



ISR*FSR Interference from $\mathcal{K}\mathcal{K}$ MC generator

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QUESTIONS:

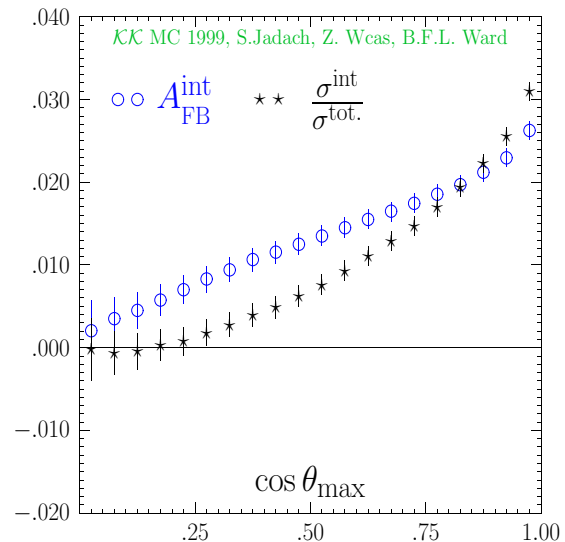
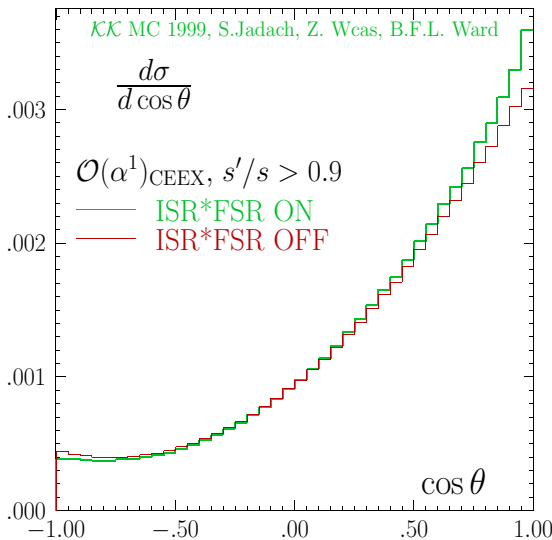
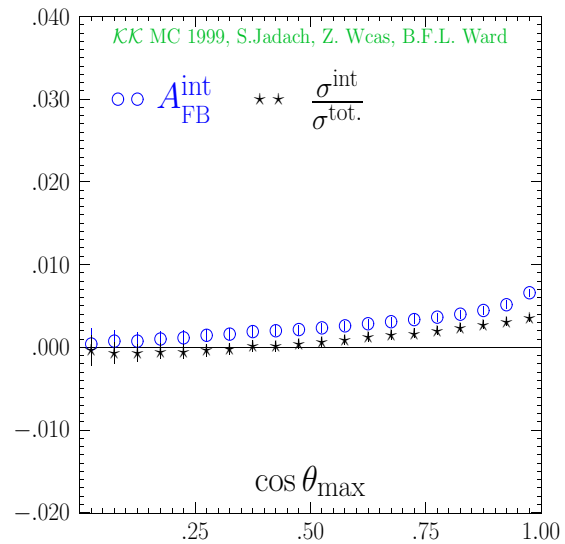
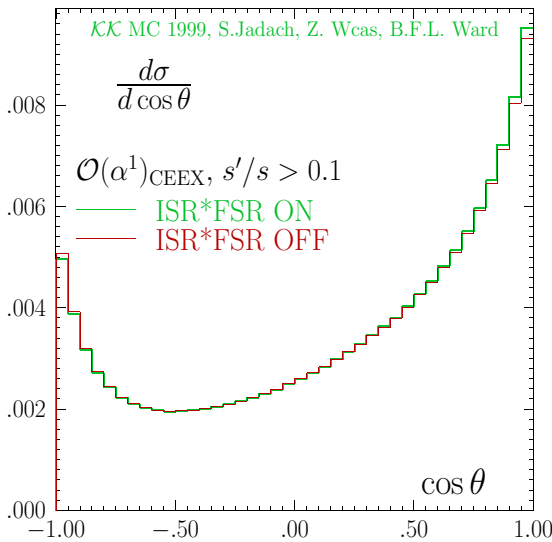
- How big is ISR*FSR Interference in σ_{tot} and A_{FB} ?
- Do we know it at $\mathcal{O}(\alpha^1)$?
- Do we know it beyond $\mathcal{O}(\alpha^1)$?
- How sensitive it is to cut-off changes?
- Conclusions

