Direct photon measurement at LHC and Korean strength

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  - Related activity by Yonsei Univ. group
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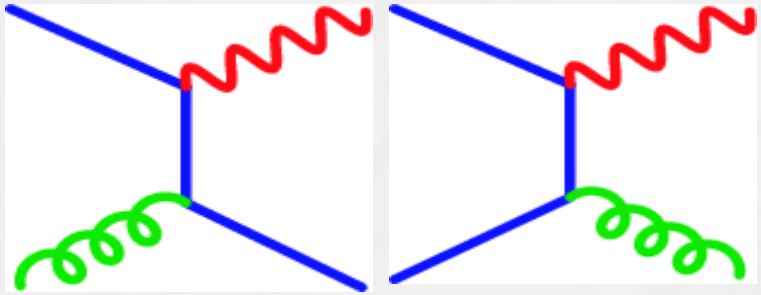
  - Related activity by Yonsei Univ. group

Motivation : Direct γ production

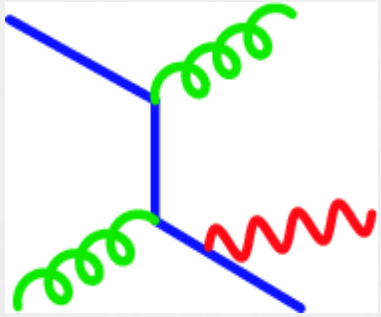
- Direct γ production in p+p

→ <u>One of the best known QCD process…</u>



Really?

→ Leading order diagram in perturbation theory

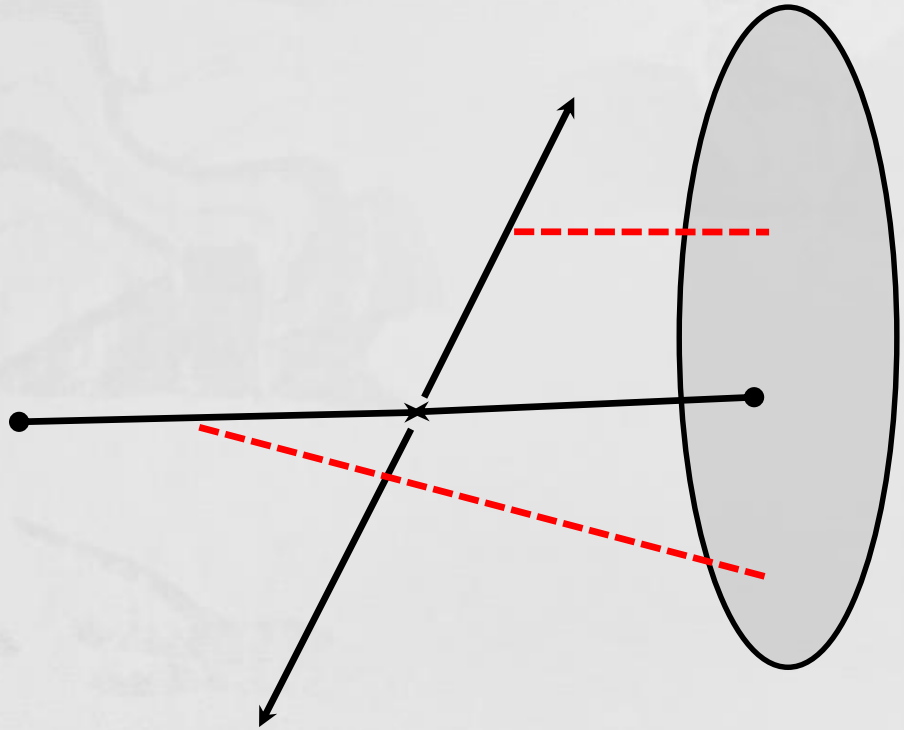


Hard photon : Higher order pQCD
Soft photon : Initial radiation,
Fragmentation function

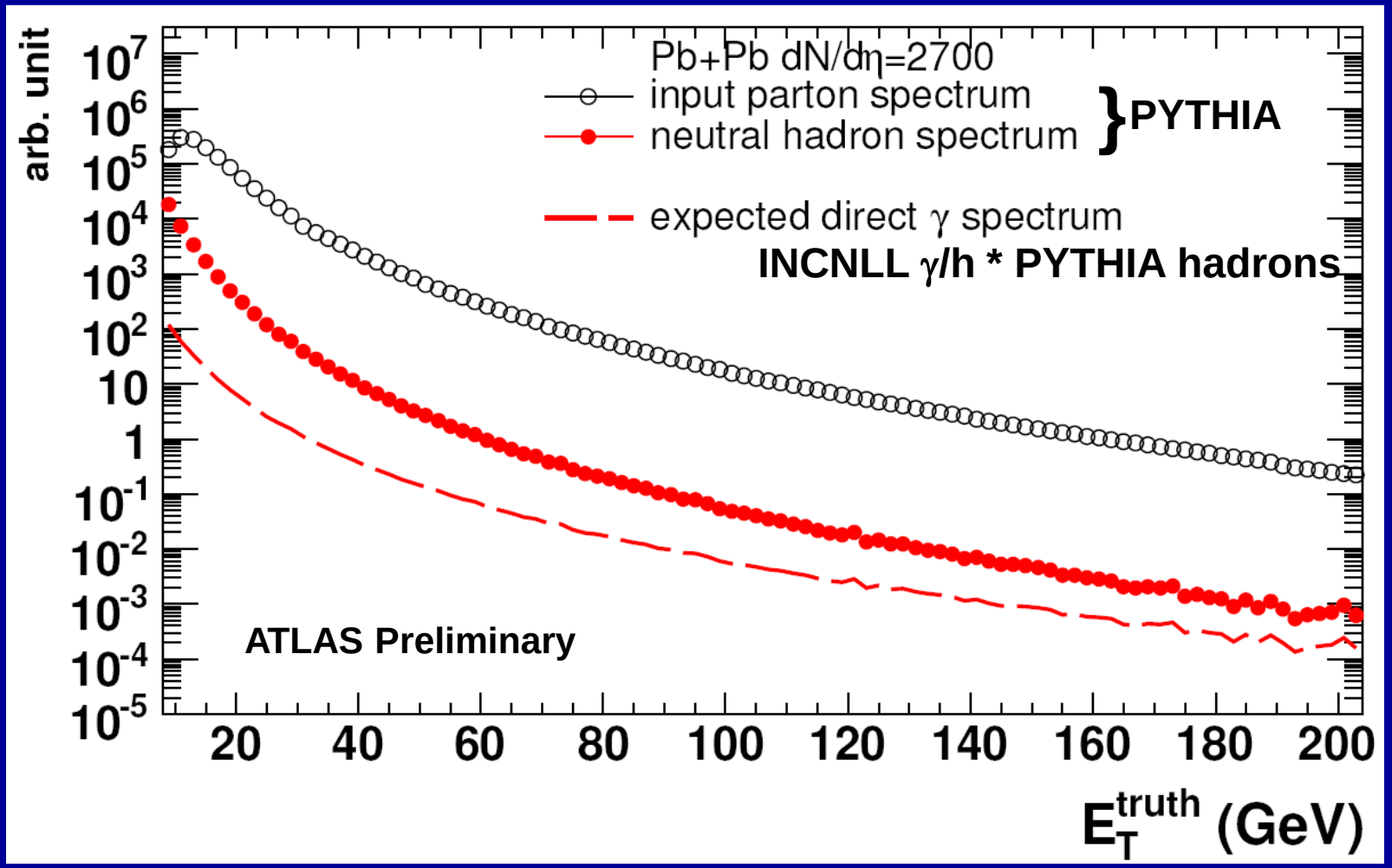
Multiple collision in factorization theorem?

Higher twist!

$$\sigma(Q) = H^0 \otimes f_2 \otimes f_2 + \left(\frac{1}{Q^2}\right) H^1 \otimes f_2 \otimes f_4 + O\left(\frac{1}{Q^4}\right)$$

