

Status report on

$$\eta \rightarrow \pi^+ \pi^- e^+ e^-$$

Phi-decays WG meeting 28-02-2007

Since the last meeting...

We were with S/B 1:5 and
main background $\phi \rightarrow \rho\pi \rightarrow \pi^+\pi^-e^+e^-\gamma$

MC studies in order to:
improve signal selection
identify other sources of background
and possible rejection

MC sample studied:
716 pb⁻¹ for mrc
8·10⁵ events signal private MC

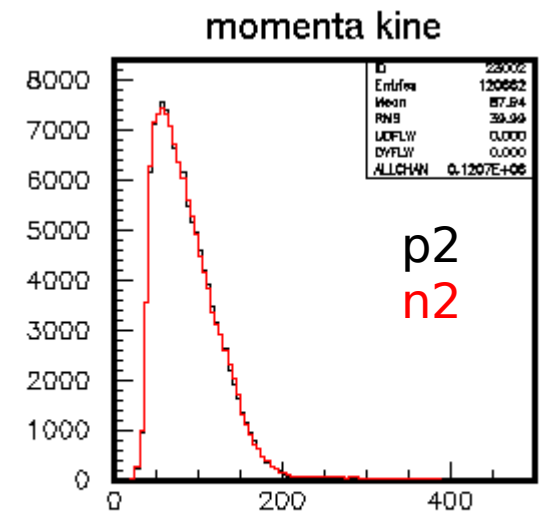
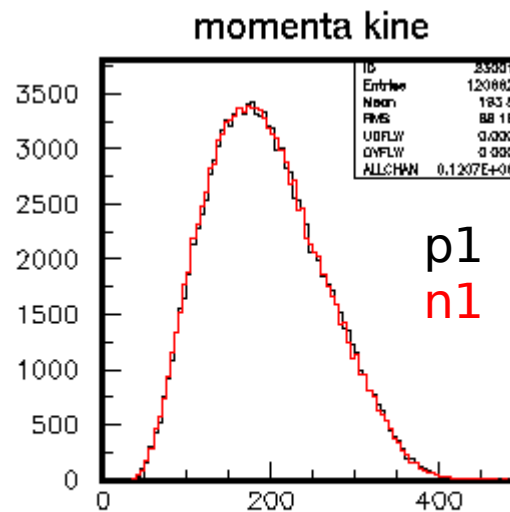
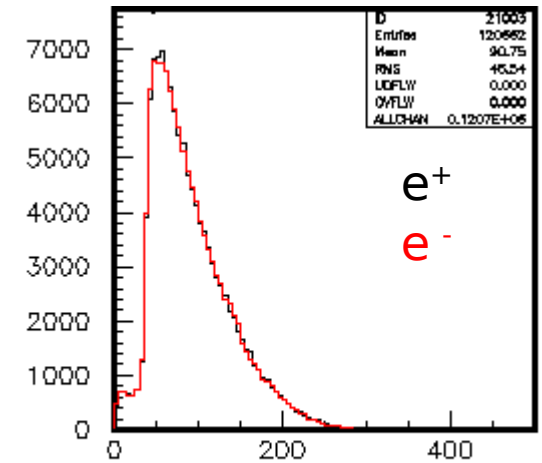
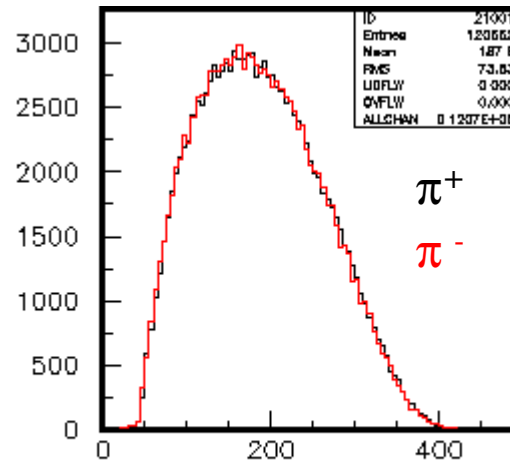
Started looking at data

Bug fixed in retrieving infos from kinematic fit

Tracks selection

Tracks ordered
by momentum

Charge requirement:
2 positive and
2 negative from IP



Private signal MC

Tracks selection

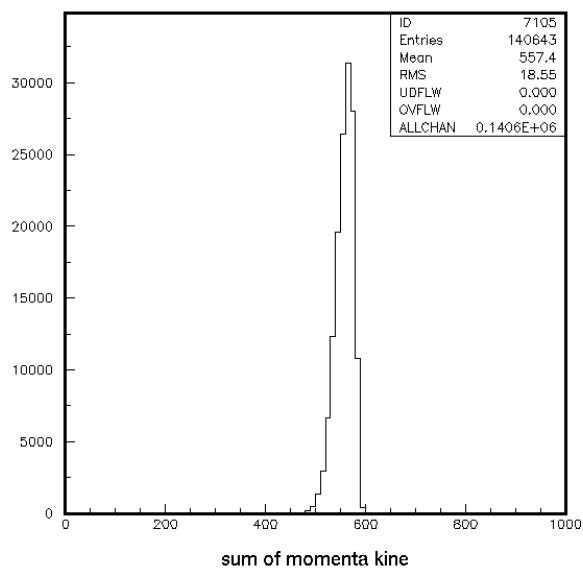
Inserted check on broken tracks:

