Status of ALICE activities within FKPPL LIA

Development of the online monitoring software for the ALICE Muon Trigger

And

Suppression Study for Υ

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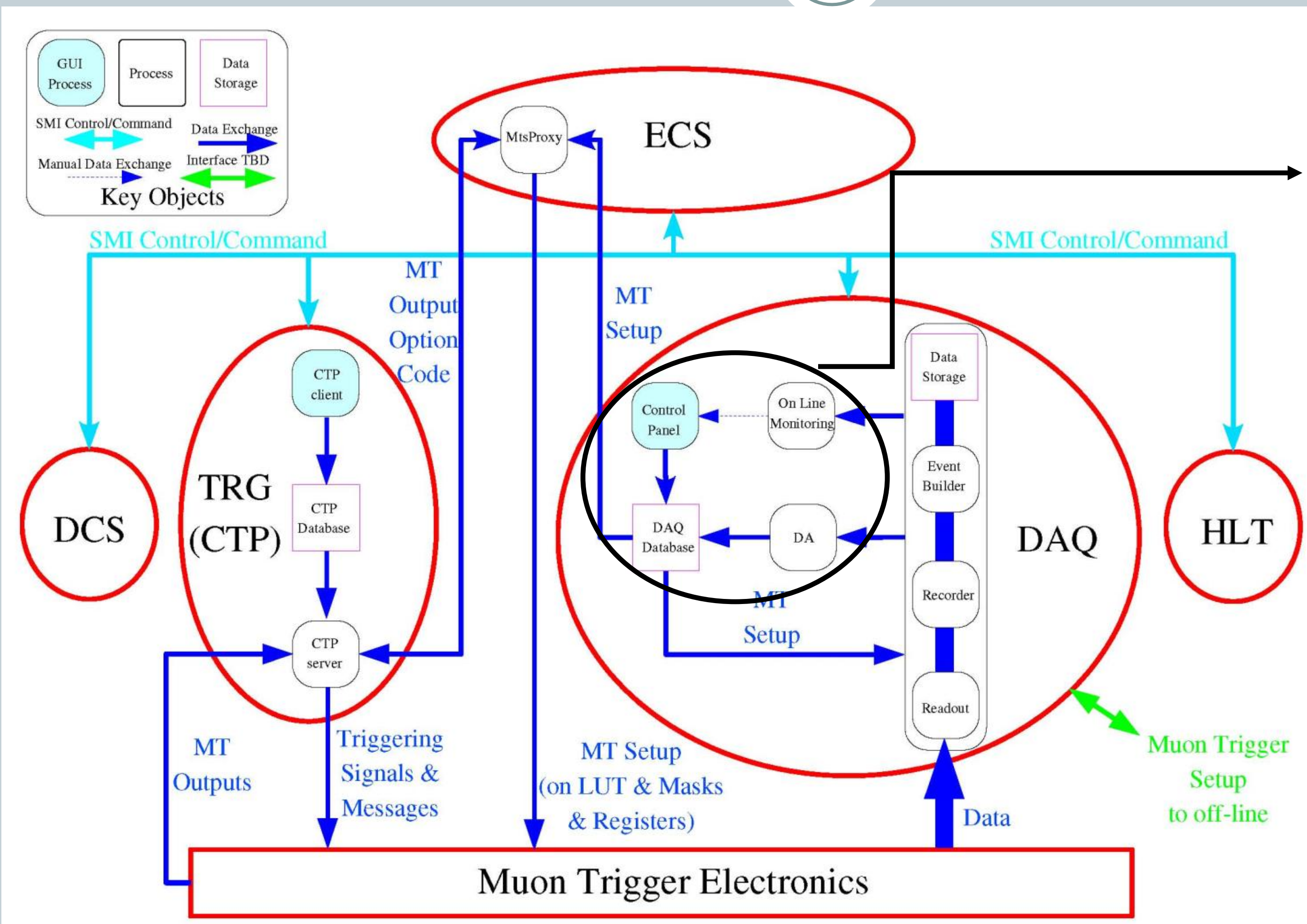
Outline

- Online monitoring & its purpose
- General Online Architecture
- Development of the online monitoring software
- Summary (1)
- Suppression Study for Υ
- Summary (2) & Plans

Online monitoring and its purpose

- Monitors quality of data
- Provide checks for the shifter so that data quality problems can be fixed in an early stage
- Especially important in the beginning of an experiment for efficiently and quickly solving runtime problems

