Spin Asymmetries of the Nucleon Experiment - SANE
(TJNAF E07-003)

PHYSICS: proton spin structures $g_2(x, Q^2)$ and $A_1(x, Q^2)$ for $2.5 \leq Q^2 \leq 6.5\text{GeV}^2$, $0.3 \leq x_{Bj} \leq 0.8$

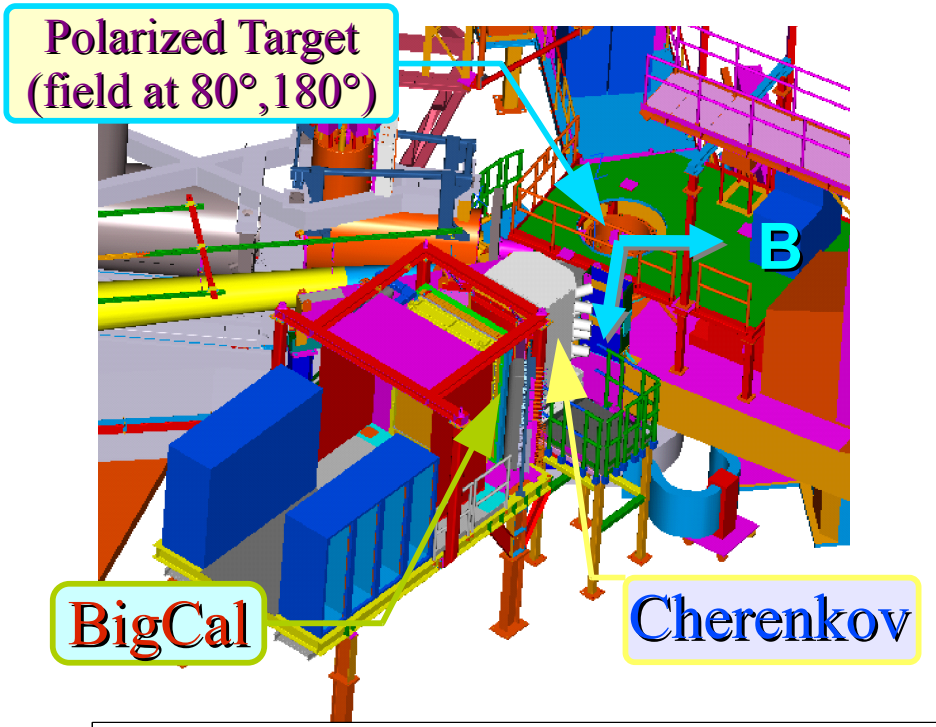
Measure inclusive double polarization near-orthogonal asymmetries to:

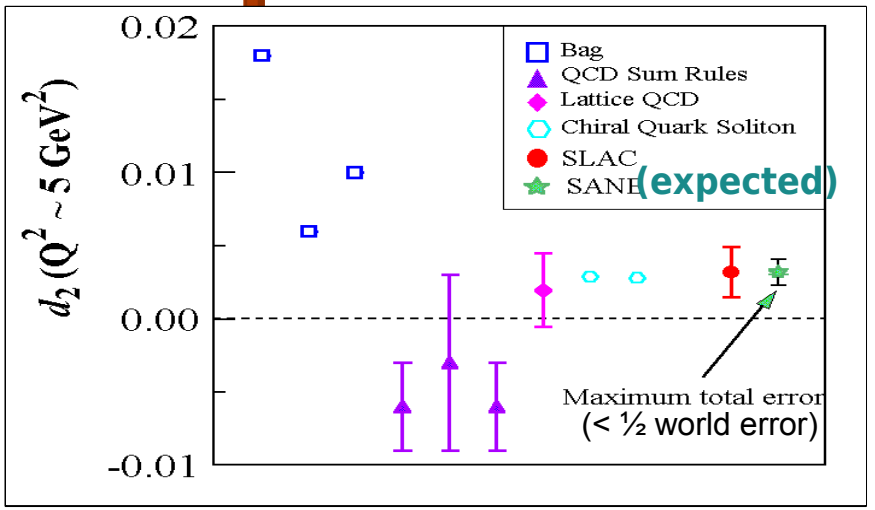
- access ***quark-gluon*** correlations using LO twist-3 effects (d_2 quark matrix element)
- compare with Lattice QCD, QCD sum rules, bag model, chiral quarks
- test nucleon models (x dependence) and Q^2 evolution
- explore $A_1(x \to 1)$; test polarized local duality

