First Draft of What I Need
for conversion e^+e^- analysis

M. J. Tannenbaum Electron WG 10/97

For Each Event

- List of electron candidates with Very Loose Cuts
- Event Vertex

Global Information to Characterize Reaction

- $E_T(\eta)$ in e.g. 7 bins of $\delta\eta = 0.1$ $(-0.35 \leq \eta \leq -0.35)$ from **EMCal**
- $dn(\eta)/d\eta$ from **MVD**

  a. in central acceptance

  b. in full MVD acceptance
- Zero Degree Cal Energy from **ZDC**
- Number, $<p_T>$ or $<m_T - m>$ for **Charged Tracks**

  a. All detected non-identified charged particles

  b. All identified π^+, π^-, K^+, K^-, p
- $<E_T>$ and number of clusters for several classes **EMCal**

  a. All calorimter clusters

  b. All calorimeter clusters caused by charged track

  c. All non-charged track calorimeter clusters

  d. All calorimeter clusters $E_T \geq 500$ MeV

  e. ...

Analysis Algorithm

1. Histogram p_T of electrons with loose cuts, + and − separately (will use to find Efficiency of cuts)

2. Histogram p_T of electrons with best cuts, + and − separately

3. Start with first member of list

4. Loop over all other members of list looking for

- **a.** pairs close in θ : $\Delta\theta \leq$ 'Pair cut' **(Conversion + Dalitz)**
- **b.** pairs somewhat close in θ: 'Pair cut' $\leq \Delta\theta \leq$ 'Dalitz cut' **(Dalitz + 'Direct Photon' +)**
- **c.** Alternatively Loop over all pairs with no θ cut— **(Combanitorics!)**
- **d.** Figure out how to reduce combinatorics, e.g. by using n small regions of size $\Delta\Omega/n$, for instance slices in η for high rate high background processes like low mass pairs which are very collimated in ϕ, η before magnet but open up in ϕ after magnet.

5. For Each Pair calculate:

- **a.** 4-vector
- **b.** pair vertex
- **c.** m, p_T, δm, δp_T (resolutions)

6. Histogram pair vertex $[r, \phi, Z]$

7. Separate, if possible, pairs with vertex

- **a.** In beam region
- **b.** Near known converters e.g. beam pipe, MVD ...
- **c.** elsewhere

8. Plot for 'clear' conversions in Beam Pipe and MVD:

$$\frac{d\sigma}{p_T dp_T d\eta} \qquad \text{also} \qquad \frac{d\sigma}{dm}$$

in p_T, m bins—probably 2-d weighted histogram. **needs some thought**

9. Ditto for 'clear' dalitz from Beam Line

8a,9a Separate plots for 'Peripheral', 'non-Peripheral' and 'Central' events

8b,9b Plot same charge vs opposite charge for Actual Events

8c,9c Plot same charge vs opposite charge for Mixed Events

10. Derive inclusive γ spectrum and π^0 spectrum from **8.**, **9.** and check whether they are consistent

* Analysis Needed to figure out how to do this

11. Check conversion measurement by making dedicated runs:

a. With extra %'s radiation lengths converter added near MVD

Now that all the hard work is done—Cash In

12. Plot $e^{\pm}/\{$ Dalitz (+ Conversion) $e^+e^-\}$ vs p_T

* There is a simple-to-calculate curve, probably a constant, if all $e^{\pm}$ due to Dalitz + conversions

The data will deviate from this curve for $p_T \geq 1$ GeV/c, allowing us to clearly see a 'charm' signal, probably $e^{\pm}$ for $p_T \geq 2.0$ Gev/c.

13. Plot invariant masses of **All** same charge and opposite charge pairs

14. Due to PHENIX excellent mass resolution, find J/Ψ peak if luminosity is adequate, and if histogram binning is reasonable.

15. Plot $\Psi/\{e^{\pm} > 2.0$ GeV/c$\} \propto \Psi/c-\bar{c}$ vs E_T

16. Find ϕ peak and plot ϕ/dalitz vs. p_T, $\phi/c-\bar{c}$ vs E_T ...

17. Look at other mass regions and their ratios

a. Ψ/Drell-Yan

b. ϕ/Drell-Yan

c. ...

Plot these ratios vs E_T à la Gonin

18. Go to

a. Stockholm (Nobel Prize)

b. Lund (Collaboration Meeting)

Depending on the result!!!