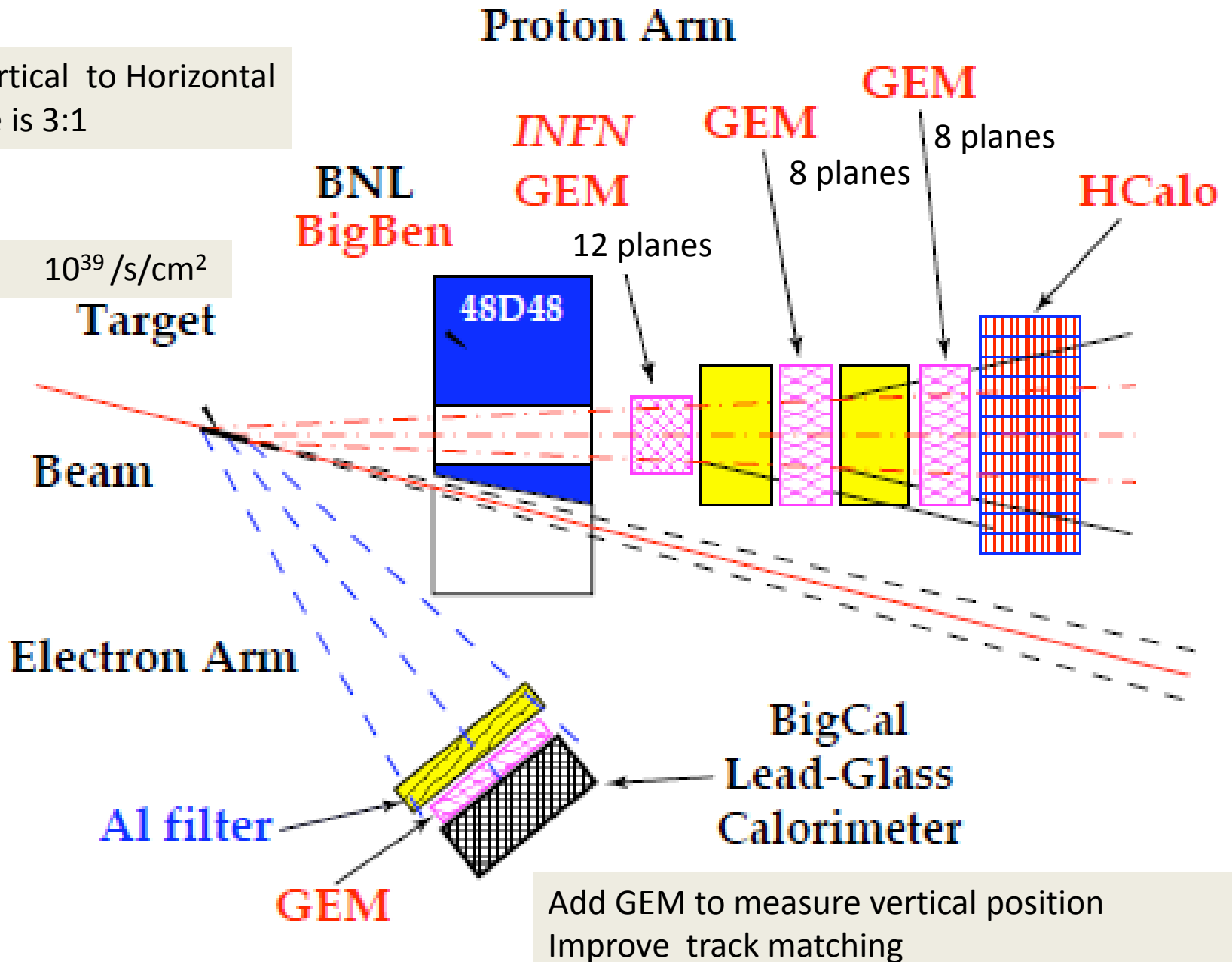# Status of Gep5 experiment

Mark Jones

for the Gep5 Collaboration

Experiment Setup

Ratio of Vertical to Horizontal acceptance is 3:1

40cm LH2 10^{39} /s/cm^2

Proton Arm

BNL
BigBen

INFN
GEM

GEM

GEM

8 planes

HCalo

12 planes

8 planes

Target

48D48

Beam

Electron Arm

BigCal
Lead-Glass
Calorimeter

Al filter

GEM

Add GEM to measure vertical position
Improve track matching

PAC35 on Gep5

PR12-07-109: The PAC recommends the beam time be reduced from 60 to 45 days by only measuring the ratio G_E/G_M up to a maximum value of $Q^2=12$ GeV^2. Different models can already be discriminated at this lower Q^2 value and the trend in the behaviour of the ratio G_E/G_M can be established before reaching $Q^2= 14.5$ GeV^2.

