

NovaScan™: A Rapid, Cell-Free and Virus-Free Functional Neutralization Platform

Standardized, scalable, and biologically relevant alternative to conventional neutralization assays

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Limitations of Current Assays

Neutralizing antibody (NAb) activity is widely recognized as a functional correlate of protection and a critical quality attribute in several vaccine development programs. However, the limitations of current detection assays slow down vaccine and therapeutic development.

Cell-based assays

- Labor-intensive and operationally complex
- Time-consuming (2–5 days)
- Sensitive to biological variability and contamination
- Difficult to standardize across laboratories
- Limited scalability for high-throughput applications
- Require biosafety facilities and specialized expertise
- Often rely on licensed or proprietary cell lines

Binding assays (ELISA)

- Binding does not equate to neutralization
- Does not assess functional inhibition
- Inability to capture post-binding events
- Do not reproduce native protein organization and density
- Do not capture membrane-driven and dynamic protein interactions
- Lack multivalent interactions such as avidity and cross-linking

Current neutralization assays are either biologically relevant or scalable but not both.

NovaScan™ Technology

NovaScan™ bridges the gap between existing methods by recreating native virus–cell interactions using biological vesicles derived from mammalian cells. These virus-like and cell-like particles (VLPs, CLPs) faithfully replicate the surface architecture of viruses and target cells.

CLPs and VLPs – Biological Fidelity

- Preserve native membrane context
- Display full-length proteins with native epitopes and binding sites
- Maintain correct protein conformation and multimerization
- Retain authentic glycosylation and post-translational modifications
- Reproduce the structural complexity of viral and cellular surfaces

CLPs and VLPs – Operational Advantages

- No cell culture required
- No sensitivity to contamination
- Stable across multiple freeze–thaw cycles
- No biosafety constraints
- Standardized and reproducible manufacturing
- Adaptable to multiple viruses and target cell types

CLPs and VLPs are a promising strategy to simplify and accelerate standardized neutralization readouts while preserving biological relevance.

Why NovaScan™?

NovaScan™ is a ready-to-use, automation-compatible assay in a multiwell plate format. It mirrors cell-based workflows while delivering results in 4 hours with less than 1 hour of hands-on time.

