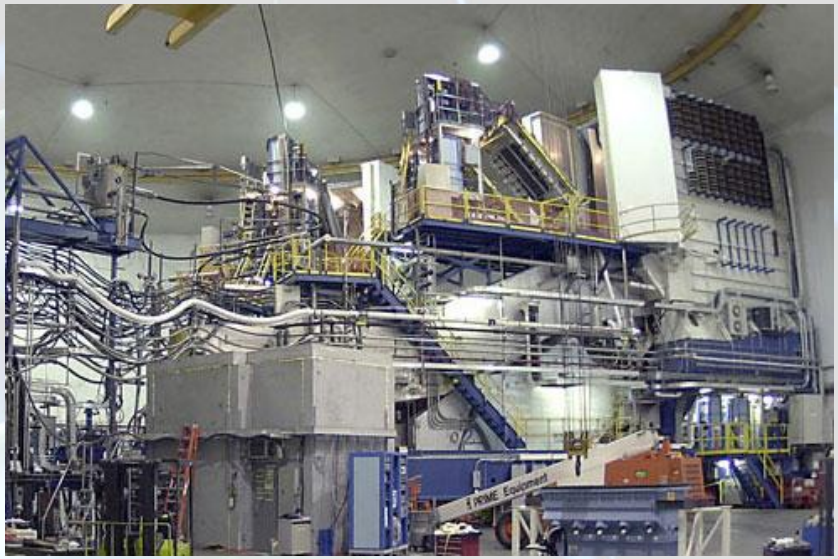
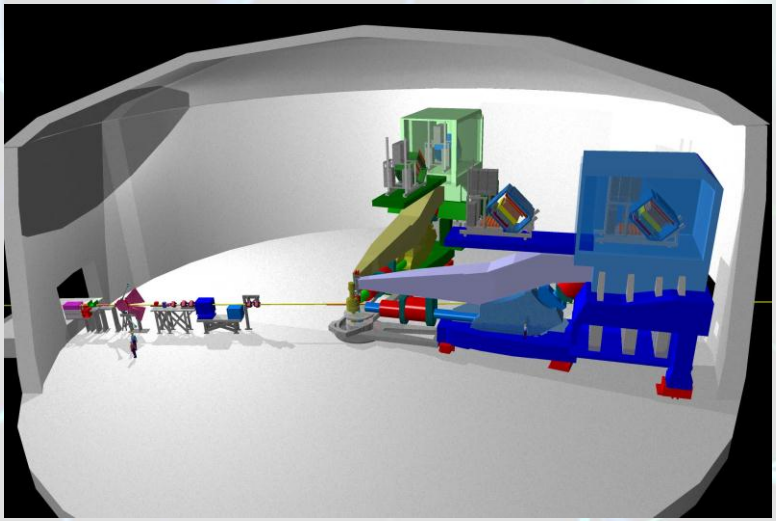
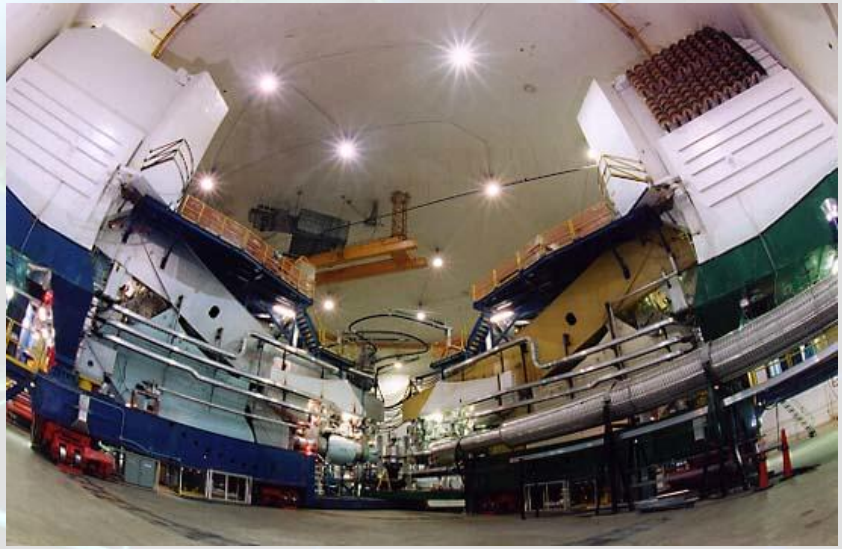
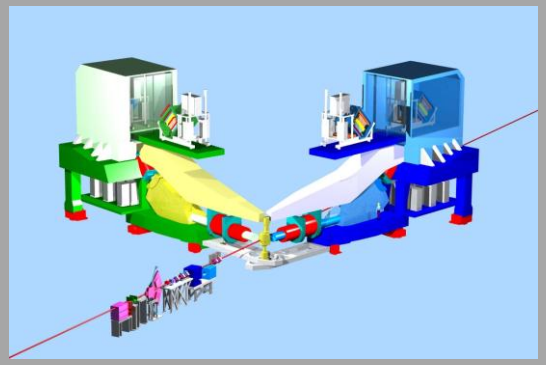
Hall A Checkout and Detector Start-up Plans

Thia Keppel









Plans for Early Running in Hall A

- 3 A-rated experiments in first years of running
- G_M^p (HRS-R) and DVCS (HRS-L + calo) run is combined
- Some flexibility incorporated

16 mo. Shutdown

12 GeV Commissioning

Early Experiments

DVCS-I and G_M^p
Access to GPDs

EM Form Factor

$^3H/^3He$ d/u at High x

APEX/PREX
Dark photon A'/Neutron skin

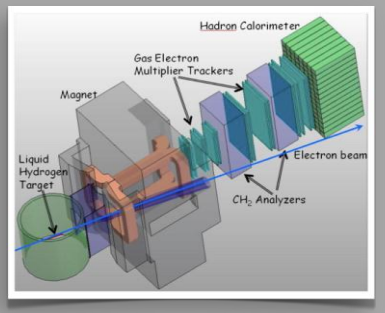
(A1n)
Neutron spin structure

SBS Experiments
EM Form Factors at high Q^2

12 GeV Projects:
1. Moller polarimeter
2. Compton polarimeter
3. Energy measurement upgrade

SBS Project

SuperBigbite Spectrometer



Beam 1st to Hall A

11 GeV

FY 2013	FY 2014	FY 2015	FY 2016	FY 2017

commissioning beam

Hall A Base Equipment Checkout Conditions

- Run anticipated late March 2014 for 1-4 weeks
  - 12 GeV milestone 3 pass > 2 GeV pulsed beam delivery
  - planning for some checkout run time at higher (CW) current
  - beam ~40% at 6.6 GeV, ~60% around 5.4 GeV to avoid trips
  - accelerator performance and operations budget dependent

