30TH ANNIVERSARY 1995-2025

INSTABILITY INDEX

DESTABILIZATION DETECTION

PHASE SEPARATION DYNAMICS

MEAN PARTICLE SIZE VARIATION


# BeScan Lab

## Stability Analyzer

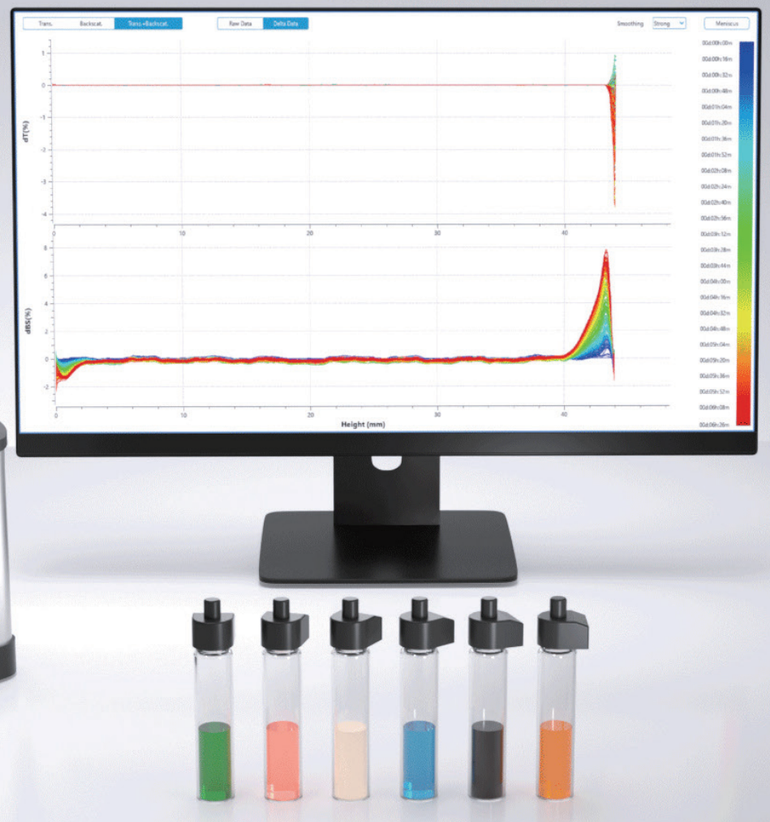
STABILITY
EXCELLENCE
WITHIN REACH

Bettersize

BETTER PARTICLE SIZE SOLUTIONS

# BeScan Lab

BeScan Lab, the versatile, sensitive, and reliable stability analyzer based on Static Multiple Light Scattering (SMLS) technology, is widely used in the formulation development and product quality control. It accommodates a wide range of sample concentrations up to 95% v/v and types such as emulsions, suspensions, and foams, with temperature scanning capabilities reaching up to 80 °C. BeScan Lab provides both qualitative analysis and quantification of destabilization, helping you monitor long-term product stability and achieve optimal shelf life.


## BeScan Lab Provides

- Instability index ($I_{US}$)
- Mean particle size
- Hydrodynamic analysis
- Radar chart for regional $I_{US}$
- Temperature trend testing
- Particle migration rate

## Features & Benefits

### Non-destructive stability analysis for various dispersions

- Non-contact, non-dilution, non-shearing
- Sample volume fraction up to **95%**
- Particle size measurement range from **0.01** to **1,000** μm

### Fast and direct stability measurement

- The high-performance LED and ultra-sensitive detectors, with a **20-micron** scan step, allow real-time monitoring and capture of subtle variations **200 times** faster than the naked eye
- Temperature control up to **80 °C** to accelerate destabilization

### Qualitative and quantitative stability results

- Identification of various unstable phenomena, such as creaming, sedimentation, flocculation, coalescence, and phase separation
- Quantification of destabilizations and study of kinetics

## From Raw Materials to Finish

BeScan Lab plays a crucial role throughout the product lifecycle, supporting formulation, production, and pre-use stages. It enables formulation optimization, quality control during manufacturing, investigation into optimal transportation and storage conditions, and research on redispersibility.

01

**Research and development**

Ensure excellent dispersibility and uniformity through raw material selection.

02

**Production and quality control**

Optimize production processes, including method, time, and temperature, to enhance efficiency.