$$|\Delta P_z| < 3 \text{ MeV}$$

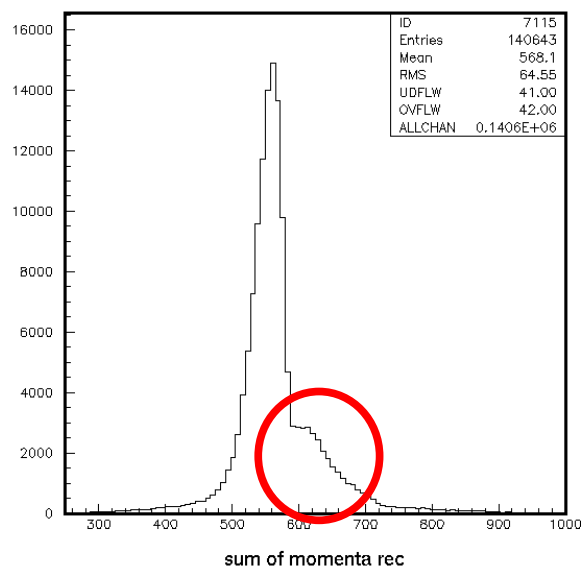
$$|\Delta P_t| < 4.5 \text{ MeV}$$

Private signal MC

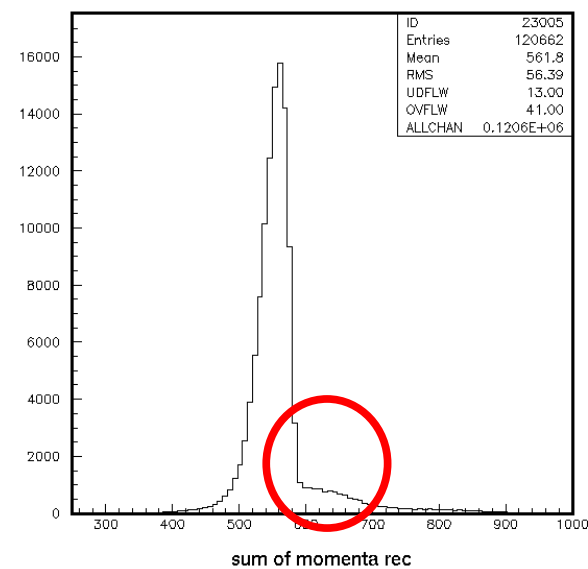
Kine



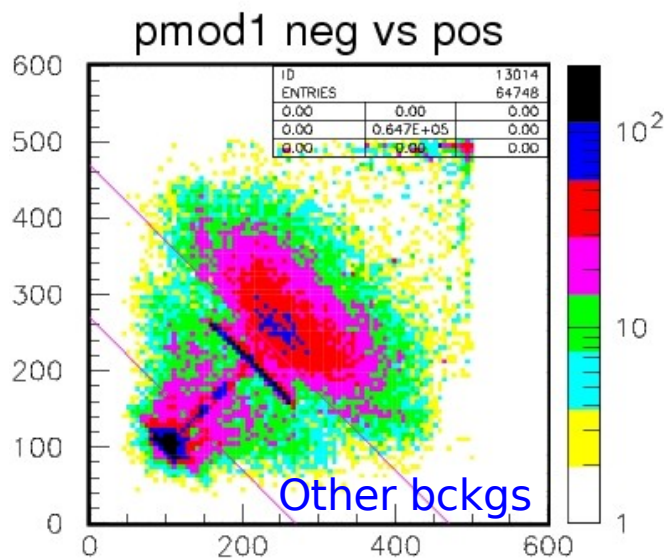
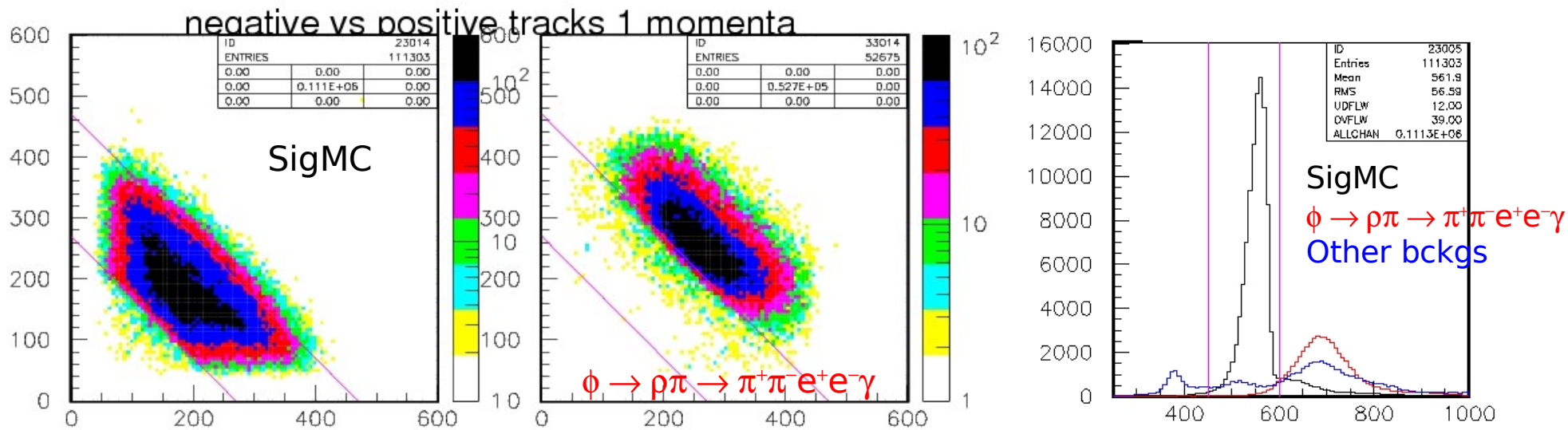
Rec. old



Rec. new



Still need fixes



pmod1 neg vs pos

sum of momenta rec

Signal MC from private production
Backgrounds from MC2005 mrc

Ordered tracks allow studies
of momenta, curvatures,
invariant mass, angles etc.

