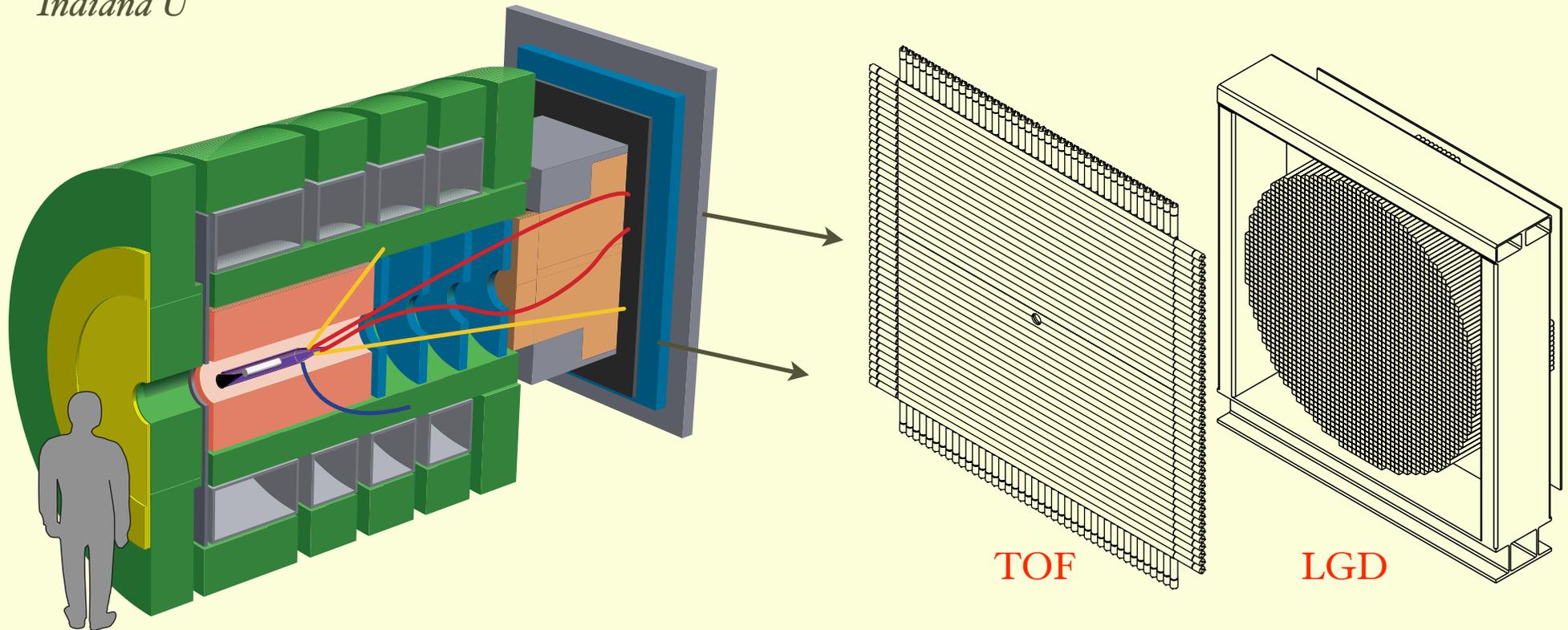


Forward TOF in the GlueX Experiment

Alex Dzierba
Indiana U

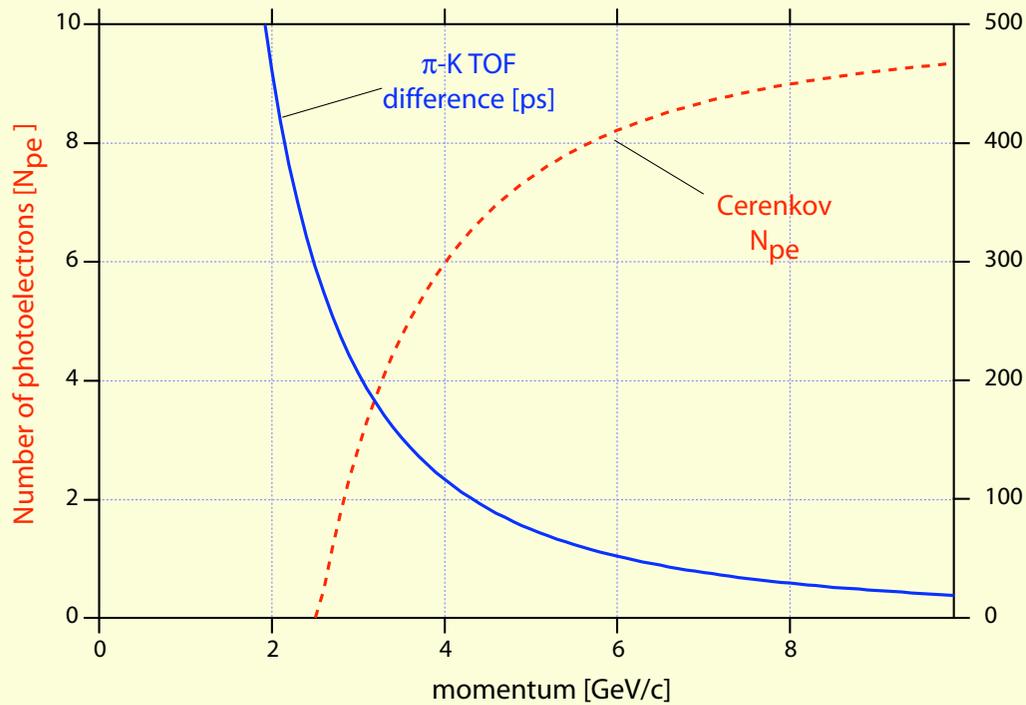


- TOF challenge for π/K separation
- Triggering: forward multiplicity for level-one trigger