03

**Storage and transportation**

Evaluate formulation stability under varying environmental conditions, observing destabilization, and predict shelf life.

04

**Pre-use treatment**

Study the reversibility of destabilization and compliance with usage standards.

# ADVANCED MEASUREMENT PRINCIPLE

## Static Multiple Light Scattering

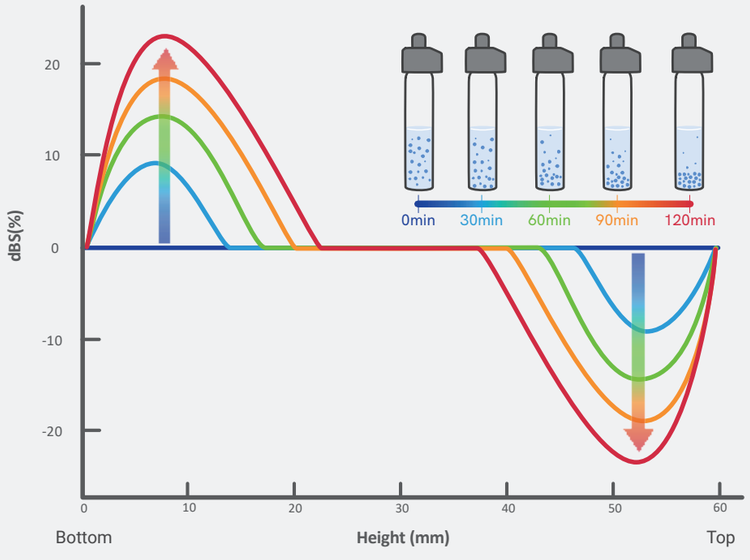
Static Multiple Light Scattering (SMLS) is an optical technique used to directly characterize native concentrated liquid dispersions. This technique emits light into the sample, where it is scattered multiple times by particles or droplets before being detected.

BeScan Lab applies SMLS using an **850 nm LED** as light source, with detectors set at **0° for capturing transmitted light** and at **135° for backscattered light**. This setup scans the sample vertically, analyzing the transmitted light for transparent systems, while the backscattered light is ideal for opaque systems.

The signals are collected at **20 µm** intervals, which enables precise observation of changes in **size** ($d$) and **concentration** ($\Phi$) of suspended materials.

### Signal display

Customized scanning  procedures allow presentation of scans with different colors corresponding to different scanning times. The overlap of scans demonstrates how signals diverge from the reference as they vary with height and time. Intuitively, the scans capture local changes that characterize unstable phenomena.




The example illustrates that during sedimentation, the backscattered signals (**dBS**) undergo a distinctive pattern of change: a decrease at the top and an increase at the bottom, which is attributed to the migration of particles.

## Features

- **Versatile measurement**
  No limitations on color or viscosity, and suitable for a wide range of samples from low to high concentrations (up to 95% v/v).
- **Non-destructive and in situ**
  Measures without preparation, thus preserving the sample's original characteristics.
- **Wide particle size range**
  Capable of measuring particles from 0.01 to 1,000 µm.
- **Applicable to various systems**
  Suitable for emulsions, suspensions, foams, and other dispersions, providing robust and high-resolution measurements.

Light source

Transmission detector

$$I_T = I_{T_0} exp[\ -\frac{3\Phi Q_S r_i}{d}\ ]$$

Backscattering detector

$$I_{BS} \propto \sqrt{\frac{3\Phi(1-g)Q_s}{2d}}$$

$d$: Mean particle size
$\Phi$: Volume fraction
$r_i$: The radius of the sample cell
$Q_s$ and g can be obtained using Mie theory

# DEDICATED SOFTWARE

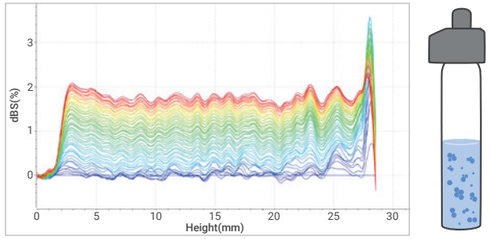
## for Superior Qualitative and Quantitative Stability Outcomes

### Qualitative Analysis - Identification of Destabilization

BeScan Lab utilizes near-infrared light and a precise 20-micrometer spatial resolution to detect early-stage destabilization phenomena like phase separation, sedimentation, creaming and aggregation (flocculation, coalescence, and coagulation) well before they are visually observable.