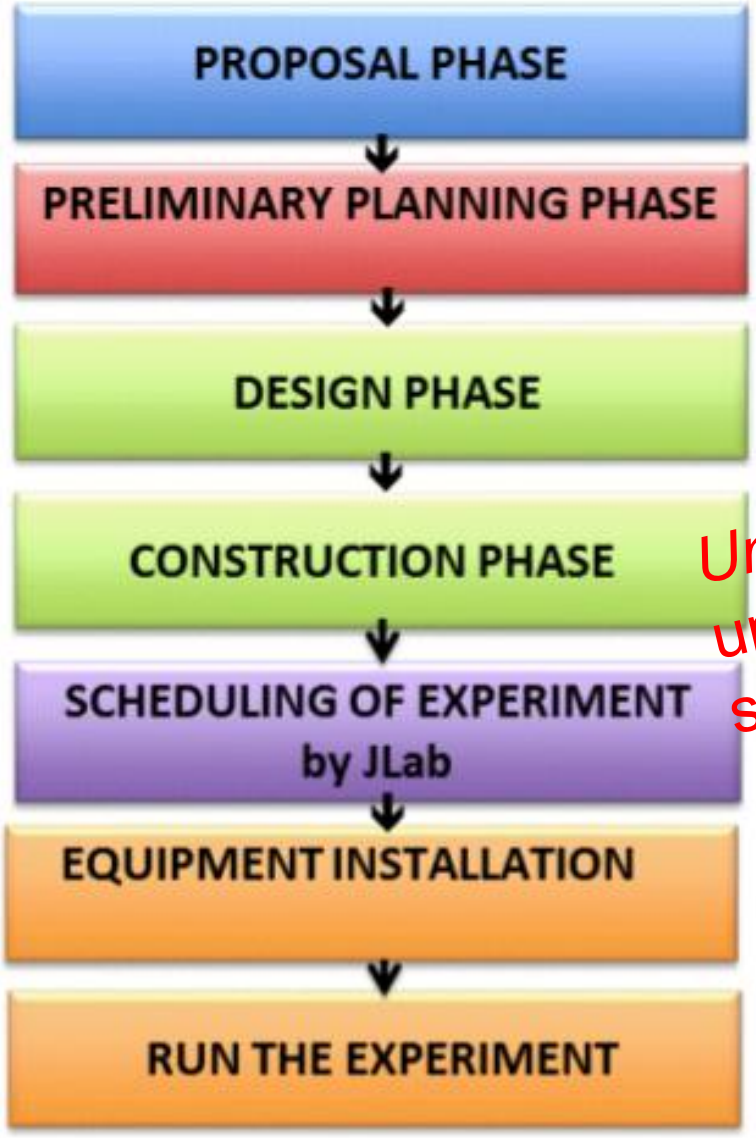
- Beam dump upgrade planned for Summer 2014 limits activation
  - agreed on 5 μAmp limit (other than *maybe* one short test for cryotarget) and thin targets, 1%, 2% Carbon, 15 cm hydrogen
  - RSAD run conditions submitted
  - RSAD required to plan annual site boundary dose - due to the limited number of weeks of operations in these initial calendar years, determined no issue (Pavel Degtiarenko)

- Accelerator is responsible for anything/everything that can steer the beam, plus transport diagnostics (BPMs, ion chambers,….)

- Hall A is responsible for target, spectrometers, and polarimetry equipment other than magnets (Compton lasers, Moller detectors,…)

Text Only Version

READINESS REVIEW PROCESS - FLOWCHART



- Submitting Proposals PAC&TAC
- Director's Decision

- Exp. Description and Requirements
- Exp. Readiness Review Calendar

- PESAD, specific equipment reviews
- Complete Conceptual Designs & "1st" Readiness Review

- Fabrication of the equipment
- Test of the individual elements of the equipment (OSP/TOSP)

Unique start-up/check-out situation!

- Construction near-completed, designs frozen
- Exp. Operation Envelop (EOE)
- "2nd" Readiness Review before scheduling request submission

"Final" readiness review
- Final ESAD & RSAD
- COO
- Safety Checklist
- Experimental Procedures

http://www.jlab.org/div_dept/physics_division/experiments/scheduling.html

Program Advisory Committee (PAC)

(See Flow Chart (http://www.jlab.org/user_resources/PFX/NP-PFX/index.html))

Basic Steps:

I. Proposal Phase (#i)

II. Approved Proposal: Preliminary Planning Phase (#ii)

III. Design Phase (Users and Experimental Hall responsibility) (#iii)

IV. Construction Phase (Users and Experimental Hall responsibility) (#iv)

V. Scheduling of Experiment by Jefferson Lab (#v)

VI. Equipment Installation (Users and Experimental Hall responsibility) (#vi)

VII. Preparation for Running the Experiment (#vii)

VIII. Commission equipment (following written procedures documented in COO) (#viii)

IX. Run the experiment (following written procedures documented in COO) (#ix)

X. Decommission the equipment (if appropriate) and store or dispose of target and/or contaminated apparatus properly (#x)

XI. For apparatus that will/may be used again (e.g. the Base Equipment in the Halls), review experience to date and, as appropriate: (#xi)

Unique start-up /check-out situation!

VII. Preparation for Running the Experiment

A. Submit documentation on personnel and procedures at least one month before the start of the experiment:

1. Submit final ESAD. ✓
2. Submit final RSAD (RSAD.html) . ✓
3. Submit COO (Describe Experiment Responsibilities, Collaboration Organization, Operations Personnel, Training Required, etc. in a written Conduct of Operations Document (COO)). . ✓
4. Submit a Safety Check list.. ✓
5. Submit experimental procedures.. ✓

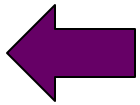
Near Future:
5. Submit HIERD (Hazard Identification and Emergency Response Document) – *under development (Physics, ESH&Q, Facilities)*
6. Submit experimental procedures.. ✓

(Note: The bulk of the experiment procedures will be in the form of an operations manual for the major experimental equipment that will be referenced by the COO.)

B. Pre-operation checkout of equipment installation and procedures by experiment collaboration can be done with work control documents. This serves to verify operability after installation and to review integration to the extent possible without the use of beam. ✓ (Hall A Operations Manual and OSPs for "new" equipment)

C. Jefferson Lab review of the safety of the installed equipment prior to its use with beam.

(This review will be carried out by Division Safety Officer in collaboration with subject matter experts, further EH&S Personnel, and the assigned Liaison Physicist, verifying conformance to the ESAD and checking functionality of safety aspects of the apparatus and items and issues specifically identified on the Experiment Installation Checklist by the RC review.)



D. Experiment Readiness Clearance (ERC) issued by AD for Physics.

(Note: This will include a verification that all reviews are in place, as denoted in the Experiment Readiness Checklist. It also verifies that the experiment installation check has been completed, as documented on the Experiment Installation Checklist, and that all issues and concerns have been satisfactorily resolved, as detailed in the Issue/Concern Checklist.)

Hall A Collaboration Meeting
December 16-17, 2013

Monday 16 December 2013

CEBAF Center F113

Remote access instructions

Note that due to significant changes in the hall, everyone has to retake the safety walk-through before participating in shifts.

