

SANE Status - 8/2006

- Ten collaboration meetings: 11/03; 3/- 6/- 9/- 11/04; 1/- 4/- 9/- 12/05, 5/06
- Latest meeting at UVA reviewed subsystems status
- Hall C schedule update:
 - 9/04: SANE tentatively to run in 2007
 - 12/05: SANE delayed to 2008
 - current: SANE tentatively to start in 4/2008
- Time lines show adequate lead time for 2008 run
- Expected beam energy < 5.8 GeV
- Need to discuss submitting a beam time request by the Sept. 15 deadline.

Hall C Status (from R. Ent)

Hall C Research Program



- Have been running experiments since November 1995
- 613 PAC Days run, or 29.7 experiments (*up to March 15, 2006*)
(If 94 days "lost" in PAC jeopardy process are included ~ 70 PAC days/year)
- 308 +27 PAC Days in queue, or 13.6 experiments
27 days Conditionally Approved (CA), and 34 additional GO-Backward days included here.
(almost all large-scale installation experiments)
(Backlog: 4.8 Years, without Qweak Phase II)

Hall C Approved Experiment Summary



Base Equipment Experiments (2.6 experiments, 25 days):

E04-001	Measurements of F_2 and R on Nuclear Targets	3 days (0.6)	B+
E05-017	Measurement of Two-Photon Exchange in Unpolarized Elastic e-p Scattering	13 days	A-
E06-009	Measurement of $R = \sigma_L/\sigma_T$ on Deuterium in the Nucleon Resonance Region and Beyond	9 days	A-

Large Installation Experiments beyond HKS (11 experiments, 274+ days)

E04-115	GO Backward Angle Measurements	70 days	A
E04-101	Measurement of the PV Asymmetry for the N- Δ	0 days	B+
E06-008	GO Backward Angle Measurements (II)	(68) days	A
E04-108	Measurement of G_E^p/G_M^p to $Q^2 = 9 \text{ GeV}^2$	40 days	A
E04-019	Measurement of the Two-Photon Exchange Contribution in e-p Elastic Scattering Using Recoil Polar.	18 days	A-
E03-109	Spin Asymmetries on the Nucleon Experiment	27 days (CA)	A-
E04-113	Semi-Inclusive Spin Asymmetries on the Nucleon	25 days	A-
E05-101	Helicity Correlations in Wide-Angle Compton Scattering	14 days	A-
E05-008	The Qweak Experiment: A Search for Physics at the TeV Scale via a Meas. of the Proton's Weak Charge	35 days	A
E04-110	The Neutron Electric Form Factor at $Q^2 = 4.3 \text{ GeV}^2$ from the D(e,e'n) Reaction via Recoil Polarimetry	25 days	A-
E05-115	Spectroscopic Investigation of Hypernuclei in ... (II)	20 days	A-

Color coding indicates experiments using similar apparatus

JLab Long term schedule

Assumptions:

- Look at years from 2007 to July (*now December*) 2010
- Qweak **shall** run before 12-GeV shutdown
- Also incorporate GEp-III, SANE, HKS/HES
- 5.7+ GeV only available Late 2007
- More weeks operations last year to facilitate Qweak Phase II

Started from these assumptions a rough Hall C schedule was made, including manpower requirements, that was circulated amongst the other Halls and Accelerator Division for feasibility/conflicts.

We have only just started on a first iteration.

The laboratory is intellectually committed, subject to total DOE-funding to do the best 6-GeV physics experiments before the 12-GeV down time. Qweak is viewed as "must-do" 6-GeV physics, with nice ties to the upcoming parity-violating 12-GeV program. GEp-III, SANE, and HKS/HES are similarly viewed as high-priority pre-12 GeV programs.

