



# *baculo*QUANT<sup>™</sup> All-In-One

DNA Extraction and Quantification Kit

User Guide  
2019-20



# *baculo*QUANT™ All-In-One User Guide 2019-20

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## Contents

1.0	Limited Use Licence	4
2.0	Kit Contents and Storage	7
3.0	Essential Information	7
4.0	Ordering and Contact Information	8
5.0	Technical Assistance and Further Information	8
6.0	Safety Requirements	8
7.0	Introduction	10
	7.1 Overview of protocol	10
	7.2 The principle of qPCR	11
	7.3 Utilising qPCR to determine virus titre	14
8.0	Protocol	16
	8.1 Supplied in <i>baculo</i> QUANT™ All-In-One	16
	8.2 Solution preparation	17
	8.3 Procedure	17
9.0	References	24

# 1. Limited Use Licence for *baculo*QUANT™ All-In-One

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- I. In the Licence the following expressions shall have the following meanings:
- |                   |  |
|-------------------|--|
| <b>DNA</b>        | shall mean deoxyribonucleic acid;  |
| <b>Fee</b>        | shall mean the fee invoiced for the Materials by the Licensor to the Licensee;   |
| <b>Licensee</b>   | shall mean the purchaser of the Materials;   |
| <b>Licensor</b>   | shall mean Oxford Expression Technologies Ltd;   |
| <b>Material</b>   | shall mean the Licensor's product known as <i>baculo</i> QUANT™ All-In-One kit comprising either or both an agreed quantity of DNA, primers and probe and the relevant User Guide; |
| <b>Purpose</b>    | shall mean the use by the Licensee of the Materials for the production of recombinant proteins and/or viruses for Research purposes only;  |
| <b>Research</b>   | shall mean the Licensor's systematic search or investigation towards increasing the sum of knowledge in the production of recombinant proteins and/or viruses;                     |
| <b>User Guide</b> | shall mean the instructions provided with <i>baculo</i> QUANT™ All-In-One to enable the Licensee to titre recombinant viruses from the <i>baculo</i> QUANT™ All-In-One kit         |
- II. The Licensor and the Licensee have agreed to enter into this Licence on the following terms and conditions.
- III. The Licensee acknowledges and accepts that by opening and/or using the Materials it is agreeing to and accepting these terms and condition. If the Licensee does not agree to these terms and conditions it must immediately return all the Materials unused to the Licensor who shall issue a refund for the fee.
- IV. The Licensor has certain know-how and has developed a product that can be used to titrate recombinant viruses and has the right to exploit the product under, inter alia, patent applications numbered 0607656.7.
- V. This Licence shall commence on the date hereof and continue until the *baculo*QUANT™ All-In-One kit has been used or destroyed.

- VI. The Licensor hereby grants to the Licensee and the Licensee hereby accepts a limited, non-exclusive, non-transferable, licence to use the Materials for the Purpose and as otherwise set out in this licence.
- VII. The Licensee warrants to the Licensor that:
  - a) it shall only use the Materials for the purpose of Research; and
  - b) it shall not alter, produce, manufacture or amplify the contents of the *baculo*QUANT™ All-In-One kit; and
  - c) if the Licensee desires to the Materials for any purpose other than the Purpose, it shall notify the Licensor accordingly and procure a suitable licence prior to any such use.
- VIII. The Licensee shall keep the *baculo*QUANT™ All-In-One kit in accordance with the directions contained in the User Guide.
- IX. The Licensor shall raise an invoice to the Licensee for the Fee and the Licensee agrees to pay the same to the Licensor within thirty (30) day of receipt of the invoice (unless otherwise agreed in writing).
- X. The Materials are provided as is and neither the Licensor nor any staff acting on its behalf accepts any liability whatsoever for any of the Materials or in connection with the Licensee's possession, handling or use of the Materials.
- XI. The Licensee's remedy pursuant to this Licence shall be limited at the Licensor's option to the replacement of the Materials or a refund of the Fee paid by the Licensee.
- XII. Ownership of the Materials shall pass to the Licensee upon dispatch of the Materials by the Licensor to the Licensee.
- XIII. The Licensee shall indemnify the Licensor for any loss suffered by the Licensor as a result of the Licensee's breach of this licence and/or third party's intellectual property rights.
- XIV. This Licence is personal to the parties and shall not be assigned or otherwise transferred in whole or in part by either party.
- XV. This Licence constitutes the entire agreement and understanding between the parties in respect of the Materials and supersedes all previous agreements, understandings and undertakings in this respect and all obligations implied by the law to the extent that they conflict with the express provisions of this Licence.
- XVI. The invalidity, illegality or unenforceability of a provision of this Licence shall not affect or impair the continuation in force of the remainder of this Licence.
- XVII. The Licensor reserves the right to revoke this permission and may require the Licensee to return or destroy any remaining *baculo*QUANT™ All-In-One kit contents and/or the User Guide.

