Hall B Status

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Jefferson Lab

CLAS Collaboration Meeting
February 27, 2003

Run status
Publication status
PAC23
Schedule for 2003
New equipment initiatives
Energy upgrade

Hall B Status Overview

- Completed 5 years of physics data taking
- 19 major CLAS production runs completed
  - e1a/b, g1a/b, g6a, e1c, e2a, g6b, g2a, g1c, g3, e1d, e5, eg1b, g8a, g6c, e1-6, e6, e2b, g7, e1e (+ 2 non-CLAS experiments: g5, radphi)
- Data analysis using JLAB off-line farm
  - 'cooking' completed for e1a/b/c/, g1a/b, g6a, eg1a, e2a, g2a, e1d, g1c, g2a, g6b, e5, e1-6, g6c, g3, e6
  - 'cooking' underway for eg1b, g8a, e2b,
  - calibration in progress for g7, e1e
- Publications
  - 15 technical papers published/accepted (14 in NIM)
  - 15 physics papers published/accepted in PRL, PRC, PRD

Technical Publications

Torus Magnet		IEEE Mag.25 (1989) 1902
Drift Chambers		
construction	Mac Mestayer	NIM A323 (1992) 191
update	Mac Mestayer	NIM A367 (1995) 316
Region I	Dan Carman	NIM A419 (1998) 315
Region II	L.M. Qin	NIM A411 (1998) 265
Summary	Dan Carman	NIM A449 (2000) 81
Cerenkov Counter	Paul Stoler	NIM A465 (2001) 414
TOF Counters	Elton Smith	NIM 432 (1999) 265
Start Counters	Simon Taylor	NIM A462 (2001) 484
Forward Cal.	Cole Smith	NIM A460 (2001) 239
Large Angle Cal.	Mauro Taiuti	NIM A447 (2000) 431
Tagging System		
window	Jim O'Brien	NIM 421 (1999)
tagger	Jim O'Brien	NIM 440/2 (2000)263
Polarized target	Chris Keith	NIM A accepted
CLAS Overview	Bernhard Mecking	NIM accepted

Physics Publications (ref. journals)

published before 10/17/02

- Photofission of Heavy Nuclei, PRL84 (2000) 5740
- ϕ-Photoproduction at large t, PRL85 (2000) 4682
- η-Electroproduction, PRL86 (2001) 1702
- ϕ-Electroproduction, PRC63 (2001) 065205-1
- $K^+\Lambda(1520)$ Electroproduction, PRC63 (2001) 044601
- ρ^0-Photoproduction, PRL87 (2001) 172002
- Beam Asymmetry in DVCS PRL87 (2001) 182002
- Double Spin Asymmetry in ep->eπ^+n, PRL88 (2002) 082001
- N->$\Delta(1232)$ Multipoles from π^0 Electroproduction, PRL88 (2002) 122001
- QED Padiative Corrections in Exclusive Pion Electroproduction PRD66 (2002) 074004
- Photofission of Heavy Nuclei, PRC65, 044622 (2002)

published/accepted since 10/18/02

- η-Photoproduction on the Proton, PRL89, (2002) 222002-1
- ω-Photoproduction at large t, PRL90 (2003) 022002
- Polarisation transfer in ep->e$K^+\Lambda$, PRL accepted (2003)
- Single Quark Transition Analysis of N* Excitations in [70,1-], PRC67, 0352XX (2003)

submitted

- Inclusive spin structure function in eD -> eX, PRC
- ep -> ep$\pi^+\pi^-$ and baryon resonance analysis , PRL
- Beam Spin Asymmetries in DIS ep->eπ^+X PRL
- Measurement of $\sigma_{LT'}$ in the $\Delta(1232)$ region, PRL
- Nuclear Scaling in A(e,e') at x>1, PRC
- F2 and Moment analysis in ep-> eX, PRD

Physics Publications cont'd

Under Collaboration Review

- Polarization Asymmetries in ep -> $ep\pi^0$ (A. Biselli))
- Inclusive double polarization asymmetries, g_1 and Γ_{1p} (R. Fatemi)

Multi Hadron WG

- Correlations in ^{3}He(e,e'pp)n (R. Niyazov)
- Femtoscopy (A. Stavinsky)

Real Photon WG

- Photoproduction of $K^+\Lambda/\Sigma$ (J. McNabb)
- Photoproduction of $p\pi^0\pi^0$ (B. Berman)
- Photoproduction of $K^+\Sigma^-$ on deuterium (I. Niculescu)
- Photoproduction of $K^+K^+\Xi^-$ (J. Price)

Structure of the Nucleon WG

- Electroproduction of $K^+\Lambda,\Sigma$ (R. Feuerbach, H. Niculescu)
- Electroproduction of ep -> $en\pi^+$ (H. Egiyan)
- Deeply virtual electroproduction of ρ^0 (C. Hadjidakis)
- SSA in ep -> $e\pi^+n$ (K. Joo)
- p(e, e'K*)X (K. Hicks)
- p(e, e'K^+)Λ (Si McAleer)

Physics Impact of CLAS Data?

Paper	Physics	#citations >10 (as of 02/26/03)
PRL85 (2000) 4682	**ϕ-Photoproduction at high t** *Gluonic effects in production mechanism*	24
PRL86 (2001) 86, 1702	**Study of $S_{11}(1535)$ in η electroproduction** *Hard transition form factor, quark models*	18
PRL87 (2001) 172002	**ρ^0-Photoproduction at high t** *Regge phenomenology, gluonic effects*	12
PRL87 (2001) 182002	**Deeply Virtual Compton Scattering** *GPD formalism, twist-2/twist-3*	68
PRL88 (2002) 182002	**Multipoles from $\gamma^*N\Delta(1232)$ transition** *Lattice QCD, Nucleon/Delta deformation* *Test of hadronic models*	14

PAC23 - Meeting, January 2003

New Proposals:

Proposal	Physics	PAC days (45 days)	Rating
P-03-006	GDH Sum Rule at very small Q^2 (M. Ripani, et al.)	20	A
P-03-012	The Structure of the free Neutron (S. Kuhn, et al.)	25	A^-

Letters of Intent:

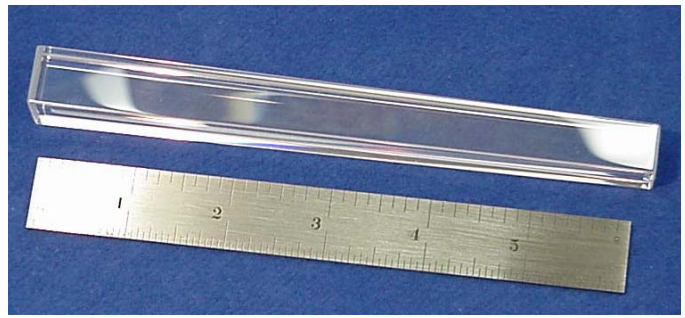
LOI 03-1	Pion Polarizabilities with low Q^2 tagger (K. Wang)	- interesting physics, more work needed for proposal
LOI 03-2	SSA with transversely polarized target (H. Avakian)	- interesting physics, more work needed for proposal
LOI 03-3	Spectroscopy on ^{4}He with low Q^2 tagger (S. Stepanyan)	- invite proposal
LOI 03-4	Spectroscopy on H_2 with low Q^2 tagger (C. Salgado)	- invite proposal

Hall B Run Plan

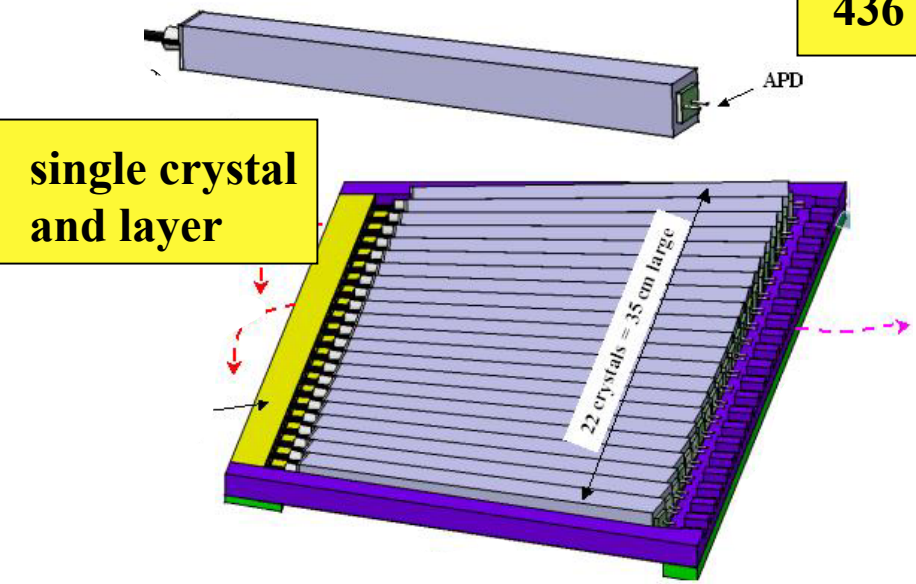
Run group	Run time (days)	PAC rating	Target	Energy (GeV)	Electron polar.	Comment
e1f/g	~40	A^-	H_2	3 - 6	High	completes e1 runs
eg2	44	B^+	nuclear	5 - 6	?	
unscheduled (alphabetical order):						
Coherent ρ	50	A^-	D_2	6.0	High	uses DVCS solenoid
DVCS	60	A	H_2	6.0	High	Solenoid, crystal EC
eg1(γ)	22	B^+	p	1.6-4.0	High	Frozen spin target
g8	29	A^-	H_2	4.2-4.5	No	Photon polarimeter
GDH (Low Q^2)	20	A	p	1.2-4.0	High	New Cerenkov counter
Missing N*	20	A^-	p		No	Frozen spin target
Neutron S.F.	25	A^-	D_2 gas	4-6	?	Radial TPC
PrimEx	22	A	nuclear	6.0	No	ECALs, ..
	248(unscheduled)					

New Equipment Initiatives I

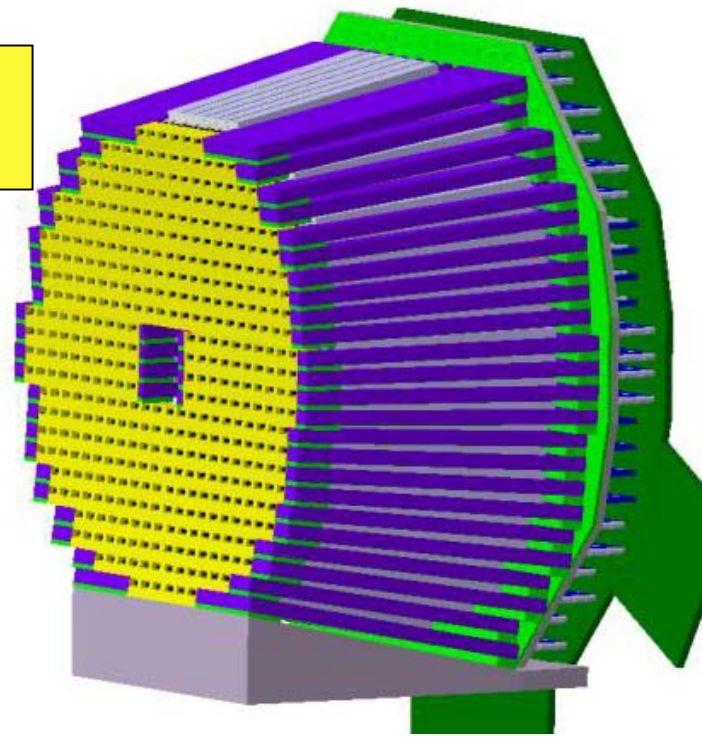
- DVCS Experiment
  - $PbWO_4$ crystal calorimeter
    - 220 (of 440) tapered crystals on site (ITEP, JLab)
    - Light readout by APDs (ITEP, obtain from CMS)
    - Mechanical structure in final design stage (Orsay)
    - Preamps - designs being evaluated (ITEP, Orsay)