General Online Architecture



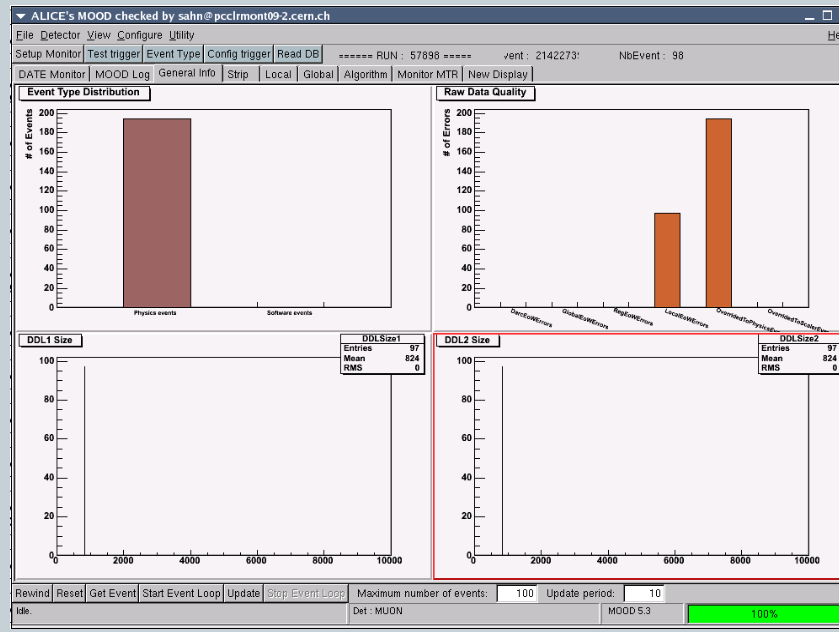
- DA
- CP
- Monitoring

Development of the online monitoring software

- On the MOOD framework
  - MOOD : Monitor Of Online Data of ALICE
  - Interactive Data Quality Monitoring framework
- Separated into two parts for experts and shifters
  - Development of the expert version has been done by Valerie Barret(LPC)
- Contribution to the development of the shifter version
- Purpose of the shifter version
  - To make the online monitoring more efficient by reducing the loading time of modules of the expert version and providing easy-to-understand information to shifters

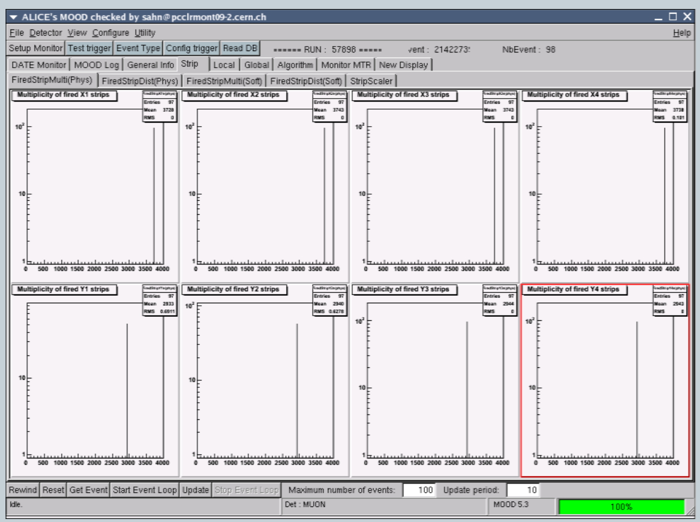
Development of the online monitoring software

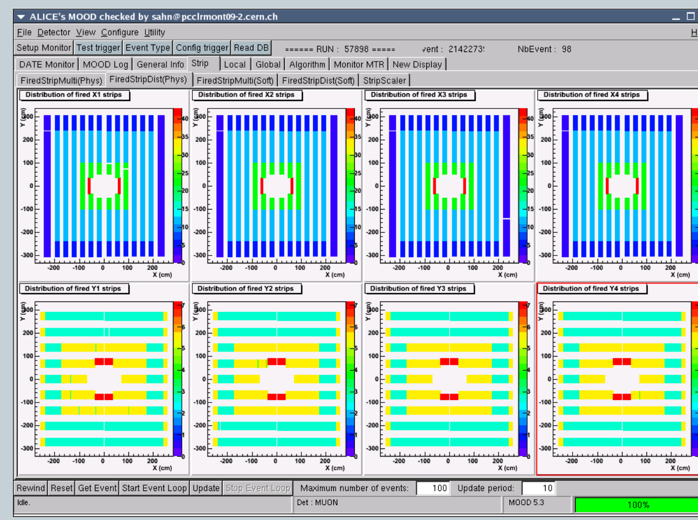
- Scheme of the shifter version
  - General Information
    - Event Type
      - Physics event
      - Software(Calibration) event
    - Raw Data Quality
    - Detector Data Link(DDL) Size



