Study of QCD matter with the ALICE detector FCPPN/L Report

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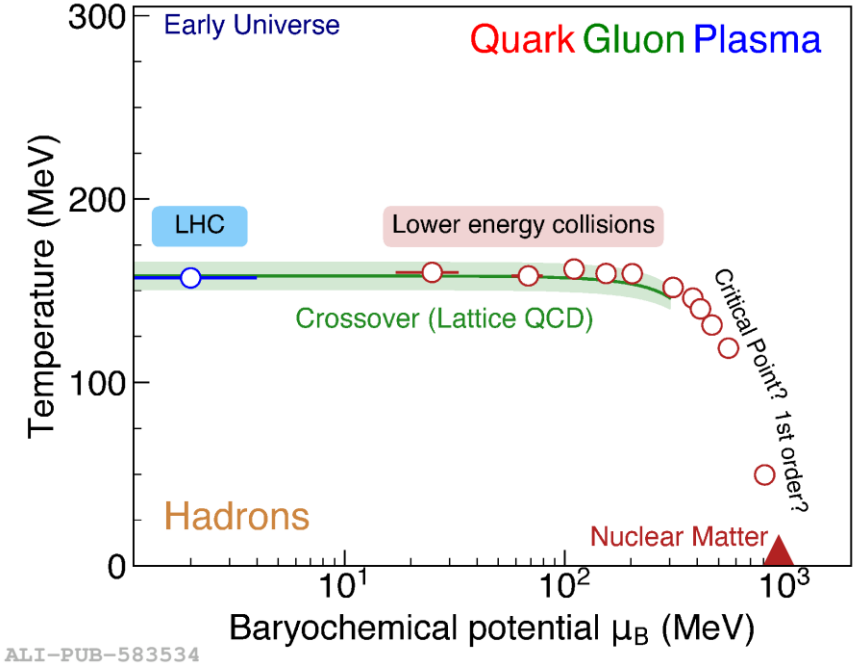
Xiaoming Zhang (IOPP, CCNU, Wuhan, China)

16th Workshop of the France China Particle Physics Network/Laboratory
Shandong University, Qingdao, July 21-25, 2025

Scientific context: the quark-gluon plasma (QGP)

Quark-Gluon Plasma: state of strongly-interacting matter in which quarks and gluons are no more confined into hadrons



❖ QCD phase diagram: shows the phase transition via temperature vs. baryochemical potential

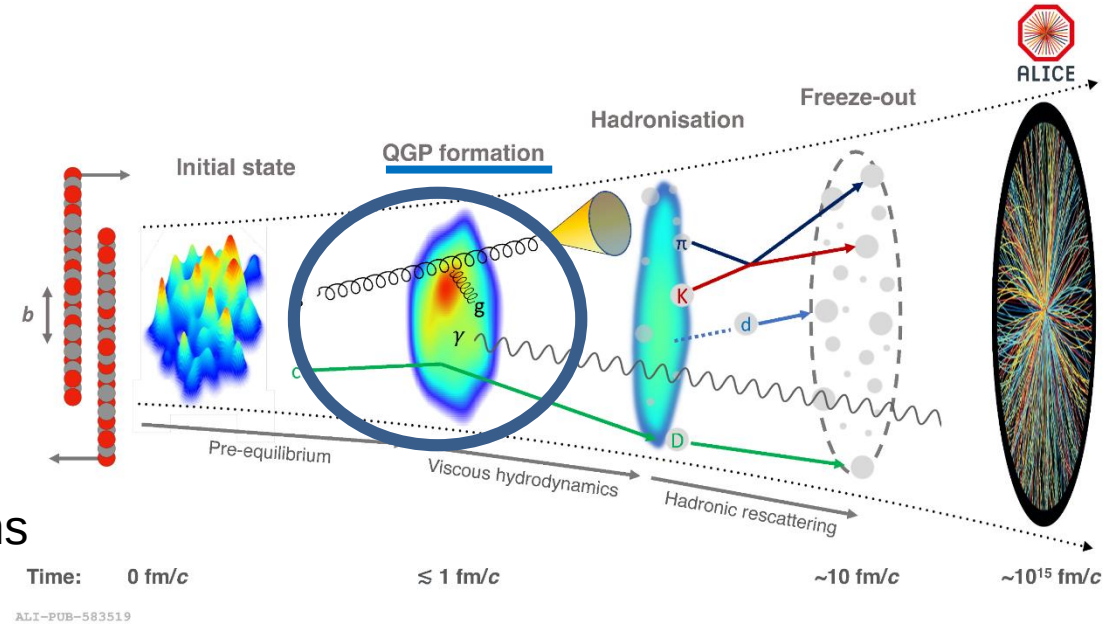
❖ Predicted by QCD, from Lattice QCD calculations:

- Critical temperature: T_c ~ 155 MeV
- Critical energy density: ε_c ~ 0.5 GeV/fm^3

❖ A QGP state can be created using ultrarelativistic heavy-ion collisions

❖ ALICE at the LHC:

- Dedicated experiment for heavy-ion physics
- Also, important physics program with small collision systems



Eur. Phys. J. C 84 (2024) 813

The ALICE Collaboration

164 institutes from 38 countries, 1897 members

https://alice.web.cern.ch

France (8 institutes)

- IP2I, Lyon
- CC-IN2P3, Lyon
- IJCLAB, Orsay
- IPHC, Strasbourg
- LPCA, Clermont-Ferrand
- LPSC, Grenoble
- Subatech, Nantes
- IRFU, Saclay

➢ 35 physicists, 4 post-docs, 13 PhDs, 44 technical staff, 17 invited

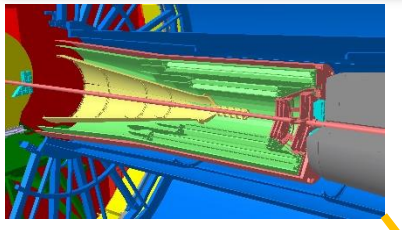
China (11 institutes)

- IOPP-CCNU & GUC*, Wuhan
- CIAE, Beijing
- USTC, Hefei
- FUDAN, Shanghai
- HUST*, Wuhan
- HBUT*, Hubei
- UCAS, Beijing
- IMP, Lanzhou
- SDU, Qingdao

} In ALICE as associate since July 18th, 2025

➢ 14 physicists, 3 post-docs, 40 PhDs, 27 Masters, 9 technical staff

The ALICE detector in Run 3 (2022-2026)



Central Barrel: $|\eta| < 0.9$

- New Time Projection Chamber (TPC)
  - GEM readout
- New Inner Tracking System (ITS2)
  - 7 layers, 10 m^2 silicon tracker based on MAPS
- Time Of Flight (TOF)

+ TRD, EMCal, HMPID, PHOS

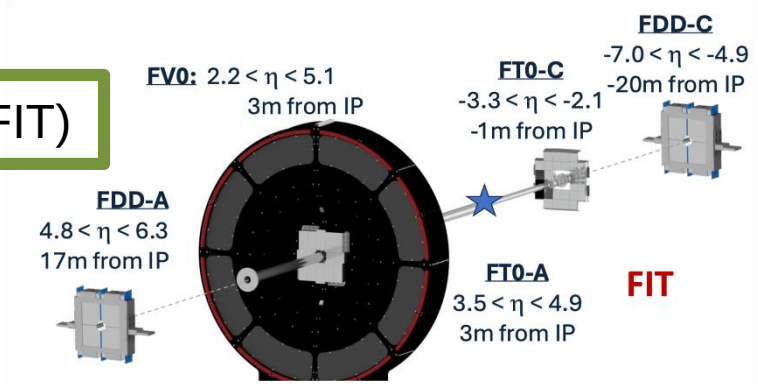
Muon spectrometer

$-4 < \eta < -2.5$

New beam pipe

- Diameter: 36.4 mm

New Fast Integration Trigger (FIT)



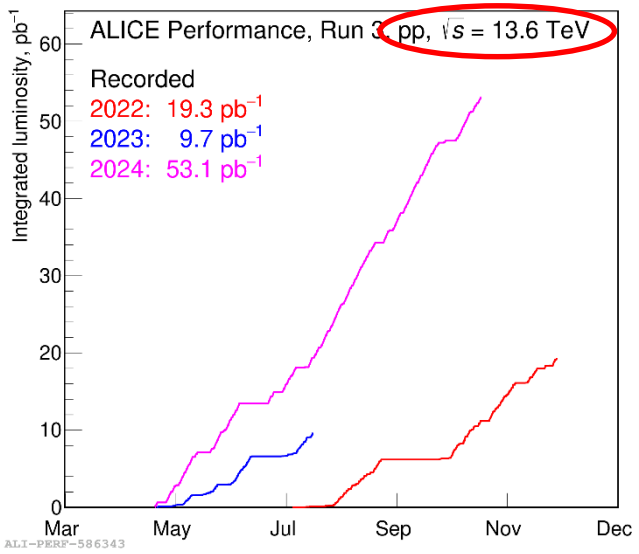
New Muon Forward Tracker (MFT): $-3.6 < \eta < -2.5$

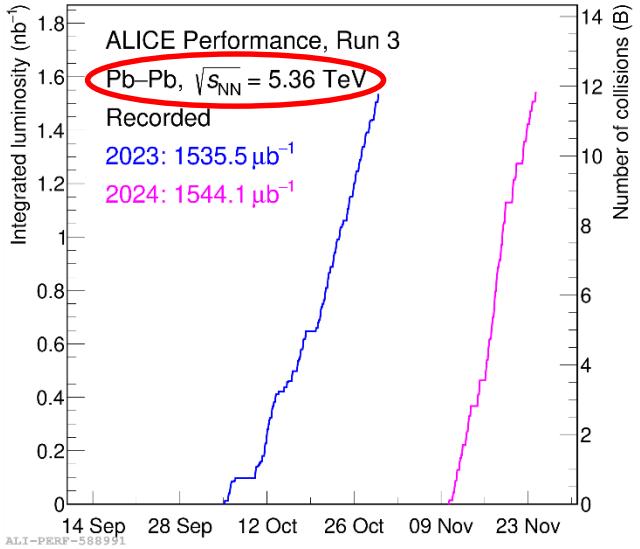
- 5 planes of MAPS
- Add vertexing also at forward rapidity for muons

ALICE data taking in Run 3 (and Run 4)

Run 1+2 (2009-2018)	**pp, p-Pb/Pb-p, Xe-Xe, Pb-Pb**
Run 3 (2022-2026)	**pp, Pb-Pb, pO, OO, Ne-Ne, p-Pb?**

- In Run 3 and Run 4: continuous readout at high interaction rate
  - larger statistics collected compared to Run 1+2
- Interaction rate:
  - pp: ~600 kHz, software triggers to store only rare events
  - Pb-Pb: up to 50 kHz, all events kept





- 70 new Run 3 results approved for 2025 conferences
  - With significant contributions from FCPPN/L@ALICE

Selection of recent ALICE highlights: Yaxian Mao's talk

5000 billion MB, factor ~x1600 w.r.t. MB Run 1+2

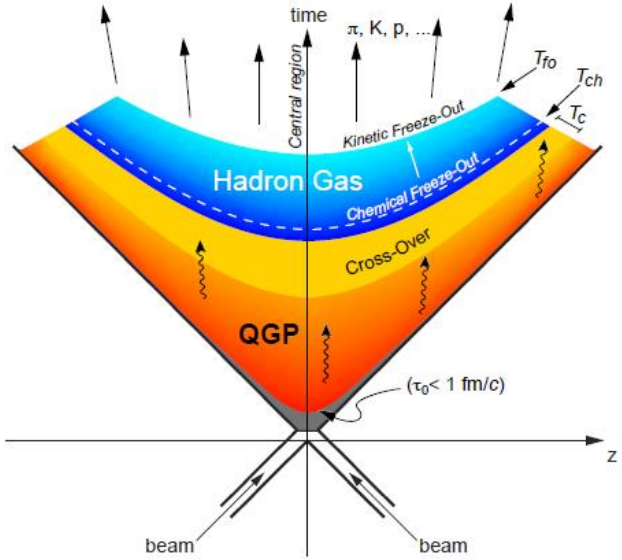
Pb-Pb: 24 billion MB, factor ~ x70 w.r.t. MB Run 1+2

