# EurobioPlex FluCoSyn

## REAL-TIME RT-PCR

For **qualitative** real-time RT-PCR

EBX-042-24 (24 reactions)
EBX-042 (96 reactions)
EBX-042-192 (192 reactions)

**24/96/192 réactions**

Version 1.00 of 2020/09/15

**Validated on**:

- CFX96$^{TM}$ Real Time PCR detection system (Bio-Rad) with analysis on CFX Manager version 3.1 (Bio-Rad)
- LightCycler®480 Instrument II (Roche) with analysis on LightCycler® 480 software v1.5 (Roche)

**Storage conditions**:

Keep all reagents between -15°C and -22°C until use and after first use

Instructions for use

# TABLE OF CONTENTS

SOMMAIRE ........ 2
UTILISATION ........ 4
INTRODUCTION ........ 4
PRINCIPE DE LA DETECTION ........ 5
DESCRIPTION ET CONTENU DU KIT ........ 6
CONSERVATION ........ 7
PRECAUTIONS ET NOTES ........ 8
COLLECTE DES ECHANTILLONS, TRANSPORT ET CONSERVATION ........ 9
PROCEDURE ........ 9
I- Extraction d'ARN ........ 9
II- Réalisation de la RT-PCR en temps réel ........ 10
II-1/ Schéma de la procédure ........ 11
II-2/ Procédure détaillée ........ 12
VALIDATION DE L'EXPERIMENTATION ........ 14
ANALYSE DES DONNEES ET INTERPRETATION ........ 15
ANALYSE DES PERFORMANCES ........ 17
BIBLIOGRAPHIE ........ 19
ELIMINATION DES DECHETS ........ 19
SYMBOLES ........ 20
TABLE OF CONTENTs ........ 22
INTENDED USE ........ 24
INTRODUCTION ........ 24
PRINCIPLE OF DETECTION ........ 25
DESCRIPTION AND CONTENT OF THE KIT ........ 26
STORAGE ........ 27
CAUTIONS AND NOTES ........ 27
SAMPLES COLLECTION, TRANSPORT AND STORAGE ........ 28
PROCEDURE ........ 29
I- RNA extraction ........ 29
II- Real-time RT-PCR Procedure ........ 29

II-1/ Diagram of the procedure ........................................................................................ 30
II-2/ Detailed Procedure ........................................................................................ 31
VALIDATION OF THE EXPERIMENT ........................................................................................ 32
DATA ANALYSIS AND INTERPRETATION ........................................................................................ 34
PERFORMANCE ANALYSIS ........................................................................................ 35
BIBLIOGRAPHY ........................................................................................ 37
WASTE DISPOSAL ........................................................................................ 37
SYMBOLS ........................................................................................ 38

## INTENDED USE

The EurobioPlex FluCoSyn is a real-time reverse transcription polymerase chain reaction (RT-PCR) amplification test in an RNA nucleic acid extract designed for the qualitative determination of the presence or absence of the following respiratory viruses:

- SARS-CoV-2, an emerging virus, which appeared in China in late 2019 in the city of Wuhan.
- Influenza A virus (Flu A) and Influenza B virus (Flu B),
- Respiratory Syncytial Virus A and B (RSV A and B),

EurobioPlex EBX-042 has been designed to detect Flu and RSV without differentiation of types A and B, and all known SARS-CoV-2 sequences known to date, and by *in silico* alignment, particularly allowing to exclude other nening or SARS-CoV-1 or MERS coronaviruses. The determination of SARS-CoV-2 status is based on the detection of 2 targets coupled to the same fluorophore: one in the RdRp gene and the other target in the N gene.

The test is indicated to diagnose presumptive infection with these three viruses associated with respiratory syndrome in humans, or to complement a proven or undetermined diagnosis, specifically distinguishing the SARS-CoV-2 coronavirus from RSV or Influenzae respiratory viruses. The diagnosis should always be made by medical personnel and in the clinical, historical and symptomatic context of the patient.

The RNA extract from any respiratory specimen is the starting material for the EurobioPlex EBX-042. It is the responsibility of the user to use extraction methods appropriate to the specimens tested.

The kit has been validated on the following type of respiratory specimen:

- Nasal swab

## INTRODUCTION

The influenza A virus (Influenza A, Flu A) and the influenza B virus (Flu B) belong to the *Orthomyxoviridae* family. Respiratory Syncytial Virus A and B (RSV A and B) are members of the *Paramyxoviridae* family. SARS-Cov-2 virus belongs to the *Coronaviridae* family and subgenus *Sarbecovirus*. The latter emerged in China at the end of 2019, in the city of Wuhan, and caused an unprecedented worldwide pandemic in the first half of 2020. All three are RNA viruses, with human-to-human transmission mainly infecting the lungs and respiratory tract (cough and sneeze droplets from infected individuals).

