How to estimate the sufficient number of the INTT layer

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(from bi-weekly meeting on Apr. 14)

Reminders - key issue -

- At least 3 inner layers (MAPS+INTT) are needed for standalone momentum reconstruction. [necessary condition]

- DCA measurements
  - more layers are preferred
  - look for "saturation point" of the DCA performance increasing layers

- Momentum resolution
  - fewer layers are preferred
  - radiation length of the 4 layers' INTT is harmless.

I focus on only these parts.

- Integration (to be confirmed by Rachid)
  - fewer layers are preferred
  - at most 5 layers should be OK.

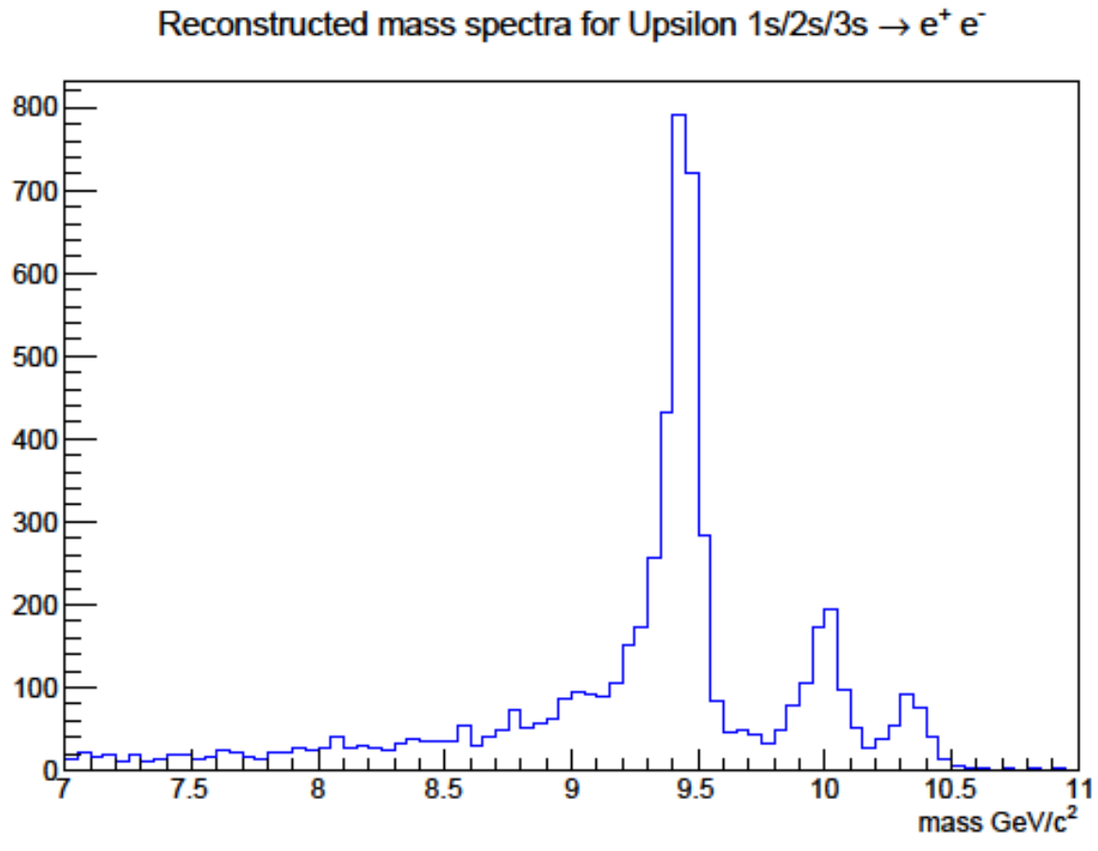
- Cost
  - fewer layers are preferred
  - 4 layers can be covered by RIKEN money, and 5 layers would be OK.

Momentum resolution

It looks good enough. However…

(SOOKHYUN LEE (Iowa State University) May 16, 2017 at sPHENIX simulation meeting)

Reconstruction of mass spectra for Single Upsilon to dielectrons



- Events generated through vector meson decay event generator
- Single pair of dielectrons created per event
- Reconstructed mass spectra shows 3 distinctive peaks for 1s/2s/3s states.

Momentum resolution

Tony's email on sPHENIX simulation meeting (May 17)

The tests were done using single Upsilons and the code from Haiwang's KalmanPatReco development area built against the new.1 libraries. The silicon layers are all ladders, and the TPC is 60 layers out to 78 cm. The results are:

set_precision	cluster resolution RMS (microns)	mass RMS (MeV)
0.040	179.8	109.2 +/- 2.3
0.030	143.5	93.3 +/- 2.4
0.025	127.4	78.3 +/- 1.7
0.020	111.9	74.7 +/- 1.6
0.001	75.8	60.1 +/- 1.5

where 0.001 is the default setting for the precision parameter.

