Review of KoALICE Experiment Group in stage 4 & Future plan

Jin-Hee Yoon

Professor

Inha University

Participation : 6 universities + 1 Institute

KoALICE

1 new institute

Man Power

- ✓ Steady but little decreasing

Institute	2016-04	2016-10	2017-04	2017-10	2018-04	NOW
PNU	12	9	7	6	4	7
GWNU	1	1	1	1	2	2
Sejong	2	2	2	2	2	2
Yonsei	12	10	12	7	7	9
Inha	7	10	12	11	12	10
Chonbuk	-	-	1	1	2	2
Total	**34**	**32**	**35**	**28**	**29**	**32**

Produced man power & Publications

- ✓ Ph. D.
  - 2016. 8 : 김민우 (연세대)
  - 2017. 2 : 송명근 (연세대)
  - 2018. 2 : 송지혜(부산대), 김태수(연세대)
- ✓ MS
  - 2016. 8 : 김민정 (인하대)
  - 2017. 2 : Qiulian Yang, Dan Liu (연세대)
  - 2018. 2 : 방혜선, 권지연, 허경범, 서진주 (인하대), 정재호, 김태준 (연세대)
  - 2019. 2 : 이상현(부산대)

- ✓ 공동연구 논문 중 주저자 논문
  - 2014 : 1/15
  - 2015 : 1/27
  - 2016 : 2/35
  - 2017 : 4/33
  - 2018(12월 초 기준) : 0/23

Achivements I - Papers

- Total Papers 42 (PA-paper: 8)

Data Analysis

- Pseudorapidity and transverse-momentum distributions of charged particles in proton-proton collisions at √s=13 TeV
- K*(892)0 and Φ(1020) production in Pb-Pb collisions at √sNN = 2.76 TeV
- Measurement of electrons from semi-leptonic heavy-flavour hadron decays in proton-proton collisions at sqrt(s) = 2.76 TeV with ALICE
- Measurement of electrons from heavy-flavour hadron decays in p-Pb collisions at √sNN = 5.02 TeV

2016-04

Detector

- MAPS development for the ALICE ITS upgrade
- Low-power priority Address-Encoder and Reset-Decoder data-driven readout for Monolithic Active Pixel Sensors for tracker system

Theory

- Lattice NRQCD study of S- and P-wave bottomonium states in a thermal medium with Nf = 2 + 1 light flavors
- Nonrelativistic lattice study of stoponium

Achivements II

- Total Talks: International 219 + Domestic 29
  - KPS (8), HIM (4), GRN (3), KoALICE
  - ALICE PAG > PWG > Plenary > Physics Forum ~ 200 (~100 in 2015)
  - ICPAQGP / JPS / NN2015 / ISLFT / LHC Era / IC New Frontier P / QCD@LCH 2015 / TWEPP / QM2015 (3) / PLAC / ATHIC 2016 (3)
- 3 Masters, 1 SASS (CERN), 3 IACs
- Press: CERN-SASS 13, Nature Physics 12
- Silicon R&D Infra + Industrialization
  - Probe Card (EQ&G, NOTICE), Pohang PAL, Kyungju p-beam
  - IBS Machine (250M) to be installed in PNU
  - C-on Technology (200M): Machine R&D and Export to CERN
  - FUREX: Wafer thinning and dicing (100M) – CERN tendering

Achivements I - Papers

- Since May of 2016
  - ✓ 11 published articles
  - ✓ 4 accepted articles : 1 PC
  - ✓ 12 submitted articles : 1 PC
- Share in % : 2/27=7.4 %
- manpower : 25/1000 = 2.5 %

2016-10

Principal Author

ELSEVIER

Physics Letters B

Volume 753, 10 February 2016, Pages 319–329

Open Access

Pseudorapidity and transverse-momentum distributions of charged particles in proton–proton collisions at $\sqrt{s} = 13$ TeV

ALICE Collaboration*,

Correlated event-by-event fluctuations of flow harmonics in Pb-Pb collisions at $\sqrt{s_{\mathrm{NN}}} = 2.76$ TeV

ALICE Collaboration

(Submitted on 26 Apr 2016)

Accepted by PRL

Measurement of electrons from beauty-hadron decays in p-Pb collisions at $\sqrt{s_{\mathrm{NN}}} = 5.02$ TeV and Pb-Pb collisions at $\sqrt{s_{\mathrm{NN}}} = 2.76$ TeV

ALICE Collaboration

(Submitted on 13 Sep 2016)

Submitted to JHEP

Achivements II

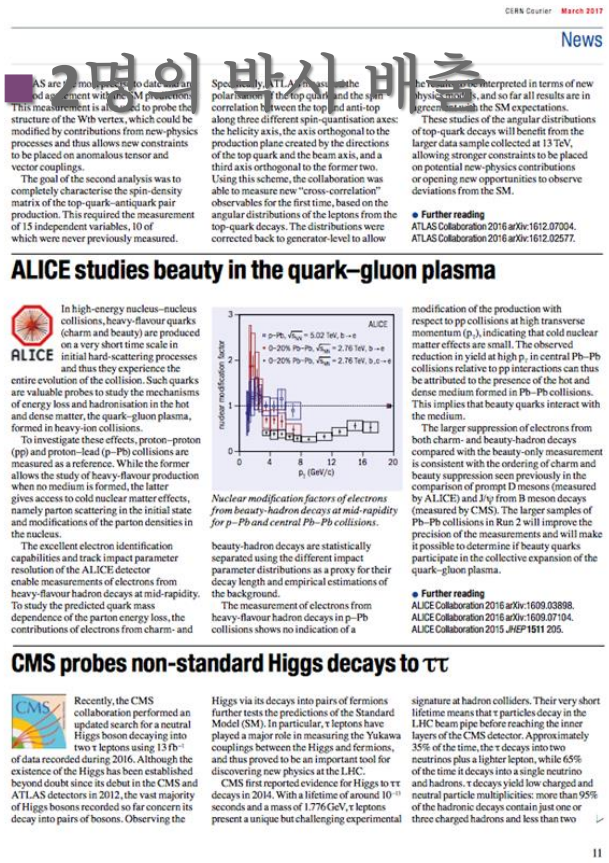
- Talks
  - ✓ International outside CERN : 13 times
    - → ICNFP 2016 / Hard Probe 2016 / 7th ALICE ITS upgrade, MFT and O2 Asian Workshop (3) / UKC 2016 / ISMD 2016(3) / Hot Quark 2016 / xQCD 2016 / J-PARC Workshop 2016(2)
  - ✓ International @ CERN : 41 times
  - ✓ KoALICE Regular Meeting : 3 times
    - → Every month :
    - → Total 31 presentations
- **2 Ph.D's &1 Master students**
- ISMD 2016 : Chief LOC