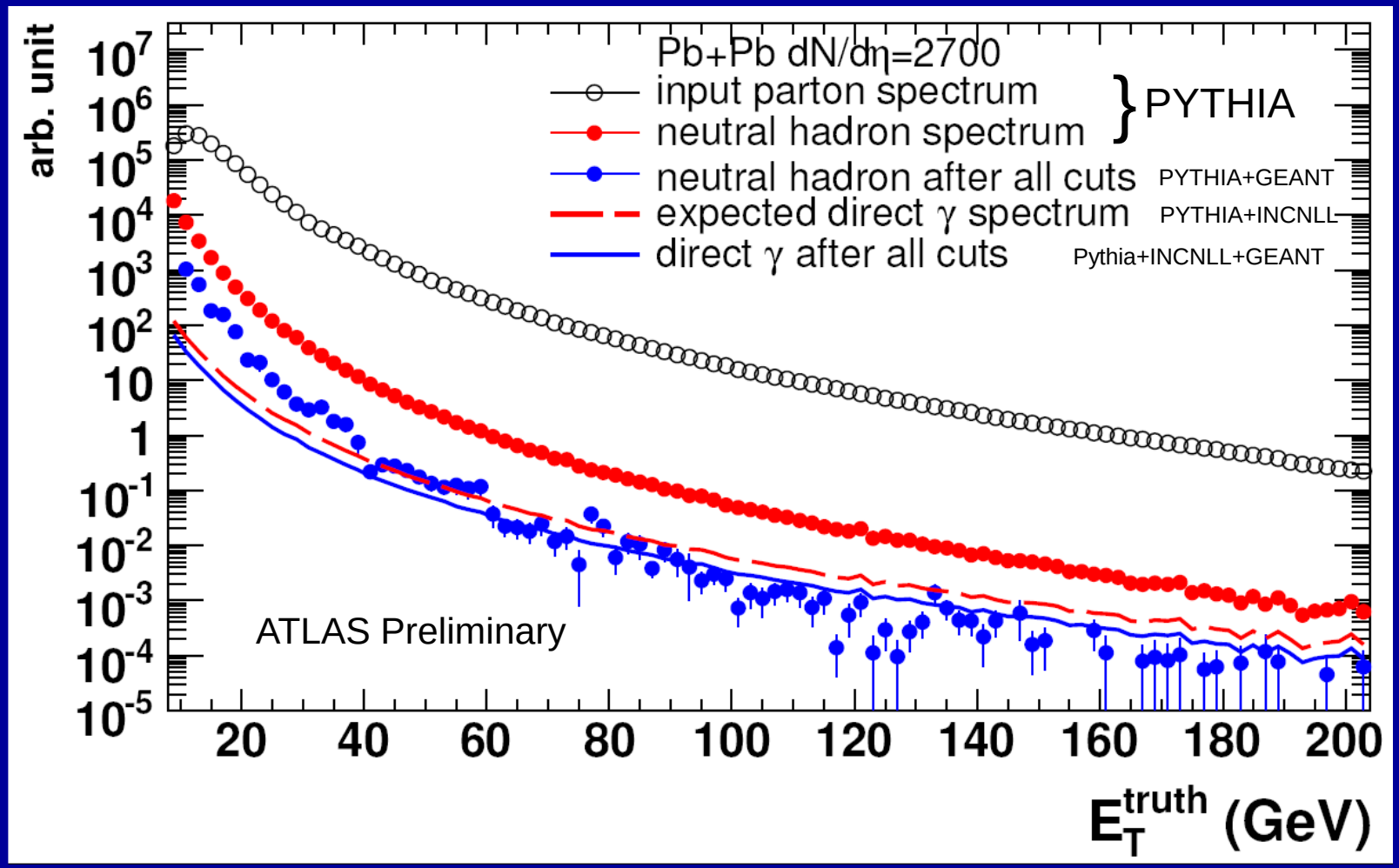


Raw truth spectra



- **Substantial background from jet+jet**

Spectra before & after cuts



- **Combined cuts suppress background**

CMS --- what I "could" find as public

Acta Physica Polonica B Proceeding Supplement, Vol. 1, p389 (2008)

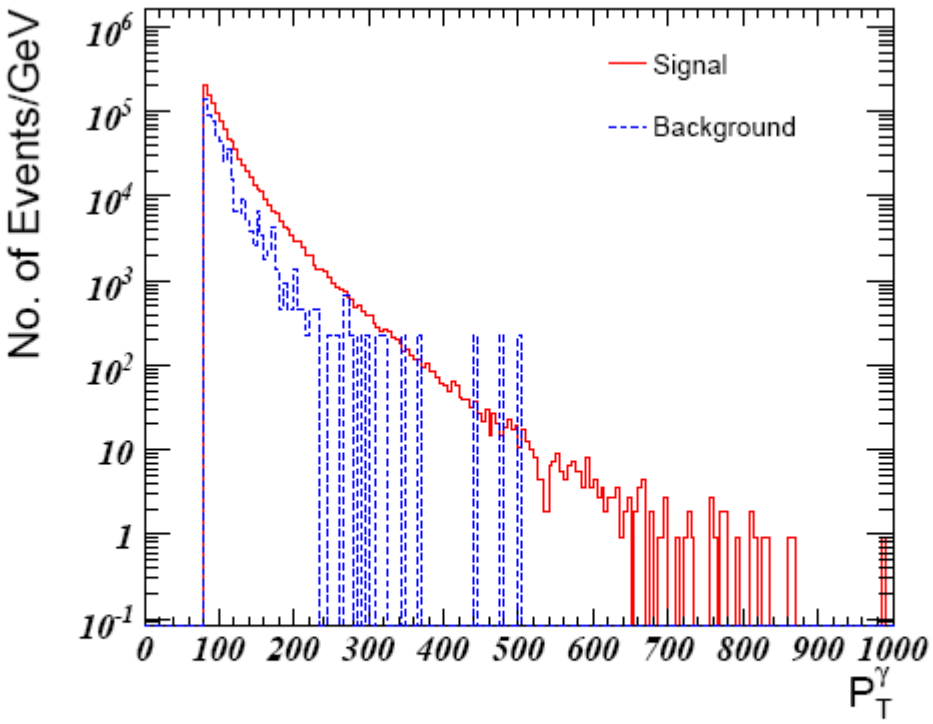
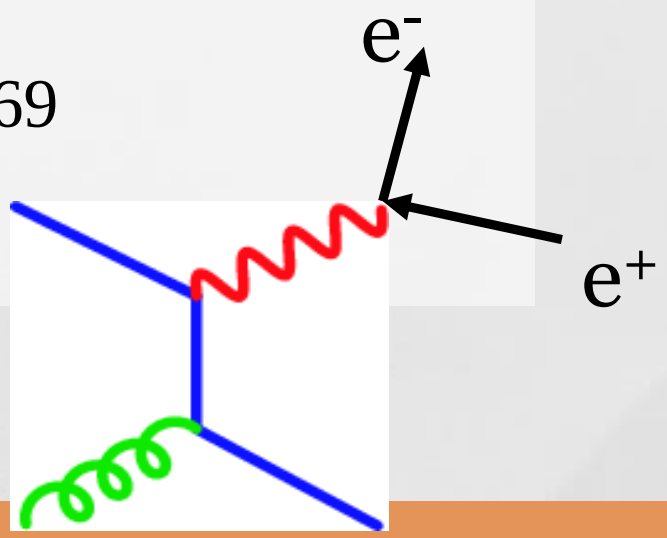


Fig. 1. Number of events/GeV for γ + jet signal and its backgrounds for $\int \mathcal{L}dt = 1$ fb^{-1} after applying selection cut C.

Possible approaches to the measurement

- Direct method
  - Nontrivial errors on inclusive photon measurement, inclusive neutral hadron measurement, and theoretical assumptions entering the background calculations

- Indirect method
  - $\gamma \rightarrow \gamma^* \rightarrow e^+e^-$, R H Dalitz 1951
    Proc. Phys. Soc. A **64** 667-669
  - AND we can avoid π^0 background!



Detector ALICE

1• L3 MAGNET
2• HMPID
3• TOF
4• DIPOLE MAGNE
5• MUON FILTER
6• TRACKING CHA
6'• TRIGGER CHAM
7• ABSORBER
8• TPC
9• PHOS
10• ITS

PHOS (PHOton Spectrometer)

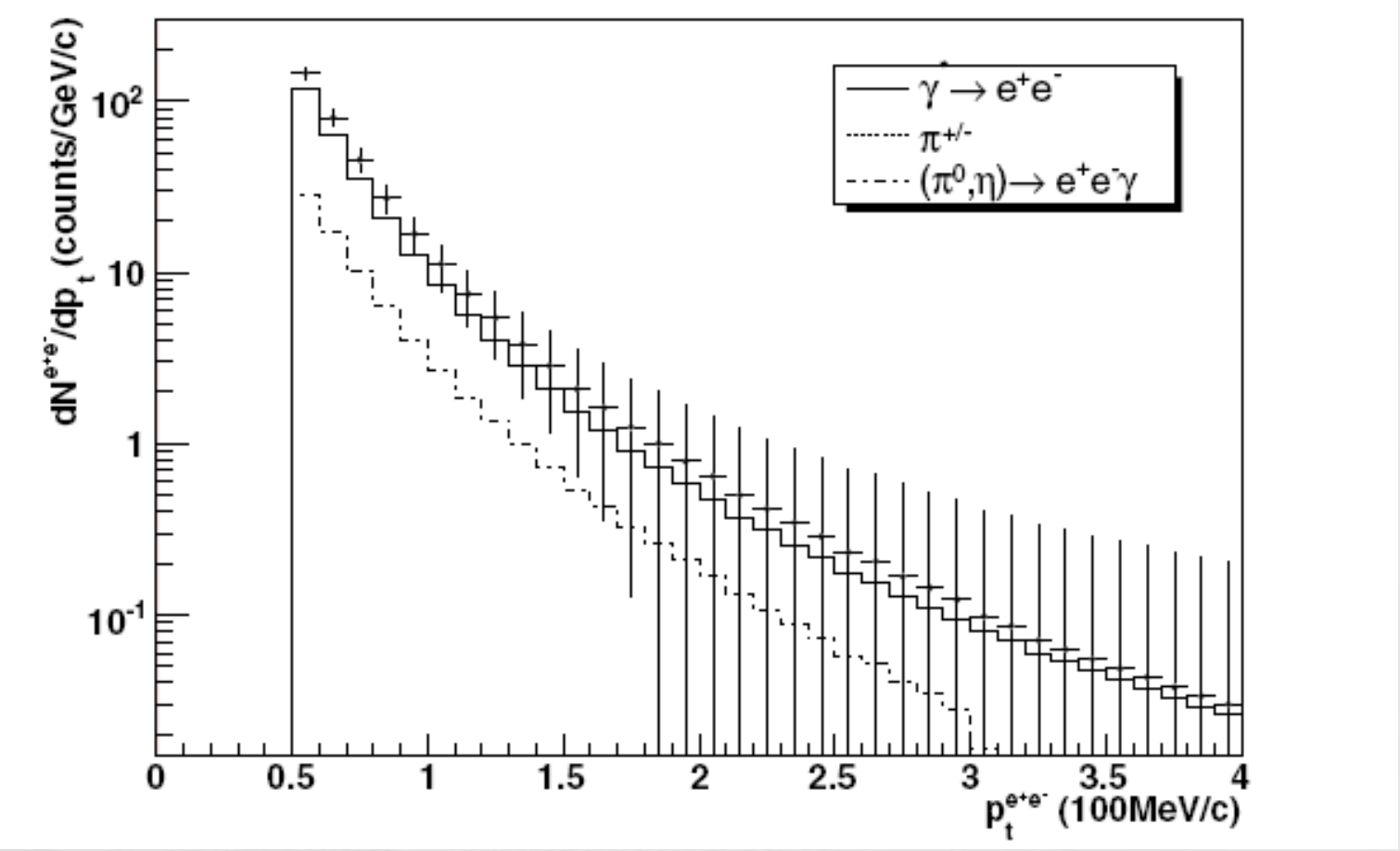
Has 17 280 detection channels of lead-tungstate crystals, $PbWO_4$ (PWO), of *2.2 ×2.2 ×18 cm3 dimensions, coupled* to large-area PIN-diodes with low-noise preamplifiers.

