GEANT Study of Electron ID and π^0 Rejection for Containerized detectors

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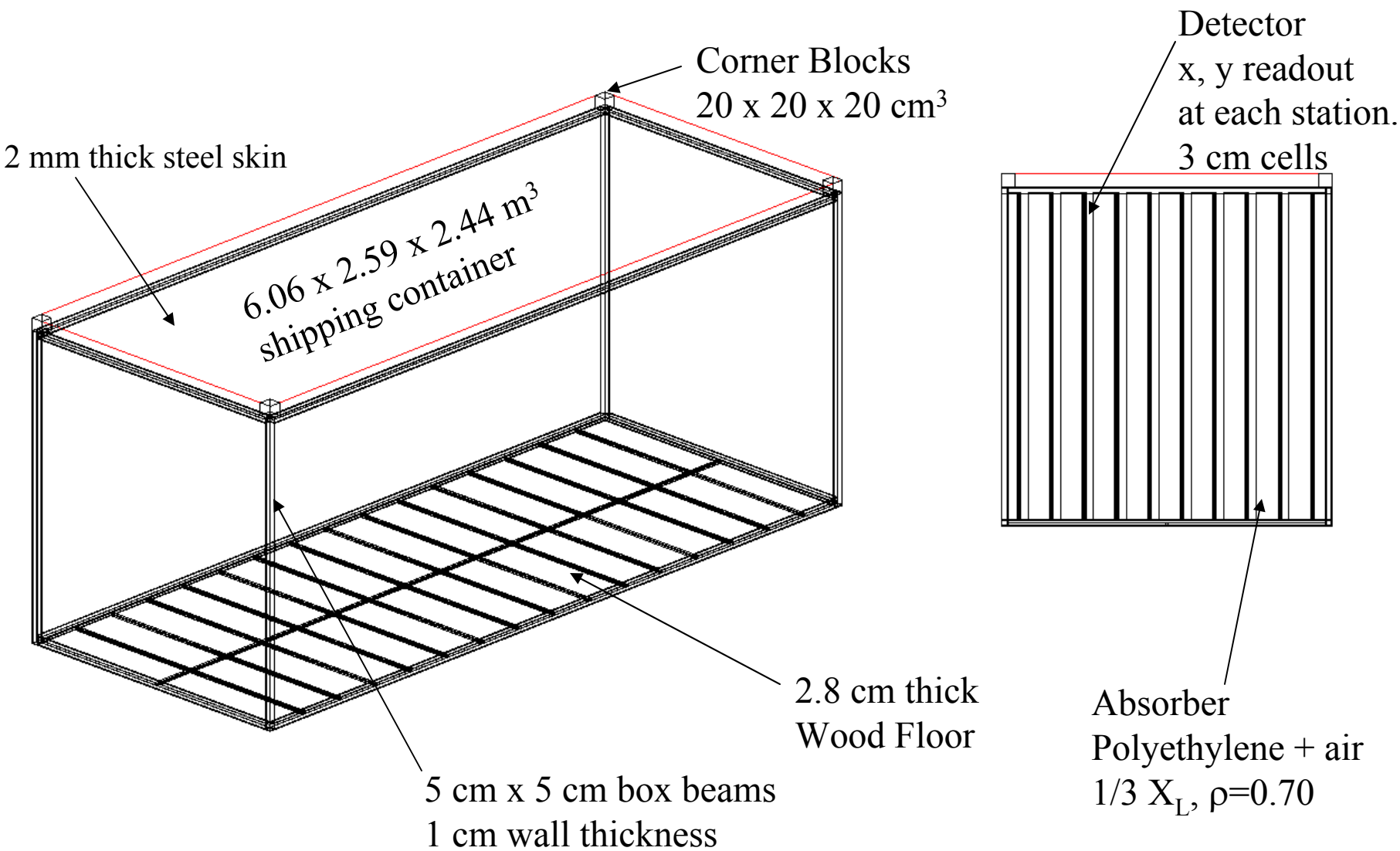
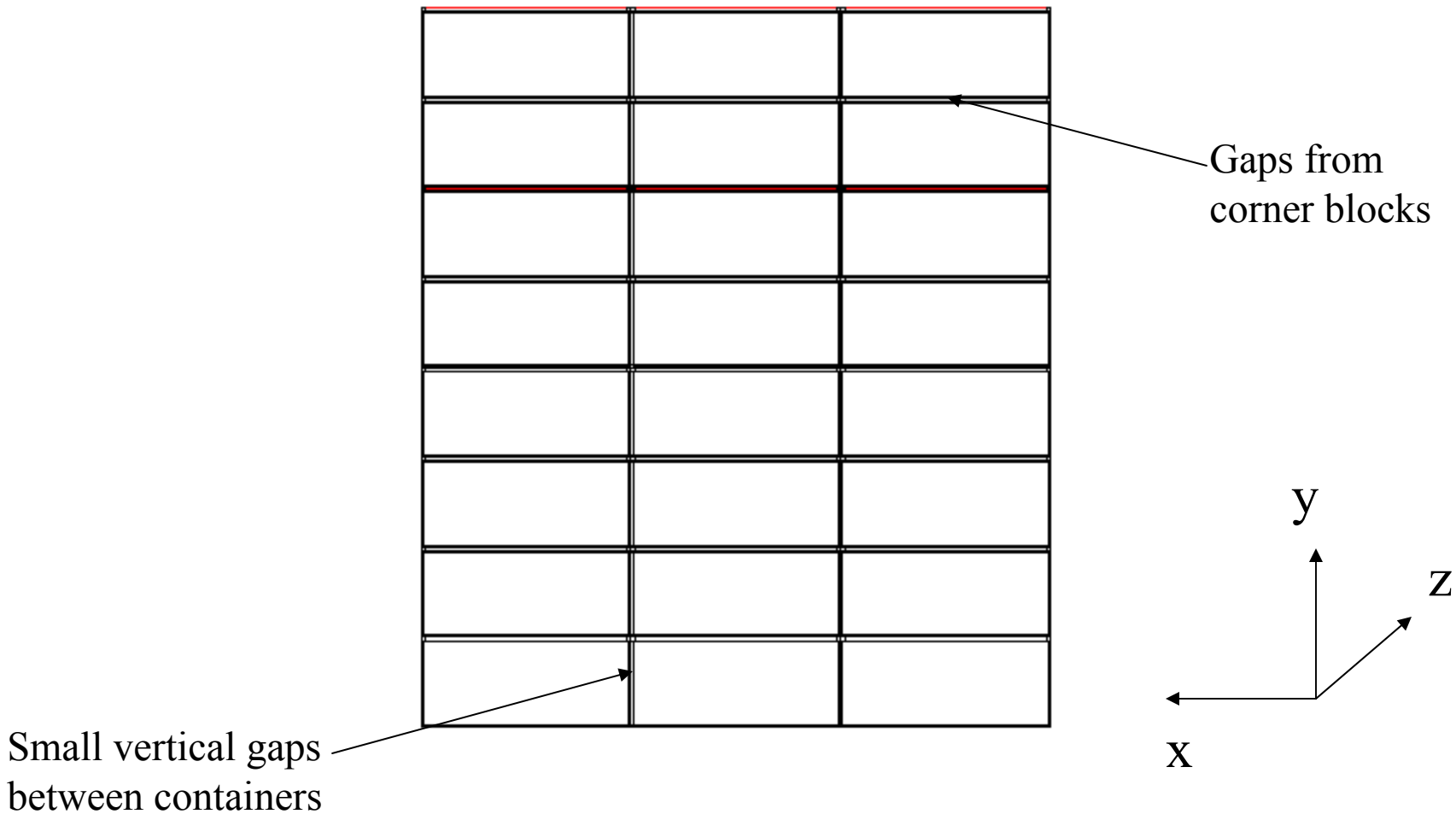
- Compare detectors in shipping containers to idealized continuous detector with no cracks
- Determine e^- and π^0 id efficiency
- Use energy and angle information from MINOS MC for electrons and π^0
- Only e^- and π^0 produced. No "underlying event"
- Use shipping container specifications provided by J. Cooper

