B-Standard NTuple at CDF Experiment

YoungJin Kim
KiHyeon Cho, Taegil Bae (KISTI)

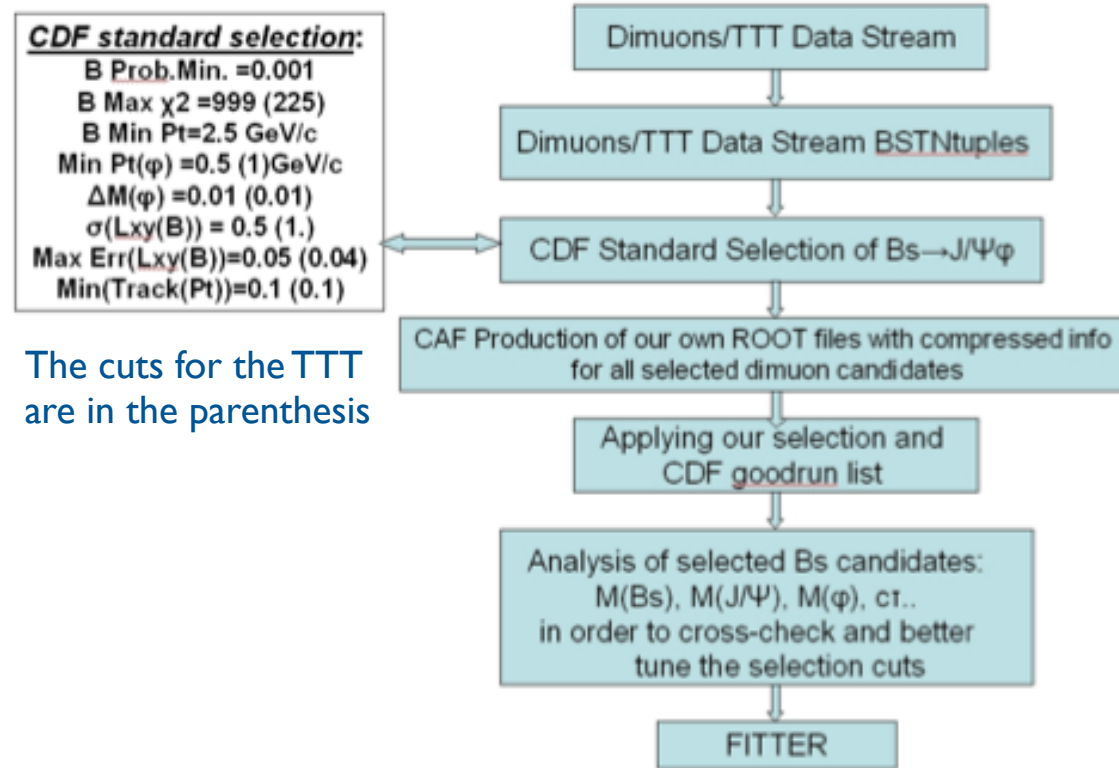2010. 10. 22
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Introduction for TTT

The selection of the Bs candidates for the study of the CP Violation

parameters in the Bs → J/Ψφ process based on the use of the two

data streams available at CDF for this study, namely the dimuon

triggered data and the two track triggered (TTT) data.

Data including the period 26.

Flow DIAGRAM

CDF standard selection:
B Prob.Min. =0.001
B Max χ2 =999 (225)
B Min Pt=2.5 GeV/c
Min Pt(φ) =0.5 (1)GeV/c
$\Delta M(\varphi)$ =0.01 (0.01)
$\sigma(Lxy(B))$ = 0.5 (1.)
Max Err(Lxy(B))=0.05 (0.04)
Min(Track(Pt))=0.1 (0.1)

The cuts for the TTT
are in the parenthesis

Dimuons/TTT Data Stream

Dimuons/TTT Data Stream BSTNtuples

CDF Standard Selection of Bs→J/Ψφ

CAF Production of our own ROOT files with compressed info
for all selected dimuon candidates

Applying our selection and
CDF goodrun list

Analysis of selected Bs candidates:
M(Bs), M(J/Ψ), M(φ), cτ..
in order to cross-check and better
tune the selection cuts

FITTER

This flow diagram in summarizes the procedure used for the data selection and analysis for both the two track trigger (TTT) and the dimuon trigger streams.

The selection follows into two stages.

First, corresponds to applying the so called standard CDF pre-selection for both data streams.

Selection cuts defining a Bs → J/Ψφ candidates

Second, refines the selection of Bs candidates on both data steams with slightly different cuts and still keeping rather loose requirements.

TTT	DIM
$5.24 < \text{Mass}(B_s^0) < 5.4\ GeV/c^2$	$5.24 < \text{Mass}(B_s^0) < 5.48\ GeV/c^2$
$2.95 < \text{Mass}(J/\psi) < 3.25\ GeV/c^2$	$3.05 < \text{Mass}(J/\psi) < 3.15\ GeV/c^2$
$P_t(J/\psi) > 2.00\ GeV/c$	$1.01 < \text{Mass}(\phi) < 1.03\ GeV/c^2$
$P_t(\phi) > 1.36\ GeV/c$	$P_t(B_s^0) > 2.50\ GeV/c$
At least one identified muon	$P_t(K) > 1.00\ GeV/c$
$\chi^2_{xy}(B_s) < 18$	
$d_0(B_s) < 65\ \mu m$	

Table : summarizes the selection cuts defining a Bs → J/ψφ candidate for both data streams in our analysis

Integrated Luminosity

The data considered correspond to the time range between the beginning of Run II and Oct. 25th 2009 (period 0 to 26). The total recorder integrated luminosity by CDF from periods 0 to 26 is 4.2 fb^{-1}.

The goodrun list version 32, as created on March 12th 2010 is applied here and the total integrated luminosity after applying the goodrun list is 5.0187 fb^{-1}.
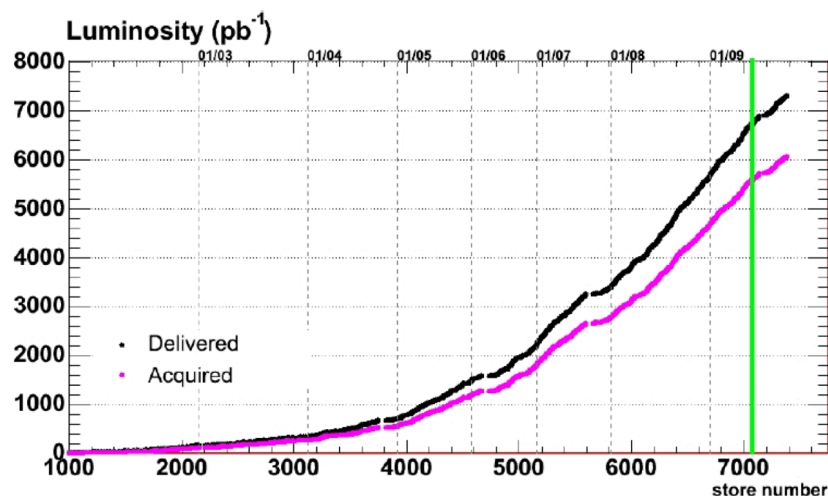
Delivered and acquired luminosity at the CDF experiment (period 0-24)
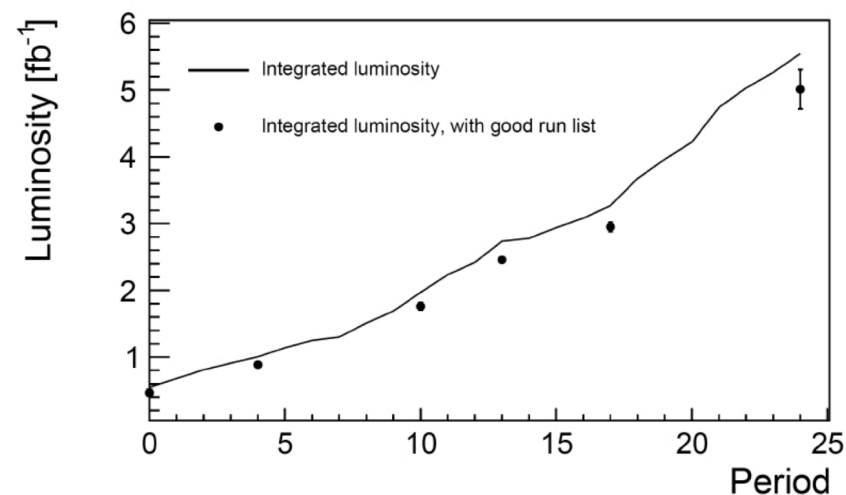
CDF integrated luminosity before (full line) and after (points) the application of the goodrun list (period 0-24)

Number of events when applying goodrun list

Numbers of events per run periods from run 0 to run 24, for the TTT data stream after applying the pre-selection and without applying or applying the goodrun list.

