

Data Interpretation 1: Fused Si

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Fused Si:



Bulk fused Si

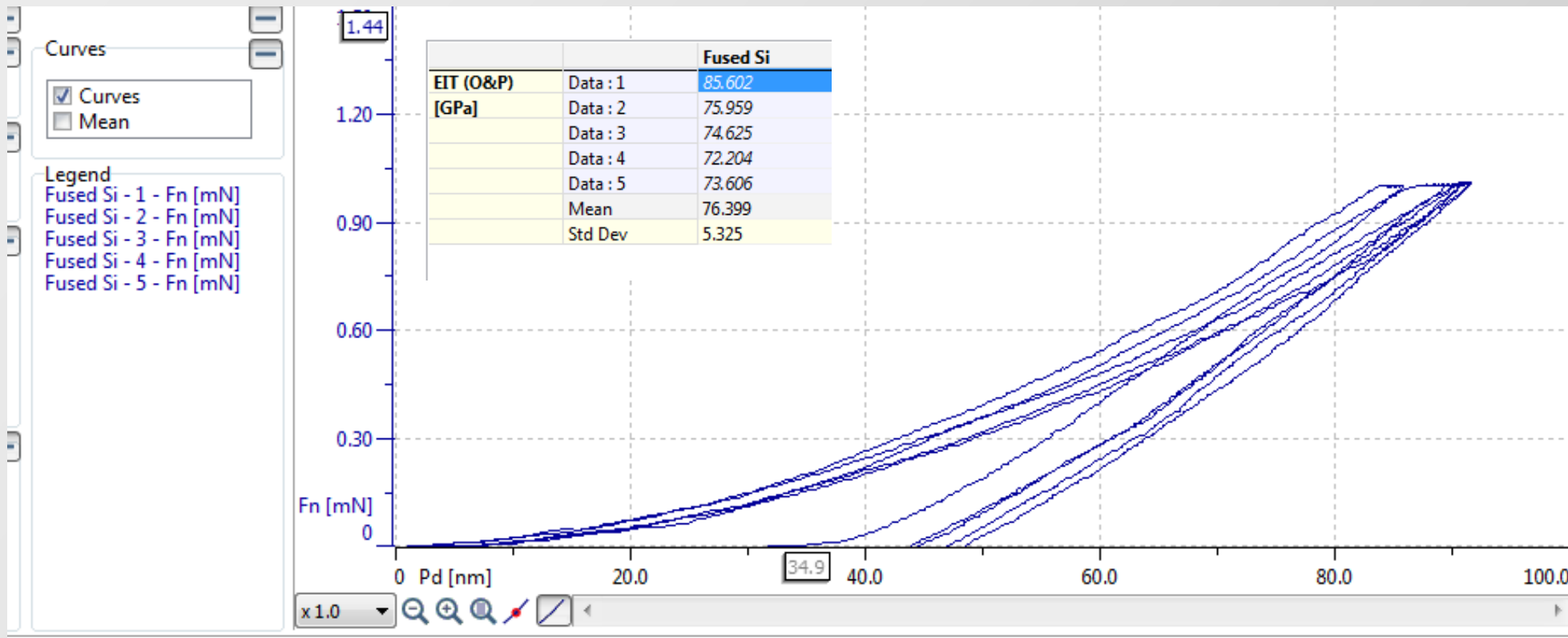
Also known as quartz

Application: optics, springs



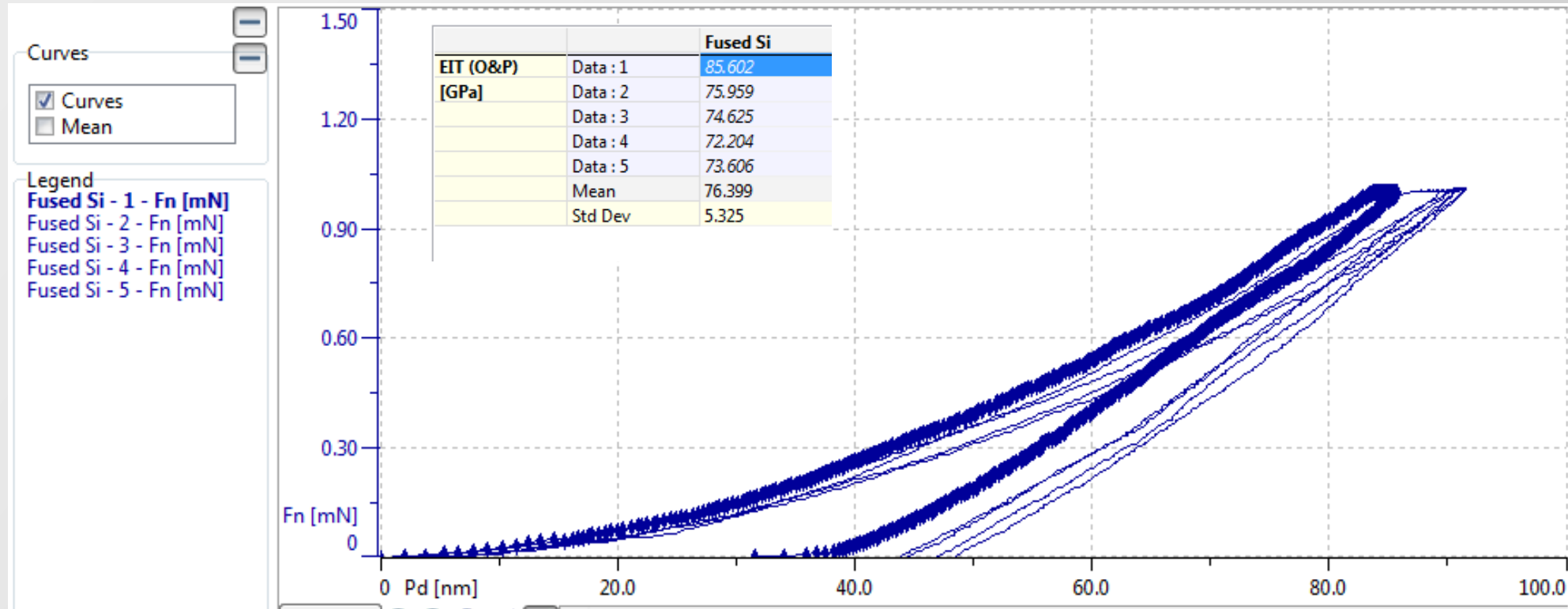
Fused Si: 1 mN

Are we happy with this data set...?



