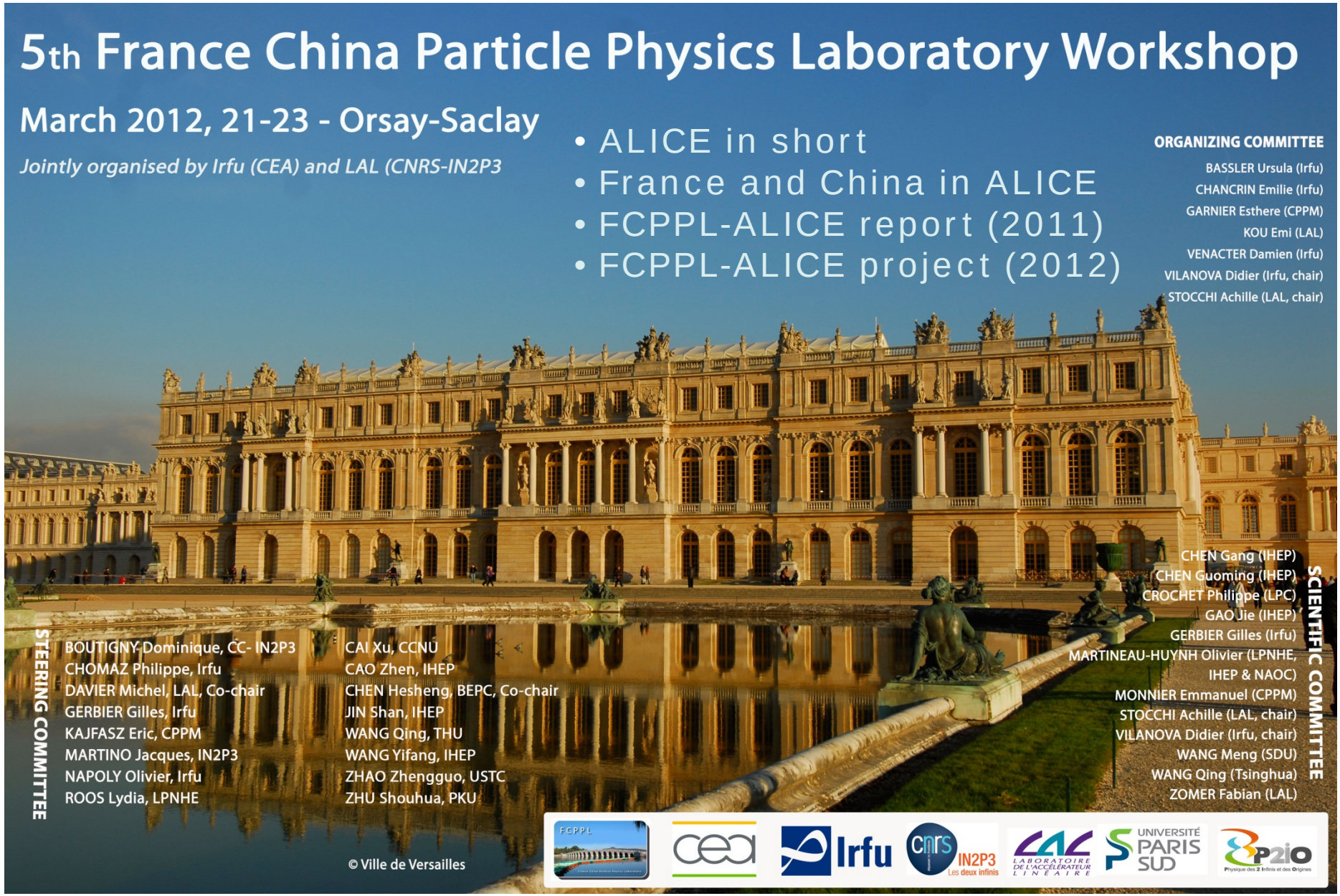
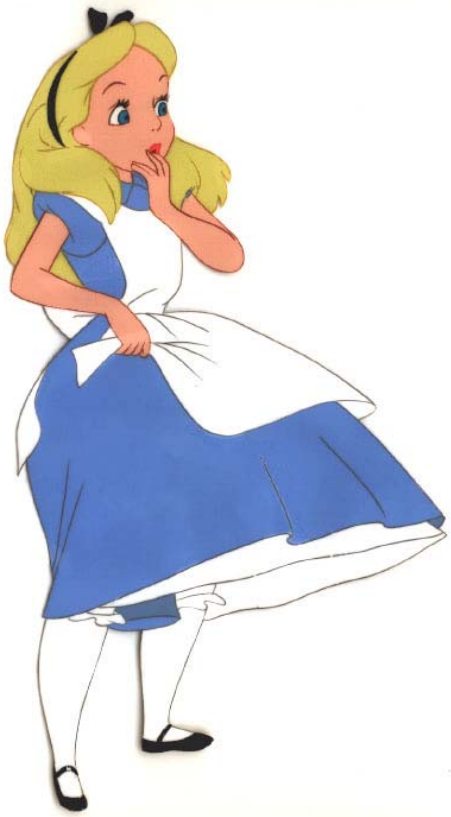
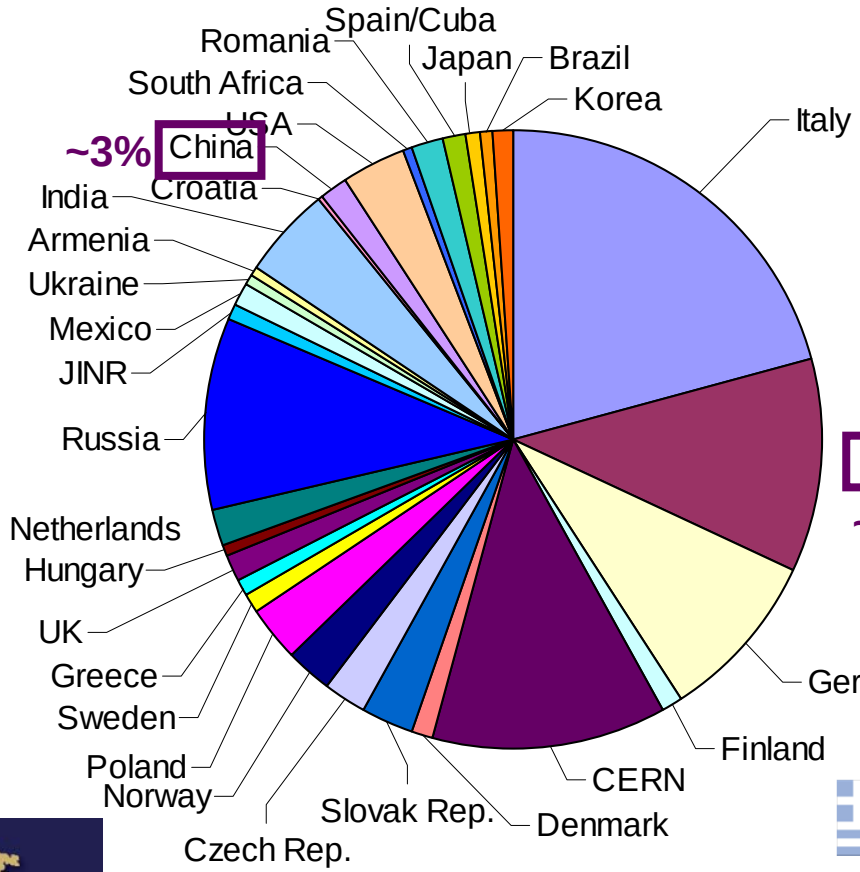
ALICE in FCPPL

