Towards B Lifetimes - A Progress Report

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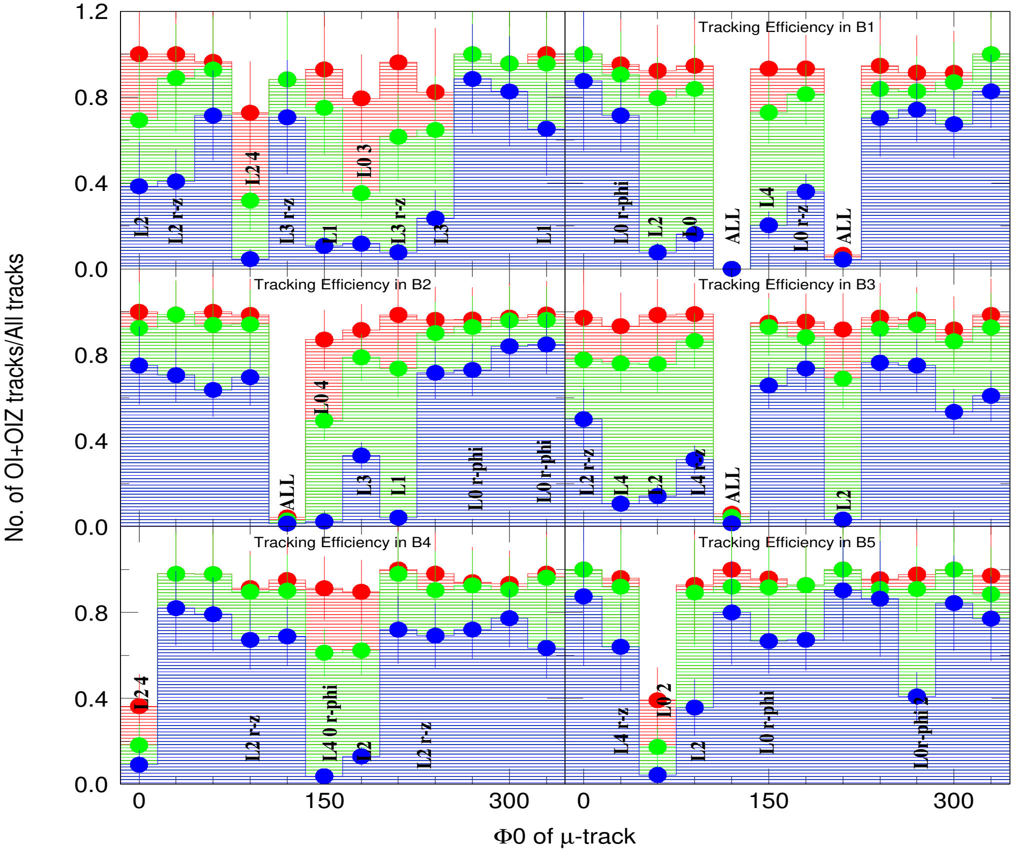
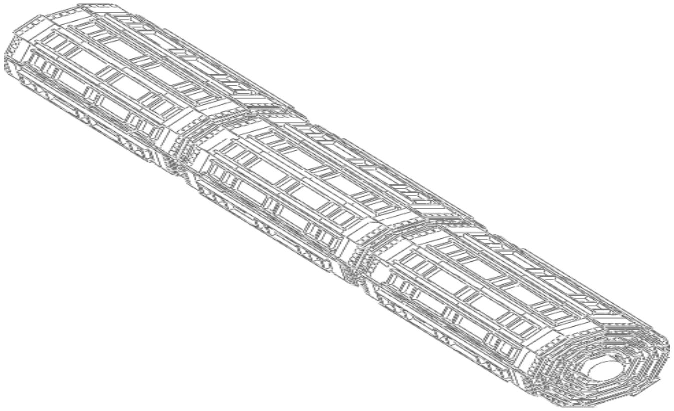
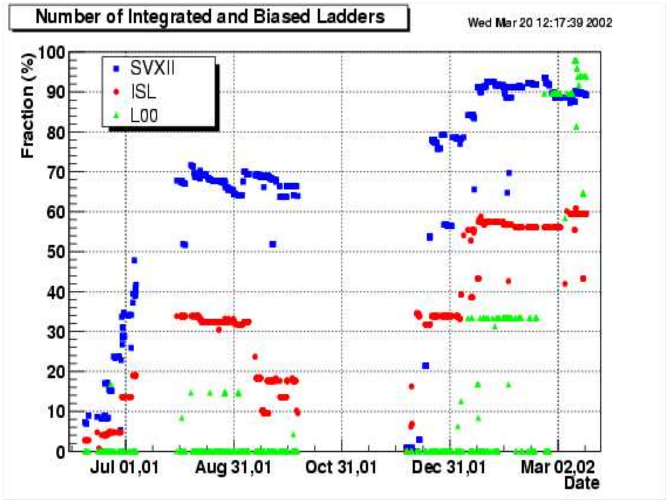
No Silicon
No lifetimes

The SVXII detector is an essential ingredient in vertex reconstruction for B lifetimes. What is the current coverage and acceptance?

