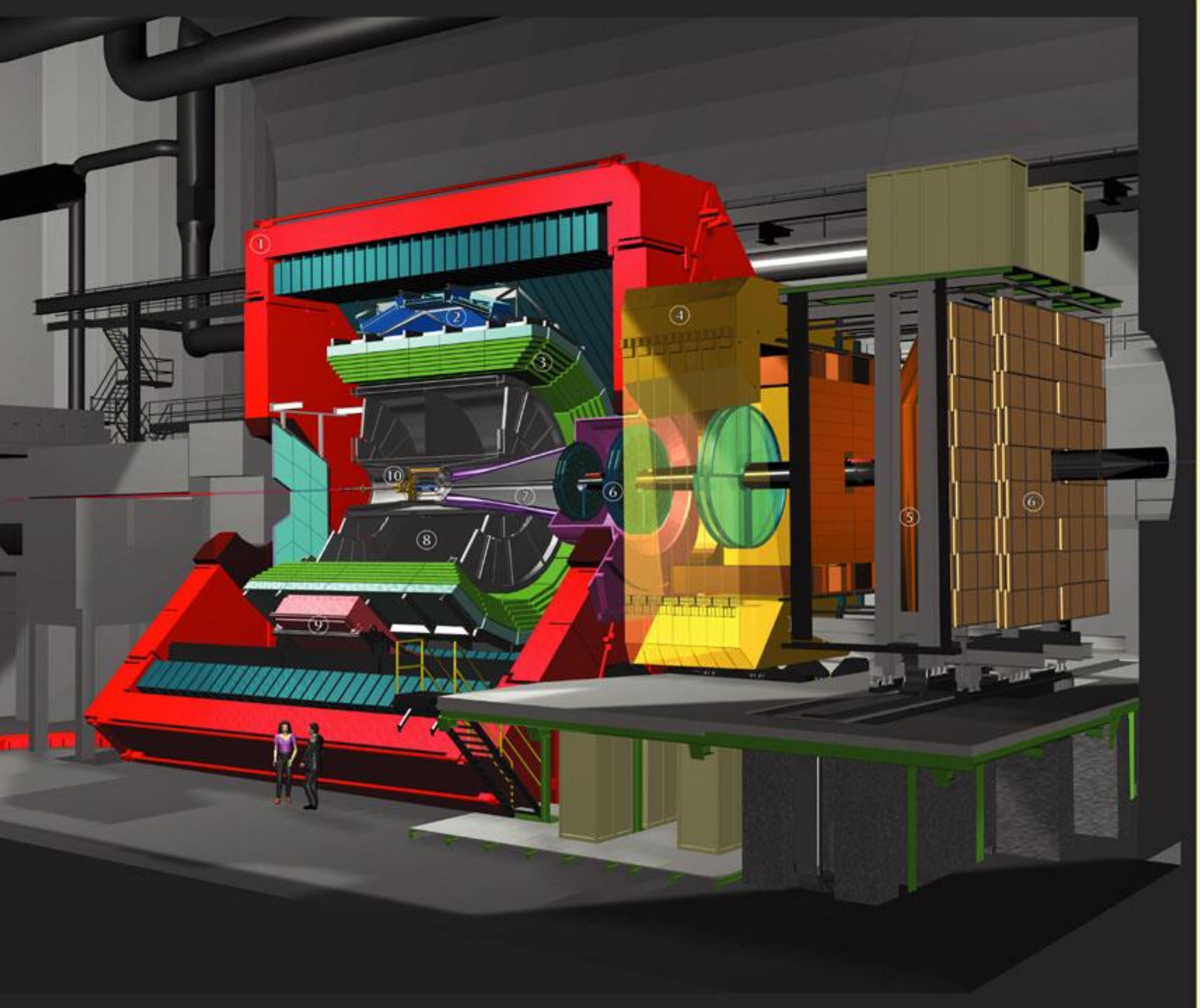
Efforts towards ALICE at Yonsei

Y. Kwon

(Yonsei HIP group)

for the April HIM, 2007



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

AGREEMENT FOR SCIENTIFIC COOPERATION

between

Institute of Physics and Applied Physics, Yonsei University, Seoul, Korea

and

Gesellschaft für Schwerionenforschung m.b.H., Darmstadt, Germany

Institute of Physics and Applied Physics at Yonsei University (IPAP) and Gesellschaft für Schwerionenforschung m.b.H.(GSI) establish a specific personnel exchange program based on the recommendation by the advisory committee formed from the previous memoranda (Prof. Kwon for Yonsei and Prof. Braun-Munzinger for GSI). Description of the exchange program and the accompanying responsibilities is given below.

1. The exchange program will work as a tool supporting activities[1)] for the ALICE collaboration which is mutual interests of both institutions.
2. IPAP will maintain support of a student stationed at GSI where physical part of the activities occurs. GSI will assist the support when advisory committee recognizes the needs.
3. Results of the activities will be reported in the annual meeting hosted by the advisory committee. Local expenses of the meeting will be covered by the hosting institution.
4. The program will continue within the scope of previous memoranda until recommended otherwise by the advisory committee.
5. Credit for the resulting academic results will be shared by both parties.