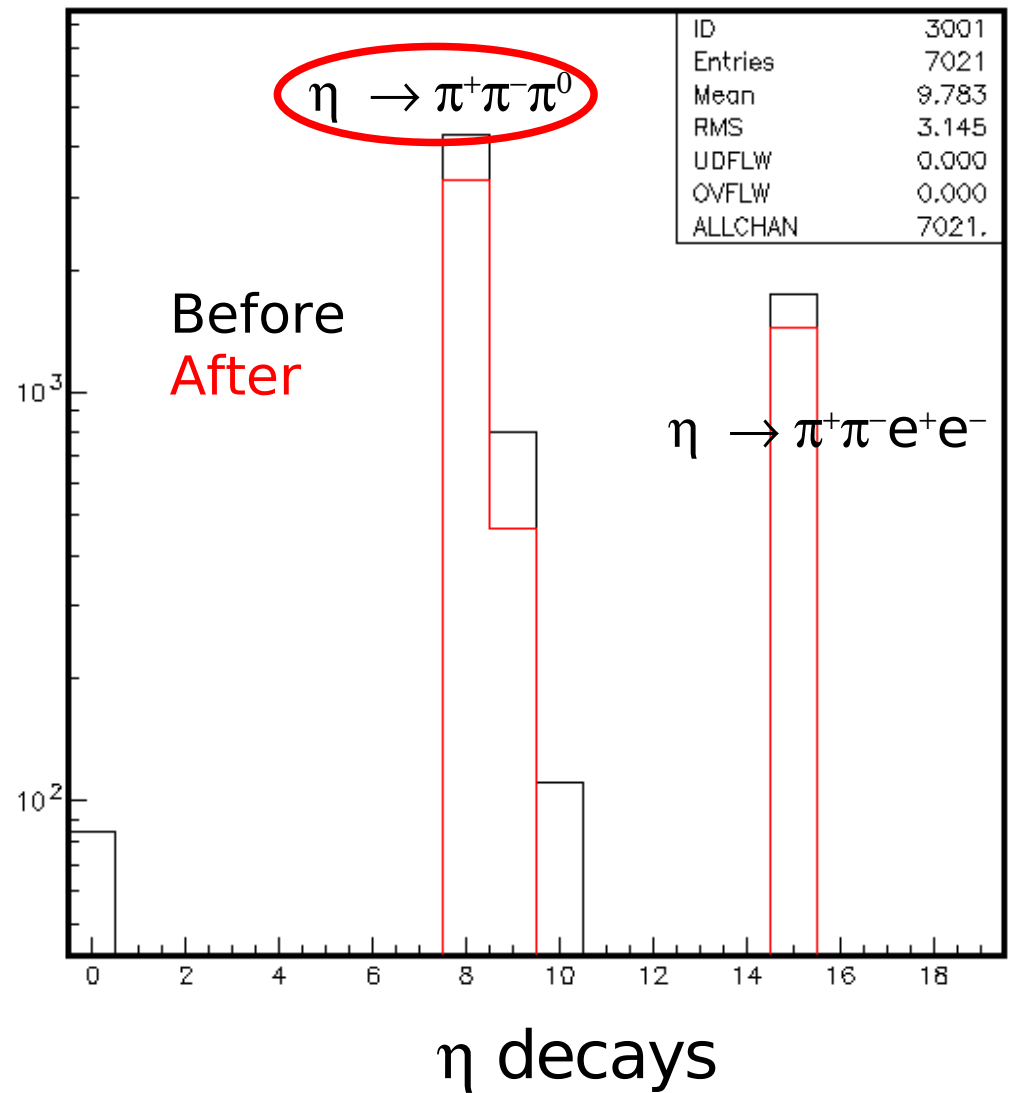
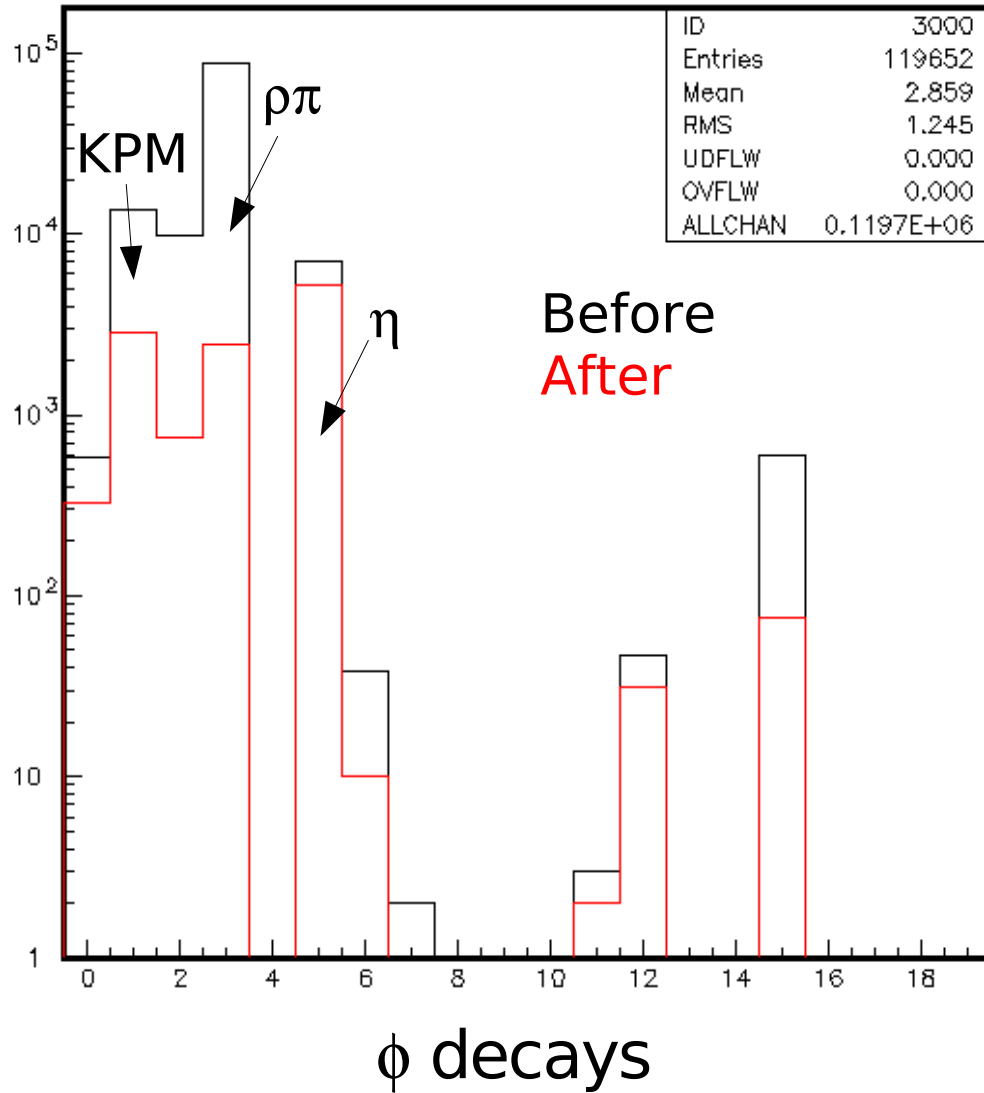
The best are:

$$450 < \sum_i |p_i| < 600 \text{ MeV}$$

$$270 < |p_{1+}| + |p_{1-}| < 470 \text{ MeV}$$

pmod1 neg vs pos

After the new cuts $\phi \rightarrow \rho\pi \rightarrow \pi^+\pi^-e^+e^-\gamma$ isn't anymore the main source of background



Efficiency of the new cuts

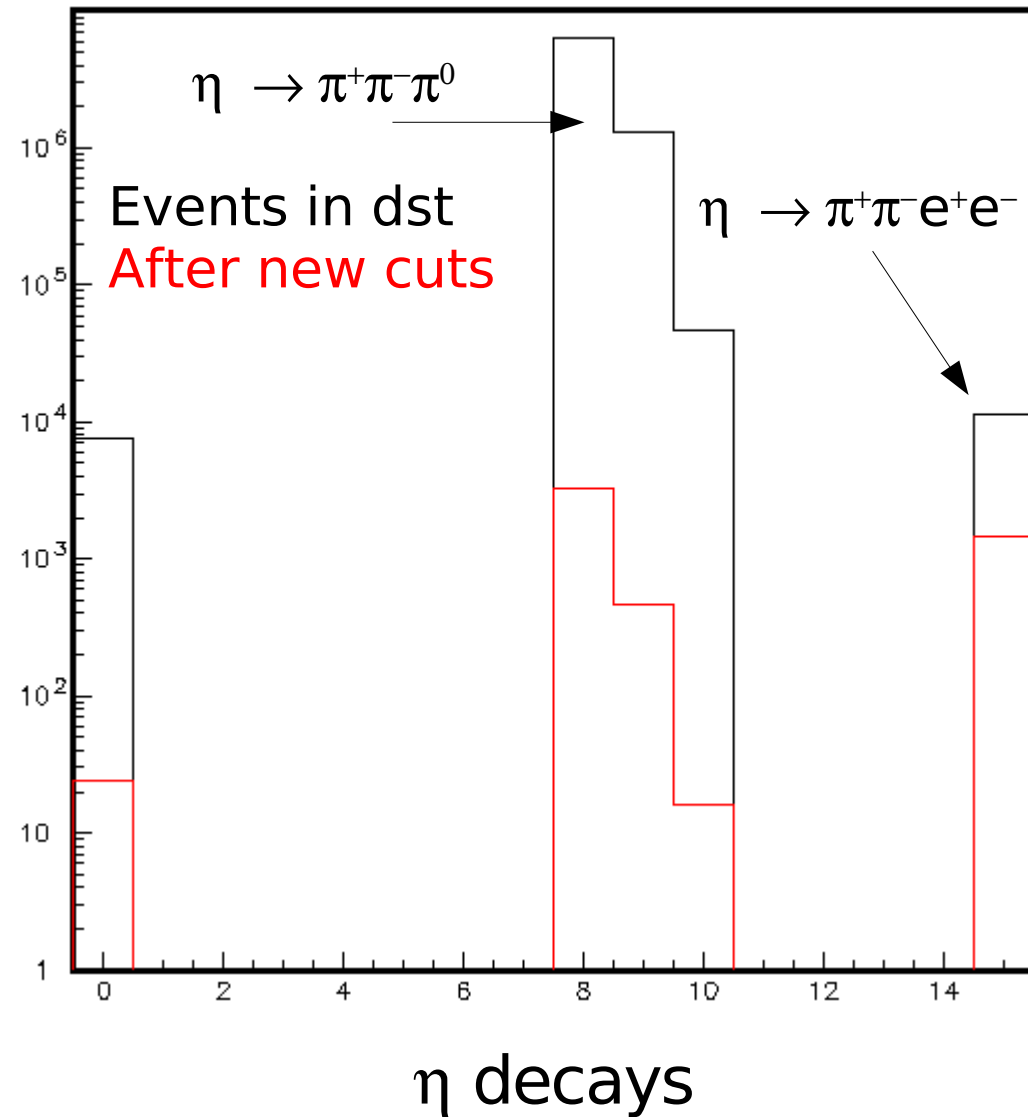
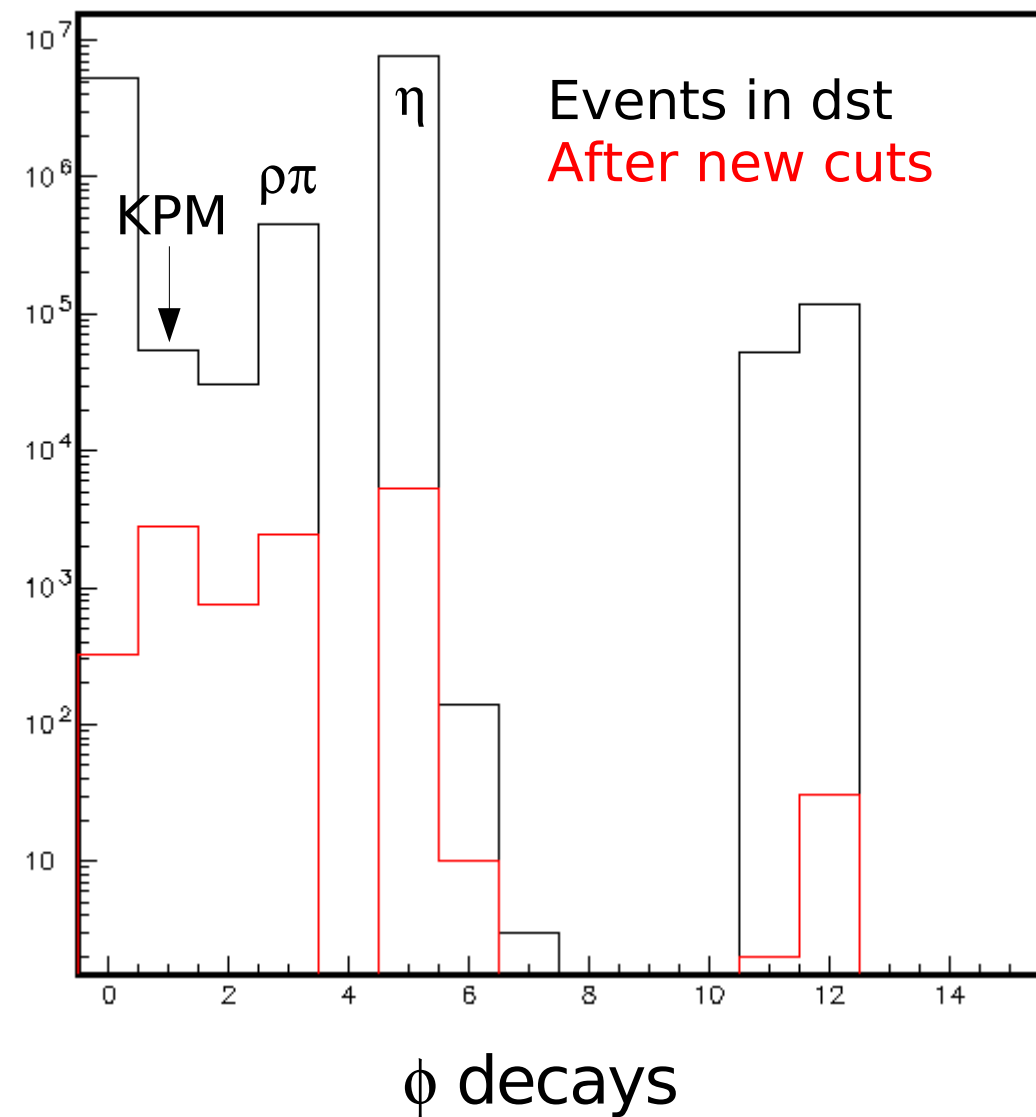
Number of events before and after applying the new cuts