A total of 1.26×10^7 reconstructed J/$\Psi\phi$ candidates are retained by this pre-selection in the TTT data stream BstNtuples, (period 0-26).
This total number decreases to 1.18×10^7 events when applying the goodrun list.
(~ 6%)
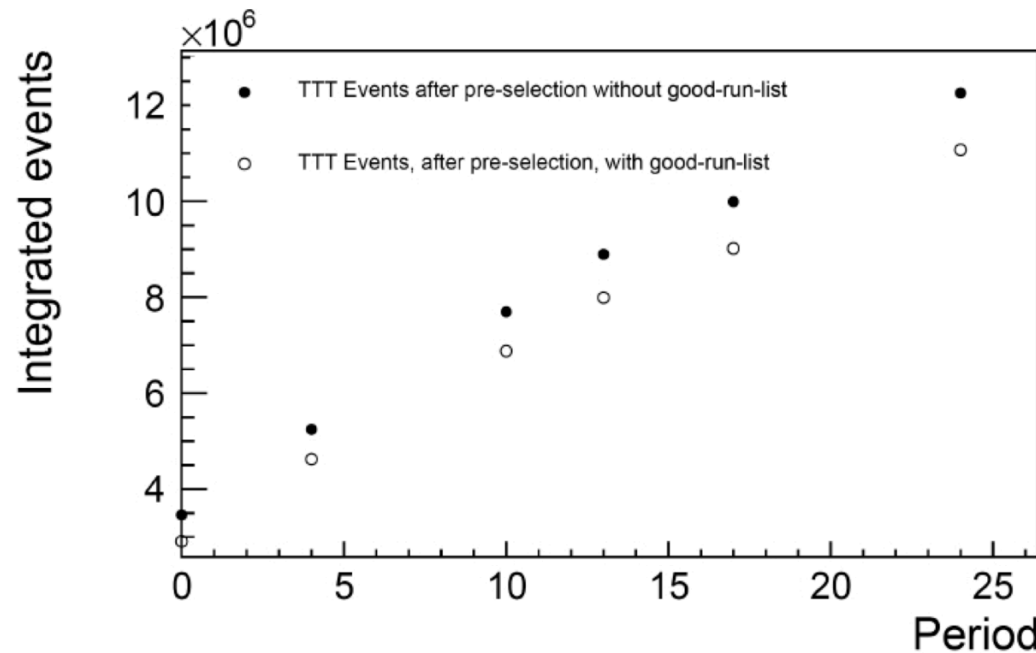
Bs → J/$\Psi\phi$ recontructed events in the TTT BstNtuples after pre-selection without (black dots) and with (white dots) applying the goodrun list (period 0-24)

Selection Cuts

This figure shows the number of Bs → J/ψφ events after this selection by run period as applied to the TTT data stream (black dots).
The corresponding numbers excluding the overlapping events are also shown (white dots).

The total number of Bs → J/ψφ events after the selection cuts in the TTT data streams is 9169 and 70168 in the dimuon data stream. After excluding the overlapping events between the two streams we are left with 8538 Bs → J/ψφ events.
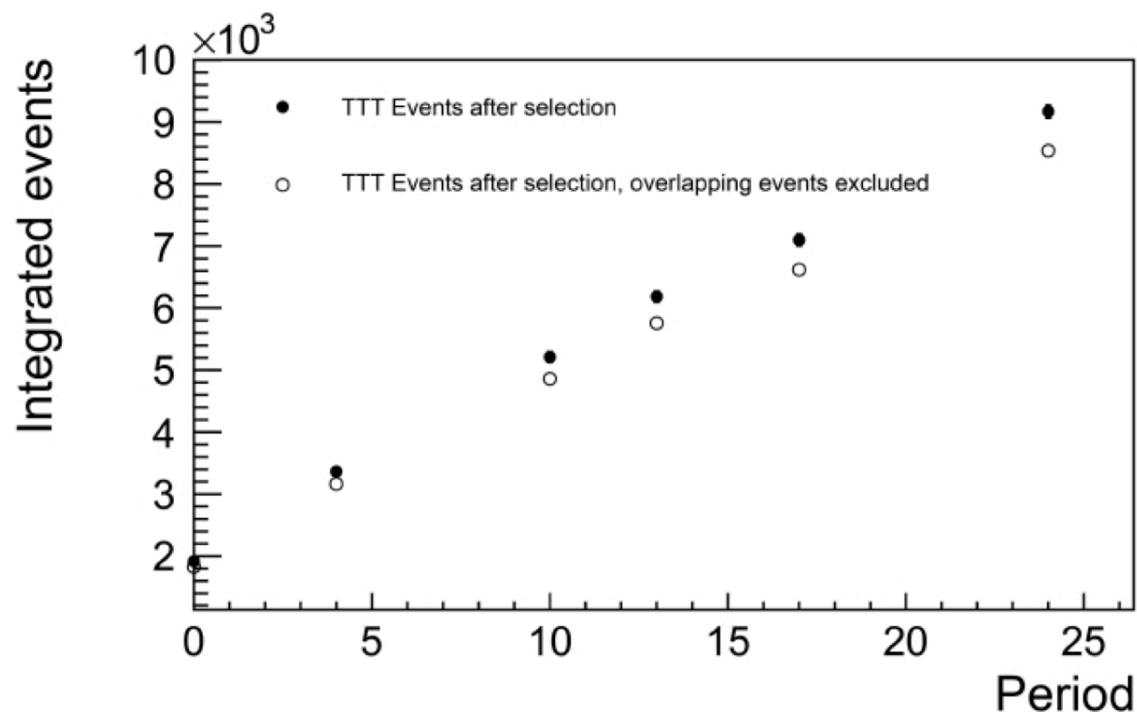
Selection Cuts

Period	Events preselection	Events (Preselection+goodrun)	Events (B_s^0 cuts)	Overlap events
0	3,463,653	2,906,425	2,009	93 (4.6%)
1 - 4	1,781,239	1,719,045	1,391	111 (8.0%)
5 - 10	2,451,679	2,252,714	1,803	164 (9.1%)
11 - 13	1,199,567	1,112,792	931	80 (8.6%)
14 - 17	1,094,714	1,025,521	874	54 (6.2%)
18 - 26	2,575,462	2,055,105	2,330	187 (8.0%)
Total	12,566,314	11,071,602	9,338	689 (7.4%)

Details of the number of events in the TTT data stream per run period at the various selection stages (period 0-26)

Run Period	Selected B_s^0 events (entries) from Dimuons without goodrun list selection	Selected B_s^0 events (entries) from Dimuons with goodrun list selection
0	7,720	6,196
1 - 4	9,263	7,189
5 - 10	15,808	14,667
11 - 13	10,535	10,167
14 - 17	8,336	7,699
18 - 26	25,002	23,717
Total	75,379	70,929