+ pp reference, pp (2025): 10.2 pb^{-1}, pO: 7.24 nb^{-1}, OO: 5.01 nb^{-1}, Ne-Ne: 0.87 nb^{-1}

Physics with ALICE

Heavy-ion collisions

- Properties of strongly-interacting matter at extreme conditions of temperature and energy density
- Characterisation of the QGP
  - Global properties
  - Transport properties
  - Hadronisation
- Influence of initial- and final-state effects on particle production



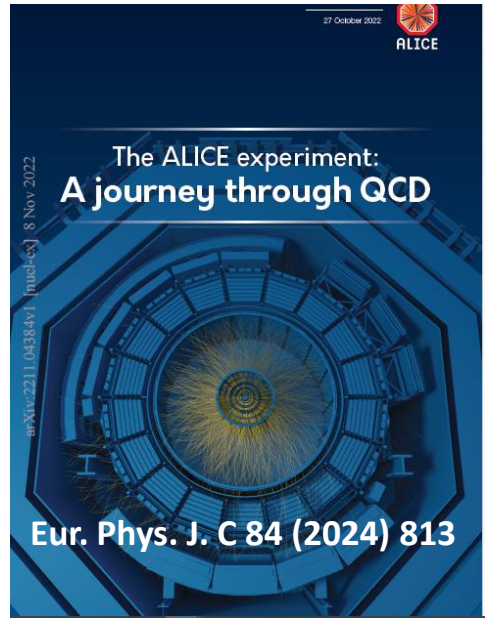
Small collision systems (pp, pA)

- Reference for heavy-ion collisions and study of cold nuclear matter effects
- Test of QCD theory, production mechanisms
- QGP-like effects in high-multiplicity pp, pA
- Structure of hadrons, connections with other fields

Many results in which FCPPN/L@ALICE is strongly contributing, see later & next talks

Studies of Run 1-2 documented in

July 2025: 529 papers submitted



FCPPN-ALICE project: members

"Study of QCD matter with the ALICE detector"

France (7 institutes)

- ❑ IP2I, Lyon & CC-IN2P3, Lyon
- ❑ IJCLAB, Orsay
- ❑ IPHC, Strasbourg
- ❑ LPCA, Clermont-Ferrand
- ❑ LPSC, Grenoble
- ❑ Subatech, Nantes
- ❑ IRFU, Saclay

China (7 institutes)

- ❑ IOPP-CCNU
- ❑ GUC*, Wuhan
- ❑ CIAE, Beijing
- ❑ USTC, Hefei
- ❑ FUDAN, Shanghai
- ❑ HUST*, Wuhan
- ❑ HBUT*, Hubei

(3 new institutes may join in 2026)

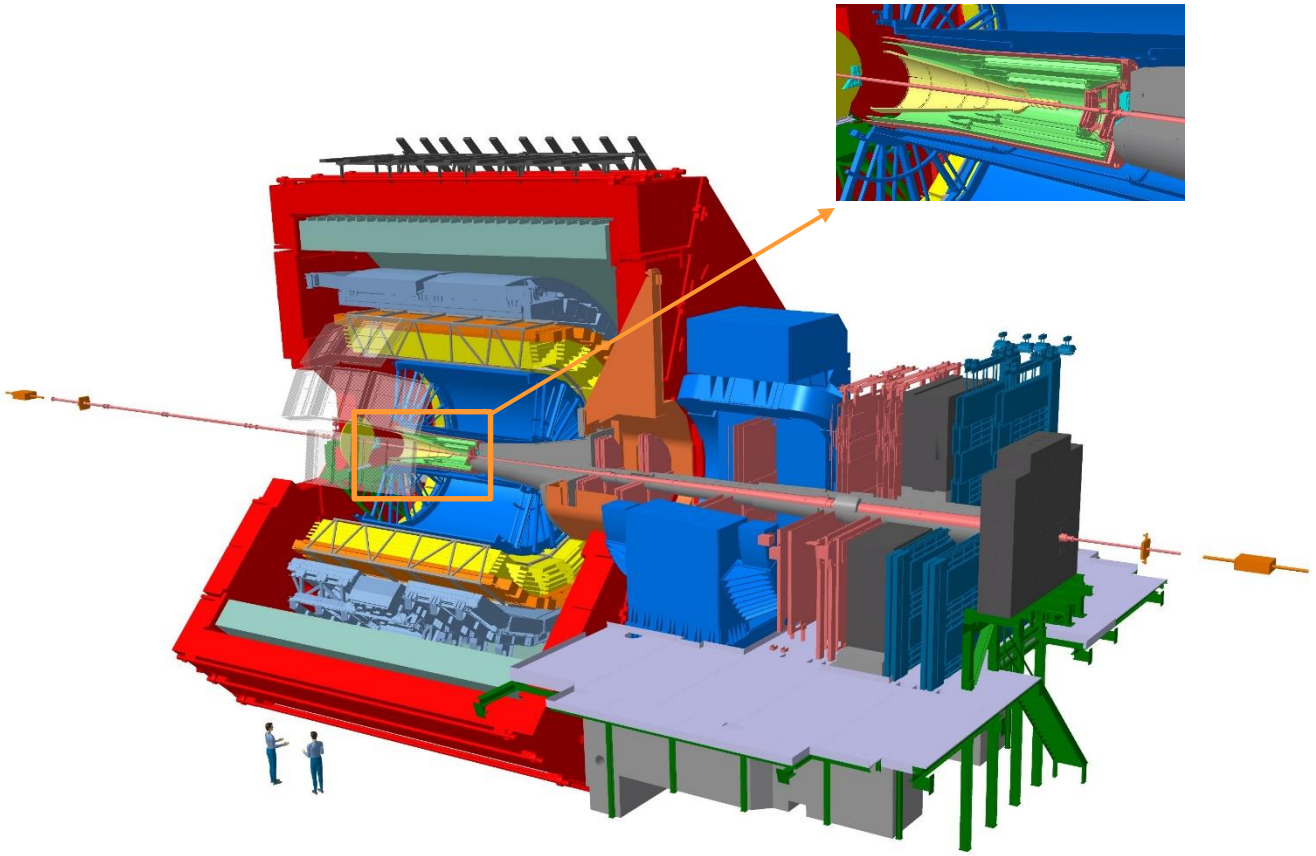
- ❑ **2025**: 63 members
  - ➢ Was 36 members in 2009
  - ➢ Robust, continue growing

- ❑ Common contributions to several subprojects:
  - Muon spectrometer and MFT (Runs 3 and 4)
  - Calorimeters
  - ITS2 (Run 3)
  - Interest for ALICE 3 new project (under discussion)

French Group			Chinese Group		
Name	**Status** (PR, MCF, DR, CR, IR/E, Postdoc, PhD)	**Affiliation** (institute)	**Name**	**Status** (PR, Ass. PR, Ing., Postdoc, PhD)	**Affiliation** (institute)
Leader **BASTID Nicole**	PR	IN2P3/LPCA	*Leader* **ZHANG Xiaoming** **ZHOU Daicui**	PR PR	IOPP/CCNU IOPP/CCNU
Baldisseri Alberto	Physicist	IRFU	Cai Xu	PR	IOPP/CCNU
Barreau Emilie	PhD	IN2P3/Subatech	Huang Guangming	PR	IOPP/CCNU
Belikov Iouri	DR	IN2P3/IPHC	Zhou Daimei	PR	IOPP/CCNU
Castillo Castellanos Javier	Physicist	IRFU	Yin Zhongbao	PR	IOPP/CCNU
Cheshkov Cvetan	DR	IN2P3/IP2I	Ma Yugang	PR	FUDAN
Conesa-Balbastre Gustavo	CR	IN2P3/LPSC	Li Xiaomei	Researcher	CIAE
Coquet Maurice	Postdoc	IN2P3/Subatech	Wang Yaping	PR	IOPP/CCNU
Crochet Philippe	DR	IN2P3/LPCA	Shao Ming	PR	USTC
Di Bella Valério	PhD	IN2P3/IPHC	Zhang Yifei	PR	USTC
Dupieux Pascal	DR	IN2P3/LPCA	Zhang Song	PR	FUDAN
Faivre Julien	MC	IN2P3/LPSC	Tang Zebo	PR	USTC
Furget Christophe	PR	IN2P3/LPSC	Mao Yaxian	PR	IOPP/CCNU
Germain Marie	DR	IN2P3/Subatech	Shou Quiye	Ass. PR	FUDAN
Guernane Rachid	CR	IN2P3/LPSC	Wang Dong	Ass. PR	IOPP/CCNU
Guilbaud Maxime	CR	IN2P3/Subatech	Pei Hua	PR	IOPP/CCNU
Hippolyte Boris	PR	IN2P3/IPHC	Yang Ping	Ass. PR	IOPP/CCNU
Kuhn Christian	DR	IN2P3/IPHC	Gao Chaosong	Ass. PR	IOPP/CCNU
Lambert Stanislas	PhD	IN2P3/Subatech	Pen Xinye	Ass. PR	CUG w/ CCNU
Lopez Xavier	PR	IN2P3/LPCA	Liu Jun	Engineer	IOPP/CCNU
Maire Antonin	CR	IN2P3/IPHC	Bai Xiaozhi	Postdoc	USTC
Mattei Lorenzo	PhD	IN2P3/LPCA	Zhao Mingrui	Ass. PR	CIAE
Millot Louise	PhD	IN2P3/LPSC	Wang Yubiao	PhD	IOPP/CCNU
Pillot Philippe	CR	IN2P3/Subatech	Xu Ran	Joint-PhD	IOPP/CCNU
Ramasubramanian Niveditha	CR	IN2P3/IP2I	Xu Lang	Joint-PhD	IOPP/CCNU
Stocco Diego	CR	IN2P3/Subatech	Zhang Maolin	Joint-PhD	IOPP/CCNU
Uras Antonio	CR	IN2P3/IP2I	Su Youpeng	PhD	IOPP/CCNU
Valencia Victor	PhD	IN2P3/Subatech	Feng Wenhui	Master	IOPP/CCNU
Xu Lang	Joint-PhD	IN2P3/IP2I	Zhang Qiuyue	Master	IOPP/CCNU
Xu Ran	Joint-PhD	IN2P3/LPSC	Zhou Xinyi	Master	IOPP/CCNU
Zhang Maolin	Joint-PhD	IN2P3/LPCA	Geng Zhaozheng	Master	IOPP/CCNU

ALICE France-China in FCPPL

Very strong cooperation program between the ALICE Chinese Cluster and French institutes since many years



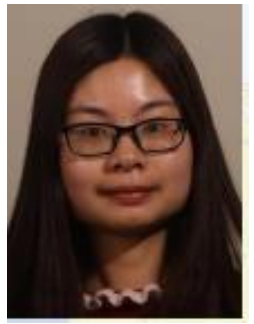
- Data analysis
  - Hard probes: heavy flavours, jets
  - Photons, W/Z bosons
- Performance/quality check studies involving
  - Forward Muon spectrometer & MFT
  - ITS2
  - Calorimeters
- Offline, online, computing
- Hardware: R&D, production/installation, commissioning, operation
  - Run 3: ITS2, MFT
  - Run 5: ALICE 3 (in discussion)
- Present responsibilities:
  - Management Board, Conference Committee, Editorial Board, Physics Analysis Group, Physics Working Group, detectors & upgrades