The genome of the SARS-CoV-2 virus consists of 29903 ribonucleic acid (RNA) bases. The SARS-CoV-2 is the seventh coronavirus identified as infecting humans, after human coronaviruses (HCoV) 229E, NL63, OC43, HKU1, SARS-CoV (coronavirus causing severe acute respiratory syndrome) and MERS-CoV (coronavirus inducing

Middle Eastern respiratory syndrome). The SARS-CoV-2 sequences present similarities with those of betacoronaviruses found in bats. The SARS-CoV-2 virus is genetically distinct from other human coronaviruses such as those related to SARS and MERS.

These viruses are a major public health problem worldwide (morbidity rate, and health and social costs). They are seasonal, mainly autumn/winter. Flu induces epidemic, with possible serious consequences especially in the elderly. RSV is the main cause of bronchiolitis in young children. SARS-CoV-2 led to a pandemic. Clinical signs usually disappear after a few days, but the symptoms are variable, commonly covering an influenza-like illness such as fever, headache, cough, runny nose, pharyngitis, myalgia, asthenia, breathing difficulty, but in the most severe cases, complications occur (pneumonia, severe respiratory syndrome, and dehydration) and can be fatal. Antivirals are currently available for influenza and RSV, but not for SARS-Cov-2, whose treatment and prophylaxis are being studied worldwide. To date, only the annual influenza vaccine has a Marketing Authorization.

In July 2020, the actual case-fatality rate associated with SARS-CoV-2 in France is between 0.5% and 1% according to the WHO, which is well above the seasonal influenza rate of 0.1%, but without any measurement compared to that associated with SARS-CoV-1 or MERS, which are 10% and 30% respectively. SARS-CoV-2 is highly contagious with more than 16 million cases worldwide at the end of July 2020. According to WHO reports, the pandemic is very active in the USA, the Middle East, and Central and South Asia, and is on the rise in countries where influenza usually circulates at this time of year (South Africa, Australia).

Respiratory viral infections are generally diagnosed clinically on the basis of symptoms and local epidemic situation. The 3 types of viruses detected by EurobioPlex FluCoSyn co-circulate. Despite the fact that the pathogenic agents lead to specific manifestations, each can lead to various symptoms of the respiratory tract, with different degree of severity, depending on the host. Moreover, the therapeutic approach is different depending on the virus. It is therefore crucial to be able to differentiate which type of virus is at the origin of the symptoms, within an epidemic and pandemic context. This is achieved with EurobioPlex EBX-042.

## PRINCIPLE OF DETECTION

EurobioPlex FluCoSyn is a test using reverse-transcription and real-time amplification of viral RNA of *Influenzae* (A and B), RSV (A and B) and SARS-CoV-2 (one target in RdRp gene and the other in N gene), based on a single Multiplex RT-PCR test, detecting all 3 viruses in a signal well.

The kit contains one oligomix to detect the 3 targets, as well as an encapsidated control of RNA extraction and RT-PCR inhibition. The test is performed from extracted RNA from a sample, using one RT-PCR reaction in a single distinct well/tube.

The RNA extraction and RT-PCR inhibition control allows to check for variations that may occur during the RNA extraction step of biological samples and real-time PCR

amplification. Thus, it ensures that a negative result may be due to a bad RNA extraction, and/or due to the presence of PCR inhibitors in too large quantities.

*Influenzae* A and B are detected with FAM-labeled probes, RSV A and B are detected with an HEX labeled probe, and SARS-CoV-2 with Texas Red labeled probes.
CI-ARN is detected using a CY5 labeled probe. Probes emit a specific fluorescence following their hydrolysis during the elongation of the amplification product. The measurement of the intensity of real-time fluorescence correlates with the accumulation of amplification products.

## DESCRIPTION AND CONTENT OF THE KIT

The real-time RT-PCR kit EBX-042 FluCoSyn is ready to use and contains the reagents and enzymes necessary for the detection of these viruses (Table 1).

The fluorescence is emitted and measured individually by an optical system during PCR. Detection of amplified fragments is performed by a fluorometer using the channels shown in Table 2.

