Hall A Target Configuration

HAPEX III and PVDIS

Revision History

1. August 18, 2009: Original document.
2. August 21, 2009: Adjusted Cryotarget BDS positions table
3. August 24, 2009: Added cryotarget cell thickness data
4. August 27, 2009: Added corrected target BDS positions to the cryostack data
5. November 20, 2009: Changed PVDIS dummy target thickness and positions and corrected thickness uniformity.

Overview

This document describes the Hall A target configuration for the run period beginning in August 2009. The HAPEX III experiment starts with a water cell active and the cryogenic target warm. The entire water cell solid target ladder is replaced with the standard solid target ladder before the cryogenic target is cooled. The following tables list the available targets and their BDS (lifter) positions for each running period.

Water Cell Installed

This table lists the targets installed with the water cell. The cryotarget cells are not permitted in the beam in this configuration. The current limits are lower for all targets as well.

Water Cell BDS Positions

Target	Description/Material	BDS Encoder Position	Corrected Encoder Position	BDS Enabled
Loop 1 Cell	20 cm He	32975295		Not Allowed
Loop 2 Cell	20 cm He	25335001		Not Allowed
Loop 3 Cell	25 cm H2	17638361		Not Allowed
Optics Target	Carbon foils O,±7.5,±15	12674495		Yes
Dummy Target Hole	Aluminum Foils 2 mm hole	12024255		Yes
Dummy Target	Aluminum Foils ±12.5 cm	11699135		Yes
BeO Viewer	BeO Foil	9277410		Yes
Thin Tantalum	Tantalum foil	7651810		Yes
Empty	N/A	6026210		Yes

Not Allowed		4400610		Yes
H2O Cell	H2O	2775010		Yes

No Water Cell

This is the normal cryotarget configuration. The hydrogen cell is allowed. At the start of the experiment, the hydrogen cell is assumed to be Loop 3.

Cryo Target BDS Positions

Target	Description/Material	BDS Encoder Position	Corrected Encoder Position	BDS Enabled
Loop 1 Cell	20 cm He	32975295	33077695	No
Loop 2 Cell	20 cm He	25335001	25437401	No
Loop 3 Cell	25 cm H2	17638361	17740761	Yes
Optics Target	Carbon foils O,±7.5,±15	12674495	12776895	Yes
Dummy Target Hole	Aluminum Foils 2 mm hole	12024255	12126655	Yes
Dummy Target	Aluminum Foils ±12.5 cm	11699135	11801535	Yes
Carbon Hole	Carbon Foil 2mm Hole	8952290	9054690	Yes
Thin Tantalum	Tantalum foil	7489250	7591650	Yes
Thick Tantalum	Tantalum foil	6026210	6128610	Yes
BeO	BeO	4563170	4665570	Yes
Empty	Empty	3100130	3202530	Yes

Standard Solid Target Ladder

The standard solid target ladder is installed when the water cell is not. The following table lists the solid targets and their thicknesses. Errors reported are systematic and assume that the foil is of uniform thickness and density (that there are no voids in the material). The standard solid target ladder is shown in JLAB drawing TGT-101-5000-3001.

Target Name	Material	Purity	Thickness (g/cm^2)
Carbon Hole	Carbon	99.95%	0.08388 ± 0.00012
Tantalum Thin	Ta	99.9%	0.021487±0.000078
Tantalum Thick	Ta	99.9%	0.12237±0.000341
BeO	BeO	99.0%	0.149 ± 0.001

Water Cell Target Ladder

The water cell ladder is only installed when the water cell is in operation. The ladder has different spacing and positions to accommodate the water cell.

Target Name	Material	Purity	Thickness (g/cm^2)
BeO	BeO	99.0%	0.149 ± 0.001
Tantalum Thin	Ta	99.9%	0.021487±0.000078
Empty	n/a	n/a	n/a
H2O cell	H2O	99.9%	~5 mm

Optics target thicknesses

The optics target consists of 5 carbon foils cut from the same sheet. The foils are 99.5% chemically pure carbon. Each foil is 0.042 ± 0.001 g/cm^2. Upstream face of each foil is located at 0 cm, ±7.5 cm and ± 15 cm. The optics target is shown in JLAB Drawing TGT-101-5000-3002.

Dummy Target

The dummy target has foils placed such that the front faces of the foils are ± 12.5 cm from the nominal target center point for HAPEX and ± 10 cm for PVDIS. The target foils and assembly are shown in JLAB drawing TGT-101-5000-3003. The thickness of these foils varies with experiment. The HAPEX foils are nominally 0.055 in thick and the PVDIS foils are slightly thicker at 0.065 in. The following table gives their thicknesses in detail. A 2 mm hole is provided in each foil to locate the target with the beam and determine the target vacuum and cryo motion. It is recommended that the user adjust the beam and target position using the drawing and survey data. The target foils are made from AL 7075 T-6 plate (this is the same as the cell).

Target	Position	Thickness (g/cm^2)
HAPEX	Upstream -12.5 cm	0.401±0.00022
	Downstream + 12.5	0.378±0.00021
PVDIS	Upstream -10 cm	0.359±0.0003
	Downstream + 10	0.367±0.0003

Measurements do not take into account any void in the material. The measurement assumes that the material free of void and is of uniform thickness. The thickness uniformity was measured on both foils and found to be within 0.05 cm.

