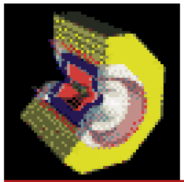

Cornell University
Laboratory for
Elementary-Particle Physics

$D_S^{*+} \to D_S^+ e^+ e^-$

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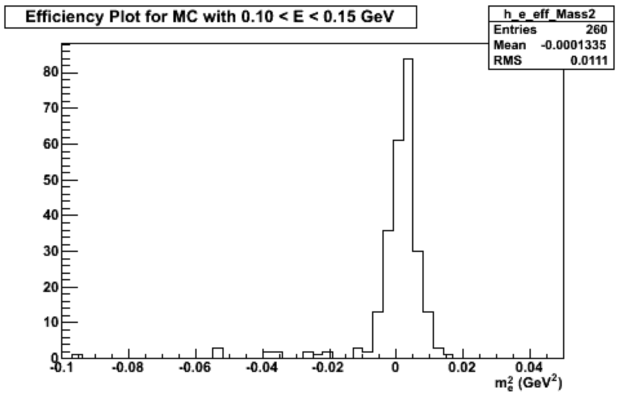
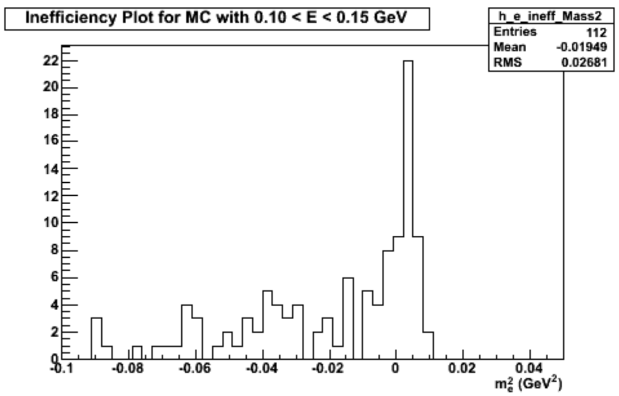
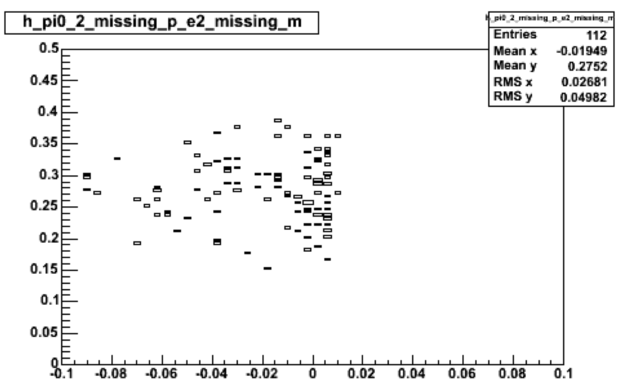
29 June 2010

Low Energy Electron Reconstruction Efficiency







The energy range for the missing electron is 100 - 150 MeV. The threshold for the photon and the first electron has been reduced to 50 MeV each (used to be 100 MeV). This gives me 28 events under the inefficiency peak between 0.002 and 0.007 GeV^2

3 independent phenomena that seem to be happening under the peak under inspection of the decay chain and the reconstructed objects.

1. We genuinely fail to see a second electron in the event.

2. The photon from the last pi0's Dalitz decay is mis-reconstructed, it is often reported 60 MeV lower in energy. At least once it is thought to be a case of split showers.

3. The candidate photon is confused with photons radiated from the e+ or e- of the pi0 decay. Often this is most of the energy of the electron. This will still give us as missing mass the invariant mass of the photon, which is 0. Will fall under peak!

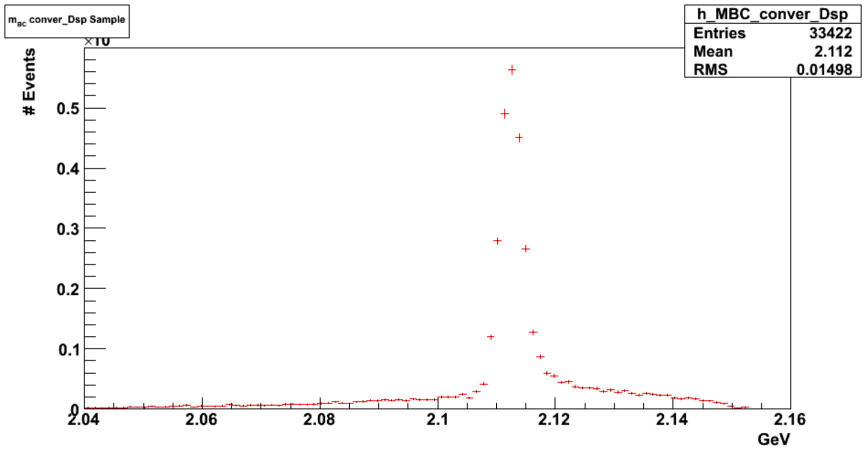
Low Energy Electron Reconstruction Efficiency