Hall C Planned Experiments to 2010

2006	E04-115	GO-Backward Angle Physics Run, E = 687 MeV
	E06-008	GO-Backward Angle Physics Run, E = 362 MeV
2007	E04-001	$R = \sigma_L/\sigma_T$ in A up to $Q^2 = 4$ (JUPITER)
	E06-009	$R = \sigma_L/\sigma_T$ in D up to $Q^2 = 4$
	E05-017 (*)	2γ Exchange in ep Rosenbluth Separation
	E04-019 (*)	2γ Exchange in ep Polarization Transfer
	E04-108	G_E^p/G_M^p up to $Q^2 = 9$ (GEp-III)
2008	E03-109	Spin Asymmetries on the Nucleon Exp. (SANE)
	E04-113 (*)	Semi-Inclusive Spin Asymmetries (semi-SANE)
	E05-101 (*)	Helicity Correlations in Wide-Angle Compton
	E05-115	Hypernuclear Spectroscopy (HKS/HES)
2009	E05-008	Qweak Experiment - Installation and Phase I
2010	E05-008	Qweak Experiment - Phase II
2010+?	E04-110 (*)	G_E^n at $Q^2 = 4.3$ (8.0) from the ${}^2\text{H}(e,e'n)$ Reaction

(*) not clear yet whether schedule constraints will preclude some of these..., need to see next iteration of long-term schedule.

Draft Schedule 2007-2008

→ 02/18/07 E06-008 GO-Backward Angle Physics Run, E = 362 MeV

Hall Reconfiguration

03/24/07	E04-001	R = σ_L/σ_T in A up to $Q^2 = 4$ (JUPITER)	}
	E06-009	R = σ_L/σ_T in D up to $Q^2 = 4$	
→ 05/24/07	E05-017 (*)	2 γ Exchange in ep Rosenbluth Separation	

Hall Reconfiguration

07/23/07	E04-019 (*)	2 γ Exchange in ep Polarization Transfer
→ 02/19/08	E04-108	G_E^p/G_M^p up to $Q^2 = 9$ (GEp-III)

Hall Reconfiguration

**5.7 GeV
start 10/07**

04/01/08	E03-109	Spin Asymmetries on the Nucleon Exp. (SANE)
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- 1) This assumes funding at restored FY05 levels (i.e., no Summer down).
- 2) Complicated (Jigsaw) schedule due to constraints for L/T's, also in Hall A (CSR).
- 3) Tentatively, E05-017 and E04-019 lucked out and on draft schedule.

SANE Physics

- Measure **proton** spin structure function $g_2(x, Q^2)$ and spin asymmetry $A_1(x, Q^2)$ at four-momentum transfer $2.5 \leq Q^2 \leq 6.5 \text{ GeV}^2$ and Bjorken x $0.3 \leq x \leq 0.8$