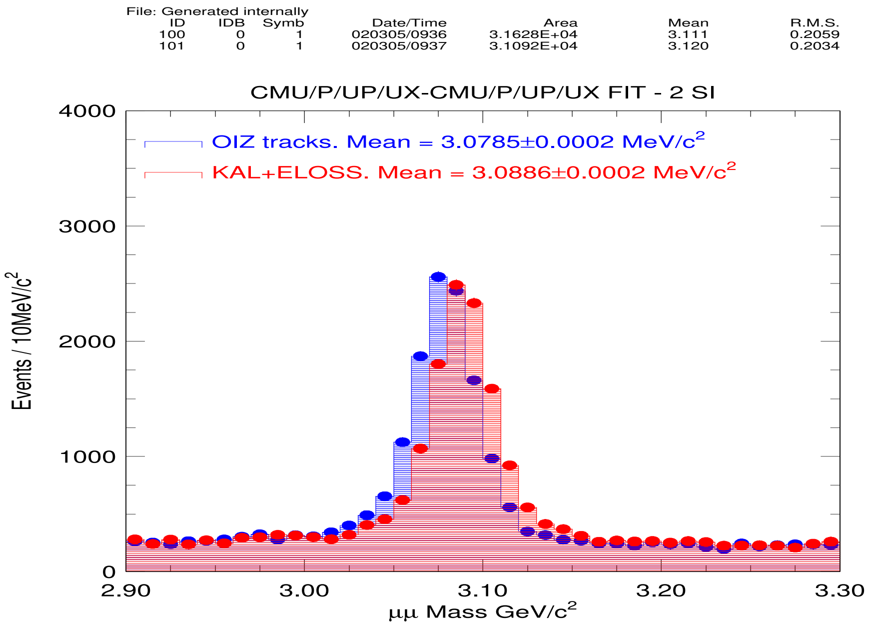
- SI track ≥ 3 r-ϕ hits
- SI track ≥ 4 r-ϕ hits
- SI track ≥ 5 r-ϕ hits

