

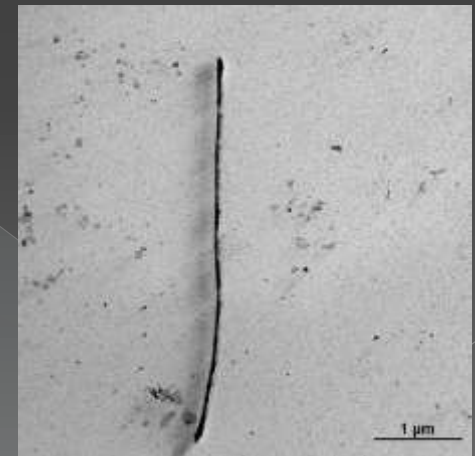
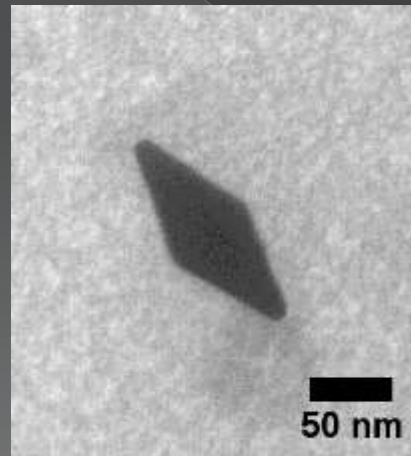
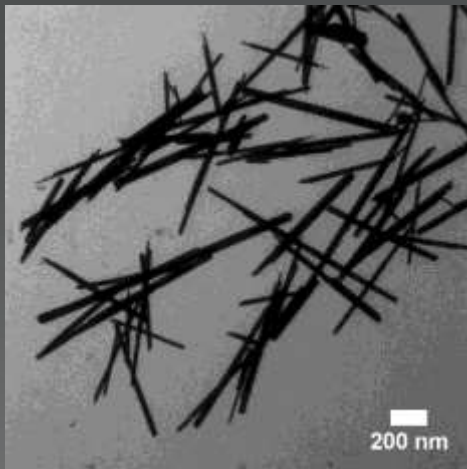
# D-DLS : Thetis by Cordouan

A new solution for anisotropic nanoparticles characterization



# Why Nanoparticle shape matters

1. Advanced materials needs more sophisticated NPs
2. Graphene, Carbon nanotube, Silver nanotube are the next generation electrical transmitters
3. New shapes for NPs available now

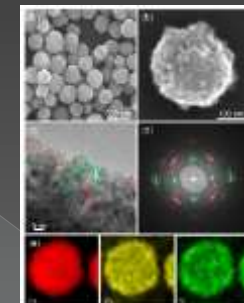
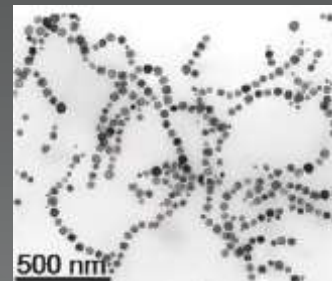
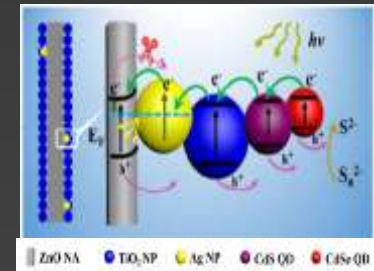
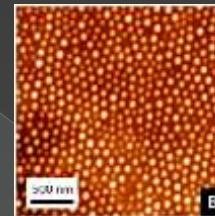


# Examples of anisotropic NPs

## 1. Hybrid nanomaterials :

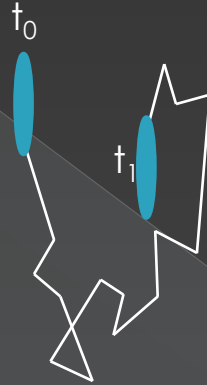
1. Combination of various material properties into one
2. Rise of new properties,
3. Examples :

1. Efficient solar cell materials
2. New optical materials
3. Nanocrystals for structural improvement
4. Magnetic NPs for imaging