Still room to extend the collaboration between French & Chinese institutes with Run 3 -4 and beyond with the new ALICE 3 project

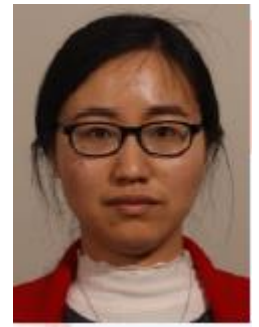
Achievements

- Up to 7-8 bilateral visits /year of senior physicists and/or engineers/technicians
- 11 joint-PhD defenses since 2007
  - Now postdocs or permanent positions
- 3 postdoc exchanges since 2009
- ~ 24 internship Master exchanges

- Numerous presentations in international conferences
- Direct contribution in several publications (analysis, paper committee…)
- Numerous conference proceedings, internal analysis ALICE notes
- Numerous approved analysis results



Yanchun DING
CCNU-IP2I
Defense: 26 May 2025



Ran XU
CCNU-LPSC
Defense: 26 May 2025

2024-2025

- 2 co-PhD defenses in 2025
- 3 ongoing co-PhD financed by CSC
- 6 bilateral visits of senior physicists
- 2 internship Masters for 2025/2026
- New PhD student and postdoc exchanges in discussion for 2025 2nd semester & 2026

Lang XU
CCNU-IP2I
(2024-2027)

Maolin ZHANG
CCNU-LPCA
(2024-2027)

Yubiao WANG
CCNU-CERN
(2025-2027)

Scientific production: July 2024-2025 (I)

❖ Peer-reviewed publications: 12

- Inclusive isolated-photon production cross section in pp and Pb—Pb collisions at $\sqrt{s_{NN}}$ = 5.02 TeV, by the ALICE Collaboration, Eur. Phys. J. C 85 (2025) 553 (**G. Conesa Balbastre et al.**)
  - Supplementary public note, ALICE-PUBLIC-2024-003
  - Isolated photons in Pb—Pb collisions with ALICE, CERN EP newsletter article, issue April 2025
- Inclusive isolated-photon production in pp collisions at $\sqrt{s}$ = 13 TeV", by the ALICE Collaboration, Eur. Phys. J. C 85 (2025) 98 (**R. Xu et al.)**
  - Isolating photons at low Bjorken *x*, CERN Courier Story, issue Jan/Feb 2025
- Multiplicity dependence of Υ production at forward rapidity in pp collisions at $\sqrt{s}$ = 13 TeV, Nucl. Phys. B 1011 (2025) 11678 (**Y. Ding et al.)**
- Beauty production via non-prompt charm hadron in p-Pb collisions at $\sqrt{s_{NN}}$ = 5.02 TeV, JHEP 11 (2024) 148 (**X. Peng, M. Zhang et al**.)
- Azimuthal anisotropy of jet particles in p-Pb and Pb-Pb collisions at $\sqrt{s_{NN}}$ = 5.02 TeV, JHEP 08 (2024) 234 (**S.Tang et al.)**
- The ALICE experiment: a journey through QCD, Eur. Phys. J. C 84 (2024) 813
- Ω_c^0 baryon production and branching-fraction ratio BR ($\Omega_c^0 \rightarrow \Omega e^+ \nu_e$) / BR ($\Omega_c^0 \rightarrow \Omega^- \pi^+$), Phys. Rev. D (2024) 032014 (**Z. Yin et al**.)
- Medium-induced yield enhancement and acoplanarity broadening of low-p_T jets in pp and central Pb-Pb collisions at $\sqrt{s_{NN}}$ = 5.02 TeV, Phys. Rev. Lett. 133 (2024) 022301 (**Y. Hou et al.)**
- Jet quenching using semi-inclusive hadron+jet distributions in pp and central Pb-Pb collisions at $\sqrt{s_{NN}}$ = 5.02 TeV, Phys. Rev. C 110 (2024) 014906 (**Y. Hou et al.**)

❖ Papers in preparation (under ALICE review): 3

- Transverse momentum fraction of strange particles in mini-jets in pp collisions at $\sqrt{s}$ = 13 TeV (**Lang Xu**)
- Charmonium production pp collisions at $\sqrt{s}$ = 13.6 TeV (**Xiaozhi Bai, Lorenzo Mattei, Yuan Zhang**)
- Semi-inclusive recoil jets via hadron-jet correlations in p-Pb collisions at $\sqrt{s_{NN}}$ = 5.02 TeV (**Yongzhen Hou, Yaxian Mao**)

❖ Conference proceedings: 4

- **Maolin Zhan**g @ SQM2024, **Xiaozhi Bai** @ HP2024, **Victor Valencia Torres** @ ICHEP 2024, Moriond 2025

❖ Many Run 3 results approved as performance and/or preliminary

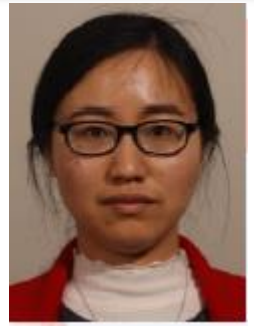
Scientific production: July 2024-2025 (II)

- **ICHEP 2024** (17-24 July, 2024, Prague, Czechia): Victor Valencia Torres, Yaxian Mao
- **International Muon Workshop** (1-5 July 2025): Maolin Zhang
- **Hard Probes 2024** (23-27 Sept. 2024, Nagasaki, Japan): Xiaozhi Bai, Gustavo Conesa Balbastre, Wenhui Feng (poster),Aimeric Landou
- **CERN EP seminar** (21 Jan. 2025): Gustavo Conesa Balbastre
- **Workshop on Advances, Innovations, and Future Perspectives in High-Energy Nuclear Physics** (19-24 Oct. 2024, Wuhan, China): Xiaozhi Bai, Nicole Bastid, Gustavo Conesa Balbastre, Maurice Coquet, Xiaomei Li, Antonin Maire, Diego Stocco, Antonio Uras, Mingrui Zhao, Zhongbao Yin, Daicui Zhou
- **15th FCPPN/L workshop** (10-14 June 2024, Bordeaux, France): Xiaozhi Bai, Nicole Bastid, Gustavo Conesa Balbastre, Yongzhen Hou, Xiaomei Li, Antonio Uras, Maolin Zhang, Xiaoming Zhang
- **USTC-PNP-Nuclear Physics Mini Worskshop Series** (Sept. 29, 2024, Hefei, China): Yongzhen Hou
- **10th China LHC Physics Conference** (14-17 Nov. 2024, Qingdao, China):Yongzhen Hou
- **Quark Matter 2025** (6-12 April, 2024, Frankfurt, Germany): Lang Xu (poster), Yubiao Wang (poster), Victor Valencia Torres (poster),Wenhui Feng (poster)
- **Hot quarks 2025** (11-17 May, 2025, Hefei, China) : Yubiao Wang
- **Rencontres de Moriond** (30 March-6 April 2025, Moriond, Italy): Victor Valencia Torres
- **LHCP 2025** (5-9 May, 2025, Taipei, Taiwan): Mingyu Zhang
- **EPS-HEP 2025** (7-11 July, 2025, Marseille, France): Emilie Barreau, Antonin Maire, Maolin Zhang (poster)

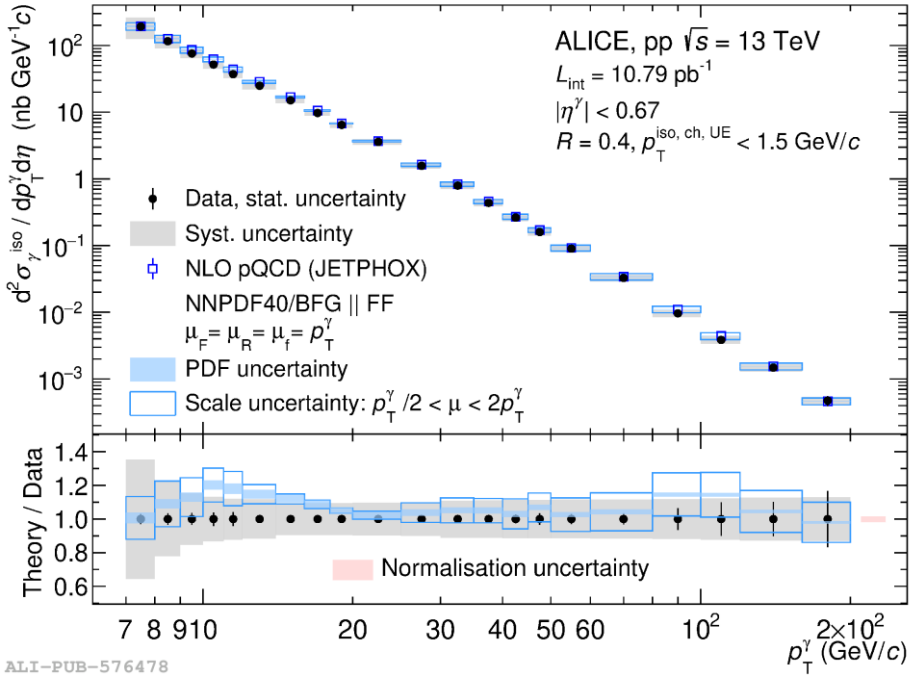
~30 talks by students, permanent members in international conferences and workshops including HP2024, ICHEP2024, Moriond2025, LHCP2025, EPS-HEP2025
+ many presentations in weekly ALICE Physics Analysis Group meetings & monthly ALICE Physics Working Group meetings, ALICE Physics Forum, ALICE Physics Week

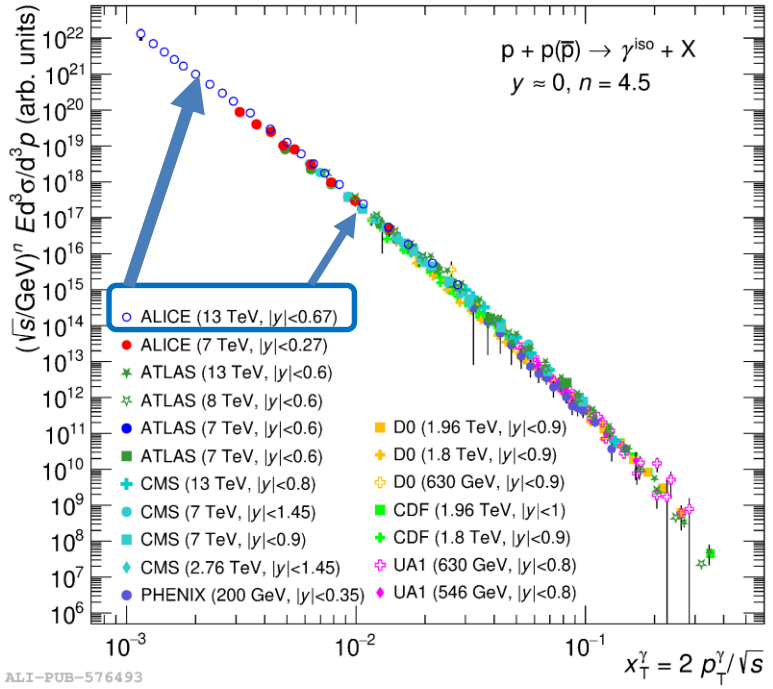
Organisation of the “Workshop on Advances, Innovations, and Future Perspectives in High-Energy Nuclear Physics” (19-24 Oct. 2024, Wuhan)