[1)] Initially proposed activities include

1) participation in construction and commissioning of the transition radiation detector (TRD),
2) participation in development of the slow control system (SCADA) for the time projection chamber(TPC) and the TRD,
3) participation in alignment & calibration of the TPC and the TRD,
4) investigation of e-h separation,
5) and analysis of data (study of direct photon production through lepton pairs).

Seung-Han Park

Prof. Seung-Han Park
Director
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March 1, 2007

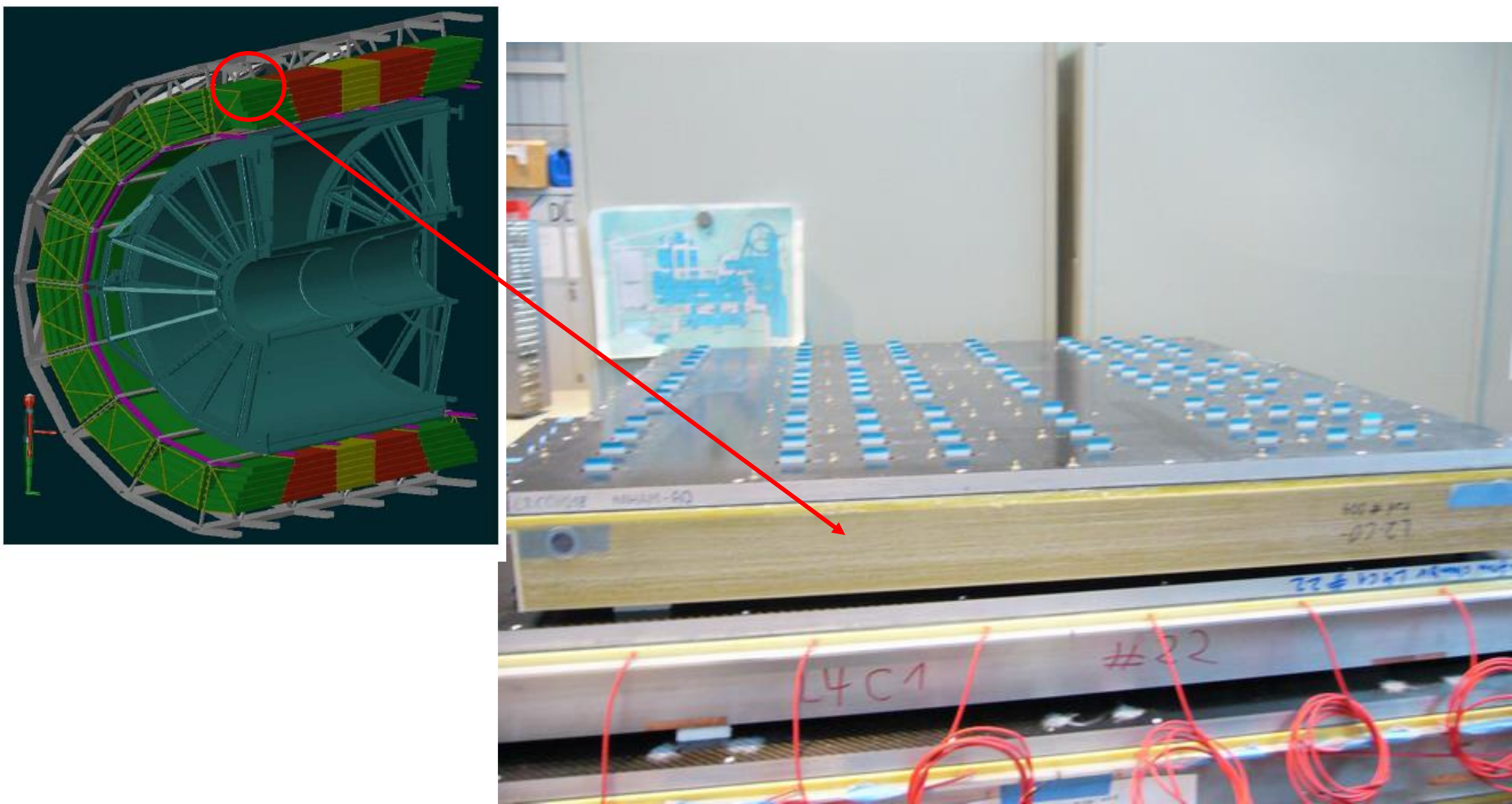
Prof. Dr. Walter F. Henning
Scientific Director
Gesellschaft für Schwerionen6forschung m.b.H.,
Darmstadt, Germany

