KLOE hadronic cross section data in the HepDATA repository

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PrecisionSM Meeting, May 26, 2021

KLOE05 in HEPData repository

https://www.hepdata.net/record/ins655225

Hide Publication Information

Measurement of $\sigma(e^+e^- \to \pi^+\pi^-\gamma)$ and extraction of $\sigma(e^+e^- \to \pi^+\pi^-)$ below 1-GeV with the KLOE detector

The KLOE collaboration

Aloisio, A. , Ambrosino, F. , Antonelli, A. , Antonelli, M. , Bacci, C. , Barva, M. , Bencivenni, G. , Bertolucci, S. , Bini, C. , Bloise, C.

Phys.Lett. B606 (2005) 12-24, 2005.

https://doi.org/10.17182/hepdata.41901

Journal | INSPIRE | HepData | Resources

Rivet Analysis

Abstract (data abstract)

FRASCATI-DAPHNE. Measurement of the cross section for the process E+ E- --& gt; PI+ PI- GAMMA at a centre-of-mass energy of 1.02 GeV. The cross section for the E+ E- --& gt; PI+ PI- process is extracted from the dependence on the invariant mass of the two-pion system. The form factor is also calculated.

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View Analyses

Filter 3 data tables

Table 1

Data from T 1

10.17182/hepdata.41901.v1/t1

The differential cross section as a function of the invariant mass of the di-pion system in the angular region THETA(PIPI)...

Table 2

Data from T 1

10.17182/hepdata.41901.v1/t2

The physical cross section for E+ E- --> PI+ PI- including FSR and vacuum polarization effects.

Table 3

Data from T 1

10.17182/hepdata.41901.v1/t3

The pion form factor with FSR and vacuum polarization effects removed.

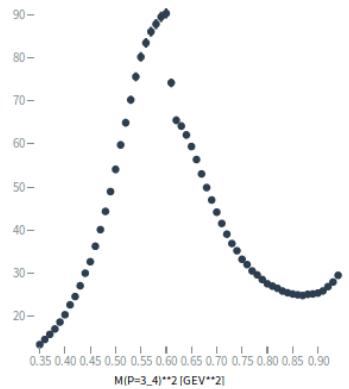
The differential cross section as a function of the invariant mass of the di-pion system in the angular region THETA(PIPI) <15 DEGREES or THETA(PIPI) >165 DEGREES and THETA(PI) in the region 0 to 180 DEGREES.

cmenergies	observables	phrases	reactions
0.023	DSIG/DM	Exclusive Single Differential E+ E- Scattering	E+ E- --> PI+ PI-

Showing 50 of 60 values — Show All 60 values

RE	E+ E- --> PI+ PI- GAMMA
SQRT(S)	0.023 GeV
M(P=3_4)**2 [GEV**2]	D(SIG)/DM(P=3_4)**2 [NB/GEV**2]
0.35	13.4 ±0.24 ±0.9% sys,Additional experimental systemat ±0.9% sys,Additional theory systematic erro
0.36	14.59 ±0.24 ±0.9% sys,Additional experimental systemat ±0.9% sys,Additional theory systematic erro
0.37	15.78 ±0.24 ±0.9% sys,Additional experimental systemat ±0.9% sys,Additional theory systematic erro
0.38	17.04 ±0.24 ±0.9% sys,Additional experimental systemat

Visualize



Sum errors ☑ Log Scale (X) ☐

KLOE05 in HEPData repository

The entry contains 3 tables:

- the differential cross section $d\sigma(e^+e^- \to \pi^+\pi^-\gamma)/ds_\pi$ as a function of the invariant mass of the di-pion system, s_π, in the angular region $\theta_{\pi\pi} < 15^o$ or $\theta_{\pi\pi} > 165^o$, $0^o < \theta_\pi < 180^o$
  - 60 points with (diagonal) stat. uncertainty and a flat syst. uncertainty of 0.9%(exp)$\oplus$ 0.9%(th)
- the physical cross section $\sigma(e^+e^- \to \pi^+\pi^-)$ including FSR and vacuum polarization effects
  - 60 points with (diagonal) stat. uncertainty and a flat syst. uncertainty of 0.9%(exp)$\oplus$0.9%(th)
- the pion form factor with FSR and vacuum polarization effects removed.
  - 60 points with (diagonal) stat. uncertainty

The syst. uncertainties given are not correct - the 0.9%(exp)$\oplus$0.9%(th) uncertainty is on the a_μ-value, not on the individual points.
No covariance matrices are listed, and no breakdown of systematical contributions (additional tables in the paper).