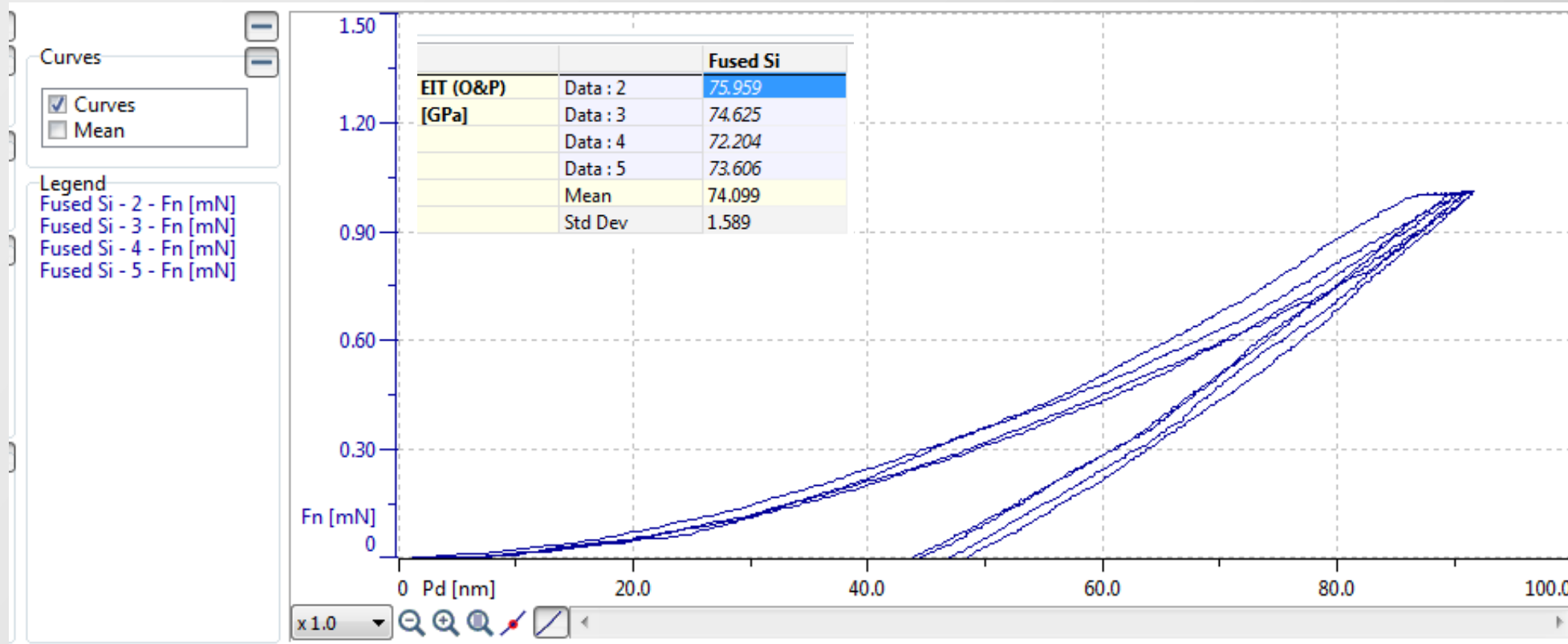
Fused Si: 1 mN

Lets remove the bad measurement...

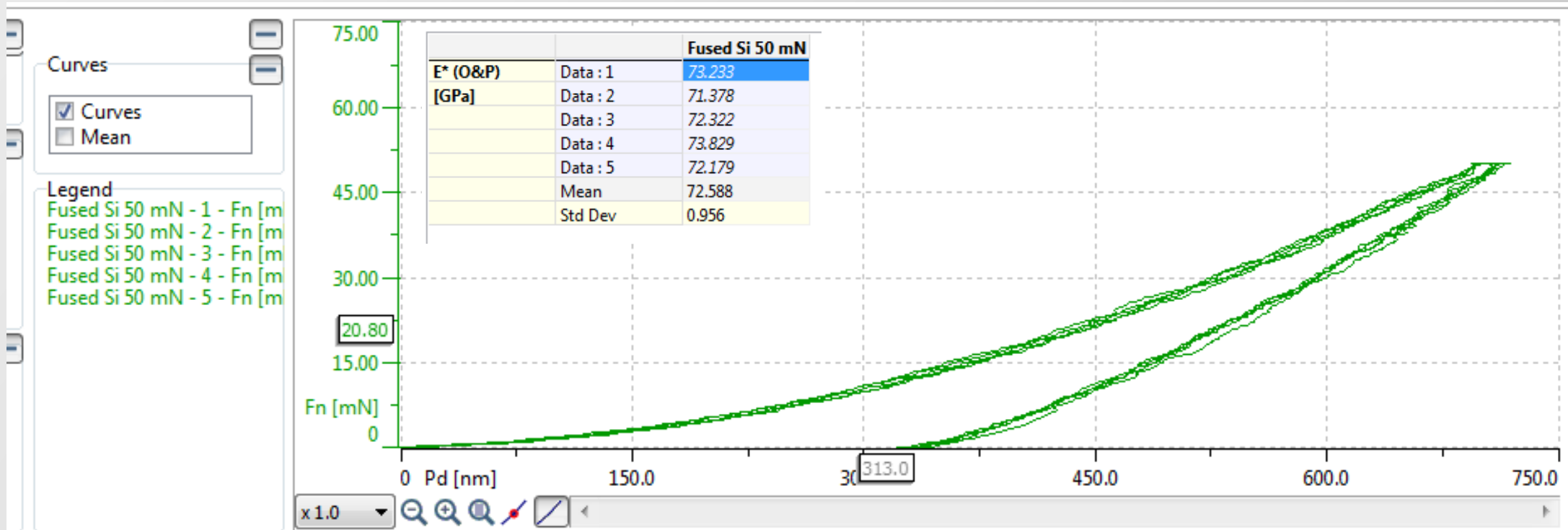


Fused Si: 1 mN

Now its looking better...