**Table 1:**

| Couleur de Bouchon | Content of the kit | 24 reactions EBX-042-24 | 96 reactions EBX-042 | 192 reactions EBX-042-192 | Reconstitution |
|---|---|---|---|---|---|
| **Red** | Enzyme Taq polymerase | 4 X 100 µl | 1500 µl | 2 x 1500 µl | Ready to use |
| **Brown** | Enzyme Reverse transcriptase | 4 X 12 µl | 24 µl | 48 µl | Ready to use |
| **Transparent** | Oligomix | 4 X 40 µl | 600 µl | 1200 µl | Ready to use |
| **Yellow** | Positive Control CP | 40 µl | 160 µl | 320 µl | Ready to use |
| **Blue** | Water = negative control (CN-H2O) | 1mL | 1mL | 1mL | Ready to use |
| **White** | RNA control (CI-ARN) | 4 X 75 µl | 1200 µl | 2 x 1200 µl | Ready to use |

Oligomix: contains the primers and probes for the 3 viral targets and the internal control CI-ARN

**Table 2:**

| Target | Fluorophor | Excitation | Emission |
|---|---|---|---|
| Flu (A+B) | FAM | 495 nm | 515 nm |
| RSV (A+B) | HEX | 535 nm | 555 nm |
| SARS-CoV-2 | Texas red | 585 nm | 605 nm |
| Control RNA (CI-ARN) | Cy5 | 647 nm | 667 nm |

Equivalent channels on different real time PCR cyclers:
- Channel **FAM** (Systems ABI, SmartCycler II, Systems Mx, CFX96™/Chromo4, T-COR8™-IVD), Channel 510 (LC 480), Channel Green (RotorGene)
- Channel **HEX** (Chromo 4/CFX96, Systèmes Mx, T-COR 8®-IVD), Canal VIC (Systèmes ABI), Canal Alexa532 (SmartCycler II), Canal 580 (LC 480), Canal Yellow (RotorGene),
- Channel **Texas Red** (Systems ABI, Chromo 4/CFX96, Systèmes Mx, T-COR 8®-IVD), LC Red 610 (LC480), Canal Orange (RotorGene)
- Channel **Cy5** (CFX96™/Chromo4, Systems ABI, Systems Mx, T-COR8™-IVD), Channel Alexa647 (SmartCycler II), Channel 660 (LC 480), Channel Red (RotorGene)
Note: On LC480 instrument II, apply color compensation for the following channels: FAM-HEX/VIC-TexasRed-Cy5 (465-510, 533-580, 533-610, 618-660) and Do not leave the Noiseband (Auto) in the Texas Red channel, but apply the Fluoresc. NoiseBand manually to 20 RFU (placement of the base line by the operator) in the **Texas Red channel only.**

**Required material not provided:**

- ◊ Biological Hood
- ◊ Real-time PCR instrument
- ◊ Micro centrifuge
- ◊ Vortex
- ◊ Plates / tubes for real-time PCR
- ◊ Micropipettes
- ◊ DNase-free RNase-free filter tips for micropipettes
- ◊ Sterile microtubes
- ◊ Gloves (powder free)

## STORAGE

All reagents must be stored between -15 and -22°C.
All reagents can be used until the expiration date indicated on the label of the kit.
Many freezing/defrosting cycles (> 5x) must be avoided, and could lead to decrease in sensitivity.

## CAUTIONS AND NOTES

**Read carefully instructions before starting.**

- ◊ The experiment must be performed by competent staff, trained to technical and safety techniques.
- ◊ The biosafety local regulations for SARS-CoV-2 testing must be followed accurately under all circumstances, using appropriate equipment and laboratories in this regard.
- ◊ Instruments must have been properly installed, calibrated and maintained according to the manufacturer's recommendations.
- ◊ It is the user's responsibility if he/she uses other non-validated equipment, and if so, the performances are not guaranteed.
- ◊ Clinical samples are potentially infectious and must be processed under a laminar flow hood.
- ◊ The experiment must be performed according to adequate laboratory practice.

- ◊ Do not use this kit after expiration date, mentioned on the label.
- ◊ The kit is shipped with dry ice, and the components of the kits must arrive frozen. If one or more components are defrosted, or of the tubes have been damaged, contact Eurobio Scientific.
- ◊ Once defrosted, spin down briefly the tubes before use.
- ◊ It is recommended to define three working areas: 1) Isolation of RNA, 2) Preparation of the reaction mix and 3) Amplification / Detection of amplified products.
- ◊ It is recommended to open and manipulate the positive controls away from biological samples to tests and from other components of the kit in order to avoid cross-contamination.
- ◊ Use specific lab coat and gloves (powder free) in each working area.
- ◊ Pipettes, reagents and other materials must not cross each area.
- ◊ Specific caution is required to preserve the purity of the reagents and reaction mixtures.
- ◊ Appropriate methods of preparation/extraction of RNA to produce high quality RNA and to be followed by an RNA application should be used, particularly avoiding all sources of RNase contamination.
- ◊ Always use RNase-free DNase-free filtered tips for micropipettes.
- ◊ Do not pipette with mouth and do not eat, drink or smoke in the area.
- ◊ Avoid sprays.