Number of Bs → J/ψφ entries from the dimuon data stream after selection and without or with applying the goodrun list and without excluding the overlapping events and excluded overlaps (period 0-26)
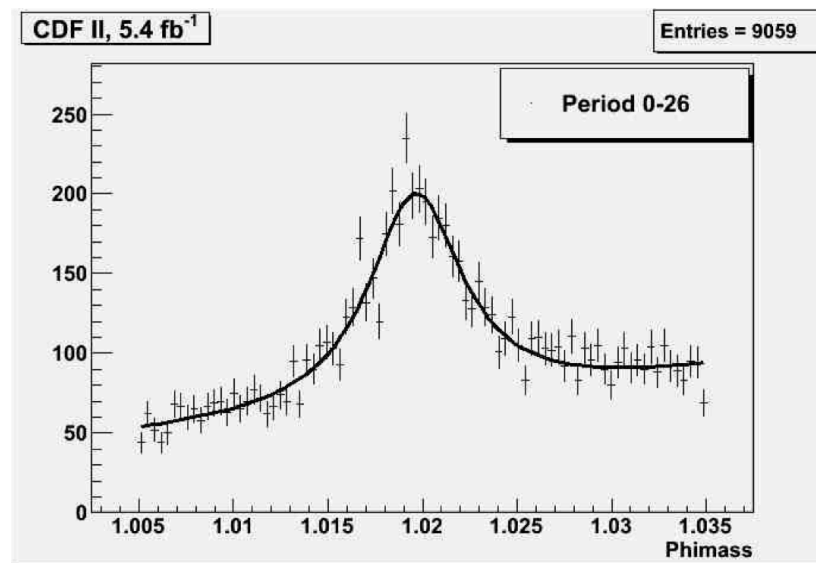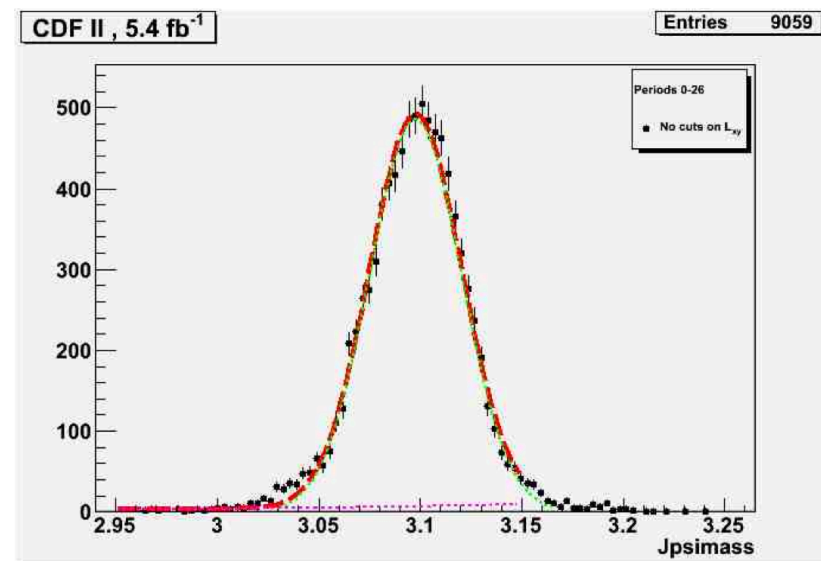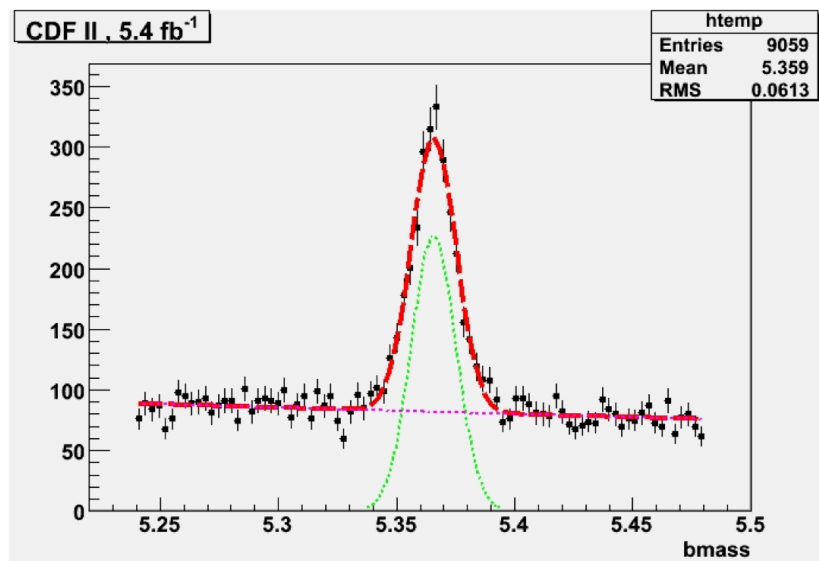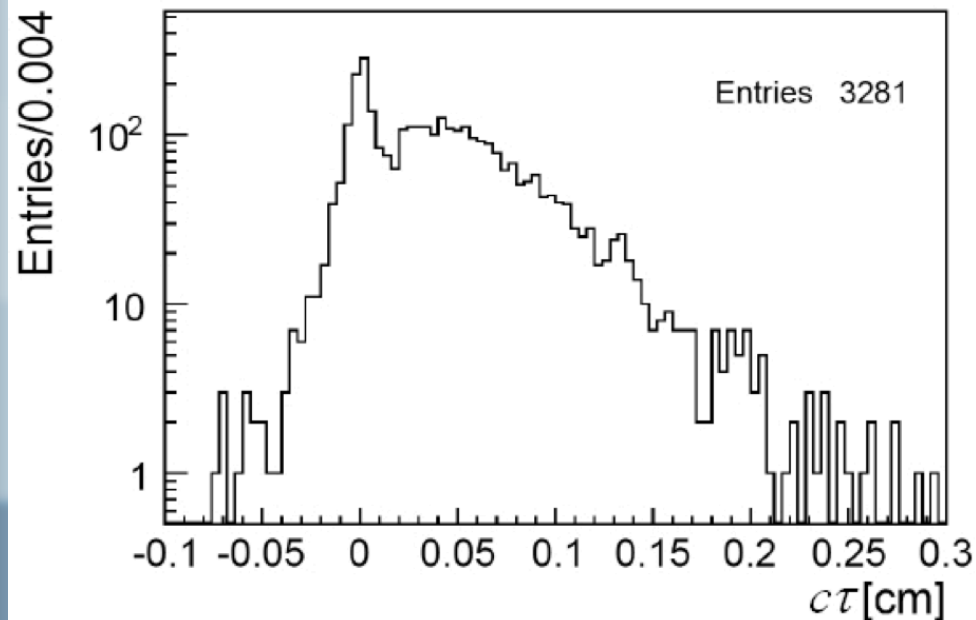
Bs Mass Spectrum Plots for TTT and Dimuon
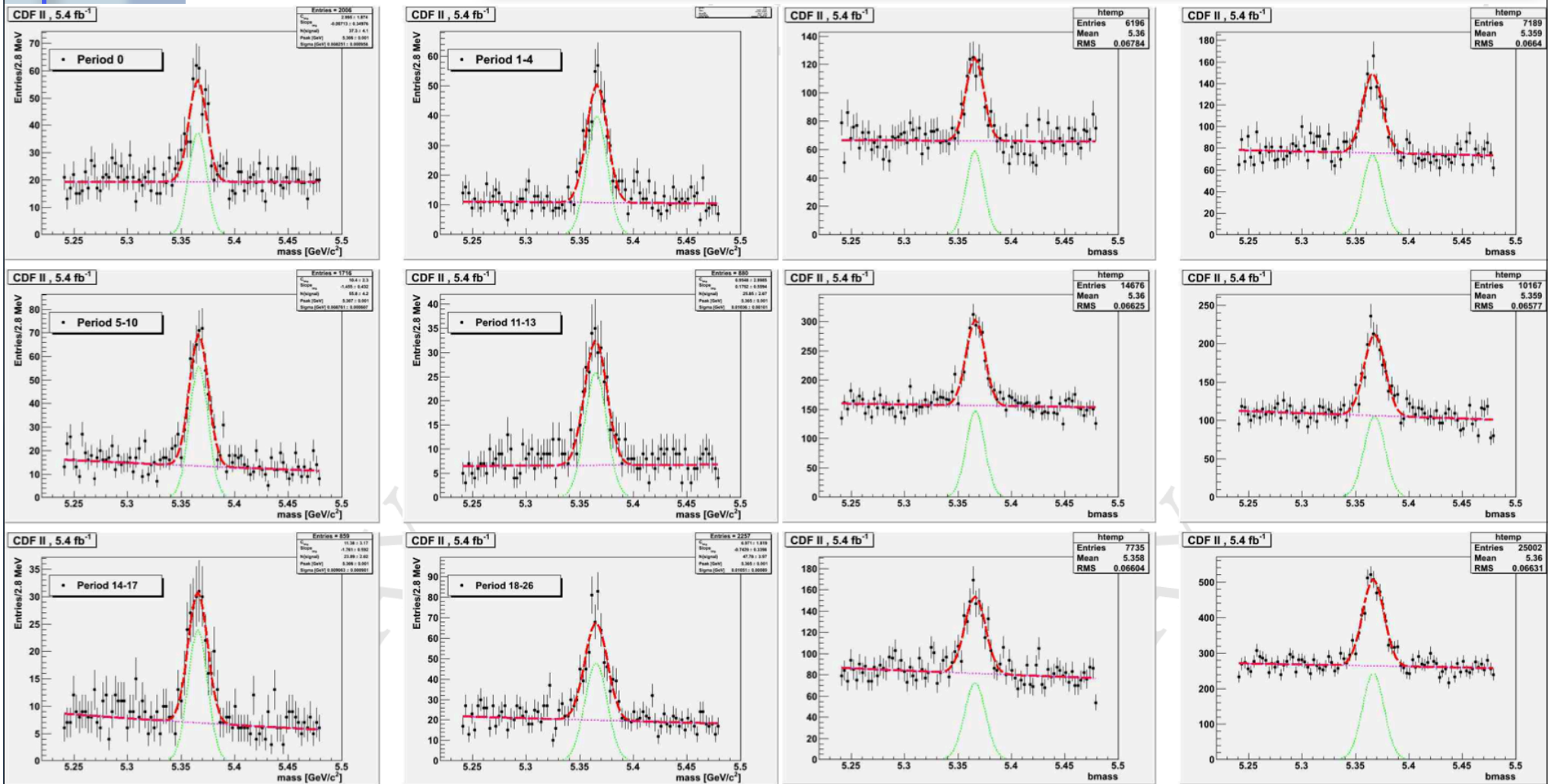
Bs mass spectrum after selection and exclusion of the overlapping events for each run period in the **TTT data sample** (period 0-26)