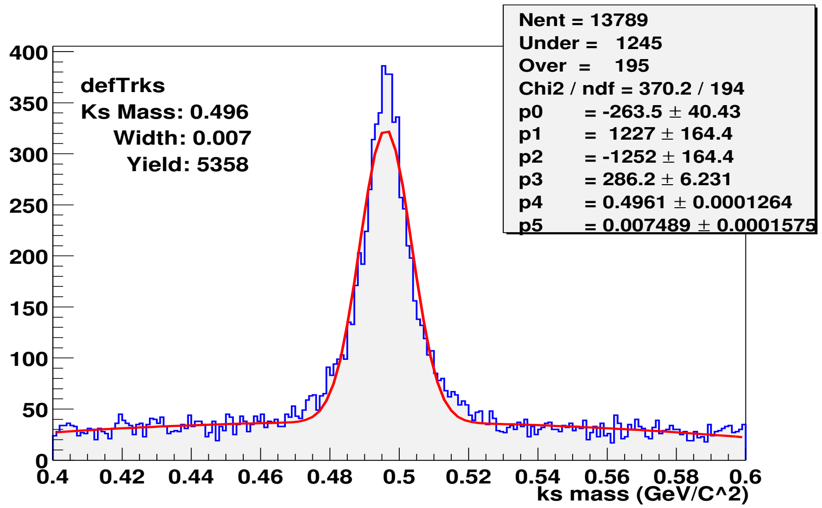


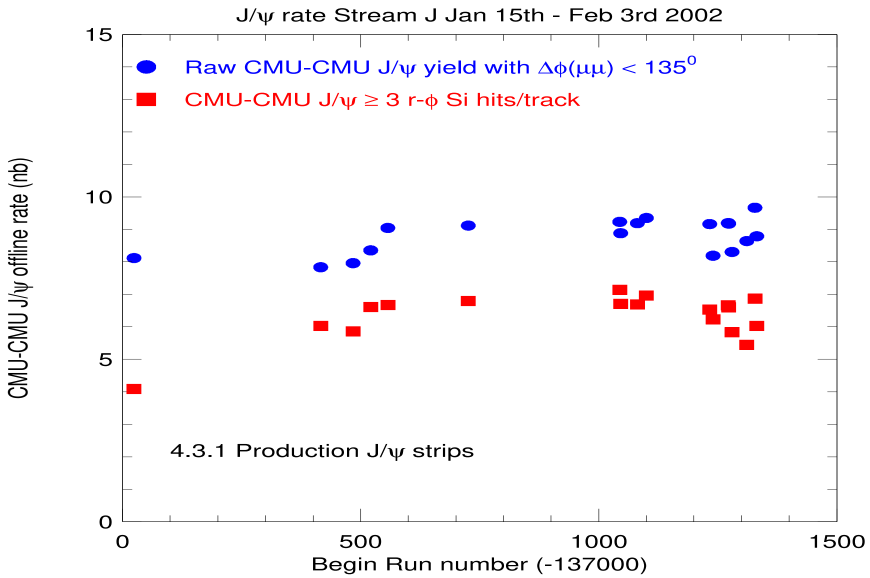


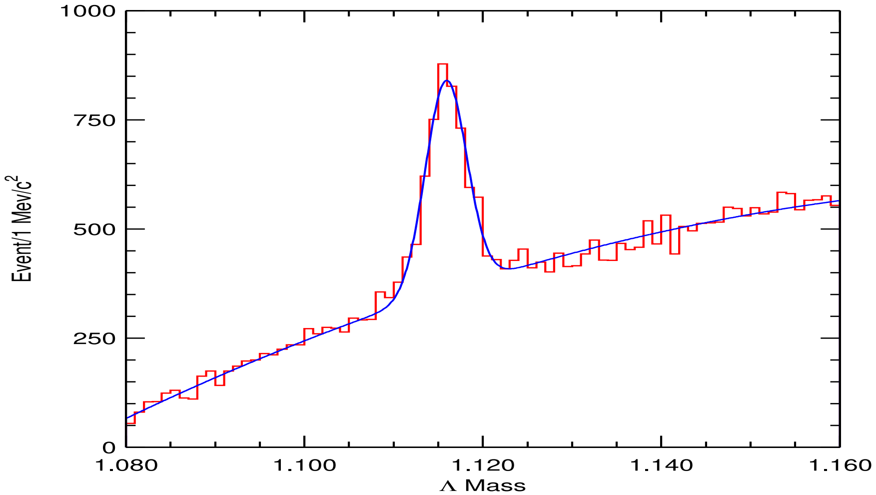


Reconstruct Si J/ψs and V0s









Measuring the 2-D lifetime

$$\mathcal{L} = \sum_{i=1}^{N} \log P$$

$$P(c\tau, \sigma_{c\tau}, m, \sigma_m) = (1 - f_B).F_{sig}(c\tau, \sigma_{c\tau}).M_{sig}(m, \sigma_m) + f_B.F_{bgr}(c\tau, \sigma_{c\tau}).M_{bgr}(m, \sigma_m)$$

Ingredients:

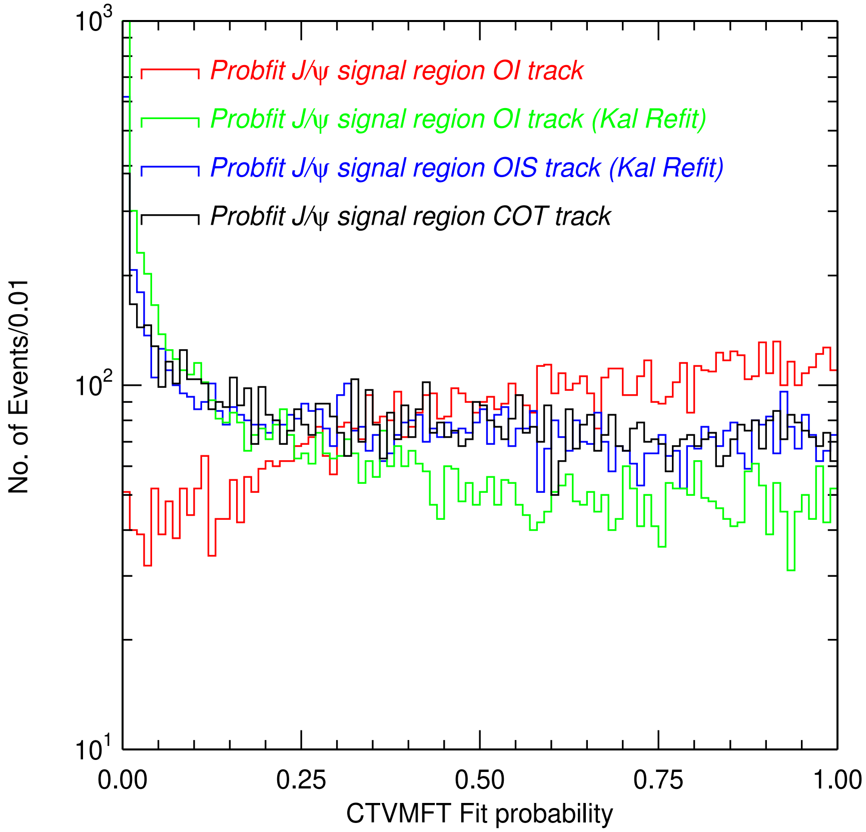
- f_B : *background fraction*
- $c\tau$: *Proper decay length*
- $\sigma_{c\tau}$: *uncertainty on $c\tau$*
- m : *invariant mass of b-hadron*
- σ_m : *error on invariant mass of b-hadron*

