

STCF-PHYSIM Collins Effect Update

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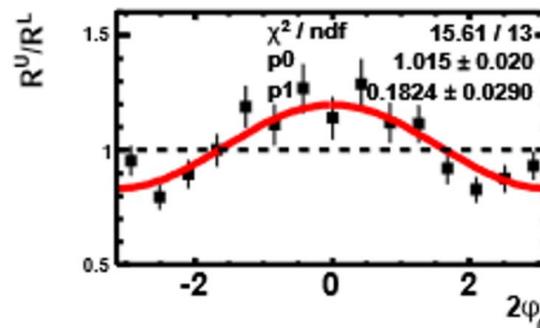
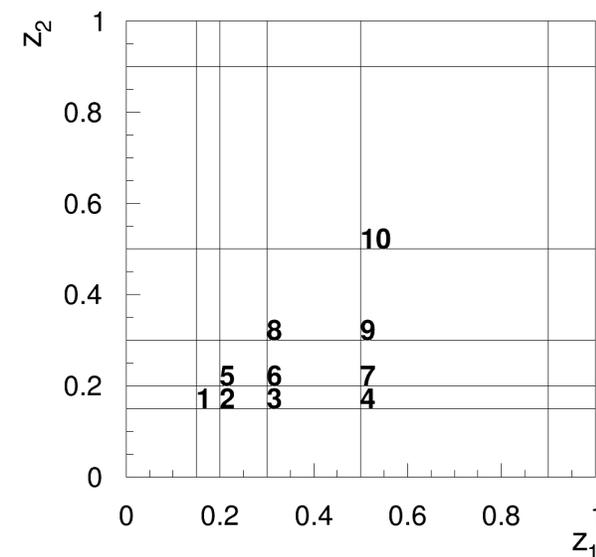
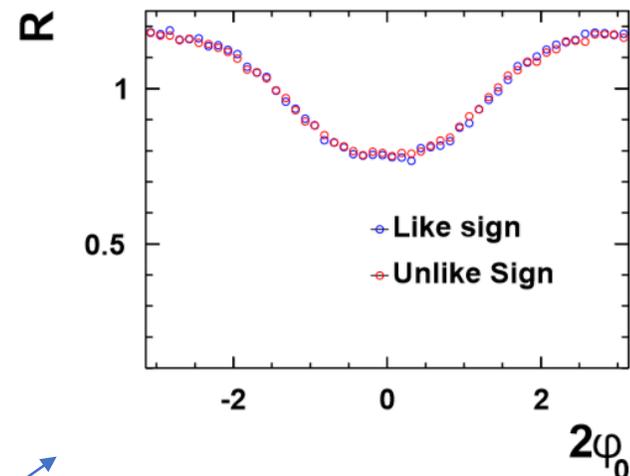
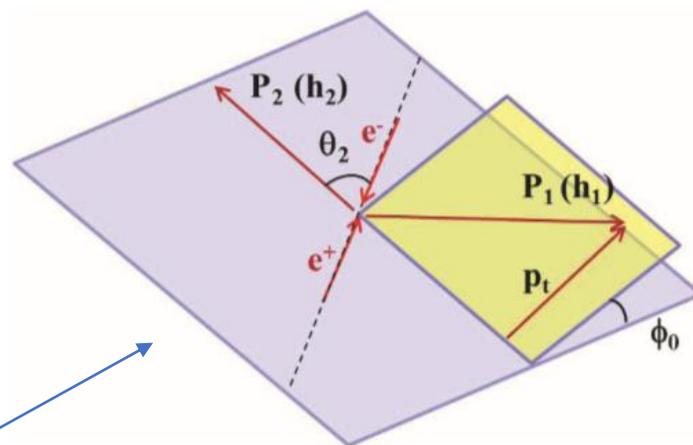
前情提要

- 1. Motivation:

- Collins Effect significance in STCF, with $L = 1ab^{-1}$

- 2. How:

1. 定义角 ϕ_0
2. Like-Sign 和Unlike-Sign
 1. 两 π 电荷相同 (L), 电荷相反 (U)
3. Like-Sign和Unlike-Sign的分布
4. 二维动量bin的划分, $z = E_\pi/E_{beam}$
5. 提取Collins Asym: 拟合RU/RL



tips

- 以下估计只做了5GeV
- 5GeV用到的MC是：Lundcharm产生的944004个qqbarMC
- 假设的Collins Asymmetry 为10%
- 假设的亮度是 1ab^{-1}

Catlog

- 首先简要的介绍一下这份MC,
- 然后介绍一下我们的Collins Asymmetry是怎么放入的
- 然后介绍一下我们的我们的显著度是怎么估计的
- 最后是中间暴露出来的一些问题, 以及我们准备的应对方法

