STRONG-2020 PrecisionSM DB and web site status and plans

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PrecisionSM meeting

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Introduction

goals (my view)

- build repository of low-energy precision measurements data
  - in a format and with instructions and examples to be readily usable
- provide instances of elaborations of the data, e.g. calculation of (part of) muon g-2 HVP contribution

on-going work

- focus on measurements of $\sigma(e^+e^- \to \text{hadrons})$ to compute HVP & LBL contributions to muon $g-2$
- rely on HEPData.net as measurements repository
  - check existing data, promote / organize data submissions
- setup collaborative web site that links to measurement data on HEPData.net and organizes the content
- provide code examples that download and elaborate data of precision measurements
- git repository used to store web site content with versioning
- eventually, additional git repositorie(s) will store more complex code examples

HEPData.net

- HEP data public storage web site, mainly used by LHC experiments
- well defined submission data format, functionally adequate for our data of interest
- uses YAML and JSON, can export to Root format and other formats
- measurements on HEPData.net link their InspireHEP.net publication and InspireHEP.net back-links HEPData.net
- possible to download data and metadata programmatically
- first release of HEPData.net
  - HEPData.net personnell harvested some measurements from the published literature
  - these old submissions were checked and found to fall short of our requirements
- second (current) HEPData.net release
  - submissions are done by authorized contact persons of collaborations
  - submissions have now quite higher quality and reliability than past ones
  - some experiments are quite active in promptly uploading their published data

HEPData.net (2)

- coordinator has privileges for submission (A.L. authorized as STRONG-2020 coordinator)
- coordinator appoints uploader and reviewer, giving appropriate permissions
- Stefan Mueller has prepared a working submission of data provided by a KLOE paper
  - submission OK and follows all HEPData.net prescriptions
- personally, would like to use a less verbose and more compact data format on submissions and have discussed the matter with Graeme Watt of HEPData.net:
  - HEPData.net accepts data in custom formats
  - plan to design a less verbose submission format and understand all implications
  - use supportted formats when required for specific supported features we like to get

HEPData.net provisional submission of KLOE10 $e^+e^- \to \pi^+\pi^-(\gamma)$

https://www.hepdata.net/record/sandbox/1599143175

hepdata.net/record/sandbox/1599143175

HEPData | Search HEPData | Search | Submit | Sandbox | About | Submission Help | Dashboard | Log out

HEPData Sandbox | Download Submission as

Hide Publication Information

Additional Resources

Abstract (data abstract)
We have measured the cross section of the radiative process $e^+e^- \to \pi^+\pi^-\gamma$ with the KLOE detector at the Frascati ϕ-factory DAΦNE, events taken at a CM energy W=1 GeV. Initial state radiation allows us to obtain the cross section for $e^+e^- \to \pi^+\pi^-$, the pion form factor $|F_\pi|^2$ and the dipion contribution to the muon magnetic moment anomaly, $\Delta a_\mu^{\pi\pi} = (478.5 \pm 2.0_{stat} \pm 5.0_{syst} \pm 4.5_{th}) \times 10^{-1}$ in the range $0.1 < M_{\pi\pi}^2 < 0.85$ GeV^2, where the theoretical error includes a SU(3) ChPT estimate of the uncertainty on photon radiation from the final pions. The discrepancy between the Standard Model evaluation of a_μ and the value measured by the Muon g-2 collaboration at BNL is confirmed.

Upload New Files

Download All

Filter 12 data tables

Figure 3a
Data from Fig. 3, Left and Table 2
Differential cross section for $e^+e^- \to \pi^+\pi^-\gamma$, with $50^o < \theta_\gamma < 130^o$

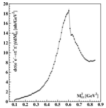
Covariance matrix values for differential cross section
Data from https://www.lnf.infn.it/kloe/ppg/ppg_
Statistical covariance matrix for differential cross section for $e^+e^- \to \pi^+\pi^-\gamma$, with $50^o < \theta_\gamma < 130^o$