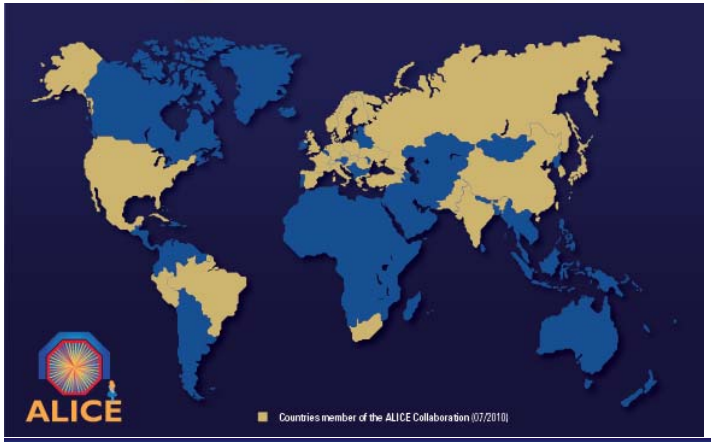


The ALICE collaboration

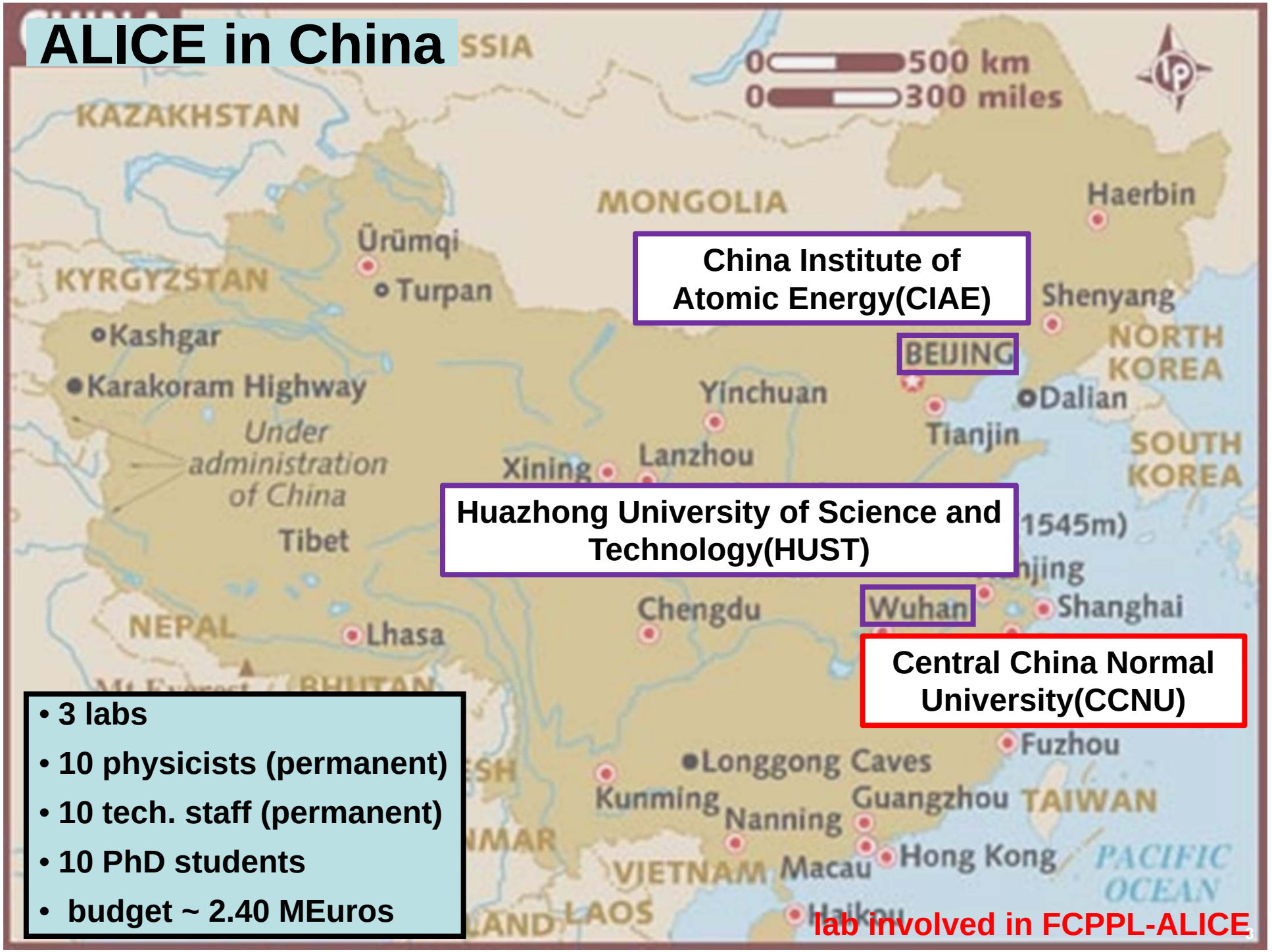




> 1300 members
120 institutes
35 countries



ALICE in China

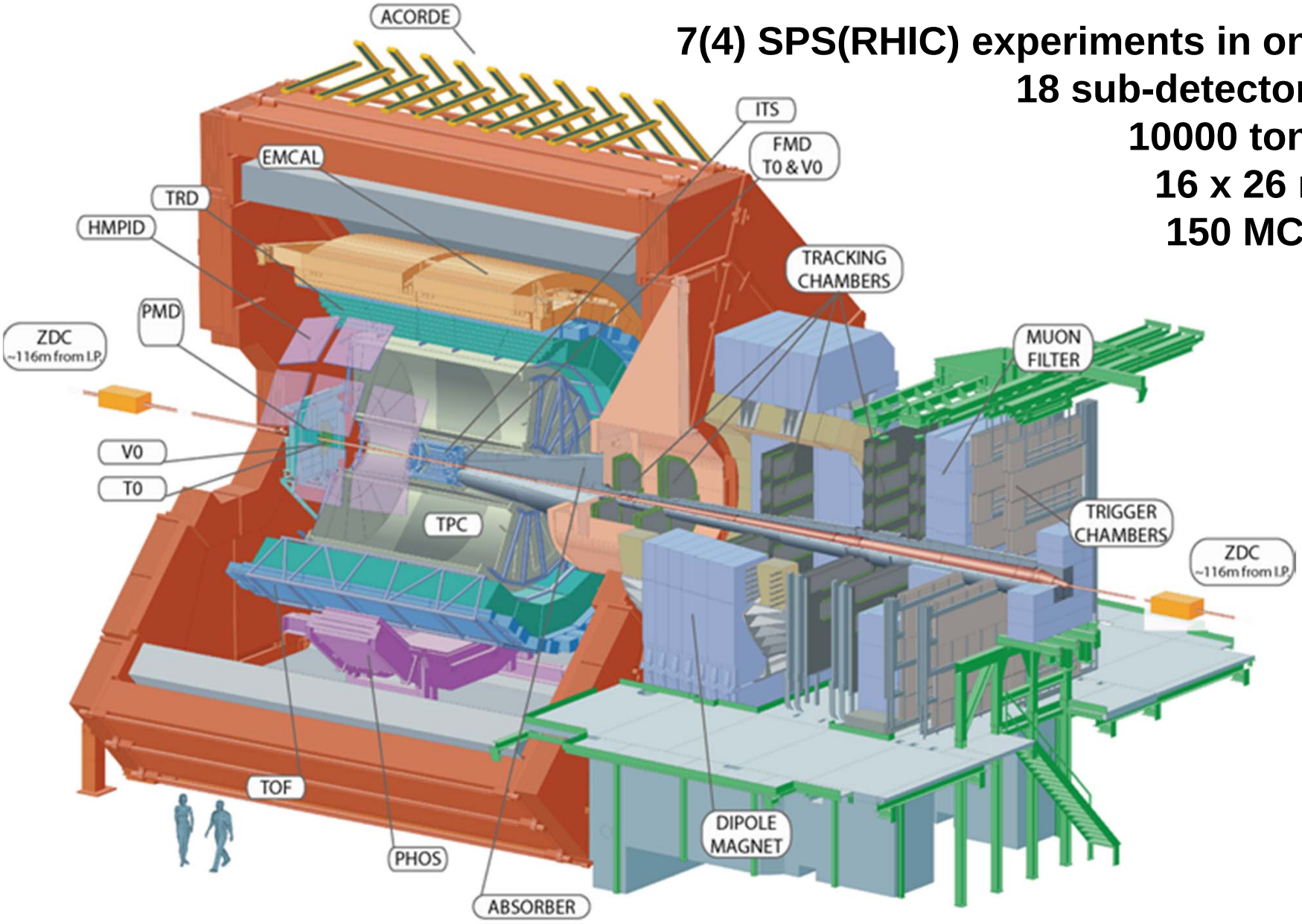


- 3 labs
- 10 physicists (permanent)
- 10 tech. staff (permanent)
- 10 PhD students
- budget ~ 2.40 MEuros

ALICE in France (alice-france.in2p3.fr)

ALICE (A Large Ion Colider Experiment)

7(4) SPS(RHIC) experiments in one
18 sub-detectors
10000 tons
16 x 26 m
150 MCH



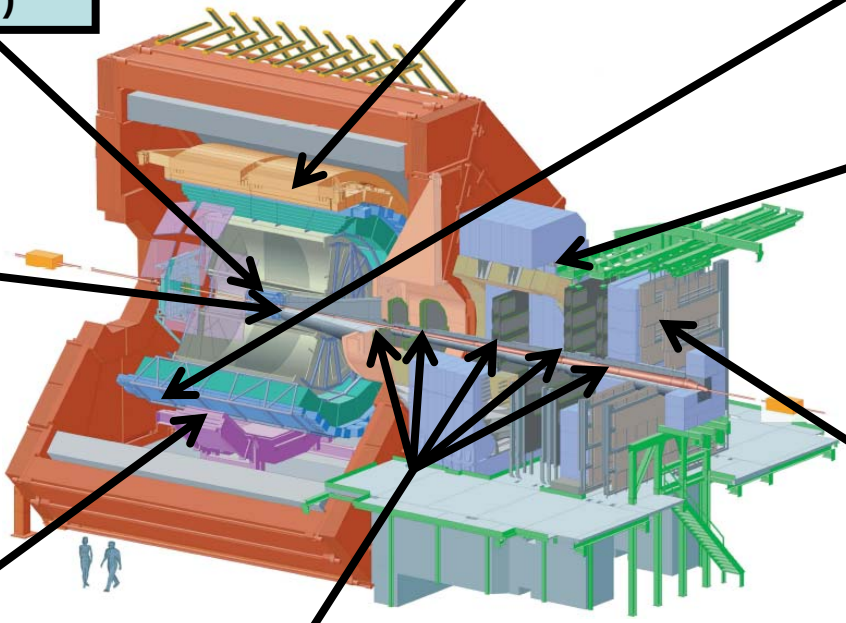
French & Chinese contributions in ALICE

ITS/SSD
SUBATECH, IPHC
(+ CERN, Italie, Poland, Russia, Ukrain, Holland, Finland)

EMCAL
SUBATECH, IPHC, LPSC
(+ USA, Italy)

DCAL
CCNU,IPHC,SUBATECH, LPSC, (+ USA, Italy, Japan)

V0
IPNL
(+ Mexico)



MUON-GMS
IPNL, LPSC
(+ Armenia)

MUON-trigger
LPC, SUBATECH
(+ Italy)

PHOS
CCNU, CIAE, HUST
(+ CERN, Czech Republic, Germany, Japan, Norway, Poland, Russia)

MUON-tracking
SUBATECH, IPNO, SACLAY
(+ Italy, India, Russia)

physics
- quarkonia & heavy flavours
- soft physics & strangeness