首先介绍一下MC

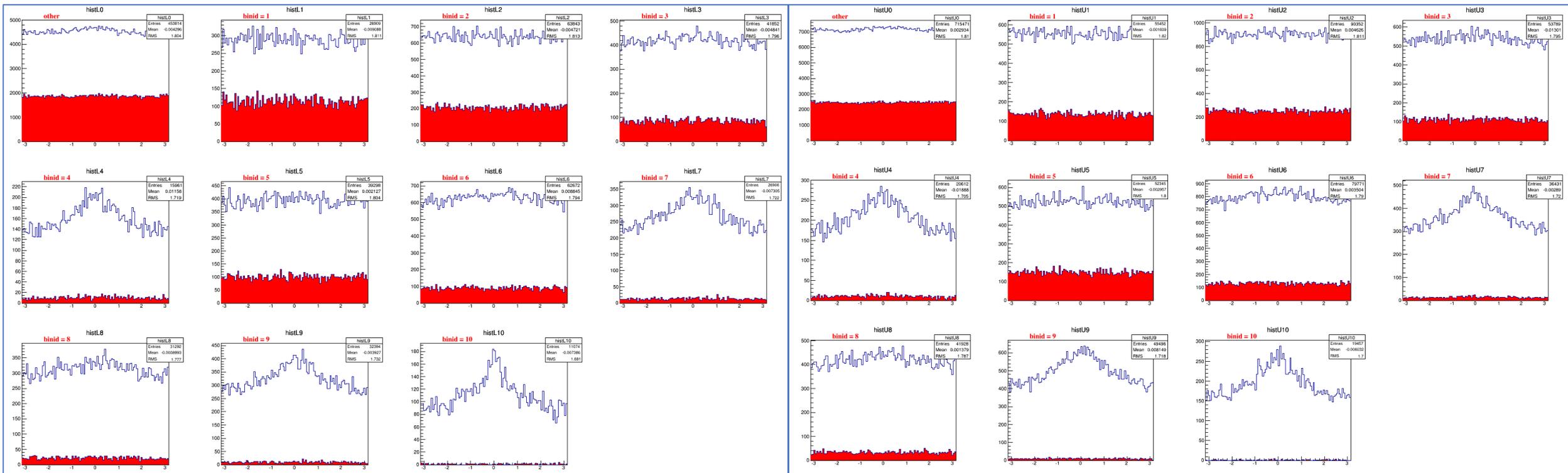
- 这份MC是我们在5GeV能量点模拟的qqbarMC,
- 模型是: Lundcharm
- 截面是: 15.300047nb
- 样本大小是: 944,004events
- Scale到 1ab^{-1} 的scale因子是
 - 15890.2
- 包含强衰变与弱衰变

• 定义弱衰变本底, mother==

- τ case 15:
- Λ_c^+ case 4122:
- D_S^+ case 431:
- D^+ case 411:
- D^0 case 421:
- Σ^- case 3112:
- K^+ case 321:*
- Σ^+ case 3222:
- Λ^0 case 3122:

- K_L^0 case 130:*
- K_S^0 case 310:
- $\Omega^-(\rightarrow \Xi^0\pi^-)$ case 3334:
- * truth里面标记为弱衰变本底, 实际上重建不出来。
- **两条track只要有一条来自于弱衰变, 标记为本底。

