

Track reconstruction efficiency - short update

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Tralgo Meeting

<http://www-d0.fnal.gov/~rakitin/tex/2006.Feb.09.Tralgo/tr.pdf>

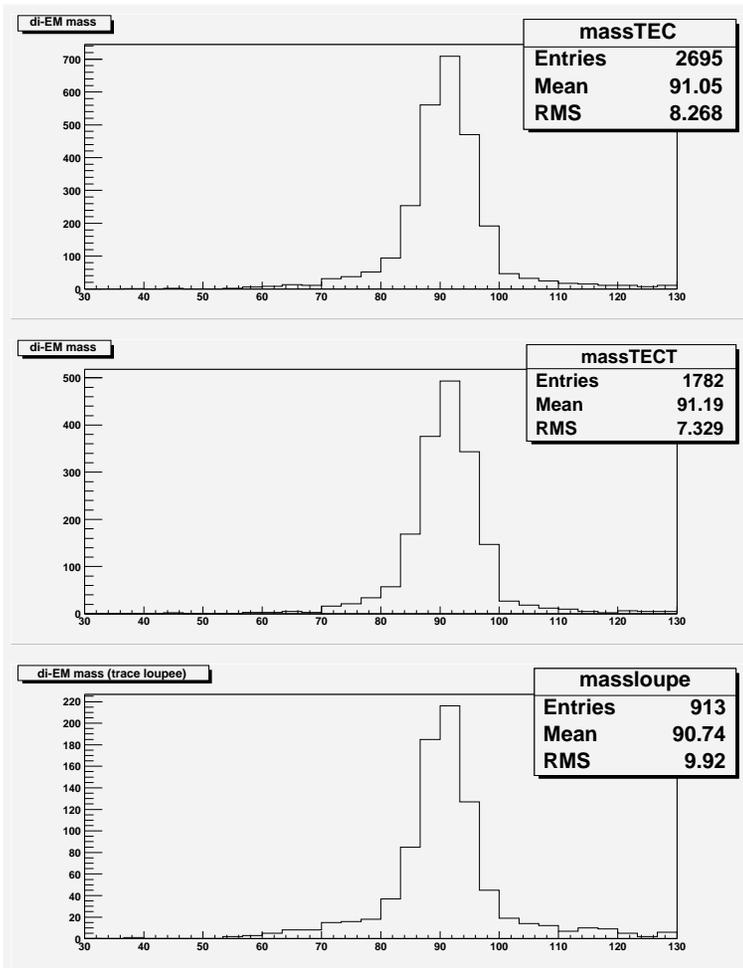


Tracking efficiency study - update:



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

- 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



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%)
- **Problem:** why the matching track is not reconstructed for probe electron in one-third of cases?
 - **Resolution:** slight change of reconstruction algorithm may help

Questions from last talk:

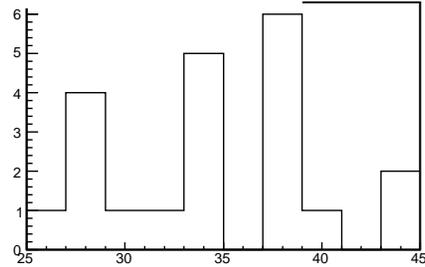
- Show η distributions for reconstructed and missing tracks
- Why sometimes tracks have only CFT hits and no SMT ones?
- How will the proposed algorithm change affect timing? – still to be answered



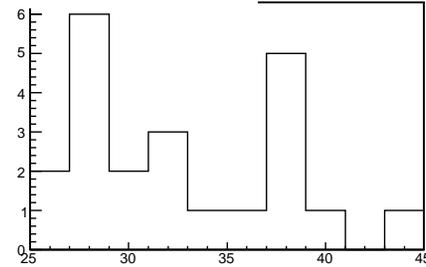
p_t, ϕ, η distributions:

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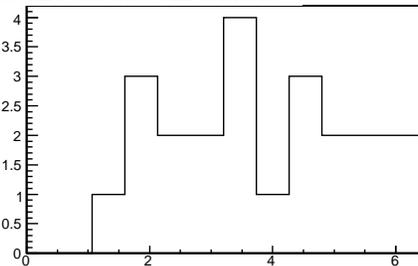
p_t OF RECONSTRUCTED TRACKS



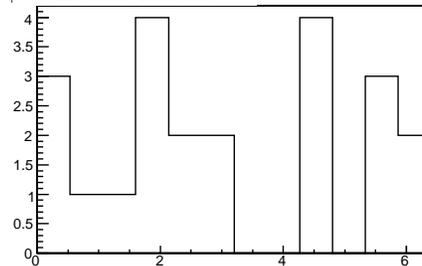
p_t OF MISSING TRACKS



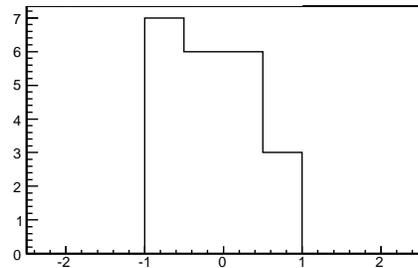
ϕ OF RECONSTRUCTED TRACKS



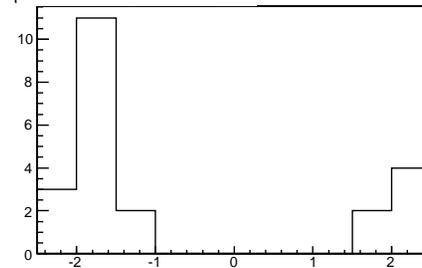
ϕ OF MISSING TRACKS



η OF RECONSTRUCTED TRACKS



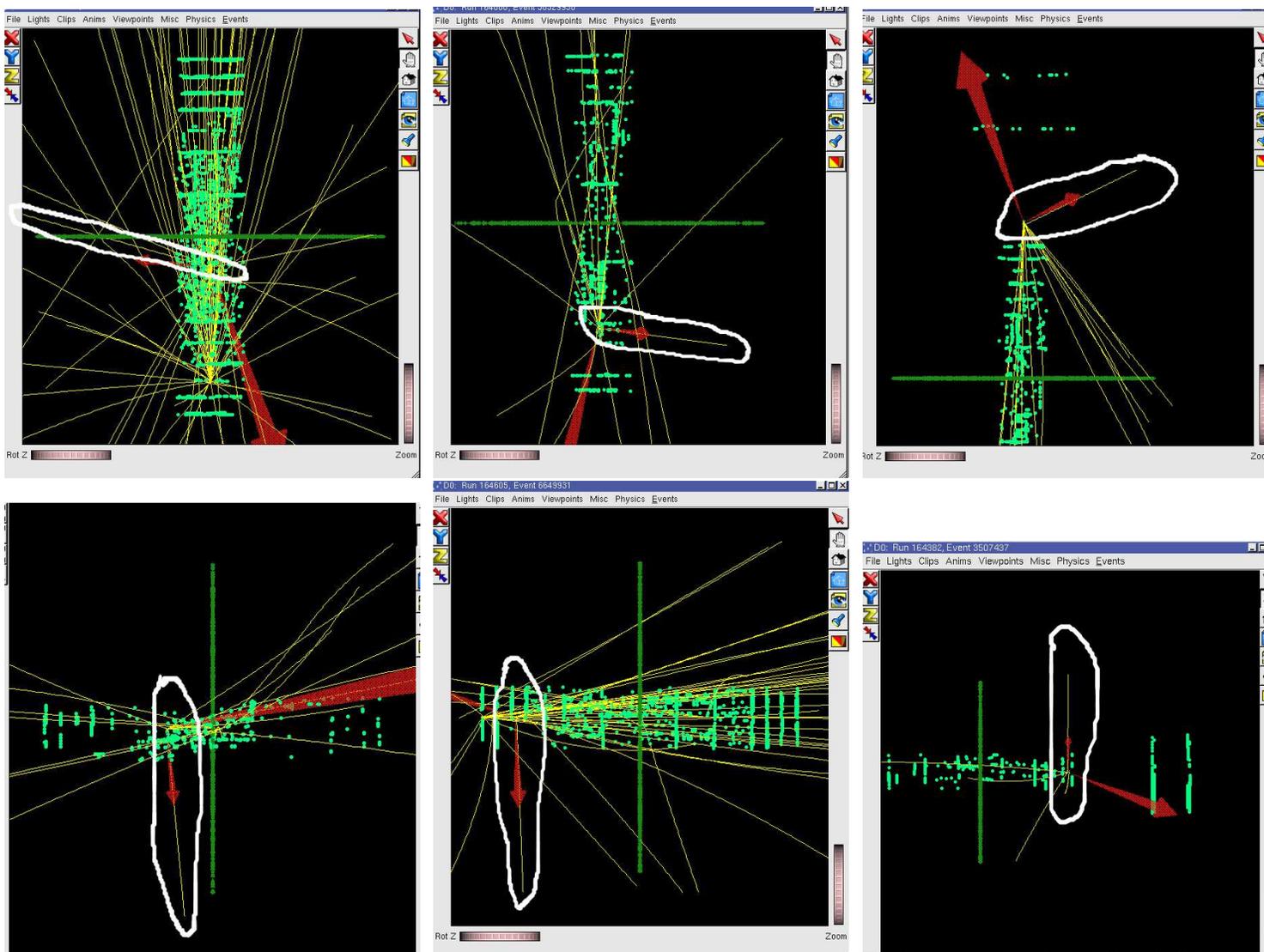
η OF MISSING TRACKS



- The p_t and ϕ distributions of reconstructed and missing tracks look similar
- The η distributions are different by construction:
 - “Tag electron” must be in CC
 - “Probe electron” must be in end-caps



Tracks with no SMT hits:



Reminder of proposed algorithm change:

- All the tracks having 3+ hits in SMT Barrels are reconstructed (“3-hit req.” of current algorithm)
- 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

Combinatorics will increase \implies how much time will it take to process?

\implies Still to be investigated

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
165906 6603711	Probe	2	3	1	0	No, 3-hit req.	Yes
	Tag	4	7	0	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
166506 46965463	Probe	2	4	1	0	No, 3-hit req.	Yes
	Tag	2	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?