Start Time	End Time	Event	Speaker
		Opening Session	**Session Chair: Julie Roche**
08:30	08:35	**Welcoming Remarks**	**Julie Roche**
08:35	08:45	**Hall A Business Meeting**	**Julie Roche**
08:45	09:00	**Hall A Status Update**	**Thia Keppel**
09:00	09:10	**12 GeV Welcome**	**Bob McKeown**
09:10	09:30	**Accelerator**	**Yves Roblin**

09:30	10:00	**Coffee Break**	

		Hall A Commissioning	**Session Chair: Jixie Zhang**
10:00	10:15	**Hall Safety**	**Doug Higinbotham**
10:15	10:30	**Hall Commissioning Plans and Beam Energy Measurement**	**Luke Myers**
10:30	10:45	**Beam Charge and Polarimetry Commissioning**	**Sasha Glamazdin**
10:45	11:00	**Preparing for Tritium Experiments**	**Dave Meekins**
11:00	11:10	**HRS and BigBite status**	**Doug Higinbotham**
		Early Scheduled Experiments	
11:10	11:30	**Early scheduled exp.: E12-06-114: DVCS**	**Alexandre Camsonne**
11:30	11:50	**Early scheduled exp.: GMp**	**Kalyan Allada**
11:50	12:10	**Early scheduled exp.: Tritium experiments**	**Patricia Solvignon**

12:10	13:30	**Lunch**	
12:15	13:15	**Hall A Safety Walk-Through** Due to changes in the hall, **everyone** has to retake the safety walk-through.	

Hall Base Equipment Checkout Activities

LEFT-TO-RIGHT INCREASING PERCEIVED LEVEL OF DEMAND

	BPM and Beamline Transport including polarimeters	Raster	Beam Charge Measurement (Unser + BCM calibration)	Beam Energy Measurment (Full Arc)	HRS Spectrometer, Detector Checkout	Cryotarget Checkout	Moller Polarimetry	Beam Charge Measurement ("Ag" calo only) - not likely to use	Beam Energy Measurment (Spectrometers)	Compton Polarimetry**	Beam Energy Measurment (Single Hall Spin Dance)	First Run Physics (GMp and/or DVCS)
Point of Contact	Yves	Bob	Javier	Doug	Bogdan, John	Jian-ping	Javier	Doug	Doug, Bogdan	Sirish	Doug	Bogdan, Alexandre
BEAM PARAMETER												
Current Range	~5 - Imax uA	any	0 - Imax**** uA	~5uA*	2 - 10 or more uAmps	5, 20 - 80 or more uAmps	0.2-1uA CW	< 5uA	10 or more uAmps*	1-80 uA	> 5uA*/***	5, 20 - 50 or more uAmps
Duty Factor	pulsed/CW	CW	CW	CW**	CW	CW	pulsed/CW	CW	CW	pulsed/CW	CW	CW
Energy Range	any	any	any	any	any	6 - 11 GeV	1.1, 4.4/6.6, 11 GeV*	power limited, up to ~2 GeV only	1 - 4.4 GeV	2.2 - 11*	any	6 - 11 GeV
Polarization	N/A	N/A	N/A	N/A	N/A	N/A	polarized	N/A	N/A	polarized	polarized	50, 70 - 100%
Spot size	N/A	N/A	N/A	N/A	N/A	raster required	N/A	N/A	N/A	80 um @ CIP	N/A	N/A

will discuss status

blue = initial checkout only, minimal utility

* energy lock required
** pulsed or CW for non-invasive, CW for invasive (high precision)
*** relative Compton polarimetry required at the ~1% level, Moller in addition preferred
**** lower max currents translate to increased systematic uncertainty

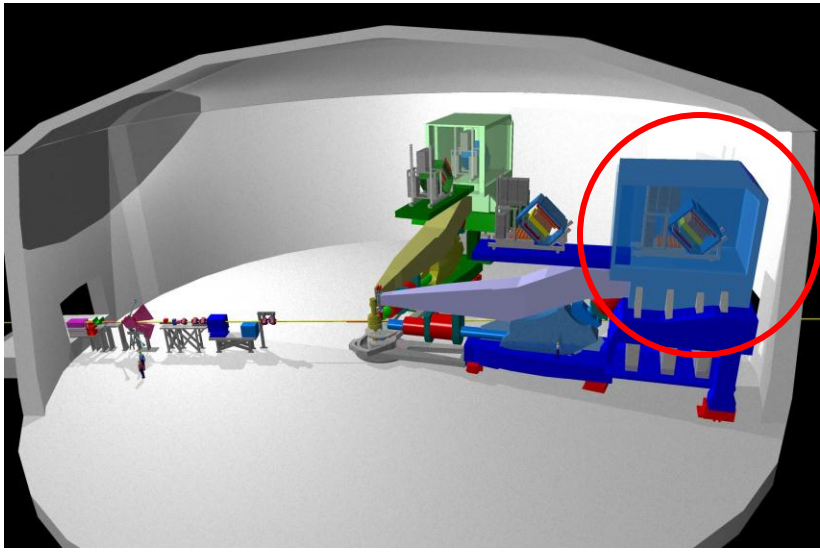
** Compton polarimetery ALSO requires (i) Compton chicane orbit lock, and (ii) beam (halo) background <1000 Hz/uA in photon detector.

- Some activities can happen in parallel
- Highly dependent on beam conditions
- Not an experiment

HRS Detector Checkout

Bogdan Wojtsekhowski, primary Hall A contact

- HRS basic detector package
  - Vertical Drift Chambers (VDCs)
  - Scintillator hodoscope planes: S0, S2m
  - Lead Glass Shower Calorimeter
  - Gas Cherenkov
  - Straw chamber – added tracking plane



