D-DLS : Thetis by Cordouan

A new solution for anisotropic nanoparticles characterization

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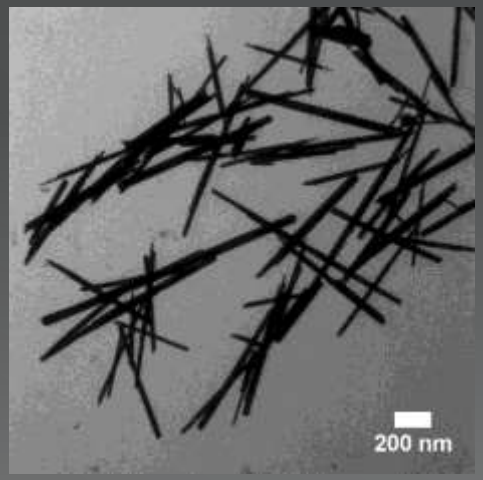
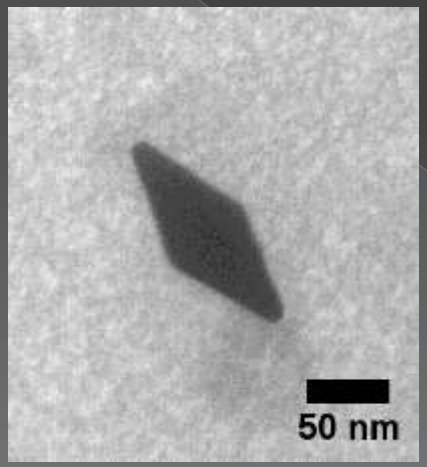
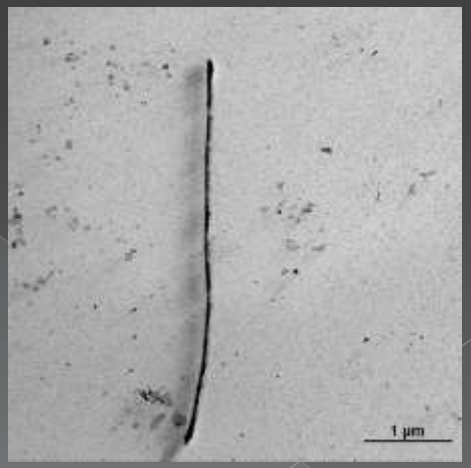
Why Nanoparticle shape matters

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







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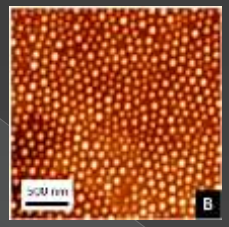
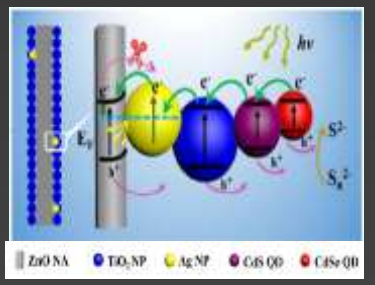
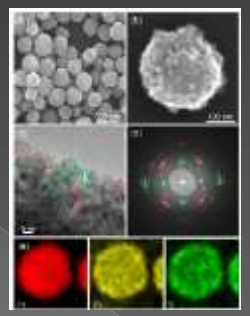
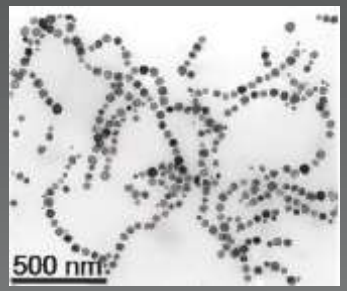
Examples of anisotropic NPs

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









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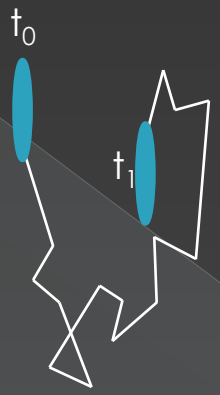
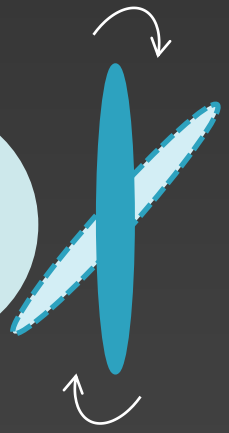
Behaviour of anisotropic particles

