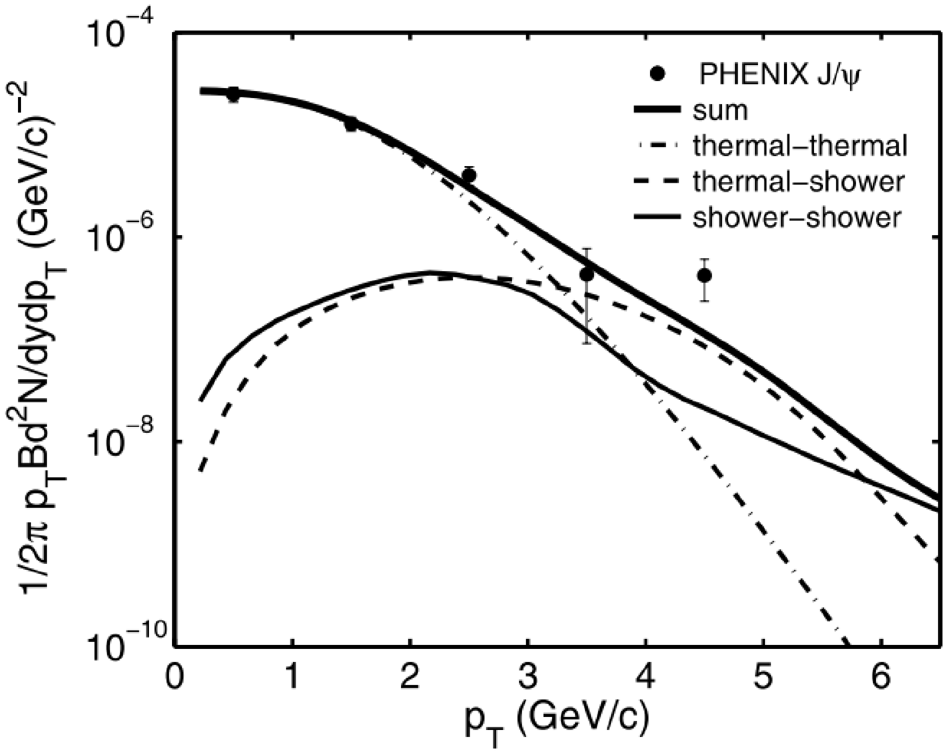
程序进展

1.疑问
2.结果
3.结论

Target:



$$\frac{dN^{\mathcal{TS}}_{J/\psi}}{d^2p} = \frac{C_{J/\psi}}{g\gamma_c}\left[\mathcal{T}_c(p/2)\mathcal{S}_{\bar{c}}(p/2) + \mathcal{S}_c(p/2)\mathcal{T}_{\bar{c}}(p/2)\right].$$

$$\frac{dN^{\mathcal{SS}}_{J/\psi}}{p\,dp} = \frac{1}{p^0 p}\sum_i \int \frac{dq}{q} F_i'(q)\frac{p}{q} D_i^{J/\psi}\left(\frac{p}{q}\right)$$

$$\frac{dN^{\mathcal{TT}}_{J/\psi}}{d^2p} = C_{J/\psi} M_T \frac{\tau A_T}{(2\pi)^3} 2\gamma_c^2 I_0\left[\frac{p\sinh\eta_T}{T}\right]\int_0^1 dx\left|\phi_{J/\psi}(x)\right|^2 k_M(x,p)$$

Over！

Notice:

which results in the increase of the FFs, so to the SPDs. Since the scale dependence of the charm parton FFs is not shown in Refs. [21] and [22], we cannot define the scale dependence of SPDs. In order to reflect the impact of the momentum on the scale, the results of $\mathcal{TS}$ and $\mathcal{SS}$ terms are multiplied by a factor of $1 - e^{-p/2}$ which suppresses the low p contributions.

Likewise:

fragmentation products of hard and semihard partons outside the medium. The SPD $S_i^j(p_2, q)$ is made to deviate from the scaling form $S_i^j(z)$ by our insertion of a cutoff factor $c_2(p_2)$

$$S_i^j(p_2, q) = S_i^j(p_2/q)c_2(p_2), \tag{14}$$

where

$$c_2(p_2) = 1 - \mathrm{e}^{-(p_2/p_c)^2}, \qquad p_c = 0.5\mathrm{GeV}/c. \tag{15}$$

Such a factor is necessary to render the shower partons meaningful in the soft region, for otherwise the IR divergent FF, $D_i(p_T/q)$, as $p_T \to 0$, would lead to unrealistically large $S_i^j(p_2/q)$. This point is discussed in appendix C of [5], where $c_2(p_2)$ is denoted by $\gamma_2(p_2)$. The

1.疑问

$$\frac{dN^{TS}_{J/\psi}}{d^2p} = \frac{C_{J/\psi}}{g\gamma_c}[\mathcal{T}_c(p/2)\mathcal{S}_{\bar{c}}(p/2)+\mathcal{S}_c(p/2)\mathcal{T}_{\bar{c}}(p/2)].$$

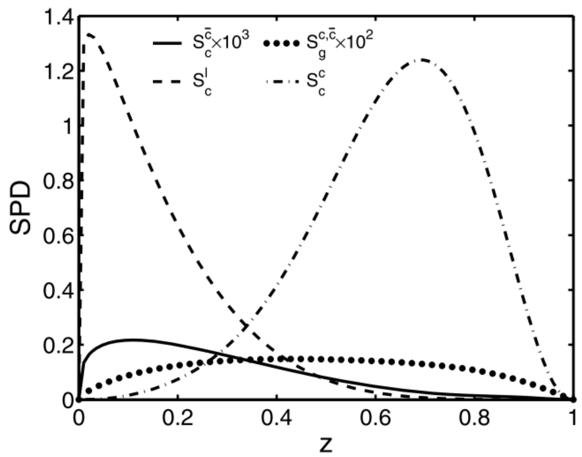
Q1：两个积分限

$$\mathcal{S}(p_1) = \sum_i \int \frac{dq}{q} F_i(q) S_i^j(p_1/q).$$

1. Shower parton distribution created by all the hard partons in the system

SPD(z)
Momentum fraction<1
i.e. pt/q<1
i.e. q>pt

Program_v15 取2-30
猜测：pt/q遍历SPD



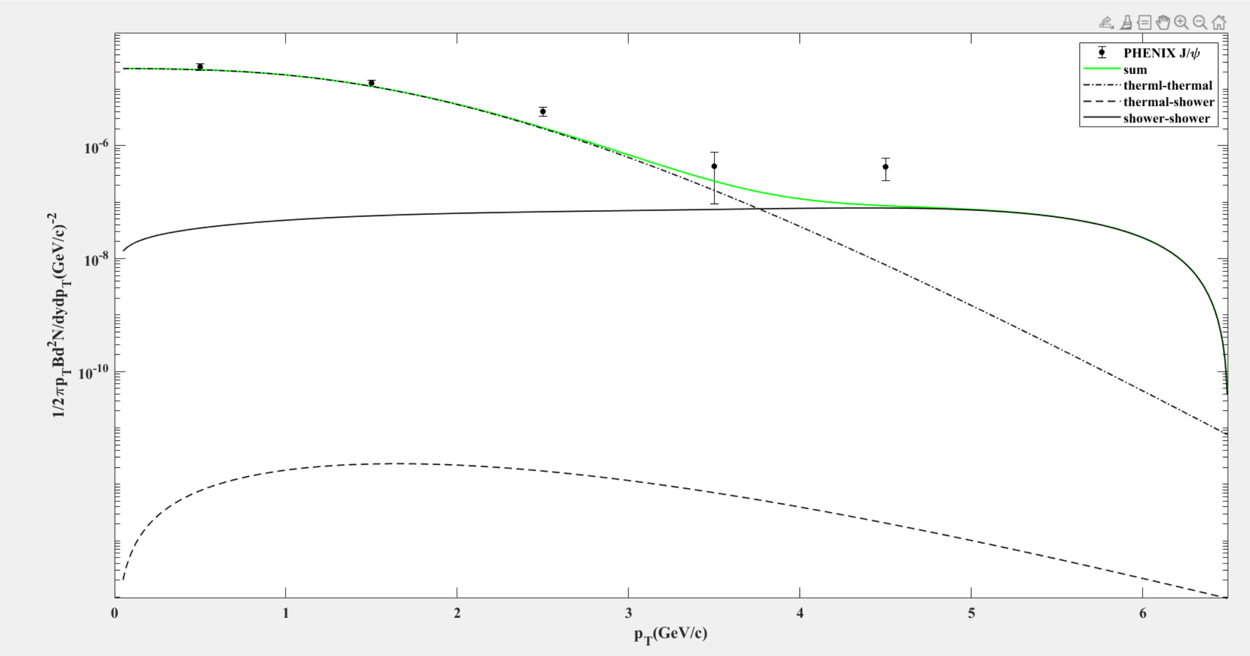
Charm program:
S_j只会影响TS term
上限：q足够大后结果变化不大，暂取50
下限：理应取pt，但是算出来结果很低，不过形状对了
（前面一个突起，因为倒着SPD积分）
发现下限取qlow，2qlow的地方就会突然落的很低
根据拟合较好的情况，暂取下限为3.5