KLOE08 in HEPData repository

https://www.hepdata.net/record/ins797438

Hide Publication Information

Measurement of $\sigma(e^+e^- \to \pi^+\pi^-\gamma(\gamma)$ and the dipion contribution to the muon anomaly with the KLOE detector

The KLOE collaboration

Ambrosino, F. , Antonelli, A. , Antonelli, M. , Archilli, F. , Bacci, C. , Beltrame, P. , Bencivenni, G. , Bertolucci, S. , Bini, C. , Bloise, C.

Phys.Lett. B670 (2009) 285-291, 2009.

https://doi.org/10.17182/hepdata.57088

Journal | INSPIRE | HepData | Resources

Rivet Analysis

Abstract (data abstract)

FRASCATI-DAPHNE. Measurement of the cross section for the process E+ E- --> PI+ PI- GAMMA (GAMMA) in the energy region 0.35 to 0.95 GeV. The data set has an integrated luminosity of 240 pb-1. The four DSYS errors in the tables are the systematic errors (in percent) from background subtraction, acceptance, detector resolution and radiator function respectively.

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Filter 3 data tables

Table 1

Data from T 7,F 4

10.17182/hepdata.57088.v1/t1

Differential cross section for E+ E- --> PI+ PI- GAMMA (GAMMA).

Table 2

Data from T 7,F 4

10.17182/hepdata.57088.v1/t2

Total cross section for E+ E- --> PI+ PI-.

Table 3

Data from T 7,F 6

10.17182/hepdata.57088.v1/t3

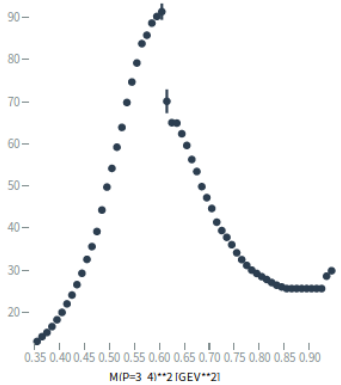
Pion form factor.

DSIG/DM | Exclusive | 0.51000,0.51000 | E+ E- --> PI+ PI- | Single Differential | E+ E- Scattering

Showing 50 of 60 values — Show All 60 values

RE	E+ E- --> PI+ PION GAMMA (GAMMA)
THETA(P=5)	> 15 DEGREES
M(P=3_4)**2 [GEV**2]	D(SIG)/DM(P=3_4)**2 [NB/GEV**2]
0.35 - 0.36	13.07 ±0.16 stat ±0.5% sys_1 ±0.6% sys_2 ±0.0% sys_3 ±0.3% sys_4
0.36 - 0.37	14.21 ±0.16 stat ±0.4% sys_1 ±0.6% sys_2 ±0.0% sys_3 ±0.4% sys_4
0.37 - 0.38	15.2 ±0.16 stat ±0.4% sys_1 ±0.6% sys_2 ±0.0% sys_3 ±0.2% sys_4
0.38 - 0.39	16.6 ±0.16 stat ±0.4% sys_1 ±0.6% sys_2 ±0.0% sys_3 ±0.1% sys_4
0.39 - 0.4	18.23 ±0.17 stat ±0.4% sys_1 ±0.5% sys_2 ±0.0% sys_3 ±0.2% sys_4
0.4 - 0.41	19.97 ±0.16 stat ±0.4% sys_1 ±0.5% sys_2 ±0.0% sys_3 ±0.1% sys_4

Visualize



Sum errors ☑ Log Scale (X) ☐

Log Scale (Y) ☐

Deselect variables or hide different error bars by clicking on them.

KLOE08 in HEPData repository

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Download All

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Differential cross section for E+ E- --> PI+ PI- GAMMA (GAMMA).

Table 2
Data from T 7,F 4
10.17182/hepdata.57088.v1/t2
Total cross section for E+ E- --> PI+ PI-.

Table 3
Data from T 7,F 6
10.17182/hepdata.57088.v1/t3
Pion form factor.

