A_NDY: Status and Plans

L.C. Bland, *Brookhaven National Laboratory*

The motivations for a transverse spin Drell-Yan production (DY) measurement were the focus of this workshop. In brief, the objective is to test the robust theoretical prediction that the sign of the Sivers function will differ between semi-inclusive deep inelastic scattering and DY production. Forward production of low-mass virtual photons from the DY process is also of great interest to the study of parton saturation at low-*x*, as discussed at this workshop. This contribution describes a proposal to demonstrate the feasibility of detecting the production of low-mass virtual photons in the forward direction at RHIC.

A_NDY is a proposed experiment at RHIC to measure the analyzing power for forward low-mass Drell-Yan production in transversely polarized proton collisions at $\sqrt{s}$ = 500 GeV. This presentation reviewed the status of the project and the plans for completing the measurement in the next two years. The basic measurement is to observe the electron and positron decays of a virtual photon produced with $x_F > 0.1$ and mass $M > 4$ GeV/c^2. The energetic dileptons are to be detected in a lead-glass calorimeter (ECal) mounted in the forward direction at RHIC interaction point 2 (IP2). Discrimination of the dilepton signal from background is accomplished by vetoing hadrons using hadronic calorimetry (HCal) mounted immediately behind the ECal. Further hadron/electron discrimination will be made by the use of segmented scintillator sandwiching a converter. The preshower/converter arrangement also will serve to discriminate photon backgrounds from the dielectrons. Simulations show that a left/right symmetric modular ECal and HCal can be ~30% efficient for the detection of dielectrons from DY production with $x_F > 0.1$ and $M > 4$ GeV/c^2 and can discriminate DY from background. We expect 9400 dielectron events in a 150 pb^{-1} data sample with this modular arrangement. A primary goal of A_NDY is to establish if charge sign discrimination is a requirement for forward dielectron identification for a future forward detector facility at RHIC. Charge sign discrimination in the forward direction is best accomplished using a dipole magnet. A dipole magnet in an interaction region is challenging for a collider.

A primary question addressed during RHIC run 11 is the impact of collisions at IP2 on luminosity and backgrounds at IP6 and IP8. The conclusion from RHIC run 11 is that collisions can be initiated at IP2 without significant impact on IP6 or IP8, and that the integrated luminosity (L_{int}) required for the first transverse spin DY measurement can be delivered in subsequent RHIC runs. Concurrent with the development of IP2 collisions, we recorded >5 pb^{-1} of polarized proton collisions with left/right symmetric modular HCal detectors. This data is expected to provide results for forward jet analyzing power.

The proposal then is to stage an ECal and the final preshower/converter arrangement for RHIC run 12. We propose to record 150 pb^{-1} in RHIC run 12 for transversely polarized proton collisions at $\sqrt{s}$ = 500 GeV with this apparatus, with the goal of observing J/ψ, $\Upsilon \rightarrow e^+e^-$ and the dilepton continuum between these two signals as a clear benchmark for DY feasibility. A split-dipole magnet and tracking stations would get staged for RHIC run 13. Our plan is to acquire a second data sample with $L_{int} > 150$ pb^{-1} with tracking through the PHOBOS split-dipole field to quantify the role of charge sign discrimination in suppressing backgrounds.

AnDY

“Feasibility Test of Large Rapidity Drell Yan Production at RHIC”

Letter of Intent submitted 24 May 2010

http://www.bnl.gov/npp/docs/pac0610/Crawford_LoI.100524.v1.pdf

PAC presentation:
http://www.bnl.gov/npp/docs/pac0610/aschenauer_DY-collider_june10.pdf