March 1, 2007

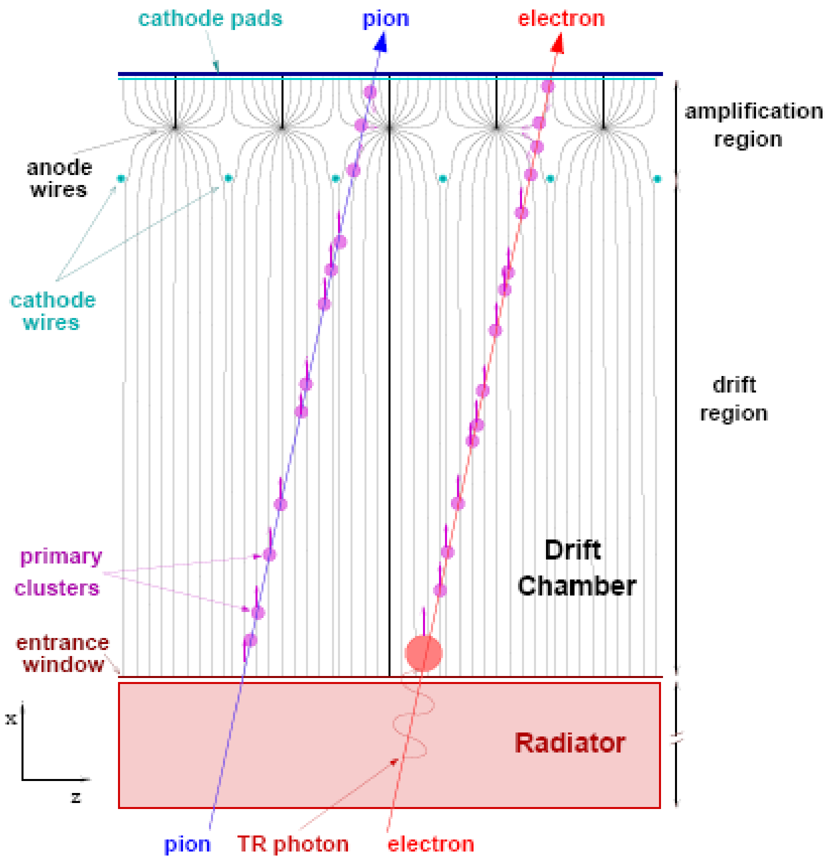
What we plans…

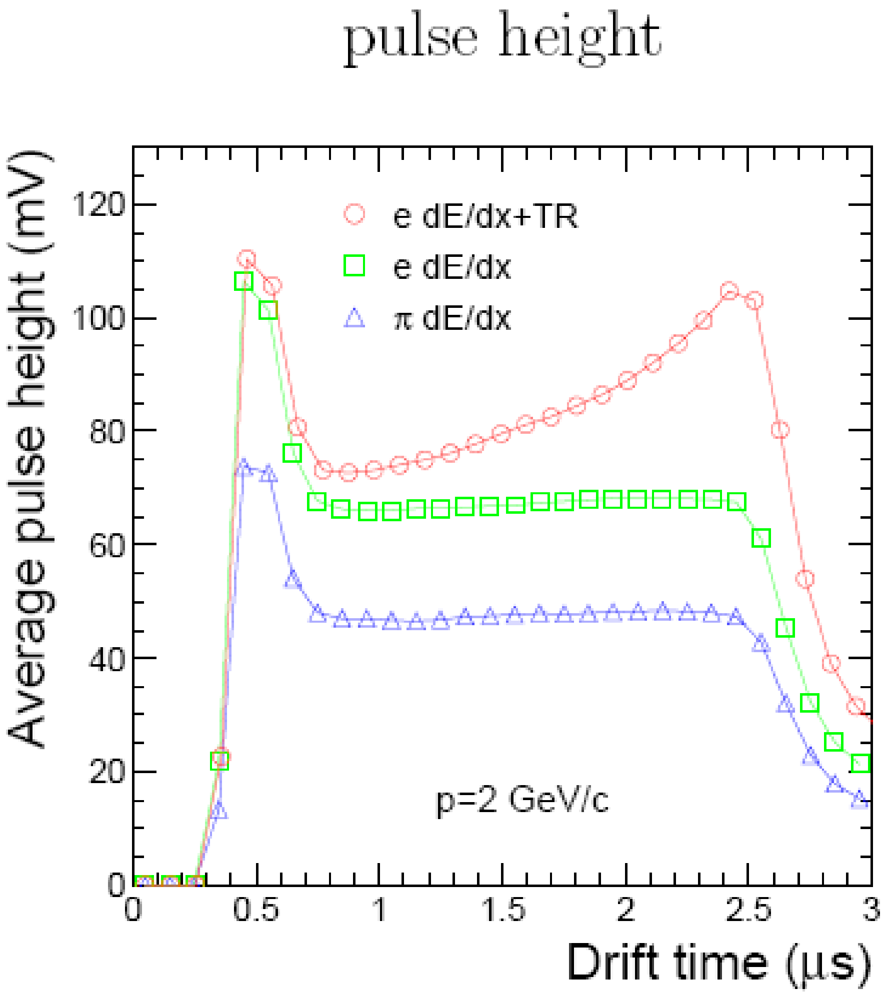
- Participation in construction and commissioning of the **transition radiation detector (TRD)**
- Participation in development of the **slow control system (SCADA)** for the **time projection chamber(TPC) and the TRD**
- Participation in **alignment & calibration of the TPC and the TRD**
- Investigation of **e-h separation**
- Analysis of data (study of **direct photon production through lepton pairs**)

TRD
(Transition Radiation Detector)



TRD working principle





FROM P. Shukla -- ICPA-QGP'05, Kolkata, 8-12 February 2005

Issues with the direct photon production at LHC? ($p_T \sim$ a few GeV/c)

- Parton distribution? $x \sim 10^{-4}$–10^{-3}
- Perturbative QCD prediction for direct photon production for the p+p and the Pb+Pb reactions(at LHC energy)?
- Thermal photon (Heavy ion collision)?