DSIG/DM | Exclusive | 0.51000,0.51000 | E+ E- --> PI+ PI- | Single Differential | E+ E- Scattering

Showing 50 of 60 values — Show All 60 values

RE	E+ E- --> PI+ PION GAMMA (GAMMA)
THETA(P=5)	> 15 DEGREES
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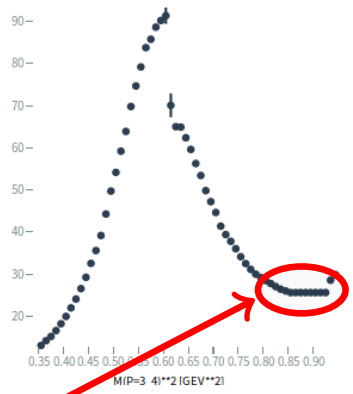
0.35 - 0.36	13.07 ±0.16 stat ±0.5% sys_1 ±0.6% sys_2 ±0.0% sys_3 ±0.3% sys_4
0.36 - 0.37	14.21 ±0.16 stat ±0.4% sys_1 ±0.6% sys_2 ±0.0% sys_3 ±0.4% sys_4
0.37 - 0.38	15.2 ±0.16 stat ±0.4% sys_1 ±0.6% sys_2 ±0.0% sys_3 ±0.2% sys_4
0.38 - 0.39	16.6 ±0.16 stat ±0.4% sys_1 ±0.6% sys_2 ±0.0% sys_3 ±0.1% sys_4
0.39 - 0.4	18.23 ±0.17 stat ±0.4% sys_1 ±0.5% sys_2 ±0.0% sys_3 ±0.2% sys_4
0.4 - 0.41	19.97 ±0.16 stat ±0.4% sys_1 ±0.5% sys_2 ±0.0% sys_3 ±0.1% sys_4

Visualize



Sum errors ☑ Log Scale (X) ☐

Log Scale (Y) ☐

Deselect variables or hide different error bars by clicking on them.

Values between 0.86 and 0.92 GeV^2 for diff. cross section are incorrect!

KLOE08 in HEPData repository

The entry contains 3 tables:

- the observed differential cross section $d\sigma_{e^+e^-\to\pi^+\pi^-\gamma}/dM^2_{\pi\pi}$ as a function of the invariant mass of the dipion system, in the angular region $\theta_{\pi\pi}(\pi-\theta_{\pi\pi}) < 15^o$
  - 60 points with (diagonal) stat. uncertainty and 4 contributions to the systematic uncertainty (background subtr., acceptance, unfolding, radiator function)
- the bare cross section $\sigma^0_{\pi\pi}$ inclusive of FSR and with vac. pol. effects removed
  - 60 points with (diagonal) stat. uncertainty and 4 contributions to the systematic uncertainty (background subtr., acceptance, unfolding, radiator function)
- the pion form factor without FSR and with vac. pol. effects included.
  - 60 points with (diagonal) stat. uncertainty and 4 contributions to the systematic uncertainty (background subtr., acceptance, unfolding, radiator function)

No covariance matrices are listed, and no constant systematical contributions.