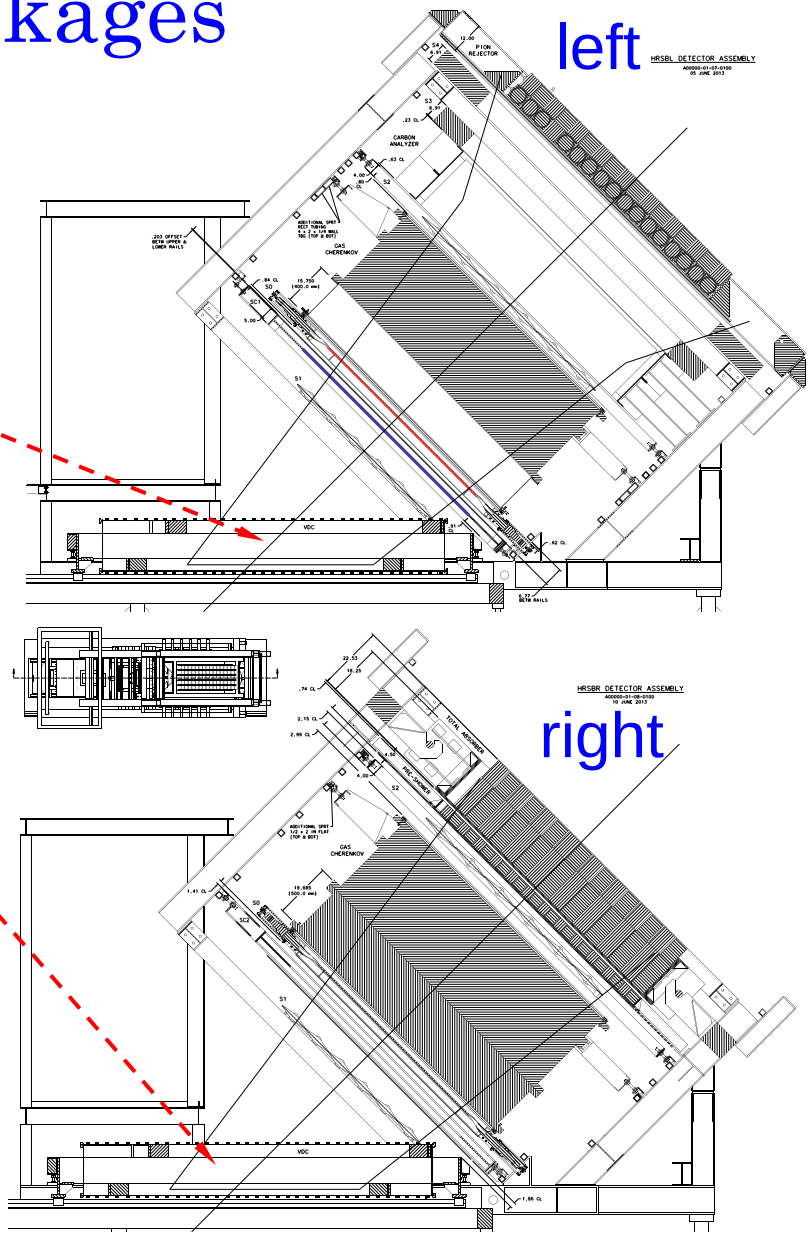
Detector Packages

VDC
S0 scintillator planes
S2

Gas Cherenkov

Lead-glass calorimeter

Straw chamber



ELSEVIER

Nuclear Instruments and Methods in Physics Research A 474 (2001) 108–131

NUCLEAR INSTRUMENTS & METHODS IN PHYSICS RESEARCH Section A

www.elsevier.com/locate/nima

Vertical drift chambers for the Hall A high-resolution spectrometers at Jefferson Lab

K.G. Fissum[a,*], W. Bertozzi[a], J.P. Chen[a,1], D. Dale[a,2], H.C. Fenker[b], J. Gao[a,3], A. Gavalya[b], S. Gilad[a], C.R. Leathers[a,4], N. Liyanage[a,1], R.O. Michaels[b], E.A.J.M. Offermann[b,5], J. Segal[b], J.A. Templon[a,6], R. Wechsler[a,7], B. Wojtsekhowski[b], J. Zhao[a,8]

[a] *Massachusetts Institute of Technology, Cambridge, MA 02139, USA*
[b] *Thomas Jefferson National Accelerator Facility, Newport News, VA 23606, USA*

Received 13 October 2000; accepted 13 February 2001

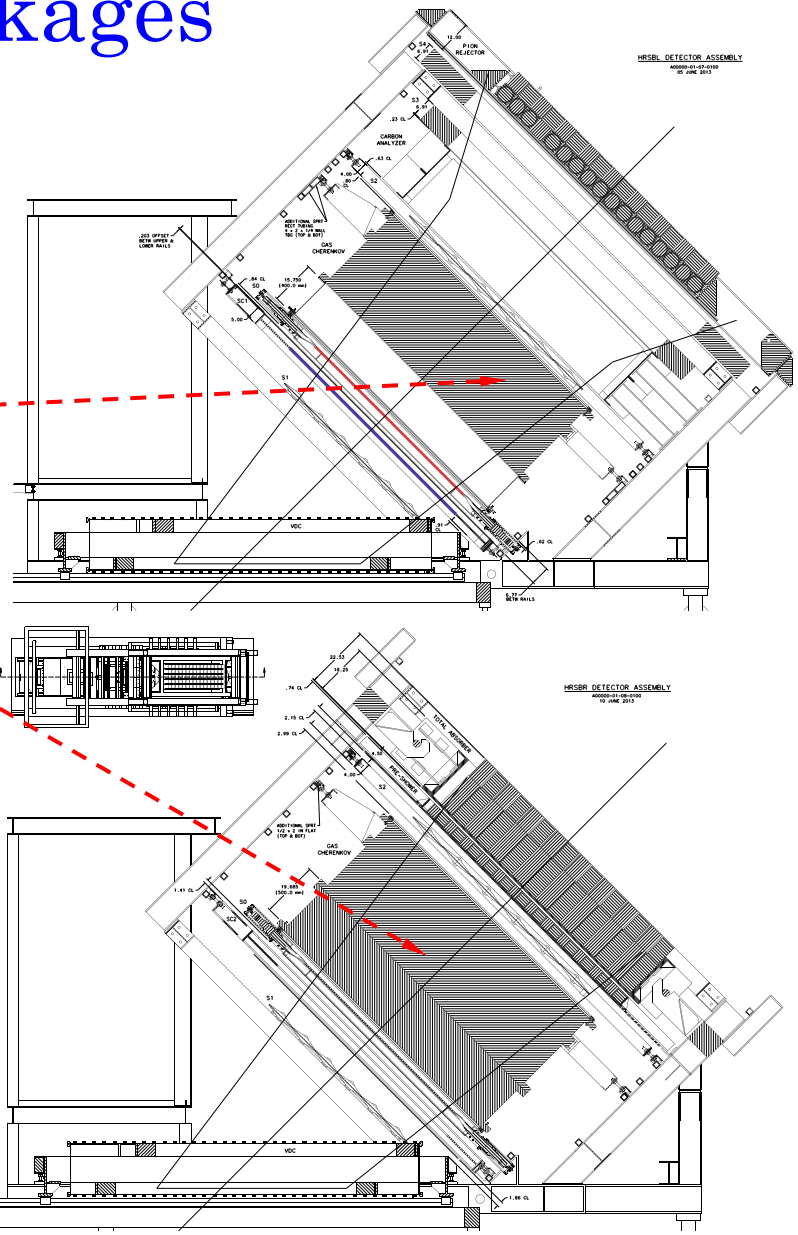
Detector Packages

VDC
S0 scintillator planes
S2

Gas Cherenkov

Lead-glass calorimeter

Straw chamber



ELSEVIER

Nuclear Instruments and Methods in Physics Research A 411 (1998) 223–237

NUCLEAR INSTRUMENTS & METHODS IN PHYSICS RESEARCH Section A

The CO_2 gas Cherenkov detectors for the Jefferson Lab Hall–A spectrometers

M. Iodice[a,*], E. Cisbani[a], S. Colilli[a], R. Crateri[a], S. Frullani[a], F. Garibaldi[a], F. Giuliani[a], M. Gricia[a], M. Lucentini[a], A. Mostarda[a], L. Pierangeli[a], F. Santavenere[a], G.M. Urciuoli[a], R. De Leo[b], L. Lagamba[b], A. Leone[c], R. Perrino[c], S. Kerhoas[d], I.C. Lugol[d], B. Mazeav[d], P. Vernin[d], A. Zaccarian[d]