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

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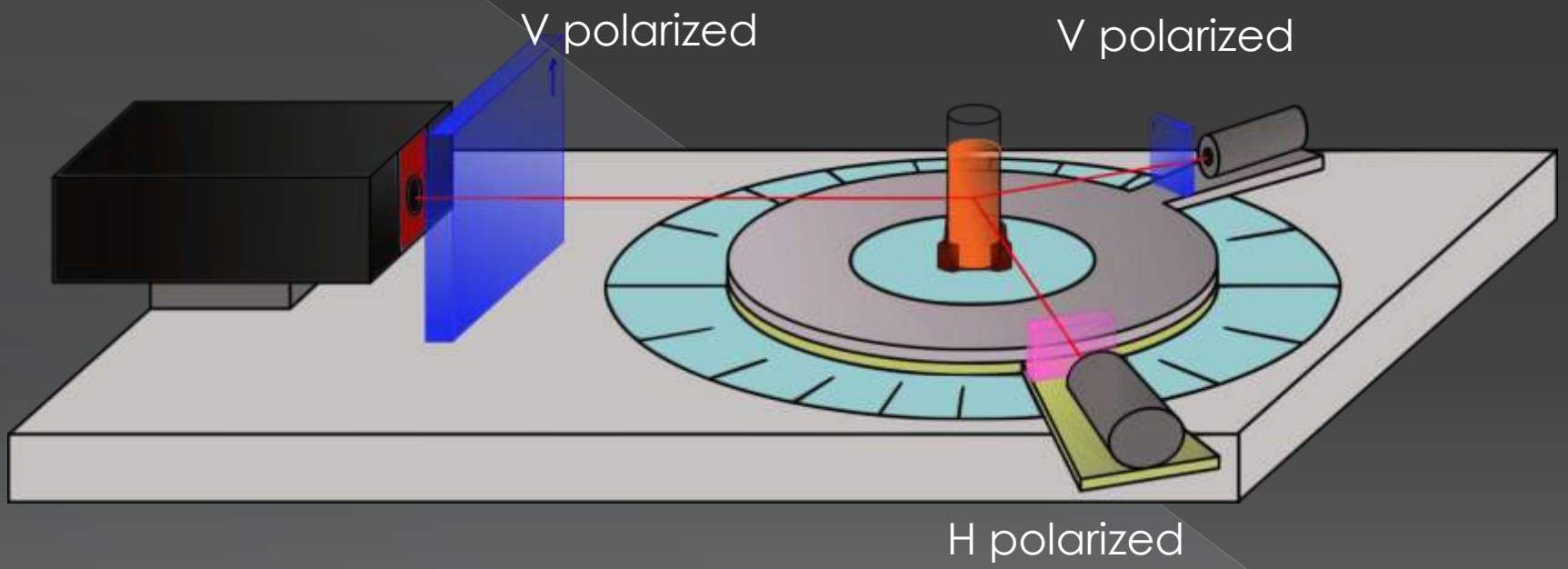
D-DLS Principle



Anisotropic Diffusion Coeff.

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

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

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

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

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

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

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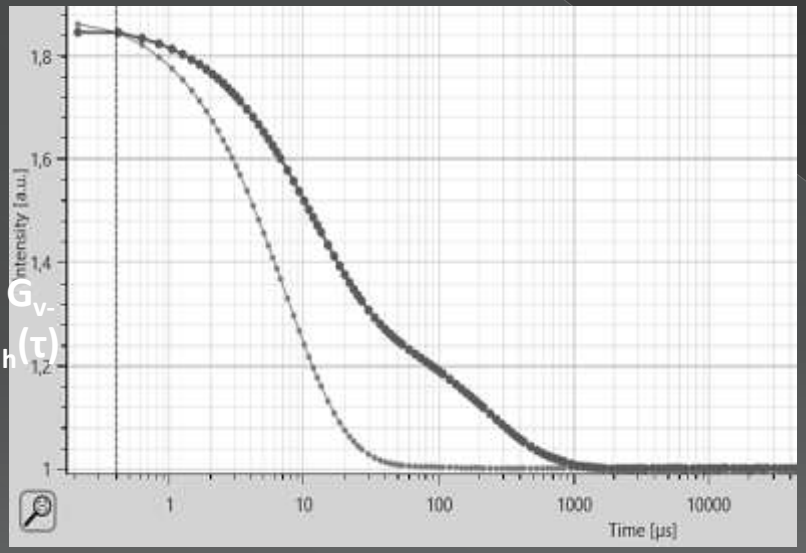
Analytical method De la Torre

