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BELLE

Belle pion form factor in TAUOLA

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- Embedding fortran code in TAUOLA
- How to use, checks
- Summary and Plans

Embedding in tauola

- On the basis of *rho3p_pionf.f* function, provided by H. Hayashii the **FPIBEL** function has been prepared and embedded in tauola.F:

  Complex*16 FUNCTION FPIBEL(W,flpar)

  w – Minv(pi pi0)

  flpar = **0** (all free fit), **1** (par(1)=F_pi(0)=1-fixed fit)

- Also modified is the **FPIRHO** function in tauola.F to provide the choice of the pion form factor:

```
      FUNCTION FPIRHO(W)
C ************************************************************
C     SQUARE OF PION FORM FACTOR
C ************************************************************

      integer flag_pipi0

      Complex FPI
      Complex*16 FPIBEL
      common /BelleForm/ flag_pipi0
      if(flag_pipi0.eq.0) FPIRHO=CABS(FPIK(W))**2
      if(flag_pipi0.eq.1) FPIRHO=SNGL(CDABS(FPIBEL(W,0))**2)
      if(flag_pipi0.eq.2) FPIRHO=SNGL(CDABS(FPIBEL(W,1))**2)
      RETURN
      END
```

How to use

- In Belle **kkmc_if.F** few strings of code were added to provide possibility to choose the type of form factor from KKMC *tau.input* control file (xpar(2020) variable is reserved as a flag to change the F_π model):

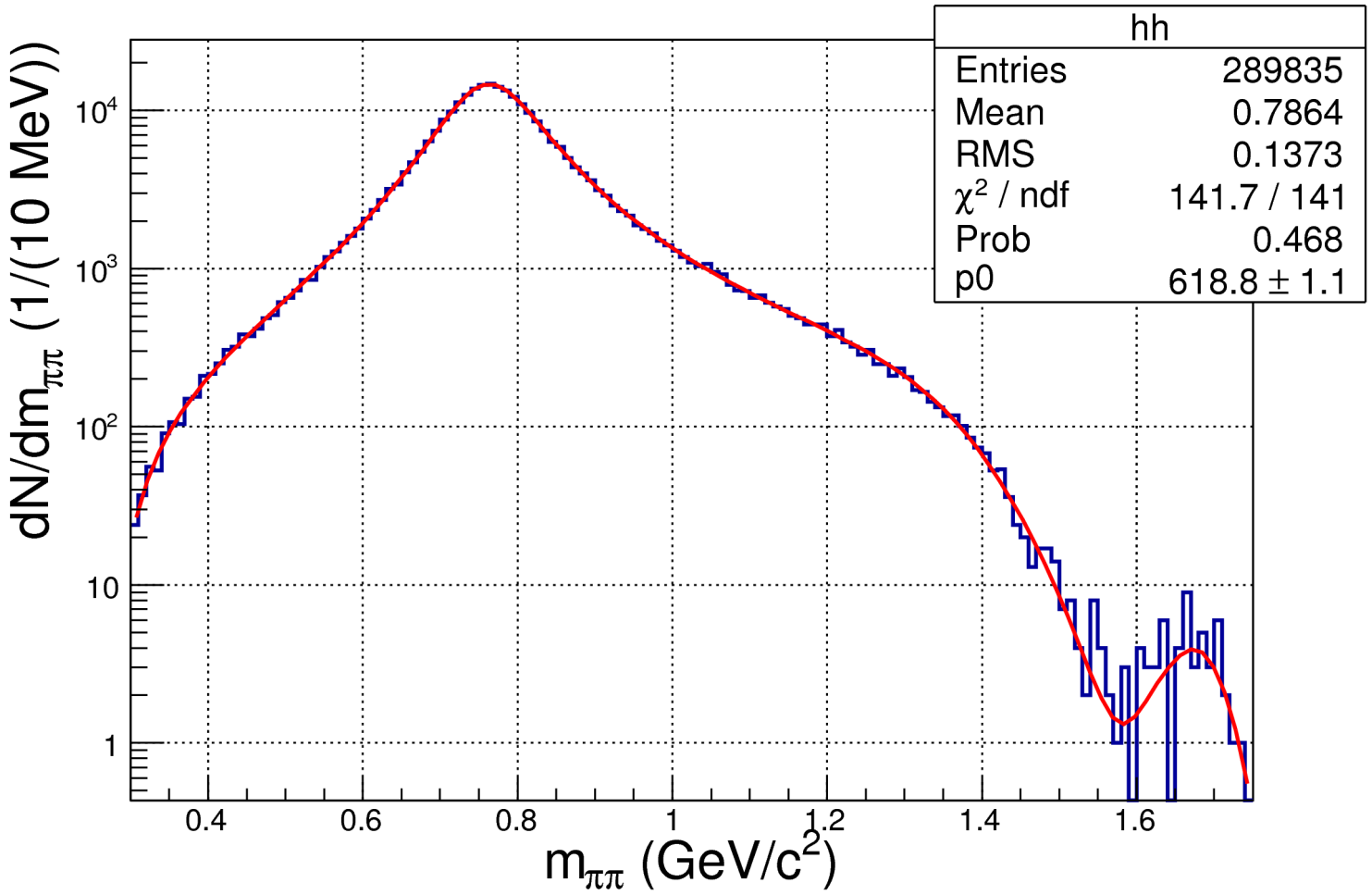
  xpar(2020) = 0 – default CLEO form factor
  xpar(2020) = 1 – Belle form factor with (all free fit) parameters, **RECOMMENDED**
  xpar(2020) = 2 – Belle form factor with ($F_\pi(0)$=1-fixed fit) parameters

- Simply add one string to your *tau.input* file:

```
0      0 -3.5     3.5                  *p(e+)(GeV)
0.1759 0 7.994565 7.9965               *p(e-)(GeV)
0.08711                                * c*tau(tau life time) (mm)
1                                      * switch for long lived (1:no decay, 0:decay)
********** Above is for basf *********
BeginX
*********************************************************************************
                ACTUAL DATA FOR THIS PARTICULAR RUN
*********************************************************************************
*indx_________________ccccccccc0ccccccccc0ccccccccc0ccccccccc0ccccccccc0ccccccccc0
*     Center-of-mass energy [GeV]
      1       10.58D0      CMSene =xpar( 1) Average Center of mass energy [GeV]
*********************************************************************************
*     Define process
   415            1      KFfin, Tau
*********************************************************************************
 2020           1      pipi0 formf flag: 0-CLEO; 1,2-Belle(1-recom. Belle case)
*********************************************************************************
EndX
```

Check of the FPIBEL

3x10^5 events were generated (xpar(2020)=1) $M_{\pi\pi}$ mass distribution was fitted by Belle diff. width function (1-case), total normalization is the only free parameter



Summary and Plans

- Belle pion form factor was embedded in tauola and checked. Now it is ready to use by others.

```
M. Fujikawa et al. [Belle Collaboration],
''High-Statistics Study of the tau- -> pi- pi0 nu(tau) Decay,''
Phys. Rev. D 78 (2008) 072006
[arXiv:0805.3773 [hep-ex]].
```

- C++ functions (TComplex ROOT class is used) for the Belle pion form factor and differential width are ready.
- Update Belle public version of KKMC.
- Plan to check with Belle $\tau \to \pi\pi^0\nu_\tau$ data (~20M events)
- Plan to embed Belle parametrizations for $M_{Ks\pi}$ mass spectrum from our previous publication.