Airport Pavement Working Group Meeting

Atlantic City, April 15-16-17, 2013

DGAC/STAC Research Update 2013

Aircraft Wander Toulouse Experiment

Serge LE CUNFF

Service technique de l'aviation civile

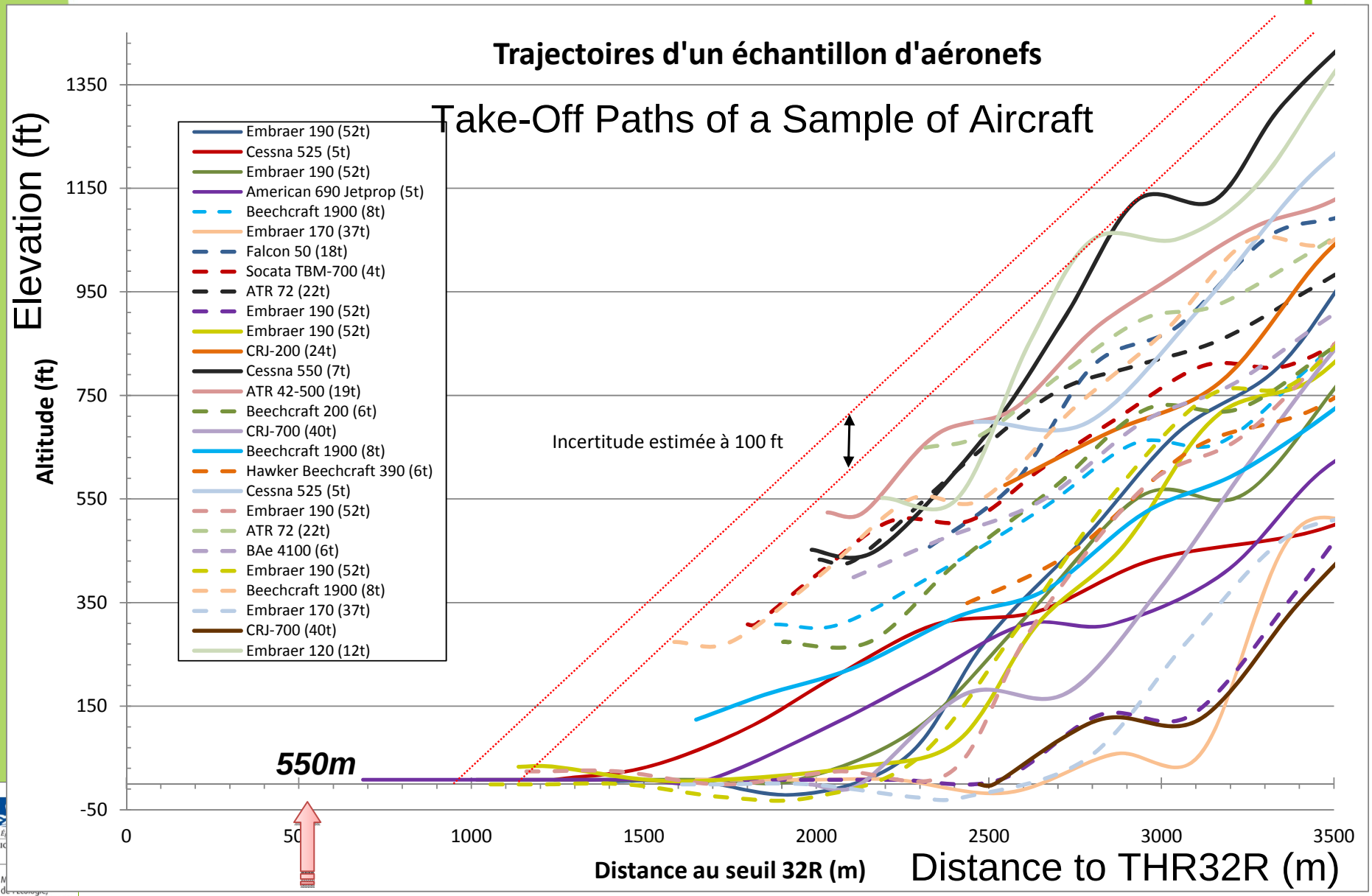
Aircraft Wander Analysis
Toulouse Rwy 14L/32R Instrumentation