Bs mass spectrum after selection for each run period in the **Dimuon data sample** (period 0-26)
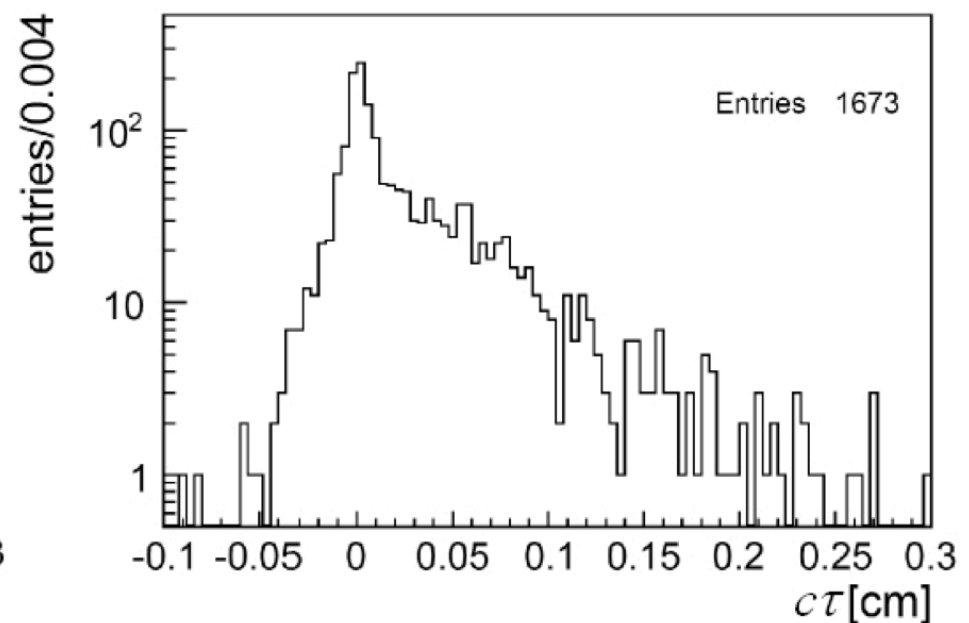
Mass spectrum of Bs, J/Ψ and φ in the TTT data sample
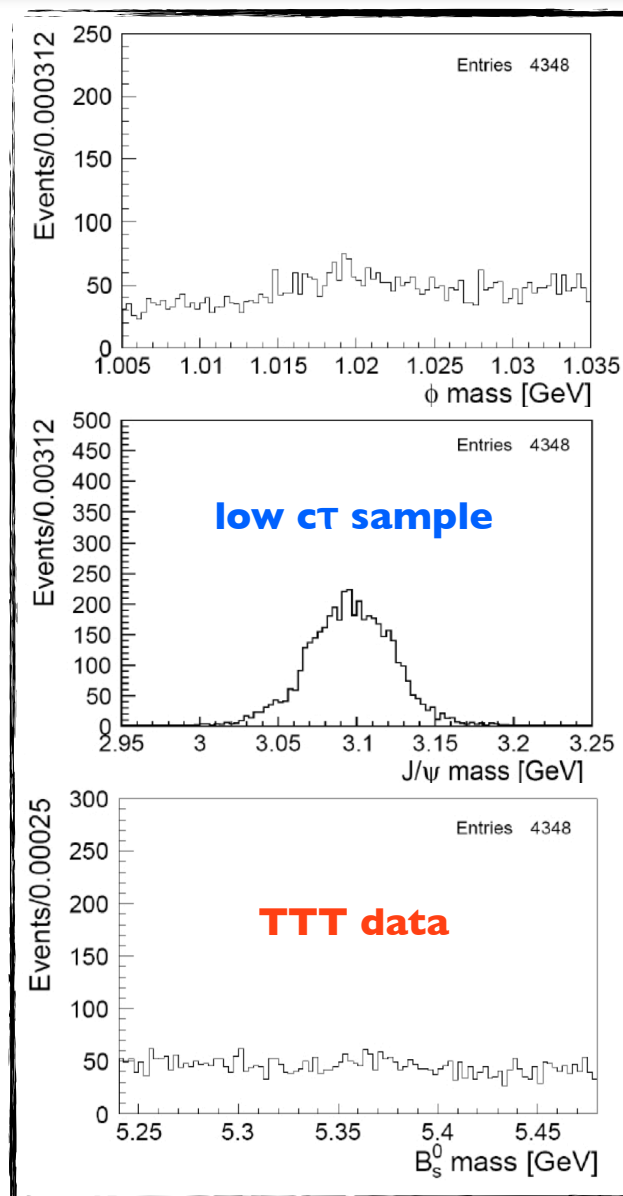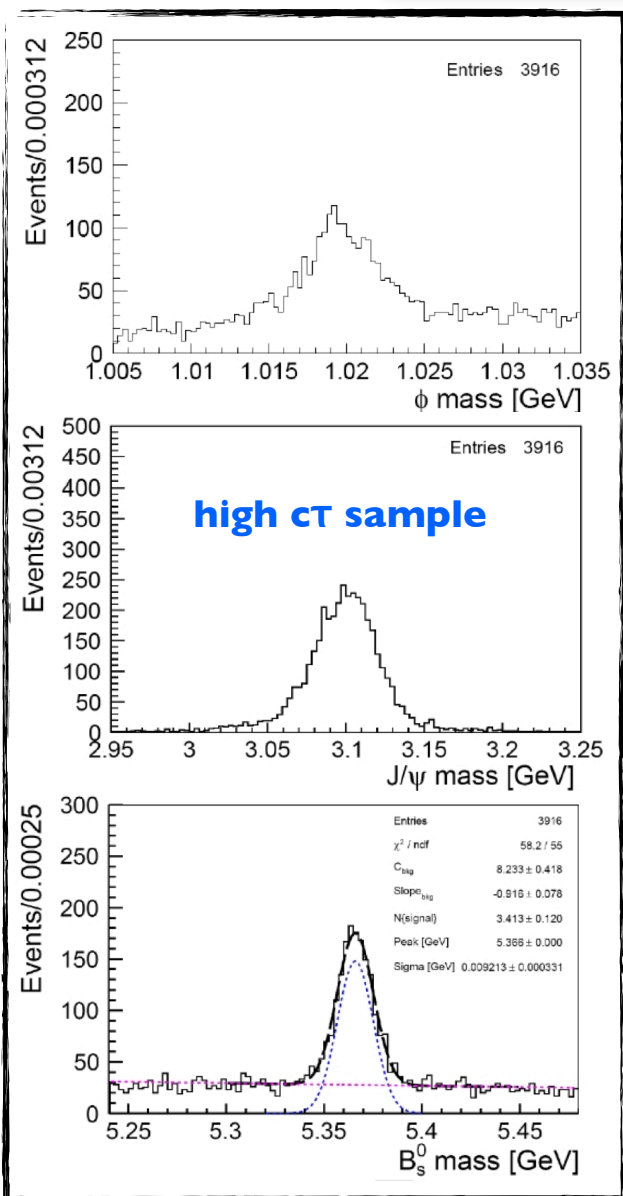
cτ distribution for the Bs candidates

