Shock Study on Cylinder W-target

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  - 10ns pulse
    - Along the path of r
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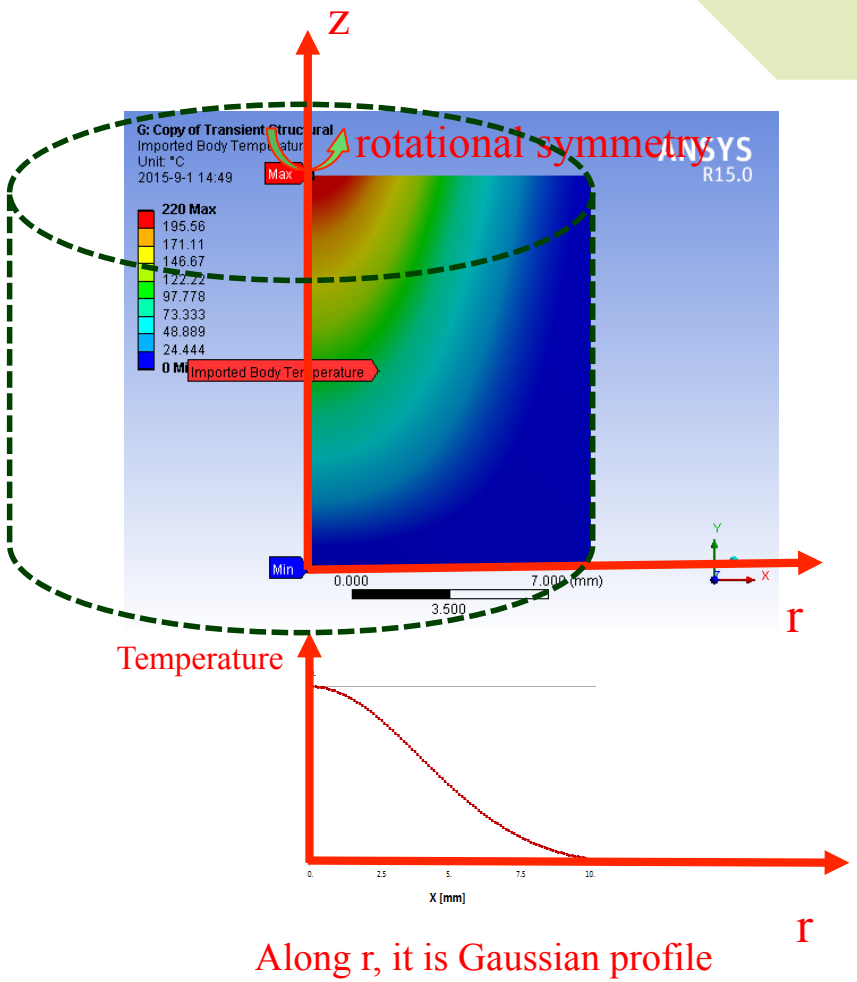
Introduction

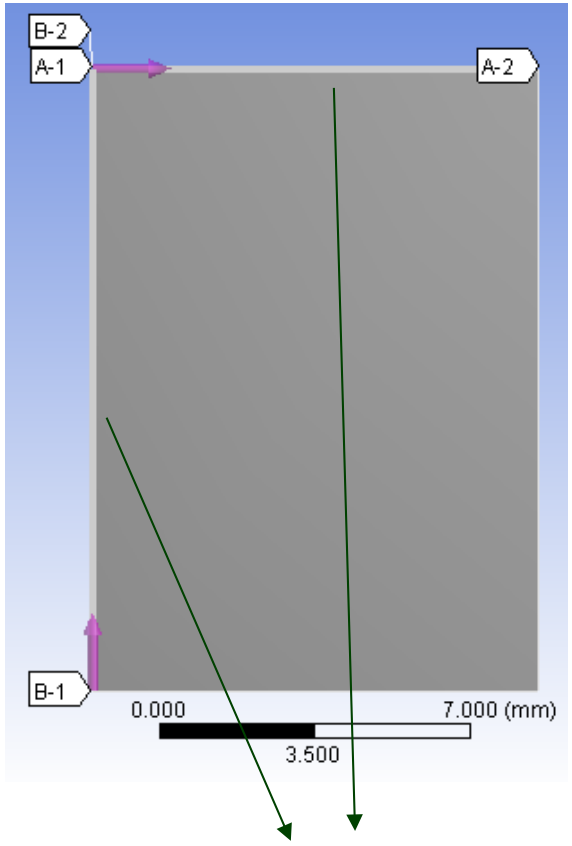
- Target
  - A target cylinder in W, with R=10 mm and a thickness z0=14 mm
  - Completely free at R and z=0 and z=z0.
  - The temperature field is given by:
    - T(r,z)= 220 oC x z/zo x Gauss(sigma 4 mm).
    - It rises with z and has rotational symmetry in r.