ETA4CTAG ⊕ checks on tracks

	before	after	
all	119055	11666	0.0331 +/- 0.0003
others	42786	2489	0.0581 +/- 0.0011
signal	1738	1448	0.8331 +/- 0.0296
$\rho\pi$ (π^0 Dalitz)	56669	1593	0.0281 +/- 0.0007
$\eta \rightarrow \pi^+\pi^-\pi^0$	4285	3296	0.7691 +/- 0.0178
KPM	13577	2840	0.2091 +/- 0.0043
Signal private MC	120662	101291	0.8394 +/- 0.0035

Main background is $\eta \rightarrow \pi^+\pi^-\pi^0$

Global efficiencies



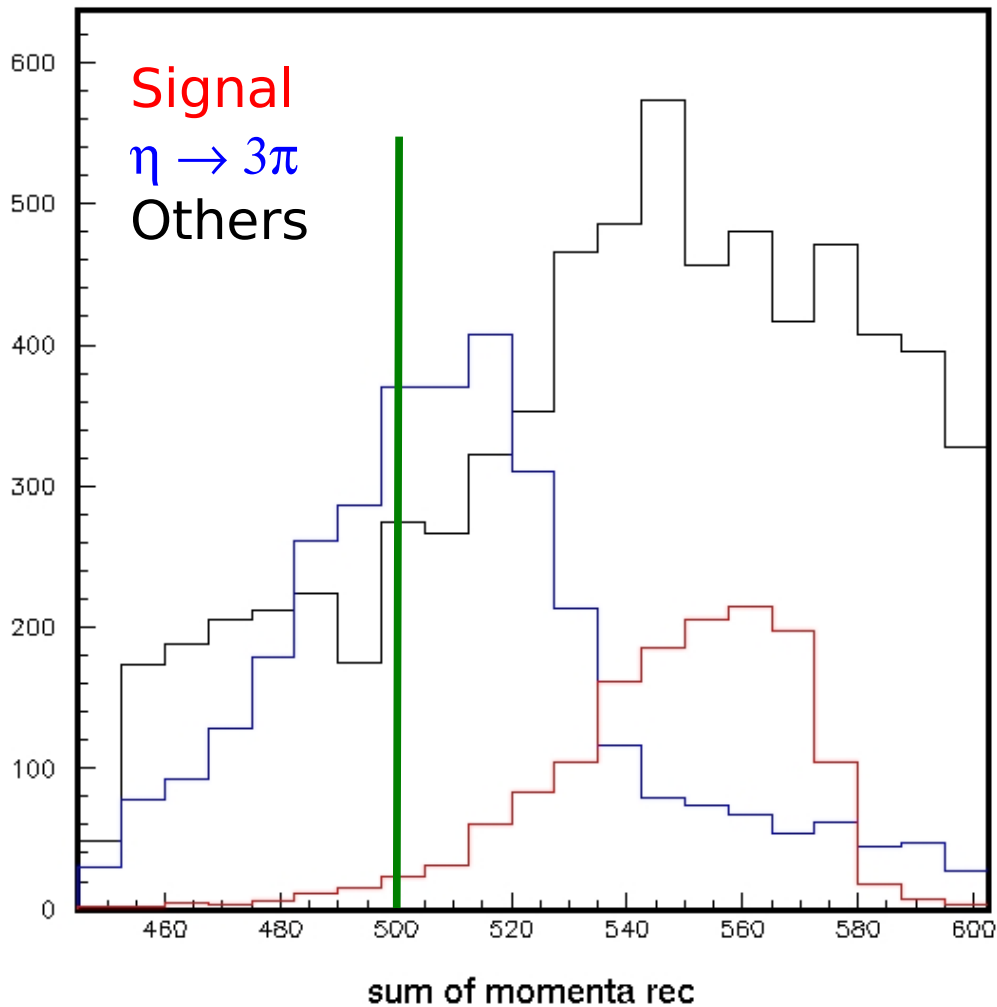
MC2005 mrc allphys

Global efficiencies

	After new cuts	Events in dst	
Signal	1448	11204	0.129(3)
$\rho\pi$ (π^0 Dalitz)	1593	112075	0.0142(3)
$\eta \rightarrow \pi^+\pi^-\pi^0$	3296	6285196	0.000524(9)
KPM	2840	54573	0.052(1)
Others	2489	7155042	0.000348(7)
Private MC	101291	799773	0.1266(4)