For $\mathcal{K}\mathcal{K}$ MC check <http://home.cern.ch/~jadach>

DESY

ISR*FSR interf. in angular distribution

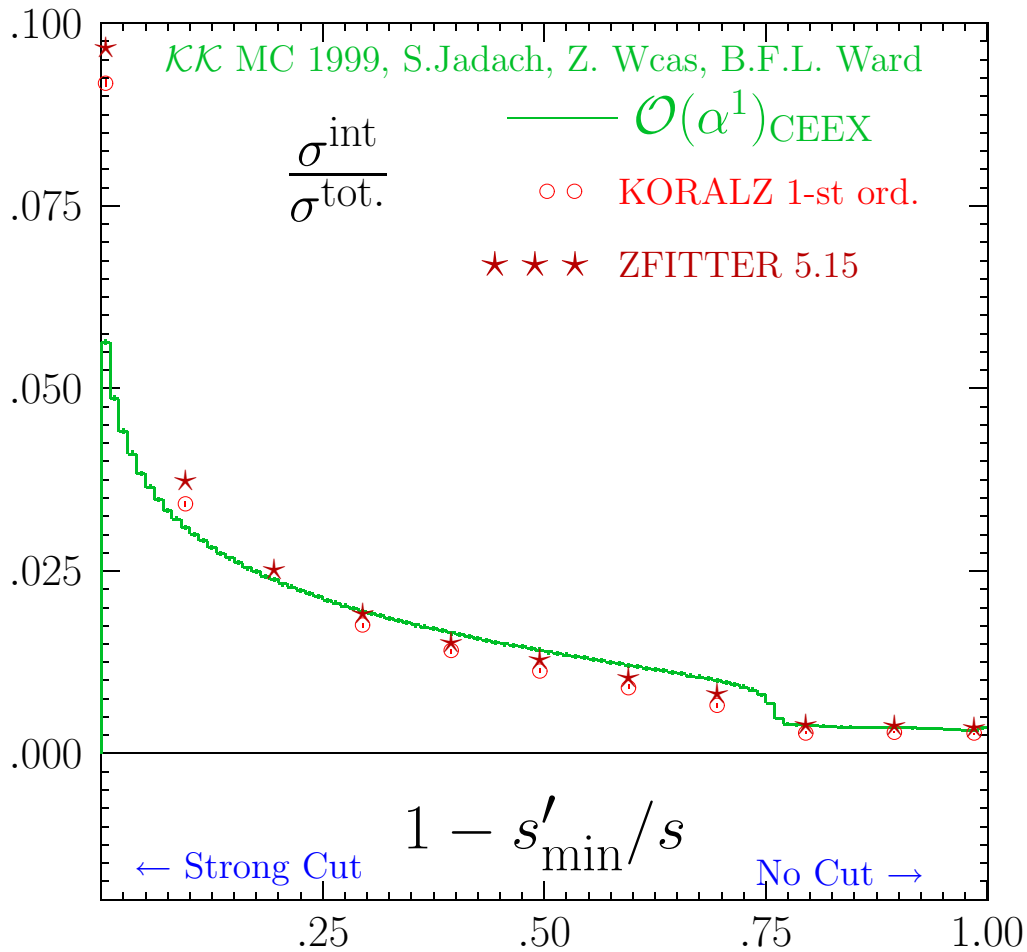
The influence of ISR*FSR interference at 189GeV. The energy cut is on s'/s , where $s' = m_f^2_{\bar{f}}$. The angular cut is $|\cos \theta| < \cos \theta_{\max}$. Scattering angle is $\theta = \theta^\bullet$. [Angle θ^\bullet is defined in Phys. Rev. **D41**, 1425 (1990)]



