Status report on the

$\eta \to e^+e^-e^+e^-$ analysis

BR: theory & experiment

CMD-2	$< 6.9 \times 10^{-5}$
Theoretical predictions	$(2.52 - 2.64) \times 10^{-5}$

In $\eta \to \pi\pi ee$ analysis we have observed 1555 events,

assuming as lower bound the same efficiency,

we expect at least 155.5 events

Data sample

Using drc/mrc streams
with ETA4C tag

1733 pb^{-1} data 2004/05

167531 pb^{-1} MC signal only

3447 pb^{-1} MC all_phys(2/3) 2004/05

1751 pb^{-1} MC allrad 2004/05

242 pb^{-1} data offpeak ($\sqrt{s}$ = 1000 MeV)

MC signal accounts for FSR and run by run conditions

Event selection

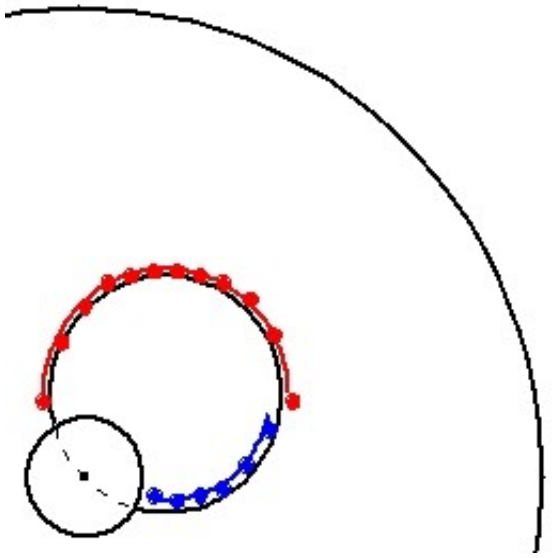
EVCL algorithm ETA4CTAG:

- ≥ 4 tracks from the Interaction Point
- 1 high energy neutral cluster ($E_{cl} \geq 250$ MeV)
- 0 medium energy neutral cluster ($50 \leq E_{cl} \leq 250$ MeV)

Track selection

Tracks are required to came from a cylinder around the IP:

$R \leq 4$ cm $h/2 = 10$ cm



Check on broken tracks is applied:

$\Delta P_T < 4.5$ MeV $\Delta P_Z < 3$ MeV

≥ 2 positive and ≥ 2 negative tracks are requested

Tracks are ordered by momentum

Kinematic fit

A kinematic fit to the ϕ meson is performed for all the events having # good tracks ≥ 4

The 22 inputs are:

- 4 tracks x 3 momenta
- x,y,z,E,t of the neutral cluster
- x,y,z of the IP
- $\sqrt{s}$ and f momentum

The 5 constraints are:

- Four momentum conservation
- Photon time of flight ($cT_\gamma = R_\gamma$)