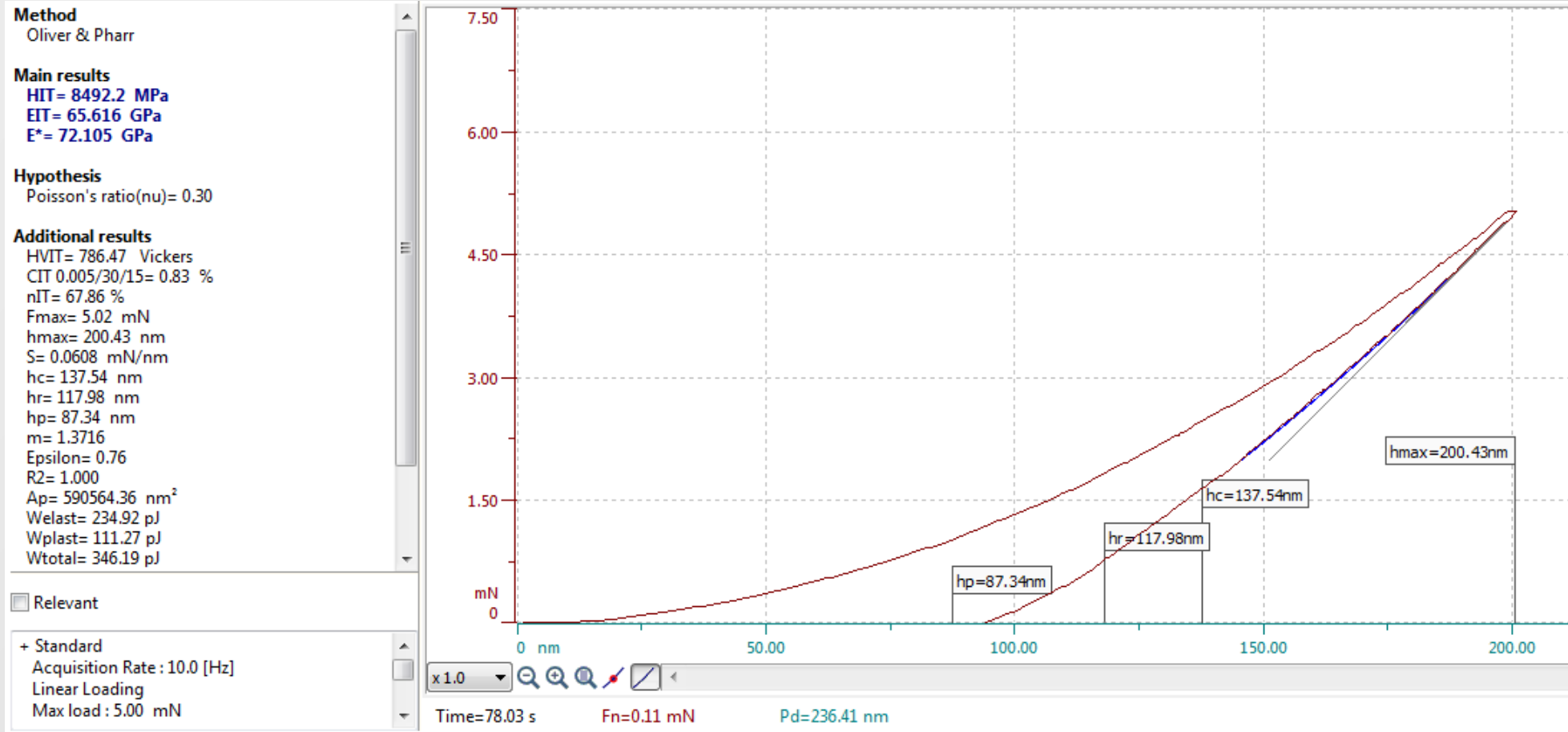


Fused Si: 50 mN

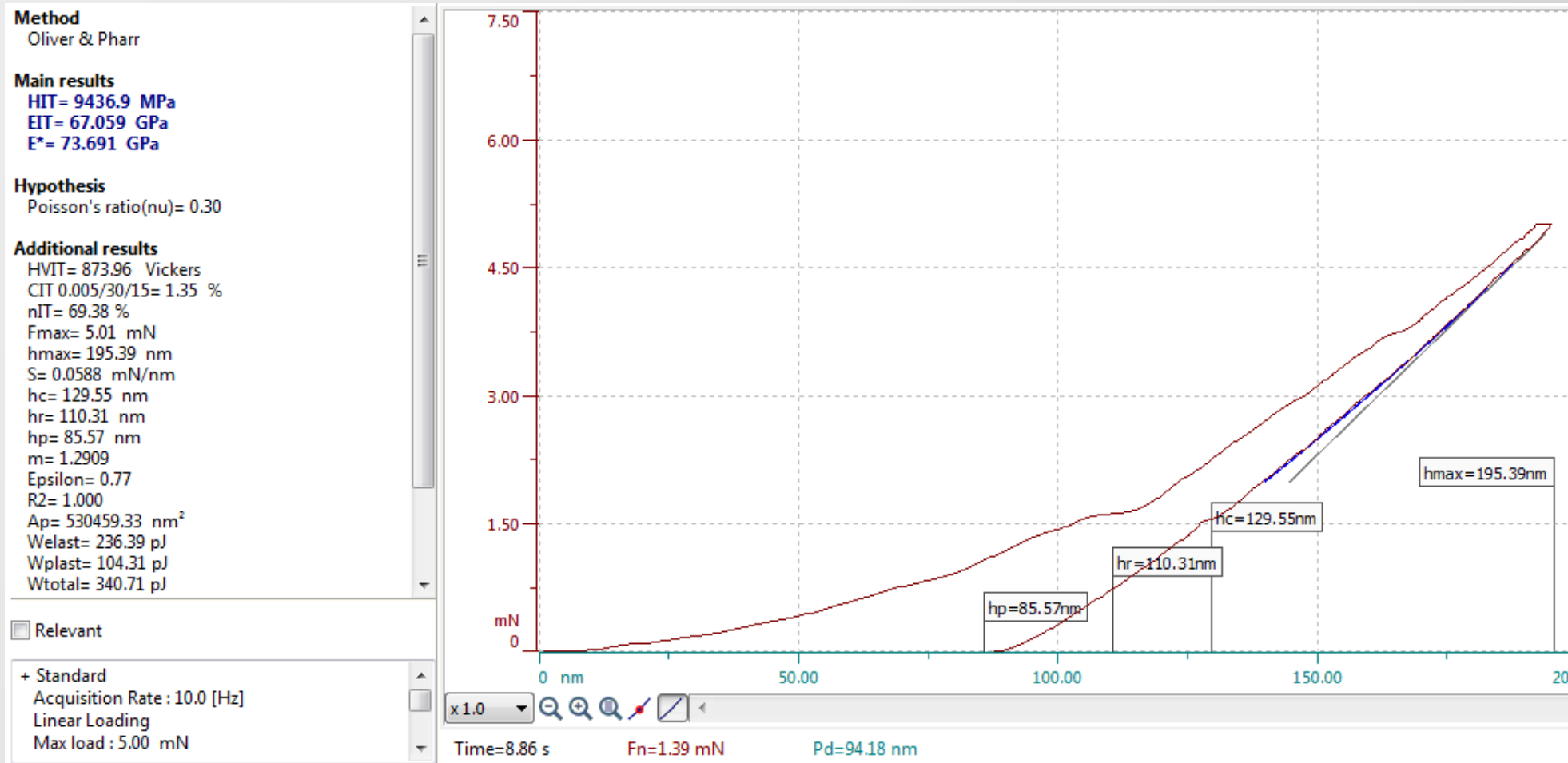


Fused Si: Good data or Bad data?

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Fused Si: Good data or Bad data?