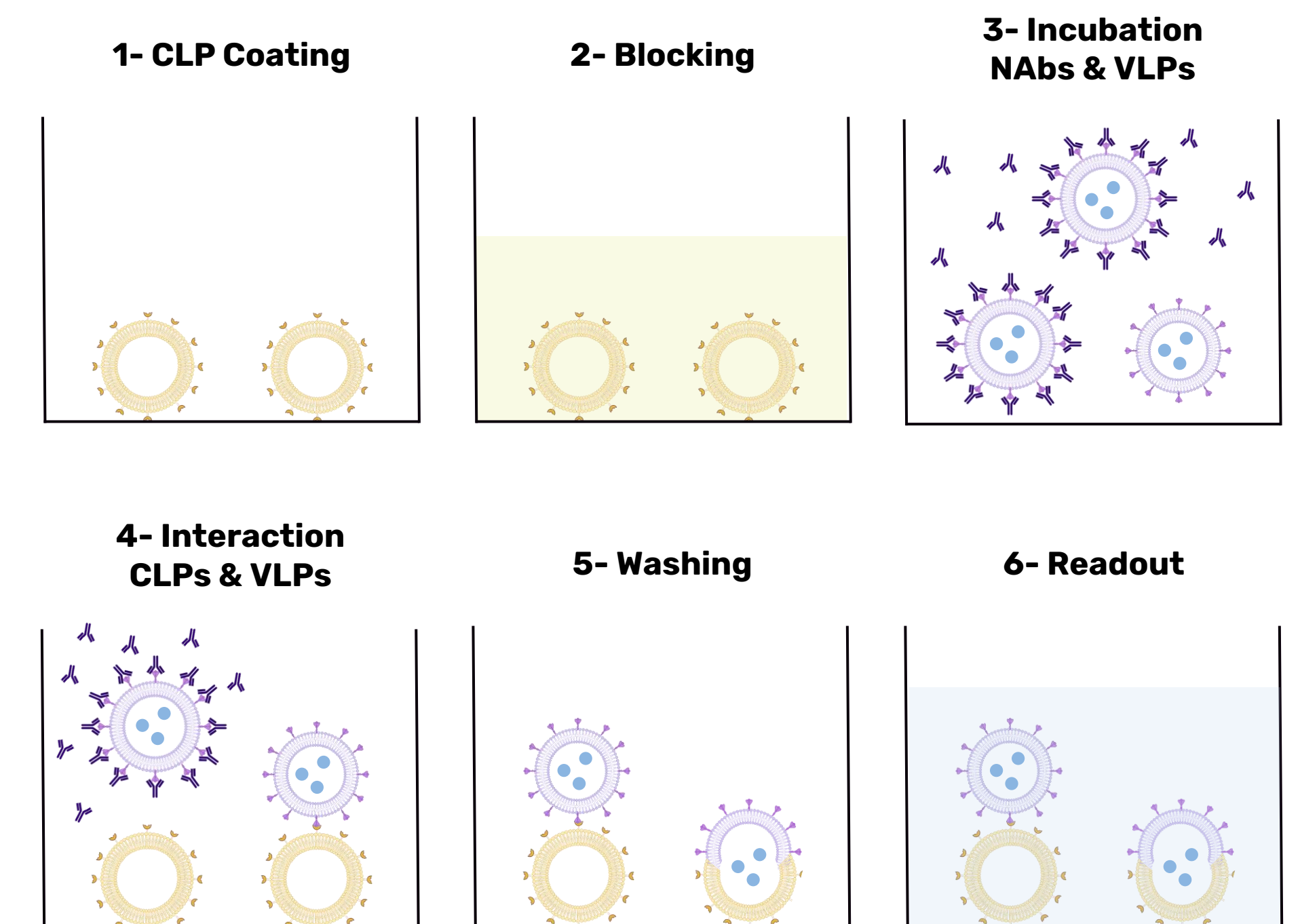


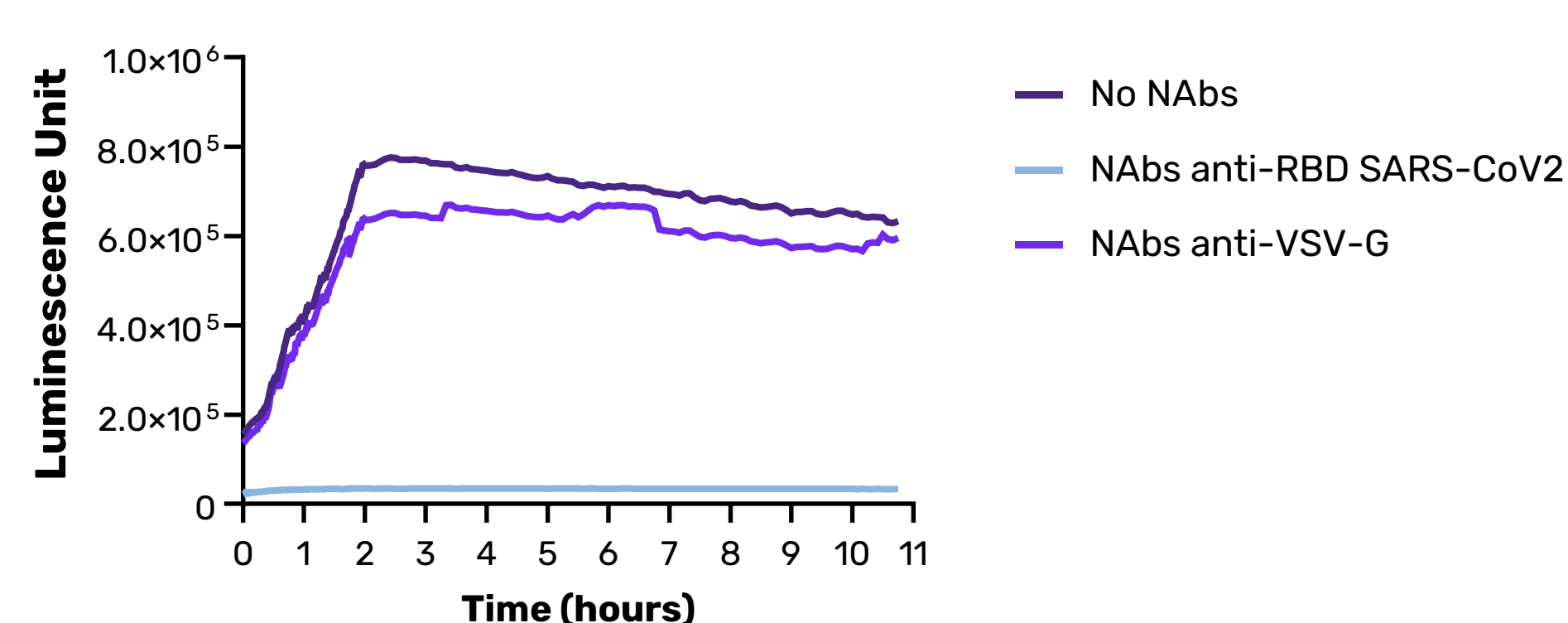
Figure 1: Principle of NovaScan

NovaScan™ as a Promising Approach

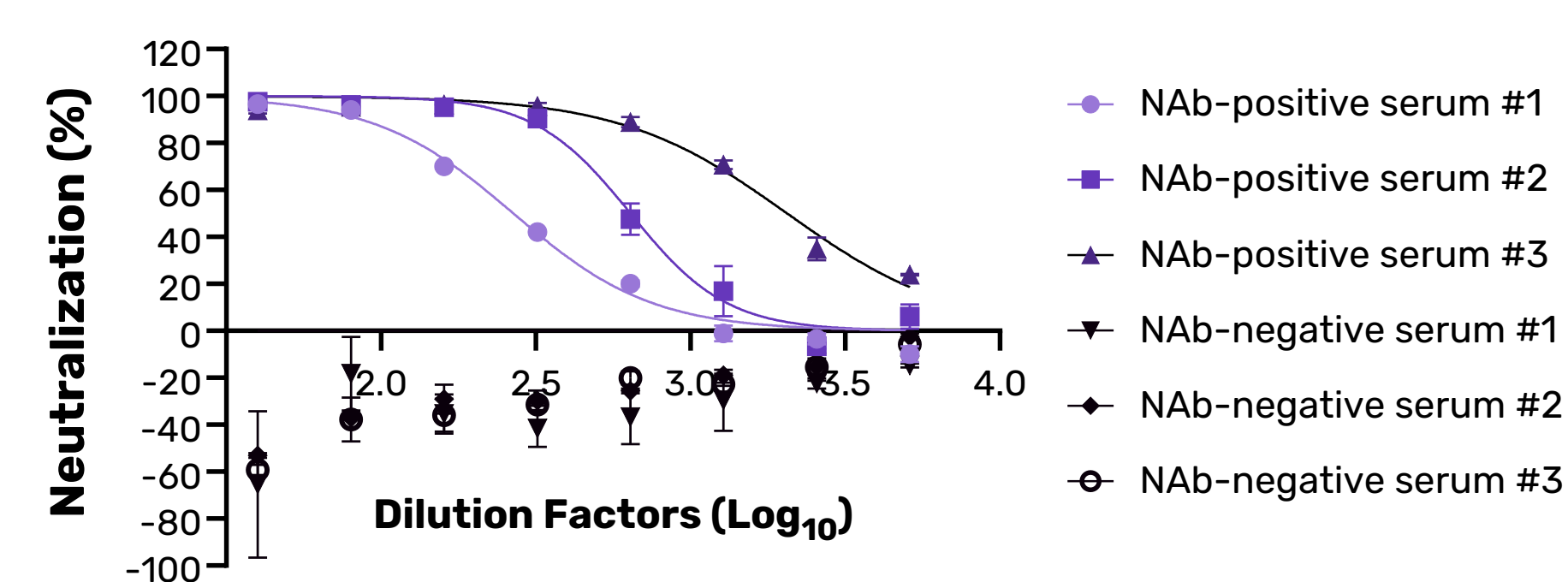
- 10× faster than cell-based assays
- Functional neutralization readouts
- BSL-1 compatible
- Automation-ready format
- Standardized workflows with improved reproducibility
- No specialized equipment or cell culture required
- Broad viral adaptability
- Stable and easy storage (–20 °C)