Location of instrumented cross-section:

- Aircraft speed :
  - High enough for significant lateral wander
  - Yet keeping enough bearing on pavement to activate sensors
- Primary and secondary radars take-off tracks (~30 aircraft sample)

⇒ ▪ @ 550 m from Threshold 32R

Instrumented Section Location



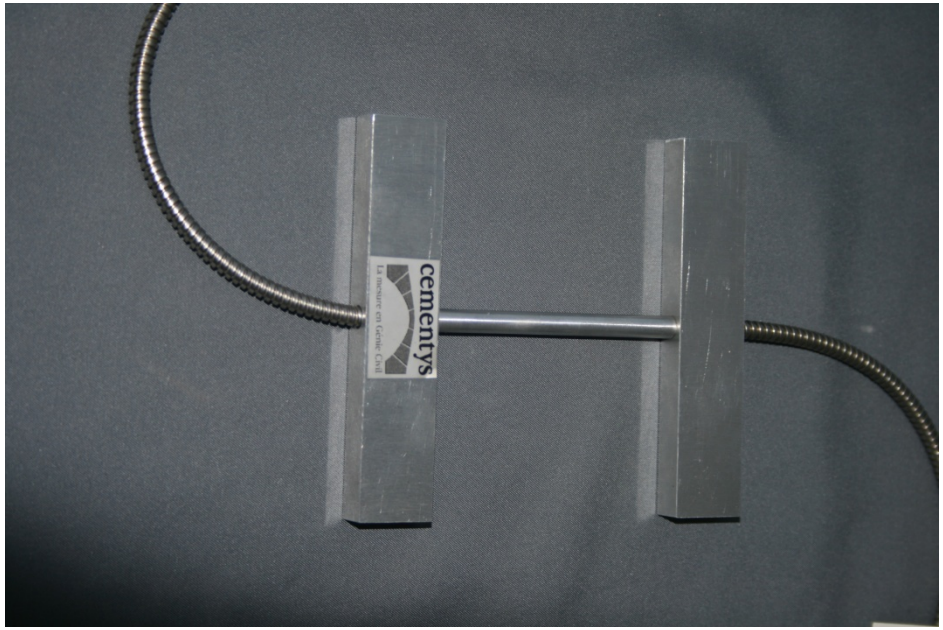
Sensors Installation Principles

- Sensors at the bottom of the 13cm thick bituminous overlay
- Only a half section instrumented : 64 sensors at 15 cm interval from 0 to 10m from runway centreline
- Optical fiber sensors (Bragg network) set to measure wearing course transverse contraction strains
- Acquisition frequency: 2.5kHz
- Per aircraft : 1 to 2 seconds recording
- 2800 aircraft / month

Sensors Installation Principles

- Aluminium tube + mounting brackets
- Optical fiber prestressed between brackets