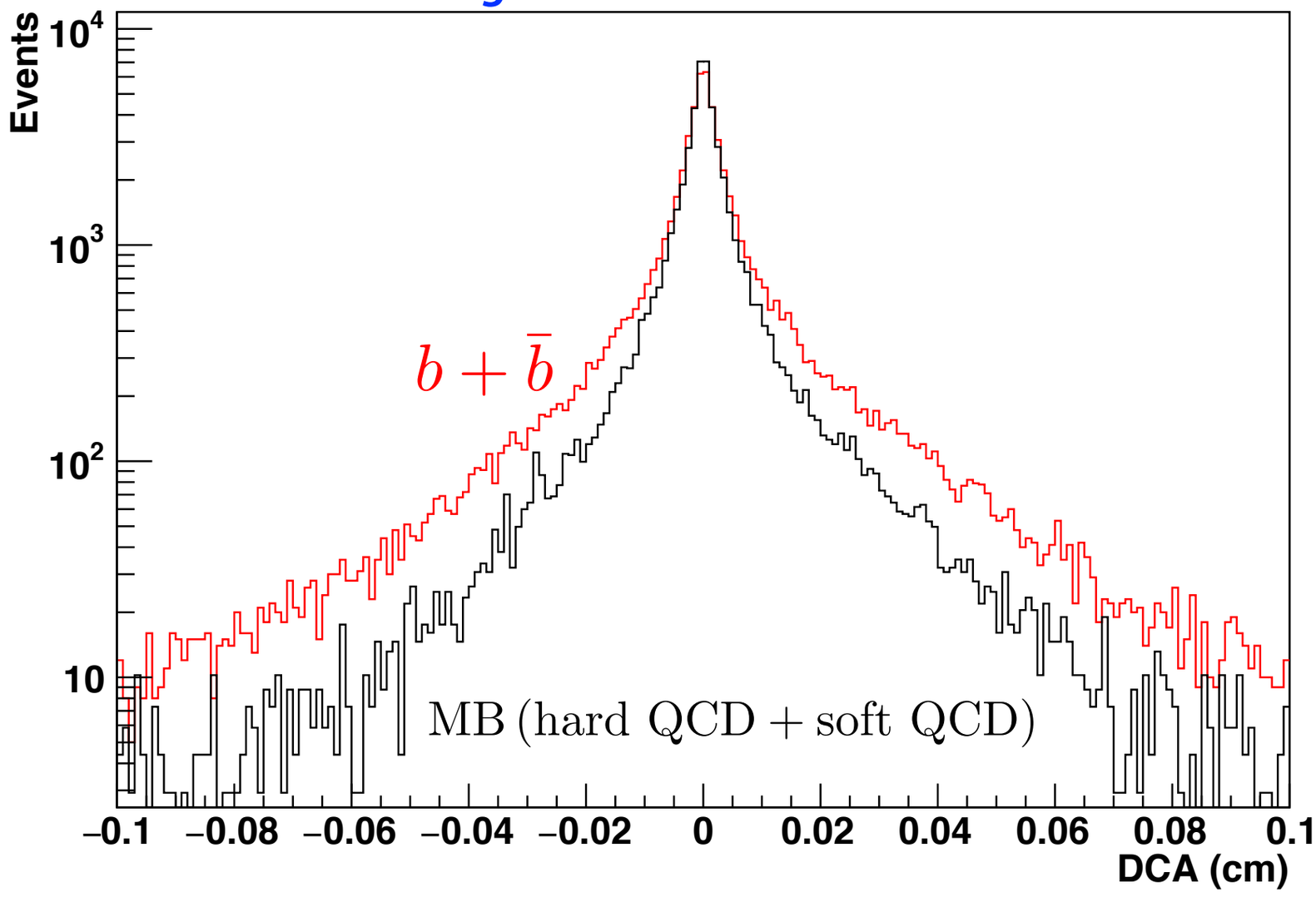
Conclusion: The extremely good momentum resolution we have been seeing is actually due to the TPC cluster resolution (obtained with the default space charge precision) being too good. Not surprising. It is clear though that the performance of the tracker depends very strongly on the TPC cluster resolution.

Carlos is working on the TPC clustering optimization.