DESY

ISR*FSR in σ , cut-off dependence

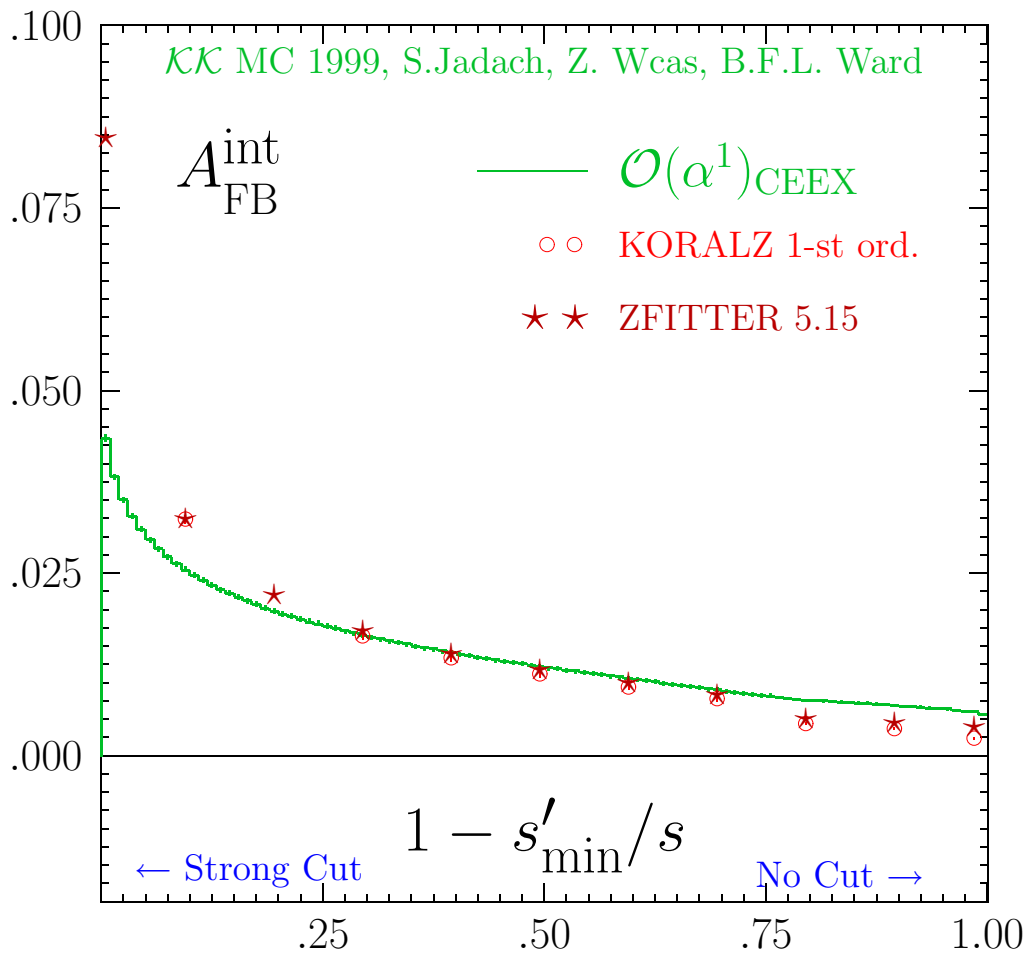
The ISR*FSR interference correction to $\sigma(s'_{\min})$ at 189GeV. No cut in $\cos\theta^*$. From $\mathcal{K}\mathcal{K}$ M.C. with $\mathcal{O}(\alpha^1)_{\text{CEEX}}$ exponentiation at the amplitude level.