Inverse Covariance matrix values for differential cross section
Data from https://www.lnf.infn.it/kloe/ppg/ppg_
Inverse statistical covariance matrix for differential cross section for $e^+e^- \to \pi^+\pi^-\gamma$, with $50^o < \theta_\gamma < 130^o$

Figure 3a
Data from Fig. 3, Left and Table 2

Resources | JSON

Differential cross section for $e^+e^- \to \pi^+\pi^-\gamma$, with $50^o < \theta_\gamma < 130^o$



cmenergies: 1.0

observables: DSIG/DQ**2

phrases: Exclusive, E+E- Scattering, Section

reactions: E+ E- --> PI+ PI- GAMMA

Showing 50 of 75 values | Show All 75 values

SQRTS(S)	1000 MeV
RE	E+ E- --> PI+ PI- GAMMA
$M_{\pi\pi}^2$ [GeV^2]	$d\sigma/dM_{\pi\pi}^2$ [nb/GeV^2]
0.105	0.34 ±0.06 stat ±0.03 syst
0.115	0.49 ±0.06 stat ±0.03 syst

Visualize

PrecisionSM collaborative web site

https://precision-sm.github.io/

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Draft PrecisionSM web site

- Example code to create a responsive plot using results stored in HEPData.net
- Example of responsive plot integrated in this website
- Example notebook
- Fedor Ignatov responsive plots

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Web site, example of responsive plot

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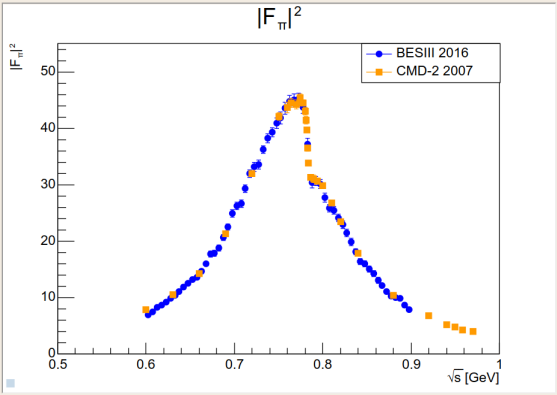
PrecisionSM Group — 2020-09-06 14:36

Example responsive plot

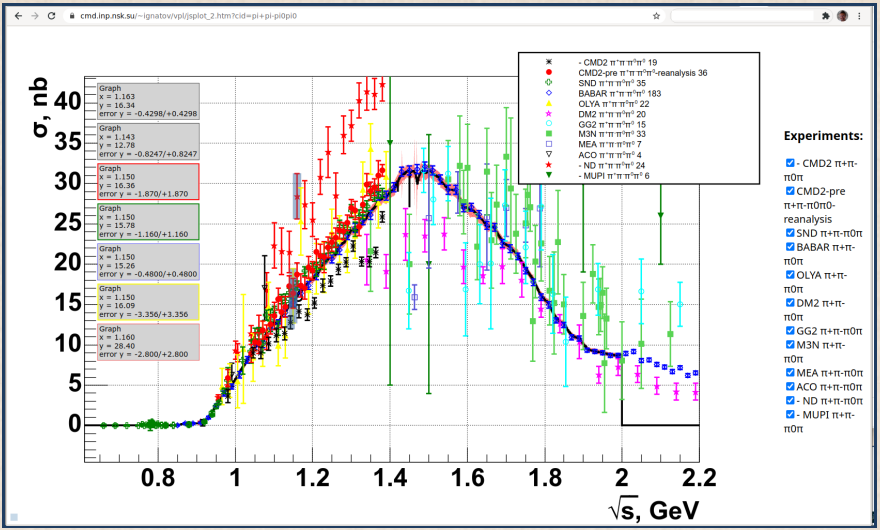
Hovering the cursor above the points reveals the respective x and y values.