**REPORT TO THE
NUCLEAR SCIENCE ADVISORY
COMMITTEE**

**Submitted by the
SUBCOMMITTEE ON PERFORMANCE
MEASURES**

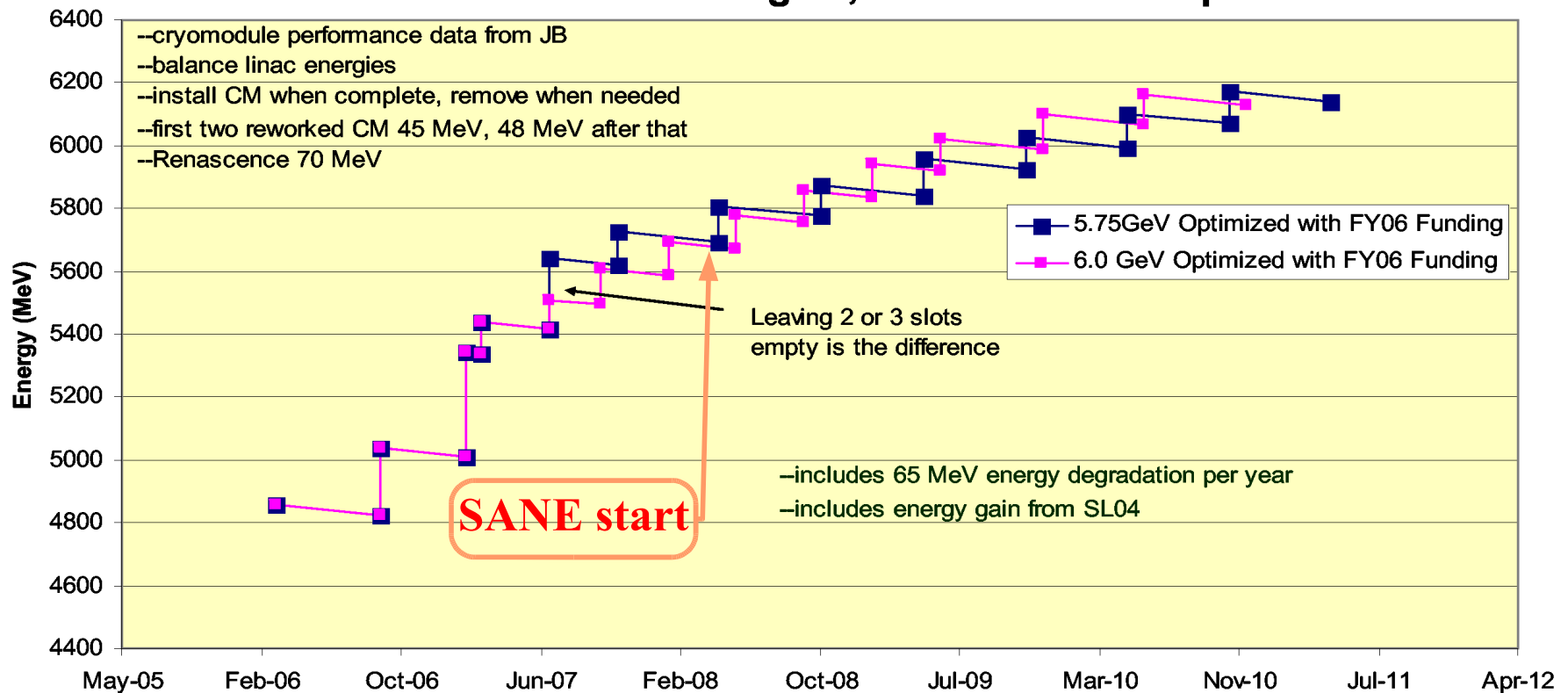
November 18, 2003

2011	<u>Measure the lowest moments of the unpolarized nucleon structure functions (both longitudinal and transverse) to 4 GeV^2 for the proton, and the neutron, and the deep inelastic scattering polarized structure functions $g_1(x, Q^2)$ and $g_2(x, Q^2)$ for $x=0.2-0.6$, and $1 < Q^2 < 5 \text{ GeV}^2$ for both protons and neutrons.</u>
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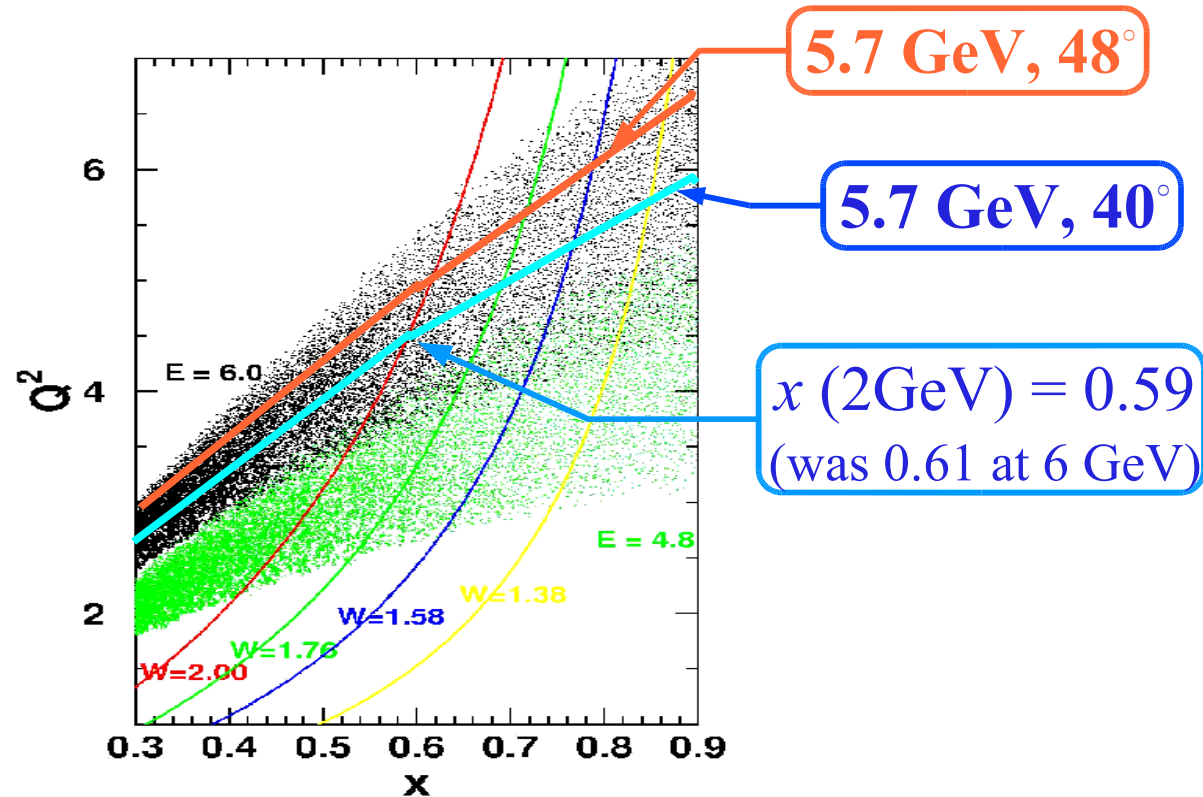
- Meets or Exceeds DOE 2011 Milestone for Proton Spin Structure, IF
 - **SANE takes data no later than 2008**