E.C.Aschenauer, A. Bazilevsky, L.C. Bland, K. Drees, C. Folz, Y. Makdisi, A. Ogawa, P. Pile, T.G. Throwe
Brookhaven National Laboratory
H.J. Crawford, J.M. Engelage, E.G. Judd
University of. California, Berkeley/Space Sciences Laboratory
C.W. Perkins
University of. California, Berkeley/Space Sciences Laboratory /Stony Brook University
A. Derevshchikov, N. Minaev, D. Morozov, L.V. Nogach
Institute for High Energy Physics, Protvino
G. Igo, S. Trentalange
University of California, Los Angeles
M. Grosse Perdekamp
University of Illinois
M.X. Liu
Los Alamos National Laboratory
H. Avakian
Thomas Jefferson National Accelerator Facility
E.J.Brash
Christopher Newport University and TJNAF
C.F.Perdrisat
College of William and Mary
V. Punjabi
Norfolk State University
Li, Xuan
Shandong University, China
Mirko Planinic, Goran Simatovic
University of Zagreb, Croatia

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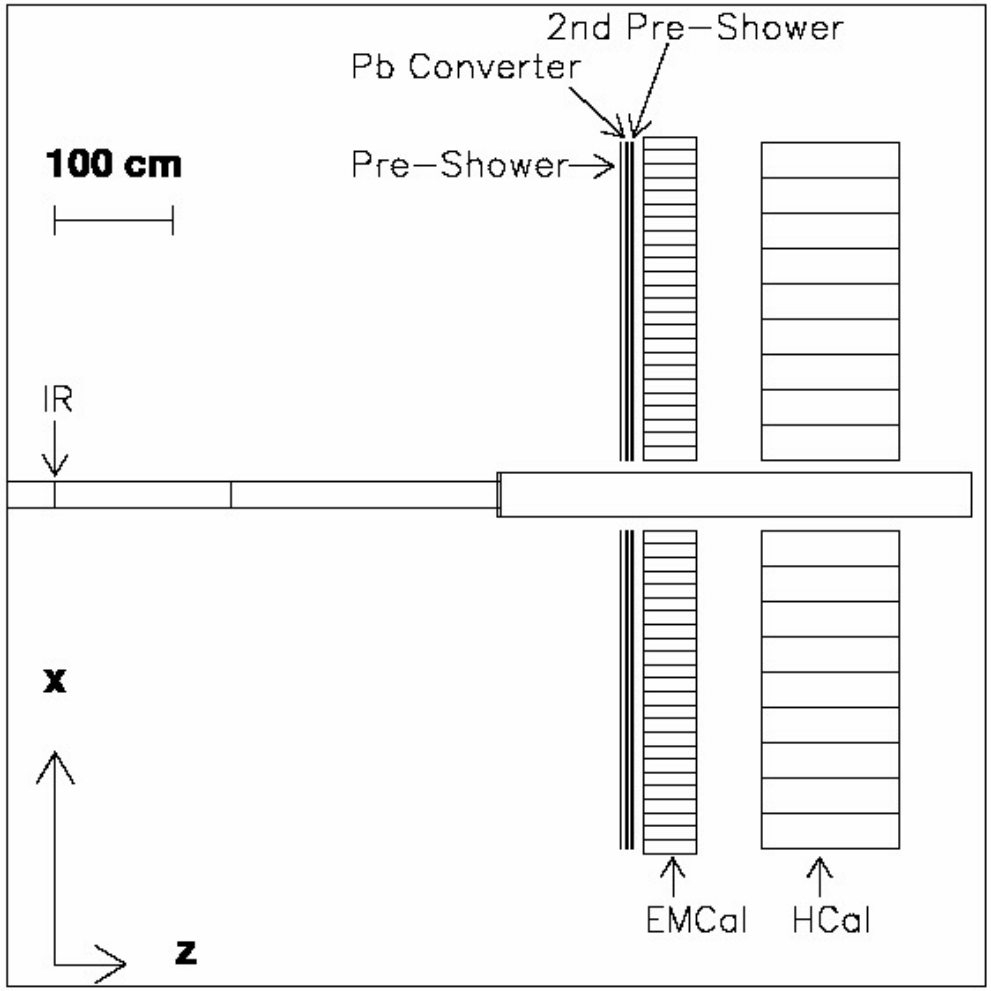
Schematic of detector considered