## SAMPLES COLLECTION, TRANSPORT AND STORAGE

- ◊ Collect samples in sterile tubes.
- ◊ It is the responsibility of the user to master its own conditions of collection, transport and storage of samples, and extraction of RNA by suitable systems to produce RNA of good quality.
- ◊ The samples should be extracted immediately or stored following the recommendations in the table below (Table 3).

**Table 3:**

| Recommendations of maximum storage of samples before extraction | |
|---|---|
| Room temperature | 2 h |
| + 4°C | 72 h |
| - 20°C (preferably - 80°C) | Long term storage |

- ◊ The user can refer to the World Health Organization or High Health Authority for storing samples.
- ◊ <u>Extracted RNAs have to be stored at -80°C.</u>
- ◊ Transport of clinical samples must obey local regulations. The biosafety local regulations for SARS-CoV-2 must be followed.

## PROCEDURE

### I- RNA extraction

It is the user's responsibility that the extraction system used is compatible with downstream real time RT-PCR technology. For this kit, we recommend to use extraction methods of viral RNA from respiratory samples, and refer to manufacturer's instructions of the extraction kit.

In the EBX-042 kit, CI-ARN on the CY5 channel can be added before extraction or in the PCR reaction. It ensures that a negative result is not due to an extraction problem or due to the presence of high amounts of RT-PCR inhibitors.
We recommend the addition of 10 µl of CI-ARN per extraction, and 50µl for elution. If the CI-ARN is added to control the RT-PCR, CI-ARN is added to the reaction mix (1 µl per PCR reaction). See real-time RT-PCR protocol for details.

### II- Real-time RT-PCR Procedure

General comments:

- The positive control, and the RNA extraction and RT-PCR inhibition control (CI-ARN) contain a very high concentration of matrix. Manipulations must be performed carefully to avoid contamination.
- To control the functioning of the PCR, and steps of extraction and real-time RT-PCR amplification, it is necessary to test the positive control, as well as the negative control (water PCR provided = CN-H2O+ CI-ARN) (see II-2/6 for real-time RT-PCR protocol for details).

## II-1/ Diagram of the procedure

### 1 - PREPARATION OF MASTERMIX

**(a) For RNA samples extracted without CI-ARN**

| Number of reactions | N+3 |
|---|---|
| Enzyme Taq polymerase | (N+3) x 12,5 µl |
| Enzyme Reverse trancriptase | (N+3) x 0,2 µl |
| Water | (N+3) x 2,3 µl |
| Oligomix | (N+3) x 5 µl |
| CI-ARN | (N+3) x 1 µl |
| Total Volume Mastermix | (N+3) x 21 µl |

**(b) For RNA samples extracted with CI-ARN**

| Number of reactions | N+3 |
|---|---|
| Enzyme Taq polymerase | (N+3) x 12,5 µl |
| Enzyme Reverse trancriptase | (N+3) x 0,2 µl |
| Water | (N+3) x 2,3 µl |
| Oligomix | (N+3) x 5 µl |
| Total Volume Mastermix | (N+3) x 20 µl |

### 2 - PREPARATION OF REACTIONS

**(a)**

**Sample**

20 µl Mastermix
+
5µl RNA sample

**Positive Control**

20 µl Mastermix
+
5µl CP

**Negative Control**

20 µl Mastermix
+
5µl Molecular biology water (CN-H2O)

**(b)**

**Sample**

20 µl Mastermix
+
5µl RNA sample

**Positive Control**

20 µl Mastermix
+
5µl CP

**Negative Control**

20 µl Mastermix
+
4µl Molecular biology water (CN-H2O)
+
1 µl CI-ARN

### 3 – REAL TIME PCR INSTRUMENT

| Program | Temperature | Duration | Cycle(s) | |
|---|---|---|---|---|
| Reverse Transcription | 45°C | 10 min | 1 | - |
| Denaturation | 98°C | 20 sec | 1 | - |
| Amplification | 98°C | 3 sec | 45 | - |
| | 58°C | 45 sec | | Acquisition de fluorescence |

## II-2/ Detailed Procedure

1) Homogenize the tube of Enzymes, and vortex the Oligomix, CP, and CI-ARN tubes before starting, and centrifuge briefly.
2) Prepare the Mastermix as below. N is the number of PCR reactions (positive and negative controls included). Plan to prepare enough reagents for at least N+3 reactions (refer to part 1-(a) or 1-(b) of the previous diagram according to the case).