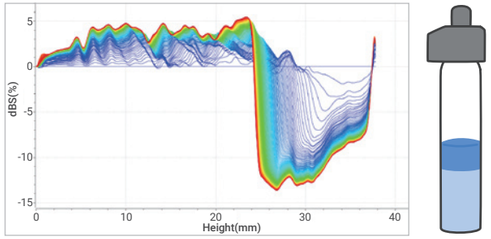
**Flocculation** often results in uniform changes in transmitted or backscattered signals across the entire sample height.

- Common in wastewater treatment, electrode slurries, and drilling fluids.



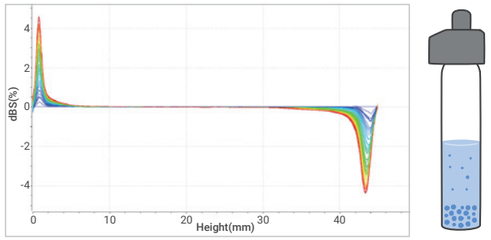

**Phase separation** typically involves evolving interfaces between phases over time.

- Common in paints and coatings, cosmetics.



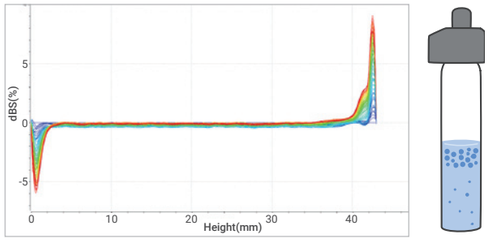

**Sedimentation** causes a decrease in backscattered signals at the top and an increase at the bottom in opaque samples.

- Common in slurries, pigments, pesticides, vaccines, and body lotions.




**Creaming** in opaque samples enhances backscattered signals while lowering bottom signals.

- Common in milk-based beverages, lipid emulsions, and pesticides.

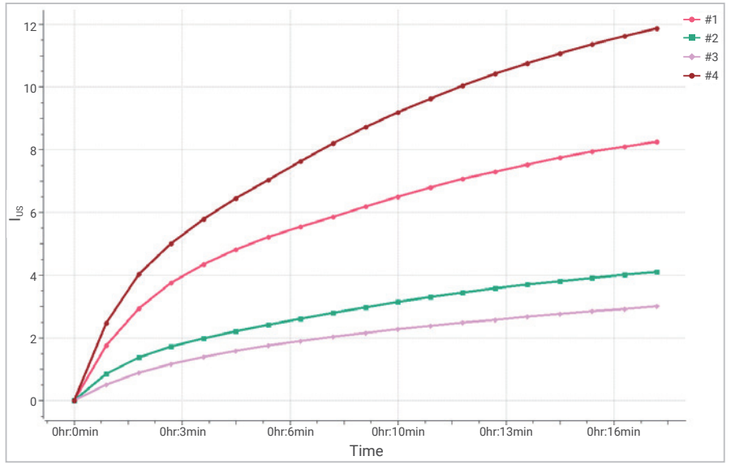



### Quantitative Analysis - Instability Index for Rating Guide

BeScan Lab provides the instability index ($I_{US}$), which quantifies the stability of dispersions. The calculation involves summing all signal variations across the entire sample height and over time, capturing all subtle variations within the sample. This facilitates sample comparison, as a greater instability index ($I_{US}$) indicates lower stability. An instability index is automatically calculated after every scan using the following formula:

$$I_{US} = \sum_n \frac{\Sigma_h |I_n(h) - I_{n-1}(h)|}{H}$$

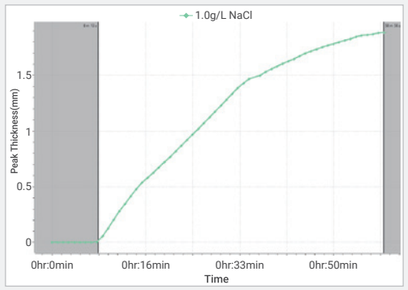
BeScan Lab offers instability indices over time to compare the stability of different samples. A slower increase in the instability index indicates higher dispersion stability, resulting in a flatter curve. Analyzing the trend allows for predicting long-term stability.




