510(k) SUBSTANTIAL EQUIVALENCE DETERMINATION
DECISION SUMMARY
ASSAY AND INSTRUMENT COMBINATION

A. 510(k) Number:

K183592

B. Purpose for Submission:

New Device

C. Measurand:

Cluster of Differentiation (CD) Surface Markers on white blood cells

D. Type of Test:

Immunophenotyping, qualitative, flow cytometric assay

E. Applicant:

Beckman Coulter Inc.

F. Proprietary and Established Names:

Trade Name: ClearLLab 10C Panels (B, T, M1, M2)
Common Name: ClearLLab

Instruments: Navios Flow Cytometer
Navios EX Flow Cytometer

G. Regulatory Information:

1. Regulation section:

   21 CFR 864.7010 − Flow Cytometric Test System for Hematopoietic Neoplasms
   21 CFR 864.5220 – Automated Differential Cell Counter

2. Classification:

   Class II

3. Product code:

   PWD−Flow Cytometric Test System for Hematopoietic Neoplasms

OYE−Flow Cytometric Reagents and Accessories

4. Panel:

   81–Hematology

H. Indications For Use:

1. Intended uses:

   ClearLLab 10C Panels (B, T, M1, M2)

   The ClearLLab 10C Panels are intended for in vitro diagnostic use for qualitative identification of cell populations by multiparameter immunophenotyping on the Navios and Navios EX flow cytometers. These reagents are used as an aid in the differential diagnosis of hematologically abnormal patients having, or suspected of having, the following hematopoietic neoplasms: chronic leukemia, acute leukemia, non-Hodgkin lymphoma, myeloma, myelodysplastic syndrome (MDS), and/or myeloproliferative neoplasms (MPN). The reagents can be used with peripheral whole blood (collected in K2EDTA, Acid Citrate Dextrose (ACD) or Heparin), bone marrow (collected in K2EDTA, ACD or Heparin) and lymph node specimens. Interpretation of the results should be confirmed by a pathologist or equivalent professional in conjunction with other clinical and laboratory findings.

   These reagents provide multiparameter, qualitative results for the surface antigens listed below:

   - ClearLLab 10C B Cell Tube: Kappa, Lambda, CD10, CD5, CD200, CD34, CD38,CD20, CD19, CD45
   - ClearLLab 10C T Cell Tube: TCRγδ, CD4, CD2, CD56, CD5, CD34, CD3, CD8, CD7, CD45
   - ClearLLab 10C M1 Cell Tube: CD16, CD7, CD10, CD13, CD64, CD34, CD14, HLA-DR, CD11b, CD45
   - ClearLLab 10C M2 Cell Tube: CD15, CD123, CD117, CD13, CD33, CD34, CD38, HLA-DR, CD19, CD45

   Navios Flow Cytometer

   The Navios Flow Cytometer is intended for use as an in vitro diagnostic device for immunophenotyping using up to ten fluorescent detection channels using three lasers (488 nm, 638 nm, and 405 nm) and two light scatter detection channels. It is intended for use with in vitro diagnostic (IVD) assays and software that are indicated for use with the instrument.

   Navios EX Flow Cytometer

   The Navios EX Flow Cytometer is intended for use as an in vitro diagnostic device for immunophenotyping using up to ten fluorescent detection channels using three lasers (488 nm, 638 nm, and 405 nm) and two light scatter detection channels. It is intended for use with

in vitro diagnostic (IVD) assays and software that are indicated for use with the instrument.

2. Indications for use: same as Intended Uses

3. Special conditions for use statements:

   For prescription use only.

   For *in vitro* diagnostic use.

4. Special instrument requirements:

   Beckman Coulter Navios and Navious EX flow cytometers, Kaluza C Software

I. Device Description:

The ClearLLab Reagents panel is used with the following reagents with their respective indicated uses. A description of the reagents provided is described below in Table 1.

Table 1: Components of the ClearLLab 10C Panel Reagents

Item	Description	Use
The B-Cell Lineage panel	Comprising B: Kappa, Lambda, CD10, CD5, CD200, CD34, CD38,CD20, CD19, CD45Monoclonal and Polyclonal Antibody Reagents.	For use to identify lymphocytes that contain the specific cell surface markers associated with the B-cell lineage.
The T-Cell Lineage panel	Comprising T: TCRγδ, CD4, CD2, CD56, CD5, CD34, CD3, CD8, CD7, CD45 Monoclonal Antibody Reagents.	For use to identify lymphocytes that contain the specific cell surface markers associated with the T-cell lineage.
The Myeloid Lineage panels	Comprising M1 and M2: CD16, CD7, CD10, CD13, CD64, CD34, CD14, HLA-DR, CD11b, CD15, CD123, CD117, CD33, CD38, HLA-DR, CD19, CD45 Monoclonal Antibody Reagents.	For use to identify lymphocytes that contain the specific cell surface markers associated with the Myeloid lineage.
Accessory Reagents Required		
Flow-Check Pro Fluorospheres	Flow-Check Pro Fluorospheres are a suspension of fluorescent microspheres used for daily verification of the optical alignment and fluidics for Forward Scatter (FS) and FL1-FL4 fluorescence parameters.	Instrument Alignment Quality Control Reagent to provide instrument alignment Quality Control instructions.

Flow-Set Pro Fluorospheres	Flow-Set Pro Fluorospheres are a suspension of fluorescent microspheres used as an aid in standardizing forward scatter, side scatter, and fluorescence detectors on the FC 500 (FL1-FL5).	Auto Setup Reagent for standardization of flow cytometer light scatter and fluorescence intensity instrument settings to provide application-specific instrument target ranges for standardization.
ClearLLab Compensation Kit	Compensation reagents consist of a combination of CD45-FITC, CD45-PE, CD45-ECD, CD45-PC5.5 and CD45-PC7. Color Compensation Reagents are recommended to be used with normal whole blood specimens to adjust color compensation settings on a flow cytometer, prior to multicolor analysis.	The ClearLLab Compensation Kit is used to adjust color compensation settings on a flow cytometer equipped with AutoSetup software, prior to multi-color analysis with FITC, PE, and ECD conjugated monoclonal antibody reagents.
ClearLLab Compensation Beads	ClearLLab Compensation Beads are to be used in conjunction with the ClearLLab Compensation Kit to establish compensation settings on the Navios and Navios EX Flow Cytometer(s) prior to multicolor analysis with the ClearLLab 10C Panels.	Used to adjust color compensation settings on a flow cytometer with AutoSetup software. Note: Color Compensation Reagents are required. It is recommended to use the reagents with normal whole blood specimens to adjust color compensation settings on a flow cytometer, prior to multi-color analysis.
IOTest 3 Fixative Solution	The IOTest 3 Fixative Solution, which has a formaldehyde base, specially developed for the fixing of leukocytes.	Leukocyte fixative solution used on all leukocytic preparations to enable leukocytic preparations to be stored for several hours without deterioration after staining with a fluorescent antibody. It is used to fix leukocytes following immunofluorescent staining with the fluorochrome-conjugated antibodies and lysis of the red blood cells.
IOTest 3 Lysing Solution	Red cell lysing reagent intended for the lysis of red blood cells in the preparation of biological samples for flow cytometry	IOTest 3 Lysing Solution is intended for the lysis of red blood cells in the preparation of biological samples for flow

	analysis.	cytometry analysis.
Kaluza C data analysis software	A stand-alone software tool designed to work with *.fcs and *.lmd files generated by flow cytometers. Kaluza C Software allows users to graphically display data, calculate descriptive statistics and many combinations of statistical operations based on users' needs. Kaluza C Software is intended for laboratory professionals in a clinical laboratory setting.	The software tool provides detailed protocols to define population gates and a series of dual parameter histograms to identify specific cell populations, with examples of normal and clinical specimen results in the product labeling.
Accessory Reagents Recommended but Not Provided		
ClearLLab Control Cells, normal	Stabilized preparations of assayed, lysable whole blood intended as process controls for the verification of the ClearLLab 10C panels on the Navios and Navios EX flow cytometers. Parameters assayed include: Kappa, Lambda, CD5, CD200, CD38,CD20, CD19, CD45, TCRγδ, CD4, CD2, CD56, CD3, CD7, CD8, CD16, CD10, CD13, CD64,CD14, HLA-DR, CD11b, CD15, and CD33	Quality control material assayed for lymphocyte-, granulocyte-, and monocyte-specific antigens and single platform absolute counts. The light scatter, population distribution, fluorescence intensity, and antigen density mimic those of normal whole blood.
ClearLLab Control Cells, abnormal	The ClearLLab Control Cells Abnormal are stabilized preparations of assayed, lysable whole blood intended as process controls for the verification of the ClearLLab 10C panels on the Navios and Navios EX flow cytometers. Parameters assayed include: Kappa, Lambda, CD5, CD200, CD38, CD20, CD19, CD45, TCRγδ, CD4, CD2, CD56, CD3, CD7, CD8, CD16, CD10,CD13, CD64, CD14, HLA-DR, CD11b, CD15, CD33, CD34, CD117, and CD123	Quality control material assayed for lymphocyte-, granulocyte-, and monocyte-specific antigens and single platform absolute counts. The light scatter, population distribution, fluorescence intensity, and antigen density mimic those of normal whole blood.

ClearLLab 10C Immunophenotyping Panel

Lineage	FITC	PE	ECD	PC5.5	PC7	APC	APC-A700	APC-A750	Pacific Blue	Krome Orange
B-cell tube	Kappa	Lambda	CD10	CD5	CD200	CD34	CD38	CD20	CD19	CD45
T-cell tube	TCRγδ	CD4	CD2	CD56	CD5	CD34	CD7	CD8	CD3	CD45
M1-cell tube	CD16	CD7	CD10	CD13	CD64	CD34	CD14	HLA-DR	CD11b	CD45
M2-cell tube	CD15	CD123	CD117	CD13	CD33	CD34	CD38	HLA-DR	CD19	CD45

J. Substantial Equivalence Information:

1. Predicate device names and numbers:

ClearLLab Reagents (T1, T2, B1, B2, M); DEN160047
Navios Flow Cytometer; K130373
Navios EX Flow Cytometer; K162897

2. Comparison with predicate:

Similarities		
Item	New Device ClearLLab 10C Panels (B, T, M1, M2)	Predicate ClearLLab Reagents (T1, T2, B1, B2, M)
Specimen Type	Human whole blood	Same
Technology	Flow cytometry	Same
Sample Preparation	Wash and prepare samples manually	Same
Standardization	Flow-Set Pro Fluorospheres	Same
Optical alignment and fluidics	Flow-Check Pro Fluorospheres	Same

Differences		
Item	New Device ClearLLab 10C Panels (B, T, M1, M2)	Predicate ClearLLab Reagents (T1, T2, B1, B2, M)
Intended Use	The ClearLLab 10C Panels are intended for in vitro diagnostic use for qualitative identification of cell populations by multiparameter immunophenotyping on the	The ClearLLab reagents are intended for in vitro diagnostic use as a panel for qualitative identification of cell populations by multiparameter immunophenotyping on an FC

Differences		
Item	New Device ClearLLab 10C Panels (B, T, M1, M2)	Predicate ClearLLab Reagents (T1, T2, B1, B2, M)
	Navios and Navios EX flow cytometers. These reagents are used as an aid in the differential diagnosis of hematologically abnormal patients having, or suspected of having, the following hematopoietic neoplasms: chronic leukemia, acute leukemia, non-Hodgkin lymphoma, myeloma, myelodysplastic syndrome (MDS), and/or myeloproliferative neoplasms (MPN). The reagents can be used with peripheral whole blood (collected in K2EDTA, Acid Citrate Dextrose (ACD) or Heparin), bone marrow (collected in K2EDTA, ACD or Heparin) and lymph node specimens. Interpretation of the results should be confirmed by a pathologist or equivalent professional in conjunction with other clinical and laboratory findings. These reagents provide multiparameter, qualitative results for the surface antigens listed below: -ClearLLab 10C B Cell Tube: Kappa, Lambda, CD10, CD5, CD200, CD34, CD38,CD20, CD19, CD45 -ClearLLab 10C T Cell Tube: TCRγδ, CD4, CD2, CD56, CD5, CD34, CD3, CD8, CD7, CD45 -ClearLLab 10C M1 Cell Tube: CD16, CD7, CD10, CD13, CD64, CD34, CD14, HLA-DR, CD11b, CD45 -ClearLLab 10C M2 Cell Tube: CD15, CD123, CD117, CD13, CD33, CD34, CD38, HLA-DR, CD19, CD45	500 flow cytometer. These reagents are used as an aid in the differential diagnosis of hematologically abnormal patients having, or suspected of having the following hematopoietic neoplasms: chronic leukemia, acute leukemia, non-Hodgkin lymphoma, myeloma, myelodysplastic syndrome (MDS), and/or myeloproliferative neoplasms (MPN). The reagents can be used with peripheral whole blood collected in EDTA (K2 and K3EDTA), Acid Citrate Dextrose or Heparin, bone marrow collected in K2EDTA, ACD, or Heparin, and lymph node specimens. Interpretation of the results should be confirmed by a pathologist or equivalent professional in conjunction with other clinical and laboratory findings. These reagents provide multiparameter, qualitative results for the Cluster of Differentiation (CD) parameters listed below: - ClearLLab T1: CD2, CD56, CD7, CD5, CD45 - ClearLLab T2: CD8, CD4, CD3, CD45 - ClearLLab B1: Kappa, Lambda, CD19, CD5, CD45 - ClearLLab B2: CD20, CD10, CD19, CD38, CD45 - ClearLLab M: CD7, CD13, CD34, CD33, CD45

Differences		
Item	New Device ClearLLab 10C Panels (B, T, M1, M2)	Predicate ClearLLab Reagents (T1, T2, B1, B2, M)
CD Markers (Underlined MARKERS ARE THE SAME)	Kappa, Lambda, CD5, CD200, CD38, CD20, CD19, CD45, TCRγδ, CD4, CD2, CD56, CD3, CD7, CD8, CD16, CD10,CD13, CD64, CD14, HLA-DR, CD11b, CD15, CD33, CD34, CD117, and CD123	CD2, CD56, CD7, CD5, CD8, CD4, CD3, CD45, Kappa, Lambda, CD19, , CD20, CD10, CD38, CD13, CD34, CD33;
Reagent Form	Dry unitized form (one test / panel)	Liquid Form
Storage Conditions	18−30°C	2−8°C
Compensation	ClearLLab Compensation Kit with ClearLLab Compensation Beads	CD45-FITC, CD45-PE and CD45-ECD from existing QuickComp 4 plus CD45-PC5.5 and CD45-PC7

Differences		
Item	New Device Navios Navios EX	Predicate Navios K130373 Navios EX K162897
Maximum Parameter Detectors	Twelve (FS, SS, FL1 – FL10)	IVD configuration – Six (FS, SS, FL1 – FL4)
Photomulti-plier Tubes (PMTs)/Colors	Standard 5 PMTs (FL1 – FL5) off of 488 nm laser (blue) Standard 3 PMTs (FL6 – FL8) off of 638 nm laser (red) Standard 2 PMTs (FL9 – FL10) off of 405 nm laser (violet)	IVD configuration – Standard 4 PMTs (FL1 - FL4) off of 488 nm laser
Lasers / Driver Boards	Navios: Blue (488 nm) • Laser Diode, 22mW Red (638 nm) • Laser Diode, 25 mW Violet (405 nm) • Laser Diode, 40 mW Navios EX: Blue (488 nm) • Laser Diode, 55mW Red (638 nm) • Laser Diode, 50 mW Violet (405 nm) • Laser Diode, 80 mW	Navios: Blue (488 nm) • Laser Diode, 22mW Navios EX: Blue (488 nm) • Laser Diode, 55mW
Optical Filters	Optical Filters: (SP = Short	Optical Filters: (SP = Short

Differences		
Item	New Device Navios Navios EX	Predicate Navios K130373 Navios EX K162897
	Pass, BP = Band Pass, LP=Long Pass) • FL1 FITC 550 SP - 525 BP • FL2 PE 595 SP - 575/30 BP • FL3 ECD 655 SP - 620/30 BP • FL4 PC5.5 730 SP - 695/30 BP • FL5 PC7 755 LP • FL6 APC 710 SP – 660/20 BP • FL7 APC-A700 750 SP – 725/20 BP • FL8 APC-A750 755 LP • FL9 PB 480 SP – 450/50 BP • FL10 KRO 550/40 BP Navios EX FL3 ECD is 655 SP - 614/20 BP	Pass, BP = Band Pass, LP=Long Pass) • FL1 FITC 550 SP - 525 BP • FL2 PE 595 SP - 575/30 BP • FL3 ECD 655 SP - 620/30 BP • FL4 PC5.5 730 SP - 695/30 BP Navios EX FL3 ECD is 655 SP - 614/20 BP
Analysis Software	Offline and Independent of Instrument: New Kaluza C data analysis software with the new ClearLLab 10C applicationthat is used off-line.	Navios or Navios EX on-board and off-line analysis software

K. Standards/Guidance Documents Referenced:

CLSI EP6-A, Evaluation of the Linearity of Quantitative Measurement Procedures, A Statistical Approach

CLSI EP05-A3, Evaluation of Precision Performance of Quantitative Measurement Methods

CLSI EP28-A3c, Defining, Establishing, and Verifying Reference Intervals in the Clinical Laboratory

CLSI H26-A2, Validation, Verification, and Quality Assurance of Automated Hematology Analyzers

CLSI EP17-A2, Protocols for Determination of Limits of Detection and Limits of Quantitation

CLSI EP25-A, Evaluation of Stability on In Vitro Diagnostic Reagents

CLSI EP12-A2, User Protocol for Evaluation of Qualitative Test Performance

L. Test Principle:

Beckman Coulter's ClearLLab 10C Panels are comprised of lineage-driven combinations of the consensus reagents, provided in a ready-to-use dry form, for evaluation of B, T and Myeloid cell neoplasia as described in Table 3 of "2006 Bethesda International Consensus Recommendations on the Immunophenotypic Analysis of Hematolymphoid Neoplasia by Flow Cytometry: Optimal Reagents and Reporting for the Flow Cytometric Diagnosis of Hematopoietic Neoplasia"[1]. The ClearLLab 10C product is intended for use on the Navios and Navios EX flow cytometers with instrument set-up performed with Flow-Check Pro Fluorospheres, Flow-Set Pro Fluorospheres, and Compensation Kit color compensation reagents and beads for alignment, voltage standardization, and compensation.