➤Change in kinematics

Q^2	θ_E (deg)	Bigcal Distance (m)	Θ_p (deg)
14.5	39	3.5	12.0
12.0	29	5.5	17.4

➤Reduction in background rates on proton side. About the same on electron side

	particle	Rates (kHz/cm2) at various GEM locations			
		Front Tracker	Second Tracker	Third Tracker	BigCal Tracker
Q^2=14.5	γ	437	7	1	34
	charged	119	352	124	96
Q^2=12.0	γ	266	3.3	0.3	39
	Charged	82	110	24	105

Projected Error bars for Gep5

Original $Q^2 = 14.5$ GeV^2 in 45 days ΔR=0.135

Gep4 point is 90 days
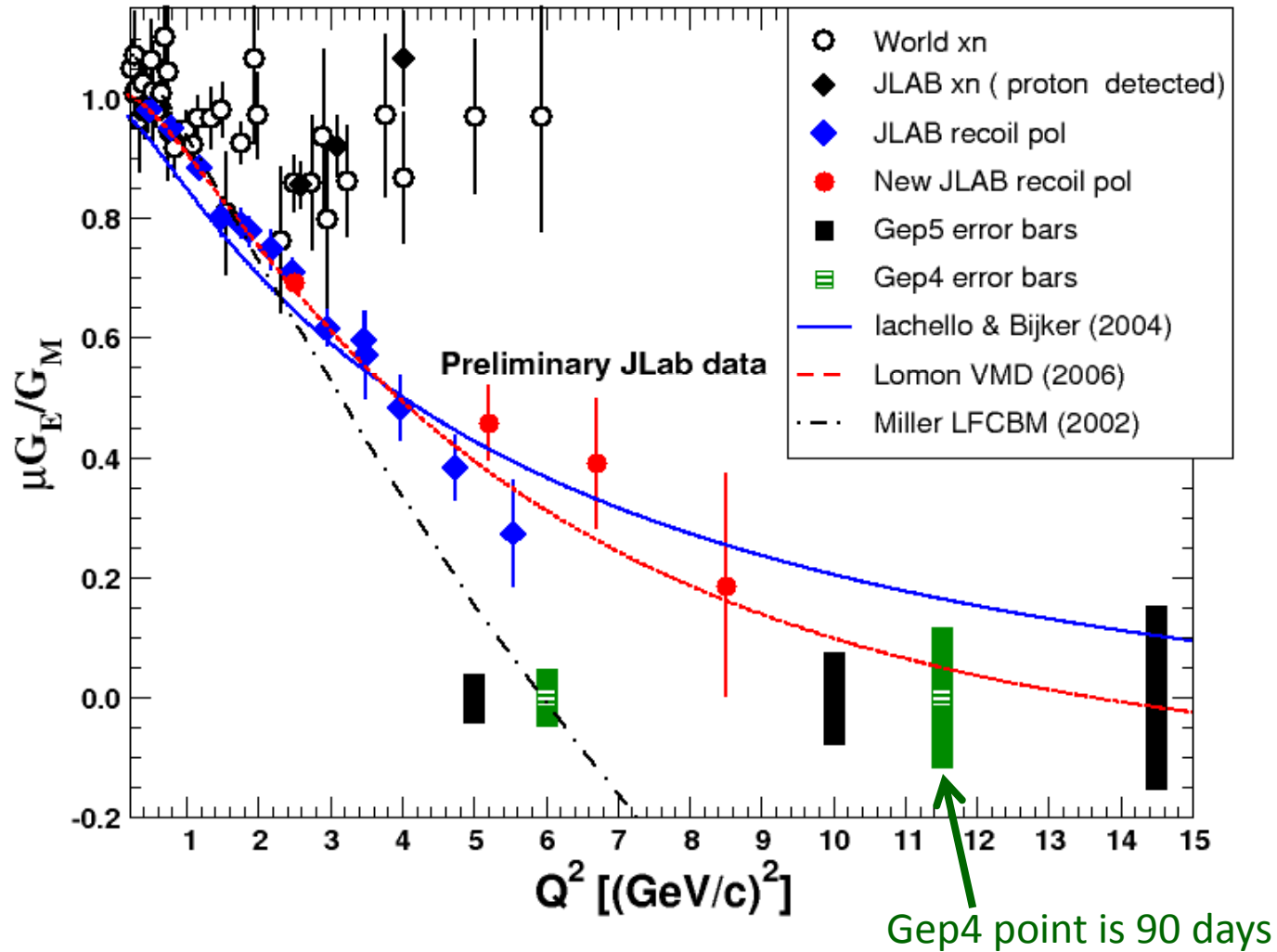
Projected Error bars for Gep5

