



**sartorius stedim**  
biotech

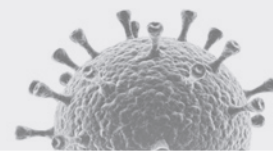
## Meet the Virus Counter<sup>®</sup> Platform Rapid, Direct, Biologically Relevant Virus Quantitation



turning science **into solutions**

» Given the potential toxicity of the adenoviral particles themselves, CBER recommends that patient dosing be based on particle number.

Guidance for Human Somatic Cell Therapy & Gene Therapy  
FDA Centers for Biologics Evaluation & Research

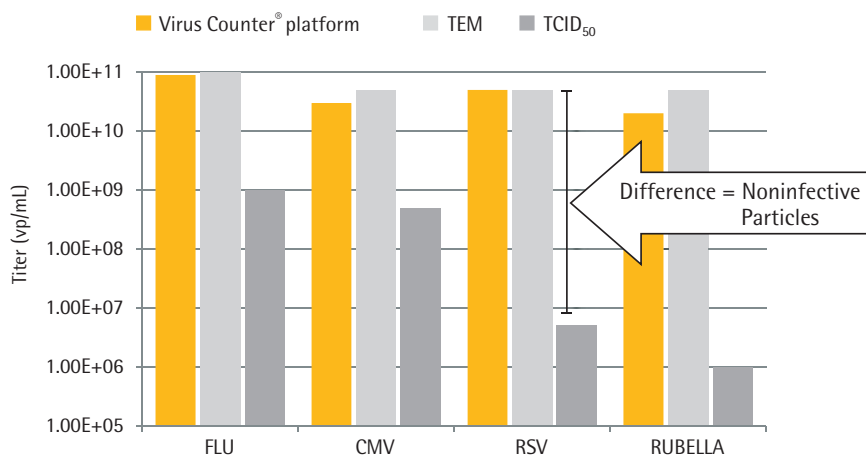


## Total Virus Particle Count Matters

The Virus Counter<sup>®</sup> platform is in use by leading companies, regulatory agencies, and research institutes around the world. Why? A growing body of evidence demonstrates that noninfective particles are of biological importance and can impact both *in vitro* and *in vivo* studies. Infectivity and total virus counts are essential for in-depth sample characterization.

### Comparison of Infectious Titers with Total Particle Count

Samples of Influenza H1N1 (FLU), Cytomegalovirus (CMV), Respiratory Syncytial Virus (RSV), and Rubella Virus (Rubella) were measured by 50% tissue culture infective dose assay (TCID<sub>50</sub>) Virus Counter<sup>®</sup> platform, and quantitative transmission electron microscopy (TEM). Total particle counts determined by either TEM or the Virus Counter<sup>®</sup> platform were not statistically different. Titers determined by TCID<sub>50</sub> measured values 2–3.5 orders of magnitude lower. These results highlight the relative abundance of noninfective particles across multiple virus types.



### If You're Working with Viruses, You Can Count on our Virus Counter<sup>®</sup> Platform

Introducing the Virus Counter<sup>®</sup> platform, the only purpose built, integrated solution for rapid, direct, biologically relevant virus quantification.



The Virus Counter<sup>®</sup> instrument detects and measures viral particles in a fluid stream.



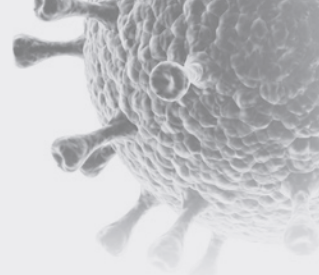
Integrated software directs instrument function and data analysis.



ViroTag<sup>®</sup> Assay and ComboDye<sup>™</sup> Assay Kits label virus particles using direct, no-wash assays.

» The Virus Counter has a short assessment time, requires minimal sample preparation, is easy to use, is a relatively inexpensive platform, and assesses the quantity and quality of viral materials.