This test depends on the ability of a monoclonal or polyclonal antibody to bind to the surface of cells expressing discrete antigenic determinants. Specimens are washed to remove endogenous plasma proteins that may interfere with the binding specificity of antibodies. Specific cell staining is accomplished by incubating washed specimen cells with the appropriate antibody reagent. The ClearLLab 10C Panels are composed of four panels containing ten monoclonal or polyclonal antibody reagents, each specific for a different cell surface antigen and conjugated to a specific fluorochrome. After sample preparation, the specimens are analyzed on the flow cytometer with manual gating.

The Navios and Navios EX flow cytometers in combination with the Kaluza C Software applies the principles of flow cytometry to acquire and analyze a whole blood, bone marrow or lymph node sample. Samples are prepared and stained with a monoclonal antibody reagents followed by lysis of red blood cells prior to introduction into the instrument. Cellular populations are identified based on the specific monoclonal and polyclonal antibodies and fluorochromes used in the different panels. Detection of fluorescent antibodies bound to cells utilizes the capability of the Navios or Navios EX flow cytometer to detect fluorescence with three lasers: a blue laser with a 488 nm, a red laser with a 638 nm, and a violet laser with a 405 nm excitation; and ten different detection channels (FL1-FL10). Preset Kaluza C LMD analysis templates for the ClearLLab 10C reagent system are provided.

The Navios and Navios EX Flow Cytometer Software provides automated instrument setup of alignment, voltage standardization, color compensation, and verification when used with the quality control reagents. The software has an Auto-Set Panel which automatically standardizes the cytometer, adjusts compensation settings, passes cytometer settings to designated test protocols, and verifies cytometer setup and antibody performance. The ClearLLab 10C Panels are processed through the Navios and Navios EX Flow Cytometers and analyzed using the Kaluza C Analysis software.

[1] 2006 Bethesda International Consensus recommendations on the immunophenotypic analysis of hematolymphoid neoplasia by flow cytometry: optimal reagents and reporting for the flow cytometric diagnosis of hematopoietic neoplasia. Wood BL, Arroz M, Barnett D, DiGiuseppe J, Greig B, Kussick SJ, Oldaker T, Shenkin M, Stone E, Wallace P. Cytometry B Clin Cytom. 2007; 72 Suppl 1:S14-22

Sample Preparation & Analysis

Whole Blood (WB) and Bone Marrow (BM) preparation:
Specimens are prepared manually with three pre-wash steps using phosphate buffered saline (PBS) containing 2% Heat Inactivated Fetal Calf Serum (HI-FCS). The remaining white blood cell pellet is then resuspended in PBS containing HI-FCS. The washed specimen is stained with the ClearLLab 10 Color Panels. Prior to analysis, the IOTest 3 Lysing Solution is used for lysing red blood cells and the IOTest 3 Fixative Solution is used for fixation.

Lymph Node preparation:
Lymph node specimens require disaggregation of the tissue into a single cell suspension. Single cell suspensions prepared from lymphoid tissues may not require washing prior to staining if the specimen was washed during the disaggregation process. If washing steps were not performed for removal of residual soluble proteins, or if the cells were re-suspended in a buffer containing human serum or serum proteins, then pre-washing is necessary.

Sample analysis:
The Navios or Navios EX System Software is used for sample acquisition in conjunction with ClearLLab 10C Panels. The acquisition protocols are provided as part of the software and contain the following plots:
• Time/FL10 plot (Ungated) for monitoring of acquisition
• FS INT/FS Peak plot (Time) to define "Singlets" and exclude the aggregated cells
• SS INT/FS INT plot (Singlets) to define "Cells" and exclude the compromised cells (see Warning)
• FL10/SS INT plot (Cells) to define "CD45+" cells
• FL10/SS INT plot (CD45+) to define the Stop Criteria of 50,000 total CD45+ cells, define populations of "Lymphs", "Monos", "Grans", and "CD45dim".
The List Mode Data (LMD) files are analyzed offline using Kaluza C Flow Cytometry Software with an appropriate combination of subpopulation gates. The Kaluza C Flow Cytometry Software allows the user to perform the LMD analysis for data generated using any of the four ClearLLab 10C Protocols. Review of the color compensation and gating are required.

M. Interpretation of Results

Flow cytometric immunophenotyping is multiparametric and relies on simultaneous identification and characterization of both normal and candidate malignant cell populations. Normal cells, which vary in type and relative numbers depending on the sample type, patient age, and clinical setting, display highly conserved and reproducible patterns of cell surface marker expression and light scatter. These normal internal control patterns may serve as both process controls for sample type, sample degradation, sample preparation and staining, data acquisition, and data analysis, as well as references against which candidate malignant populations may be compared. Candidate malignant populations may display aberrant loss of a marker, aberrant gain of a marker, or aberrant over- or under-expression of a marker. Any population that does not conform to the normal internal control pattern is evaluated for malignancy. Interpretation of these patterns requires expert knowledge and training in the technique. It is not possible to predict the phenotype of a particular patient's hematolymphoid malignancy and apply fixed templates for samples for detection of specific phenotypes. Even well-characterized diseases such as chronic lymphocytic leukemia may display case-to-case immunophenotypic variability and it is therefore the role of the expert interpreter to assess the significance of findings and to interpret them

together with clinical history, morphological assessment, and other ancillary techniques in order to arrive at a final diagnosis. The device labeling states that interpretation of specimens should be performed by a pathologist or equivalent professional who has the appropriate training. Finally, a small number of rare samples contain no or very few normal cells and require careful evaluation and correlation with other sources of information such as clinical history and other laboratory findings to obtain the appropriate final diagnosis.

N. Performance Characteristics:

All results provided below met the manufacturer's pre-specified acceptance criteria.

1. Analytical Performance:

   a. *Precision and Reproducibility*: Precision studies were conducted according to the methodology presented in *CLSI EP05-A3, Evaluation of Precision Performance of Quantitative Measurement Procedures; Approved Guideline – Third Edition.*

      i. *Precision (repeatability):* The repeatability of normal and abnormal clinical specimens representing clinical matrices and anticoagulants was evaluated with the ClearLLab 10C Panels at four sites. Eighty three specimens across the three specimen types were evaluated. Each site employed a different anticoagulant for specimens, according to their current clinical practice: K2EDTA, acid citrate dextrose (ACD), or heparin. For the three specimen matrices (i.e. whole blood [WB], bone marrow [BM], lymph node[LN]), three sites evaluated all three matrices; one did not evaluate lymph node. Two sites operated the Navios instrument, and the other two operated the Navios EX. Each site evaluated a minimum of 18 specimens. For lymph node specimens (LN), testing was conducted at two sites. Since LN specimens are not collected using an anticoagulant, this was not a variable for lymph node specimen analysis.

      Unless otherwise specified, a minimum of two specimens per specimen type per panel per anticoagulant (site) were included. Each specimen per panel was analyzed twice each day. There were six sample preparations in the morning and six sample preparations in the afternoon, resulting in a total of 12 replicates per specimen per panel. From 1092 initial total replicates, 96 were excluded for reasons of specimen quality or insufficient quantity. Both quantitative and qualitative assessment were applied to the precision assessment where the presence or absence of an abnormal phenotype was reported.

      All results showed 100% qualitative agreement across all sites, panels, anticoagulants, specimen types, and phenotypes. The number of samples tested is depicted in the tables below.

      For repeatability evaluation, pre-defined hematopoietic lineage populations were defined as in the table below:

Population definitions for evaluation of multi-site reproducibility of ClearLLab 10 color				
Panel	Normal Population	Immunophenotype of Normal Population	Specimen Type	Abnormal Markers
B	Mature κ^+ B cells	$CD45^{bright}$ SSc^{low} $CD19^+$ $CD20^+$ $Kappa^+$ $CD38^{dim}$ $CD200^+$ $CD10^-$ $CD5^-$ $CD34^-$	WB	CD5 CD10 CD34
			BM	
			LN	
	Mature λ^+ B cells	$CD45^{bright}$ SSc^{low} $CD19^+$ $CD20^+$ $Lambda^+$ $CD38^{dim}$ $CD200^+$ $CD10^-$ $CD5^-$ $CD34^-$	WB	
			BM	
			LN	
T	Helper T cells	$CD45^{bright}$ SSc^{low} $CD2^+$ $CD3^+$ $CD4^+$ $CD8^-$ $CD5^+$ $CD7^+$ $CD56^-$ $TCR\gamma\delta^-$ $CD34^-$	WB	CD34
			BM	
			LN	
	Cytotoxic T cells	$CD45^{bright}$ SSc^{low} $CD2^+$ $CD3^+$ $CD8^+$ $CD4^-$ $CD5^+$ $CD7^+$ $CD56^-$ $TCR\gamma\delta^-$ $CD34^-$	WB	
			BM	
			LN	
	NK cells	$CD45^{bright}$ SSc^{low} $CD56^+$ $CD2^+$ $CD3^-$ $CD4^-$ $CD8^{+/-}$ $CD5^-$ $CD7^+$ $TCR\gamma\delta^-$ $CD34^-$	WB	
			BM	
			LN	
	γδ T cells	$CD45^{bright}$ SSc^{low} $CD2^+$ $CD3^{bright}$ $TCR\gamma\delta^-$ $CD4^-$ $CD8^-$ $CD5^+$ $CD7^+$ $CD56^+$ $CD34^-$	WB	
			BM	
			LN	
M1	Neutrophils	$CD45^{dim}$ SSc^{high} $CD16^+$ $CD10^+$ $CD13^+$ $CD11b^+$ $CD7^-$ $CD64^-$ $CD14^-$ $CD34^-$ $HLA\text{-}DR^-$	WB	CD7 CD34
			BM	
	Monocytes	$CD45^{med}$ SSc^{med} $CD13^+$ $CD64^+$ $CD14^+$ $HLA\text{-}DR^+$ $CD11b^+$ $CD16^-$ $CD7^-$ $CD10^-$ $CD34^-$	WB	
			BM	
M2	Neutrophils	$CD45^{dim}$ SSc^{high} $CD15^+$ $CD13^+$ $CD33^{+/-}$ $CD123^-$ $CD117^-$ $CD34^-$ $CD38^-$ $HLA\text{-}DR^-$ $CD34^-$	WB	CD19 CD34 CD117
			BM	
	Monocytes	$CD45^{med}$ SSc^{med} $CD13^+$ $CD33^+$ $CD38^+$ $HLA\text{-}DR^+$ $CD15^-$ $CD123^-$ $CD19^-$ $CD34^-$ $CD117^-$	WB	
			BM	
	Basophils	$CD45^{dim}$ $CD123^{bright}$ $CD38^{bright}$ $CD13^+$ $CD33^+$ $CD15^-$ $CD117^-$ $CD34^-$ $HLA\text{-}DR^-$ $CD19^-$	WB	
			BM	

Qualitative Agreement, by Specimen, by Site					
Site	Panel	Anticoagulant	Specimen Type	Phenotype	N
1	B	ACD	BM	Abnormal (+)	12
1	B	ACD	BM	Normal (−)	12
1	B	ACD	BM	Normal (−)	12
1	B	n/a	LN	Abnormal (+)	12
1	B	n/a	LN	Abnormal (+)	12
1	B	n/a	LN	Normal (−)	12
1	B	ACD	WB	Abnormal (+)	12
1	B	ACD	WB	Abnormal (+)	12
1	B	ACD	WB	Normal (−)	12
2	B	K_2EDTA	BM	Abnormal (+)	12
2	B	K_2EDTA	BM	Abnormal (+)	12
2	B	K_2EDTA	BM	Normal (−)	12
2	B	n/a	LN	Abnormal (+)	12
2	B	n/a	LN	Normal (−)	12
2	B	K_2EDTA	WB	Abnormal (+)	12
2	B	K_2EDTA	WB	Abnormal (+)	12
3	B	Heparin	BM	Abnormal (+)	12

Qualitative Agreement, by Specimen, by Site					
Site	Panel	Anticoagulant	Specimen Type	Phenotype	N
3	B	Heparin	BM	Abnormal (+)	12
3	B	Heparin	WB	Abnormal (+)	12
3	B	Heparin	WB	Abnormal (+)	12
3	B	Heparin	WB	Normal (−)	12
4	B	K_2EDTA	BM	Abnormal (+)	12
4	B	K_2EDTA	BM	Abnormal (+)	12
4	B	n/a	LN	Abnormal (+)	12
4	B	n/a	LN	Abnormal (+)	12
4	B	n/a	LN	Normal (−)	12
4	B	Heparin	WB	Abnormal (+)	12
4	B	Heparin	WB	Abnormal (+)	12
4	B	Heparin	WB	Normal (−)	12
1	M1	ACD	BM	Abnormal (+)	12
1	M1	ACD	BM	Abnormal (+)	12
1	M1	ACD	WB	Abnormal (+)	12
1	M1	ACD	WB	Normal (−)	12
2	M1	K_2EDTA	BM	Abnormal (+)	12
2	M1	K_2EDTA	BM	Normal (−)	12
2	M1	K_2EDTA	WB	Abnormal (+)	12
2	M1	K_2EDTA	WB	Abnormal (+)	12
2	M1	K_2EDTA	WB	Abnormal (+)	12
3	M1	Heparin	BM	Abnormal (+)	12
3	M1	Heparin	BM	Abnormal (+)	12
3	M1	Heparin	WB	Abnormal (+)	12
3	M1	Heparin	WB	Abnormal (+)	12
3	M1	Heparin	WB	Normal (−)	12
4	M1	K_2EDTA	BM	Abnormal (+)	12
4	M1	K_2EDTA	BM	Normal (−)	12
4	M1	Heparin	WB	Abnormal (+)	12
4	M1	K_2EDTA	WB	Abnormal (+)	12
4	M1	Heparin	WB	Normal (−)	12
1	M2	ACD	BM	Abnormal (+)	12
1	M2	ACD	BM	Abnormal (+)	12
1	M2	ACD	WB	Abnormal (+)	12
1	M2	ACD	WB	Normal (−)	12
1	M2	ACD	WB	Normal (−)	12
2	M2	K_2EDTA	BM	Abnormal (+)	12
2	M2	K_2EDTA	BM	Abnormal (+)	12
2	M2	K_2EDTA	WB	Abnormal (+)	12
2	M2	K_2EDTA	WB	Normal (−)	12
3	M2	Heparin	BM	Abnormal (+)	12
3	M2	Heparin	BM	Abnormal (+)	12
3	M2	Heparin	WB	Abnormal (+)	12
3	M2	Heparin	WB	Abnormal (+)	12
4	M2	K_2EDTA	BM	Abnormal (+)	12
4	M2	K_2EDTA	BM	Abnormal (+)	12
4	M2	K_2EDTA	BM	Normal (−)	12
4	M2	Heparin	WB	Abnormal (+)	12
4	M2	Heparin	WB	Normal (−)	12
1	T	ACD	BM	Normal (−)	12
1	T	ACD	BM	Normal (−)	12
1	T	ACD	BM	Normal (−)	12
1	T	ACD	WB	Normal (−)	12
1	T	ACD	WB	Normal (−)	12
2	T	K_2EDTA	BM	Normal (−)	12

