



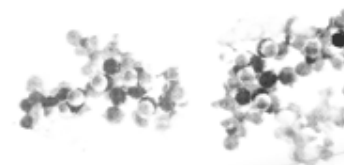
# Measuring the Particle Size and Shape of Building Materials



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[www.horiba.com/us/particle](http://www.horiba.com/us/particle)



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# What we'll talk about

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- **Measurement technologies**
- **Application data**
- **Q&A**

# Technologies in this Webinar

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- **LA-950**

Laser Diffraction

- **SZ-100**

Dynamic Light Scattering & Zeta Potential

- **CAMSIZER & CAMSIZER XT**

Dynamic Image Analysis

- **PSA300**

Static Image Analysis

- **SA-9600**

Flowing Gas BET Surface Area

# LA-950: Laser Diffraction

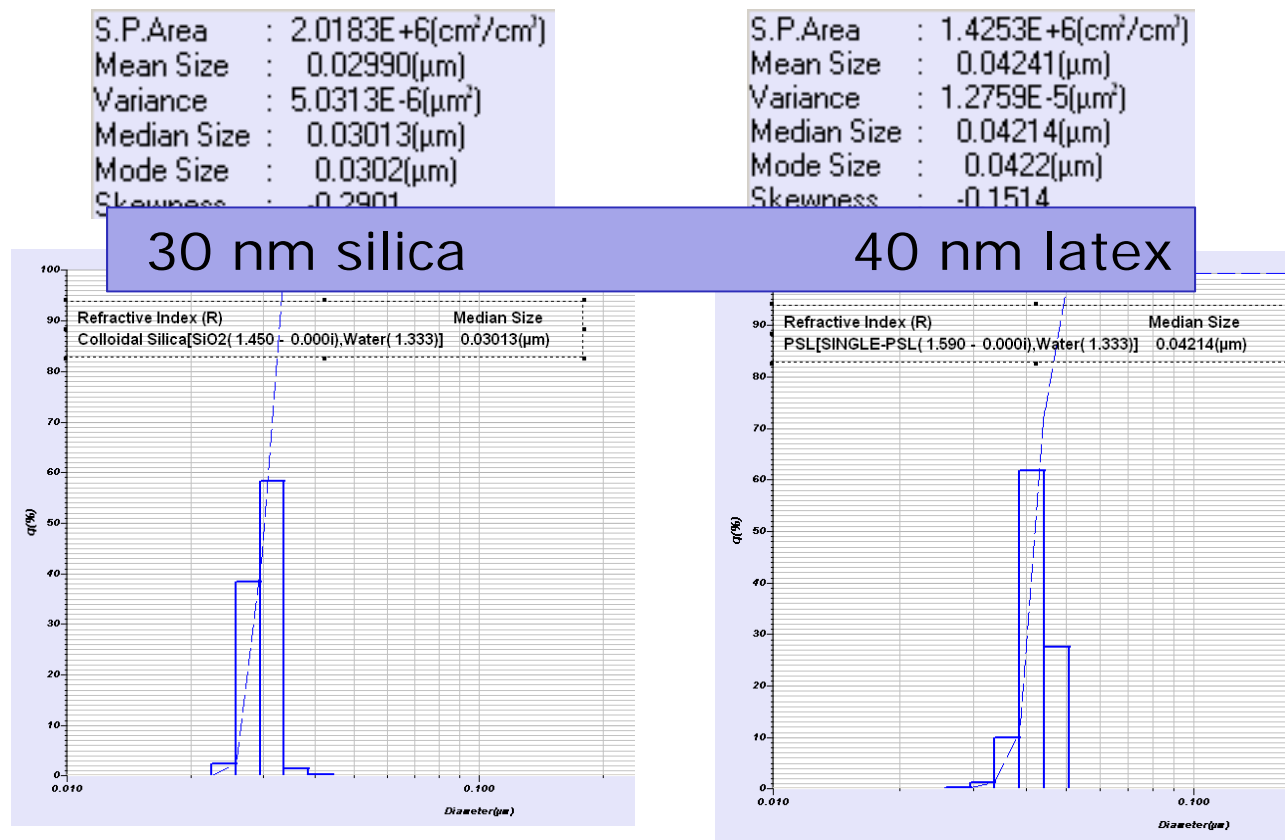
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- Particle size performance leader
- Ninth generation
- Ultra durable
- Lowest total cost of ownership
- Suspension, emulsion, powder, paste, gel
- 10 nanometer – 3 mm