Run-12 configuration
(PHOBOS split-dipole expected to be in place, but not used)

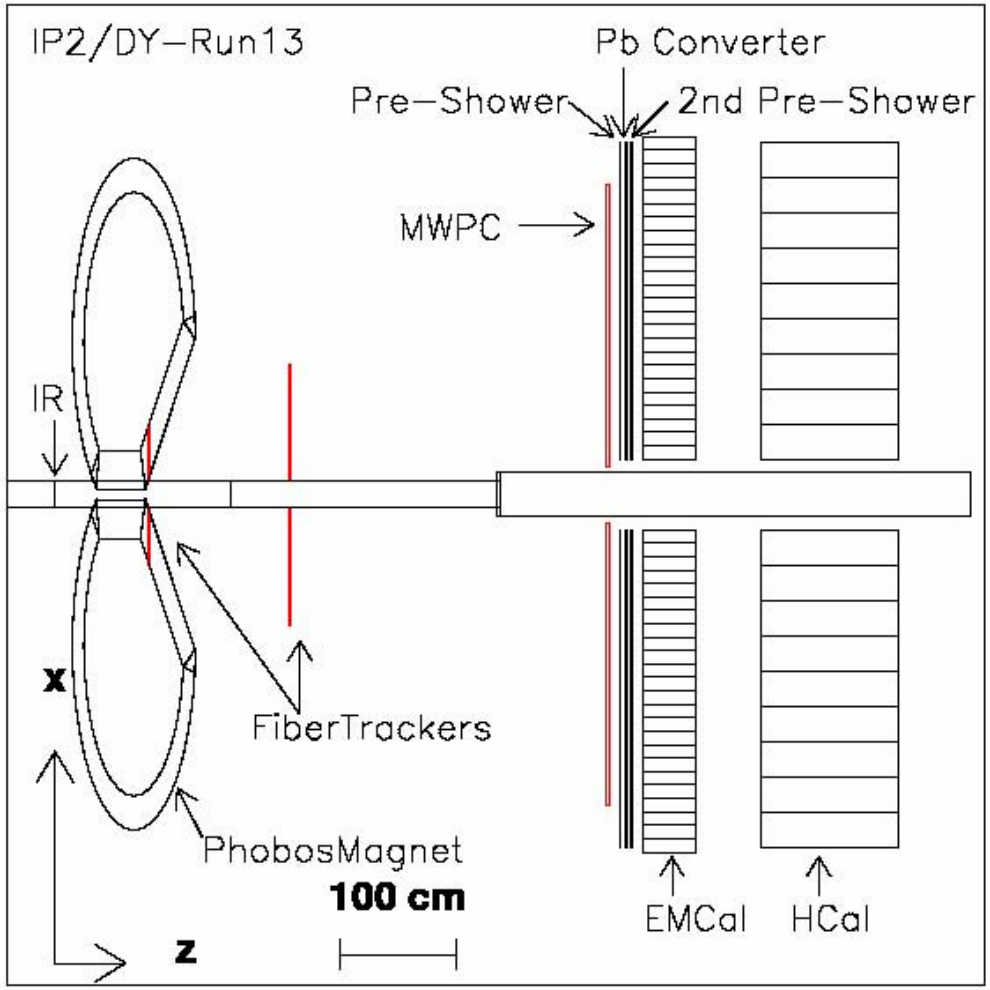


- Hcal is existing 9x12 modules from E864 (NIM406,227)
- EMcal is modeled as only $(3.8cm)^2x(45cm)$ lead glass
- Preshower would require construction

