

# HE4 EIA

REF 404-10

IVD



## Instructions for use. 2008-02

**DE** Wenden Sie sich bitten an die deutsche Niederlassung um die geltende Gebrauchsanweisung zu erhalten.

**ES** Por favor contacte con su distribuidor para una versión válida de "Instrucciones de uso" en español

**IT** Contattare il proprio Distributore per ottenere la versione ufficiale della traduzione in lingua Italiana delle Istruzioni per l'Uso

**FR** Pour une version certifiée de la Notice en Français, veuillez contacter votre Distributeur.

**DK** Kontakt venligst den danske distributør for gældende version af dansk brugsanvisning.

**GR** Παρακαλούμε όπως επικοινωνήσετε με τον προμηθευτή σας για την έγκυρη απόδοση στα Ελληνικά των οδηγιών χρήσης

**SE** Vänligen kontakta Er distributör för gällande version av bruksanvisning på svenska.

**GB** EXPLANATION OF SYMBOLS  
**DE** BEDEUTUNG DER SYMBOLE  
**ES** EXPLICACIÓN DE SÍMBOLOS  
**IT** SIGNIFICATO DEI SIMBOLI  
**FR** EXPLICATION DES SYMBOLES  
**NL** PICTOGRAMMEN  
**DK** SYMBOLFORKLARING  
**CS** VYSVĚTLENÍ SYMBOLŮ  
**GR** ΕΠΕΞΗΓΗΣΗ ΤΩΝ ΣΥΜΒΟΛΩΝ  
**PT** INTERPRETAÇÃO DE SÍMBOLOS  
**HU** JELMAGYARÁZAT  
**SE** SYMBOLFÖRKLARING  
**PL** INTERPRETACJA SYMBOLI  
**LT** SIMBOLIŲ PAAIŠKINIMAI  
**RU** ОБОЗНАЧЕНИЯ



Use By/Verwendbar bis/  
Fecha de caducidad/  
Utilizzare entro/Utiliser jusque/  
Houdbaar tot/Holdbar til/  
Použitelné do/Ημερομηνία λήξης/  
Prazo de validade/Felhasználható  
Bäst före datum/Użyty przed/  
Sunaudoti iki/Использовать до

LOT

Batch code/  
Chargenbezeichnung/  
Codigo de lote/  
Codice del lotto/Code du lot/  
Lot nummer/Lotnummer/  
Číslo šarže/Αριθμός Παρτίδας/  
Código do lote/Sarzszzám  
Lotnummer/Kod partii/Partijos  
koda/Номер лота



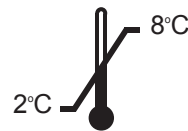
Date of manufacture/  
Herstellungsdatum/  
Fecha de fabricación/  
Data di fabbricazione/  
Date de fabrication/  
Produktie datum/Produktionsdato/  
Datum výroby/Ημερομηνία  
Παραγωγής/Data de fabrico/  
Gyártás időpontja/Tillverkningsdatum/  
Data produkcji/Pagaminimo data/  
Дата производства



In Vitro Diagnostic Medical Device/  
In Vitro Diagnostikum/Producto sanitario para diagnóstico in vitro/  
Dispositivo medico-diagnostico in vitro/  
Dispositif médical de diagnostic in vitro/  
Medisch hulpmiddel voor in-vitro diagnostiek/Medicinsk udstyr til in vitro-diagnostik/In Vitro diagnostický zdravotnický prostředek /  
In Vitro Διαγνωστικό Ιατροτεχνολογικό προϊόν/Dispositivo médico para diagnóstico in vitro/In vitro diagnostikum/Endast för in vitro-diagnostik/Wyrób do diagnostyki In Vitro/In Vitro Diagnostinė Medicinos Priemonė/Только для диагностики In Vitro



Catalogue number/Bestellnummer/  
Número de catálogo/  
Numero di catalogo/Référence du catalogue/Catalogus nummer/Katalognummer/Katalogové číslo/  
Αριθμός καταλόγου/  
Referência de catálogo/  
Katalógusszám/Produktnummer/  
Numer katalogowy/Katalogo numeris/  
Номер по каталогу



Temperature limitation/  
Temperaturbegrenzung/  
Límite de temperatura/  
Limiti di temperatura/  
Limites de température/  
Temperatuurlimiet/  
Temperaturbegrænsning/  
Teplotní rozmezí od do/  
Περιορισμοί θερμοκρασίας/  
Limites de temperatura/  
Hőmérséklettartomány/  
Temperaturbegränsning/  
Przestrzeżać zakresu temperatury/  
Temperatūriniai apribojimai/  
Температурный режим



Manufacturer/Hersteller/Fabricante/  
Fabbicante/Fabricant/Fabrikant/  
Producent/Výrobce/Κτασκευαστής/  
Fabricante/Gyártó/Tillverkare/  
Producent/Gamintojas/  
Производитель



Contains sufficient for <96> tests/  
Inhalt ausreichend für <96> Prüfungen/  
Contenido suficiente para <96> ensayos/Contenuto sufficiente per "96" saggi/Contenu suffisant pour "96" tests/Inhoud voldoende voor "96" testen/Indeholder tilstrækkeligt til "96" test/Lze použiť pro <96> testů/  
Περιεχόμενο επαρκές για «96» εξετάσεις/Conteúdo suficiente para "96" ensaios/A doboz tartalma <96> vizsgálat elvégzéséhez elegendő/  
Innehåller tillräckligt till "96" antal tester/  
Wystarczy na wykonanie <96> testów/  
Turinys skirtas atlikti <96> tyrimus /Содержит достаточные количества для «96» определений



Consult Instructions for Use/  
Gebrauchsanweisung beachten/  
Consulte las instrucciones de uso/  
Consultare le istruzioni per l'uso/  
Consulter les instructions d'utilisation/  
Raadpleeg de gebruiksaanwijzing/  
Se brugsanvisning/Viz návod k použití/Συμβουλευτείτε τις οδηγίες χρήσης/Consulte as instruções de utilização/Nézze meg a Használati utasítást/Se bruksanvisning/Sprawdź w instrukcji obsługi/Dél naudojimo žiūrėkite instrukcijas/  
Обратитесь к инструкции по применению



Biological risks/Biogefährdung/  
Riesgo biológico/Rischio biologico/  
Risques biologiques/Biologisch  
risico/Biologisk fare/  
Biologicky nebezpečné  
Βιολογικοί κίνδυνοι/Risco biológico  
Biológiai kockázat/Biologisk risk/  
Ryzyko biologiczne/Biologinis pavojus/  
Биологическая опасность

**CONT**

Contents of kit/Inhalt/Contenido/  
Contenido/Contenu/Indhold/  
ανιδραστήρια/Kit innehåll/  
Rinkinio turinys/  
Компоненты набора

**ORIG** **MOU**

From mouse/der Maus/de ratón/  
Murino/De souris/Mus/απο ποντίκι/  
Från mus/Pelés kilmés/  
Мышиного происхождения

**ORIG** **HUM**

Human/Human/Humano/  
Origine Umana/Humaine/Human  
δείγματα αναφοράς/Human/  
Žmogaus kilmės/  
Человеческого происхождения

# HE4 EIA

Instructions for use

Enzyme immunometric assay kit  
For 96 determinations

## INTENDED USE

The HE4 EIA is an enzyme immunometric assay for the quantitative determination of HE4 in human serum. The assay is to be used as an aid in monitoring response to therapy for patients with invasive epithelial ovarian cancer. Serial testing for patient HE4 assay values should be used in conjunction with other clinical methods used for monitoring ovarian cancer.

It is further intended to be used in conjunction with either ARCHITECT CA 125 II or CanAg CA125 EIA as an aid in estimating the risk of epithelial ovarian cancer in premenopausal and postmenopausal women presenting with pelvic mass. The results must be interpreted in conjunction with other methods in accordance with standard clinical management guidelines.

## SUMMARY AND EXPLANATION OF THE ASSAY

Human epididymis protein 4 (HE4) belongs to the family of whey acidic four-disulfide core (WFDC) proteins with suspected trypsin inhibitor properties. Other proteins in this family include SLPI, Elafin, and PS20 (WFDC1) (1, 2). The HE4 gene codes for a 13kD protein, although in its mature glycosylated form the protein is approximately 20-25 kD, and consists of a single peptide containing two WFDC domains (3). HE4 was first identified in the epithelium of the distal epididymis and originally predicted to be a protease inhibitor involved in sperm maturation (4, 5). HE4 has since been reported to be expressed in several normal tissues including epithelia of respiratory and reproductive tissues and also in ovarian cancer tissue (6-10). In addition to expression on a cellular level, secreted HE4 has been detected in high levels in the serum of ovarian cancer patients. In a case/control study comparing patients with ovarian cancer to healthy and benign conditions, Hellström et al. found that HE4 detected ovarian cancer with 67% sensitivity at a specificity level of 96% (11). In a subsequent study evaluating numerous known biomarkers for ovarian cancer, HE4 showed the highest sensitivity for the detection of ovarian cancer, particularly in early stage disease. In this study, the combination of HE4 and CA125 was a more accurate predictor of malignancy than either marker alone, with a sensitivity of 76% and a specificity of 95% (12).