- XVIII. Clauses 1, 3, 7, 9, 10, 13, 16, 18-20 shall survive any termination or expiry of this Licence.
- XIX. The interpretation construction and effect of this Licence shall be governed and construed in all respects in accordance with the laws of England and the parties hereby submit to the non-exclusive jurisdiction of the English courts.
- XX. The Contracts (Rights of Third Parties) Act 1999 shall have no application to this Licence whatsoever and the parties do not intend hereunder to benefit any third party.

End of Limited Use Licence.

#### NOTE

**This product is for research use only. The use of the licensed probe in this kit is covered by one or more of the following US patents and corresponding patent claims outside the US: 5,538,848, 5,723,591, 5,876,930, 6,030,787, 6,258,569 and 5,804,375. The use of TaqMan™ fluorogenic probes in 5' nuclease assays is covered by U.S. Patent No. 5,210,015 and 5,487,972 owned by Roche Molecular Systems Inc. and by U.S. Patent No. 5,538,848 owned by The Applera Corporation. Purchase of the *baculo*QUANT™ All-In-One Titration Kit does not provide a licence to use this patented technology. Further information on purchasing licences to practice this technology may be obtained from Applied Biosystems®, 850 Lincoln Centre Drive, Foster City, CA 94404 or from Roche Molecular Systems Inc., 1145 Atlantic Avenue, Alameda, CA 94501, USA. Diagnostic uses under Roche patents require a separate licence from Roche.**

## 2. Kit Contents, Preparation and Storage

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All reagents and materials provided and referred to in this User Guide are for research purposes only:

- a) Virus internal standard (for plotting standard curve; 450µL at  $\sim 10^8$  pfu/mL). **Aliquot and store at -20°C.**
- b) RNase-free water for diluting virus internal standard (1.9mL). **Store at -20°C.**
- c) RNase-free water for qPCR mix and negative control (1.9mL). **Store at -20°C.**
- d) DNA positive control. **Store at -20°C.**
- e) 2 x Brilliant II qPCR Low ROX Master Mix (2 × concentration; 1.3mL). **Aliquot and store at -20°C.**
- f) Primer/ probe mix lyophilised. (dissolve in 330µL of RNase-free water provided in c). **Aliquot and store at -20°C in the dark.**
- g) Lysis buffer (1mL). **Aliquot and store at -20°C.**
- h) *baculo*QUANT™ All-In-One User Guide.

## 3. Essential Information

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The information given in this User Guide is accurate to the best of our knowledge. It is a practical guide to allow researchers to determine baculovirus titres via quantitative PCR (qPCR) using primers and probe to the viral gene *gp64*. It is not intended as a comprehensive guide to qPCR or other virus titration methods.

Use of the kits requires access to a thermal cycler with heated lid (for the DNA extraction step) and access to a real-time qPCR system for the amplification of DNA.

## 4. Ordering and Contact Information

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Phone: +44 (0) 1865 483236  
Fax: +44 (0) 1865 483250  
Email: [info@oetltd.com](mailto:info@oetltd.com)  
Online: <http://oetltd.com/products>

## 5. Technical Assistance and Further Information

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For additional help or guidance, please contact us at [info@oetltd.com](mailto:info@oetltd.com). All technical assistance is provided without charge and is given in good faith; we cannot take any responsibility whatsoever for any results you obtain by relying on our assistance. We make no warranties of any kind with respect to technical assistance or information we provide.