Background rejection - step 1

$$600\ \text{MeV} < \sum_{i=1}^{4} |\vec{p}_i| = s4p < 700\ \text{MeV}$$

Data

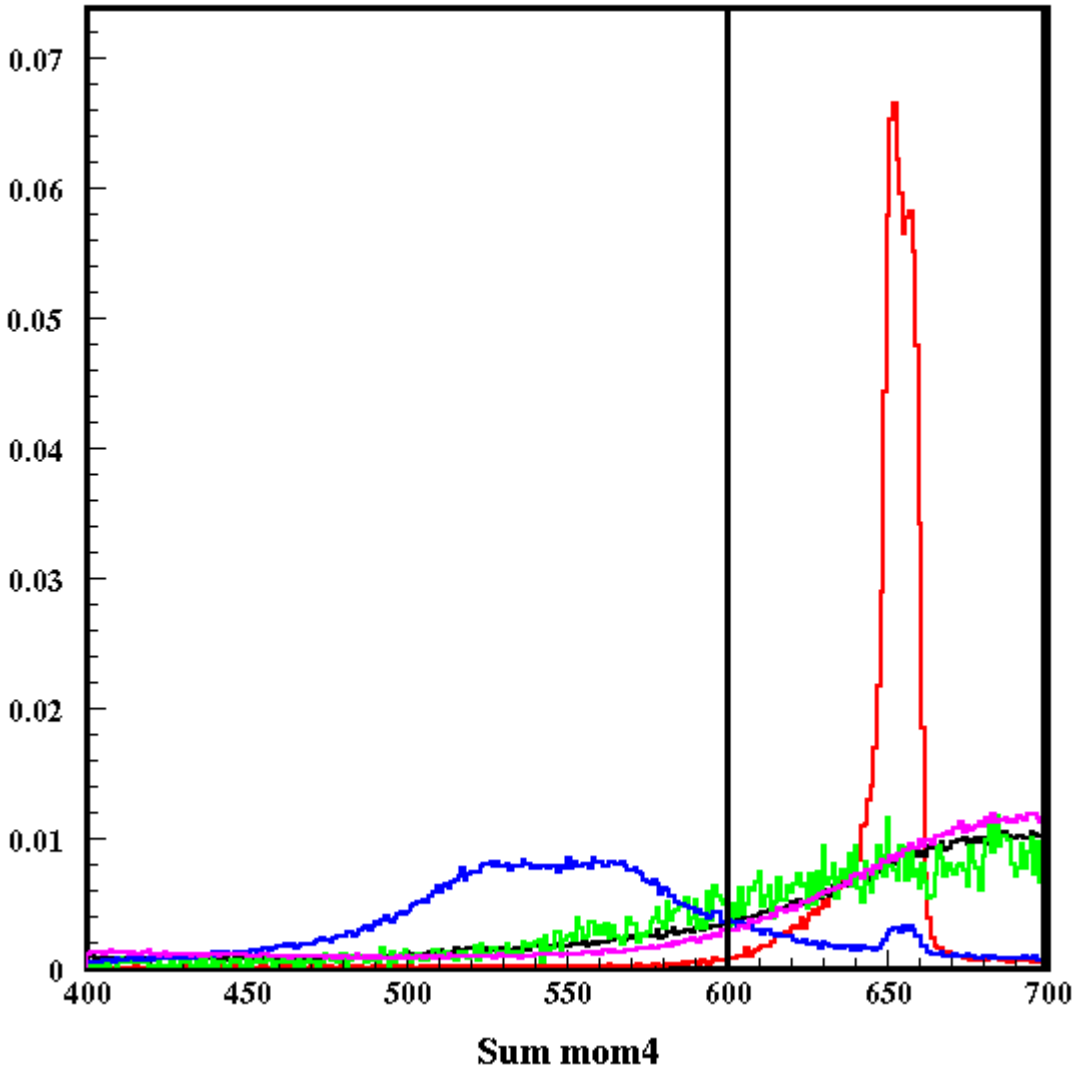
Continuum

allrad

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

all_phys (kaons + 3pions)