Development of the online monitoring software

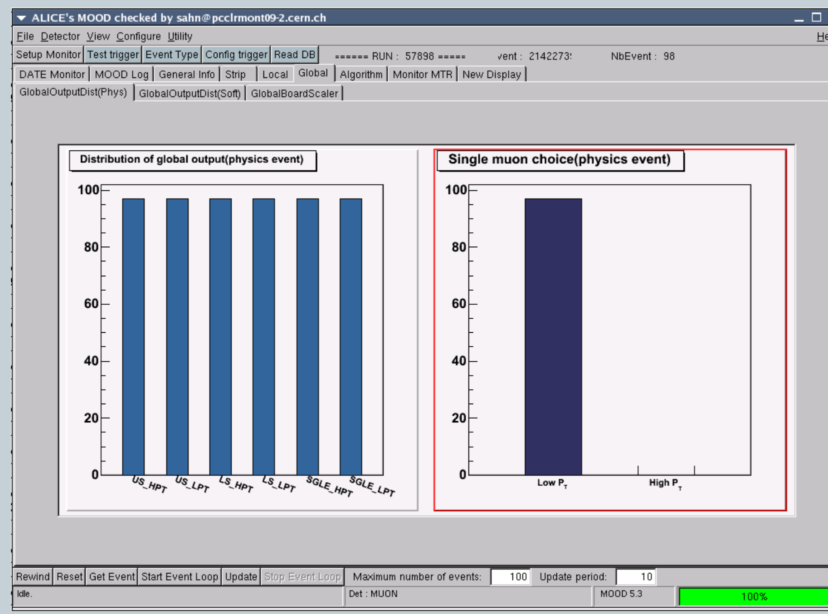
- Scheme of the shifter version
  - Strip Level Information
    - Fired strip multiplicity & distribution
      - Immigrated from the expert version
    - Strip scaler distribution
      - Software event only





Development of the online monitoring software

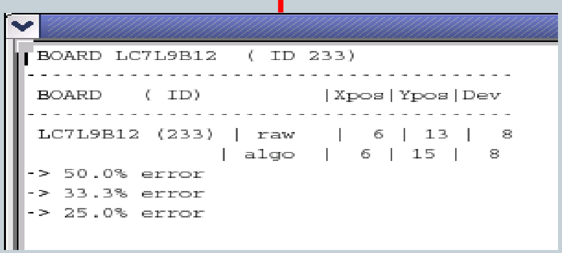
- Scheme of the shifter version
  - Global Trigger Board Information
    - Global trigger output
      - Unlike-Sign di-muon High P_T
      - Unlike-Sign di-muon Low P_T
      - Like-Sign di-muon High P_T
      - Like-Sign di-muon Low P_T
      - Single muon High P_T
      - Single muon Low P_T
      - Single Choice Low/High P_T