Covers *$-0.12 \leq \eta \leq 0.12$, and 100° in azimuthal angle.*

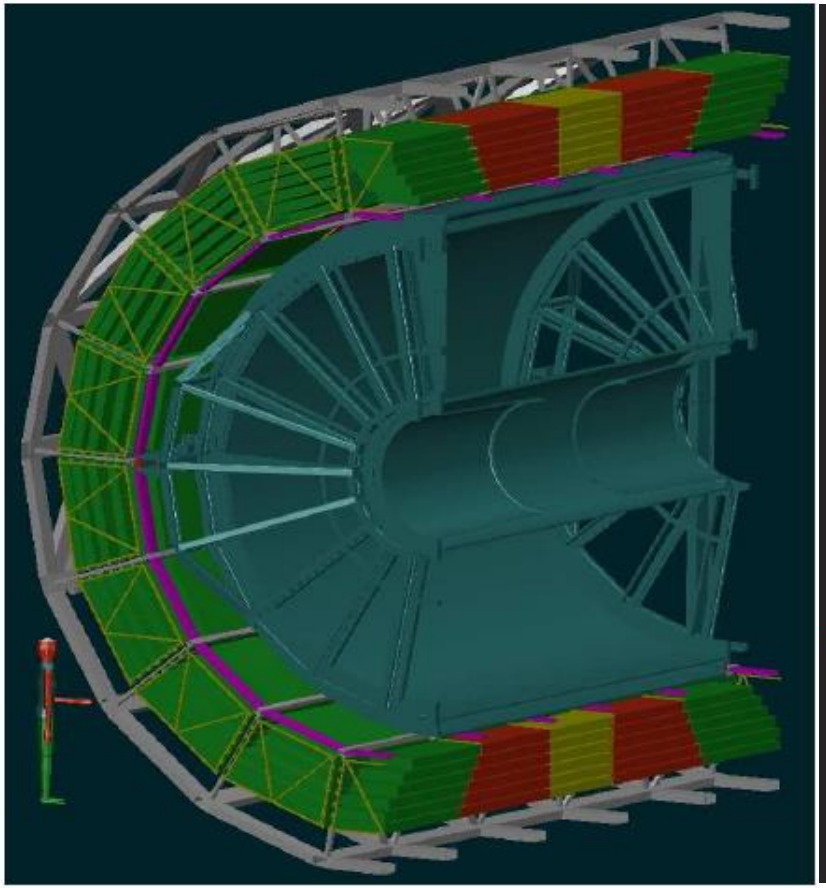
Optimized for measuring photons (of *~0.5–10 GeV/c*), π^0's (of *~1–10 GeV/c) and η mesons (of ~2–10 GeV/c).*

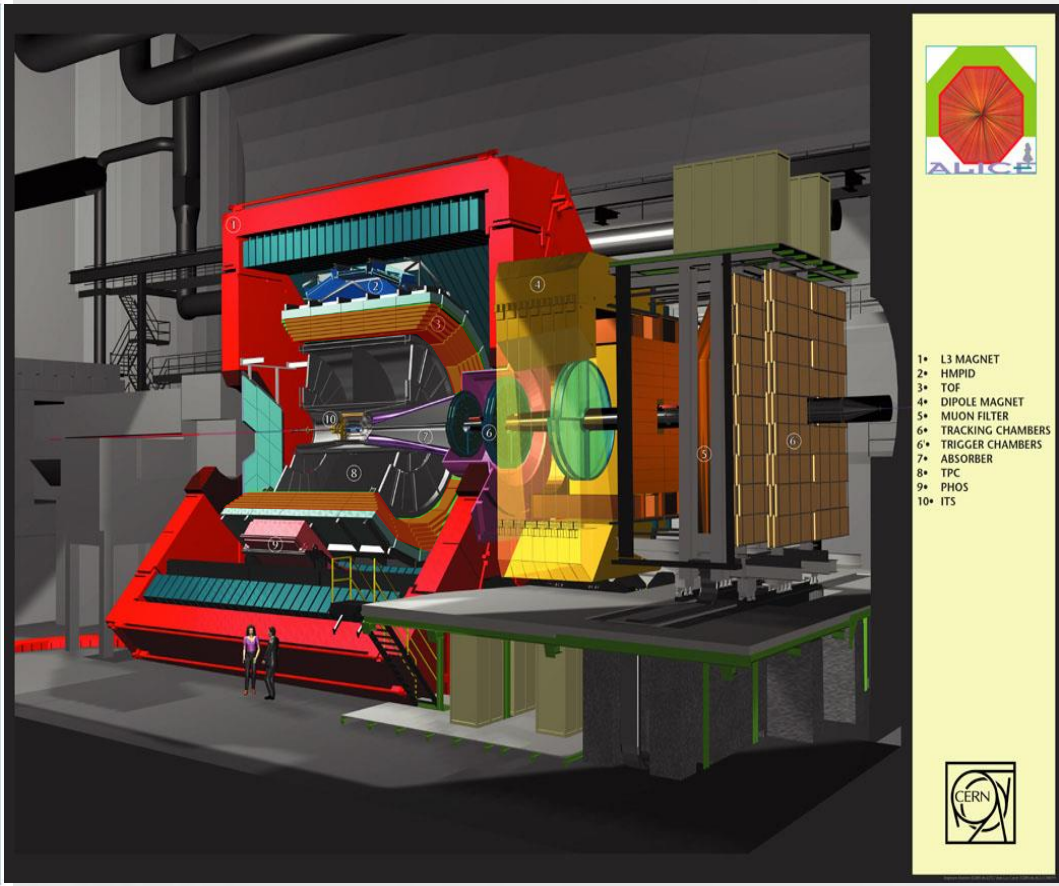
Possible approaches to the measurement

One standard year of data taking



TRD (Transition Radiation Detector)



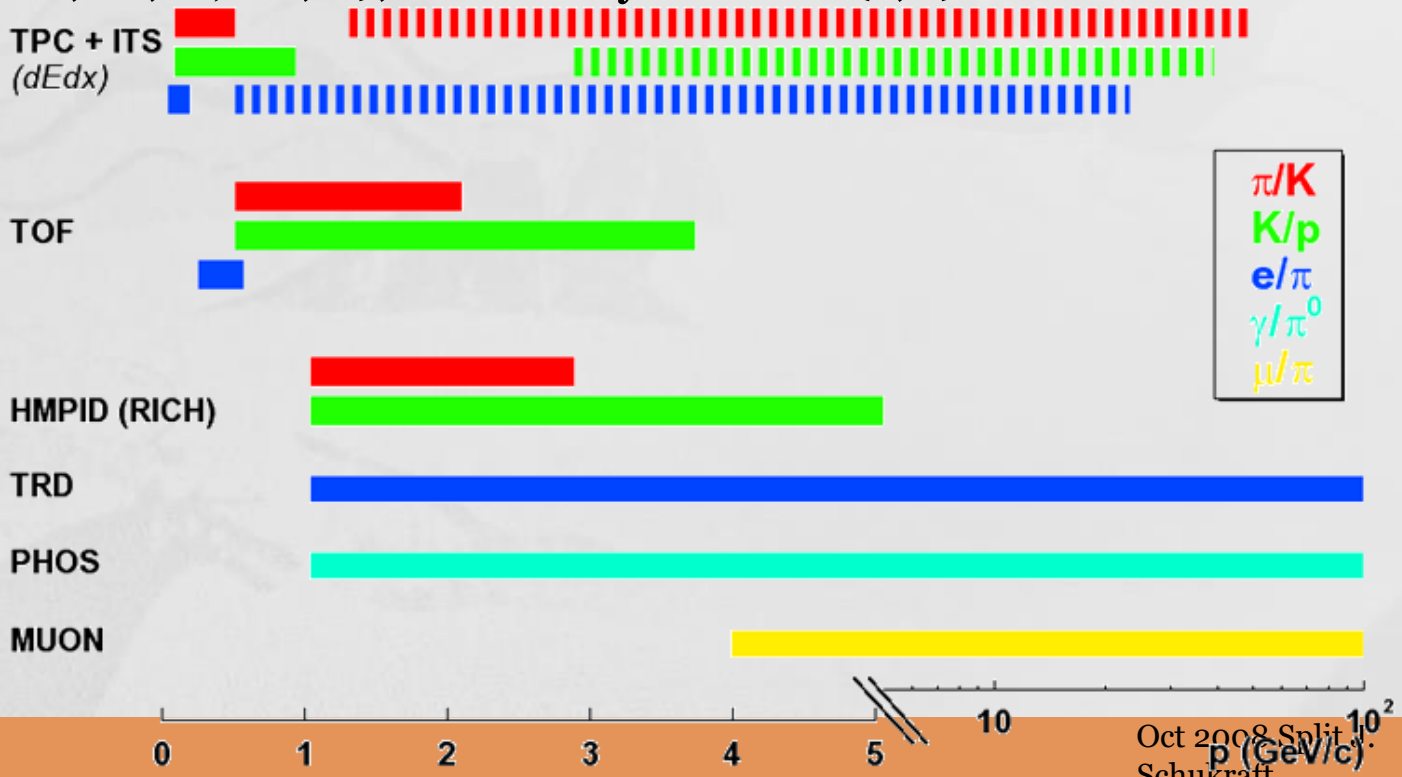


Particle Identification

- stable hadrons (π, K, p):
  - dE/dx in silicon (ITS) and gas (TPC) + Time-of-Flight (TOF) + Cerenkov (HMPID)
- leptons (e, μ)
  - transition radiation (TRD), muon spectrometer
- photons, η,π^0
  - e.m calorimeters (PHOS, EMCAL)
- decay topology (K^0, K^+, K^-, Λ, D^+, ..), secondary vertices (c,b)

