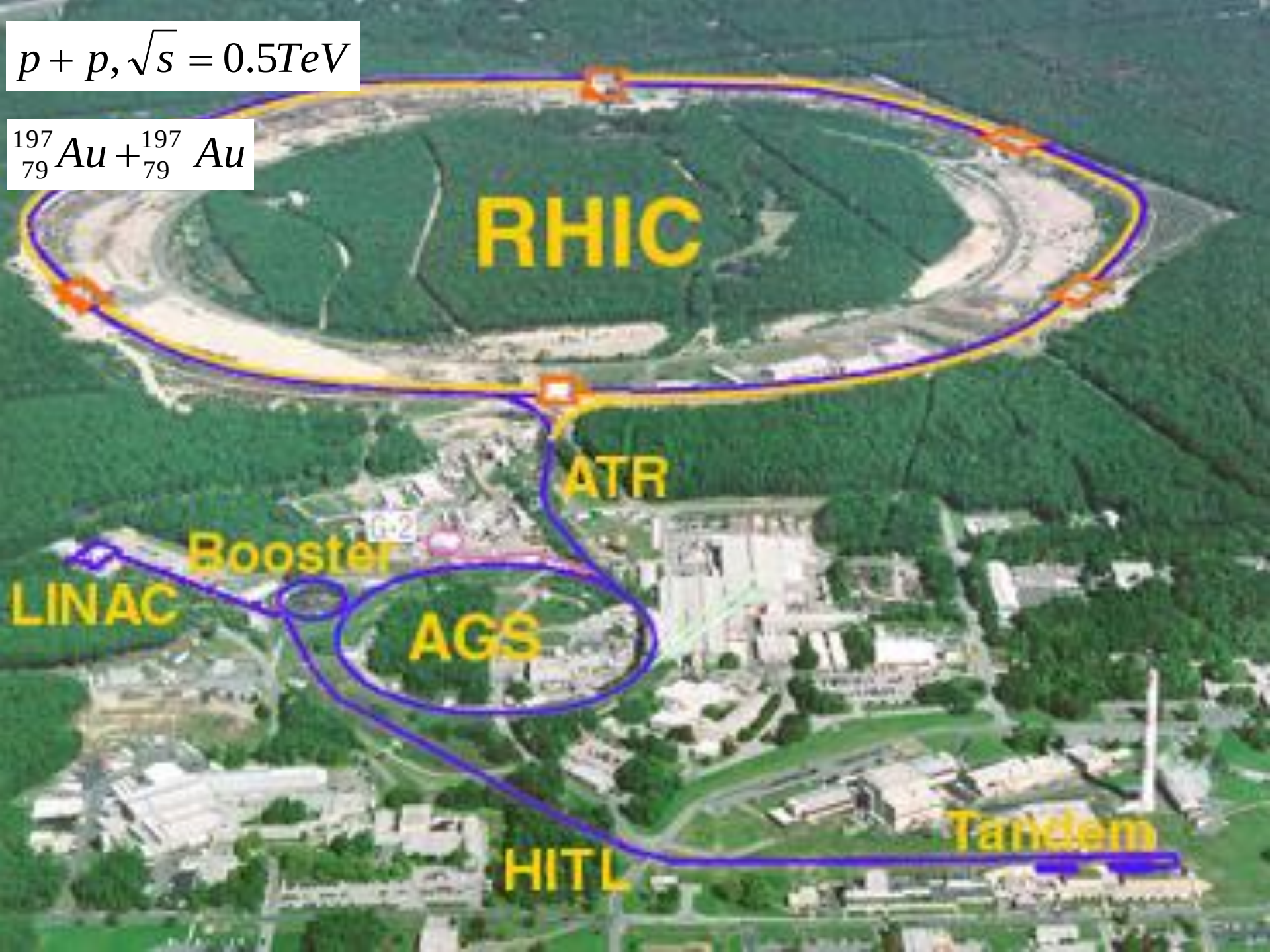
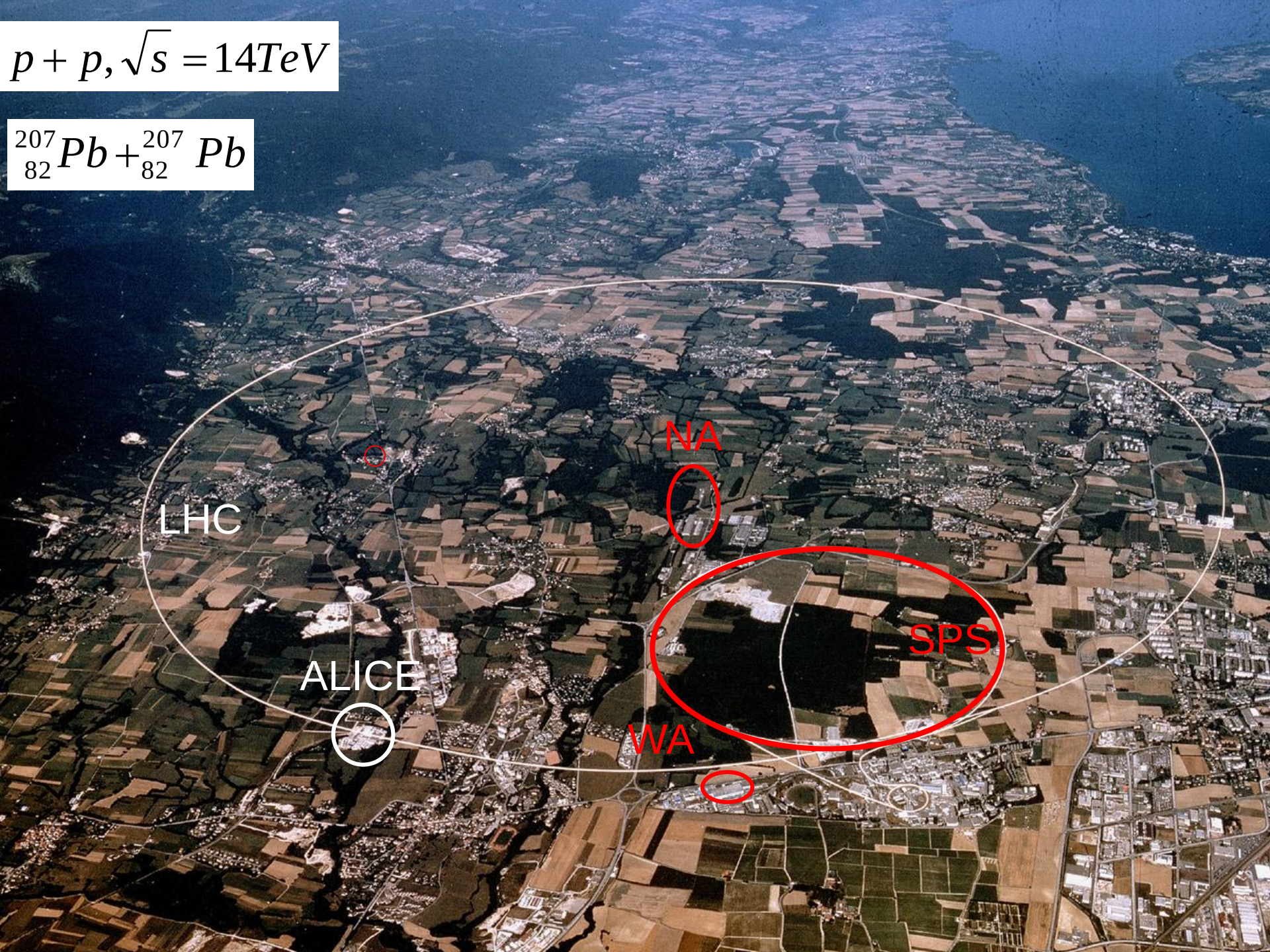
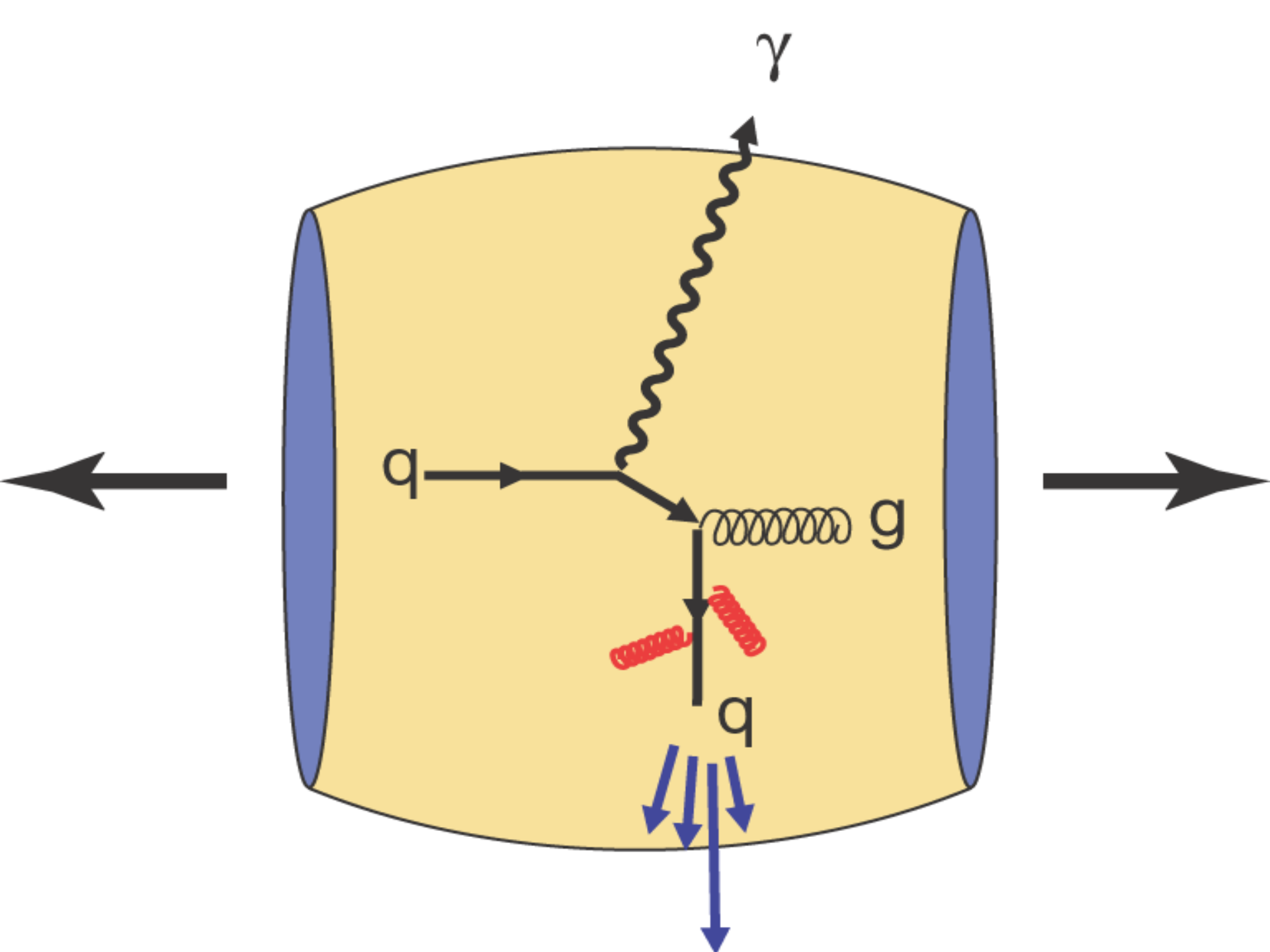
Efforts by Yonsei towards ALICE