- jets & photons

offline, online, computing, management

ALICE published papers (23)

- Two-pion Bose-Einstein correlations

Phys. Rev. D 82 (2010) 052001; Phys. Lett. B 696 (2011) 328
Phys. Rev. D 84 (2011) 112004

- Charged particle multiplicity and spectra

Eur. Phys. J. C 65 (2010) 111; Eur. Phys. J. C 68 (2010) 89,
Eur. Phys. J. C 68 (2010) 345; Phys. Lett. B 693 (2010) 53,
Phys. Rev. Lett. 106 (2011) 032301; Phys. Rev. Lett. 105 (2010) 252301
Eur. Phys. J. C 71 (2011)1655; Phys. Lett. B 704 (2011) 442

- Charged particle suppression and flow

Phys. Lett. B 696 (2011) 30; Phys. Rev. Lett. 105 (2010) 252302
Phys. Rev. Lett. 107 (2011) 032301; Phys. Rev. Lett. 108 (2012) 092301

- Antiproton to proton ratio

Phys. Rev. Lett. 105 (2010) 072002

- Strange particle production

Eur. Phys. J. C 71 (2011) 1594

- Two particle correlations

Phys. Lett. B 708 (2012) 249;

- Heavy flavor production and J/psi production & polarization

Phys. Rev. Lett. 108 (2012) 082001, Phys. Lett. B 704 (2011) 442,
Phys. Lett. B 708 (2012) 265; JHEP 01 (2012) 128