METHOD:

- **CEBAF 4.7 & 5.9 GeV polarized electrons**
- **Solid polarized ammonia target**
- **BETA,** novel large solid angle (.2 sr) electron telescope:
  - calorimeter + gas Cherenkov + tracking

Took data in Hall C Jan-March 2009





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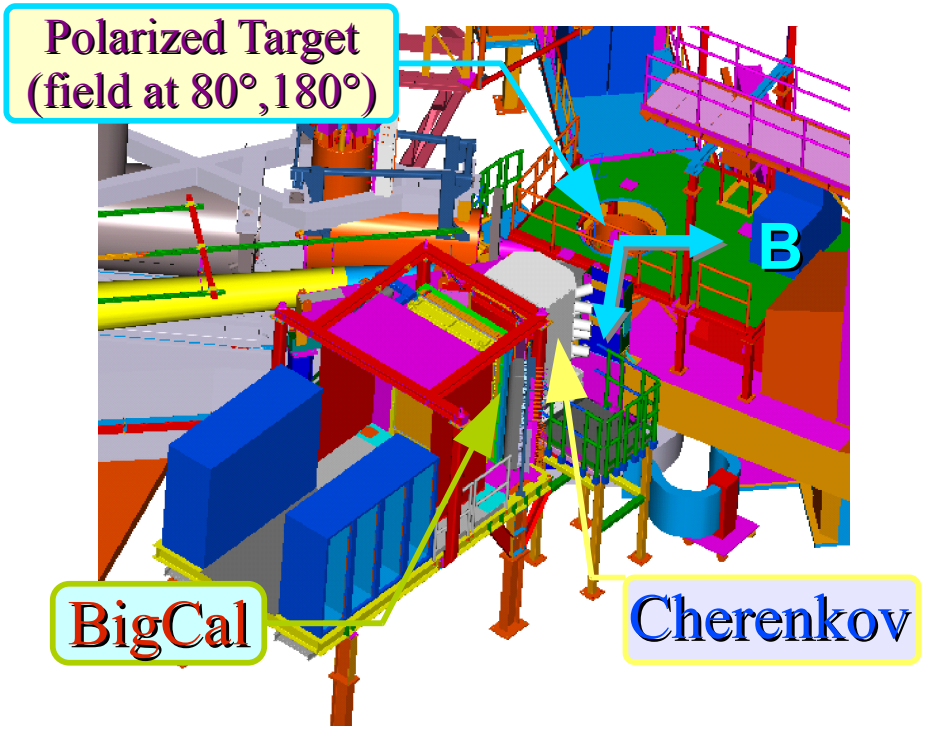
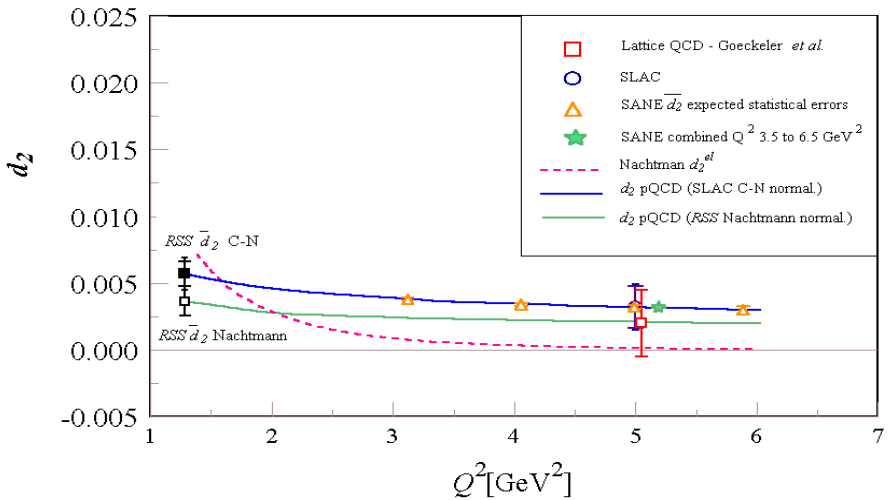
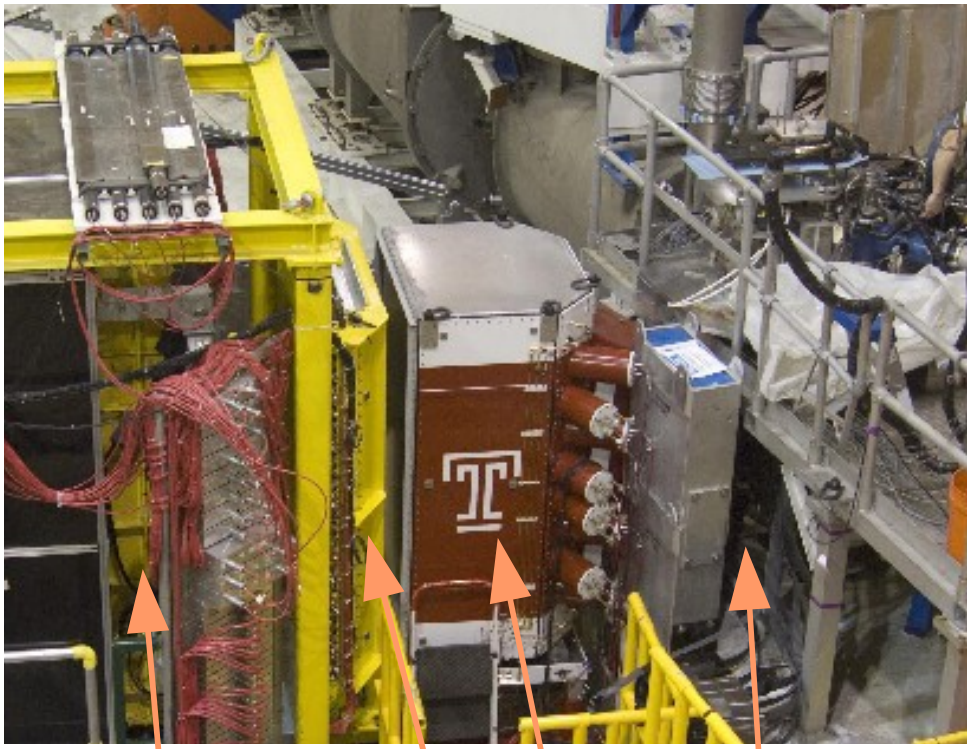


