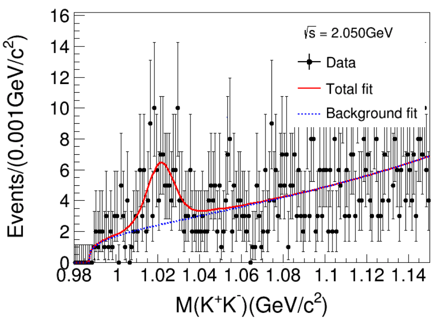
Weekly report




```
                                    ERR DEF= 0.5
 EXTERNAL ERROR MATRIX.    NDIM=  25    NPAR=  6    ERR DEF=0.5
  1.118e+00  4.294e+00  4.295e+00  2.154e-04 -1.259e-01  1.529e-04
  4.294e+00  2.580e+02  1.831e+02  1.056e-03  3.416e-03  8.375e-03
  4.295e+00  1.831e+02  8.222e+02  1.054e-03  3.402e-03  8.371e-03
  2.154e-04  1.056e-03  1.054e-03  2.235e-06 -3.442e-05  8.656e-08
 -1.259e-01  3.416e-03  3.402e-03 -3.442e-05  1.882e-02  6.844e-06
  1.529e-04  8.375e-03  8.371e-03  8.656e-08  6.844e-06  1.880e-06
 PARAMETER  CORRELATION COEFFICIENTS
       NO.  GLOBAL      1      2      3      4      5      6
        1  0.90697   1.000  0.253  0.142  0.136 -0.868  0.105
        2  0.61428   0.253  1.000  0.397  0.044  0.002  0.380
        3  0.41327   0.142  0.397  1.000  0.025  0.001  0.213
        4  0.18472   0.136  0.044  0.025  1.000 -0.168  0.042
        5  0.90148  -0.868  0.002  0.001 -0.168  1.000  0.036
        6  0.39936   0.105  0.380  0.213  0.042  0.036  1.000
[#1] INFO:Minization -- RooMinuit::optimizeConst: deactivating const optimization
[#1] INFO:Caching -- RooAbsCachedPdf::getCache(bw0_f1) creating new cache 0x3512100 with pdf bw0_CONV_gauss0_CACHE_Obs[kpkm]
[#1] INFO:NumericIntegration -- RooRealIntegral::init(poly_Int[kpkm]) using numeric integrator RooIntegrator1D to calculate I
massframe->chi^2  ==  0.587349
[#1] INFO:Plotting -- RooAbsPdf::plotOn(sum) directly selected PDF components: (poly)
[#1] INFO:Plotting -- RooAbsPdf::plotOn(sum) indirectly selected PDF components: ()
[#1] INFO:Caching -- RooAbsCachedPdf::getCache(bw0_f1) creating new cache 0x3692980 with pdf bw0_CONV_gauss0_CACHE_Obs[kpkm]
[#1] INFO:NumericIntegration -- RooRealIntegral::init(poly_Int[kpkm]) using numeric integrator RooIntegrator1D to calculate I
Info in <TCanvas::Print>: eps file 2050_fit_Phi_1000.eps has been created
[#1] INFO:Eval -- RooRealVar::setRange(kpkm) new range named 'windows' created with bounds [1.005,1.035]
[#1] INFO:Eval -- RooRealVar::setRange(kpkm) new range named 'sideband1' created with bounds [1.05,1.17]
[#1] INFO:NumericIntegration -- RooRealIntegral::init(poly_Int[kpkm]) using numeric integrator RooIntegrator1D to calculate I
Warning: wrong member access operator '->' Test.c:108:
Polynominal = 639.089
poly bkg in signal range: [#1] INFO:NumericIntegration -- RooRealIntegral::init(poly_Int[kpkm|windows]_Norm[kpkm]) using nume
71.9692
poly bkg in sideband: [#1] INFO:NumericIntegration -- RooRealIntegral::init(poly_Int[kpkm|sideband1]_Norm[kpkm]) using numeri
642.404

####job done!####
root [1]
```

Poly bkg in signal range/ Poly bkg in sideband: 信号下本底和边带本底的比例，用来标定卡方图中本底贡献的Scale：
/besfs/users/tanyx/Run665p01_tanyx/Y2175/PhiPiPiAlg/Analysis/2125/Chisq_2125_Data_MC_PhiPiPi.cxx
文件中hchisq_4c_Side->Scale(0.169);（52行）

此处Poly bkg in signal range/ Poly bkg in sideband=0.169

自动化

/besfs/users/wangwp/Lambdac/boss/Lambdac/Fit/Modified_Realdata_fit/mbc_fit/FVersionX/FixedPara/SkimEvtNo/4600_fit_mbc

realdata_mode1_fit.cxx

cpp_HeadFile.sh

whole_mv.sh

看自动更改程序的脚本是怎么实现的，对相似操作多的工作提速很大

/workfs/bes/gaoxl/workarea-6.6.5.p01/OmegaetaAlg/OmegaetaAlg-00-00-01/src/Omegaeta.cxx
232——234行

```
m_run = eventHeader->runNumber();
m_rec = eventHeader->eventNumber();
m_evttag=eventHeader->eventTag();
```