Hard Processes?

Factorization theorem

$d\sigma\,[A+B\to\gamma+X] = \Sigma_{ij}\, f_{i/A} \otimes f_{j/B} \otimes d\hat{\sigma}\,[ij\to\gamma+X]$ + ...

$f_{i/A}, f_{j/B}$: distribution fuction for parton ij

$D_{k\to h}$: fragmentation function for k

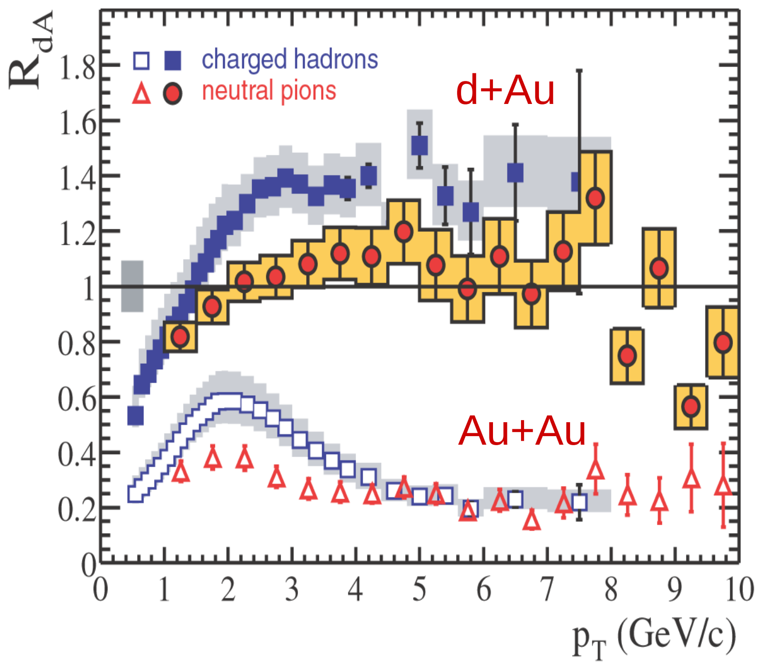
$d\hat{\sigma}\,[ij\to k+X]$: parton cross section

+... : higher twist (power suppressed by Λ_{QCD}/m_c, or Λ_{QCD}/p_t if $p_t \gg m_c$) : e.g. "recombination"

Application to nuclei:

$f_{i/Au} \approx 79\, f_{i/p} + 118\, f_{i/n} \approx 197\, f_{i/N}$

$f_{i/d} \approx f_{i/p} + f_{i/n} \approx 2\, f_{i/N}$

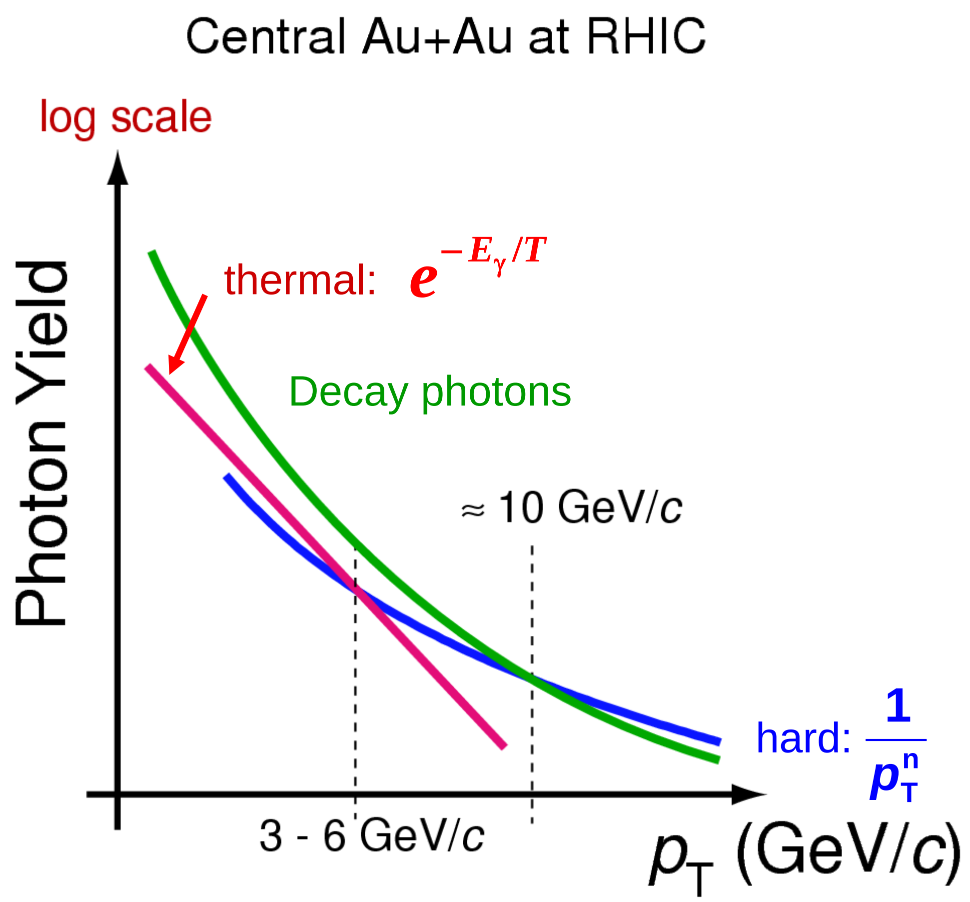


Binary scaling not working

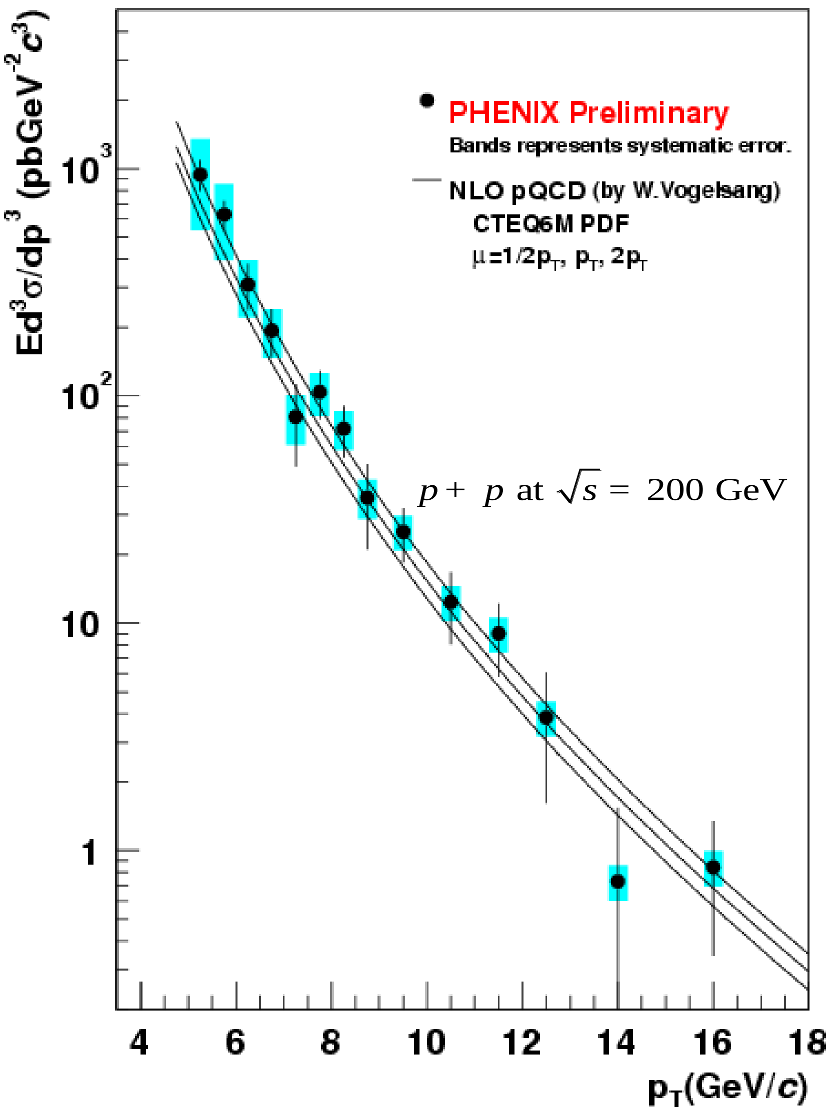
for high pt particles in central AuAu collisions

PHENIX: PRL, 91, 072303 (2003)