Achivements III

- Silicon R&D Infra + Industrialization
  - ✓ Probe Card (EQ&G, NOTICE)
  - ✓ IBS Machine (230M) to be installed in PNU (통관 절차 중)
  - ✓ C-On Technology (200M): completed Machine R&D and exported to CERN to be installed at Yonsei Univ.
  - ✓ FUREX: Wafer thinning and dicing (100M above) (입찰 후 계약 성사)
- Collaboration with Tier-1 Center
  - ✓ Regular Meeting between Manager and Users
  - ✓ Every two weeks since 2016-6-9 : 8 times
  - ✓ KIAF : Sunccessfully working comp. to CAF or GRID
  - ✓ Error report & suggestions

Scientific Achievements

- 논문 : 22 (including acc
- 발표 : 68(20)+11=79
- 2명의 박사 배출



CERN Courier March 2017

News

...AS are the most up-to-date ... good agreement with the SM prediction. This measurement is also used to probe the structure of the Wtb vertex, which could be modified by contributions from new-physics processes and thus allows new constraints to be placed on anomalous tensor and vector couplings.

The goal of the second analysis was to completely characterise the spin-density matrix of the top-quark–antiquark pair production. This required the measurement of 15 independent variables, 10 of which were never previously measured. Specifically, ATLAS measured the polar nature of the top quark and the spin correlation between the top and anti-top along three different spin-quantisation axes: the helicity axis, the axis orthogonal to the production plane created by the directions of the top quark and the beam axis, and a third axis orthogonal to the former two. Using this scheme, the collaboration was able to measure new "cross-correlation" observables for the first time, based on the angular distributions of the leptons from the top-quark decays. The distributions were corrected back to generator-level to allow the results to be interpreted in terms of new physics models, and so far all results are in agreement with the SM expectations.

These studies of the angular distributions of top-quark decays will benefit from the larger data sample collected at 13 TeV, allowing stronger constraints to be placed on potential new-physics contributions or opening new opportunities to observe deviations from the SM.

● Further reading
ATLAS Collaboration 2016 arXiv:1612.07004.
ATLAS Collaboration 2016 arXiv:1612.02577.

ALICE studies beauty in the quark–gluon plasma

In high-energy nucleus–nucleus collisions, heavy-flavour quarks (charm and beauty) are produced on a very short time scale in initial hard-scattering processes and thus they experience the entire evolution of the collision. Such quarks are valuable probes to study the mechanisms of energy loss and hadronisation in the hot and dense matter, the quark–gluon plasma, formed in heavy-ion collisions.

To investigate these effects, proton–proton (pp) and proton–lead (p–Pb) collisions are measured as a reference. While the former allows the study of heavy-flavour production when no medium is formed, the latter gives access to cold nuclear matter effects, namely parton scattering in the initial state and modifications of the parton densities in the nucleus.

The excellent electron identification capabilities and track impact parameter resolution of the ALICE detector enable measurements of electrons from heavy-flavour hadron decays at mid-rapidity. To study the predicted quark mass dependence of the parton energy loss, the contributions of electrons from charm- and beauty-hadron decays are statistically separated using the different impact parameter distributions as a proxy for their decay length and empirical estimations of the background.

The measurement of electrons from heavy-flavour hadron decays in p–Pb collisions shows no indication of a modification of the production with respect to pp collisions at high transverse momentum (p_T), indicating that cold nuclear matter effects are small. The observed reduction in yield at high p_T in central Pb–Pb collisions relative to pp interactions can thus be attributed to the presence of the hot and dense medium formed in Pb–Pb collisions. This implies that beauty quarks interact with the medium.

The larger suppression of electrons from both charm- and beauty-hadron decays compared with the beauty-only measurement is consistent with the ordering of charm and beauty suppression seen previously in the comparison of prompt D mesons (measured by ALICE) and J/ψ from B meson decays (measured by CMS). The larger samples of Pb–Pb collisions in Run 2 will improve the precision of the measurements and will make it possible to determine if beauty quarks participate in the collective expansion of the quark–gluon plasma.

Nuclear modification factors of electrons from beauty-hadron decays at mid-rapidity for p–Pb and central Pb–Pb collisions.