CEBAF energy

CEBAF Energy Projection 2006-2009 Balanced Linac Energies, 5.75 or 6.0 GeV Optimized



SANE Kinematics



- Two beam energies: 6 GeV (now ~ 5.7 GeV), 4.8 GeV
- Very good high x coverage at 6 GeV with detector at 40°
 - need 45° for same $x(\text{DIS})$ with 5.7 GeV.
 - but BETA's rates will be greater

Beam Time Request

	Energy	θ_N	Time (h)	
Production	6.0	180	100	
	6.0	80	200	
	4.8	180	70	
	4.8	80	130	
	2.4	-	10	
Systematics	Packing Fraction		20	
	Mollers		21	
	Total beam time		551	(23 d)
Overhead	Anneals		62	
	Energy Change		48	
	Target Rotation		48	
	Stick Changes		48	
	Total Overhead		206	(9 d)
	Requested Time		654	(27 d)

BigCal elastic $e-p$ calibration

- Garth Huber's preliminary study
 - two-pass (2.3 GeV) beam
 - three target field conditions: 0° , 180° and OFF
 - symmetric 40° BETA position relative to field saves calibration with 80° field
 - field off covers band of 27 to -27 cm about BigCal's middle ~ 14 rows
 - no need for target polarization allows use of $1 \mu\text{A}$ beam
 - need ~ 2 PAC days

Target field off kinematics - 180° configuration

Approximate coincidence rates per crystal, assuming $1 \mu\text{A}$ on 3 cm target

Electron beam energy: 2.317 GeV

$\theta_{e'}$	Q^2	$E_{e'}$	θ_p	P_p	$d\sigma(\text{nb/sr})$	Hrs/(400coin/crystal)
29.1	1.03	1.77	-48.0	1.16	14.	0.2
32.2	1.20	1.68	-45.0	1.27	7.0	0.4
35.5	1.37	1.59	-42.0	1.38	3.6	0.9
39.2	1.55	1.49	-39.0	1.50	1.8	1.6
43.3	1.75	1.39	-36.0	1.62	0.9	3.1
47.9	1.95	1.28	-33.0	1.74	0.46	6.4

