

*Investigation of $B^+ \rightarrow \rho^+ \pi^0$
(or $\pi^+ \pi \pi^0$ in the ρ mass region)*



BABAR



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motivation and goals

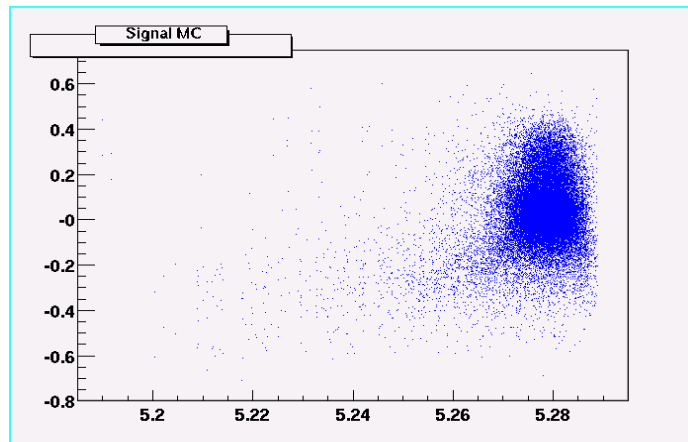
- A measurement of $B \rightarrow \rho\pi$ can give an unambiguous measurement of the CKM angle α .
- Source of bg to other analyses ($\pi^0 \pi^0$)
- Direct CP Violation in $B^+ \rightarrow \rho^+ \pi^0$
 - Theoretical asymmetry $\sim 2\%$
 - Unlikely to observe with expected number of events and high backgrounds
- Theoretical Branching Fraction is $\sim 3-27 \times 10^{-6}$.

goals

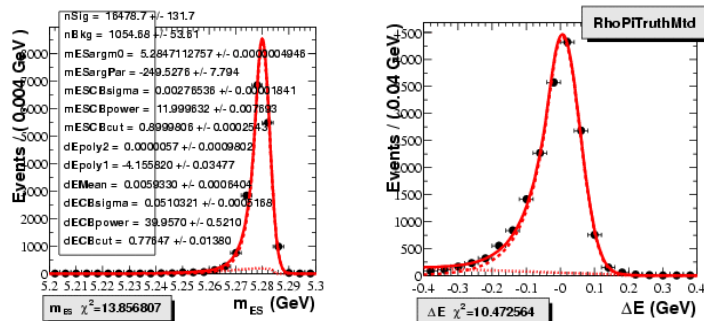
- BF measurement with cut-and-count analysis initially
- Move on to extended ML analysis afterwards

igna

ronnisonal events
Truth matched candidates

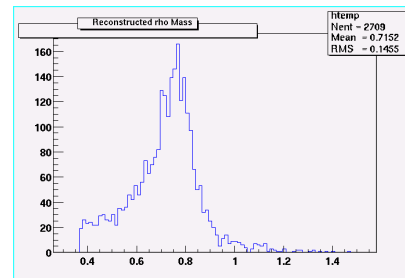
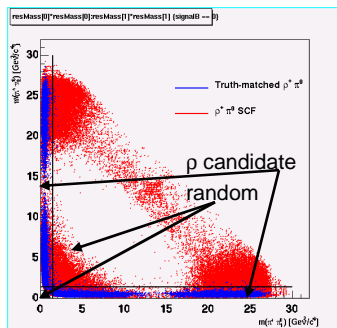


- fine Signal o as
- oth fitted ith rystal all
- .271 m .27 eV c
- Δ 0.1 eV



ρ candidate selection

- Due to the presence of 2 π^0 s there are two possible ρ candidates
- Need to decide which $\pi\pi^0$ is the ρ candidate in order to calculate certain quantities (e.g. helicity)



mass range

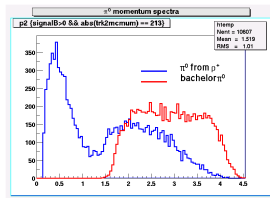
ρ

event

- necessary to retain the whole line-shape of the ρ to help potentially resolve interference from other $\pi\pi^0\pi^0$ final states later
- note that ρ lineshape is wrong. will have to re-run MC

ts so fa

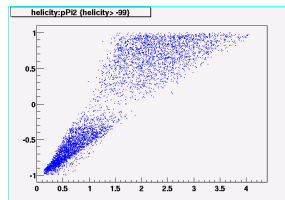
elicity



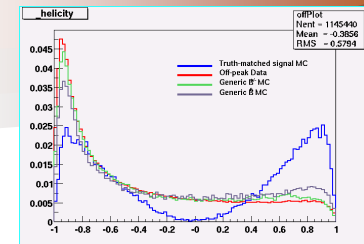
π^+

ρ

π^0

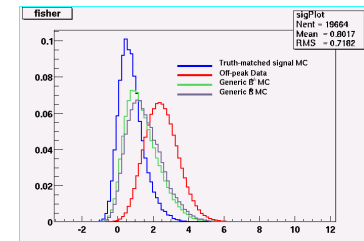


ρ



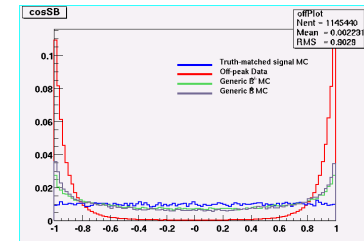
isher

+ +



- $\cos B_{mom}$ is the cosine of the angle between B direction and beam axis
- $\cos B_{thr}$ is the angle between the thrust axis of the B candidate and the beam axis