[a] *Physics Laboratory, Istituto Superiore di Sanità and Sezione INFN Sanità, viale Regina Elena 299, I-00161 Roma, Italy*
[b] *Dipartimento Interateneo di Fisica e Sezione INFN Bari, via Amendola 173, I-70126 Bari, Italy*
[c] *INFN Sezione di Lecce, via Arnesano, I-73100 Lecce, Italy*
[d] *CEA - Saclay, France*

Received 12 December 1997

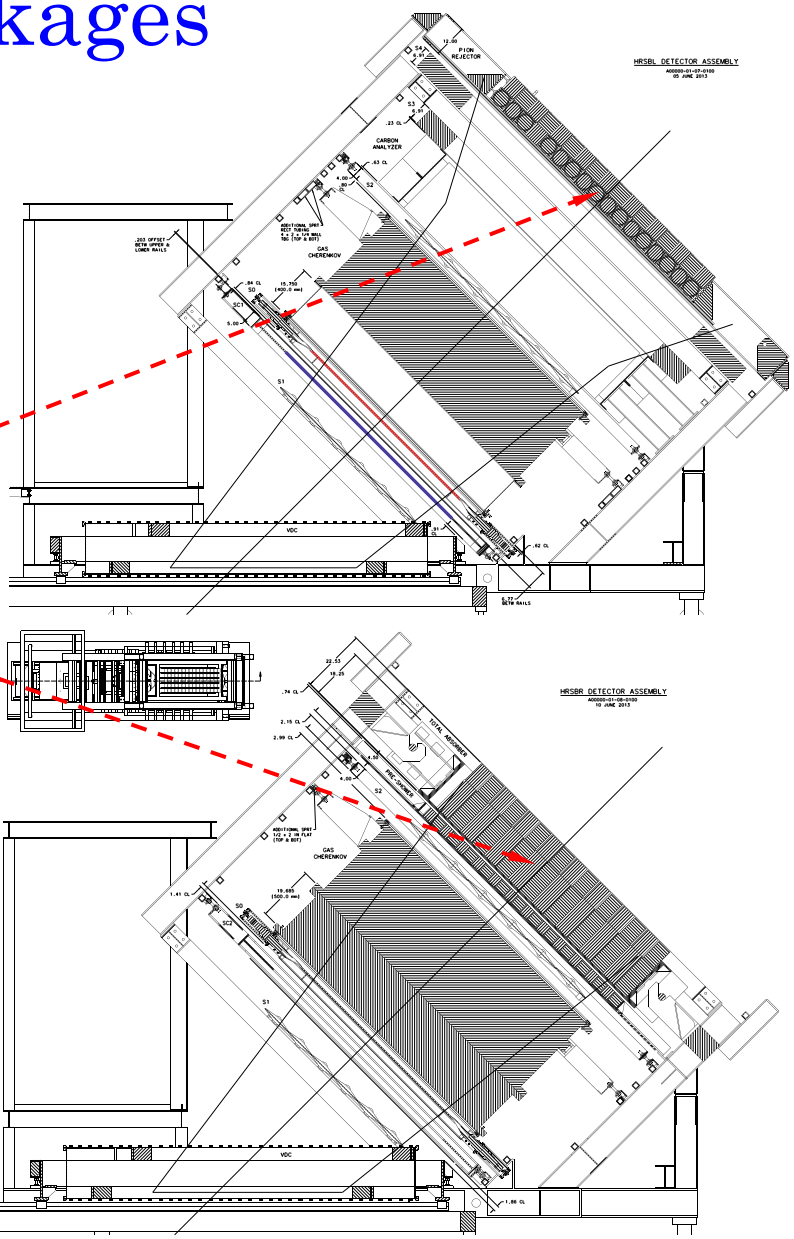
Detector Packages

VDC
S0 plane
S2 hodoscope

Gas Cherenkov

Lead-glass calorimeter

Straw chamber



Available online at www.sciencedirect.com
SCIENCE DIRECT
ELSEVIER
Nuclear Instruments and Methods in Physics Research A 522 (2004) 294–346
NUCLEAR INSTRUMENTS & METHODS IN PHYSICS RESEARCH Section A
www.elsevier.com/locate/nima

Basic instrumentation for Hall A at Jefferson Lab

J. Alcorn[a], B.D. Anderson[b], K.A. Aniol[c], J.R.M. Annand[d], L. Auerbach[e], J. Arrington[f], T. Averett[g], F.T. Baker[h], M. Baylac[a,i], E.J. Beise[j], J. Berthot[k], P.Y. Bertin[k], W. Bertozzi[l], L. Bimbot[m], T. Black[l,1], W.U. Boeglin[n], D.V. Boykin[o], E.J. Brash[p], V. Breton[k], H. Breuer[j], P. Brindza[a], D. Brown[j], E. Burtin[i], J.R. Calarco[o], L.S. Cardman[a], R. Carr[q], G.D. Cates[r,s], C. Cavata[i], Z. Chai[l], C.C. Chang[j], N.S. Chant[j], J.-P. Chen[a], S. Choi[e], E. Chudakov[a], S. Churchwell[t], M. Coman[n], E. Cisbani[u], S. Colilli[u], N. Colombel[i,s], R. Crateri[u], D.S. Dale[v], N. Degrande[w], C.W. de Jager[a,*], R. De Leo[x], A. Deur[a,k,s], G. Dezern[a], B. Diederich[y], S. Dieterich[z], R. di Salvo[k], P. Djawotho[g], J. Domingo[a], J.-E. Ducret[i], D. Dutta[l,t], K. Egiyan[aa], M.B. Epstein[c], S. Escoffier[i], S. Esp[a], L.A. Ewell[j], J.M. Finn[g], K.G. Fissum[l,ab], E. Folts[a], H. Fonvieille[k], B. Frois[i], S. Frullani[u], H. Gao[l,t], J. Gao[l,q], F. Garibaldi[u], A. Gasparian[v,ac], A. Gavalya[a], O. Gayou[g,l], S. Gilad[l], R. Gilman[a,z], F. Giuliani[u], A. Glamazdin[ad], C. Glashausser[z], J. Gomez[a], V. Gorbenko[ad], T. Gorringe[v], M. Gricia[u], K. Griffioen[g], D. Hamilton[d], J.-O. Hansen[a], F.W. Hersman[o], D.W. Higinbotham[a], R. Holmes[ae], H. Holmgren[j], M. Holtrop[o], N. d'Hose[i], E. Hovhannisyan[aa], C. Howell[t], G.M. Huber[p], E. Hughes[q], C.E. Hyde-Wright[y], H. Ibrahim[y], S. Incerti[e], M. Iodice[af], R. Iommi[u], D. Ireland[d], S. Jaminion[k], J. Jardillier[i], S. Jensen[q], X. Jiang[z], C.E. Jones[q], M.K. Jones[a,g], K. Joo[s,2], C. Jutier[k,y], W. Kahl[ae],

