

# Status of ALICE activities within FKPPL LIA

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Development of the online monitoring  
software for the ALICE Muon Trigger  
And  
Suppression Study for Y

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UNIVERSITY





# Outline



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Online monitoring & its purpose

General Online Architecture

Development of the online monitoring software

Summary (1)

Suppression Study for Y

Summary (2) & Plans

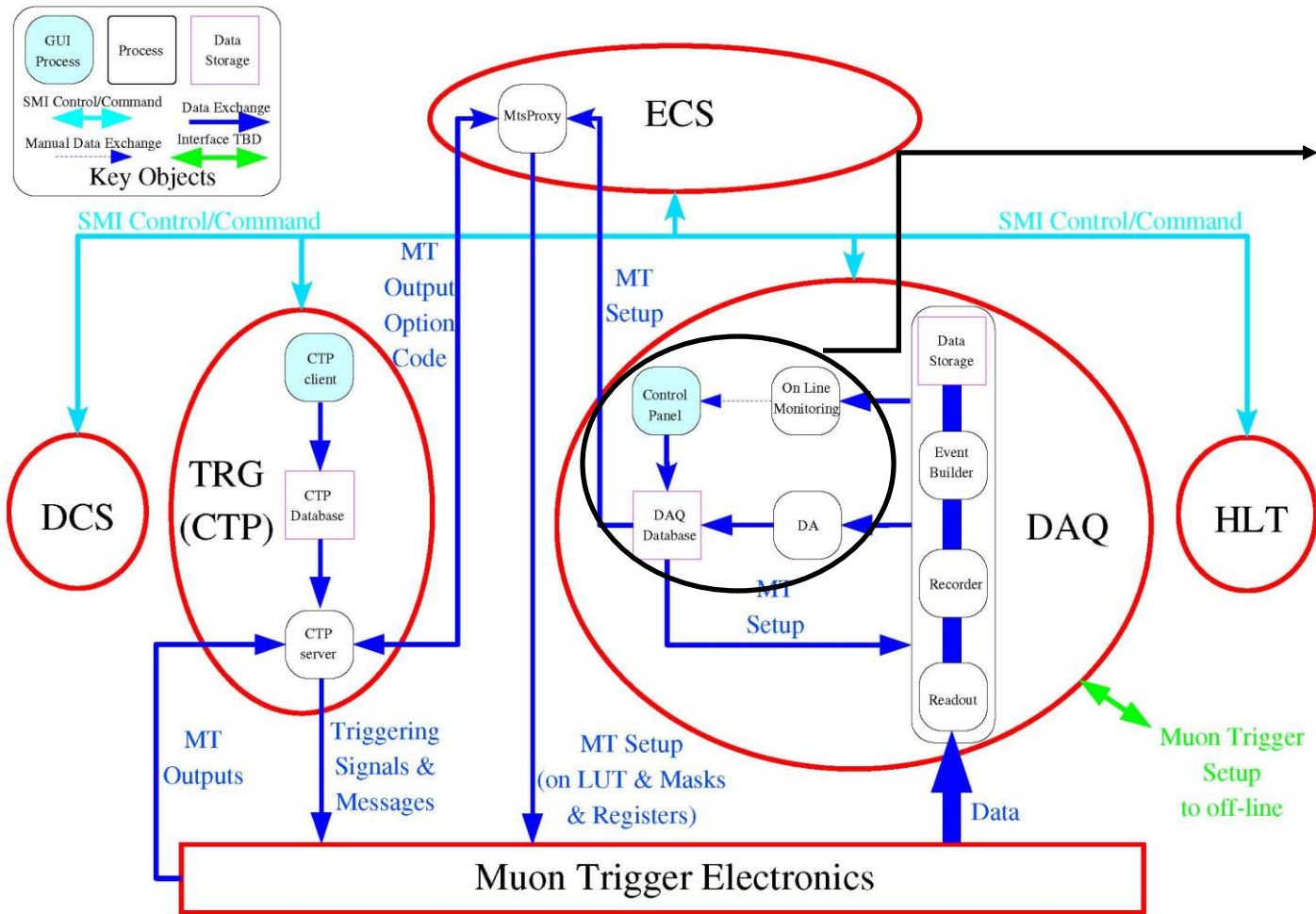


# Online monitoring and its purpose



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- 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