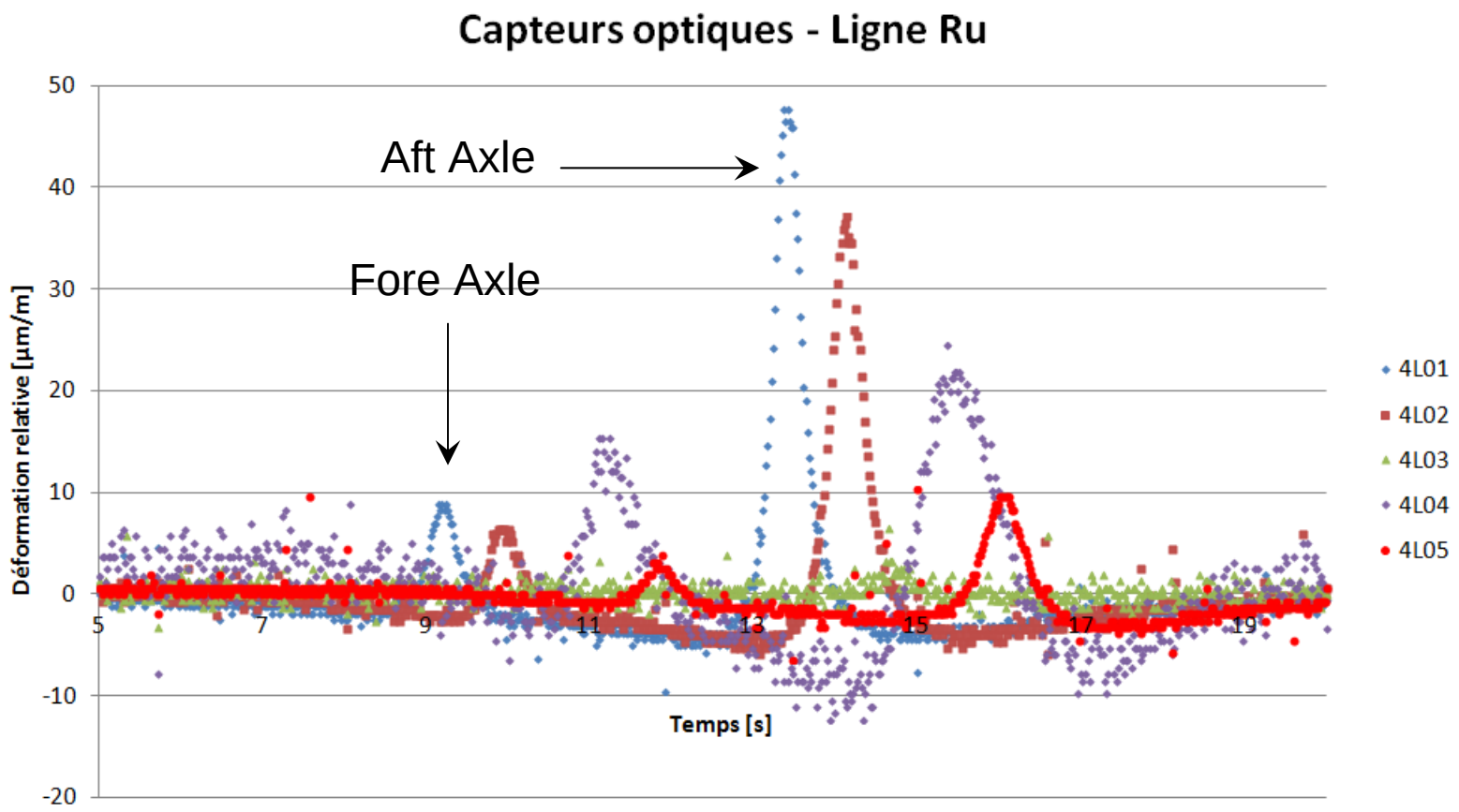
➢Measurement of pure contraction, with no flexion problems



Sensors Installation Principles

- Proof trials - Bonneuil experimental pavement:

12.5t tandem



Signal Preprocessing / Analysis

- 64 Optical sensors @ 15cm spacing :
  - ⇒ contraction basin along runway cross section
  - ⇒ symetry axis of aircraft main gear strut
- ANS traffic control database:
  - Identification of aircraft type/series
- STAC WinFicav Aircraft database :
  - ⇒ Aircraft main gear track
  - ⇒ Offset of Aircraft axis from Rwy centreline