Ovarian cancer is the fourth most common cause of cancer-related death in women worldwide. In Europe, the mortality rate range is from 3.6 to 9.3 per 100.000 women

(13). The symptoms of ovarian cancer are related to the presence of adnexal masses and are often vague and nonspecific. The primary goal of diagnostic evaluation of an adnexal mass is to determine whether it is benign or malignant. It is estimated that 5 to 10 percent of women in the United States will undergo a surgical procedure for a suspected ovarian neoplasm during their lifetime, and 13 to 21 percent of these women will be found to have an ovarian malignancy (14). The American College of Obstetricians and Gynecologists Practice Bulletin published in 2007 states the following "Women with ovarian cancer whose care is managed by physicians who have advanced training and expertise in the treatment of women with ovarian cancer, such as gynecologic oncologists, have improved overall survival rates compared with those treated without such collaboration." (15). Since the majority of adnexal masses are benign, it is important to determine preoperatively whether a patient is at high risk for ovarian malignancy, in order to ensure proper management (15). Since the initial report in 1988, clinical impression, serum CA125 and ultrasound along with CT scan, MRI and CT/PET have been the standards in the determination of whether an adnexal mass is suspicious for malignancy (16). Although the literature is replete with papers describing which modality is the more accurate, the combination of physical examination, CA125 and imaging affords the highest positive predictive value (17-19). To improve the triage of patients presenting with pelvic mass, the HE4 EIA may be used in conjunction with either the ARCHITECT CA 125 II or CanAg CA125 EIA assay as an aid in estimating the risk that the patient is harboring epithelial ovarian cancer. The results must be interpreted in conjunction with other methods in accordance with standard clinical management guidelines. An additional use of the HE4 EIA is as an aid in monitoring response to therapy for patients with invasive epithelial ovarian cancer. The results should be used in conjunction with other clinical methods used for monitoring ovarian cancer.

## **PRINCIPLE OF THE TEST**

The HE4 EIA is a solid-phase, non-competitive immunoassay based upon the direct sandwich technique using two mouse monoclonal antibodies, 2H5 and 3D8, directed against two epitopes in the C-WFDC domain of HE4. Calibrators, controls and patient samples are incubated together with biotinylated Anti-HE4 monoclonal antibody (MAb) 2H5 in streptavidin coated microstrips. HE4 present in calibrators or samples is adsorbed to the streptavidin coated microstrips by the biotinylated Anti-HE4 MAb during the incubation. The strips are then washed and incubated with HRP labeled Anti-HE4 MAb 3D8. After washing, buffered Substrate/Chromogen reagent (hydrogen peroxide and 3, 3', 5, 5' tetra-methyl-benzidine) is added to each well and the enzyme reaction is allowed to proceed. During the enzyme reaction a blue color will develop if antigen is present. The intensity of the color is proportionate to the amount of HE4 present in the samples. The color intensity is determined in a microplate spectrophotometer at 620 nm (or optionally at 405 nm

after addition of Stop Solution).

Calibration curves are constructed for each assay by plotting absorbance value versus the concentration for each calibrator. The HE4 concentrations of patient samples are then read from the calibration curve.

## REAGENTS

- Each HE4 EIA kit contains reagents for 96 tests.
- The expiry date of the kit is stated on the label on the outside of the kit box.
- Do not use the kit beyond the expiry date.
- Do not mix reagents from different kit lots.
- Store the kit at 2–8°C. Do not freeze.
- Opened reagents are stable according to the table below provided they are not contaminated, stored in resealed original containers and handled as prescribed. Return to 2-8°C immediately after use.

---

Component	Quantity	Storage and stability after first use
-----------	----------	---------------------------------------

---

<b>MICROPLA</b>
-----------------

<b>Streptavidin Microplate</b>	1 Plate	2–8°C until expiry date stated on the plate
--------------------------------	---------	---------------------------------------------

12 x 8 breakable wells coated with streptavidin. After opening, immediately return unused strips to the aluminium pouch, containing desiccant. Reseal carefully to keep dry.

<b>CAL</b>	<b>HE4</b>	<b>A</b>
------------	------------	----------

<b>HE4 Calibrator A</b>	1 x 8 mL	2–8°C until expiry date stated on the vial
-------------------------	----------	--------------------------------------------

Phosphate buffered salt solution containing bovine serum albumin, an inert yellow dye, and a non-azide antimicrobial preservative. Ready for use. Should also be used for dilution of samples.

Component	Quantity	Storage and stability after first use			
<b>HE4 Calibrators B-F</b>	5 vials, lyophilized	Stability after reconstitution 4 weeks at 2-8°C 4 months at -20°C or below			
<table border="1"><tr><td>CAL</td><td>HE4</td><td>B</td></tr></table>	CAL	HE4	B	1 x 1 mL	
CAL	HE4	B			
<table border="1"><tr><td>CAL</td><td>HE4</td><td>C</td></tr></table>	CAL	HE4	C	1 x 1 mL	
CAL	HE4	C			
<table border="1"><tr><td>CAL</td><td>HE4</td><td>D</td></tr></table>	CAL	HE4	D	1 x 1 mL	
CAL	HE4	D			
<table border="1"><tr><td>CAL</td><td>HE4</td><td>E</td></tr></table>	CAL	HE4	E	1 x 1 mL	
CAL	HE4	E			
<table border="1"><tr><td>CAL</td><td>HE4</td><td>F</td></tr></table>	CAL	HE4	F	1 x 1 mL	
CAL	HE4	F			

The lyophilized calibrators contain HE4 antigen in a phosphate buffered salt solution containing bovine serum albumin, an inert yellow dye, and a non-azide antimicrobial preservative. To be reconstituted with distilled or deionized water before use.

**NOTE:** The exact HE4 concentration is lot specific and is indicated on the label of each vial.

<b>HE4 Controls</b>	2 vials, lyophilized	Stability after reconstitution 4 weeks at 2-8°C 4 months at -20°C or below			
<table border="1"><tr><td>CONTROL</td><td>HE4</td><td>1</td></tr></table>	CONTROL	HE4	1	1 x 1 mL	
CONTROL	HE4	1			
<table border="1"><tr><td>CONTROL</td><td>HE4</td><td>2</td></tr></table>	CONTROL	HE4	2	1 x 1 mL	
CONTROL	HE4	2			

The lyophilized controls contain HE4 antigen in a human serum matrix and a non-azide antimicrobial preservative. To be reconstituted with distilled or deionized water before use.

<b>BIOTIN</b>	<b>Anti-HE4</b>
---------------	-----------------

<b>Biotin Anti-HE4</b>	1 x 15 mL	2-8°C until expiry date stated on the vial
------------------------	-----------	--------------------------------------------

Biotin Anti-HE4 monoclonal antibody from mouse, approximately 1 µg/mL. Contains phosphate buffered saline (pH 7.2), bovine serum albumin, blocking agents, detergent, an inert red dye, and a non-azide antimicrobial preservative. Ready for use.

---

Component	Quantity	Storage and stability after first use
-----------	----------	---------------------------------------

---

<b>CONJ</b>	<b>Anti-HE4</b>
-------------	-----------------

<b>Tracer, HRP Anti-HE4</b>	1 x 0.75 mL	2–8°C until expiry date stated on the vial
-----------------------------	-------------	--------------------------------------------

Stock Solution of HRP Anti-HE4 monoclonal antibody from mouse, approximately 40 µg/mL. Contains non-azide antimicrobial preservatives. To be diluted with Tracer Diluent prior to use.

<b>DIL</b>	<b>CONJ</b>
------------	-------------

<b>Tracer Diluent</b>	1 x 15 mL	2–8°C until expiry date stated on the vial
-----------------------	-----------	--------------------------------------------

Phosphate buffered saline (pH 7.2) with bovine serum albumin, blocking agents, detergents, an inert blue dye, and a non-azide antimicrobial preservative. Ready for use.

<b>SUBS</b>	<b>TMB</b>
-------------	------------

<b>TMB HRP-Substrate</b>	1 x 12 mL	2–8°C until expiry date stated on the vial
--------------------------	-----------	--------------------------------------------

Contains buffered hydrogen peroxide and 3, 3', 5, 5' tetra-methylbenzidine (TMB). Ready for use.

<b>STOP</b>
-------------

<b>Stop Solution</b>	1 x 15 mL	2–8°C until expiry date stated on the vial
----------------------	-----------	--------------------------------------------

Contains 0.12 M hydrochloric acid. Ready for use.

Component	Quantity	Storage and stability after first use
<b>WASHBUF</b>   <b>25X</b>		
<b>Wash Concentrate</b>	1 x 50 mL	2–8°C until expiry date stated on the bottle

A Tris-HCl buffered salt solution with Tween 20. Contains Germall II as preservative. To be diluted with distilled or deionized water 25 times before use.

### Indications of instability

The TMB HRP-Substrate should be colorless or slightly bluish. A blue color indicates that the reagent has been contaminated and should be discarded.