Realistic temperature profile for one single pulse

Introduction

- Simulation focus on:
  - for 10 ns and 1 micro-s pulse heating;
  - For checking sigma r, sigma phi and sigma z and v.M. stress,respectively;
  - Paths for study are at the end face at z=zo and versus r and the stresses at r=0 along the axis z;
  - We will see the stresses on following time:
    - for the 10 ns pulse: at 10 ns, and 200 ns, 500 ns, 1000 ns, and later, if interesting.
    - For the 1 micro-s pulse at 200 ns, 500 ns, 1000 ns=1 micro-s, and later if interesting.

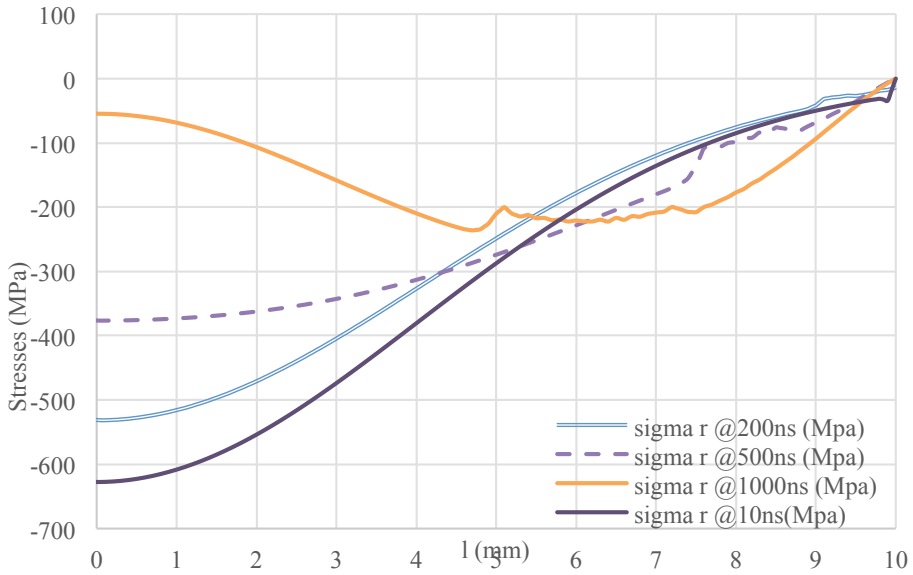


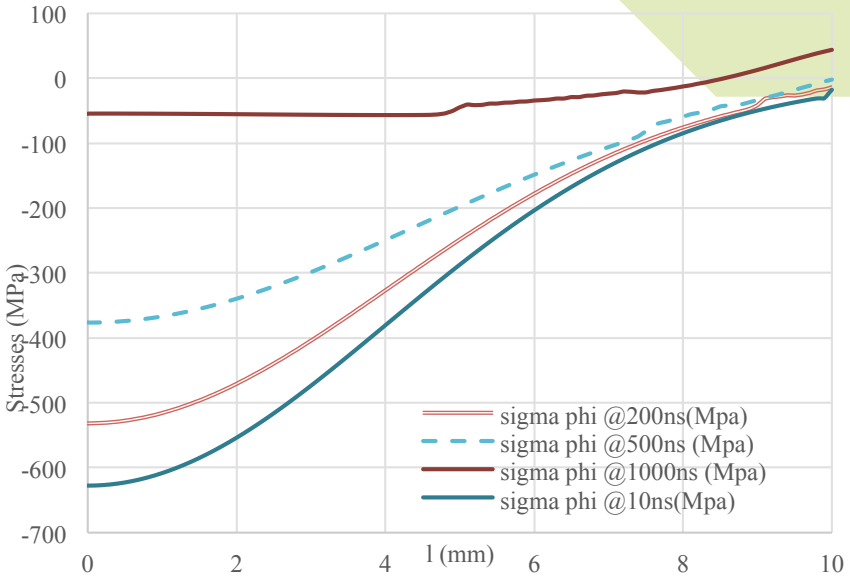
We will see the stress on the two paths

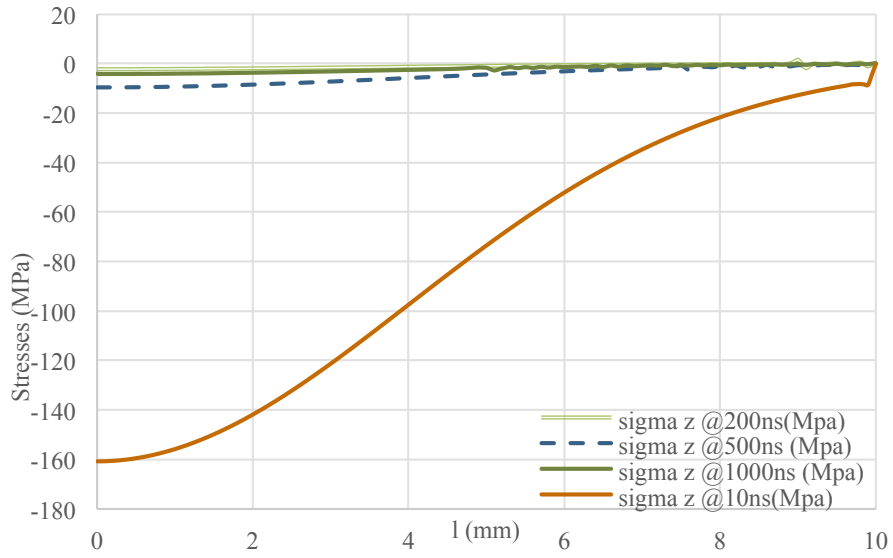
10ns pulse

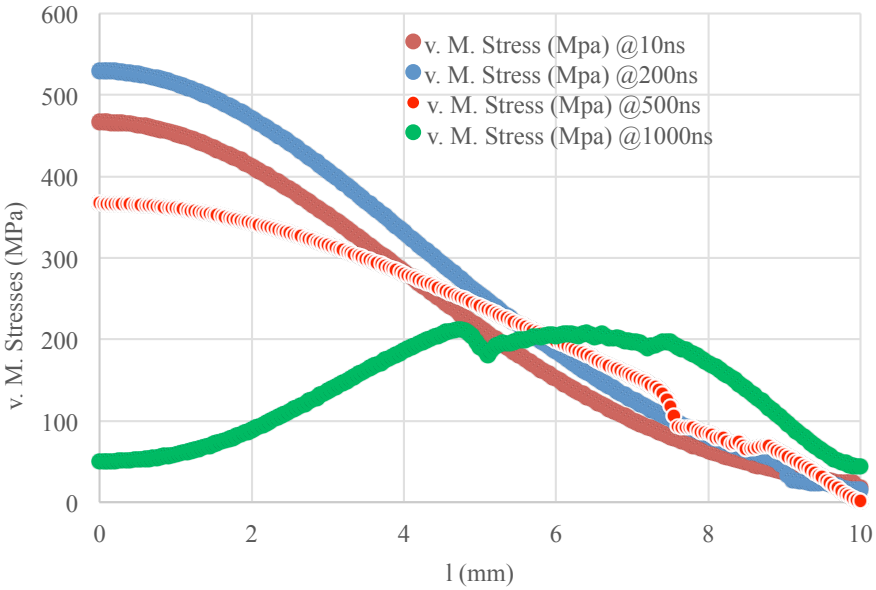
-----to verify the code and understand the principle of waves