Efficiency of
ETA4CTAG \oplus checks on tracks \oplus new cuts

$\eta \rightarrow 3\pi$



$\Sigma|p_i| > \text{“Cut” MeV}$

Cut	450	500
Signal	1448	1398
$\rho\pi$ (π^0 Dalitz)	1593	1425
$\eta \rightarrow \pi^+\pi^-\pi^0$	3296	2117
KPM	2840	2035
Others	2489	2154

More fine tuning is possible: need feedback from data

η mass from kinematic fit

Warning! Kinematic performed only for events with ntracks = 4
Possible to recover events with ntracks > 4

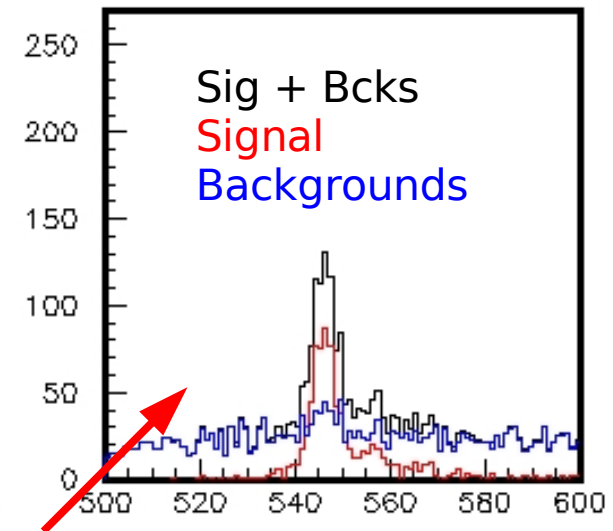
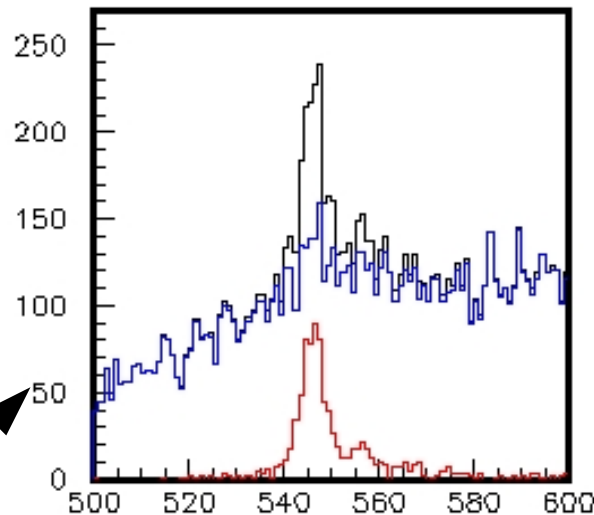


Signal

1448 → 829

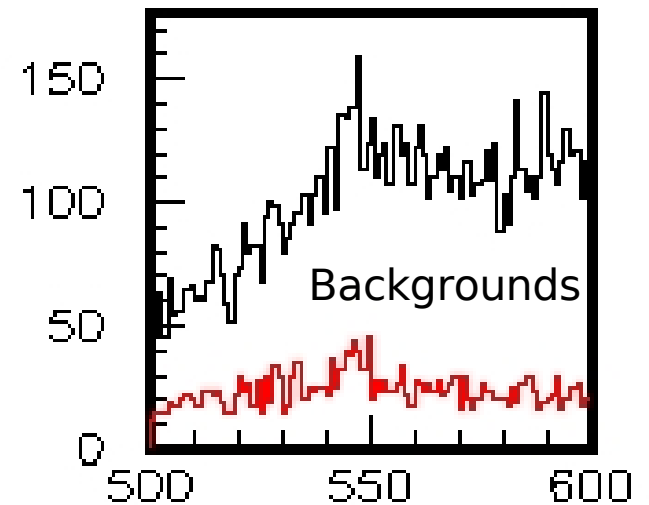
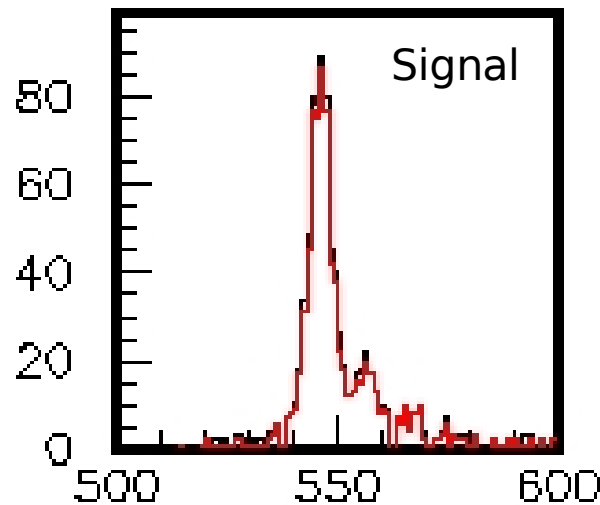
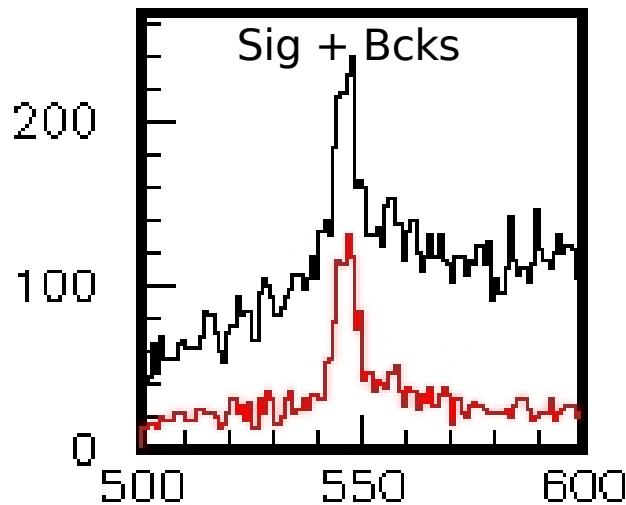
Bcks