Qualitative Agreement, by Specimen, by Site					
Site	Panel	Anticoagulant	Specimen Type	Phenotype	N
2	T	K_2EDTA	BM	Normal (−)	12
2	T	K_2EDTA	WB	Normal (−)	12
2	T	K_2EDTA	WB	Normal (−)	12
3	T	Heparin	BM	Normal (−)	12
3	T	Heparin	BM	Normal (−)	12
3	T	Heparin	WB	Normal (−)	12
3	T	Heparin	WB	Normal (−)	12
4	T	K_2EDTA	BM	Abnormal (+)	12
4	T	K_2EDTA	BM	Normal (−)	12
4	T	Heparin	WB	Abnormal (+)	12
4	T	Heparin	WB	Normal (−)	12

Qualitative Agreement, by Anticoagulant and Specimen Type, across Sites and Specimens				
Panel	Anticoagulant	Specimen Type	Phenotype	N
B	ACD	BM	Normal (−)	24
B	ACD	BM	Abnormal (+)	12
B	ACD	WB	Normal (−)	12
B	ACD	WB	Abnormal (+)	24
B	Heparin	BM	Abnormal (+)	24
B	Heparin	WB	Normal (−)	24
B	Heparin	WB	Abnormal (+)	48
B	K_2EDTA	BM	Normal (−)	12
B	K_2EDTA	BM	Abnormal (+)	48
B	K_2EDTA	WB	Abnormal (+)	24
B	n/a	LN	Normal (−)	36
B	n/a	LN	Abnormal (+)	60
M1	ACD	BM	Abnormal (+)	24
M1	ACD	WB	Normal (−)	12
M1	ACD	WB	Abnormal (+)	12
M1	Heparin	BM	Abnormal (+)	24
M1	Heparin	WB	Normal (−)	24
M1	Heparin	WB	Abnormal (+)	36
M1	K_2EDTA	BM	Normal (−)	24
M1	K_2EDTA	BM	Abnormal (+)	24
M1	K_2EDTA	WB	Abnormal (+)	48
M2	ACD	BM	Abnormal (+)	24
M2	ACD	WB	Normal (−)	24
M2	ACD	WB	Abnormal (+)	12
M2	Heparin	BM	Abnormal (+)	24
M2	Heparin	WB	Normal (−)	12
M2	Heparin	WB	Abnormal (+)	36
M2	K_2EDTA	BM	Normal (−)	12
M2	K_2EDTA	BM	Abnormal (+)	48
M2	K_2EDTA	WB	Normal (−)	12
M2	K_2EDTA	WB	Abnormal (+)	12
T	ACD	BM	Normal (−)	36
T	ACD	WB	Normal (−)	24
T	Heparin	BM	Normal (−)	24
T	Heparin	WB	Normal (−)	36
T	Heparin	WB	Abnormal (+)	12
T	K_2EDTA	BM	Normal (−)	36
T	K_2EDTA	BM	Abnormal (+)	12
T	K_2EDTA	WB	Normal (−)	24

Quantitative Results, by Specimen, by Site for Navios												
Panel	Site	Specimen Type	Anti-coagulant	Population	N	Mean (%)	Repeatability		Between Run		Within Sample	
							SD	%CV	SD	%CV	SD	%CV
B	1	WB	ACD	Mature κ^+ B cells	12	60.01	0.94	1.57	1.50	2.50	1.77	2.95
B	1	WB	ACD	Mature λ^+ B cells	12	40.08	0.99	2.47	1.39	3.47	1.71	4.26
B	1	LN	NA	Mature κ^+ B cells	12	60.37	0.94	1.55	0.00	0.00	0.94	1.55
B	1	LN	NA	Mature λ^+ B cells	12	39.50	0.94	2.37	0.00	0.00	0.94	2.37
B	1	BM	ACD	Mature κ^+ B cells	12	45.01	1.44	3.19	0.00	0.00	1.44	3.19
B	1	BM	ACD	Mature λ^+ B cells	12	15.19	0.95	6.25	0.00	0.00	0.95	6.25
B	1	BM	ACD	Abnormal $CD10^+$ B cells	12	60.06	1.45	2.41	0.00	0.00	1.45	2.41
B	1	WB	ACD	Abnormal $CD5^+$ B cells	12	85.62	0.28	0.33	0.31	0.37	0.42	0.49
B	1	BM	ACD	Abnormal $CD5^+$ B cells	12	89.48	0.65	0.72	0.00	0.00	0.65	0.72
B	1	LN	NA	Abnormal $CD10^+$ B cells	12	99.42	0.06	0.06	0.07	0.07	0.09	0.09
B	1	WB	ACD	Abnormal $CD10^+$ B cells	12	26.53	1.75	6.59	2.11	7.96	2.74	10.33
B	1	BM	ACD	Abnormal $CD10^+$ B cells	12	89.84	1.37	1.52	1.08	1.20	1.74	1.94
B	1	LN	NA	Abnormal $CD5^+$ B cells	12	19.80	1.01	5.08	1.58	7.97	1.87	9.45
B	2	WB	Heparin	Abnormal $CD5^+$ B cells	12	97.67	0.47	0.48	0.00	0.00	0.47	0.48
B	2	BM	Heparin	Abnormal $CD5^+$ B cells	12	99.56	0.12	0.12	0.12	0.12	0.17	0.18
B	2	BM	Heparin	Mature κ^+ B cells	12	3.09	0.21	6.83	0.25	7.95	0.32	10.48
B	2	BM	Heparin	Mature λ^+ B cells	12	3.01	0.14	4.81	0.00	0.00	0.14	4.81
B	2	BM	Heparin	Abnormal $CD5^+$ B cells	12	93.33	0.25	0.27	0.00	0.00	0.25	0.27
B	2	WB	Heparin	Abnormal $CD5^+$ B cells	12	98.58	0.17	0.17	0.12	0.12	0.21	0.21
B	2	WB	Heparin	Mature κ^+ B cells	12	58.53	1.24	2.13	0.67	1.15	1.41	2.42
B	2	WB	Heparin	Mature λ^+ B cells	12	41.37	1.26	3.05	0.71	1.72	1.45	3.50
M1	1	WB	ACD	Neutrophils	12	41.96	1.88	4.47	3.53	8.41	4.00	9.52
M1	1	WB	ACD	Monocytes	12	5.67	0.23	3.97	0.00	0.00	0.23	3.97
M1	1	WB	ACD	Abnormal $CD34^+CD7^+$	12	17.25	0.25	1.44	1.07	6.20	1.10	6.37
M1	1	BM	ACD	Abnormal $CD34^+CD7^+$	12	13.50	0.15	1.10	0.09	0.63	0.17	1.27
M1	1	BM	ACD	Neutrophils	12	28.77	0.47	1.63	0.63	2.17	0.78	2.71
M1	1	BM	ACD	Monocytes	12	5.32	0.19	3.63	0.22	4.08	0.29	5.46
M1	2	BM	Heparin	Abnormal $CD34^+$ $CD7^+$	12	22.64	0.21	0.95	0.00	0.00	0.21	0.95
M1	2	WB	Heparin	Abnormal $CD34^+$ $CD7^+$	12	74.67	0.26	0.35	0.38	0.51	0.46	0.62
M1	2	BM	Heparin	Neutrophils	12	32.01	1.66	5.17	0.00	0.00	1.66	5.17
M1	2	BM	Heparin	Monocytes	12	3.30	0.14	4.23	0.00	0.00	0.14	4.23
M1	2	WB	Heparin	Abnormal $CD34^+$ $CD7^+$	12	25.76	0.40	1.56	0.34	1.33	0.53	2.05
M1	2	WB	Heparin	Neutrophils	12	61.46	1.99	3.23	3.03	4.93	3.62	5.90
M1	2	WB	Heparin	Monocytes	12	3.57	0.18	4.97	0.13	3.64	0.22	6.16
M2	1	WB	ACD	Neutrophils	12	42.92	1.59	3.70	3.42	7.96	3.77	8.78
M2	1	WB	ACD	Monocytes	12	5.74	0.38	6.69	0.00	0.00	0.38	6.69
M2	1	WB	ACD	Neutrophils	12	13.68	0.97	7.12	0.51	3.73	1.10	8.04

Quantitative Results, by Specimen, by Site for Navios												
Panel	Site	Specimen Type	Anti-coagulant	Population	N	Mean (%)	Repeatability		Between Run		Within Sample	
							SD	%CV	SD	%CV	SD	%CV
M2	1	WB	ACD	Abnormal $CD34^+$ $CD123^+$	12	77.57	0.55	0.71	1.51	1.94	1.60	2.07
M2	1	WB	ACD	Abnormal $CD117^+$	12	79.34	0.55	0.70	2.15	2.71	2.22	2.80
M2	1	BM	ACD	Abnormal $CD34^+$ $CD123^+$	12	72.64	0.39	0.53	0.00	0.00	0.39	0.53
M2	1	BM	ACD	Abnormal $CD117^+$	12	75.39	0.57	0.76	0.38	0.51	0.69	0.91
M2	1	BM	ACD	Neutrophils	12	33.13	0.67	2.01	0.36	1.09	0.76	2.29
M2	1	BM	ACD	Monocytes	12	5.62	0.22	3.93	0.00	0.00	0.22	3.93
M2	1	BM	ACD	Abnormal $CD34^+$ $CD123^+$	12	45.07	0.42	0.94	0.56	1.23	0.70	1.55
M2	1	BM	ACD	Abnormal $CD117^+$	12	47.58	0.46	0.98	0.50	1.05	0.68	1.43
M2	2	BM	Heparin	Neutrophils	12	12.73	0.38	3.02	0.74	5.84	0.84	6.58
M2	2	BM	Heparin	Monocytes	12	4.34	0.18	4.05	0.38	8.65	0.41	9.55
M2	2	BM	Heparin	Abnormal $CD34^+$ $CD123^+$	12	66.97	0.42	0.63	2.76	4.13	2.79	4.17
M2	2	BM	Heparin	Abnormal $CD117^+$	12	51.66	0.44	0.85	1.10	2.14	1.19	2.30
M2	2	BM	Heparin	Neutrophils	12	23.92	0.39	1.62	1.66	6.95	1.71	7.14
M2	2	BM	Heparin	Monocytes	12	17.60	0.31	1.74	1.61	9.15	1.64	9.31
M2	2	BM	Heparin	Abnormal $CD34^+$ $CD123^+$	12	35.51	0.52	1.48	0.46	1.31	0.70	1.97
M2	2	BM	Heparin	Abnormal $CD117^+$	12	34.17	0.46	1.35	0.00	0.00	0.46	1.35
M2	2	WB	Heparin	Neutrophils	12	3.30	0.18	5.41	0.21	6.27	0.27	8.28
M2	2	WB	Heparin	Monocytes	12	7.15	0.21	2.94	0.27	3.74	0.34	4.76
M2	2	WB	Heparin	Abnormal $CD34^+$ $CD123^+$	12	98.08	0.07	0.07	0.61	0.62	0.61	0.62
M2	2	WB	Heparin	Abnormal $CD117^+$	12	98.33	0.06	0.06	0.44	0.45	0.45	0.46
T	1	WB	ACD	Helper T cells	12	68.87	0.54	0.78	0.00	0.00	0.54	0.78
T	1	WB	ACD	Cytotoxic T cells	12	23.79	0.47	1.96	0.22	0.94	0.52	2.17
T	1	WB	ACD	NK cells	12	11.90	0.22	1.82	0.15	1.30	0.27	2.24
T	1	WB	ACD	γδ T cells	12	2.71	0.14	5.07	0.00	0.00	0.14	5.07
T	1	BM	ACD	Helper T cells	12	55.24	1.02	1.84	0.18	0.32	1.03	1.87
T	1	BM	ACD	Cytotoxic T cells	12	27.47	0.97	3.55	0.00	0.00	0.97	3.55
T	1	BM	ACD	NK cells	12	6.94	0.32	4.61	0.20	2.85	0.38	5.42
T	1	BM	ACD	γδ T cells	12	7.14	0.46	6.39	0.22	3.07	0.51	7.09
T	1	WB	ACD	Helper T cells	12	51.20	0.49	0.95	0.35	0.68	0.60	1.17
T	1	WB	ACD	Cytotoxic T cells	12	32.09	1.01	3.14	0.00	0.00	1.01	3.14
T	1	WB	ACD	NK cells	12	1.39	0.07	4.93	0.00	0.00	0.07	4.93
T	1	WB	ACD	γδ T cells	12	3.93	0.21	5.40	0.00	0.00	0.21	5.40
T	1	BM	ACD	Helper T cells	12	81.53	0.72	0.88	0.00	0.00	0.72	0.88
T	1	BM	ACD	Cytotoxic T cells	12	9.83	0.34	3.47	0.22	2.24	0.41	4.13
T	1	BM	ACD	NK cells	12	13.26	0.35	2.60	0.22	1.68	0.41	3.10
T	1	BM	ACD	γδ T cells	12	1.79	0.15	8.66	0.00	0.00	0.15	8.66
T	1	BM	ACD	Helper T cells	12	38.68	1.17	3.04	0.00	0.00	1.17	3.04
T	1	BM	ACD	Cytotoxic T cells	12	33.46	1.01	3.03	0.89	2.65	1.35	4.02
T	1	BM	ACD	NK cells	12	44.50	0.96	2.15	0.96	2.15	1.35	3.04
T	2	BM	Heparin	Helper T cells	12	70.20	0.88	1.25	0.00	0.00	0.88	1.25
T	2	BM	Heparin	Cytotoxic T cells	12	13.27	0.53	3.96	0.48	3.61	0.71	5.36
T	2	BM	Heparin	NK cells	12	6.42	0.22	3.40	0.00	0.00	0.22	3.40
T	2	BM	Heparin	γδ T cells	12	11.92	0.36	2.98	0.37	3.09	0.51	4.30
T	2	WB	Heparin	Helper T cells	12	18.47	0.42	2.30	0.58	3.16	0.72	3.90
T	2	WB	Heparin	Cytotoxic T cells	12	49.52	1.16	2.35	1.43	2.89	1.84	3.72
T	2	WB	Heparin	NK cells	12	7.09	0.20	2.78	0.00	0.00	0.20	2.78
T	2	WB	Heparin	γδ T cells	12	17.53	0.47	2.70	0.39	2.22	0.61	3.49

Quantitative Results, by Specimen, by Site for Navios												
Panel	Site	Specimen Type	Anti-coagulant	Population	N	Mean (%)	Repeatability		Between Run		Within Sample	
							SD	%CV	SD	%CV	SD	%CV
T	2	WB	Heparin	Helper T cells	12	64.03	0.53	0.82	0.00	0.00	0.53	0.82
T	2	WB	Heparin	Cytotoxic T cells	12	24.38	0.33	1.36	0.30	1.25	0.45	1.85
T	2	WB	Heparin	NK cells	12	9.59	0.26	2.75	0.19	1.93	0.32	3.36
T	2	WB	Heparin	γδ T cells	12	4.67	0.18	3.88	0.04	0.78	0.18	3.96
T	2	BM	Heparin	Helper T cells	12	53.86	0.79	1.47	0.00	0.00	0.79	1.47
T	2	BM	Heparin	Cytotoxic T cells	12	21.96	0.69	3.13	0.00	0.00	0.69	3.13
T	2	BM	Heparin	NK cells	12	32.55	0.34	1.05	0.09	0.27	0.35	1.08
T	2	BM	Heparin	γδ T cells	12	14.64	0.85	5.78	0.14	0.95	0.86	5.86