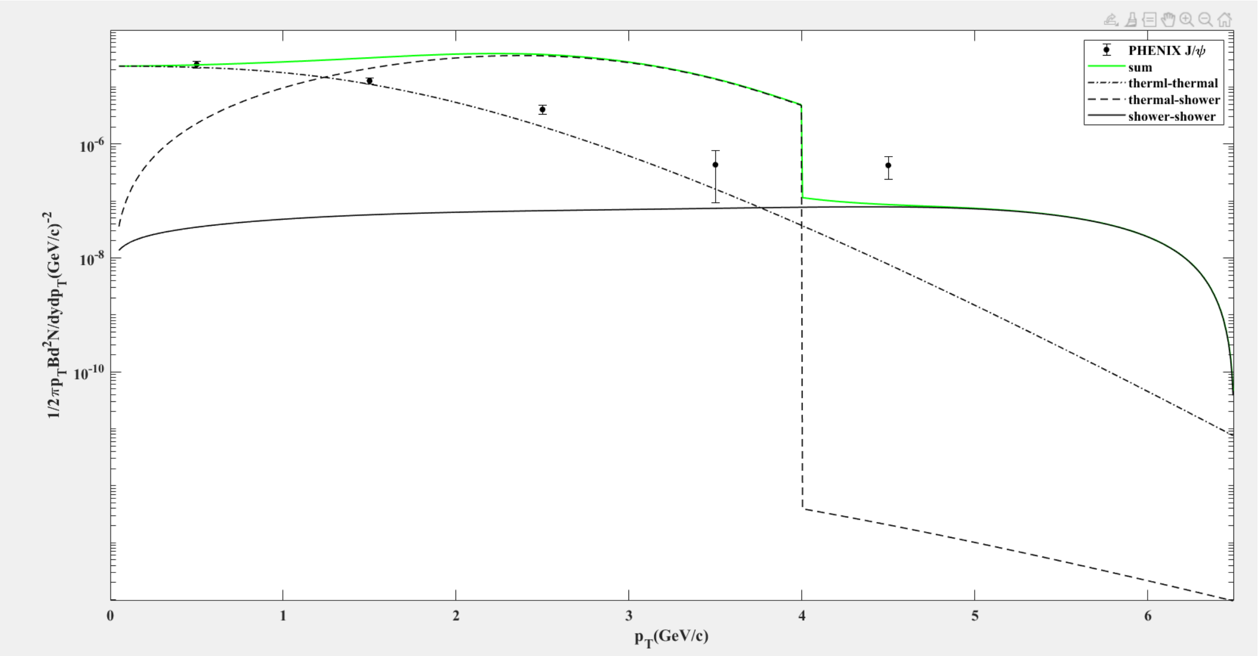
```
! set up the hard jet momentum limits
    if(IYangZhu.eq.1)then
    plowlim = 3.0d0
    phighlim = 20.0d0
    else
    plowlim = 2.0d0
    phighlim = 30.0d0
    endif
!

fa = plowlim
fb = phighlim
fdel = 0.02D0
fp1 = p
fp2 = 0.0D0
fp3 = 0.0D0
fpt = 0.0D0
fIDP1 = IDP
fIDP2 = 0
fIDP3 = 0
fcentr = centr

if(fp1.ge.plowlim) then
fa = fp1
endif

call Integral_1d(Intf_S1J, fa, fb, fdel, fp1, fp2, f
```

未找到相关问题

1.疑问

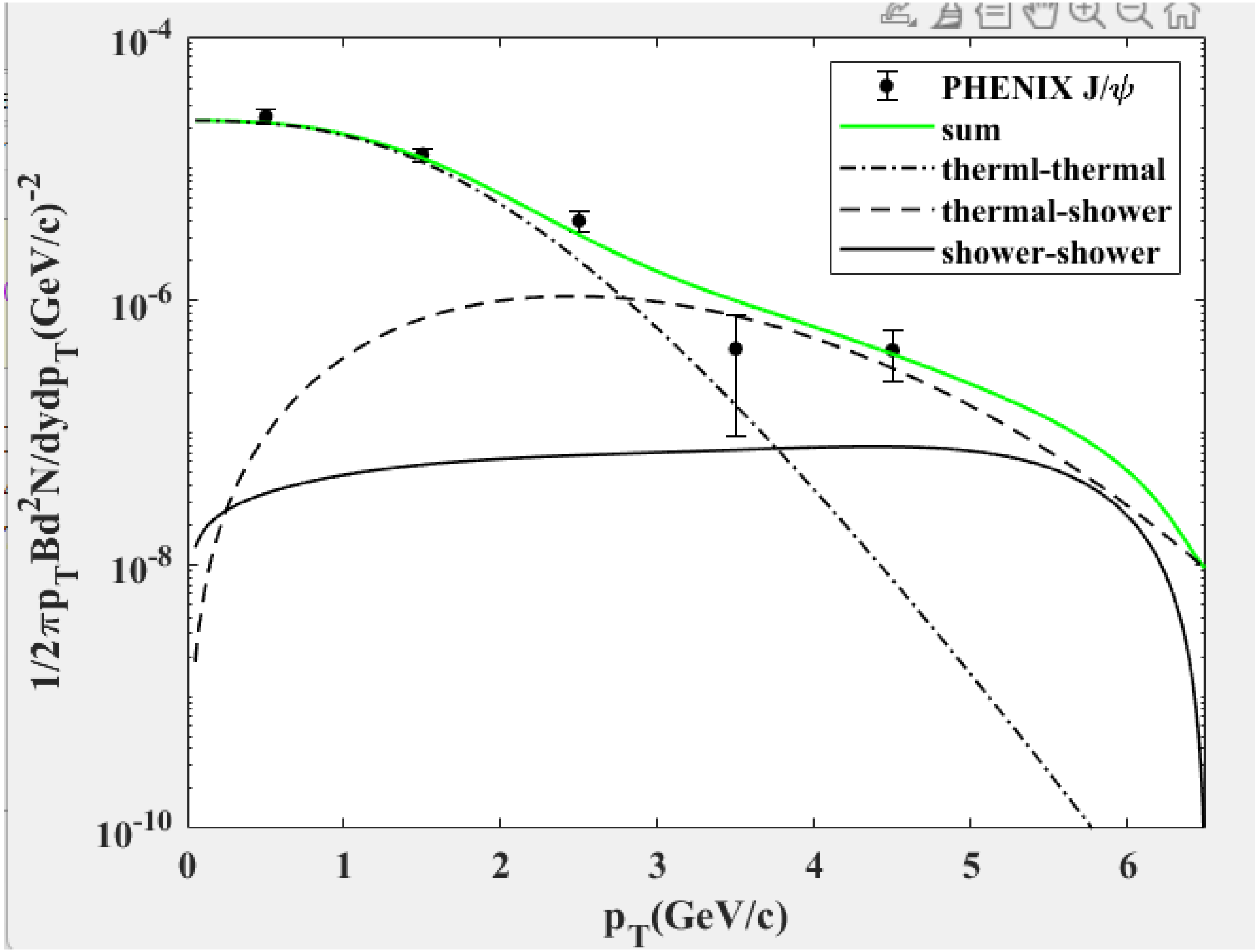
只看TS term





qlow=pt

qlow=2.0


PHENIX J/ψ
sum
therml-thermal
thermal-shower
shower-shower
$1/2\pi p_T B d^2N/dydp_T (GeV/c)^{-2}$
p_T(GeV/c)
10^{-4}
10^{-6}
10^{-8}
10^{-10}
0
1
2
3
4
5
6