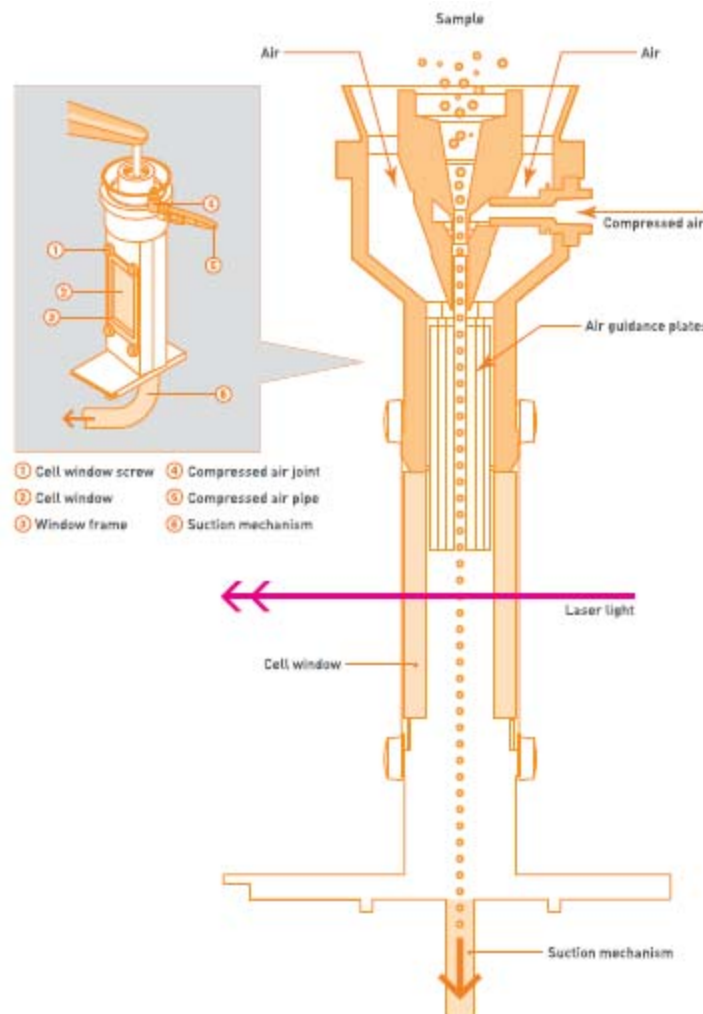


# Dynamic Range 0.01 – 3000 $\mu\text{m}$

- Widest wet measurement range
- Only system to measure 30 nm!



# Superior Dry Powder Feeder



Direct flow of powder down to cell rather than turn 90°, then around plastic tube, no density restriction like horizontal units, zero impact surfaces means good dispersion w/o comminution

## Webinar TE016: Optimizing Dry Powder Measurements

# Superior Dry Powder Feeder

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- Automatic control of sample feed rate
  - LA-950 monitors amount of sample supplied by the vibratory feeder. Automatic feed back control keeps constant mass flow rate of powder during measurement
  - This is CRITICAL
    - More reproducible, robust
    - No ghost peaks
    - No cutting off results
    - Fewer headaches!
  - Unique to HORIBA



# CAMSIZER Series: Image Analysis

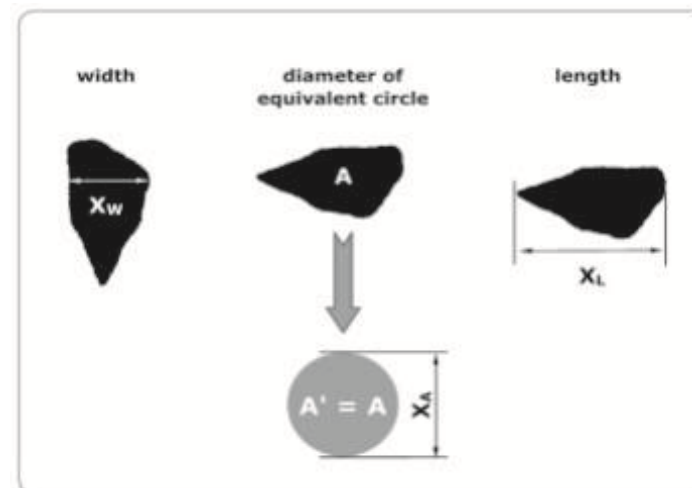
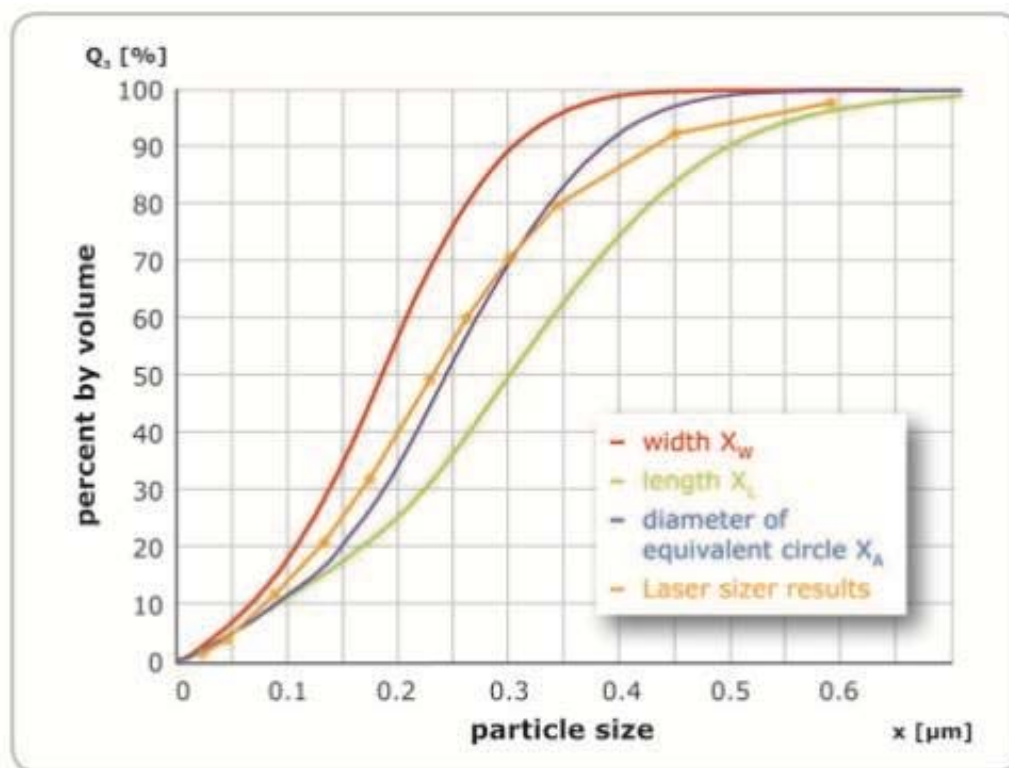
- High resolution size & shape
- Intelligent sieve correlation
- Patented dual capture
- CAMSIZER 30 micron – 30 millimeter
- CAMSIZER XT 1 micron – 3 millimeter