## 6. Safety Requirements

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The research products have not been approved for human or animal diagnostic or therapeutic use.

Procedures described within this User Guide should only be carried out by a qualified person trained in appropriate laboratory safety procedures.

Always use good laboratory practice when handling this product.

**WARNING:** SAFETY PRECAUTIONS MAY BE NECESSARY WHEN HANDLING SOME OF THE PRODUCTS DESCRIBED IN THIS USER GUIDE. PLEASE REFER TO THE MATERIAL AND SAFETY DATA SHEET SUPPLIED BY THE APPROPRIATE MANUFACTURER.

## 7. Introduction to the Baculovirus DNA Extraction and Quantification Kit

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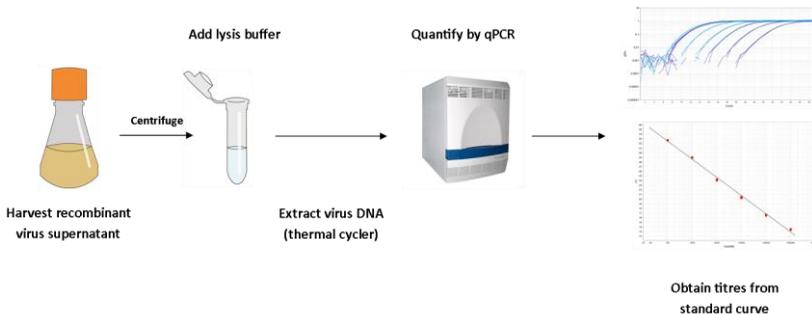
The baculovirus expression system is widely used for the production of foreign proteins in insect cells. Recombinant baculoviruses can be amplified to very high titres in suspension cell culture. However, virus amplification can be variable and is dependent on a number of factors such as the health of cells, multiplicity of infection and culture conditions, for example temperature and oxygenation of cultures amongst others. A prime cause of failure to detect recombinant protein production is reliance on un-titrated recombinant virus stocks that on subsequent analysis are found to have unexpectedly low titres. It is therefore essential that an accurate titre of virus be obtained to ensure optimal recombinant protein production.

We have developed a rapid and accurate method for titration of baculoviruses based on qPCR. By utilising qPCR, it is possible to establish viral titres from budded virus stocks in a number of hours, compared to 4-6 days to obtain a titre via plaque assay. This ability to rapidly and accurately quantify large numbers of viruses ultimately results in a fast and reliable titration system that will eliminate the need for plaque assays. This kit includes all of the components required to allow the user to extract baculovirus DNA from their amplified virus stock, to carry out qPCR on the extracted virus DNA and then convert the obtained cycle threshold ( $C_t$ ) value to an equivalent titre value.

### 7.1 Overview of Protocol

1. Virus DNA is extracted from recombinant viruses of unknown titre and from a series of dilutions of the virus internal standard (no columns are needed, simply add lysis solution to the virus sample and place into a thermocycler (**Figure 1**)).

- qPCR is carried out to determine the  $C_t$  values for the virus DNA samples and internal standards (real-time PCR machine).
- The titres of the virus DNA samples are determined by plotting their  $C_t$  values onto a standard curve generated using virus internal standards (provided in the kit).