Update on KLOE10 HEPData preparations

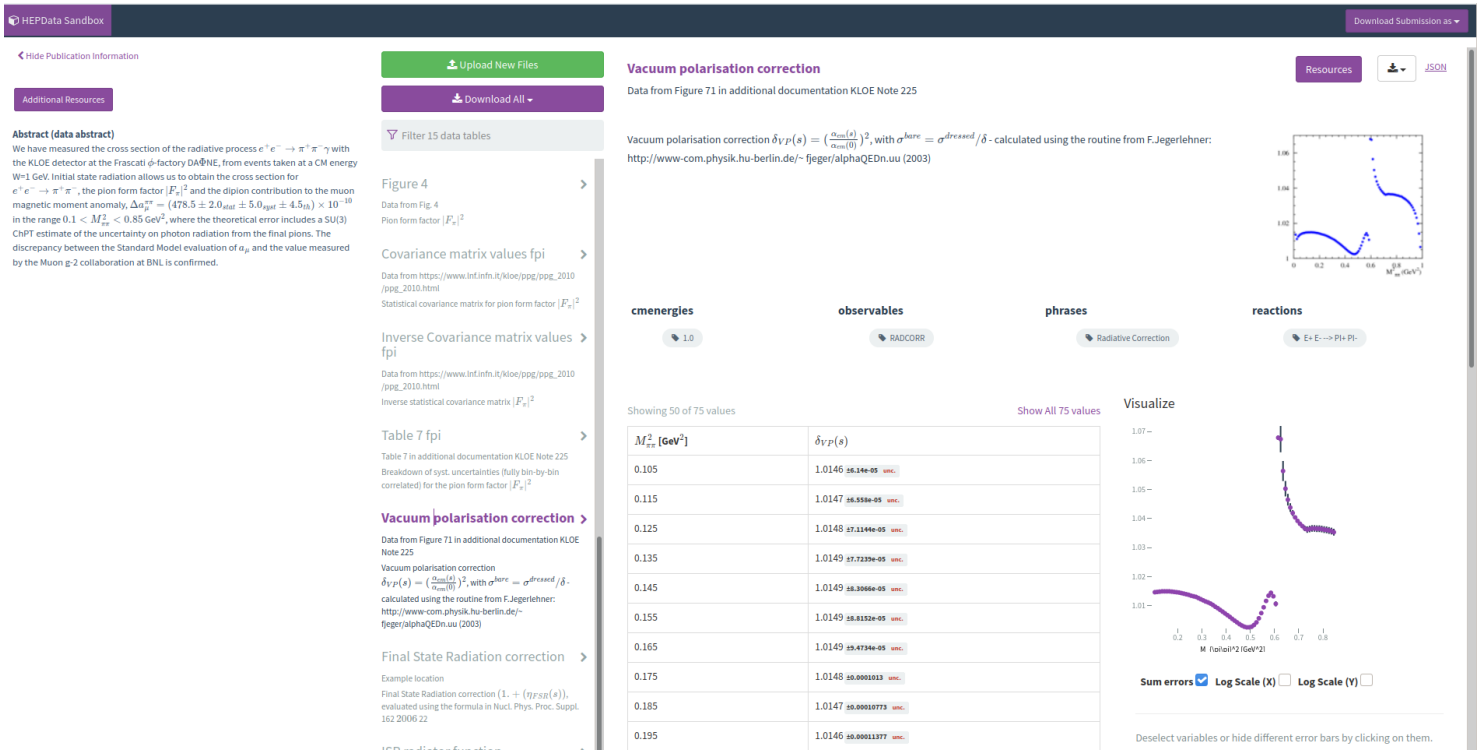
Include radiative corrections in **HEPData** record:

- Correction due to Vacuum Polarization
  - To go from *dressed* to *bare* cross section
  - $\delta_{VP}(s) = (\alpha_{em}(s)/\alpha_{em}(0))^2$
  - based on routine from Fred Jegerlehner: `http://www-com.physik.hu-berlin.de/~fjeger/alphaQEDn.uu` (2003)
- Correction due to FSR from pointlike pions
  - To remove the effect from FSR from pion form factor
  - Correction defined as $(1 + \eta_{FSR}(s))$
  - $\eta_{FSR}(s)$ from F. Jegerlehner, Nucl. Phys. Proc. Suppl. 162 (2006) 22 (originally from Schwinger, but there is a typo in the original publication?)
- Correction due to ISR photon emission
  - To go from the differential cross section $d\sigma_{e^+e^-\to\pi^+\pi^-\gamma}/dM^2_{\pi\pi}$ to the *bare* cross section $\sigma^0_{\pi\pi}$
  - evaluated with PHOKHARA5 MC generator (2005)

Update on KLOE10 HEPData preparations

Include radiative corrections in **HEPData** record:

Vacuum polarization correction for KLOE10 in HEPData:

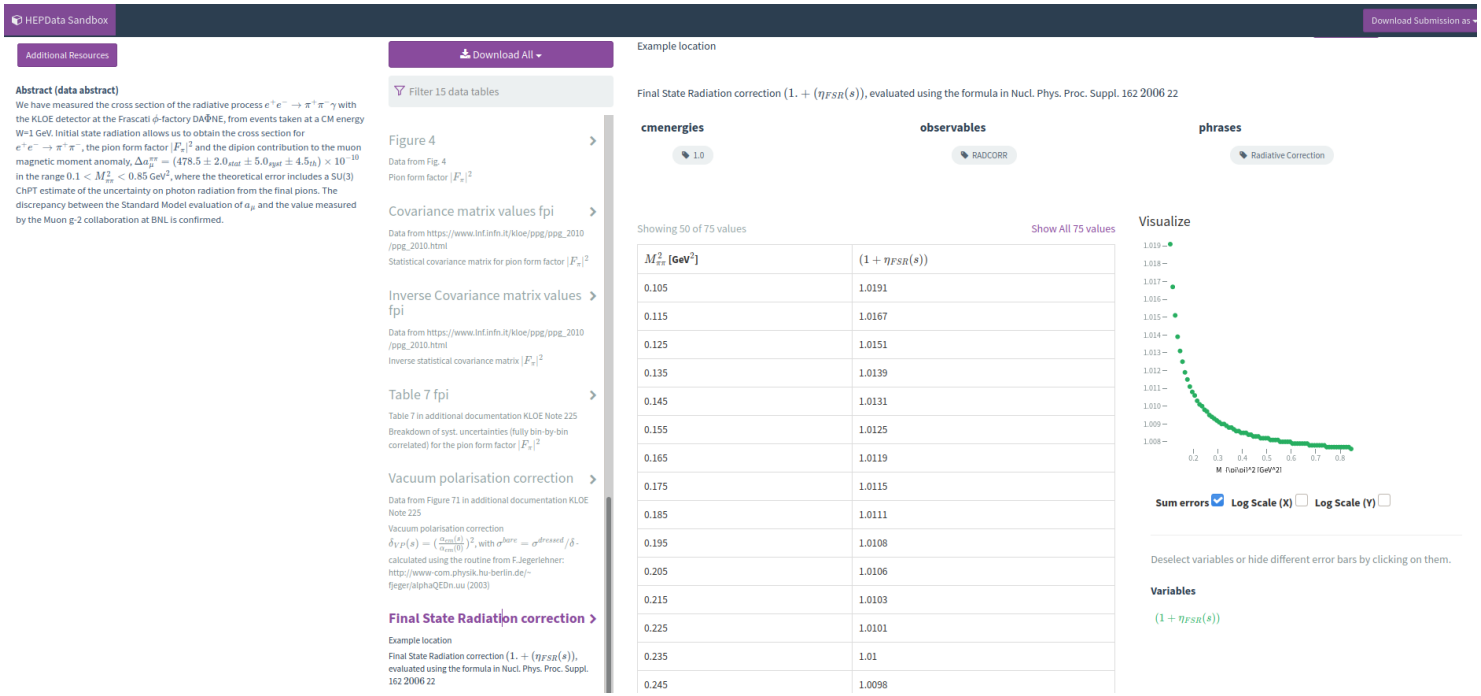


Using HEPData `observable` keyword [`''RADCORR''`] and `phrases` keywords [`''Vacuum Polarisation''`] and [`''Radiative Correction''`]

Update on KLOE10 HEPData preparations

Include radiative corrections in **HEPData** record:

FSR correction $(1+\eta(s))$ from pointlike pions for KLOE10 in HEPData:

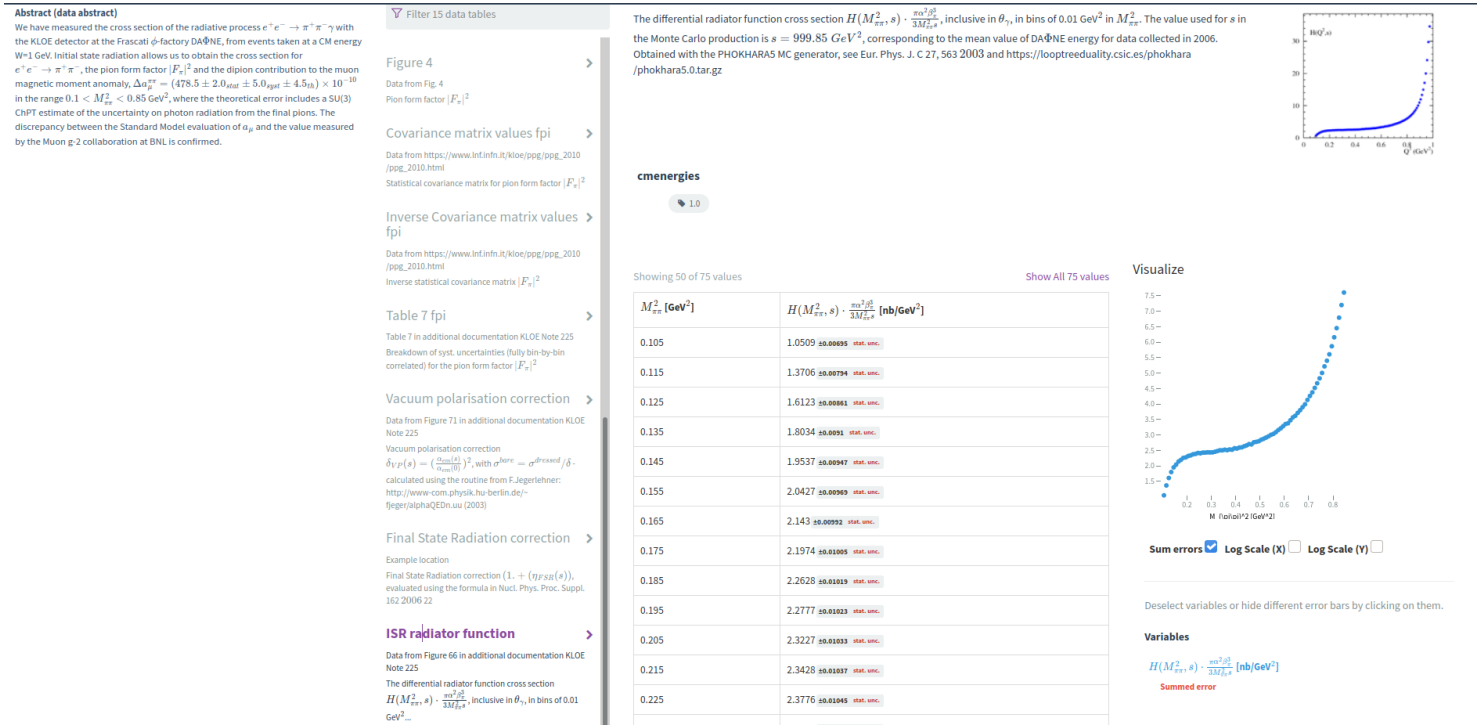


Using HEPData `observable` keyword [‘‘`RADCORR`’’] and `phrases` keywords [‘‘`Final State Radiation`’’] and [‘‘`Radiative Correction`’’]

Update on KLOE10 HEPData preparations

Include radiative corrections in **HEPData** record:

ISR radiator function used in KLOE10 in HEPData:



Using HEPData `observable` keyword [`‘‘RADCORR’’`] and `phrases` keywords [`‘‘Radiator Function’’`] and [`‘‘Radiative Correction’’`]

Conclusions/Open questions

- existing HEPData KLOE entries need revision:
  - incorrect systematic uncertainties for KLOE05 entry
  - wrong data points for differential cross section of KLOE08 entry
  - missing covariance matrices
  - additional systematic contributions
  - what if data is considered “superseded”? Entry should be flagged accordingly (or removed?)
- entry for KLOE10 data has been prepared
  - including radiative corrections (VP correction, FSR correction, Radiator function)
- To be done:
  - KLOE17 entry (paper on combination of all 3 relevant KLOE data sets, contains updated individual data sets)
  - KLOE12 entry
  - Update KLOE05 and KLOE08 entries (and point to KLOE17 entry)

Conclusions/Open questions

What about computer codes used to produce the radiative corrections?

- Fred's old routine can still be downloaded, but is not listed anymore on his webpage

The alphaQED package: last update December 30, 2019

Fortran package alphaQED instruction: "alphaQED19.pdf" see also:

"$\alpha_{\mathrm{QED,\ eff}}$ (s) for precision physics at the FCC-ee/ILC" Invited Talk, 11th FCC-ee workshop: Theory and Experiments, 8-11 January 2019, CERN Geneva. Proceeding published in CERN Yellow Reports: Monographs Vol. 3 2020 [arXiv:1905.05078]

- I also had a hard time to find the PHOKHARA webpage - it is now at `https://looptreeduality.csic.es/phokhara/`, v10 has been added in Oct. 2020

PHOKHARA

radiative return at flavour factories

Physics Electron--positron annihilation into hadrons plus an energetic photon from initial state radiation (ISR) allows the hadronic cross-section to be measured over a wide range of energies at high luminosity flavour factories [DAPHNE, CESR, PEP-II, KEK-B, Super-KEKB, BESIII].

Content **PHOKHARA** is a Monte Carlo event generator which simulates this process at the next-to-leading order (NLO) accuracy. This includes virtual and soft photon corrections to one photon emission events and the emission of two real hard photons.

Downloads **VERSION 10.0 (October 2020):** Includes complete NLO radiative corrections for the extraction of the **pion form factor**. The new implementation is described in detail in Phys. Rev. D100 (2019) no.7, 076004 [arXiv:1903.10197 hep-ph].

- manual [PDF], source [.tar.gz]

- **STRONG need** to get these codes on a public data repository (CERN Zenodo, RODARE, ...) - also for legacy versions!