DESY

ISR*FSR in A_{FB} , energy cut-off study

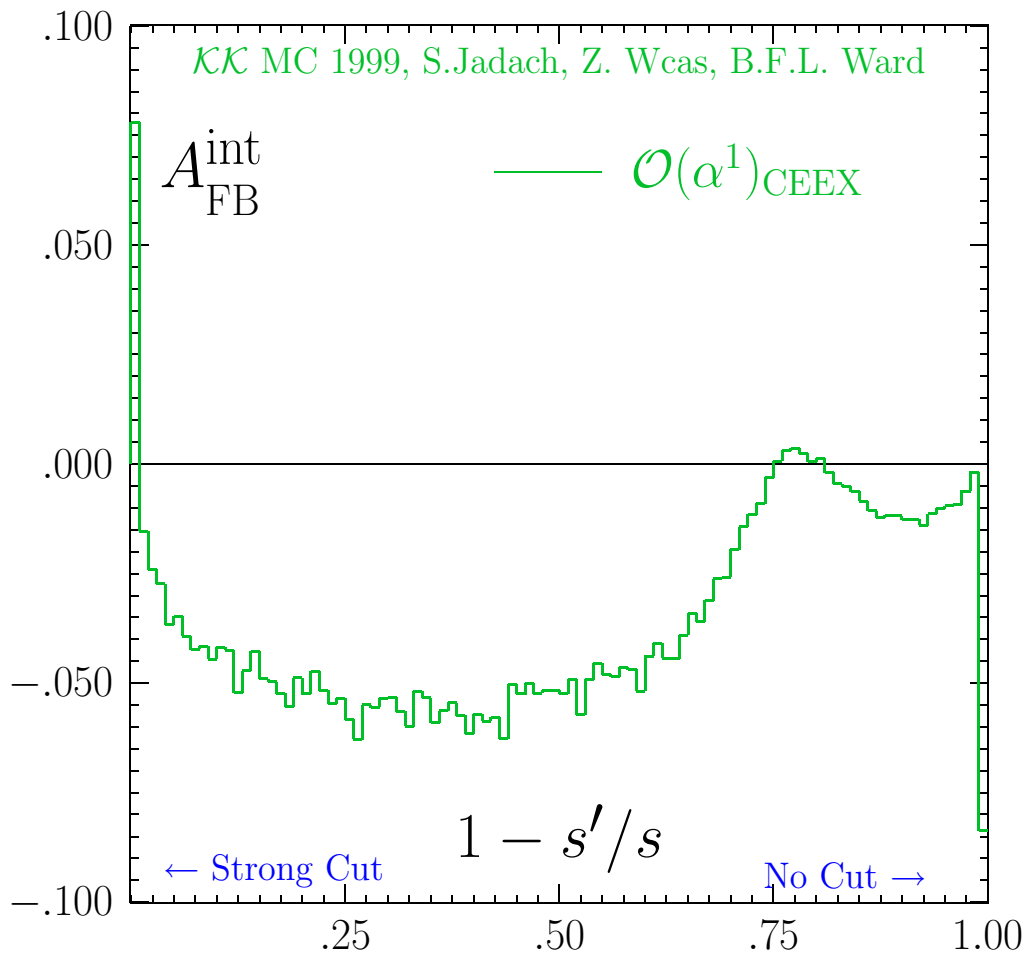
The ISR*FSR interference correction to A_{FB} at 189GeV. No cut in $\cos\theta^*$. From $\mathcal{K}\mathcal{K}$ M.C. with $\mathcal{O}(\alpha^1)_{\text{CEEX}}$ exponentiation at the amplitude level.



DESY

ISR*FSR in A_{FB} , energy cut-off study

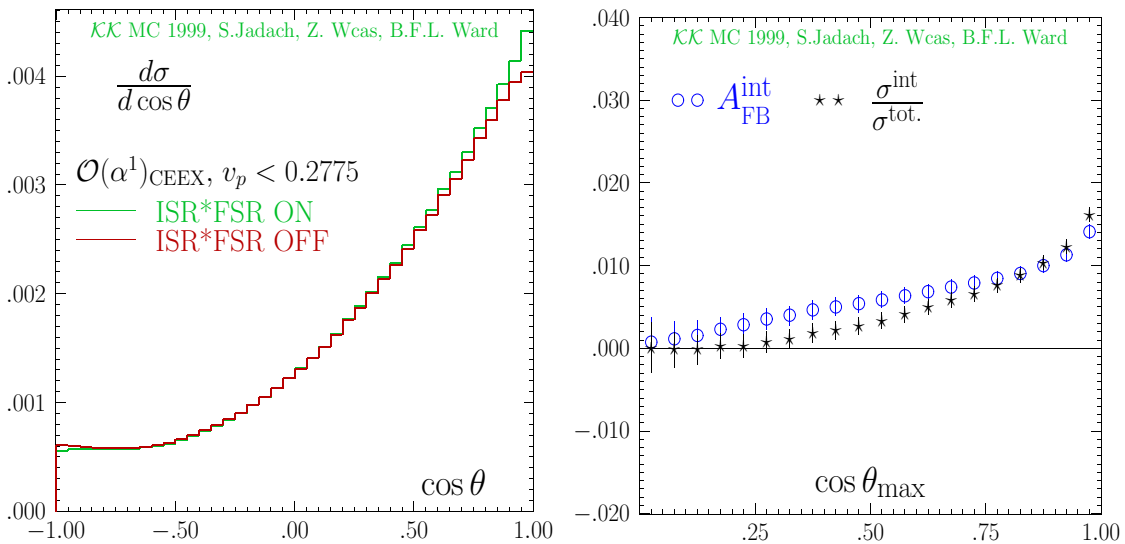
Bin-per-bin s' -dependence of A_{FB}
– the ISR*FSR interference contribution at 189GeV.
Results from $\mathcal{K}\mathcal{K}$ M.C. with $\mathcal{O}(\alpha^1)_{\text{CEEX}}$
exponentiation at the amplitude level.
No cut in $\cos\theta^*$.