Y. Kwon
(Yonsei Univ.)


$p + p, \sqrt{s} = 0.5TeV$
$^{197}_{79}Au + ^{197}_{79}Au$
RHIC
ATR
Booster
LINAC
AGS
HITL
Tandem


$p + p, \sqrt{s} = 14TeV$
$^{207}_{82}Pb + ^{207}_{82}Pb$
LHC
NA
SPS
ALICE
WA


γ
q
g
q

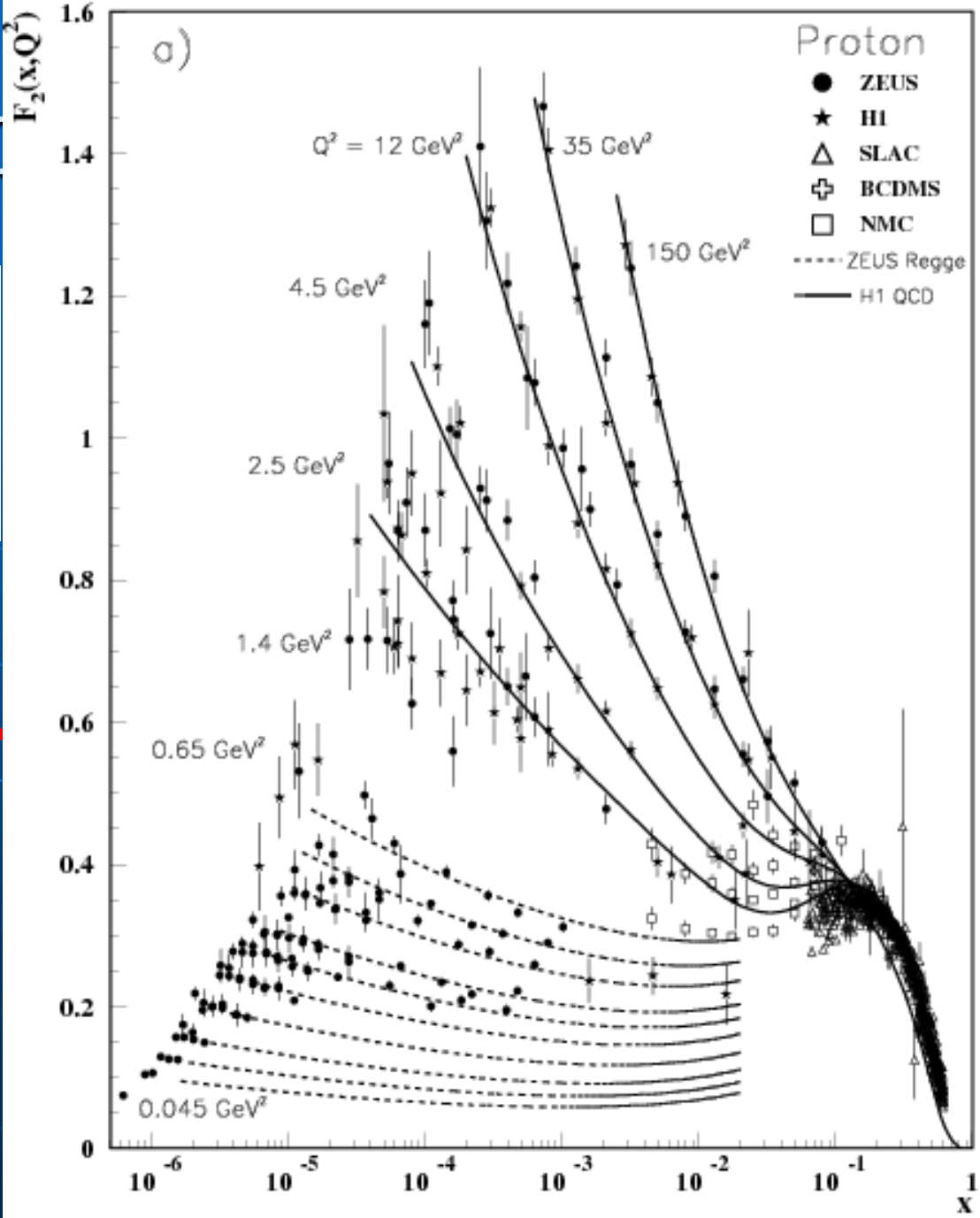
2 by 2 parto

$x \approx 0.02 \qquad p_h = 100 GeV/c$

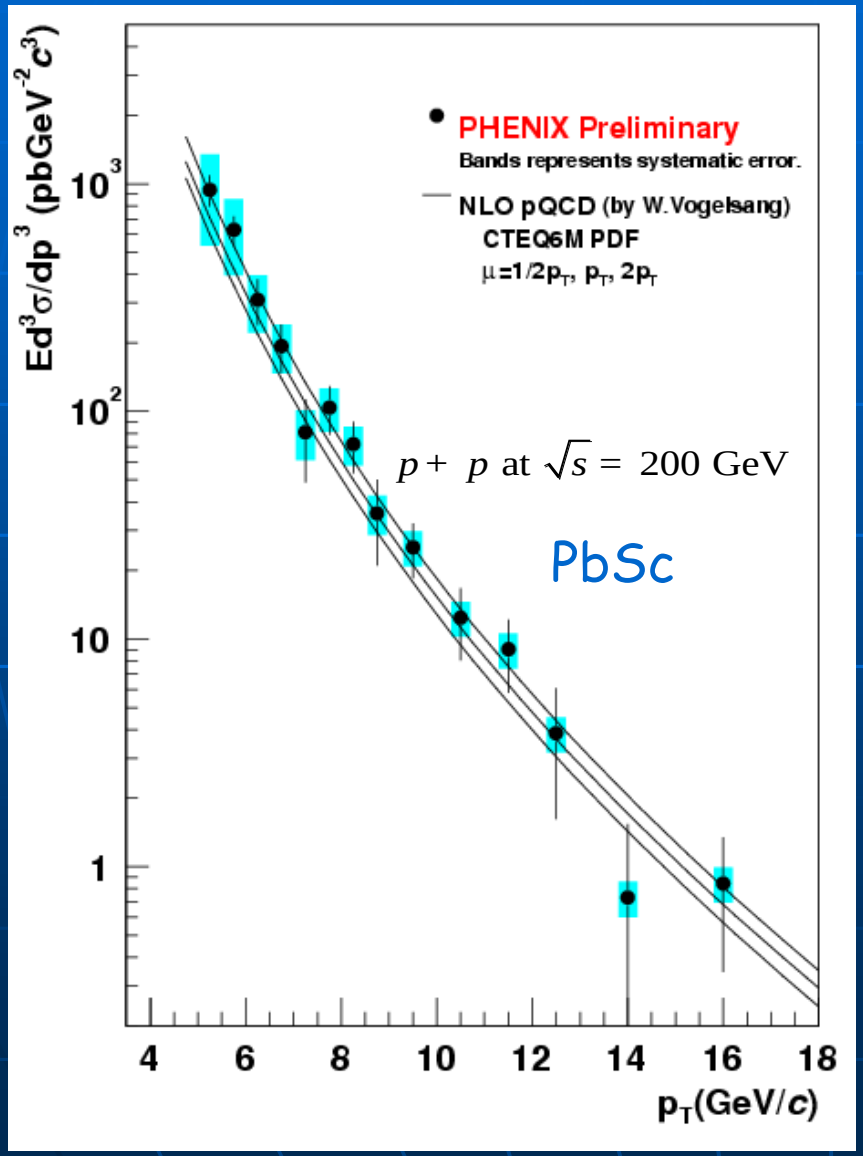
$x \approx 3 \cdot 10^{-4} \qquad p_h = 7 TeV/c$