10ns pulse along r



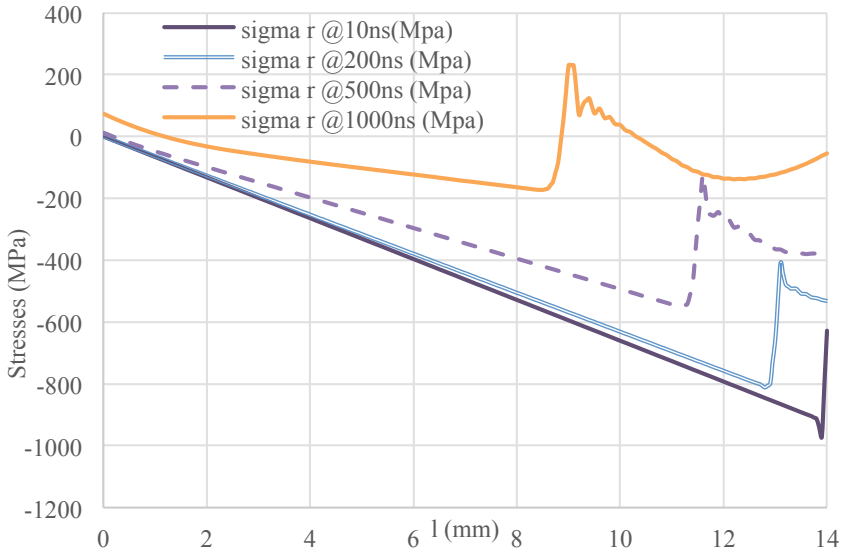


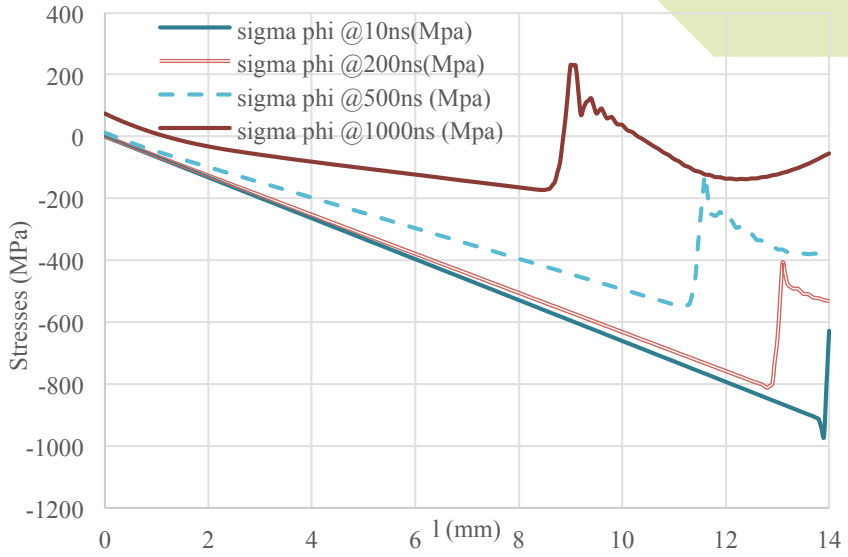


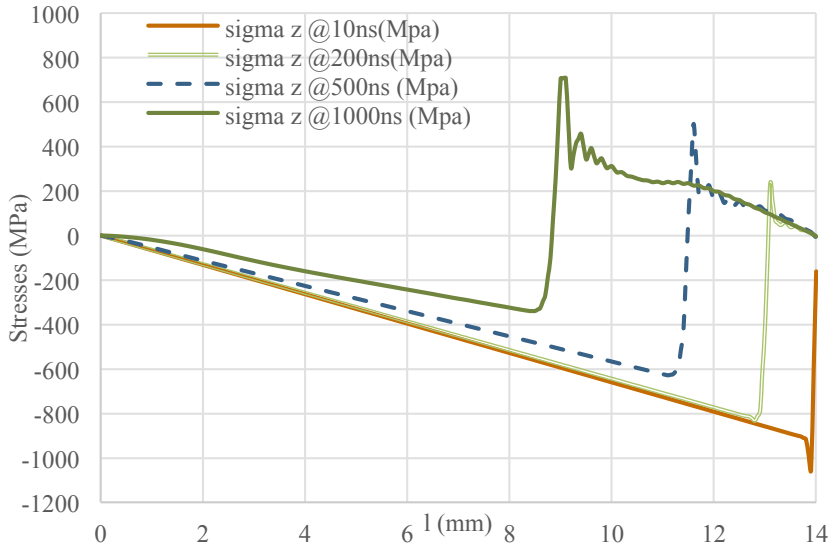


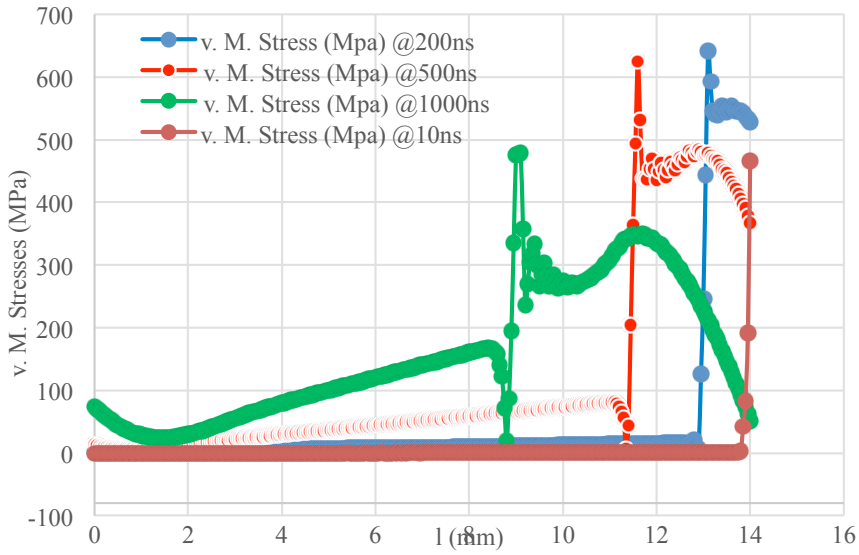