DCA distributions
(New track finding + cylinder + PYTHIA)

Note that
- new track finding does not support the ladder geometry yet
- new track finding sometimes crash with HIJING (this is why I use PYTHIA)

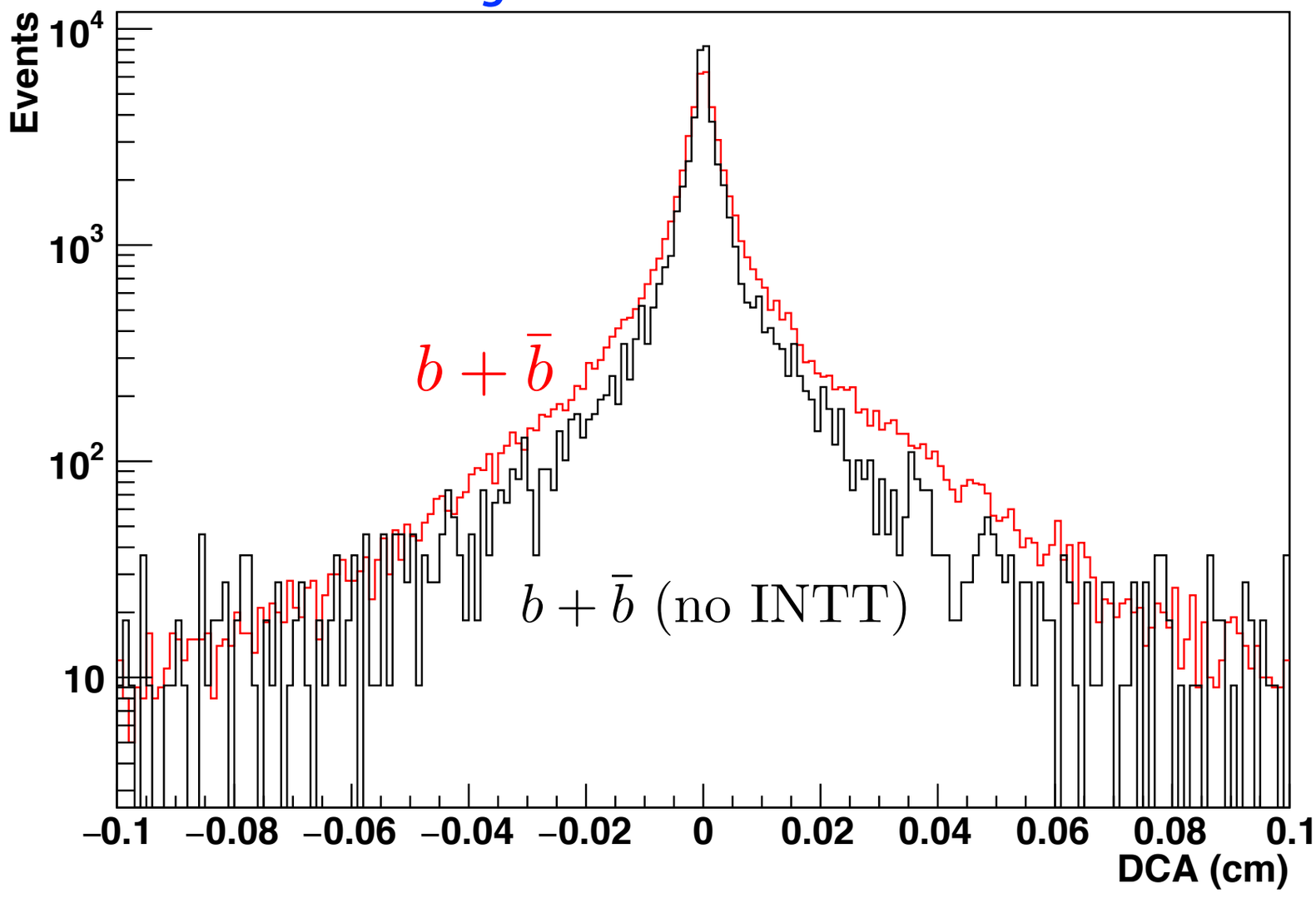
Each histogram normalized around 0 cm.



Is b+bbar too sharp?