Method

Oliver & Pharr

Main results

HIT= 14232 MPa

EIT= 109.12 GPa

E*= 119.91 GPa

Hypothesis

Poisson's ratio(ν)= 0.30

Additional results

HVIT= 1318 Vickers

CIT 0.005/30/15= 3.51 %

nIT= 76.01 %

Fmax= 4.99 mN

hmax= 150.85 nm

S= 0.0750 mN/nm

hc= 101.90 nm

hr= 84.30 nm

hp= 34.45 nm

m= 1.7491

Epsilon= 0.74

R2= 0.999

Ap= 350791.79 nm²

Welast= 212.69 pJ

Wplast= 67.13 pJ

Wtotal= 279.81 pJ

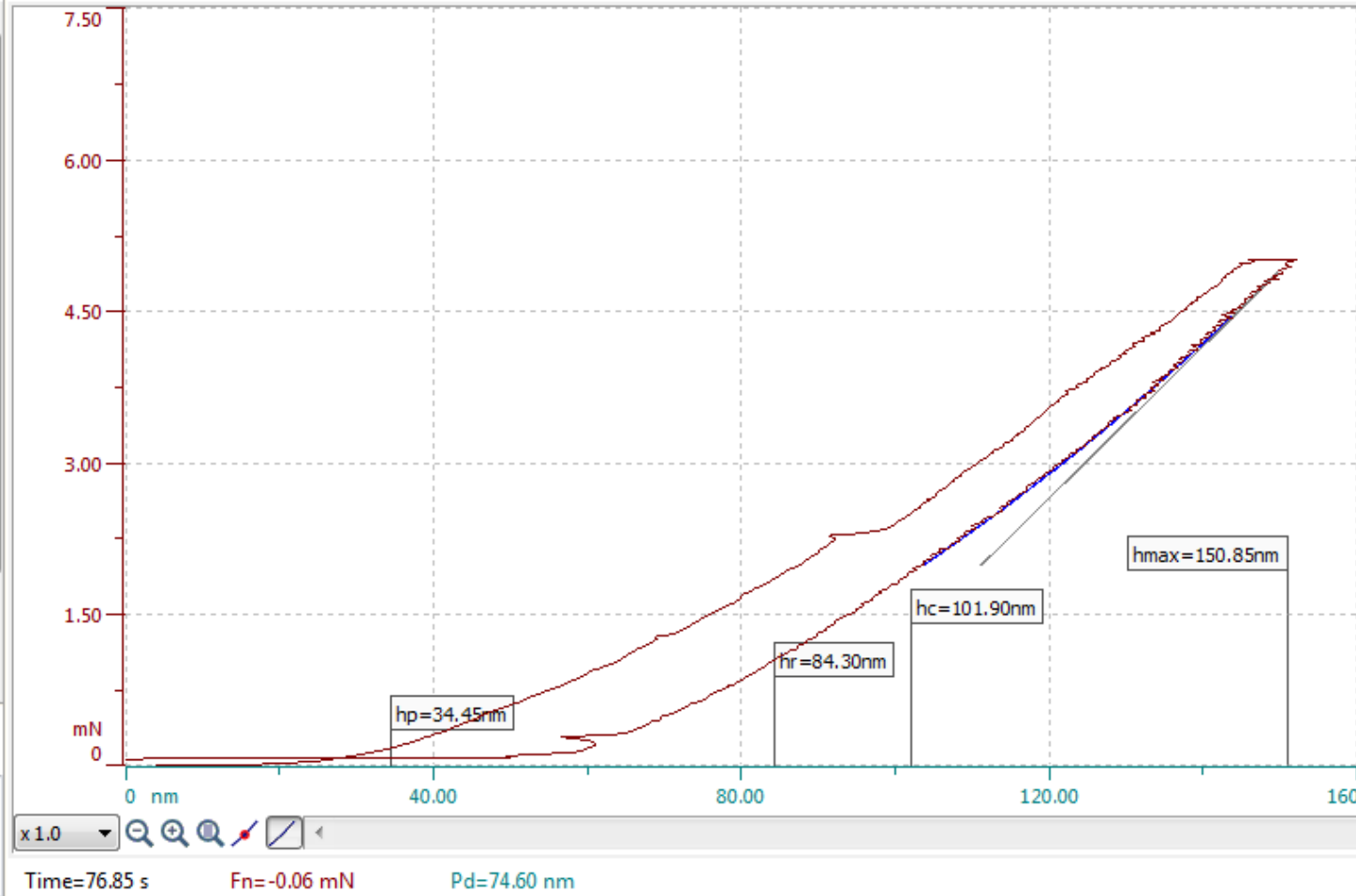
☐ Relevant

+ Standard

Acquisition Rate : 10.0 [Hz]

Linear Loading

Max load : 5.00 mN



Fused Si: Good data or Bad data?

Method

Oliver & Pharr

Main results

HIT= 100.57 MPa

EIT= 6.9042 GPa

E*= 7.587 GPa

Hypothesis

hc out of calibrated range [19 nm, 632 nm]

Poisson's ratio(ν)= 0.30

Additional results

HVIT= 9.3136 Vickers

CIT 0.005/30/15= 0.36 %

nIT= 39.76 %

Fmax= 5.00 mN

hmax= 1482.65 nm

S= 0.0620 mN/nm

hc= 1422.37 nm

hr= 1402.02 nm

hp= 1359.00 nm

m= 1.5336

Epsilon= 0.75

R2= 1.000

Ap= 49706144.79 nm²

Welast= 234.27 pJ

Wplast= 354.99 pJ

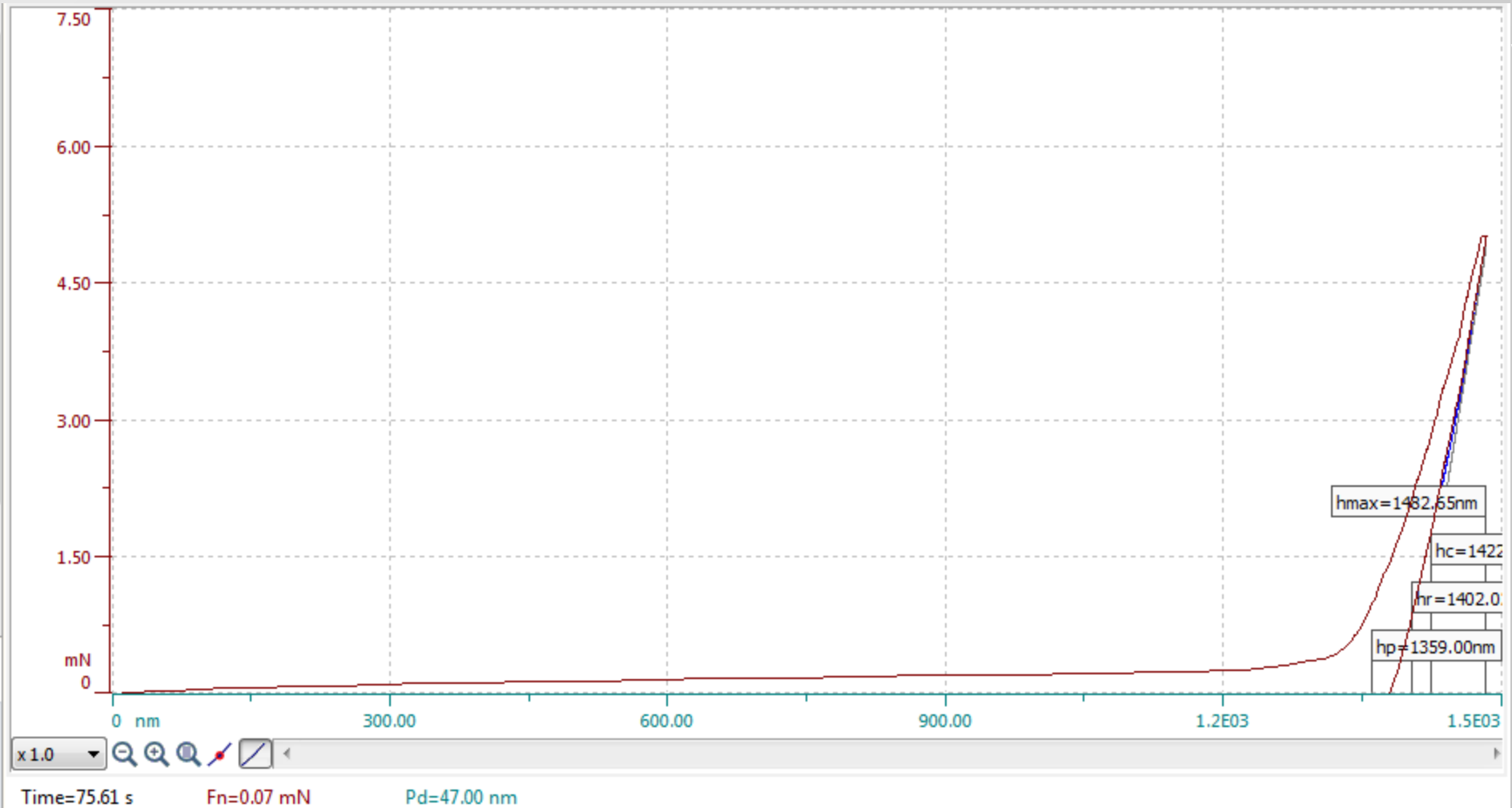
☐ Relevant

+ Standard

Acquisition Rate : 10.0 [Hz]