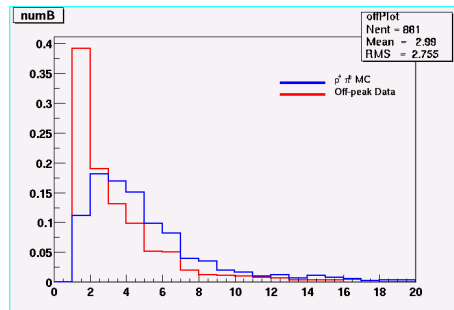
$\cos \theta_s$



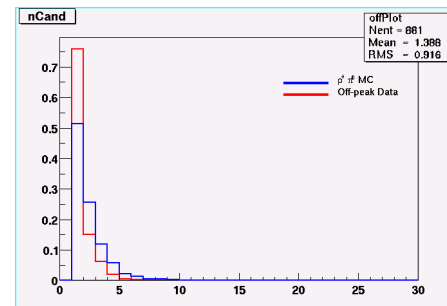
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- After cuts choose the candidate within an event which has the lowest Δ
 - igh multilpicity $2 \times \pi$ s in the final state

o c ts



o inal c ts



0

- When a candidate has passed all cuts with only one candidate per event $B \rightarrow \rho \pi^0$ candidates are taken to be those where the ρ candidate mass lies within the ρ mass window previously defined (0 - 1.2 eV/c)



Mode	No. Events	Events per fb ⁻¹	Equivalent Luminosity [fb ⁻¹]
$\rho^+ \pi^0$ MC	59,000	25	2360.00
generic B ⁰	63,745,700	525000	121.42
generic B ^{+/-}	66,722,000	525000	127.09
uds	139,397,000	2090000	66.70
ccbar	86,906,400	1300000	66.85

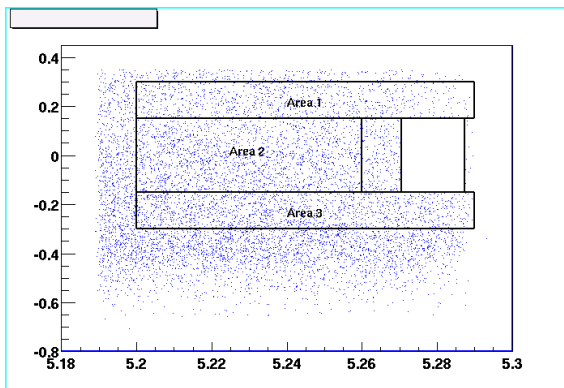
vaila le data

- Summer Data Set

fb n peak ata
fb ff peak ata

ata o a isons

- Still blind (obviously)
- Look in different regions of the Δ -m plane and compare with generic Data (cross-checks)



Mode	Area 1	Area 2	Area 3
$\rho^+ \pi^0$ MC	572	1106	605
generic B^0	47	258	449
generic $B^{+/-}$	80	395	523
uds	896	1876	1224
ccbar	104	279	203
Off-peak	91	193	118
On-peak	763	1772	1287

Δ ES
 Δ ES
 Δ ES

comparison of on peak vs ff peak generic

	On-peak	Off-peak + generic B
Area 1	763 +/- 13	860 +/- 80
Area 2	1772 +/- 42	1996 +/- 120
Area 3	1287 +/- 36	1480 +/- 100

comparison of ff peak vs uds ccbar

	Off-peak	uds + ccbar
Area 1	91 +/- 10	96 +/- 3
Area 2	193 +/- 14	207 +/- 5
Area 3	118 +/- 11	137 +/- 4

to tisation

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tag rec

ρ^0
 π^0
 π^0
 π^0

pologies but the table below is for identical cuts but using no tagging information