DCA distributions
(New track finding + cylinder + PYTHIA)

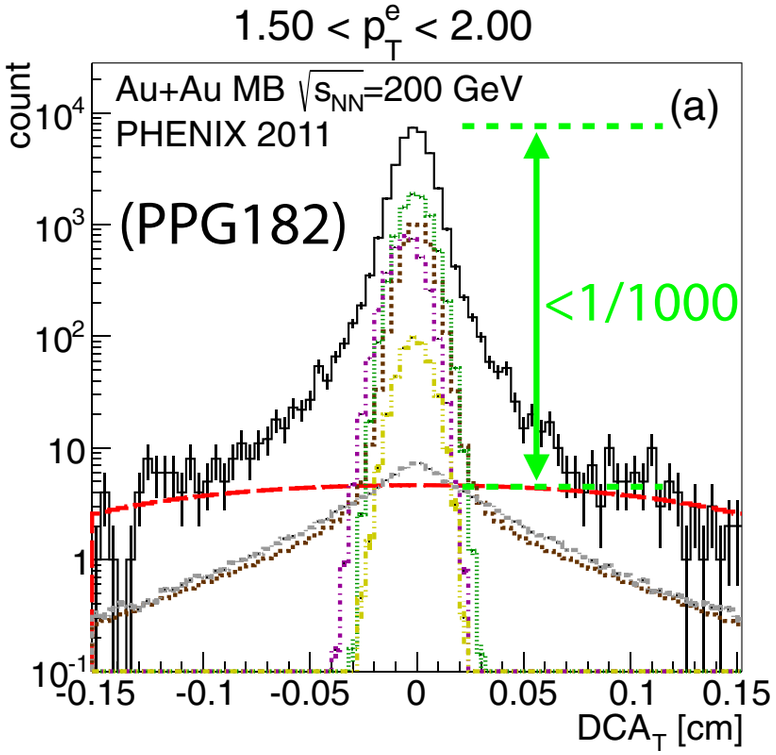
Each histogram normalized around 0 cm.



No INTT tends to make a DCA distribution sharper.

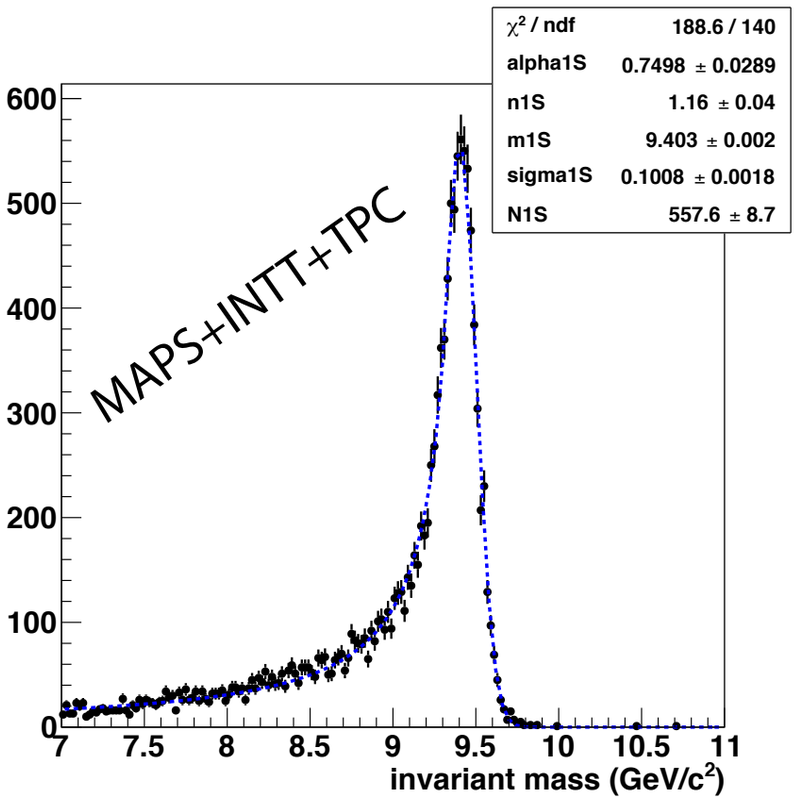
(from bi-weekly meeting on Apr. 14)

Procedure and time scale



1. **Determine the sufficient number of INTT layers** to achieve a smaller background level than 1/1000 of the peak at DCA = 0 cm.
   - We may add one or more layers for redundancy.
   - This task needs a correct track finding algorithm. We can use the track finding newly developed by Hawing et al. (see slides 4 and 5.)

2. Too many layers are meaningless and worsen momentum resolution. **Determine the maximum number of INTT layers** to keep $\sigma_\Upsilon < 100$ MeV.
   - This task needs a correct track fit algorithm. Track fit based on Genfit2 is ready for use.



April	May	June
Haiwang will set up track finding for ladder geom.	New track finding sometimes crashes for HIJING. Still under investigation (need a week).	
GM will remember how to use my sim codes.	Task 1 & Task 2 → Estimation of number of redundancy layers	Contingency

Backup