Isolated direct photon production



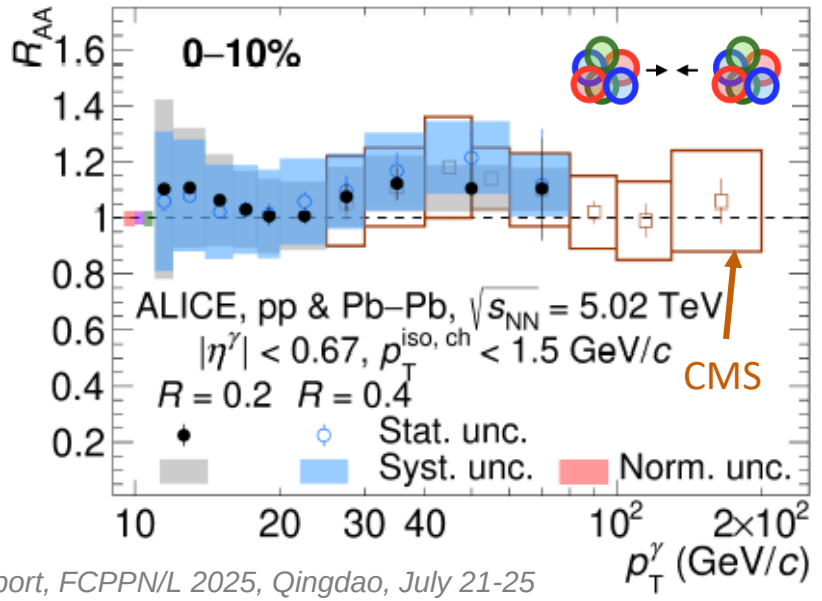
Ran XU
CCNU-LPSC
Defense: 26 May 2025
Supervisors: Y. Mao/G. Conesa Balbastre





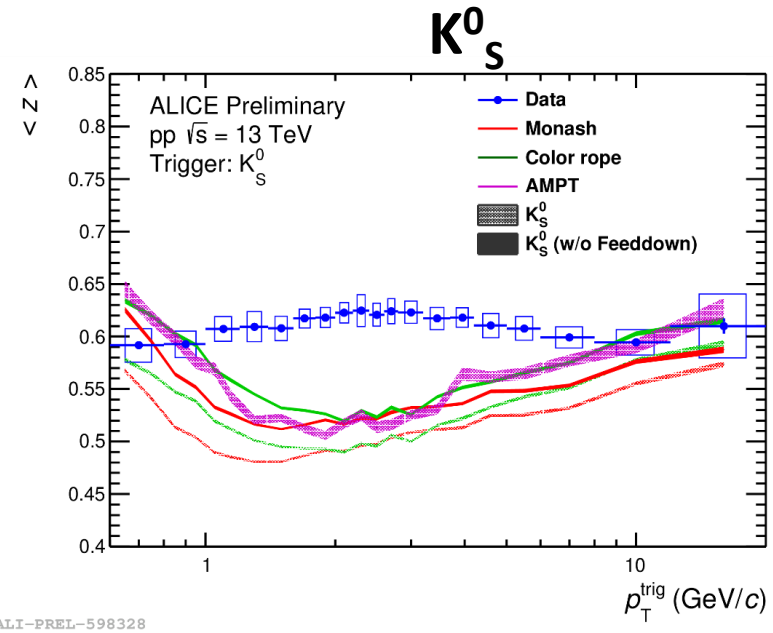
Eur. Phys. J. C 85 (2025) 98 & CERN courier story, issue Jan./Feb. 2025

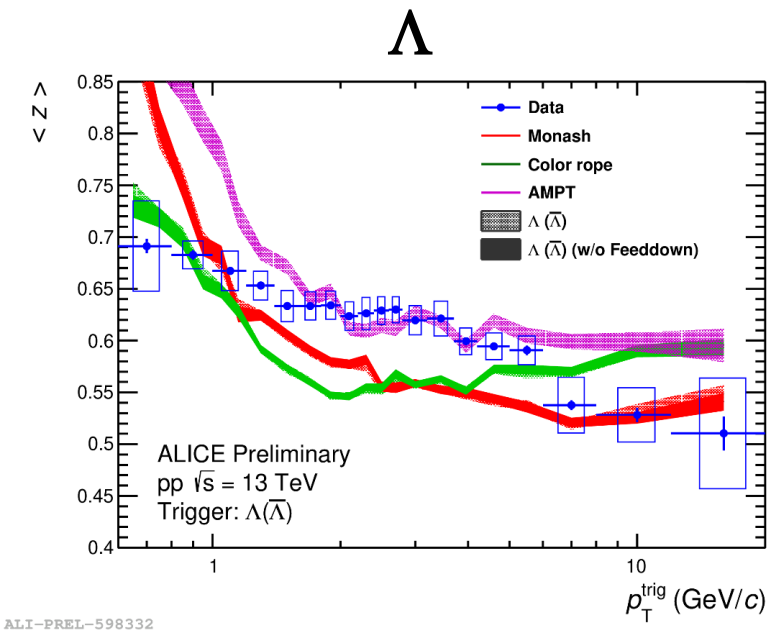
ALICE Eur. Phys. J. C 85 (2025) 553
CMS: JHEP 07 (2020) 116



- Isolated direct photon production cross section in a wide p_T range and down to low p_T
  - In agreement with NLO pQCD (JETPHOX) calculations
  - In line with ATLAS and CMS measurements performed at much higher p_T
- Lowest x_T at midrapidity from 10^{-3} ~10^{-1}
  - Additional constraints to the gluon PDF at low Bjorken-x
- Isolated photons not modified by QGP (R_{AA} ~ 1 in Pb-Pb)
  - Candle/calibrated probes

p_T fraction of strange baryons & mesons in mini-jets in pp collisions at $\sqrt{s}$ = 13 TeV





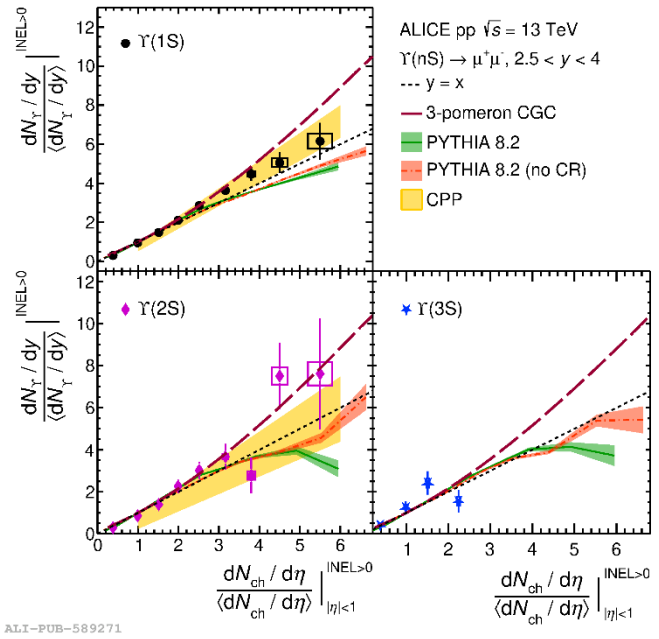
Lang XU
CCNU-IP2I (CSC)
(2024-2027)
Supervisors:
X. Zhang/C. Cheshkov

- First measurement of the mean p_T fraction (<z>) vs p_T for K^0_S and Λ produced in mini-jets in pp collisions using a novel technique based on angular correlations between strange hadrons and charged hadrons
- Different trends at low/intermediate p_T for K^0_S and Λ
  - Different hadronisation for strange mesons and baryons
- Results in the low/intermediate p_T region: a challenge for models

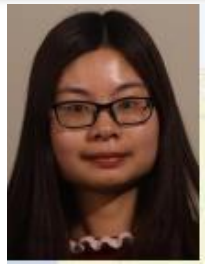
- Publication in preparation, under ALICE review
- Next step: move to Run 3 with the measurement of multi-strange particles

More: Lang Xu
Thurday, July24th, 15:30-15:50

Quarkonium measurements with ALICE

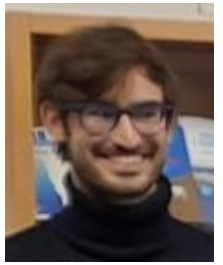


Yanchun DING
co-PhD CCNU-IP2I
Defense: May 26th, 2025
Supervisors: X. Zhang/B.Cheynis-A. Uras
Now Postdoc in CMs at SCNU



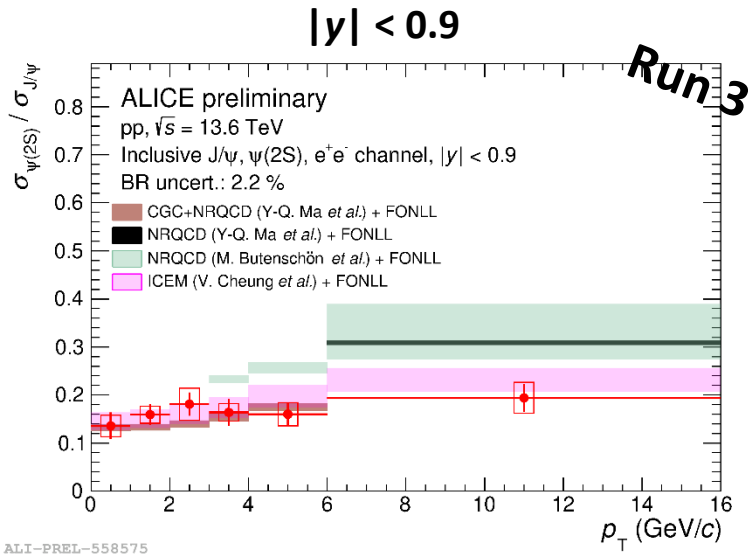
❖ Interplay between soft and hard processes

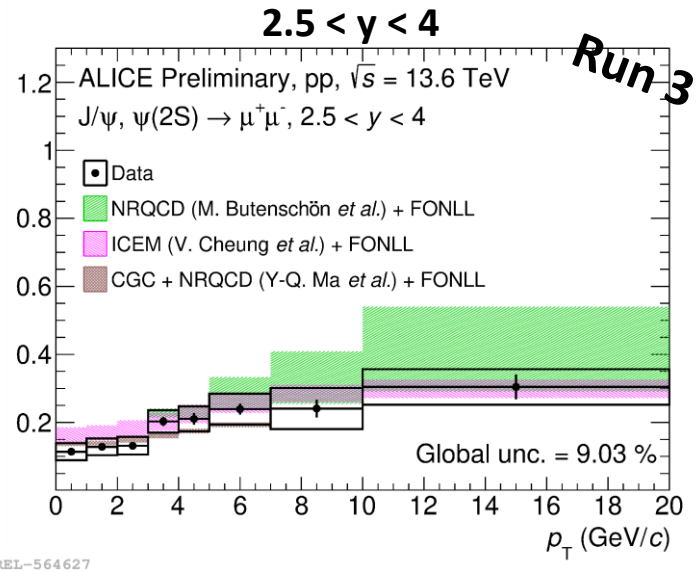
Nucl. Phys. B 1011 (2025) 116786



Lorenzo Mattei
LPCA/INFN

Xiaozhi Bai
USTC





❖ σ(ψ (2s)/σ(J/ψ) ratio similar at both forward and midrapidity
❖ In agreement with models within uncertainties at forward *y*
❖ Some tension with NRQCD at midrapidity
❖ Paper under ALICE review