qqbarMC中存在来自于强相互作用的 $\pi\pi$ ，也包含weak过程过来的。



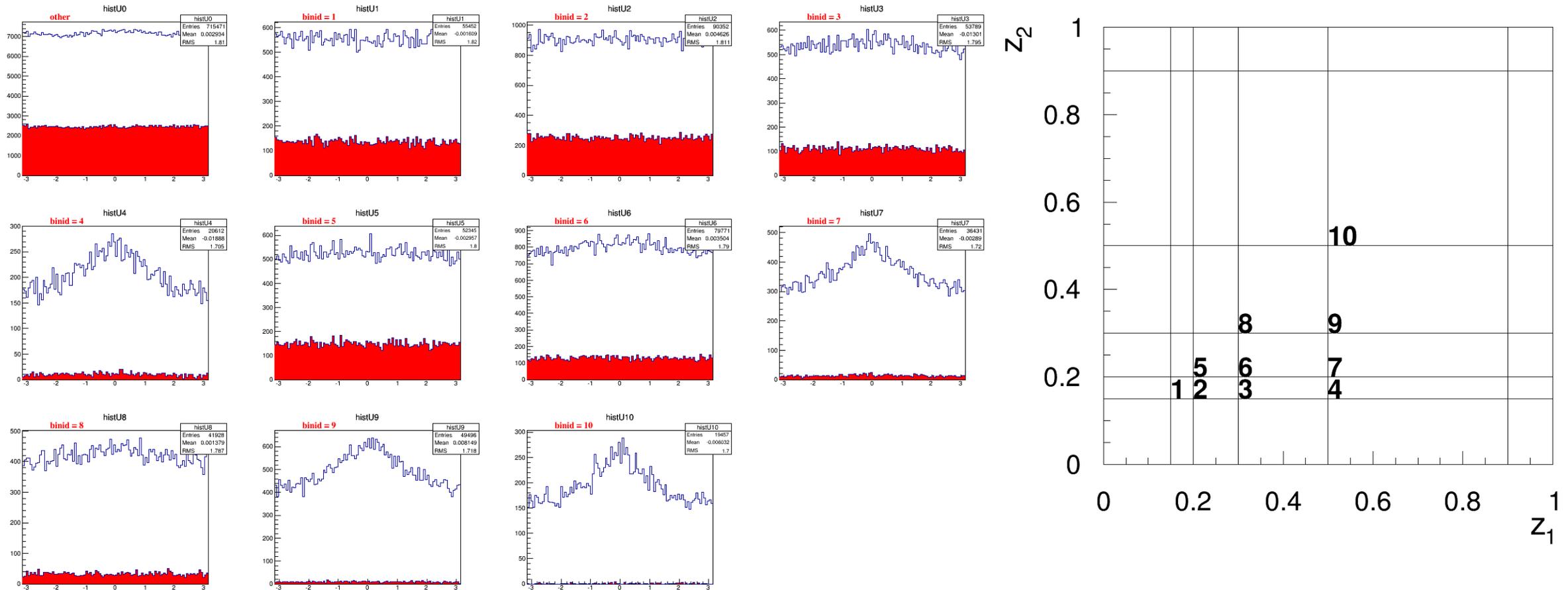
左like-sign, 右Unlike-Sign

我们已经使用了 $n_{trk} \geq 3$ & $n_e = 0$, 以及两pion夹角大于120度这样的物理cut

随着动量的增大 (zbin增大), weak本底减少

Weak本底是平的, 这将对以后的拟合 $(1 + A \cos(2\phi_0))$ 有影响

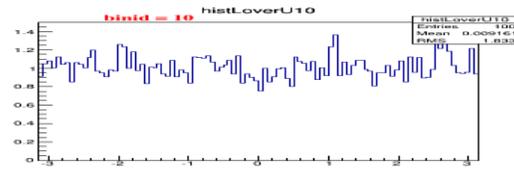
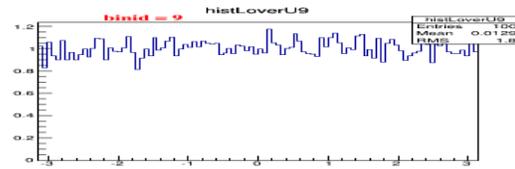
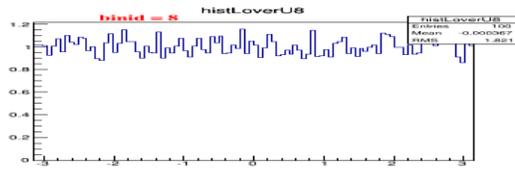
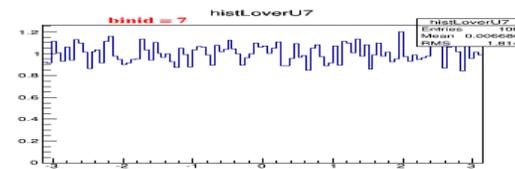
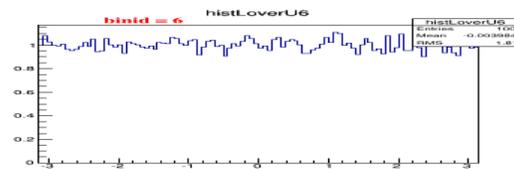
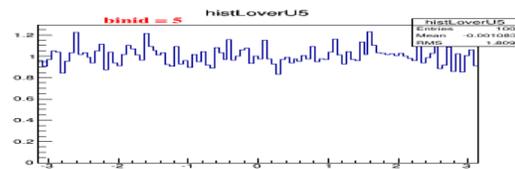
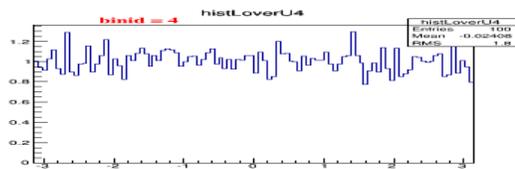
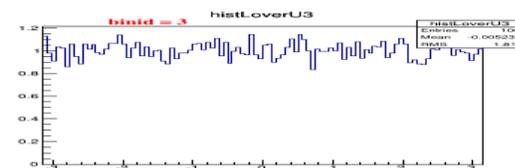
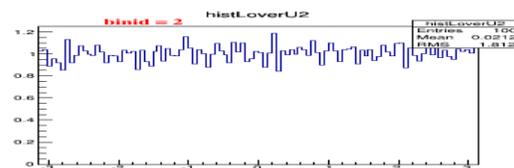
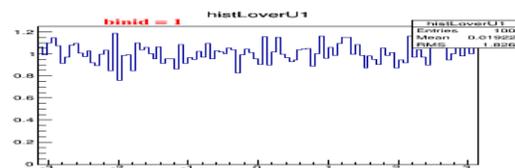
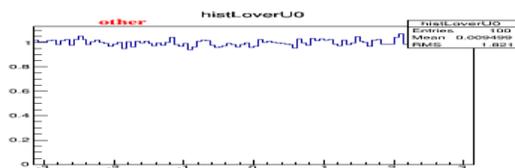
Weak本底 v.s. 动量