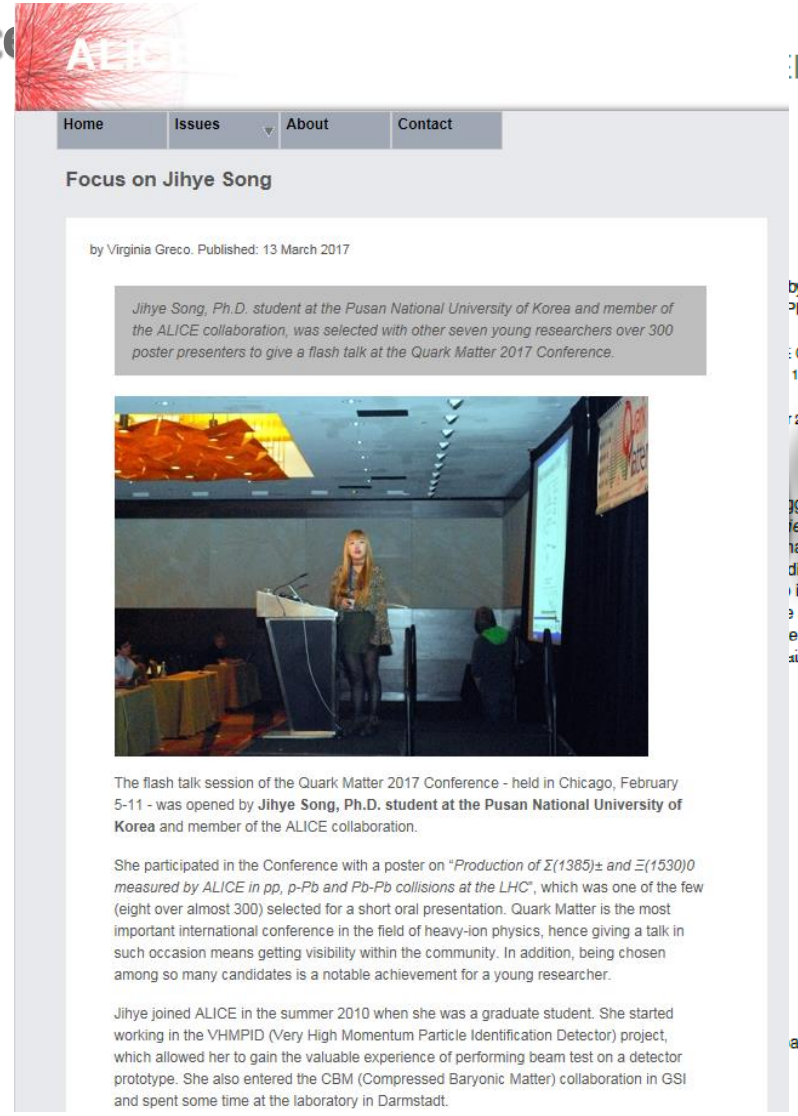
● Further reading
ALICE Collaboration 2016 arXiv:1609.03898.
ALICE Collaboration 2016 arXiv:1609.07104.
ALICE Collaboration 2015 JHEP1511 205.

CMS probes non-standard Higgs decays to ττ

Recently, the CMS collaboration performed an updated search for a neutral Higgs boson decaying into two τ leptons using 13 fb^{-1} of data recorded during 2016. Although the existence of the Higgs has been established beyond doubt since its debut in the CMS and ATLAS detectors in 2012, the vast majority of Higgs bosons recorded so far concern its decay into pairs of bosons. Observing the Higgs via its decays into pairs of fermions further tests the predictions of the Standard Model (SM). In particular, τ leptons have played a major role in measuring the Yukawa couplings between the Higgs and fermions, and thus proved to be an important tool for discovering new physics at the LHC.

CMS first reported evidence for Higgs to ττ decays in 2014. With a lifetime of around 10^{-13} seconds and a mass of 1.776 GeV, τ leptons present a unique but challenging experimental signature at hadron colliders. Their very short lifetime means that τ particles decay in the LHC beam pipe before reaching the inner layers of the CMS detector. Approximately 35% of the time, the τ decays into two neutrinos plus a lighter lepton, while 65% of the time it decays into a single neutrino and hadrons. τ decays yield low charged and neutral particle multiplicities: more than 95% of the hadronic decays contain just one or three charged hadrons and less than two

11



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Focus on Jihye Song

by Virginia Greco. Published: 13 March 2017

Jihye Song, Ph.D. student at the Pusan National University of Korea and member of the ALICE collaboration, was selected with other seven young researchers over 300 poster presenters to give a flash talk at the Quark Matter 2017 Conference.

The flash talk session of the Quark Matter 2017 Conference - held in Chicago, February 5-11 - was opened by **Jihye Song, Ph.D. student at the Pusan National University of Korea** and member of the ALICE collaboration.

She participated in the Conference with a poster on "*Production of Σ(1385)± and Ξ(1530)0 measured by ALICE in pp, p-Pb and Pb-Pb collisions at the LHC*", which was one of the few (eight over almost 300) selected for a short oral presentation. Quark Matter is the most important international conference in the field of heavy-ion physics, hence giving a talk in such occasion means getting visibility within the community. In addition, being chosen among so many candidates is a notable achievement for a young researcher.

Jihye joined ALICE in the summer 2010 when she was a graduate student. She started working in the VHMPID (Very High Momentum Particle Identification Detector) project, which allowed her to gain the valuable experience of performing beam test on a detector prototype. She also entered the CBM (Compressed Baryonic Matter) collaboration in GSI and spent some time at the laboratory in Darmstadt.

:RS

APS physics

by-event fluctuations of flow
Pb collisions at $\sqrt{s_{NN}} = 2.76$ TeV

: Collaboration)
182301 (2016)

2016

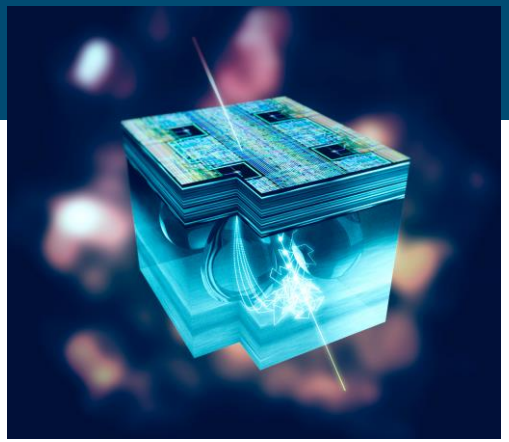
4

...ublication of a Letter is
...ccepts fewer than 1/4 of
...athema... ...ournals by the Google
...ditiona... ...icance, because only about
... its particular importance, innovation,
...e as often as the average Letter, and are
...estions were a separate publication,
...ation about our journal and its history