Time-dependent instability index

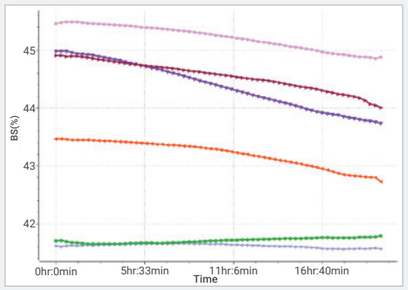
#### Phase separation dynamics and mean particle size

Hydrodynamic analysis reveals layer thickness and particle migration rate over time, thereby determining the hydrodynamic mean diameter.



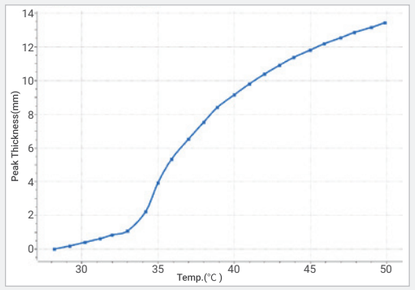

#### Optical analysis and mean particle size variation

Particle size variation analysis is achievable with BeScan Lab, correlating transmitted and backscattered light signals.



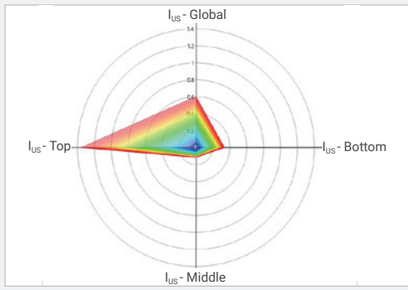

#### Temperature trend measurement

Programmable temperature trend measurement up to 80°C, which explores stability under extreme conditions and accelerates destabilization.




#### Radar chart

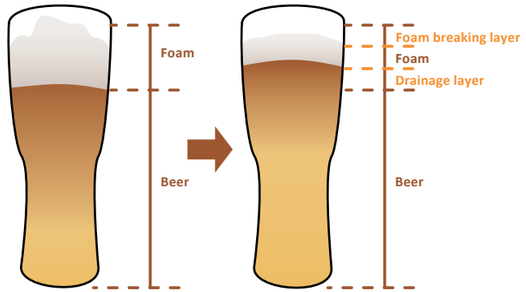
Global and regional instability indices for each scanning are illustrated in form of a radar chart, intuitively providing a way to investigate regional stability (top, middle, and bottom).



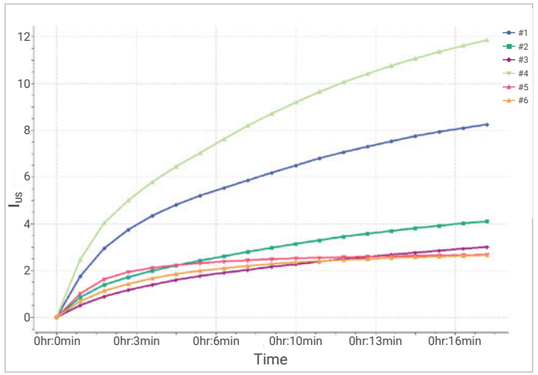
# VERSATILE APPLICATIONS
## for Diverse Real World Cases

### Beer Foam Stability

Beer foam stability is key to quality and freshness. BeScan Lab analyzes this stability by capturing changes in transmitted signals, revealing the impact on foam transmission, drainage rate, and the progression of the instability index. These insights aid in formulating the best beer recipe for market success.




| Sample | Alcohol content (vol%) | Wort concentration (°p) | Packaging |
|---|---|---|---|
| #1 | 3.0 | 8 | Canned |
| #2 | 3.5 | 10 | Canned |
| #3 | 3.5 | 10 | Bottled |
| #4 | 9.0 | 18 | Bottled |
| #5 | 4.5 | 11 | Bottled |
| #6 | 5.0 | 12 | Canned |



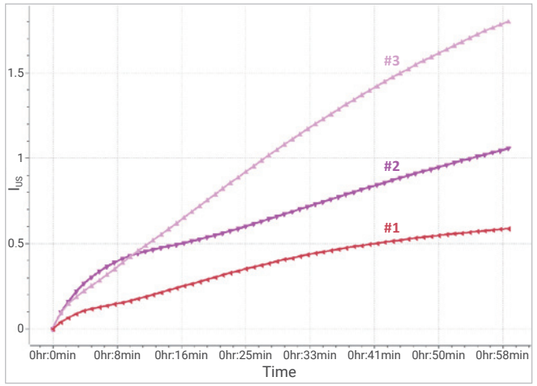

- Sample **#1** with the highest alcohol content is the most unstable.
- Stability is different due to different packaging forms.
- Samples **#5** and **#6** with low alcohol content and proper wort concentration are the most stable.