Histograms not scaled for luminosity



Background rejection - step 2

$\chi^2_{KF} < 10000$

Data

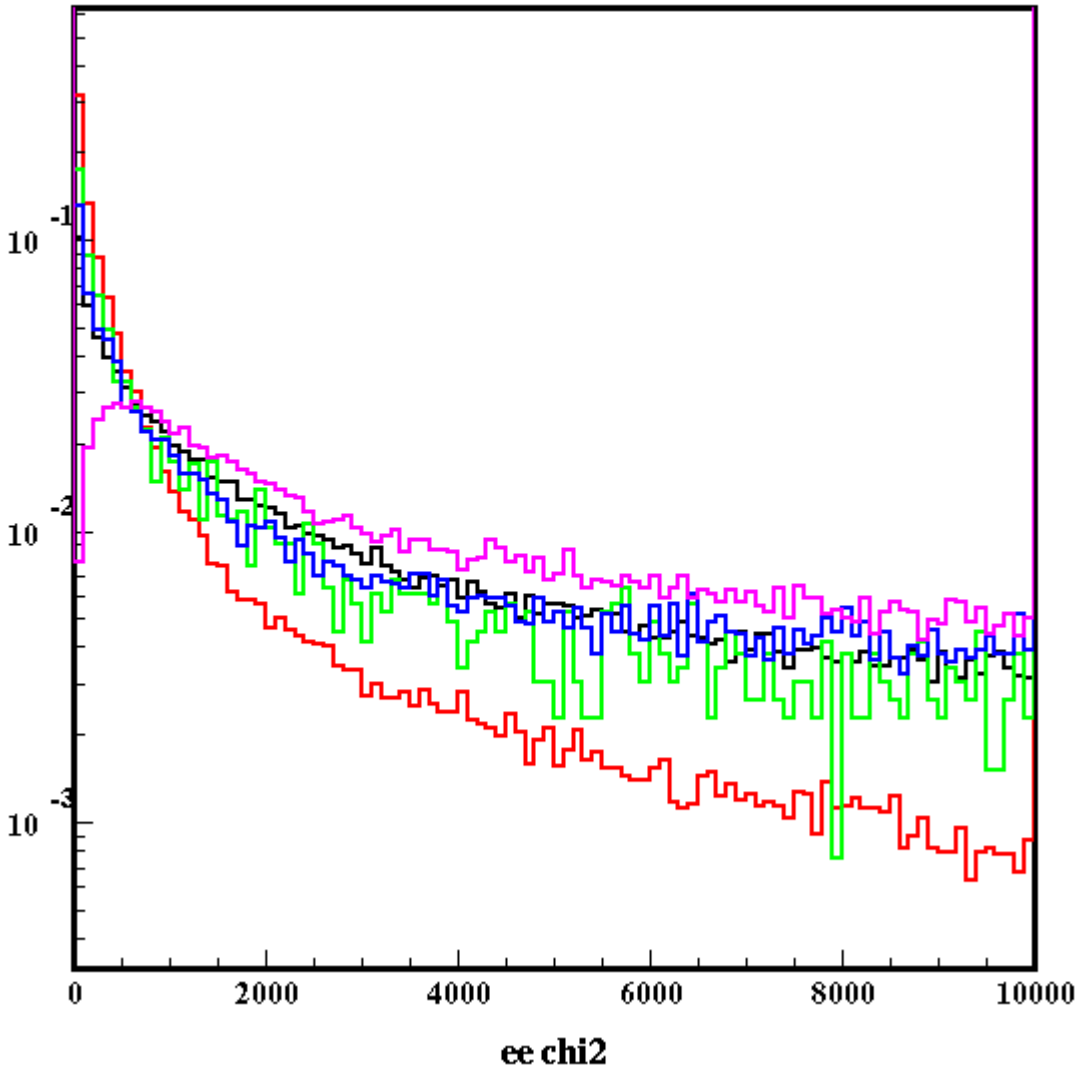
Continuum

allrad

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

all_phys (kaons + 3pions)