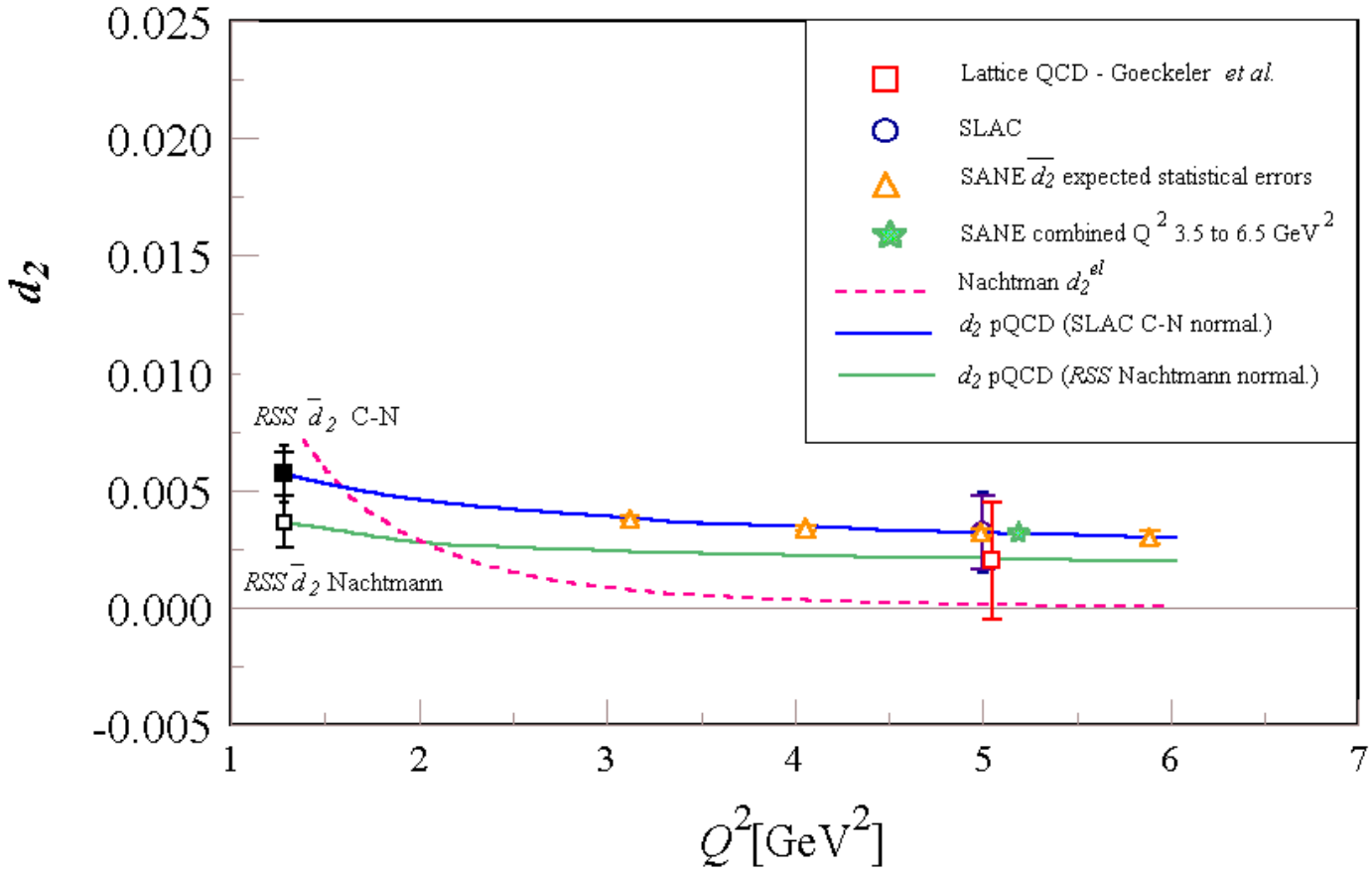


Big Electron Telescope Array – BETA

- **BigCal** lead glass calorimeter: main detector used in *GEp-III*.
- Tracking **Lucite hodoscope**
- **Gas Cherenkov:** pion rejection
- Tracking fiber-on-scintillator **forward hodoscope**
- BETA specs
  - Effective solid angle = 0.194 sr
  - Energy resolution 9%/$\sqrt{}$ E(GeV)
  - 1000:1 pion rejection
  - angular resolution ~ 1 mr
- Target field sweeps low E background
  - 180 MeV/c cutoff



Sample of SANE Expected Results



SANE expected statistical errors for $\bar{d}_2 = \int_{xmin}^{xmax} x^2 (2g_1 + 3g_2) dx$

Q^2 GeV^2	x_{min} - x_{max} Projected	$\delta d_2/d_2$ Projected
2.5 - 3.5	.29 - .71	4.6%
3.5 - 6.5	.41 - .84	3.2%