Sanofi Pasteur



## Nimble, Meet Quick

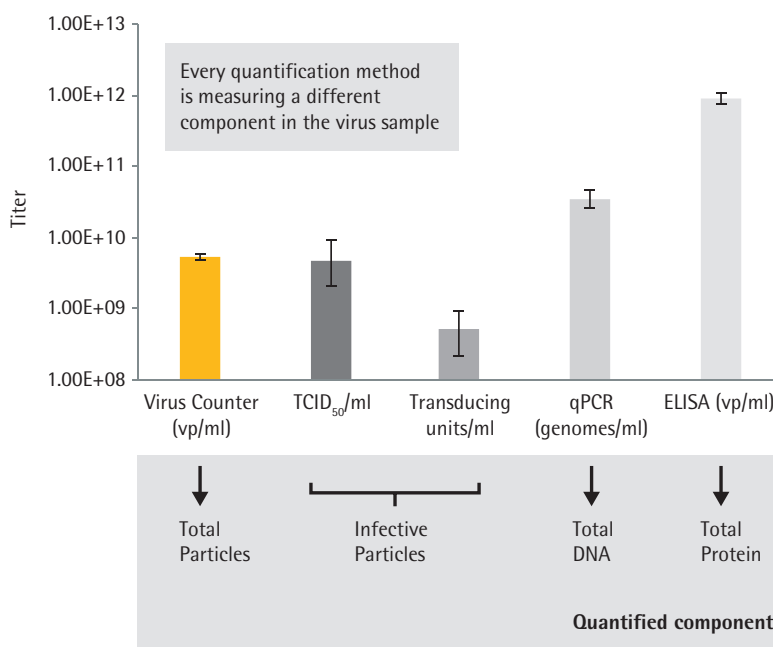
Quantitative detection of individual virus particles is a critical issue for safety and efficiency for many applications. Due to limitations of conventional techniques this issue remained challenging, until now.

Technique	Detection principle	Reproducibility	Time	Labor	Cost per sample
<b>Virus Counter® platform</b>	<b>Viral Particle</b>	<b>Excellent</b>	<b>Minutes</b>	<b>Low</b>	<b>\$</b>
Plaque Assay	Infectivity	Poor	Days	High	\$
TCID <sub>50</sub> , LD <sub>50</sub>	Infectivity	Poor	Days	High	\$
qPCR	Viral Nucleic Acid	Excellent	Hours	Mod	\$\$\$
ELISA	Viral Protein	Good	Hours	Mod	\$
HPLC	Viral Protein	Excellent	Days	High	\$\$
Viral Flow Cytometry	Viral Particle	Excellent	Hours	High	\$\$\$
Transmission Electron Microscopy	Viral Particle	Excellent	Weeks	High	\$\$\$

The Virus Counter® platform provides excellent reproducibility at a lower cost per sample in minutes, not hours or days, compared to other detection methods.\* LD<sub>50</sub> (Lethal dose, 50%), qPCR (quantitative polymerase chain reaction), ELISA (enzyme-linked immunosorbent assay), HPLC (High-performance liquid chromatography)

### We Deliver More of What Matters When Quantitating Viruses

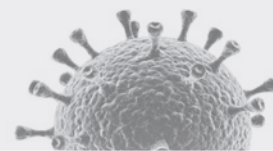
- Fast time to results – answers in minutes, not hours
- Direct quantification of total particle counts
- Specific and versatile reagents offer the right solution for every virus sample
- Software-assisted system operation, easy system maintenance
- No-wash assays – mix, incubate and measure
- More complete data in real time means better decisions sooner



\*The table is adapted from Pankaj Kumar, Methods for Rapid Virus Identification and Quantification, MATER METHODS 2013;3:207, 10.13070/mm.en.3.207, with the permission of the copyright owner Labome (www.labome.com).

» Virus Counter results significantly correlated with both plaque assay and qRT-PCR. These results demonstrated that the VC is an easy, fast, and consistent method to quantify filoviruses in stock preparations.

USAMRIID



## Virus Counter<sup>®</sup> Reagent Kits

### ComboDye<sup>™</sup> Assay Kit

With the ComboDye<sup>™</sup> Kit, viral genomes and viral envelope proteins are stained with a combination of two fluorogenic dyes. When fluorescent emission is simultaneously observed in both channels, this 'simultaneous event' is counted as one intact particle.

- Detects a wide range of viruses with genome >9,000 bases
- Optimized for enveloped viruses
- Compatible with single- and double-stranded DNA and RNA viruses

### ViroTag<sup>®</sup> Assay Kits

The ViroTag<sup>®</sup> reagent family utilizes a fluorescently labeled, high-affinity antibody which binds to a unique viral epitope. ViroTag reagents are detected on a single channel. Quantification of viruses using ViroTag<sup>®</sup> is independent of the presence of nucleic acid.