10ns pulse along z

---max. stress can be as high as 1000MPa





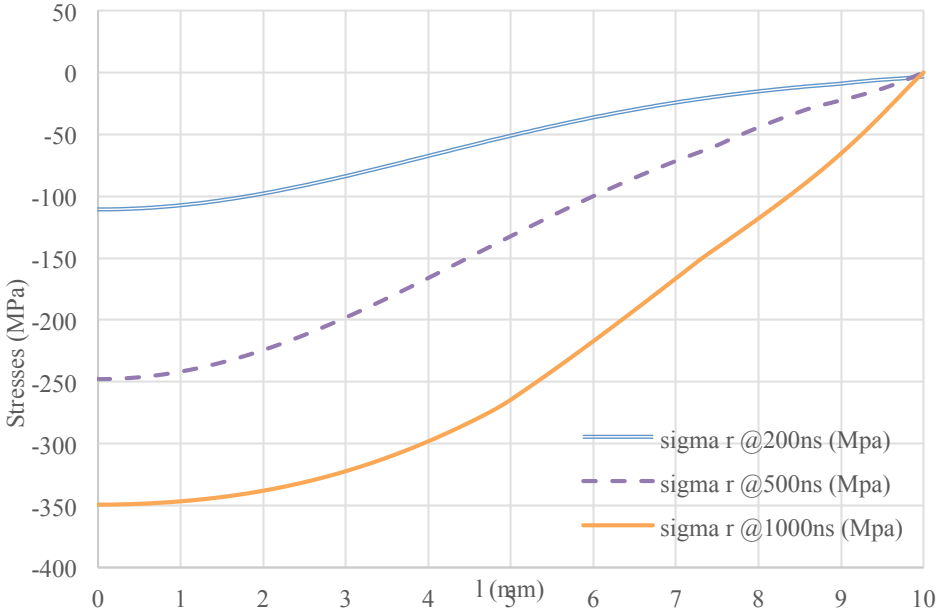


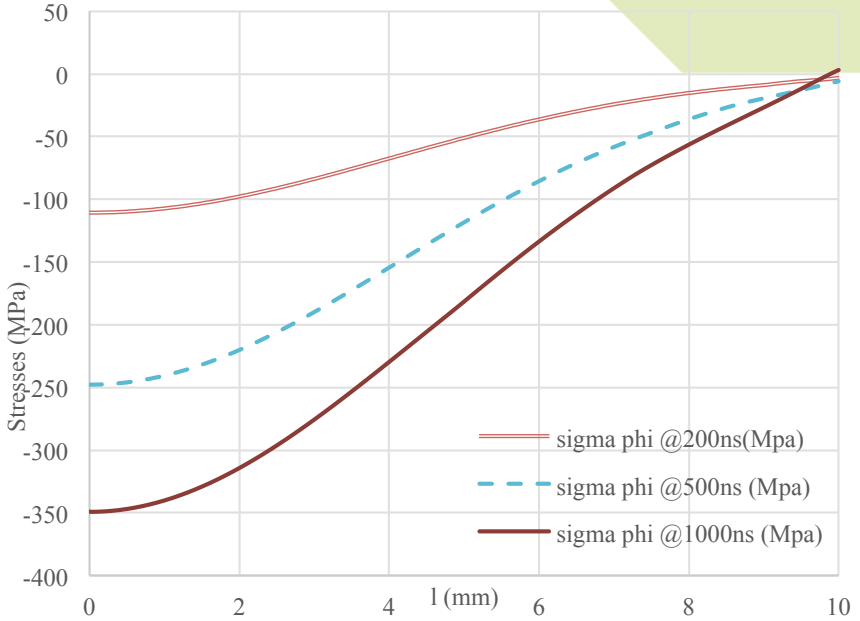