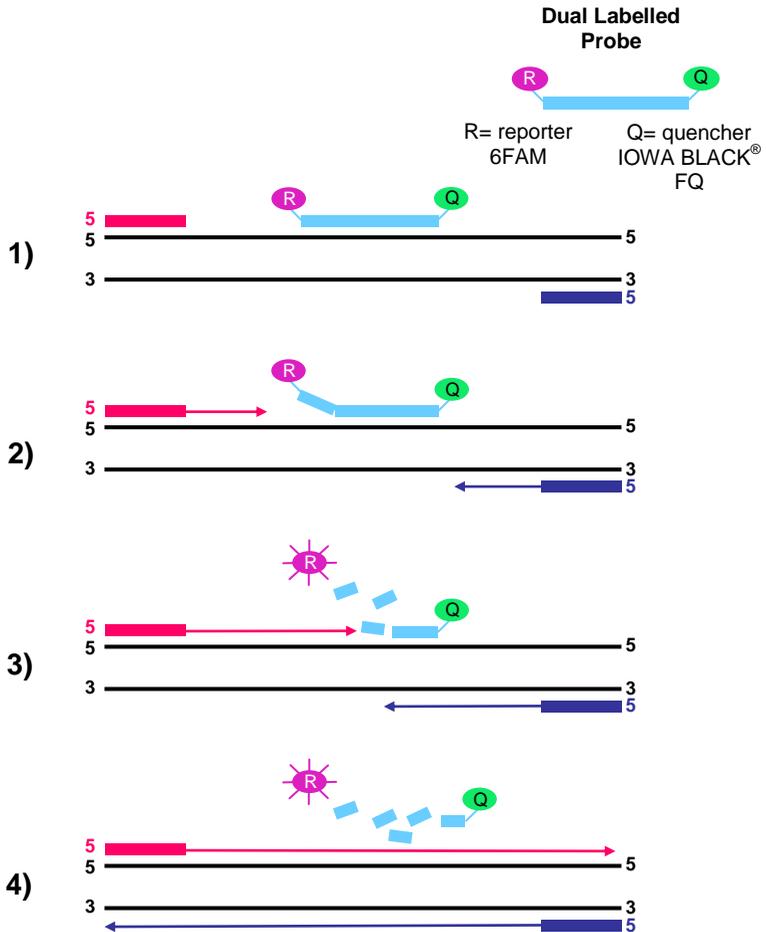
**Figure 1.** Schematic of baculovirus DNA extraction and titration

## 7.2 The Principle of qPCR

Quantitative real-time PCR was first developed by Higuchi *et al.*<sup>1</sup> who determined PCR kinetics by developing a system capable of detecting PCR products as they accumulate during a PCR cycling reaction. This system was further advanced by the 5' nuclease assay<sup>2</sup> which utilises the 5' exonuclease activity of *Taq* polymerase to digest a dual-labelled probe hybridized between flanking PCR primer. The target-specific probe consists of an oligonucleotide tagged with a reporter fluorescent dye (6FAM) at the 5' end and a quencher dye (IOWA BLACK® FQ) at the 3' end. Whilst the probe is intact, the proximity of the two dyes results in fluorescent resonance energy transfer (FRET), with the quencher greatly reducing the fluorescence of the reporter dye.

During the qPCR reaction, the target-specific probe anneals downstream from one of the primer sites (**Figure 2**). During PCR amplification, the 5'-3' exonuclease activity of *Taq* polymerase cleaves the dual-labelled probe as the primer extends, resulting in a release of the reporter dye and interruption of the FRET, and therefore increasing the reporter dye fluorescence signal. This cleavage removes the probe from the target DNA strand permitting primer extension. Subsequent rounds of PCR amplification result in additional cleavage of reporter dye molecules from their respective dual-labelled probes, culminating in a successive increase in fluorescence intensity proportional to the amount of PCR product produced. This increase in fluorescence can be quantified in real-time and permits quantification during the exponential phase of the reaction as opposed to end-point accumulation of a product by conventional PCR.

Quantitative analysis is represented by means of an amplification plot, illustrating the fluorescence signal versus the  $C_t$  of the reaction. During the initial cycles of the qPCR reaction, there is minimal change in the levels of fluorescence intensity, thus defining the baseline levels of fluorescence for the assay. The cycle number at which point the fluorescence intensity rises above the background-noise baseline is referred to as the  $C_t$  value and is determined at the most exponential phase of the PCR reaction. This value is inversely proportional to the amount of target DNA molecules and therefore permits quantification of the template DNA using a standard curve. Therefore, the higher the concentration of target DNA, the more rapidly a significant increase in fluorescent intensity will be detected resulting in a lower  $C_t$  value.



**Figure 2.** 5' nuclease assay using dual labelled probes. **(1)** Forward and reverse primers anneal to target DNA sequences and are extended as per standard PCR. The probe, dual-labelled with 6FAM and IOWA BLACK® FQ fluorescent dyes, anneals to the gene sequence between flanking PCR primers. **(2)** As the Taq polymerase extends the primer, the probe is displaced. **(3)** The 5'-3' nuclease activity of the polymerase cleaves the reporter dye (6FAM) from the probe, interrupting the FRET between the reporter and quencher dyes and thus generating a fluorescent signal **(4)**.