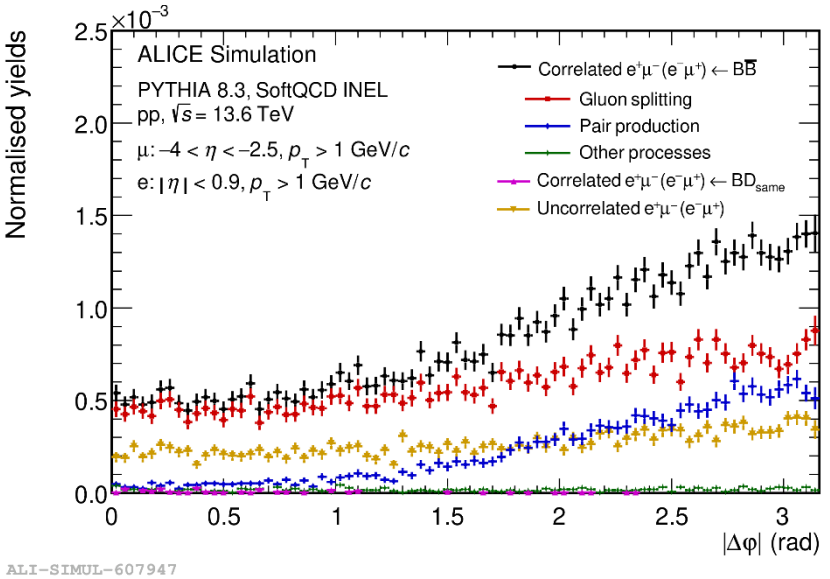
More: Xiaozhi Bai
Thurday, July24th, 14:10-14:30

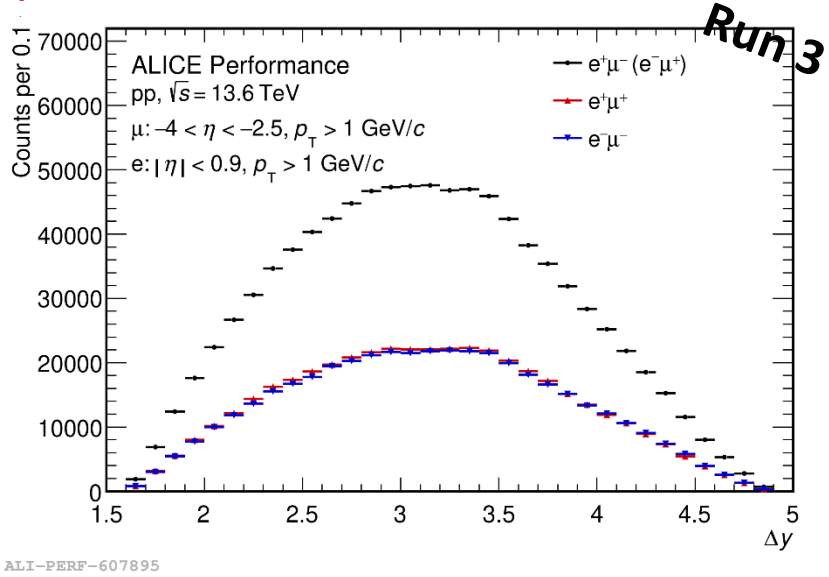
Heavy-flavour lepton measurements in Run 3

Maolin ZHANG
CCNU-LPCA
(2024-2027)
Supervisors: X. Zhang/N. Bastid

- Charm & beauty quarks produced in initial hard scatterings
  - Heavy-flavour hadrons & decay particles: excellent probes to characterise the QGP
  - In pp collisions: reference for pA, AA but not only: test of QCD theory, production mechanisms, study QGP-like effects…

- Associated production of electrons and muons from heavy-flavour hadron decays in ALICE
  - Interesting probe for measuring the correlated charm/beauty production in a *y* region between Central Barrel and muon arm
  - New insights on production mechanisms and the role of multi-parton interactions
    - Study the relative contributions of single parton scatterings (SPS) and double parton scatterings (DPS)





- Uncorrelated contribution small for beauty signal
- Unique $|\Delta y|$ reach at the LHC, up to $|\Delta y| \sim 5$

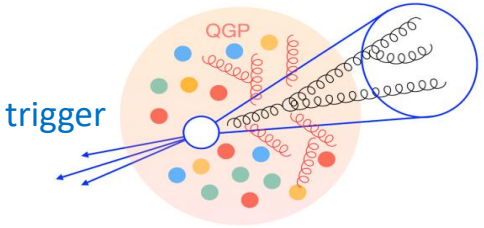
More: Maolin Zhang
Thurday, July24th, 15:10-15:30

Hadron-jet correlations in pp, p-Pb & Pb-Pb collisions

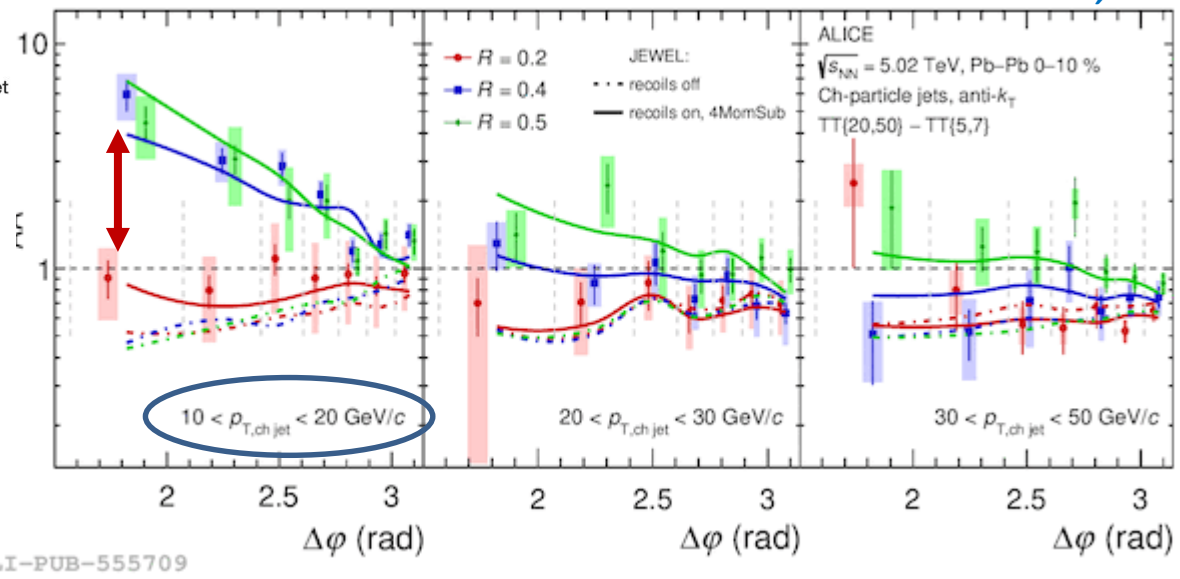
❖ Semi-inclusive distributions of charged-particle jets recoiling from a high-p_T charged hadron measured in pp, p-Pb and central Pb-Pb collisions and compared via the I_{AA} ratio

- ➢ Probe medium-induced jet energy loss, intra-jet broadening, in-medium jet scattering and medium response
- ➢ Low-p_T reach: unique space phase for studying interaction of jets with the QGP

ALICE, PRL 133 (2024) 022301
ALICE, PRC 110 (2024) 014906



$$I_{AA} = \frac{\Delta_{recoil}(Pb-Pb)}{\Delta_{recoil}(pp)}$$



Yongzhen HOU
CCNU-IPHC, 2021-2024
Supervisors:
Y. Mao/C.Kuhn
April 2025: CGU & GSI

Yubiao WANG
CCNU-CERN (CSC), 2025-2027
Supervisor: Y. Mao

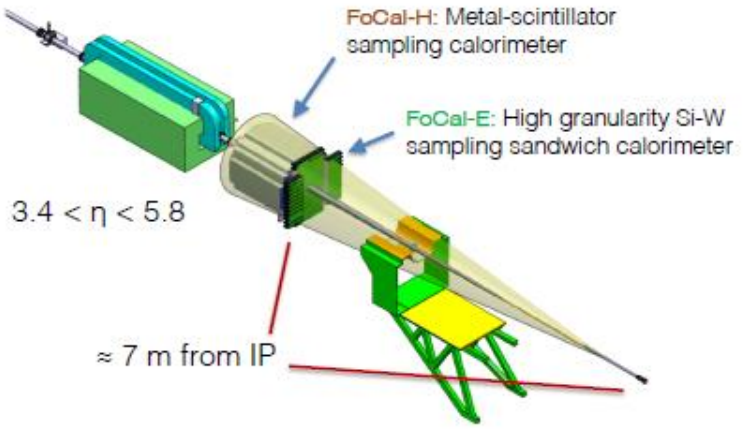
❖ First observation of significant medium-induced yield enhancement and acoplanarity broadening of low-p_T jets in Pb-Pb, while I_{AA} ~ 1 in p-Pb (publication in preparation)

More: Xiaoming Zhang
Thurday, July24th, 14:30-14:50

❖ Ongoing (**Run 3**): charged-jet v_2 in Pb-Pb (Yubiao Wang)

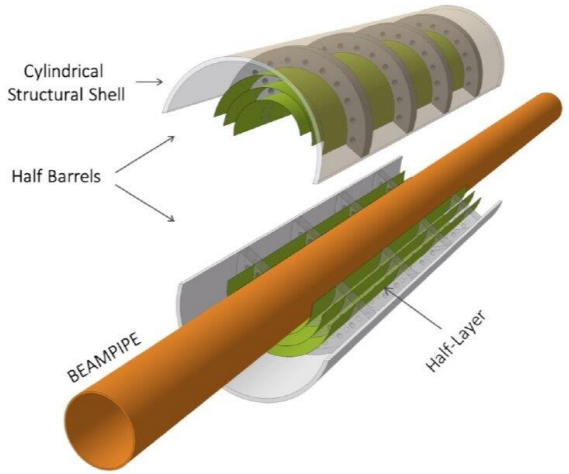
ALICE upgrades

FOCAL

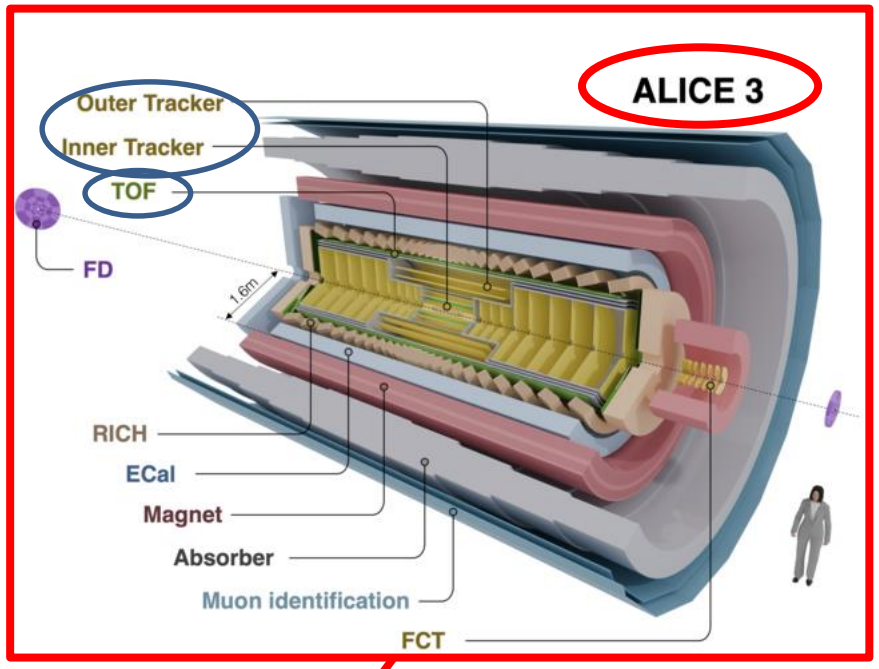


TDR: CERN-LHCC-2024-004

ITS 3



TDR: CERN-LHCC-2024-003



LoI: CERN-LHCC-2022-009
Scoping Doc.: CERN-LHCC-2025-002

FCPPN/L ALICE: interest for ALICE 3*

*in discussion for ALICE 3 in both institutes from China & France

Zhongbao Yin, Friday, July 25th, 9:00-9:25
Antonio Uras, Friday , July 25th, 9:25-9:45

Conclusion

Solid China-France cooperation via the FCPPN in the ALICE scientific program with a recognised visibility within ALICE and at international level

- Strong contribution to data taking, data analysis and performance studies
  - Excellent contributions of students
  - Significant contributions to scientific production
  - Many talks in conferences
- Important contributions to ALICE upgrades: detector and software developments
- Numerous Run 3 analyses ongoing: more to come soon, stay tuned!