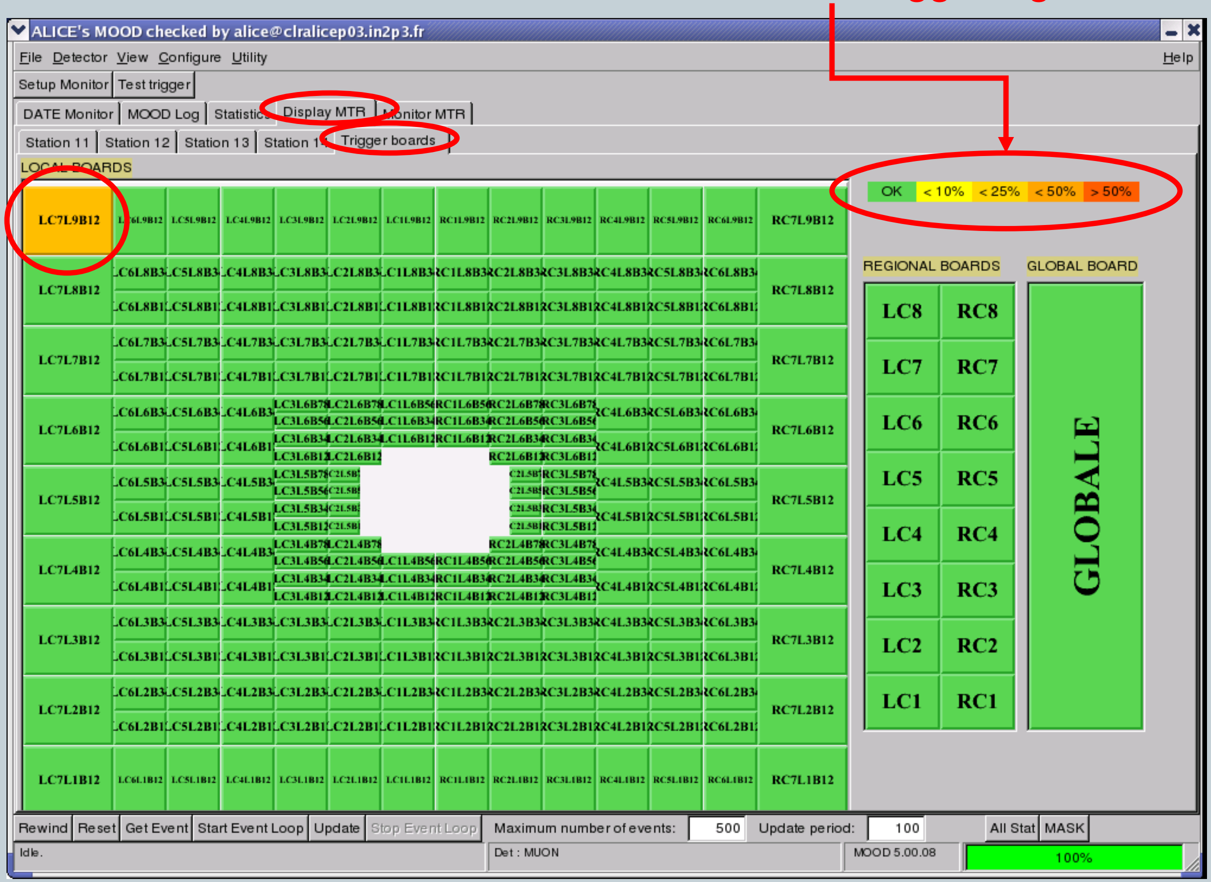


Development of the online monitoring software

Checking Trigger Board Algorithms (expert version)

% of errors of Muon Trigger algorithm





Summary (1)

- Summary (1)
  - The purpose of the online monitoring is to monitor data quality through the information provided by the online monitoring software
  - Development of the online monitoring software is separated into the expert version and the shifter version
  - The aim of the shifter version is to make the online monitoring more efficient
  - A few parts of modules of the shifter version are now in development

Suppression Study for Υ

PHYSICS MOTIVATION
AND
PERFORMANCES
FOR HEAVY QUARKONIA MEASUREMENT
OF
ALICE MUON SPECTROMETER

Suppression Study for Υ

- Heavy quarkonium suppression was supposed to be an ideal test of the deconfinement phase transition, Quark-Gluon Plasma (QGP)
  - *T. Matsui, H. Satz, Phys. Lett. B 178 (1986) 416*

- Due to color screening effects, a $q\bar{q}$ pair cannot form a bound state in the QGP with T > T_D (screening temperature)
  - Leads to the suppression of heavy quarkonia yield

- A strong motivation for experimental studies of quarkonia production which have been (and are being) carried out both at CERN SPS and RHIC energies

- In fact, since the Υ(1S) dissolves only significantly above the critical temperature T_C (3 or $4T_C$, T_C = 190 MeV), at a value which should not be reached at RHIC($\sqrt{s}_{NN}$ = 200 GeV, upper limit of $T^{RHIC} \leq 2T_C \approx 400$ MeV), the spectroscopy of the Υ family at LHC energies($\sqrt{s}_{NN}$ = 5.5 TeV, $T^{LHC} \geq$ 600 MeV) should reveal an unique set of information on the characteristics of the QGP