PID
from ~ 100 MeV
to above 50 GeV

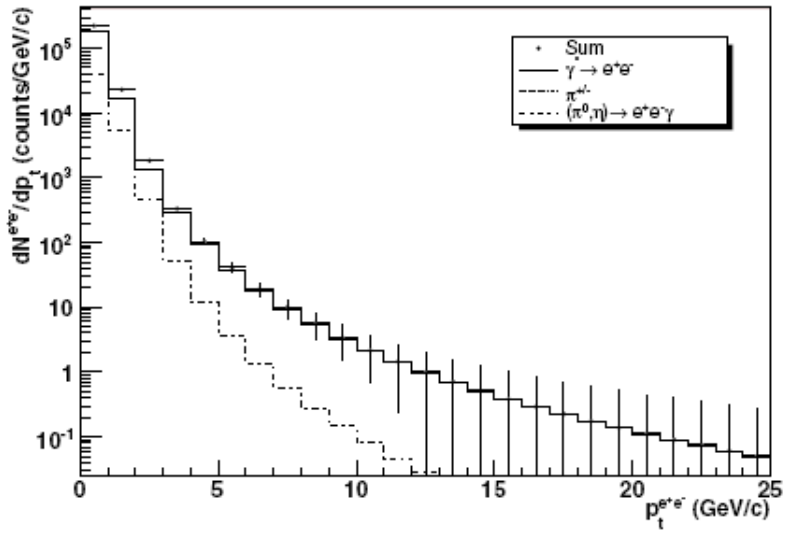
Alice uses ~ all known techniques!



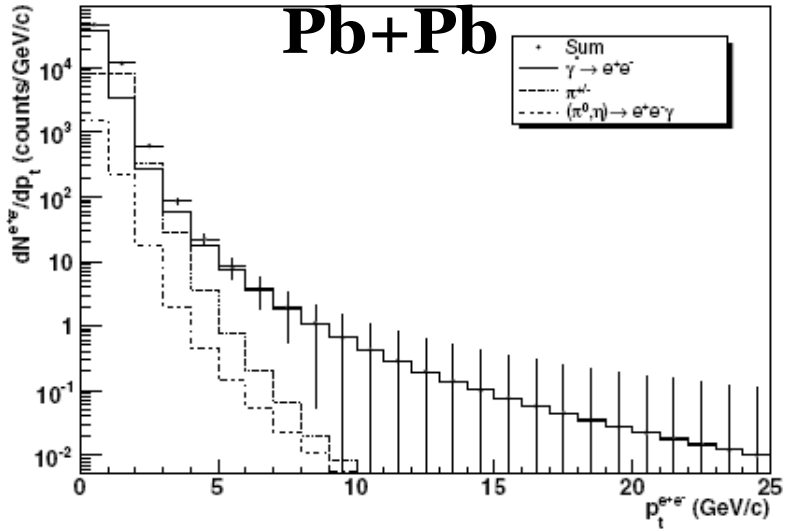
Possible approach to the measurement : indirect method