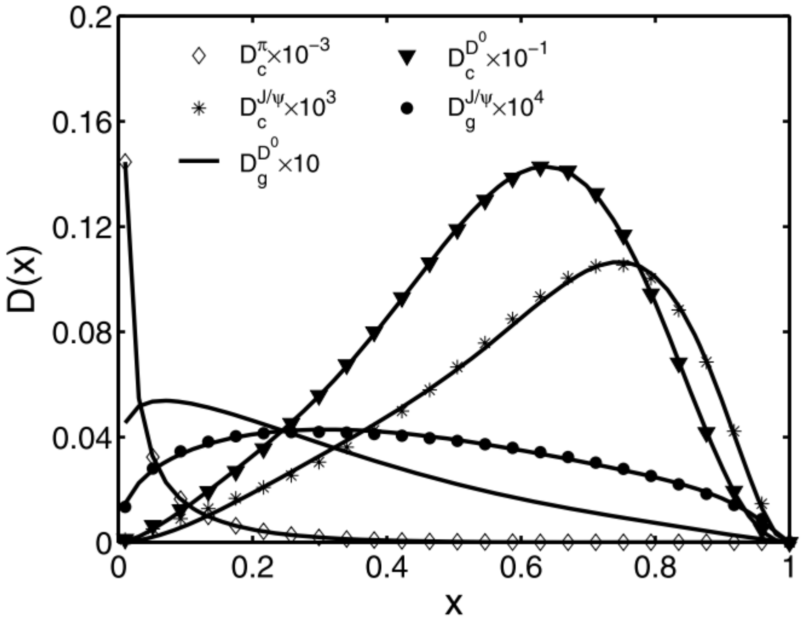
qlow=3.5

2. SS term

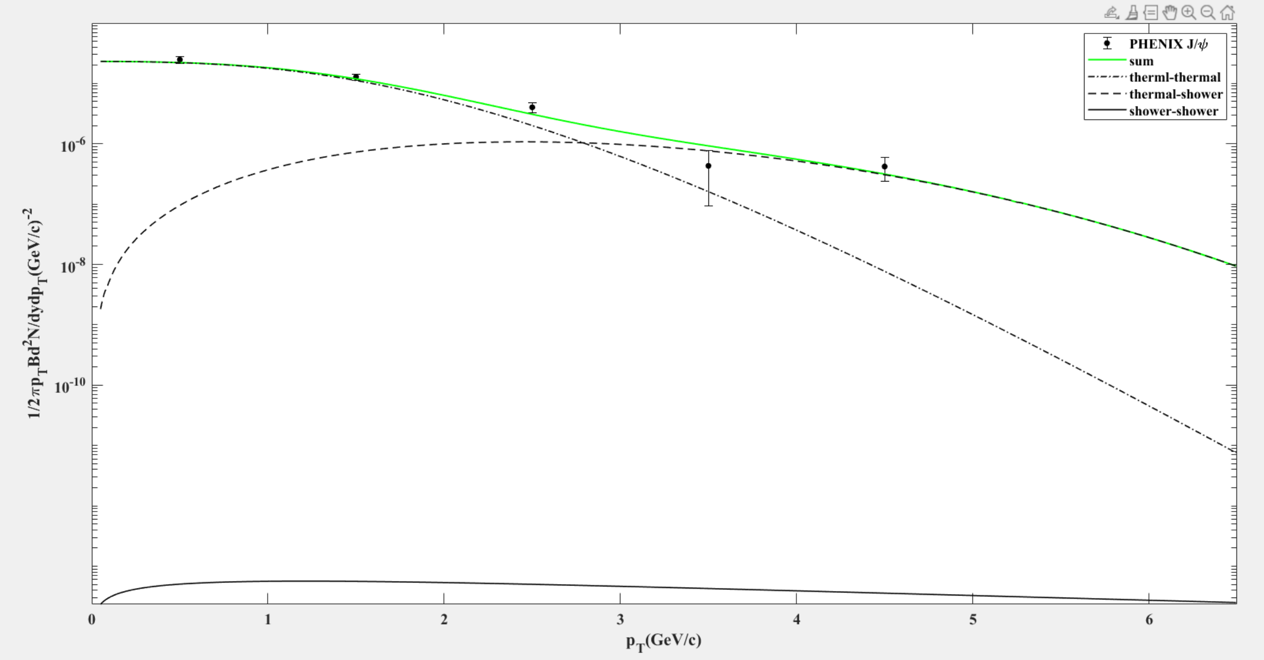
$$\frac{dN^{SS}_{J/\psi}}{p\,dp} = \frac{1}{p^0 p}\sum_i \int \frac{dq}{q} F_i'(q)\frac{p}{q} D_i^{J/\psi}\left(\frac{p}{q}\right)$$

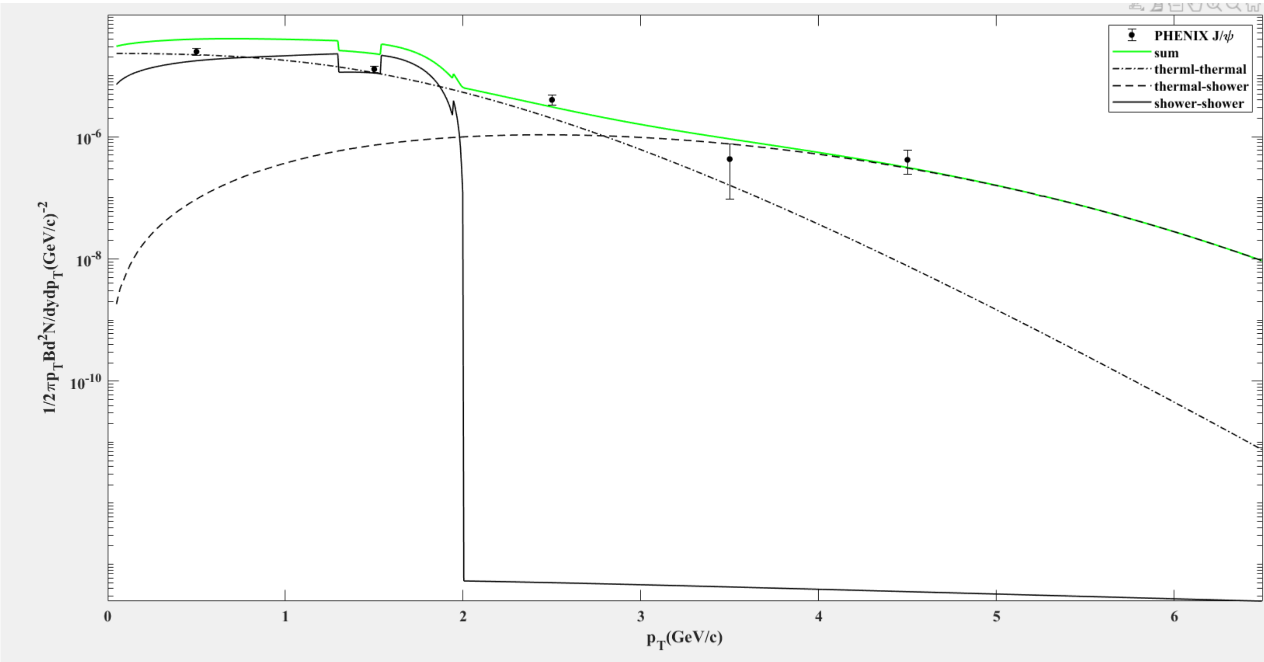
For proton whose mass is certainly not negligible, we replace p^0 in equation (3) by the transverse mass $m_T^p = (m_p^2 + p_T^2)^{1/2}$ for $\eta = 0$. With the RF given in equation (17), we have

猜测：同样遍历D(z)
那么同样前面有一个峰就对了，但实际并不尽然
可能是D_g的影响？但应该是D_c占主导？
有可能是Fiq出了问题？因为两个Fiq不同
Likewise
上限：取100.0
下限：
理应取pt，但是算出来结果很低，不过形状真的对了！
发现下限取qlow，qlow的地方就会突然落的很低
根据拟合较好的情况，暂取下限为6.5