在code中把事例编号存出，每个事例有对应的eventNumber，可以对单个event进行处理。

setup BOSS environment on lxslc

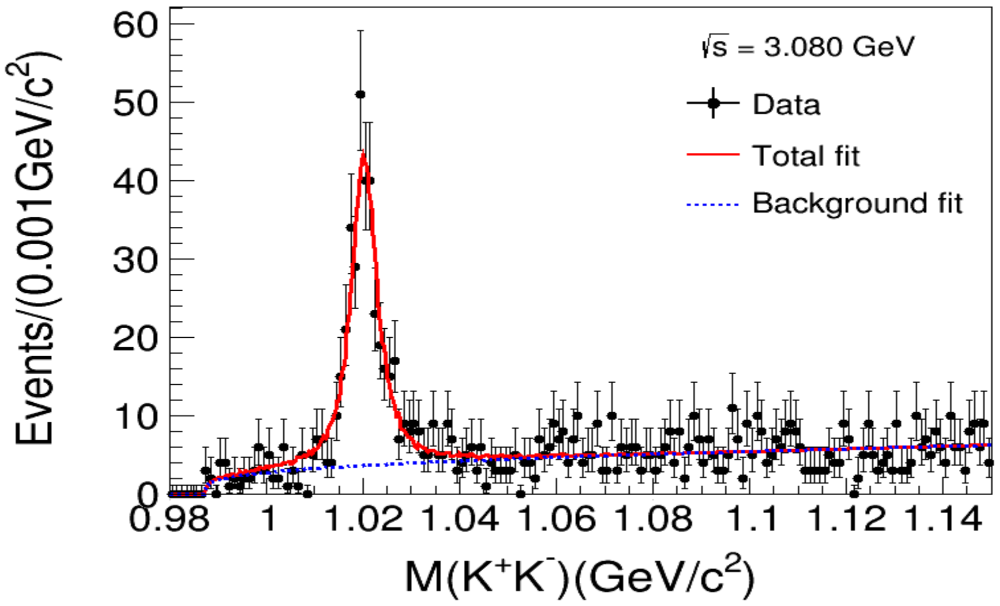
- 1. BOSS665p01.

- 2.R-scan data sets:
  2014/12/31
  2015
  2175MeV

Lxslc6 @3080MeV： L=$123.0pb^{-1}$

Event

X^2_{4C}(K+K-π+ π-):3080MeV



(1) X^2_{4C}(K+K-π+ π-)<20;

(2) φ(1020) Fitting :

Signal: Gaussian function Convolute MC shape

Background: Argus function $f(x;\chi,c) = \frac{\chi^3}{\sqrt{2\pi}\Psi(\chi)} \cdot \frac{x}{c^2}\sqrt{1-\frac{x^2}{c^2}} \exp\left\{-\frac{1}{2}\chi^2\left(1-\frac{x^2}{c^2}\right)\right\},$

N_{Signal}=344.3±23.2;

Argus definition

Definition [edit]

The probability density function (pdf) of the ARGUS distribution is:

$$f(x;\chi,c)=\frac{\chi^3}{\sqrt{2\pi}\,\Psi(\chi)}\cdot\frac{x}{c^2}\sqrt{1-\frac{x^2}{c^2}}\exp\left\{-\frac{1}{2}\chi^2\left(1-\frac{x^2}{c^2}\right)\right\},$$

for $0 \leq x < c$. Here χ, and c are parameters of the distribution and

$$\Psi(\chi)=\Phi(\chi)-\chi\phi(\chi)-\tfrac{1}{2},$$

and $\Phi(\cdot)$, $\phi(\cdot)$ are the cumulative distribution and probability density functions of the standard normal distribution, respectively.

Differential equation [edit]

The pdf of the ARGUS distribution is a solution of the following differential equation:

$$\left\{\begin{array}{l} c^2 x(c-x)(c+x)f'(x)+f(x)\left(-c^4-c^2\left(\chi^2-2\right)x^2+\chi^2 x^4\right)=0, \\ \\ f(1)=-\dfrac{\sqrt{2-\frac{2}{c^2}}\,\chi^3 e^{\frac{\chi^2}{2c^2}}}{c^2\left(\sqrt{2}\chi-\sqrt{\pi}e^{\frac{\chi^2}{2}}\operatorname{erf}\left(\frac{\chi}{\sqrt{2}}\right)\right)} \end{array}\right\}$$

Roofit

- Estimate way
  - Least square fit ($\chi 2$)
  - Maximum Likelihood (ML) Fit
- How to fit in ROOT
  - Create a parametric function object, TF1(available in ROOT library)

```
TF1 * f1 = new TF1("f1","[0]*TMath::Gaus(x,[1],[2])");
```

  - Set the initial values of the function parameters

```
root [] f1->SetParameters(1,0,1);
```

  - Fit the data object

```
root [] h1->Fit(f1);
```

Minimization

- Methods like Minuit based on gradient can get stuck easily in local minima

- Stochastic methods like simulated annealing or genetic algorithms can help to find the global minimum
  - (but it can be quite inefficient, e.g. many function calls)

- **Parameter Errors**

  A approximation to estimate the confidence level:

  -use directly the log-likelihood function and look at the difference from the minimum

purpose

- Efficiency
- **fit successful**

  1.Make sure functions all right;

  2.Fit in Liufang's criteria;

  3.Maybe improve criteria.
- To do

  1.Code and Roofit checked;

  2.debug in Liufang's criteria→Change resonance state the same with liu;

$$M\Gamma * \frac{B_2}{(Q_{abc}^2)^{2.5}} * \frac{(Q_{abc}^2)^{2.5}}{B_2}$$

  3.Fit and find a good result;