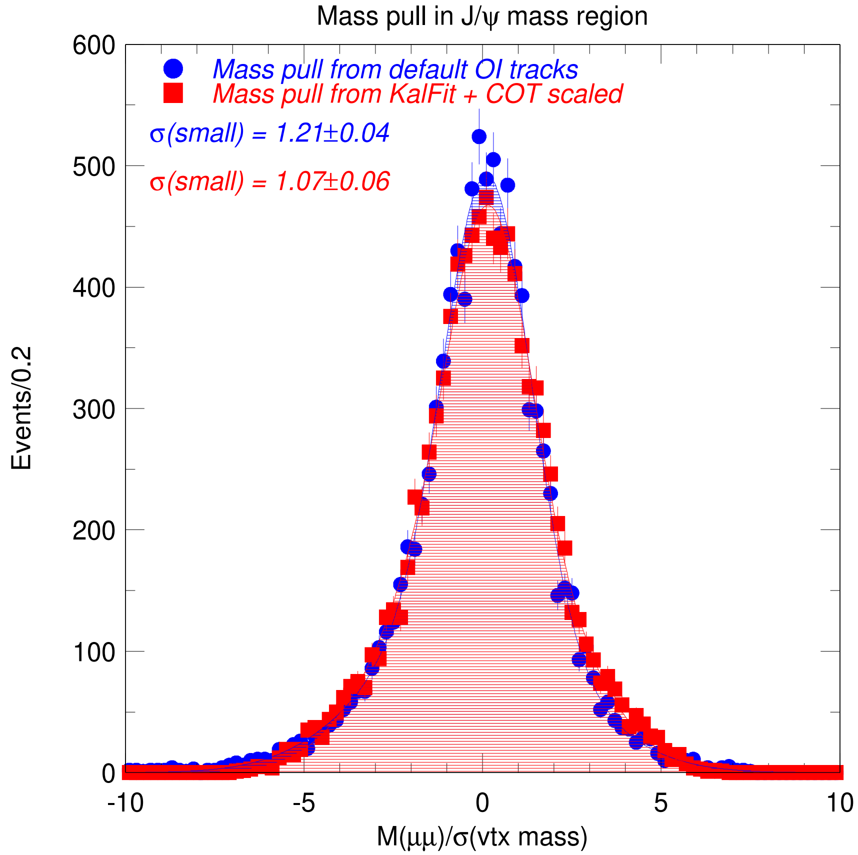
$$c\tau(2D) = L_{xy}\frac{1}{\beta_T^B \gamma_T^B} = \frac{L_{xy}}{m_B/P_t^B}$$

L_{xy} is the projection of the vector pointing from the primary vertex to the B decay vertex.