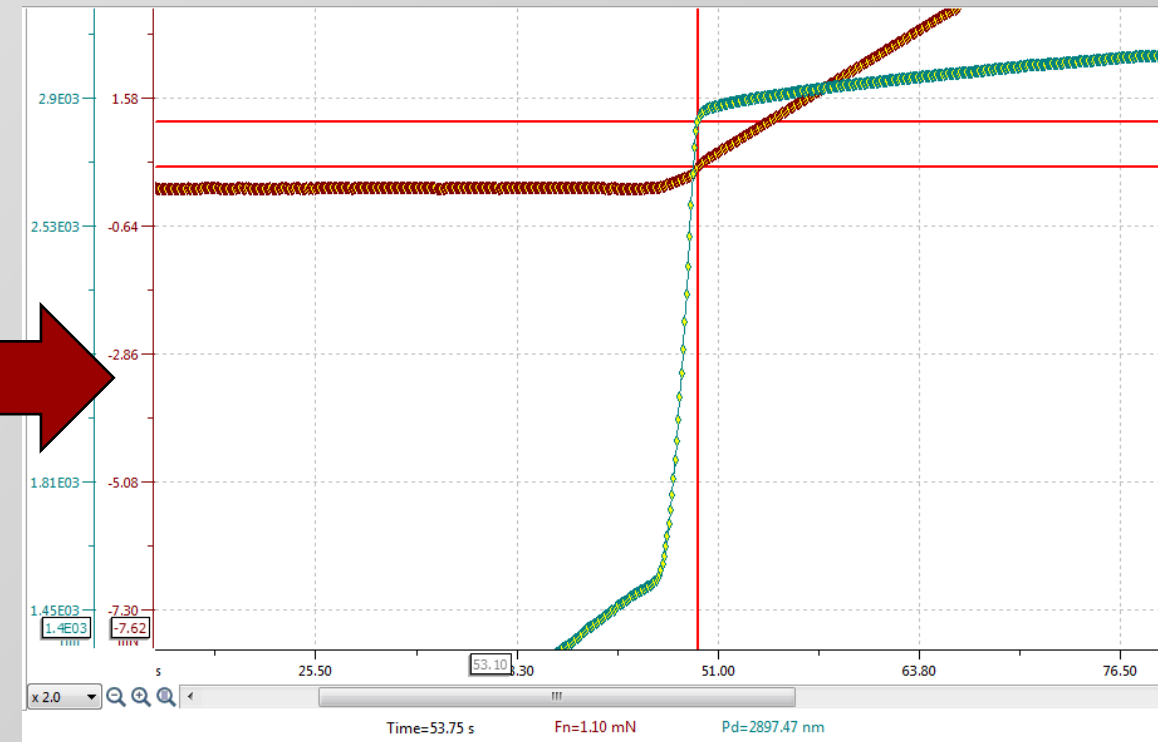
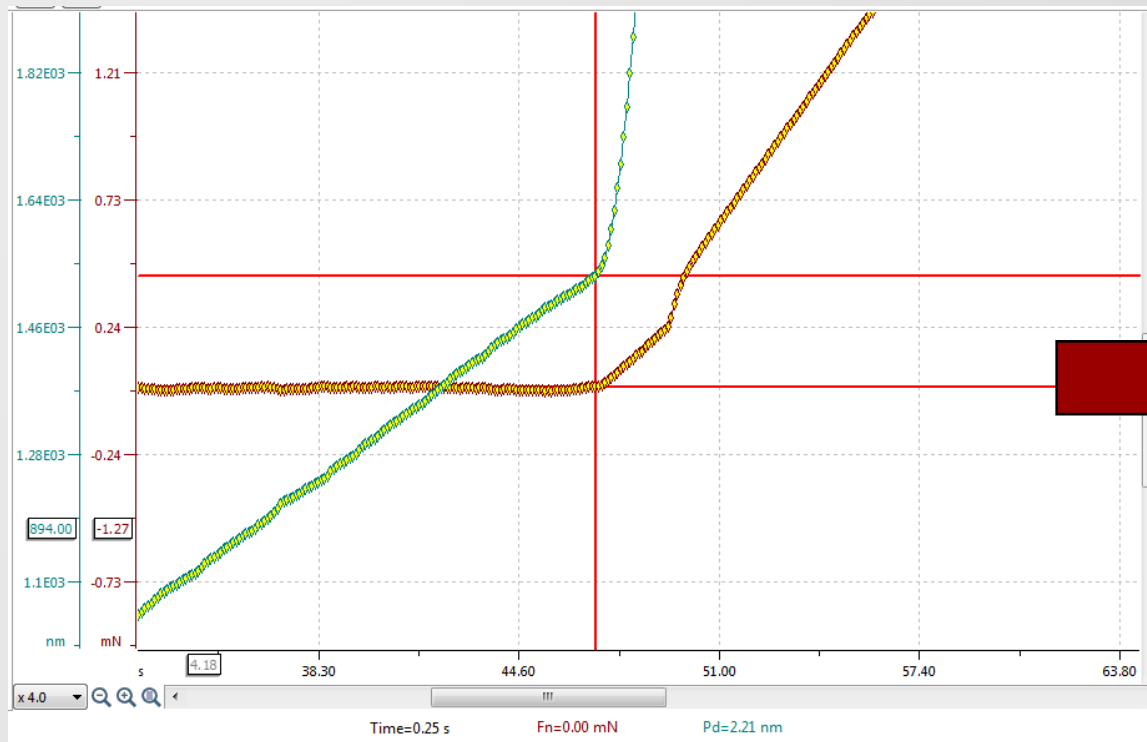
Linear Loading

Max load : 5.00 mN



Fused Si: Good data or Bad data?

Can readjustment of the contact point save this measurement...?



Fused Si: Good data or Bad data?