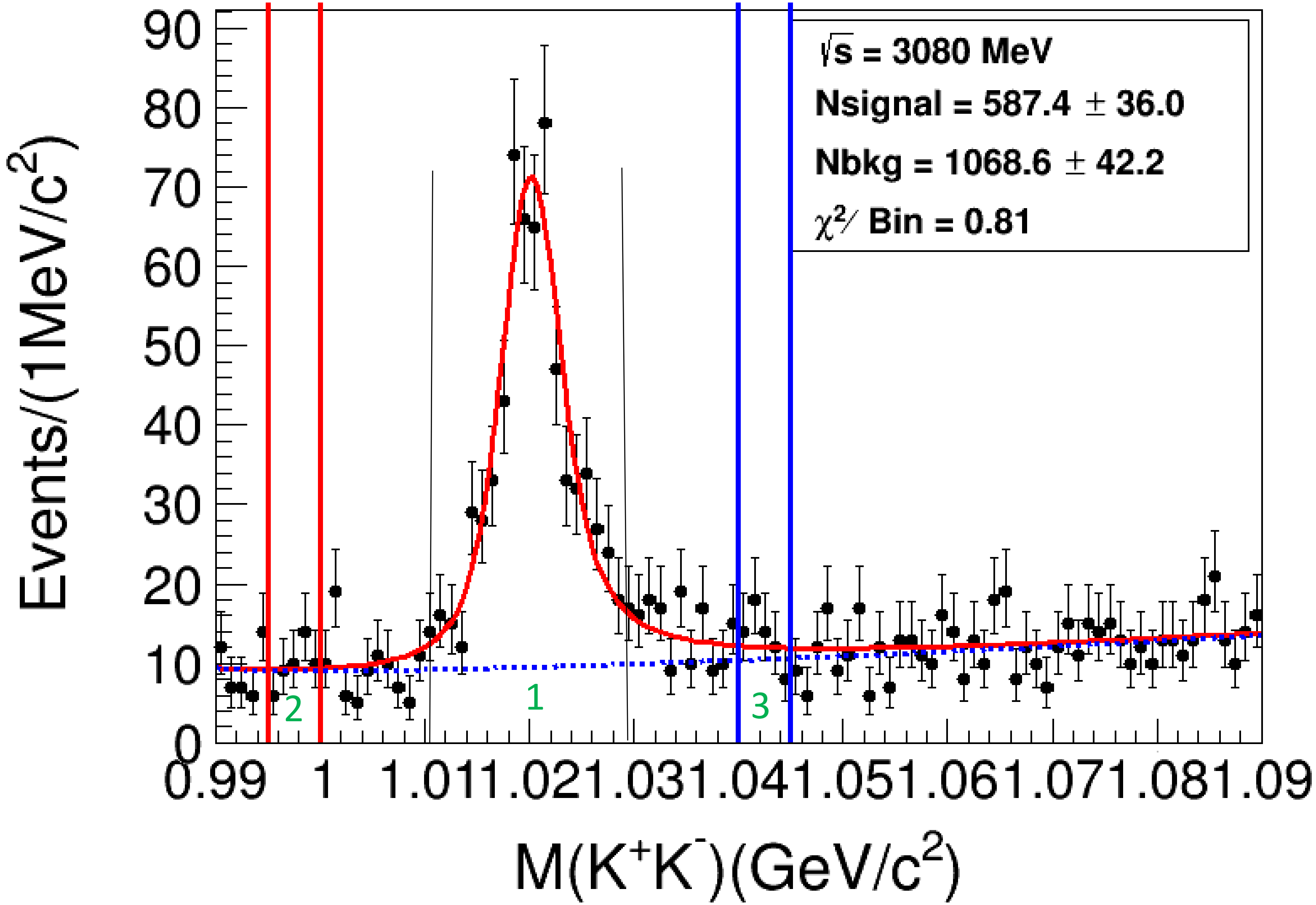
  4..

resonance

$<\phi f_J|\mathrm{LS}>$

$<\phi f_0|01>$: phasespace, $f_0(980)$, $f_0(1370)$, σ,
$<\phi f_0|21>$: $f_0(980)$, $f_0(1370)$, σ
$<\phi f_2|01>$: $f_2(1270)$,
$<\phi f_2|21>$: $f_2(1270)$,
$<\phi f_2|22>$: $f_2(1270)$,
$<\phi f_2|23>$: $f_2(1270)$,
$<\phi f_2|43>$: $f_2(1270)$,

bkg/sid系数 = 1/(2+3)



拟合一个能量点的步骤

1.拟合K+K-不变质量，计算本底/sideband系数用于background数据

（已移入能量点文件夹，替换能量数值）

/besfs/users/tanyx/Run665p01_tanyx/pwa_c++/zhangyt/datae/normalization

2.产生拟合用数据.dat文件:

修改realdata地址、phspMC地址（已移入能量点文件夹，替换能量数值）

修改MC数量、bkg/sid系数，编译运行，结果移入能量点文件夹

/besfs/users/tanyx/Run665p01_tanyx/pwa_c++/zhangyt/datae/sun

3.复制修改拟合文档

- 改creat.sh中地址（已移入能量点文件夹，替换能量数值），修改为产生一个文件夹并取消交后台
- 改PWAPdf.cxx中质心能量、数据地址（已移入能量点文件夹，替换能量数值）
- 改test.cxx中数据地址（已移入能量点文件夹，替换能量数值）
- 改run.sh中地址（文件夹按能量点区分，替换能量数值）
- 编译