- Alignment of the tracking system

J. Instrum. 5 (2010) 03003

The FCPPL-ALICE project

PART-CCNU-IN2P3-ALICE: **Study of QCD matter with the ALICE detector**

Members	French Group			Chinese Group		
	Name	Title	Affiliation (institute)	*Name*	Title	Affiliation (institute)
	Leader Bastid Nicole	Pr	IN2P3	*Leader* Zhou Daicui	Pr	CCNU
	Aphecetche Laurent	CR	IN2P3	Cai Xu	Pr	CCNU
	Batigne Guillaume	MC	IN2P3	Li Shuang	PhD student	CCNU
	Cheynis Brigitte	CR	IN2P3	Luo Jiebin	Mast. student	CCNU
	Conessa-B Gustavo	Post-doc	IN2P3	Mao Yaxian	Lecture	CCNU/XJU
	Crochet Philippe	DR	IN2P3	Wan Renzhuo	Lecture	CCNU/WTV
	Delagrange Hugues	DR	IN2P3	Wang Dong	Lecture	CCNU
	Dialinas Manoel	IR	IN2P3	Wang Mengliang	PhD student	CCNU
	Ducroux Laurent	MC	IN2P3	Wang Yaping	Ass. Pr	CCNU
	Dupieux Pascal	DR	IN2P3	Xiang Changzhou	PhD student	CCNU
	Estienne Magali	CR	IN2P3	Yang Chunbin	Pr	CCNU
	Faivre Julien	MC	IN2P3	Yin Zhongbao	Pr	CCNU
	Furget Christophe	Pr	IN2P3	Yuan Xianbao	Lecture	CCNU/TGU
	Germain Marie	CR	IN2P3	Zhang Fan	PhD student	CCNU
	Grossiord Jean-Yves	DR Emérite	IN2P3	Zhang Haitao	PhD student	CCNU
	Guernane Rachid	CR	IN2P3	Zhang Xiaoming	PhD student	CCNU
	Kox Serge	DR	IN2P3	Zhou Daimei	Ass. Pr	CCNU
	Martinez-Garcia Ginès	DR	IN2P3	Zhou Fengchou	PhD student	CCNU
	Massacrier Laure	Post-doc	IN2P3	Zhu Jianlin	PhD student	CCNU
	Pillot Philippe	CR	IN2P3	Zhu Jianhui	PhD student	CCNU
	Rosnet Philippe	Pr	IN2P3	Zhu Hongsheng	PhD student	CCNU
	Roy Christelle	DR	IN2P3	Zhu Xiangrong	PhD student	CCNU
	Schutz Yves	DR	IN2P3			
	Tieulent Raphaël	CR	IN2P3			

- **46 members**
- **physics:**
  - **photons**
  - **jets**
  - **muons**
- **computing**
- **detector construction & operation**

- **36 members in 2009**

FCPPL-ALICE report (2011): students

- **Co-PhD theses**

  Yaxian Mao (CCNU) at LPSC Grenoble

  Renzhuo Wan (CCNU) at IPHC Strasbourg

  Xiaoming Zhang (CCNU) at LPC Clermont-Ferrand,

- **Master-III training:**

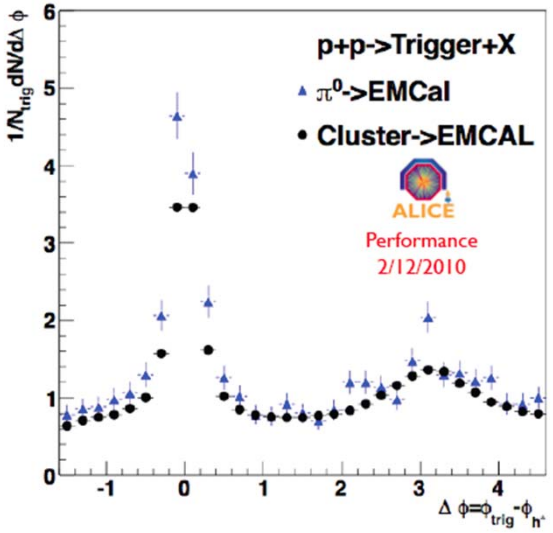
  Jiebin Luo (CCNU) at LPC Clermont-Ferrand for 6 months

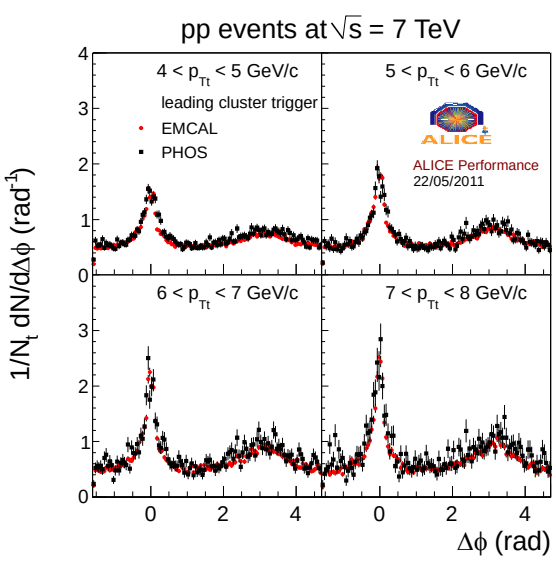
- **PhD training**

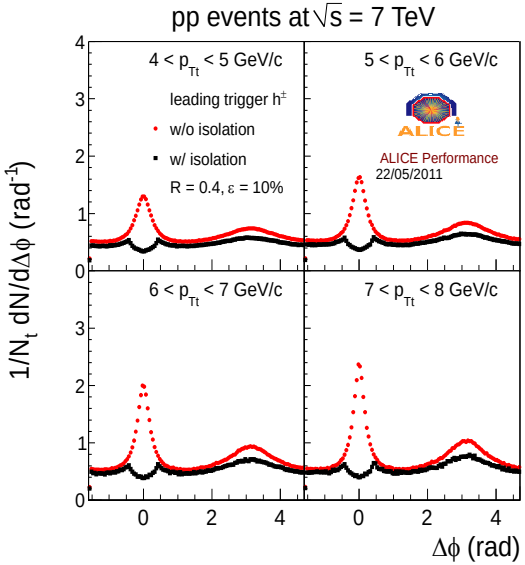
  Jianhui Zhu (CCNU) at LPC Clermont-Ferrand for 5 months

Yaxian Mao (CCNU) at LPSC Grenoble

- co-PhD thesis Wuhan-Grenoble
- topic: gamma tagged-hadron correlations in ALICE
- duration: 3 years at LPSC Grenoble/CERN
- funding: China Scholarship Council and French Embassy
- defense: done in June 2011
- diploma: two diplomas awarded both by Grenoble and CCNU