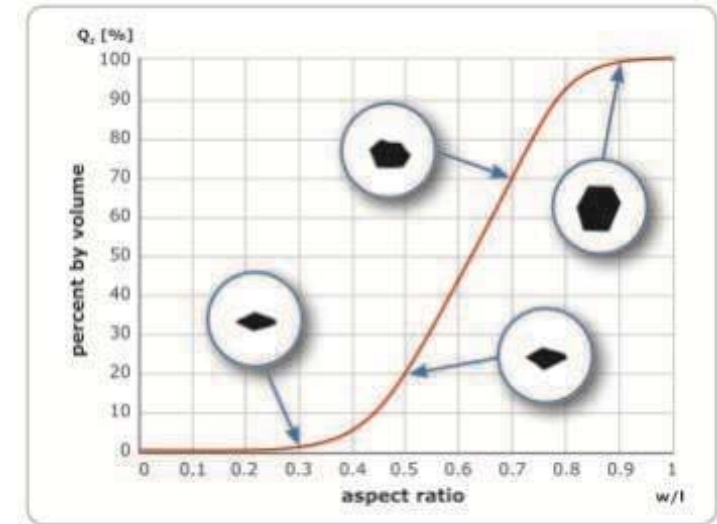
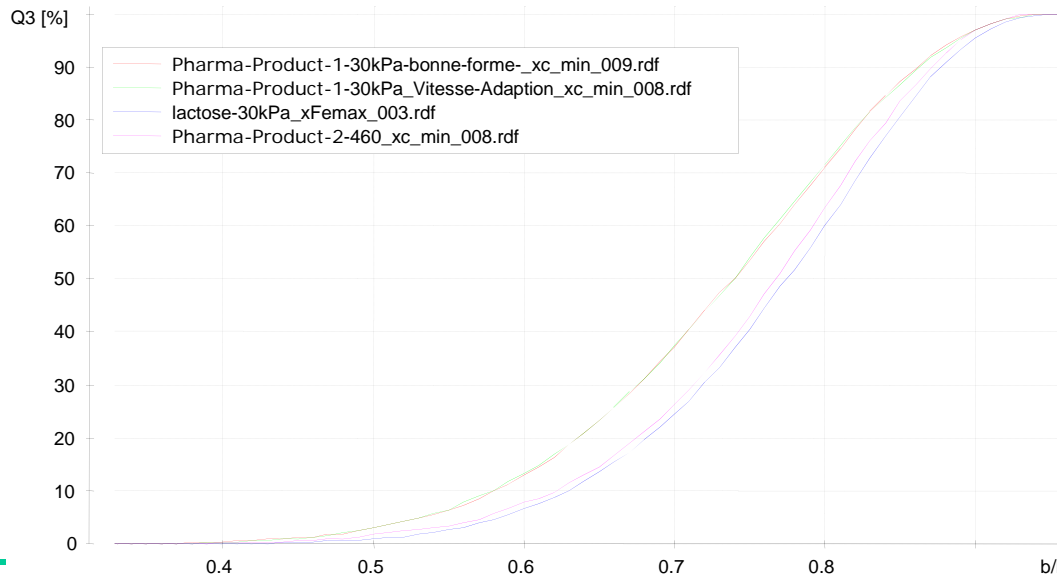


# Advantage of Image Analysis

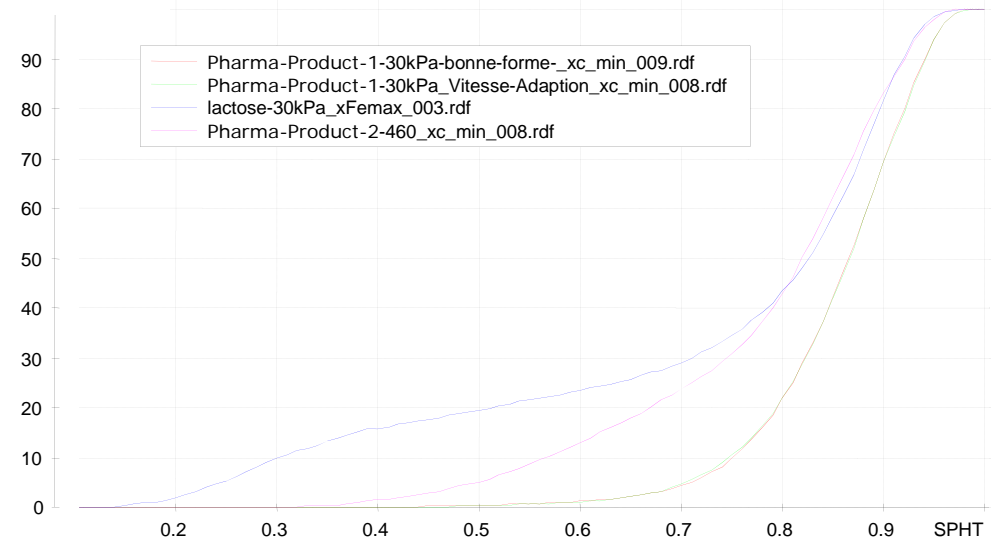
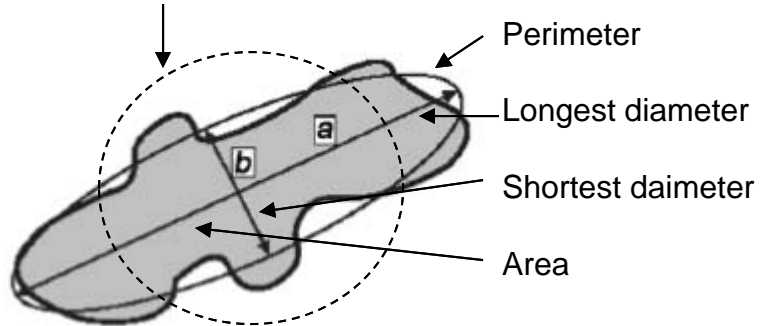
**More Detailed Size Analysis due to Understanding of Particle Shape:  
Length, Width, Average Diameter**



# Shape Analysis



Equivalent spherical diameter



# What we'll talk about

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# Applications in this Webinar

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- **Cement**
- **Concrete**
- **Limestone/GCC/PCC/Dolomite**
- **Gypsum**
  
- **There are MANY others, but only so much time...**

# General Importance for Powders

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- Powder flow
  - Particle size, Particle shape
- Dust hazard/nuisance
  - Particle size
- Dissolution
  - Particle size, Surface area
- Reactivity
  - Particle size, Particle shape, Surface area