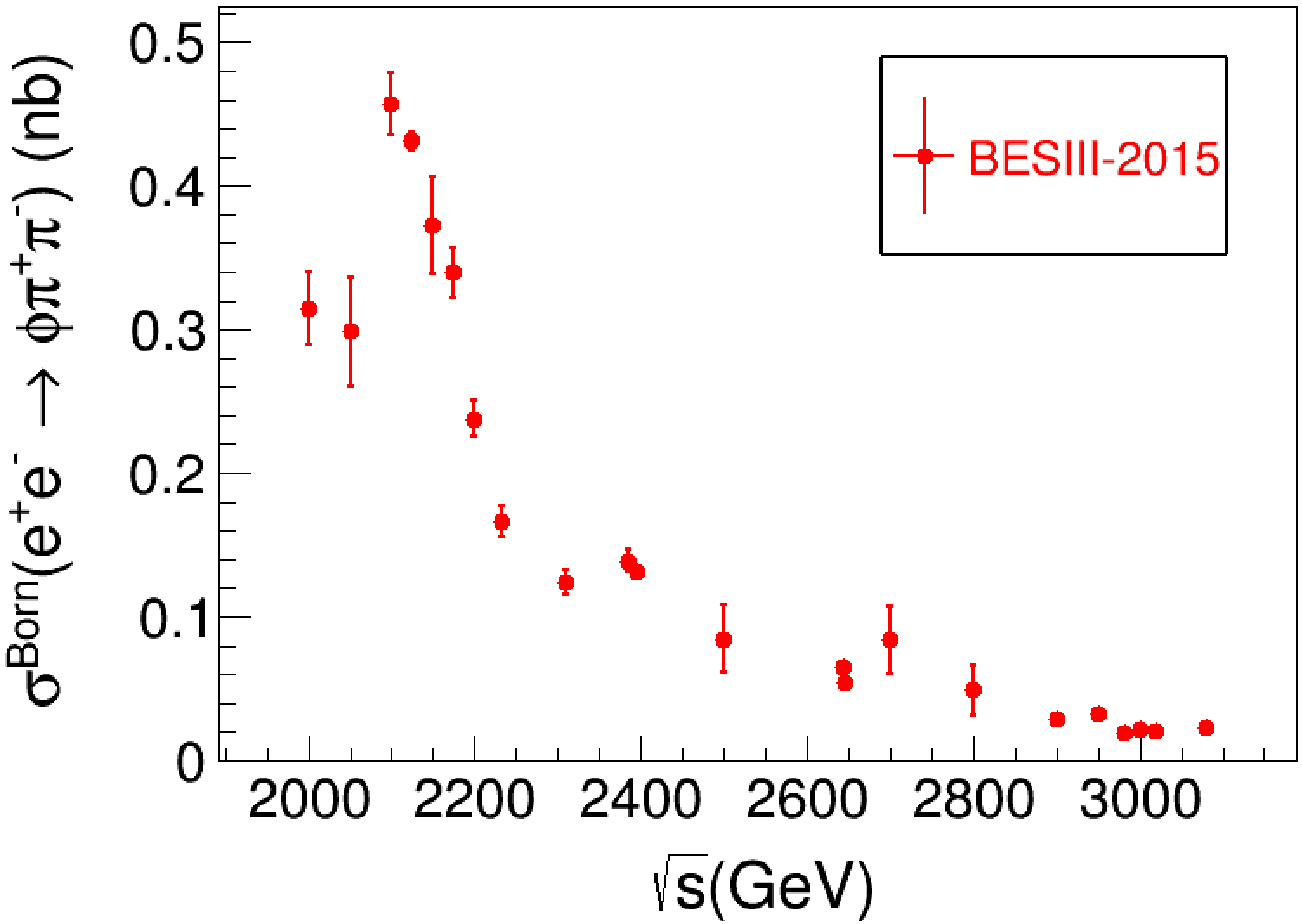
4. creat.sh，前台测试

5.测试拟合不成功，批量交后台

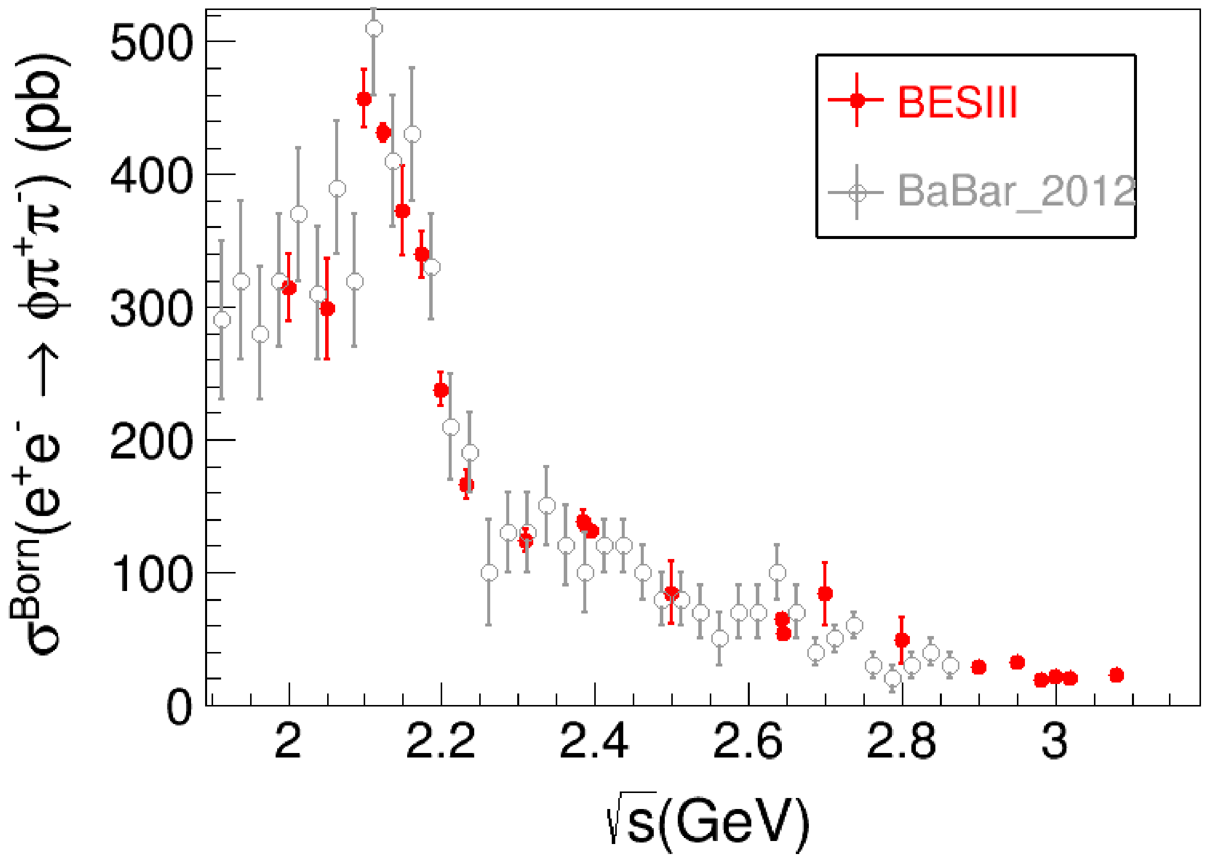
Cross section: $\sigma(e^+e^- \to \phi(1020)\,\pi^+\pi^-)_{2400,}$

$$\sigma = \frac{N^{obs}}{L \times (1+\delta)^{VP} \times (1+\delta)^{ISR} \times \varepsilon \times Br}$$