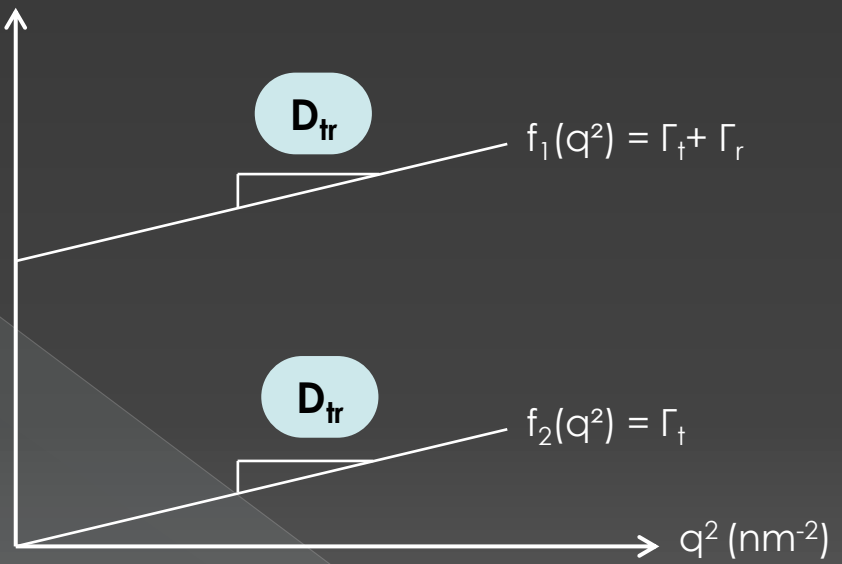
1 $G_{(vv)}(\tau) = A_1.\exp^{-(\Gamma t + \Gamma r)\tau} + A_2.\exp^{-(\Gamma t)\tau} + B$

$G_{(vh)}(\tau) = A_3.\exp^{-(\Gamma t + \Gamma r)\tau} + B$



$G_{v-h}(\tau)$

3 coefficients D_t and D_r



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

$\Gamma_{rot} = 6D_r$

4 Calculation

Length L, Aspect Ratio AR and width w

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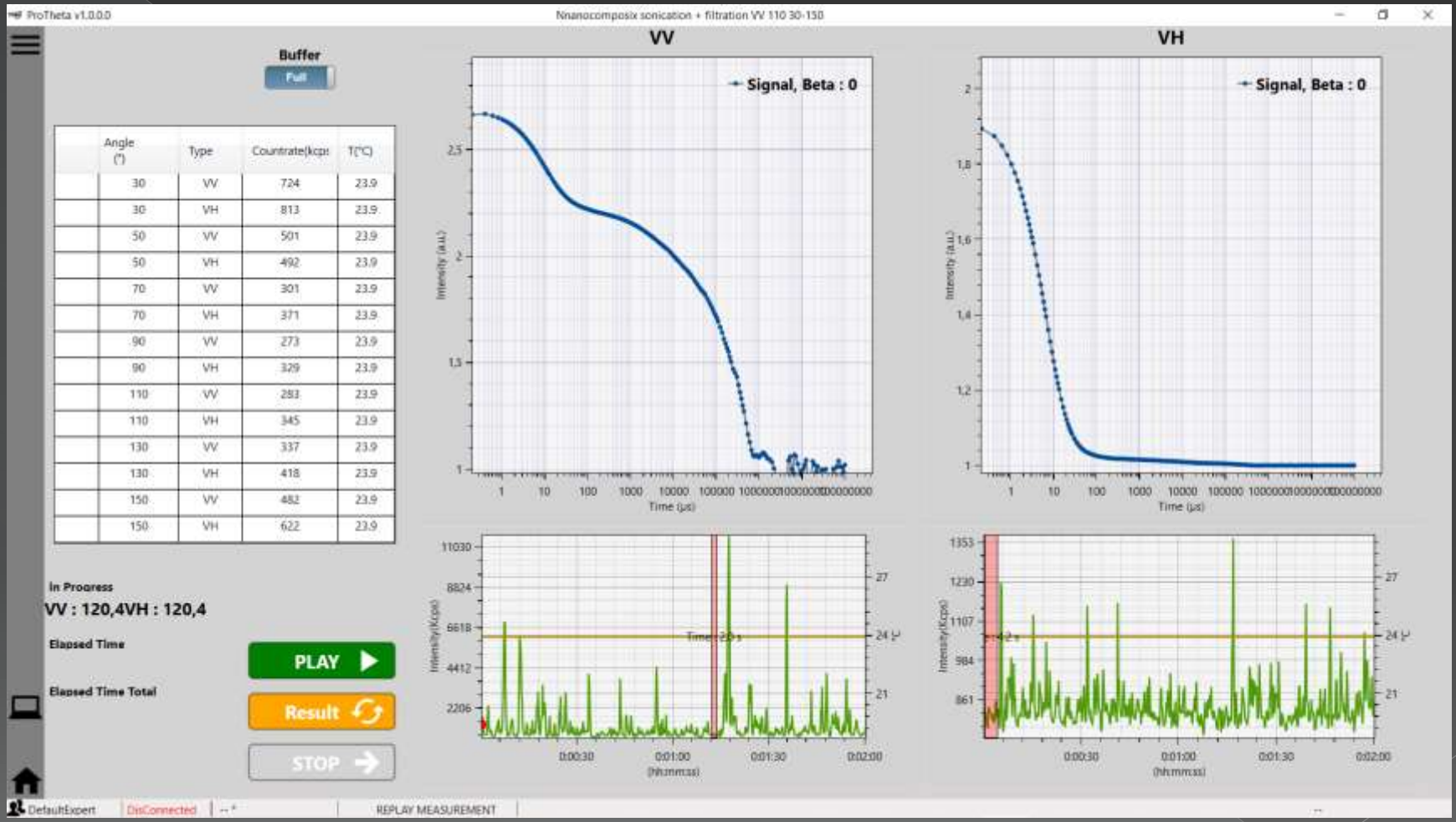
Protheta : the instrument software