# Portland Cement

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- Most common cement
- Particle size affects rate of hydration  
(1  $\mu\text{m}$  ~ 1 day, 10  $\mu\text{m}$  ~ 1 month)
  - Set too fast, set too slow
  - Fast expansion, poor strength
- Monitor size to control grinding process
- Historically measured using sieves and *Blaine* values
  - Misleading

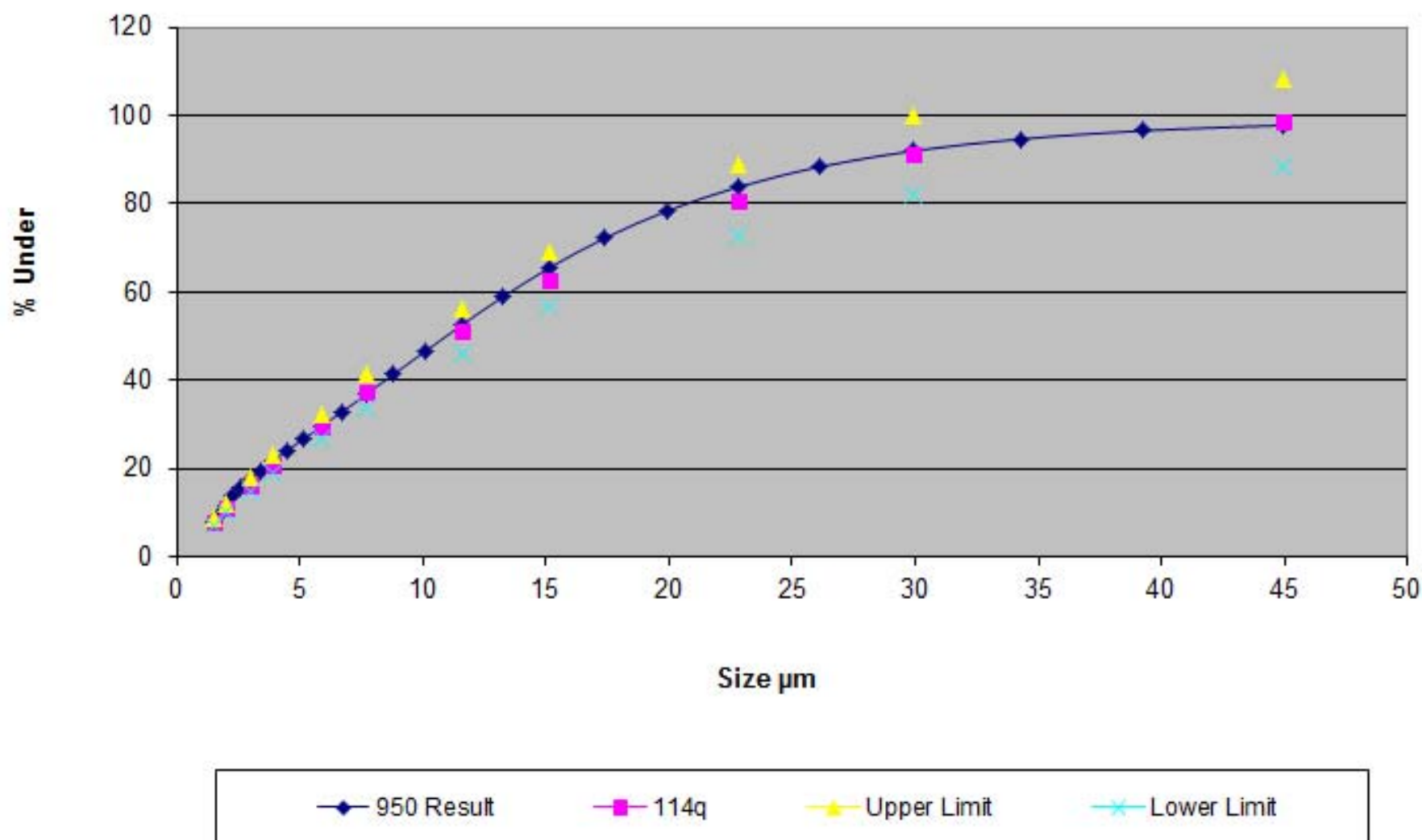
# Portland Cement

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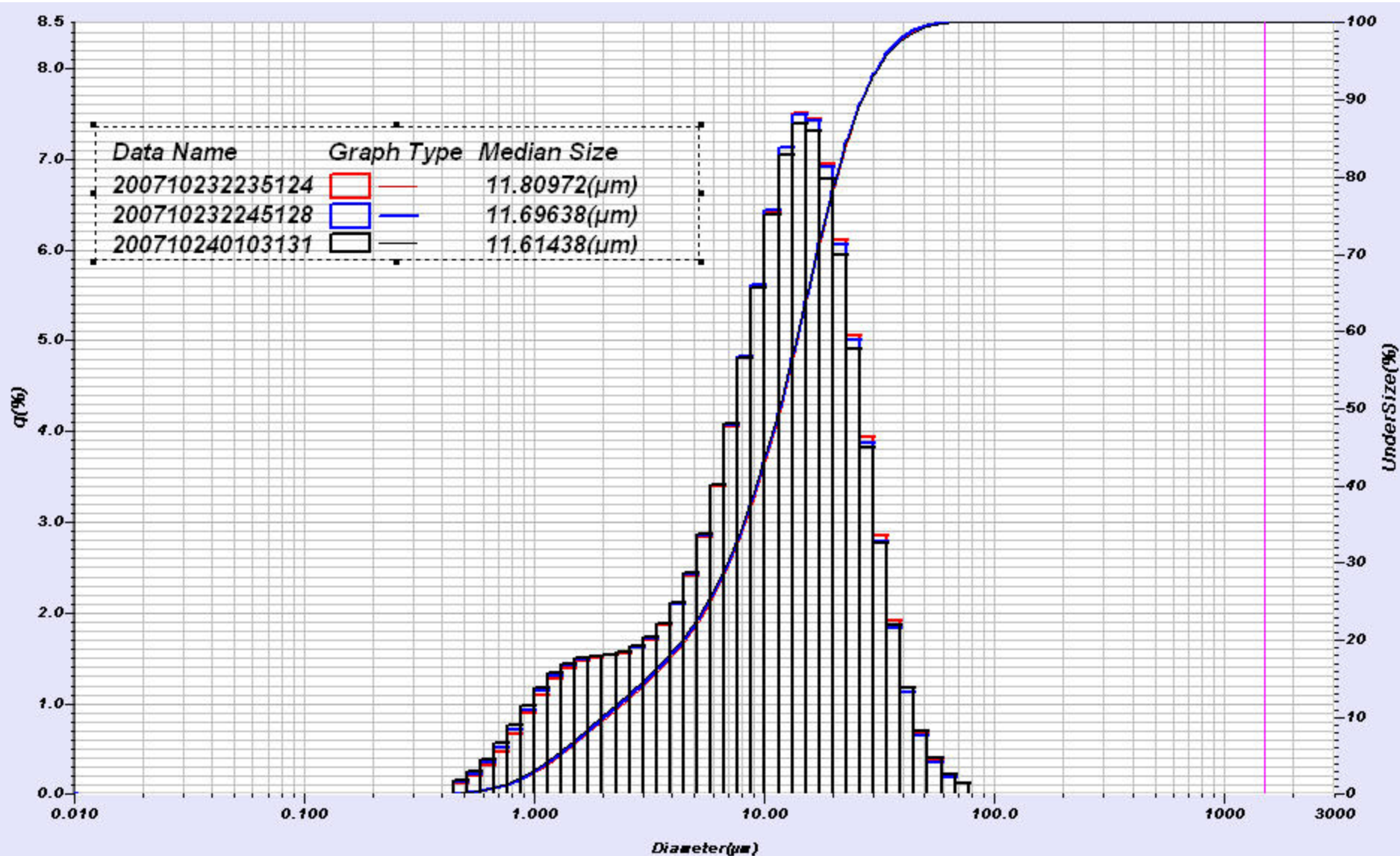
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# NIST SRM 114q