NovaScan™ proof of concept with CLPs and VLPs engineered for SARS-CoV-2

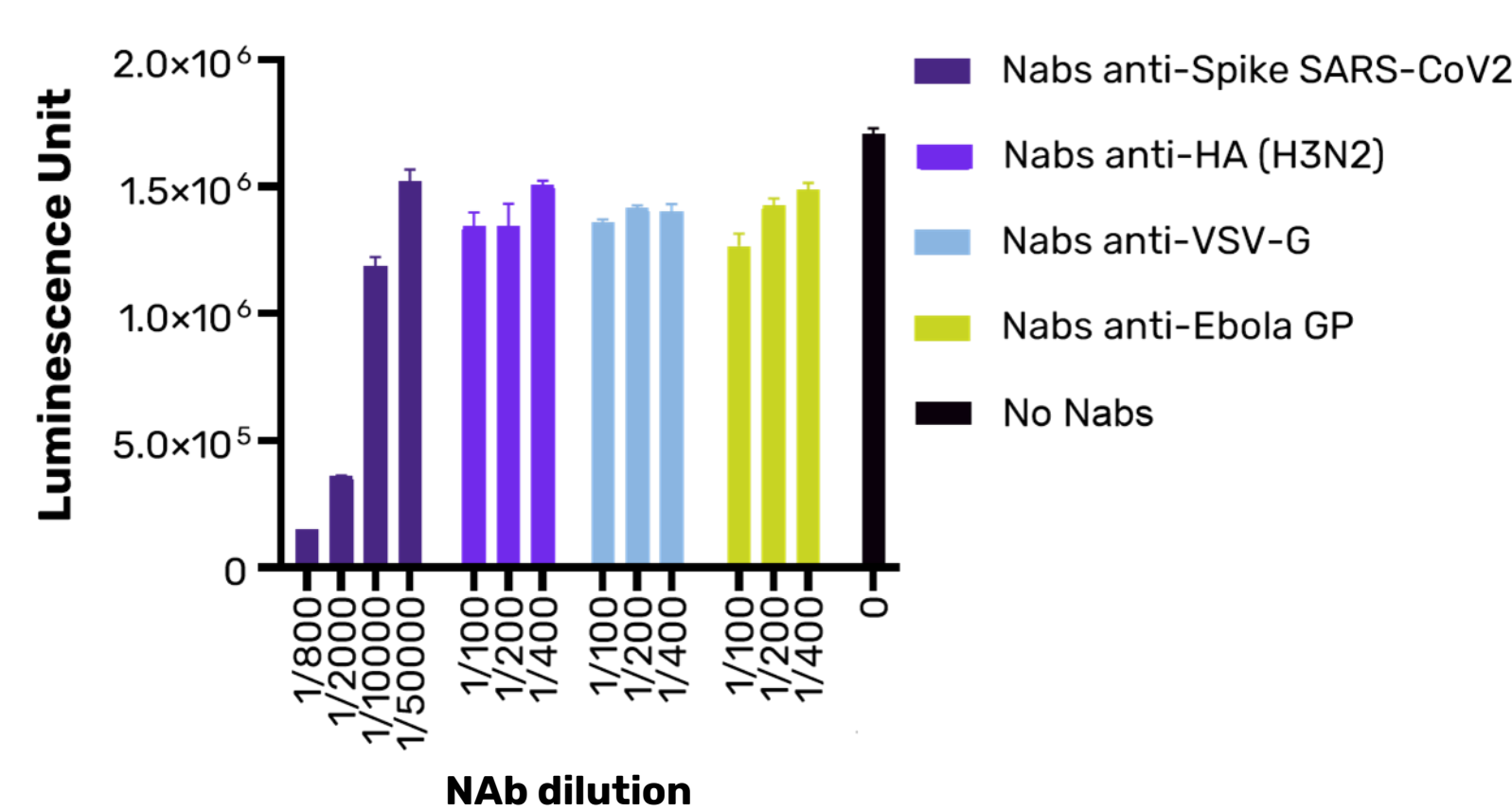
Binding and fusion capability: CLP–VLP incorporating luciferase complementation system captures key viral entry steps in a cell-free format.