## WARNINGS AND PRECAUTIONS

### For In Vitro Diagnostic Use:

- For professional use only.
- Follow the instructions in the Package insert. Reliability of assay results cannot be guaranteed if there are any deviations from the instructions in this package insert.
- Handle all patient specimens as potentially infectious. It is recommended that human source reagent and human specimens be handled in accordance with the OSHA Standard on Bloodborne pathogens (20). Biosafety level 2 (21) or other appropriate biosafety practices should be used for material that contain or are suspected of containing infectious agents.
- Follow local guidelines for disposal of all waste material.

### Caution

Material used in the preparation of human source reagent has been tested and found to be Non-Reactive for HIV 1 and 2 Antibody, HCV Antibody and Hepatitis B Surface Antigen (HBsAg). Since no method can completely rule out the presence of blood borne diseases, the handling and disposal of human source reagents from this product should be made as if they were potentially infectious.

## SPECIMEN COLLECTION AND HANDLING

The HE4 EIA is intended for use with serum (including serum collected in separator tubes (SST)). Plasma and other body fluids have not been validated for use with the HE4 EIA. Collect blood by venipuncture and follow the tube manufacturer's processing instructions for collection tubes. When serial specimens are being evaluated,

the same type of specimen should be used throughout the study.

Serum can be stored at 2–8°C for 3 days before being tested. For longer periods store samples at -40°C or colder.

Bring frozen samples to room temperature and mix **THOROUGHLY** by gently inverting multiple times before analysis. Samples that contain gross particulates should be centrifuged at 10,000 x g for 10 minutes prior to use to eliminate any particulate matter that may have developed from the thawing process.

## **PROCEDURE**

### **Materials required but not supplied with the kit**

**1. Microplate shaker**

Shaking should be medium to vigorous, approximately 700-1100 oscillations/min.

**2. Microplate washer**

Automatic plate washer capable of performing 1, 3 and 6 washing cycles, and with a minimal fill volume of 350 µL/well/washcycle.

An 8-channel pipette with disposable plastic tips for delivery of 350 µL is recommended if an automatic microplate washer is not used.

**3. Microplate spectrophotometer**

With a wavelength of 620 nm and/or 405 nm, and an absorbance range of 0 to 3.0.

**4. Precision pipettes**

With disposable plastic tips for dispensing microliter volumes. An 8-channel pipette or dispenser pipette with disposable plastic tips for delivery of 100 µL is recommended but not required. Pipettes for dispensing milliliter volumes.

**5. Distilled or deionized water**

For reconstitution of HE4 Calibrators, HE4 Controls and for preparation of diluted Wash Solution.

### **Procedural notes**

1. A thorough understanding of this package insert is necessary to ensure proper use of the HE4 EIA kit. The reagents supplied with the kit are intended for use as an integral unit. Do not mix identical reagents from kits having different lot numbers. Do not use the kit reagents after the expiry date printed on the outside of the kit box.
2. Reagents should be allowed to reach room temperature (20–25°C) prior to use. Frozen specimens must be gently but thoroughly mixed after thawing. **The assay should only be performed at temperatures between**

**20–25°C to obtain accurate results.**

3. Before starting to pipette calibrators and patient specimens it is advisable to mark the strips to be able to clearly identify the samples during and after the assay.
4. The requirement for efficient and thorough washing for separation of bound and unbound antigen and reagents from the solid-phase bound antibody-antigen complexes is one of the most important steps in an EIA. **In order to ensure efficient washing make sure that all wells are completely filled to the top edge with wash solution during each wash cycle, that wash solution is dispensed at a good flow rate, that the aspiration of the wells between and after the wash cycles is complete and that the wells are empty. If there is liquid left, invert the plate and tap it carefully against absorbent paper.**
  - Automatic strip washer: Follow the manufacturer’s instructions for cleaning and maintenance diligently and wash the required number of wash cycles prior to and after each incubation step. The aspiration/wash device should not be left standing with the Wash Solution for long periods, as the needles may get clogged resulting in poor liquid delivery and aspiration.
5. The TMB HRP-Substrate is very sensitive to contamination. For optimal stability of the TMB HRP-Substrate, pour the required amount from the vial into a carefully cleaned reservoir or preferably a disposable plastic tray to avoid contamination of the reagent. Be sure to use clean disposable plastic pipette tips (or dispenser pipette tip).
6. Be sure to use clean disposable plastic pipette tips and a proper precision pipetting technique when handling samples and reagents. Do not allow the pipette tip to touch the surface of the liquid in order to avoid carry-over. A diligent pipetting technique is of particular importance when handling the samples and the TMB HRP-Substrate solution.

---

**Preparation of reagents**

---

**Stability of prepared reagent**

**HE4 Calibrators B-F**

4 weeks at 2–8°C  
4 months at -20°C or below

Add exactly 1.0 mL of distilled or deionized water to each vial. Allow to stand for at least 15 minutes to reconstitute and mix gently before use. NOTE: The concentration of the calibrators is stated on the labels and should be used for calculation of results.

Preparation of reagents	Stability of prepared reagent
<b>HE4 Controls 1 and 2</b>	4 weeks at 2–8°C 4 months at -20°C or below

Add exactly 1.0 mL of distilled or deionized water to each vial and mix gently. Allow to stand for at least 15 minutes to reconstitute and mix gently before use. NOTE: The ranges of the controls are stated on the labels.

<b>Wash Solution</b>	2 weeks at 2–25°C in a sealed container
----------------------	-----------------------------------------

Pour the 50 mL Wash Concentrate into a clean container and dilute 25-fold by adding 1200 mL of distilled or deionized water to give a buffered Wash Solution.

<b>Tracer Working Solution</b>	4 weeks at 2–8 °C in a sealed container
--------------------------------	-----------------------------------------

Prepare the required quantity of Tracer working solution by mixing 50 µL of Tracer, HRP Anti-HE4 with 1 mL of Tracer Diluent per strip (see table below):

No. of Strips	Tracer, HRP Anti-HE4 (µL)	Tracer Diluent (mL)
1	50	1
2	100	2
3	150	3
4	200	4
5	250	5
6	300	6
7	350	7
8	400	8
9	450	9
10	500	10
11	550	11
12	600	12

Be sure to use a clean plastic or glass tube for preparation of Tracer working solution.

**Alternative:** Pour the contents of the Tracer, HRP Anti-HE4 into the vial of Tracer Diluent and mix gently. Make sure that the entire content of the Tracer, HRP Anti-

HE4 vial is transferred to the vial of Tracer Diluent.

**NOTE:** The Tracer working solution is stable for 4 weeks at 2–8°C. Do not prepare more Tracer working solution than will be used within this period and make sure that it is stored properly.

---

## ASSAY PROCEDURE

Perform each determination in duplicate for both calibrators, controls and unknown specimens. A calibration curve should be run with each assay. All reagents and specimens must be brought to room temperature (20–25°C) before use.

1. Start preparing Calibrators B-F, Controls 1 and 2, Wash Solution and Tracer working solution. It is important to use clean containers. Follow the instructions carefully.
2. Transfer the required number of microplate strips to a strip frame. (Immediately return the remaining strips to the aluminum pouch containing desiccant and reseal carefully). Wash each strip once with the Wash Solution. Do not wash more strips than can be handled within 30 min.
3. Pipette 25 µL of each of the HE4 Calibrators (CAL A, B, C, D, E and F), HE4 Controls (C1, C2) and unknown specimens (Unk) into the strip wells according to the following scheme:

	1	2	3	4	5	6	7 etc
A	Cal A	Cal E	1 st Unk				
B	Cal A	Cal E	1 st Unk				
C	Cal B	Cal F	2nd Unk				
D	Cal B	Cal F	2nd Unk				
E	Cal C	C1					
F	Cal C	C1					
G	Cal D	C2					
H	Cal D	C2					

4. Add 100 µL of Biotin Anti-HE4 to each well using a 100 µL precision pipette (or an 8-channel 100 µL precision pipette). Do not allow the pipette tip to touch the surface of the liquid in order to avoid carry-over.

5. Incubate the plate for 1 hour ( $\pm$  10 min) at room temperature (20-25°C), constantly shaking the plate using a microplate shaker.
6. After the first incubation aspirate and wash each strip 3 times using the wash procedure described in Procedural notes, item 4.
7. Add 100  $\mu$ L of Tracer working solution to each well. Use the same pipetting procedure as in item 4 above.
8. Incubate the frame for 1 hour ( $\pm$  5 min) at room temperature (20–25°C) with constant shaking.
9. After the second incubation aspirate and wash each strip 6 times, using the wash procedure described in Procedural notes, item 4.
10. Add 100  $\mu$ L of TMB HRP-Substrate to each well using the same pipetting technique as described in item 4 above.  
The TMB HRP-Substrate should be added to the wells as quickly as possible and the time between addition to the first and last well should not exceed 5 min.
11. Incubate for 30 min ( $\pm$  5 min) at room temperature (20–25°C) with constant shaking. Avoid exposure to direct sunlight.
12. Immediately read the absorbance at 620 nm in a microplate spectrophotometer.