Quantitative Results, by Specimen, by Site for Navios EX												
Panel	Site	Specimen Type	Anti-coagulant	Population	N	Mean (%)	Repeatability		Between Run		Within Sample	
							SD	%CV	SD	%CV	SD	%CV
B	3	BM	K_2EDTA	Abnormal $CD10^+$ B cells	12	97.17	0.12	0.12	0.89	0.92	0.90	0.93
B	3	LN	n/a	Mature κ^+ B cells	12	56.82	0.40	0.70	0.19	0.33	0.44	0.78
B	3	LN	n/a	Mature λ^+ B cells	12	42.33	0.39	0.93	0.42	0.99	0.57	1.35
B	3	WB	K_2EDTA	Mature κ^+ B cells	12	3.39	0.18	5.20	0.30	8.93	0.35	10.34
B	3	WB	K_2EDTA	Abnormal $CD5^+$ B cells	12	99.43	0.04	0.04	0.12	0.12	0.13	0.13
B	3	BM	K_2EDTA	Abnormal $CD5^+$ B cells	12	17.78	0.69	3.89	1.29	7.25	1.46	8.23
B	3	WB	K_2EDTA	Mature κ^+ B cells	12	2.65	0.22	8.39	0.10	3.67	0.24	9.15
B	3	WB	K_2EDTA	Mature λ^+ B cells	12	1.93	0.05	2.33	0.16	8.37	0.17	8.68
B	3	WB	K_2EDTA	Abnormal $CD10^+$ B cells	12	94.95	0.18	0.19	0.37	0.39	0.41	0.43
B	3	BM	K_2EDTA	Mature κ^+ B cells	12	54.43	1.75	3.22	4.51	8.28	4.84	8.89
B	3	BM	K_2EDTA	Mature λ^+ B cells	12	15.15	0.57	3.75	1.43	9.41	1.54	10.13
B	3	LN	n/a	Abnormal $CD5^+$ B cells	12	16.08	0.22	1.38	0.00	0.00	0.22	1.38
B	4	WB	Heparin	Mature κ^+ B cells	12	56.22	0.91	1.63	0.00	0.00	0.91	1.63
B	4	WB	Heparin	Mature λ^+ B cells	12	43.76	0.90	2.06	0.00	0.00	0.90	2.06
B	4	WB	Heparin	Abnormal $CD5^+$ B cells	12	86.18	0.37	0.43	0.36	0.41	0.51	0.60
B	4	BM	K_2EDTA	Mature κ^+ B cells	12	67.09	1.07	1.60	0.72	1.07	1.29	1.92
B	4	BM	K_2EDTA	Mature λ^+ B cells	12	30.82	1.20	3.90	0.78	2.54	1.44	4.66
B	4	BM	K_2EDTA	Abnormal $CD10^+$ B cells	12	30.16	1.18	3.90	1.05	3.47	1.58	5.22
B	4	BM	K_2EDTA	Abnormal $CD5^+$ B cells	12	99.17	0.11	0.11	0.12	0.12	0.16	0.16
B	4	LN	n/a	Abnormal $CD5^+$ B cells	12	98.49	0.21	0.21	0.02	0.02	0.21	0.22
B	4	WB	Heparin	Mature κ^+ B cells	12	57.89	1.31	2.27	0.80	1.38	1.54	2.66
B	4	WB	Heparin	Mature λ^+ B cells	12	41.94	1.26	3.01	0.78	1.86	1.48	3.54
B	4	LN	n/a	Abnormal $CD5^+$ B cells	12	37.81	1.60	4.22	2.77	7.32	3.19	8.45
B	4	LN	n/a	Abnormal $CD10^+$ B cells	12	42.92	1.43	3.33	1.26	2.93	1.90	4.44
B	4	LN	n/a	Mature κ^+ B cells	12	58.08	0.23	0.40	0.00	0.00	0.23	0.40
B	4	LN	n/a	Mature λ^+ B cells	12	41.67	0.22	0.52	0.00	0.00	0.22	0.52
M1	3	BM	K_2EDTA	Neutrophils	12	7.93	0.25	3.19	0.73	9.24	0.78	9.78
M1	3	BM	K_2EDTA	Monocytes	12	10.71	0.31	2.89	0.64	5.96	0.71	6.63

Quantitative Results, by Specimen, by Site for Navios EX												
Panel	Site	Specimen Type	Anti-coagulant	Population	N	Mean (%)	Repeatability		Between Run		Within Sample	
							SD	%CV	SD	%CV	SD	%CV
M1	3	BM	K_2EDTA	Abnormal $CD34^+CD7^+$	12	2.46	0.10	4.15	0.00	0.00	0.10	4.15
M1	3	WB	K_2EDTA	Monocytes	12	5.46	0.29	5.38	0.13	2.29	0.32	5.85
M1	3	BM	K_2EDTA	Neutrophils	12	27.24	0.67	2.44	0.00	0.00	0.67	2.44
M1	3	BM	K_2EDTA	Monocytes	12	13.24	0.43	3.21	0.69	5.19	0.81	6.11
M1	3	BM	K_2EDTA	Abnormal $CD34^+CD7^+$	12	1.88	0.14	7.37	0.12	6.34	0.18	9.72
M1	3	WB	K_2EDTA	Neutrophils	12	22.43	0.48	2.14	1.41	6.27	1.49	6.62
M1	3	WB	K_2EDTA	Monocytes	12	4.32	0.16	3.68	0.17	3.89	0.23	5.36
M1	3	WB	K_2EDTA	Abnormal $CD34^+CD7^+$	12	90.31	0.34	0.38	0.76	0.84	0.83	0.92
M1	4	WB	Heparin	Neutrophils	12	40.34	1.19	2.96	0.00	0.00	1.19	2.96
M1	4	BM	K_2EDTA	Neutrophils	12	33.68	0.68	2.03	1.78	5.29	1.91	5.66
M1	4	BM	K_2EDTA	Monocytes	12	10.42	0.30	2.86	0.56	5.37	0.63	6.08
M1	4	BM	K_2EDTA	Abnormal $CD34^+$ $CD7^+$	12	54.58	0.39	0.72	0.59	1.08	0.71	1.30
M1	4	WB	Heparin	Neutrophils	12	5.30	0.21	3.99	0.40	7.61	0.46	8.59
M1	4	WB	Heparin	Monocytes	12	5.41	0.20	3.62	0.00	0.00	0.20	3.62
M1	4	WB	K_2EDTA	Abnormal $CD34^+$ $CD7^+$	12	48.13	1.04	2.17	1.42	2.96	1.76	3.67
M2	3	BM	K_2EDTA	Neutrophils	12	19.43	0.64	3.31	1.06	5.46	1.24	6.38
M2	3	BM	K_2EDTA	Monocytes	12	7.77	0.30	3.92	0.66	8.56	0.73	9.41
M2	3	BM	K_2EDTA	Abnormal $CD34^+CD123^+$	12	39.03	0.44	1.12	0.65	1.65	0.78	2.00
M2	3	BM	K_2EDTA	Abnormal $CD117^+$	12	46.47	0.34	0.73	0.14	0.29	0.36	0.78
M2	3	WB	K_2EDTA	Abnormal $CD34^+CD123^+$	12	25.71	0.62	2.41	0.95	3.69	1.13	4.41
M2	3	BM	K_2EDTA	Abnormal $CD117^+$	12	27.58	0.30	1.07	0.55	1.99	0.62	2.27
M2	3	BM	K_2EDTA	Neutrophils	12	9.83	0.20	2.05	0.64	6.53	0.67	6.84
M2	3	BM	K_2EDTA	Monocytes	12	14.84	0.31	2.08	0.27	1.80	0.41	2.75
M2	3	BM	K_2EDTA	Abnormal $CD34^+CD123^+$	12	43.88	0.40	0.92	1.10	2.50	1.17	2.66
M2	3	BM	K_2EDTA	Abnormal $CD117^+$	12	51.60	0.38	0.74	1.08	2.10	1.15	2.23
M2	3	WB	K_2EDTA	Neutrophils	12	66.46	1.07	1.61	0.23	0.34	1.09	1.64
M2	3	WB	K_2EDTA	Monocytes	12	8.25	0.27	3.24	0.38	4.63	0.47	5.65
M2	4	WB	Heparin	Neutrophils	12	39.49	0.82	2.07	0.00	0.00	0.82	2.07
M2	4	WB	Heparin	Monocytes	12	5.07	0.26	5.14	0.24	4.76	0.36	7.01
M2	4	BM	K_2EDTA	Abnormal $CD117^+$	12	89.69	0.16	0.18	0.00	0.00	0.16	0.18
M2	4	BM	K_2EDTA	Neutrophils	12	69.13	1.07	1.55	0.80	1.16	1.34	1.94
M2	4	BM	K_2EDTA	Monocytes	12	97.37	0.12	0.12	0.00	0.00	0.12	0.12
M2	4	BM	K_2EDTA	Abnormal $CD34^+CD123^+$	12	6.10	0.09	1.48	0.23	3.82	0.25	4.09
M2	4	WB	Heparin	Abnormal $CD34^+CD123^+$	12	11.57	0.16	1.35	0.03	0.24	0.16	1.38
M2	4	WB	Heparin	Abnormal $CD117^+$	12	35.17	0.20	0.57	0.43	1.23	0.48	1.36
T	3	WB	K_2EDTA	Helper T cells	12	61.29	1.44	2.36	0.00	0.00	1.44	2.36
T	3	WB	K_2EDTA	Cytotoxic T cells	12	25.02	1.09	4.35	0.00	0.00	1.09	4.35
T	3	WB	K_2EDTA	NK cells	12	27.02	0.76	2.79	0.41	1.50	0.86	3.17
T	3	BM	K_2EDTA	Helper T cells	12	43.01	0.54	1.26	0.00	0.00	0.54	1.26
T	3	BM	K_2EDTA	Cytotoxic T cells	12	51.90	0.68	1.31	0.56	1.08	0.88	1.69
T	3	BM	K_2EDTA	NK cells	12	5.12	0.17	3.30	0.00	0.00	0.17	3.30
T	3	BM	K_2EDTA	Helper T cells	12	67.99	1.42	2.09	1.76	2.59	2.26	3.33
T	3	BM	K_2EDTA	Cytotoxic T cells	12	21.20	0.51	2.43	0.28	1.34	0.59	2.77
T	3	BM	K_2EDTA	NK cells	12	21.87	0.46	2.09	0.70	3.21	0.84	3.83

Quantitative Results, by Specimen, by Site for Navios EX												
Panel	Site	Specimen Type	Anti-coagulant	Population	N	Mean (%)	Repeatability		Between Run		Within Sample	
							SD	%CV	SD	%CV	SD	%CV
T	3	BM	K_2EDTA	γδ T cells	12	6.68	0.60	9.01	0.24	3.56	0.65	9.69
T	3	WB	K_2EDTA	Helper T cells	12	46.97	0.72	1.54	1.14	2.42	1.35	2.87
T	3	WB	K_2EDTA	Cytotoxic T cells	12	41.40	0.54	1.30	1.21	2.93	1.33	3.21
T	3	WB	K_2EDTA	NK cells	12	5.00	0.21	4.14	0.00	0.00	0.21	4.14
T	3	WB	K_2EDTA	γδ T cells	12	8.21	0.26	3.17	0.17	2.05	0.31	3.78
T	4	BM	K_2EDTA	Helper T cells	12	46.46	0.69	1.49	0.29	0.62	0.75	1.61
T	4	BM	K_2EDTA	Cytotoxic T cells	12	49.46	0.61	1.23	0.00	0.00	0.61	1.23
T	4	BM	K_2EDTA	NK cells	12	16.51	0.43	2.62	0.31	1.90	0.53	3.23
T	4	BM	K_2EDTA	γδ T cells	12	3.14	0.21	6.66	0.06	1.95	0.22	6.94
T	4	WB	Heparin	Helper T cells	12	62.00	0.46	0.75	0.00	0.00	0.46	0.75
T	4	WB	Heparin	Cytotoxic T cells	12	30.62	0.47	1.52	0.00	0.00	0.47	1.52
T	4	WB	Heparin	NK cells	12	10.03	0.20	2.01	0.04	0.43	0.21	2.06
T	4	WB	Heparin	γδ T cells	12	2.18	0.15	7.03	0.10	4.47	0.18	8.33
T	4	BM	K_2EDTA	Helper T cells	12	55.26	1.12	2.03	0.46	0.83	1.21	2.19
T	4	BM	K_2EDTA	Cytotoxic T cells	12	34.30	0.86	2.52	1.00	2.90	1.32	3.85
T	4	BM	K_2EDTA	NK cells	12	14.81	0.93	6.30	0.99	6.68	1.36	9.18
T	4	BM	K_2EDTA	γδ T cells	12	7.54	0.33	4.33	0.25	3.29	0.41	5.44
T	4	WB	Heparin	Helper T cells	12	61.77	0.39	0.63	0.00	0.00	0.39	0.63
T	4	WB	Heparin	Cytotoxic T cells	12	26.20	0.25	0.96	0.72	2.75	0.76	2.91
T	4	WB	Heparin	NK cells	12	5.99	0.19	3.13	0.31	5.22	0.36	6.08
T	4	WB	Heparin	γδ T cells	12	8.31	0.11	1.36	0.05	0.55	0.12	1.46

ii. *Operator-to-operator and instrument-to-instrument imprecision:* Five normal and five abnormal clinical specimens representing clinical matrices and anticoagulants were evaluated with the ClearLLab 10C Panels at one site, across three operators utilizing two Navios EX instruments. Each operator performed separate sample preparations in triplicate twice per day. Samples were acquired on each of the two instruments, the order of which was randomized. Following acquisition, each operator analyzed listmode datafiles as instructed, using Kaluza C software. A reviewer assessed each LMD analysis as normal or abnormal, and further described the immunophenotype of abnormal results. From 396 initial acquisitions, 36 replicates from one specimen were excluded for reasons of insufficient quantity.

All results showed 100% qualitative agreement across Instruments and Operators. The number of samples tested is depicted in the tables below.

Qualitative Agreement across Instruments and Operators		
Panel	Phenotype	N
B	Normal (−)	36
B	Abnormal (+)	108
M1	Normal (−)	36
M1	Abnormal (+)	36
M2	Normal (−)	36
M2	Abnormal (+)	36
T	Normal (−)	72

Quantitative Results, by Instrument, by Operator													
Panel	Population	N	Mean (%)	Repeatability		Between-Run		Between-Instruments		Between-Operators		Within-Specimen	
				SD	%CV	SD	%CV	SD	%CV	SD	%CV	SD	%CV
B	Abnormal $CD5^+$ B cells	36	99.97	0.02	0.02	0.00	0.00	0.01	0.01	0.01	0.01	0.02	0.02
B	Abnormal $CD10^+$ B cells	36	96.26	0.19	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.19	0.20
B	Abnormal $CD5^+$ B cells	36	67.67	1.05	1.55	0.00	0.00	0.00	0.00	0.71	1.04	1.27	1.87
B	Mature κ^+ B cells	36	58.64	1.63	2.79	0.00	0.00	0.00	0.00	0.00	0.00	1.63	2.79
B	Mature λ^+ B cells	36	41.22	1.61	3.90	0.00	0.00	0.00	0.00	0.00	0.00	1.61	3.90
M1	Abnormal $CD34^+$	36	1.70	0.15	8.77	0.00	0.00	0.00	0.00	0.00	0.00	0.15	8.77
M1	Abnormal $CD7^+$	36	5.93	0.47	7.97	0.00	0.00	0.14	2.37	0.00	0.00	0.49	8.32
M1	Neutrophils	36	87.17	0.67	0.76	0.00	0.00	0.68	0.78	0.00	0.00	0.95	1.09
M1	Monocytes	36	4.08	0.19	4.65	0.00	0.00	0.22	5.33	0.00	0.00	0.29	7.07
M2	Abnormal $CD34^+CD123^+$	36	76.27	0.49	0.65	0.00	0.00	0.00	0.00	0.00	0.00	0.49	0.65
M2	Abnormal $CD117^+$	36	76.32	0.68	0.89	0.00	0.00	0.00	0.00	0.00	0.00	0.68	0.89
M2	Neutrophils	36	87.15	0.85	0.97	0.00	0.00	0.10	0.11	0.11	0.12	0.86	0.98
M2	Monocytes	36	9.57	0.56	5.84	0.00	0.00	0.16	1.62	0.00	0.00	0.58	6.06
T	Helper T cells	36	58.28	0.93	1.60	0.40	0.69	0.00	0.00	0.00	0.00	1.02	1.74
T	Cytotoxic T cells	36	37.49	1.01	2.69	0.00	0.00	0.00	0.00	0.12	0.32	1.01	2.71
T	NK cells	36	35.32	0.66	1.86	0.00	0.00	0.17	0.47	0.00	0.00	0.68	1.92
T	Helper T cells	36	28.22	0.38	1.34	0.00	0.00	0.00	0.00	0.00	0.00	0.38	1.34
T	Cytotoxic T cells	36	59.30	0.50	0.84	0.00	0.00	0.24	0.40	0.00	0.00	0.55	0.93
T	NK cells	36	14.43	0.26	1.77	0.00	0.00	0.00	0.00	0.00	0.00	0.26	1.77
T	γδ T cells	36	10.63	0.25	2.39	0.00	0.00	0.00	0.00	0.00	0.00	0.25	2.39

iii. *Site-to-Site Reproducibility with Control Material*: The reproducibility of the ClearLLab 10C reagent system on Navios and Navios EX flow cytometers was evaluated utilizing one lot each of control cell materials: ClearLLab Normal Control Cells and ClearLLab Abnormal Control Cells. These control materials express all surface markers comprising the ClearLLab 10C panels. For multi-site testing, control materials allow samples to be shared between sites in a manner not available for native samples. For each panel, the two controls were tested on three Navios instruments and three Navios EX instruments, across five total sites × three ClearLLab 10 color reagent lots. At site 1, testing was performed for 20 days × two runs/day × two replicates/run × three sites × one instrument/site. At sites 2 and 3, testing was performed for five days × two runs/day × three replicates/run × three sites × one instrument/site. Across all three sites, a total of 140 test results for each panel were generated; three results were excluded for operator error.