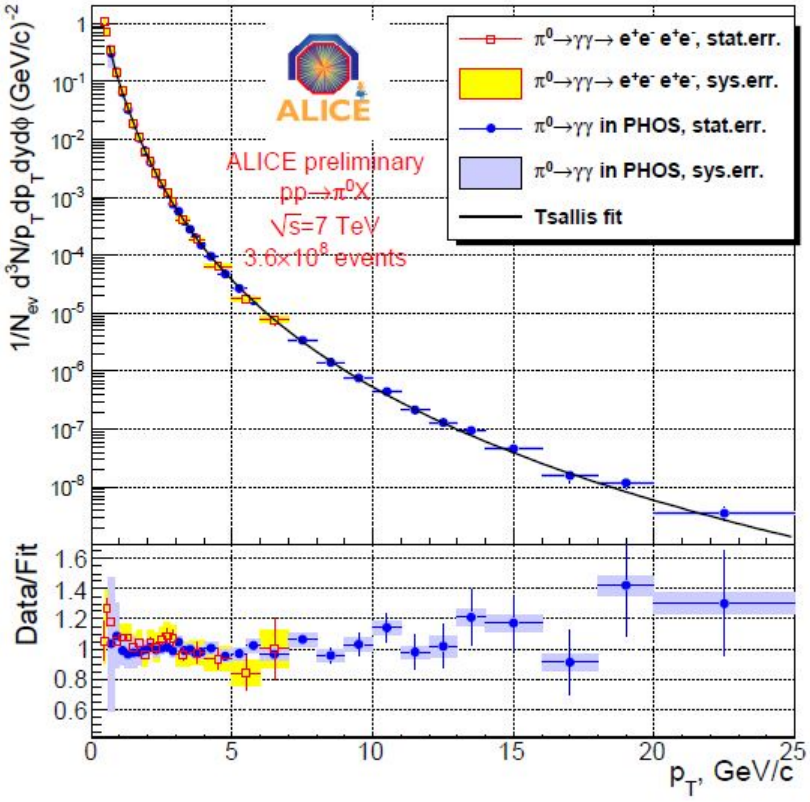




- validation of the photon-tagged hadron correlation observables in pp and PbPb collisions
- EMCAL calibration
- in charge of calorimeter offline Data Quality Assurance
- ALICE shifts at CERN

Renzhuo Wan (CCNU) at IPHC Strasbourg

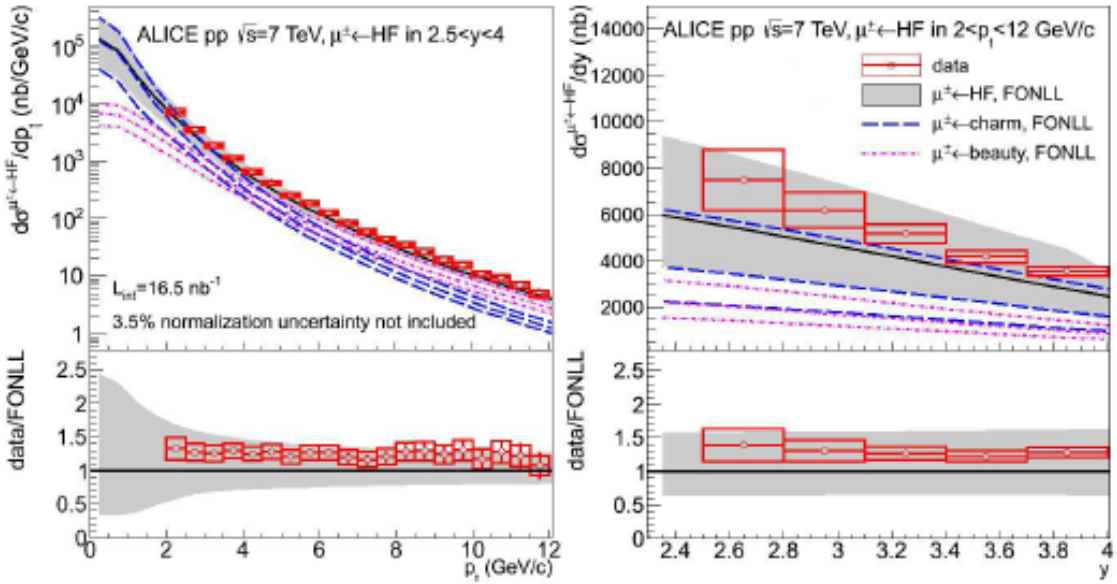
- co-PhD thesis Wuhan-Strasbourg
- topic: neutral meson measurements in ALICE with PHOS and EM-Calorimeters
- duration: 1 year in Wuhan, 2 years in France
- funding: China Scolarship Council
- defense: done in June 2011
- diploma: both awarded by Strasbourg and CCNU



- measurement of π^0/η up to 25/15 GeV/c
- measurement of ω in the $\pi^0\,\gamma$ channel
- ALICE shifts at CERN

Xiaoming Zhang (CCNU) at LPC Clermont-Ferrand

- co-PhD thesis Wuhan- LPC Clermont
- topic: heavy flavour decay muon production in pp & PbPb and elliptic flow in Pb-Pb with ALICE
- duration: 6 months alternately in China and France over 3 years
- funding: French Embassy (3 x 6 months)
- defense: on 23rd of May 2012

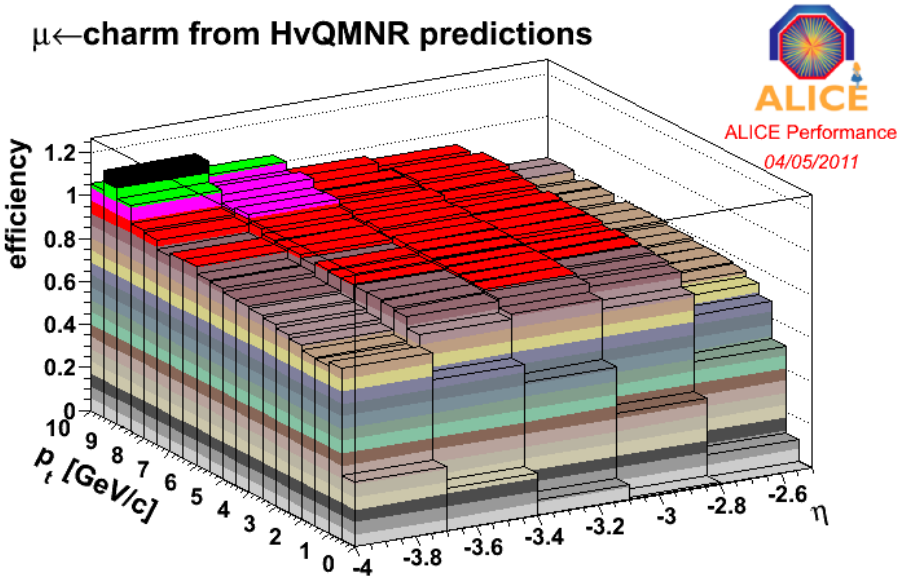


- heavy flavour decay muon differ. cross-sections in pp collisions: published
- heavy flavour decay muon suppression in PbPb collisions (talk at QM2011, results have been approved by ALICE: publication in preparation)
- elliptic flow of muons from heavy flavour decays presented at APW in Aug. 2011
- ALICE shifts at CERN

Xiaoming Zhang: talk at QM2011 and at Bormio 2011
Phys. Lett. B 708 (2012) 265 (PC member)