One standard year of data taking

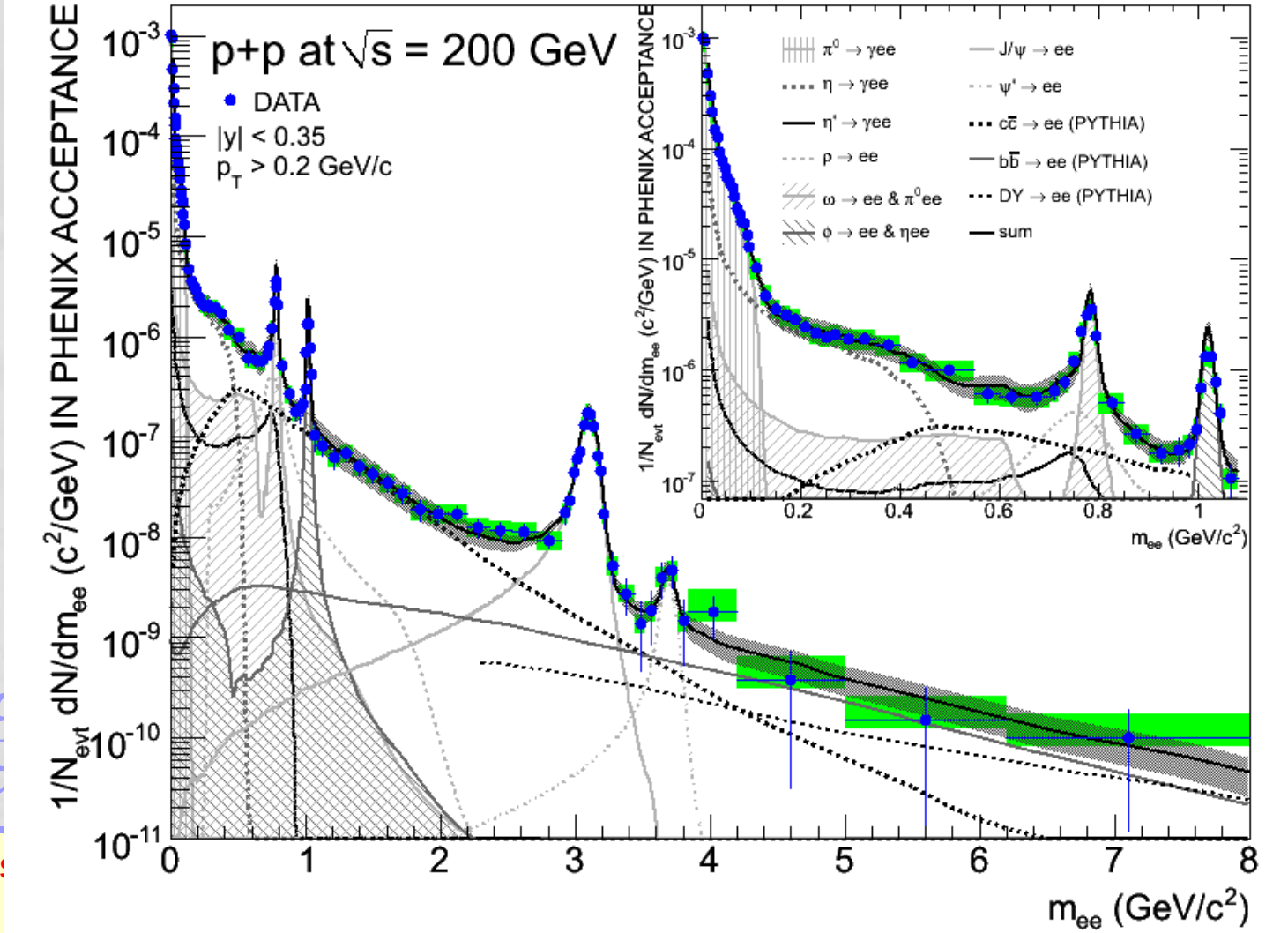
p+p



Pb+Pb



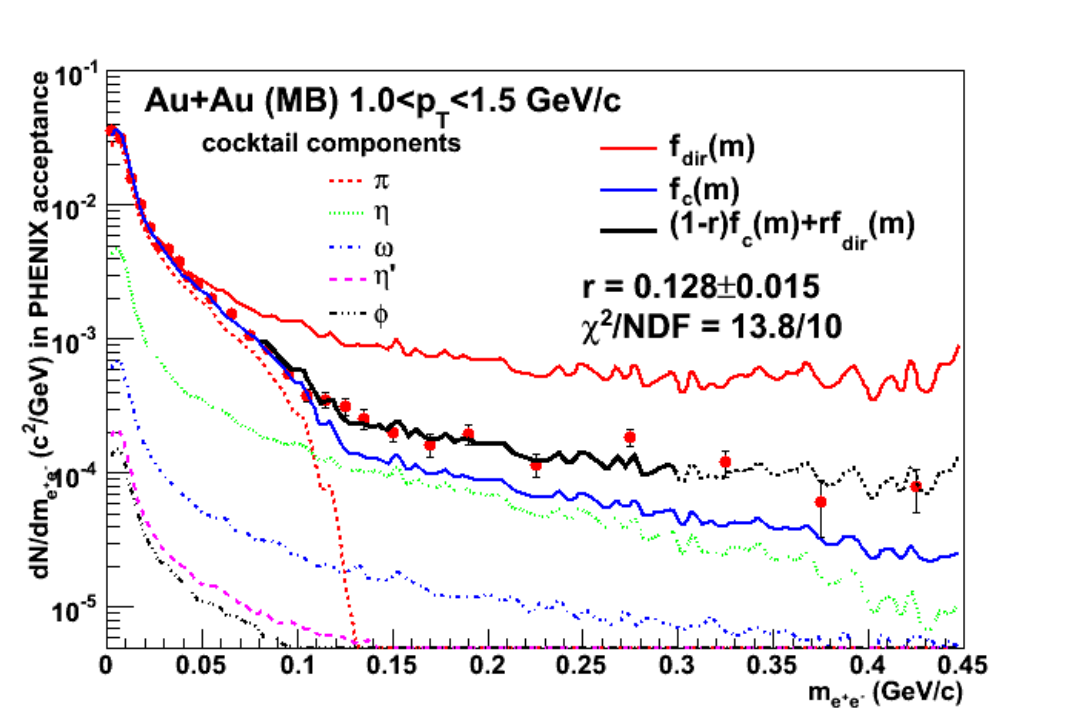
e^+e^- pair mass distribution

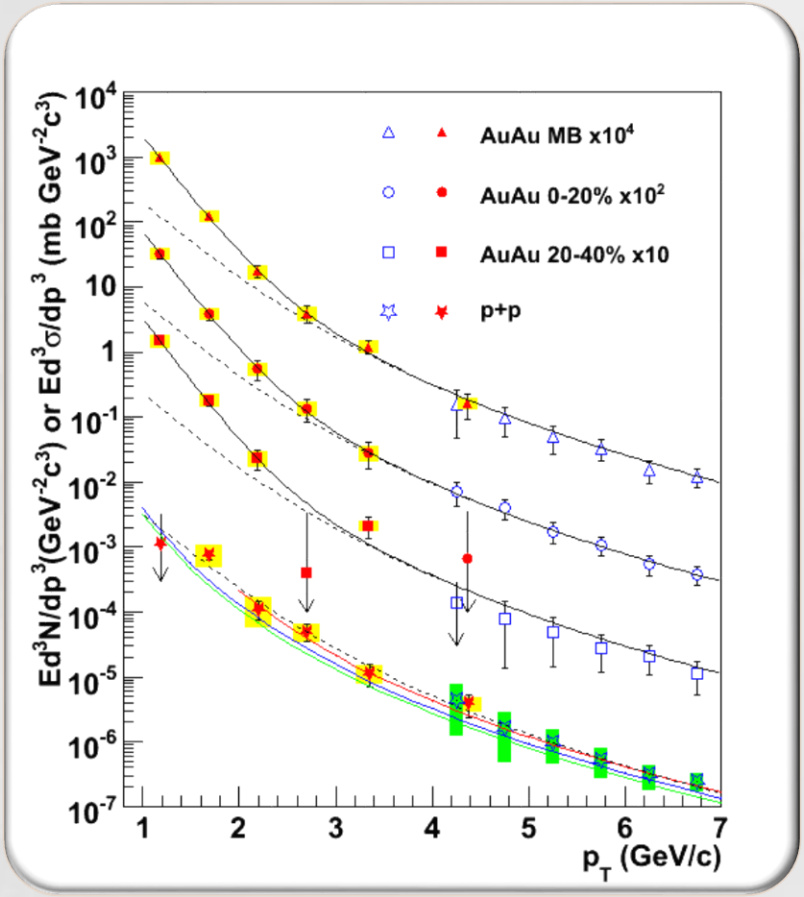


$$\frac{1}{N_\gamma}\frac{d}{}$$

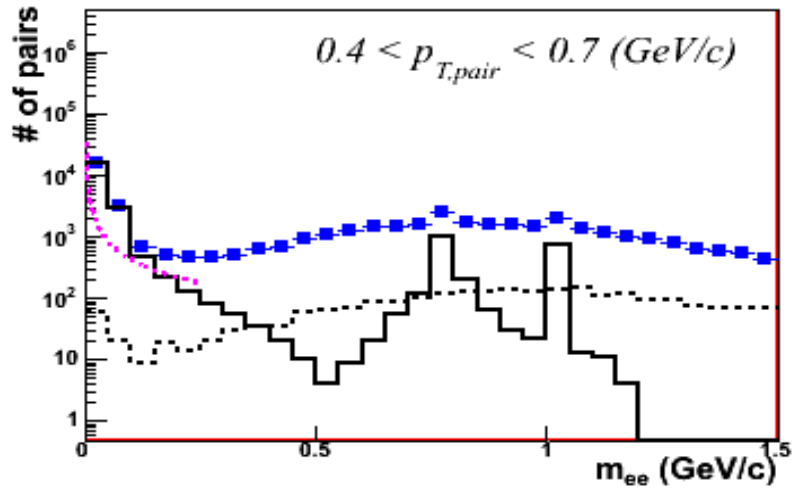
invariant mas
Dalitz pair

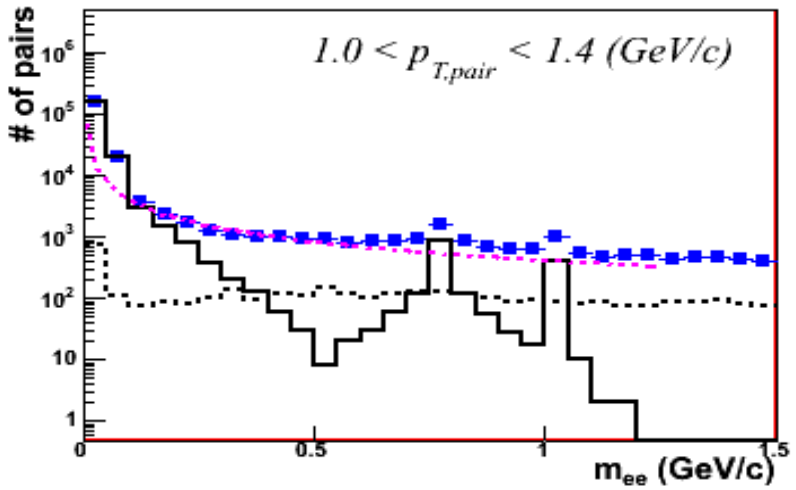
Publication from PHENIX

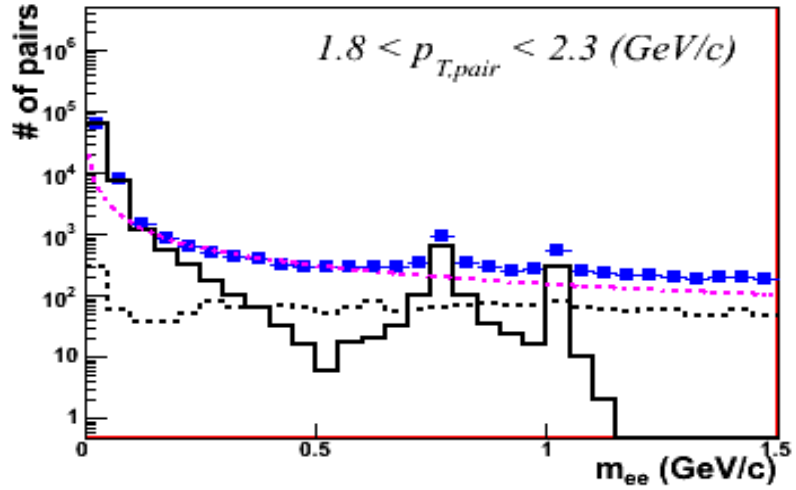


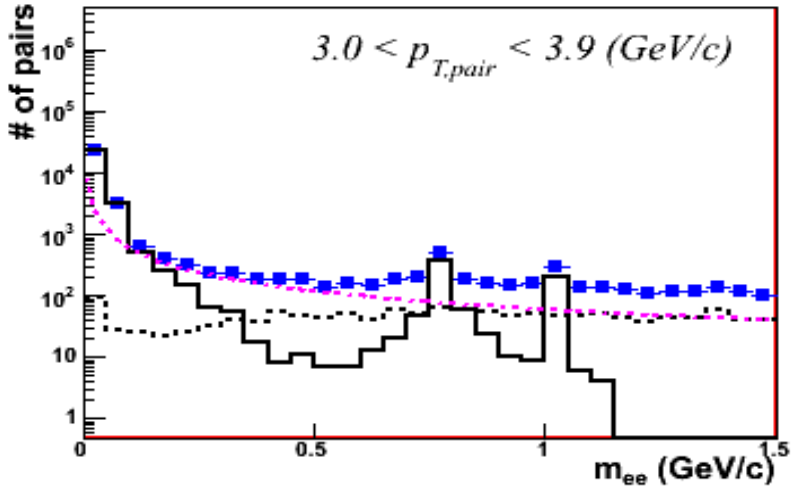


A piece of detail : Reality & Combinatorial background



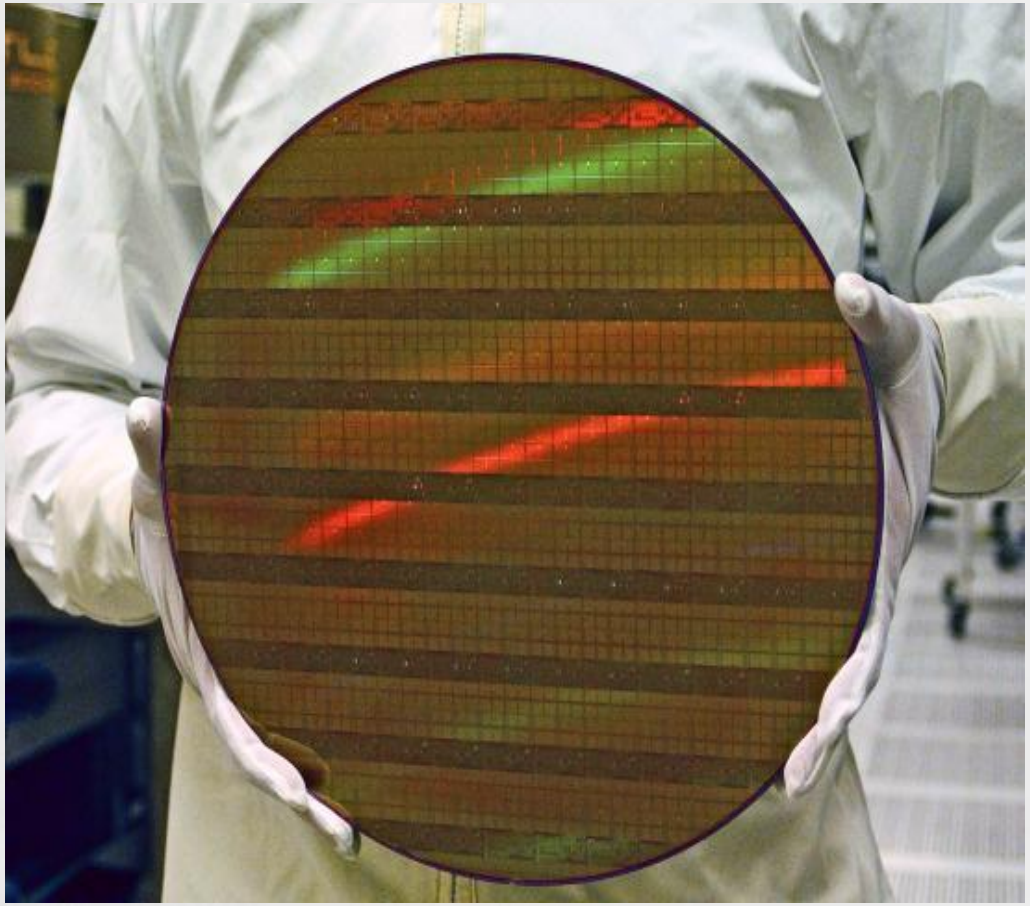




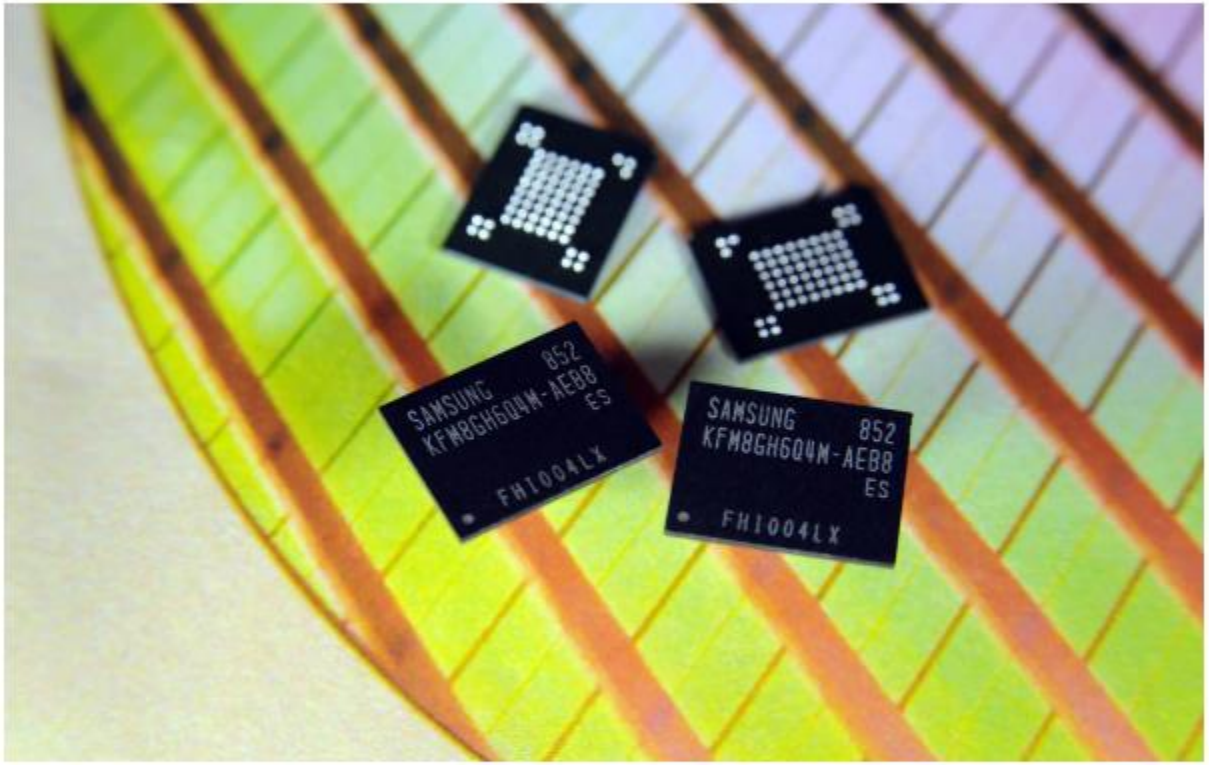


Korean strength

D-Ram? CPU? Si-detector?



삼성전자(www.sec.co.kr)가 40나노급(1나노 : 10억분의 1미터) 공정을 적용한 8기가 플렉스 원낸드(Flex-OneNANDTM)를 개발했다.