- Cosmic ray tests
- Beam tests at IHEP (Protvino)
- Status

Responsible Groups:

- IHEP (Protvino)
- Indiana U

Challenge for the TOF

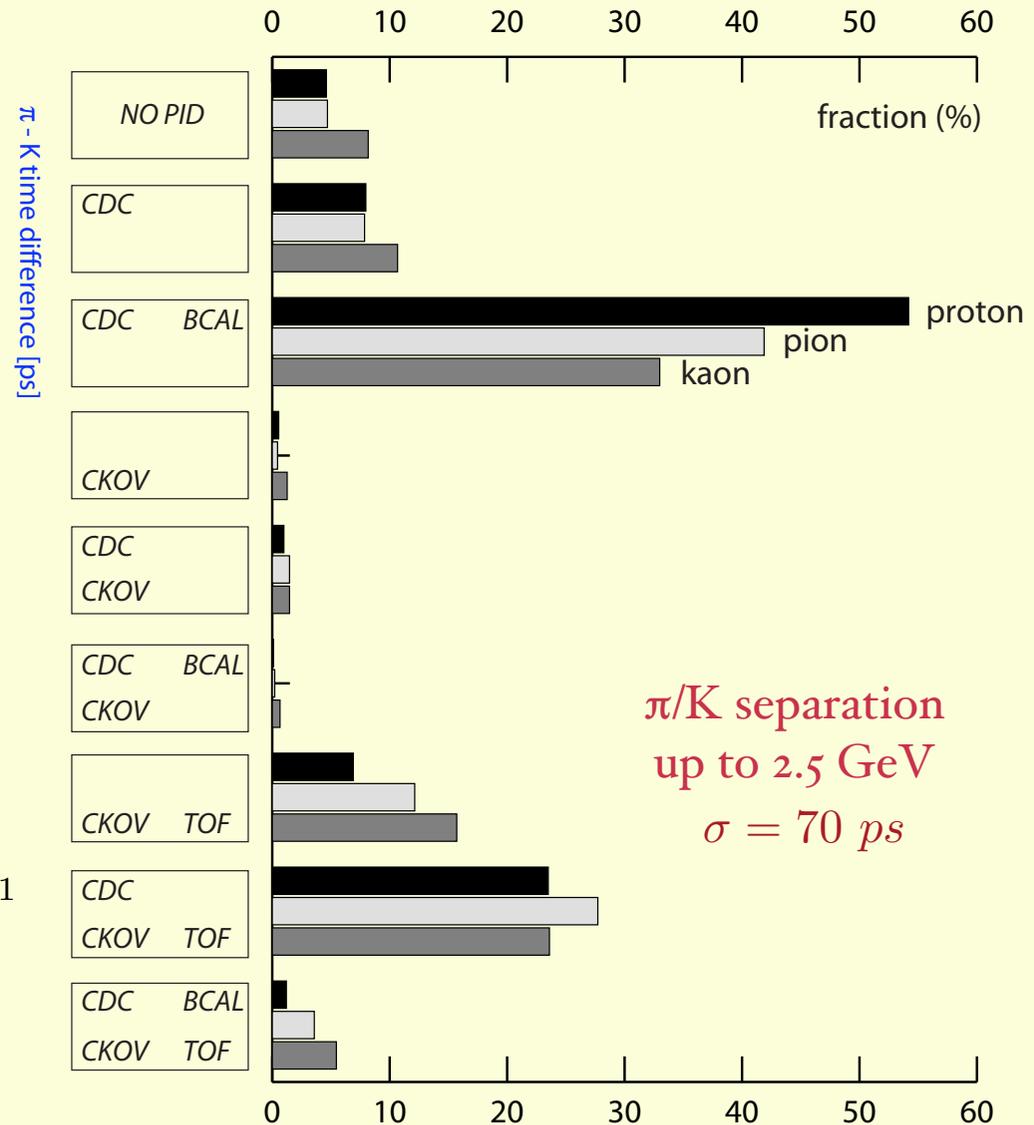
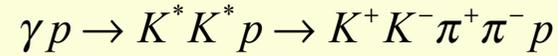