http://www.star.bnl.gov/~akio/ip2/topview2.jpeg

Schematic of detector considered

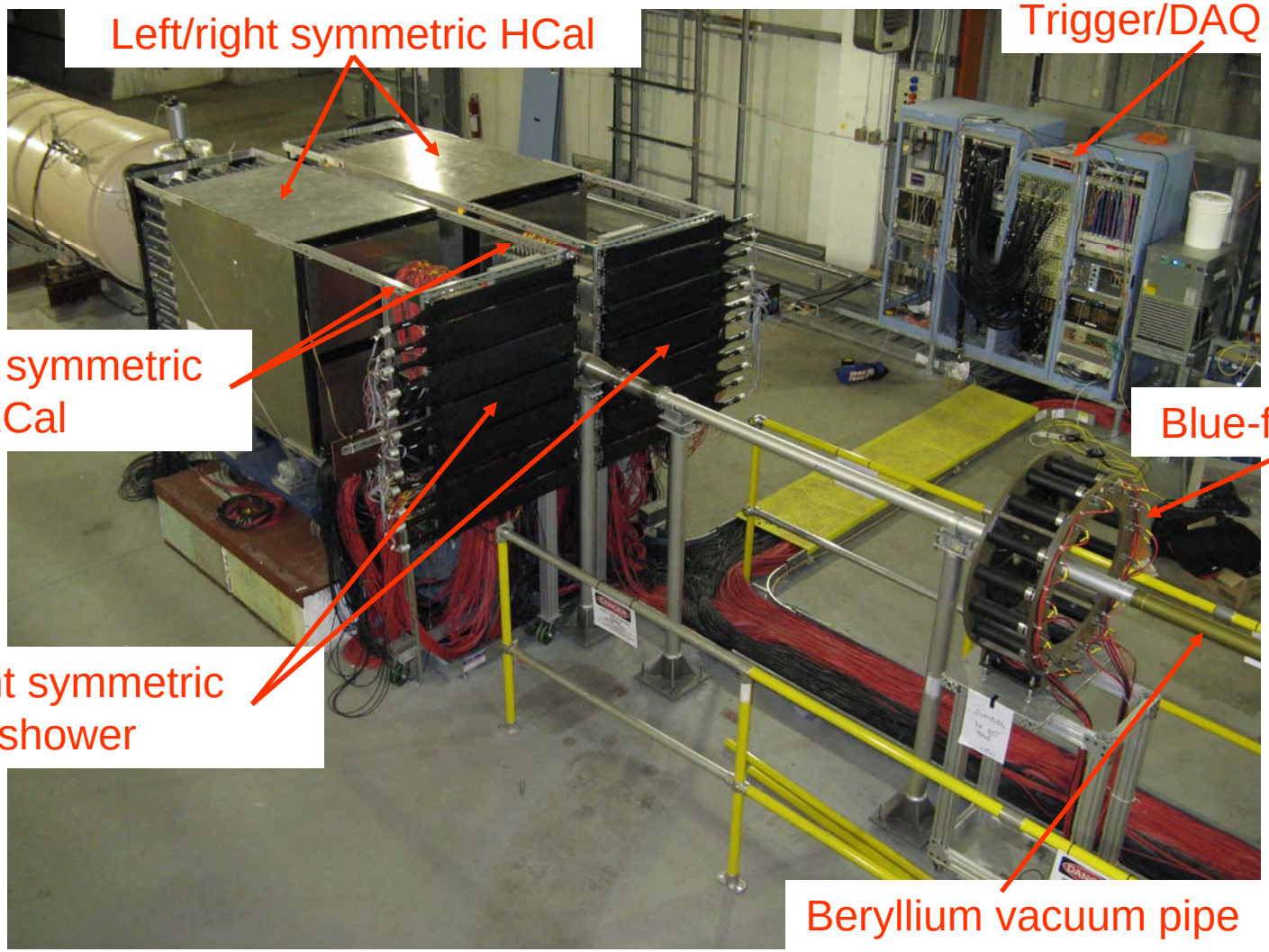
Run-13 configuration
(Uses PHOBOS Split Dipole for charge sign)