Q^2 = 14.5 GeV^2 in 30 days gives ΔR=0.165

Gep4 point is 90 days
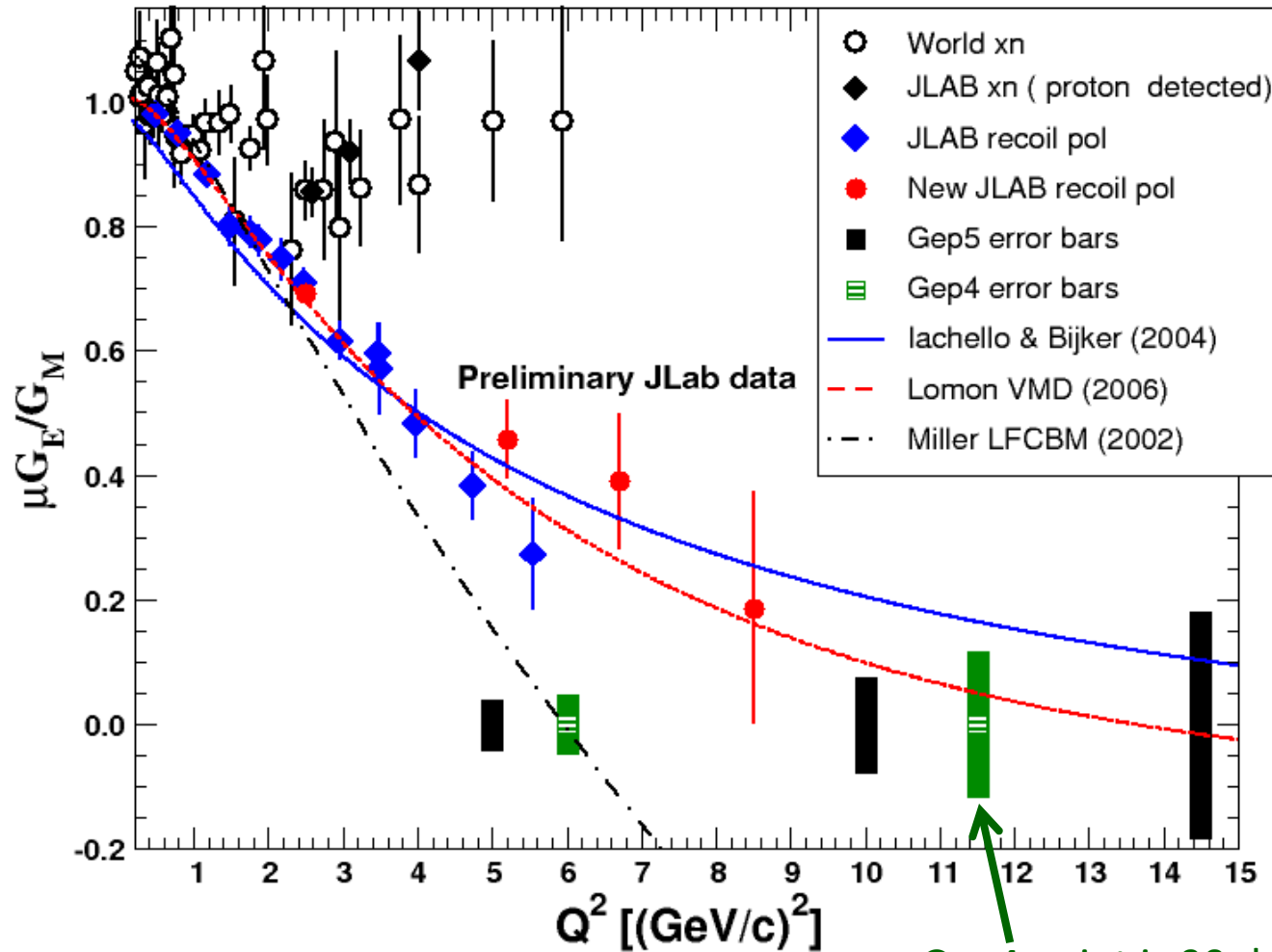
Projected Error bars for Gep5