Crystal array with 436 crystals



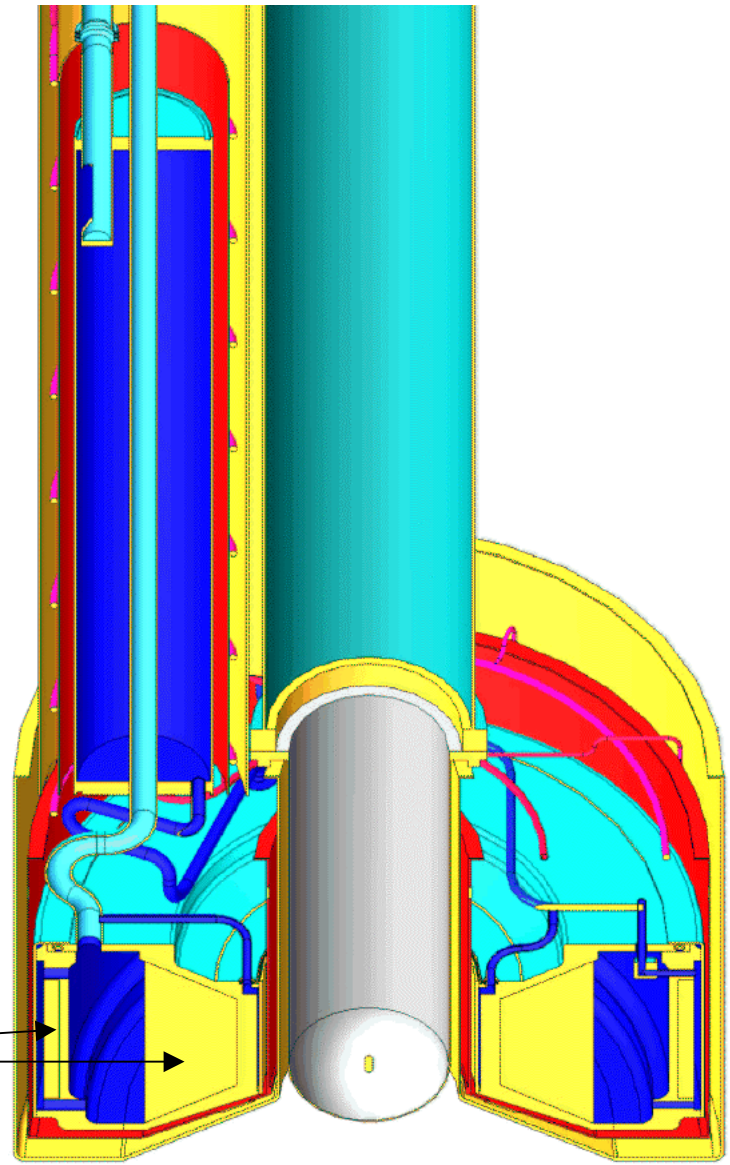
single crystal and layer



New Equipment Initiatives I

- DVCS Experiment cont'd
  - Superconducting solenoid (Saclay)
    - Sweep Møller electrons away from DVCS calorimeter
    - Final engineering design stage
    - Some delays occured due to changes in engineering personel

trapezoidal and rectangular coils



New Equipment Initiatives II

- Frozen Spin Target

Needed for Search for missing N* in hyperon photoproduction,
Experiment E-02-112, F. Klein et al.

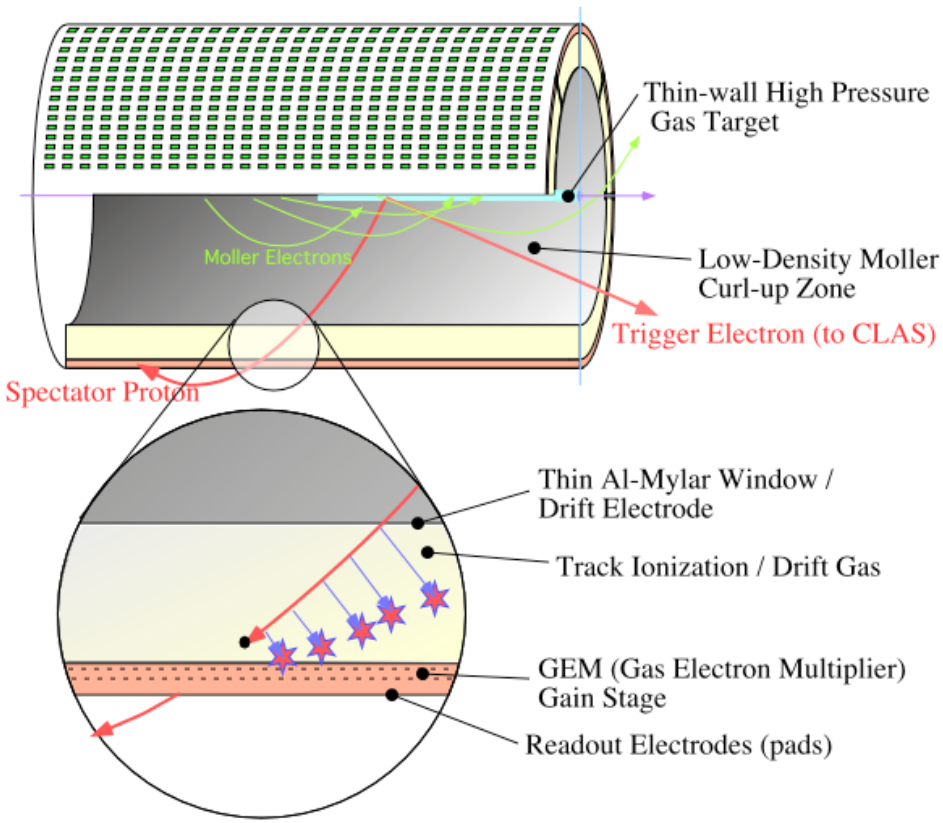
Work by Target group (Chris Keith, et al.)