## 7.3 Utilising qPCR to Determine Virus Titre

Virus titration by qPCR is carried out as described by Hitchman *et al.*<sup>3,4</sup> using probes and primers specific to *gp64*, a gene that encodes the essential virus envelope protein GP64. GP64 is involved in membrane fusion during viral entry and incorporated into budded virus particles during virus egress<sup>5</sup>. Following extraction of virus DNA from freshly amplified low passage budded virus samples, it is possible to determine the number of virus particles via qPCR amplification using the *gp64* probe and primers.

The greater the number of virus particles within a sample, the higher the concentration of virus DNA that will be present and correspondingly, the lower their  $C_t$  value. By comparing this  $C_t$  value to a known standard curve, it is possible to establish an accurate titre which can be converted to equivalent plaque forming units per ml (Qpfu/mL).

### Advantages of *baculoQUANT*<sup>™</sup> All-In-One:

- Titre accuracy comparable to plaque assay method
- Less than 1 hour hands-on time with virus DNA extraction and titration in under 3 hours
- Compatible with any AcMNPV-based baculovirus system containing *gp64*
- Single step virus DNA extraction
- qPCR primers/ probe provided as a single reagent mix
- Agilent Technologies' high performance, ultra-sensitive master mix reagent included
- Plaque assay titred virus stock included for standard curve generation

### Limitations of *baculoQUANT*<sup>™</sup> All-In-One:

- *baculoQUANT*<sup>™</sup> All-In-One extraction and titration system must be used on fresh budded virus stocks (less than 3 months old). After this period it would not be safe to assume that the qPCR titre is

comparable with the infectious titre. Aggregation and degradation of virus particles over a period of time may occur resulting in misleading Qpfu/mL values.

- Virus DNA extracted using this kit is stable for a short period of time if stored at -20°C (i.e. overnight). However, we recommend preparing the DNA for immediate use.

## 8. Protocol: Rapid Baculovirus Titration Using *baculo*QUANT™ All-In-One

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### 8.1 Supplied in *baculo*QUANT™ All-In-One kit:

Please refer to page 7

#### Required:

- Recombinant budded virus stock(s) to be analysed  
*NB: Prior to virus DNA extraction, ensure cell culture media has been clarified by centrifugation to remove all traces of cellular DNA and debris. This is normally a routine procedure when producing budded virus stocks.*
- PCR thermal cycler with heated lid
- Real-Time PCR system, such as Applied Biosystems® 7500 Real-Time PCR Sequence Detection System (SDS)  
*NB: The Applied Biosystems® 7500 Real Time PCR Sequence Detection System requires a Low ROX mix. Using high ROX will result in the system being unable to automatically detect the threshold and it will then need to be adjusted manually.*
- Optical 96 well plates and adhesive plate seals (e.g., from ABI)
- 96-well plate rotor for low-speed centrifuge
- Ice box
- Sterile 1.5 and 0.2mL microtubes (optional 0.5mL)
- Sterile pipette tips

**NOTE**

This kit provides reagents sufficient for 100 qPCR reactions. The kit can be used to titrate up to 24 recombinant viruses in triplicate alongside a standard curve in a single run on a 96-well plate or a lesser number of recombinant viruses if they are titrated in multiple runs alongside multiple standard curves. Lysis buffer provided is sufficient for 50 virus extractions. Since reactions are carried out in triplicate, this is more than sufficient to constitute 100 reactions.

The protocol described below has been developed using Applied Biosystems® 7500 Real Time PCR Sequence Detection System (SDS). We recommend following the manufacturer's instructions when using alternative qPCR systems.

## 8.2 Solution Preparation

Please refer to page 7

## 8.3 Procedure

### Virus DNA Extraction

1. Prepare serial log (1 in 10) dilutions of the virus internal standard with the RNase-free water; both supplied in the kit. These will be used to generate the virus standard curve.