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	1	0	Yes	Yes

Hits too far from track:

Run/Event	Electron	SMT Barrels	CFT	SMT F	SMT H	Reconstructed?	Reconstructible?
164385 4847391	Probe	0	4	2	0	No, hits too far	Yes?
	Tag	3	8	0	0	Yes	Yes
164080 30329930	Probe	0	7	0	0	No, hits too far	Yes?
	Tag	1	5	0	0	Yes	Yes
166872 41058810	Probe	0	5	1	0	No, hits too far	Yes?
	Tag	2	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?
165645 5273011	Probe	2	2	0	0	No	No, too few hits
	Tag	3	7	0	0	Yes	Yes
164636 16204878	Probe	0	0	2	0	No	No, too few hits
	Tag	0	8	1	0	Yes	Yes
165765 36883677	Probe	0	3	1	0	No	No, too few hits
	Tag	3	8	0	0	Yes	Yes
164382 3507437	Probe	0	2	0	0	No	No, too few hits
	Tag	0	7	0	0	Yes	Yes
166483 3946198	Probe	0	0	0	1	No	No, too few hits
	Tag	0	7	0	0	Yes	Yes
163172 49593518	Probe	0	0	0	0	No	No, too few hits
	Tag	0	7	0	0	Yes	Yes
164605 6649931	Probe	0	0	1	1	No	No, too few hits
	Tag	0	8	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
⇒ see how much time all combinations will take to process
- 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:

Still need

- to implement algorithm changes
- to see how much they affect tracking efficiency
- to see how much time it takes to process