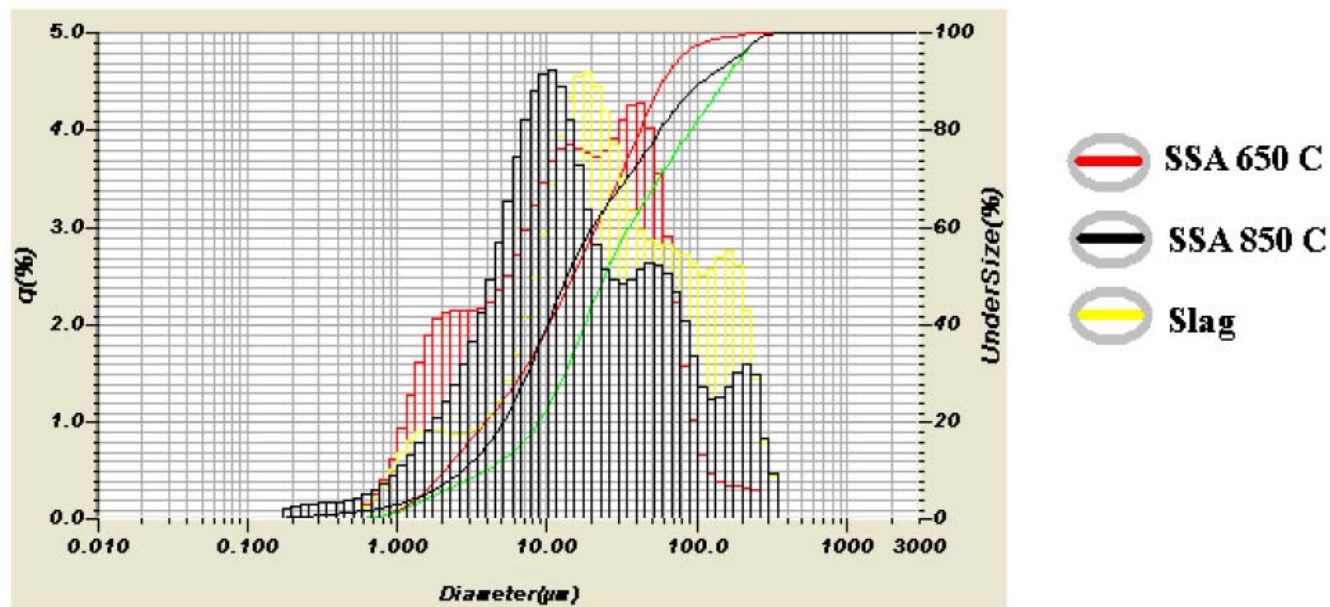


# Portland Cement on the LA-950



# Cement Replacements

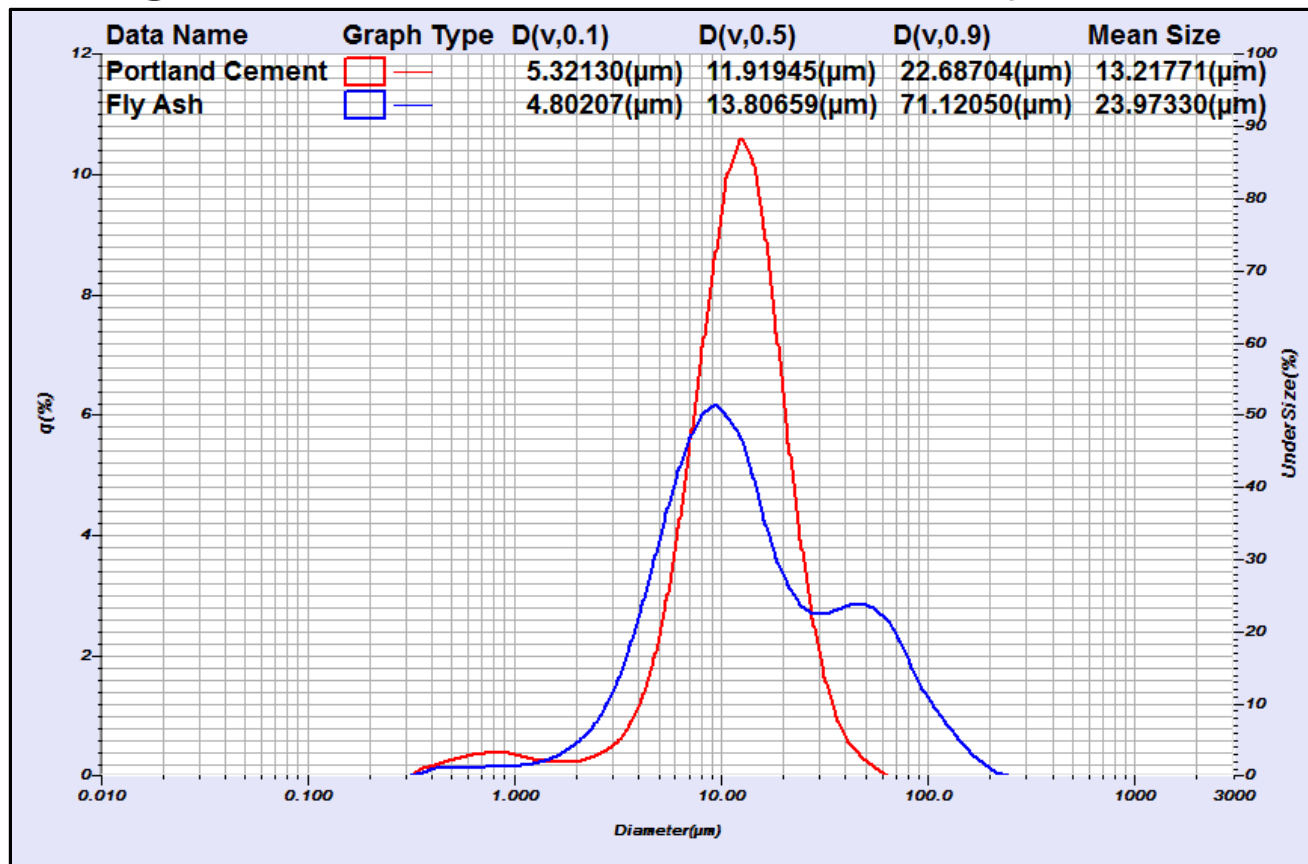
- Raw material cost and/or “green” costs
- Fly ash
- Slag (GGBS)



\*Housing and Building National Research Center, Egypt

# Cement Replacements

- Fly ash overlay with Portland cement using LA-950 PowderJet dry feeder



# Concrete

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- Generally: cement + aggregate + water

- Size of cement affects hydration
- Size and shape of aggregate affects workability, compressibility

