

# Activity of Koreans in ALICE Collaboration

Do-Won Kim

Kangnung National University

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- R&D of the Multi-gap RPC
- Participation in the ALICE-TOF project
- Contribution to the ALICE offline project
- Summary

Korean institutions in ALICE  
Kangnung National University  
Pohang Accelerator Laboratory  
Sejong University (plan to apply)

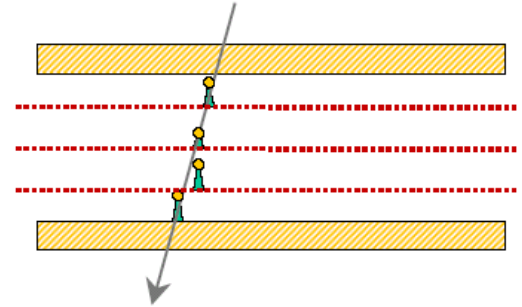
# R&D of the Multi-gap RPC

## <Start of the R&D of MRPC>

Napoli in 1997, Presentation of MRPC by C. Williams

January-February 1998 at CERN

Team: D. Hatzifotiadou, J. Valverde, C. Williams, E. Zebalos (CERN)  
D.W. Kim, S.C. Lee (Kangnung)



Production of two RPCs with 3-gaps of 1.2 mm (24 cm × 24 cm active area)

Measured the performance using cosmic rays

Obtained satisfactory results from this first trial:

Time resolution : 4 ns FWHM

Efficiency plateau > 2 kV

Time walk < 900 ps/kV (2.5 ns/ 3 kV)

Publication in NIM-A 'Effect of adding SF<sub>6</sub> to the gas mixture in a MRPC'

Presentation in Vienna Conference

Presentation in the KPS meeting – as a promising device for LHC

# R&D of the Multi-gap RPC

## <Production of a Big MRPC for LHC>

Late-1998 at CERN, - more collaborators -

Team: D. Hatzifotidou, J. Valverde, C. Williams, E. Zebalos (CERN)  
D.W. Kim, S.C. Lee (Kangnung), J. Choi (Pohang)  
E. Platner, J. Roberts (Rice)

Production of a big (3.4m × 1.3m) MRPC with 4-gaps of 0.7mm  
as muon trigger device of an LHC experiment

Measurement of the performance using PS-T10 beam

Time resolution : 1.9 ns FWHM

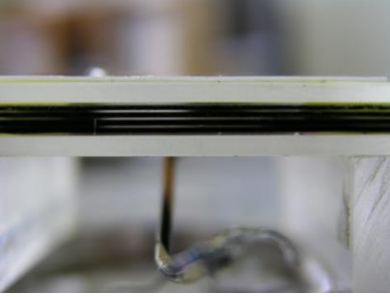
Time walk : 400 ps/kV

Rate capability : 15 kHz/cm<sup>2</sup> (at 95% efficiency), Dark current : 50μA/m<sup>2</sup>

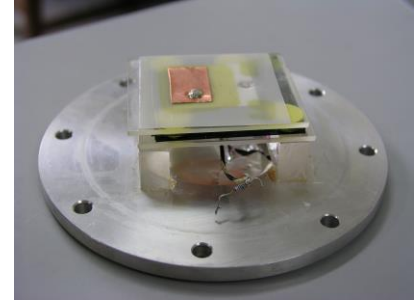
Publication in NIM-A ‘A very large multi-gap resistive plate chamber’

Showed suitability of the MRPC for the construction of large area modules.





# R&D of the Multi-gap RPC



## <Small gap MRPC with very high time resolution>

1999 at CERN - better resolution / smaller gaps -

N. Y. Kim (Kangnung) started working at CERN as World Laboratory fellow (supervisor C. Williams)

Production of cell, 5-gap RPC with 0.22 mm gap size

Obtained 70 ps Time resolution (T-A correction) :  
Satisfy the requirement of ALICE TOF detector

Discussion on the use of MRPC for ALICE TOF project

Presentation in RPC workshop, Bari (1999)

Publication in NIM-A 'The multigap resistive plate chamber as a time-of-flight detector'

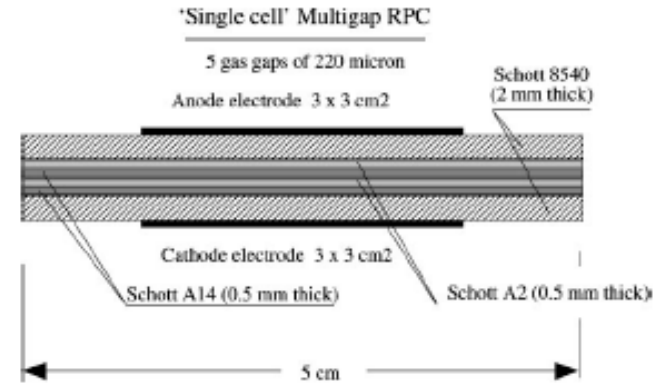
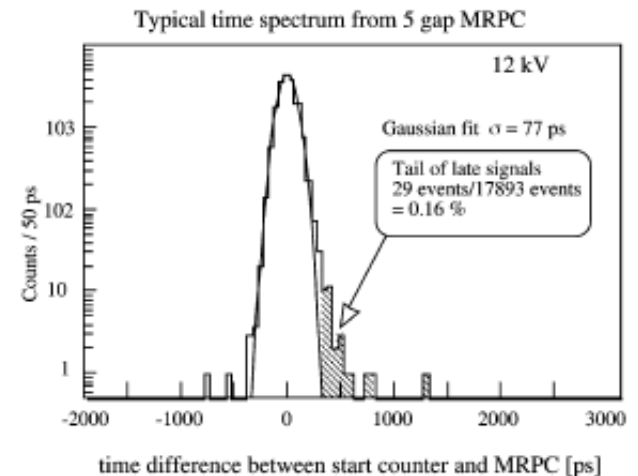


Fig. 1. Cross-section of a multigap RPC tested for time-of-flight purposes.