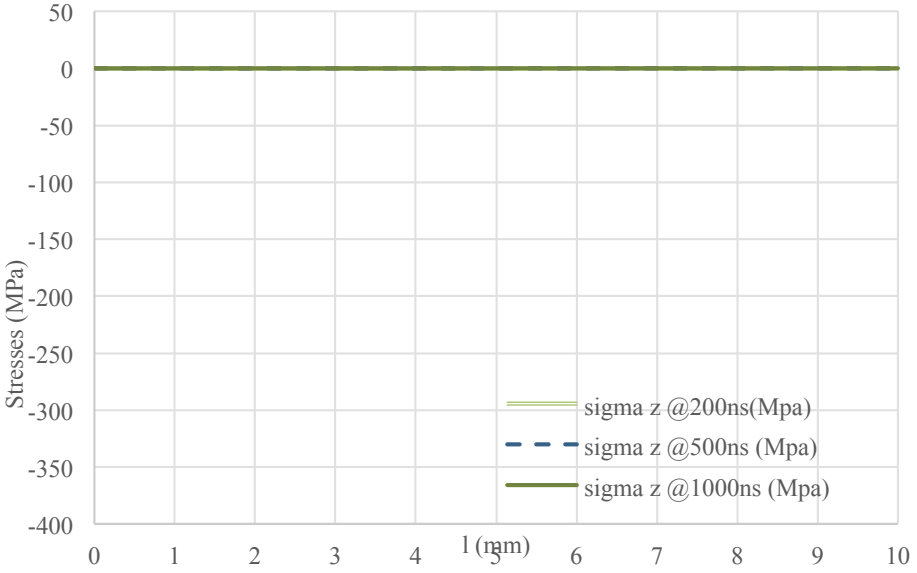
1us pulse

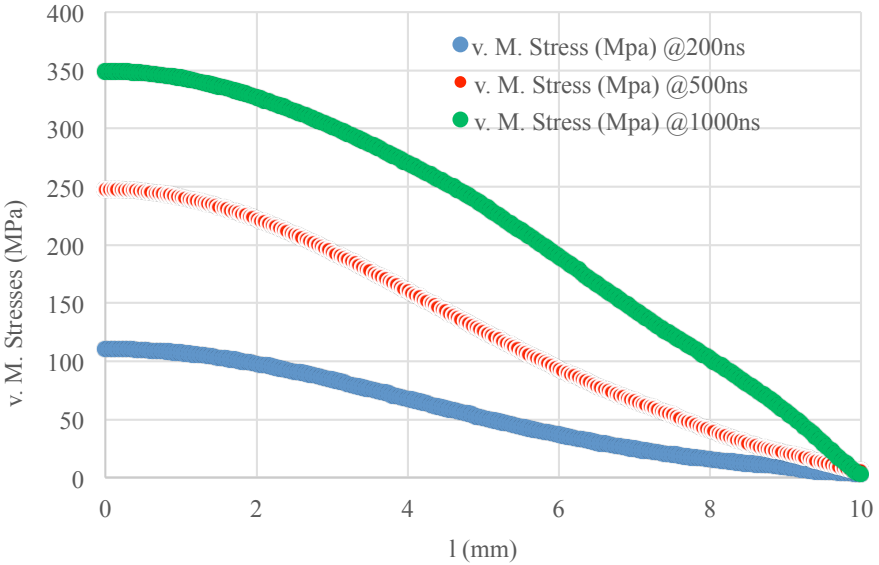
-----for the realistic pulse duration, as expected further conventional, e-beam driven target.