Pierre Meystre
Editor in Chief
Physical Review

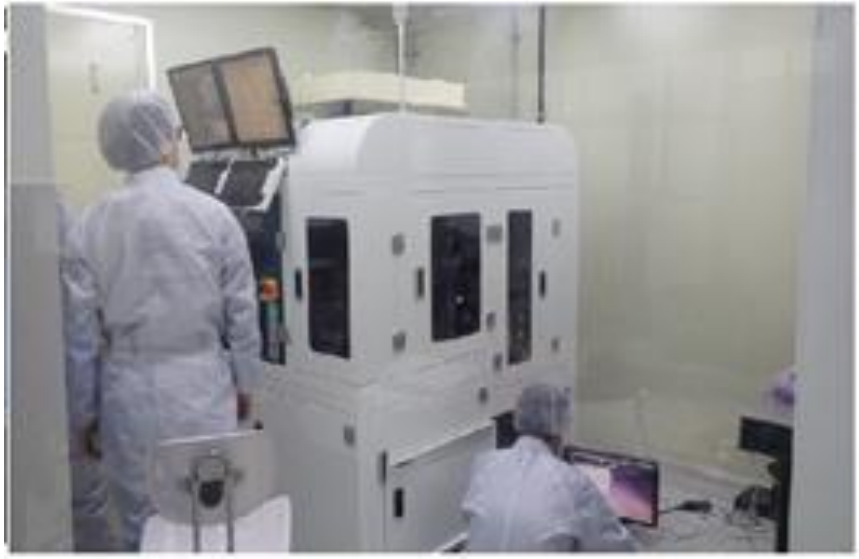
...ad, Ridge, NY 11961-2701

Scientific Achievements



- ✓ ITS Upgrade Project
- ✓ Mass Chip Test Set Up and Training

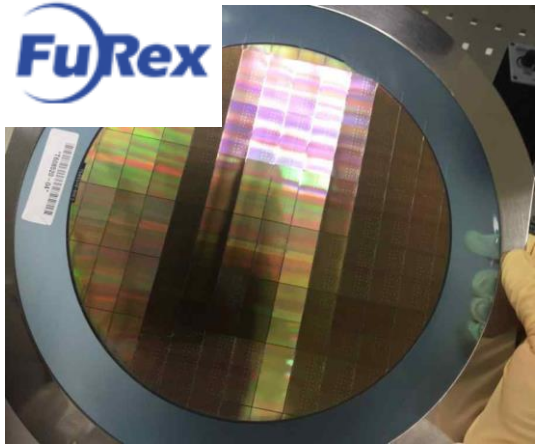
부산대 **ALICIA-2**



연세대 **COREA-YS-01**

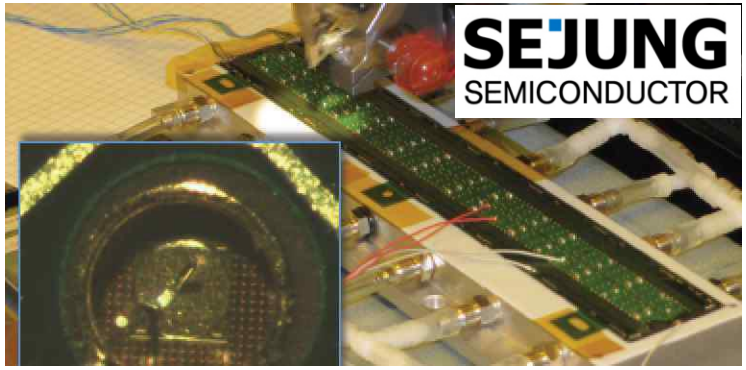
- ✓ Attract many Korean companies participating in this project!!