⇒ <u>Wander Distribution per Aircraft type</u>

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HWD Visco-Elastic Modeling

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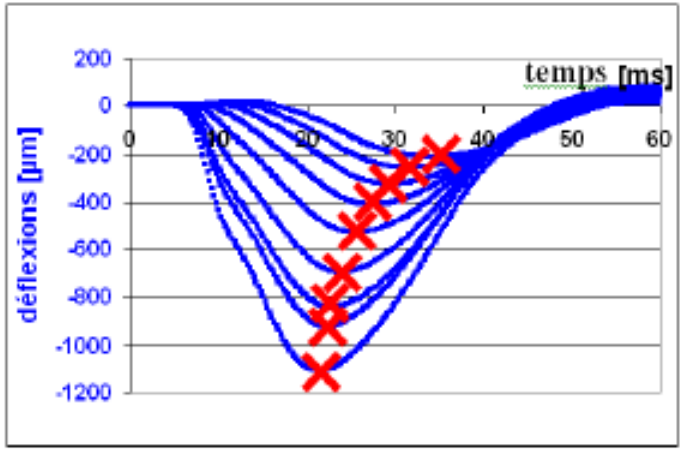
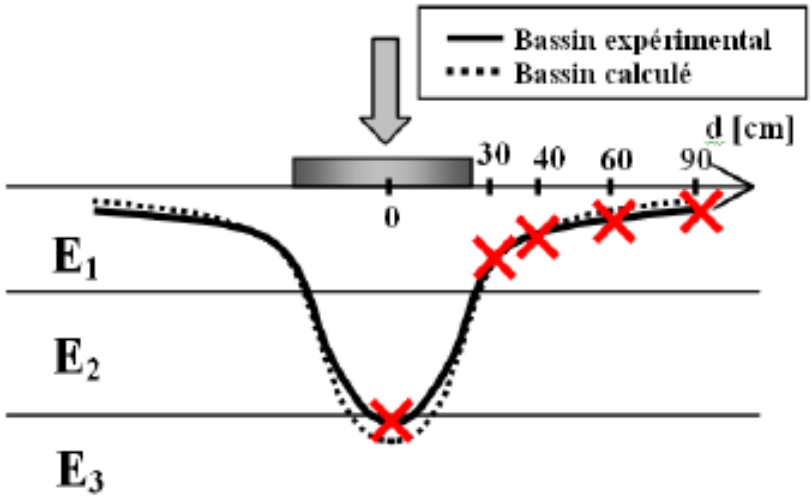
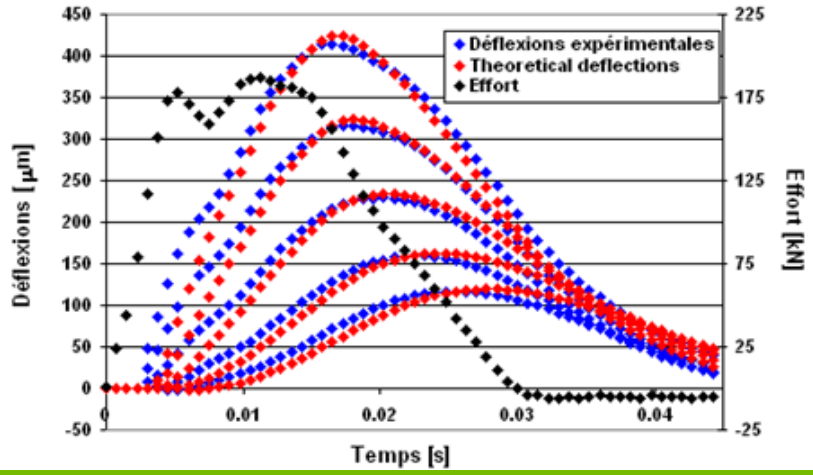
STAC HWD Visco-Elastic Modeling