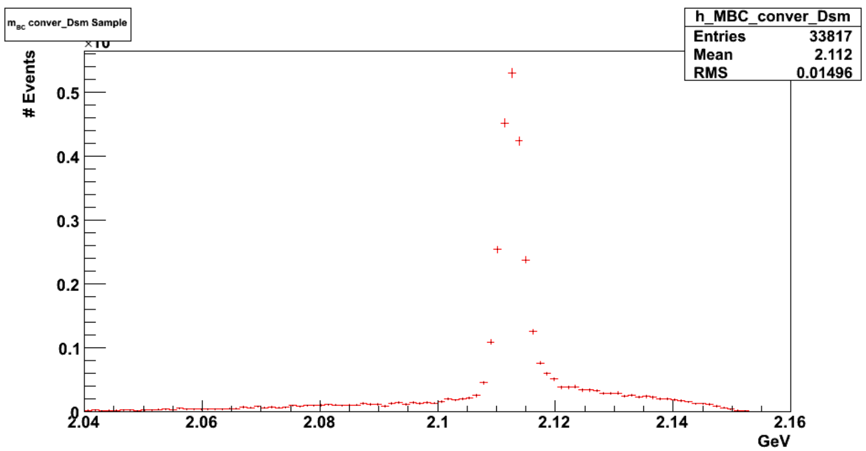
We barked up the wrong tree. We will now reconstruct J/Psi -> pi0 pi0; where both pi0s decay to photons as the denominator channel and one pi0 Dalitz decays as the numerator channel.

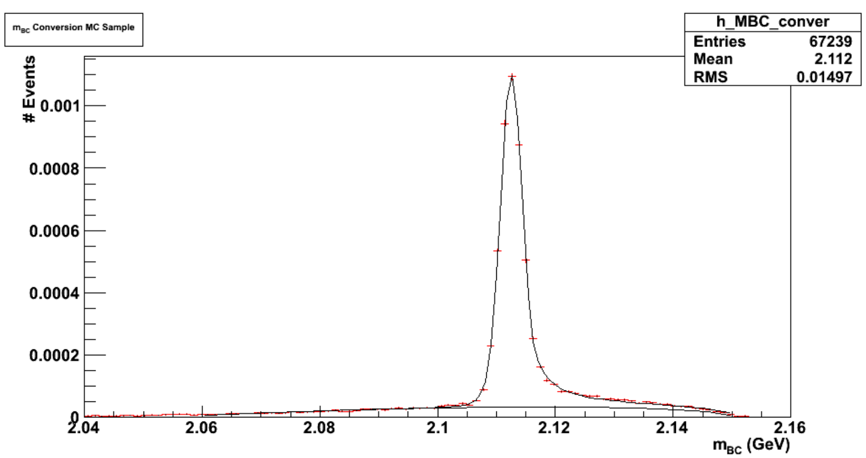
Advantage to this: This is going to encapsulate the uncertainties in our photon and electron reconstruction efficiencies, exactly like our main analysis.

Work started – Signal samples for the numerator and denominator channels ready. Analyzer ready… need to cross check and run.

Should have numbers by Thursday.