- Conceptual design is completed, mechanical design in progress
- Design of saddle coil for transverse holding field is ongoing
- Construction of a 1K prototype nearly complete (final cryostat to operate at < 50mK)

New Equipment Initiatives III

- Radial Time Projection Chamber (RTPC)

(needed for the BoNuS experiment, S. Kuhn, et al.)
Goal: detect spectator protons with momenta as low as 70 MeV/c



- Concept of a prototype being developed (H. Fenker), expected to be ready this summer

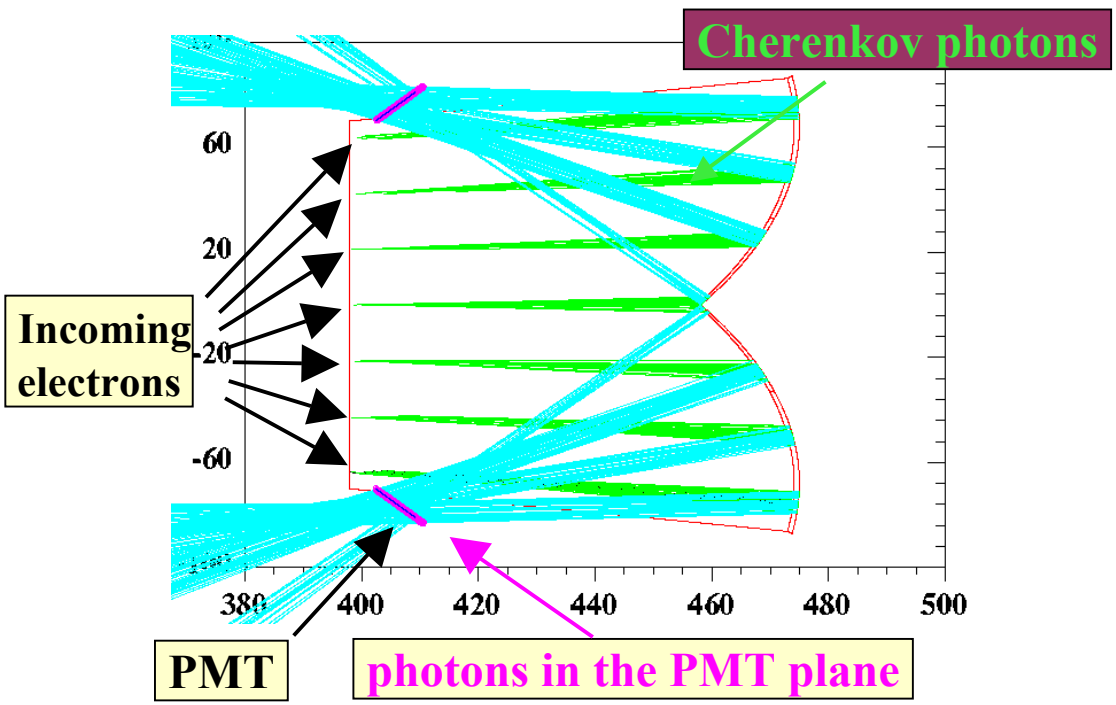
- Would like to test prototype during the DVCS run (needs solenoid magnet for Moller shielding)

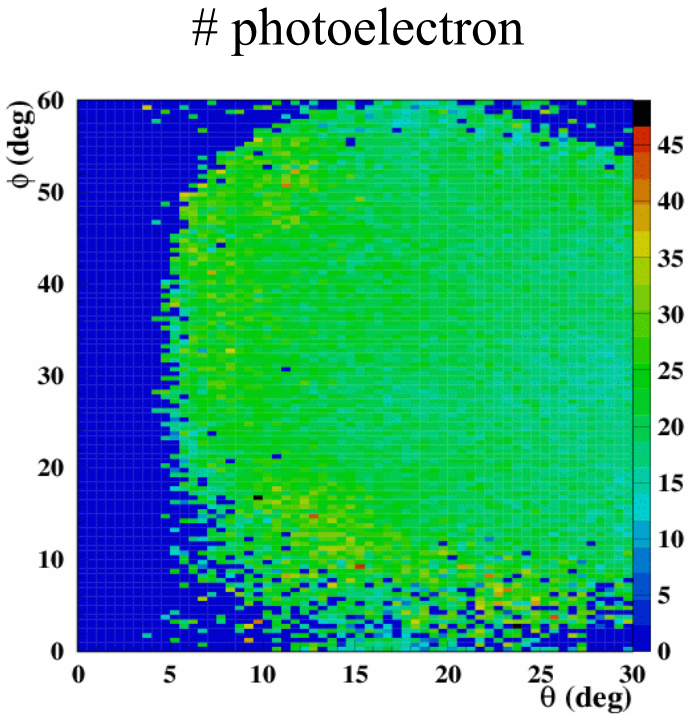
New Equipment Initiatives IV

- Gas Cerenkov Counter for outbending electrons (INFN, Genova)

(Experiment E-03-006 : GDH sum rule at very low Q^2, M. Ripani et al.)

  - Simulations and conceptual design underway





Hall B 2003/2004 Schedule

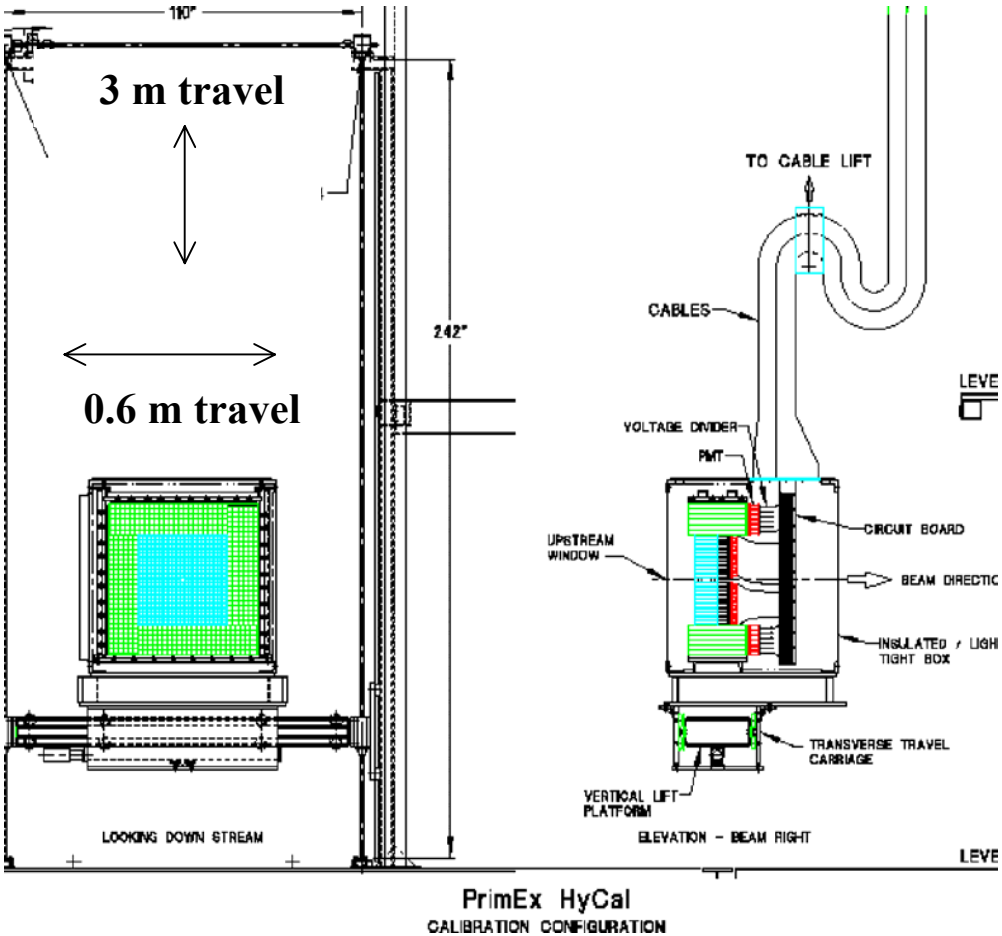
01/06 - 01/23/03	e1e	continued from 2002
01/26		Decision to begin DC repair period more than 3 weeks ahead of original schedule to allow for the repair of 4 drift chambers (low voltage shorts, corrosion on pre-amps boards, broken wire)
01/26 - 04/11/03		Hall maintenance, status: two chambers finished, repair of #3 underway