Navios ClearLLab Normal Control Cells, across sites													
Cell Population	Panel	N	Mean (%)	Repeatability		Between Run		Between Days		Between Site		Reproducibility	
				SD	%CV	SD	%CV	SD	%CV	SD	%CV	SD	%CV
WBC	B	140	98.90	0.23	0.23	0.00	0.00	0.29	0.29	0.09	0.09	0.38	0.38
lymphocyte	B	140	34.28	0.72	2.10	0.00	0.00	0.40	1.16	0.00	0.00	0.82	2.40
monocyte	B	140	8.17	0.31	3.75	0.00	0.00	0.24	2.88	0.46	5.61	0.60	7.34
granulocyte	B	140	54.70	0.89	1.62	0.00	0.00	0.53	0.97	0.00	0.00	1.03	1.89
$CD5^+$	B	140	73.43	0.40	0.54	0.00	0.00	1.00	1.37	0.00	0.00	1.08	1.47

Navios ClearLLab Normal Control Cells, across sites													
Cell Population	Panel	N	Mean (%)	Repeatability		Between Run		Between Days		Between Site		Reproducibility	
				SD	%CV	SD	%CV	SD	%CV	SD	%CV	SD	%CV
$CD10^+$	B	140	53.36	0.85	1.59	0.00	0.00	0.47	0.89	1.51	2.82	1.79	3.36
$CD19^+CD20^+$	B	140	11.18	0.26	2.32	0.04	0.38	0.16	1.40	0.57	5.11	0.65	5.79
$CD38^+$	B	140	8.67	0.31	3.60	0.00	0.00	0.23	2.68	0.26	3.00	0.47	5.40
$CD200^+$	B	140	10.24	0.26	2.53	0.03	0.29	0.21	2.01	0.80	7.80	0.86	8.44
$Kappa^+$	B	140	57.02	1.34	2.34	0.00	0.00	0.36	0.64	1.14	2.00	1.79	3.14
$Lambda^+$	B	140	40.44	1.24	3.07	0.25	0.61	0.00	0.00	0.81	2.01	1.50	3.71
WBC	M1	140	98.59	0.24	0.24	0.00	0.00	0.35	0.36	0.07	0.07	0.43	0.43
lymphocyte	M1	140	33.98	0.76	2.23	0.00	0.00	0.55	1.61	0.12	0.36	0.94	2.77
monocyte	M1	140	8.07	0.30	3.77	0.00	0.00	0.24	2.92	1.01	12.56	1.08	13.43
granulocyte	M1	140	54.88	1.02	1.86	0.00	0.00	0.71	1.30	0.16	0.29	1.26	2.29
$CD7^+$	M1	140	84.45	0.48	0.57	0.00	0.00	0.51	0.61	0.67	0.79	0.97	1.15
$CD10^+$	M1	140	54.28	0.90	1.66	0.00	0.00	0.56	1.03	0.66	1.22	1.25	2.30
$CD14^+CD11b^+$	M1	140	7.76	0.31	3.94	0.00	0.00	0.18	2.28	0.39	5.09	0.53	6.83
$CD13^+$	M1	140	56.10	0.92	1.65	0.00	0.00	0.75	1.34	0.74	1.32	1.470	2.50
$CD16^+$	M1	140	52.63	0.82	1.56	0.12	0.23	0.65	1.23	0.18	0.35	1.07	2.03
$CD14^+CD64^+$	M1	140	7.64	0.28	3.66	0.02	0.31	0.18	2.36	0.27	3.52	0.43	5.61
$HLA\text{-}DR^+$	M1	140	8.90	0.31	3.52	0.00	0.00	0.23	2.61	0.00	0.00	0.39	4.38
WBC	M2	140	98.60	0.16	0.16	0.00	0.00	0.32	0.32	0.00	0.00	0.36	0.36
lymphocyte	M2	140	34.17	0.78	2.27	0.00	0.00	0.54	1.59	0.50	1.46	1.07	3.13
monocyte	M2	140	8.24	0.34	4.15	0.00	0.00	0.26	3.17	0.45	5.40	0.62	7.51
granulocyte	M2	140	54.08	1.03	1.90	0.00	0.00	0.77	1.43	1.02	1.88	1.64	3.03
$CD13^+$	M2	140	54.78	0.92	1.67	0.00	0.00	0.69	1.25	0.00	0.00	1.15	2.09
$CD15^+$	M2	140	54.77	0.90	1.63	0.00	0.00	0.80	1.45	0.00	0.00	1.20	2.19
$CD19^+$	M2	140	9.22	0.37	4.05	0.00	0.00	0.39	4.28	1.27	13.76	1.38	14.97
$CD33^+$	M2	140	8.81	0.40	4.58	0.00	0.00	0.24	2.77	0.30	3.38	0.56	6.33
$CD38^+$	M2	140	8.66	0.35	4.03	0.00	0.00	0.23	2.66	0.22	2.50	0.47	5.44
$HLA\text{-}DR^+$	M2	140	8.79	0.33	3.72	0.00	0.00	0.18	2.10	0.24	2.77	0.45	5.09
WBC	T	140	99.04	0.19	0.20	0.00	0.00	0.31	0.31	0.00	0.00	0.36	0.37
lymphocyte	T	140	33.95	0.68	1.99	0.00	0.00	0.57	1.68	0.62	1.84	1.08	3.19
monocyte	T	140	8.31	0.33	3.94	0.00	0.00	0.27	3.22	0.66	7.92	0.78	9.42
granulocyte	T	140	54.70	0.91	1.67	0.00	0.00	0.61	1.11	0.56	1.02	1.23	2.25
$CD2^+$	T	140	84.31	0.40	0.48	0.00	0.00	0.35	0.42	0.65	0.77	0.84	1.00
$CD3^+$	T	140	74.33	0.45	0.60	0.00	0.00	0.63	0.85	1.02	1.37	1.28	1.72
$CD4^+CD8^-$	T	140	53.15	0.51	0.96	0.00	0.00	0.44	0.82	0.52	0.99	0.85	1.60
$CD4^-CD8^+$	T	140	38.32	0.50	1.31	0.04	0.10	0.21	0.54	0.64	1.67	0.84	2.19
$CD5^+$	T	140	75.30	0.42	0.56	0.00	0.00	0.45	0.59	0.61	0.82	0.87	1.15
$CD7^+$	T	140	83.98	0.50	0.60	0.00	0.00	0.48	0.57	0.78	0.93	1.04	1.24
$CD3^-CD56^+$	T	140	11.27	0.31	2.71	0.00	0.00	0.13	1.18	2.08	18.42	2.10	18.66
$TCR\gamma\delta^+$	T	140	4.37	0.15	3.51	0.04	0.93	0.05	1.24	0.08	1.83	0.19	4.25

Navios ClearLLab Abnormal Control Cells, across sites													
Cell Population	Panel	N	Mean (%)	Repeatability		Between Run		Between Days		Between Site		Reproducibility	
				SD	%CV	SD	%CV	SD	%CV	SD	%CV	SD	%CV
WBC	B	140	98.79	0.18	0.18	0.00	0.00	0.43	0.43	0.00	0.00	0.47	0.47
lymphocyte	B	140	34.23	0.78	2.29	0.00	0.00	0.61	1.78	0.26	0.75	1.02	2.99
monocyte	B	140	8.03	0.27	3.38	0.00	0.00	0.17	2.16	0.62	7.77	0.70	8.74
granulocyte	B	140	54.65	0.93	1.71	0.00	0.00	0.65	1.18	0.00	0.00	1.13	2.08
$CD5^+$	B	140	73.80	0.40	0.55	0.00	0.00	0.62	0.84	0.00	0.00	0.74	1.00
$CD10^+$	B	140	53.66	0.91	1.69	0.00	0.00	0.64	1.18	0.64	1.18	1.28	2.38
$CD19^+CD20^+$	B	140	11.12	0.27	2.43	0.17	1.51	0.24	2.15	0.51	4.57	0.65	5.81
$CD34^+$	B	140	8.58	0.19	2.23	0.00	0.00	0.12	1.39	0.04	0.43	0.23	2.66

Navios ClearLLab Abnormal Control Cells, across sites													
Cell Population	Panel	N	Mean (%)	Repeatability		Between Run		Between Days		Between Site		Reproducibility	
				SD	%CV	SD	%CV	SD	%CV	SD	%CV	SD	%CV
$CD38^+$	B	140	8.69	0.26	2.95	0.11	1.31	0.11	1.29	0.46	5.32	0.55	6.36
$CD200^+$	B	140	10.08	0.27	2.71	0.14	1.39	0.28	2.74	0.70	3.91	0.81	8.04
$Kappa^+$	B	140	57.09	1.36	2.37	0.00	0.00	0.18	0.32	1.44	2.52	1.98	3.48
$Lambda^+$	B	140	40.43	1.31	3.25	0.00	0.00	0.15	0.37	0.25	0.61	1.34	3.32
WBC	M1	139	98.34	0.27	0.27	0.00	0.00	0.37	0.38	0.01	0.01	0.46	0.47
lymphocyte	M1	139	34.25	0.74	2.16	0.00	0.00	0.72	2.10	0.00	0.00	1.03	3.01
monocyte	M1	139	7.96	0.33	4.19	0.00	0.00	0.24	2.98	1.20	15.03	1.26	15.88
granulocyte	M1	139	54.59	0.94	1.72	0.00	0.00	0.79	1.45	0.00	0.00	1.23	2.25
$CD7^+$	M1	139	84.30	0.43	0.51	0.00	0.00	0.62	0.73	0.80	0.95	1.10	1.30
$CD10^+$	M1	139	53.73	0.82	1.52	0.00	0.00	0.83	1.54	0.27	0.50	1.19	2.22
$CD14^+CD11b^+$	M1	139	7.74	0.25	3.24	0.00	0.00	0.12	1.54	0.20	2.55	0.34	4.40
$CD13^+$	M1	139	55.82	0.78	1.39	0.26	0.47	0.85	1.53	0.88	1.58	1.47	2.64
$CD16^+$	M1	139	51.78	0.77	1.49	0.00	0.00	0.74	1.44	0.00	0.00	1.07	2.07
$CD34^+$	M1	139	8.52	0.19	2.21	0.00	0.00	0.12	1.41	0.00	0.00	0.22	2.62
$CD14^+CD64^+$	M1	139	7.63	0.25	3.30	0.00	0.00	0.10	1.37	0.11	1.49	0.30	3.87
$HLA\text{-}DR^+$	M1	139	8.87	0.28	3.16	0.00	0.00	0.16	1.78	0.12	1.32	0.34	3.86
WBC	M2	140	98.33	0.16	0.16	0.00	0.00	0.38	0.38	0.00	0.00	0.41	0.41
lymphocyte	M2	140	34.28	0.74	2.15	0.00	0.00	0.58	1.69	0.72	2.09	1.18	3.45
monocyte	M2	140	7.81	0.26	3.34	0.00	0.00	0.28	3.63	1.02	13.08	1.09	13.98
granulocyte	M2	140	54.41	0.86	1.58	0.18	0.33	0.66	1.21	0.00	0.00	1.10	2.02
$CD13^+$	M2	140	54.76	0.85	1.56	0.11	0.21	0.74	1.35	0.09	0.17	1.14	2.08
$CD15^+$	M2	140	54.40	0.86	1.58	0.00	0.00	0.78	1.44	0.43	0.80	1.24	2.28
$CD19^+$	M2	140	9.00	0.37	4.15	0.00	0.00	0.34	3.76	1.13	12.52	1.23	13.71
$CD33^+$	M2	140	8.42	0.30	3.51	0.00	0.00	0.20	2.41	0.35	4.16	0.50	5.96
$CD34^+$	M2	140	8.51	0.18	2.08	0.02	0.20	0.10	1.14	0.15	1.79	0.25	2.98
$CD38^+$	M2	140	8.55	0.30	3.47	0.00	0.00	0.18	2.13	0.32	3.70	0.47	5.50
$CD117^+$	M2	140	8.57	0.18	2.10	0.03	0.36	0.08	0.96	0.14	1.64	0.24	2.86
$CD123^+$	M2	140	8.57	0.17	2.03	0.05	0.57	0.10	1.12	0.17	1.96	0.26	3.09
$HLA\text{-}DR^+$	M2	140	8.80	0.26	2.97	0.00	0.00	0.12	1.32	0.28	3.13	0.40	4.51
WBC	T	139	98.82	0.20	0.20	0.00	0.00	0.45	0.46	0.06	0.06	0.50	0.50
lymphocyte	T	139	34.00	0.72	2.11	0.21	0.63	0.67	1.97	0.63	1.87	1.19	3.50
monocyte	T	139	7.92	0.24	3.08	0.08	1.04	0.22	2.80	0.56	7.10	0.66	8.30
granulocyte	T	139	54.77	0.84	1.53	0.23	0.41	0.73	1.34	0.68	1.24	1.32	2.42
$CD2^+$	T	139	84.17	0.34	0.40	0.00	0.00	0.34	0.41	0.62	0.74	0.79	0.94
$CD3^+$	T	139	74.11	0.40	0.54	0.00	0.00	0.68	0.91	0.70	0.94	1.05	1.42
$CD4^+CD8^-$	T	139	53.47	0.48	0.89	0.19	0.35	0.36	0.66	0.55	1.04	0.84	1.56
$CD4^-CD8^+$	T	139	38.26	0.46	1.20	0.18	0.47	0.14	0.36	0.30	0.79	0.59	1.55
$CD5^+$	T	139	75.34	0.40	0.53	0.00	0.00	0.51	0.67	0.63	0.84	0.90	1.20
$CD7^+$	T	139	83.54	0.37	0.44	0.00	0.00	0.50	0.60	0.89	1.07	1.09	1.30
$CD34^+$	T	139	8.35	0.17	2.01	0.00	0.00	0.13	1.58	0.16	1.88	0.26	3.17
$CD3^-CD56^+$	T	139	10.71	0.28	2.60	0.00	0.00	0.21	1.99	1.60	14.91	1.63	15.26
$TCR\gamma\delta^+$	T	139	4.24	0.16	3.74	0.02	0.48	0.03	0.67	0.07	1.67	0.18	4.17

Navios EX ClearLLab Normal Control Cells, across sites													
Cell Population	Panel	N	Mean (%)	Repeatability		Between Run		Between Days		Between Site		Reproducibility	
				SD	%CV	SD	%CV	SD	%CV	SD	%CV	SD	%CV
WBC	B	140	98.97	0.23	0.24	0.00	0.00	0.20	0.20	0.19	0.19	0.36	0.36
lymphocyte	B	140	33.21	1.15	3.45	0.00	0.00	0.45	1.34	0.85	2.55	1.49	4.50
monocyte	B	140	8.39	0.43	5.08	0.00	0.00	0.36	4.28	0.15	1.84	0.58	6.90
granulocyte	B	140	55.58	1.23	2.22	0.18	0.33	0.58	1.05	1.76	3.17	2.23	4.02
$CD5^+$	B	140	74.52	0.52	0.70	0.00	0.00	0.45	0.60	0.43	0.58	0.81	1.09