Vertex errors

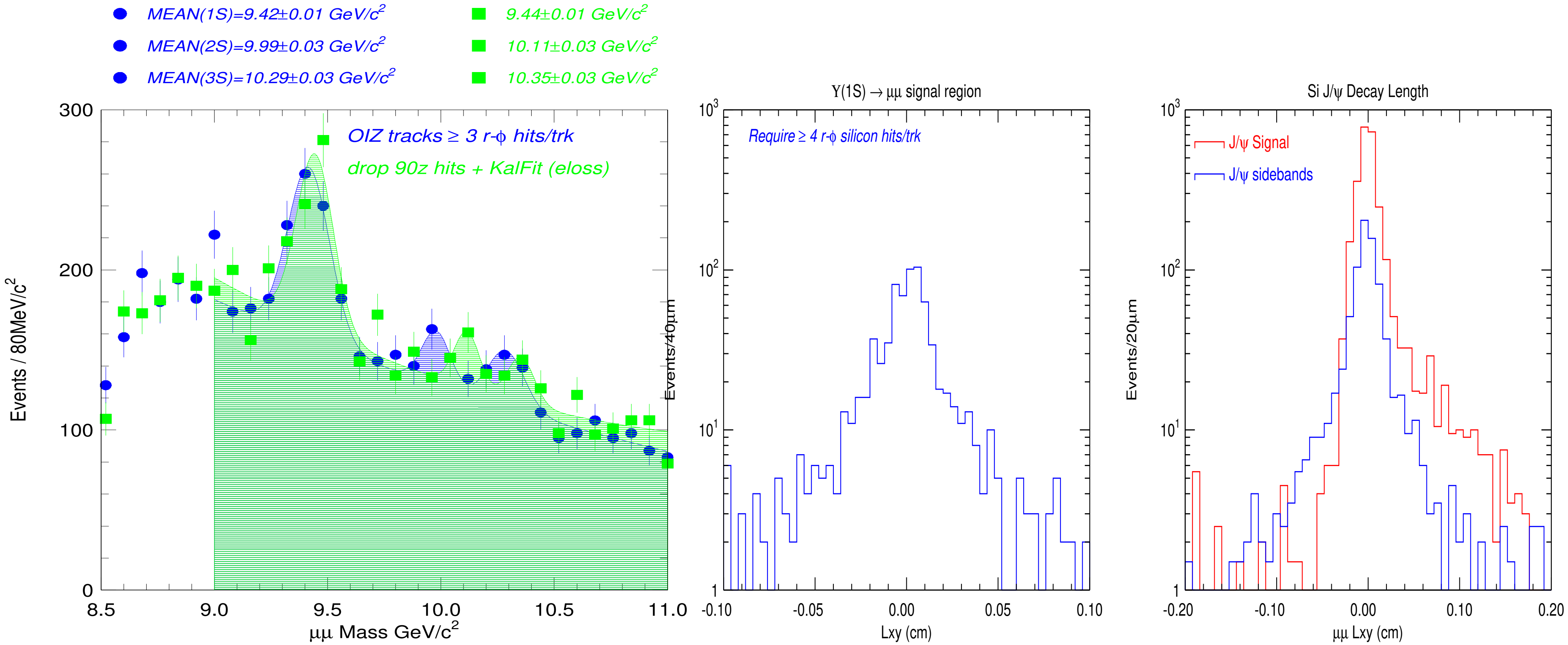
To measure L_{xy} we need to reconstruct the B vtx reliably. Vertexing is sensitive to many issues: Alignment, geometry, track parameter errors...etc. Constrained vtx probability should be flat with small peak at 0. Pull distributions $\sigma = 1.0$