Charm本底，由于来自于中间态，动量比较小
这份MC不是PHSP的，所以再0的位置是凸起来的

这份MC让人难受的地方

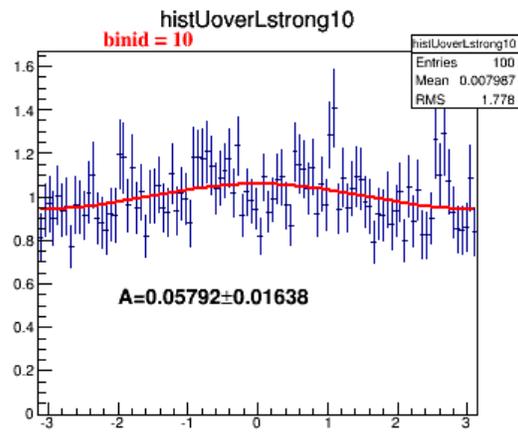
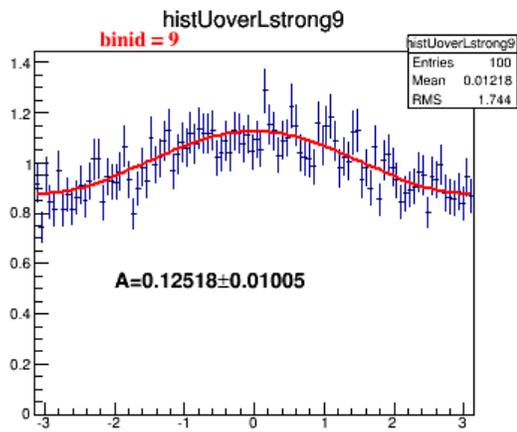
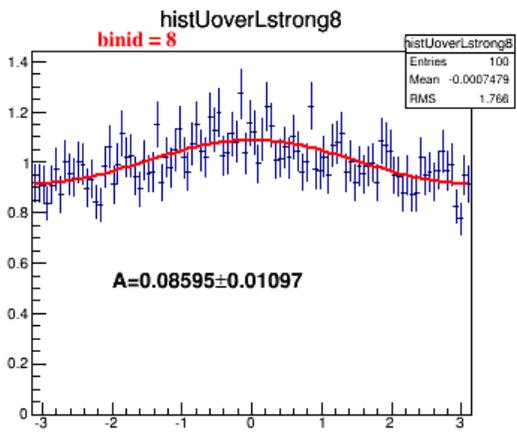
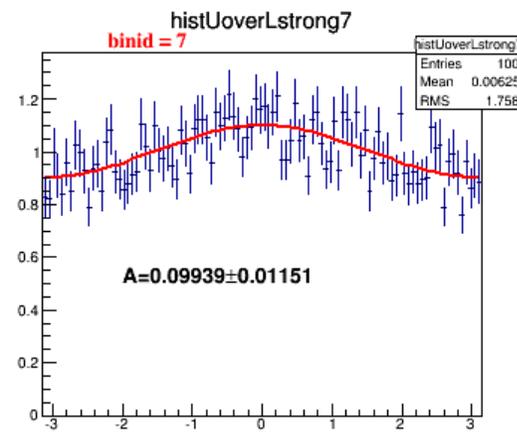
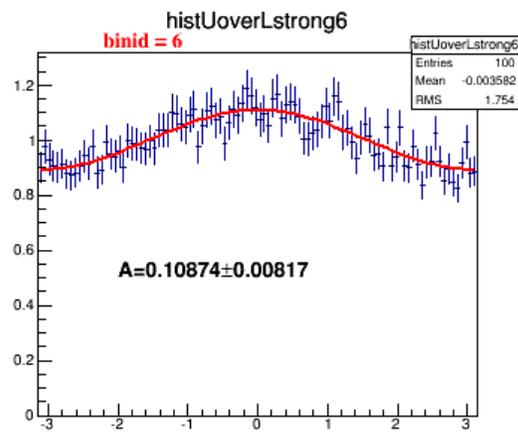
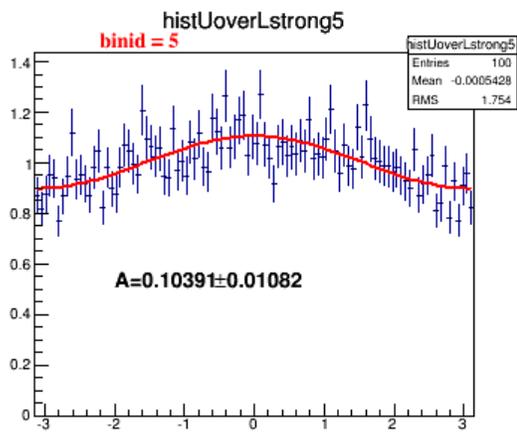