Navios EX ClearLLab Normal Control Cells, across sites													
Cell Population	Panel	N	Mean (%)	Repeatability		Between Run		Between Days		Between Site		Reproducibility	
				SD	%CV	SD	%CV	SD	%CV	SD	%CV	SD	%CV
$CD10^+$	B	140	55.95	1.27	2.27	0.00	0.00	0.58	1.04	1.60	2.86	2.12	3.80
$CD19^+CD20^+$	B	140	11.31	0.37	3.24	0.00	0.00	0.18	1.55	0.39	3.49	0.57	5.01
$CD38^+$	B	140	8.73	0.44	5.00	0.03	0.32	0.26	3.02	0.66	7.58	0.84	9.58
$CD200^+$	B	140	10.16	0.35	3.46	0.00	0.00	0.18	1.77	0.78	7.68	0.87	8.61
$Kappa^+$	B	140	57.30	1.22	2.14	0.35	0.61	0.50	0.87	0.00	0.00	1.37	2.39
$Lambda^+$	B	140	39.79	1.26	3.18	0.00	0.00	0.36	0.92	0.98	2.45	1.64	4.12
WBC	M1	140	98.08	0.15	0.16	0.00	0.00	0.10	0.10	0.23	0.24	0.30	0.30
lymphocyte	M1	140	33.62	I.I I	3.30	0.00	0.00	0.69	2.05	0.45	1.33	1.38	4.10
monocyte	M1	140	9.01	0.47	5.23	0.00	0.00	0.43	4.80	0.66	7.33	0.92	10.20
granulocyte	M1	140	54.57	1.27	2.33	0.00	0.00	0.79	1.45	1.67	3.06	2.24	4.11
$CD7^+$	M1	140	84.64	0.46	0.55	0.07	0.09	0.62	0.74	0.28	0.33	0.83	0.98
$CD10^+$	M1	140	55.02	1.22	2.22	0.00	0.00	0.87	1.58	1.79	3.25	2.33	4.24
$CD14^+CD11b^+$	M1	140	7.88	0.41	5.22	0.00	0.00	0.32	4.03	0.29	3.64	0.59	7.53
$CD13^+$	M1	140	55.25	1.21	2.19	0.00	0.00	0.87	1.57	2.13	3.85	2.60	4.70
$CD16^+$	M1	140	53.22	1.23	2.32	0.00	0.00	0.81	1.51	1.56	2.94	2.15	4.04
$CD14^+CD64^+$	M1	140	7.75	0.39	5.06	0.00	0.00	0.27	3.54	0.23	2.91	0.53	6.83
$HLA\text{-}DR^+$	M1	140	8.78	0.40	4.52	0.04	0.51	0.34	3.88	0.52	5.97	0.74	8.45
WBC	M2	140	98.12	0.20	0.21	0.00	0.00	0.16	0.16	0.46	0.47	0.53	0.54
lymphocyte	M2	140	33.95	1.02	2.99	0.00	0.00	1.03	3.03	1.54	4.52	2.11	6.21
monocyte	M2	140	8.79	0.49	5.63	0.18	2.02	0.18	2.06	0.56	6.32	0.79	8.94
granulocyte	M2	140	54.65	1.20	2.19	0.00	0.00	0.91	1.67	2.16	3.96	2.63	4.82
$CD13^+$	M2	140	55.50	1.21	2.18	0.00	0.00	0.99	1.79	2.57	4.63	3.01	5.43
$CD15^+$	M2	140	55.20	1.12	2.04	0.00	0.00	1.10	1.98	2.41	4.37	2.88	5.21
$CD19^+$	M2	140	10.39	0.41	3.97	0.00	0.00	0.17	1.61	0.76	7.28	0.88	8.45
$CD33^+$	M2	140	8.31	0.43	5.16	0.19	2.25	0.36	4.30	0.71	8.50	0.92	11.06
$CD38^+$	M2	140	8.39	0.41	4.92	0.15	1.73	0.24	2.91	0.76	9.04	0.91	10.84
$HLA\text{-}DR^+$	M2	140	8.44	0.43	5.06	0.12	1.46	0.30	3.53	0.62	7.30	0.82	9.67
WBC	T	140	99.03	0.18	0.18	0.00	0.00	0.12	0.12	0.21	0.21	0.30	0.30
lymphocyte	T	140	33.72	0.96	2.84	0.00	0.00	0.75	2.24	0.55	1.64	1.34	3.97
monocyte	T	140	8.56	0.44	5.15	0.00	0.00	0.36	4.18	0.27	3.19	0.63	7.36
granulocyte	T	140	54.95	1.16	2.12	0.1 4	0.25	0.66	1.20	1.49	2.72	2.01	3.66
$CD2^+$	T	140	84.71	0.29	0.35	0.19	0.23	0.14	0.17	0.20	0.24	0.43	0.51
$CD3^+$	T	140	75.18	0.35	0.47	0.2 7	0.36	0.21	0.29	0.12	0.16	0.51	0.68
$CD4^+CD8^-$	T	140	53.37	0. 54	1.02	0.24	0.46	0.00	0.00	0.42	0.79	0.73	1.37
$CD4^-CD8^+$	T	140	38. 79	0.46	1.19	0.24	0.62	0.02	0.06	0.16	0.42	0.55	1.41
$CD5^+$	T	140	76.35	0.40	0.53	0.12	0.16	0.13	0.18	0.89	1.17	0.99	1.30
$CD7^+$	T	140	85.16	0.49	0.57	0.28	0.32	0.13	0.15	0.30	0.36	0.65	0.76
$CD3^-CD56^+$	T	140	11.24	0.30	2.70	0.10	0.85	0.24	2.12	0.30	2.68	0.50	4.44
$TCR\gamma\delta^+$	T	140	4.40	0.17	3.82	0.03	0.69	0.09	2.03	0.07	1.57	0.20	4.65

Navios EX ClearLLab Abnormal Control Cells, across sites													
Cell Population	Panel	N	Mean (%)	Repeatability		Between Run		Between Days		Between Site		Reproducibility	
				SD	%CV	SD	%CV	SD	%CV	SD	%CV	SD	%CV
WBC	B	140	99.13	0.13	0.13	0.02	0.02	0.19	0.19	0.24	0.24	0.33	0.33
lymphocyte	B	140	33.39	1.05	3.14	0.00	0.00	1.37	4.09	0.00	0.00	1.72	5.16
monocyte	B	140	8.55	0.40	4.69	0.00	0.00	0.25	2.94	0.18	2.08	0.51	5.91
granulocyte	B	140	55.31	1.23	2.22	0.00	0.00	1.33	2.41	1.10	1.98	2.12	3.83
$CD5^+$	B	140	74.54	0.55	0.74	0.00	0.00	0.35	0.47	0.57	0.76	0.87	1.16
$CD10^+$	B	140	55.04	1.17	2.12	0.00	0.00	1.28	2.32	1.23	2.23	2.12	3.85
$CD19^+CD20^+$	B	140	11.44	0.30	2.59	0.00	0.00	0.16	1.37	0.32	2.81	0.46	4.06
$CD34^+$	B	140	8.72	0.32	3.70	0.00	0.00	0.23	2.61	0.39	4.48	0.56	6.37

Navios EX ClearLLab Abnormal Control Cells, across sites													
Cell Population	Panel	N	Mean (%)	Repeatability		Between Run		Between Days		Between Site		Reproducibility	
				SD	%CV	SD	%CV	SD	%CV	SD	%CV	SD	%CV
$CD38^+$	B	140	8.97	0.35	3.90	0.00	0.00	0.00	0.00	0.60	6.71	0.70	7.76
$CD200^+$	B	140	10.21	0.28	2.76	0.00	0.00	0.20	1.98	0.69	6.74	0.77	7.55
$Kappa^+$	B	140	56.54	1.16	2.06	0.00	0.00	0.72	1.27	0.00	0.00	1.37	2.42
$Lambda^+$	B	140	40.15	1.19	2.96	0.00	0.00	0.70	1.74	0.80	1.99	1.59	3.97
WBC	M1	140	98.02	0.17	0.17	0.00	0.00	0.20	0.21	0.02	0.02	0.27	0.27
lymphocyte	M1	140	33.71	1.09	3.23	0.00	0.00	1.93	5.72	0.43	1.27	2.25	6.69
monocyte	M1	140	8.93	0.36	4.04	0.08	0.86	0.33	3.75	0.30	3.32	0 .58	6.49
granulocyte	M1	140	54.50	1.19	2.19	0.00	0.00	2.03	3.73	1.14	2.10	2.62	4.80
$CD7^+$	M1	140	84.29	0.50	0.60	0.00	0.00	0.58	0.69	0.50	0.60	0.92	1.09
$CD10^+$	M1	140	54.43	1.21	2.23	0.00	0.00	2.01	3.70	1.66	3.05	2.88	5.29
$CD14^+CD11b^+$	M1	140	8.01	0.34	4.28	0.00	0.00	0.26	3.30	0.15	1.92	0.46	5.74
$CD13^+$	M1	140	54.80	1.15	2.10	0.00	0.00	2.07	3.78	1.19	2.18	2.65	4.84
$CD16^+$	M1	140	52.41	1.14	2.18	0.00	0.00	1.96	3.73	1.67	3.18	2.81	5.37
$CD34^+$	M1	140	8.94	0.30	3.38	0.00	0.00	0.32	3.55	0.57	6.37	0.72	8.04
$CD14^+CD64^+$	M1	140	7.87	0.34	4.37	0.00	0.00	0.22	2.81	0.16	1.99	0.44	5.56
$HLA\text{-}DR^+$	M1	140	8.94	0.34	3.83	0.08	0.94	0.29	3.26	0.32	3.56	0.56	6.23
WBC	M2	140	98.06	0.19	0.20	0.00	0.00	0.33	0.33	0.64	0.65	0.74	0.76
lymphocyte	M2	140	34.19	1.26	3.68	0.00	0.00	2.25	6.58	0.59	1.71	2.64	7.73
monocyte	M2	140	8.65	0.39	4.51	0.00	0.00	0.24	2.76	0.13	1.47	0.47	5.49
granulocyte	M2	140	54.38	1.31	2.41	0.00	0.00	2.26	4.16	1.45	2.66	2.99	5.50
$CD13^+$	M2	140	54.99	1.34	2.43	0.00	0.00	2.45	4.45	1.56	2.84	3.20	5.82
$CD15^+$	M2	140	54.60	1.30	2.39	0.00	0.00	2.43	4.44	1.12	2.05	2.97	5.44
$CD19^+$	M2	140	10.48	0.38	3.65	0.00	0.00	0.31	2.98	0.68	6.44	0.84	7.98
$CD33^+$	M2	140	8.48	0.39	4.54	0.00	0.00	0.53	6.23	0.42	4.96	0.78	9.17
$CD34^+$	M2	140	8.74	0.33	3.74	0.00	0.00	0.33	3.76	0.53	6.08	0.70	8.06
$CD38^+$	M2	140	8.46	0.36	4.24	0.00	0.00	0.33	3.90	0.61	7.27	0.78	9.27
$CD117^+$	M2	140	8.81	0.33	3.77	0.00	0.00	0.33	3.78	0.57	6.45	0.74	8.37
$CD123^+$	M2	140	8.84	0.32	3.67	0.00	0.00	0.32	3.57	0.54	6.08	0.70	7.95
$HLA\text{-}DR^+$	M2	140	8.49	0.38	4.45	0.00	0.00	0.27	3.17	0.57	6.76	0.74	8.69
WBC	T	139	99.15	0.16	0.16	0.00	0.00	0.14	0.14	0.24	0.24	0.32	0.32
lymphocyte	T	139	33.77	1.25	3.70	0.00	0.00	1.25	3.69	0.00	0.00	1.77	5.23
monocyte	T	139	8.50	0.43	5.02	0.00	0.00	0.36	4.20	0.23	2.74	0.60	7.09
granulocyte	T	139	54.77	1.27	2.32	0.00	0.00	1.44	2.64	1.15	2.10	2.24	4.09
$CD2^+$	T	139	84.68	0.37	0.44	0.02	0.02	0.24	0.28	0.11	0.13	0.46	0.54
$CD3^+$	T	139	75.14	0.44	0.59	0.00	0.00	0.32	0.43	0.26	0.35	0.61	0.81
$CD4^+CD8^-$	T	139	53.46	0.66	1.23	0.00	0.00	0.00	0.00	0.62	1.16	0.90	1.69
$CD4^-CD8^+$	T	139	38.72	0.59	1.52	0.00	0.00	0.00	0.00	0.27	0.71	0.65	1.68
$CD5^+$	T	139	76.50	0.47	0.61	0.00	0.00	0.30	0.39	0.95	1.24	1.10	1.44
$CD7^+$	T	139	84.81	0.4 1	0.48	0.26	0.31	0.22	0.26	0.22	0.26	0.57	0.68
$CD34^+$	T	139	8.55	0.34	4.03	0.00	0.00	0.24	2.86	0.54	6.37	0.69	8.06
$CD3^-CD56^+$	T	139	11.00	0.33	2.96	0.00	0.00	0.26	2.40	0.21	1.86	0.47	4.24
$TCR\gamma\delta^+$	T	139	4.34	0.18	4.07	0.03	0.68	0.00	0.00	0.00	0.00	0.18	4.13

iv. *ClearLLab 10C Reagents Lot-to-Lot Reproducibility:* For each panel, three normal whole blood specimens were tested in triplicate × three lots, using one Navios instrument. Certain markers are expressed at levels too low to reliably assay in normal specimens. For these markers, enriched cell populations or cell lines were employed. For evaluation of CD34, the human leukemic stem-like cell line KG1a was tested. For CD117 (c-kit, stem cell factor receptor) within the M2 panel, normal blood specimens were spiked with the human leukemic cell line MO7e. Enriched basophils were used to assess CD123 (interleukin 3 receptor alpha chain). From each panel, nine

populations were selected as numerical outputs for a total of 108 datapoints per sample, per panel, per lot.

ClearLLab 10 color lot-to-lot reproducibility for whole blood specimen number 1									
Cell Population	Panel	N	Mean (%)	Repeatability		Between-Lot		Within-Sample	
				SD	%CV	SD	%CV	SD	%CV
$CD10^+$	B	9	77.97	0.38	0.49%	0.37	0.48%	0.54	0.69%
$CD19^+$	B	9	12.12	0.36	2.99%	0.00	0.00%	0.36	2.99%
$CD200^+CD19^+$	B	9	8.43	0.73	8.72%	0.00	0.00%	0.73	8.72%
$CD20^+CD19^+$	B	9	11.72	0.34	2.92%	0.00	0.00%	0.34	2.92%
$CD34^+$	B	9	8.06	0.37	4.61%	0.00	0.00%	0.37	4.61%
$CD38^+$	B	9	7.17	0.28	3.85	0.00	0.00	0.28	3.85
$CD5^+CD19^-$	B	9	64.03	0.41	0.64	0.45	0.70	0.61	0.95
$Kappa^+$	B	9	61.96	1.60	2.58	0.00	0.00	1.60	2.58
$Lambda^+$	B	9	37.87	1.64	4.33	0.00	0.00	1.64	4.33
$CD2^+$	T	9	74.73	0.33	0.44	0.28	0.37	0.43	0.58
$CD34^+$	T	9	7.66	0.25	3.28	0.00	0.00	0.25	3.28
$CD3^+$	T	9	64.95	0.52	0.80	0.00	0.00	0.52	0.80
$CD4^+CD8^-$	T	9	62.13	0.41	0.65	0.58	0.93	0.70	1.13
$CD5^+$	T	9	65.37	0.53	0.82	0.00	0.00	0.53	0.82
$CD7^+$	T	9	82.46	0.27	0.33	0.17	0.21	0.32	0.39
$CD8^+CD4^-$	T	9	29.18	0.26	0.90	0.38	1.31	0.46	1.59
$TCR\gamma\delta^+CD3^+$	T	9	5.69	0.27	4.83	0.00	0.00	0.27	4.83
$CD56^+CD3^-$	T	9	18.32	0.39	2.13	0.00	0.00	0.39	2.13
$CD10^+$	M1	9	78.17	0.60	0.77	0.00	0.00	0.60	0.77
$CD11b^+$	M1	9	7.31	0.26	3.61	0.00	0.00	0.26	3.61
$CD13^+$	M1	9	78.10	0.62	0.80	0.00	0.00	0.62	0.80
$CD14^+$	M1	9	7.45	0.27	3.66	0.00	0.00	0.27	3.66
$CD16^+$	M1	9	75.57	0.58	0.76	0.00	0.00	0.58	0.76
$CD34^+$	M1	9	8.48	0.27	3.16	0.00	0.00	0.27	3.16
$CD64^+$	M1	9	7.10	0.27	3.88	0.00	0.00	0.27	3.88
$CD7^+$	M1	9	10.92	0.26	2.39	0.00	0.00	0.26	2.39
$HLA\text{-}DR^+$	M1	9	6.75	0.27	4.05	0.20	2.91	0.34	4.99