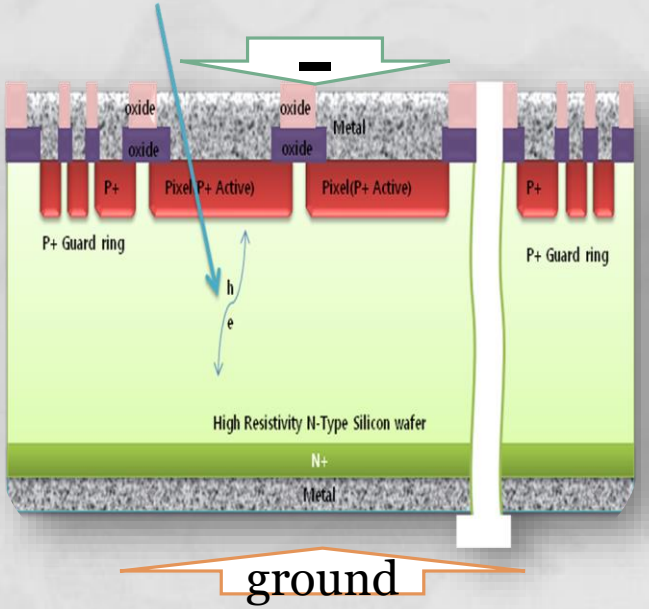
삼성전자는 '07년 60나노급 4기가 플렉스 원낸드 제품 개발로 고성능 스마트폰에서 퓨전 메모리 시장을 더욱 확대한 데 이어, 올 3월부터 8기가 플렉스 원낸드를 양산해 고용량 하이엔드 휴대폰 시장까지 퓨전 메모리 제품으로 전환해 나갈 예정이다.

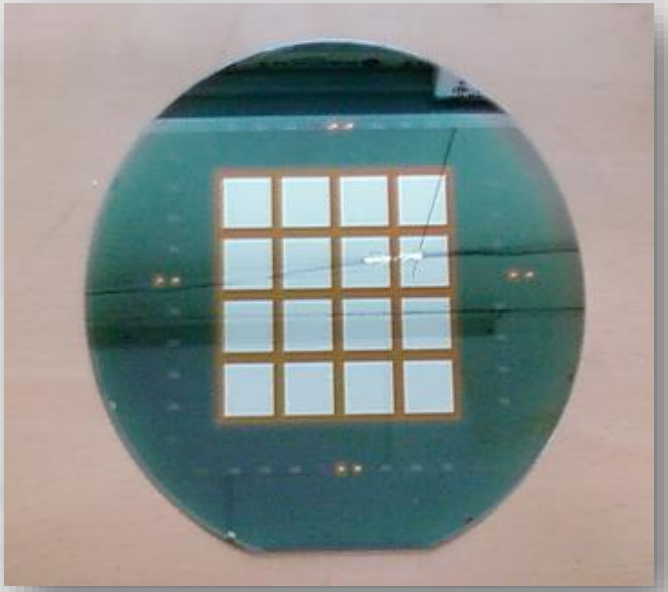
이번에 개발된 제품은 퓨전 메모리 제품 최초로 40나노 공정을 적용해 기존 60나노급 4기가 플렉스 원낸드 제품 대비 생산성을 약 2.8배 향상시켜 제품 경쟁력을 한 단계 더 강화했다. 올해는 원낸드(OneNANDTM)제품도 40나노급 공정으로 1기가/2기가/4기가 제품을 양산해 타사 대비 1~2세대 앞선 제품 경쟁력 우위를 지속 유지해 나갈 계획이다.

PHENIX FOCAL

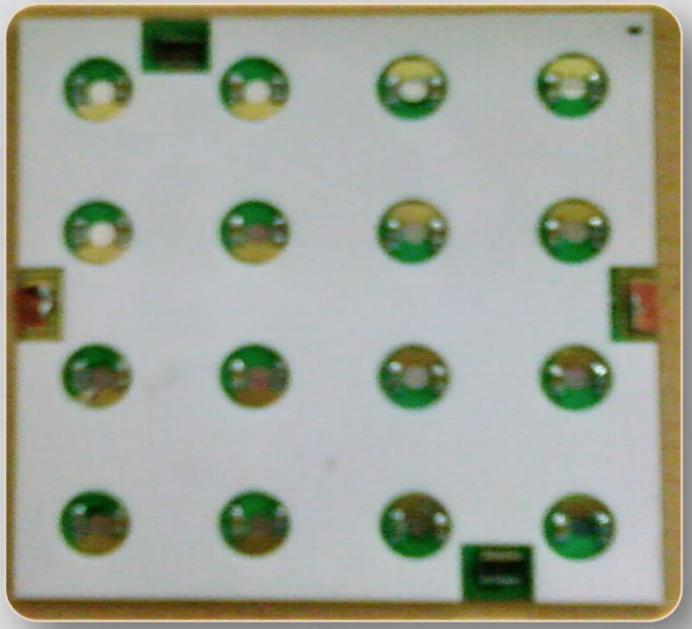
Silicon sensor

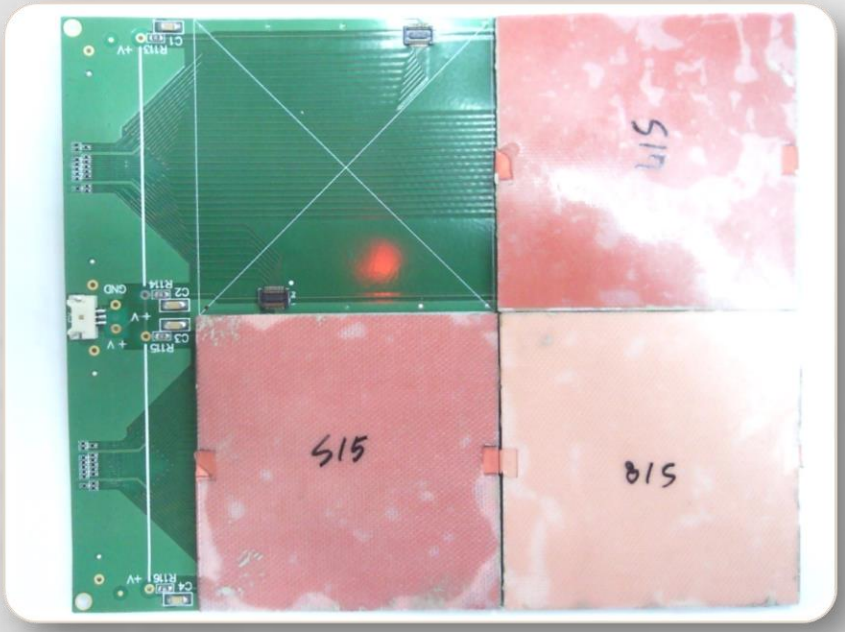
- Basically PN junction diode in reverse bias mode.
- N-type substrate and p-type pattern for high energy application
  => electrons are carriers