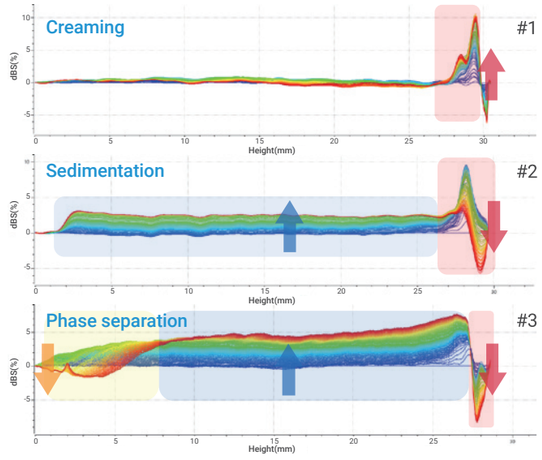
### Ibuprofen Suspension Redispersion Stability

Ibuprofen suspension is a widely used pain reliever whose active ingredients may settle after storage. Stability after redispersion is strongly associated with its effectiveness. BeScan Lab provides a convenient way to evaluate redispersibility.

| Sample | Zeta potential (mV) | Particle size (μm) | Viscosity (mPa·s) |
|---|---|---|---|
| #1 | -14.62 | $D_{10}$ =19.38, $D_{50}$ =38.57, $D_{90}$ =57.74 | 55.30 |
| #2 | -6.03 | $D_{10}$ =21.56, $D_{50}$ =51.11, $D_{90}$ =118.90 | 223.00 |
| #3 | -26.39 | $D_{10}$ =12.74, $D_{50}$ =67.96, $D_{90}$ =228.20 | 16.80 |

*Zeta potential is measured by BeNano 180 Zeta Pro.*
*Particle size is measured by Bettersizer 2600.*




- High viscosity, high zeta potential, and small particle size are beneficial to stability.
- Ibuprofen **#1** with small particle size, medium zeta potential, and proper viscosity is the most stable.

### Agrochemicals

Evaluate the stability of pesticide formulations to predict shelf life and ensure the consistent performance of suspension systems.

### Battery and Energy

Test the stability of electrode materials and electrolytes, crucial for enhancing battery performance and lifespan.

### Ceramics

Analyze the stability of ceramic slurries and monitor the stability of glazes and pigments, ensuring reliable production processes.

### Home and Personal Care

Ensure product stability in cosmetics, lotions, creams, and other formulations for reliable performance.

### Food and Beverage

Test the stability of food products, from milk to sauces, and assess the dispersibility of food powders to maintain product quality.

### Petrochemicals

Monitor and ensure the stability of oil products, providing critical insights into the long-term performance of lubricants and the behavior of polymers in oil.