**NOTE**

To do this, aliquot 90µL of RNase-free water into five 1.5mL microtubes (one for each virus dilution) and label accordingly. Then add 10µL of the virus internal standard (~10<sup>8</sup> pfu/mL) to the first tube containing 90µL of water (this virus will now be 10<sup>7</sup> pfu/mL) and vortex. Then, using a fresh pipette tip, remove 10µL from this tube and transfer it to a fresh tube (this will be 10<sup>6</sup> pfu/mL) and vortex. Continue diluting the virus internal standard to 10<sup>3</sup> pfu/mL. In total you will have 5 tubes with virus ranging from 10<sup>7</sup>-10<sup>3</sup> pfu/mL.

2. Extract virus DNA from 80µL of (a) the undiluted virus internal standard (10<sup>8</sup> pfu/mL), (b) each of the five diluted viral standards (10<sup>7</sup>-10<sup>3</sup> pfu/mL) and (c) each of the undiluted recombinant budded virus stocks that you wish to titrate, using a thermal cycler with a heated lid and the supplied lysis buffer, as described below:
  - a) Set up a thermal cycler to run the following lysis programme and allow to reach temperature whilst preparing the virus DNA samples (stages b – e);
    - Step 1: 65°C for 15 minutes
    - Step 2: 96°C for 2 minutes
    - Step 3: 65°C for 4 minutes
    - Step 4: 96°C for 1 minutes
    - Step 5: 65°C for 1 minutes
    - Step 6: 96°C for 30 seconds
    - Step 7: 20°C hold
  - b) Dispense 80µL of each of the six virus internal standards (1 undiluted and 5 diluted standards) into a 0.2mL clear microtube (or use a 0.5mL clear microtube).
  - c) Dispense 80µL of each of your unknown virus stocks that you wish to titrate into similar tubes (if you suspect the titre of your sample

- to be greater than  $10^8$  pfu/mL, you should dilute it down so that the titre is within the range of the standard curve).
- d) Centrifuge at high speed (~16,000 x g or 13,000rpm) for 5 minutes in a microfuge.
  - e) Remove the supernatant fraction carefully and discard into Virkon or similar disinfectant.

**NOTE**

**Hold the tube in the same orientation as positioned in the centrifuge and pipette out the supernatant fraction from the opposite side of where the pellet should gather.**

- f) Re-suspend the virus pellet in 20µL of lysis buffer (supplied) by briefly vortexing (if using a 0.5mL tube, transfer to a 0.2mL tube at this stage).
- g) Place the 0.2mL tubes into the thermal cycler and run the lysis program (stage a).
- h) The DNA is now ready to use for qPCR titration or it can be stored overnight at -20°C.

### qPCR Amplification

3. Prepare qPCR reactions on ice, as a master mix (see page 19), according to how many viruses you need to titrate. Multiply the amounts shown in **Table 1** by the number of reactions required. Each virus to be titrated, together with the DNA positive control sample (supplied in kit), negative control sample (RNase-free water, supplied in kit) and each of the six virus standard samples (step 2), should be analysed in triplicate.

**NOTE**

**The probe is light sensitive and therefore should be stored in the dark as much as possible.**

**Table 1. Components for qPCR master mix reaction**

<b>Reagents (supplied in kit)</b>	<b>1 qPCR Reaction</b>	<b>Flask Example (for 5 unknown virus samples)</b> 1 set of DNA standards (6 x 3) + control samples (2 x 3) + 5 unknown virus DNA samples (5 x 3) + 2 extra reactions* = 41
<b>qPCR Low ROX Mix</b>	12.5µL	512.5µL (12.5µL x 41)
<b>RNase Free Water (qPCR)</b>	7.5µL	307.5µL (7.5µL x 41)
<b>Probe + Primers Solution</b>	3µL	123µL (3µL x 41)
<b>Total Volume</b>	<b>23µL</b>	<b>943µL</b>

**NOTE**

It is advised that the user prepares enough master mix to allow for a few extra qPCR reactions to ensure sufficient final volume as shown by the example in Table 1. The kit allows for a maximum of 24 samples to be titrated including 2 extra reactions.