- DA
- CP
- Monitoring



# Development of the online monitoring software



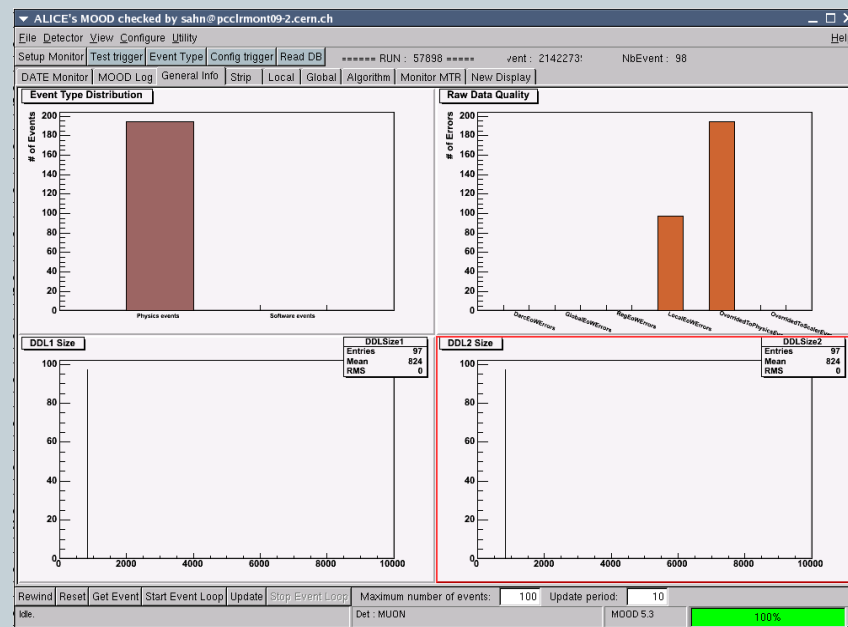
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- **On the MOOD framework**
  - MOOD : Monitor Of Online Data of ALICE
  - Interactive Data Quality Monitoring framework
- **Separated into two parts for experts and shifters**
  - Development of the expert version has been done by Valerie Barret(LPC)
- **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

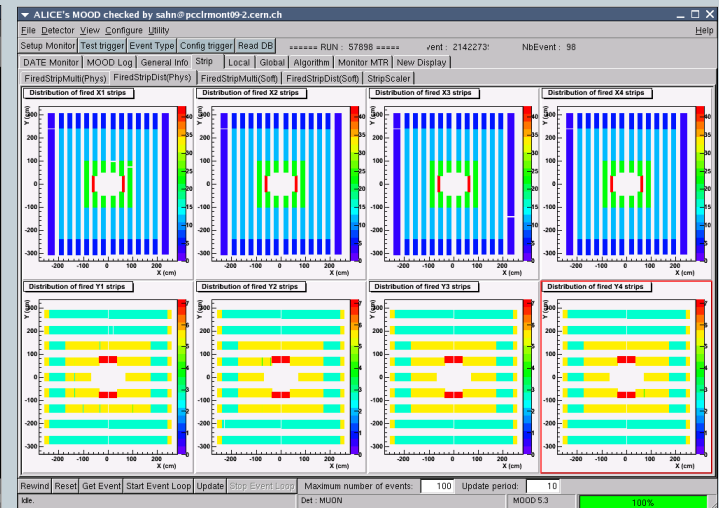
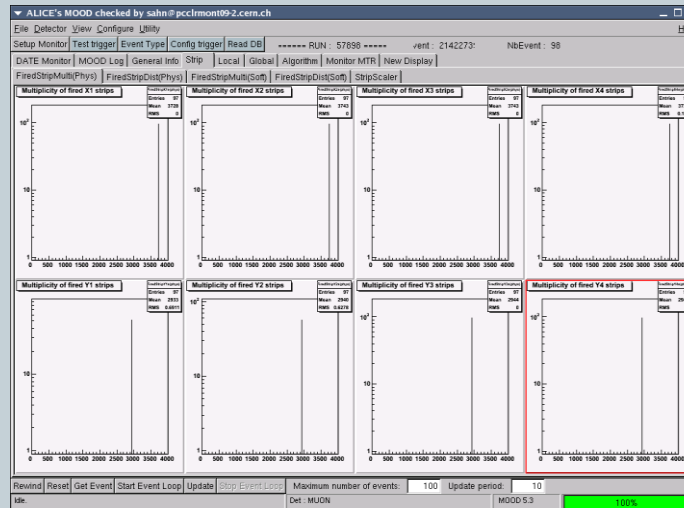
- Scheme of the shifter version