cτ Spectrum of reconstructed Bs
Signal region

cτ Spectrum of reconstructed Bs
Sideband region

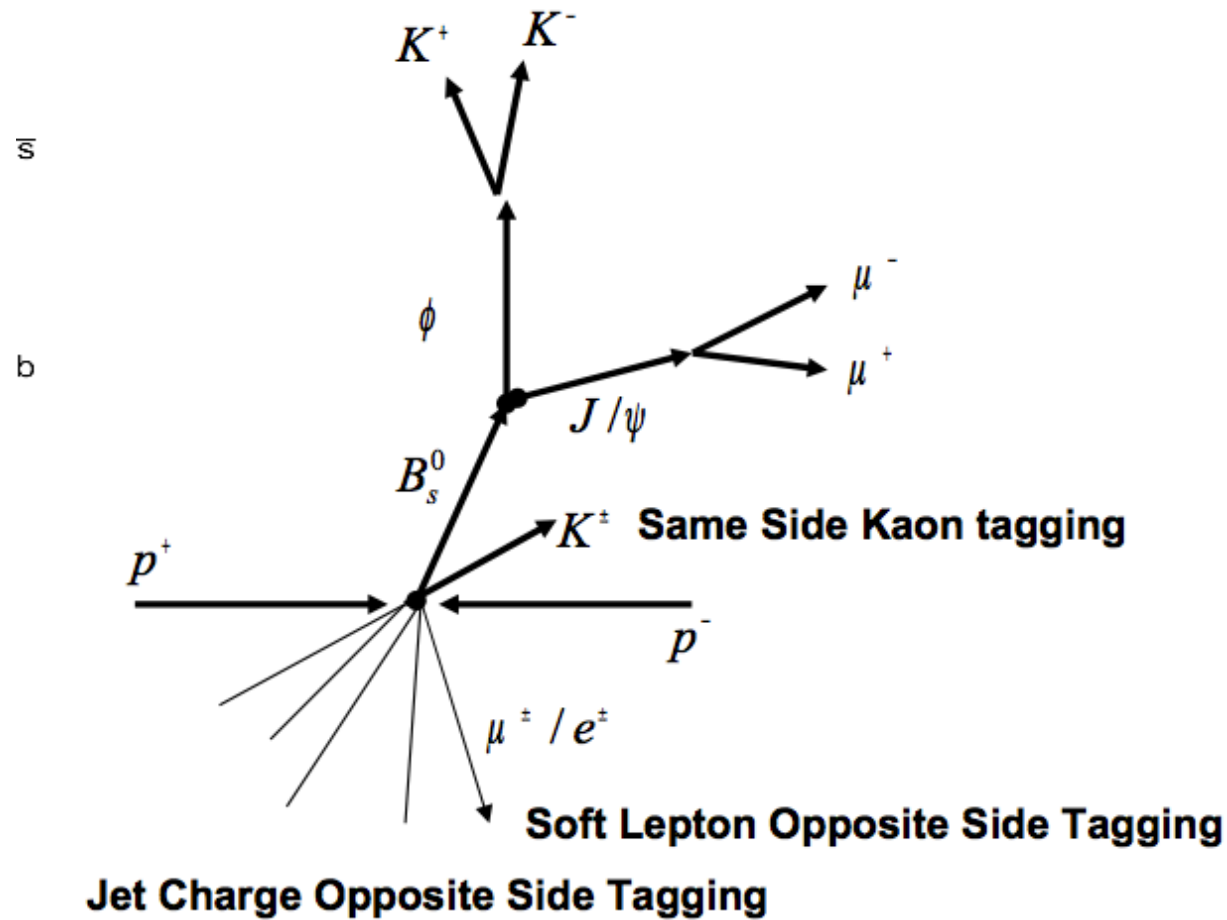# φ, J/ψ and Bs mass spectra for two cτ samples

The LOW cτ sample < 0.02cm

**The HIGH cτ sample > 0.02cm**

$B \rightarrow J/\psi\varphi$ decay

$\overline{s}$

K^+ K^-

b

ϕ

μ^-

μ^+

J/ψ

B_s^0

$K^\pm$ **Same Side Kaon tagging**

p^+

p^-

$\mu^\pm/e^\pm$

Soft Lepton Opposite Side Tagging

Jet Charge Opposite Side Tagging

Kinematics of an event

Effects of L_xy cuts on the Bs Sample

	Signal Events (S)	Background (B)	$S\sqrt{S+B}$
No cuts on L_{xy}	1889 ± 142	1634	31.8
$L_{xy} > 100\mu m$	1846 ± 128	971	34.8
$L_{xy} > 150\mu m$	1856 ± 124	811	36.0
$L_{xy} > 200\mu m$	1844 ± 121	703	36.5
$L_{xy} > 250\mu m$	1837 ± 119	636	36.9
$L_{xy} > 290\mu m$	1837 ± 118	589	37.3