Reducing to $Q^2 = 12$ GeV^2 in 30 days gives $\Delta R = 0.08$

Gep4 point is 90 days
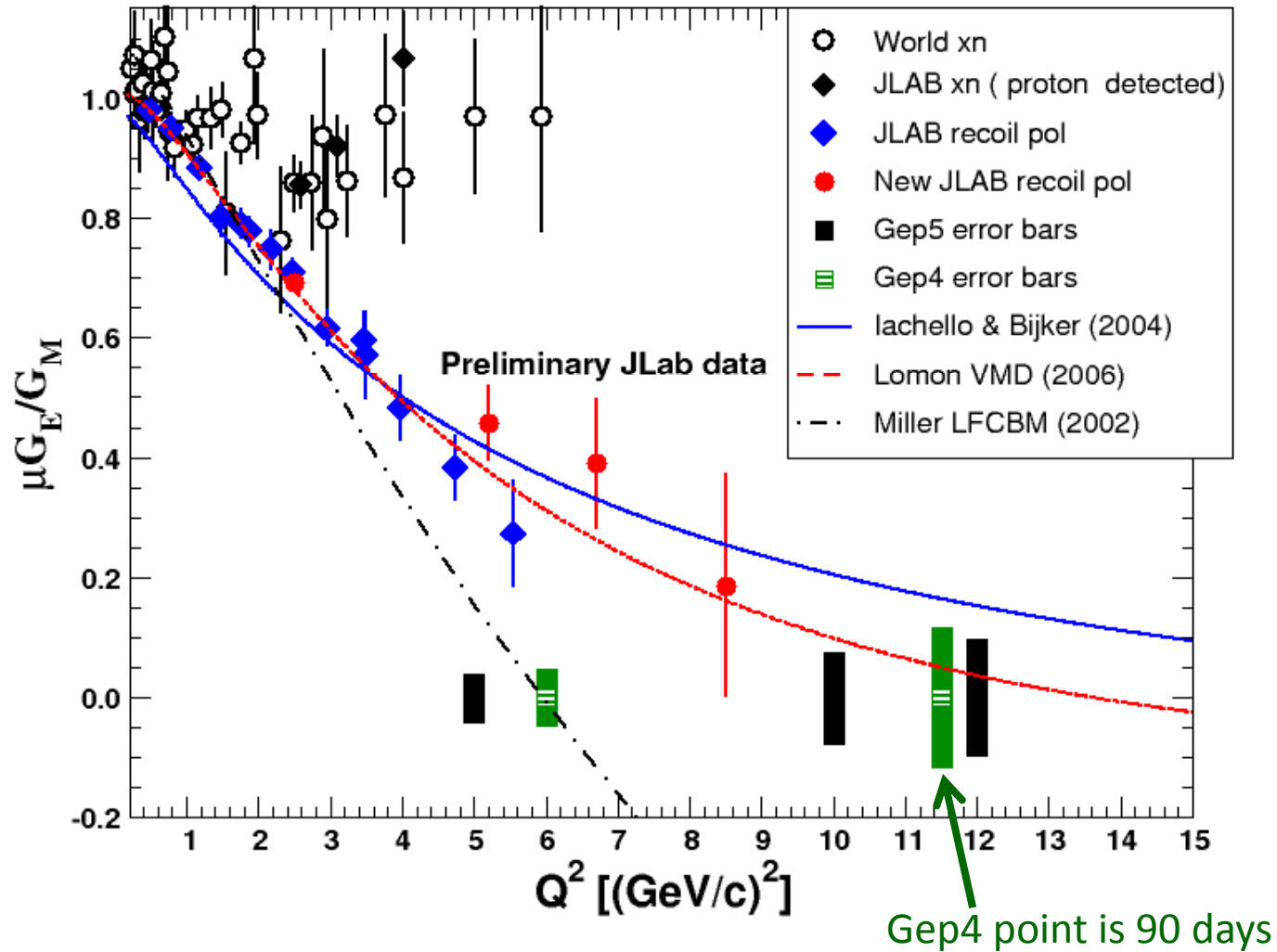
Technical Review on Gep5

Recommendations:

- Noise performance studies of the chamber with UV strip orientation, and therefore varying strip lengths, and an analysis of its impact on resolution and efficiency are of a great importance before the start of mass production. Special tests to estimate S/B performance should be also foreseen for the ST and TT chambers, where four strips are connected into a single readout channel (longer effective strip length mean higher capacitance, i.e. more noise).