### **Option**

If the laboratory does not have access to a microplate reader capable of reading at 620 nm, the absorbance can be determined as described in the alternative item 12 below:

- Alt. 12. Add 100  $\mu$ L of Stop Solution, mix and read the absorbance at 405 nm in a microplate spectrophotometer within 15 min after addition of Stop Solution.

### **Measurement range**

The HE4 EIA measures concentrations between 15 and 900 pM. If HE4 concentrations above the measuring range are expected, it is recommended that samples be diluted with HE4 Calibrator A prior to analysis (see “Calculation of results with diluted samples”).

### **Quality control**

HE4 Control 1 and 2 should be used for validation of each assay series. Ranges of expected results are indicated on the vial labels.

The HE4 assay results should be considered valid if:

- The mean values of control duplicates are within the specified ranges.
- The duplicate replicates of calibrators B-F and controls do not exceed a CV of 15%.

- The duplicate replicates of calibrator A (zero) are not more than 0.06 OD units different from each other.

If an assay results in invalid calibrator or control results, a complete check of reagents, accuracy of pipettes, plate washer and reader performance should be made and the analysis repeated. Each laboratory may also prepare its own serum pools at different levels, which can be used as internal controls in order to assure the precision of the assay.

### **Reference material**

Since no common reference material is available for HE4 antigen, HE4 EIA Calibrator values are assigned against a set of in-house reference standards.

### **CALCULATION OF RESULTS**

If a microplate spectrophotometer with built-in data calculation program is used, refer to the manual for the spectrophotometer and create a program using the concentration stated on the label of each of the HE4 Calibrators.

For automatic calculation of HE4 results it is recommended to use either of the following methods:

- Cubic spline curve fit method. Calibrator A should be included in the curve with the value 0 pM.
- Interpolation with point-to-point evaluation. Calibrator A should be included in the curve with the value 0 pM.
- Quadratic curve fit method. Calibrator A should be included in the curve with the value 0 pM.

**NOTE:** 4-parametric or Linear regression evaluation methods should not be used.

For manual evaluation, a calibration curve is constructed by plotting the absorbance (A) values obtained for each HE4 Calibrator against the corresponding HE4 concentration (in pM).

The unknown HE4 concentrations can then be read from the calibration curve using the mean absorbance value of each patient specimen.

### **Calculation of results with diluted samples**

If samples in an initial analysis give HE4 levels higher than 900 pM the samples should be diluted 1/10 and 1/100 with HE4 Calibrator A to obtain the accurate HE4 concentration of the samples.

- 1/10 dilution = 50 µL of specimen + 450 µL of HE4 Calibrator A
- 1/100 dilution = 50 µL of 1/10 dilution + 450 µL of HE4 Calibrator A

The HE4 concentration of the undiluted sample is then calculated as:

- Dilution 1/10: 10 x measured value
- Dilution 1/100: 100 x measured value

# Protocol Sheet

## HE4 EIA REF 404-10

Prepare the components directly before use. Use wash and incubation conditions according to the Instructions.

**Note. The assay should only be performed at temperatures between 20–25°C to obtain accurate results.**

Step	Vial/Plate	Procedure																																							
1. Prepare HE4 Calibrators	<span style="border: 1px solid black; padding: 2px;">CAL</span> <span style="border: 1px solid black; padding: 2px;">HE4</span> B, C, D, E, F	Add 1 mL of distilled or deionised water to each vial and mix gently. Allow to stand for at least 15 minutes. <b>NOTE:</b> The exact concentration of each calibrator is stated on the label. Reconstituted stability: 4 weeks at 2-8°C.																																							
Prepare HE4 Controls	<span style="border: 1px solid black; padding: 2px;">CONTROL</span> <span style="border: 1px solid black; padding: 2px;">HE4</span> 1, 2																																								
Prepare Wash Solution	<span style="border: 1px solid black; padding: 2px;">WASHBUF</span> <span style="border: 1px solid black; padding: 2px;">25X</span>	Dilute 50 mL of Wash Concentrate with 1200 mL of distilled or deionised water.																																							
Prepare Tracer working solution	<span style="border: 1px solid black; padding: 2px;">CONJ</span> <span style="border: 1px solid black; padding: 2px;">Anti-HE4</span> <span style="border: 1px solid black; padding: 2px;">DIL</span> <span style="border: 1px solid black; padding: 2px;">CONJ</span>	Mix 50 µL of Tracer, HRP Anti-HE4 with 1 mL of Tracer Diluent per strip:																																							
	<table border="1"><thead><tr><th>No. of Strips</th><th>Tracer, HRP Anti-HE4 (µL)</th><th>Tracer Diluent (mL)</th></tr></thead><tbody><tr><td>1</td><td>50</td><td>1</td></tr><tr><td>2</td><td>100</td><td>2</td></tr><tr><td>3</td><td>150</td><td>3</td></tr><tr><td>4</td><td>200</td><td>4</td></tr><tr><td>5</td><td>250</td><td>5</td></tr><tr><td>6</td><td>300</td><td>6</td></tr><tr><td>7</td><td>350</td><td>7</td></tr><tr><td>8</td><td>400</td><td>8</td></tr><tr><td>9</td><td>450</td><td>9</td></tr><tr><td>10</td><td>500</td><td>10</td></tr><tr><td>11</td><td>550</td><td>11</td></tr><tr><td>12</td><td>600</td><td>12</td></tr></tbody></table>	No. of Strips	Tracer, HRP Anti-HE4 (µL)	Tracer Diluent (mL)	1	50	1	2	100	2	3	150	3	4	200	4	5	250	5	6	300	6	7	350	7	8	400	8	9	450	9	10	500	10	11	550	11	12	600	12	
No. of Strips	Tracer, HRP Anti-HE4 (µL)	Tracer Diluent (mL)																																							
1	50	1																																							
2	100	2																																							
3	150	3																																							
4	200	4																																							
5	250	5																																							
6	300	6																																							
7	350	7																																							
8	400	8																																							
9	450	9																																							
10	500	10																																							
11	550	11																																							
12	600	12																																							

2. Wash	<b>MICROPLA</b>	Wash each well once with Wash Solution. Use manual or automatic washer.
3. Add calibrators, controls and samples	<b>CAL HE4</b> A, B, C, D, E, F <b>CONTROL HE4</b> 1, 2	25 µL in each well
4. Add Biotin Anti-HE4	<b>BIOTIN Anti-HE4</b>	100 µL in each well
5. Incubate	<b>MICROPLA</b>	1 hour shaking at 20–25°C
6. Wash	<b>MICROPLA</b>	Wash each well three times with Wash Solution Use manual or automatic washer.
7. Add Tracer working solution	<b>TRACER WORKING SOLUTION</b>	100 µL in each well
8. Incubate	<b>MICROPLA</b>	1 hour shaking at 20–25°C
9. Wash	<b>MICROPLA</b>	Wash each well six times with Wash Solution. Use manual or automatic washer.
10. Add TMB HRP-Substrate	<b>SUBS TMB</b>	100 µL in each well
11. Incubate	<b>MICROPLA</b>	30 min shaking at 20–25°C
12. Read absorbance	<b>MICROPLA</b>	620 nm
Alt.12 Add Stop Solution	<b>STOP</b>	100 µL in each well
Alt.13 Mix	<b>MICROPLA</b>	Allow to mix at 20–25°C
Alt.14 Read absorbance	<b>MICROPLA</b>	Read at 405 nm within 15 min

## **Risk of Ovarian Malignancy Algorithm (ROMA) for estimating the risk of epithelial ovarian cancer in premenopausal and postmenopausal women presenting with pelvic mass**

### ***Calculation of Predictive Index***

A Predictive Index (PI) is calculated for premenopausal and postmenopausal women separately using the equations (1) and (2) below. To calculate the PI, the assay values obtained from the HE4 EIA and either the ARCHITECT CA125 II or CanAg CA125 EIA assays, respectively, are inserted into the applicable equation of the algorithm below, depending on menopausal status of the woman.