10218 → 6283



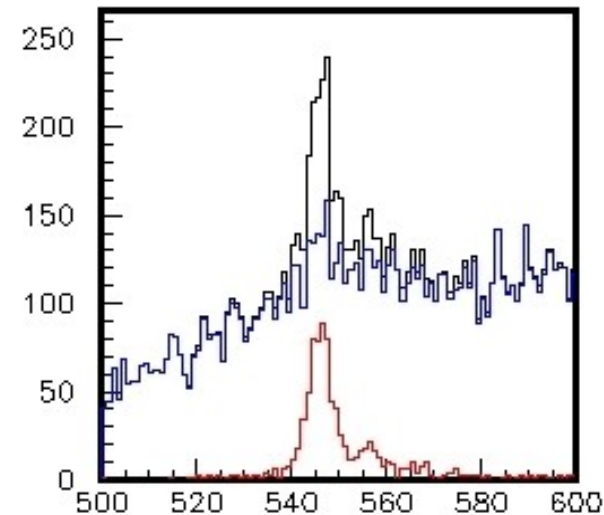
Before cuts on momenta

After cuts on momenta



η mass from kinematic fit

Warning! Kinematic performed only for events with ntracks = 4



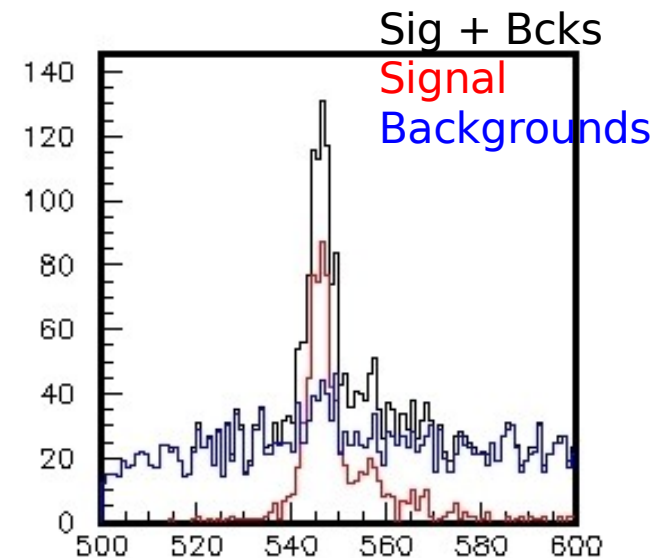
Before cuts
on momenta

[540:555] Mev

S/B=0.32 611 signal events

[542:552] Mev

S/B=0.42 540 signal events



After cuts
on momenta

[540:555] Mev

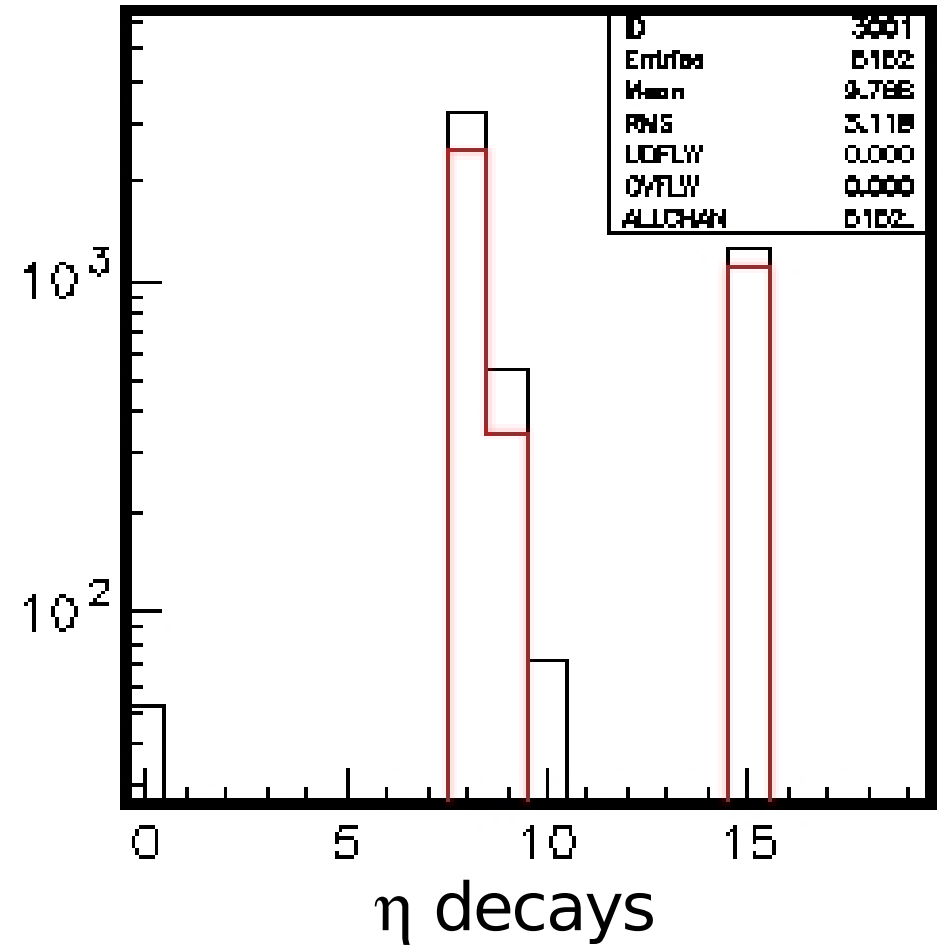
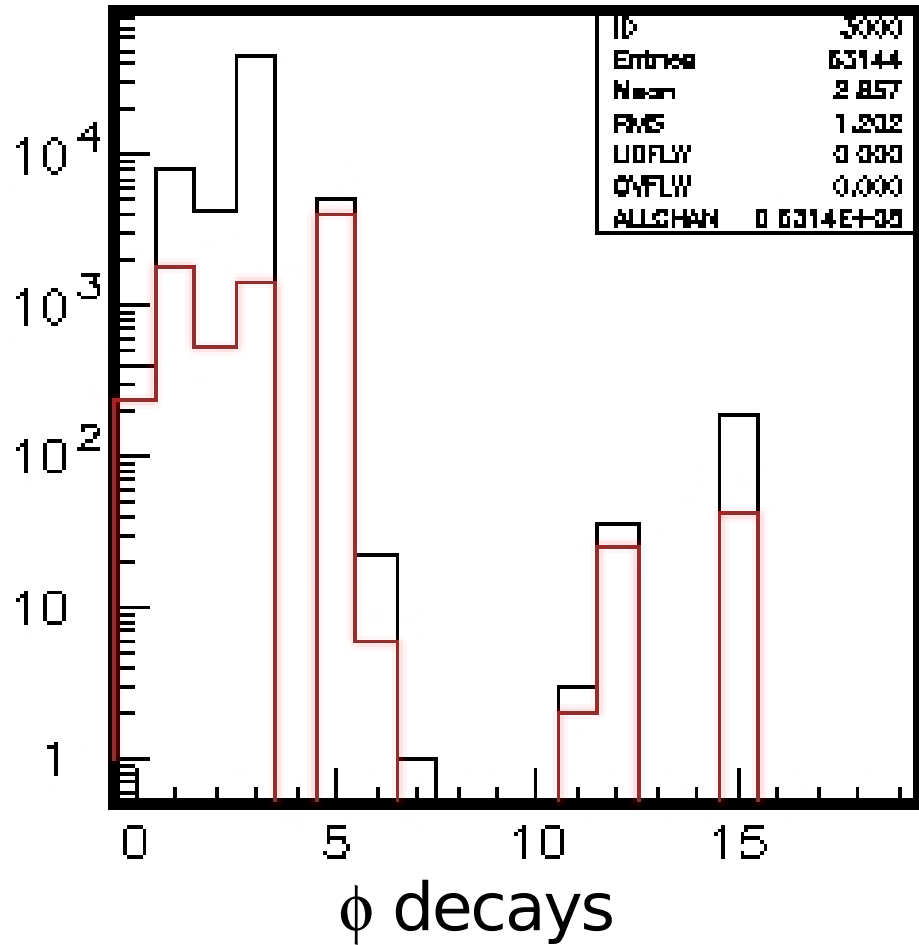