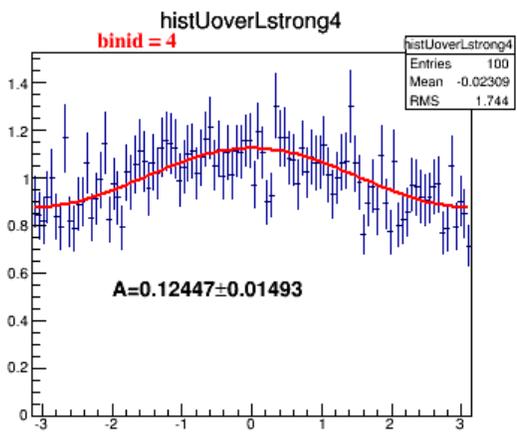
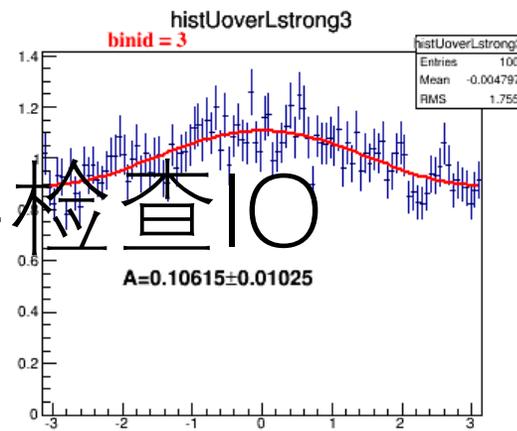
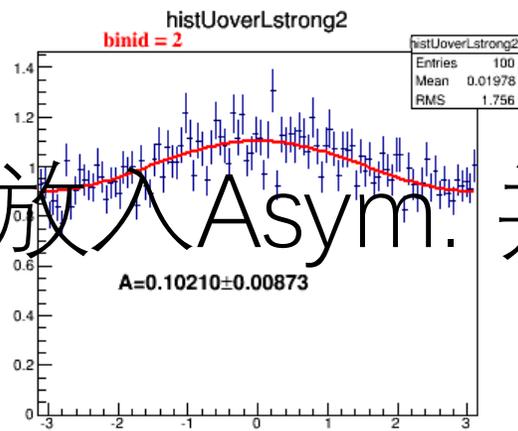
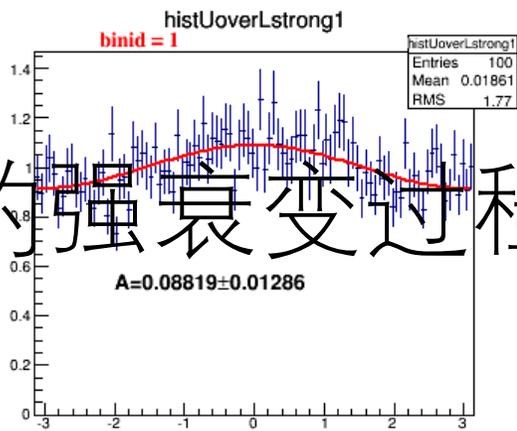
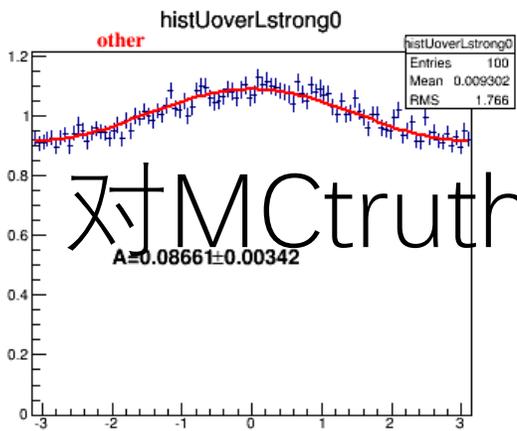
1. Dst中没有包含中间粒子的信息，所以在dst文件中无法判断弱本底，因此无法正确的减除弱本底。
2. 不是PHSP产生，因此在 $\phi = 0$ 的位置上产生了峰。对IO检查带来了麻烦。
3. RU/RL是平的，可以直接放入Asym