,...et al

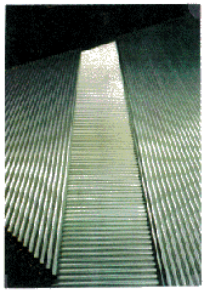
Detector Packages

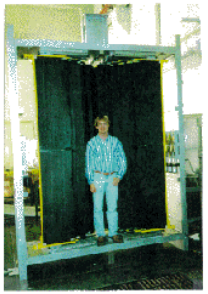
VDC
S0 plane
S2 hodoscope

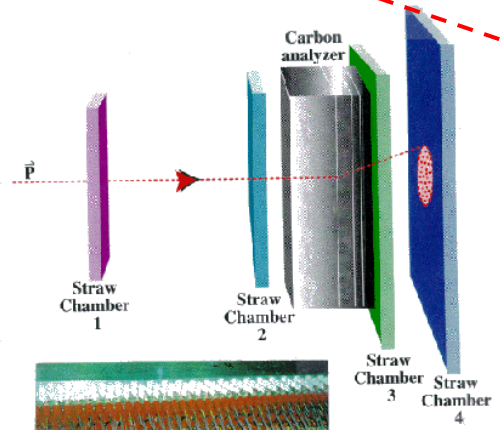
Gas Cherenkov

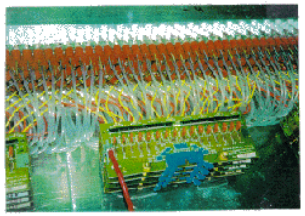
Lead-glass calorimeter

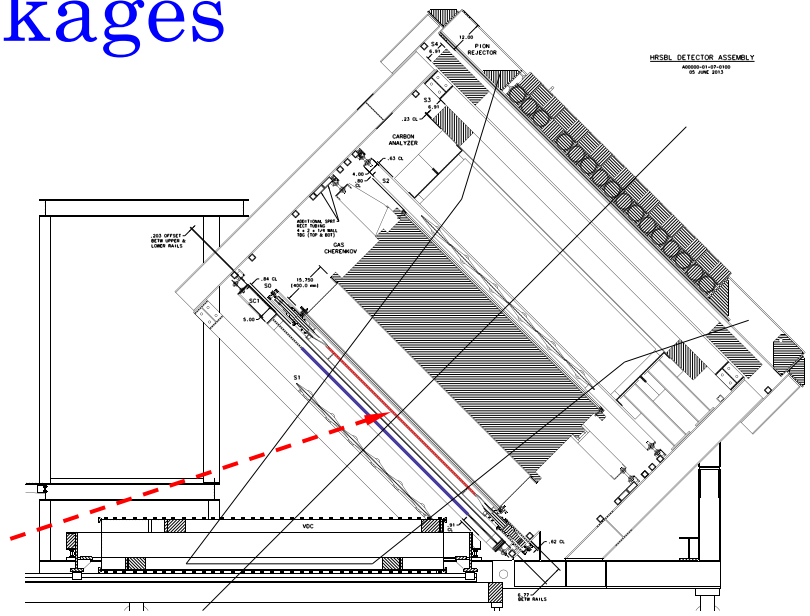
Straw chamber

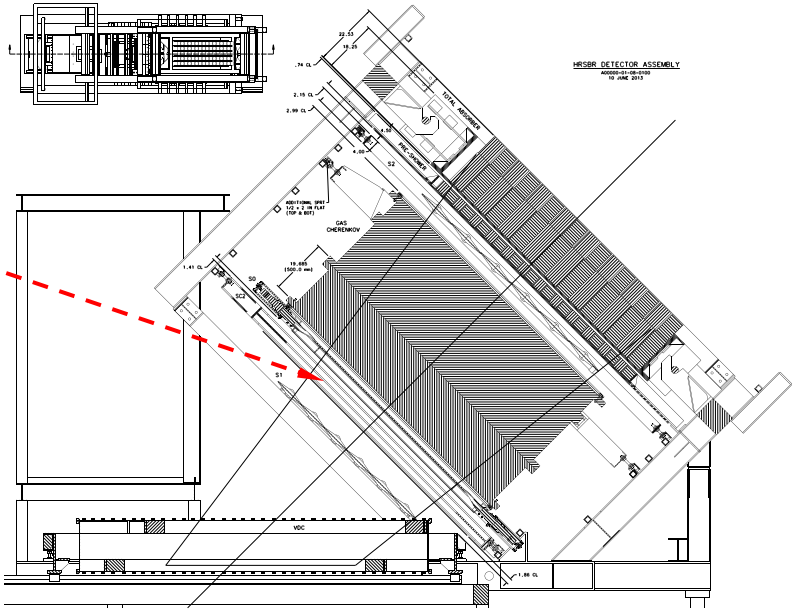












Status of Detector Checkout

VDC:

Front end electronics upgraded

HRS-L gas, DAQ restored and tested (cosmic rays)
HRS-R underway, to complete by 12/20

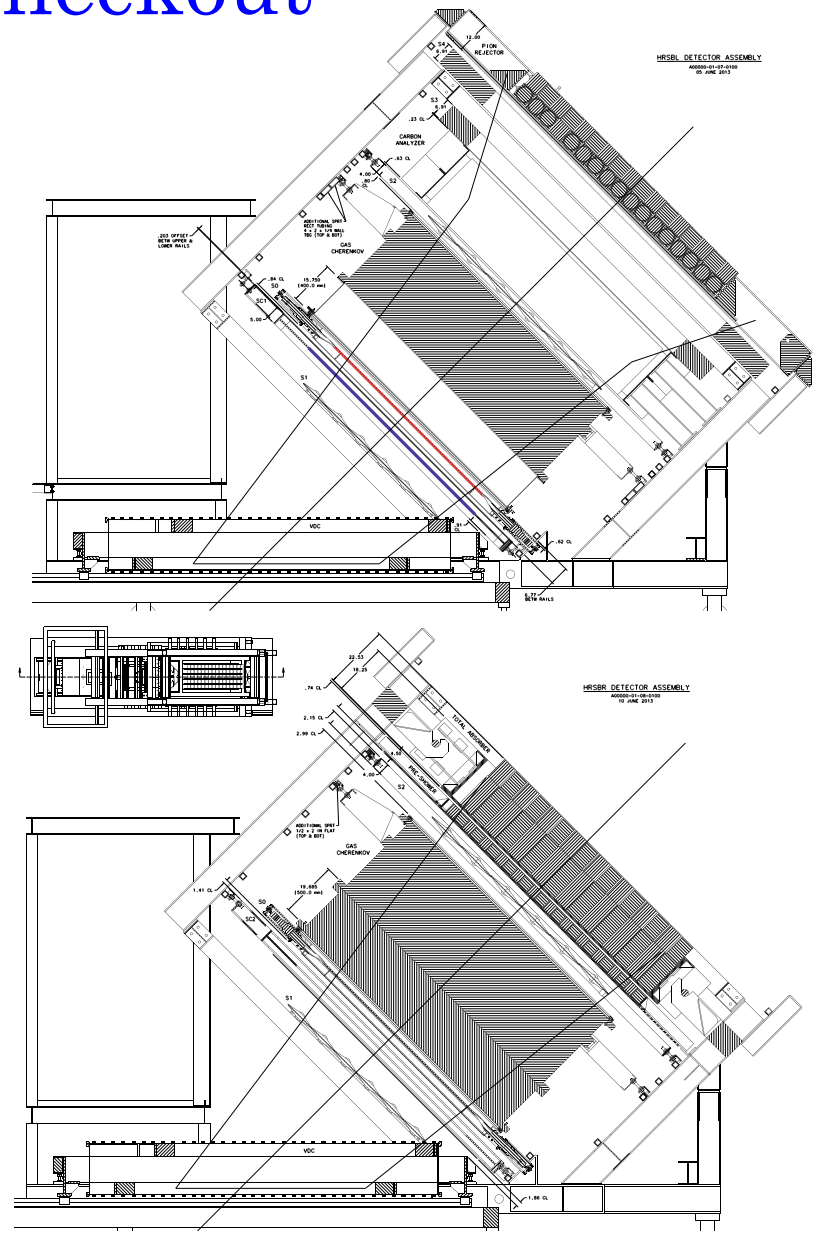
S0 plane: installation in progress (HRS-R in, needs adjustment, HRS-L not yet installed)