Previous post Next post

Web site, Fedor Ignatov responsive plot

- re-using (with his collaboration) techniques used by F. Ignatov in https://cmd.inp.nsk.su/~ignatov/vpl/



Web site, how to read HEPData measurements and prepare a responsive plot

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Prepare Root Plot with data from HEPData

PrecisionSM Group — 2020-11-21 01:05

get two cross-section measurements from HEPData and plot them

- e+ e- -> pi+ pi- BES-III 2016 https://www.hepdata.net/record/ins1385603
- e+ e- -> pi+ pi- CMD-2 2007 https://www.hepdata.net/record/ins728302

In [1]:

```
from math import *
import re
from pprint import pprint
import urllib.request
from requests.utils import requote_uri
from array import array
import json
import yaml
import itertools
import ROOT
from ROOT import TCanvas, TFile, TProfile, TNtuple, TH1F, TH2F, TLegend
from ROOT import TGraph, TGraphErrors, TGraphAsymmErrors
from ROOT import gROOT, gBenchmark, gRandom, gSystem, gStyle, gPad
```

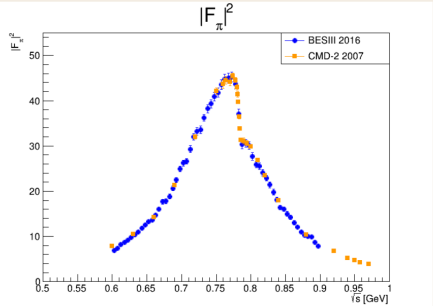
```
Welcome to JupyROOT 6.22/08
```

In [2]:

```
##
## iterator generator using outer product of two lists
## - first list is inner and second one is outer
## - also able to return nth elements of iterator
## - iterator never ends but folds
##
class iterprod2:
  def __init__(self, arr1, arr2):
    self.arr1, self.arr2 = arr1, arr2
  def __iter__(self):
    self.i1 = 0
    self.i2 = 0
    return self
  def __next__(self):
```

In [15]:

```
leg = TLegend(0.65, 0.80, 0.90, 0.90)
leg.SetTextSize(0.035)
leg.AddEntry(ins1385603_gr, ins1385603_gr.GetTitle(), "LP")
leg.AddEntry(ins728302_gr, ins728302_gr.GetTitle(), "LP")
leg.Draw()
canvas.Draw()
```



In [16]:

```
rfile = TFile("precsm-resp-plot-example.root", "recreate")
canvas.Write("F_pip_pim")
rfile.Close()
```

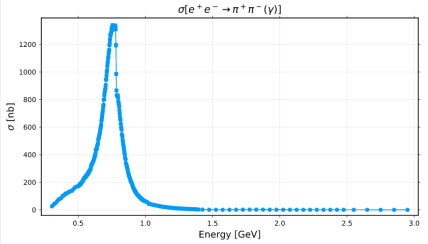
Web site, read BaBar $e^+e^- \to \pi^+\pi^-(\gamma)$ and make plots

cross-section

In [56]:

```
##
## plot cross-section vs. energy (stat. unc. only)
##
curpl = @df sigma_df plot(
  :E,
  :sigma_val,
  yerror = :sigma_unc,
  title = L"$\sigma[e^+e^- \rightarrow \pi^+\pi^-(\gamma)]$",
  xlabel = "Energy [GeV]",
  ylabel = L"$\sigma$ [nb]",
  markerstrokecolor = :auto,
  legend = false
)
## mysavefig(curpl, "curpl.pdf")
## display(curpl)
```

Out[56]:

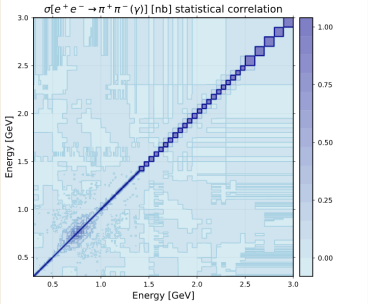


correlation

In [65]:

```
##
## plot statistical correlation contour plot
##
curpl = @df sigma_df contourf(
  range(extrema(vcat(:E_l, :E_h))..., length=500),
  range(extrema(vcat(:E_l, :E_h))..., length=500),
  sigma_stat_corr,
  ## clims = sigma_stat_corr_clims,
  color = :blues,
  title=L"$\sigma[e^+e^- \rightarrow \pi^+\pi^-(\gamma)]$ [nb] statistical correlation",
  xlabel="Energy [GeV]",
  ylabel="Energy [GeV]",
  size=(600, 500)
)
```