$x \approx 7 \cdot 10^{-4} \qquad p_h = 2.8 TeV$

$2 GeV/c$

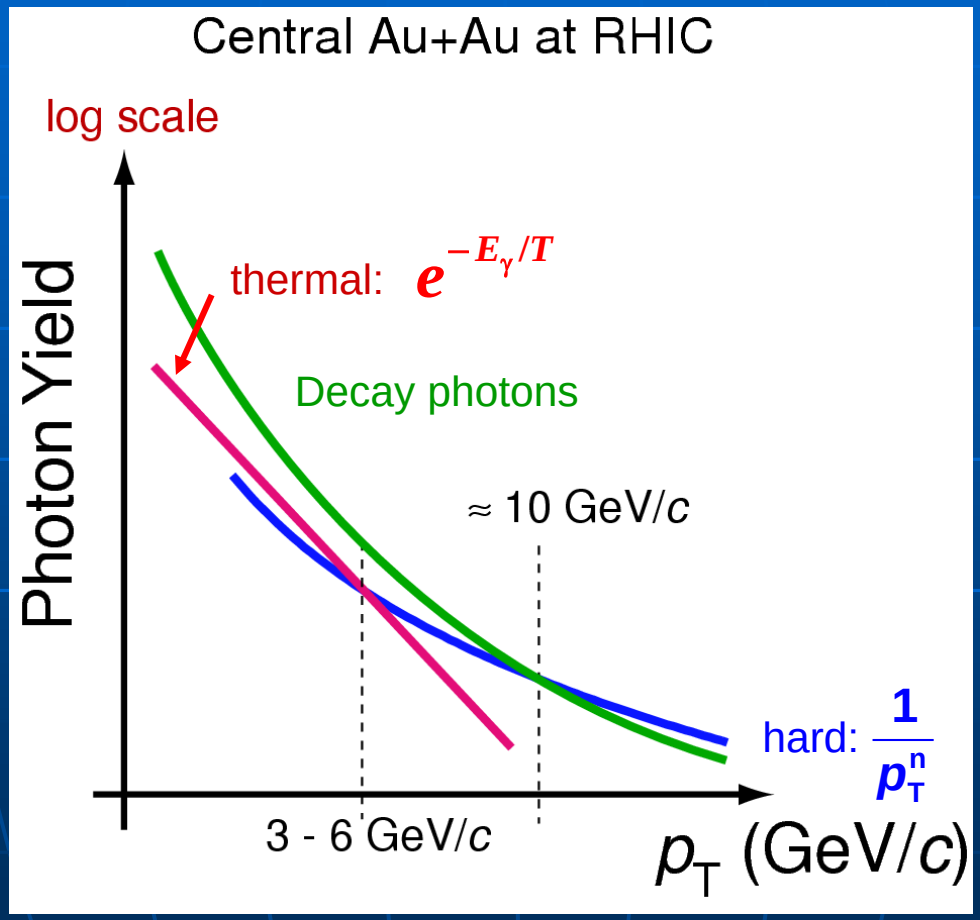


Direct Photons in *p+p*



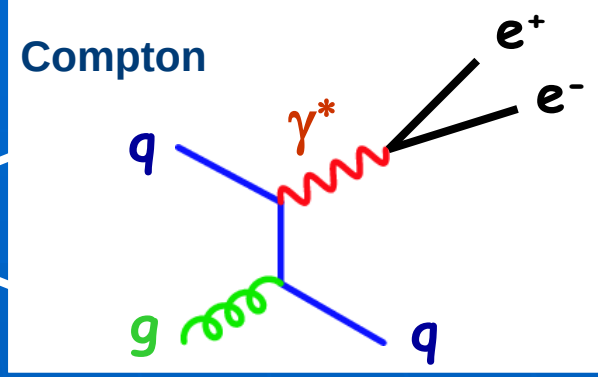
- Good agreement with NLO pQCD
- Important baseline for Au+Au

Schematic Photon Spectrum in Au+Au



The Idea

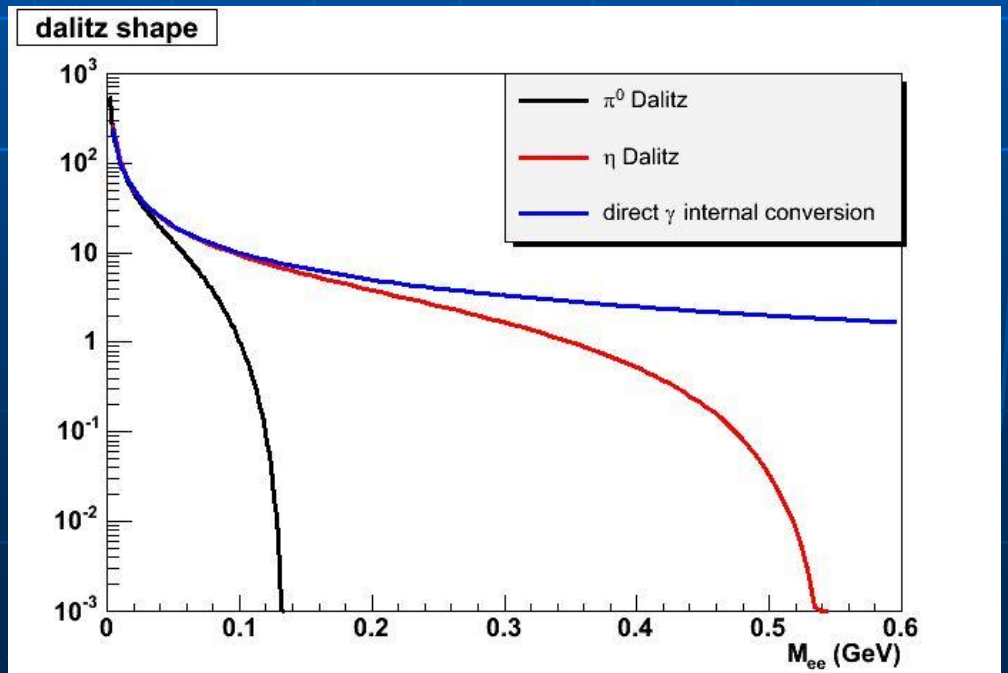
- Start from Dalitz decay
- Calculate invariant mass distribution of Dalitz pairs