1.疑问

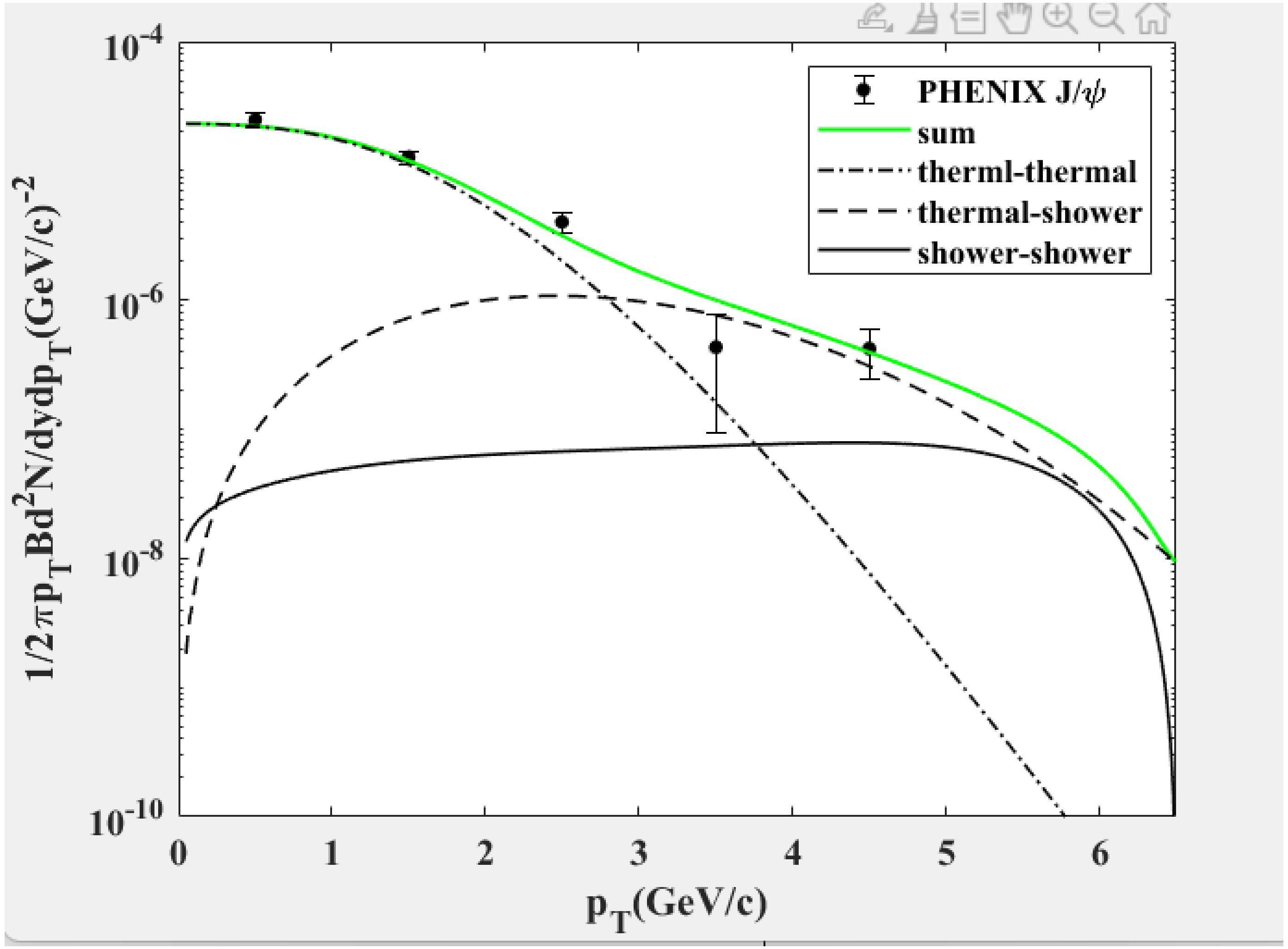




qlow=pt
前面一个峰！

qlow=2.0

1.疑问


PHENIX J/ψ
sum
therml-thermal
thermal-shower
shower-shower
1/2πp_TBd^2N/dydp_T(GeV/c)^-2
p_T(GeV/c)
10^-4
10^-6
10^-8
10^-10
0
1
2
3
4
5
6

qlow=6.5

1.疑问

Q2：质量问题，自然单位制

GeV/c^2 -> GeV? c=1?

Quark flavor properties

Particle		Mass (MeV/c^2)*
Name	Symbol	
up	u	2.3 ±0.7 ± 0.5
down	d	4.8 ±0.5 ± 0.3
charm	c	1275 ±25
strange	s	95 ±5
top	t	173 210 ±510 ± 710 *
bottom	b	4180 ±30

```
if((IDP .eq. 8) .or. (IDP .eq. 9))then !c, cbar
    m_h=1.5
elseif((IDP .eq. 6) .or. (IDP .eq. 7))then !s, sbar
    m_h=0.46
elseif((IDP .eq. 1) .or. (IDP .eq. 3))then !u, ubar
    m_h=0.26
elseif((IDP .eq. 2) .or. (IDP .eq. 4))then !d, dbar
    m_h=0.26
elseif(IDP.eq.5)then!gluon
    m_h=0.7
endif
```

$\gamma_u = \gamma_d = 1$, $\gamma_s = 0.8$ and $m_u = m_d = 0.26$ GeV, $m_s = 0.46$ GeV.

$$Q = 2m_c = 3 \text{ GeV}/c$$

$$m_c = m_{\bar{c}} = 1.5 \text{ GeV} \text{ and } m_{J/\psi} = 3.097 \text{ GeV}$$

Q3：Fiq

$$\mathcal{S}(p) = \sum_i \int \frac{dq}{q} F_i(q) S_i^j(p/q), \tag{8}$$

where

$$F_i(q) = \frac{1}{\beta L} \int_q^{qe^{\beta L}} \frac{dk}{k} f_i'(k), \tag{9}$$

with $f_i'(k) = f_i(k) \cdot (2\pi)^3/E$ [5]. The distribution $f_i(k) = dN_i^{hard}/d^2kdy$ of hard parton i just after hard scattering in Au+Au collisions at $\sqrt{s_{NN}} = 200$ GeV at mid-rapidity can be found in Refs.[14] and [15]. βL is the explicit dynamical medium factor to describe the

$$\frac{dN_M^{SS}}{pdp} = \frac{1}{p^0 p} \sum_i \int \frac{dq}{q} F_i'(q) \frac{p}{q} D_i^M(\frac{p}{q}),$$

where

$$F_i'(q) = \frac{1}{\beta L} \int_q^{qe^{\beta L}} dkk f_i(k),$$

and D_i^M is the FF of quark i splitting into meson M.

1.疑问

$$dN = V \cdot \frac{d^3k}{(2\pi)^3}\omega(k). \tag{19}$$

On the other hand the hard parton transverse momentum distribution is defined as

$$f_i(k) = E\frac{dN}{d^3k}, \tag{20}$$

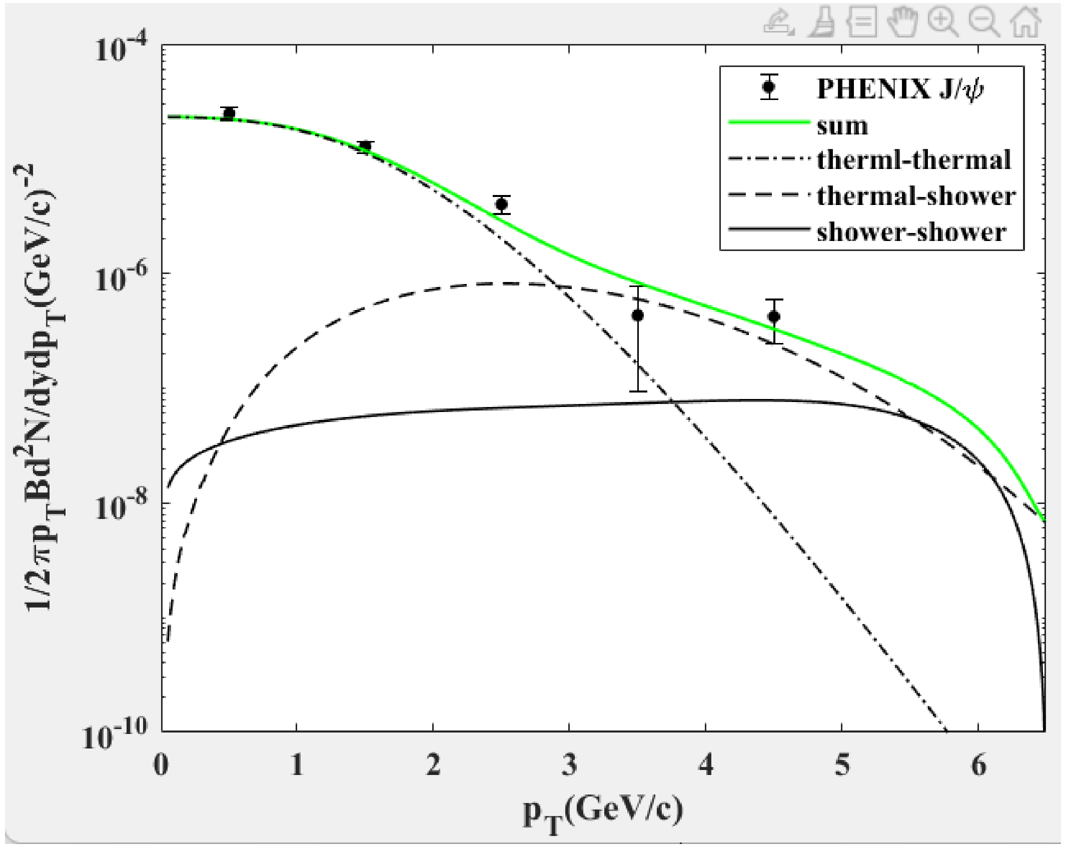
where E is the energy of the hard parton. From the above two equations, one can get $\omega(k) \cdot V = f_i(k) \cdot (2\pi)^3/E$. Therefore, the shower distributions $\mathcal{S}_c$ and $\mathcal{S}_{\bar{c}}$ in Eq. (18), which correspond to