- General Information

- ✦ Event Type
  - Physics event
  - Software(Calibration) event
- ✦ Raw Data Quality
- ✦ Detector Data Link(DDL) Size



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

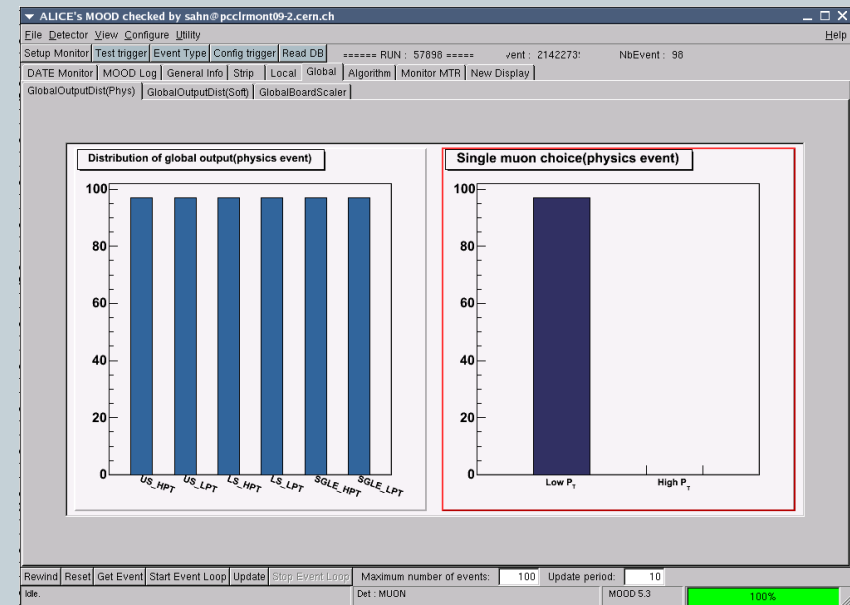


- Scheme of the shifter version

- Global Trigger Board Information

- ✦ Global trigger output

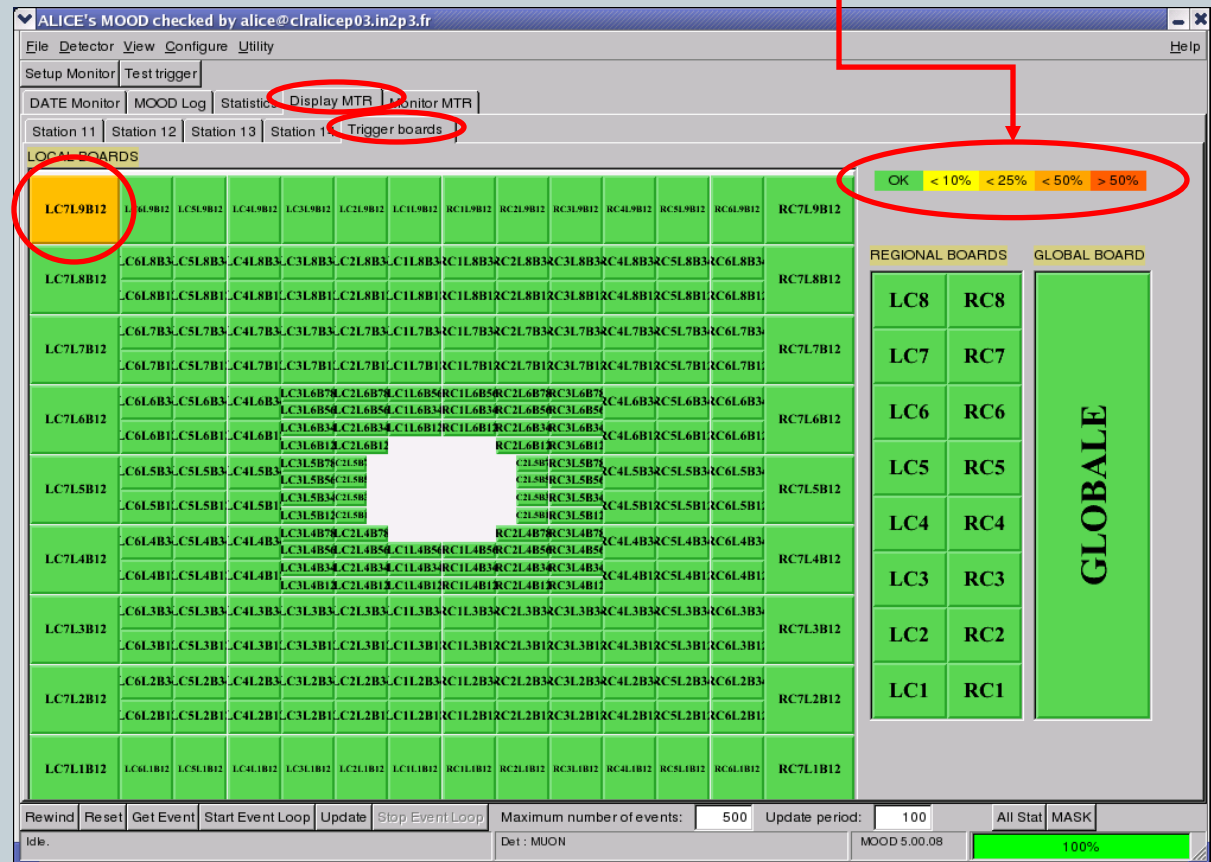
- Unlike-Sign di-muon High  $P_T$
    - Unlike-Sign di-muon Low  $P_T$
    - Like-Sign di-muon High  $P_T$
    - Like-Sign di-muon Low  $P_T$
    - Single muon High  $P_T$
    - Single muon Low  $P_T$
    - Single Choice Low/High  $P_T$