E=76 GPa

Method
Oliver & Pharr

Main results

HIT= 8092.2 MPa
EIT= 69.206 GPa
E*= 76.051 GPa

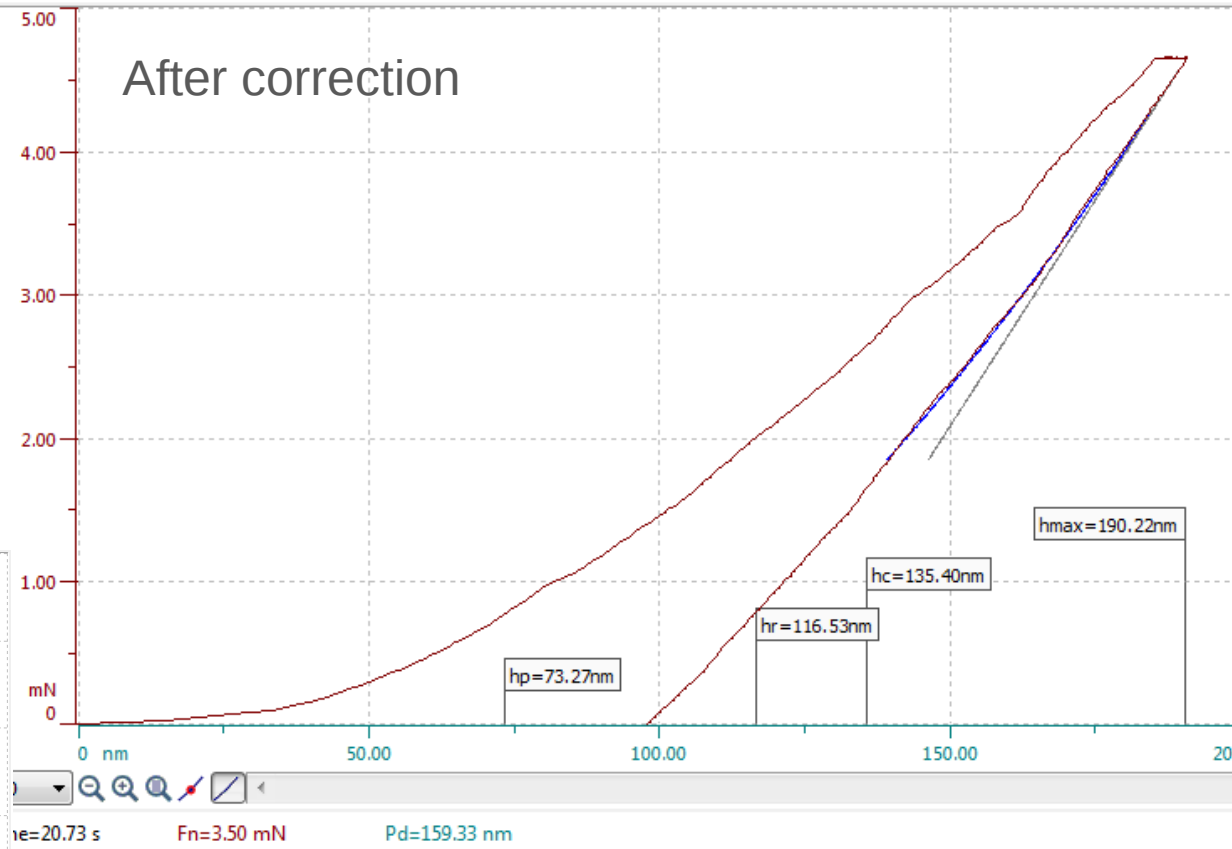
Hypothesis

Poisson's ratio(ν)= 0.30

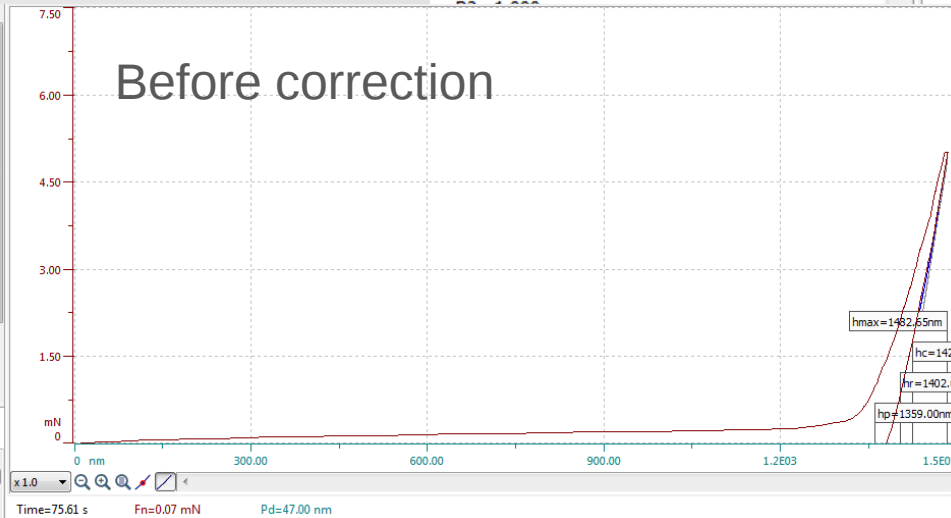
Additional results

HVIT= 749.43 Vickers
CIT 0.005/30/15= 2.84 %
nIT= 62.02 %
Fmax= 4.65 mN
hmax= 190.22 nm
S= 0.0631 mN/nm
hc= 135.40 nm
hr= 116.53 nm
hp= 73.27 nm
m= 1.5870
Epsilon= 0.74