Schematic Photon Spectrum in Au+Au

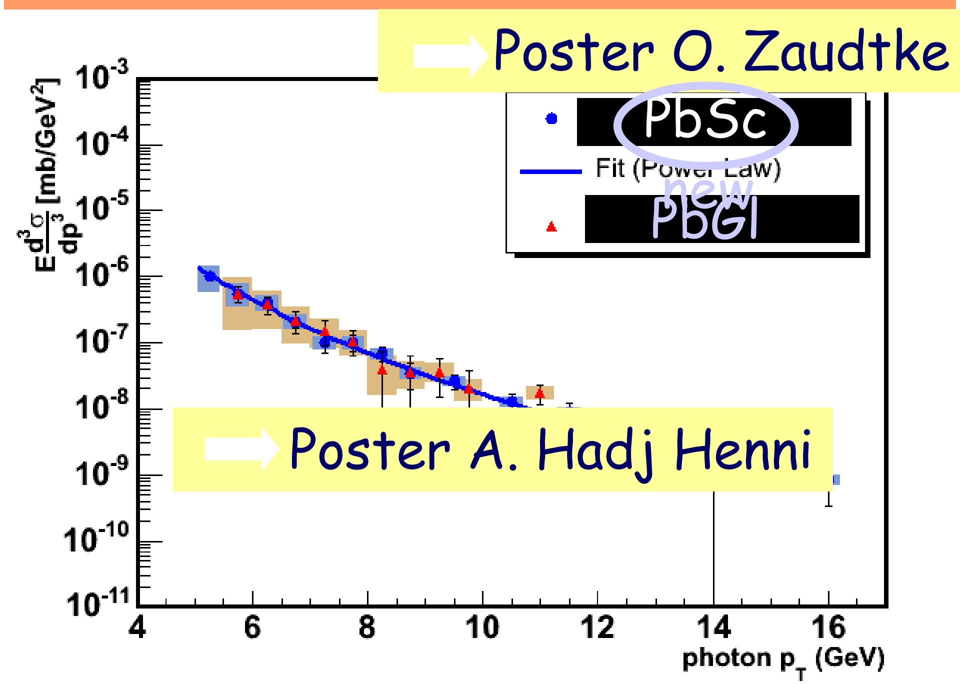


Direct Photons in *p+p*



- good agreement with NLO pQCD
- Important baseline for Au+Au

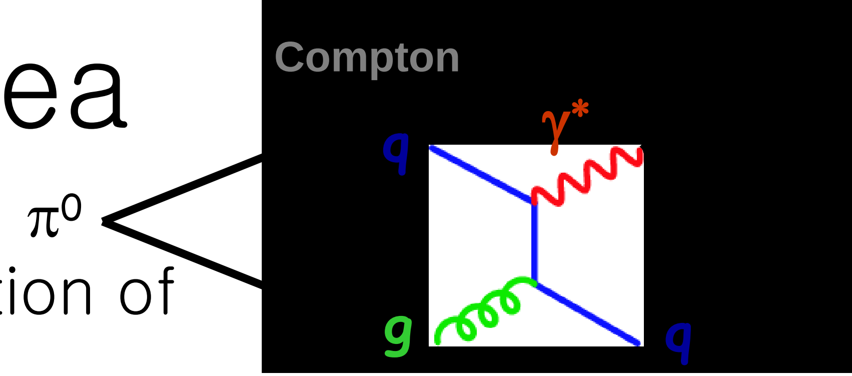
New for QM: PHENIX Preliminary



New Technique – Lepton Pairs?

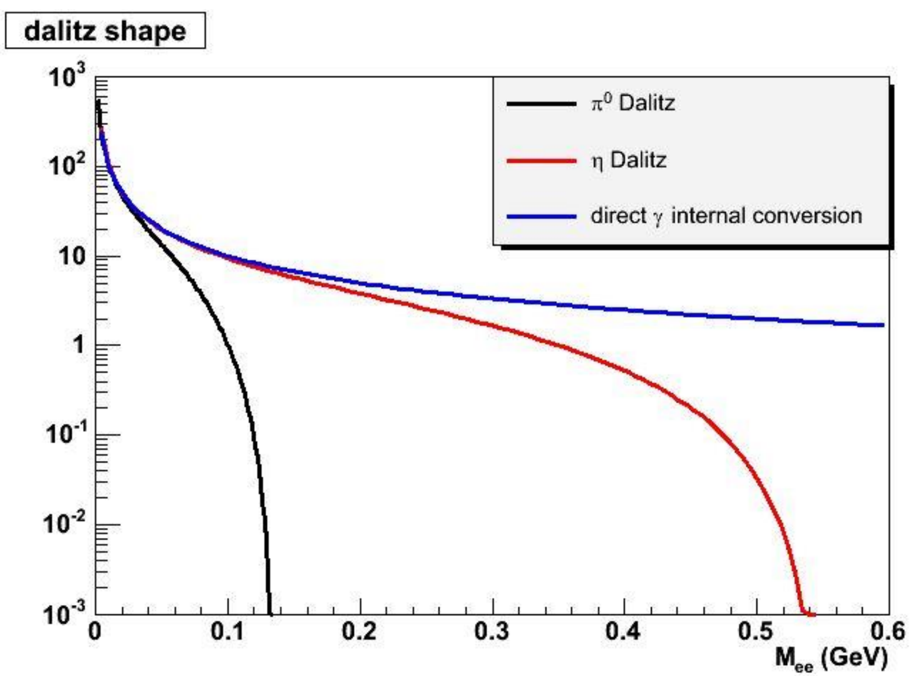
The Idea

- Start from Dalitz decay
- Calculate invariant mass distribution of Dalitz pairs