산업체 협력



Thinning & Dicing

Probecard



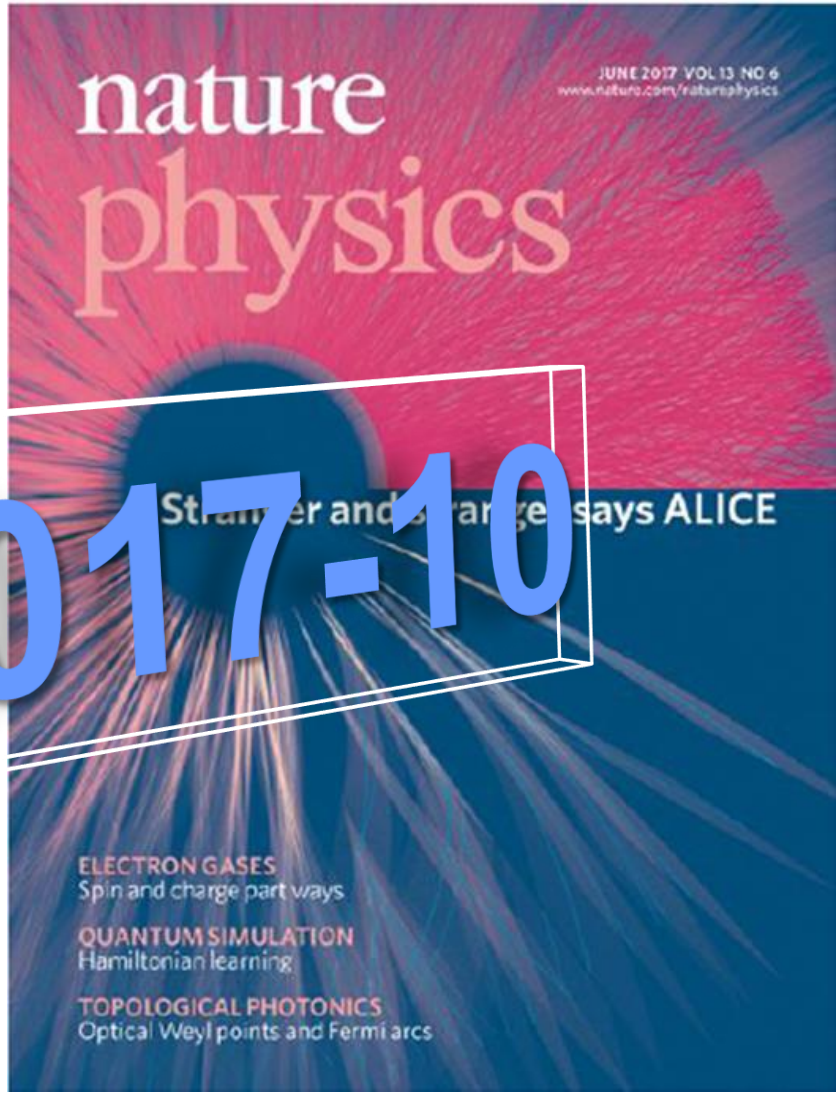
Wire Bonding

C-on

ATE machine

Scientific Achievements

- ✓ 논문 : 16 (주저자 논문 3건)
  - 김민정, 권민정 JHEP 07, 052
  - 송지혜, 유인권 Eur. Phys. J. C 77, 389
  - 송지혜, 유인권 Nuclear Physics A 967, 920
- ✓ 발표 : 61건
  - 국제학회 10건
  - 국내학회 1건
  - CERN 내부 50건
- ✓ 박사 1명, 석사 2명 배출



Nature Physics 표지논문, June 2017, Vol 13, No 6

Scientific Achievement

9th ALICE ITS upgrade, MFT and O2 Asian Workshop

26-27 June 2017
HOTEL NONGSHIM, 2nd Floor, Emerald Hall
Asia/Seoul timezone

Search...

- Overview
- Timetable
- Contribution List
- Registration
- Videoconference Rooms
- Participant List
- Workshop Venue and Travel Information
- Sightseeing in Dongnae
- Photos

Hyeyoung PARK
tdw1978@pusan.ac.kr
+82-51-513-2594

The 9th ALICE ITS Upgrade, MFT, and O2 Asian Workshop will be held in Pusan, South Korea from **Monday 26 to Thuesday 27 of June, 2017**

The workshop will be organised and sponsored by Pusan National University(PNU) and Pusan National University Supercomputing Center. Both ITS-MFT and O2 Sessions will be held in parallel on both days.

REGISTRATION AND ACCOMMODATION

You can register online here

The registration fee will be due on workshop venue in cash, before the workshop begins
The registration fee will be **130,000 KRW** or 120 USD

it will contain:

- Workshop participation
- Lunches, Snacks and Banquet

it will **NOT** contain:

- Room charge of the hotel

Accommodation:
Room charge: **133,100 KRW** (per night) (about 120 USD)
Payment can be made at the hotel front desk upon arrival at the hotel.
Please register by May 31st so that we can book your room.

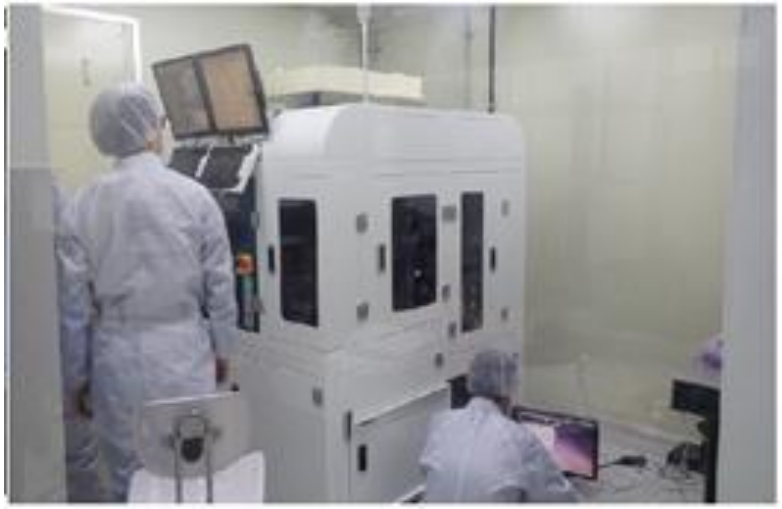
During your stay, you will be able to enjoy a special hot spring, "HURSHIMCHEONG" at the hotel.

Travel and Venue Information

20개 기관 65명 참석, 43건 발표

Scientific Achievements

- ✓ Mass Chip Test : 부산대, 인하대, 연세대
  - 총 테스트 대상량 : 60,000 개
  - 내년 4월까지 36000 개(60%) 목표
  - 9월 말 현재 6072 개(10%) 테스트 완료
  - 2018년 10월 완료 예정



- ✓ ITS HIC 모듈 조립 : 부산대, 인하대
  - 총 조립 대상량 : OB 400 /2000 개
  - 모듈 조립 공정 최종 확정(9월 말)
  - 10월 중으로 20개의 모듈 시험조립
  - **국내 와이어본딩 업체(세정 반도체)와 CERN 사이에 10월 말 계약 예정**
  - 10월 말 조립공정 개시 예정, 내년 4월까지 215개 조립 목표
  - 2018년 12월 말 완료 예정

산업체 협력

[중소·중견기업]'힉스'비밀 캐낸 CERN이 최초 구매한 한국 제품 1호

태현지 기자 입력 2017-08-28 03:00 수정 2017-08-28 03:00

㈜씨온테크


김현춘 대표

스위스 제네바에 위치한 유럽입자물리연구소(CERN)는 2012년 우주 탄생의 원리를 규명하는 '힉스입자'의 존재를 입증하며 과학사의 한 획을 그었다. 이 CERN이 최근 국내 중소기업의 센서 측정 장비를 처음으로 구입했다. 바로 인천에 위치한 ㈜씨온테크가 그 주인공. 2006년 설립 이후 카메라 모듈 제조 및 반도체 제조 자동화 장비 분야에서 기술력을 쌓아온 ㈜씨온테크는 최근 50마이크로미터(100만 분의 1미터) 두께의 초박형 반도체 소자의 전기 특성 측정 완전 자동화 장비를 개발하여 CERN에 납품하는 데 성공했다.