DESY

ISR*FSR interf. Realistic acceptance

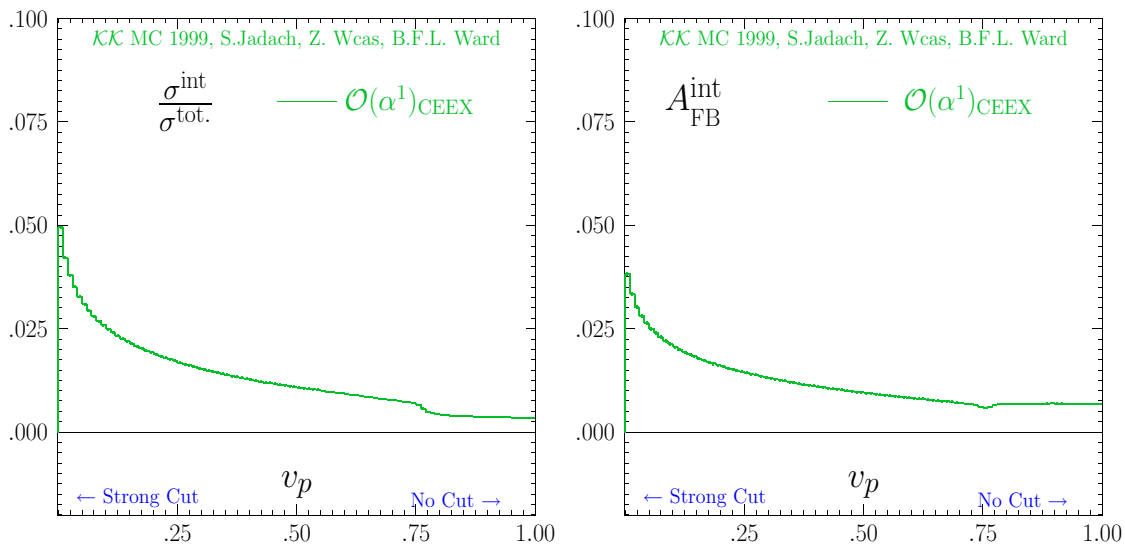
The influence of ISR*FSR interference at 189GeV.
 The energy cut is on $v_p = 1 - Q_{Aleph}^2/s$, where
 Q_{Aleph}^2 is s-channel propagator variable of ALEPH.
 The angular cut is $|\cos \theta| < \cos \theta_{\max}$ Scattering angle
 is $\theta = \theta^\bullet$. [Angle θ^\bullet is defined in Phys. Rev. **D41**, 1425 (1990)]