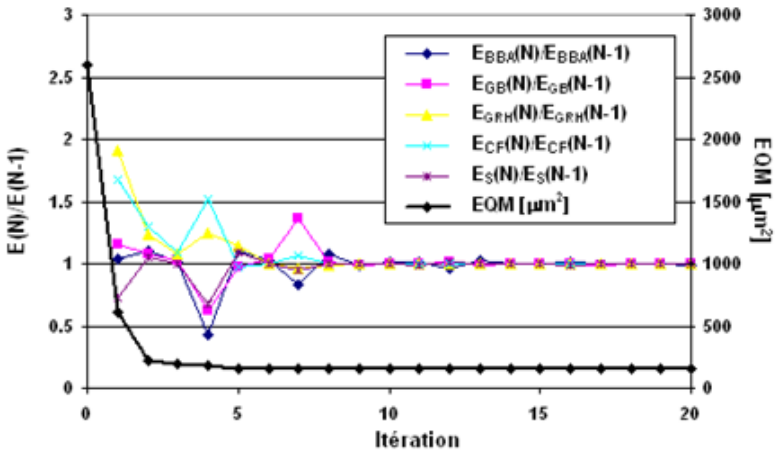
Classical Method





STAC Method [Broutin, 2010] (Time Calculation)

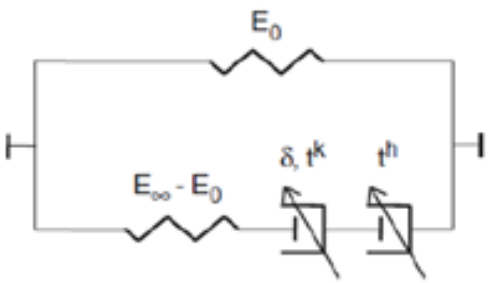


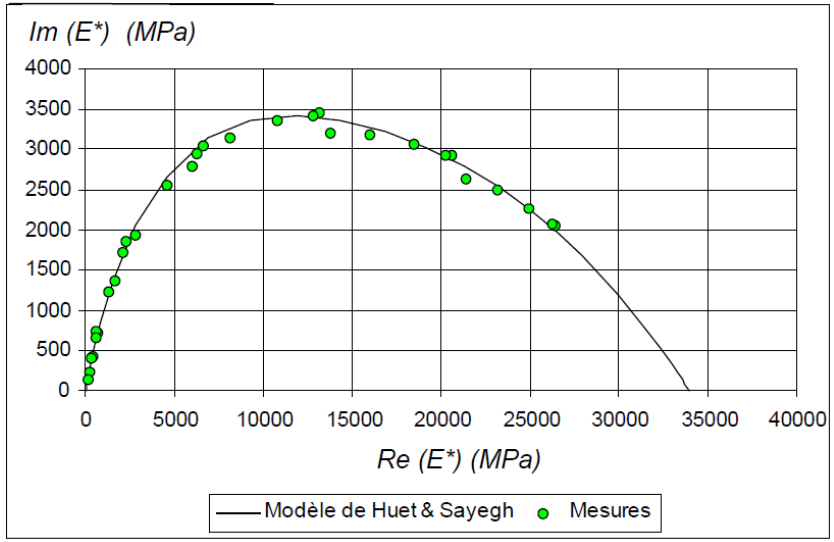


Contribution of the Viscosity of Bituminous materials

- Huet & Sayegh Rheological Model [Sayegh,1965] :

$$E^*(w) = E_0 + \frac{E_\infty - E_0}{1 + \delta(i\omega a(T))^{-k} + (i\omega a(T))^{-h}}$$