π^0

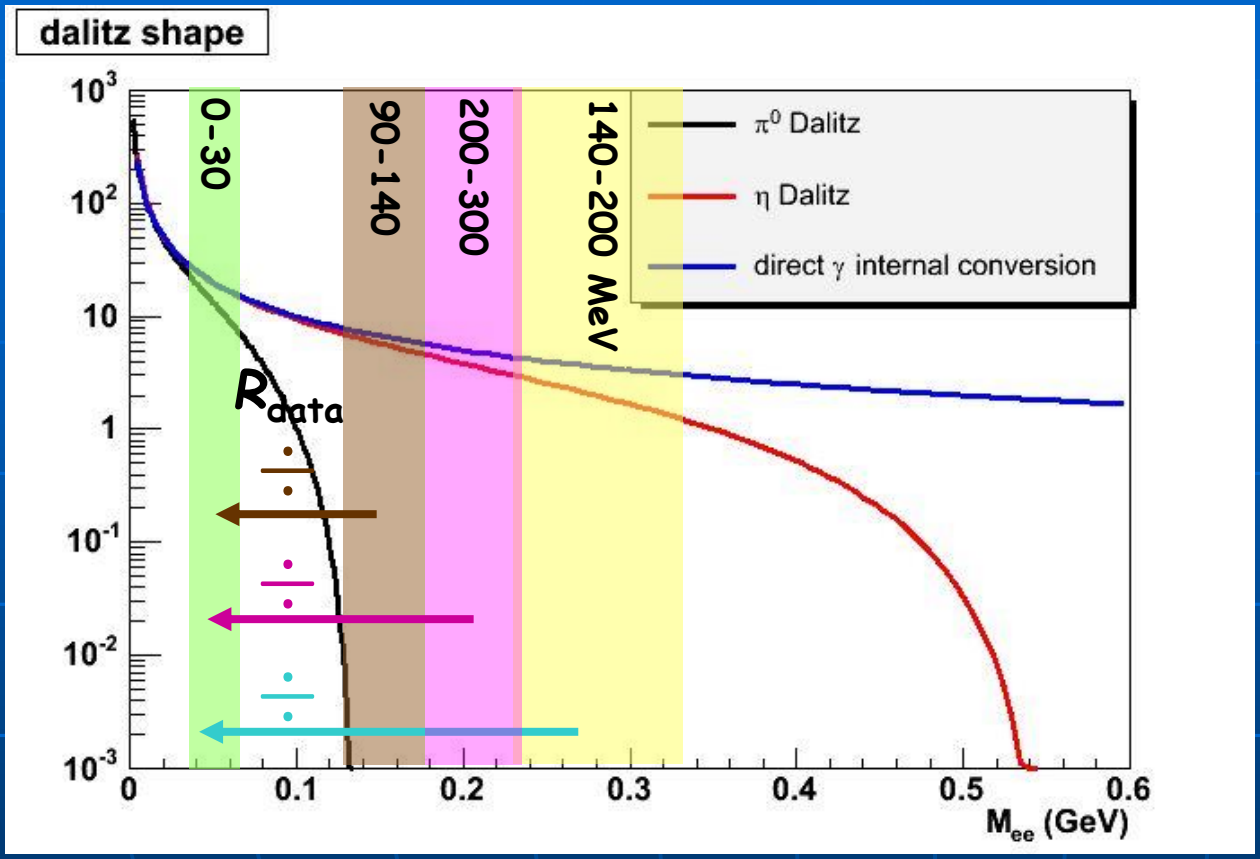
$$\frac{1}{N_\gamma}\frac{dN_{ee}}{dm_{ee}} = \frac{2\alpha}{3\pi}\sqrt{1-\frac{4m_e^2}{m_{ee}^2}}\left(1+\frac{2m_e^2}{m_{ee}^2}\right)\frac{1}{m_{ee}}\left|F(m_{ee}^2)\right|^2\left(1-\frac{m_{ee}^2}{M^2}\right)^3$$

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 $m_{ee} << p_T^{photon}$

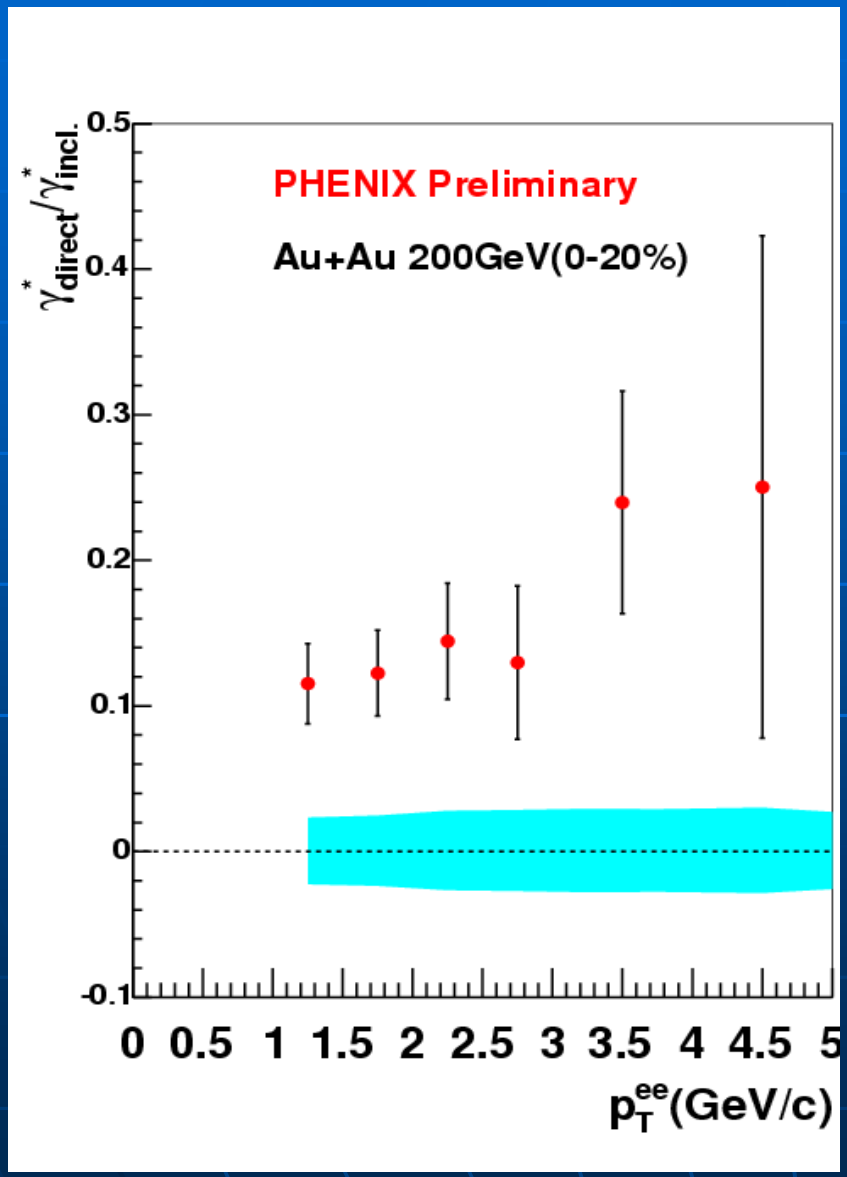
Method



- 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
- If excess: direct photons