## Checking Trigger Board Algorithms (expert version)

% of errors of Muon Trigger algorithm



ALICE's MOOD checked by alice@clralicep03.in2p3.fr

File Detector View Configure Utility

Setup Monitor Test trigger

DATE Monitor MOOD Log Statistics Display MTR Monitor MTR

Station 11 Station 12 Station 13 Station 14 Trigger boards

LOCAL BOARDS

LC7L9B12	LC6L9B12	LC5L9B12	LC4L9B12	LC3L9B12	LC2L9B12	LC1L9B12	RC1L9B12	RC2L9B12	RC3L9B12	RC4L9B12	RC5L9B12	RC6L9B12	RC7L9B12
LC7L8B12	LC6L8B12	LC5L8B12	LC4L8B12	LC3L8B12	LC2L8B12	LC1L8B12	RC1L8B12	RC2L8B12	RC3L8B12	RC4L8B12	RC5L8B12	RC6L8B12	RC7L8B12
LC7L7B12	LC6L7B12	LC5L7B12	LC4L7B12	LC3L7B12	LC2L7B12	LC1L7B12	RC1L7B12	RC2L7B12	RC3L7B12	RC4L7B12	RC5L7B12	RC6L7B12	RC7L7B12
LC7L6B12	LC6L6B12	LC5L6B12	LC4L6B12	LC3L6B12	LC2L6B12	LC1L6B12	RC1L6B12	RC2L6B12	RC3L6B12	RC4L6B12	RC5L6B12	RC6L6B12	RC7L6B12
LC7L5B12	LC6L5B12	LC5L5B12	LC4L5B12	LC3L5B12	LC2L5B12	LC1L5B12	RC1L5B12	RC2L5B12	RC3L5B12	RC4L5B12	RC5L5B12	RC6L5B12	RC7L5B12
LC7L4B12	LC6L4B12	LC5L4B12	LC4L4B12	LC3L4B12	LC2L4B12	LC1L4B12	RC1L4B12	RC2L4B12	RC3L4B12	RC4L4B12	RC5L4B12	RC6L4B12	RC7L4B12
LC7L3B12	LC6L3B12	LC5L3B12	LC4L3B12	LC3L3B12	LC2L3B12	LC1L3B12	RC1L3B12	RC2L3B12	RC3L3B12	RC4L3B12	RC5L3B12	RC6L3B12	RC7L3B12
LC7L2B12	LC6L2B12	LC5L2B12	LC4L2B12	LC3L2B12	LC2L2B12	LC1L2B12	RC1L2B12	RC2L2B12	RC3L2B12	RC4L2B12	RC5L2B12	RC6L2B12	RC7L2B12
LC7L1B12	LC6L1B12	LC5L1B12	LC4L1B12	LC3L1B12	LC2L1B12	LC1L1B12	RC1L1B12	RC2L1B12	RC3L1B12	RC4L1B12	RC5L1B12	RC6L1B12	RC7L1B12