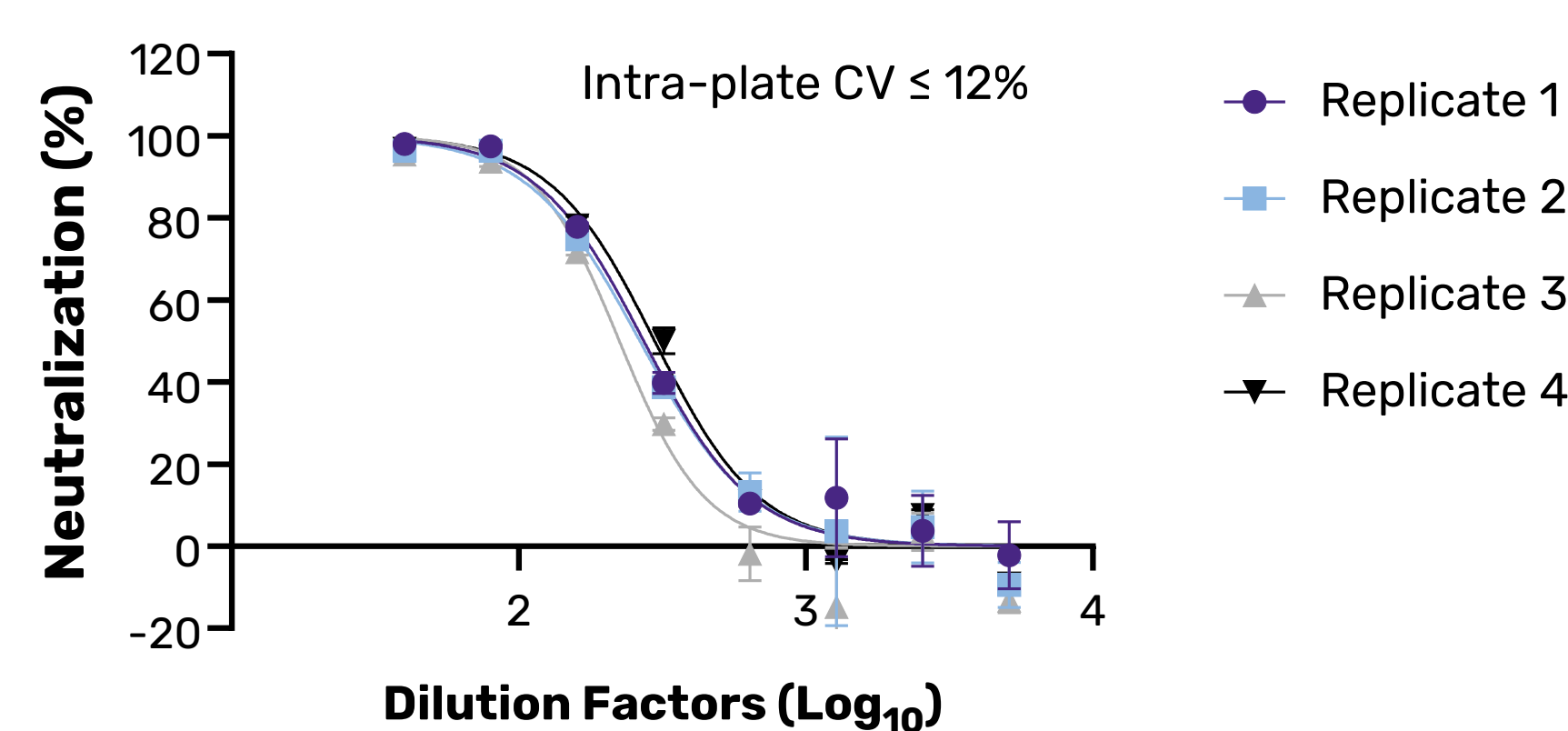
Serum screening: CLP–VLP neutralization assay distinguishes NAb-positive from NAb-negative serum samples and enables the generation of neutralization curves.