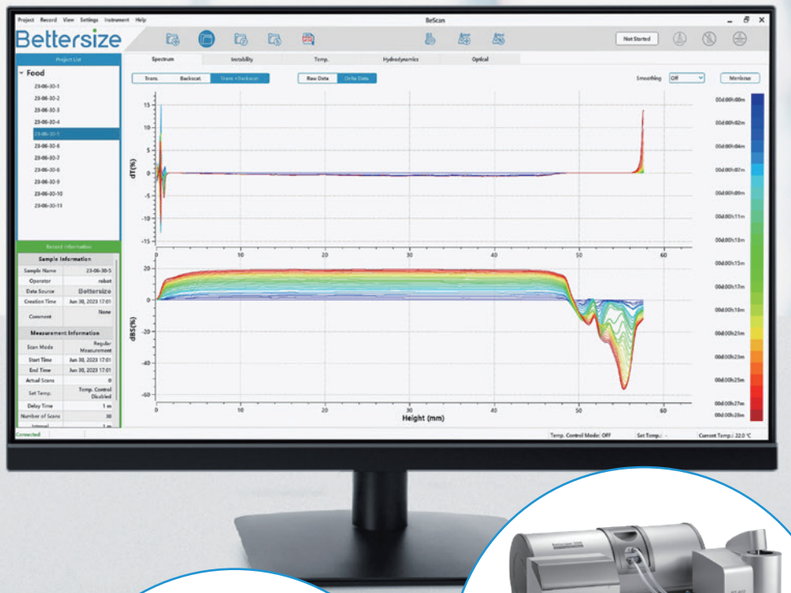
### Pharmaceuticals

Conduct stability testing for medicinal formulations, assess long-term drug stability, and analyze biomacromolecule aggregation to ensure product efficacy.

### Paints, Coatings and Inks

Measure the stability of coatings and inks, and evaluate the dispersion of pigments and dyes for uniform product quality.

# COMPREHENSIVE STABILITY ANALYSIS SOLUTIONS


## BeScan Lab

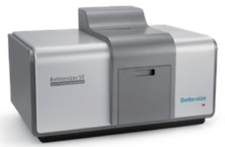
Monitoring product stability throughout the entire product lifecycle. Whether used independently or in combination with other instruments, BeScan Lab ensures product quality, process stability, and safety.

## BeNano Series

Nanoparticle size
Size distribution
Zeta potential
Rheological properties


## BetterPyc 380

Powder density
Liquid density
Slurry solid content



## Bettersizer ST

Particle size
Particle size distribution
0.1 µm - 1,000 µm



## Bettersizer 2600

Particle size
Particle size distribution
0.02 µm - 2,600 µm

## Bettersizer S3 Plus

Particle size
Particle size distribution
0.01 µm - 3,500 µm

## Internal Factors

### Formulation and physical properties challenge

It is challenging to select the optimal raw materials and determine the concentrations of additives, ensure high-quality raw materials, achieve compatibility among formulation components, optimize the mixing process, and manage physical properties like density to maintain stability during storage and application.

### Our solution

Combine **BeScan Lab** with **BeNano Series**, **Bettersizer Series**, and **BetterPyc 380**.

- BeScan Lab facilitates the screening and optimization of formulation components, guaranteeing superior product development.
- The BeNano series, Bettersizer series, and BetterPyc 380 collectively measure particle size, zeta potential, and density. These instruments provide comprehensive particle data, enabling the identification and control of key internal factors affecting formulation stability, thereby optimizing product performance and longevity.

## External Factors

### External forces challenge

Mitigating the impact of stirring, oscillation, and transportation to prevent destabilization.

### Environmental conditions challenge

Controlling the effects of temperature, humidity, and light exposure to prevent degradation and maintain quality.

### Our solution

Use **BeScan Lab** with **Bettersizer** and **BeNano Series**.

- BeScan Lab evaluates the stability of a system under environmental conditions throughout its distribution, storage, display, and usage, assessing the impacts of external forces on the system's stability.
- The Bettersizer and BeNano series provide essential data on particle size effects influenced by external forces, crucial for maintaining product safety, compliance, and consistency, and ensuring quality through precise control that meets industry standards and regulatory requirements.

| Specifications | |
|---|---|
| Measurement principle | SMLS (Static Multiple Light Scattering) |
| Detection angle | 0° transmission and 135° backscattering |
| Light source | 850 nm LED |
| Scan step | 20 μm |
| Scan height | 0 - 60 mm |
| Number of samples | 1 |
| Maximum volume fraction* | 95% |
| Measurement range of particle size | 0.01 - 1,000 μm |
| Temperature control | RT - 80 °C (± 0.5 °C ) |
| Sample volume | 4 - 25 mL |
| Measurement mode | Regular / Fixed point / Temp. trend |
| Dimension | 460 (L) x 260 (W) x 280 (H) mm |
| Weight | 13.5 kg |
| Power supply | AC100 - 240 V, 50 - 60 Hz, 3.8 A |
| ISO compliance | ISO / TR 18811:2018, ISO / TR 13097:2013<br>ISO / TS 21357:2022, ISO / TS 22107:2021 |

* Sample and sample preparation dependent

Bettersize
BETTER PARTICLE SIZE SOLUTIONS

30TH ANNIVERSARY
BREAKING
BOUNDARIES
SHAPING
THE FUTURE

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