Histograms not scaled for luminosity



Fit description

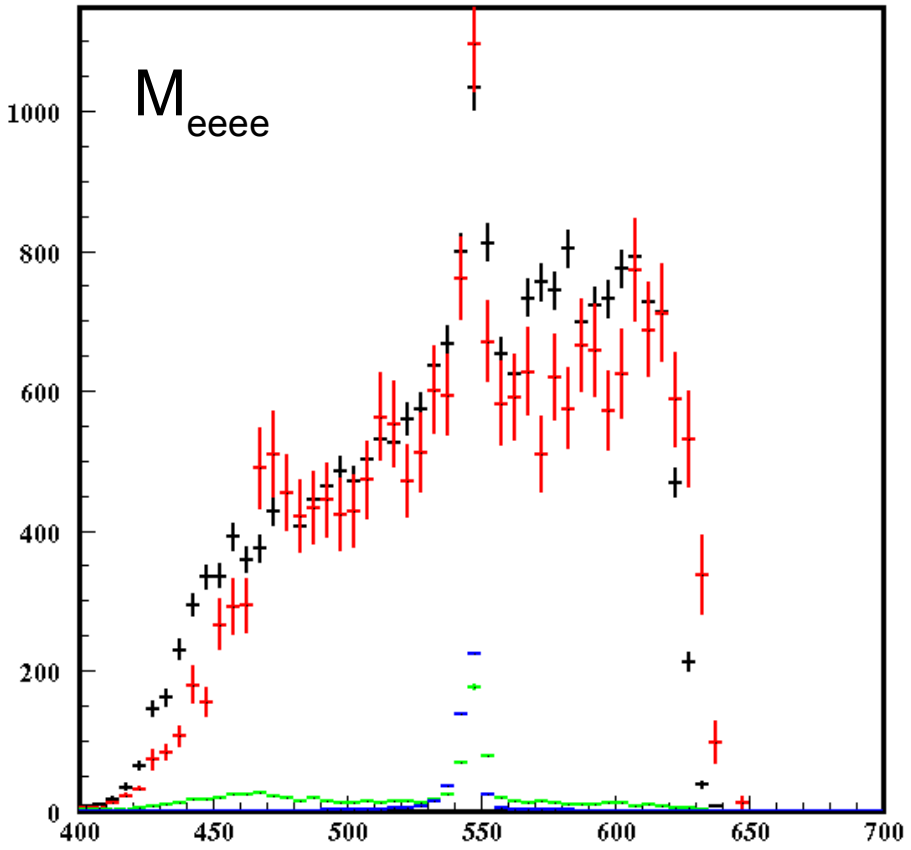
- Stand alone program using HBOOK and MINUIT
- Components that can be used:
  MC signal, MC all_phys, MC allrad, Data offpeak
- Possible to fit both whole spectrum and sidebands
- Possible to fix scale factors using luminosity