#### (1) Premenopausal woman

$$\text{Predictive Index (PI)} = -12.0 + 2.38 \cdot \text{LN}[\text{HE4}] + 0.0626 \cdot \text{LN}[\text{CA125}]$$

#### (2) Postmenopausal woman

$$\text{Predictive Index (PI)} = -8.09 + 1.04 \cdot \text{LN}[\text{HE4}] + 0.732 \cdot \text{LN}[\text{CA125}]$$

### ***Calculation of ROMA value***

To calculate the ROMA value (i.e. Predictive Probability), insert the calculated value for Predictive Index into equation (3):

$$(3) \text{ ROMA value (\%)} = \exp(\text{PI}) / [1 + \exp(\text{PI})] \cdot 100$$

The examples below can be used in order to validate calculations of PI and ROMA value:

<b>Menopausal status</b>	<b>HE4 (pM)</b>	<b>CA125 (U/mL)</b>	<b>PI calculation</b>	<b>PI</b>	<b>ROMA (%)</b>
Pre-menopausal	37.5	74.9	-12.0+(2.38*3.624) +(0.0626*4.316)	-3.10388	4.29
Pre-menopausal	386.6	21.8	-12.0+(2.38*5.957) +(0.0626*3.082)	2.371517	91.5
Post-menopausal	66.7	11.3	-8.09+(1.04*4.200) +(0.732*2.425)	-1.94683	12.5
Post-menopausal	383.1	22.7	-8.09+(1.04*5.948) +(0.732*3.122)	0.381799	59.4

## **LIMITATIONS OF THE PROCEDURE**

Patients with confirmed ovarian cancer may have HE4 assay values in the same range as healthy women. Certain histological types of ovarian cancer e.g. mucinous or germ cell tumors, rarely express HE4, therefore HE4 is not recommended for monitoring of patients with known mucinous or germ cell ovarian cancer (7). Conversely, elevated levels of HE4 antigen may be present in individuals with non-

malignant disease. Therefore, the level of HE4 cannot be used as absolute evidence for the presence or absence of malignant disease and the HE4 test should not be used in cancer screening. The results of the test should be interpreted only in conjunction with other investigations and procedures in the diagnosis of disease and the management of patients, and the HE4 test should not replace any established clinical examination.

The risk of ovarian malignancy algorithm has not been validated for the following patient groups: patients previously treated for malignancy, patients currently being treated with chemotherapy and patients < 18 years of age.

Failure of the HE4 EIA and/or the CA125 assay to perform as indicated, or error in the calculation of results could lead to inaccurate risk assessment and improper management of the patient. Specifically, a falsely low result of the assay(s) could result in a determination that the patient is at lower risk of having epithelial ovarian cancer, which could triage the patient to a less specialized level of care. Use of the assay results without consideration of the other laboratory findings, imaging studies, and clinical assessment could therefore pose a risk.

Anti-reagent antibodies (human anti-mouse antibody (HAMA) or heterophilic antibodies) in the patient sample may occasionally interfere with the assay, even though specific blocking agents are included in the buffers.

**The assay must be performed in a temperature controlled environment since incubation at temperatures above the recommended temperature range 20 - 25°C may give false low results.**

## EXPECTED VALUES

The distribution of HE4 levels determined in 1147 specimens is shown in the table below:

<b>Distribution of HE4 Assay Values</b>					
	<b>Number of subjects</b>	<b>0 - 150 pM</b>	<b>150.1 - 300 pM</b>	<b>300.1 - 500 pM</b>	<b>&gt; 500 pM</b>
<b>APPARENTLY HEALTHY</b>					
Females (Premenopausal)	76	72	3	0	1
Females (Postmenopausal)	103	97	5	0	1
<b>BENIGN CONDITIONS</b>					
Pregnancy	22	21	1	0	0
Benign Gynecological Disease	347	324	18	1	4
Other Benign Disease	108	82	8	7	11
Hypertension/Cong. Heart Failure	96	75	16	2	3
<b>CANCER</b>					
Ovarian Cancer	127	27	18	21	61
Breast Cancer	46	40	4	2	0
Lung Cancer	50	29	15	6	0
Endometrial Cancer	116	86	15	4	11
Gastrointestinal Cancer	56	47	8	0	1

In this study 94.4% of the healthy female subjects had a HE4 assay value at or below 150 pM. It is recommended that each laboratory establish its own reference value for the population of interest.

### Monitoring of Disease status in Patients Diagnosed with Ovarian Cancer

The effectiveness of the HE4 EIA as an aid in monitoring of disease status in ovarian cancer patients was determined by assessing changes in HE4 levels in serial serum samples from 80 patients compared to changes in disease status. A study involving a total of 354 pairs of observations was undertaken with an average number of 4.4 observations per patient. A positive change in HE4 was defined as an increase in the value that was at least 25% greater than the previous value of the test. This level of change takes into account the variability of the assay and the biological variability. Sixty percent (60%) or 76/126 of the patient samples with a positive

change correlated with the disease progression while seventy-five percent (75%) or 171/228 of the patient serial samples with no significant change in HE4 value correlated with no progression. The total concordance was seventy percent (70% or 247/354). The following table presents the data in a 2 x 2 format.

<b>Change in Disease State per Sequential Pair</b>			
<b>Increase in HE-4 concentration</b>	<b>Progression</b>	<b>No Progression</b>	<b>Total</b>
>25%	76	57	133
≤ 25%	50	171	221
Total	126	228	354

The following table shows the distribution per patient. Ninety-three percent (93%) or 54/58 of the per patient serum sets with a positive change correlated with the disease progression while Thirty-two percent (32%) or 7/22 of serum sets showing no significant change in HE4 value correlated with no progression. The total concordance in this study was seventy-six percent (76 %) or 61/80.

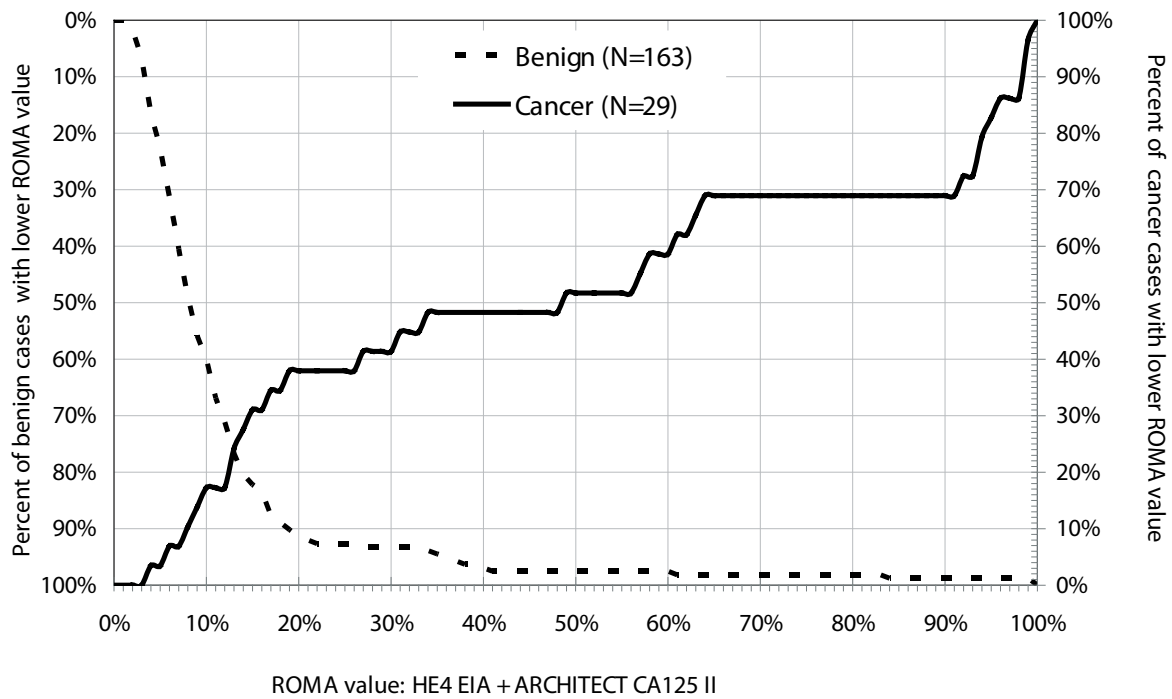
<b>Change in Disease State per Patient</b>			
<b>Increase in HE-4 concentration</b>	<b>Progression</b>	<b>No Progression</b>	<b>Total</b>
>25%	54	15	69
≤ 25%	4	7	11
Total	58	22	80