IO检查

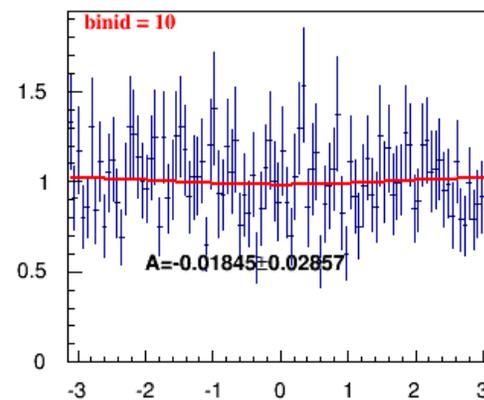
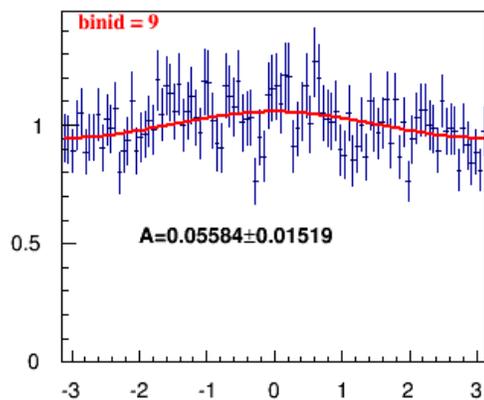
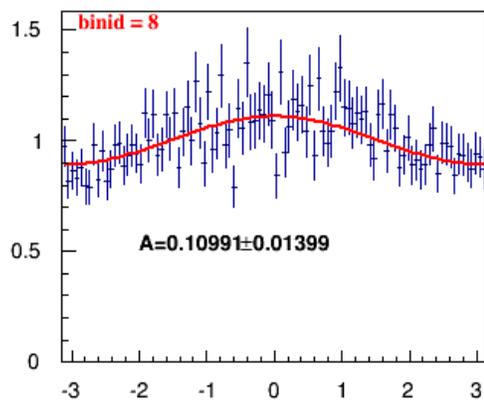
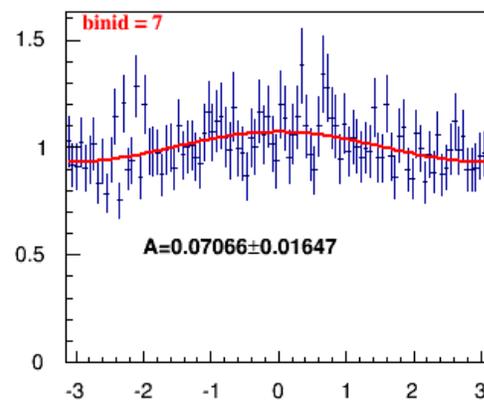
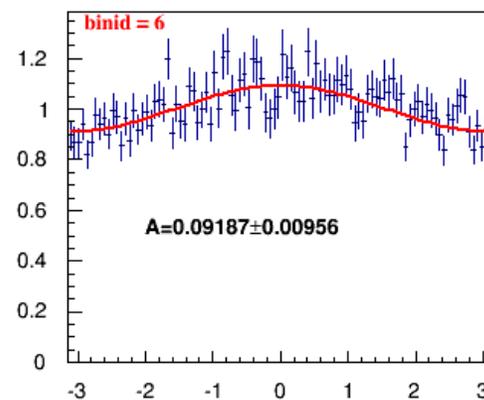
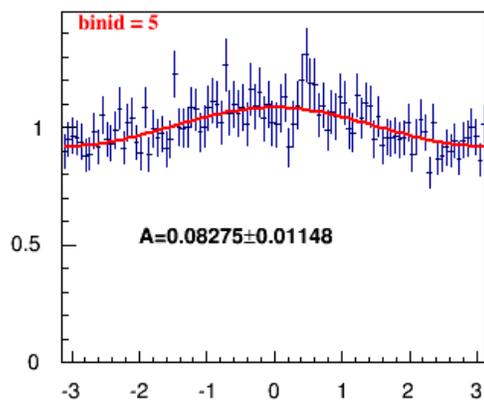
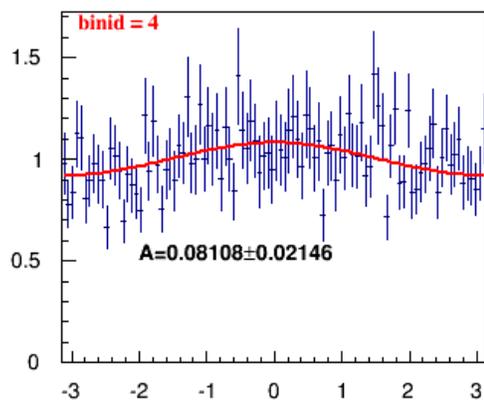
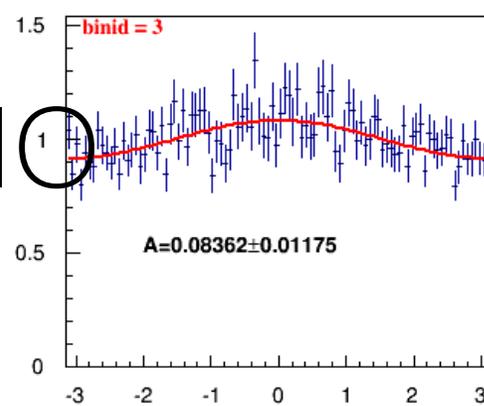
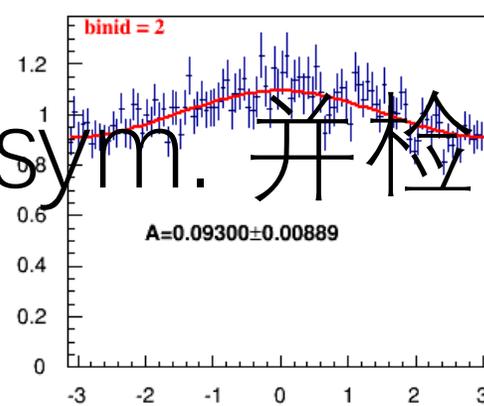
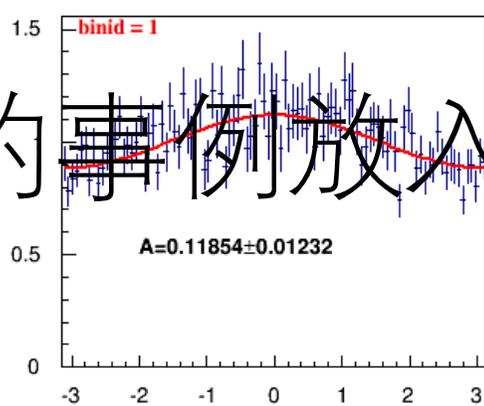
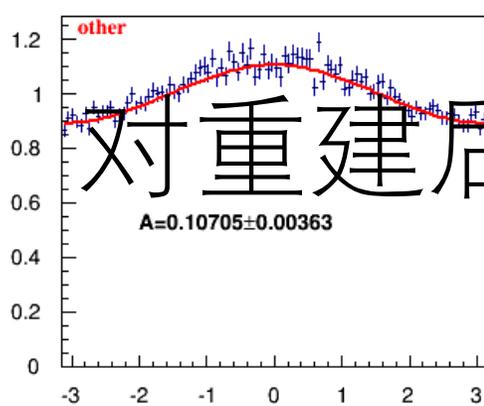
- 方法：我们准备放入10%的不对称度。
 - 将Like-Sign按照 $(1 - 5\% \cos(2\phi_0))$ 进行抽样 (weight)
 - 将Unlike-Sign按照 $(1 + 5\% \cos(2\phi_0))$ 进行抽样 (weight)
 - 一阶近似下 $RL/RU = 1 + 10\% \cos(2\phi_0)$
- 舍选法由于会丢弃事例，故此采用weight的方法
- 平均weight为1，因此事例数不变。