㈜씨온테크의 제품은 CERN의 대형 이온충돌기실험 검출기(ALICE ITS) 업그레이드 프로그램의 CMOS 공정을 이용해 개발된 ALPIDE 센서 양산 측정 장비로 개발되었다. CERN과 공동연구를 수행하며 국내 중소기업의 글로벌 기술 경쟁력을 확신하고 있던 연세대학교 물리학과 권영일 교수 연구팀으로부터 측정 장비의 개발을 권유받은 후

Adobe Flash Player을(를) 사용하려면 세요.

주요뉴스


文대통령-푸틴, '대북 원유공급 중

푸틴 "초강경 대북 제재 요청 거절만 해결 못해"

동아일보 8월 28일자 온라인 판

Scientific Achievements (2017.10.01 ~ 2018.02.28)

✓ **논문 : 13 (주저자 논문 4건)**

- 니어바이쿠마 Phys. Rev. C 96 , 054906
- 윤태욱, 윤진희 JKPS 71, 917
- 권지연, 권민정 New Physics: Sae Mulli 68, 189
- 김민정 EPJ Web of Conferences 164, 07006

✓ **발표 : 40건**

- 국제 학회 6건 (ALICE ITS Upgrad Resonance Workshop 외)
- 국내 학회 7건 (KPS Fall meeting 외)
- CERN 내부 27건 (ALICE QA Meeting 외)

2018-04

✓ **인력양성 : 박사 2명, 석사 5 명**

- 박사: 김태수, 송지혜
- 석사: 허경범, 방혜선, 권지연(박사), 정재호, 김태준(박사)

Scientific Achievements

- ✓ **Mass Chip Test : 부산대, 인하대, 연세대**
  - 총 테스트 대상량 : 60,000 개
  - 4월까지 60% 예상하였으나, 칩 배달 지연과 기계 고장 등으로 인하여 지연
  - 4월 말까지 50% 완료 예상
  - 2018년 말 또는 2019년 초까지 완료 예정

- ✓ **ITS HIC 모듈 조립 : 부산대, 인하대**
  - 총 조립 대상량 : OB 400 /2000 개
  - **CERN을 대신해서 인하대가 국내 와이어본딩 업체(세정 반도체)와 2월 말 계약 체결 및 선수금 지급 완료**
  - 조립공정 95% 완료
  - Endurance Test 장비 등 최종 파워어댑터 부품 배달 대기중.
  - '18년 4월까지 당초 목표대로 ~25개 HIC 모듈 생산 예정.

Scientific Achievements

(2018.03.01 ~ 2018.09.31)

- ✓ **논문 : PA paper 1건(JKPS, HS Bang) 외 ALICE Collaboration 14 편**
- ✓ **발표 : 학술회의 22건 , CERN meeting 87건**
  - 국제 학회 15건 (QM, ALICE ITS Asian Workshop, ICHEP 2018 외)
  - 국내 학회 7건 (KPS Spring meeting, HIM2018-05)
  - CERN 내부 87건 (ALICE QA, ITS, PF, KoALICE, PWG, PAG 외)
- ✓ **학술회의 개최 : 2건**

2018-10

- **발표 : 28건, 참가자 38명**

SEOUL
AL CONFERENCE ON high Energy PHYSICS
EOUL

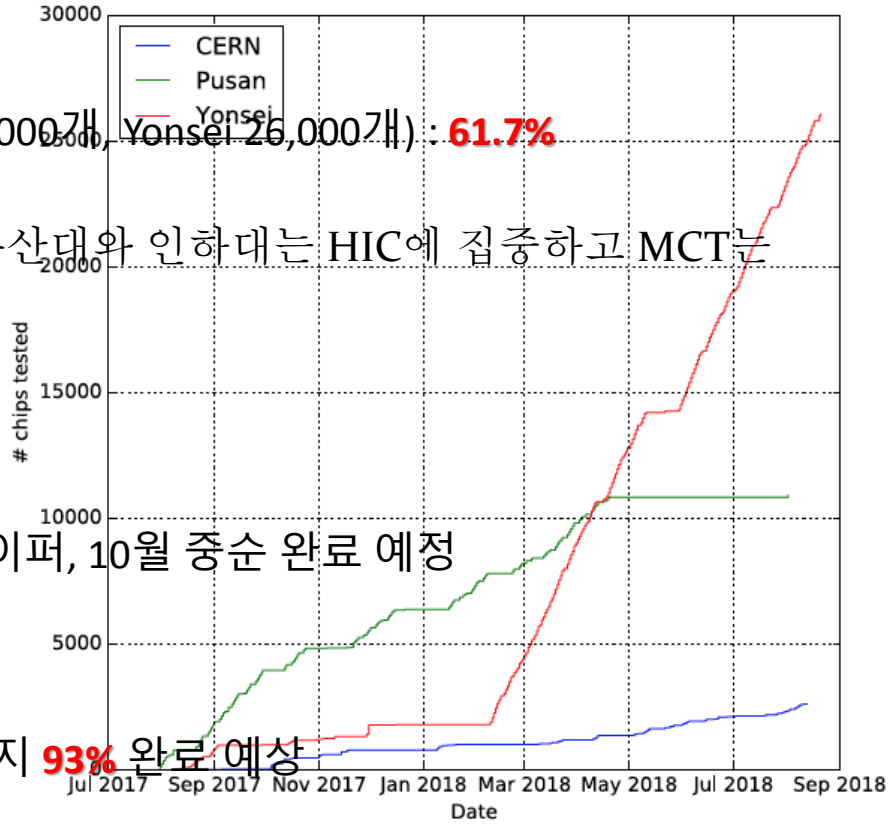
- **발표 : 6건 from KoALICE**

Upgrade Project and Plan

✓ Mass Chip Test : 연세대

- 총 테스트 대상량 : 60,000 개
- 현재 37,000개 테스트 완료 (Pnu+INHA 11,000개, Yonsei 26,000개) : **61.7%**

