

III.G2a. SEARCH OF BEAUTY PARTICLES WITH A HYBRID
TECHNIQUE AT TEVATRON ENERGIES

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The lifetime of b particles is estimated of the order of $10^{-13}/10^{-14}$ corresponding at Tevatron energies to paths of the order of 50/500 μm , clearly indicating that the emulsion is a technique able to provide the direct observation of their decays.

The highest possible energy for the primary beam is obtainable in order to maximize the number of events produced, i.e., the reaction

$$\text{hadron} + N \rightarrow b + \bar{b} + X.$$

In order to have a maximum number of events we used a large emulsion volume and a high hadron flux. Preliminary tests indicate that (with 370 GeV π) a flux of 2000 fast particles/cm² is the maximum acceptable. We can get more information when we start to screen and measure emulsions on NA 19 experiment at CERN.

In that experiment the emulsion volume is 50 liters; muons charge prong multiplicity $\langle \mu_c \rangle \sim 16$ and with the pulsed flux we have

$$\text{int/mm}^3 \sim \overset{5}{\text{primary}} + \overset{2.5}{\text{secondary}} \quad (\lambda_{\text{int}} \approx 400 \text{ mm}),$$

assuming a cross section for $b\bar{b}$ production $\sigma_{b\bar{b}} \approx 50 \mu\text{b}$, we expect $n_{b\bar{b}}/\text{mm}^3 \sim 8 \times 10^{-6}$.

These figures are valid even at Tevatron energies. In order to trigger the scanning we propose using the semi-leptonic cascade decay. An appropriate chamber-counter set-up allows the μ detection. The 3μ trigger is the more appropriate to reduce the background/signal ratio to $\sim 30/100$. [Figures used for the computation $(c + \mu)/(c + \text{all}) = 0.1$; $(b + e)/(b + \text{all}) = 0.15$; $(b + \mu)/(b + \text{all}) = 0.15$.] Emulsions are waved in front of the beam. The area scanned can be reduced to few mm³ using centroid chambers (waved with emulsions) for the determination of primary track ($\pm 100 \mu\text{m}$) together with a vertex detector (MWPC).

All these figures probably are of the same order of magnitude even at Tevatron energies, but the work of the vertex detector may be not as good as at lower energy ($\pm 3 \text{ mm}$ along the beam).