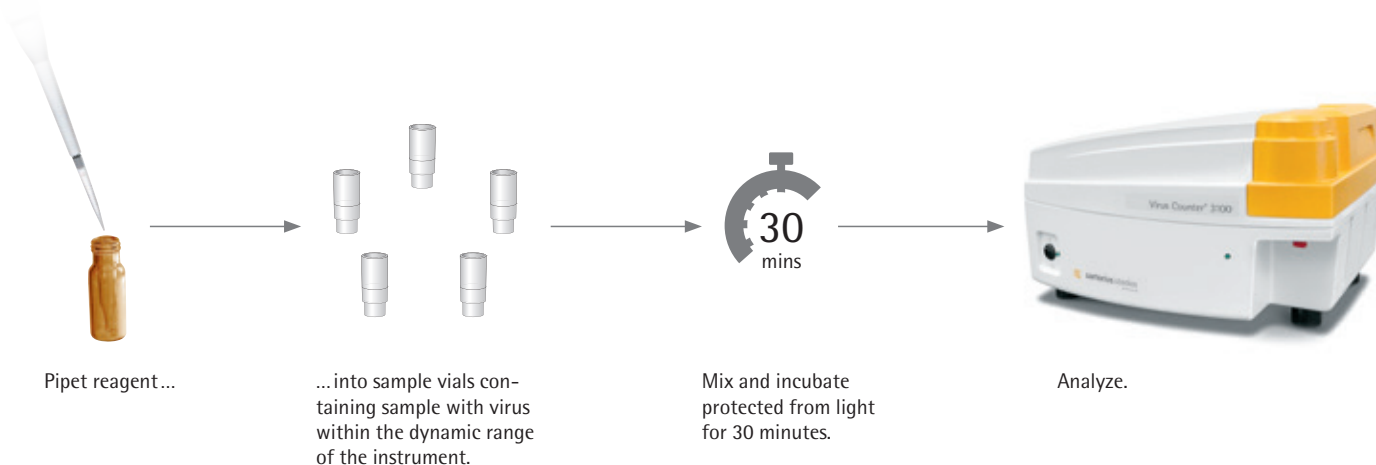
- Highly specific detection reagent
- Detection of total viral particles
- Quantification of virus like particles (VLP)
- Intact vs damaged capsid discrimination
- Enumeration of both enveloped and non-enveloped viruses

### ViroTag<sup>®</sup> Kits Currently Available

- AAV2-3 for Adeno-Associated Virus Serotypes 2, 3
- INVX for Influenza Virus
- BCVB for Baculovirus
- EV71 for Enterovirus 71
- VSVG for pseudotyped viruses such as Lentivirus or BacMam
- INVA for Influenza A seasonal flu virus
- INVB for Influenza B seasonal flu virus

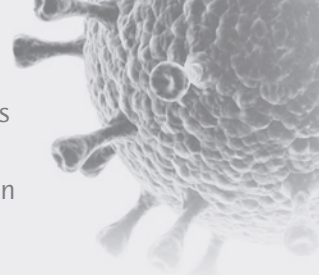
### No Wash Assay!

Both ComboDye<sup>™</sup> and ViroTag<sup>®</sup> labeling systems use a rapid, no-wash workflow.

