are reconstructed (standard “3-hit req.” of current algorithm)
- Select events with one reconstructed (“tag”) and one missing (“probe”) track
- Non-reconstructed tracks can be divided into 4 categories:
 - ➔ Tracks with
 - either 2 hits in SMT barrels and 1 in F-disks
 - or 1 hit in SMT barrels and 2 in F-disks
 - ➔ Tracks with 2 hits in SMT and 4+ in CFT
 - ➔ Tracks with hits being a little outside of “standard” 3σ window
 - ➔ Tracks with too few hits to be reconstructed

By changing tracking algorithm we can reconstruct first three categories

This is illustrated by following tables (see next pages):

Number of hits close to imaginary track:

“2+1” or “1+2” SMT hits:

Run/Event	Electron	SMT Barrels	CFT	SMT F	SMT H	Reconstructed?	Reconstructible?
164605 10233199	Probe	2	3	2	0	No, 3-hit req.	Yes
	Tag	6	7	0	0	Yes	Yes
165805 2576564	Probe	2	2	2	0	No, 3-hit req.	Yes
	Tag	0	7	1	0	Yes	Yes
166113 39215346	Probe	1	3	2	0	No, 3-hit req.	Yes
	Tag	4	8	1	0	Yes	Yes
166295 20638511	Probe	1	0	2	1	No, 3-hit req.	Yes?
	Tag	3	8	0	0	Yes	Yes
166302 24938931	Probe	1	3	2	0	No, 3-hit req.	Yes
	Tag	3	8	0	0	Yes	Yes
166302 24109618	Probe	1	3	2	0	No, 3-hit req.	Yes
	Tag	4	8	0	0	Yes	Yes
164605 7263701	Probe	1	3	3	0	No, 3-hit req.	Yes
	Tag	2	8	0	0	Yes	Yes

Number of hits close to imaginary track:

2 SMT hits and 4+ CFT hits:

Run/Event	Electron	SMT Barrels	CFT	SMT F	SMT H	Reconstructed?	Reconstructible?
166313 32787929	Probe	2	8	0	0	No, 3-hit req.	Yes
	Tag	0	4	2	0	Yes	Yes
165977 6659303	Probe	2	4	0	0	No, 3-hit req.	Yes
	Tag	0	5	0	0	Yes	Yes
163171 48542536	Probe	1	4	1	0	No, 3-hit req.	Yes?
	Tag	0	8	0	0	Yes	Yes
166869 37137074	Probe	0	5	2	0	No, 3-hit req.	Yes?
	Tag	0	8	2	0	Yes	Yes

Hits too far from track:

Run/Event	Electron	SMT Barrels	CFT	SMT F	SMT H	Reconstructed?	Reconstructible?
164080 30329930	Probe	0	7	0	0	No, hits too far	Yes
	Tag	1	5	0	0	Yes	Yes
164385 4847391	Probe	0	4	2	0	No, hits too far	Yes?
	Tag	3	8	0	0	Yes	Yes

Number of hits close to imaginary track:

Too few hits to reconstruct track:

Run/Event	Electron	SMT Barrels	CFT	SMT F	SMT H	Reconstructed?	Reconstructible?
164382 3507437	Probe	0	2	0	0	No	No, too few hits
	Tag	0	7	0	0	Yes	Yes
165645 5273011	Probe	2	2	0	0	No	No, too few hits
	Tag	3	7	0	0	Yes	Yes
165765 36883677	Probe	0	3	1	0	No	No, too few hits
	Tag	3	7	0	0	Yes	Yes



Conclusion

Majority of the missing tracks from the “probe” electrons can be reconstructed by slight variations of the algorithm:

- Require 3+ hits in **both** SMT barrels and F-disks, not only on barrels
- Allow for 2 hits in SMT (barrels and F-disks) if CFT has 4+ hits
- Allow hits to be further than 3σ away (maybe only for high- p_t tracks?)

Plans:

To implement these changes and to see how much they affect tracking efficiency