Schedule heavily constraint by two parity experiments in A/C, both need ~ 3 GeV

04/15 - 07/01/03	e1f/g	continued (5.5 and 3.3 GeV)
07/12 - 09/14/03	eg2	A(e,e'X), A(γ,X)
09/15 - 10/19/03		Accelerator and Hall maintenance
10/20 - 10/27/03		DVCS Tests (with polarized target magnet in CLAS)
11/01 - 12/14/03	eg2	continued
12/15 - 12/24/03		PrimEx Installation
2004		no schedule yet

PrimEx Preparations

Hybrid Calorimeter (HyCal)



Status:

- Engineering design completed
- All $PbW0_4$ crystals and Pb-glass blocks at JLab, are being assembled
- Plan for cosmic ray testing in July
- Installation in Hall B in 12/2003

12 GeV Upgrade

12/2002 - Preliminary Design Report - Hall B/CLAS^{++} *
01/2003 - PAC23 Upgrade Meeting

CLAS collaboration members in working groups:

Meeting at Jlab:	pCDR Working groups
*Generalized Parton Distributions**	- *V. Burkert,* C. Hyde-Wright
PDF - High-x Physics	- S. Kuhn
*Formfactors and GPDs**	- *P. Stoler*
Limits of S.M. of Nuclear Physics	- *L. Weinstein*
*Hadronization**	- *W. Brooks,* J.M. Laget
*Semi-Inclusive Processes**	- *H. Avakian,* L. Elouadrhiri

Meeting at the Outer Banks:

*Detector Upgrade & Physics**	- *V. Burkert,* B. Mecking

*) slides available: http://www.jlab.org/Hall-B/xxxxx

12 GeV Upgrade - cont'd

Very positive reaction of the extended PAC23 to the Hall B Physics plans and equipment upgrade.

Preliminary PAC23 comments on Hall B Upgrade:

□ A major new initiative for Jlab is the study of Generalized Parton Distributions to add a new dimension to our understanding of nuclear structure. …. Such measurements are ideally carried out with a full acceptance detector designed to identify specific exclusive channels. This can be accomplished by an upgrade to the existing CEBAF Large Aceptance Spectrometer (CLAS).

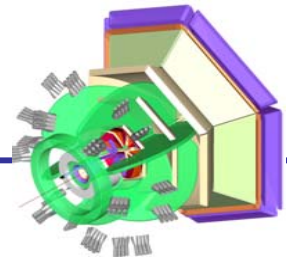
□ The upgrade plan is well matched to the high priority physics goals that are best addressed in a large acceptance apparatus: measurements of GPD's through DVCS and DVMP, and measurements of spin/flavor PDF's through inclusive and semi-inclusive electron scattering. ….. The ability to measure neutron structure functions through spectactor proton tagging is unique to CLAS^{++} and essential to the PDF program. The important study of spacetime chracterization of hadronization requires the new capabilities of CLAS^{++}.

□ Several experimental programs would benefit from a transversely polarized target in CLAS^{++} and from a tagged real photon facility in one of the existing Halls. We recommend exploring the feasibility of developing these capabilities.