Jiebin Luo (CCNU) at LPC Clermont-Ferrand

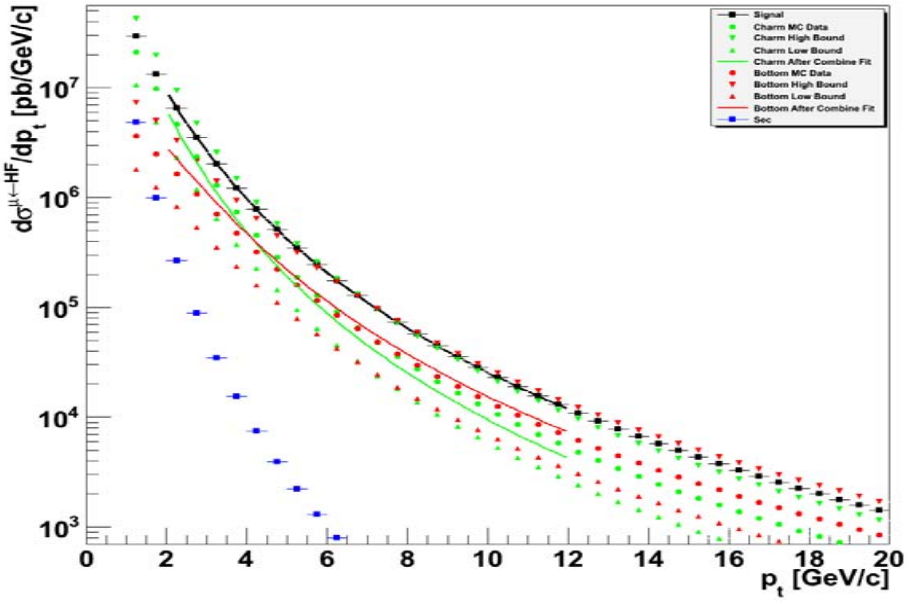
- Master-III training
- topic: efficiency correction for muon analyses, muon spectra (heavy flavour and $W^{\pm}$) in pp at 7TeV and Pb-Pb at 2.76 TeV
- duration: 6 months at LPC Clermont
- funding: financed by FCPPL, LPC/UBP and CCNU



- production of efficiency matrices based on MC productions
- comparison MC productions with Geant3 and Geant4
- ongoing activities with X. Zhang on muon spectra, heavy flavour decay muon R_{AA} and $W^{\pm}$ in muon channel

Jianhui Zhu (CCNU) at LPC Clermont-Ferrand

- **PhD training**
- **topic:**
  - **separation of charm and beauty decay muon components via a combined fit in pp at 7TeV**
  - **$W^{\pm}$ production in pp at 7 TeV: performance studies and data analysis**
- **duration: 5 months**
- **funding: financed by CCNU and LPC/UBP**



Using combinatorial fit function

$$F(p_t) = (T - B)\cdot\left(f_c(p_t) + R \times f_b(p_t)\right)$$

$$f_{c/b}(p_t) = \frac{a_1}{\left(1 + \left(P_t / a_2\right)^2\right)^{a_3}}$$

to separate muons from charm and beauty.

Scientific production of the cooperation (2011-now)

- X. Zhang for the ALICE Collaboration, Heavy flavour physics with the ALICE muon spectrometer at the LHC: talk at 49th International Winter Meeting on Nuclear Physics, Jan. 24-28, 2011, Bormio, Italy; proceedings: PoS (2011) 030
- X. Zhang for the ALICE Collaboration. Heavy flavour production in the semi-muonic channel at forward rapidity in pp collisions at $\sqrt{s}$ = 7 TeV and Pb-Pb collisions at $\sqrt{s_{NN}}$= 2.76 TeV.: talk at Quark Matter 2011, May 23-28, 2011, Annecy, France; proceedings: J. Phys. G 38 (2011) 124067
- X. Zhang for the ALICE Collaboration: talk at the 4th FCPPL workshop, April 7-9, 2011, Jinan, China on Heavy flavour physics with the ALICE Muon Spectrometer at the LHC
- R. Averbeck, N. Bastid, Z. Conesa del Valle, P. Crochet, A. Dainese, X. Zhang
  Reference heavy flavour cross sections in pp collisions at $\sqrt{s}$ = 2.76 TeV, using a pQCD-driven $\sqrt{s}$-scaling of ALICE measurements at $\sqrt{s}$ = 7 TeV , arXiv :1107.3243 [hep-ph]
- X. Zhang for the ALICE Collaboration
  Heavy flavour decay muon production in pp collisions at 7 TeV and single muon elliptic flow in Pb-Pb collisions at 2.76 TeV 5th ALICE Physics Week, Jyväskylä, Finland, Aug. 29-Sept. 2, 2011
- B. Abelev,..J. Luo,...X. Zhang,.. (The ALICE Collaboration)
  Heavy flavour decay muon production at forward rapidity in proton-proton collisions at $\sqrt{s}$ = 7 TeV. CERN-PH-EP-2011-215, Phys. Lett. B 708 (2012) 26
- B. Abelev,..J. Luo,...X. Zhang,.. (The ALICE Collaboration)
  Masurement of heavy flavour decay muon suppression at forward rapidity in Pb-Pb collisions at $\sqrt{s_{NN}}$ = 2.76 TeV, in preparation, to be submitted to Phys. Rev. Lett.
- Y. Mao for the ALICE Collaboration, High p_t particle correlations in pp collisions at LHC/ALICE: talk at Quark Matter 2001, Mai 23-28, 2011, Annecy, France; proceedings: J. Phys. G 38 (2011) 12409
- Y. Mao for the ALICE Collaboration, Two particle correlations: a probe of the LHC QCD medium, J. Phys.: Conf. Ser. 270 (2011) 012032
- Y. Mao for the ALICE Collaboration, Photon-jet correlations measurement with ALICE at LHC: a feasibility study in proton-proton collisions, Indian J. Phys. 85 (2011) 959
- R. Wan for the ALICE Collaboration, Charged particle identification with PHOS and central tracking of ALICE, Indian J. Phys. 85 (2011) 1197
- R. Wan for the ALICE Collaboration, From raw data to physics results with ALICE PHOS, J. Phys. Conf. Ser. 293 (2011) 012026
- R. Wan for the ALICE Collaboration, π^0 measurement with ALICE electromagnetic calorimeters in p+p collisions at LHC, J. Phys. Conf. Ser. 270 (2011) 012004
- R. Wan for the ALICE Collaboration, Study of $\omega(782) \rightarrow \pi^0\gamma$ in pp collisions at $\sqrt{s}$ = 7 TeV with ALICE electromagnetic calorimeters, Poster at Quark Matter 2001, Mai 23-28, 2011, Annecy, France
- In addition, our students are co-authors of 7 ALICE papers published in 2011

• 14 talks in conferences & workshops
• 8 proceedings
• 1 ALICE Internal Note
• 1 poster
• many talks in weekly Physics Working Group meetings and monthly collaboration weeks
• significant contribution to ALICE publications

FCPPL-ALICE report (2011): visits

- Seven ALICE physicists attended the 4th FCPPL workshop in Jinan in April 2011 (2 from IN2P3 and 5 from CCNU)

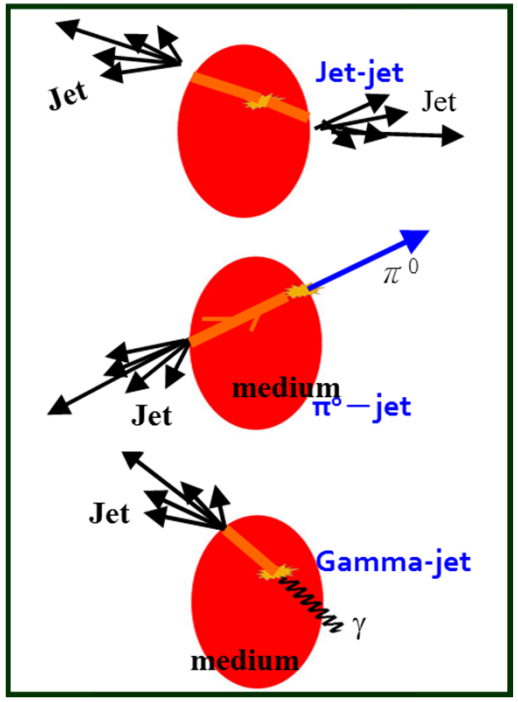
- G. Conesa Balbastre from LPSC Grenoble visited CCNU-Wuhan for three weeks from June 2nd to 21st, working on the ALICE analysis.