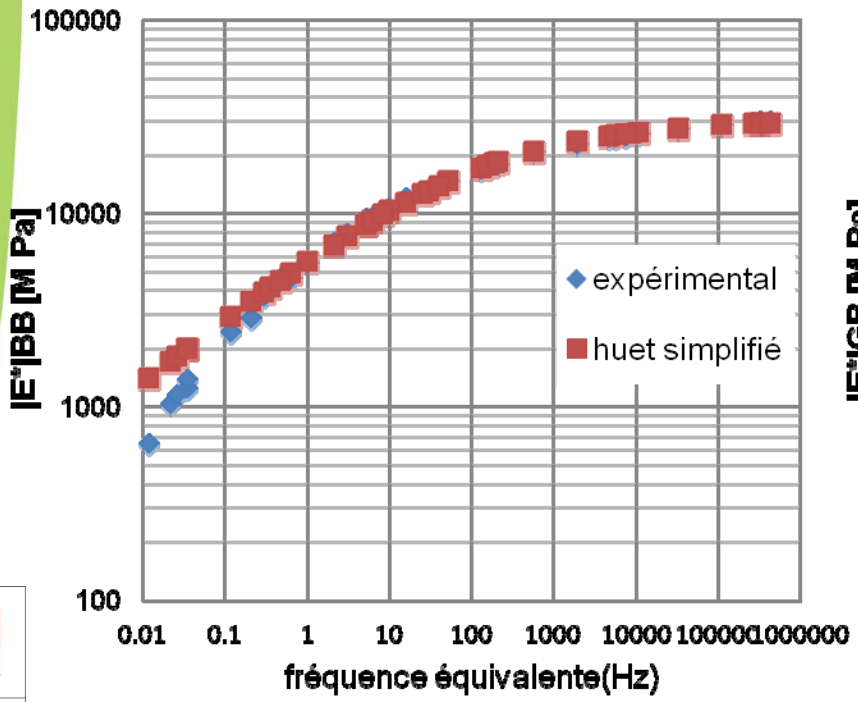
- Huet simplified model [Huet, 1963]:

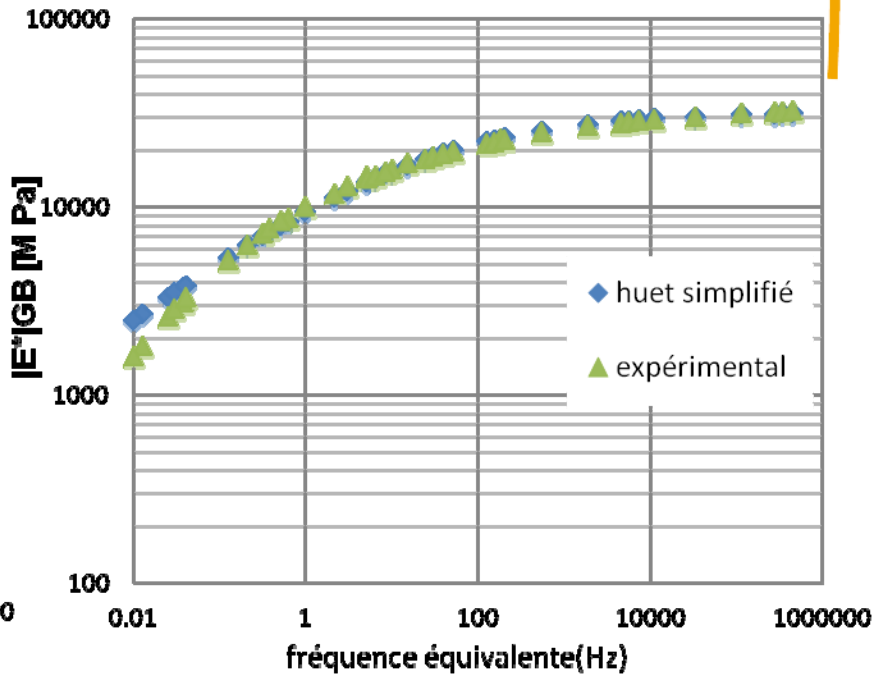
$$E^*(\omega) = \frac{E_\infty}{1 + A(i\omega)^{-\alpha}}$$