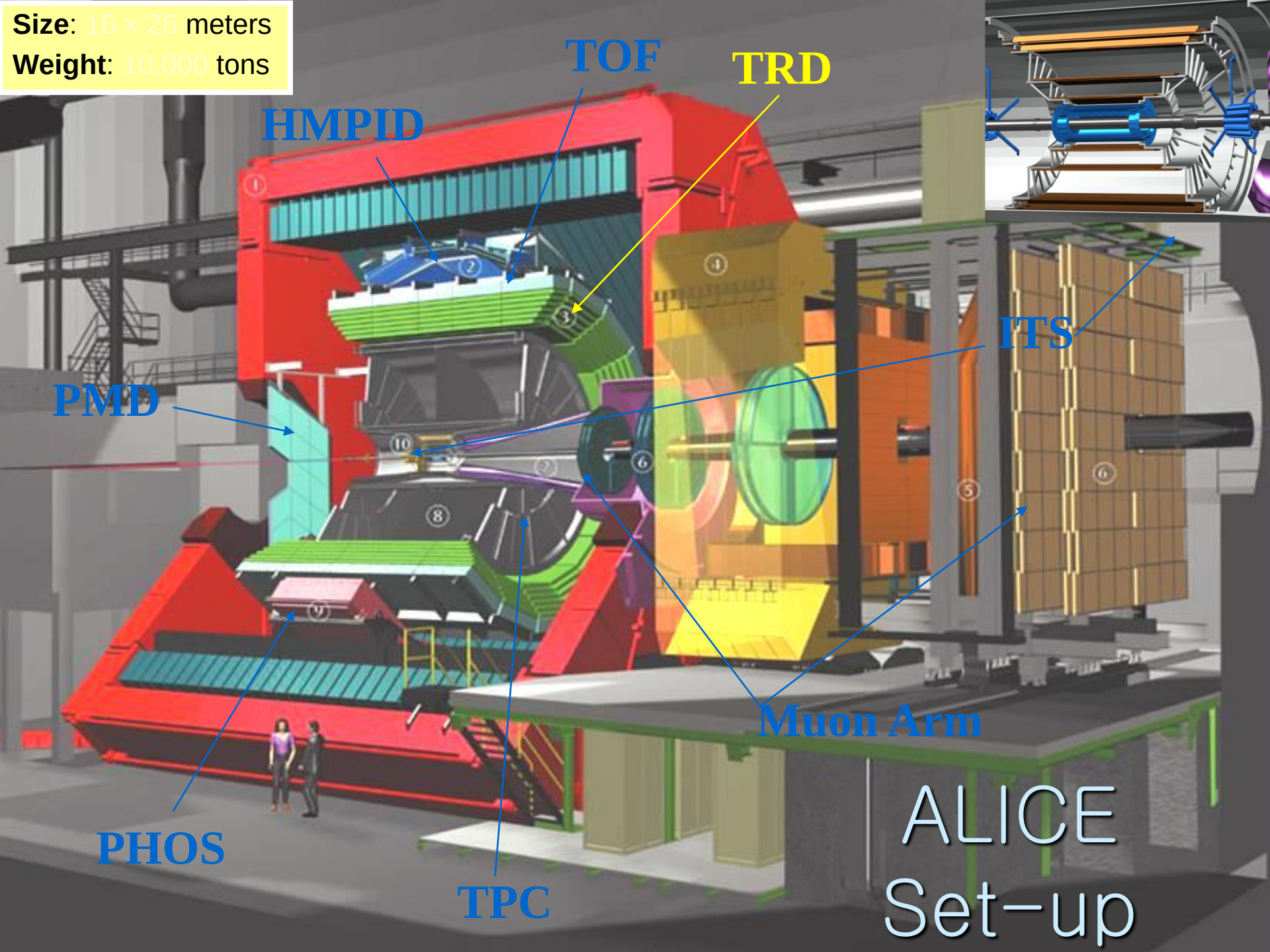
$\gamma^*_{direct}/\gamma^*_{inclusive}$



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

0-20 %

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


Size: 16 x 26 meters
Weight: 10,000 tons
TOF
TRD
HMPID
ITS
PMD
Muon Arm
PHOS
TPC
ALICE
Set-up

TRD(Transition Radiation Detector)

- $|\eta|<0.9$, $45°<\theta<135°$
- 18 supermodules in Φ sector
- 6 Radial layers
- 5 z-longitudinal stack
  - → total 540 chambers
  - → 750m² active area
  - → 28m³ of gas
- In total 1.18 million read-out channels

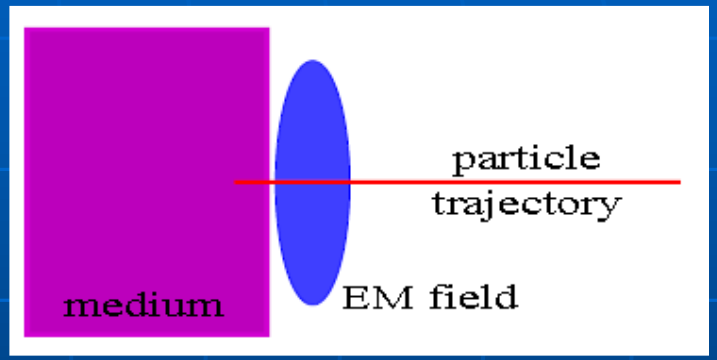
FROM C. Adler -- Hadron Collider Physics, Les Diablerets, 4-9 July 2005

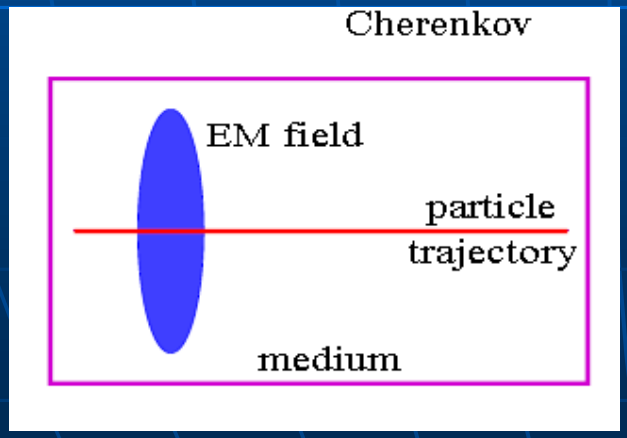
TRD(Transition Radiation Detector)
(What is transition radiation?)

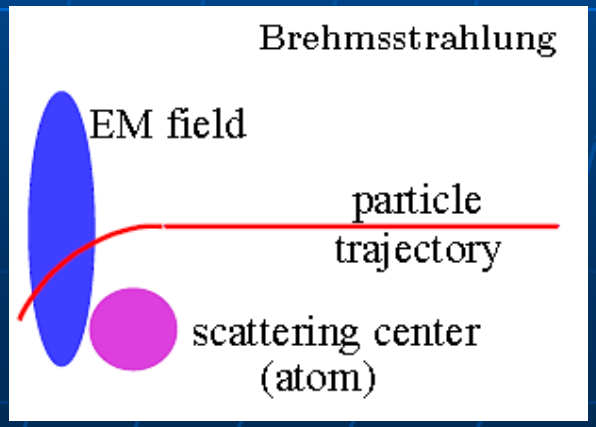
"Transition radiation is emitted whenever a charged particle crosses an interface between two media with different dielectric functions."

- L.Durand, Phys. Rev. D 11, 89(1975)