S2m: tested (cosmic rays, no DAQ last spring), HRS-L tested with DAQ, HRS-R underway

Gas Cherenkov: Checked mirror reflectivity
Coating PMTs with wavelength shifter
Re-installed HRS-R
Ready for installation of HRS-L
Cosmic preparation stage by mid January
Expect 10-15 photoelectrons per track

Lead-glass: cosmic testing underway HRS-L, sufficient approach for 5-10% tune
HRS-R cosmic tests to start before 12/20

Straw tubes: HRS-L cosmic tests to start this week
Needs data analysis GUI
HRS-R needs clean CO2 gas line



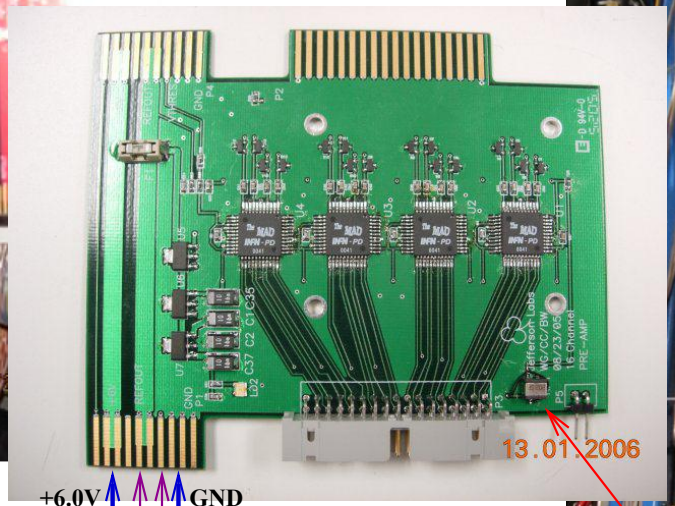
VDC Status

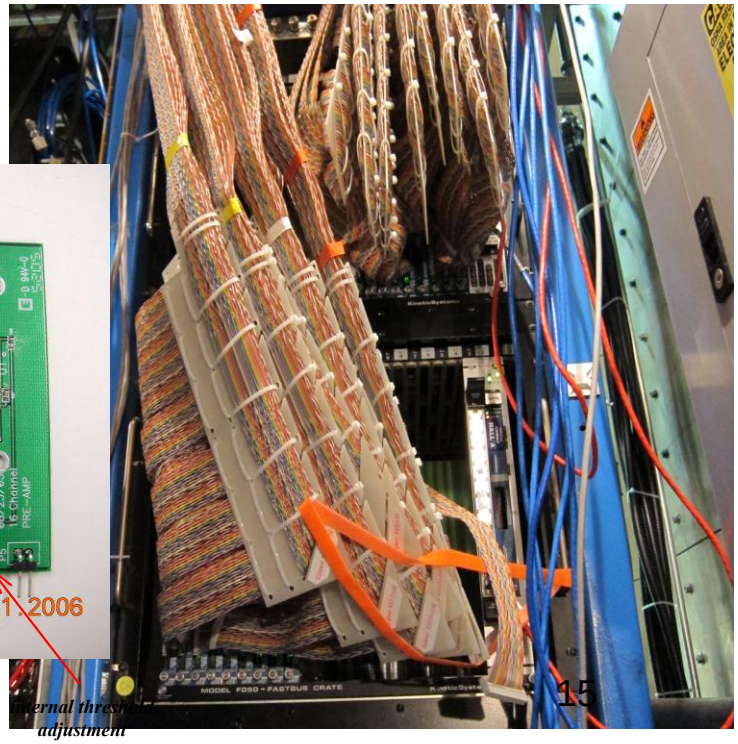
Amplifier discriminator card upgrade of the front-end electronics – installed cards and level translators and tested operation using cosmic rays with DAQ in both HRSs 9/2012 to 2/2013

The MAD card (used in G0, BigBite) has lower voltage of output logic pulse, less preamp noise, makes possible reduction of HV from 4 to 3.5 kV (allows higher track rate without aging), and reduction of the signal threshold

Very good stability against oscillation (reduced cross talk)

Subset tested in-beam during APEX test run





Detector checkout considerations for startup

- Two HRS spectrometers will be utilized in “Single Arm mode” (independent, not using coincidence triggers)
- All detectors will be on *months in advance* of beam delivery (Startup includes the detailed checklist, below.)
- Begin move back into counting house this month – DAQ based in hall currently (counting house upgrade, had to move out)
- Almost all tests will be prepared in advance using cosmic rays
- Cherenkov and Shower final calibration will require beam
- CODA3 tested some already

Initial detector tests

- Cosmic ray testing
  - VDC (full test)
  - Straw chamber (full test)
  - Scint. counters: S0, S2m (timing and amplitude)
  - Shower (timing and 20% amplitude calibration)
  - Gas Cherenkov (timing and single photo-electron peak)
- First beam on target
  - VDC (confirmation of rates, efficiency)
  - Straw chamber (the same)
  - Scint. counters: S0, S2m (confirmation)
  - Shower (< ~5% amplitudes/HV tune in hardware)
  - Gas Cherenkov (light collection measurement)
  - Move to tracking, trigger timing,…. as much as we can do!
- Test/adjustment of the software and DAQ in parallel

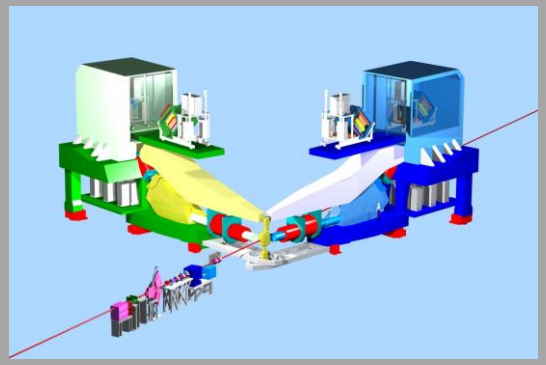
Table 1: HRS detector long checklist part A. Completed by . Date .