GEANT Implementation



3 x 8 x 33 Stack of Containers



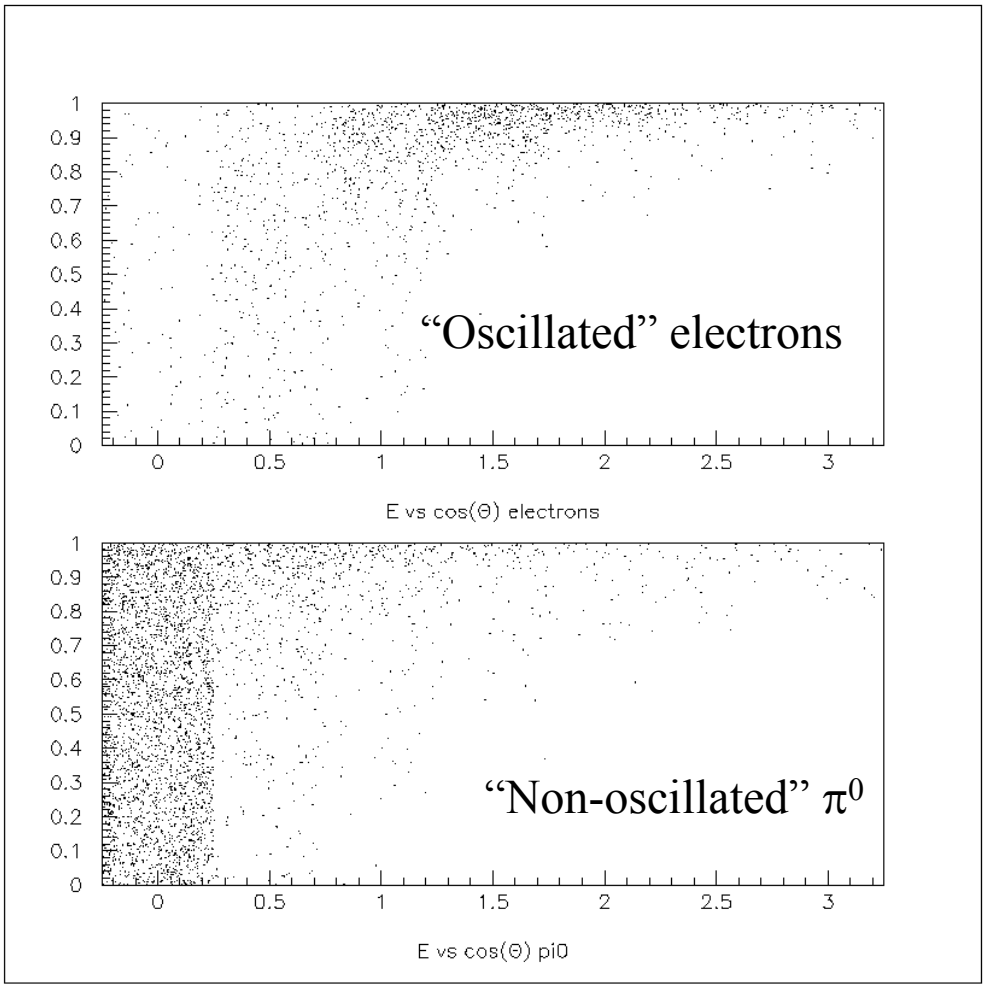
Kinematic Input Distributions

Distributions input to Geant

Obtained from MINOS MC
(Courtesy of Debbie)

Distributions not generated with 3° beam angle

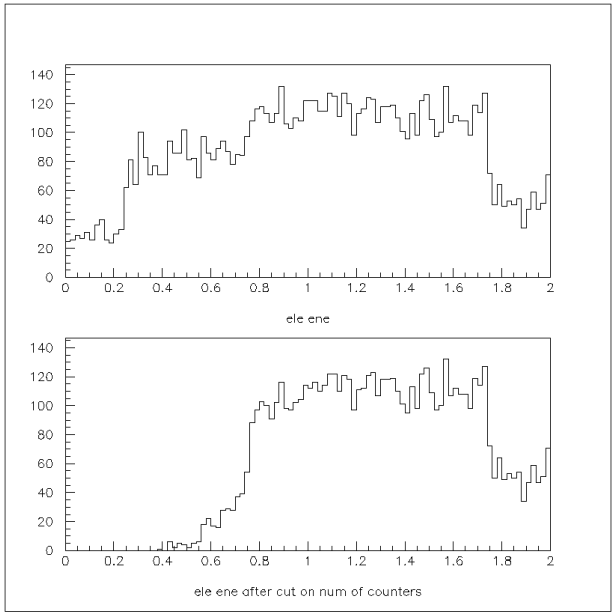
Vertices uniformly distributed in volume ±10 x ±10 x ±60 m^3 about the center of the detector



Analysis Cuts

1) Number of hit counters > 20

(~ proportional to energy cut)