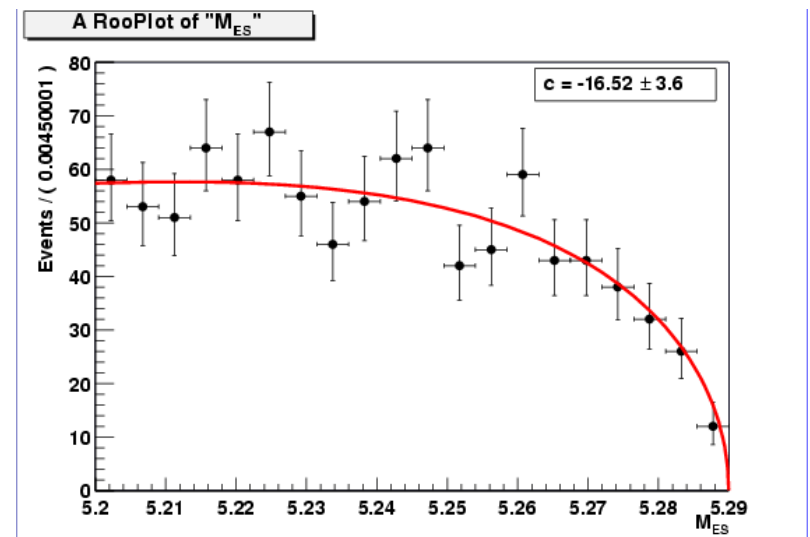
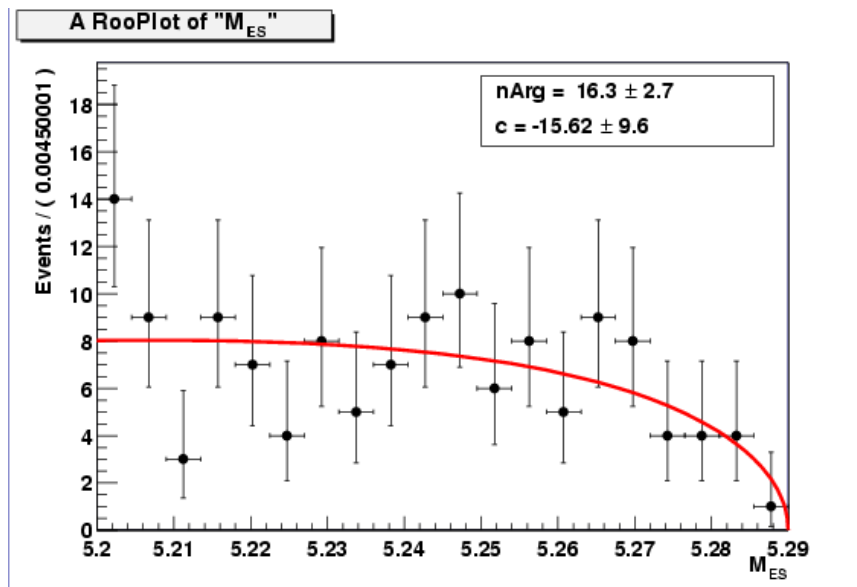
Mode	No. Events in Sig. Box	Normalised to 81 fb ⁻¹
$\rho^+ \pi^0$ MC	2243	76.98432203
generic B ⁰	9	6.00395322
generic B ^{+/-}	20	12.7468723
uds	103	125.0824588
ccbar	14	16.96335079
Off-peak	15	189.84375
On-peak	N/A	N/A

Ba g o n s

- B-related backgrounds are currently a problem to understand
 - For now, the dominant contributions arise from decay channels that are nearly only UL exist
 - Utilise the correlations between Δ and τ to get more accurate fraction of signal events using Likelihood
 - Not yet done

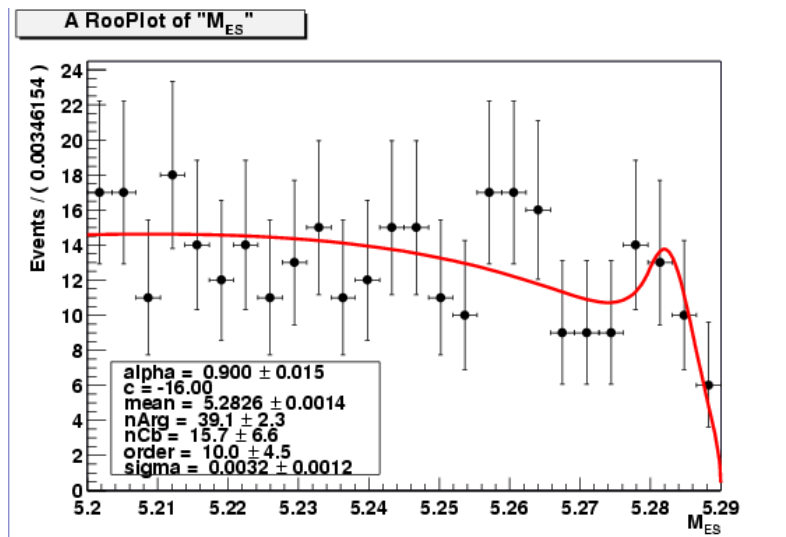
n in ing

- Fit an 'Argus' function to off-peak data and udsc MC



n in ing

- use parameters from the Argus fit and from fitting generic + MC do a combined fit



- Contributions from 'B' events?



t e o

- Current writing theories capture
- use mainly unique words to distinguish signals