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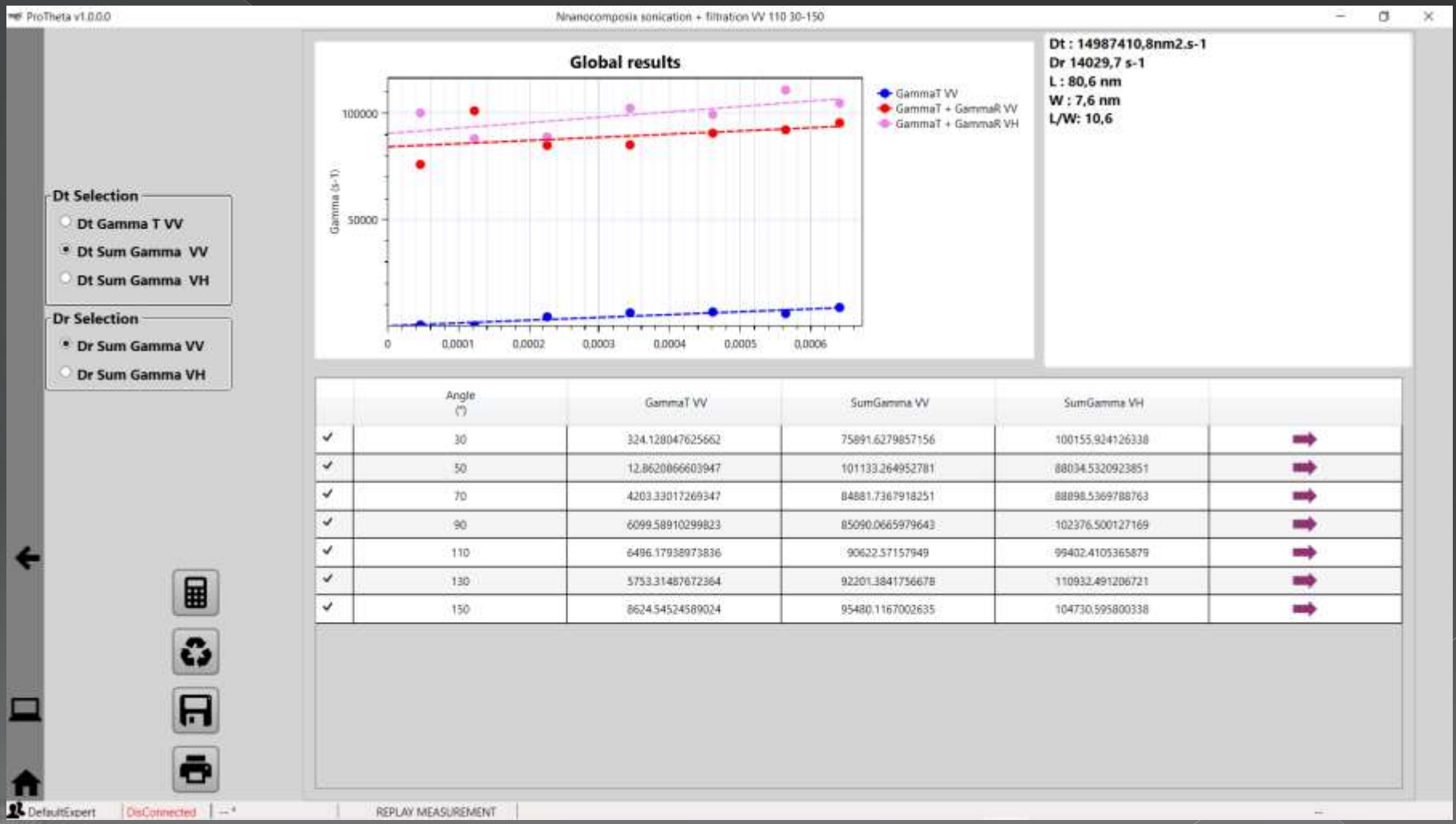
Results presentation



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*

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Thank you for your attention

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