Contribution of the Viscosity of Bituminous materials

- Adjusting Huet's Simplified Visco-Elastic Model

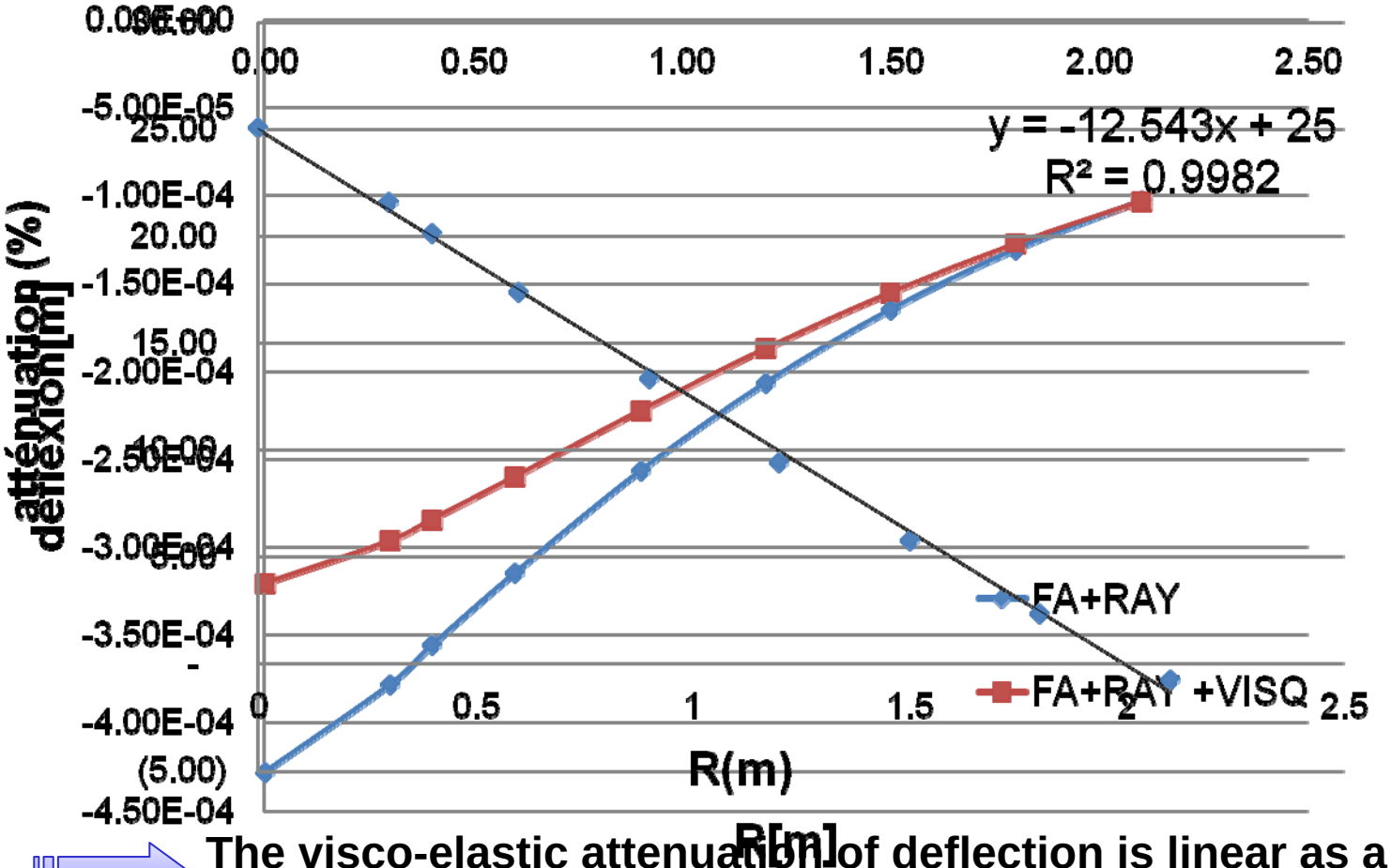
Matériaux	E_∞	A	α
BB 0/10	30378,889	8,623	0,343
GB 0/14	31859,653	4,733	0,339





Contribution of the Viscosity of Bituminous materials

- Analysing the deflexion basin



The visco-elastic attenuation of deflection is linear as a function of distance from the center of the load.

Thank you for you attention

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