1. E 的形式没有给出

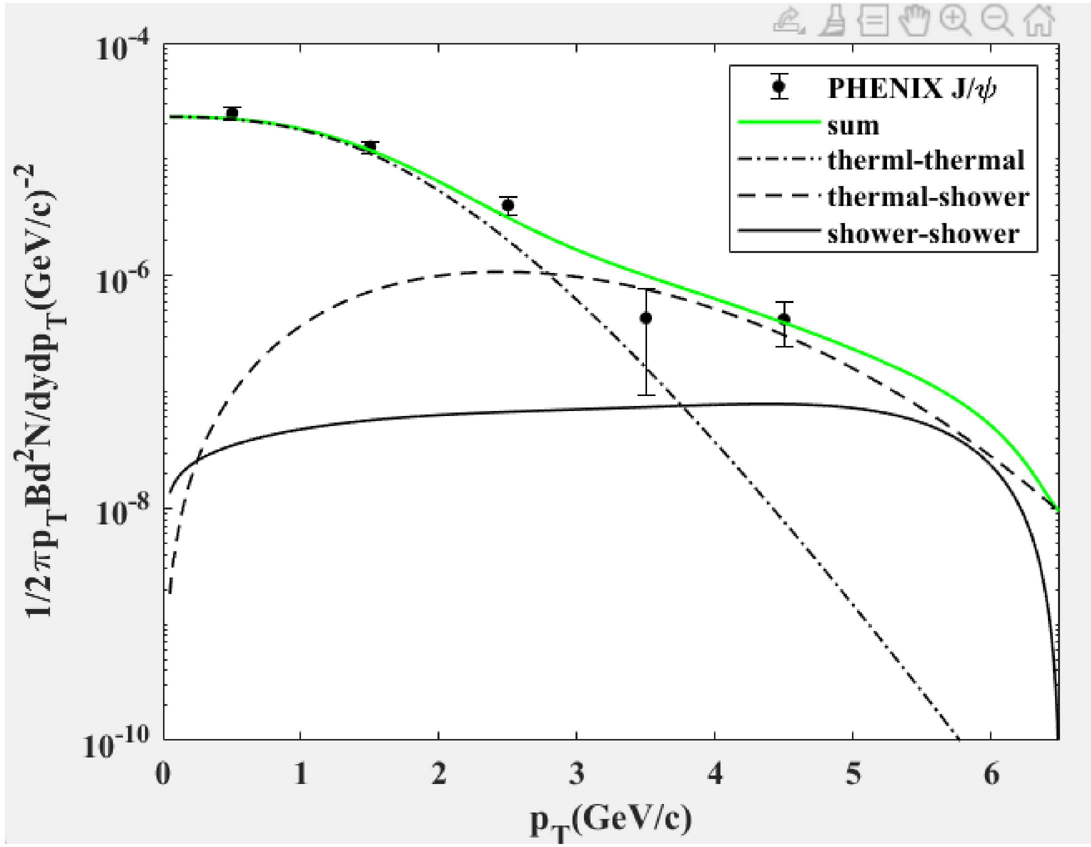
两种形式：　　相对论：E=sqrt(m^2+k^2)　——采用

　　　　　　　经典：　E=k^2/(2m)

1.疑问



经典： E=k^2/(2m)



相对论：E=sqrt(m^2+k^2) ——采用

1.疑问

2. Fiq的形式
暂全部使用fik*k

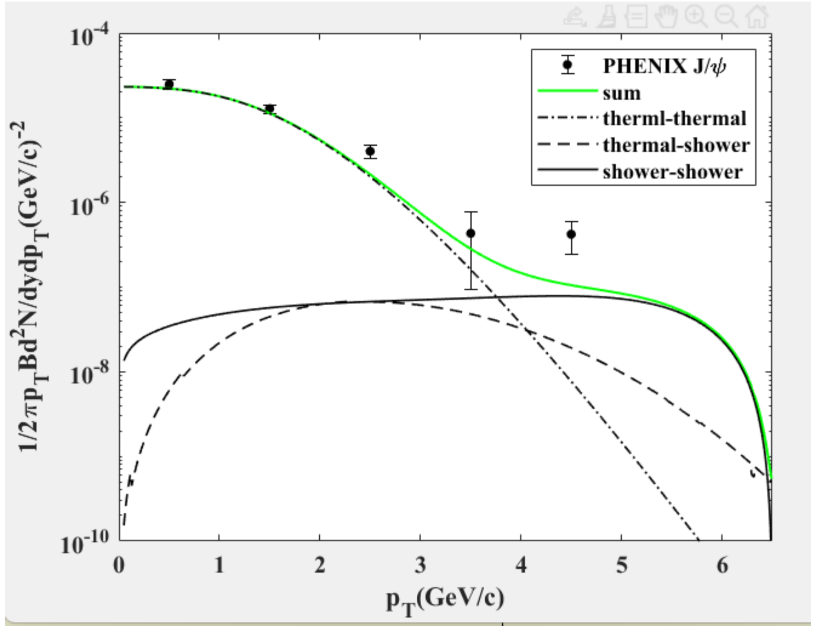
$$F_i(q) = \frac{1}{\beta L}\int_q^{qe^{\beta L}} \frac{dk}{k} f_i'(k),$$

Here, it is noticeable that $\mathcal{T}(p_1)$ is the parton transverse momentum distribution divided by the volume of the parton system $V = \tau A_T$, as exhibited in Eq. (13). $\mathcal{S}(p_1)$ denotes the shower parton distribution created by all the hard partons in the system. If we use $\omega(k)$ to denote the three-dimensional momentum space distribution, the number of hard partons in the system is

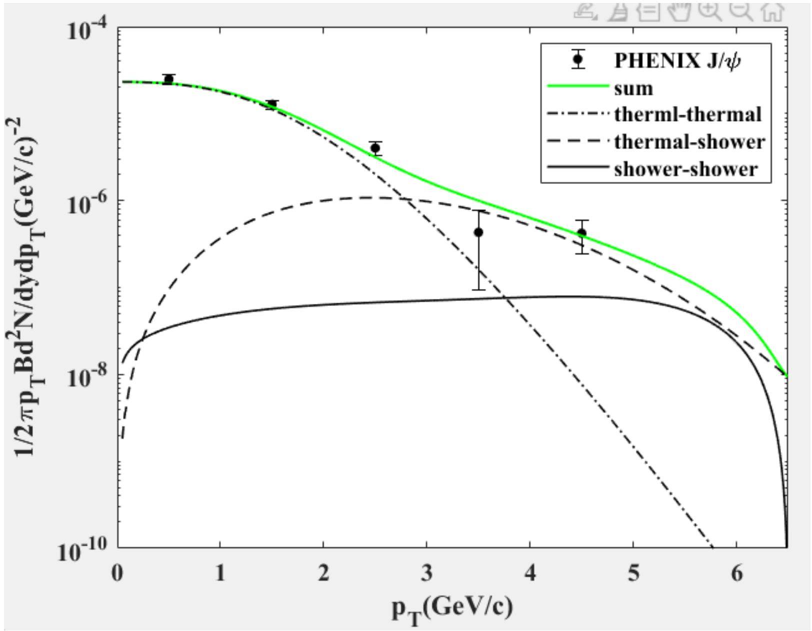
$$dN = V \cdot \frac{d^3k}{(2\pi)^3}\omega(k). \tag{19}$$

$$F_i(q) = \frac{1}{\beta L}\int_q^{qe^{\beta L}} dk k f_i(k)$$

R. C. Hwa and C. B. Yang, Phys. Rev. C 79, 044908 (2009).



F’ ik/k
文献中的形式
TS偏小



F’ ik*k
之前的结果都是用的这个，暂时采用的跟文献的不一样以拟合结果

1.疑问

3. bL=2.9 or 0.0 for charm quark?

The suppression factor quantified by βL in $F_i(q)$ and $F_i'(q)$ for gluon jet has been determined with $\beta L = 2.9$ by fitting the single-pion inclusive distribution [28]. $f_i(k)$ is the distribution for parton with momentum k at creation point. $F_i'(q)$ is the corresponding distribution after traversing a distance t in the medium with momentum $q = ke^{-\beta t}$. In Eq. (22) the lower limit of integration corresponds to $t = 0$, i.e., when the hard scattering occurs at the surface, while the upper limit corresponds to the case with the hard scattering point on the far side so that k is a factor of $e^{\beta L}$ larger than q. But for hard parton c, the traversing distance in QGP is much smaller than other light partons, since J/ψ is produced at the early stage in the collisions. So we choose $\beta L \to 0$ for $i = c$. In our calculations for J/ψ spectrum, we only consider g and c $(\bar{c})$

bL=2.9 for gluon
bL -> 0 for charm
——采用

be found in Refs.[14] and [15]. βL is the explicit dynamical medium factor to describe the energy loss effect with $\beta L = 2.39$ for i =light quarks, gluon in Au+Au collisions for $0-20\%$ centrality [16]. Recent measurements of the transverse momentum distributions and nuclear modification factors of non-photonic electrons from heavy quark decays at high p_T show a suppression level of heavy quarks similar to light quarks [17]. So we choose the same energy loss factor βL for $i = c, b$ as that for light quarks.

bL=2.39 for gluon
bL=2.39 for charm

1.疑问

4. fik for charm quark?

with $f'_i(k) = f_i(k) \cdot (2\pi)^3/E$ [5]. The distribution $f_i(k) = dN_i^{hard}/d^2kdy$ of hard parton i just after hard scattering in Au+Au collisions at $\sqrt{s_{NN}} = 200$ GeV at mid-rapidity can be found in Refs.[14] and [15]. βL is the explicit dynamical medium factor to describe the

[14]:

$$\left.\frac{dN^{\text{jet}}}{d^2p_T\,dy}\right|_{y=0} = T_{AA}\left.\frac{d\sigma^{\text{jet}}}{d^2p_T\,dy}\right|_{y=0} = K\frac{C}{(1+p_T/B)^\beta}$$

parameters without charm

[15]:

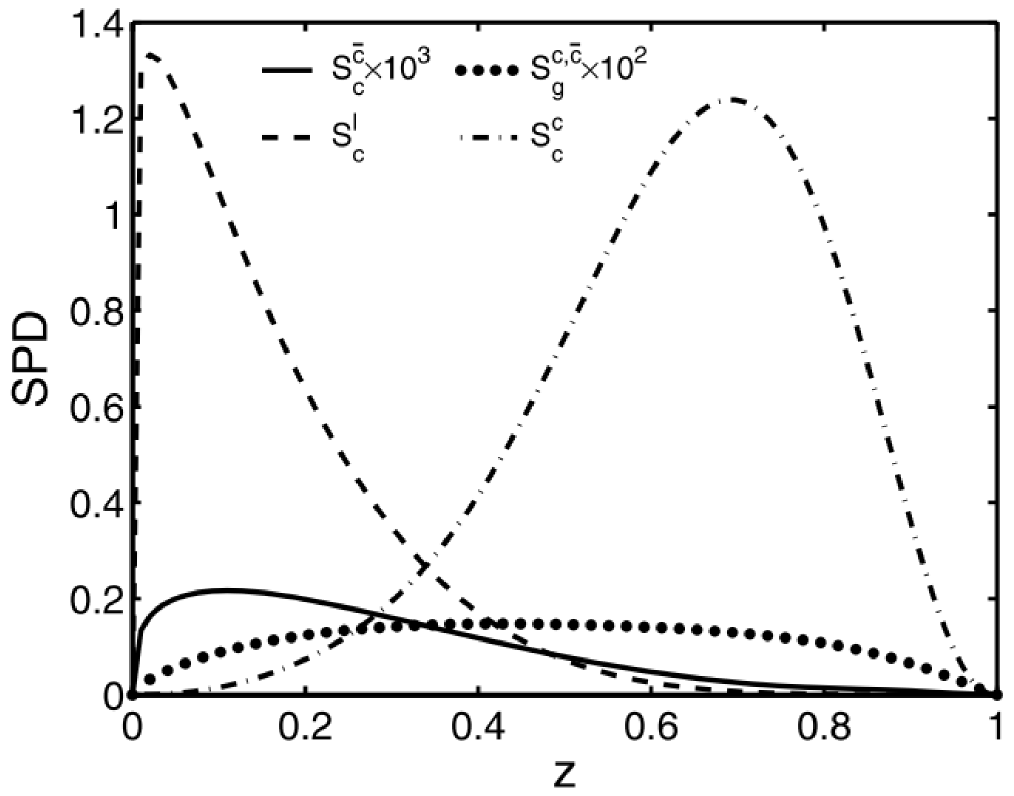
$$\frac{dN_c}{d^2p_T} = \frac{19.2[1+(p_T/6)^2]}{(1+p_T/3.7)^{12}[1+\exp(0.9-2p_T)]}$$

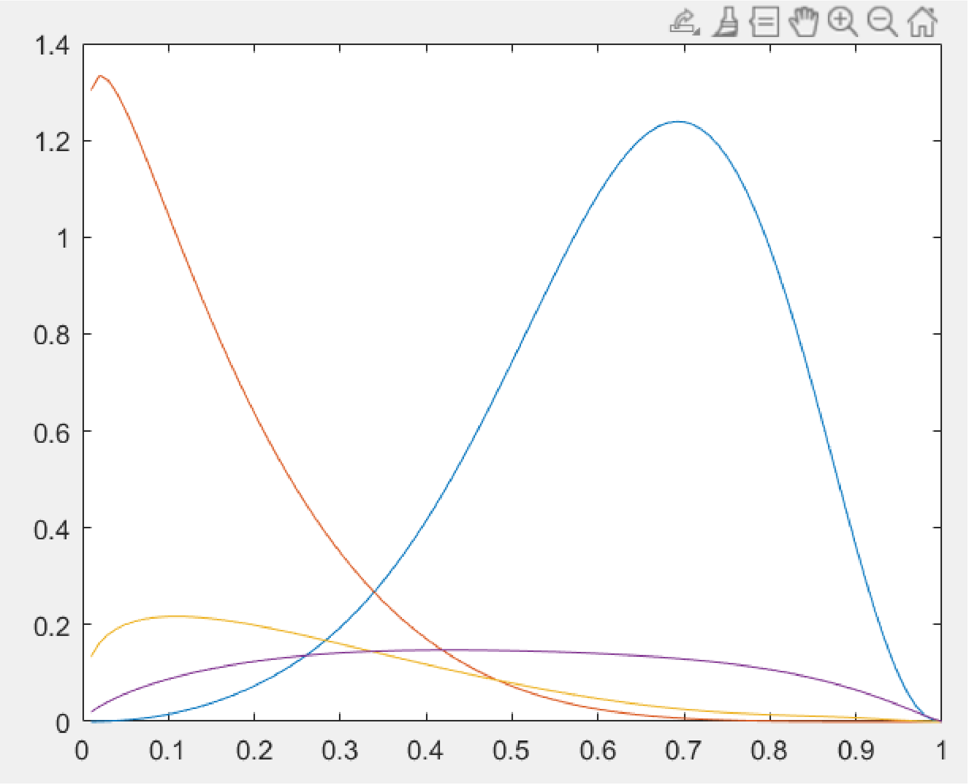
dy?

2.结果

复现（参数使用）： R. Peng, C. B. Yang, Nucl. Phys. A 837, 54 (2010).
主要参考： *Int.J.Mod.Phys.E* 20 (2011) 1213-1226

1. 验证程序





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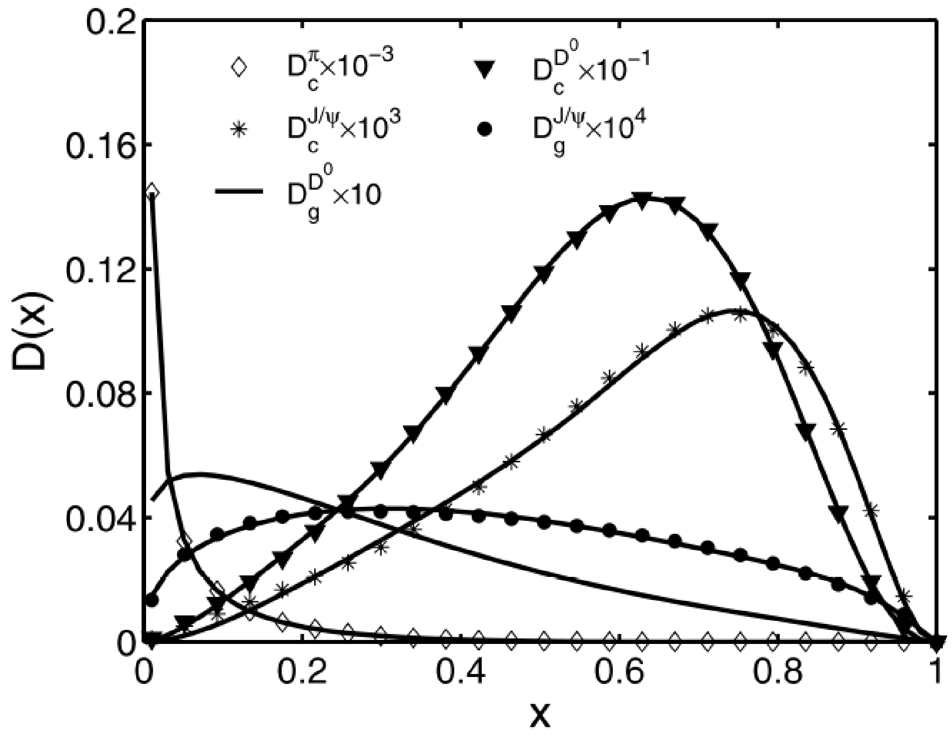