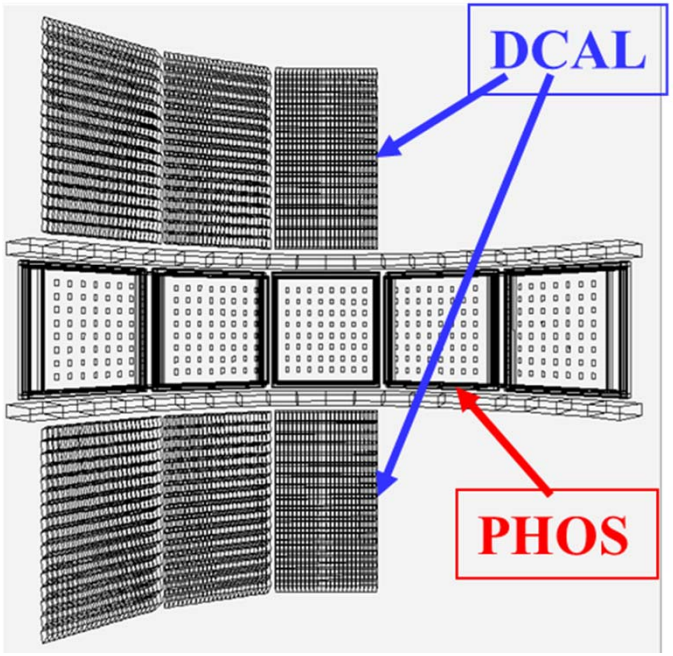
- Five French colleagues (F. Crenner, C. Furget, S. Kox, C. Roy and Y. Schutz) visited Wuhan in-between May 31st to June 6, 2011 to attend the PhD defense of Y. Mao and R. Wan as Defense Committee members. Further collaboration has been discussed.

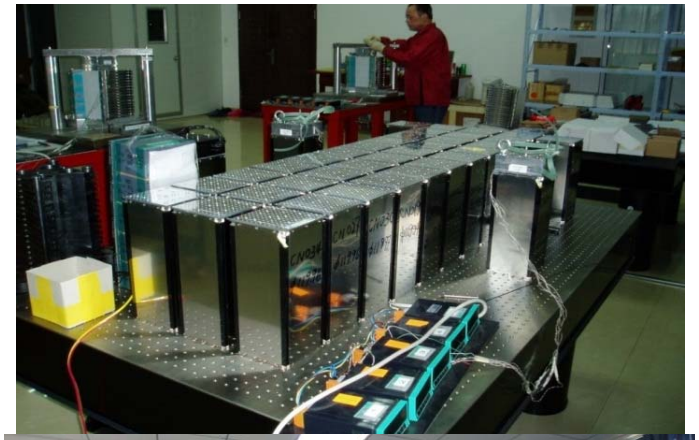
- M. Dialinas (engineer at Subatech-Nantes) visited CCNU for the DCal construction cooperation in June 2011.

Activities with DCAL

- participation to DCal project to extend the existing coverage of EMCAL
- improve back-to-back measurements of jet-jet and gamma-jet
- 6 supermodules in total, ½ built in Subatech, 1 built at CCNU in Wuhan
- installation during the 2012-13 long LHC shutdown







- collaboration Wuhan-France (Nantes & Grenoble) within FCPPL:
  - common module assembly platform for design and production
  - technical training of Chinese engineers and technicians in France

FCPPL-ALICE project (2012)

- **Funding from France. Total: 17,200 Euros**
  - **travel costs for 4 people to Wuhan for the defense of X. Zhang**
  - **travel and stay costs for French physicists to the 5th FCPPL workshop**
  - **stay costs for 2 French physicists to Wuhan for cooperation**
  - **stay costs for 2 Chinese people to Nantes for the DCal assembly for two months.**
  - **stay costs for 2 Chinese people to Grenoble for Dcal tests and calibrations for one month**

- **Funding from China. Total: 183,400 Yuan**

1 EUR=8.36 Yuan

  - **travel and stay costs for a student to LPC for three months, and travel cost for a PhD student**
  - **travel costs for technicians & engineers to Subatech-Nantes to work on DCal strip modules, and students to work on muons and jets**
  - **travel costs for Chinese Engineers and technicians to Grenoble to work on DCal tests and calibrations**
  - **travel costs for Chinese physicists to the 5th FCPPL in France**
  - **Stay costs for French physicists at Wuhan for Xiaoming's defense**

- **Other fundings**
  - **2 CSC-PhD grants: joint-PhDs CCNU/Subatech-Nantes,CCNU/LPC Clermont-Ferrand**
  - **1 CSC-Post doctoral grant: LPC Clermont-Ferrand**
  - **a three years PhD program to Nantes on jet structure and gamma-jet correlation**

Summary

The FCPPL-ALICE French/Chinese collaboration is solid, healthy and very fruitful

- **excellent contributions on physics**
- **large scientific production through cooperation**
- **technical contribution to DCAL is ongoing**