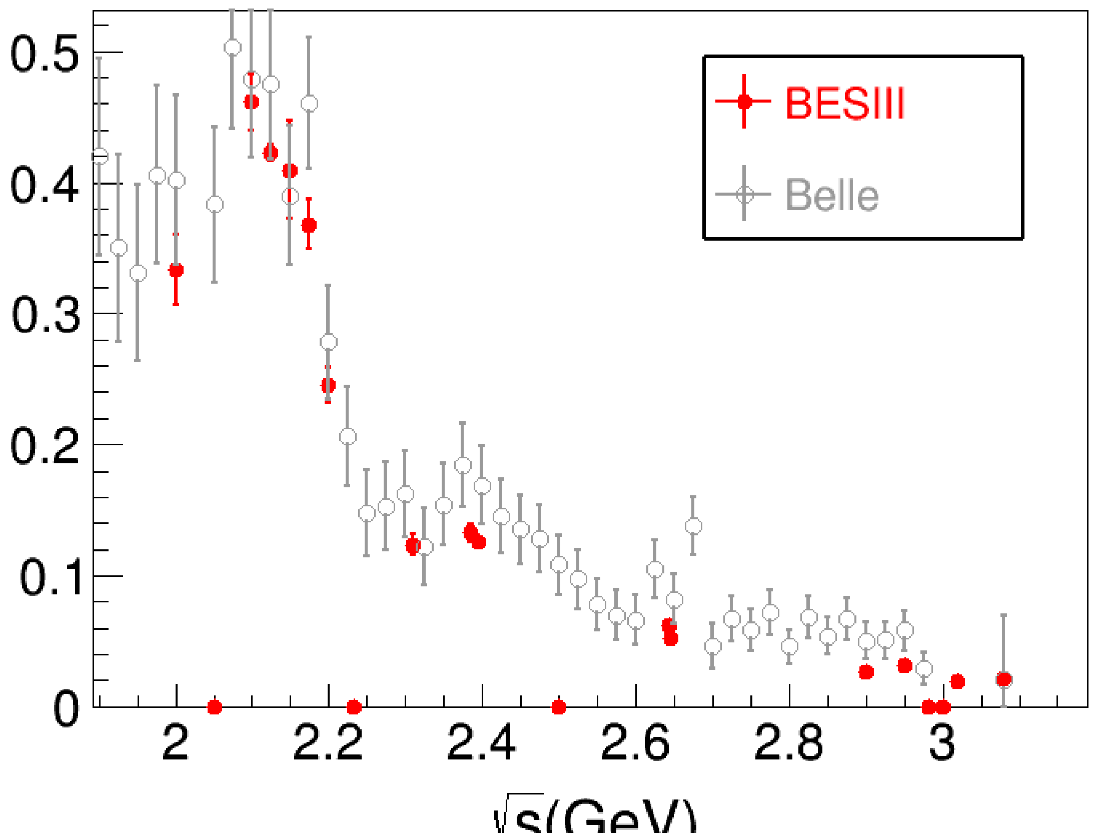
$\sqrt{s}(GeV)$	$Lum.(pb^{-1})$	$N(\phi)$	$(1+\delta)^{ISR}$	$\varepsilon(\%)$	$B(\%)$	$\sigma(pb)$	pwa参数来源
2	10.074	577.034 ± 46.7585	1.01	36.82	48.9	315.0 ± 25.5	2
2.05	3.343	191.501 ± 24.6026	1.06	37.03	48.9	298.4 ± 38.3	2.1
2.1	12.167	1100.68 ± 51.0709	1	40.48	48.9	457.0 ± 21.2	2.1
2.125	108.49	9372.07 ± 144.744	1.01	40.53	48.9	431.6 ± 6.7	2.125
2.15	2.841	219.774 ± 20.0234	1.06	40.02	48.9	372.9 ± 34.0	2.175
2.175	10.625	760.786 ± 39.1472	1	43.1	48.9	339.7 ± 17.5	2.175
2.2	13.699	706.123 ± 38.2991	1.16	38.18	48.9	238.0 ± 12.9	2.2
2.232	11.856	435.23 ± 29.4726	1.26	35.87	48.9	166.1 ± 11.2	2.2
2.309	21.089	587.337 ± 37.7342	1.25	36.74	48.9	124.0 ± 8.0	2.309
2.386	22.549	697.256 ± 36.9567	1.12	40.6	48.9	139.1 ± 7.4	2.386
2.396	66.869	1977.73 ± 65.4859	1.13	40.62	48.9	131.8 ± 4.4	2.396
2.5	1.1	21.204 ± 5.80658	1.26	36.95	48.9	84.7 ± 23.2	2.396
2.644	34.003	500.99 ± 33.1534	1.24	37.93	48.9	64.6 ± 4.3	2.644
2.646	33.722	423.423 ± 29.8042	1.25	37.31	48.9	54.6 ± 3.8	2.646
2.7	1.03	21.9937 ± 6.07232	1.7	30.67	48.9	83.8 ± 23.1	2.646
2.8	1.01	11.5793 ± 4.14874	1.5	31.91	48.9	49.0 ± 17.5	2.9
2.9	105.253	687.028 ± 37.6891	1.36	34.27	48.9	28.6 ± 1.6	2.9
2.95	15.942	114.385 ± 14.5631	1.23	36.41	48.9	32.8 ± 4.2	2.9
2.981	16.071	72.4495 ± 15.1859	1.7	27.88	48.9	19.5 ± 4.1	2.9
3	15.881	74.5714 ± 13.4033	1.69	27.12	48.9	21.0 ± 3.8	3.08
3.02	17.29	78.136 ± 12.1619	1.7	26.56	48.9	20.5 ± 3.2	3.08
3.08	126.185	576.907 ± 34.8024	1.74	23.38	48.9	23.0 ± 1.4	3.08