Case (a): For samples extracted without CI-ARN

| Number of reactions | N+3 |
|---|---|
| Enzyme Taq polymerase | (N+3) x 12,5 µl |
| Enzyme Reverse trancriptase | (N+3) x 0,2 µl |
| Water | (N+3) x 2,3 µl |
| Oligomix | (N+3) x 5 µl |
| CI-ARN | (N+3) x 1 µl |
| Total Volume Mastermix | (N+3) x 21 µl* |

Case (b): For samples extracted with CI-ARN

| Number of reactions | N+3 |
|---|---|
| Enzyme Taq polymerase | (N+3) x 12,5 µl |
| Enzyme Reverse trancriptase | (N+3) x 0,2 µl |
| Water | (N+3) x 2,3 µl |
| Oligomix | (N+3) x 5 µl |
| Total Volume Mastermix | (N+3) x 20 µl |

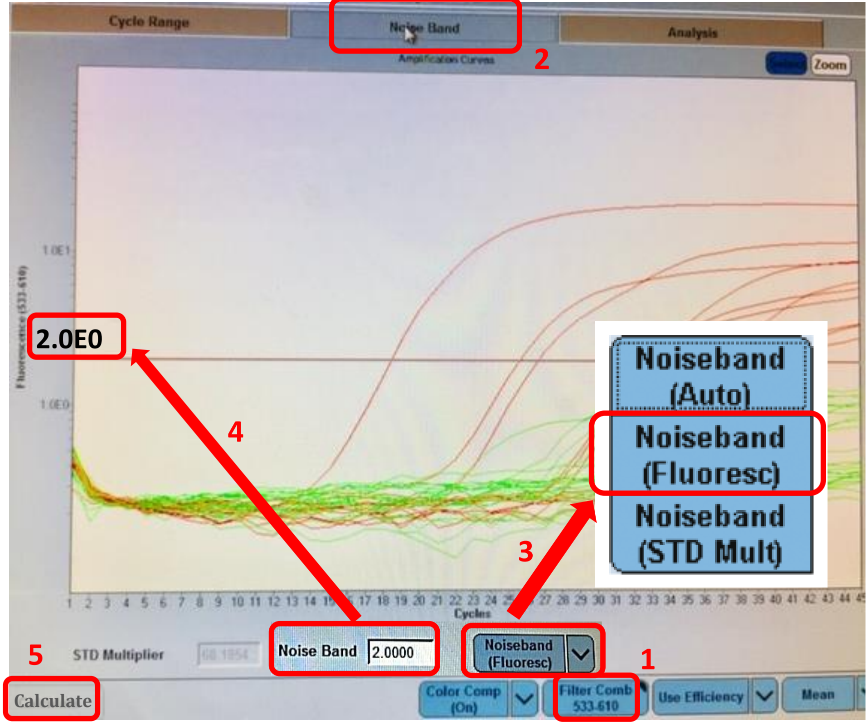
* *The volume difference between case (a) or (b) has no effect on performance.*

3) Homogenize the Mastermix prepared in 2) and centrifuge briefly.
4) Distribute 20 µL of Mastermix* with a micropipette and filtered tips in each tube or well of a microplate for real-time PCR.
5) Add 5 µL of extracted RNA sample.
6) In parallel test the following controls:
   - Positive control:
     - 20 µl Mastermix + 5 µl CP.
   - Negative Control:
     - Case (a): For samples extracted without CI-ARN
       - 20 µl de Mastermix + 5 µl provided water (CN-H2O)
     - Case (b): For samples extracted with CI-ARN
       - 20 µl de Mastermix + 4 µl provided water (CN-H2O) + 1 µl CI-ARN
7) Close immediately the tubes, or plate with an adhesive film to avoid all contamination.
8) Centrifuge briefly to collect all the reaction mix at the bottom of the tubes or plate.
9) Program the real-time PCR instrument as follows:

| Program | Temperature | Duration | Cycle(s) | |
|---|---|---|---|---|
| **Reverse Transcription** | 45°C | 10 min | 1 | - |
| **Denaturation** | 98°C | 20 sec | 1 | - |
| **Amplification** | 98°C | 3 sec | 45 | - |
| | 58°C | 45 sec | | Acquisition de fluorescence |

Note 1: For the Applied Biosystems systems, select “NONE” in "PASSIVE REFERENCE".
Note 2: On Rotorgene ™, please calibrate the signal by clicking on “GAIN optimization”.
Note 3: On CFX96™ (Bio-Rad), start the run using the v1.6 or later version of CFX Manager software, and analyze with v 3.1 (see § Validation of the Experiment)
Note 4: On LightCycler® 480 systems (Roche), two optical systems are available: only "System II" is compliant with use of the kit.
Note 5: On LC480 instrument II, apply color compensation for the following channels: FAM-HEX/VIC-TexasRed-Cy5 (465-510, 533-580, 533-610, 618-660).
Note 6: On LC480 Instrument II: When analyzing, do not leave the Noiseband (Auto) in the Texas Red channel, but apply the NoiseBand Fluoresc. manually to 2.0 RFU (placement of the baseline by the operator) in the **Texas Red channel only.**