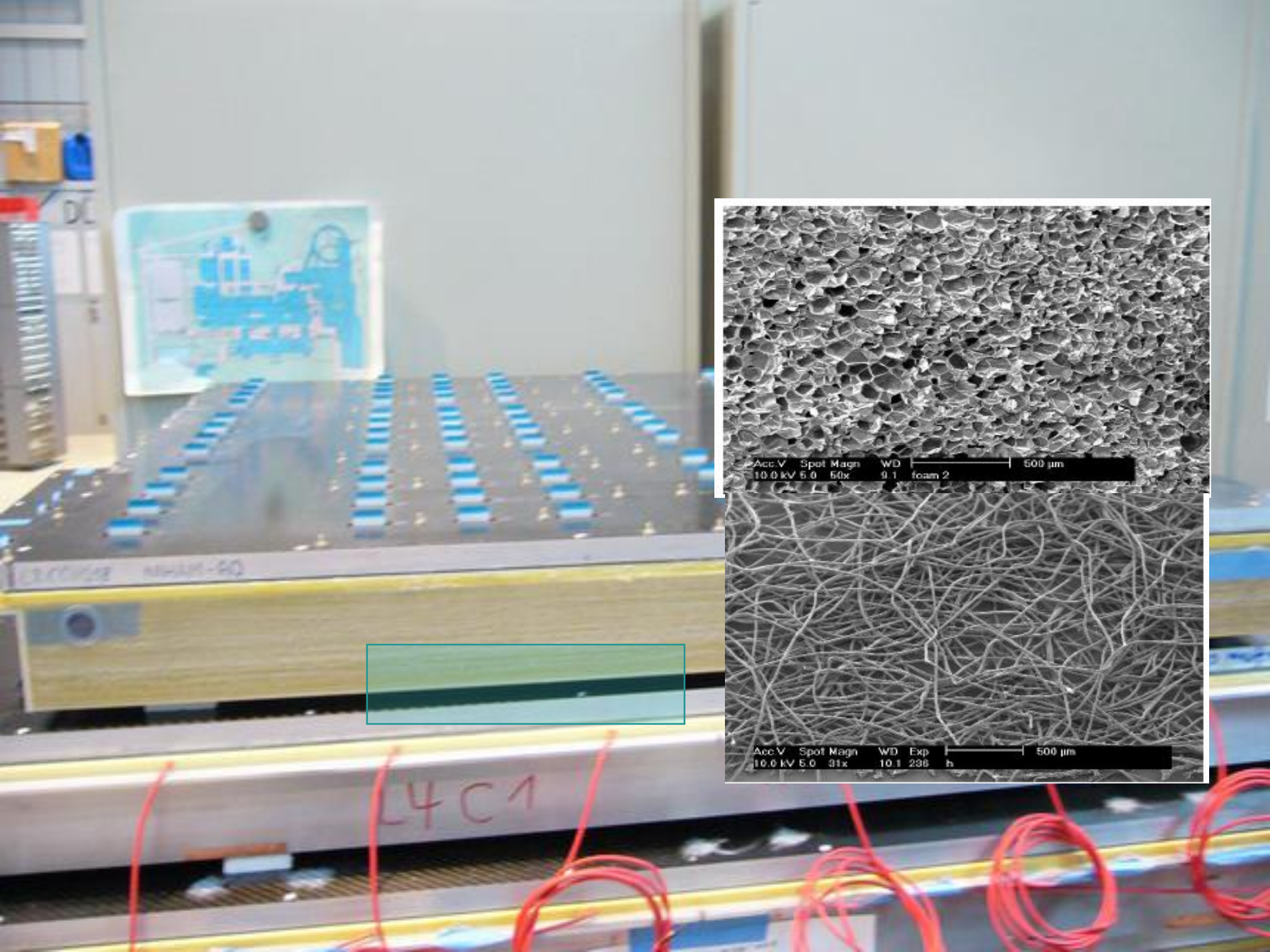
- Predicted : Ginzburg & Frank, 1946
- Observed : Goldsmith & Jelly, 1959(optical)
- It's sizeable(X-rays) for relativistic particles.



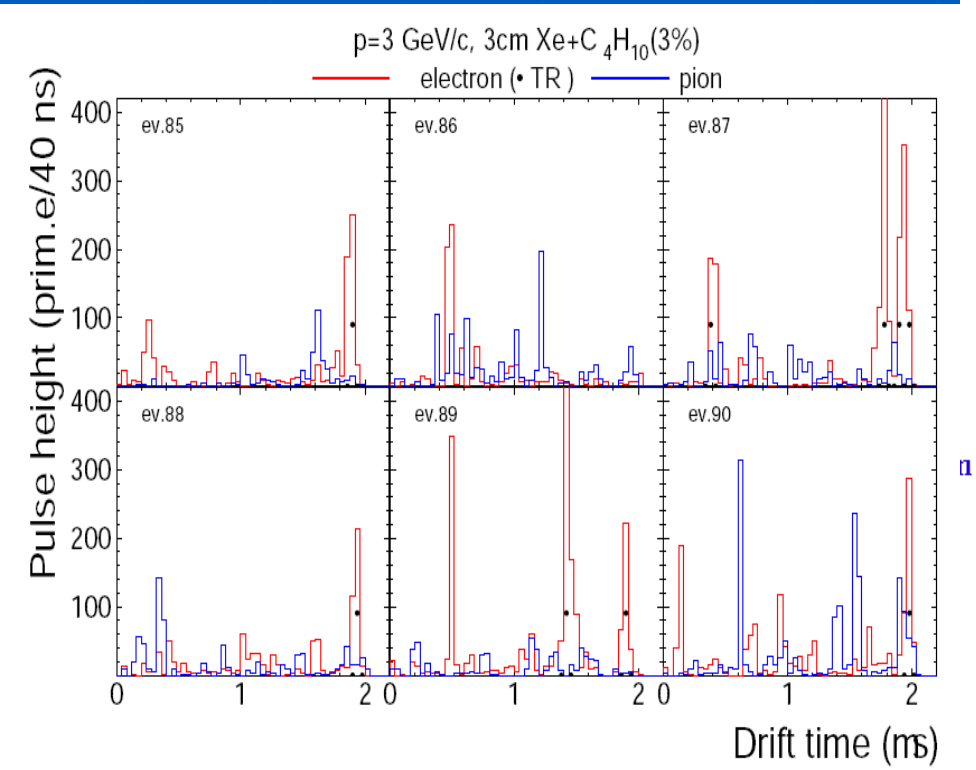


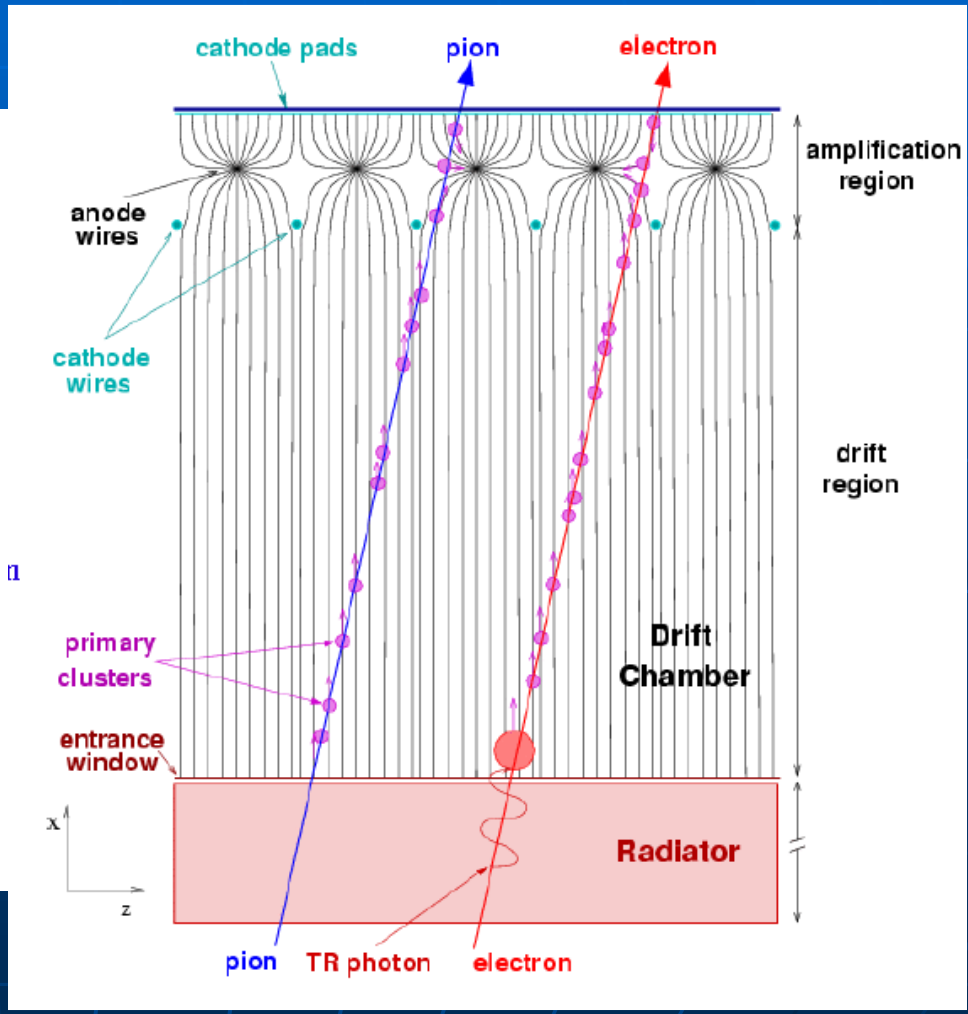


FROM A. Andronic -- an overview for students, GSI, Feb. 6th, 2007


L4C1
Acc.V Spot Magn WD 500 µm
10.0 kV 5.0 50x 9.1 foam 2
Acc.V Spot Magn WD Exp 500 µm
10.0 kV 5.0 31x 10.1 236 h