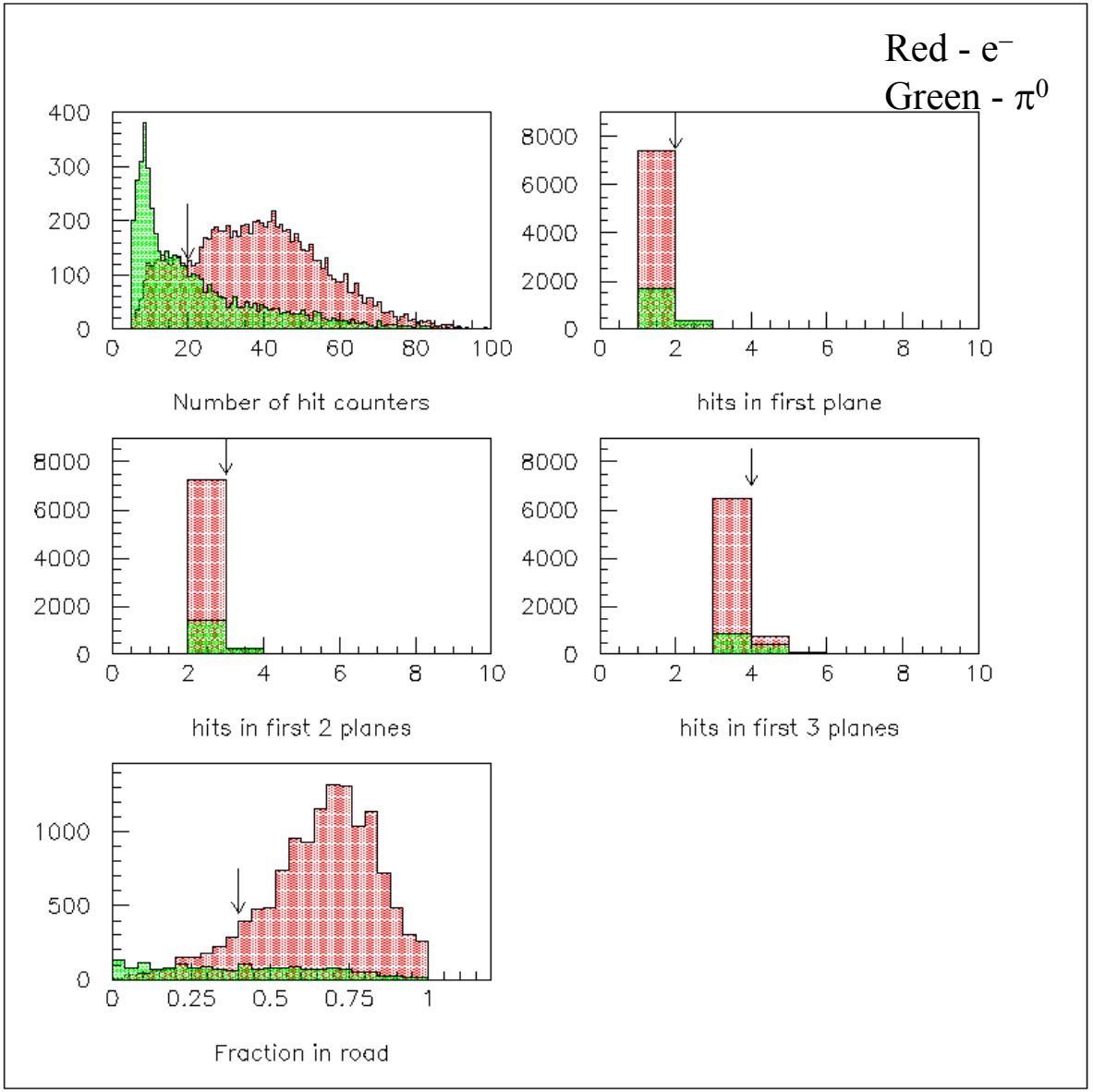


2) 1 hit in each of the first 3 planes with hits

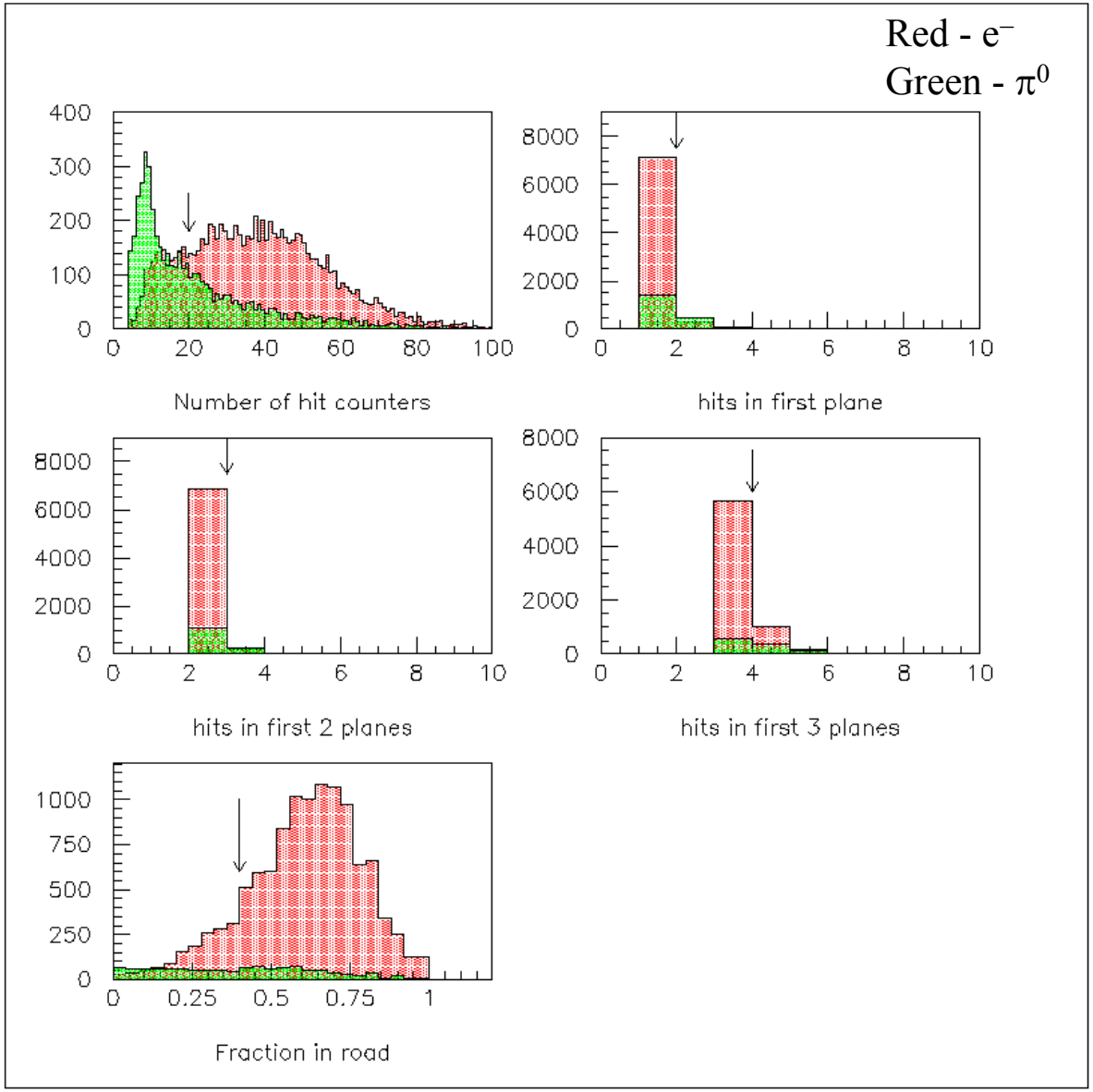
(look for min ionizing e^- before it showers)

3) 40% of all hits in event lie in ± 4 cm road along shower axis in both views.