REGIONAL BOARDS

LC8	RC8
LC7	RC7
LC6	RC6
LC5	RC5
LC4	RC4
LC3	RC3
LC2	RC2
LC1	RC1

GLOBAL BOARD

GB1

GB2

GB3

GB4

GB5

GB6

GB7

GB8

GB9

GB10

GB11

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GB100

BOARD LC7L9B12 ( ID 233)

```

BOARD ( ID) | Xpos | Ypos | Dev
-----
LC7L9B12 (233) | raw | 6 | 13 | 8
                | algo | 6 | 15 | 8
-> 50.0% error
-> 33.3% error
-> 25.0% error
    
```

Rewind | Reset | Get Event | Start Event Loop | Update | Stop Event Loop | Maximum number of events: 500 | Update period: 100 | All Stat | MASK

Idle. Det: MUON MOOD 5.00.08 100%



# Summary (1)



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- **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 $\Upsilon$

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

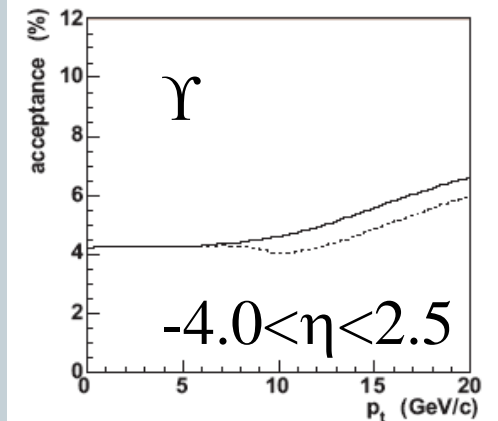
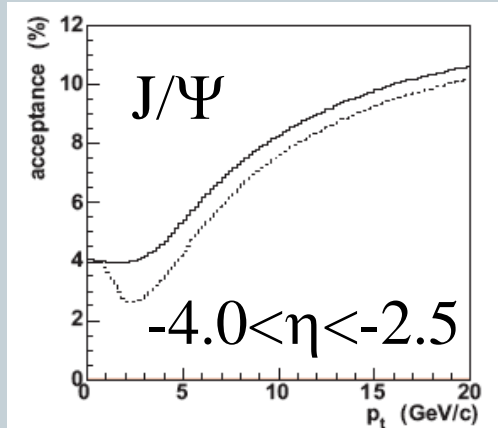
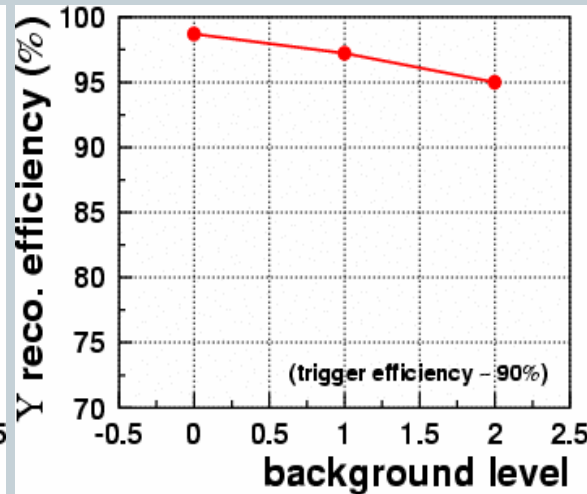
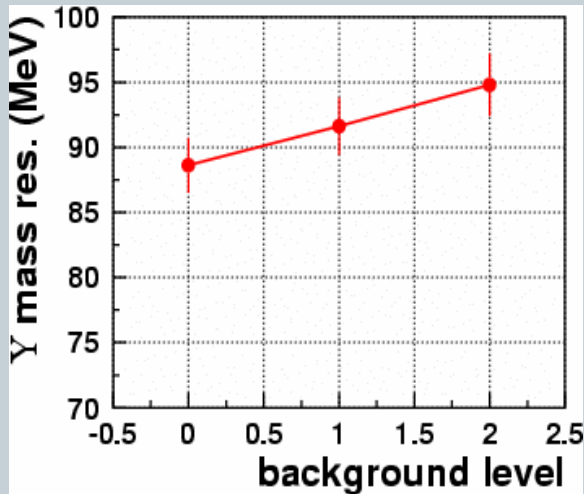
- Heavy quarkonium suppression was supposed to be an ideal test of the deconfinement phase transition, Quark-Gluon Plasma (QGP)
  - *T. Matsui, H. Satz, Phys. Lett. B 178 (1986) 416*
- Due to color screening effects, a  $q\bar{q}$  pair cannot form a bound state in the QGP with  $T > T_D$  (screening 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 Y(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  $T^{\text{RHIC}} \leq 2T_c \approx 400$  MeV), the spectroscopy of the Y family at LHC energies ( $\sqrt{s}_{NN} = 5.5$  TeV,  $T^{\text{LHC}} \geq 600$  MeV) should reveal an unique set of information on the characteristics of the QGP