- Aliquot 23µL of master mix into the appropriate number of wells in a 96-well plate depending on the number of reaction required. Each reaction will be carried out in triplicate i.e. 3 x 6 wells for standards, 3 wells for negative control, 3 wells for the positive control and 3 wells per unknown virus (see **Table 1**).
- To each appropriate set of triplicate wells, add either 2µL of the purified virus DNA from the virus internal standards or the unknown viruses (step 2), 2µL of the DNA positive control or 2µL negative control (RNase-free water), to give a final reaction volume of 25µL in each well.

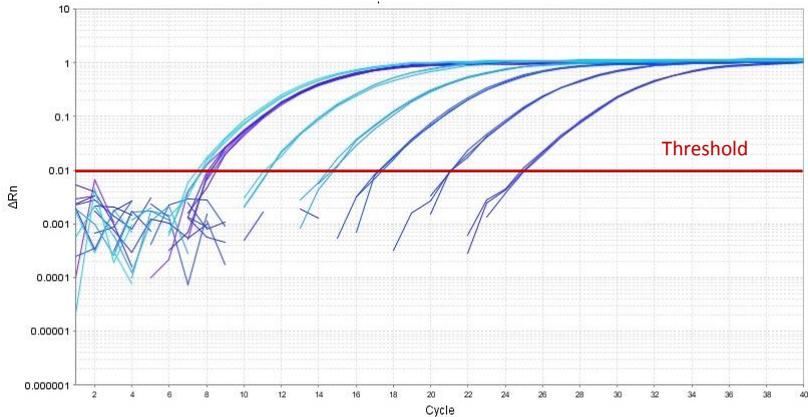
6. Seal the 96-well plate using an adhesive plate seal and plastic spreader, according to the manufacturer's instructions.
7. Centrifuge the 96-well plate briefly at low speed to bring the reaction mixtures to the bottom of the wells. Ensure there are no bubbles on the surface of the reactions.
8. Place the 96-well plate within the Real-Time PCR Sequence Detection System (SDS) and enter the required information into the software, e.g. the position of each reaction, the fluorescent dyes used (6FAM and IOWA BLACK® FQ) and the standard DNA dilutions. If IOWA BLACK® FQ is not listed as a standard dye, please select TAMRA.
9. Perform the DNA amplification following the manufacturer's instructions (for Quantitative Analysis if using the SDS 7500) using the manufacturer's default cycling conditions as detailed in **Table 2** for SDS 7500.

**Table 2. Applied Biosystems® 7500 Real Time PCR SDS cycling conditions**

	Temperature	Time	Number of Cycles
<b>Enzyme Activation</b>	95°C	10 minutes	1 cycle
<b>Denaturation</b>	95°C	15 seconds	40 cycles
<b>Annealing/Extension</b>	60°C	60 seconds	-

10. On completion of the qPCR cycle programme, the most exponential part of each of the amplification curves will have been automatically detected by the SDS software and their  $C_t$  values calculated from the default threshold (see page 22). Occasionally, this may need to be adjusted manually and the threshold may need to be adjusted to the most exponential phase of amplification to give improved slope and correlation coefficient values (as described by the thermal cycler's manufacturer). However, where possible, baseline setting and

threshold levels should remain consistent between assays to improve accuracy and reproducibility.