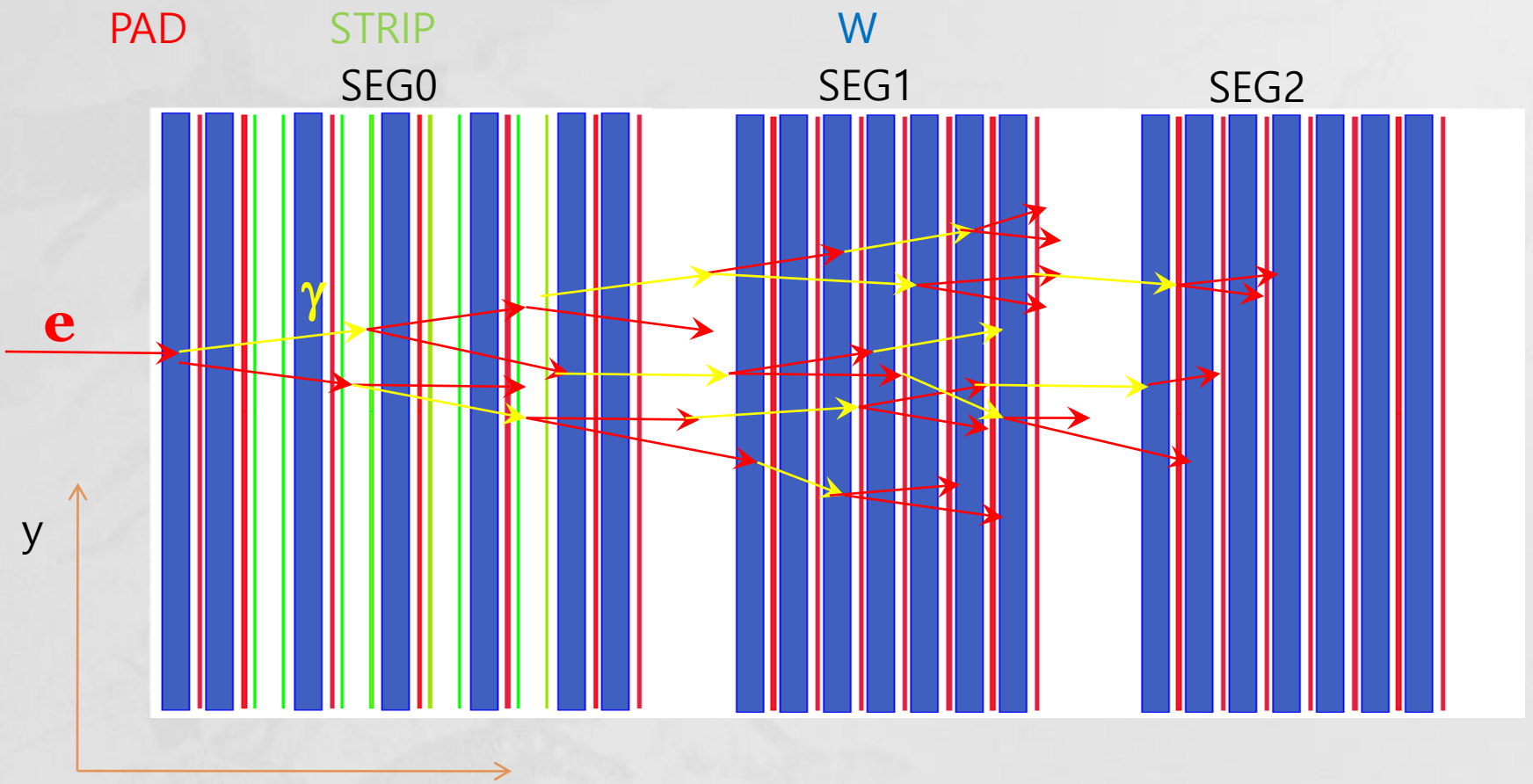
Production results





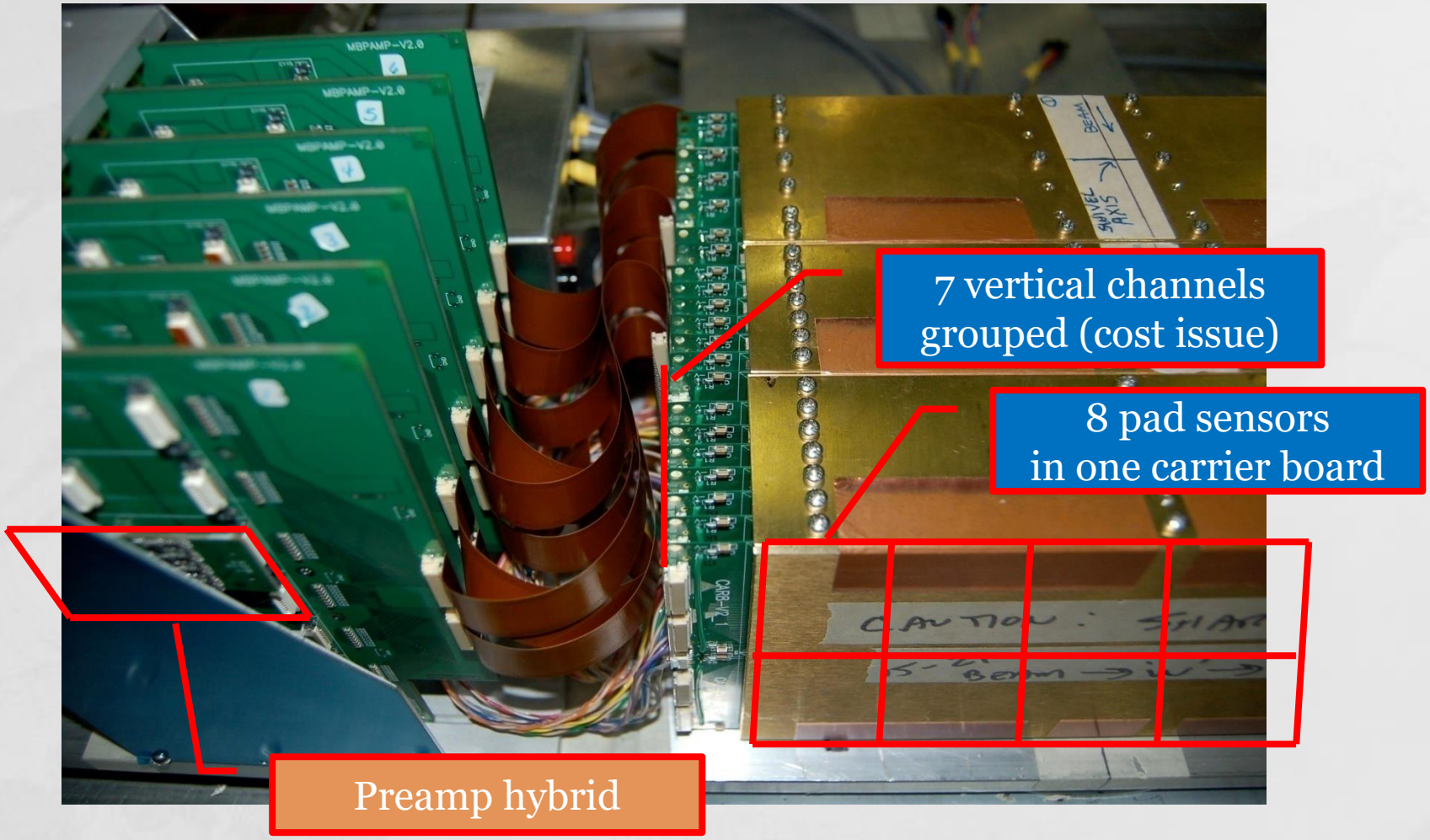
- 4 sample micro-module production has completed.
- Mechanical and electrical issues have been checked