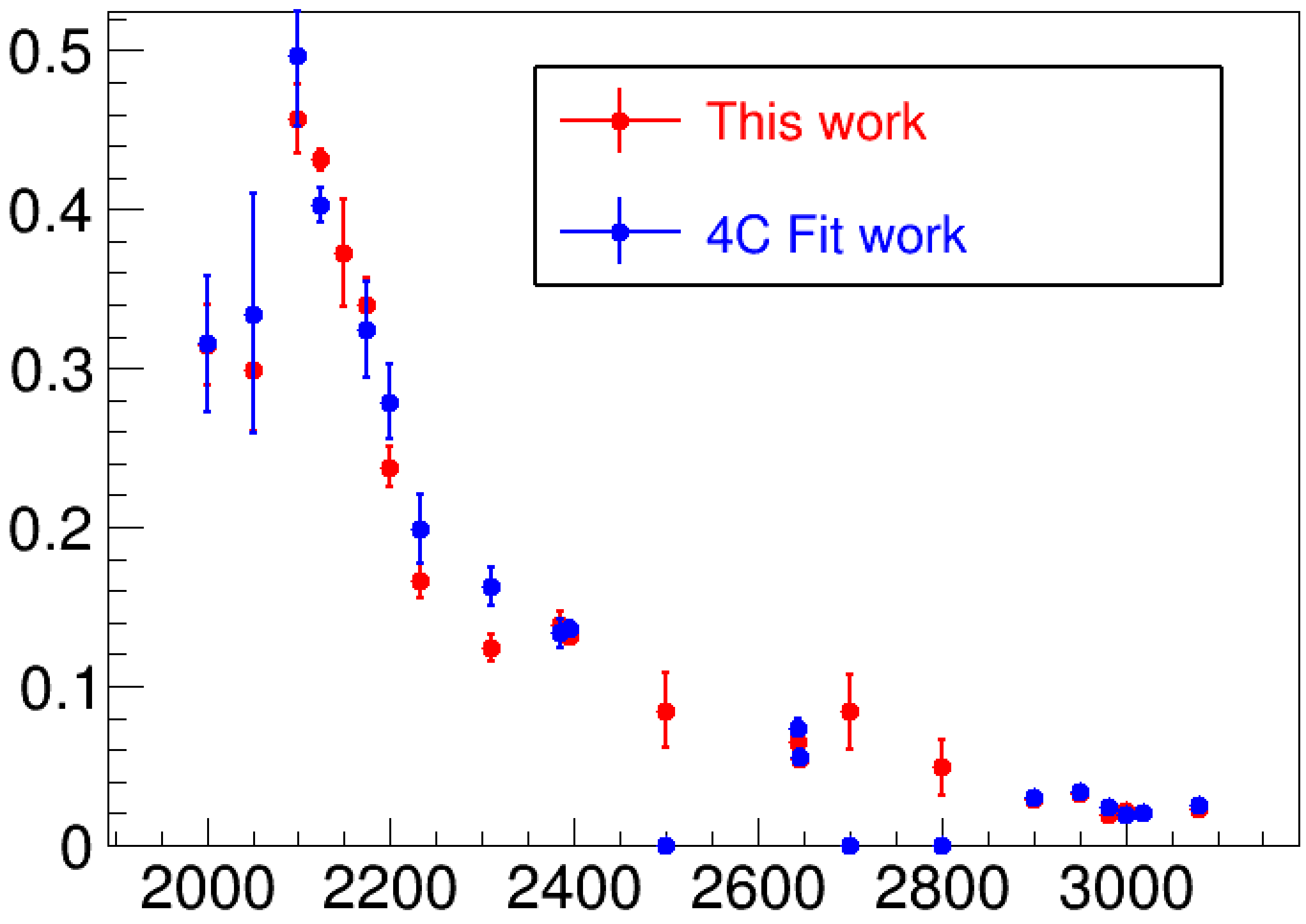
BESIII-2015
$\sigma^{Born}(e^+e^- \to \phi\pi^+\pi^-)$ (nb)
$\sqrt{s}$(GeV)
0
0.1
0.2
0.3
0.4
0.5
2000
2200
2400
2600
2800
3000



$\sigma^{Born}(e^+e^- \to \phi\pi^+\pi^-)$ (pb)
500
400
300
200
100
0
2
2.2
2.4
2.6
2.8
3
$\sqrt{s}$(GeV)
BESIII
BaBar_2012



0.5
0.4
0.3
0.2
0.1
0
2
2.2
2.4
2.6
2.8
3
BESIII
Belle



This work
4C Fit work
0.5
0.4
0.3
0.2
0.1
0
2000
2200
2400
2600
2800
3000

Cross section: $\sigma(e^+e^- \to \phi(1020)\,\pi^+\pi^-)_{2400,}$

$$\sigma = \frac{N^{obs}}{L\times(1+\delta)^{VP}\times(1+\delta)^{ISR}\times\varepsilon\times Br}$$