对MCtruth的强衰变过程放入Asym. 并检查IO

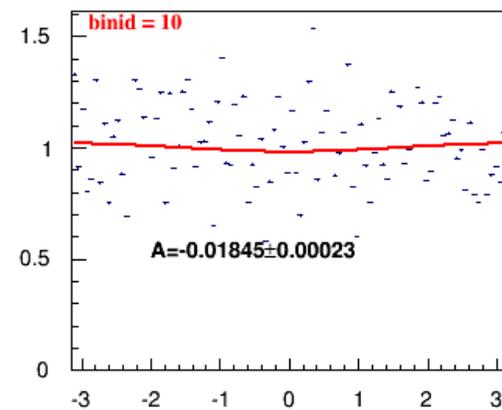
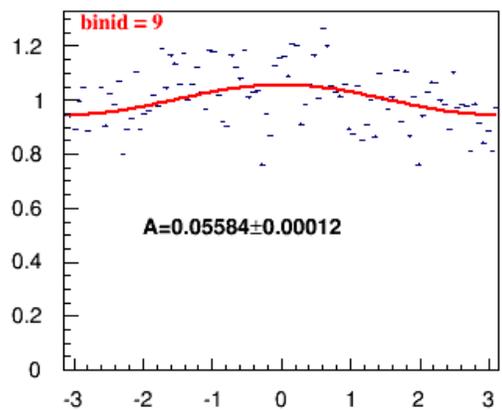
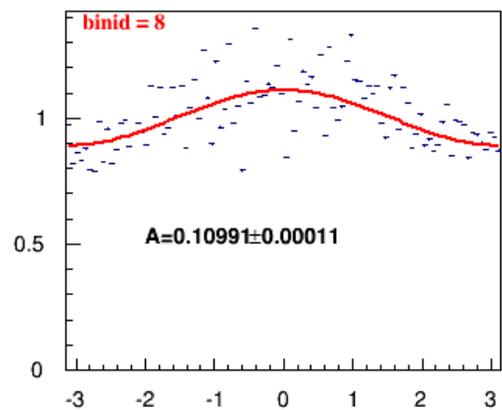
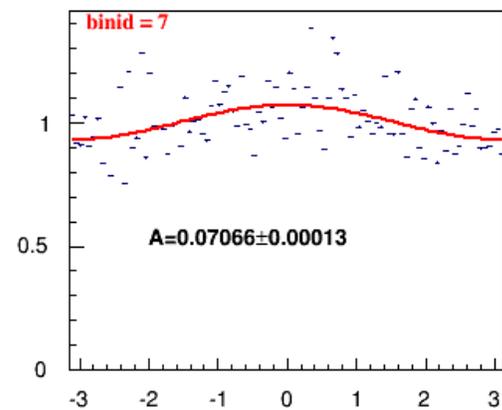
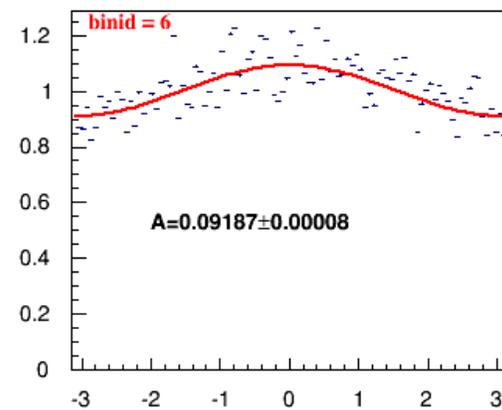
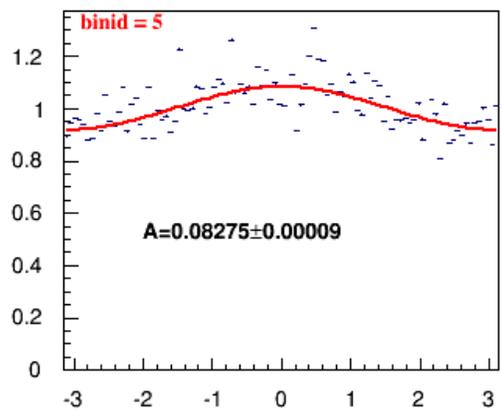
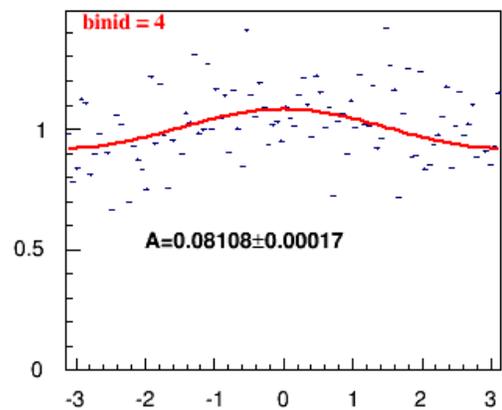
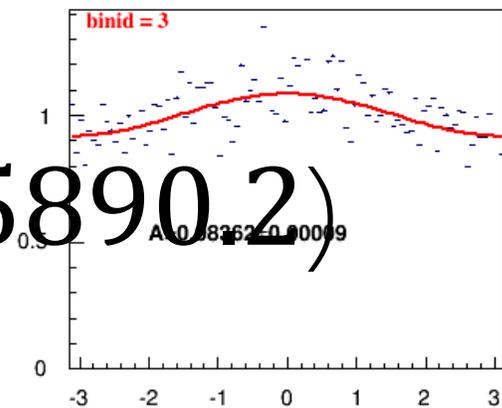
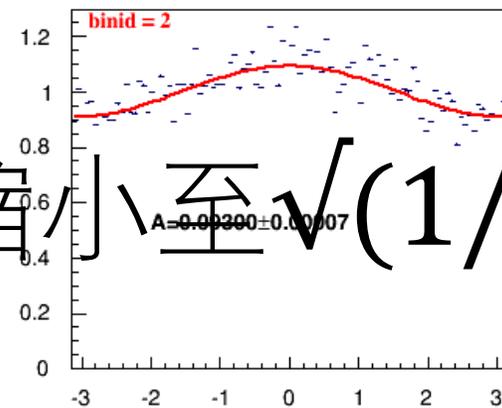
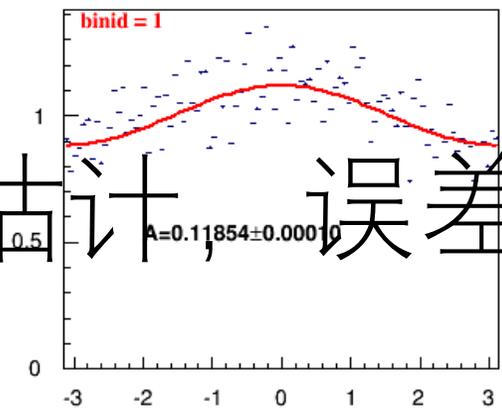