### **Risk estimation in patients presenting with pelvic mass**

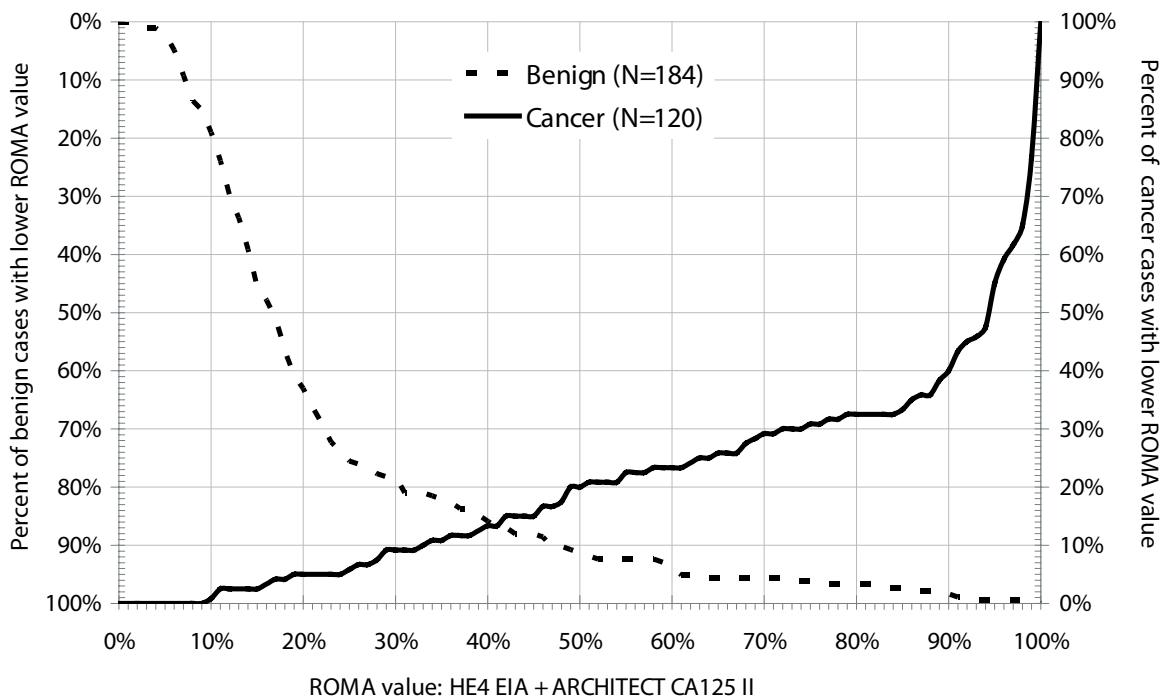
The effectiveness of HE4 EIA in combination with CA125 determined either with the ARCHITECT CA125 II assay or the CanAg CA125 EIA for risk estimation for epithelial ovarian cancer of patients presenting with pelvic mass was determined in a prospective, multi-center, double blind clinical trial. An algorithm (ROMA, see page 18) was developed for estimation of the risk of epithelial ovarian cancer. The algorithm takes into account the HE4 and CA125 values as well as the menopausal status of the patient. The algorithm calculates a predictive probability of finding epithelial ovarian cancer on surgery. In the prospective study a total of 496 patients were included and the predictive probability for ovarian cancer as well as the ability for separation into a low and a high risk group based on ROMA values was determined.

The cumulative frequency distribution of the ROMA values for benign and ovarian cancer cases respectively using the algorithm is shown in Figures 1 and 2 for the HE4 EIA and ARCHITECT CA125 II assay combination and in Figures 3 and 4 for the HE4 EIA and CANAG CA125 EIA combination.

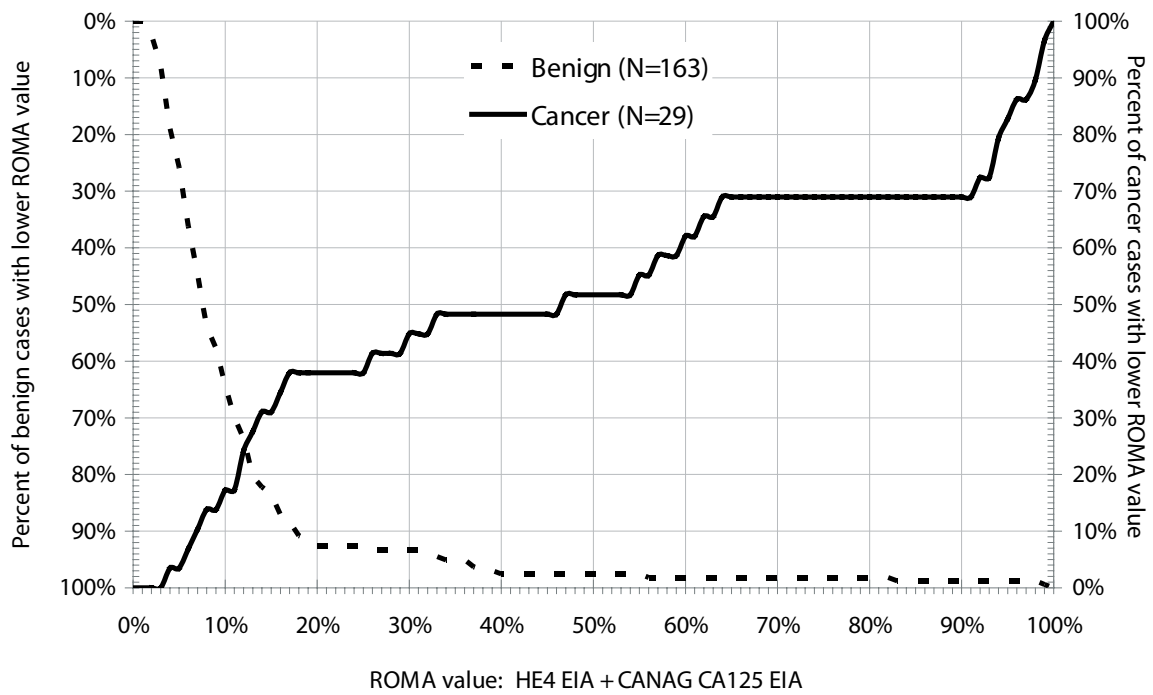
**Fig. 1** Cumulative frequency distribution of ROMA values for **premenopausal** women. HE4 EIA + ARCHITECT CA125 II assay combination



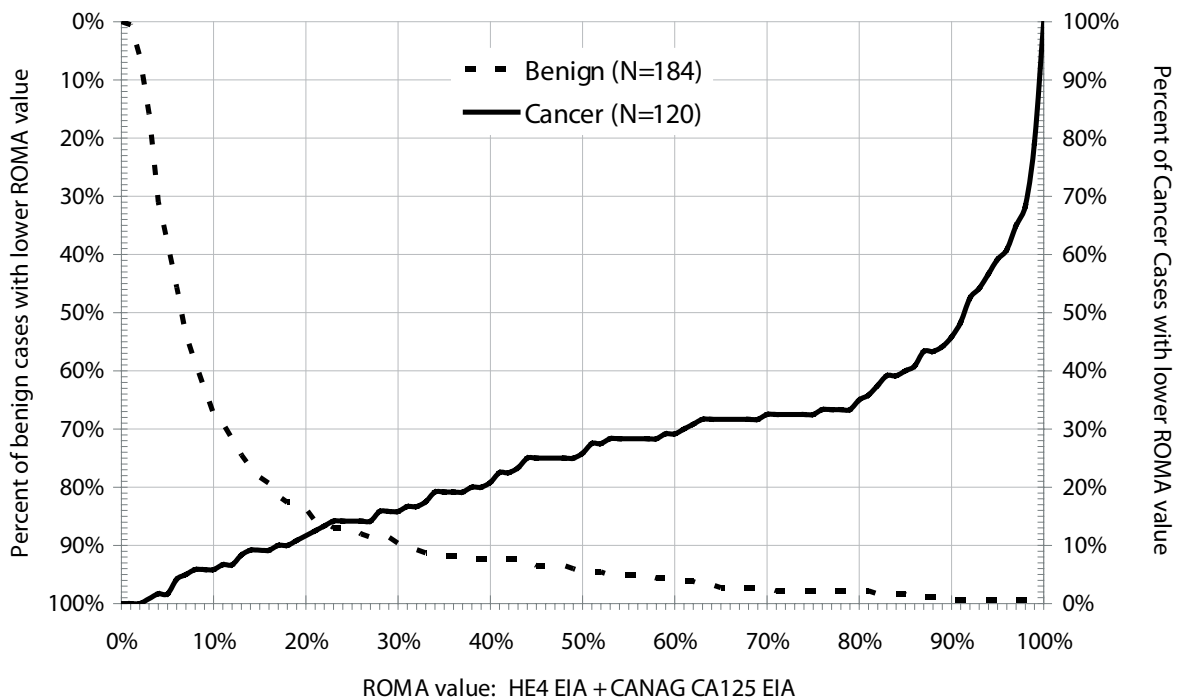
**Fig. 2** Cumulative frequency distribution of ROMA values for **postmenopausal** women. HE4 EIA + ARCHITECT CA125 II assay combination



**Fig. 3** Cumulative frequency distribution of ROMA values for **premenopausal** women. HE4 EIA + CanAg CA125 EIA combination



**Fig. 4** Cumulative frequency distribution of ROMA values for **postmenopausal** women. HE4 EIA + CanAg CA125 EIA combination



### ***Stratification into low risk and high risk groups***

The risk of ovarian malignancy algorithm was used to stratify women into risk groups for finding epithelial ovarian cancer. The following cut-points were used in order to provide a specificity level of 75% for the HE4 EIA and ARCHITECT CA125 II assay combination:

#### **Premenopausal women**

ROMA value  $\geq$  12.9% = High risk of finding epithelial ovarian cancer

ROMA value  $<$  12.9% = Low risk of finding epithelial ovarian cancer

#### **Postmenopausal women**

ROMA value  $\geq$  24.7% = High risk of finding epithelial ovarian cancer

ROMA value  $<$  24.7% = Low risk of finding epithelial ovarian cancer

The risk stratification of all patients (pre- and postmenopausal) presenting with pelvic mass using the ROMA values for the HE4 EIA and ARCHITECT CA125 II assay combination is shown in Table 1. The sensitivity for stratifying patients with epithelial ovarian cancer into the high risk group was 91% at the set specificity of 75%, such that 75% of women with benign pelvic mass were classified into the low risk group. The positive and negative predictive values were 61% and 95% respectively.