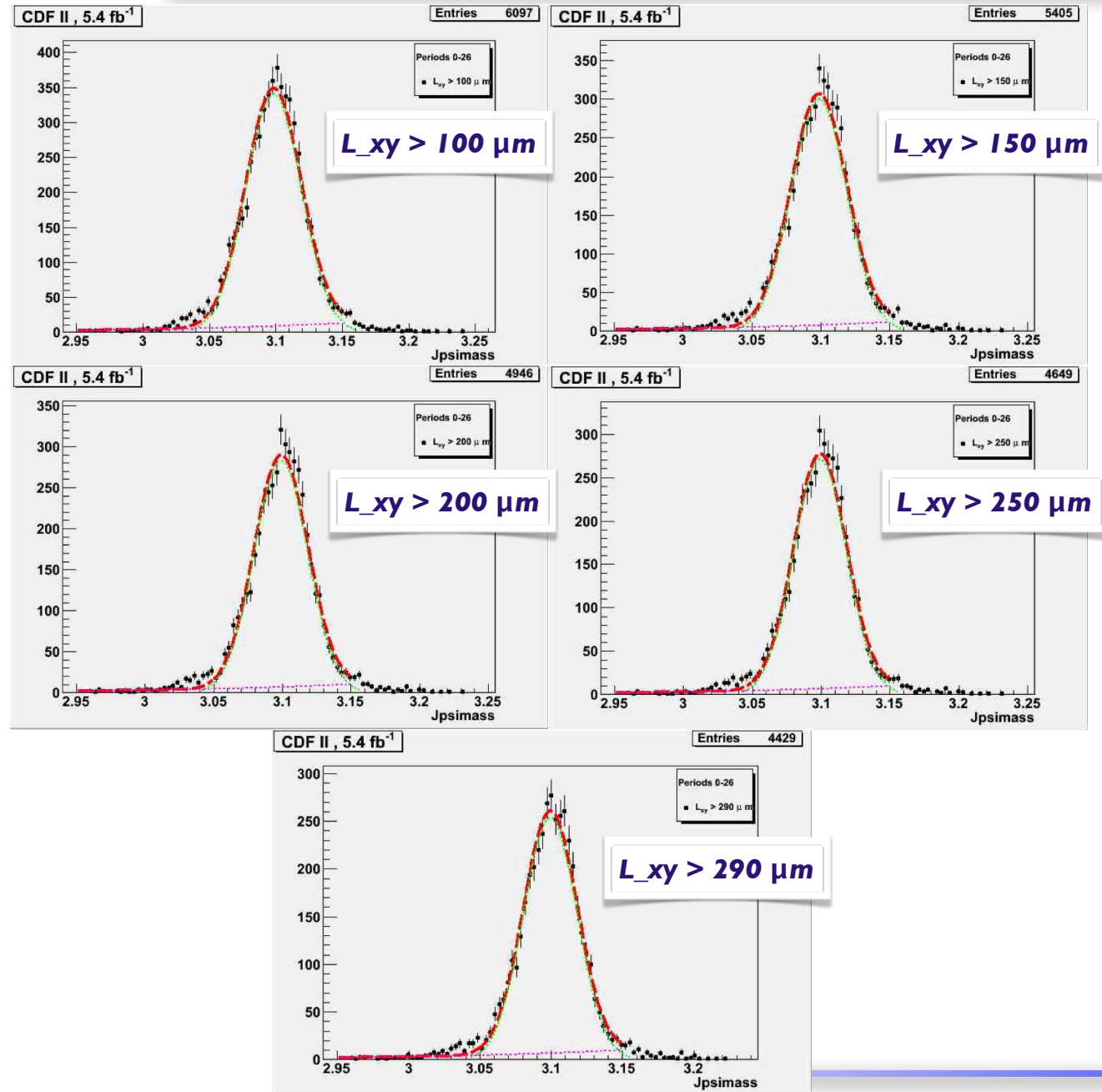The Number of events in the TTT data stream for different cuts on L_xy of the Bs candidates
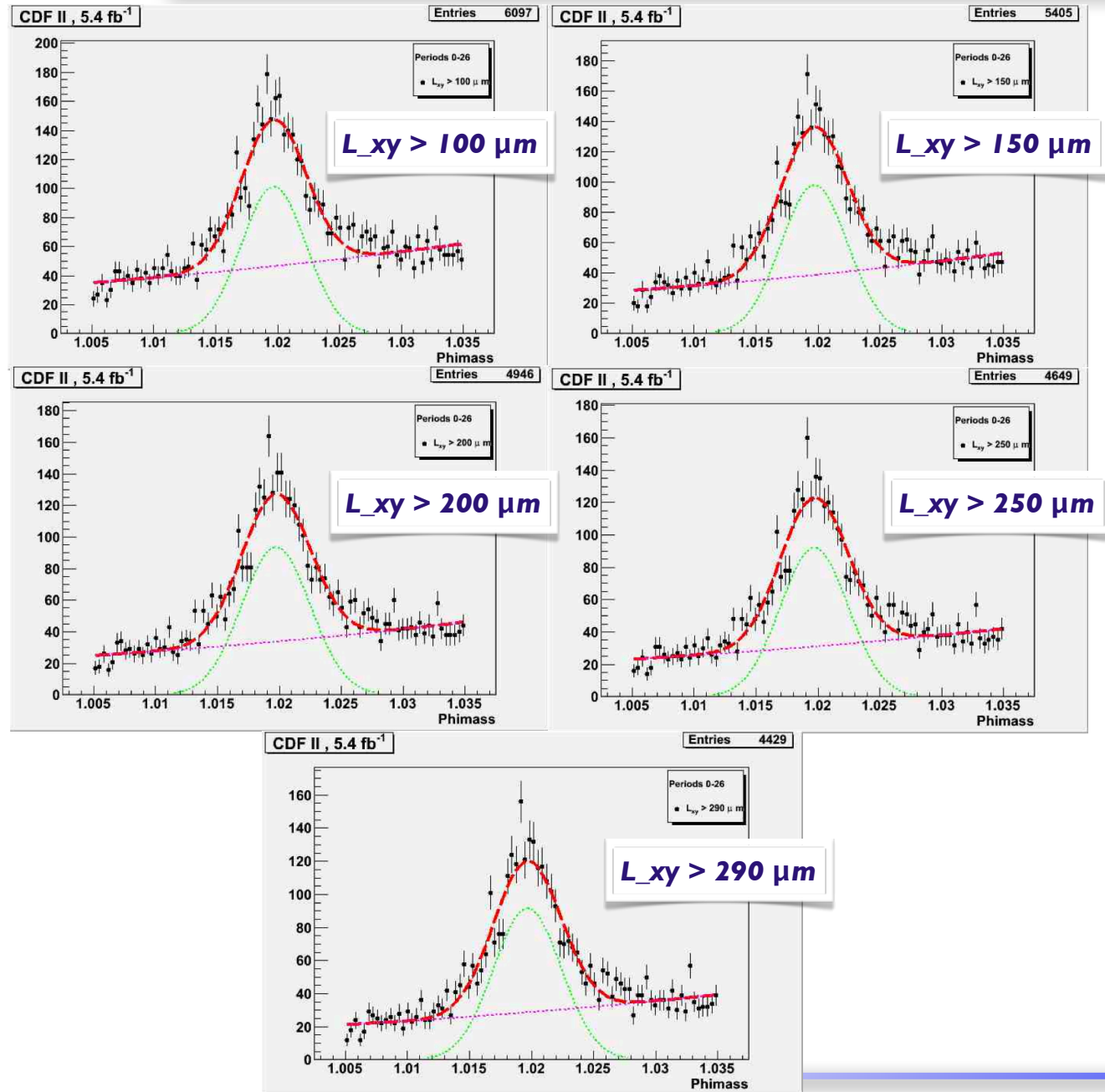
Applying different cuts on L_xy
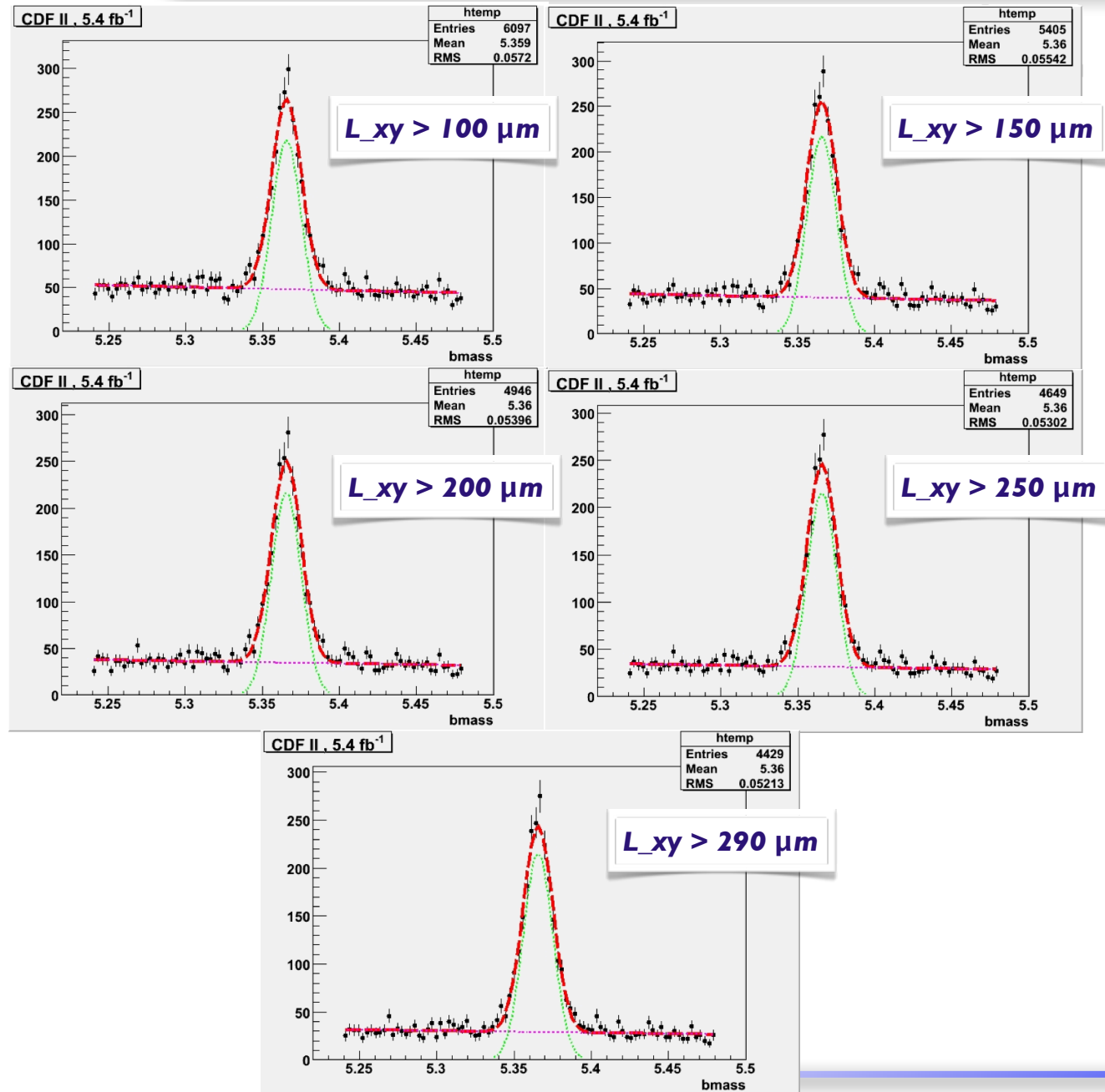
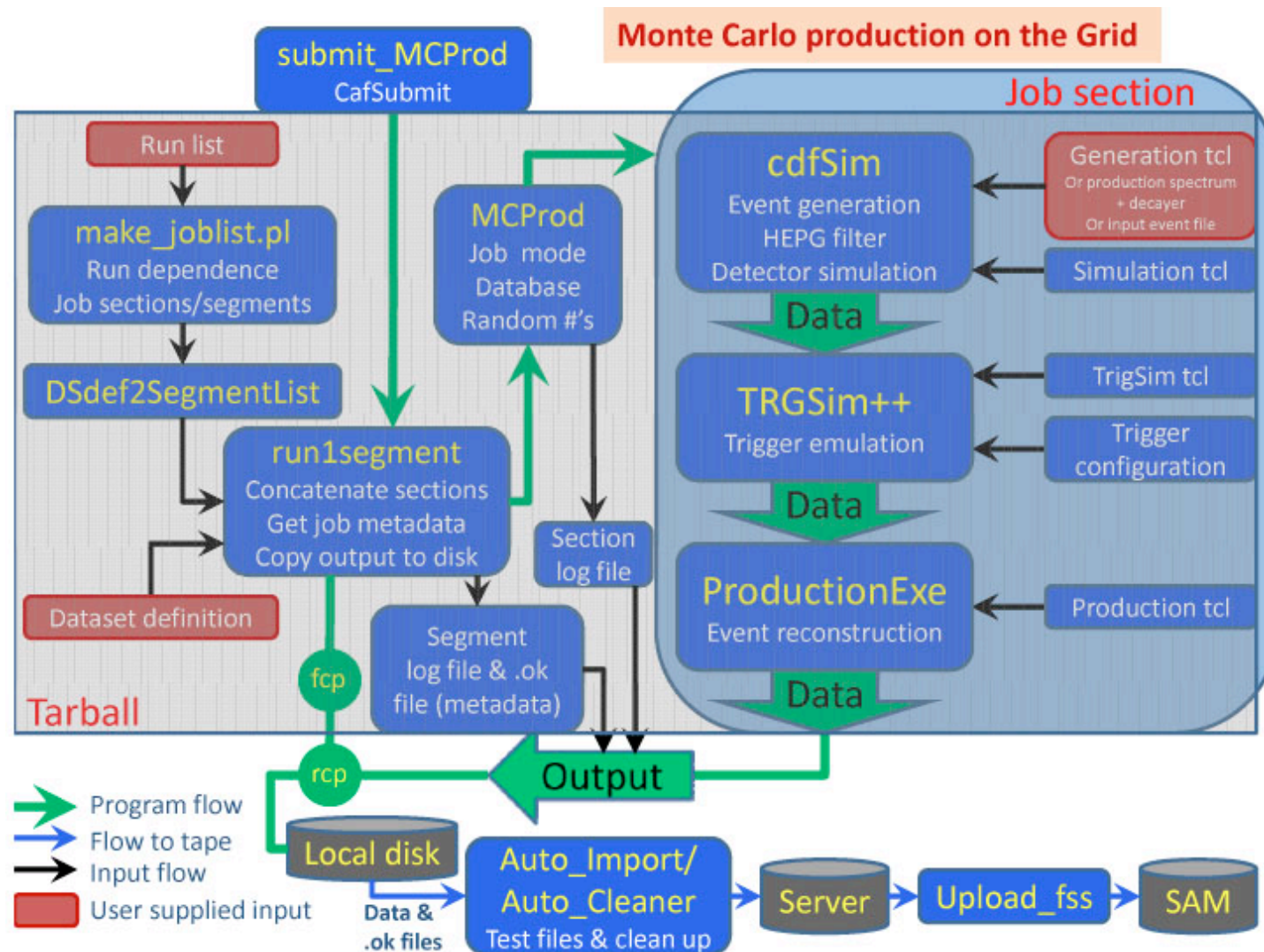# Evolution of signal Vs. backgound with the applied L_xy cut value (period 0-26)