Suppression Study for Υ

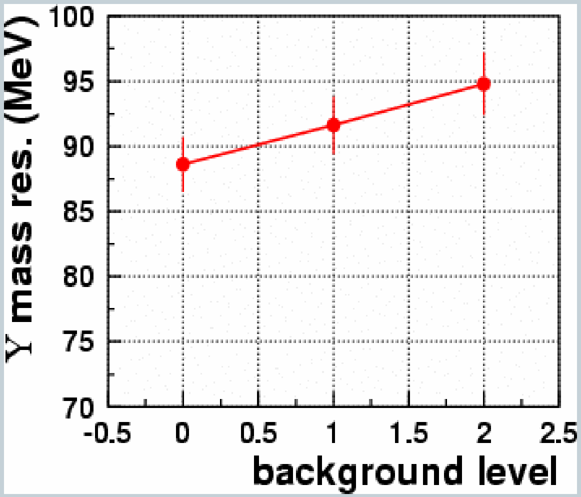
- Heavy quarkonia will be detected in ALICE both in the dielectron (in the central barrel) and in the dimuon channel (in the forward region)
  - The key detectors for this study are the Transition Radiation Detector (TRD) and the Forward Muon Spectrometer

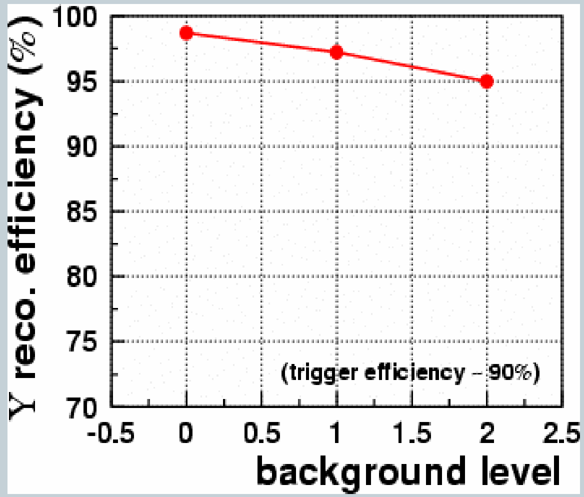
※ Acceptance coverage for dileptons in the ALICE experiment. The x ranges are given for Pb-Pb at $\sqrt{s}$ = 5.5 TeV per nucleon pair

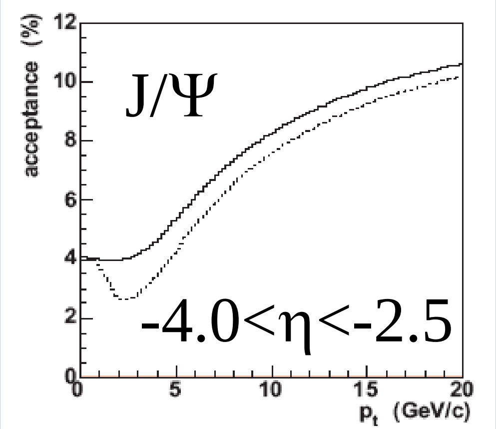
	State	y range	x range	min. p_t (triggerable)	Prompt vs. sec. J/ψ
Electron	J/ψ	$-0.9 \leqslant y \leqslant 0.9$	$2.3\times10^{-4} \leqslant x_{1,2} \leqslant 1.4\times10^{-3}$	5 GeV/c	Yes
	Υ	$-0.9 \leqslant y \leqslant 0.9$	$7.0\times10^{-4} \leqslant x_{1,2} \leqslant 4.2\times10^{-3}$	0	
Muon	J/ψ	$2.5 \leqslant y < 4.0$	$7.0\times10^{-3} \leqslant x_1 \leqslant 3.1\times10^{-2}$ $1.0\times10^{-5} \leqslant x_2 \leqslant 4.6\times10^{-5}$	0	No
	Υ	$2.5 \leqslant y < 4.0$	$2.1\times10^{-2} \leqslant x_1 \leqslant 9.3\times10^{-2}$ $3.1\times10^{-5} \leqslant x_2 \leqslant 1.4\times10^{-4}$	0	