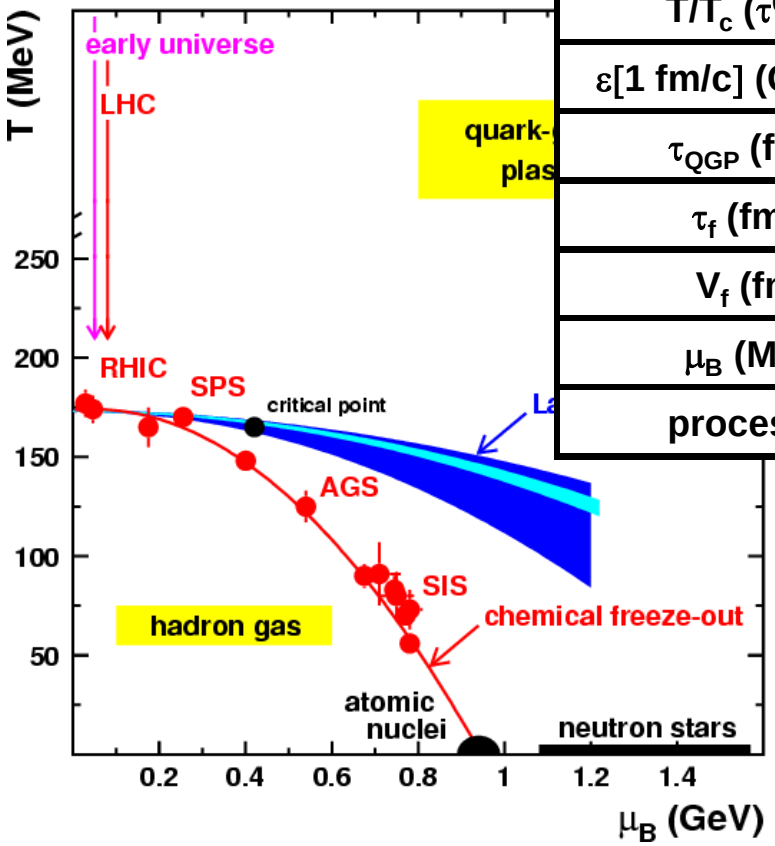
Thanks a lot

Backup

Heavy ion collisions & QGP @ LHC

the biggest step in energy in the history of heavy-ion collisions

machine	SPS	RHIC	LHC	
$\sqrt{s}$ (GeV)	17	200	5500	
N_{ch}	1000	4000	50 000*	
τ^0_{QGP} (fm/c)	1	0.2	0.1	⇒ faster
T/T_c (τ^0_{QGP})	1.1	1.9	3.0-4.2	⇒ hotter
ε[1 fm/c] (GeV/fm^3)	3	5	15-60	⇒ denser
τ_{QGP} (fm/c)	≤ 2	2-4	≥ 10	⇒ longer
τ_f (fm/c)	~ 10	20-30	30-40	
V_f (fm^3)	~ 10^3	~ 10^4	~ 10^5	⇒ bigger
μ_B (MeV)	250	20	1	⇒ cleaner
processes	soft → semi-hard →		hard	⇒ harder



ε, vol. & τ QGP × 10(4) from SPS(RHIC) to LHC

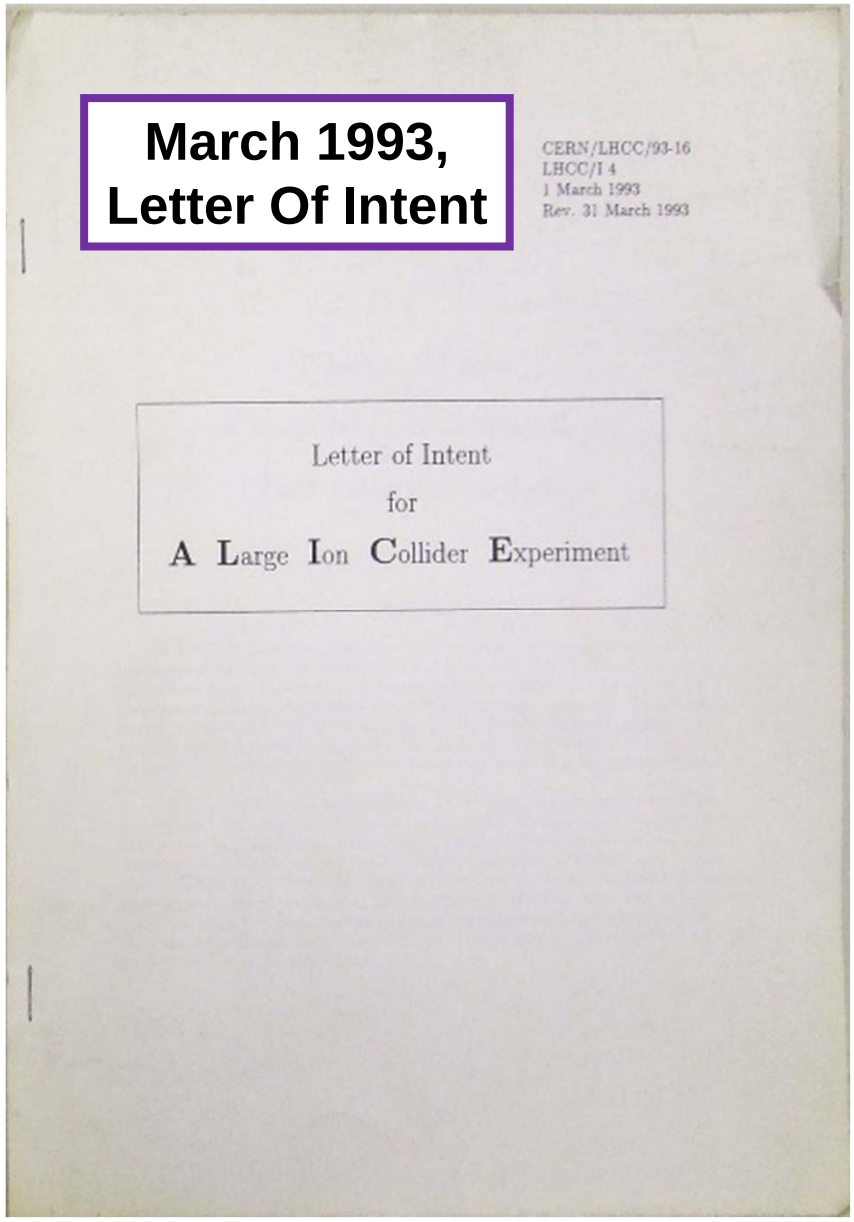
"...the LHC will become the ideal facility for a systematic exploration and quantitative confirmation of the insights obtained at RHIC, aided by the plentiful abundance of hard probes."

B. Müller, hep-ph/0410115

J. Schukraft, Nucl. Phys. A 698 (2002) 287, *prediction

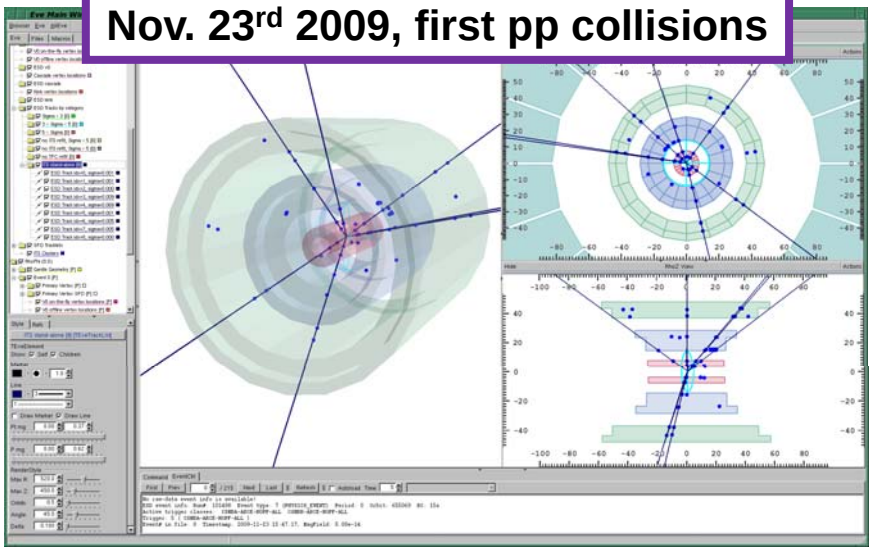
From the ALICE LOI to the first collisions

March 1993, Letter Of Intent


CERN/LHCC/93-16
LHCC/I 4
1 March 1993
Rev. 31 March 1993

Letter of Intent
for
A Large Ion Collider Experiment

Nov. 23rd 2009, first pp collisions



Nov. 8th 2010, first PbPb collisions