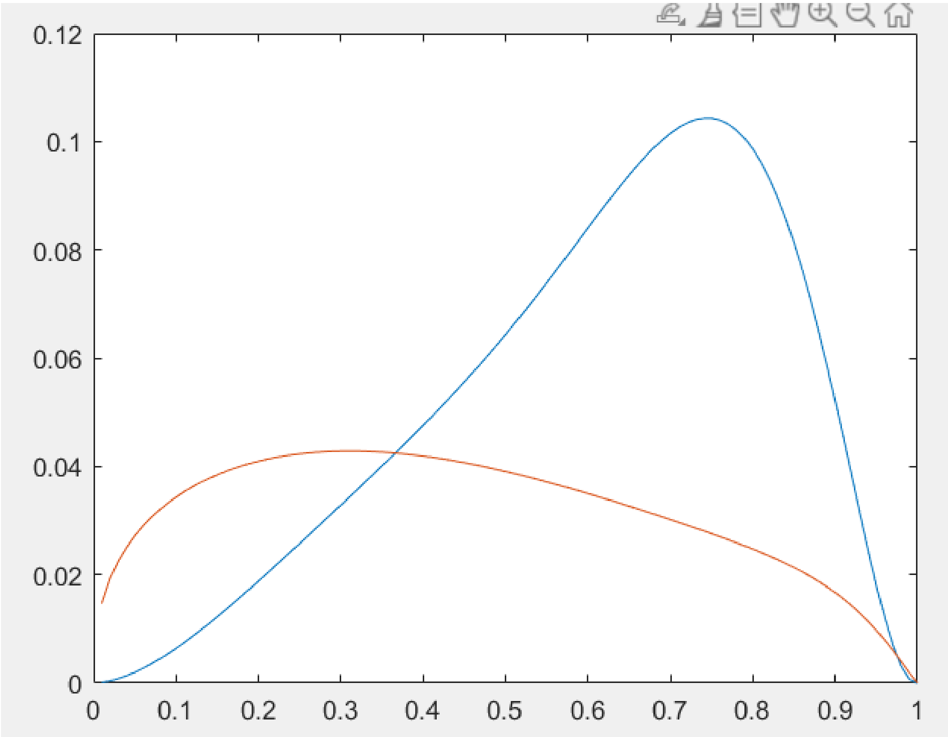

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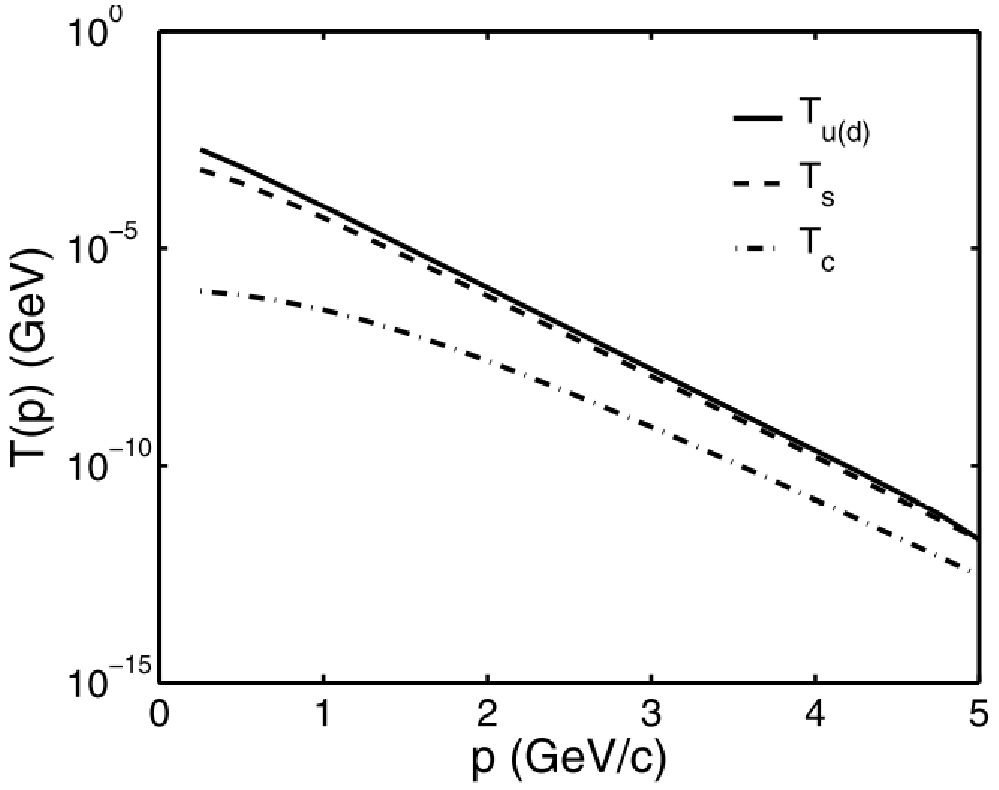

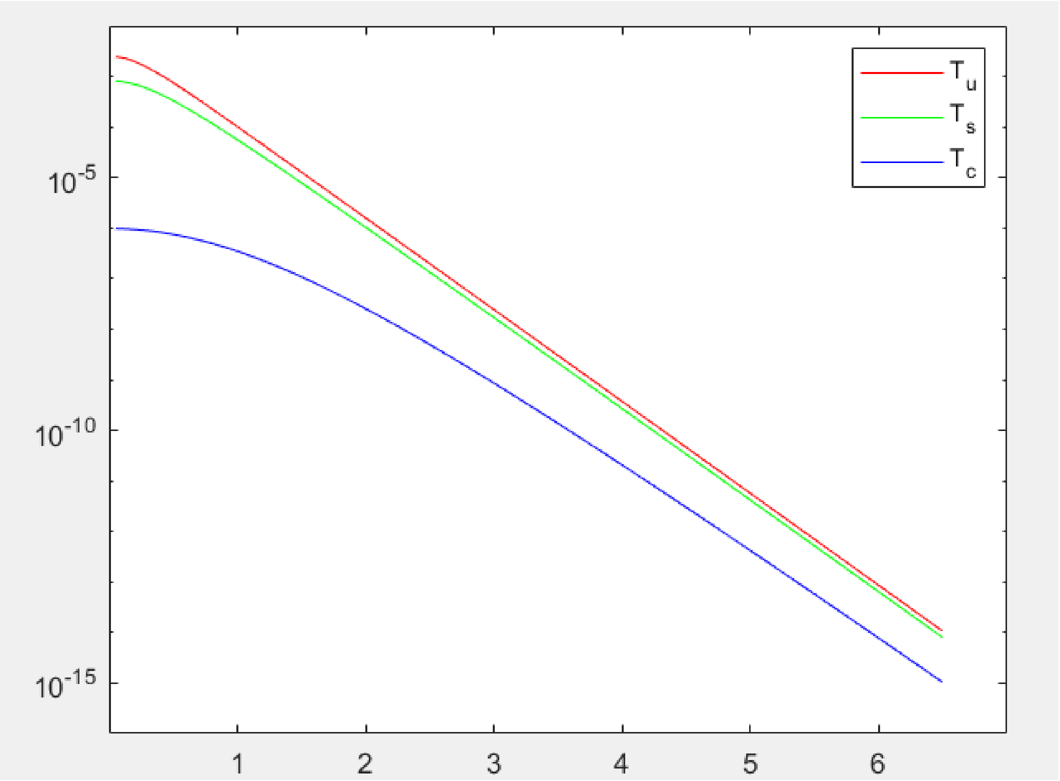

2.结果

2. results

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$$\frac{dN_{J/\psi}^{\mathcal{TS}}}{d^2p} = \frac{C_{J/\psi}}{g\gamma_c}\left[\mathcal{T}_c(p/2)\mathcal{S}_{\bar{c}}(p/2) + \mathcal{S}_c(p/2)\mathcal{T}_{\bar{c}}(p/2)\right].$$

$$\frac{dN_{J/\psi}^{\mathcal{SS}}}{p\,dp} = \frac{1}{p^0 p}\sum_i \int \frac{dq}{q} F_i'(q)\frac{p}{q} D_i^{J/\psi}\left(\frac{p}{q}\right)$$

除了Fiq=int(fik*k) or (fik/k)那个环节，其他参数与文献一致，问题出在Fiq与S_j

2.结果

复现（参数使用）： R. Peng, C. B. Yang, Nucl. Phys. A 837, 54 (2010).
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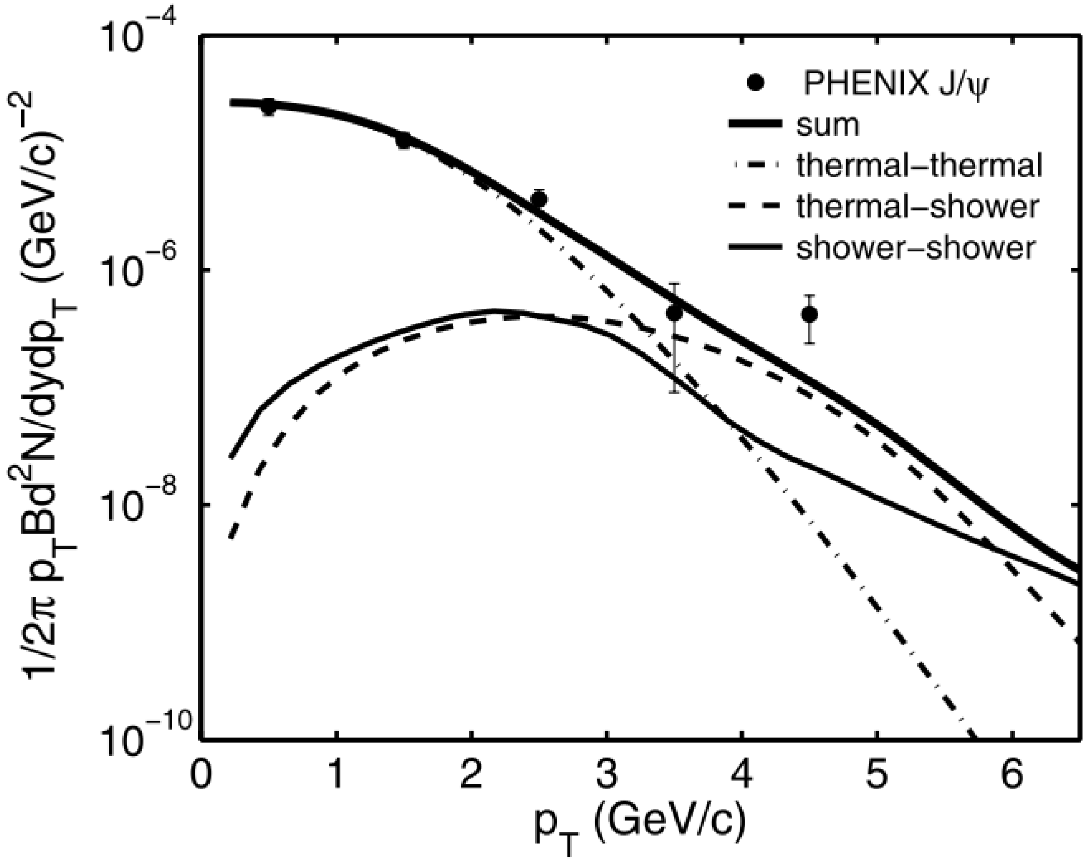
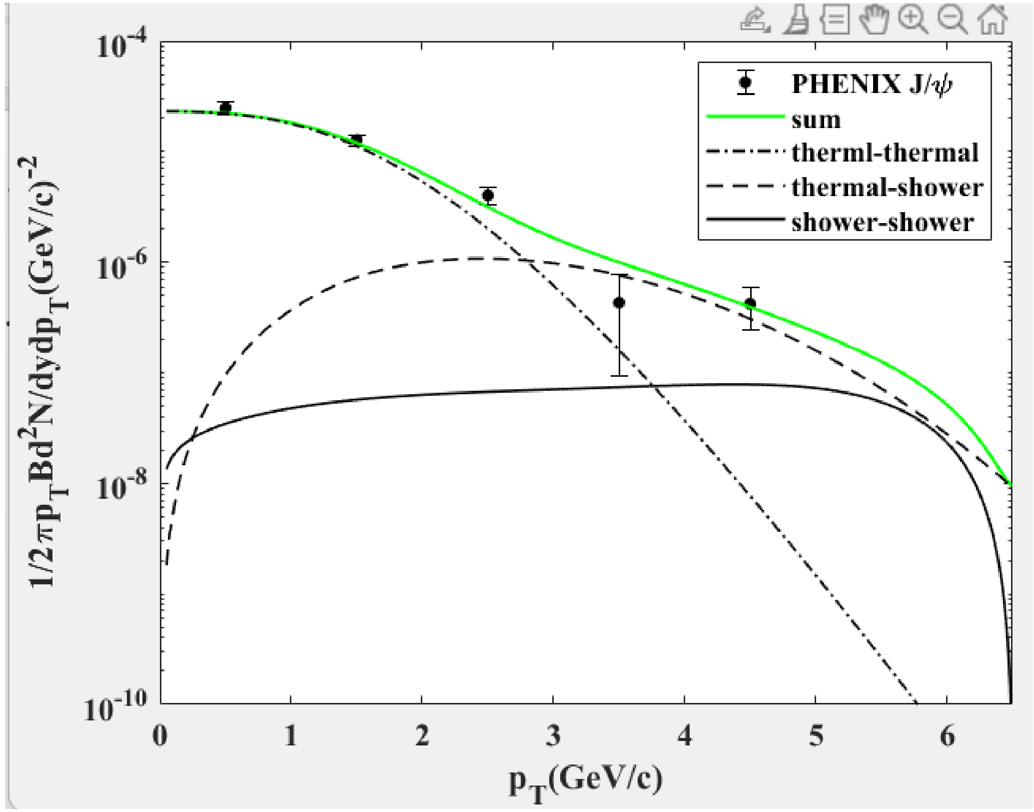
2. results