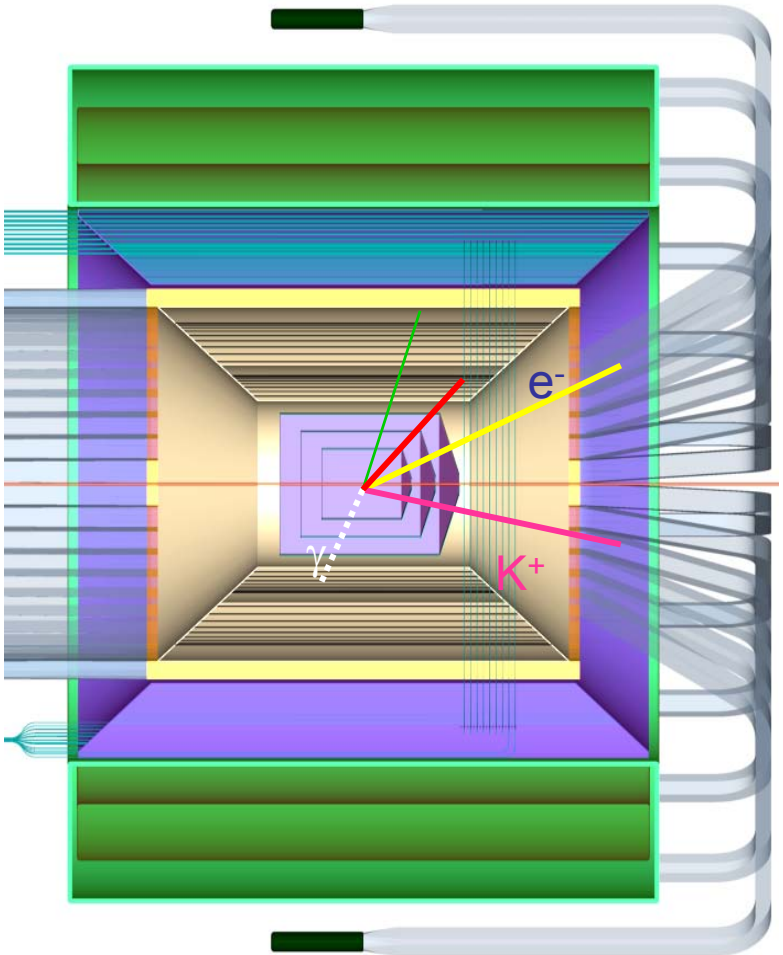
12 GeV Upgrade - cont'd

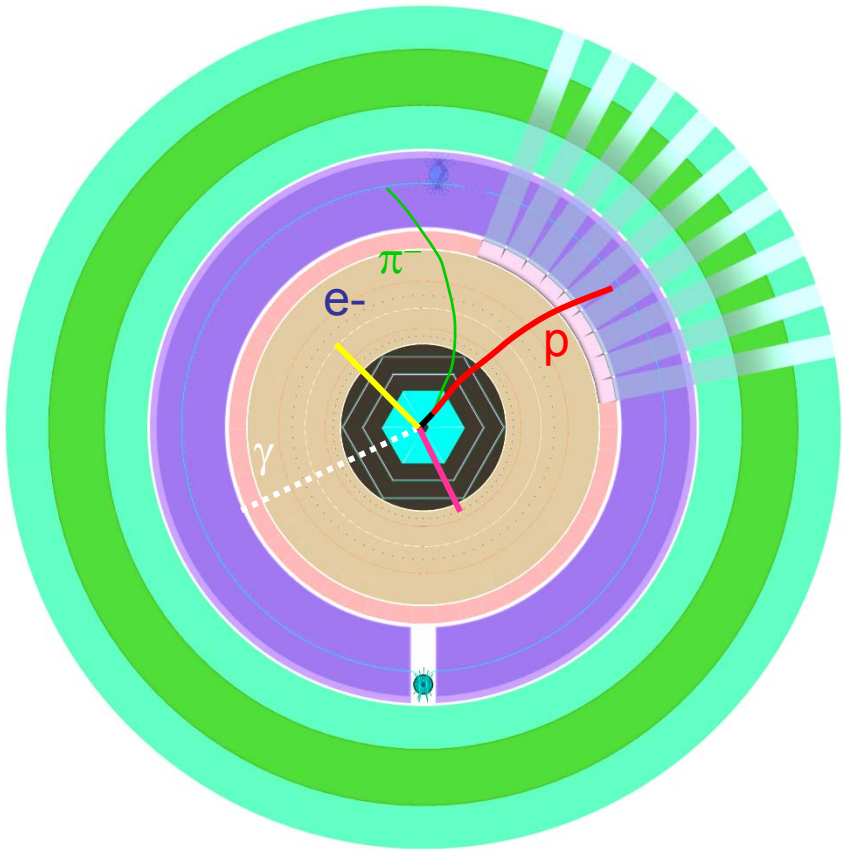
- Preliminary Conceptual Design Report (pCDR) March '03
- NSAC subcommittee on future projects, meeting Feb 15
  - full support for the 12 GeV Upgrade
    - physics program 'absolutely central' for the field
    - ready for construction
  - NSAC chairman Rick Carstens to visit Jlab in April
  - JLab beyond 12 GeV (ELIC and 25 GeV fixed target) => talk by Rolf Ent.