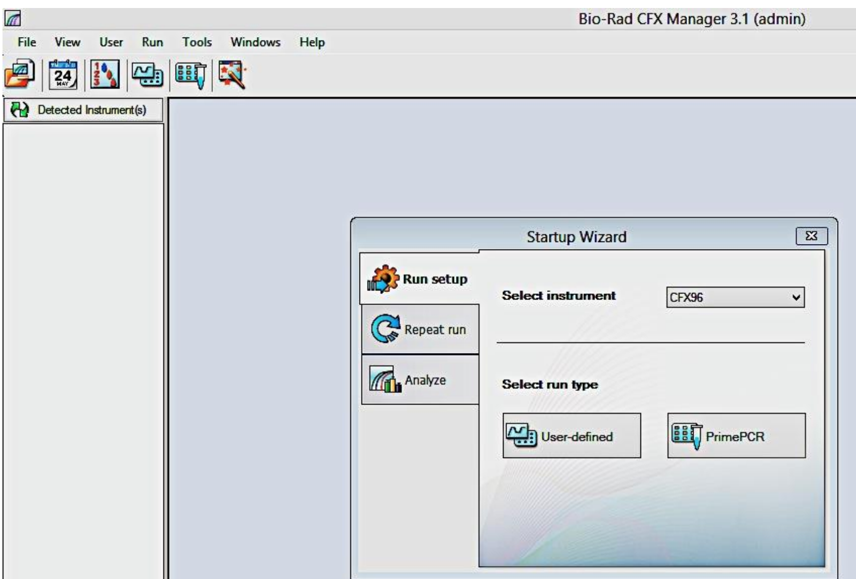
1. Select the Texas Red channel
2. Click on the Noise Band window.
3. Click on Noiseband Fluoresc. tab
4. Manually move the Threshold Bar to 2.0 RFU, or Note 2.O for the Noise Band value.
5. Click on "calculate" to obtain the Ct values of your experiment.



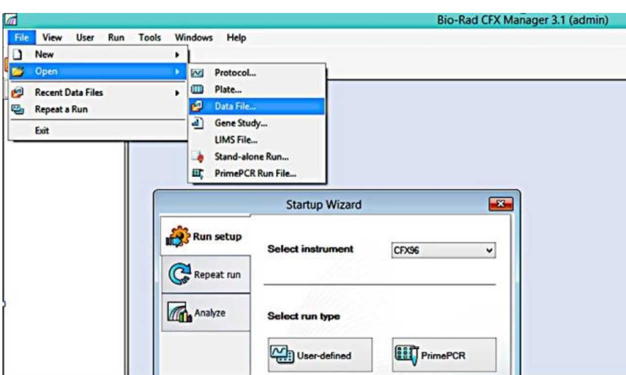

# VALIDATION OF THE EXPERIMENT

The analysis of data post-acquisition on a CFX96™ PCR instrument (Bio-Rad) must be done with version 3.1 of CFX Manager software (Bio-Rad). In order to use this v3.1 version from a run started with an older version, follow the procedure below: at the end of the run, the data file with “pcrd” suffix must be open and treated with version 3.1 of CFX Manager (Bio-Rad).

If the run was done with CFX Manager v1.6 for instance, to open the data file with CFX Manager v3.1, click on CFX Manager v3.1 icon. The screen below appears.

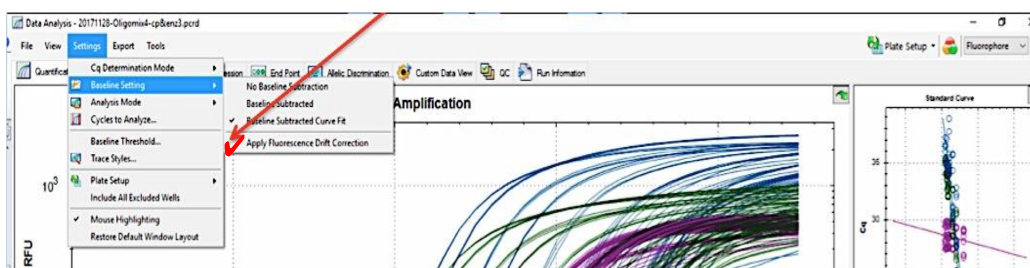



- Click on “File” and select “Open”, then “Data File”




- Select the file you want to analyze and click on “Open”.

The “drift correction” option must be selected from the “Settings” Tab, as indicated on the image below: click on “Settings”, then “Baseline Setting” then on “Apply Fluorescence Drift Correction”.