# Participation in the ALICE–TOF project

## <INFN-Bologna joins ALICE with TOF project>

Spring 2000

INFN-Bologna, Salerno group led by A. Zichichi joins ALICE with the full responsibility of the ALICE-TOF construction, Collaborating institutions :

ITEP-Moscow

Kangnung National University

Pohang Accelerator Laboratory

Kangnung and Pohang have been accepted as ALICE collaborators

MoU between INFN-Bologna, Salerno and Kangnung, Pohang established.

Efforts of World Laboratory to help Korean colleagues financially

# Participation in the ALICE–TOF project

## <Collaboration with INFN-Bologna for ALICE - TOF R&D>

No Korean source of funding for this experiment at CERN.

Italy-Korea S&T cooperation agreement signed in Roma (2000) between  
Ministero degli Affari Esteri - Italia

Ministry of Science and Technology – Korea

*- thanks to Prof. Mario Scalet, the Science Attaché of the Italian Embassy in Seoul -*

Based on this agreement, we got funded for the exchange of scientists (2001-2004)

Yearly budget of ~ 10,000 CHF for travel from MoST

+ Staying expenses from the Italian government

Allowed Kangnung scientists to keep participating in the R&D at Bologna/CERN (strips, electronics, beam test) and to do Gamma Irradiation test at Pohang Accelerator Laboratory (D.W. Kim, S.C. Lee, K.S. Lee, J.H Jeong + R. Nania)

Continuous help from World Laboratory to support fellows from Korea

Dr. Y. W. Baek (CERN, 2000-2002), Strip production, Radiation hardness, Beam test

D. H. Kim (CERN, 2003-2004), Strip production, Beam test

# Participation in the ALICE–TOF project

## <Outcome of the Collaboration with INFN-Bologna for ALICE - TOF R&D>

### Scientific publications in NIM-A (2004)

Study of gas mixtures and ageing of the multigap resistive plate chamber used for the Alice TOF  
(Eugenio Scapparone)

Design aspects and prototype test of a very precise TDC system implemented for the Multigap RPC of the  
ALICE-TOF (Pietro Antonioli)

Latest results on the performance of the multigap resistive plate chamber used for the ALICE TOF  
(Despina Hatzifotiadou)

Operation of the Multigap Resistive Plate Chamber using a gas mixture free of flammable components  
(Do-Won Kim)

### Training of students & researchers

N.Y. Kim > Ph.D student (physics) in Jung-Ang University

K.S. Lee > Ph.D student (physics) in Kangnung National University

Y.W. Baek > research associate, CMS-MUON group at CERN, Wisconsin University

J.H. Jeong > researcher, PSI, Atomic Microscope co.



# Participation in the ALICE-TOF project

## <Collaboration with INFN-Bologna for TOF detector production>

Italy-Korea cooperation agreement renewed in Seoul (2003) between  
Ministero degli Affari Esteri - Italia  
Ministry of Science and Technology - Korea

Funding for the **exchange** of scientists approved (2004-2007)  
Yearly budget of ~ 5,000 CHF for travel from MoST  
+ Staying expenses from the Italian government

Will help Korean scientists to keep activity in **MRPC R&D** : test with various gas mixtures  
H.T. Jung, D.W. Kim, S.C. Lee, K.S. Lee

Support from the INFN-Bologna for Korean students  
H.N. Kim, and W.W. Jeong (2004- ), in Bologna, ALICE-TOF **production** and **test**

World Laboratory supports one fellow from Korea  
J. S. Kim (2004- ) at CERN for **more R&D on MRPC** ( ~ 10 ps resolution )

# Contribution to the ALICE offline project

## <Collaboration with ALICE Offline Team at CERN>

In May 2004 Korean MoST approved funding Collaboration of Koreans with **EGEE** on  
High Energy Physics  
Bioinformatics with a total budget of 150,000 CHF/yr  
*- thanks to Yves Schutz and Fabrizio Gagliardi -*

**CKSC** has been formed :

Chonnam National University - Bioinformatics  
Kangnung National University - ALICE - TOF  
Sejong University - ALICE offline, HEP theory

A Korean engineer is staying at CERN supported by the MoST working in **ALICE offline gr.**  
C. Y. Choi (2004 - ) on the development of the system for  
- **remote installation** of the software for GRID  
- **monitoring** remote machines on the GRID  
(supervisor, F. Carminati)

H. T. Jeong is working with him at distance staying in Kangnung

Prepare for the participation in the **ALICE data challenge** with the **Linux clusters** in **Sejong** and  
**Kangnung**

# Summary

Koreans in ALICE are making small contributions in

- (1) R&D of MRPC at **CERN** (J.S. Kim)
- (2) Production of ALICE - TOF at INFN - **Bologna**  
(H.N. Kim & W.W. Jeong)
- (3) ALICE offline project at **CERN** (C.Y. Choi)

In Korea, there are

- (4) Theoretical works at **Sejong** (D.S. Hwang, S. Kim)
- (5) R&D of MRPC - study of gas mixtures at **Kangnung**  
(D.W. Kim, S.C. Lee, and K.S. Lee)
- (6) Participation in EGEE network at **Sejong** (H.G. Kim) and  
**Kangnung** (H.T. Jeong)

Young Korean students in ALICE enjoy learning Detector technology, Information Technology, European Culture and Languages.

Thanks to Korean MoST, Italian MAF, Italian INFN, World Laboratory-Lausanne,  
and to the **ALICE Collaboration**