**Table 1:** Risk stratification of combined pre- and postmenopausal patients presenting with pelvic mass using the HE4 EIA and ARCHITECT CA125 II assay combination to calculate ROMA value. Premenopausal cut-point  $\geq$  12.9%, postmenopausal cut-point  $\geq$  24.7%.

<b>Patient groups presenting with pelvic mass (Pre- &amp; Postmenopausal Women Combined)</b>	<b>Low Risk</b>	<b>High Risk</b>	<b>Total</b>
<b>Benign disease</b>	260 (75%)	87 (25%)	347 ( 70%)
<b>Epithelial Ovarian Cancer (Invasive and Low Malignant Potential Tumors)</b>	14 ( 9%)	135 (91%)	149 ( 30%)
<b>Total</b>	274 (55%)	222 (45%)	496 (100%)

There were no statistically significant differences in the sensitivity and specificity of the ROMA value using ARCHITECT CA125 II or CanAg CA125 EIA values to differentiate between benign diseases and epithelial ovarian cancer (Fig. 5). **It should be noted that the cut-points for risk stratification into high and low risk groups at a desired specificity must be adjusted based upon which CA125**

**assay is used.** The cumulative frequency distribution of ROMA values shown in Figures 1-4 can be used as a guideline to select the appropriate cut-point. The following cut-points were selected in order to provide a specificity level of 75% for the HE4 EIA and CanAg CA125 EIA assay combination:

**Premenopausal women**

ROMA value  $\geq$  12.4% = High risk of finding epithelial ovarian cancer

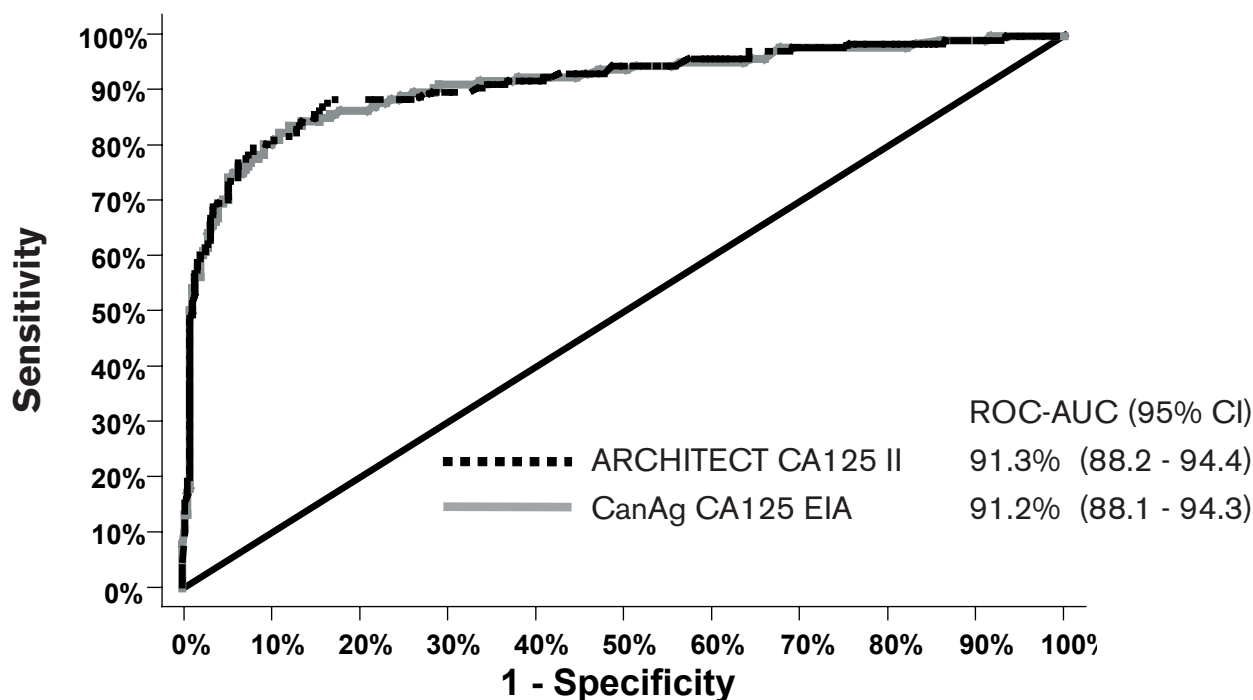
ROMA value  $<$  12.4% = Low risk of finding epithelial ovarian cancer

**Postmenopausal women**

ROMA value  $\geq$  13.5% = High risk of finding epithelial ovarian cancer

ROMA value  $<$  13.5% = Low risk of finding epithelial ovarian cancer

**Fig. 5** ROC analysis of sensitivity and specificity of the ROMA value calculated using HE4 EIA combined with ARCHITECT CA125 II and CanAg CA125 EIA respectively, to differentiate between benign disease and epithelial ovarian cancer (N=496).



**PERFORMANCE CHARACTERISTICS**

**Precision**

The HE4 assay precision is  $\leq$  15% total CV. A study was performed as described per the National Committee for Clinical Laboratory Standards NCCLS (CLSI) guideline EP5-A2 (22). A panel of four serum samples was assayed, using two lots of reagents, in replicates of two, at two separate times per day for 20 days. Data from this study is summarized below.\*

Sample	Reagent lot	n	Mean conc. (pM)	Within-run SD (pM)	Within-run CV %	Total SD (pM)	Total CV %
1	1	80	50.3	0.81	1.6	2.34	4.7
	2	80	48.0	0.69	1.4	2.17	4.5
2	1	80	75.3	1.81	2.4	2.96	3.9
	2	80	72.4	1.73	2.4	4.70	6.5
3	1	80	255	5.68	2.2	12.0	4.7
	2	80	242	5.21	2.2	12.8	5.3
4	1	80	407	6.22	1.5	14.5	3.6
	2	80	385	8.71	2.3	21.6	5.6

\*Representative data; results in individual laboratories may vary from these data.

### Detection limit

The limit of detection of the HE4 EIA assay is  $\leq 15$  pM. The limit of detection (LoD) corresponds to the upper limit of the 95% confidence interval and represents the lowest concentration of HE4 antigen that can be distinguished from zero. The NCCLS guideline EP17-A (23) was used to design the LoD experiments. A study was conducted where HE4 Calibrator A (zero) and 4 samples from healthy subjects diluted to 5 pM with Sample Diluent was tested in replicates of 24 per run in 4 runs on two separate days. The LoD was calculated as follows:

$$\text{LoD (pM)} = 5.0 \text{ pM} \times (1.65 \times \text{SD}_0 + 1.65 \times \text{SD}_5) / (\text{OD}_5 - \text{OD}_0)$$

The Limit of Detection of the HE4 EIA Kit was calculated to be  $< 2.5$  pM.

### Functional sensitivity

The functional sensitivity of the HE4 EIA assay is  $\leq 25$  pM. The functional sensitivity is expressed as the concentration of an analyte at which the CV is 20%. The NCCLS guideline EP5-A2 (22) was used to design the experiments for determination of functional sensitivity. A study was conducted where a five member sensitivity panel was tested in replicates of 4 in 2 runs on twenty separate days with two lots of reagents. The functional sensitivity determined for the HE4 EIA was found to be  $< 5$  pM.

### Recovery

The HE4 EIA assay mean recovery is  $100 \pm 15\%$ . A study was performed where dilutions of a patient sample with known concentrations of HE4 were added to normal human serum samples. The concentration of HE4 was determined using the HE4 EIA assay and the resulting percent recovery was calculated. Representative data from this study is summarized in the table below\*.

Sample	Endogenous Assay Value (pM)	HE4 Antigen Added (pM)	Observed HE4 Assay Value (pM)	Percent Recovery** %
1	44.6	15	60.6	102
		75	96.0	89
		350	397	96
		650	686	96
2	41.1	15	55.7	99
		75	95.2	91
		350	400	98
		650	657	93
3	40.6	15	54.0	97
		75	95.1	91
		350	403	99
		650	680	96
4	46.6	15	63.3	103
		75	106	97
		350	410	99
		650	645	90
5	40.2	15	56.5	102
		75	102	98
		350	402	99
		650	676	96

The average recovery across the four separate spiked concentrations shown above was found to be 97%.

\*Representative data; results in individual laboratories may vary from these data.

\*\*% Recovery=Observed HE4 Concentration (pM)/Endogenous HE4 Conc. (pM) + HE4 Added (pM)

### High Dose Hook

High dose hook is a phenomenon whereby very high level specimens may read within the dynamic range of the assay. For the HE4 EIA, no high dose hook effect was observed for samples containing up to 300 000 pM HE4 native antigen.

## Dilution Linearity

The HE4 EIA assay mean dilution linearity is  $100 \pm 15\%$ . A study was conducted for the HE4 EIA modeled after the NCCLS (CLSI) guideline EP6-A (24). Serum samples with elevated HE4 values were diluted with HE4 Calibrator A (zero). The HE4 concentration was determined for each dilution and the percent (%) recovery was calculated. Representative data from this study is summarized in the table below\*.