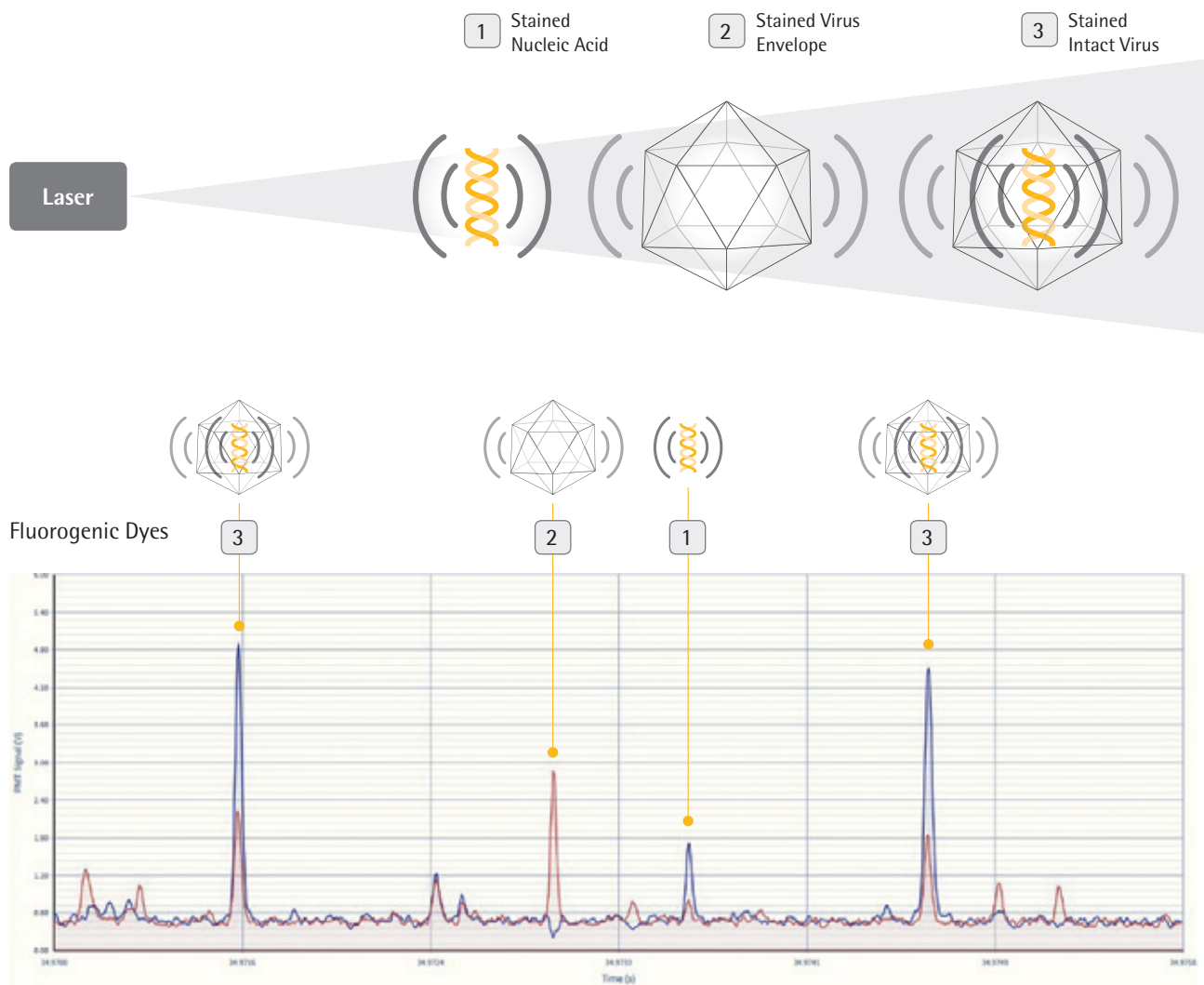


» We have basically stopped running plaque assays on our P0 and P1 virus stocks because the accuracy of the titers obtained with the Virus Counter® leads to better virus amplifications than those obtained using plaque assay titers. The instrument saves one to two weeks on our virus production timeline and it is very helpful to know within a day or two that a transfection or co-transfection has yielded virus particles.

Kempbio



## ComboDye™ Reagent: Virus Staining Principle





# Research Areas

## Viral Vaccines

Due to surging demand for a wider range of vaccines, the industry needs to evolve from traditional, time-consuming methods to new, more efficient approaches. Virus quantitation represents a rate-limiting step at many stages of vaccine development and production, for both egg and cell culture.

## Protein Expression

Therapeutics produced using Baculovirus expression system include viral vectors for gene therapy and personalized immunotherapy, vaccines such as subunit proteins, and VLPs.

Baculovirus-mediated expression of recombinant proteins is a complex, multistep, time-consuming process. Virus quantitation has been an especially notable source of delays, since many methods require days or weeks to complete.

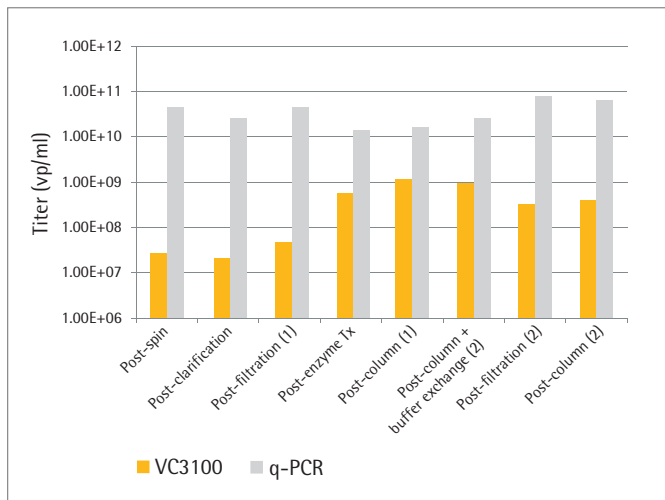
## Virotherapy

Virotherapy is an emerging application that involves engineering viruses for viral vectors used for gene therapy, oncolytic therapeutics and viral immunotherapy.

The quantitation of viral vectors during growth, harvest, purification, and release using current methods like qPCR and absorbance readings are highly variable, resulting in over- or underestimation of particles present at any given step. This compounds the risk associated with administering too little (no therapeutic effect) or too much (adverse immune response) product to patients.