Lifetime background shape and $\sigma(L_{xy})$

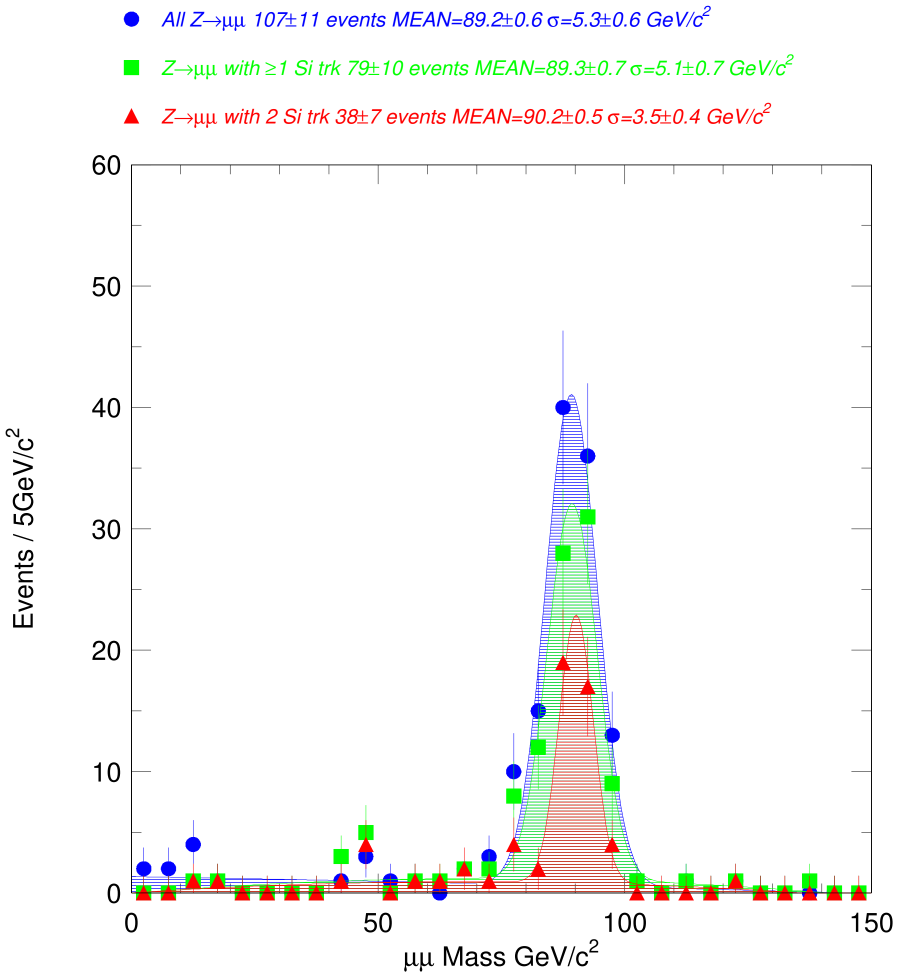
Run I B lifetime analysis: "lifetime distributions of background is well described by a central Gaussian and the sum of 2 exponential functions for the positive $c\tau$ region and one exponential function for the negative $c\tau$ region." $\Upsilon \to \mu\mu$ has 0 lifetime.

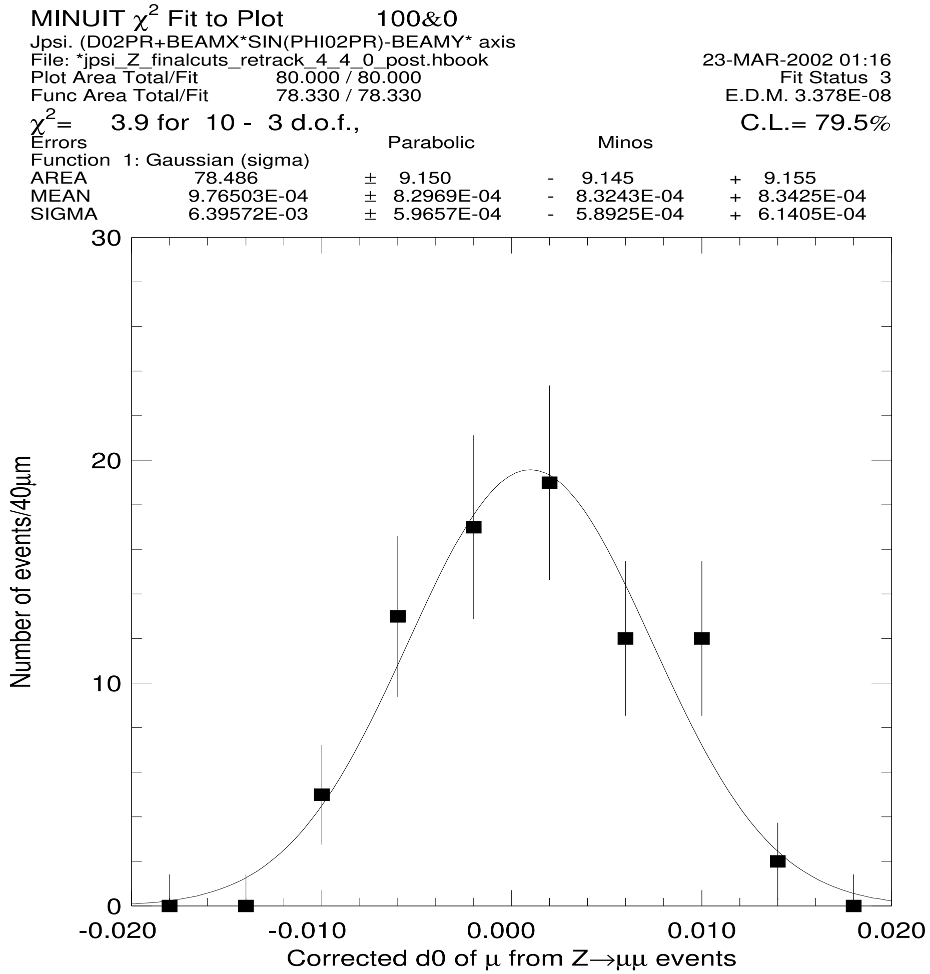


- Fit to $L_{xy}/\sigma(L_{xy})$ = single Gaussian with $\sigma = 1.8 \pm 0.2$.