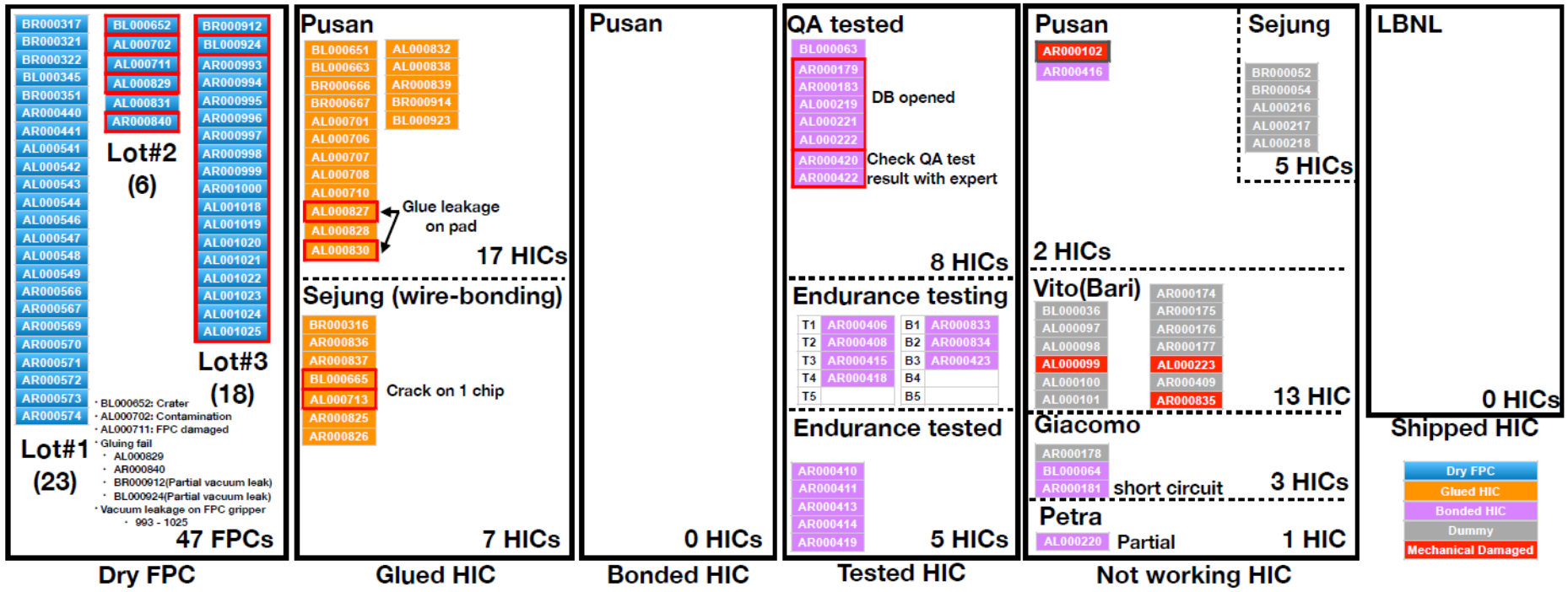
  **지연된 HIC 일정으로 인해 5월부터 부산대와 인하대는 HIC에 집중하고 MCT는 emergency back up plan으로 전환
- 현재 생산된 웨이퍼(1200) 모두 소화.
- 2차 생산라인 개시(Tower Jazz) : 275개 웨이퍼, 10월 중순 완료 예정
- FUREX와 연세대 대기 중
- 이후 **1,000개/wk** chip test 예상 : 2월 말까지 **93%** 완료 예상
- **2019년 3월 중순** 완료 예정



Upgrade Project and Plan

HIC Production Status - 20181010 updated

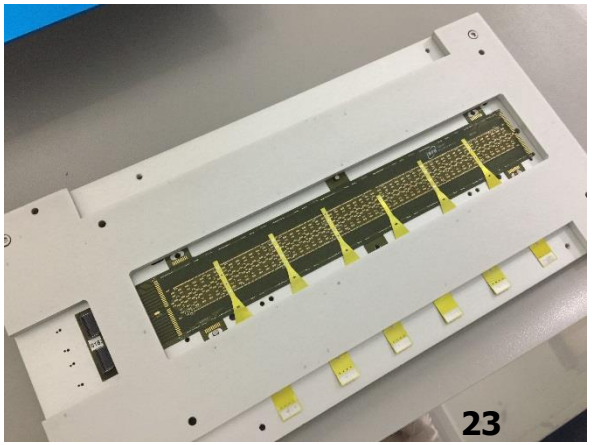
	Glue masks	Carrier plates	FPC	Chips	Not tested chips
Material Availability	~170	97(Including Sejung)	47	496(S) + 212(B)	4.5 wafers



Upgrade Project and Plan

✓ **ITS HIC 모듈 조립 : 부산대, 인하대**

- 총 조립 대상량 : OB 400 /2000 개
- ~ 5월 : 조립공정 완료
- ~ 8월 : 기기수리 및 커미셔닝
- ~ 9 월 : 시험 테스트 및 조립 시작
- 현재 20개 HIC 조립
  - 5개 electric test까지 모두 완료. CERN으로 송달 예정
  - 7개 electrical test 진행 중
  - 8개 standby 중
- 최대 **10개/wk** 조립 가능
- 2019년 2월까지 ~150개 HIC 모듈 생산 예정(**38%**)
- 2019년 9월까지 완료 예정