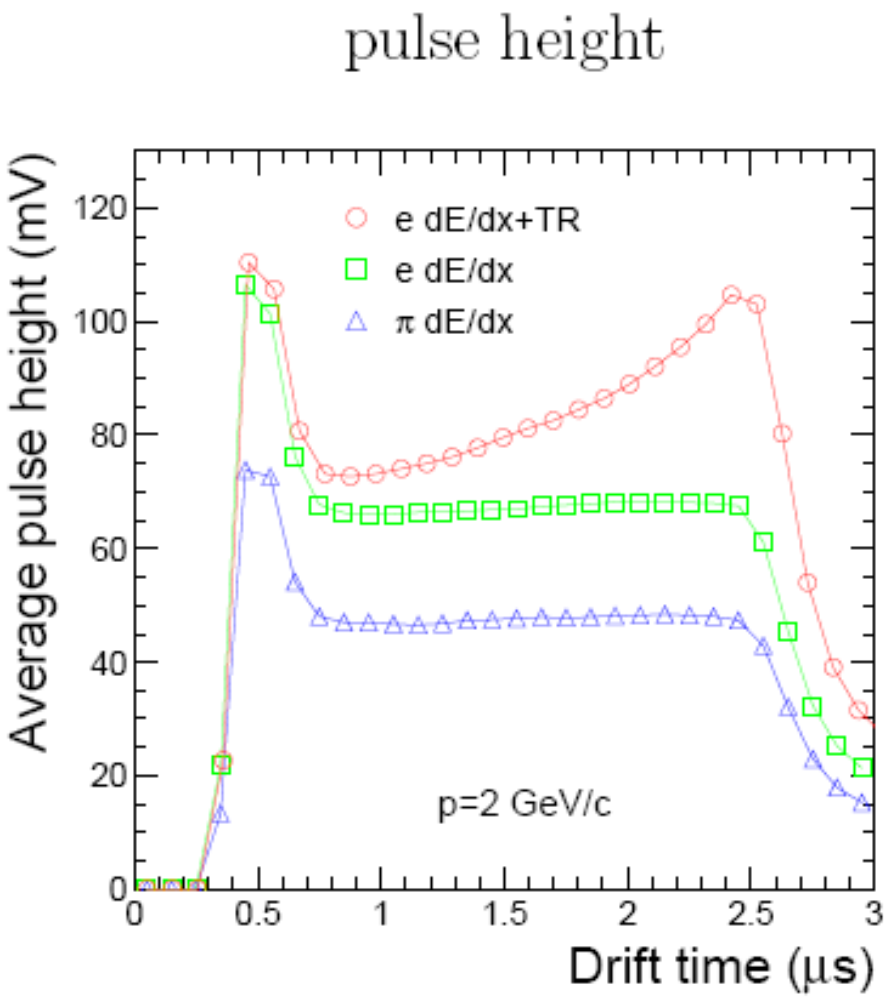
1 Event signals of Electron and Pion

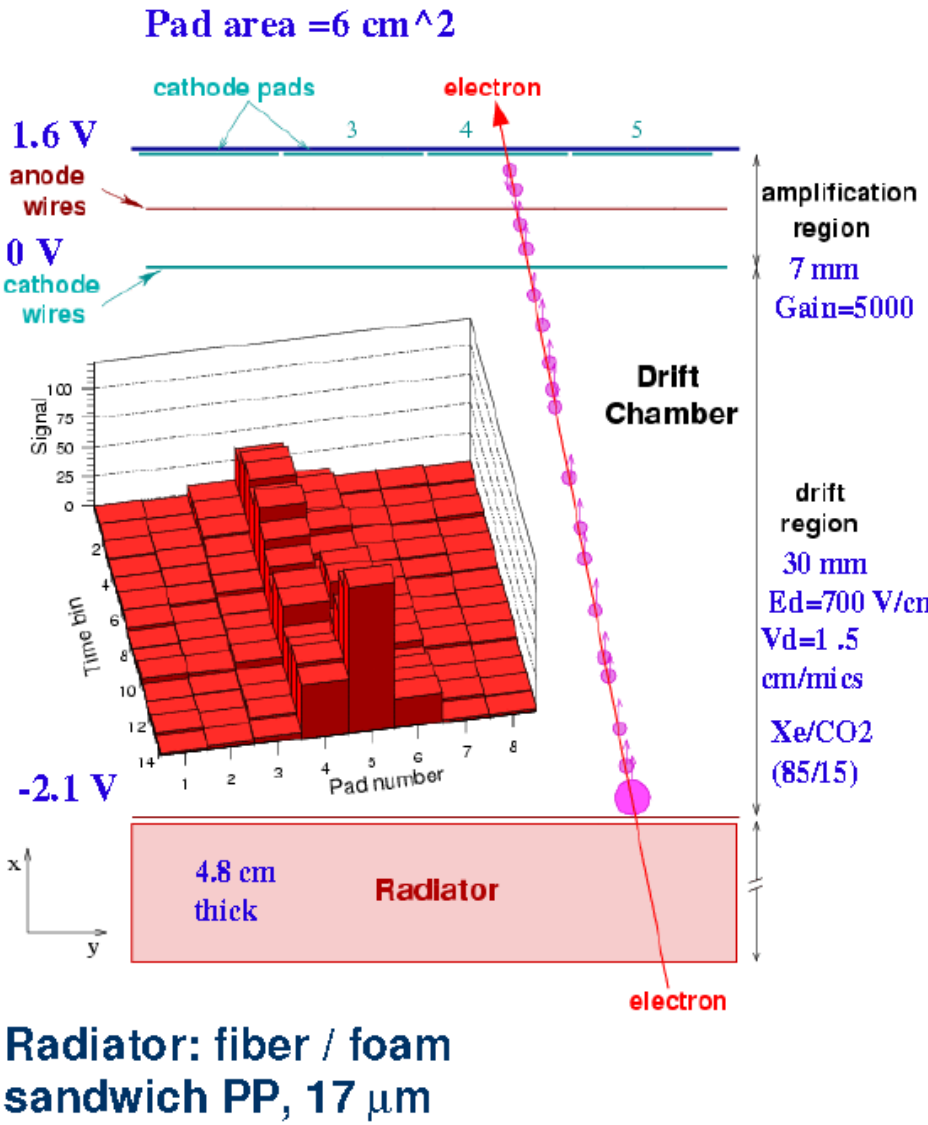




FROM P. Shukla -- ICPA-QGP'05, Kolkata, 8-12 February 2005

TRD working principle





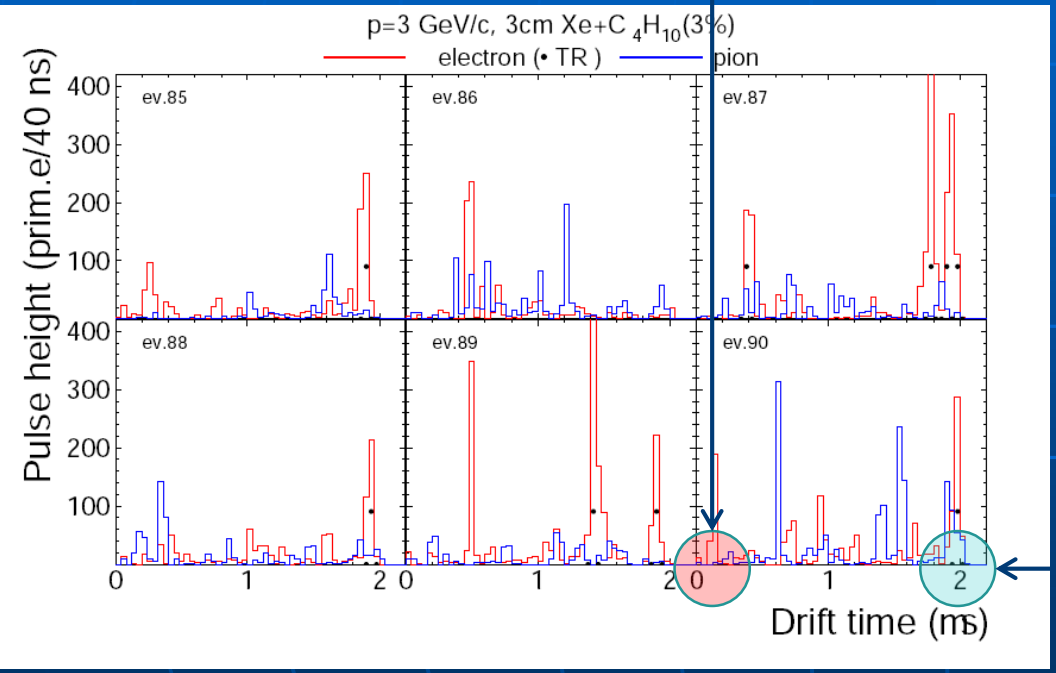
FROM P. Shukla -- ICPA-QGP'05, Kolkata, 8-12 February 2005