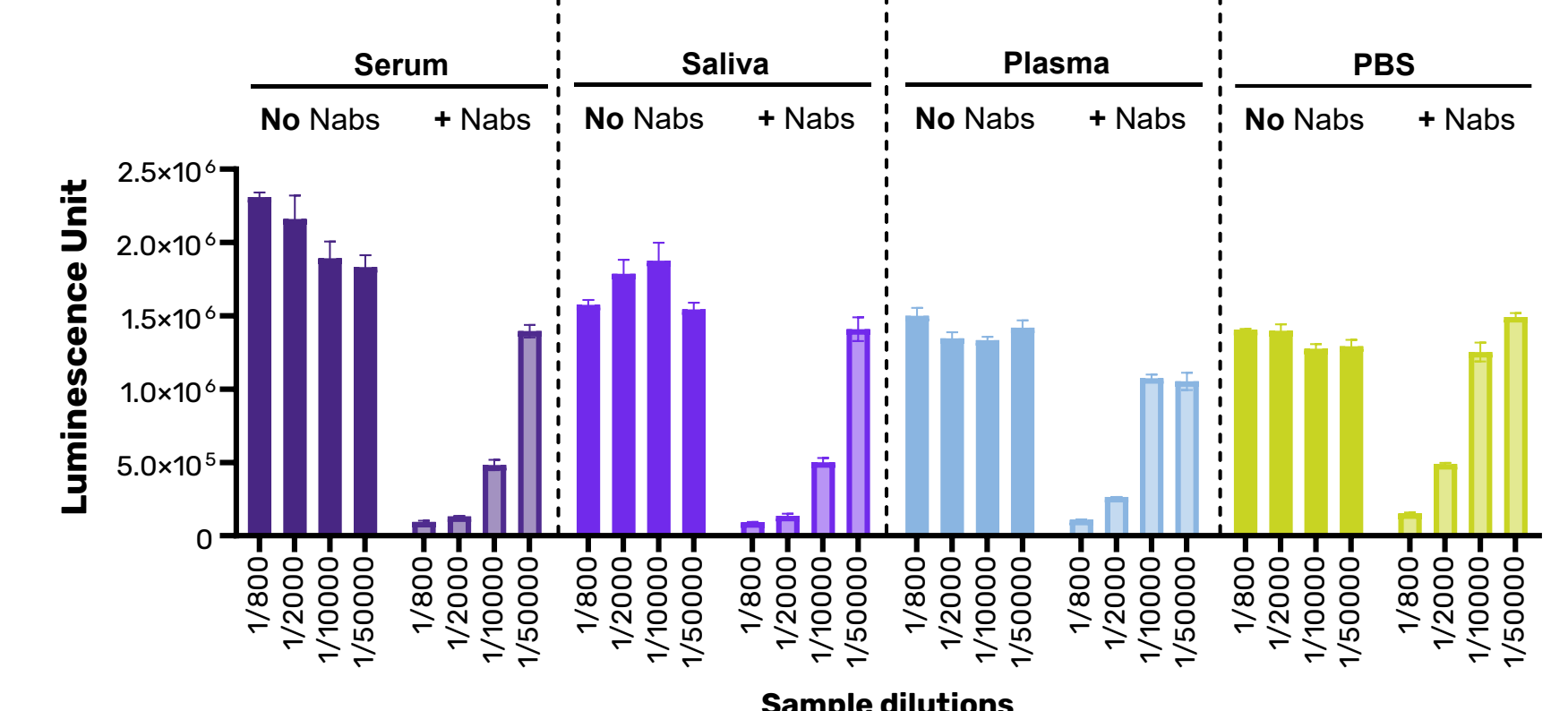
Specific Neutralization: CLP–VLP neutralization assay with purified antibodies reveals specific inhibition by SARS-CoV-2-targeting NAb.