S/B=1.21 579 signal events

[542:552] Mev

S/B=1.48 512 signal events

Spare

KPM stream

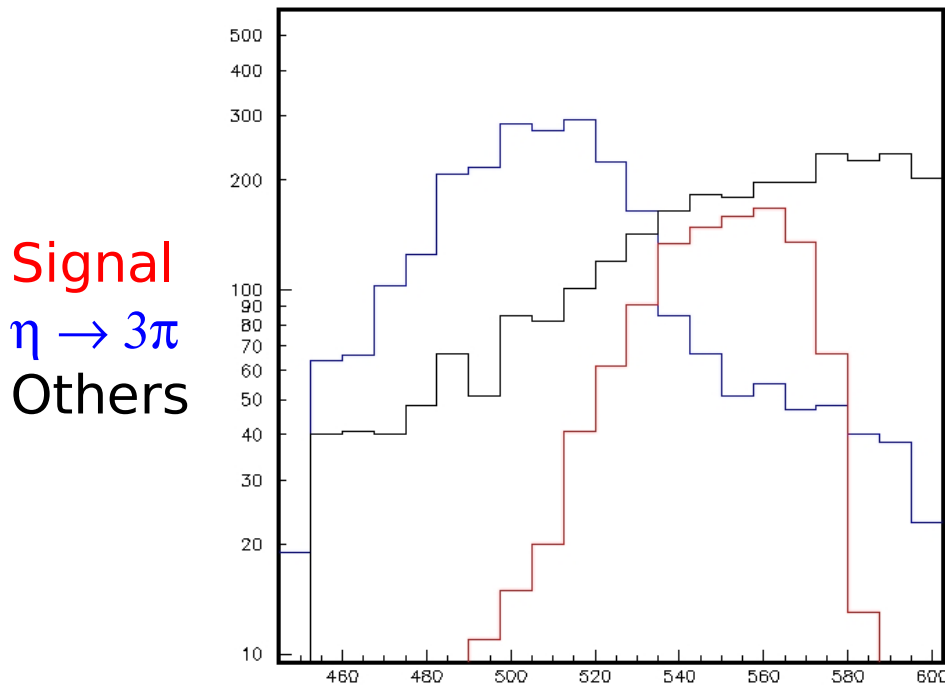


MC2005 kpm allphys 629 pb⁻¹

Similar to mrc

Efficiency of the new cuts - KPM

	before	after	
all	62952	8025	0.1274 +/- 0.0015
others	18286	1740	0.0951 +/- 0.0023
signal	1265	1098	0.8679 +/- 0.0358
$\rho\pi$ (π^0 Dalitz)	31871	908	0.0284 +/- 0.0009
$\eta \rightarrow 3\pi$	3225	2496	0.7739 +/- 0.0206
KPM	8305	1783	0.2146 +/- 0.0056



Similar to mrc