12 GeV Upgrade - cont'd

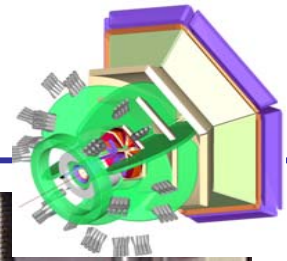


CLAS^{++} Central Detector - Prototyping Effort



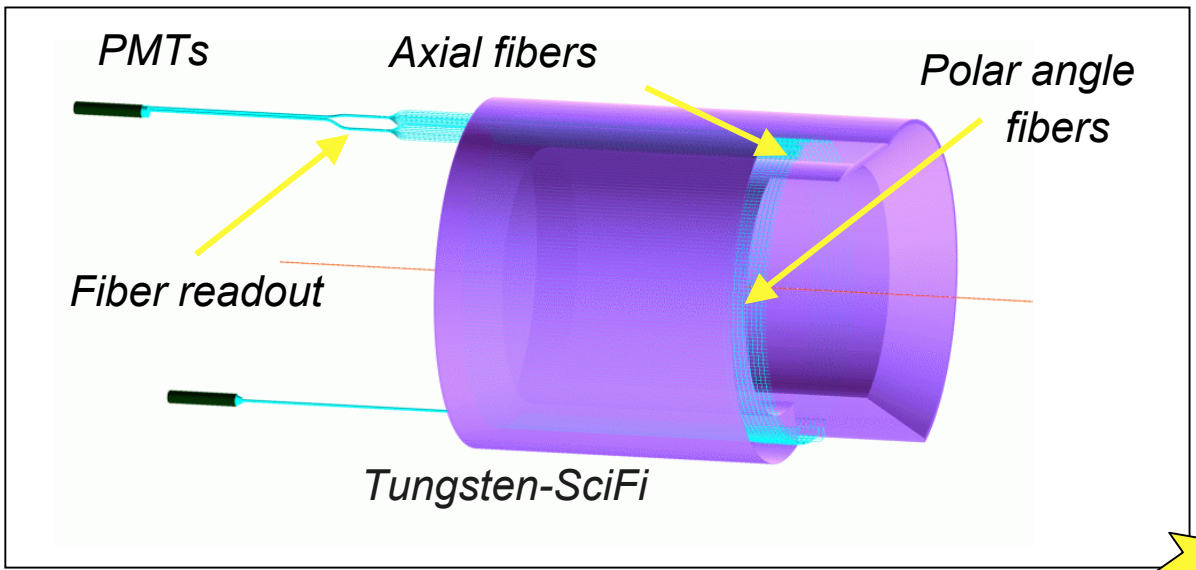


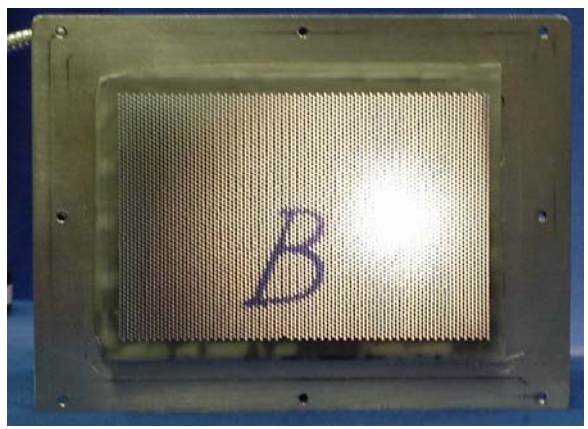
12 GeV Upgrade - cont'd



CLAS^{++} - Prototyping Effort I

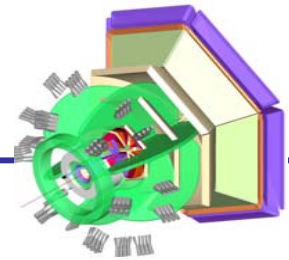
Central Detector:
Tungsten-powder-SciFi calorimeter (Jlab & Norfolk State University, NASA)





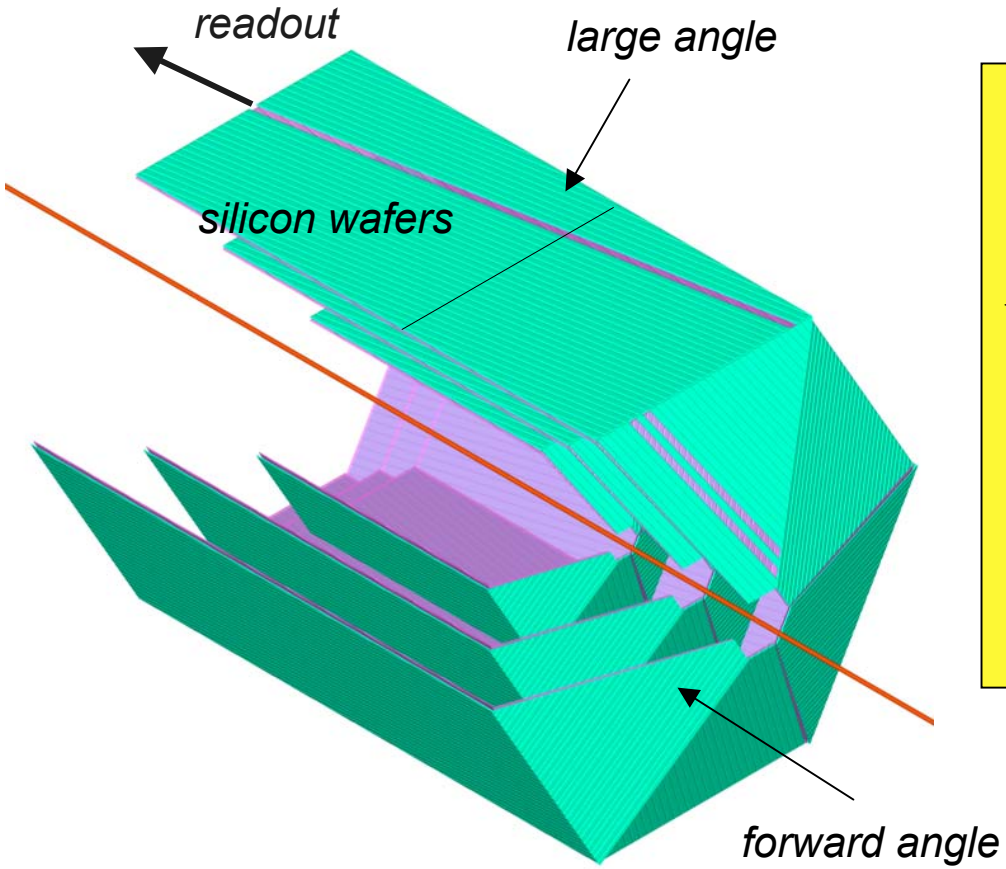
Prototype with axial readout of 5,500 fibers under construction

12 GeV Upgrade - cont'd



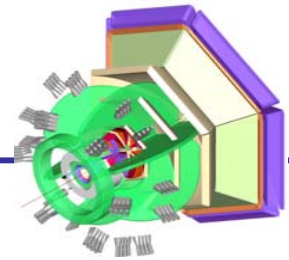
CLAS^{++} - Prototyping Effort II

Central Detector:
Silicon Strip Vertex Detector



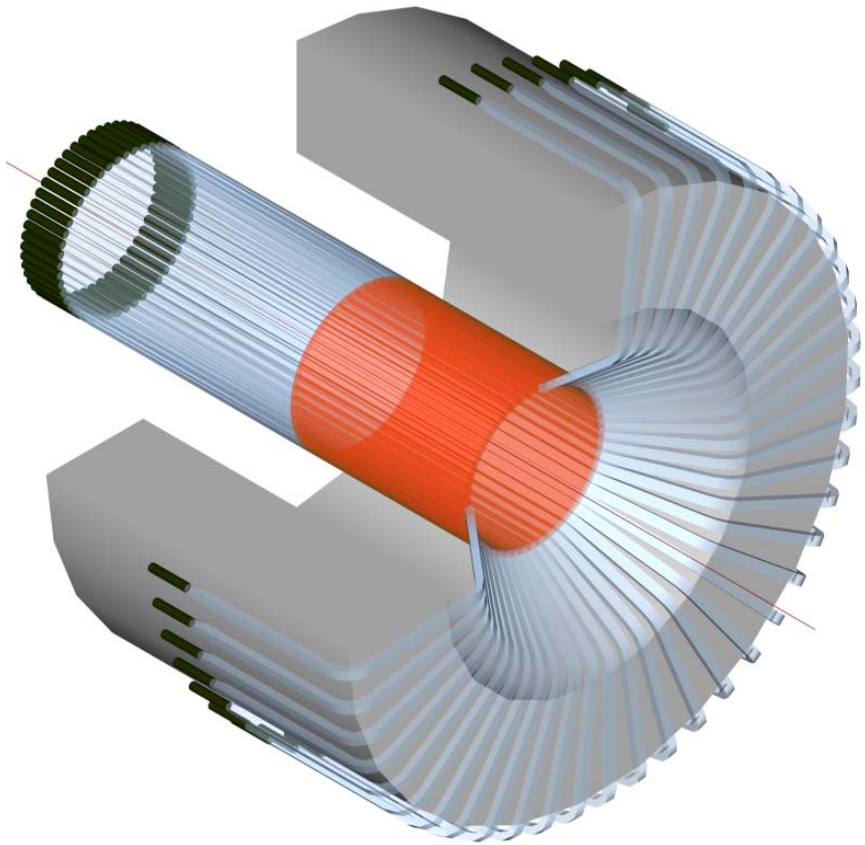
- **Goal:** Build a complete sector, single layer prototype within one year, with help from the BNL instrumentation group
- **Status:** Specifying read-out chip (F. Barbosa)