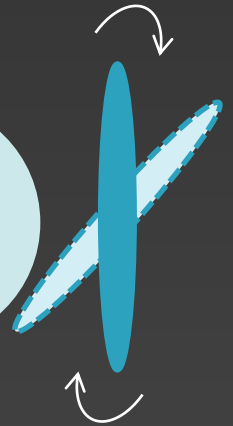


# Behaviour of anisotropic particles

Translational  
coefficient  
 $D_t$

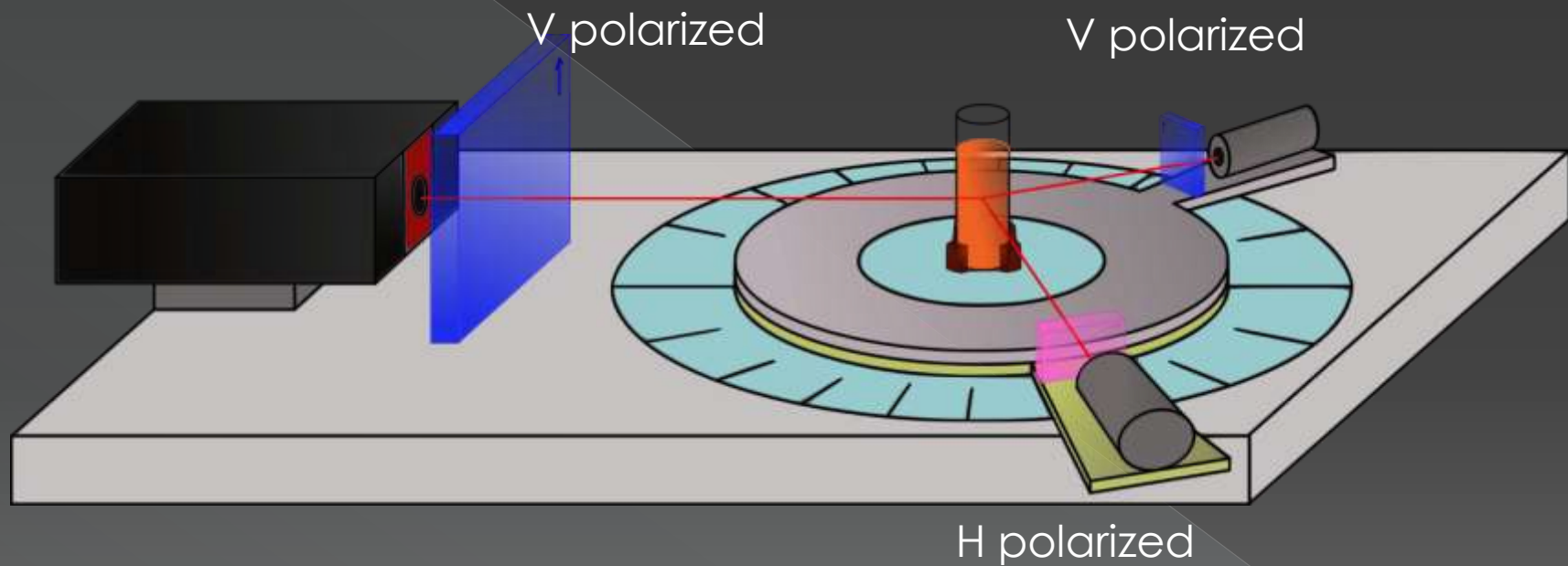


Rotational  
coefficient  
 $D_r$



1. 2 different movements : translational and rotational
2. Leading to 2 different Diffusion coefficients
3. Leading to a superposition of 2 different correlograms

# D-DLS Principle



# Anisotropic Diffusion Coeff.

$$\Gamma_{vv} = D_t \cdot q^2$$

$$\Gamma_{vh} = D_t \cdot q^2 + 6 \cdot D_r$$

$$D_t = \frac{k_B \cdot T}{3 \cdot \pi \cdot \eta \cdot L} \cdot \left[ \ln \left( \frac{L}{w} \right) + \gamma \right]$$

$$D_r = \frac{3 \cdot k_B \cdot T}{\pi \cdot \eta \cdot L^3} \cdot \left[ \ln \left( \frac{L}{w} \right) + \varepsilon \right]$$