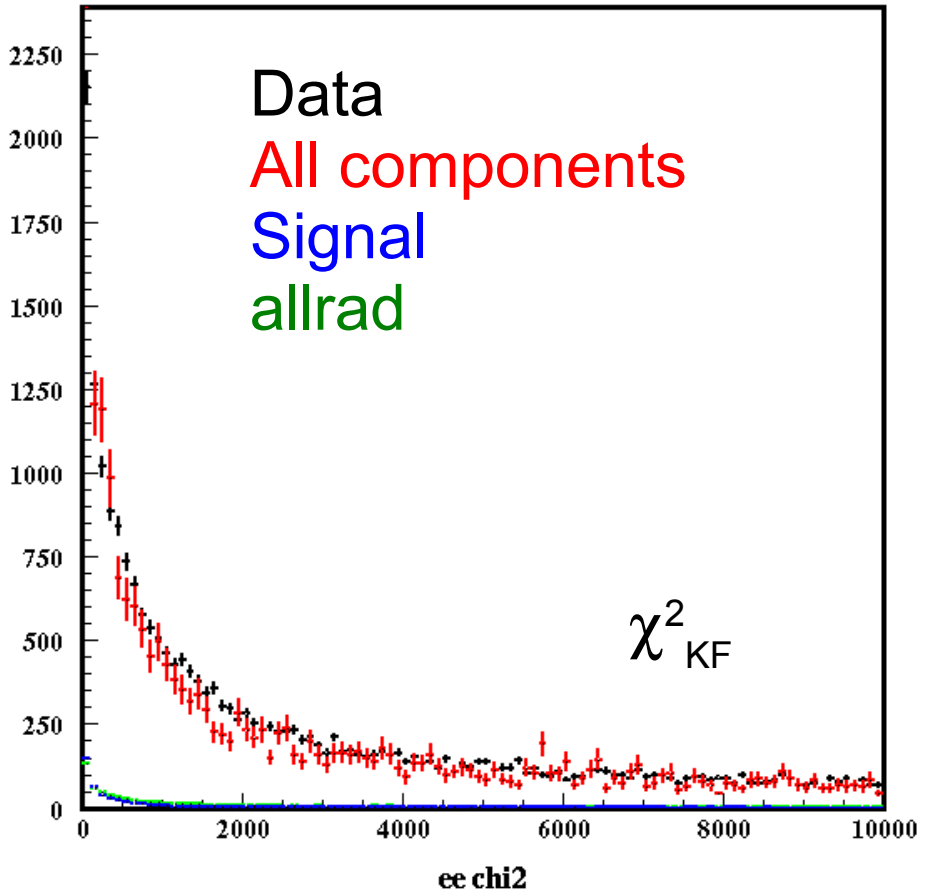
Same as $\eta \rightarrow \pi\pi ee$

Applying scale factors from the fit

Fixing all_phys and allrad with the luminosity

Fitting with offpeak and signal MC between 470 and 620 MeV





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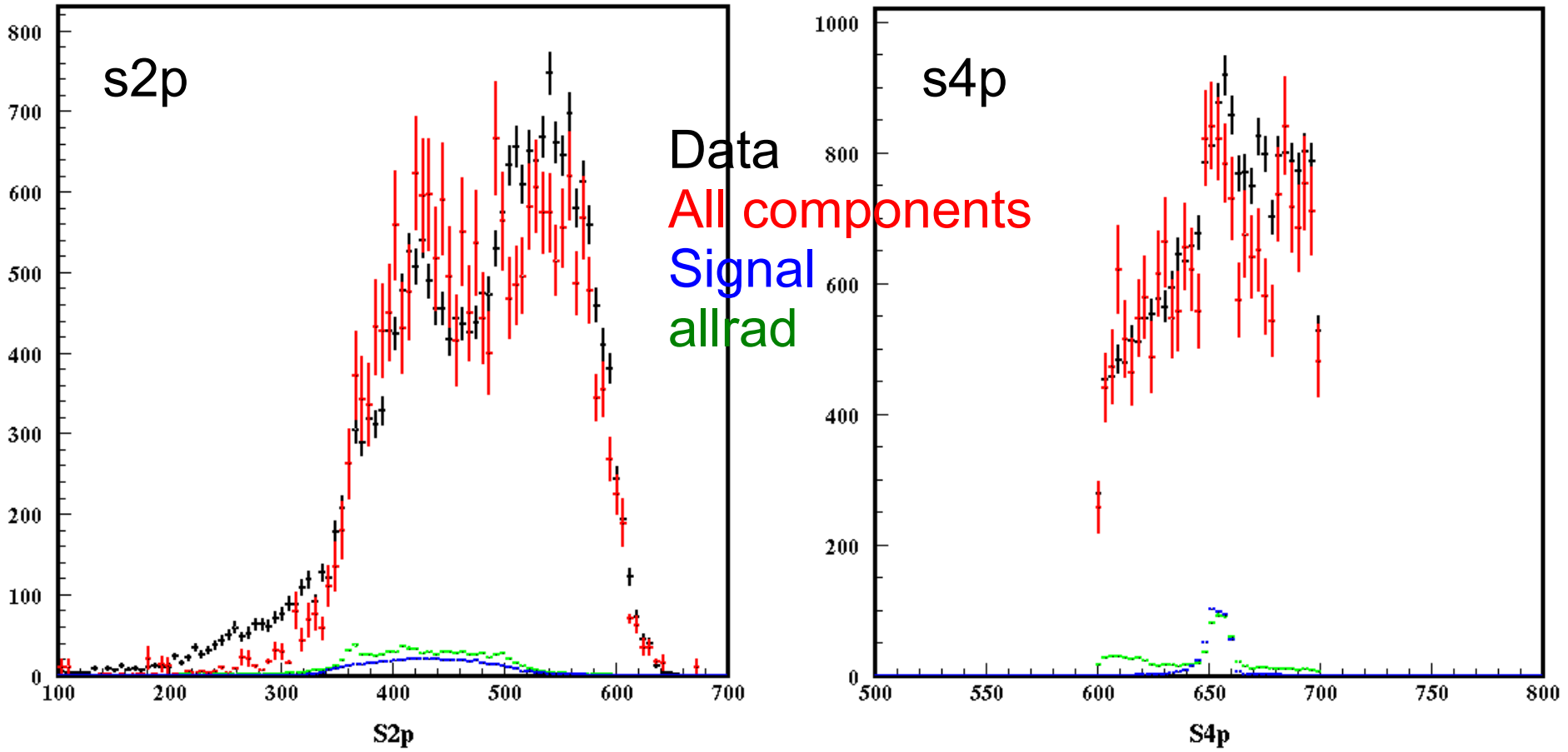

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