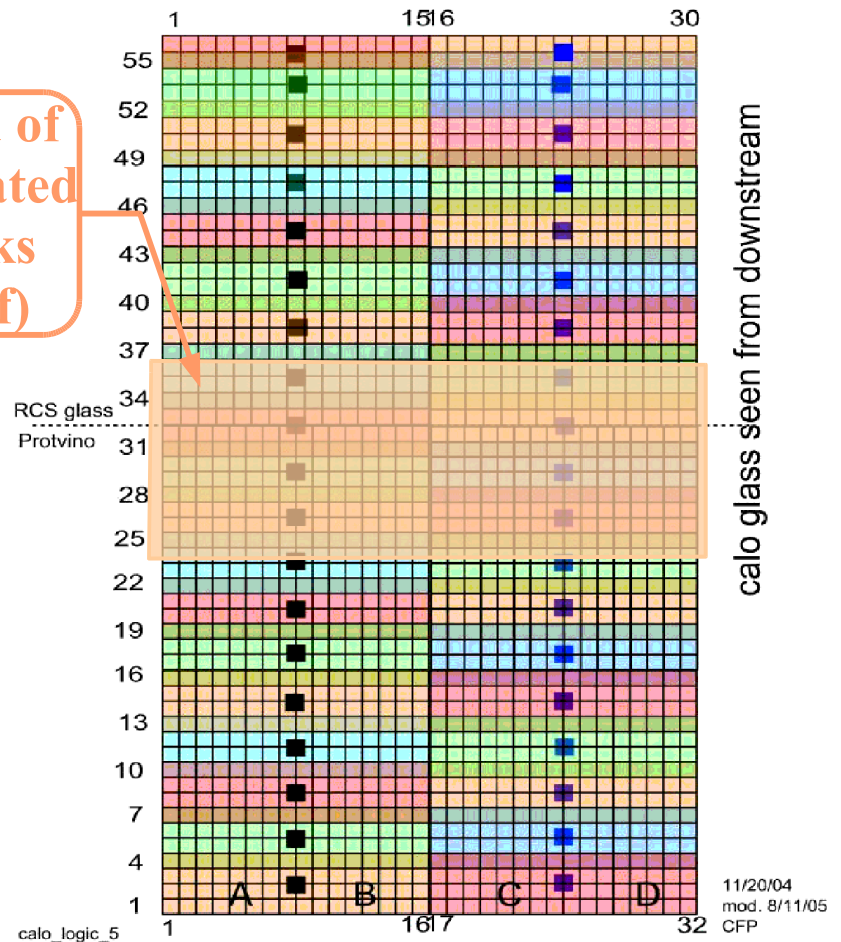
Target field vertical deflections and accurate coincidence rates require a SIMC simulation, to be done later.

CONCLUSIONS:

1. The HMS will require a target viewing window from 31° - 50° , plus allowance for proton deflection in the target field.
2. In the field-on calibration, the electron vertical deflection is approximately 30 cm, so some blocks away from the center can be calibrated. The band of calibrated off-center blocks could be doubled by a second run with reversed target field.
3. If we aim for 400 coincidences per crystal for all settings, the full scan can be completed in about 13 hours (at 100% efficiency). Folding in the standard 60% efficiency, this is 21 hours of real beam time. Including set-up and two scans with reversed and off target field gives a total of 2-3 days at this beam energy.
4. This is somewhat more than the 1 day (folding in efficiency) requested for this purpose in Table 10 of the proposal, although probably only one scan was planned then.

BigCal elastic $e-p$ calibration

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 - field off covers band of 27 to -27 cm about BigCal's middle ~ 14 rows
 - no need for target polarization allows use of $1 \mu\text{A}$ beam
 - need ~ 2 PAC days
 - working on full simulation