After correction



Before correction



Method
Oliver & Pharr

Main results

HIT= 100.57 MPa
EIT= 6.9042 GPa
E*= 7.587 GPa

Hypothesis

hc out of calibrated range [19 nm, 632 nm]
Poisson's ratio(ν)= 0.30

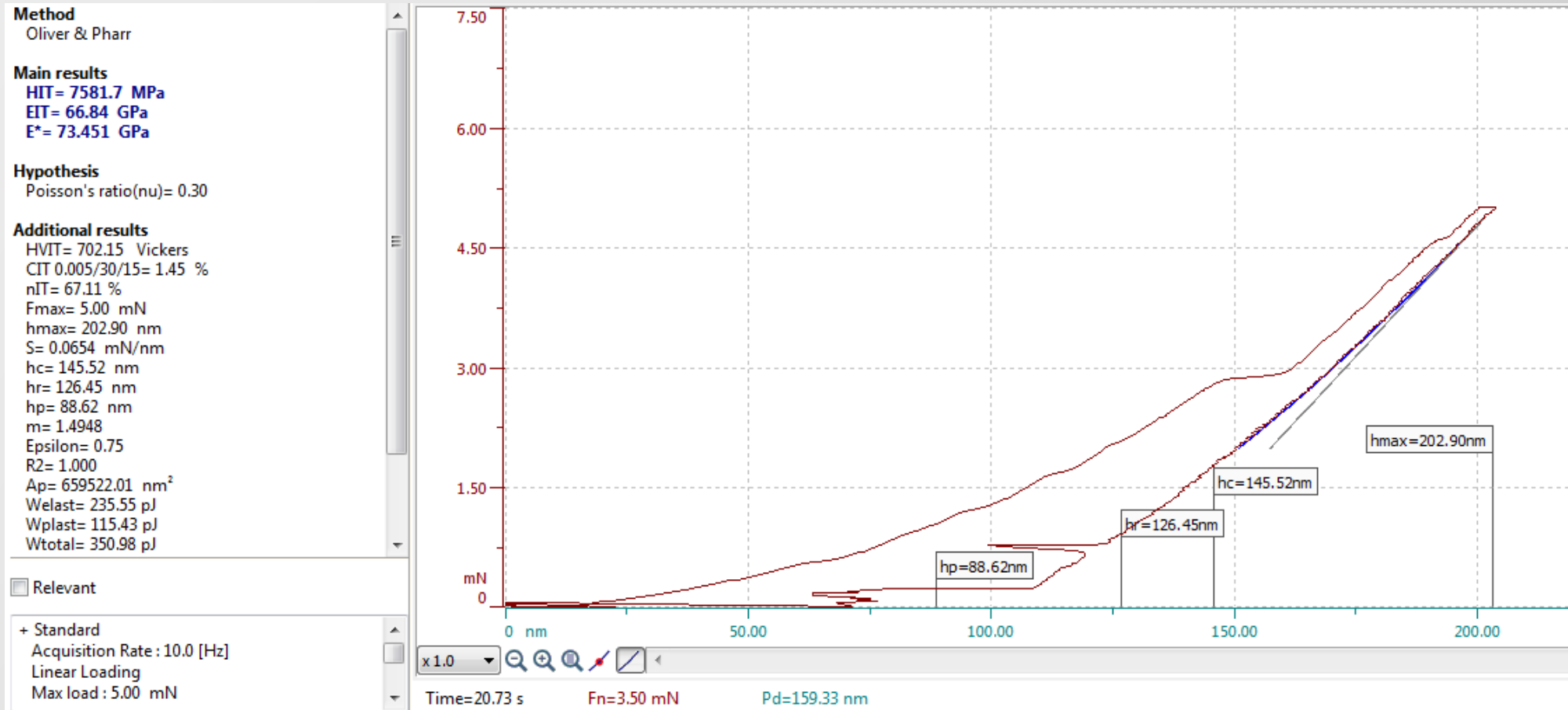
Additional results

HVIT= 9.3136 Vickers
CIT 0.005/30/15= 0.36 %
nIT= 39.76 %
Fmax= 5.00 mN
hmax= 1482.65 nm
S= 0.0620 mN/nm
hc= 1422.37 nm
hr= 1402.02 nm
hp= 1359.00 nm
m= 1.5336
Epsilon= 0.75
R2= 1.000
Ap= 49706144.79 nm²
W elast= 234.27 pJ
W plast= 354.99 pJ

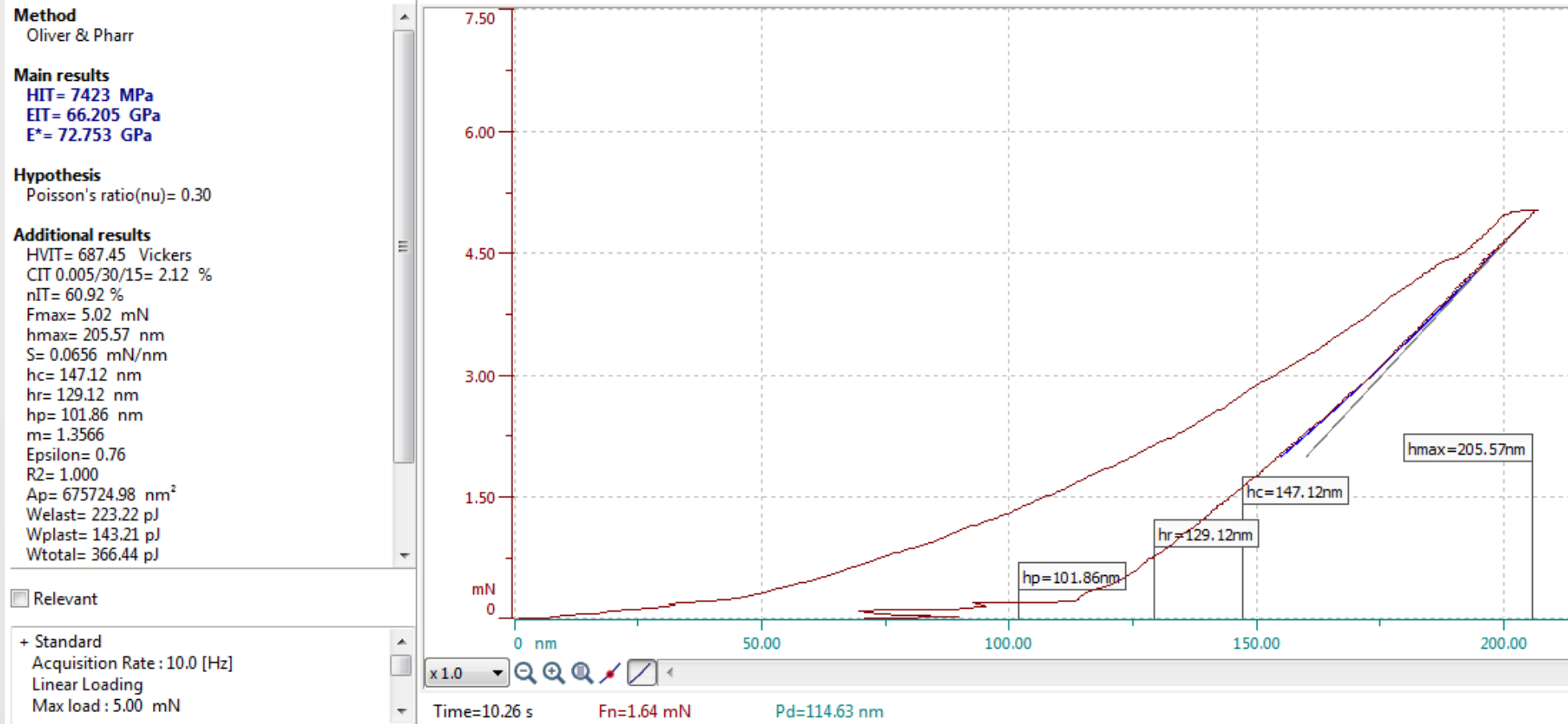
Relevant

Standard
Acquisition Rate: 10.0 [Hz]
Linear Loading
Max load: 5.00 mN

Fused Si: Good data or Bad data?



Fused Si: Good data or Bad data?



Fused Si: Good data or Bad data?