$\sqrt{s}(GeV)$	Lum.(pb^{-1})	$N(\phi)$	$(1+\delta)^{ISR}$	$\varepsilon(\%)$	B(%)	$\sigma(pb)$
2.000	10.074	577.3± 46.8	1.01	34.1	48.9	340.3 ± 27.6
2.050	3.343	191.6± 24.6	1.06	39.4	48.9	280.7 ± 36.0
2.100	12.167	1101.4± 51.1	1.00	39.3	48.9	471.0 ± 21.8
2.125	108.49	9376.8± 144.3	1.01	40.5	48.9	432.1 ± 6.7
2.150	2.841	220.0± 20.0	1.06	35.7	48.9	418.4 ± 38.1
2.175	10.625	761.2± 39.2	1.00	39.0	48.9	375.7 ± 19.3
2.200	13.699	706.6± 38.3	1.17	35.9	48.9	251.1 ± 13.6
2.232	11.856	435.5± 29.5	1.26	33.1	48.9	180.1 ± 12.2
2.309	21.089	587.6± 37.8	1.25	35.7	48.9	127.7 ± 8.2
2.386	22.549	698.2± 37.0	1.12	40.9	48.9	138.2 ± 7.3
2.396	66.869	1978.8± 65.5	1.14	40.6	48.9	130.7 ± 4.3
2.644	34.003	501.3 ± 33.1	1.24	37.8	48.9	64.9 ± 4.3
2.646	33.722	423.4± 29.7	1.25	36.8	48.9	55.4 ± 3.9
2.900	105.253	687.4± 37.6	1.36	34.1	48.9	28.8 ± 1.6
2.950	15.942	114.4± 14.5	1.23	36.0	48.9	33.1 ± 4.2
2.981	16.071	72.5± 15.2	1.70	28.5	48.9	19.0 ± 4.0
3.000	15.881	75.2± 13.5	1.69	28.2	48.9	20.3 ± 3.6
3.020	17.29	78.2± 12.2	1.70	26.3	48.9	20.7 ± 3.2
3.080	126.185	577.2± 34.8	1.74	22.9	48.9	23.5 ± 1.4

1C分波截面

$\sqrt{s}(GeV)$	$N(\phi)$	ε	$\sigma(pb)$
2	166.03 22.3169	0.1008	331.1 44.5
2.05	79.5321 17.8691	0.1455	315.4 70.9
2.1	338.646 29.9151	0.1135	501.5 44.3
2.125	2816.15 75.9514	0.1242	423.2 11.4
2.15	78.578 11.8603	0.1047	509.6 76.9
2.175	238.837 22.038	0.121	379.9 35.1
2.2	263.625 21.8965	0.112	300.3 24.9
2.232	159.198 17.0104	0.1105	197.2 21.1
2.309	318.654 23.9457	0.1698	145.6 10.9
2.386	368.014 25.5505	0.2195	135.8 9.4
2.396	1241.75 46.6822	0.2211	150.7 5.7
2.644	345.304 23.9599	0.2289	73.8 5.1
2.646	248.835 21.9581	0.2173	55.1 4.9
2.9	460.273 28.0503	0.223	29.5 1.8
2.95	78.8343 10.7962	0.2439	33.7 4.6
2.981	63.5504 10.3671	0.1959	24.3 4.0
3	48.568 9.20646	0.1975	18.7 3.6
3.02	51.1802 9.20825	0.1758	20.3 3.6
3.08	429.154 26.0364	0.156	25.6 1.6

4C分波截面（使用1C分波MC）

事例选择程序增加排坏run包

1. 说明网址https://docbes3.ihep.ac.cn/~tauqcdgroup/index.php/Data_Quality

2.安装包到自己的work版本下

不用做改动，编译

3.在要加的事例选择程序中

（/workfs/bes/tanyx/workarea-6.6.5.p01/Analysis/Physics/liufang/PhiPiPi_MissAlg/PhiPiPi_MissAlg-00-00-01/src/PhiPiPi_Miss.cxx）

- 头文件：#include "RscanDQ/RscanDQ.h“

- 函数：RscanDQ rsc(abs(eventHeader->runNumber()));

```
if (rsc.getStatus()==-1)
{cout<<"bad run: "<<eventHeader->runNumber()<<endl;
return StatusCode::SUCCESS;
}
```

- 在cmt/requirements中添加行：

```
use RscanDQ    RscanDQ-*
```

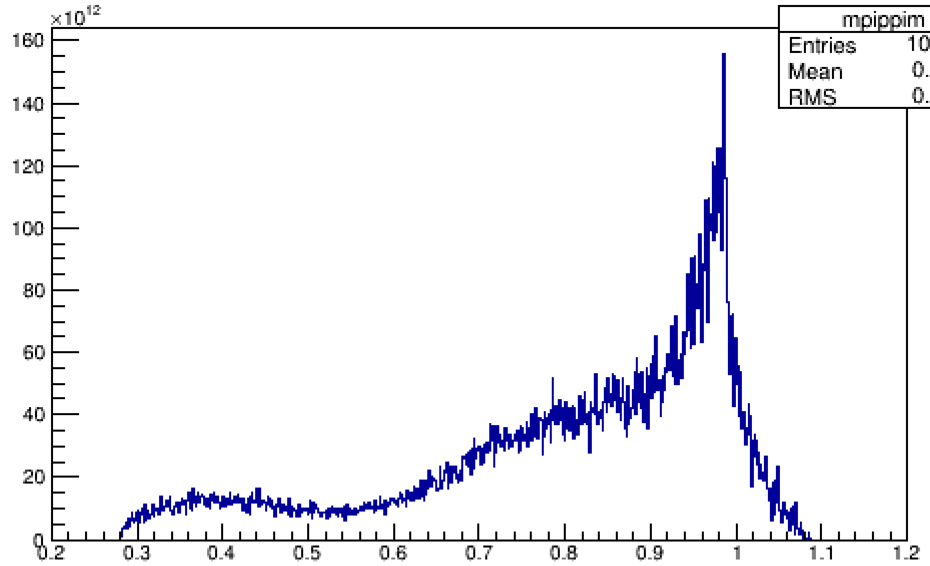
Cross section: $\sigma(e^+e^- \to \phi(1020)\,\pi^+\pi^-)$,