1us pulse along r

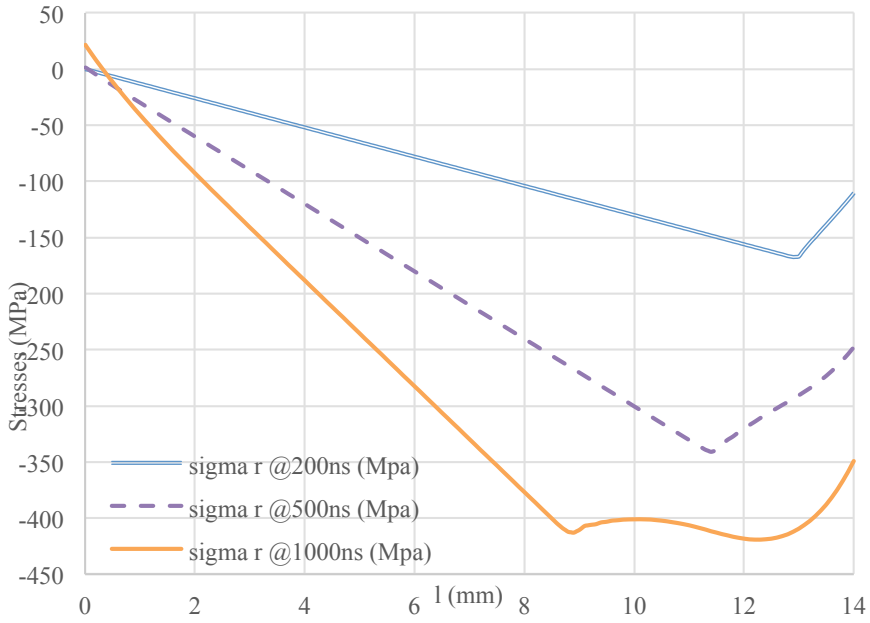


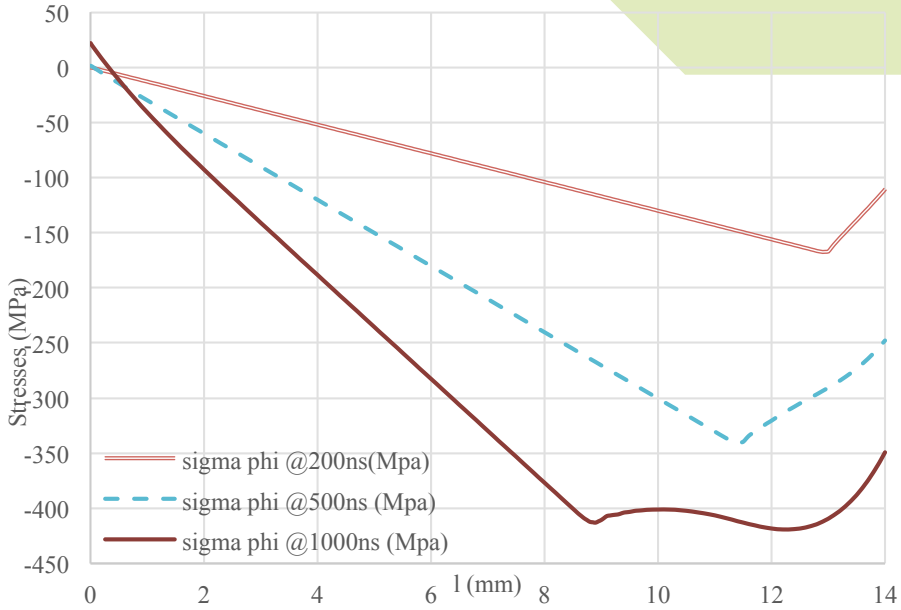