25 and 20 cm Cells

The target cells are installed at the top of the stack. Loops 1 and 2 are 20 cm long cells that have seen use in Hall A in the past. The 25 cm cell, which is installed on loop 3 is new. Each cell is made from aluminum alloy Al 7075-T6. This alloy is not pure aluminum. A mill test report for the material used in the 25 cm cell is in this DocuShare directory. The other cells will have very similar chemical compositions. Loops 2 and 3 are assembled with Ti Gr5 fasteners. Loop 3 cell block has Ti helicoils.

The cell thicknesses are measured with a MagnaMike Hall Effect gauge. The thickness data for Loops 1 and 2 are given in the first table below. An average of many shots is taken for each position. The first error reported is the standard deviation of this average and the second is a systematic error from the calibration of the instrument.

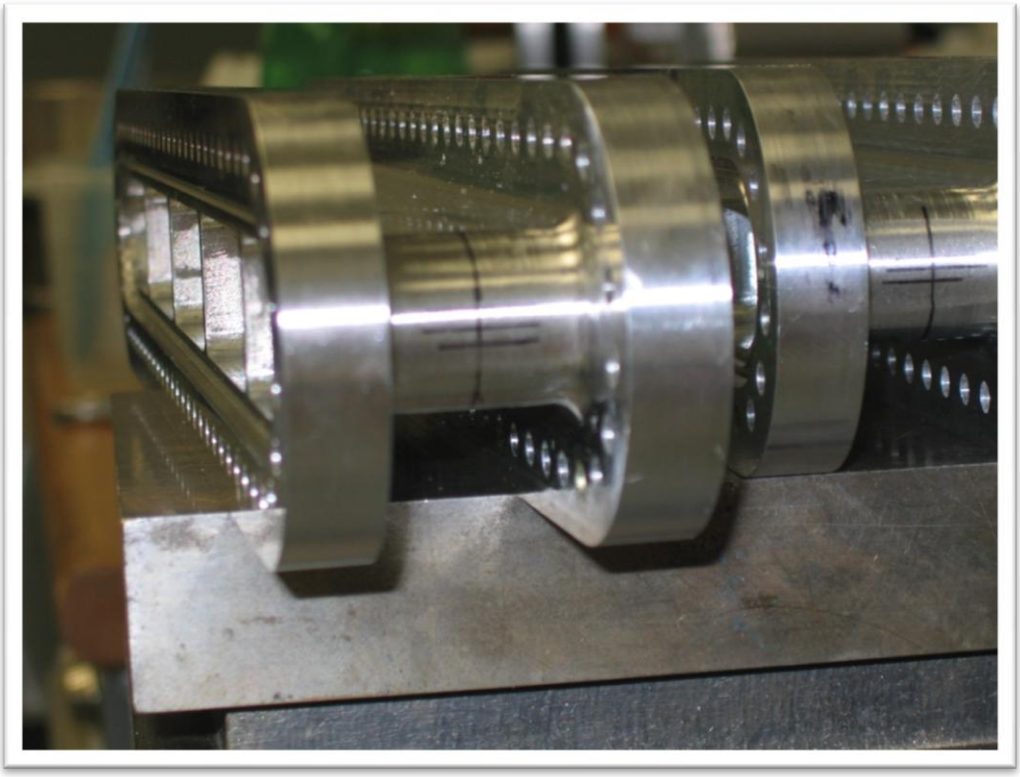
Target	Position	Thickness (mm)
Loop 1	Entrance	0.126±0.011±0.003
	Exit	0.100±0.008±0.003
	Beam left upstream	0.313±0.008±0.003
	Beam left middle	0.317±0.002±0.003
	Beam left downstream	0.323±0.003±0.003
	Beam right upstream	0.340±0.002±0.003
	Beam right middle	0.336±0.007±0.003
	Beam right downstream	0.313±0.008±0.003
Loop 2	Entrance	0.008±0.020±0.005
	Exit	0.180±0.010±0.005
	Left side	0.262±0.005±0.005
	Right side	0.249±0.005±0.005

Loop 1 and 2 Cell thicknesses. First error is standard deviation of average second is systematic from calibration data

25 cm cell

The 25 cm cell was measured, using the same instrument, in more places on the end caps and sides. A 2 mm grid was drawn on the end caps of the cell. Many shots were recorded inside each of the grid squares. An average of these shots and standard deviation are recorded in the table below. The systematic error is 0.002 mm in all cases and results from the calibration of the device. The cell is labeled #2. A picture of the grid on one end of a cell is shown in the figure.

Position	Location	Thickness (mm)
Entrance	Top beam left	0.116±0.002
	Top beam right	0.113±0.004
	Bottom beam left	0.119±0.001
	Bottom beam right	0.122±0.002
Exit	Top beam left	0.150±0.003
	Top beam right	0.149±0.002
	Bottom beam left	0.151±0.002
	Bottom beam right	0.151±0.002
Beam left side	Upstream	0.228±0.005
	Middle	0.225±0.025
	Downstream	0.227±0.020
Beam right side	Upstream	0.202±0.005
	Middle	0.225±0.030
	Downstream	0.248±0.050



Pictures

Pictures are included in the DocuShare folder containing this document.