- In view of the high background levels ($\sim$ 500 kHz/cm^2) in the GEp(5) spectrometer, the Committee recommends that the 3-sample readout method of the APV25 be adopted as the default solution for all trackers (FT, ST, TT). This will increase the bandwidth requirement and data rates from tracking stations to the DAQ which, however, seems to be consistent with the plans for the Hall A DAQ upgrade.

Response:
➢ When is it possible to do the noise performance studies?

➢ Need to clearly defined data size.

Technical Review on Gep5

"A reduction of the occupancy is absolutely mandatory, e.g. by splitting the strips, by reducing the preamplifier and shaping time constants of the APV, and/or by decreasing the background rate by going back to the original scattering angle of 14°. "

Recommendation:

- The Committee strongly recommends that the response of a GEM detector to low-energy photons should be measured using a prototype detector and electronics. The results should be compared to the GEANT modeling to confirm that the background levels in the Monte Carlo simulation are realistic. The expected level of occupancy in the GEM detectors, using an APV time window of 250 ns and an average number of strips in cluster per MIP particle ~ 3.5, seems to be exceedingly high.

Response:
  ➢ Need to firm up plans for a test with beam this fall.
  ➢ Work on improved MC has begun by INFN-Rome. Tracking discussed in talk by O. Hansen

Technical Review on Gep5

Recommendations

Provide calculations of the energy and spatial resolution with the 20 cm Al absorber taking into account the average radiation damage. Evaluate the impact of the resolutions on the general performance including tracking and trigger rate. Clarify the impact of the expected energy resolution not meeting the requirement on page 107. Provide evidence or arguments that a 5 fold increase in the UV light intensity will increase the rate of curing by a factor of about 5.

Response:
- Sergey gave talk earlier about calculations of energy and position
  - Found $\Delta E/E$ = 9.4% and Δx = 2mm at 3 GeV with 20cm absorber.
  - But his calculations show better resolution than earlier Protvino calculations. Maybe missing constant term.
  - Even Protvino was calculations was 1% below measured resolution.
  - Conservative estimate of $\Delta E/E$ = 14%?
- For UV curing, do we need to do tests to prove that the planned 5x increase in UV light intensity will increase curing rate by 5x?

Measurement of analyzing power for the reaction $\vec{p}$ - CH2 at polarized proton momentum of 7.5 GeV/c (ALPOM2 proposal)

V.P. Balandin, A.E. Baskakov, S.N. Basilev, Yu.P. Bushuev,
O.P. Gavrishchuk, V.V. Glagolev, M.G. Kadykov, D.A. Kirillov,
Yu.T. Kiryushin, E.V. Kostyukhov, N.A. Kuzmin, P.K. Manyakov,
S.A. Movchan, J. Mušinsky, N.M. Piskunov, A.A. Povtoreiko,
P.A. Rukoyatkin, A.V. Shutov, N.A. Shutova, I.M. Sitnik, V.M.
Slepnev, I.V. Slepnev, S.Ya. Sychkov, S.E. Vasiliev, A.V. Vishnevsky,
A.I. Yukaev