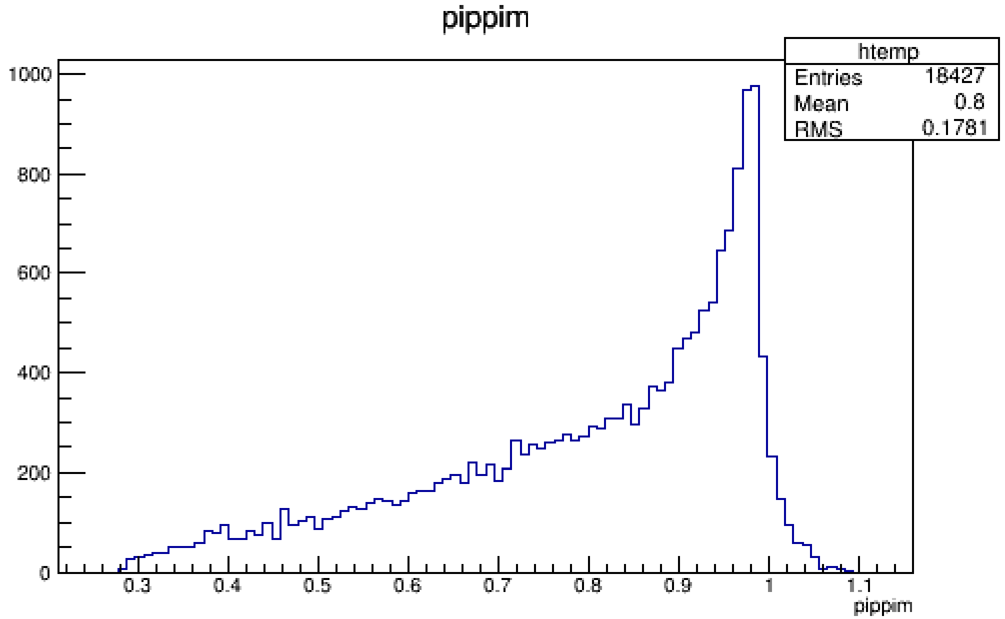
$$\sigma = \frac{N^{obs}}{L \times (1+\delta)^{VP} \times (1+\delta)^{ISR} \times \varepsilon \times Br}$$

	Lum.(pb^{-1})	$N(\phi)$	$(1+\delta)^{ISR}$	$\varepsilon(\%)$	$B(\%)$	$\sigma(pb)$
1C	108.49	9372.1 ± 144.7	1.01	40.5	48.9	431.6 ± 6.7
4C	108.49	2693.6 ± 78.1	1.01	15.9	48.9	316.2 ± 9.1

2125分波截面

Backup


×10^12
mpippim
Entries 100000
Mean 0.8067
RMS 0.1882
0
20
40
60
80
100
120
140
160
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
1.1
1.2


pippim
htemp
Entries 18427
Mean 0.8
RMS 0.1781
0
200
400
600
800
1000
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
1.1
pippim

Cross section: $\sigma(e^+e^- \to \phi(1020)\,\pi^+\pi^-)_{2400}$,

$$\sigma = \frac{N^{obs}}{L\times(1+\delta)^{VP}\times(1+\delta)^{ISR}\times\varepsilon\times Br}$$

序质心能量2.2324
什么值？

$\sqrt{s}(GeV)$	$Lum.(pb^{-1})$	$N(\phi)$	$(1+\delta)^{ISR}$	$\varepsilon(\%)$	$B(\%)$	$\sigma(pb)$	Pwa参数来源	本底/sideband系数	phspMC数量	MC信号数(0.98,1.09)
2.000	10.074	577.3± 46.8	1.01	34.1	48.9	340.3 ± 27.6	2.000	1.066	20000	34101/99990
2.050	3.343	191.6± 24.6	1.06	39.4	48.9	280.7 ± 36.0	2.100	1.06	20000	39433
2.100	12.167	1101.4± 51.1	1.00	39.3	48.9	471.0 ± 21.8	2.100	1.06	50000	39330
2.125	108.49	9376.8± 144.3	1.01	40.5	48.9	432.1 ± 6.7	2.125	1.05/1.03(4C)	150000	405274/1000000
2.150	2.841	220.0± 20.0	1.06	35.7	48.9	418.4 ± 38.1	2.175	0.95	20000	35731
2.175	10.625	761.2± 39.2	1.00	39.0	48.9	375.7 ± 19.3	2.175	1.05	20000	38951
2.200	13.699	706.6± 38.3	1.17	35.9	48.9	251.1 ± 13.6	2.200	1.02	20000	35873
2.232	11.856	435.5± 29.5	1.26	33.1	48.9	180.1 ± 12.2	2.200	1.07	20000	33126
2.309	21.089	587.6± 37.8	1.25	35.7	48.9	127.7 ± 8.2	2.309	1.016	20000	35662/99900
2.386	22.549	698.2± 37.0	1.12	40.9	48.9	138.2 ± 7.3	2.386	1.03	20000	40889
2.396	66.869	1978.8± 65.5	1.14	40.6	48.9	130.7 ± 4.3	2.396	1.02	50000	40623
2.500	1.10	21.2± 5.8	1.26	37.0	48.9	84.7± 23.2	2.396	/	/	
2.644	34.003	501.3 ± 33.1	1.24	37.8	48.9	64.9 ± 4.3	2.644	1.07	10000 (change to 20000)	37803
2.646	33.722	423.4± 29.7	1.25	36.8	48.9	55.4 ± 3.9	2.646	1.00	10000 (change to 20000)	36853
2.700	1.03				48.9		2.646	/	/	
2.800	1.01				48.9		2.900	/	/	
2.900	105.253	687.4± 37.6	1.36	34.1	48.9	28.8 ± 1.6	2.900	0.99	20000	34074
2.950	15.942	114.4± 14.5	1.23	36.0	48.9	33.1 ± 4.2	2.900	1.05	2000	36026
2.981	16.071	72.5± 15.2	1.70	28.5	48.9	19.0 ± 4.0	2.900	1.08	2000	28483
3.000	15.881	75.2± 13.5	1.69	28.2	48.9	20.3 ± 3.6	3.080	1.05	2000	28164
3.020	17.29	78.2± 12.2	1.70	26.3	48.9	20.7 ± 3.2	3.080	1.00	2000	26266
3.080	126.185	577.2± 34.8	1.74	22.9	48.9	23.5 ± 1.4	3.080	0.98	20000	22918