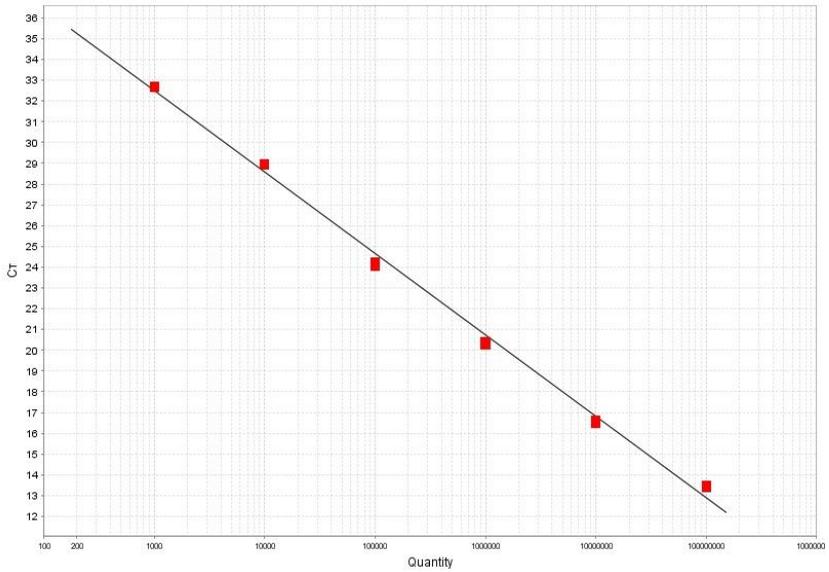


**Figure 3.** Typical amplification plot generated from Applied Biosystems® 7500 Real Time PCR SDS

11. Export the  $C_t$  values into a data analysis program (e.g. Microsoft Excel) and calculate the mean  $C_t$  for each virus.
12. Generate a standard curve using the virus internal standard  $C_t$  values vs. pfu/mL titre (as shown in page 23).

**NOTE**

Data points that significantly deviate from the trend line should be omitted when plotting the standard curve. Ideally, the standard curve should have an R2 value >0.95. If the R2 value is <0.95 then omit the last two dilutions ( $10^4$  and  $10^3$ ) and re-plot the standard curve.



**Figure 4.** Standard curve showing  $C_t$  value vs. pfu/mL

13. Plot the unknown virus  $C_t$  values against your standard curve to obtain a pfu/mL value for each virus.

**NOTE**

Standard curve values may differ between different real time qPCR machines and operators. We recommend carrying out the standard curve for each qPCR run.

## 9. References

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1. **Higuchi, R., Fockier, C., Dollinger, G. and Watson, R.** (1993). Kinetic PCR: Real time monitoring of DNA amplification reactions. *Biotechnology*. **1**; 1026 – 1030.
2. **Holland, P. M., Abramson, R. D., Watson, R. and Gelfand, D. H.** (1991). Detection of specific polymerase chain reaction product utilizing the 5'-3' exonuclease activity of *Thermus aquaticus* DNA polymerase. *Proc Natl Acad Sci USA*. **88**; 7276 – 7280.
3. **Hitchman, R. B., Siaterli, E. A., Nixon, C. P., King, L. A.**. Quantitative real-time PCR for rapid and accurate titration of recombinant baculovirus particles. *Biotechnol. Bioeng.* 2006 Sep 1; [Epub ahead of print].
4. **Hitchman, R. B. and King, L. A.** Method for determining baculovirus titres. Patent pending - No. 0607656.7.
5. **Blissard, G. W. and Wenz, J. R.** (1992). Baculovirus gp64 envelope glycoprotein is sufficient to mediate pH-dependent membrane fusion. *J. Virol.* **66**, 6829-6835.

## Acknowledgements

This guide to *baculo*QUANT™ All-In-One was prepared by the OETeam of Robert Possee, Adam Chambers, Olga Lissina, Linda King and Laura Swan. We hope it is helpful.

## OET Kits & Products

All our baculovirus products have been optimised to ensure rapid and straightforward generation of recombinant virus, gene expression, and protein production. We offer everything you might need, from the revolutionary *flashBAC*<sup>™</sup> baculovirus expression vectors and baculovirus qPCR titration kit, to transfection reagents and transfer plasmids. In addition we also stock a variety of *Spodoptera frugiperda* insect cell lines and culture media.



## OET Services & Contract Work

Oxford Expression Technologies Ltd is a name you can trust when it comes to baculovirus services and contract work. Our team of experts have over 30 years' experience with recombinant protein production, having not only worked on it but helped to develop new and improved systems. From concept to completion, all projects are performed using the most up to date methods to ensure the highest quality throughout. OET also understand that every project is important, which is why we offer assistance at every step of the way, with all our services tailored to individual needs and requirements.

The services we offer include:

Gene Design and Synthesis  
Expression Vector Choice  
PCR Cloning and Sub-cloning  
Recombinant Virus Production  
Optimising Gene Expression

Protein Purification  
Scale-up of Protein Production  
Proteins for Diagnostic Kits  
BacMAM Vectors  
Virus Infectivity Titrations