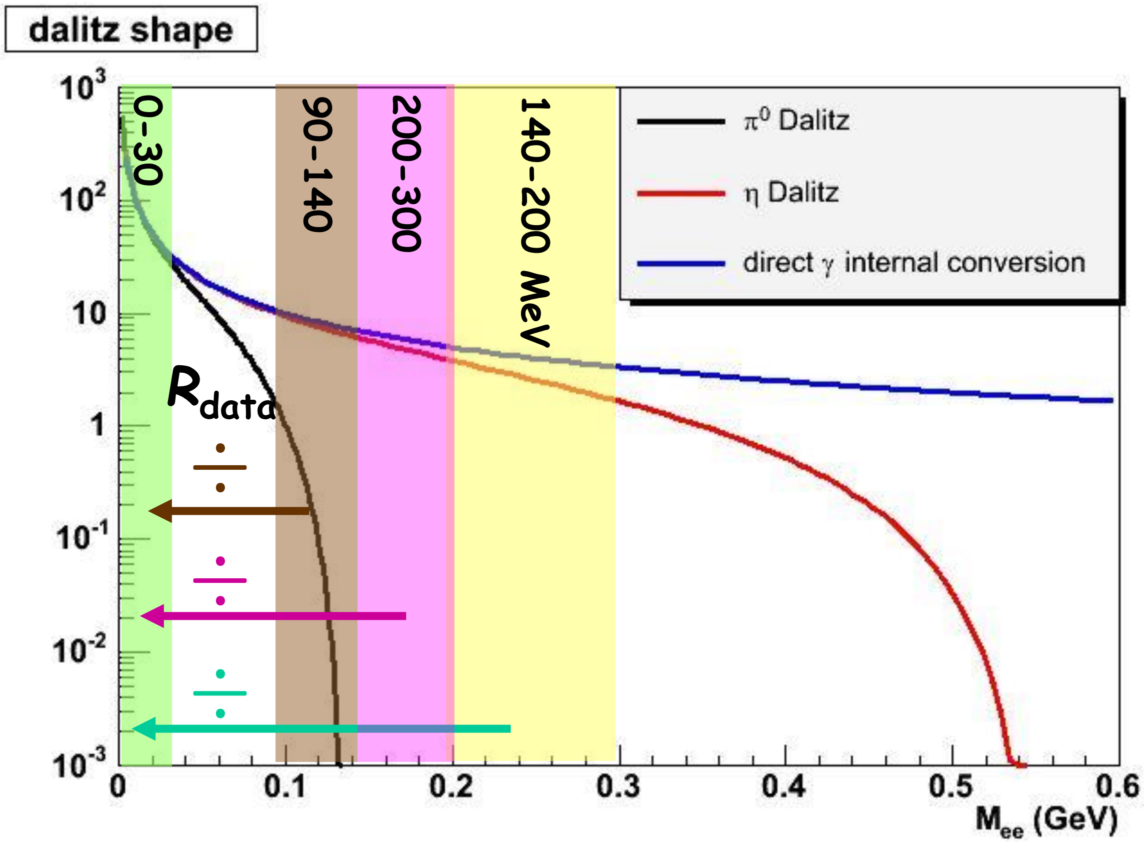
$$\frac{1}{N_\gamma}\frac{dN_{ee}}{dm_{ee}} = \frac{2\alpha}{3\pi}\sqrt{1-\frac{4m_e^2}{m_{ee}^2}}\left(1+\frac{2m_e^2}{m_{ee}^2}\right)\frac{1}{m_{ee}}\left|F(m_{ee}^2)\right|^2\left(1-\frac{m_{ee}^2}{M^2}\right)^3$$

invariant mass of Dalitz pair	invariant mass of virtual photon	form factor	phase space factor



- Now direct photons
- Any source of real γ produces virtual γ with very low mass
- Rate and mass distribution ~ similar
  - No phase space factor for $m_{ee} << p_{T\,photon}$

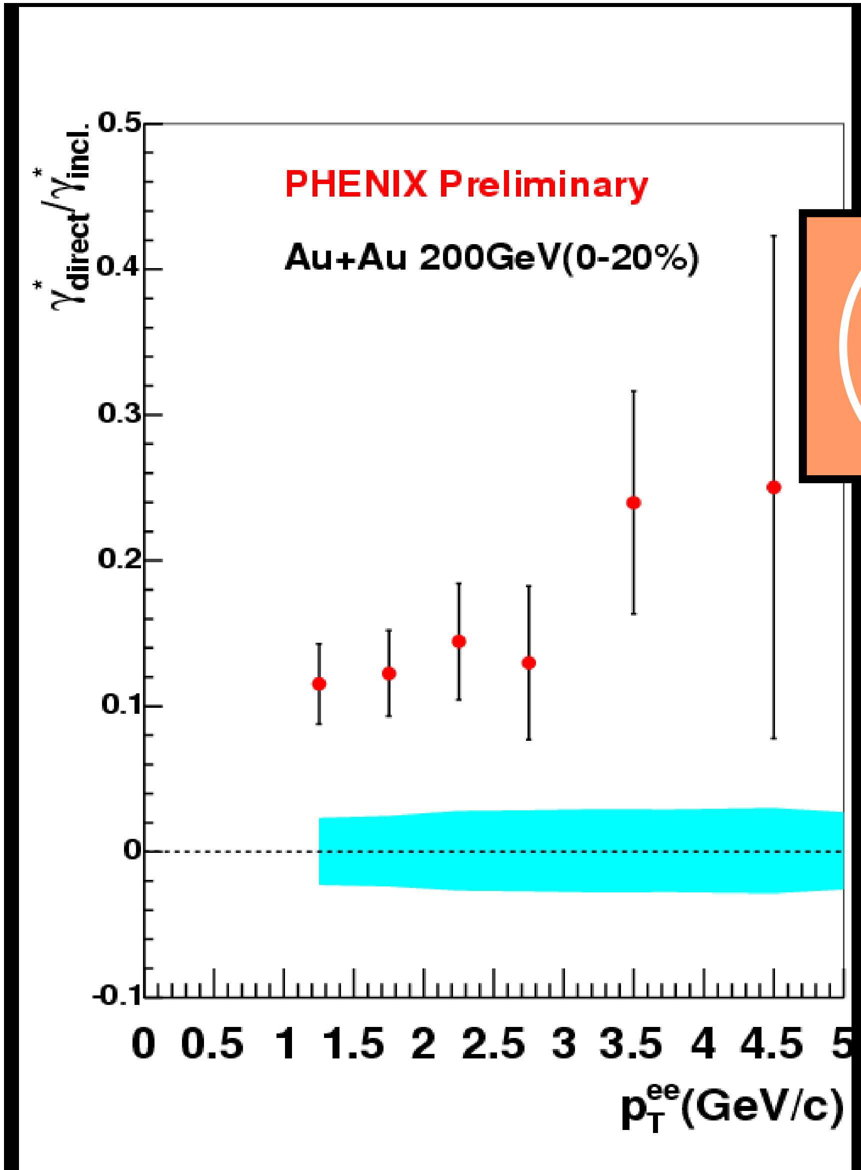
Method



- Material conversion pairs removed by analysis cut
- Combinatorics removed by mixed events