- Commonly use admixtures to control properties



- Plasticizers



- Pigments

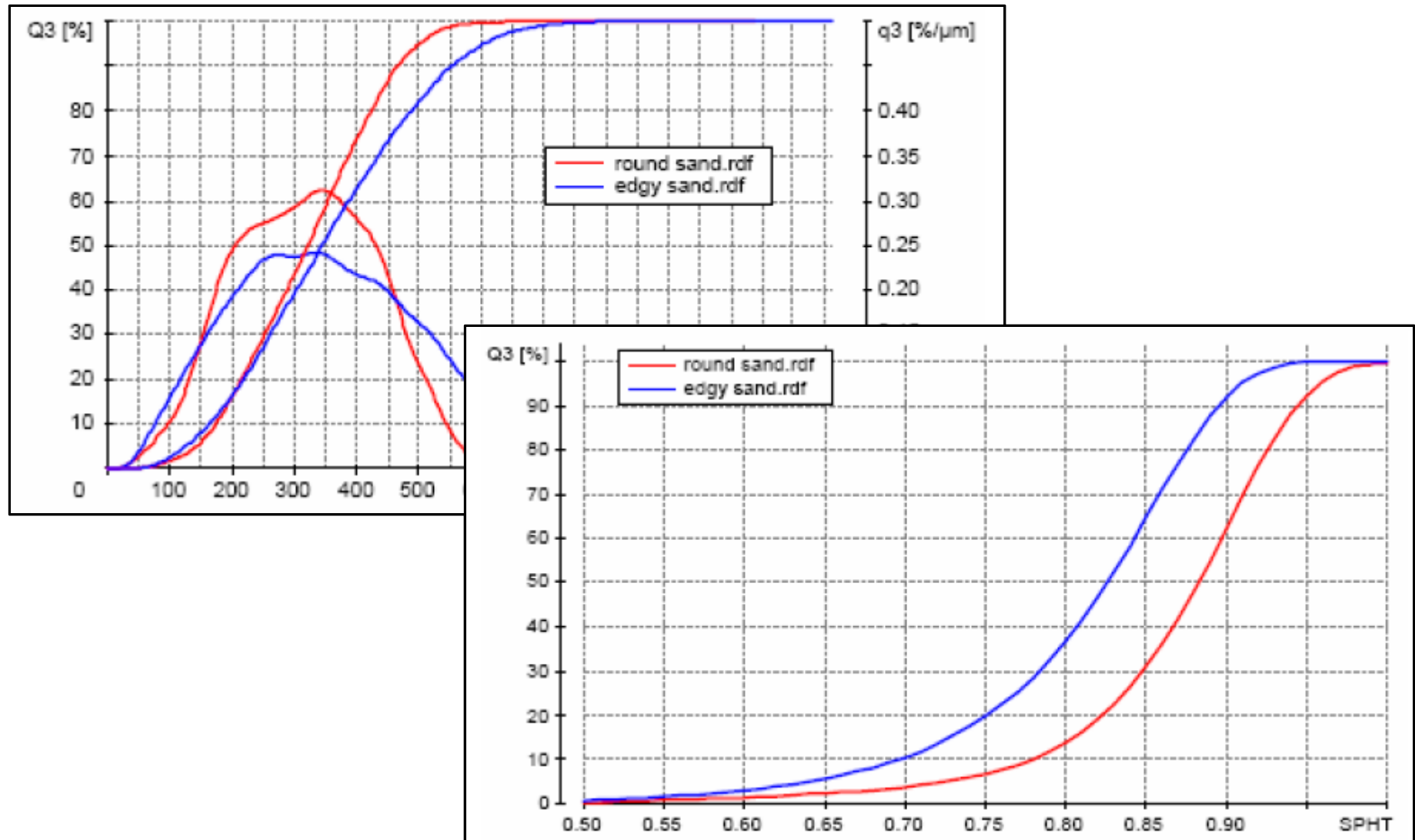


- Accelerate/retard hydration



- Fumed silica

# Aggregate on the CAMSIZER





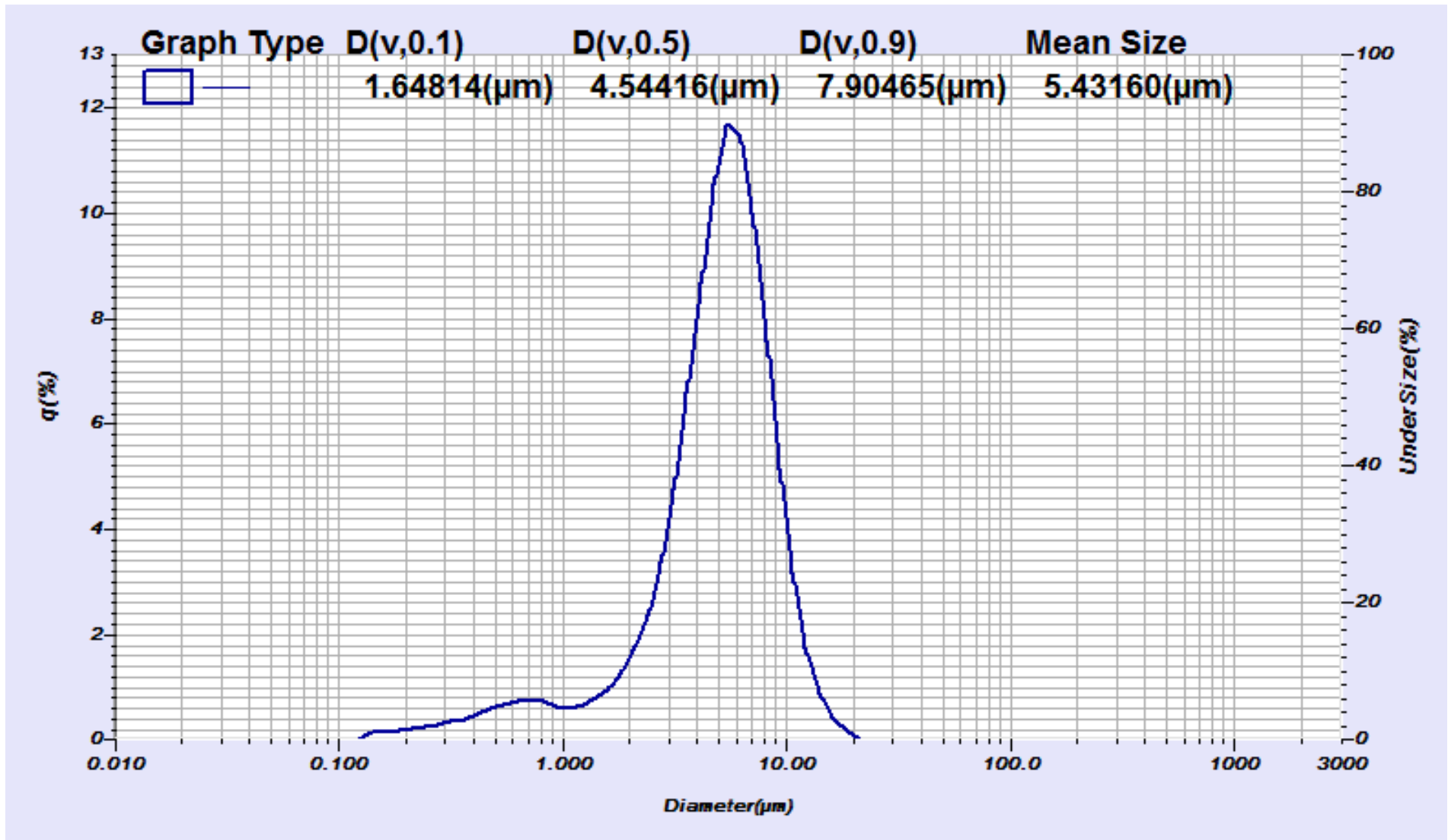
# Calcium Carbonate

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- Comes in two varieties
  - Ground  $\text{CaCO}_3$ 
    - Typically broader size distributions
    - Irregular particle shape
  - Precipitated  $\text{CaCO}_3$ 
    - Can be narrow distributions
    - Can produce any of several morphologies
- Size, color, and chemical composition determine application
- Roofing, Stucco, Grout, Masonry blocks