Continue to extend the collaboration in more and more common activities

- **Need to strengthen manpower (new student/postdoc exchanges & short stay physicists) and funding!**

Huge statistics already collected for pp and Pb-Pb collisions and recenty for pO, OO, Ne-Ne interesting opportunities beyond Run 4 with ALICE 3 project

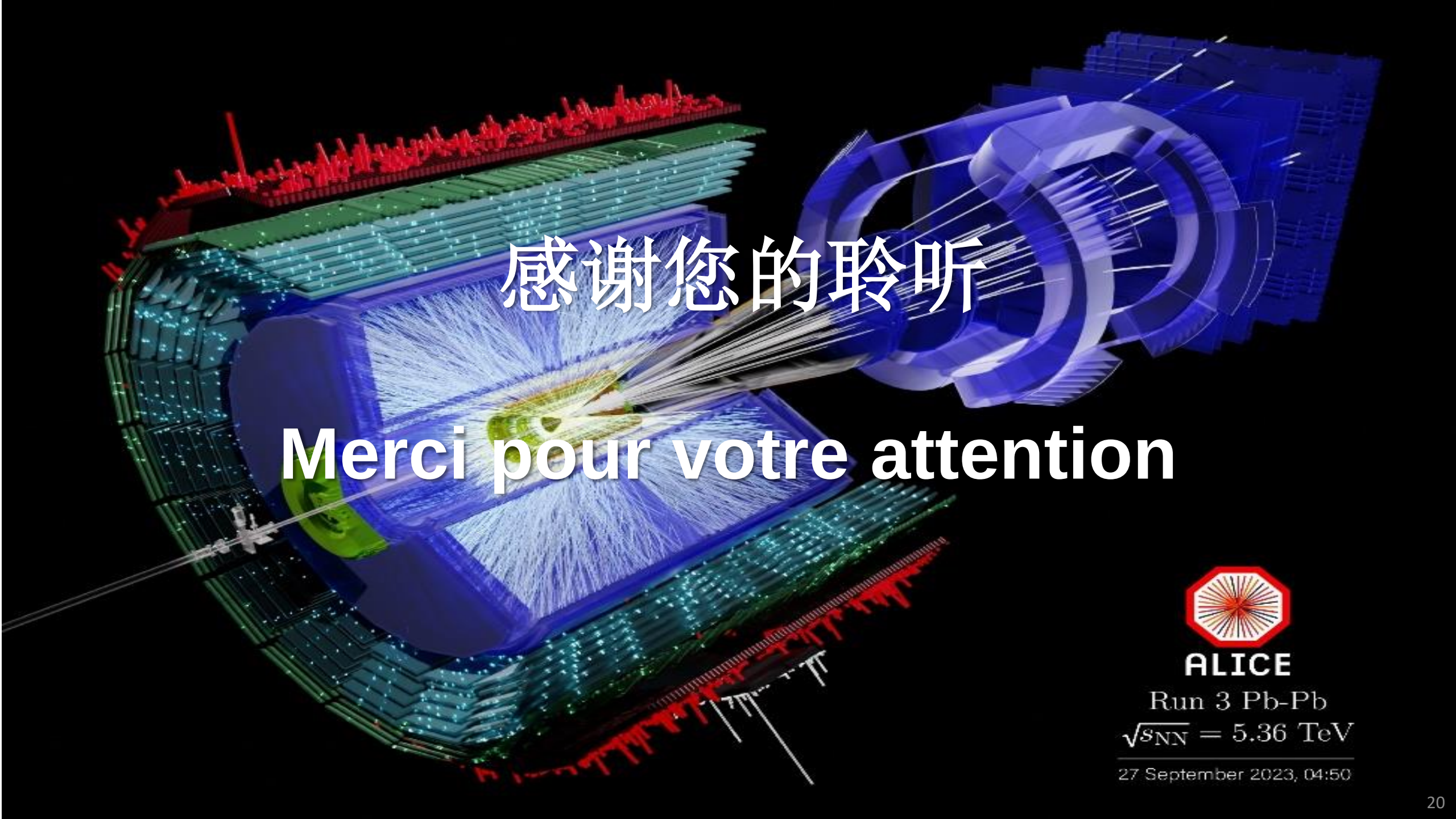
Timetable of ALICE session

Thursday, July 24

	ALICE Report of FCPPN/L project	*Nicole BASTID*
	Rose Hall (on the first floor), Haitian Grand Theatre Hotel, Qingdao	11:25 - 11:45
	Overview of recent ALICE highlights	*Yaxian MAO*
12:00	*Rose Hall (on the first floor), Haitian Grand Theatre Hotel, Qingdao*	11:45 - 12:10
	Critical fluctuations and correlations of quark spin near CEP	*Haolei CHEN*
14:00	*Rose Hall (on the first floor), Haitian Grand Theatre Hotel, Qingdao*	13:45 - 14:10
	Vector meson spin alignment measurements with ALICE	*Xiaozhi BAI*
	Rose Hall (on the first floor), Haitian Grand Theatre Hotel, Qingdao	14:10 - 14:30
	Jet physics with ALICE	*Xiaoming ZHANG*
	Rose Hall (on the first floor), Haitian Grand Theatre Hotel, Qingdao	14:30 - 14:50
	Physics analysis activities at ALICE-CIAE group	*Mingrui ZHAO*
15:00	*Rose Hall (on the first floor), Haitian Grand Theatre Hotel, Qingdao*	14:50 - 15:10
	Heavy-flavour lepton measurements with ALICE in Run 3	*Maolin ZHANG*
	Rose Hall (on the first floor), Haitian Grand Theatre Hotel, Qingdao	15:10 - 15:30
	Transverse momentum fraction of strange hadrons in mini-jets in pp collisions	*Lang XU*
	Rose Hall (on the first floor), Haitian Grand Theatre Hotel, Qingdao	15:30 - 15:50

Friday, July 25

09:00	**The ALICE3 Upgrade Project**	*Zhongbao YIN*
	Rose Hall (on the first floor), Haitian Grand Theatre Hotel, Qingdao	09:00 - 09:25
	Physics programme with ALICE 3	*Antonio URAS*
	Rose Hall (on the first floor), Haitian Grand Theatre Hotel, Qingdao	09:25 - 09:45
	Research and Application of Detectors and Electronics at CIHENP	*Xiaomei LI*
10:00	*Rose Hall (on the first floor), Haitian Grand Theatre Hotel, Qingdao*	09:45 - 10:10


感谢您的聆听
Merci pour votre attention
ALICE
Run 3 Pb-Pb
$\sqrt{s_{NN}} = 5.36$ TeV
27 September 2023, 04:50

Backup slides

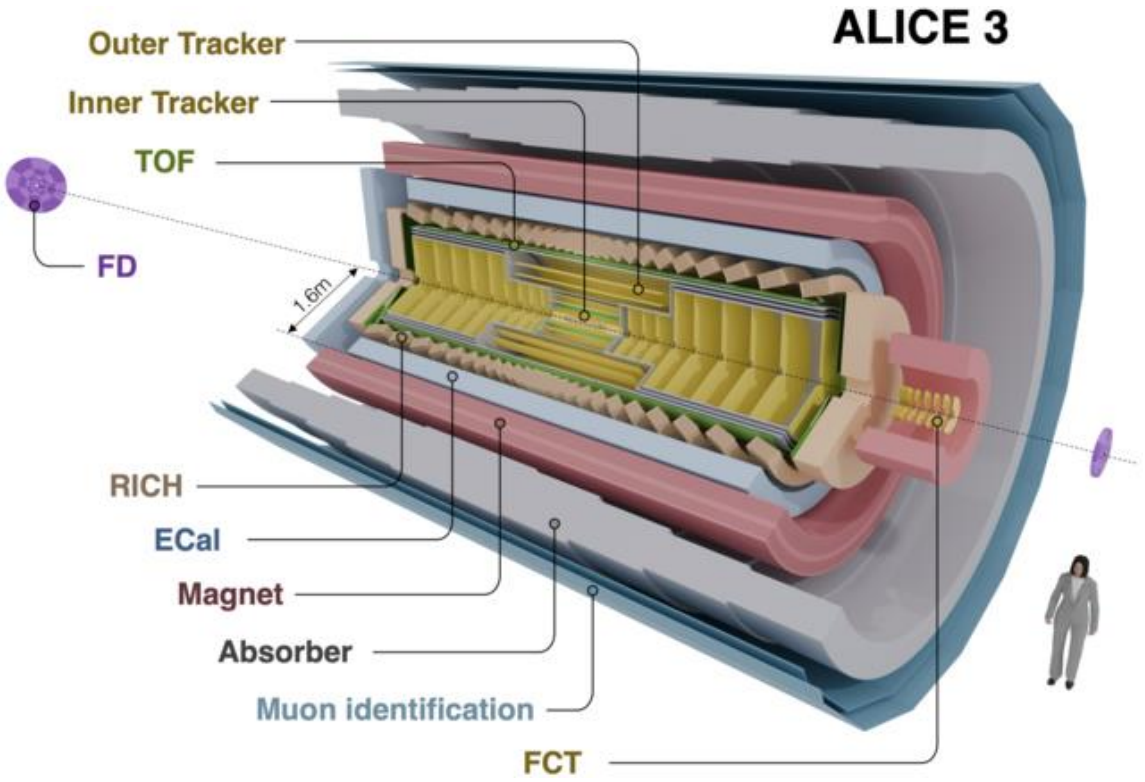
FCPPN/L ALICE Project 2025

- funding from France. Total: XXXX Euros
  - travel costs for French Physicists to the FCPPN/L workshop (4 persons)
  - travel costs for the PhD defense of Ran Xu (1 person)
  - stay costs for a visit of 1 Chinese physicist in France
  - stay costs for 1 month-postdoc visit at LPCA
  - stay costs for 2 Chinese master-II students in France (postponed to 2026)

- funding from China. Total: XXXXX Yuan
  - travel costs for Chinese physicists, technicians & students in France
  - stay costs for French physicists in Jinan & Wuhan
  - stay costs for Chinese physicists in France

- concern: the reduction of the French budget (14 000 Euros attributed for a request of 42 200 Euros) strongly affects the future collaboration →