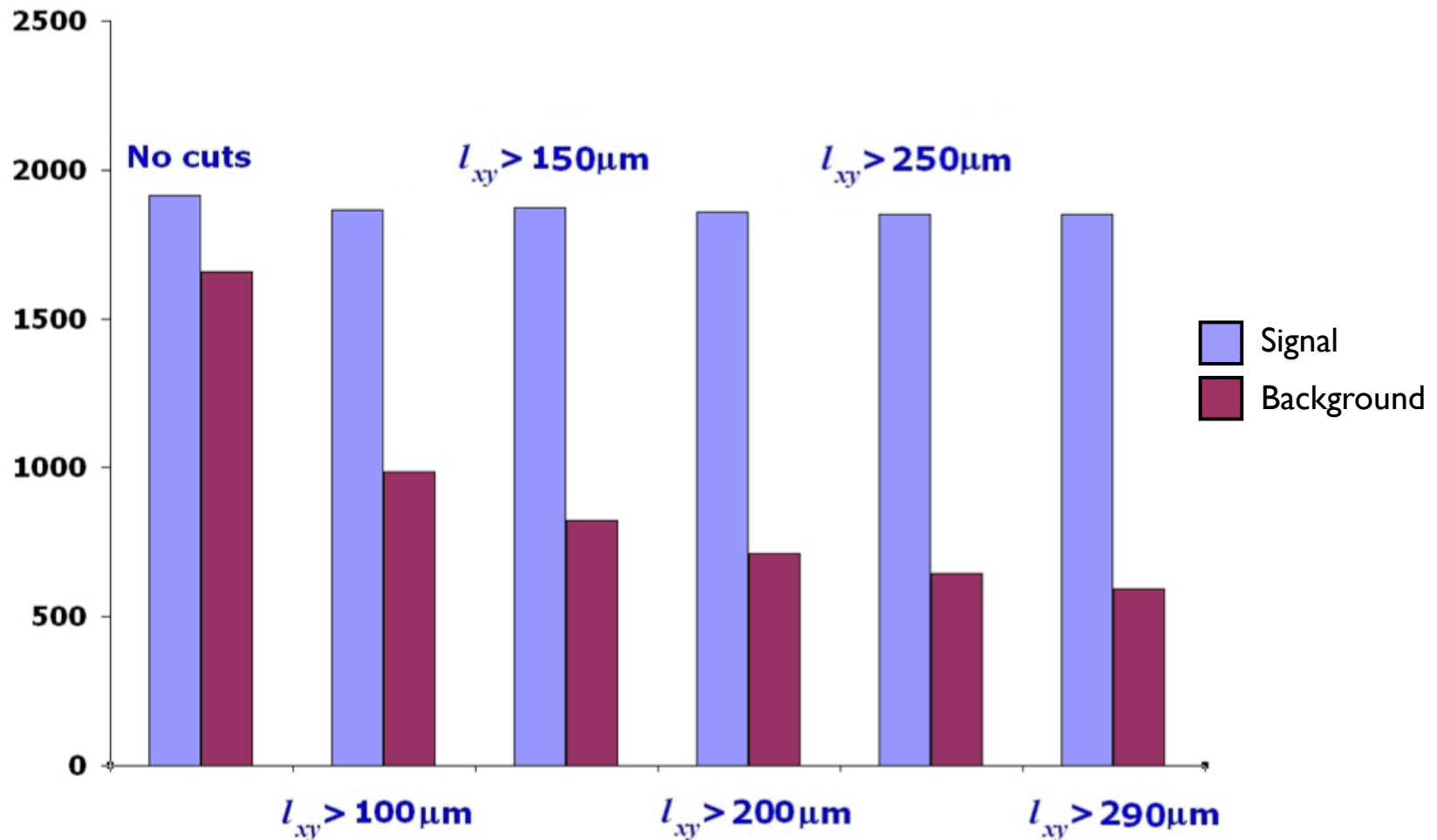
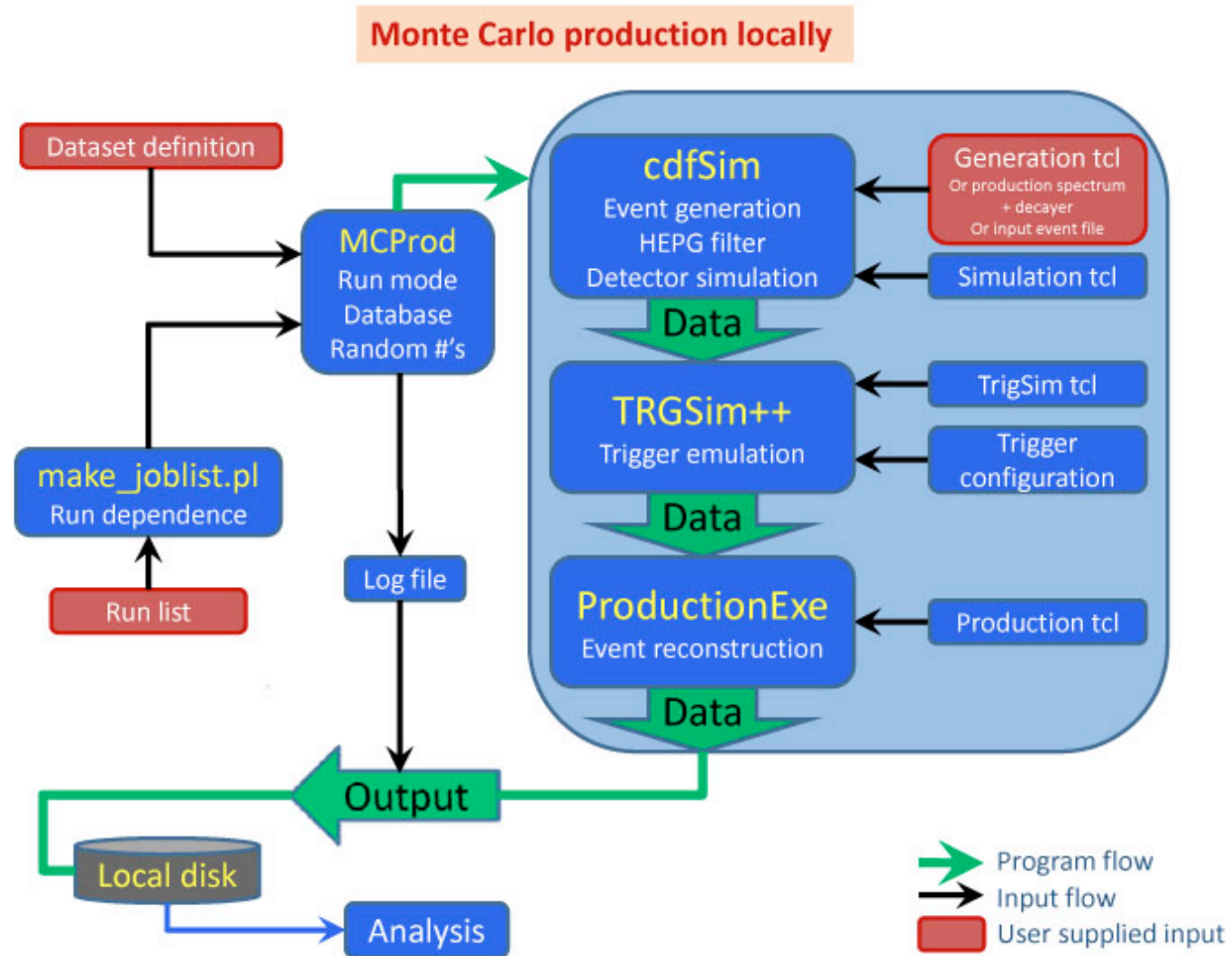# Mass Spectrum of the J/ψ for similar cuts on L_xy in the TTT data sample (period 0-26)

Mass Spectrum of the φ for similar cuts on L_xy in the TTT data sample (period 0-26)

Monte Carlo production on the Grid

Monte Carlo production on the local

Monte Carlo production locally

Results

The TTT provides as a signal (±3σ) a total of 1914 events (excluding overlaps) over a background (±3σ) of 1690 events, over the full period 0 to 26.

In the same run period we are left with a total of 5932 events from the dimuons.

This meaning that the TTT data are bringing 32.2 % more events to the analysis.