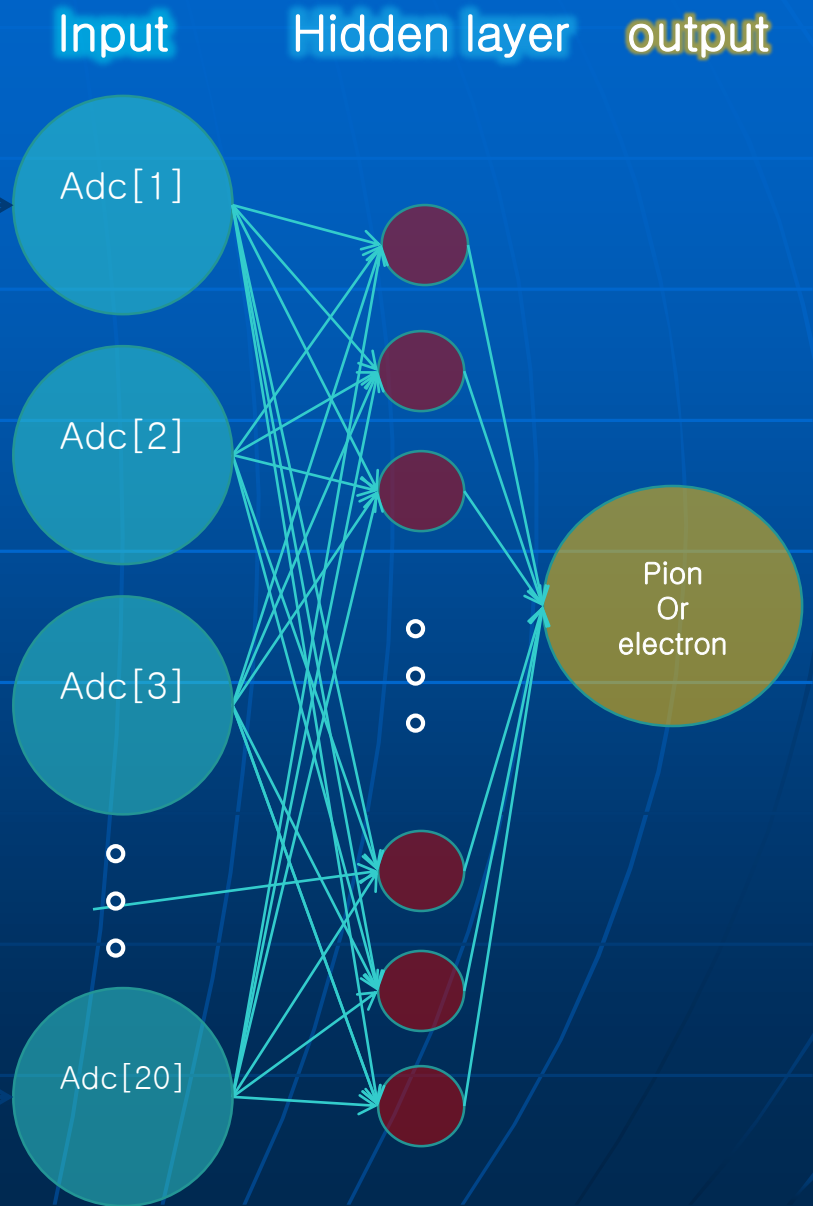
Pattern Recognition? Neural network!

Neural-network

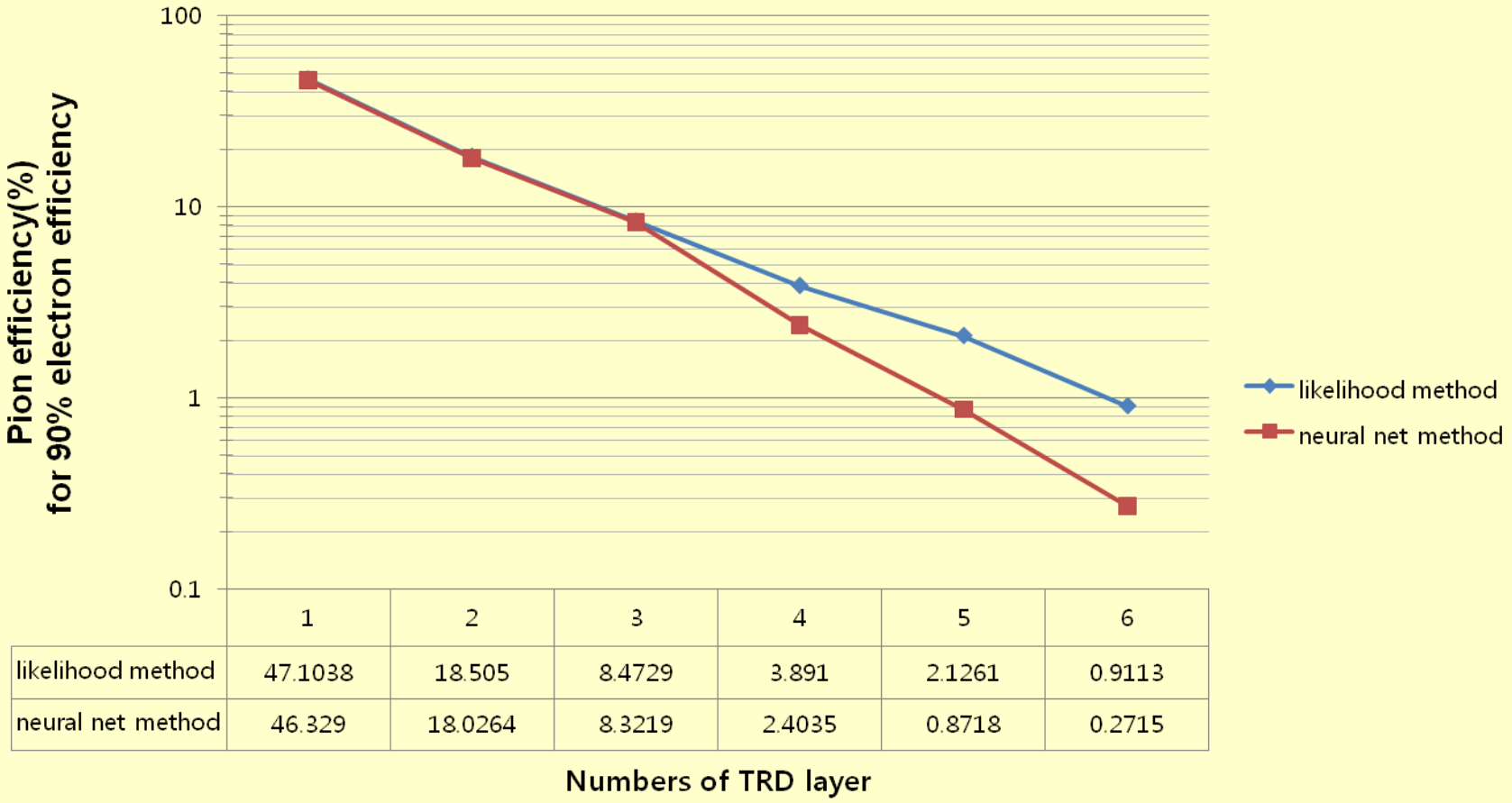
- A simple Modeling of the biological neuron
- Being used in various fields for data analysis and classification
- Examples : Image analysis, Financial movement's prediction, Sales forecast, Particle physics

Current Neural Network





Comparison of methods



	1	2	3	4	5	6
likelihood method	47.1038	18.505	8.4729	3.891	2.1261	0.9113
neural net method	46.329	18.0264	8.3219	2.4035	0.8718	0.2715

Summary

- We consider
  - LHC : New frontier for perturbative QCD,
  - Direct γ : an interesting subject,
  - Virtual γ : the best path to measurement,
  - TRD : hardware for electron IDentification,
  - Neural network : software for electron ID.
- Our endeavor just started… Where would we reach in the end?