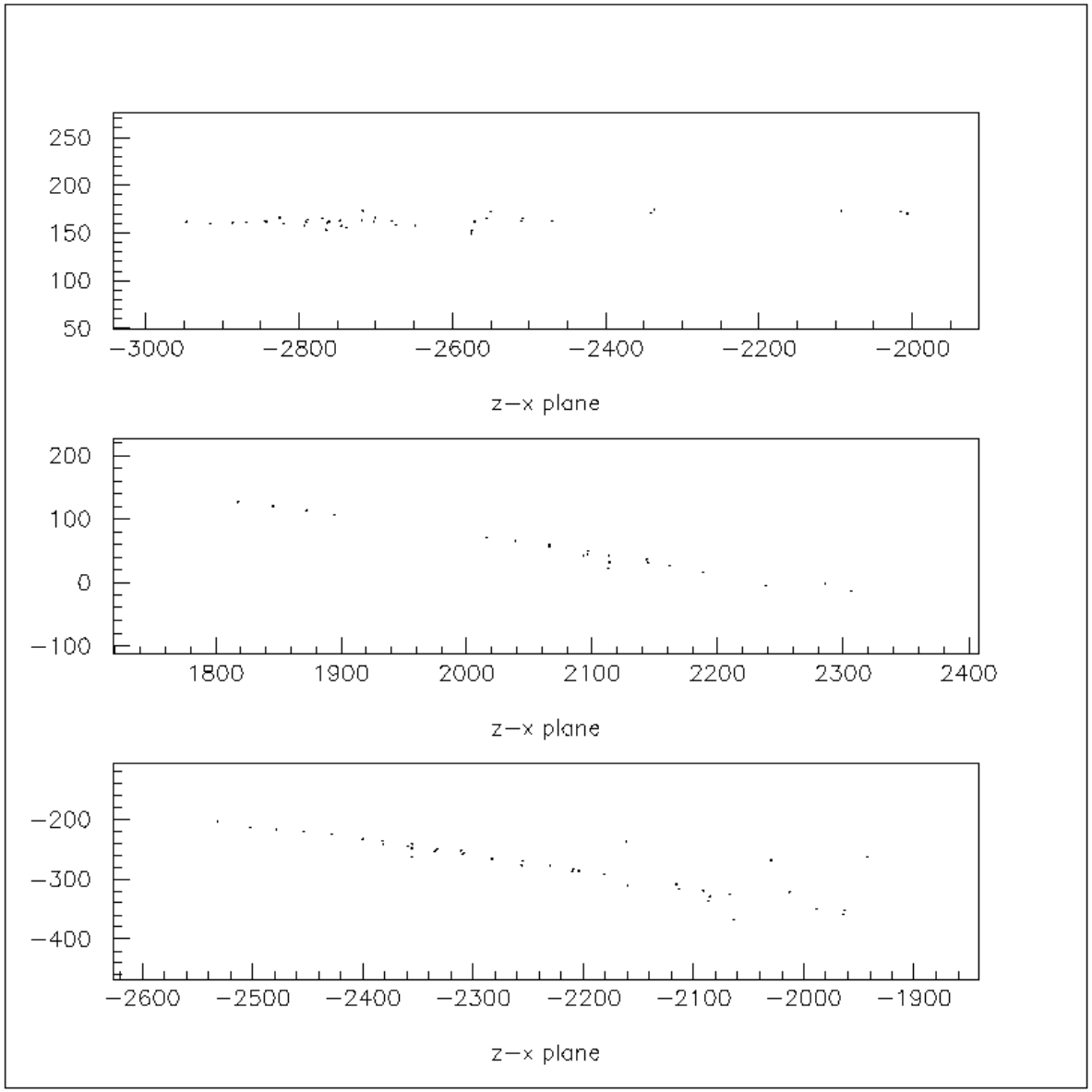
Cuts, No Containers



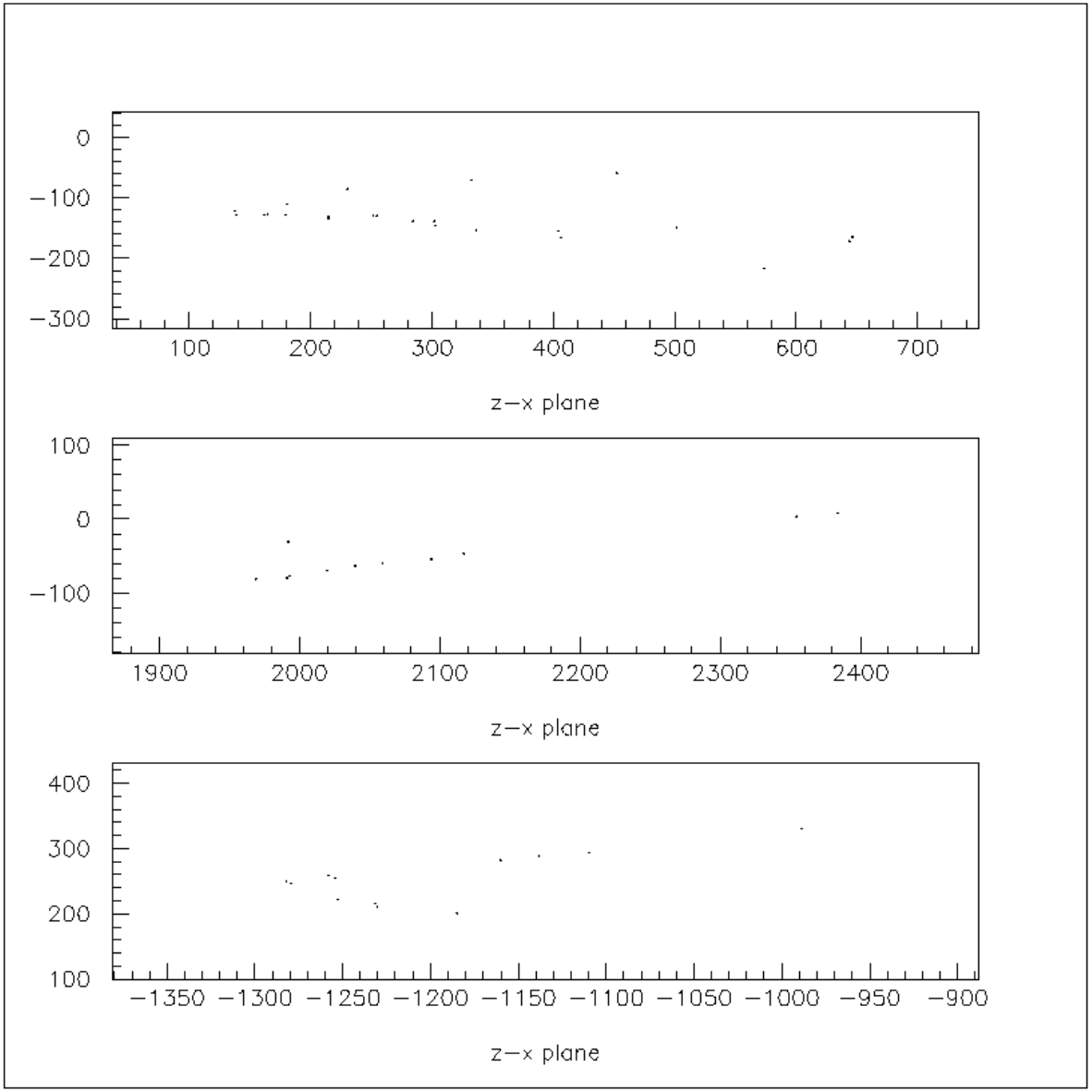
Cuts for Containerized Detectors



Typical e^- Events in Containerized Detector



Typical π^0 Events in Containerized Detectors



Results

	No Container		Containerized Same Cuts		Containerized, Tuned Cuts**	
	e^-	π^0	e^-	π^0	e^-	π^0
Events	10000	10000	10000	10000	10000	10000
Nhits>20	7614	2055	7409	1988	7477	1966
1 hit in first 3 planes	6457	882	5602	585	5650	586
Road cut	5354	264	4388	164	4868	222
electron eff.	**53.5%**		**43.9%**		**48.7%**	
S/N*	**20.3**		**26.8**		**21.9**	

* Not Properly normalized!

** Road Cut optimized

Results

	Containerized 3 cm border		Containerized 6 cm border		Containerized 15 cm border		Containerized 30 cm border		Containerized 60 cm border	
	e^-	π^0	e^-	π^0	e^-	π^0	e^-	π^0	e^-	π^0
Events	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000
Nhits>20	7348	1923	7267	1878	6861	1722	6006	1486	3942	946
1 hit in first 3 planes	5503	567	5367	554	4906	486	4153	410	2597	235
Road cut	4296	181	4196	178	3832	164	3190	151	2029	95
electron eff.	**43.0%**		**42.0%**		**38.3%**		**31.9%**		**20.3%**	
S/N*	**23.7**		**23.6**		**23.4**		**21.1**		**21.4**	

* Not Properly normalized!

Conclusions

- Effects from containers are noticeable
- Do not appear to be debilitating
- Decreased Electron ID efficiency is primary effect rather than increase in background.
- Before committing to a containerized solution the study should be extended to include a full event simulation