General operation

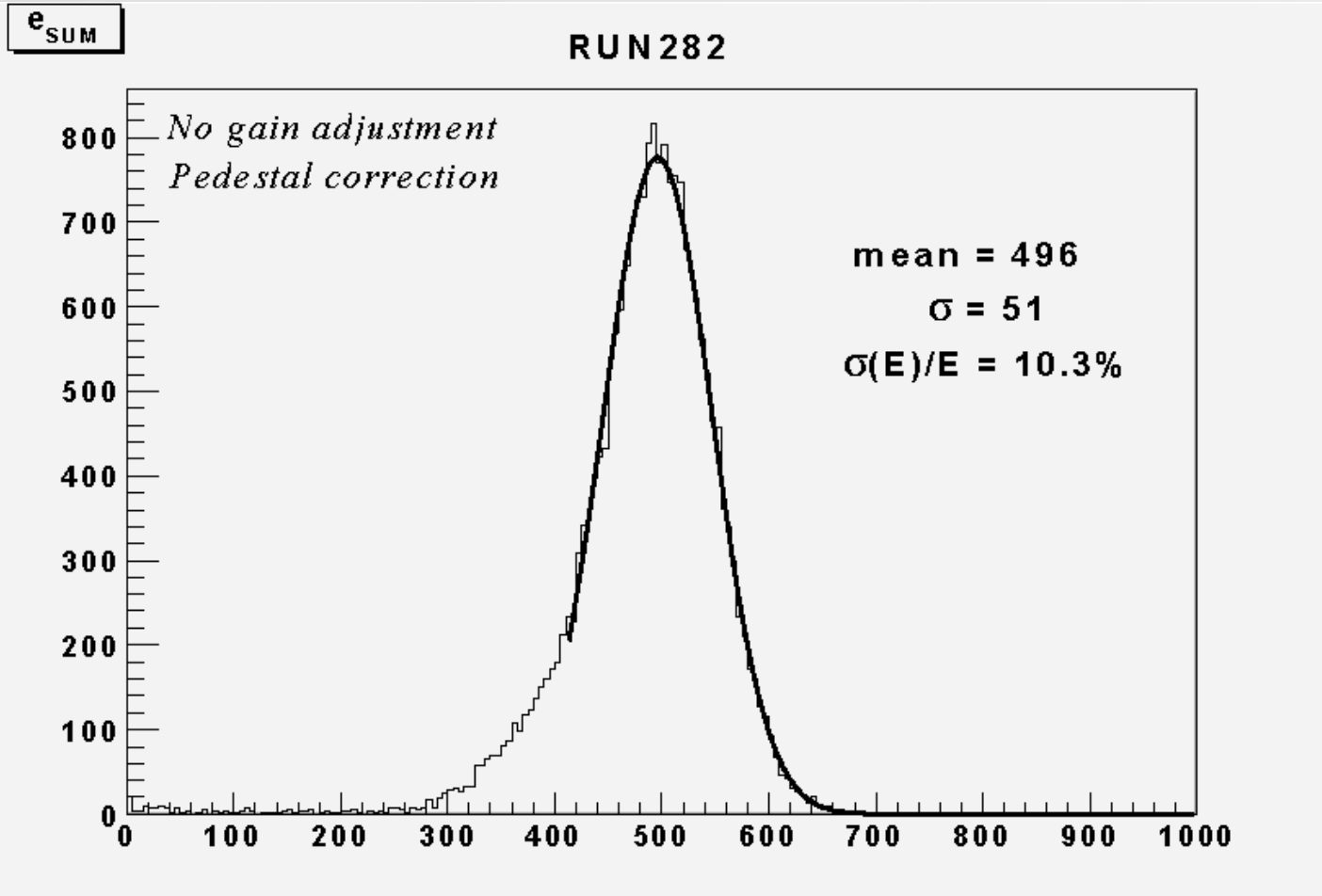


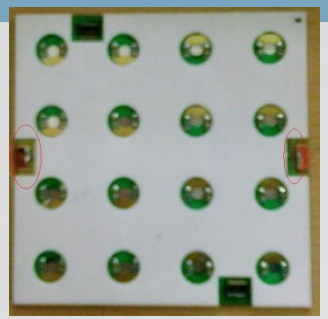
- Each tungsten layer : ~1 radiation length.
- R_M ~ 1.5 cm

Readout configuration

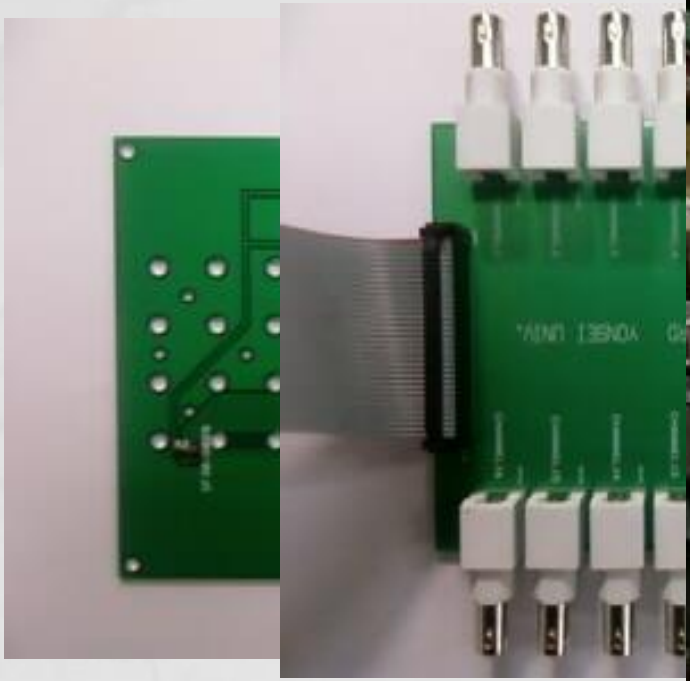


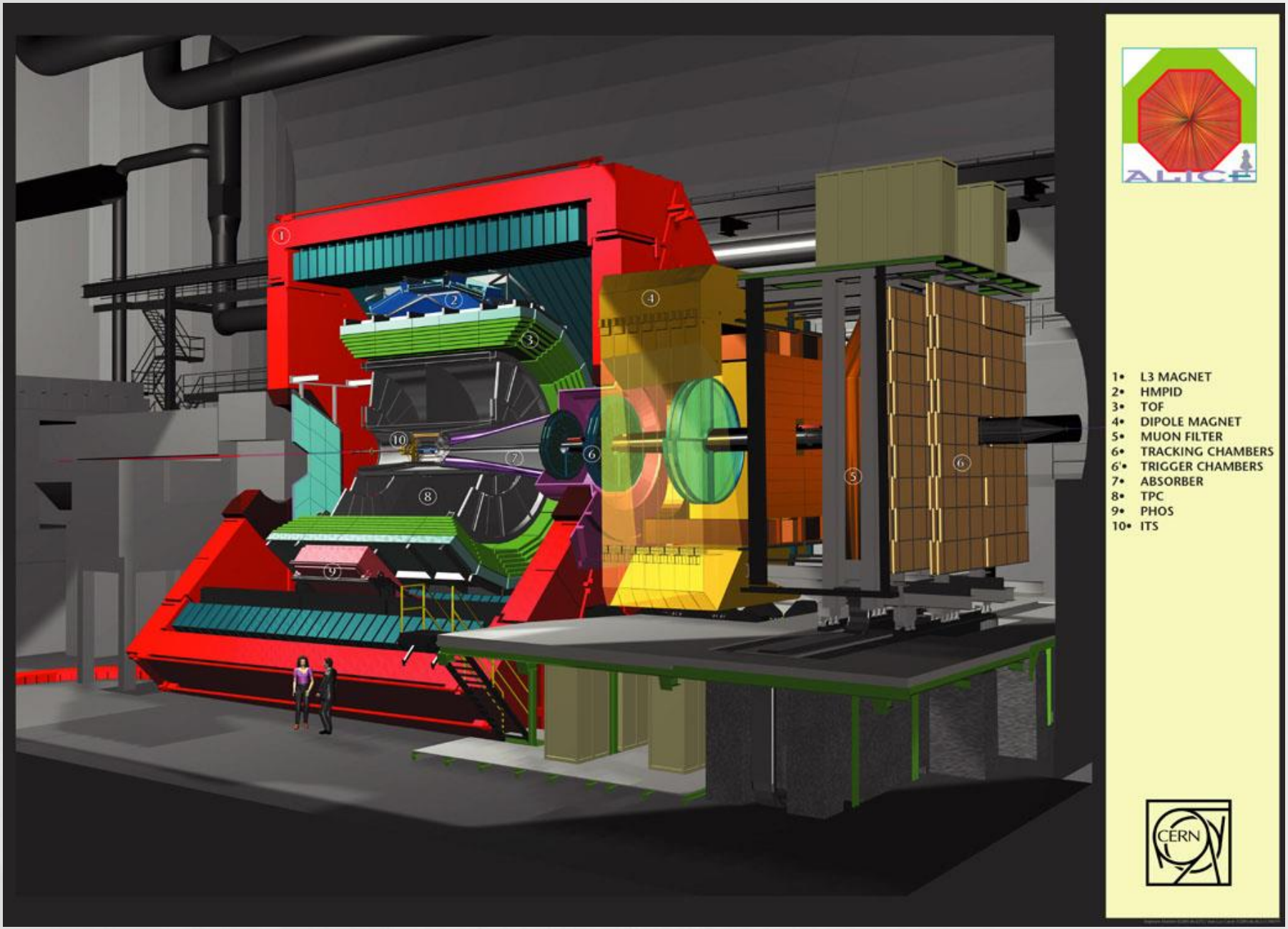
Result obtained while in beam test





Details in Cp-III-032




1• L3 MAGNET
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5• MUON FILTER
6• TRACKING CHAMBERS
6'• TRIGGER CHAMBERS
7• ABSORBER
8• TPC
9• PHOS
10• ITS
ALICE
CERN

E_{sum} for π^+ and e^- surviving selection

p_T = 10 GeV/c, Rejection factor of 200 with ε_γ=95%

답장 | 전체답장 | 전달 | 삭제 | 인쇄 | 저장 | 원문 | 스팸메일함 | 이동 | 복사

제 목	RE: Mail [스팸메일신고]
보낸 날짜	2009/08/25 화요일 오전 1:34:22
보낸 사람	"Tapan Nayak" <tapan.nayak@cern.ch> 주소록에 추가 수신거부
받는 사람	"Tapan Nayak"<tapan.nayak@cern.ch>, ykwon@yonsei.ac.kr
참 조	

Hi Youngil,

Nice and clear presentation. I am sitting in the auditorium and it was good.

I would like to make one comment:

SEG0 is almost 7 radiation length
why do you make it so thick - like shower max????

I would like to make SEG0 as preshower after 1 or 2X0
and then SEG1 can be 7 radiation length
and then SEG2 and SEG3 as it is.

So total 4 would be better.

On top of that if you have a charged particle veto that would be good.

Is the designed final in PHENIX

Tapan

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****
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CERN Cell: +41 76 487 2171 or 162171
url: http://www.cern.ch/nayak
****

Conclusion

- The π^0 particle is an important background to the measurement of direct γ.
- ALICE can deal with the problem through the low mass e^+e^- pairs.
- Korea possesses great potential in Si processing.
- We will pursue W/Si sandwich calorimeter in ALICE.