Sample	Final Dilution Factor	Obtained Value (pM)	Expected Value (pM)	Percent Recovery** (%)
1	Undiluted	889.6	889.6	100
	1:1.25	720.0	711.7	101
	1:1.7	543.1	533.8	101
	1:2	450.6	444.8	101
	1:2.5	345.9	355.8	97.2
	1:5	183.6	177.9	103
	1:10	97.6	89.0	109
	1:20	49.1	44.5	110
	1:40	25.9	22.2	116
2	Undiluted	697.0	697.0	100
	1:1.25	544.9	557.6	97.7
	1:1.7	429.8	418.2	103
	1:2	361.1	348.5	104
	1:2.5	275.9	278.8	99.0
	1:5	134.5	139.4	96.5
	1:10	74.4	69.7	107
	1:20	39.1	34.9	112
	1:40	21.0	17.4	120
3	Undiluted	680.2	680.2	100
	1:1.25	499.7	544.2	91.8
	1:1.7	354.4	408.1	86.8
	1:2	296.7	340.1	87.2
	1:2.5	247.2	272.1	90.9
	1:5	124.9	136.0	91.8
	1:10	61.7	68.0	90.7
	1:20	34.6	34.0	102
	1:40	18.4	17.0	109

Average recovery across the three diluted samples shown above = 101%

\*Representative data; results in individual laboratories may vary from these data.

\*\*% Recovery= HE4 Concentration obtained x Dilution factor / Undiluted HE4 Concentration.

## Analytical Specificity

The HE4 EIA assay mean assay specificity is  $100 \pm 15\%$ . Recovery studies were performed to compare sera containing the following compounds at the indicated concentrations with control sera. The NCCLS guideline EP7-A (25) was used to design the interference experiments. The following substances and concentrations were tested and found not to interfere with the test.

<b>Endogenous serum interferences</b>	<b>Test Concentration</b>
Triglycerides	30 mg/mL
Billirubin	0.2 mg/mL
Hemoglobin	10 mg/mL
Total Protein	120 mg/mL

<b>Chemotherapeutic drug interferences</b>	<b>Test Concentration</b>
Carboplatin	500 $\mu$ g/mL
Cisplatin	165 $\mu$ g/mL
Clotrimazole	0.3 $\mu$ g/mL
Cyclophosphamide	500 $\mu$ g/mL
Dexamethasone	10 $\mu$ g/mL
Doxorubicin	1.16 $\mu$ g/mL
Leucovorin	2.68 $\mu$ g/mL
Melphalan	2.8 $\mu$ g/mL
Methotrexate	45 $\mu$ g/mL
Paclitaxel	3.5 ng/mL

## Potentially interfering clinical conditions

The HE4 EIA assay was evaluated using specimens with HAMA and Rheumatoid Factor (RF) to further assess the assay specificity. Five specimens positive for HAMA and five specimens positive for RF were evaluated for % recovery with HE4 antigen spiked into each specimen at approximately 50 and 450 pM. Mean recovery results are summarized in the following table.\*

<b>Clinical condition</b>	<b>Number of specimens</b>	<b>Mean % recovery</b>
HAMA	5	101
RF	5	95

\*Representative data; results in individual laboratories may vary from these data.

## WARRANTY

The performance data presented here were obtained using the assay procedure indicated. Any change or modification of the procedure not recommended by Fujirebio Diagnostics may affect the results, in which event Fujirebio Diagnostics disclaims all warranties expressed, implied or statutory including the implied warranty of merchantability and fitness for use.

## REFERENCES

1. Israeli O, Goldring-Aviram A, Rienstein S, Ben-Baruch G, Korach J, Goldman B, Friedman E. In silico chromosomal clustering of genes displaying altered expression patterns in ovarian cancer. *Cancer Genet Cytogenet* 2005;160:35-42.
2. Bouchard D, Morisset D, Bourbonnais Y, Tremblay GM. Proteins with whey-acidic-protein motifs and cancer. *Lancet Oncol* 2006;7:167-174.
3. Bingle L, Singleton V, Bingle CD. The putative ovarian tumour marker gene HE4 (*wfdc2*), is expressed in normal tissues and undergoes complex alternative splicing to yield multiple protein isoforms. *Oncogene* 2002;21:2768-2773.
4. Kirchhoff C, Habben I, Ivell R, et al. A major human epididymis-specific cDNA encodes a protein with sequence homology to extracellular protease inhibitors. *Biol Reprod* 1991;45:350-357.
5. Kirchhoff C. Molecular characterization of epididymal proteins. *Rev Reprod* 1998;3:86-95.
6. Galgano MT, Hampton GM, Frierson HF Jr. Comprehensive analysis of HE4 expression in normal and malignant human tissues. *Mod Pathol* 2006;19:847-853.
7. Drapkin R, von Horsten HH, Lin Y, Mok SC, Crum CP, Welch WR, Hecht JL. Human epididymis protein 4 (HE4) is a secreted glycoprotein that is overexpressed by serous and endometrioid ovarian carcinomas. *Cancer Res* 2005;65:2162-2169.
8. Hough CD, Sherman-Baust CA, Pizer ES, Montz FJ, Im DD, Rosenshein NB, Cho KR, Riggins GJ, Morin PJ. Large-scale serial analysis of gene expression reveals genes differentially expressed in ovarian cancer. *Cancer Res* 2000;60:6281-6287.
9. Schummer M, Ng WV, Bumgarner RE, Nelson PS, Schummer B, Bednarski DW, Hassell L, Baldwin RL, Karlan BY, Hood L. Comparative hybridization of an array of 21,500 ovarian cDNAs for the discovery of genes overexpressed in ovarian carcinomas. *Gene* 1999;238:375-385.
10. Gilks CB, Vanderhyden BC, et al. Distinction between serous tumors of low malignant potential and serous carcinomas based on global mRNA expression profiling. *Gynecol Oncol* 2005;96:684-694.

11. Hellstrom I, Raycraft J, et al. The HE4 (WFDC2) protein is a biomarker for ovarian cancer. *Cancer Res* 2003;63:3695-3700.
12. Moore RM, Brown AK, Miller MC, et al. The use of multiple novel tumor markers for the detection of ovarian carcinoma in patients with a pelvic mass. *Gynecol Oncol* 2008;108:402-408.
13. Bray F, Loos AH, Tognazzo S, La Vecchia C. Ovarian cancer in Europe: Cross-sectional trends in incidence and mortality in 28 countries, 1953-2000. *Int J Cancer* 2005;113(6):977-90.
14. National Institutes of Health Consensus Development Conference Statement. Ovarian Cancer: Screening, treatment and follow-up. *Gynecol Oncol* 1994;55:S4-14.
15. ACOG Practice Bulletin. Clinical Management Guideline for Obstetrician-Gynecologists. Management of Adnexal Masses. *Obstet Gynecol* 2007;110:201-213.
16. Finkler NJ, Benacerraf B, Lavin PT, Wojciechowski C, Knapp RC. Comparison of serum CA 125, clinical impression and ultrasound in the preoperative evaluation of ovarian masses. *Obstet Gynecol* 1988;72:659-64.
17. Maggino T, Gadducci A, D'Addario V, et al. Prospective Multicenter Study on CA 125 in postmenopausal pelvic masses. *Gynecol Oncol* 1994;54:117-123.
18. Roman LD, Muderspach LI, Stein SM, et al. Pelvic Examination, Tumor marker level, and Gray-Scale and Doppler Sonography in the prediction of pelvic cancer. *Obstet Gynecol* 1997;89:493-500.
19. DePriest PD, Shenson D, Fried A, et al. A morphology index based on sonographic findings in ovarian cancer. *Gynecol Oncol* 1993;51:7-11.
20. US Department of Labor, Occupational Safety and Health Administration, 29 CFR Part 1910.1030, Occupational Exposure to Blood Borne Pathogens.
21. US Department of Health and Human Services: Biosafety in Microbiological and Biomedical Laboratories: 4th Edition Washington DC: US Government Printing Office May, 1999.
22. National Committee for Clinical Laboratory Standards (NCCLS/CLSI), Evaluation of Precision Performance of Clinical Chemistry Devices; Approved Guideline – Second Edition. EP5-A2 (2004).
23. National Committee for Clinical Laboratory Standards (NCCLS/CLSI), Protocols for Determination of Limits of Detection and Limits of Quantitation; Approved Guideline. EP17-A (2004).
24. National Committee for Clinical Laboratory Standards (NCCLS/CLSI), Evaluation of the Linearity of Quantitative Measurement Procedures: A Statistical Approach; Approved Guideline. EP6-A.
25. National Committee for Clinical Laboratory Standards (NCCLS/CLSI), Interference Testing in Clinical Chemistry, Approved Guideline, EP7-A.



---

**Fujirebio Diagnostics AB**  
**Majnabbeterminalen**  
**SE-414 55 Göteborg**  
**Sweden**  
**Phone + 46 31 85 70 30**  
**Fax + 46 31 85 70 40**  
**[info@fdab.com](mailto:info@fdab.com)**  
**[www.fdab.com](http://www.fdab.com)**