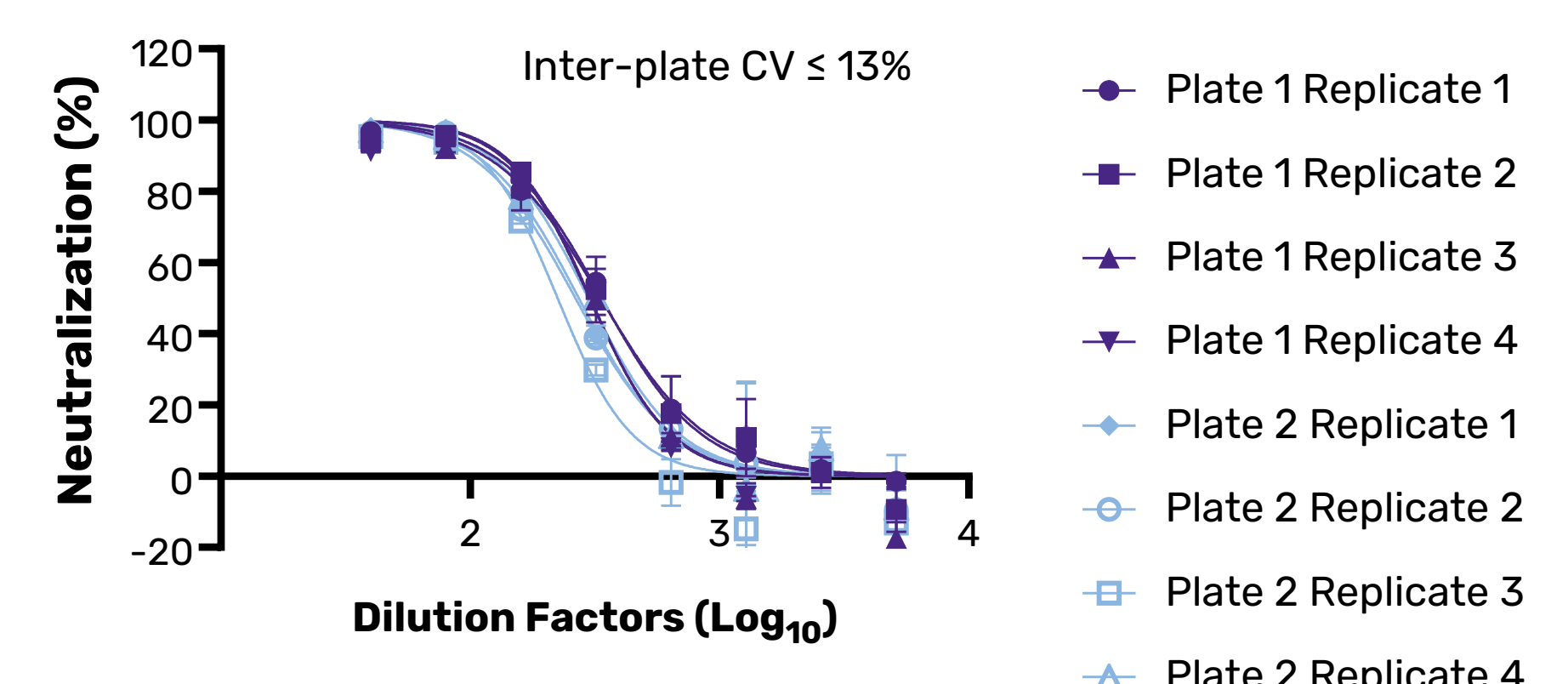
Reproducibility intra-plate: NovaScan provides low intra-plate variability (CV ≤ 12%)



Biological fluid compatibility: CLP–VLP neutralization assay confirms antibody-mediated inhibition in complex biological fluids spiked with purified NAb.



Reproducibility inter-plate: NovaScan provides low inter-plate variability (CV ≤ 13%)



Conclusion

The first results of this proof of concept suggest that NovaScan™ is a promising alternative to conventional neutralization assays, bridging the gap between binding assays and cell-based methods. By leveraging engineered CLPs and VLPs, it replicates key early steps of viral entry, enabling detection of neutralizing antibodies across biological fluids and discrimination between NAb-positive and NAb-negative sera with good reproducibility.

Perspectives

- Further characterization of virus–cell interaction mechanisms
- Validation across diverse clinical samples
- Integration with automated workflows
- Expansion to additional viral targets (e.g., norovirus, influenza, RSV)