Status of Common Fund and cash contribution

	item	~'15 paid	'16	'17	'18	'19	Total Sum
A	CF	″K',	″K',	″K',	″K',	″K',	K
B	ITS **cash**	,K″'ß	″··	″··	″··	ß',	—
C	ITS in-kind	,	˘K	˘K	˘K	˘K	,″
B+C	ITS total	,K″'ß	″˘K	″˘K	″˘K	″˘K	K
A+B	**Cash total**	,″″	″″K',	″″K',	″″K',	ß	
Contribution total		,″″	″Kß',	″Kß',	″Kß',	″	″, ,

CF (ALICE RRB-2013-125)

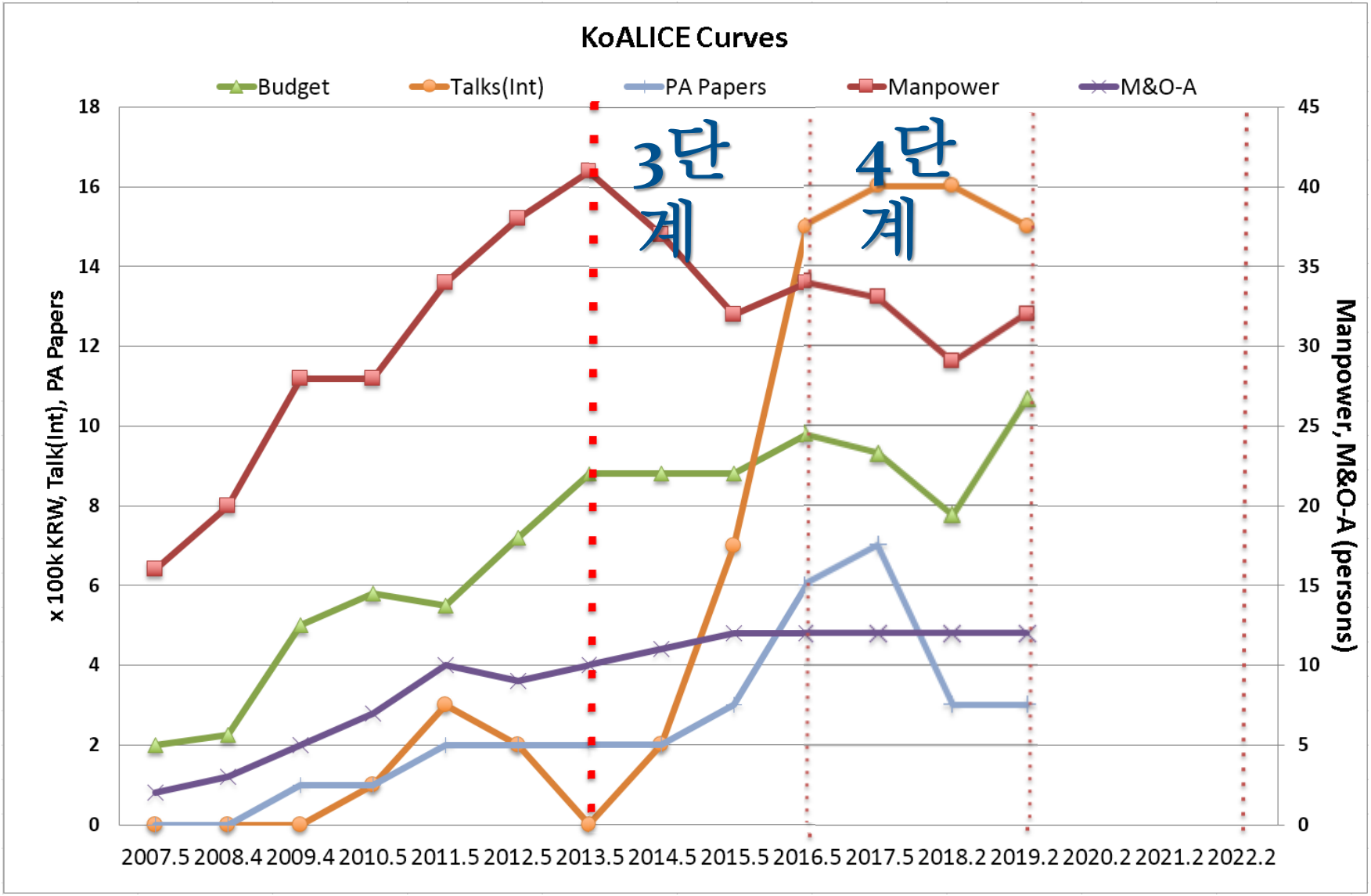
— **Paid : 57.6 / 96.046 kCHF** (60%)

ITS contribution(ALICE RRB-2014-104)

— **Paid : 491.8 / 976 kCHF** (75%)

*** Contribution for 2018 Will be paid soon. : 80/90% will be finished by the end of 2018.

KoALICE Curve



Plan for 5 stage

- ✓ 데이터 분석을 통한 쿼크물질상태 연구
- ✓ 검출기의 유지/보수/운영/테스트를 통한 ALICE 실험 참여
- ✓ ALICE 검출기 업그레이드 연구개발참여를 통한 국제적 기여 및 국내 인프라 구축

→ **인력양성**

<4단계 목표>

활동과 성과의 양적/질적 확대

검출기 센서기술의 확보와 응용

Plan for 5 stage

- ✓ 데이터 분석을 통한 쿼크물질상태 연구
- ✓ 검출기의 유지/보수/운영/테스트를 통한 ALICE 실험 참여
- ✓ ALICE 검출기 업그레이드 연구개발참여를 통한 국제적 기여 및 국내 인프라 구축

→ **인력양성**

<5단계 목표>

국제 무대에서의 **KoALICE recognition** 제고

검출기 센서기술을 활용하여 **LS2**에 주도적 참여