Upgrade for Run 5: ALICE 3



Detector

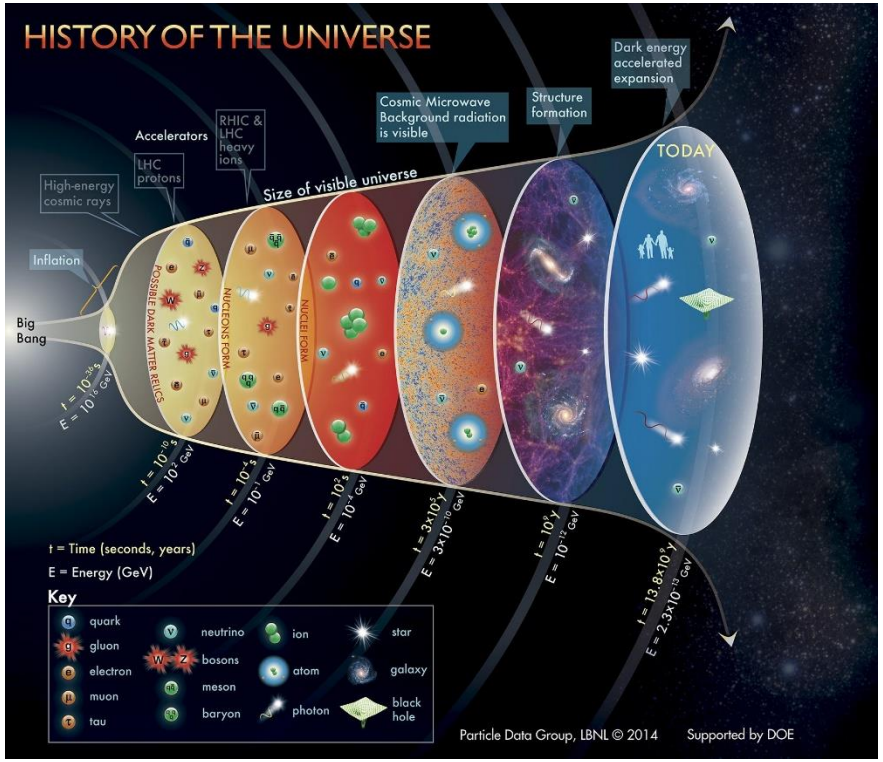
- Compact and low mass all-silicon tracker
- Retractable vertex detector
- Large acceptance $|\eta| < 4$
- PID (TOF, RICH, MID, Ecal) over a wide p_T range
- Excellent pointing precision: ~3μm at $p_T > 3$ GeV/c

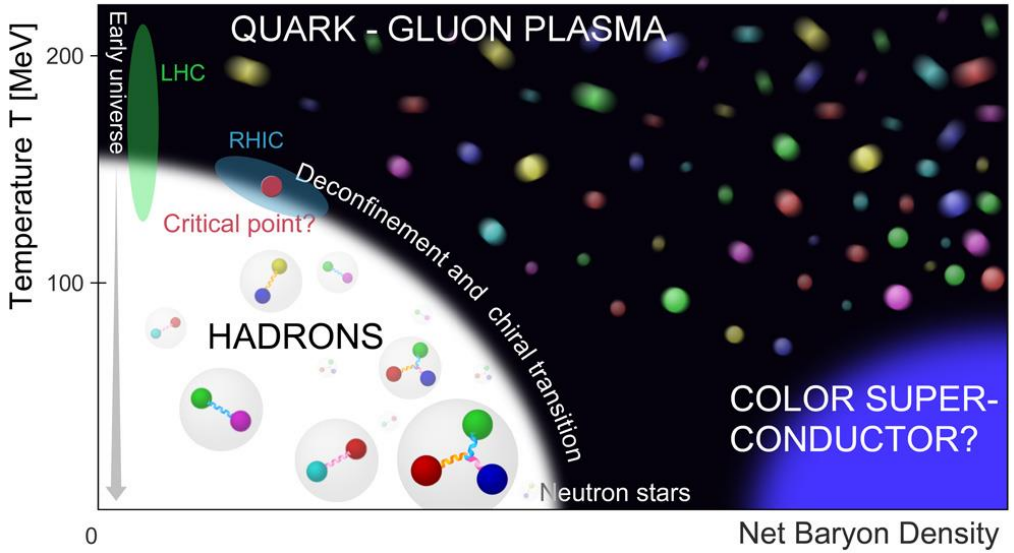
Key physics motivations

- Early stage temperature with dielectrons
- Properties and hadronisation of the QGP with (multi) heavy-flavour hadrons
- Fundamental aspects of QCD phase transition

LoI: CERN-LHCC-2022-009
Scoping Doc.: CERN-LHCC-2025-002

Scientific context: the quark-gluon plasma (QGP)





- Study the properties of nuclear matter at extreme conditions of temperature and energy density
  - Deconfined state of matter: quark-gluon plasma (QGP)
  - Predicted by QCD: T_c ~ 155 MeV, ε_c ~ 0.5 GeV/fm^3

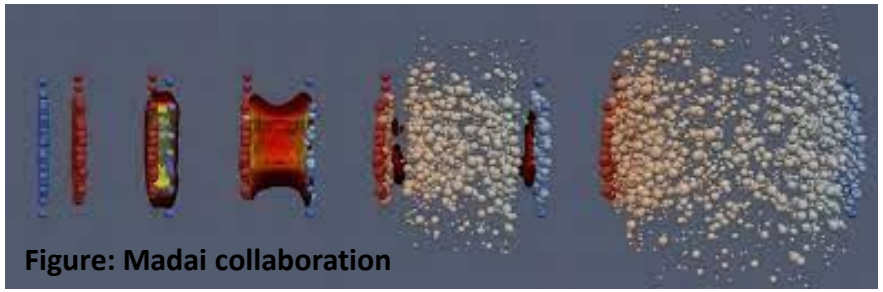
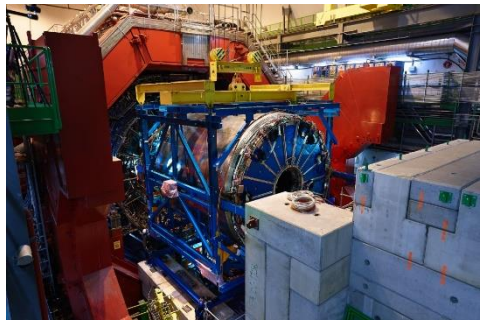


Figure: Madai collaboration

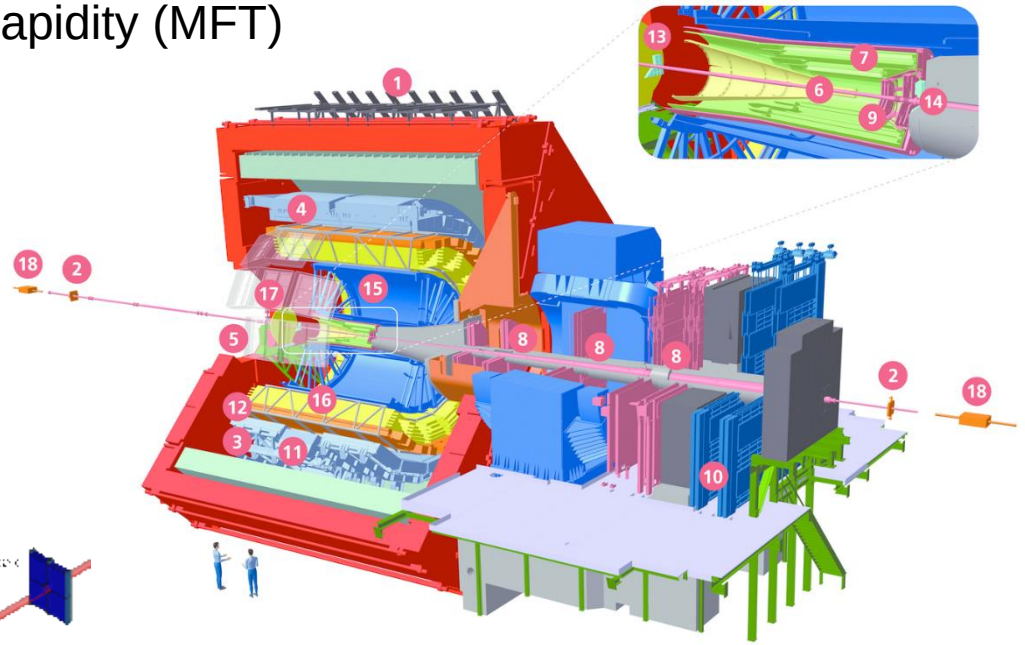
- A QGP state can be created using ultrarelativistic heavy-ion collisions
- ALICE at the LHC: dedicated experiment for heavy-ion physics

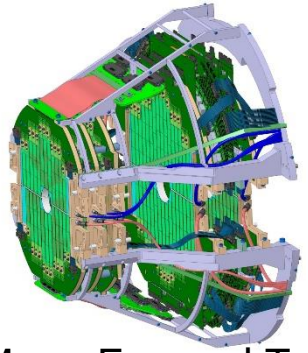
The new ALICE detector for Run 3 (2022-2025)

❖ In operation since 2022 with much higher interaction rate, 3 to 6 x improvement in pointing resolution, vertexing at forward rapidity (MFT)

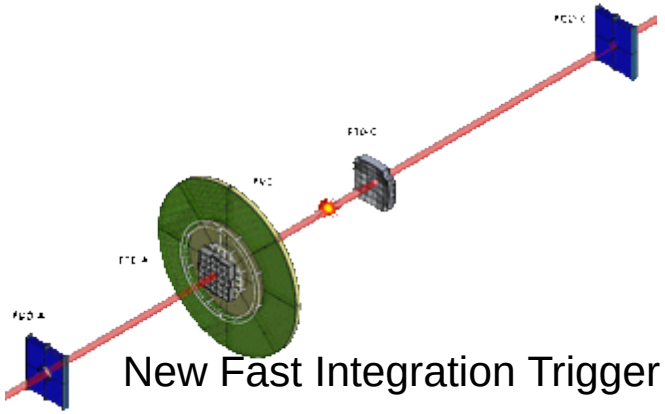


New GEM-based TPC

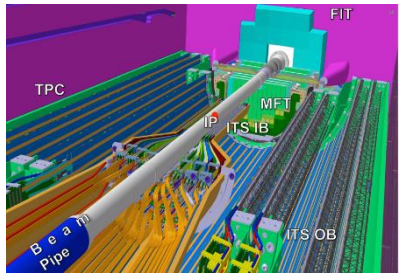




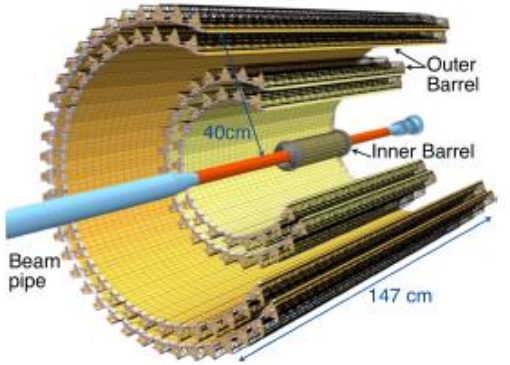
New Muon Forward Tracker (MFT)



New Fast Integration Trigger (FIT)



New beam pipe



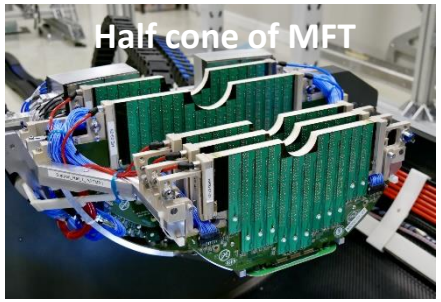
New Inner Tracking System (ITS2)

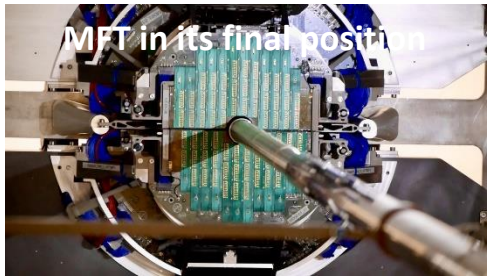
Readout upgrade: MUON, TOF, TRD, ZDC, Calorimeters (continuous readout)
Integrated Online-Offline system (O^2)