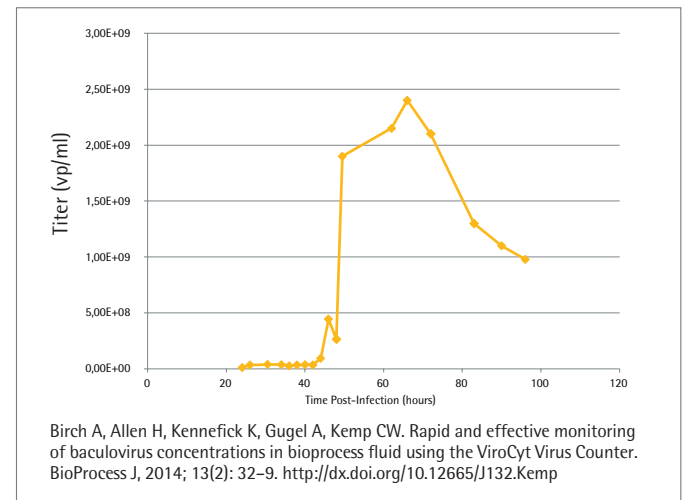
The Virus Counter® Platform is Specifically Designed to Enable Rapid Virus Quantitation in Each of these Three Research Areas:

### Virus Counter® Platform in Viral Vaccine Manufacturing



- Real-time insights into virus titer during the bioprocess allows optimization of each processing step
- Increased viral vector yield by comparing growth conditions and recovery during process development

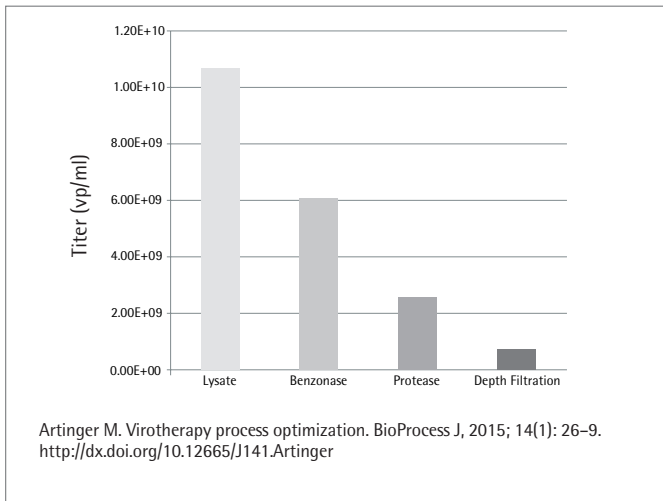
### Virus Counter® Platform in the Field of Protein Expression



- Optimize protein expression yields and shortened timelines by harvesting with pinpoint precision
- Early identification of problems during manufacturing can reduce loss of time and money



## Virus Counter® Platform in Virotherapy Development



- In-depth characterization of total particle concentration in final product increases safety and efficiency
- Rapid and accurate determination of biologically relevant readout- total virus particle counts



## The Virus Counter® Platform is Versatile

The number of viruses and VLPs quantifiable by the Virus Counter® platform is continuously growing and includes viruses that impact human health (e.g., Influenza); viruses used in expression systems (e.g., Baculovirus); viruses used in veterinary science (e.g. Canine Distemper Virus), and viruses used in gene and cell therapy (e.g., Adeno-associated Viruses 2, 3, 5 and Lentivirus).

### Virus Counter® Instrument Specifications

Dimensions (W × D × H): 43.2 cm × 51.9 cm × 27.9 cm (17" × 16.5" × 11")

Weight: 13.2 kg (29 lbs)

Linear dynamic range of  $5 \times 10^5$  vp/ml –  $1 \times 10^9$  vp/ml

Enveloped and non-enveloped virus detection

Detection of large (Baculovirus, 30 to 60 x 250 to 300 nm) and small (AAV, 20 nm) viruses

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Learn why leaders in vaccine development, protein expression, and viral therapeutics choose the Virus Counter<sup>®</sup> 3100 Platform as their tool of choice for virus quantitation. Please visit: [www.sartorius.com/virus-analytcs](http://www.sartorius.com/virus-analytcs)

The Virus Counter<sup>®</sup> Platform is for research use or further manufacturing use only – not for use in therapeutic or diagnostic procedures. They are not for in vitro diagnostic use nor are they medical devices. Drug manufacturers and clinicians are responsible for obtaining the appropriate IND/BLA/NDA approvals for clinical applications.



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