ClearLLab 10 color lot-to-lot reproducibility for whole blood specimen number 2									
Cell Population	Panel	N	Mean (%)	Repeatability		Between-Lot		Within-Sample	
				SD	%CV	SD	%CV	SD	%CV
$CD10^+$	B	9	49.19	1.36	2.76	0.16	0.33	1.36	2.77
$CD19^+$	B	9	13.15	0.74	5.64	0.00	0.00	0.74	5.64
$CD200^+CD19^+$	B	9	10.90	0.48	4.37	0.34	3.13	0.59	5.37
$CD20^+CD19^+$	B	9	13.10	0.74	5.64	0.00	0.00	0.74	5.64
$CD34^+$	B	9	13.97	0.51	3.65	0.27	1.94	0.58	4.14
$CD38^+$	B	9	5.70	0.41	7.25	0.12	2.07	0.43	7.54
$CD5^+CD19^-$	B	9	70.78	0.40	0.56	0.36	0.52	0.54	0.76
$Kappa^+$	B	9	51.73	1.53	2.95	0.00	0.00	1.53	2.95
$Lambda^+$	B	9	48.22	1.53	3.18	0.00	0.00	1.53	3.18
$CD2^+$	T	9	80.57	0.48	0.59	0.00	0.00	0.48	0.59
$CD34^+$	T	9	14.72	0.49	3.34	0.31	2.10	0.58	3.94
$CD3^+$	T	9	70.36	0.41	0.58	0.00	0.00	0.41	0.58
$CD4^+CD8^-$	T	9	71.18	0.37	0.52	0.19	0.27	0.41	0.58
$CD5^+$	T	9	71.34	0.45	0.63	0.00	0.00	0.45	0.63
$CD7^+$	T	9	80.34	0.53	0.65	0.00	0.00	0.53	0.65
$CD8^+CD4^-$	T	9	23.86	0.34	1.42	0.19	0.80	0.39	1.63
$TCR\gamma\delta^+CD3^+$	T	9	1.96	0.06	2.95	0.00	0.00	0.06	2.95

ClearLLab 10 color lot-to-lot reproducibility for whole blood specimen number 2									
Cell Population	Panel	N	Mean (%)	Repeatability		Between-Lot		Within-Sample	
				SD	%CV	SD	%CV	SD	%CV
$CD56^{+}CD3^{-}$	T	9	12.66	0.42	3.32	0.00	0.00	0.42	3.32
$CD10^{+}$	M1	9	48.57	1.01	2.08	0.00	0.00	1.01	2.08
$CD11b^{+}$	M1	9	6.58	0.10	1.51	0.00	0.00	0.10	1.51
$CD13^{+}$	M1	9	48.45	1.02	2.10	0.00	0.00	1.02	2.10
$CD14^{+}$	M1	9	6.70	0.11	1.64	0.00	0.00	0.11	1.64
$CD16^{+}$	M1	9	45.36	0.97	2.15	0.00	0.00	0.97	2.15
$CD34^{+}$	M1	9	13.91	0.58	4.17	0.00	0.00	0.58	4.17
$CD64^{+}$	M1	9	6.67	0.14	2.05	0.00	0.00	0.14	2.05
$CD7^{+}$	M1	9	34.34	0.64	1.88	0.00	0.00	0.64	1.88
$HLA\text{-}DR^{+}$	M1	9	6.31	0.14	2.19	0.00	0.00	0.14	2.19

*

ClearLLab 10 color lot-to-lot reproducibility for whole blood specimen number 3									
Cell Population	Panel	N	Mean (%)	Repeatability		Between-Lot		Within-Sample	
				SD	%CV	SD	%CV	SD	%CV
$CD10^{+}$	B	9	52.87	4.26	8.05	0.00	0.00	4.26	8.05
$CD19^{+}$	B	9	8.90	0.59	6.61	0.27	3.06	0.65	7.28
$CD200^{+}CD19^{+}$	B	9	7.57	0.41	5.42	0.11	1.44	0.42	5.61
$CD20^{+}CD19^{+}$	B	9	8.82	0.59	6.67	0.34	3.86	0.68	7.71
$CD34^{+}$	B	9	14.37	1.06	7.38	0.06	0.39	1.06	7.39
$CD38^{+}$	B	9	5.82	0.70	12.10	0.28	4.90	0.76	13.06
$CD5^{+}CD19^{-}$	B	9	66.72	1.57	2.35	0.00	0.00	1.57	2.35
$Kappa^{+}$	B	9	62.02	1.30	2.09	0.00	0.00	1.30	2.09
$Lambda^{+}$	B	9	37.93	1.29	3.41	0.00	0.00	1.29	3.41
$CD2^{+}$	T	9	85.78	0.29	0.34	0.17	0.19	0.33	0.39
$CD34^{+}$	T	9	14.77	0.42	2.85	0.00	0.00	0.42	2.85
$CD3^{+}$	T	9	69.78	0.17	0.25	0.36	0.51	0.40	0.57
$CD4^{+}CD8^{-}$	T	9	49.78	0.41	0.82	0.00	0.00	0.41	0.82
$CD5^{+}$	T	9	67.80	0.29	0.43	0.21	0.30	0.36	0.53
$CD7^{+}$	T	9	75.10	0.35	0.47	0.57	0.77	0.68	0.90
$CD8^{+}CD4^{-}$	T	9	44.93	0.43	0.96	0.00	0.00	0.43	0.96
$TCR\gamma\delta^{+}CD3^{+}$	T	9	3.74	0.12	3.26	0.02	0.43	0.12	3.29
$CD56^{+}CD3^{-}$	T	9	15.32	0.35	2.28	0.00	0.00	0.35	2.28
$CD10^{+}$	M1	9	54.15	2.13	3.93	0.00	0.00	2.13	3.93
$CD11b^{+}$	M1	9	6.97	0.58	8.28	0.28	4.07	0.64	9.23
$CD13^{+}$	M1	9	53.96	2.18	4.04	0.00	0.00	2.18	4.04
$CD14^{+}$	M1	9	6.97	0.60	8.67	0.21	3.06	0.64	9.19
$CD16^{+}$	M1	9	49.26	1.98	4.01	0.00	0.00	1.98	4.01
$CD34^{+}$	M1	9	15.71	1.08	6.87	1.21	7.71	1.62	10.33
$CD64^{+}$	M1	9	7.10	0.64	9.04	0.00	0.00	0.64	9.04
$CD7^{+}$	M1	9	27.84	1.10	3.96	0.00	0.00	1.10	3.96
$HLA\text{-}DR^{+}$	M1	9	6.27	0.51	8.08	0.00	0.00	0.51	8.08

To adequately represent rare cell populations and markers in the M2 panel, separate sets of samples enriched for M2 markers were tested in a similar manner, summarized in the tables below.

ClearLLab M2 panel lot-to-lot reproducibility for whole blood sample set 1								
Population	N	Mean (%)	Repeatability		Between-Lot		Within-Sample	
			SD	%CV	SD	%CV	SD	%CV
$CD13^{+}$	9	64.65	0.82	1.27	4.35	6.73	4.43	6.85

ClearLLab M2 panel lot-to-lot reproducibility for whole blood sample set 1								
Population	N	Mean (%)	Repeatability		Between-Lot		Within-Sample	
			SD	%CV	SD	%CV	SD	%CV
$CD15^+$	9	62.70	0.59	0.94	3.25	5.18	3.30	5.27
$CD19^+$	9	11.09	0.31	2.79	0.00	0.00	0.31	2.79
$CD33^+$	9	6.62	0.14	2.18	0.22	3.29	0.26	3.95
$CD34^+$	9	12.64	0.52	4.12	0.30	2.38	0.60	4.76
$CD38^+$	9	6.44	0.06	0.86	0.21	3.21	0.21	3.32
HLA-DR^+	9	6.58	0.10	1.56	0.20	3.11	0.23	3.48
$CD123^+$	9	1.37	0.07	5.12	0.00	0.00	0.07	5.12
$CD117^+$	9	2.92	0.19	6.39	0.00	0.00	0.19	6.39

ClearLLab M2 panel lot-to-lot reproducibility for whole blood sample set 2								
Population	N	Mean (%)	Repeatability		Between-Lot		Within-Sample	
			SD	%CV	SD	%CV	SD	%CV
$CD13^+$	9	69.96	1.31	1.87	0.97	1.38	1.63	2.33
$CD15^+$	9	68.12	1.29	1.90	0.89	1.30	1.57	2.30
$CD19^+$	9	9.56	0.23	2.44	0.14	1.50	0.27	2.86
$CD33^+$	9	7.35	0.16	2.13	0.16	2.18	0.22	3.04
$CD34^+$	9	9.07	0.23	2.50	0.24	2.62	0.33	3.62
$CD38^+$	9	7.23	0.20	2.74	0.15	2.04	0.25	3.41
HLA-DR^+	9	7.37	0.19	2.58	0.28	3.84	0.34	4.63
$CD123^+$	9	1.01	0.01	1.29	0.00	0.00	0.01	1.29
$CD117^+$	9	4.41	0.30	6.78	0.00	0.00	0.30	6.78

ClearLLab M2 panel lot-to-lot reproducibility for whole blood sample set 3								
Population	N	Mean (%)	Repeatability		Between-Lot		Within-Sample	
			SD	%CV	SD	%CV	SD	%CV
$CD13^+$	9	68.87	0.41	0.59	0.00	0.00	0.41	0.59
$CD15^+$	9	65.49	0.43	0.65	0.00	0.00	0.43	0.65
$CD19^+$	9	11.60	0.28	2.41	0.00	0.00	0.28	2.41
$CD33^+$	9	6.66	0.08	1.18	0.13	1.93	0.15	2.26
$CD34^+$	9	11.96	0.24	1.99	0.26	2.16	0.35	2.93
$CD38^+$	9	6.38	0.08	1.29	0.13	2.09	0.16	2.45
HLA-DR^+	9	6.60	0.12	1.74	0.12	1.86	0.17	2.55
$CD123^+$	9	1.20	0.05	4.14	0.00	0.00	0.05	4.14
$CD117^+$	9	4.57	0.38	8.30	0.00	0.00	0.38	8.30

b. Linearity/Reportable Range:

Instrument Linearity: The study was conducted on four Navios EX flow cytometers and four Navios flow cytometers. A study was performed to evaluate the linearity and dynamic range of the Navios and Navios EX flow cytometers' acquisition systems, from the photomultiplier tubes (PMT) to the electronics, independent of the application and gating methodology. The Navios and Navios EX flow cytometers' acquisition system demonstrated linear results independent of the application and gating methodology.

c. Detection Limit: The study was used to establish the detection capability, i.e., the ability to differentiate between abnormal and normal populations, of the ClearLLab reagents.

i. Limit of Blank (LoB):

The LoB was determined by testing five replicates of four normal specimens run with two lots of each ClearLLab 10C panels. The highest LoB observed from the two lots across all four panels was 0.10% population of abnormal cells.

ii. Limit of Detection (LoD):

The LoD was determined by using one normal specimen as a blank sample. One clinical specimen that contained a representative abnormal population was used to test each of the four ClearLLab 10C Panels. The clinical specimen was spiked into a normal specimen to prepare low level of the abnormal population targeting 2%, 1% and 0.5% of the total Leukocytes.

The Limit of Detection defined as 1% population of abnormal cells for all four panels used in the ClearLLab application is therefore confirmed.

d. Analytical Specificity:

i. Interfering Substances:

Not applicable. Adequate washing with phosphate buffered saline (PBS) before staining with reagents removes residual plasma and interfering substances.

ii. Assay Carryover:

Carryover studies were conducted on three Navios and three Navios EX flow cytometers according to the methodology presented in *CLSI H26-A2: Validation, Verification, and Quality Assurance of Automated Hematology analyzers; Approved Standard-Second Edition, Section 5.7* with regard to high or low value sample order. Two studies were conducted to evaluate specimen and reagent carryover.

Specimen Carryover

Three samples with high WBC counts (HTv1, HTv2, HTv3) were prepared from one clinical whole blood specimen containing a high level of WBCs. The samples were prepared to target 20,000 cells /µL WBCs. CD34 marker analysis was performed using a $CD34^+$ clinical whole blood specimen.

Three samples with low WBC counts (LTv1, LTv2, LTv3) were prepared by spiking a diluted (1:10,000) whole blood specimen with a red blood cell pool which had been depleted of white blood cells and diluted 4:1 with Immuno-Trol storage buffer. This resulted in a contrived specimen that had a red blood cell concentration similar to whole blood with very low concentrations of white blood cells.

The reagent selected for specimen carryover was the ClearLLab M1 Cell Tube reagent as a representative reagent because it contains all types of conjugates (FITC, PE, ECD, PC5.5, PC7, APC, APC-A700, APC-A750, Pacific Blue and Krome Orange) used in other ClearLLab 10C Panels as well as markers that can be used to identify

and assess the recovery of all leukocyte populations (lymphocytes, monocytes and granulocytes). Testing with M1 reagent also assesses the impact of lysing and fixative reagents on integrity of cell membranes for all relevant cell subsets and the conjugated antibodies that are found in the ClearLLab reagents.

Three HTv samples (HTv1, HTv2, HTv3) were analyzed consecutively followed immediately by the three LTv samples (LTv1, LTv2, LTv3). This was repeated three times on three Navios and three Navios EX flow cytometers. A total of nine sets of specimen carryover runs were evaluated for each Navios and Navios EX systems. No significant carryover was detected as determined by percent carryover for specimens, calculated from the analysis of the averages of the three runs on each flow cytometer for LTv1, LTv3, and HTv3. The specimen carryover is less than 1% for all markers.

Reagent Carryover

High concentration samples (HTv1, HTv2, HTv3): Normal whole blood specimens (for B, T, and M1 Cell Tubes) and clinical specimens (for M2 Cell Tubes) stained with all four ClearLLab 10C Panels were used as the high concentration samples.

Low concentration samples (LTv1, LTv2, LTv3): The same normal blood specimen or clinical whole blood as in the high concentration sample was processed in triplicate using antibody dilution buffer (RD1), in place of antibody reagent.

All the ClearLLab 10C antibody reagents (B, T, M1 and M2 reagents) were selected for the reagent carryover studies. The potential for carryover of these products and the subsequent impact on performance were assessed for FS, SS, and FL1-FL10, in all twelve of the detection channels.

The testing consisted of a high concentration sample analyzed consecutively three times (HTv1, HTv2, HTv3) followed immediately by testing the low concentration sample three times (LTv1, LTv2, LTv3). This run was repeated three times on three Navios and three Navios EX flow cytometers for a total of nine reagent carryover runs per instrument.

The reagent carryover is less than 1% for all markers demonstrating acceptable scatter and fluorescent carryover performance.

e. Traceability, Stability (Reagent and Specimen)and Controls:

i. Traceability:

For monoclonal antibodies, Leukocyte Typing Workshop information for each antibody clone was provided. Each clone identity is controlled and is traced back to the original source. Polyclonal antibodies for identification of Kappa or Lambda cell markers are supported by referenced literature.