$$\frac{dN_{pe}}{dx} = N_0 \left(1 - \frac{1}{\beta^2 n^2} \right)$$

$$C_4F_{10} : L = 80 \text{ cm}; n = 1.0015; N_0 = 45 \text{ cm}^{-1}$$

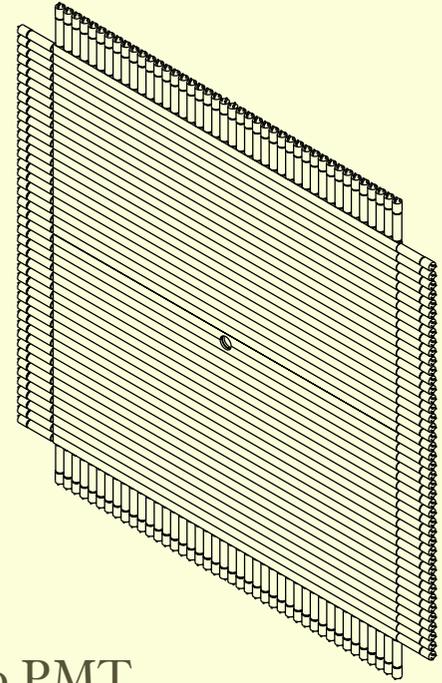
$$\Delta t \approx \frac{L}{2c} \frac{m_K^2 - m_\pi^2}{p^2} = \frac{1870}{p^2} \text{ ps}$$

$$L = 5 \text{ m}$$



Overall Design:

- **Time resolution**
 - Goal: $\sigma = 70 \text{ ps}$
- **Dimensions and channel count**
 - 2.5 m long to cover aperture of the solenoid
 - 6.0 cm wide - based on occupancy and coupling scintillator to PMT
 - 1.25 cm thick - minimize material in front of LGD - adequate light
 - 2 PMT's per each of 42 modules each in two walls: 168 channels
- **Cosmic ray tests and Helmholtz coil tests**
 - Carried out to study various scintillator and shielding schemes
- **Beam tests**
 - Carried out in a 5 GeV hadron beam at IHEP (Protvino) - more in 2005



Technical Publications Based on GlueX R&D

Timing characteristics of scintillator bars

A478 (2002)

S. Denisov^a, A. Dzierba^b, R. Heinz^b, A. Klimenko^a, V. Samoylenko^{a,*},
E. Scott^b, A. Shchukin^a, P. Smith^b, C. Steffen^b, S. Teige^b

^aInstitute for High Energy Physics, State Comm. for Util. of Atom Energy, Protvino 142284, Moscow Region, Russia

^bPhysics Department, Indiana University, Bloomington, IN 47405, USA

A494 (2002)

Characteristics of the TOF counters for GlueX experiment

S. Denisov^a, A. Dzierba^b, R. Heinz^b, A. Klimenko^a, I. Polezhaeva^a,
V. Samoylenko^{a,*}, E. Scott^b, A. Shchukin^a, P. Smith^b, C. Steffen^b,
S. Teige^b, S. Volodina^a

^aInstitute for High Energy Physics, Protvino, Pobada 1, Moscow Region, Protvino 142281, Russia

^bPhysics Department, Indiana University, Bloomington, IN 47405, USA

A595 (2004)