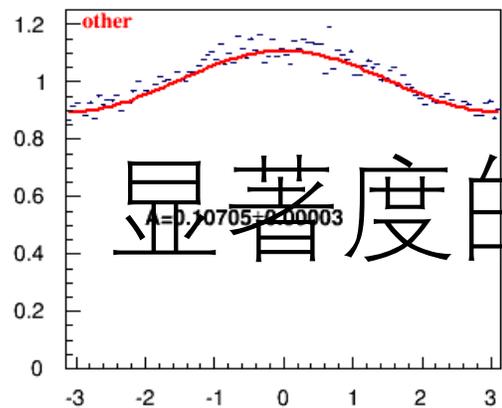


Bin拟合
手动设置error

对重建后的事例放入Asym. 并检查IO



不能区分weak本底,
都放进去了



显著度的估计, 误差缩小至 $\sqrt{(1/15890.2)}$

误差在万分之一量级

回顾

- 我们产生了5GeV的MC，并且利用这份MC，人工放入了10%的不对称度，在包含了弱本底的情况下，并且没有考虑其他本底的情况下，给出了显著度的量级。

存在的问题有

- Weak本底的估计，我们准备采用数据驱动的方法，尽量在Lundcharm中将中间共振态的截面，分支比放准。
- Weak本底的压制问题，由于Weak本底的平台，会对我们在 $1 + A\cos(2\phi_0)$ 的拟合中的1带来影响，因此需要合适的变量压制Weak本底。//可能用到TMVA
- 不对称度的放入问题，由于一个事例可能存在有多种组合，因此我们将会思考合适MC模型放入不对称度