More: ALICE upgrades during LS2, arXiv:2303.01238

Common contributions to the ALICE upgrade for Run 3

❖ Involvements in the ITS upgrade and new MFT

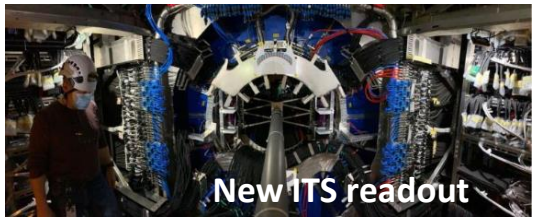


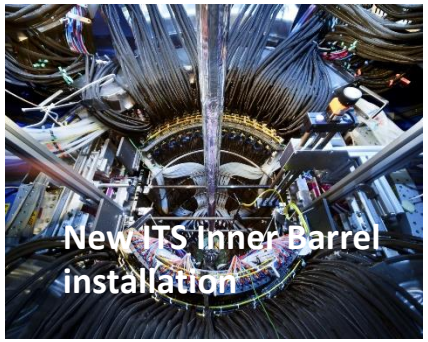


Technical aspects

❑ Contribution to the global readout electronics of MFT, Printed Circuit Boards (CCNU & IP2I)
- ➢ Design optimization, test and production

❑ Contribution to the new ITS for Run 3
- ➢ Installation (Jan.-March, 2021): Yitao Wu, USTC and IPHC



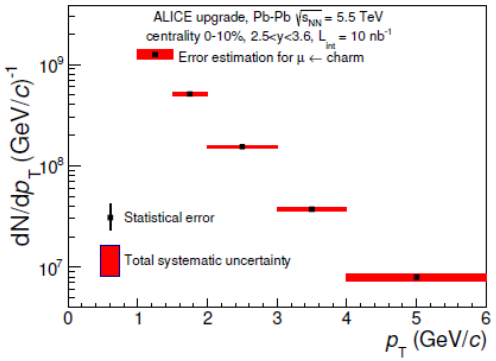


❑ Contribution to ITS3 (Run 4) sensor characterization & qualification (Yitao Wu, with USTC and IPHC)
- ➢ Development of run control and analysis tools,
- ➢ Participation to system installation and beam test (SPS, July 2021)

Physics performances for both upgraded ITS and MFT

❑ Charm and beauty measurements via muons with MUON-MFT (LPC & CCNU)

❑ D-meson fragmentation function with new ITS for Run 3



CERN-LHCC-2015-001

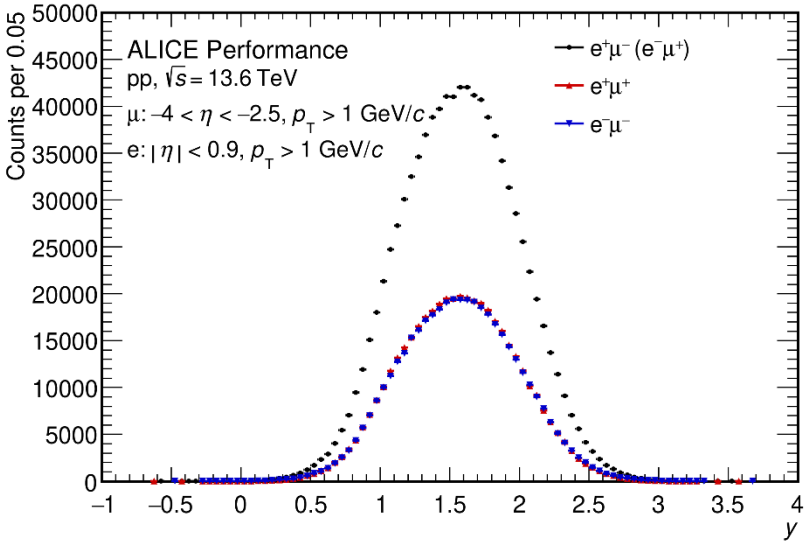
➢ Now: moving to the preparation of the full analysis chain in O^2 for first pp collisions

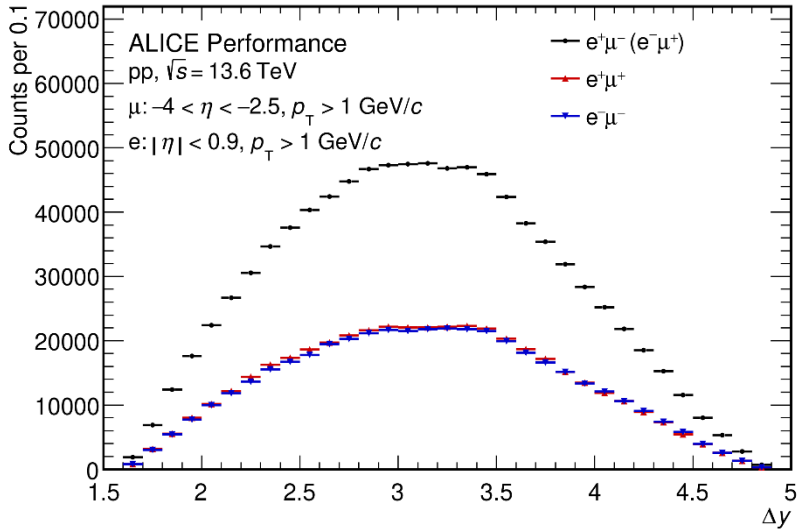
Heavy-flavour lepton measurements in Run 3

Maolin ZHANG
CCNU-LPCA
(2024-2027)
Supervisors: X. Zhang/N. Bastid

- Charm & beauty quarks produced in initial hard scatterings
  - Heavy-flavour hadrons & decay particles: excellent probes to characterise the QGP
  - In pp collisions: reference for p-A, A-A but not only: test of QCD theory, production mechanisms…

- Associated production of electrons and muons from heavy-flavour hadron decays in ALICE:
  - Interesting probe of correlated charm/beauty production
  - New insights on production mechanisms and the role of multi-parton interactions
    - Study the relative contributions of single parton scatterings (SPS) and double parton scatterings (DPS)
    - Relevant observables: $|\Delta y|$, $\Delta\varphi$

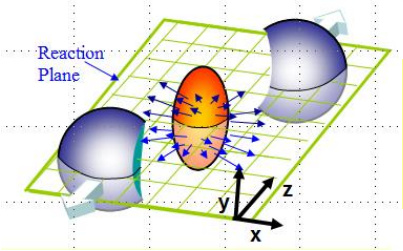




- Rapidity coverage between Central Barrel and muon arm
- Unique $|\Delta y|$ reach at the LHC, up to $|\Delta y| \sim 5$

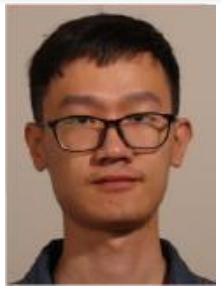
Maolin Zhang
Thurday, July24th, 15:10-15:30

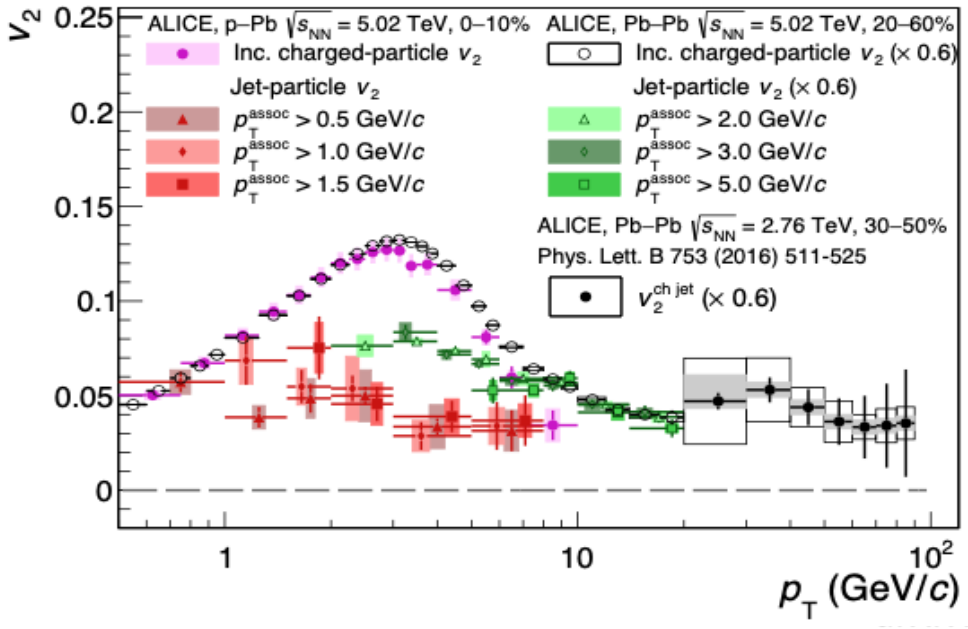
Jet-particle v_2 in p-Pb & Pb-Pb collisions at 5.02 TeV

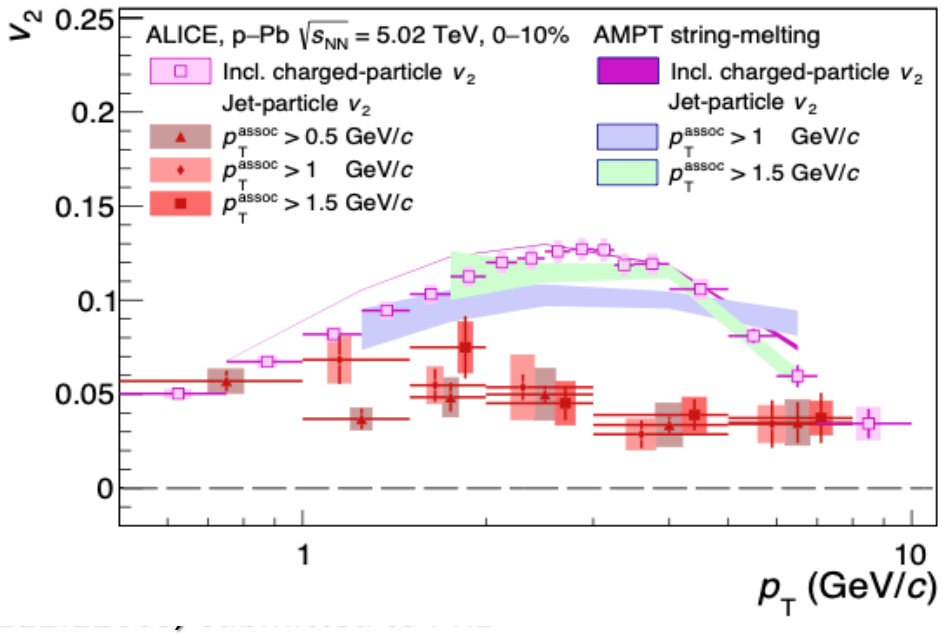


$$\frac{2\pi}{N}\frac{\mathrm{d}N}{\mathrm{d}\varphi} = 1 + \sum_{n=1}^{\infty} 2v_n \cos[n(\varphi - \Psi_n)]$$

Siyu Tang's PhD (CCNU Wuhan -LPC), funding CSC + LPC/IOPP-CCNU, defense: May 27th, 2022
Now lecturer at Wuhan Textile University







JHEP 08 (2024) 234

- First measurement of the jet-particle v_2 in high-multiplicity (0-10%) p-Pb collisions and Pb-Pb collisions down to low p_T
- Significant positive v_2 in p-Pb collisions with almost no dependence on p_T
- AMPT calculations generate a positive v_2 for inclusive charged particles and jet particles in p-Pb collisions
  - Important role of parton interactions
- Crucial information about the origin of the jet-particle v_2 in p-Pb collisions and key constraints on theoretical calculations