Systematic studies of timing characteristics for 2 m long scintillation counters

S. Denisov^{a,*}, A. Dzierba^b, R. Heinz^b, A. Klimenko^a, V. Samoylenko^a,
E. Scott^b, P. Smith^b, S. Teige^b

^aInstitute for High Energy Physics, Protvino 142281, Moscow Region, Russian Federation

^bDepartment of Physics, Indiana University, Bloomington, IN 47405, USA

in press (2004)

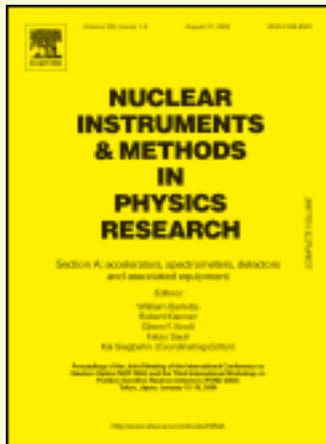
Studies of magnetic shielding for phototubes[☆]

S. Denisov^a, J. Dickey^b, A. Dzierba^{b,*}, W. Gohn^b, R. Heinz^b, D. Howell^b,
M. Mikels^b, D. O'Neill^b, V. Samoylenko^a, E. Scott^b, P. Smith^b, S. Teige^b

^aInstitute for High Energy Physics, Protvino, Moscow Region, 142281, Russia

^bDepartment of Physics, Indiana University, Swain Hall West 117, Bloomington, IN 47405-5533, USA