Method

Oliver & Pharr

Main results

HIT = 6175.2 MPa

EIT = 56.701 GPa

E* = 62.308 GPa

Hypothesis

Poisson's ratio(ν) = 0.30

Additional results

HVIT = 571.89 Vickers

CIT 0.005/30/15 = 0.78 %

nIT = 67.87 %

Fmax = 5.01 mN

hmax = 228.22 nm

S = 0.0621 mN/nm

hc = 164.04 nm

hr = 147.55 nm

hp = 131.98 nm

m = 1.1930

Epsilon = 0.80

R2 = 0.999

Ap = 811464.49 nm²

Welast = 230.36 pJ

Wplast = 109.08 pJ

Wtotal = 339.43 pJ

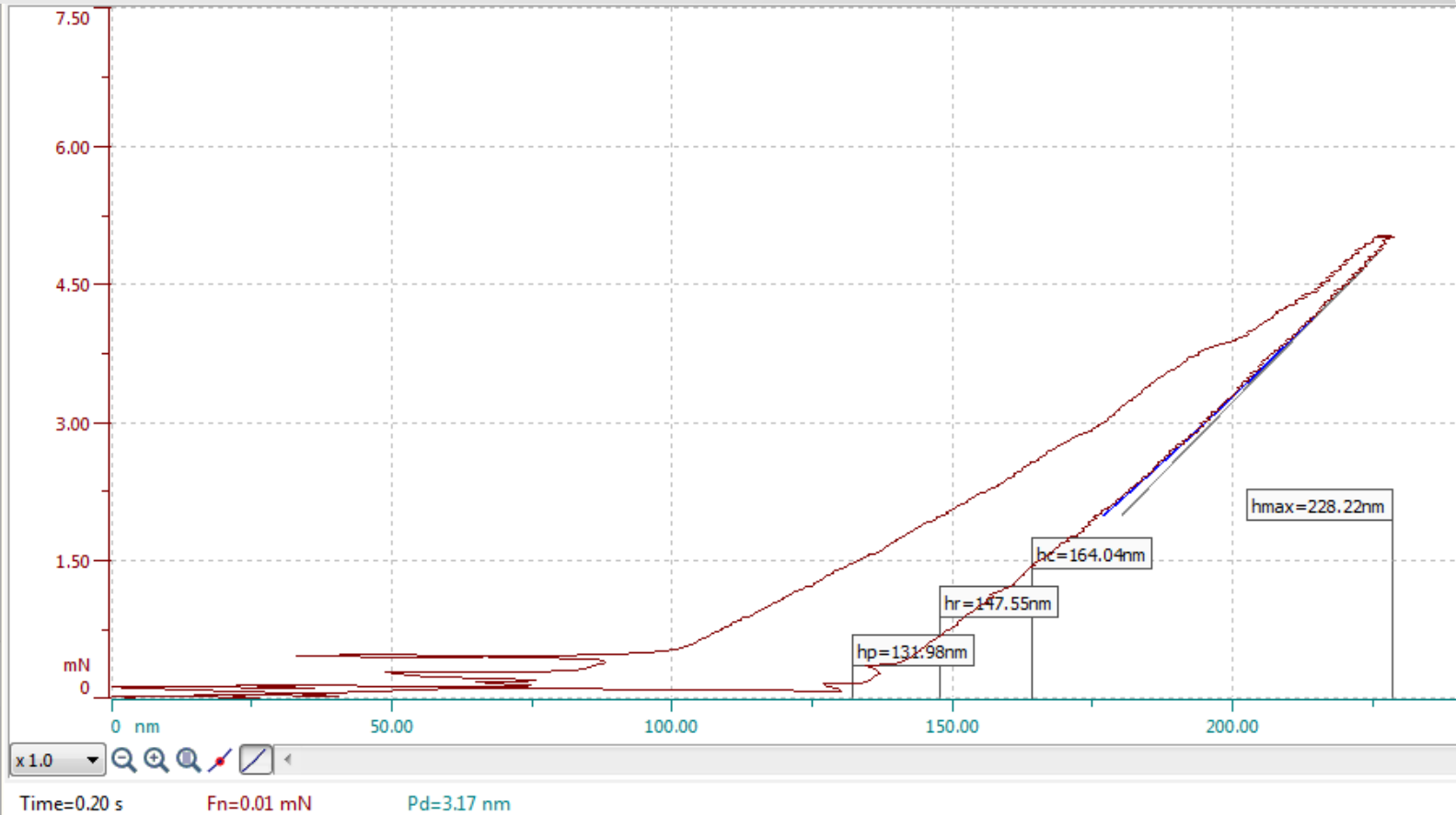
☐ Relevant

+ Standard

Acquisition Rate: 10.0 [Hz]

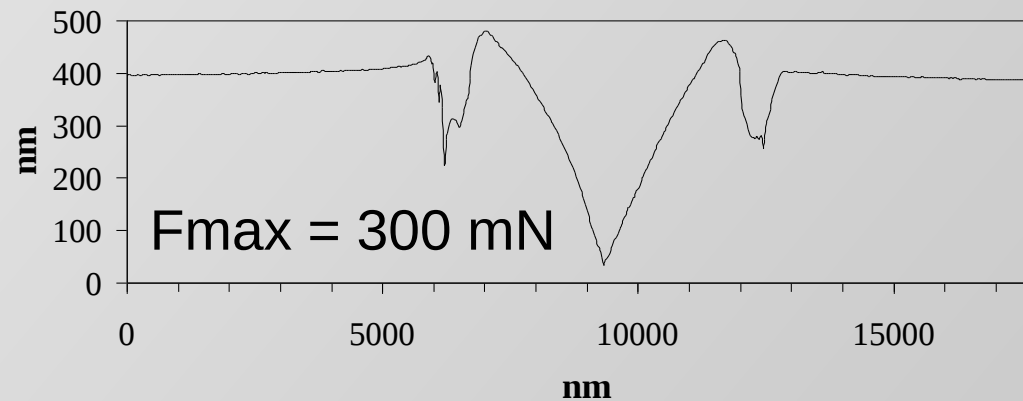
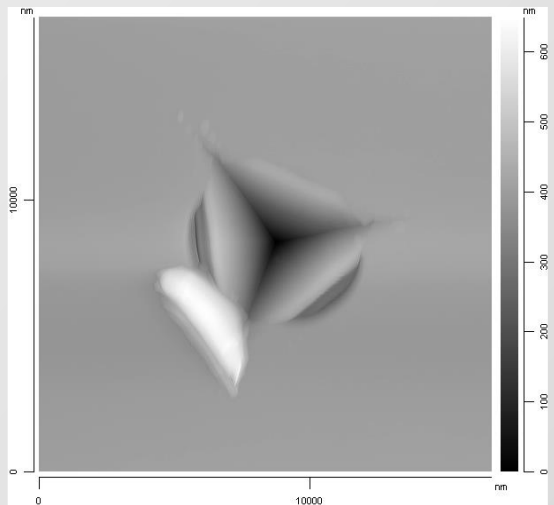
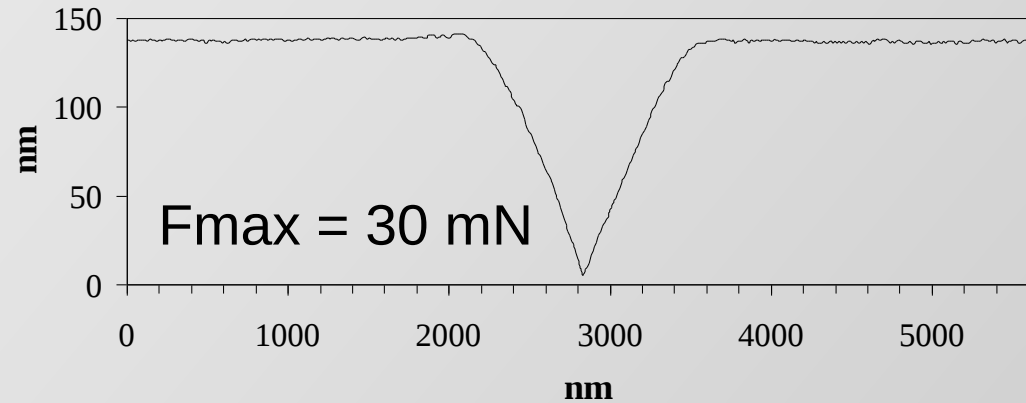
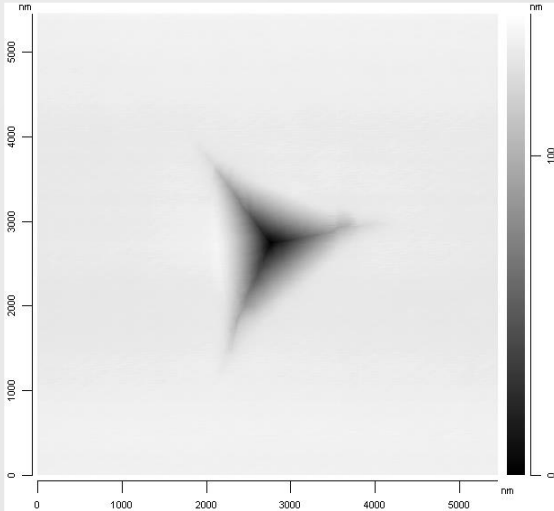
Linear Loading

Max load: 5.00 mN



Fused Si

- Fused Si tends to crack at loads > 50 mN (with Berkovich)



Fused Si: Dry vs. Liquid testing