- Calculate ratios of various M_{inv} bins to lowest one: R_{data}
- If no direct photons: ratios correspond to Dalitz decays

$\gamma^*_{direct}/\gamma^*_{inclusive}$

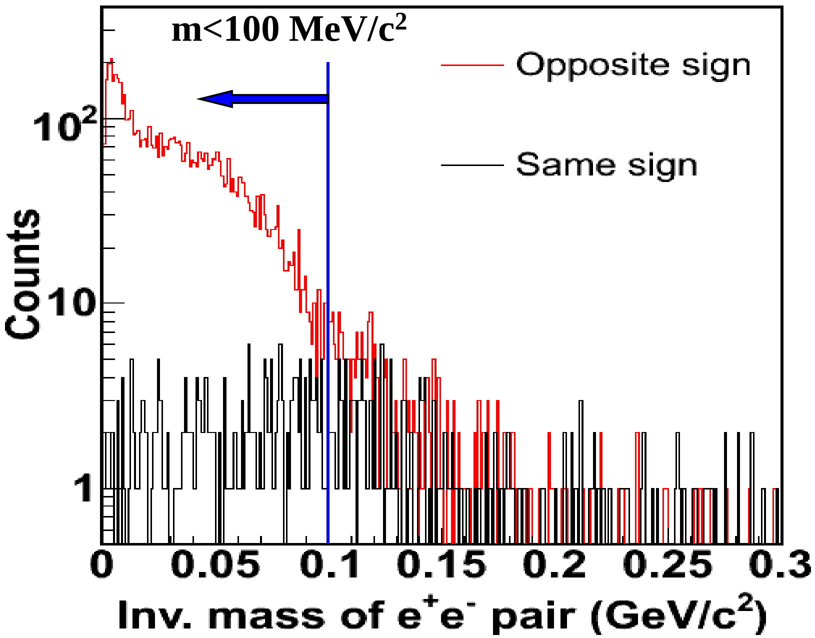


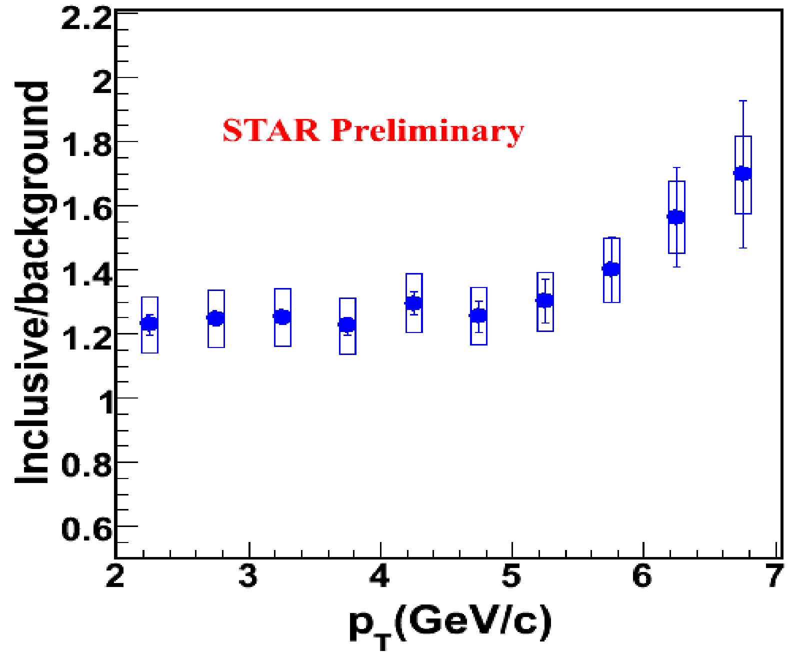
$$\frac{\gamma^*_{direct}}{\gamma^*_{incl.}} = \frac{R_{data} - R_{\pi^0+\eta}}{R_{direct} - R_{\pi^0+\eta}} = \frac{\gamma_{direct}}{\gamma_{incl.}}$$

0-20 %

Significant 10% excess of very-low-mass virtual direct photons

Xiaoyan Lin (for STAR at QM06)





- Electron candidates are combined with tracks passing a loose cut on dE/dx around the electron band.
- The invariant mass for a pair of photonic electrons is small.

- The combinatorial background is small in p+p collisions.
- Reconstructed photonic = Opposite sign – Same sign.
- Photonic electron = reconstructed-photonic/ ε. ε is the background reconstruction efficiency calculated from simulations.

We look forward to exciting adventures and physics! Educating student is a challenge, but it's fun to see students learn!

Many challenges to a junior faculty (Did you see he was making transparencies to the last minute? ^^;). **He will fight the challenges with passion and your support.**