Measuring the $r - \phi$ resolution

$\sigma(d0)_{measured} = \sigma(d0)_{detector} \oplus constant/P\beta \sin\theta^{3/2}$, since $Z \to \mu\mu$ v. high $P_t \Rightarrow \sigma(d0)_{measured} \approx \sigma(d0)_{detector}$. Back to back tracks $\Rightarrow \sigma(d0) = \sigma(d0_{\mu 1} - d0_{\mu 2})$

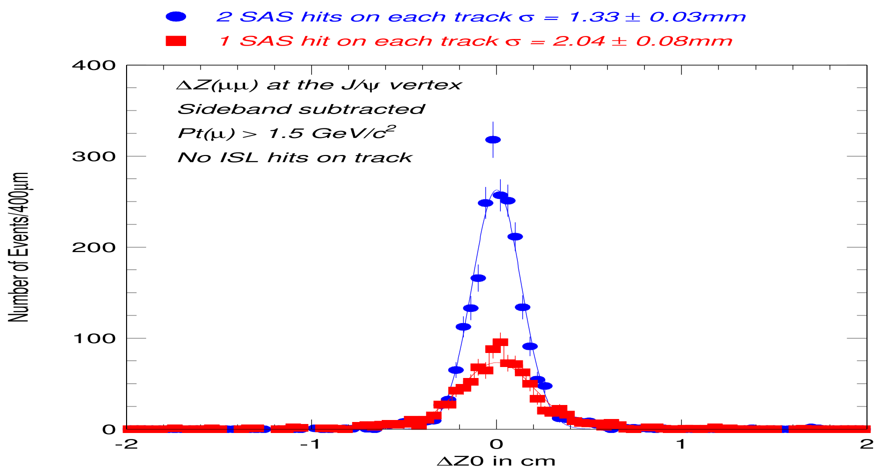


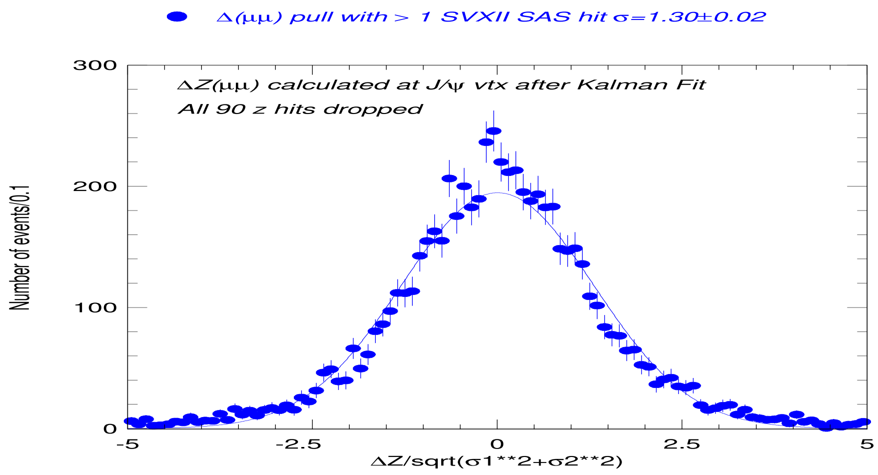


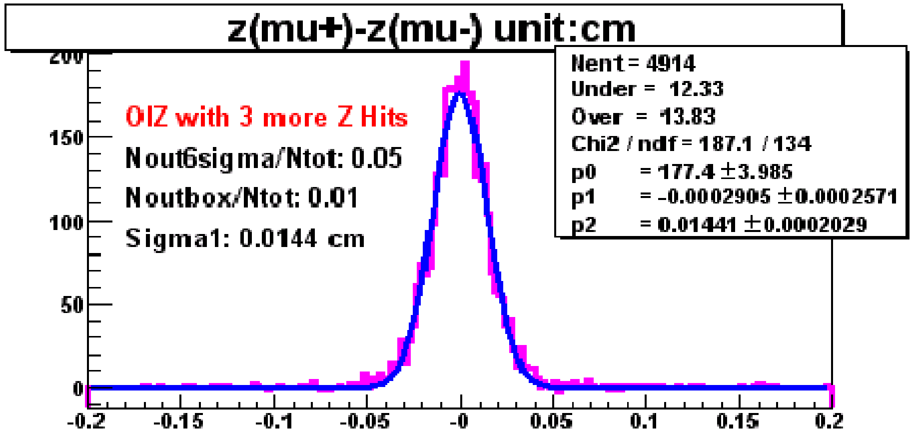