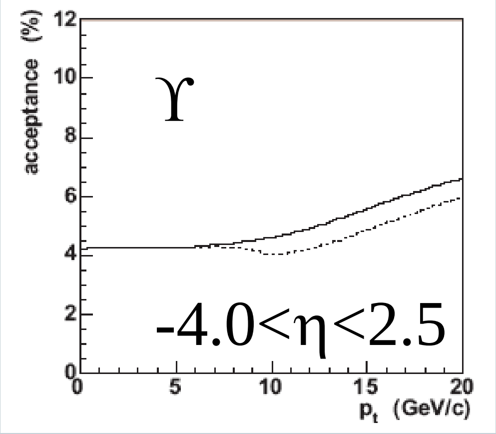
Suppression Study for ϒ

ALICE Muon Spectrometer Performances for heavy quarkonia measurement









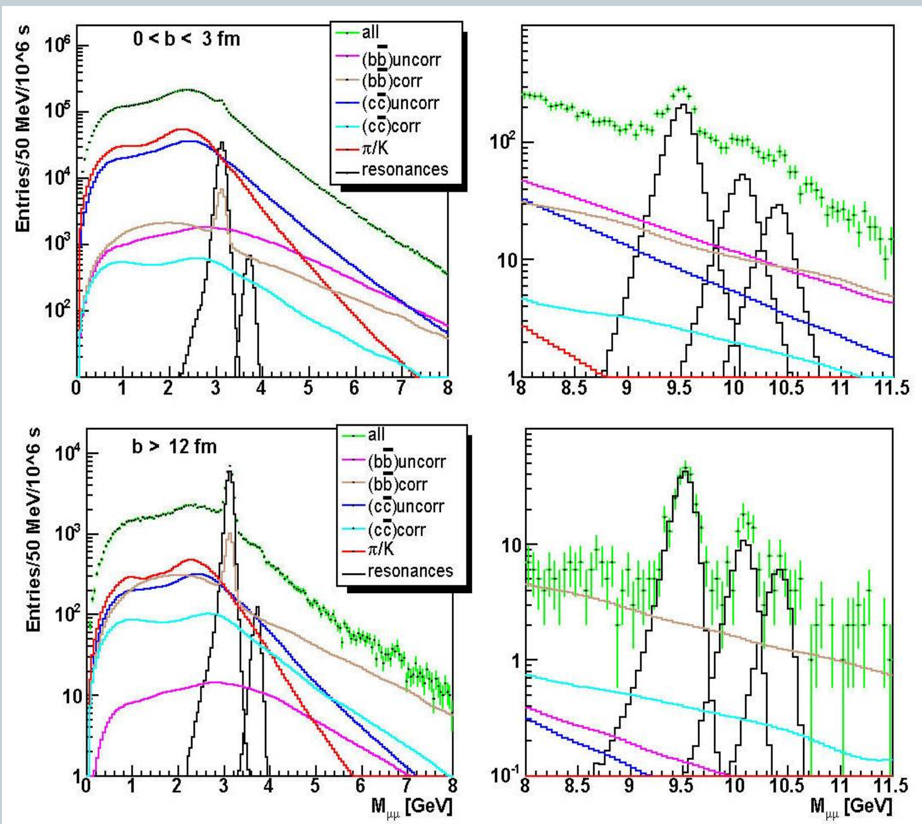
※ background level 1 = 2 Pb-Pb HIJING events with $dN_{ch}/d\eta$ = 6000 @ η = 0 each

- ϒ mass resolution ~ 92 MeV
- ϒ reconstruction efficiency ~ 97%
- J/ψ & ϒ acceptance down to P_t = 0 (unique @ LHC)
- acceptance/4π : J/ψ ~4.6%, ϒ~4.2%

Suppression Study for Υ

ALICE Muon Spectrometer Performances for heavy quarkonia measurement

- Unlike sign dimuon mass spectra (Pb-Pb ~ 10^6s, L = 5 x 10^{26} $cm^{-2}s^{-1}$)



with p_t^{cut} > 1GeV/c
no nuclear effects

b<3 fm
Correlated and uncorrelated $b\bar{b}$ are dominant @ M_{Υ}

b>12 fm
Correlated $b\bar{b}$ is dominant @ M_{Υ}

Summary (2) & Plans

- Summary (2)
  - Heavy quarkonium suppression was supposed to be an ideal test of the deconfinement phase transition, QGP
  - Within the LHC energy and the acceptances of ALICE Muon Spectrometer, Υ(1S) suppression study via dimuon channel will be possible, in the p-p and Pb-Pb, and should reveal an unique set of information on the characteristics of the QGP
- Next plans
  - Converting MOOD-Based monitoring software into AMORE
  - Starting "Cotutelle" program between Blaise Pascal Univ.(Clermont-Ferrand) and Konkuk Univ.(Seoul) within FKPPL LIA
  - Study for Υ in p-p collision first