Received 8 April 2004; accepted 16 June 2004



Cosmic Ray Tests and Magnetic Shielding Tests



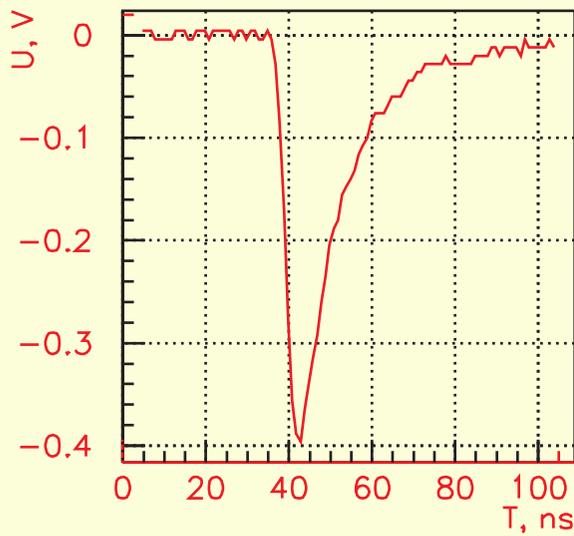
Cosmic ray test facility at Indiana U



Helmholtz coils - 1 m diameter
200 G central field
Indiana U

Beam Tests - IHEP

5 GeV hadron beam



Typical pulse from XP2020 from a 2-m bar after passing through 40-m delay cable

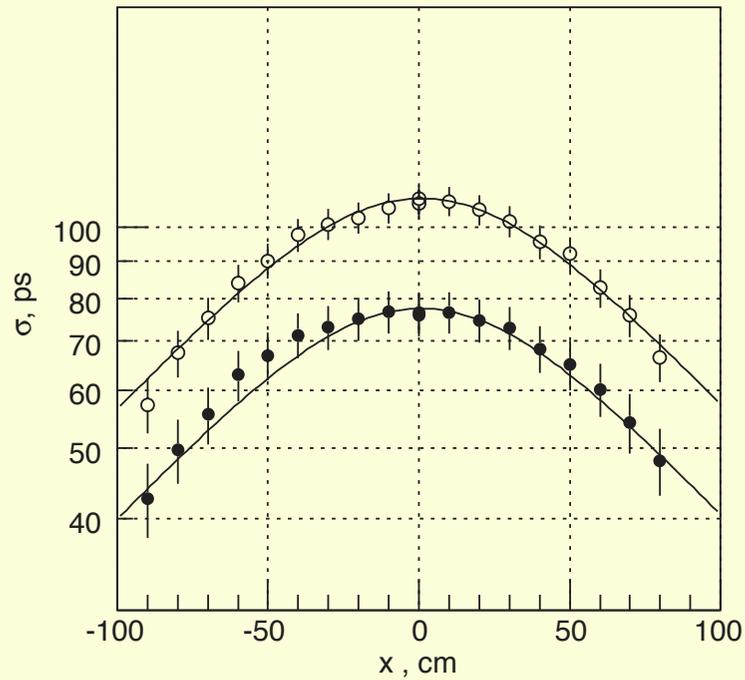
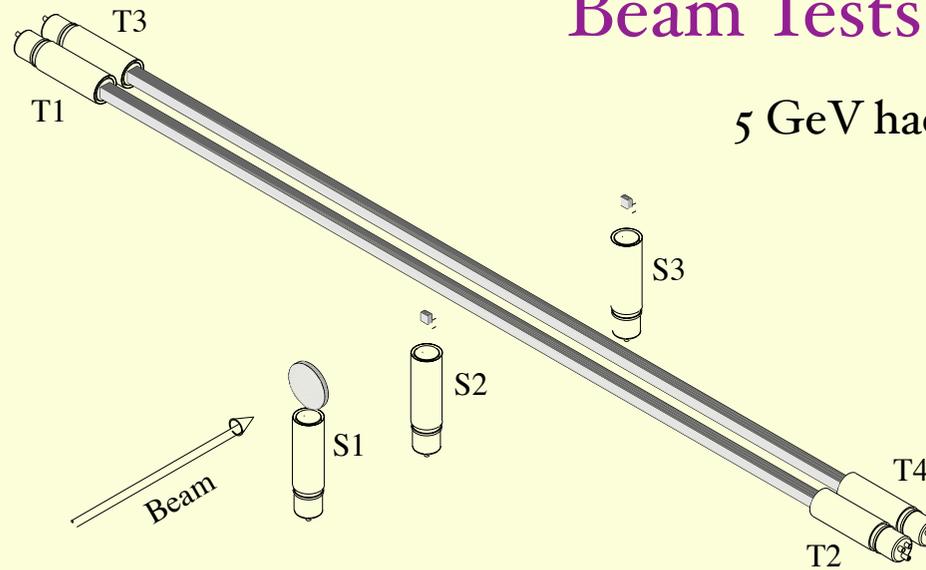


Fig. 6. The time resolution for one (\circ) and two (\bullet) $1.25 \times 6.0 \text{ cm}^2$ bars viewed by XP2020 PMTs.

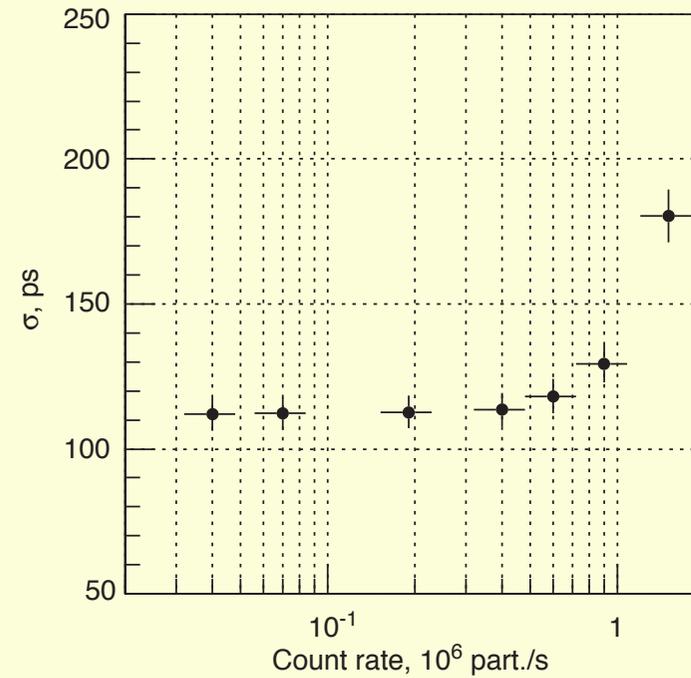


Fig. 7. Time resolution vs counting rate for $1.25 \times 6.0 \text{ cm}^2$ bar viewed by XP2020.

Outstanding Issues & Conclusions:

- **Monitoring**

And LED-based system used for a 5000-PMT system in D0 (FNAL) or a laser-based system will be used.

- **Magnetic shielding**

Magnetic simulations of fringe field using TOSCA are underway. Research on coupling (of PMT to scintillator) schemes continues.

- **Further beam tests**

An 8-module (4 elements in two walls) test with 2.5-m long counters and GlueX electronics will be made in April 2005.

- **TDC's**

HPTDC (CERN) - with 25 ps least count might be used - will examine how this fits into our pipeline architecture.

- **Beam hole**

Schemes to keep the two-ended readout in the central region while allowing for a beam hole are being studied.