Beam Time Request

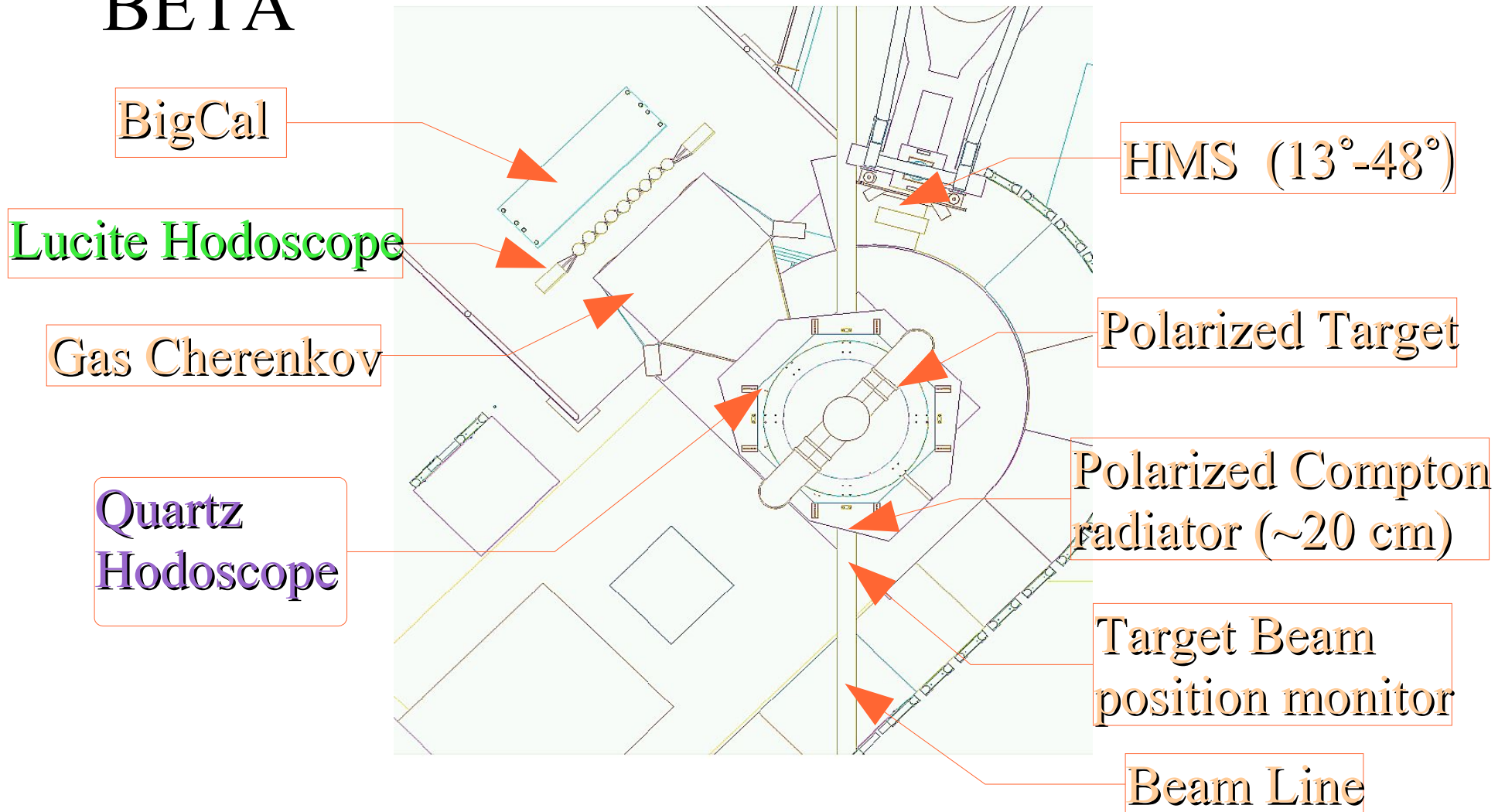
	Energy	θ_N	Time (h)	
Production	2.3	off, 0, 180	40	
	4.6	180	70	
	4.6	80	130	rotate
	5.7	80	200	
	5.7	180	100	rotate
Systematics	Packing Fraction		20	
	Mollers		21	
	Total beam time		581	(23 d)
Overhead	Anneals		62	
	Energy Change		48	
	Target Rotation		48	
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SANE Current Design (8/06)

BETA



SANE Status - Open Issues

- Backgrounds and their reduction:
 - from beam line: detailed simulation and shielding design:
 - Pavel Degtiarenko provided us with latest version of .MCWORKS code
 - available for all at SANE's /group/c-e03109 disk space
- Update of SANE and BETA's GEANT
 - Glen Warren's code available on SANE's /group disk
- Target material: $^{14}\text{NH}_3$. UVA studying improvements to freezing methods.
- Target platform design, integration with BETA stands in the works with Hall C engineering and design group, Temple, UVA and Hall C physics providing input

Cherenkov Update

I am truly sorry I cannot attend the meeting.

To bring you up to date with respect to the Cherenkov counter progress:

We are waiting to receive the frame which should be fairly soon according to our purchase order.

We have made progress on all the peripheral elements like mirror mounts, phototube mounts, mu metal shields, readout control of temperature and pressure for the gas system.

- We made a leak test of all the phototube mounts and the setup is very stable.
- We have therefore ordered all the necessary gaskets for the tube mounts.
- We have been talking to a company in regard to the front and back windows.
- The spherical mirrors substrates have been ordered from Glass Eagle and we are waiting to receive them.
- The cylindrical mirrors are not yet ordered.
- The mirrors deposition will be performed at CERN in December, 2006-January 2007.

Zein-Eddine