1. Calculation can be performed
2. Leading to L and w

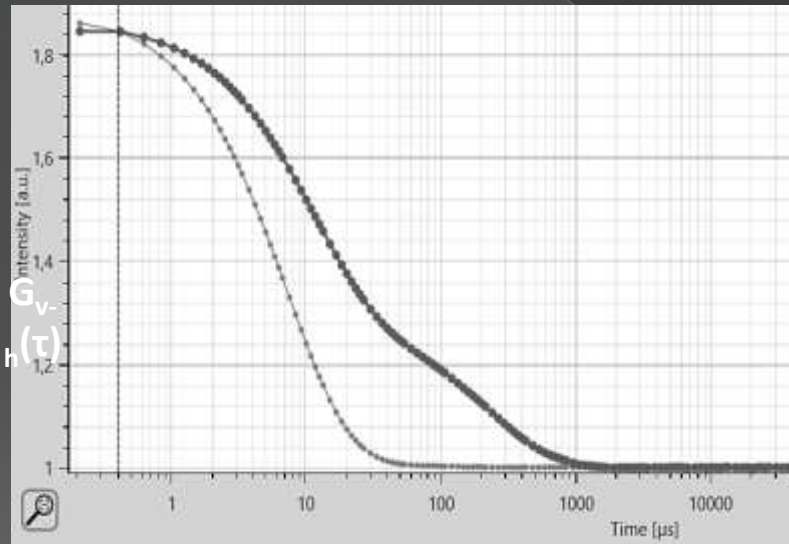
- **L: length**
- **w: width**
- **L/w: aspect ratio**

# Analytical method De la Torre

1

$$G_{(vv)}(\tau) = A_1 \cdot \exp^{-(\Gamma_t + \Gamma_r)\tau} + A_2 \cdot \exp^{-(\Gamma_t)\tau} + B$$

