

Benedikt Kloss





MC production at BES-III

The view of a newcomer working on ISR@BES-III My job

Studying the channel

$$e^+e^- \rightarrow \pi^+\pi^-\pi^+\pi^-\gamma_{ISR}$$
 at BES - III

 e^+ \sim^{γ} $\pi^+\pi^-\pi^+\pi^-$ 1 1 e^{-}



My job

 e^+

Studying the channel

$$e^-
ightarrow \pi^+ \pi^- \pi^+ \pi^- \gamma_{_{ISR}}\,$$
 at BES - III

$$e^+$$
 γ
 $\pi^+\pi^-\pi^+\pi^ e^-$

to measure the cross section of $e^+e^- \rightarrow \pi^+\pi^-\pi^+\pi^-$

via





MC production of my channel

MC production of my channel possible with PHOKHARA in LO and NLO

- ✓ great tool for studying my channel
- \checkmark I can simulate nearly everything I need, however:



MC production of my channel

MC production of my channel possible with PHOKHARA in LO and NLO

- \checkmark great tool for studying my channel
- \checkmark I can simulate nearly everything I need, however:

X My 1. problem: No FSR implemented for my channel



MC production of my channel

MC production of my channel possible with PHOKHARA in LO and NLO

- \checkmark great tool for studying my channel
- \checkmark I can simulate nearly everything I need, however:

X My 1. problem: No FSR implemented for my channel

 \Rightarrow **possible solution:** I could implement the PHOTOS package in PHOKHARA

but that would be very hard work for me and I would feel **much much** better if an expert would do that correctly!



Current status of my analysis





possible Background channels are for example

$$e^{+}e^{-} \rightarrow \pi^{+}\pi^{-}\pi^{+}\pi^{-}\pi^{0}(\gamma)$$

$$e^{+}e^{-} \rightarrow K^{0}_{s}K^{\pm}\pi^{\mp}(\gamma) \rightarrow \pi^{+}\pi^{-}K^{\pm}\pi^{\mp}(\gamma)$$

$$e^{+}e^{-} \rightarrow K^{+}K^{-}\pi^{+}\pi^{-}(\gamma)$$



possible Background channels are for example

$$e^{+}e^{-} \rightarrow \pi^{+}\pi^{-}\pi^{+}\pi^{-}\pi^{0}(\gamma)$$

$$e^{+}e^{-} \rightarrow K^{0}_{s}K^{\pm}\pi^{\mp}(\gamma) \rightarrow \pi^{+}\pi^{-}K^{\pm}\pi^{\mp}(\gamma)$$

$$e^{+}e^{-} \rightarrow K^{+}K^{-}\pi^{+}\pi^{-}(\gamma)$$

My 2. problem: These channels are not implemented PHOKHARA



possible Background channels are for example

$$e^{+}e^{-} \rightarrow \pi^{+}\pi^{-}\pi^{+}\pi^{-}\pi^{0}(\gamma)$$

$$e^{+}e^{-} \rightarrow K^{0}_{s}K^{\pm}\pi^{\mp}(\gamma) \rightarrow \pi^{+}\pi^{-}K^{\pm}\pi^{\mp}(\gamma)$$

$$e^{+}e^{-} \rightarrow K^{+}K^{-}\pi^{+}\pi^{-}(\gamma)$$

My 2. problem: These channels are not implemented PHOKHARA

⇒ **possible solution:** I could use the KKMC generator

but there is no radiative return implemented.I would feel much much better if I could use a better generator



possible Background channels are for example

$$e^{+}e^{-} \rightarrow \pi^{+}\pi^{-}\pi^{+}\pi^{-}\pi^{0}(\gamma)$$

$$e^{+}e^{-} \rightarrow K^{0}_{s}K^{\pm}\pi^{\mp}(\gamma) \rightarrow \pi^{+}\pi^{-}K^{\pm}\pi^{\mp}(\gamma)$$

$$e^{+}e^{-} \rightarrow K^{+}K^{-}\pi^{+}\pi^{-}(\gamma)$$

My 2. problem: These channels are not implemented PHOKHARA

⇒ possible solution: I could use the KKMC generator

but there is no radiative return implemented.I would feel much much better if I could use a better generator

for example AFKQED like the BaBar people. Unfortunately it is not implemented in BOSS yet.



Imagine I would have a generator for the background like AFKQED then I could scale the MC samples to the luminosity of data

scaling factor =
$$\frac{L_{data}}{N_{produced}} \sigma_{ISR,tagged}$$



Imagine I would have a generator for the background like AFKQED then I could scale the MC samples to the luminosity of data

scaling factor =
$$\frac{L_{data}}{N_{produced}} \sigma_{ISR, tagged}$$

My present 3. problem: I need a very precise calculation of the ISR cross section in a specific angular range (tagged or untagged) and a specific cms energy



Imagine I would have a generator for the background like AFKQED then I could scale the MC samples to the luminosity of data

scaling factor =
$$\frac{L_{data}}{N_{produced}} \sigma_{ISR, tagged}$$

My present 3. problem: I need a very precise calculation of the ISR cross section in a specific angular range (tagged or untagged) and a specific cms energy

 \Rightarrow current solution: I calculate it with the non ISR cross sections published by BaBar



Imagine I would have a generator for the background like AFKQED then I could scale the MC samples to the luminosity of data

scaling factor =
$$\frac{L_{data}}{N_{produced}} \sigma_{ISR, tagged}$$

My present 3. problem: I need a very precise calculation of the ISR cross section in a specific angular range (tagged or untagged) and a specific cms energy

 \Rightarrow current solution: I calculate it with the non ISR cross sections published by BaBar

but then I have a large uncertainty.

I would feel **much much** better if I could do that with a MC generator for example AFKQED.



Summary

These are the problems with MC production appearing after 6 months:

No FSR for every channel implemented in PHOKHARA
 No proper generator for ISR processes which are not implemented in PHOKHARA

Currently 8 people are working on ISR physics @ BES-III in Mainz and all have the same type of problems.

> Achim Denig (big boss) Frank Maas (big boss) Yaqian Wang (postdoc) Andreas Hafner (postdoc) Cristina Morales (postdoc) Paul Larin (Master student) Benedikt Kloss (PhD) Martin Ripka (PhD)





This was the view on MC production at BES-III of a newcomer.

Implementation of new channels and of FSR in PHOKHARA would be the ideal solution!

Thank you for your attention!