Once this is done, the analysis can start.
The results for the controls must be the following (Table 4); otherwise, the experiment is not valid.

**Table 4: Validation of the run**

| Positive Control | |
|---|---|
| FAM | Ct ≤ 30 |
| HEX | Ct ≤ 30 |
| Texas Red | Ct ≤ 30 |
| **Negative Control** | |
| FAM | Undetermined Ct |
| HEX | Undetermined Ct |
| Texas Red | Undetermined Ct |
| Cy5 | Ct ≤ 45 |

## DATA ANALYSIS AND INTERPRETATION

**RNA extraction and RT-PCR inhibition control in samples:**

Two results can be obtained:
1/ CI-ARN (channel Cy5) test is positive: the result can be validated.
2/ CI-ARN (channel Cy5) test is negative: either due to the presence of RT-PCR inhibitors and/or RNA was not extracted, if extraction was performed. It is then recommended to dilute the sample (or perform/repeat extraction), unless a specific signal appears in the targeted channels (FAM, HEX, TEXAS RED).

For high viral loads detected on the targeted channels (FAM or HEX or TEXAS RED), the Ct value of CI-ARN can be increased compared to the one in the negative control. This does not invalidate positivity.

**For clinical samples, the following results are possible:**

***SARS-CoV-2 (Texas Red), Flu (FAM) ou RSV (HEX): Ct < 45**

**Table 5:**

| PCR Signal Flu and/or RSV and/or SARS-CoV-2 | CI-PCR Signal | Presence of virus | Test validity/comment |
|---|---|---|---|
| FAM and/or HEX and/or Texas Red | Cy5 | | |
| +* | + | Yes | **VALID** |
| - | + | No | **VALID** |
| +* | - | Yes | **VALID** |

|  |  |  | Possible RT-PCR inhibition or problem with extraction that does not prevent the detection of viruses. |
|---|---|---|---|
| - | - | No possible interpretation | RT-PCR inhibition or problem with extraction → **dilute first 5 x the sample and test again; if necessary redo an extraction** |

- All samples must be treated as potentially infected by SARS-CoV-2, and biosafety local regulations must be thoroughly followed.
- Interpretation of results must take into account the possibility of false negatives and false positives.

False negative can be due to:

- Inappropriate collection of samples, or bad storage
- Samples outside the viremic phase
- Incorrect extraction methods or use of non-validated PCR instruments
- Manipulations that do not rigorously follow all the indications of this manual.

False positive can be due to:

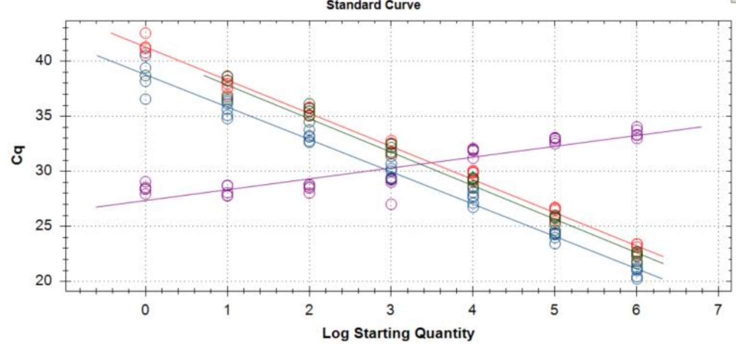
- A contamination related to wrong manipulation of highly positive samples, or from the positive control, or PCR products
- Procedures that do not rigorously follow precautions to avoid contamination described in this manual

- Results must be interpreted by medical professionals in the clinical context of the patient, its history and symptoms.
- This test does not exclude the presence of other pathogens than the SARS-CoV-2.
- A negative result for this test does not absolutely exclude a possible infection with SARS-CoV-2.

## PERFORMANCE ANALYSIS

- **Limit of detection / Analytical sensitivity: Positive control of the kit :**
  - 5 copies/ µl pour Influenzae/Flu
  - 15 copies/µl pour RSV
  - 15 copies/ µl pour SARS-CoV-2

**Example of experiment performed on real-time PCR thermocycleur CFX96™ (Bio-Rad): FAM (Flu) / HEX (RSV) / Texas Red (SARS-CoV-2) / CI-ARN (Cy5)**



- **Reproducibility**

  Intra-experiment Ct variability (n= 5 replicates) and between 3 lots of EBX-042 on each virus are the following:

| Channel-Virus | CV % intra-experiment | CV % inter-lots |
|---|---|---|
| FAM-Flu | 1.82 | 3.92 |
| HEX-RSV | 2.26 | 4.43 |
| TEXAS RED-SARS-CoV-2 | 2.14 | 2.69 |

*CV : coefficient of variation*

- **Validation on clinical samples**

Specificity has been evaluated on pre-tested extracted samples supplied by reference laboratories, including 110 samples pre-tested positive for Flu, 120 pre-tested samples positive for RSV, 102 pre-tested samples positive for SARS-CoV-2.