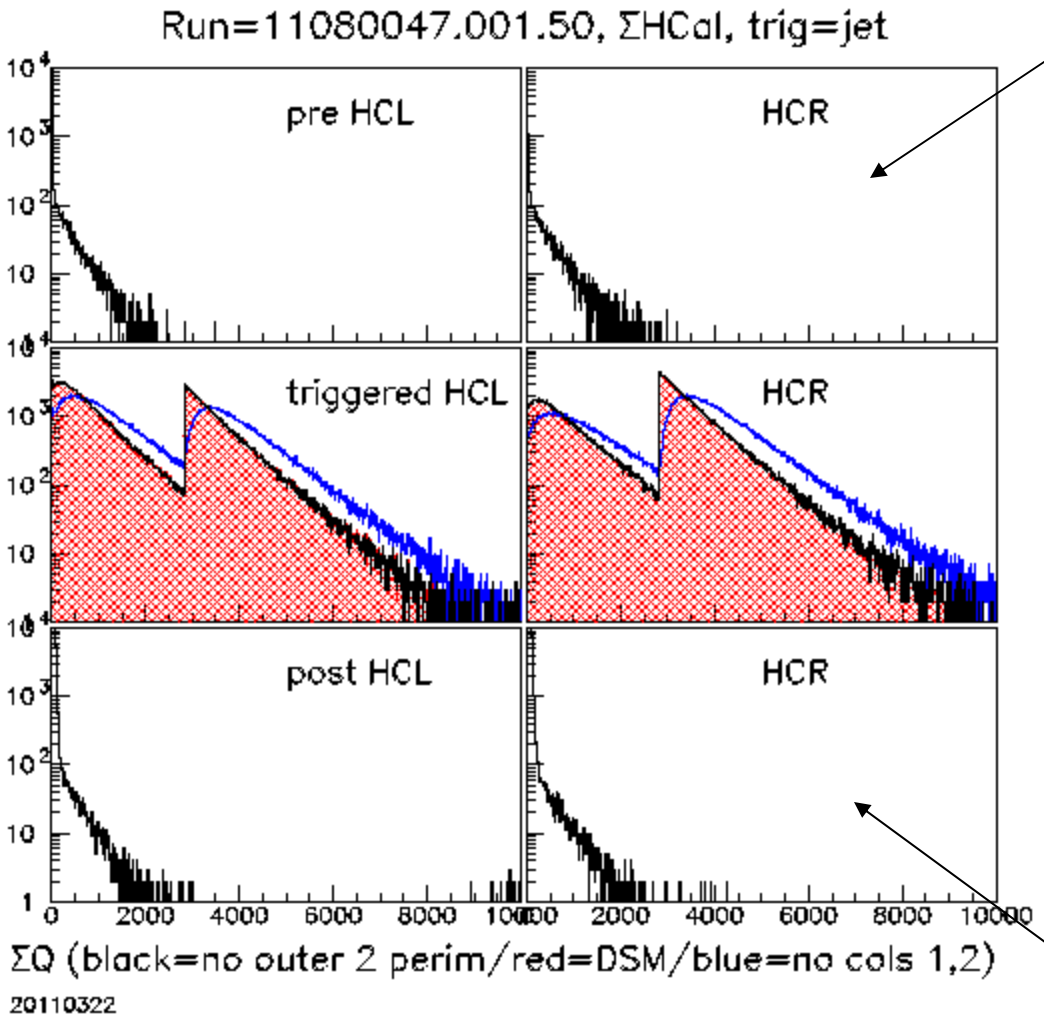
- Hcal is existing 9x12 modules from E864 (NIM406,227)
- EMcal is modeled as only $(3.8cm)^2x(45cm)$ lead glass
- Preshower would require construction
- PHOBOS split-dipole magnetic field in GEANT model
- Fiber tracker stations and MWPC require construction

http://www.star.bnl.gov/~akio/ip2/topview_run13.jpeg

IP2 in January, 2011



Jet Trigger



Hadron calorimeter is quiet ~107ns before jet event

- Jet trigger sums HCal response excluding outer two perimeters (rather than just two columns closest to beam)
- Definition is consistent with objective of having jet thrust axis centered in hadron calorimeter modules
- HCal energy scale determination from ECal/HCal correlations is underway

Hadron calorimeter is quiet again ~107ns after jet event