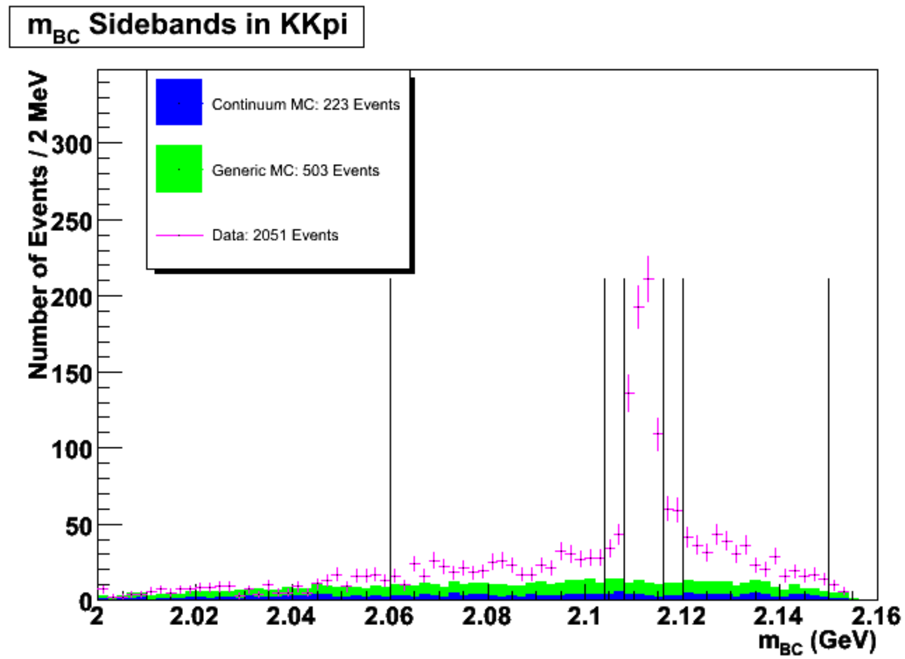






Ds* -> Ds gamma Channel

1. I made sure the generic + continuum MC with Ds* -> Ds gamma vetoed at generator level does not peak in the mBC after all other cuts.



2. The signal sample for this channel can be fitted very nicely to a double-sided Crystal Ball function on top of an Argus function.
3. The double-sided CB function will be fitted on top of a different Argus function in data.
4. Should be accomplished by end of today.

m_{ee} versus Vertex Fitting χ^2

Brian suggested two ways to try and improve S:B

1. Vertex constrain the e+ and e- candidates.

2. Vertex constrain the beamspot, Ds, e+ and e- candidates. Vertex constrain the beamspot and Ds candidates.

Now apply cuts on the reduced chi^2, and m_ee and see if that gains us statistical power. I have written the appropriate n-tuplizer. Will I really have TIME to do this before un-blinding? August 19th is my defense.

Conversion backgrounds contribute ~ 30% of our total backgrounds, mostly from the KKpi channel.

m_{ee} versus Vertex Fitting χ^2

Table 3: Number of signal and background events expected from Monte Carlo in pion mass fitted data.

Mode	Signal	Generic Background	Continuum Background	Total Background	$s/\sqrt{b}$
$K^+K^-\pi^+$	11.7	2.03	0.00	2.03	8.2
K_SK^+	3.12	0.78	0.00	0.78	3.5
$\eta\pi^+$	4.00	0.21	0.20	0.41	6.3
$\eta'\pi^+;\eta'\to\pi^+\pi^-\eta$	1.02	0.47	0.00	0.47	1.5
$K^+K^-\pi^+\pi^0$	4.62	3.49	0.40	3.89	2.3
$\pi^+\pi^-\pi^+$	2.99	0.73	0.60	1.33	2.6
$K^{*+}K^{*0}$	1.78	1.35	0.00	1.35	1.5
$\eta\rho^+$	5.54	2.40	3.60	6.00	2.3
$\eta'\pi^+;\eta'\to\rho^0\gamma$	2.17	0.83	1.60	2.43	1.4
Total	36.94	12.29	6.4	18.69	8.6

Table 4: Number of signal and background events expected from Monte Carlo in electron mass fitted data.

Mode	Signal	Conversion Background	Generic Background Conversions Vetoed	Continuum Background	Total Background	$s/\sqrt{b}$
$K^+K^-\pi^+$	13.36	1.04	0.42	0.00	1.45	11.1
K_SK^+	3.05	0.34	0.21	0.00	0.54	4.13
$\eta\pi^+$	4.54	0.17	0.10	0.20	0.47	6.6
$\eta'\pi^+;\eta'\to\pi^+\pi^-\eta$	0.74	0.00	0.00	0.00	0.00	∞
$K^+K^-\pi^+\pi^0$	4.86	0.63	1.46	0.20	2.29	3.2
$\pi^+\pi^-\pi^+$	3.67	0.28	0.21	1.60	2.09	2.5
$K^{*+}K^{*0}$	2.02	0.23	0.63	0.20	1.05	2.0
$\eta\rho^+$	5.71	0.85	0.99	1.00	2.84	3.4
$\eta'\pi^+;\eta'\to\rho^0\gamma$	2.41	0.34	0.21	1.80	2.35	1.6
Total	40.36	3.88	4.23	5.00	13.08	11.2