Sensitivity has been evaluated on pre-tested extracted samples supplied by reference laboratories, including 73 samples pre-tested negative for Flu, 20 pre-tested samples negative for RSV, 48 pre-tested samples negative for SARS-CoV-2.

Overall performances are:

| | | EBX-042 | | |
|---|---|---|---|---|
| | | Flu | | |
| | | POSITIVE | NEGATIVE | TOTAL |
| Pretestés | POSITIVE | 70 | 3 | 73 |
| | NEGATIVE | 0 | 110 | 110 |
| | | RSV | | |
| | | POSITIVE | NEGATIVE | TOTAL |
| Pretestés | POSITIVE | 20 | 0 | 20 |
| | NEGATIVE | 0 | 120 | 120 |
| | | SARS-CoV-2 | | |
| | | POSITIVE | NEGATIVE | TOTAL |
| Pretestés | POSITIVE | 48 | 0 | 48 |
| | NEGATIVE | 0 | 102 | 102 |

The tests were performed on CFX96$^{TM}$ (Bio-Rad).

- **Sensitivity: Flu / RSV / SARS-CoV-2: 96 % / > 99 % / > 99 %**
- **Specificity: Flu / RSV / SARS-CoV-2: > 99 % / >99 % / >99 %**
- **Positive predictive value (PPV): Flu / RSV / SARS-CoV-2:> 99 %/> 99 %/> 99 %**
- **Negative predictive value (NPV): Flu / RSV / SARS-CoV-2: 97 %/>99 %/>99 %**

No-cross reaction was observed between the 3 targets of the kit, neither the following pathogens: Adenovirus, Parainfluenzae, Rhinovirus, Metapneumovirus, Bocavirus, Legionella pneumophilia, Mycoplasma pneumoniae, Bordetella pertussis, Bordetella parapertussis, Parechovirus Type 1 to 6, Enterovirus, Human coronavirus NL63, Human coronavirus OC43.

RNA extraction was performed on the following systems: EasyMag (Biomérieux), NucleoMAG Pathogen (Macherey-NAGEL), EZ1 Advanced XL (Qiagen).

## BIBLIOGRAPHY


Xiaojing Wu, Ying Cai, Xu Huang, Xin Yu, Li Zhao, Fan Wang, Quanguo Li, Sichao Gu, Teng Xu, Yongjun Li, Binghuai Lu, Qingyuan Zhan, Co-infection with SARS-CoV-2 and Influenza A Virus in Patient with Pneumonia, China,
Emerg Infect Dis. 2020 Jun;26(6):1324-1326.

Yan Li , Jiangshan Wang , Chunting Wang , Qiwen Yang , Yingchun Xu , Jun Xu , Yi Li Xuezhong Yu , Huadong Zhu , Jihai Liu Characteristics of respiratory virus infection during the outbreak of 2019 novel coronavirus in Beijing. Int J Infect Dis. 2020 Jul;96:266-269.

Chan JF, Kok KH, Zhu Z, Chu H *et al.* Genomic characterization of the 2019 novel human-pathogenic coronavirus isolated from a patient with atypical pneumonia after visiting Wuhan. Emerg microbes infect. 2020 Dec; 9(1):221-236.

Cohen J, Normile D. New SRAS-like virus in China triggers alarm, Science. 2020 Jan 17;367(6475):234-235.

Drosten C, Muth D, Corman VM, Hussain R *et al.* An observational, laboratory-based study of outbreaks of middle east respiratory syndrome coronavirus in Jeddah and Riyadh, kingdom of Saudi Arabia, 2014. Clin infect dis. 2015 Feb 1; 60(3):369-77.

Cryopréservation de tissus, cellules et liquides biologiques issus du soin, Recommandations de bonnes pratiques, www.has-santé.fr.


## WASTE DISPOSAL

Be in accordance with the law on the elimination of waste of clinical infectious material.

# SYMBOLS

| Symbol | Meaning |
|---|---|
| REF | Reference |
| LOT | Batch number |
| | Limits of storage temperature |
| | Expiration Date |
| Σ | Content sufficient for « N » reactions |
| | Keep protected from light |
| | Manufacturer |
| CE | CE labeled product |
| IVD | In vitro Diagnostic |
| i | Instructions for use |

7, avenue de Scandinavie
ZA Courtaboeuf
91940 Les Ulis
FRANCE