Out[65]:



Web site collaborative framework

- source web site files on Github repository
- Nikola static web generator generates website (= HTML, CSS and javascript)
- simple procedure to publish on Github Pages at https://precision-sm.github.io/
  - generated web site can be published anywhere else if more convenient
- web pages are edited in simplified markup languages like Markdown
  - but HTML, CSS and Javascript can be used if desired
- collaborators can be added as editors of Github repository
- written, tested and documented procedure to convert data into responsive jsRoot plots (https://precision-sm.github.io/posts/mk-hepdata-plot/)

Next steps

- responsive plot feature of channel selection (know how to do it, just matter of available time)
- collect list of measurements to be uploaded to HEPData.net
- organize and collaborate with experiments to upload the measurements' data
- produce responsive plots from data uploaded on HEPData.net (semi-automatic)
- document measurements in web site
  - link to HEPData.net, inspirehep, brief description, plots
- organize measurements in categories
- publish example code pieces: data downloading, elaborations

Thanks for your attention!

Backup Slides

Website workflow

```
##-- install code
shell: pip3 install -user -U nikola notebook ghp-import2
##-- get website source
shell: git clone git@github.com:precision-sm/precision-sm.github.io.git
shell: cd precision-sm.github.io/

##-- web files in branch "master", source in branch "src"
shell: git branch
* master
shell: git checkout src
shell: git branch
master
* src

##--source of web pages in rst, markdown, jupyter notebooks and other
shell: ls pages posts

##-- build web site, destination in output/
shell: nikola build

##-- upload to github pages
shell: nikola github_deploy

##-- view web site locally for development
shell: nikola auto -browser
```

Additional notes on collaborative web site

- Nikola documentation:
  - https://getnikola.com/getting-started.html
  - https://getnikola.com/creating-a-site-not-a-blog-with-nikola.html
- Github Pages documentation: https://pages.github.com/
  - master & src branches are specific to github pages
- if web site hosted elsewhere
  - content of src branch should be in master branch
  - content of output/ directory (generated web site) should not be included in versioned repository
  - content of output/ should be copied in the web site root directory
- free account functionality of github appropriate for the moment
- evolution to different hosting framework is straightforward

home page source index.rst

```
.. title: Main Page
.. slug: index
.. date: 2020-06-28 18:41:26 UTC+02:00
.. tags:
.. category:
.. link:
.. description:
.. has_math: true
.. type: text
.. hidetitle: true

.. image:: /images/colibri-plain.svg
    :target: /images/colibri-plain.svg
    :width: 12 em
    :align: right

Draft PrecisionSM web site
==========================

* ‘Example code to create a responsive plot using results stored in HEPData.net
  </posts/mk-hepdata-plot/>‘_

* ‘Example of responsive plot integrated in this website </posts/example-responsive-plot/>‘_

* ‘Example notebook </posts/BaBar-ep-em-to-pip-pim/>‘_

* ‘Fedor Ignatov responsive plots </posts/fedor-ignatov-e%2Be-to-hadrons-plots/>‘_
```

home page source for responsive plot

```
.. title: example responsive plot
.. slug: example-responsive-plot
.. date: 2020-09-06 14:36:05 UTC+02:00
.. tags:
.. category:
.. link:
.. description:
.. type: text
.. hidetitle: true

Example responsive plot
=======================

.. TEASER_END

Hovering the cursor above the points reveals the respective x and y values.

.. raw:: html

  <iframe
    style="width:90%; height:67.5vh; margin:0px auto; display:block;"
    src="/jsroot/index.htm?nobrowser&file=../resp-plots/precsm-resp-plot-example.root&item=F_pip_pim&opt=ep">
  </iframe>
```