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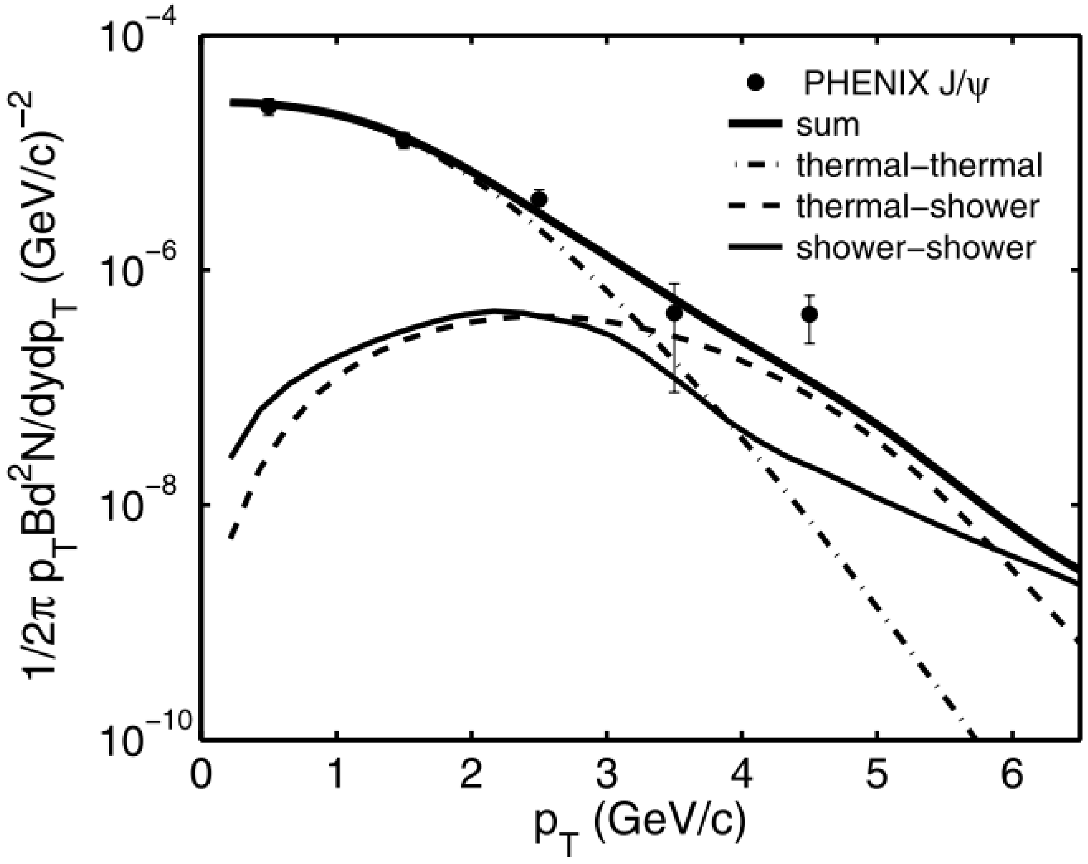
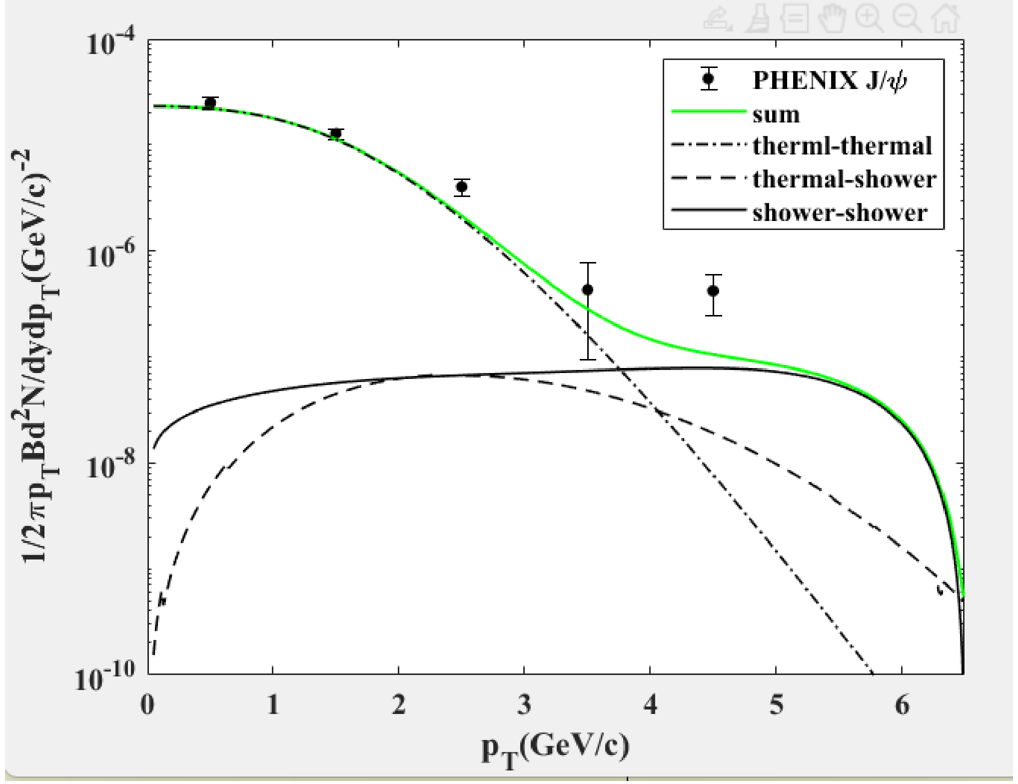
主要参考：*Int.J.Mod.Phys.E* 20 (2011) 1213-1226

2. results(全用文章)





3.结论

Summary in brief:

TT完成复现
SS基本复现
主要问题出在TS，除了积分限的问题，感觉Fiq有点问题，如果fik没有问题（估计没有），应该是energy of hard parton E 的形式的问题，从而导致S_j也有问题。

References

[1] J/ψ production and elliptic flow parameter v2 at LHC energy.

[2] J/ψ production in Au + Au collisions at $\sqrt{s}$NN = 200 GeV in the recombination model.

[3] Productions of Heavy Flavored Mesons in Relativistic Heavy Ion Collisions in the Recombination Model.

[4] π-J/ψ Correlation and Elliptic Flow Parameter v2 of Charmed Mesons at RHIC Energy.

[5] Hadron production in heavy ion collisions: Fragmentation and recombination from a dense parton phase.

More···