Dubna

C.F. Perdrisat, L. Pentchev and M. Meziane
V. Punjabi, M. Khandaker
M.K. Jones, B. Wojtsekhowski
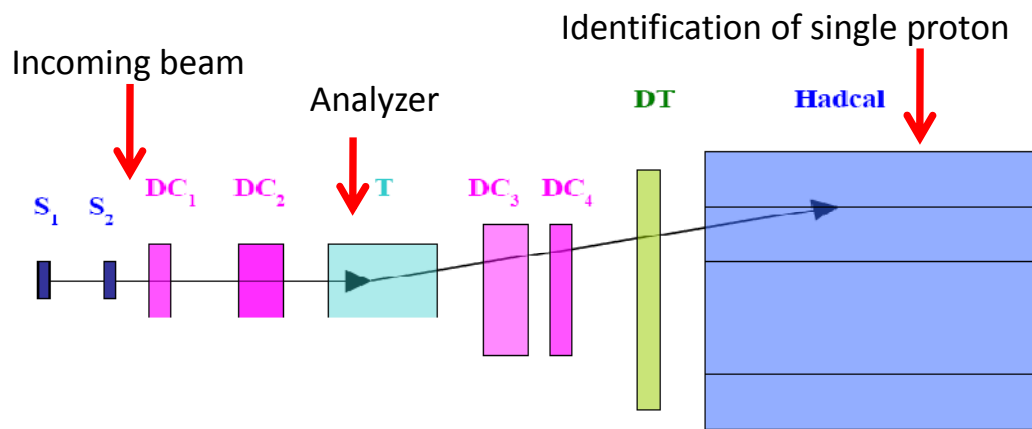E. Brash

USA

G. Martinska, J. Urban

Slovak Republic

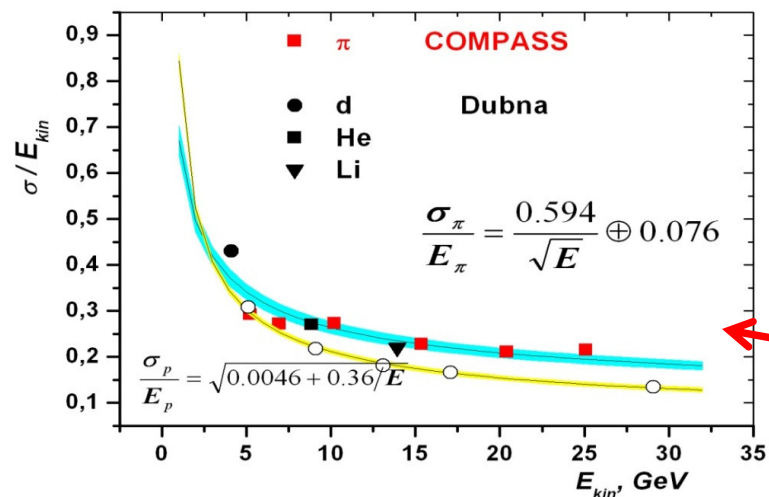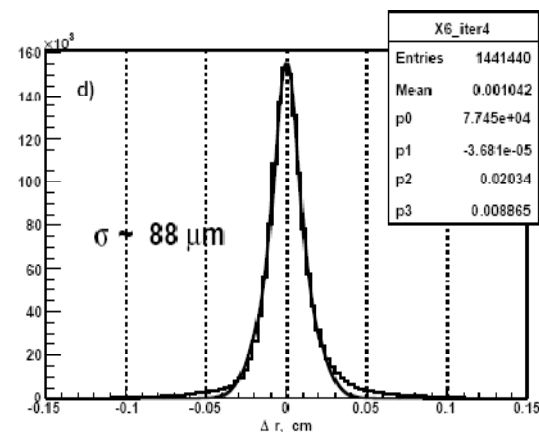E. Tomasi-Gustafsson

France

Approved 2009, to run 2010-2012

Details of Dubna FPP test

Polarized protons up to 7.5 GeV/c, from breakup of polarized deuterons produced
in (former Indiana) CIPIOS polarized source, and accelerated to 12 GeV/c in NUCLOTRON.
Fermi momentum in deuteron provide protons with ~same polarization as deuteron, up to
momentum 25% larger than half deuteron momentum (established at SATURNE).

Identification of single proton

Incoming beam

Analyzer

S_1 S_2 DC_1 DC_2 T DC_3 DC_4 DT Hadcal

Drift chamber, Fall 2009

$\sigma = 88\ \mu m$

π COMPASS

d Dubna
He
Li

$$\frac{\sigma_\pi}{E_\pi} = \frac{0.594}{\sqrt{E}} \oplus 0.076$$

$$\frac{\sigma_P}{E_P} = \sqrt{0.0046 + 0.36/E}$$

Use 25 COMPASS hadron calorimeter bars
refurbished in Protvino. Select proton track
for polarimetry, provide high level trigger in SBS .

Dubna test in Spring 2009, compared to
COMPASS data.

Other items for Gep5

➢ Layout of calorimeter blocks and changes to HV/LV boards

➢1us delay for 148 "groups of 32" before coincidence trigger

➢Layout of single arm trigger

Backup slides