#	Marker	Clone/Ig Chain (species)	Leukocyte Typing International Workshop*	Reactivity
1	CD2	39C1.5 IgG2a (rat)	Second	T cells and most of the NK cells
2	CD3	UCHT1 IgG1 (mouse)	First	Mature T cell (cytoplasmic expression in immature T cells)
3	CD4	SFCI12T4D11 IgG1 (mouse)	First	Helper / inducer T cells, monocytes, immature myeloid cells
4	CD5	BL1a IgG2a (mouse)	Third	Thymocytes, mature T cells, subpopulation of B cells
5	CD7	8H8.1 IgG2a (mouse)	Second	T cells, NK cells, subpopulation of immature myeloid cells
6	CD8	SFCI21Thy2D3 (T8) IgG1 (mouse)	Second	Cytotoxic / suppressor T cells, subpopulation of NK cells
7	CD10	ALB1 IgG1 (mouse)	Third	Common acute leukemia antigen (CALLA), lymphatic precursor cells, neutrophils, subpopulation of mature B cells
8	CD11b	Bear 1 IgG1 (mouse)	First	Mature and immature myeloid cells (granulocytes and monocytes) and NK cells
9	CD13	SJ1D1 366 IgG1 (mouse)	Third	Mature and immature myeloid cells (granulocytes and monocytes)
10	CD14	RMO52 igG2a (mouse)	First	Strongly expressed on monocytes, macrophages and weakly expressed on neutrophils
11	CD15	W6D3 IgG1 (mouse)	First	Neutrophils, eosinophils, monocytes, macrophages, normal myeloid precursor
12	CD16	3G8 IgG1 (mouse)	Second	NK cells, monocytes, neutrophils and macrophages
13	CD19	J3-119 IgG1 (mouse)	Fourth	Precursor and mature B cells
14	CD20	B9E9 (HRC20) IgG2a (mouse)	Fifth	B cells and a subpopulation of B precursor cells
15	CD33	D3HL60.251 IgG1 (mouse)	Fifth	Monocytes, myeloid precursor cells, weak on neutrophils
16	CD34	581 IgG1 (mouse)	Fifth	Myeloid and lymphoid precursor cells
17	CD38	LS198-4-3 IgG1 (mouse)	Fifth	Activated lymphocytes, subpopulation of B cells, plasma cells

18	CD45	J.33 IgG1 (mouse)	Third	All leukocytes
19	CD56	N901/NKH-1 IgG1 (mouse)	Second	NK cell subset and activated T-cells
20	CD64	22 IgG1 (mouse)	Fourth	Monocytes, macrophages
21	CD117	104D2D1 IgG1 (mouse)	Sixth	Myeloid precursor cells and mast cells
22	CD123	9F5	Sixth	Hematopoietic stem cells
23	CD200	OX-104 IgG1 (mouse)	Seventh	B cells, activated T cells and B cells, thymocytes, dendritic cells
24	HLA-DR	Immu-357 IgG1 (mouse)	Supported by test data	Dendritic cells, B cells, monocytes, macrophages, activated T cells
25	TCRγδ	Immu510 IgG1 (Mouse)	Supported by literature	Subset of T cells
26	Kappa	N/A: Polyclonal	N/A	Subpopulation of immature B Lymphocytes, subpopulation of mature B cells
27	Lambda	N/A: Polyclonal	N/A	Subpopulation of immature B Lymphocytes, subpopulation of mature B cells

* Table below : Human Leukocyte Differentiation antigens Workshops

Human Leukocyte Differentiation antigens Workshops

Workshop		CDs assigned	Number of CDs assigned
I First	Paris 1982[2]	CD1−CDw15	15
II Second	Boston 1984[3]	CD16−CDw26	11

[2] Bernard AR, Boumsell L, Dausset J, *et al*. eds. Leucocyte Typing: Human Leucocyte Differentiation Antigens Detected by Monoclonal antibodies. Berlin: Springer-Verlag, 1984.

III Third	Oxford 1987[4]	CD27−CD45	19
IV Fourth	Vienna 1989[5]	CD46−CDw78	33
V Fifth	Boston 1993[6]	CD79−CDw109	31
VI Sixth	Kobe[7]	CD110−CD166	55
VII Seventh	Harrogate 2000[8]	CD167−CD247	81

ii. Reagent Stability:

Testing of reagent stability was based on *CLSI EP-25A (Evaluation of Stability of In vitro Diagnostic Reagents, Approved Guideline*. Each of the ClearLLab 10C Panels (B, T, M1 and M2 Cell Tubes) is in dry format and separately packaged in a kit containing five sealed pouches each with five capped single test tubes for a total of 25 units per package. Each tube is used once, therefore, open vial stability is not applicable.

Four lots of each panel were tested. Of those four lots, one lot of each ClearLLab 10C Panel was subjected to environmental/transportation cycling (shipping) for stability testing. Data was collected on the Navios system. Three lots were held at 20−30ºC while the fourth lot was tested at three separate temperature conditions, 18ºC, 18 − 25ºC (RT) and 30ºC. The real time studies were conducted for closed pouch (CP) and open pouch (OP) testing for the duration of the target reagent shelf life. Three whole blood specimens from healthy donors were used for testing at seven time points. At each time point the lot under test (Test Lot) was compared to a fresh lot (Reference Lot). The percent positive of each marker was evaluated. The common markers in multiple panels were tested at least in one panel. CD123 was assessed using Basophils and CD10 was assessed using Granulocytes of the normal whole blood samples. Three lots of ClearLLab Abnormal Control Cells, or three normal whole blood spiked with KG1a Cell Line were used for CD34. CD34-APC is a common marker in all panels and was tested using the M2 Cell tube only. Three lots of ClearLLab Abnormal Control Cells or three normal whole blood spiked with Mo7e cell line were used for CD117. CD45-KrO is a common gating marker for all panels and was assessed using Lymphocytes in the T Cell Tube. CD10-ECD, CD13-PC5.5, CD38-AA700, HLA-DR-AA750, CD19-PB were evaluated in all corresponding panels. This study demonstrated that the ClearLLab 10C Panels (B, T, M1, and M2) met the stability claims of 180 days for closed pouch and 30 days for open pouch.

iii. Whole Blood ,Bone Marrow, and Lymph Node Specimen Stability:

A total of 110 clinical specimens consisting of 24 clincial whole blood samples, 51

[3] Reinherz EL, Haynes BF, Nadler L, Bernstein ID, eds. Leukocyte Typing II. New York: Springer-Verlag, 1985.
[4] McMichael AJ, Beverley PCL, Cobbold S, *et al*. eds. Leucocyte Typing III. White Cell Differentiation Antigens. Oxford: Oxford University Press, 1987.
[5] Knapp W, Dorken B, Gilks W *et al*., eds. Leucocyte Typing IV. Oxford: Oxford University Press, 1989.
[6] Schlossman SF, Boumsell L, Gilks W, et al. eds. Leucocyte Typing V: White cell differentiation antigens. Oxford: Oxford University Press, 1995.
[7] Kishimoto T, Kikutani H, von dem Born AEGK, et al. eds. Leucocyte Typing VI. New York: Garland Publishing, Inc., 1997.
[8] Mason D, Andre P, Bensussan A, et al. eds. Leucocyte Typing VII. Oxford: Oxford University Press, 2002.

bone marrow specimens, 12 lymph node specimens and 33 normal whole blood specimens were collected with different anticoagulants. The specimens included 33 collected in K2EDTA, 35 collected in ACD, and 30 collected in Heparin. Specimens were analyzed on the Navios flow cytometer for each of the ClearLLab 10C Panels at two sites. The study matrix included the specimen age (T0, T-inter, T-aged) and prepared sample (P0, P3, P6) stability for whole blood and bone marrow specimens. Only prepared sample stability was assessed for lymph node specimens. Lymph node samples were stained with the B Panel and T Panel only, as these are the only pertinent panels. Presence or absence of the abnormal phenotype was assessed for each specimen for each time point tested. The study examined the combined effect of specimen and prepared sample stability drift by evaluating recovery of percent positive phenotypes. The specimen (4−25ºC) and prepared sample stability claims at room temperature (20−25ºC) are shown below:

Anticoagulant	Whole Blood		Bone Marrow		Lymph Node
	Specimen stability 4ºC(RT)	Prepared Sample stability	Specimen stability 4ºC(RT)	Prepared Sample stability	Prepared Sample stability
EDTA	24 hours	< 5 hours	24 hours	< 5 hours	
ACD	48 hours	< 5 hours	48 hours	< 5 hours	
Heparin	48 hours	< 5 hours	48 hours	< 5 hours	
None (media)					< 5 hours

Current standard lab practice allows use of specimens without a time restriction if cell viability permits. Labeling will reflect continuation of this practice.

iv. Controls

ClearLLab Control Cells, normal and abnormal, are assayed, lysable, whole-blood quality control products used to verify the activity of the ClearLLab 10C Panel reagents and to verify the methods used for staining targeted cells, lysing erythrocytes, and analyzing samples with flow cytometry.

f. Assay cut-off: Not applicable

2. Comparison studies:

a. Method comparison with predicate device: Not applicable

b. Matrix comparison:

Whole Blood Samples: The study evaluated ClearLLab 10C panels parameter recovery for normal whole blood specimens collected in different anticoagulants (K2EDTA, Heparin, and ACD). Forty three normal whole blood samples were collected in three different anticoagulants and processed. One replicate per donor and per anticoagulant was analyzed. The specimens were tested to assess the normal markers by comparing between each pair of two anticoagulants against the specification. The performance of ClearLLab

10C panels with whole blood specimens collected in K2EDTA, ACD, and Heparin anticoagulants was demonstrated to be equivalent.

Whole Blood and Bone Marrow: A total of 65 whole blood and 68 bone marrow clinical specimens were collected in each of the anticoagulants (K2EDTA, ACD or Heparin) and were tested with both ClearLLab 10C Panels and ClearLLab Reagents (5C) to assess the 10C performance with each anticoagulant. Presence or absence of the abnormal phenotypes was assessed for each specimen for the ClearLLab 10C Panels and ClearLLab 5C Reagents. The qualitative agreement between the ClearLLab 10C Panels and the ClearLLab Reagents (5C) was analyzed for each anticoagulant, for both positive and negative outcomes in addition to the overall agreement. This multi-center anticoagulant study for whole blood and bone marrow was conducted across five sites covering hematopoietic malignancies as well as those with hematological abnormalities but no malignancy. Peripheral blood and bone marrow collected in K2EDTA were analyzed within 24 hours. Specimens collected in ACD and Sodium Heparin were analyzed within 48 hours. Equivalent performance between the ClearLLab 10C and 5C Panels was demonstrated using the different anticoagulants for both whole blood and bone marrow specimens.

3. Clinical studies:

a. Clinical Sensitivity and Specificity:

A multi-center, retrospective study was conducted at four sites comparing the diagnostic accuracy of the ClearLLab reagents to detect the presence or absence of an abnormal phenotype to the clinical outcome of "malignant" or "non-malignant" based on the clinical sites' final patient diagnosis. Patients with abnormal B-cell, T-cell, Natural Killer (NK) cell, and myeloid cell populations were tested. Residual samples were tested from a diverse population of patients covering hematopoietic malignancies as well as those with hematological abnormalities but no malignancy. This study included whole blood, bone marrow and lymph node specimen types. Specimen types tested reflected the distribution of the diseases and clinical indications encountered in the population of patients that are routinely encountered in evaluations of patients suspected of having hematopoietic neoplasia by flow cytometry. Consecutive specimens evaluated for flow cytometric immunophenotyping of leukemia and lymphoma and meeting the target disease categories were enrolled at these sites.

Clinical sites provided final diagnosis ("malignant" or "non-malignant") for all subjects and all specimen types based on the clinical testing performed at the respective sites regardless of the specimen type sent to the flow cytometry laboratory for testing as per WHO guidelines.[9] A qualified flow expert from each sitereviewed the Kaluza generated flow report independently to determine the absence or presence of abnormal phenotype and was blinded to the final clinical diagnosis. The result was designated as "malignant" if an abnormal population was identified, and "non-malignant" if an abnormal population was not identified.

[9] Swerdlow, S, et al. WHO Classification of Tumours of Haematopoietic and Lymphoid Tissues 4th Edition. . Lyon: International Agency for Research on Cancer, 2008.

A total of 453 abnormal hematologic specimens were enrolled: 200 hematologically abnormal but no malignancy and 253 with hematolymphoid malignancy per site's final diagnosis. Information about the types of specimens and samples evaluated is shown in the tables below.

Distribution of Specimen Type by Anticoagulant

Disease Category / Anticoagulant	Specimen Type			**Sum**
	WB	BM	LN	
No Malignancy	**105**	**71**	**24**	**200**
K2EDTA	32	24		56
Heparin	26	19		45
ACD	47	28		75
Malignancy	**109**	**111**	**33**	**253**
K2EDTA	38	28		66
Heparin	31	32		63
ACD	40	51		91
Sum	**214**	**182**	**57**	**453**

Number of Samples in Disease categories from each site

Sites	Category								
	Abnormal Hematology- No Malignancy	Abnormal Hematology- Malignancy							Total Number of Samples per Site
		Acute Leukemia	Chronic Leukemia	NHL	Plasma Cell Neoplasm	MDS	MPN	Others	
Site 1	51	13	12	35	4	6	0	2	123
Site 2	45	11	22	16	4	2	3	2	105
Site 3	42	13	19	21	3	5	1	1	105
Site 4	62	8	13	26	7	4	3	0	120
Total Number per Category	200	45	66	98	18	17	4	5	453

Statistical analysis of sensitivity, specificity, PPV, and NPV are presented below.

Sensitivity and Specificity for All Specimen Types

ClearLLab 10C Panels Population	**Clinical Diagnosis**		
	Malignant	**Non-Malignant**	**Total**
Malignant	235	10	245
Non-Malignant	18	190	208
Total	253	200	453

	Estimate	Lower 95%CI	Upper 95%CI
Sensitivity	92.9%	89.0%	95.5%
Specificity	95.0%	91.0%	97.3%
PPV	95.9%	92.7%	97.8%
NPV	91.3%	86.7%	94.5%

A separate analysis was performed for the 214 hematologically abnormal whole blood specimens consisting of 105 hematologically abnormal with no malignancy and 109 with hematolymphoid malignancy from all sites combined. Statistical analysis results on sensitivity, specificity, PPV, and NPV for the two experts are presented below.

Sensitivity and Specificity for Whole Blood Specimen Types

ClearLLab 10C Panels Population	**Clinical Outcome**		
	Malignant	**Non-Malignant**	**Total**
Malignant	104	4	108
Non-Malignant	5	101	106
Total	109	105	214

Statistics	Estimate	Lower 95%CI	Upper 95%CI
Sensitivity	95.4%	89.7%	98.0%
Specificity	96.2%	90.6%	98.5%
PPV	96.3%	90.9%	98.6%
NPV	95.3%	89.4%	98.0%

4. Clinical cut-off: The clinical cutoff is 3% of total leukocytes in the bone marrow CD45 Dim (blast) population which is normally undetected in peripheral whole blood (<1%) or lymph node (<1%). A clincal cutoff of 1% of total leukocytes was applied to all the other abnormal populations detected in BM, WB or LN specimen types.

O. Instrument Name: Beckman Coulter Navios and Navios EX flow cytometers

P. System Descriptions:

1. Modes of Operation:

Flow cytometers combine fluidics, optics, and electronics subsystems to measure and analyze signals emitted when particles in a liquid stream flow through a glass cuvette at which beams of laser light are directed. The scatter and fluorescence light signals from these particles provide information about cell size, internal complexity, and relative fluorescence intensity. The Instructions for Use for Navios and Navios EX flow cytometer instruments includes more

details on the system components and theory of operations. Batch or single tube analysis can be performed on both flow cytometers.

The cleared Instrument is indicated for use with cleared or approved in vitro diagnostic (IVD) assays for the identification and enumeration of human cell subsets that are indicated for use with the instrument.

Does the applicant's device contain the ability to transmit data to a computer, webserver, or mobile device?

Yes ___X_____ or No _____

Does the applicant's device transmit data to a computer, webserver, or mobile device using wireless transmission?

Yes ___X_____ or No _____

2. Software:

FDA has reviewed the applicant's Hazard Analysis and software development processes for this line of product types:

Yes __X__ or No _____

3. Specimen Identification:

Barcode reader or manual entry

4. Specimen Sampling and Handling:

The automated sample loader for the instrument uses a carousel that holds thirty-two 12 x 75-mm test tubes and includes a barcode reader.

5. Calibration:

Fluorescence intensity is calibrated by adjusting photomultiplier voltage using Flow-Set Pro Fluorospheres. The absolute count of a population is based on the calibration factor (CAL Factor) and the number of Flow-Count fluorospheres particles within a user defined CAL region.

6. Quality Controls:

The Navios and Navios EX Flow Cytometer Software provides automated instrument setup of alignment, voltage standardization, color compensation, and verification when used with the quality control reagents. The Software has an Auto-Set Panel which automatically

standardizes the cytometer, adjusts compensation settings, passes cytometer settings to designated test protocols, and verifies cytometer setup and antibody performance.

Q. Other Supportive Instrument Performance Characteristics Data Not Covered In The "Performance Characteristics" Section above:

R. Proposed Labeling:

The labeling is sufficient and it satisfies the requirements of 21 CFR Parts 801 and 809, as applicable, and the special controls for this device type under 21 CFR 864.7010.

S. Conclusion:

The submitted information in this premarket notification is complete and supports a substantial equivalence decision.