# GCC on the LA-950



S

M

Q3 19

10

10

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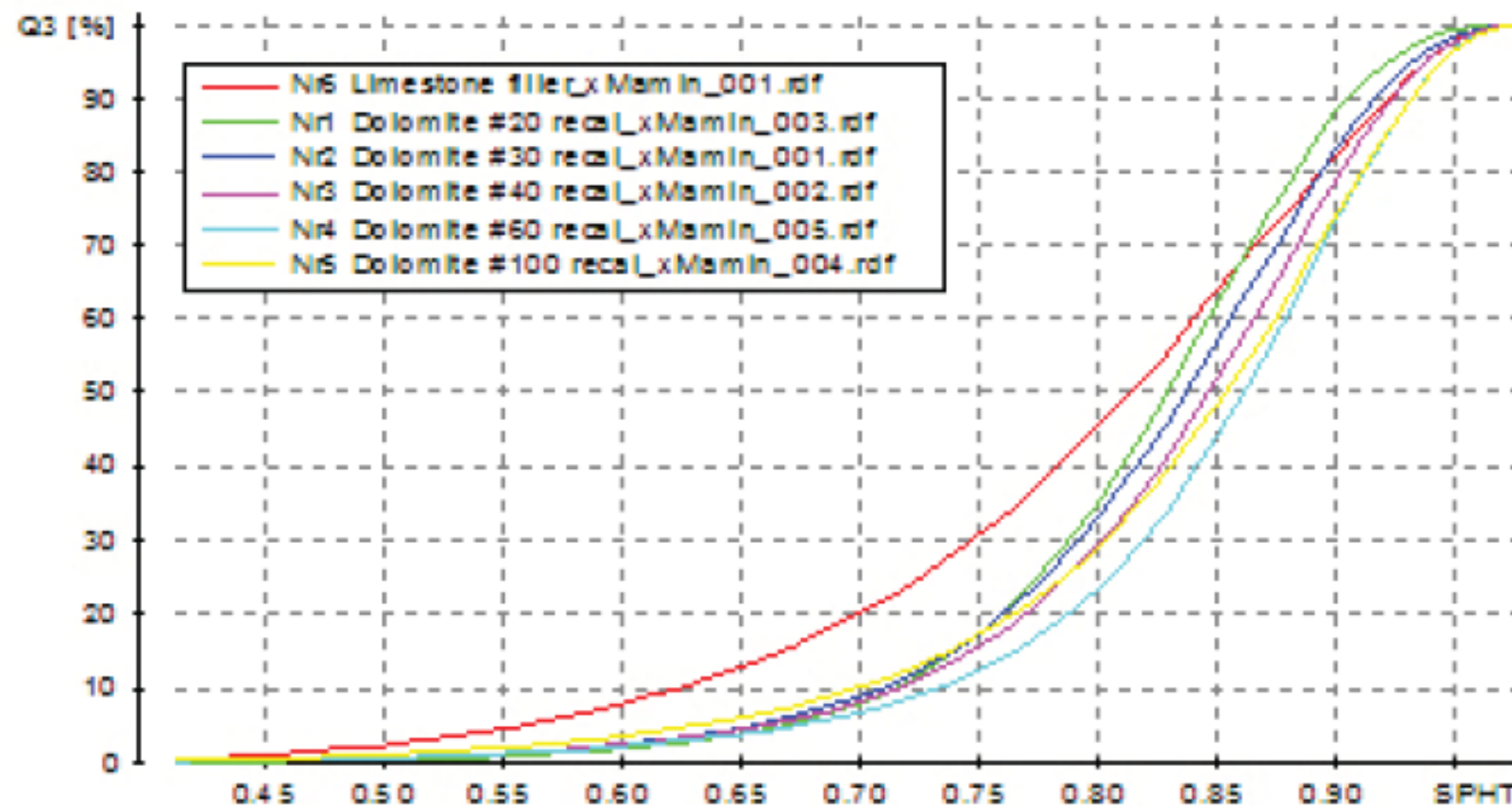
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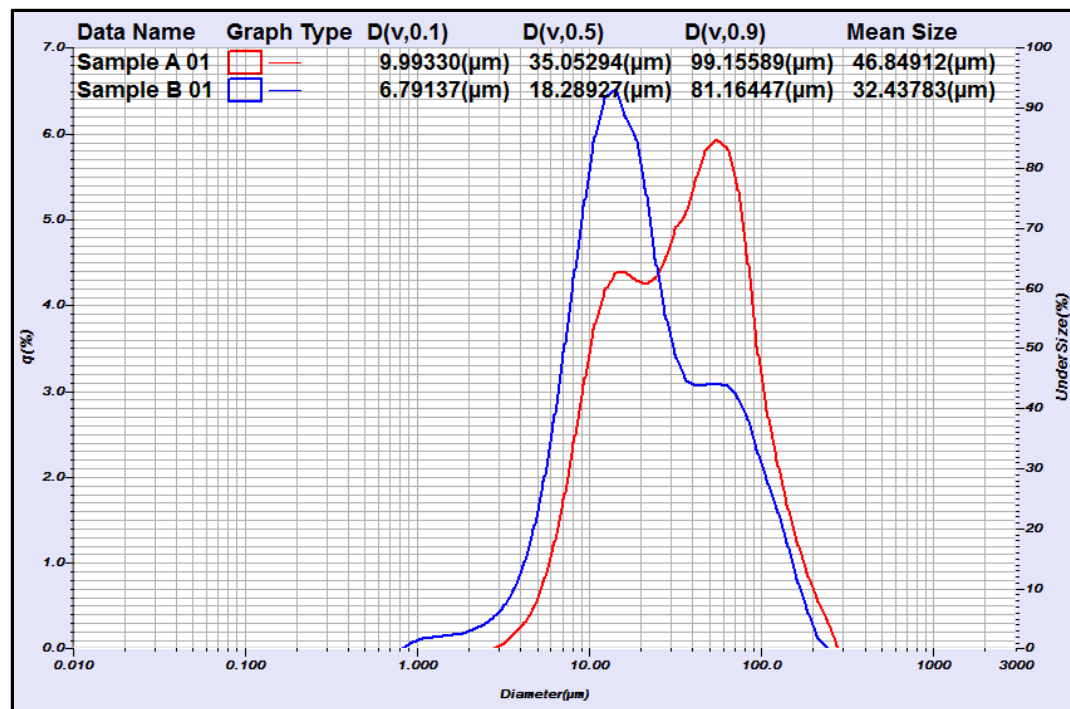
# Dolomite

## ■ Shape data for same six grades



# Gypsum

- Gypsum board/drywall, plaster, cement
- Recovered from flue-gas, variable size
- Naturally occurring typically finer



# What we'll talk about

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# For More Details

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Visit <http://www.horiba.com/particle>

Contact us directly at [labinfo@horiba.com](mailto:labinfo@horiba.com)

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# Thank-you

**Thank you**

ありがとうございました

ขอบคุณครับ

谢谢

اشكر

**Gracias**

**Grazie**

Σας ευχαριστούμε

धन्यवाद

நன்றி

**Tacka dig**

**Danke**

**Merci**

감사합니다

Большое спасибо

**Obrigado**

おかしく おかしく

*Omoshiro Okashiku*