DESY

ISR*FSR interf. Realistic acceptance

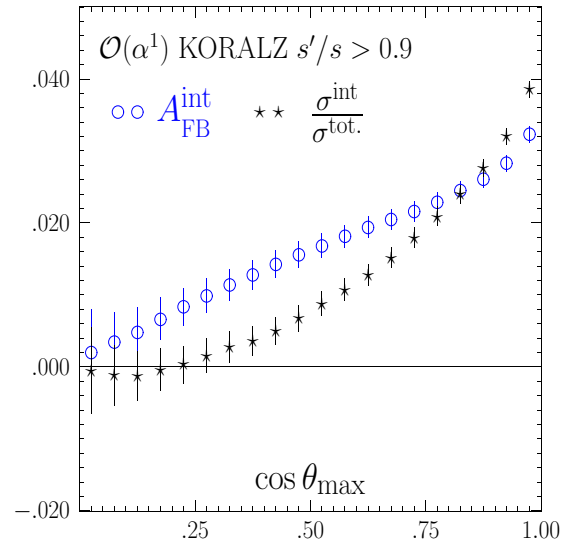
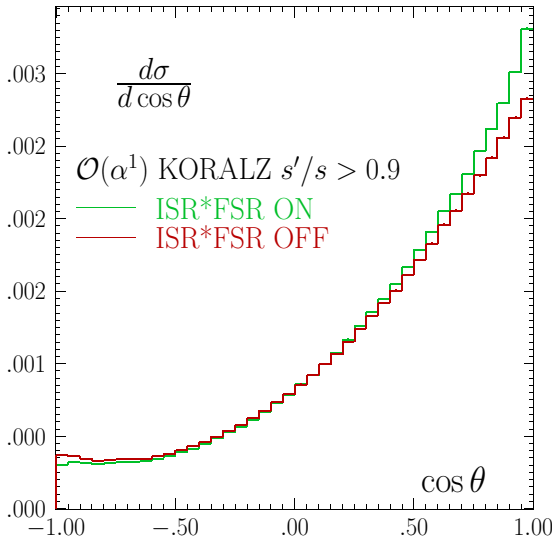
The influence of ISR*FSR interference at 189GeV.
The energy cut is on $v_p = 1 - Q_{Aleph}^2/s$, where
 Q_{Aleph}^2 is s-channel propagator variable of ALEPH.
No angular cut.



DESY

ISR*FSR interf. KORALZ 1-st order

The influence of ISR*FSR interference at 189GeV.
 The energy cut is on s'/s , where $s' = m_{f\bar{f}}^2$. The
 angular cut is $|\cos\theta| < \cos\theta_{\max}$ Scattering angle is
 $\theta = \theta^\bullet$. [Angle θ^\bullet is defined in Phys. Rev. **D41**, 1425 (1990)]



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Appendix: $\mathcal{K}\mathcal{K}$ versus our older MC's and plans

Feature	KORALB	KORALZ	$\mathcal{K}\mathcal{K}$ now	$\mathcal{K}\mathcal{K}$ 2000
ISR	$\alpha + \alpha L$	$(\alpha + \alpha L + \alpha^2 L^2)_{\text{exp}}$	$(\dots + \alpha^3 L^3)_{\text{exp}}$	$(\dots + \alpha^3 L^3)_{\text{exp}}$
FSR	$\alpha + \alpha L$	$(\alpha + \alpha L + \alpha^2 L^2)_{\text{exp}}$	$(\dots + \alpha^2 L^2)_{\text{exp}}$	$(\dots + \alpha^3 L^3)_{\text{exp}}$
ISR*FSR interf.	$\alpha + \alpha L$	$\alpha + \alpha L$, no exp.	$(\alpha + \alpha L)_{\text{exp}}$	$(\alpha + \alpha L)_{\text{exp}}$
Exponentiation	NONE	for $ M(p_i) ^2$	for $M(p_i)$	for $M(p_i)$
Exact m.el. for real photons	up to 1	1, 2coll.	1, 2coll, 3coll.	up to 3
El-Weak	No Z-reson.	YES	YES	YES
Beam polar.	long+trans.	longit.	long+trans.	long+trans.
τ polar.	long+trans.	longit.	long+trans.	long+trans.
Hadronization	—	Yes	Yes	Yes
τ decay	Yes	Yes	Yes	Yes
Inclusive mode	—	No	Yes	Yes
Beamstrahlung	—	No	Yes	Yes
beam spread	—	No	Yes	Yes
$\nu\nu$ channel	—	Yes	No	Yes
ee channel	—	No	No	Yes
tt channel	—	No	No	???
WW channel	—	No	No	???

DESY



Conclusions

$\mathcal{K}\mathcal{K}$ Monte Carlo and KORALZ answers on ISR*FSR Interference:

- For typical exp. energy cut 0.3 ISR*FSR int. is about 1.5% in σ_{tot} and A_{FB} .
- For energy cut 0.1 it is twice bigger.
- The cut $|\cos\theta| < 0.9$ makes it 25% smaller.
- The $\mathcal{O}(\alpha^1)$ ISR*FSR int. is under total control using KORALZ and $\mathcal{K}\mathcal{K}$ Monte Carlo for arbitrary cuts.
- Effects beyond $\mathcal{O}(\alpha^1)$ are negligible, (<20% of $\mathcal{O}(\alpha^1)$), except when energy cut is stronger than 0.1.
- ISR*FSR int. at Z radiative return is very small, as expected.
- Change from s' to Q^2 -propagator in energy cut has no effect.