$$G_{(vh)}(\tau) = A_3 \cdot \exp^{-(\Gamma_t + \Gamma_r)\tau} + B$$



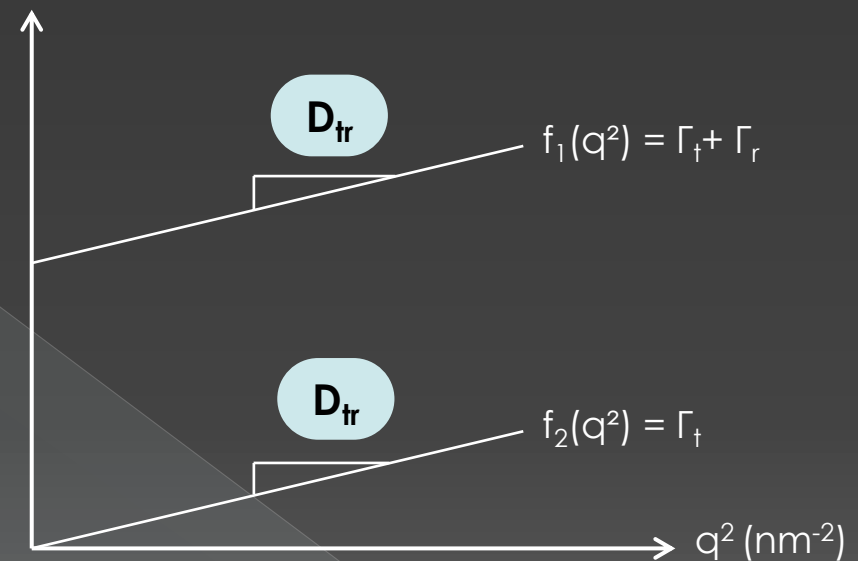
2

$$\Gamma_{tr} = D_t q^2$$

$$\Gamma_{rot} = 6D_r$$

3

coefficients  $D_t$  and  $D_r$

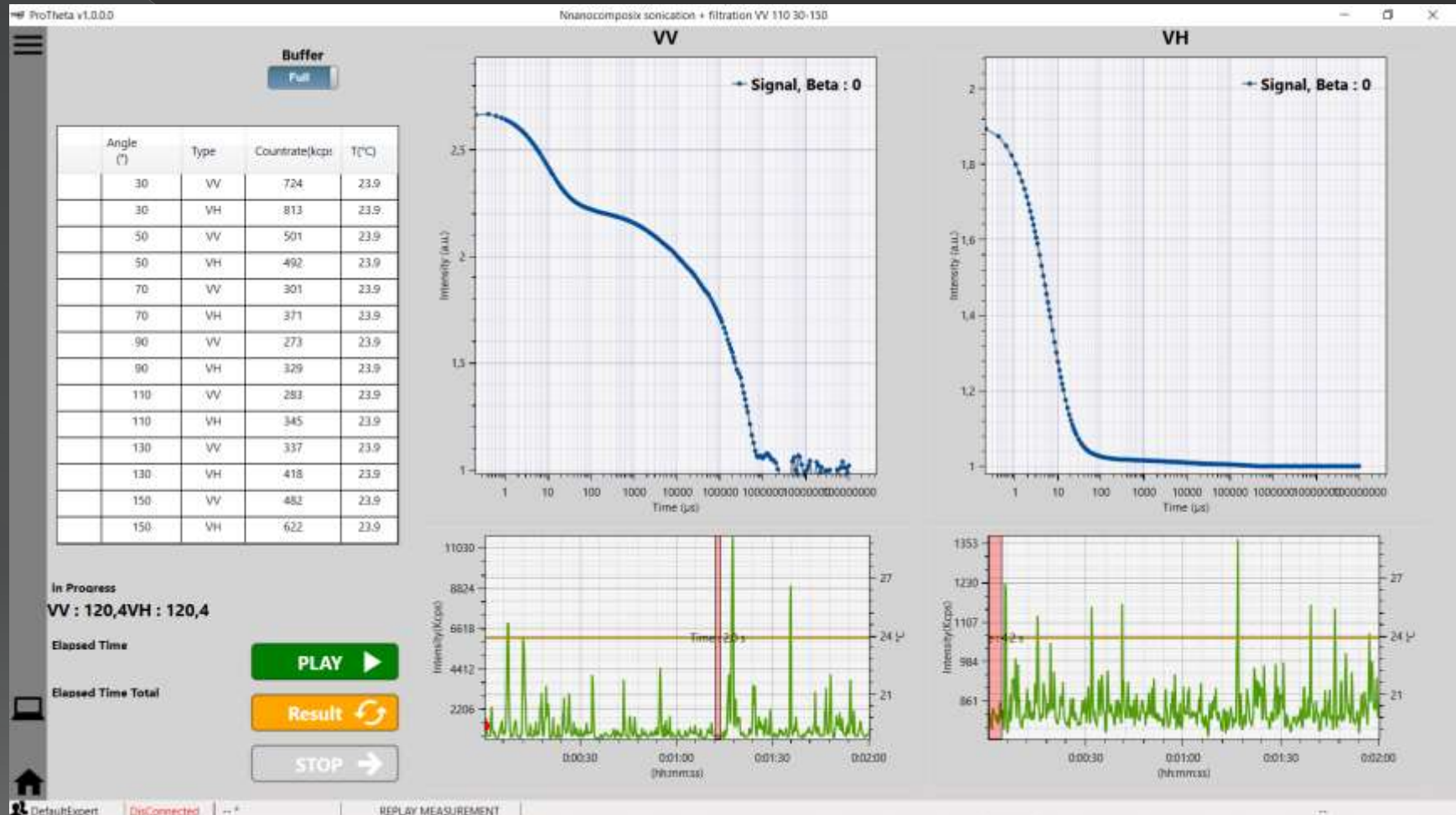


4

Calculation

Length  $L$ , Aspect Ratio  $AR$  and width  $w$

# Protheta : the instrument software





# Results presentation

ProTheta v1.0.0.0      Nanocompositi sonication + filtration WV 110 30-150

**Dt : 14987410,8nm2.s-1**  
**Dr 14029,7 s-1**  
**L : 80,6 nm**  
**W : 7,6 nm**  
**L/W: 10,6**

### Global results

**Dt Selection**

- Dt Gamma T WV
- Dt Sum Gamma WV
- Dt Sum Gamma VH

**Dr Selection**

- Dr Sum Gamma WV
- Dr Sum Gamma VH

	Angle (°)	GammaT WV	SumGamma WV	SumGamma VH	
✓	30	324.128047625662	75891.6279857156	100155.924126338	→
✓	50	12.8620866603947	101133.264952781	88034.5320923851	→
✓	70	4203.33017269347	84881.7367918251	88898.5369788763	→
✓	90	6099.58910299823	85090.0665979643	102376.500127169	→
✓	110	6496.17938973836	90622.57157949	99402.4105365879	→
✓	130	5753.31487672364	92201.3841756678	110932.491206721	→
✓	150	8624.54524589024	95480.1167002635	104730.595800338	→

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# Our instruments

## VASCO

Adapted for high concentration and absorbing samples



## WALLIS

Zeta potential

## VASCO KIN

*In situ* and software correlator



## AMERIGO

Standard cell, *In situ* and software correlator

DLS and Zeta potential



## THETIS

Standard cell, *Multi angle* for *anisotropic NPs*



Thank you for your attention



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