3-D lifetime fits

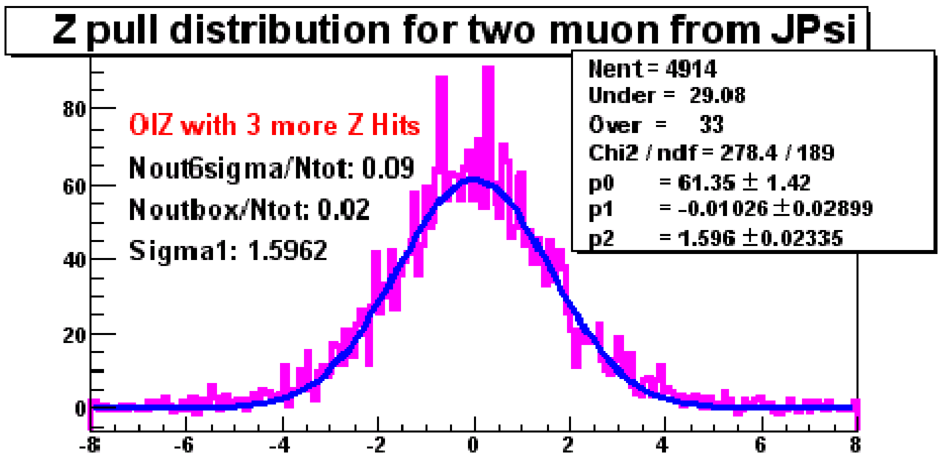
SVXII is a 3-D device. 5 double sided silicon layers = 2 1.2^0 + 3 90^0 r-z layers.

How good can we reconstruct the 3-D $J/\psi \rightarrow \mu\mu$ vertex?





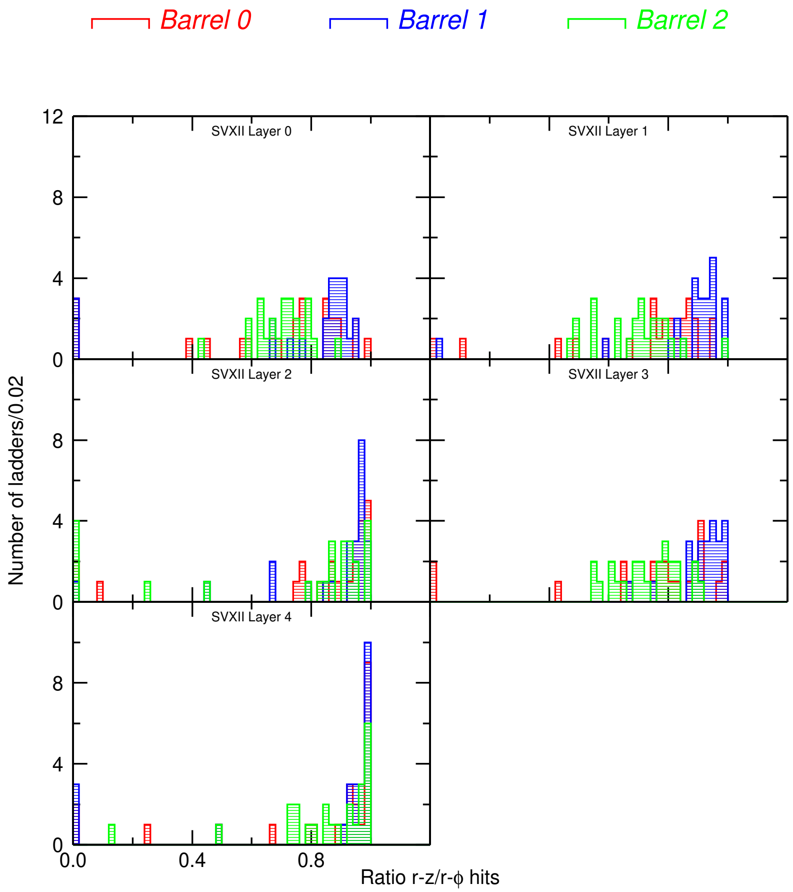




3-D Silicon - Alignment!!!!

Ladders bow, warp O(100μm)! 90z pitch is 112μm. Need v. good alignment to find the right hit.

Wrong global z positions



Correct global z to O(100μm)