1	☐	The air cooling in the detector hut is operational
2	☐	Fresh air flow is turned on for PMTs on S0, S1 and S2m detectors, P ¿ 0.5 inches
3	☐	Each of the cooling fans (9 of them) is working in the electronics relay racks
4	☐	The cooling fan is working on the VME crate
5	☐	The cooling fan is working on the Trigger Supervisor crate
6	☐	Each of the cooling fans (4 of them) is working in the FastBus relay rack
7	☐	The cooling fans are working on the VDC level translator panel
8	☐	The cooling fan is working in the VME slow control VME crate
9	☐	Power to the front-end discs is turned ON for the S2m and cooling fans are operational.
10	☐	The control of the MLU (VME) unit for the trigger is operational (via GUI)
11	☐	The control of the HV crate for the detector is operational (via GUI)
12	☐	The internet connection to each of the three FastBus CPUs is operational (via GIU)
13	☐	The internet connection to the VME CPU is operational (via GIU)
14	☐	The internet connection to the Trigger Supervisor CPU is operational (via GIU)
15	☐	All high voltage and signal cables in the detector hut are secured
16	☐	The VDC gas flows are turned on at a level of 30 in the flowmeters
17	☐	The flow is seen from the exhaust bubblers/flowmeters
18	☐	The power supply is turned on for the VDC amplifier cards (+5V, 10A)
19	☐	The level translators (+5V and -5V), and the threshold control (+3V, 0.1A)
20	☐	The VDC HV power is set at 3.5 kV and the leakage current is below 0.01 μA

Table 2: HRS detector long checklist part B. Completed by . Date .

21	☐	The Straw chamber gas flow is turned on at a level of 45 in the flowmeter
22	☐	The pressure on the gauge is about 0.2 inches.
23	☐	The power supply is turned on for the amplifier cards and the threshold control.
24	☐	The AC power of the level translator box is ON.
25	☐	The Straw chamber HV power is set at 1.6 kV and
26	☐	the leakage current on each of the six lines is below 0.001 mA.
27	☐	Power to the front-end discs is turned ON for the S2m and cooling fans are operational.
28	☐	The S2m HV power is set at 1.6 kV settings and the current at each of the 32 channels is <1 mA.
29	☐	The S2m scaler rates are below 2 kHz in each of the 32 channels.
30	☐	The S0 HV power is set at 1.8 kV settings and the current in both channels is <1 mA.
31	☐	The S0 scaler rates are below 2 kHz.
32	☐	The Gas Cherenkov, GC, CO2 flow is turned ON at the level of 50 at the flowmeter.
33	☐	The GC HV power is set at 1.6 kV settings and the current at each of the 10 channels is <1 mA.
34	☐	The GC scaler rates are below 10 kHz in each of the 10 channels.

Date	Check performed	Check approved (B. Wojtsekhowski)



The Hall is Dynamic – Base Equipment a Minimum

- 3 A-rated experiments in first years of running
- G_M^p (HRS-R) and DVCS (HRS-L + calo) run is combined
- Some flexibility incorporated

16 mo. Shutdown

12 GeV Commissioning

Early Experiments

DVCS-I and G_M^p

Access to GPDs

EM Form Factor

Photon calorimeter to be installed on floor

^{3}H/^{3}He APEX/PREX (A1n)

d/u at High x

Requires tritium target, venting system and BigBite spectrometer

Dark photon A'/Neutron skin

Both require additional small angle septum magnets

Neutron spin structure

Polarized 3He target

SBS Experiments

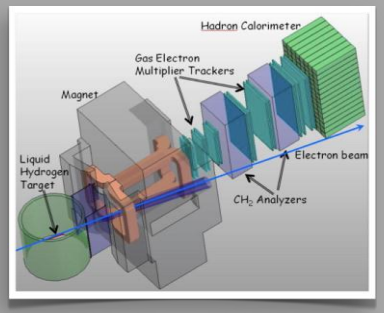
EM Form Factors at high Q^2

12 GeV Projects:

1. Moller polarimeter
2. Compton polarimeter
3. Energy measurement upgrade

SBS Project

SuperBigbite Spectrometer



Beam 1st to Hall A

11 GeV

FY 2013	FY 2014	FY 2015	FY 2016	FY 2017

commissioning beam

EXPERIMENT DESCRIPTION AND REQUIREMENTS

THE SUBMITTED INFORMATION IS CONSIDERED FROZEN. MODIFICATIONS TO THE EXPERIMENT SHOULD BE APPROVED BY THE DIVISION MANAGEMENT.

Experimental Hall: A

Experiment Number:	**Days Approved:** 100 days (88 beam + 12 overhead)
E12-06-114	**Estimated Installation Time:** Fall 2013
	Estimated Checkout Time: Fall 2014

Spokespersons:
A. Camsonne, C. Hyde, C. Munoz Camacho, J. Roche

Short (Technical) Description of the Experiment (max 100 words)

---The E12-06-114 experiment will need the same equipment successfully used during the previous experiments E07-007 and E08-025. The Left Hall A HRS will detect scattered electrons in DIS kinematics and the dedicated DVCS 208-channel PbF2 calorimeter will be used for photon detection.

We have kinematics at different beam energies (6.6, 8.8 and 11 GeV) with beam currents varying from 2 to 25 uA depending on the setting.

The current calorimeter stand needs to be modified in order to reach some small angle settings, and some additional shielding is required around the beamline.

An upgrade of the coincidence trigger module is currently underway at LPC-Clermont (France).

List Beam Energies and Beam Days: (e.g. 30 Days at 11 GeV, 20 Days at 8 GeV)

8 days at 6.6 GeV, 35 days at 8.8 GeV and 45 days at 11 GeV

List Range of Beam Currents: (e.g. 10-60 μA)

2-25 μA, longitudinally polarized beam (>75%).

Base Equipment Used
(including description of conditions)

- Hall A Left HRS with electron package configuration, including VDC, Cerenkov counter with its long extension, pion rejector, S1 and S2 scintillators.
- Hall A DVCS Calorimeter.
- DVCS DAQ sampling ("ARS") system and coincidence trigger electronics.

Modifications to Base Equipment
(or use of base equipment with different conditions)

- Modification of DVCS calorimeter stand in order to reach smaller angles than previous E07-007/E08-025.
- Addition of beamline shielding.
- Upgrade of coincidence trigger module (performed at LPC-Clermont).

- Experiments looking forward to physics start!
- Submitted draft beam request
- DVCS trigger review expected Spring 2014
- Calorimeter install Summer 2014 (in test lab now)
- Beam request to run Fall 2014