BACKUP

- Scheme of the shifter version

  - To be done
    - Local Trigger Board Information
      - Multiplicity of local trigger board delivering trigger
      - Distribution of local trigger board delivering trigger
    - Global Trigger Board Information
      - Global Trigger Board Scaler
    - Checking Trigger Board Algorithms

Quarkonium yields vs centrality

with p_t^{cut} > 1GeV/c
no nuclear effects

Significance is good almost ever ywhere and is higher for the med ium centralities

Good statistics, except for ϒ **(3S)**

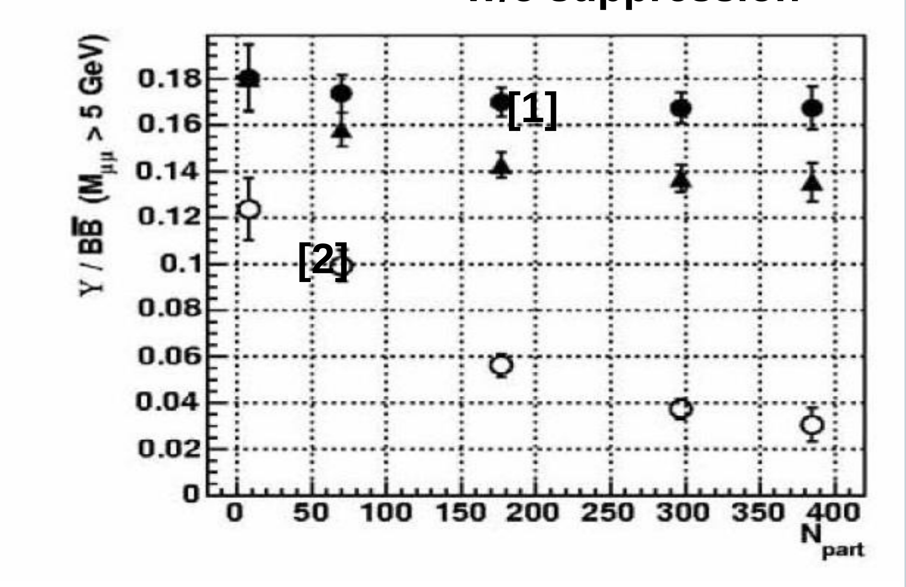
ϒ family separation

	b (fm)	0-3	3-6	6-9	9-12	12-16
	ε (GeV/fm³)	32	30	28	16	5
J/ψ	S (×10³)	133	235	198	95	22
	S/B	0.20	0.27	0.48	1.08	3.13
	S/√S+B	148	224	254	222	128
ψ'	S (×10³)	3.7	6.5	5.5	2.6	0.6
	S/B	0.01	0.02	0.03	0.06	0.17
	S/√S+B	6.7	10.4	12.6	12.4	9.3
ϒ (1S)	S (×10³)	1.35	2.38	1.99	0.93	0.20
	S/B	1.66	2.35	3.60	6.06	9.12
	S/√S+B	29.0	40.9	39.5	28.3	13.6
ϒ(2S)	S (×10³)	0.36	0.63	0.53	0.25	0.05
	S/B	0.65	0.92	1.36	2.25	3.46
	S/√S+B	11.8	17.3	17.3	13.0	6.4
ϒ (3S)	S (×10³)	0.20	0.36	0.30	0.14	0.03
	S/B	0.48	0.64	0.99	1.57	2.22
	S/√S+B	8.1	11.8	12.2	9.2	4.6

Suppression studies for ϒ (1S)

Due to color screening effects, a $Q\bar{Q}$ pair cannot form a bound state in QGP with $T > T_D$ (screening temperature). T_D can be calculated for different quarkonia states in lattice QCD and potential models.

w/o suppression



Good sensitivity: the 2 scenarii can be distinguished

Assumptions

- ✓ no nuclear absorption of ϒ (1S)
- ✓ no energy loss of b quarks
- ✓ suppression : 2 extreme scenarii (T_C=270 MeV [1] and T_C=190 MeV [2])

	ϒ(1S)
τ_F (fm) (formation)	0.76
T_D/T_C, D=dissociation C=critical	4
T_D/T_C	2.9

W.M. Alberico et al, hep-ph/0507084
C.Y. Wong, hep-ph/0606200