- 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. $J/\psi$
Electron	$J/\psi$	$-0.9 \leq y \leq 0.9$	$2.3 \times 10^{-4} \leq x_{1,2} \leq 1.4 \times 10^{-3}$	5 GeV/ $c$	Yes
	$\Upsilon$	$-0.9 \leq y \leq 0.9$	$7.0 \times 10^{-4} \leq x_{1,2} \leq 4.2 \times 10^{-3}$	0	
Muon	$J/\psi$	$2.5 \leq y < 4.0$	$7.0 \times 10^{-3} \leq x_1 \leq 3.1 \times 10^{-2}$ $1.0 \times 10^{-5} \leq x_2 \leq 4.6 \times 10^{-5}$	0	No
	$\Upsilon$	$2.5 \leq y < 4.0$	$2.1 \times 10^{-2} \leq x_1 \leq 9.3 \times 10^{-2}$ $3.1 \times 10^{-5} \leq x_2 \leq 1.4 \times 10^{-4}$	0	

## ALICE Muon Spectrometer Performances for heavy quarkonia measurement

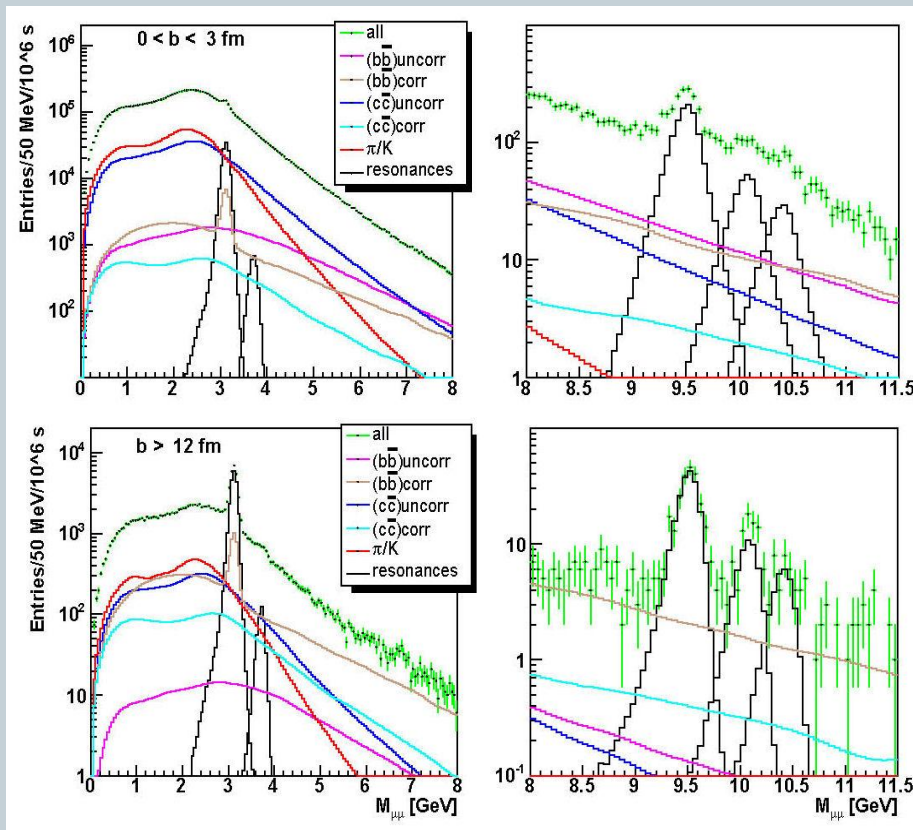


※ background level 1 = 2 Pb-Pb HIJING events with  $dN_{ch}/d\eta = 6000$  @  $\eta = 0$  each