12 GeV Upgrade - cont'd



CLAS^{++} - Prototyping Effort III

Central Detector:
Time-of-flight Counters



Kyungpook University

- Setup for tests of timing resolution of short scintillators and fast PMTs.
- Goal: $\delta T \sim 50$psec

Conclusions

CLAS is doing well:

- Physics output is accelerating
- Physics scope is broadening
- Proposals receive high ratings
- Interesting instrumention developments provide basis for future experiments

- Compelling Physics for the 12 GeV Upgrade
- CLAS^{++} - a good start for detector upgrade

But:

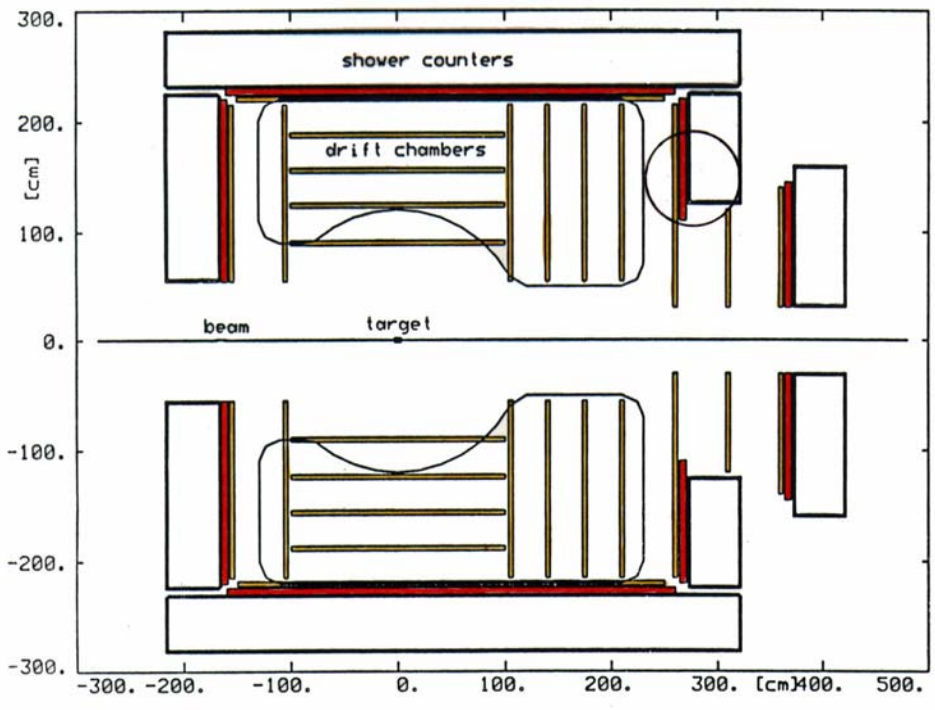
- Need wider distribution of results
- involve theorists in solving specific problems
- more presence at conferences/workshop

Lurking problem:

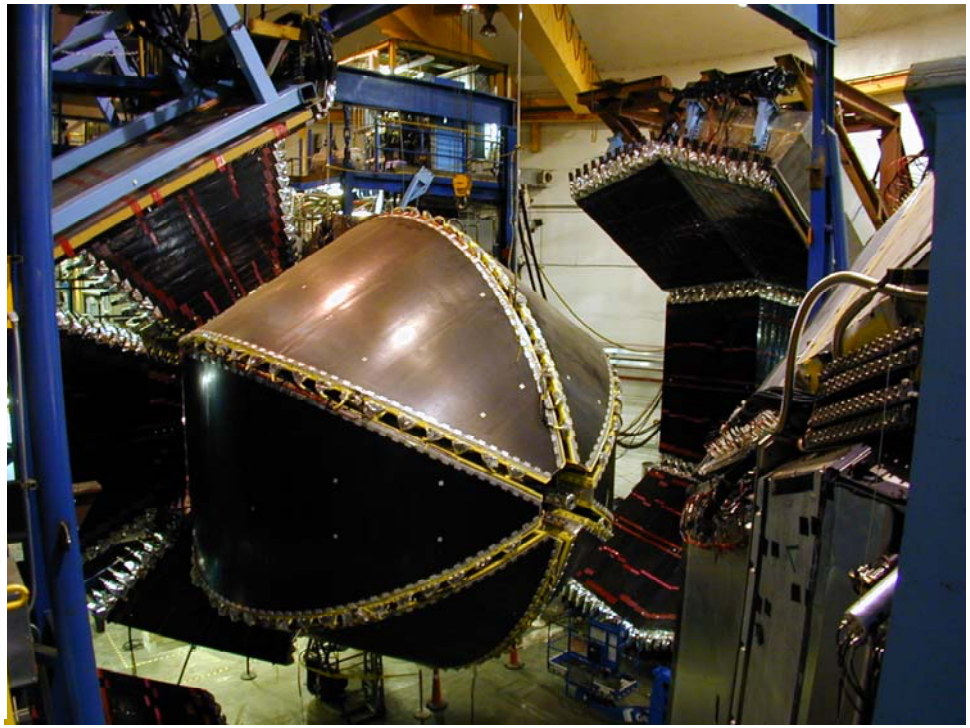
- Drift chamber electronics board corrosion

CLAS - Then and Now

1987



2003



Bernhard,
Thank you for your leadership, inspiration, and foresight!

Bernhard,
Electromagnetic Nuclear Physics would not be what it is today, without your vision!