- $\Upsilon$  mass resolution  $\sim 92$  MeV
- $\Upsilon$  reconstruction efficiency  $\sim 97\%$
- J/ψ &  $\Upsilon$  acceptance down to  $P_t = 0$  (unique @ LHC)
- acceptance/ $4\pi$  : J/ψ  $\sim 4.6\%$ ,  $\Upsilon \sim 4.2\%$

## ALICE Muon Spectrometer Performances for heavy quarkonia measurement

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



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

**b < 3 fm**

Correlated and uncorrelated  
 $b\bar{b}$  are dominant @  $M_\Upsilon$

**b > 12 fm**

Correlated  $b\bar{b}$  is dominant  
@  $M_\Upsilon$





# Summary (2) & Plans



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- **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,  $Y(1S)$  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  $Y$  in p-p collision first



# BACKUP

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# Development of the online monitoring software



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- 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



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

**Significance** is good almost everywhere and is higher for the medium centralities

Good statistics, except for  $\Upsilon$  (3S)

$\Upsilon$  family separation

	b (fm)	0-3	3-6	6-9	9-12	12-16
	$\epsilon$ (GeV/fm <sup>3</sup> )	32	30	28	16	5
J/ $\psi$	S ( $\times 10^3$ )	133	235	198	95	22
	S/B	0.20	0.27	0.48	1.08	3.13
	S/ $\sqrt{S+B}$	148	224	254	222	128
$\psi'$	S ( $\times 10^3$ )	3.7	6.5	5.5	2.6	0.6
	S/B	0.01	0.02	0.03	0.06	0.17
	S/ $\sqrt{S+B}$	6.7	10.4	12.6	12.4	9.3
$\Upsilon$ (1S)	S ( $\times 10^3$ )	1.35	2.38	1.99	0.93	0.20
	S/B	1.66	2.35	3.60	6.06	9.12
	S/ $\sqrt{S+B}$	29.0	40.9	39.5	28.3	13.6
$\Upsilon$ (2S)	S ( $\times 10^3$ )	0.36	0.63	0.53	0.25	0.05
	S/B	0.65	0.92	1.36	2.25	3.46
	S/ $\sqrt{S+B}$	11.8	17.3	17.3	13.0	6.4
$\Upsilon$ (3S)	S ( $\times 10^3$ )	0.20	0.36	0.30	0.14	0.03
	S/B	0.48	0.64	0.99	1.57	2.22
	S/ $\sqrt{S+B}$	8.1	11.8	12.2	9.2	4.6

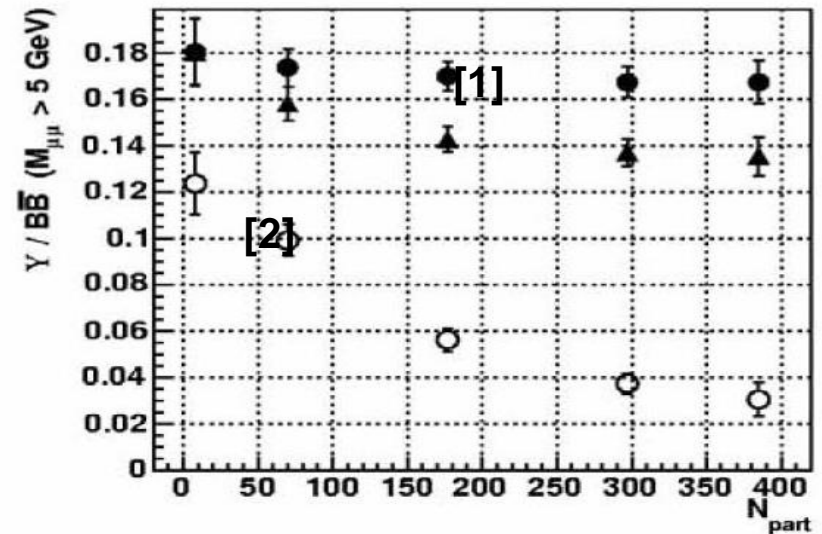
Due to color screening effects, a  $Q\bar{Q}$  pair cannot form a bound state in QGP with  $T > T_D$  (screening temperature).  $T_D$  can be calculated for different quarkonia states in lattice QCD and potential models.

## Assumptions

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

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

w/o suppression



Good sensitivity: the 2 scenarii can be distinguished

	$\Upsilon(1S)$
$\tau_F$ (fm) (formation)	0.76
$T_D/T_C$ , D=dissociation C=critical	4
$T_D/T_C$	2.9