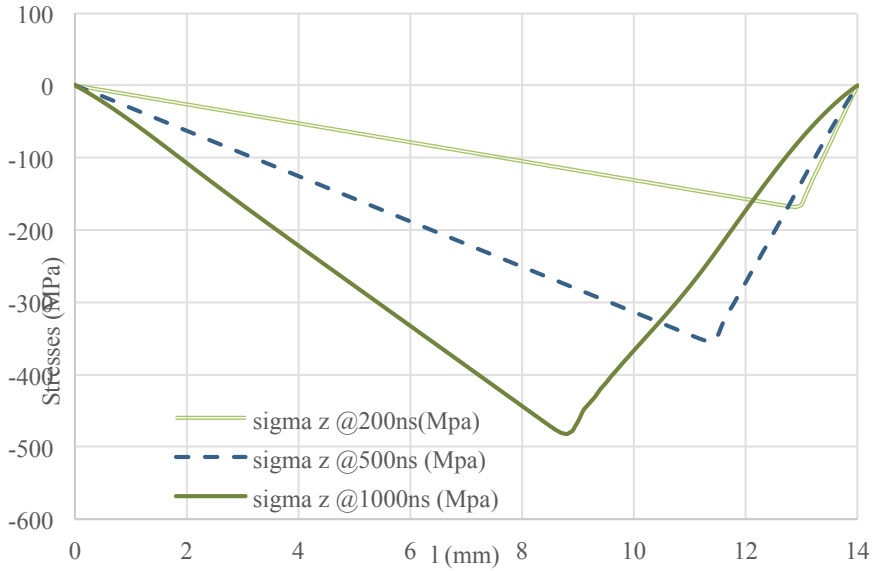


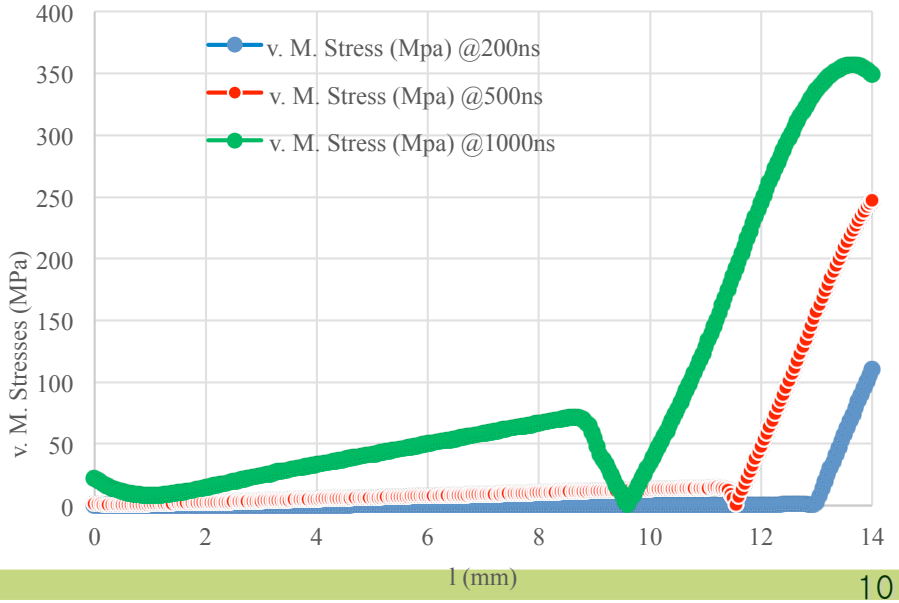


1us pulse along z (max. stress under 500MPa)

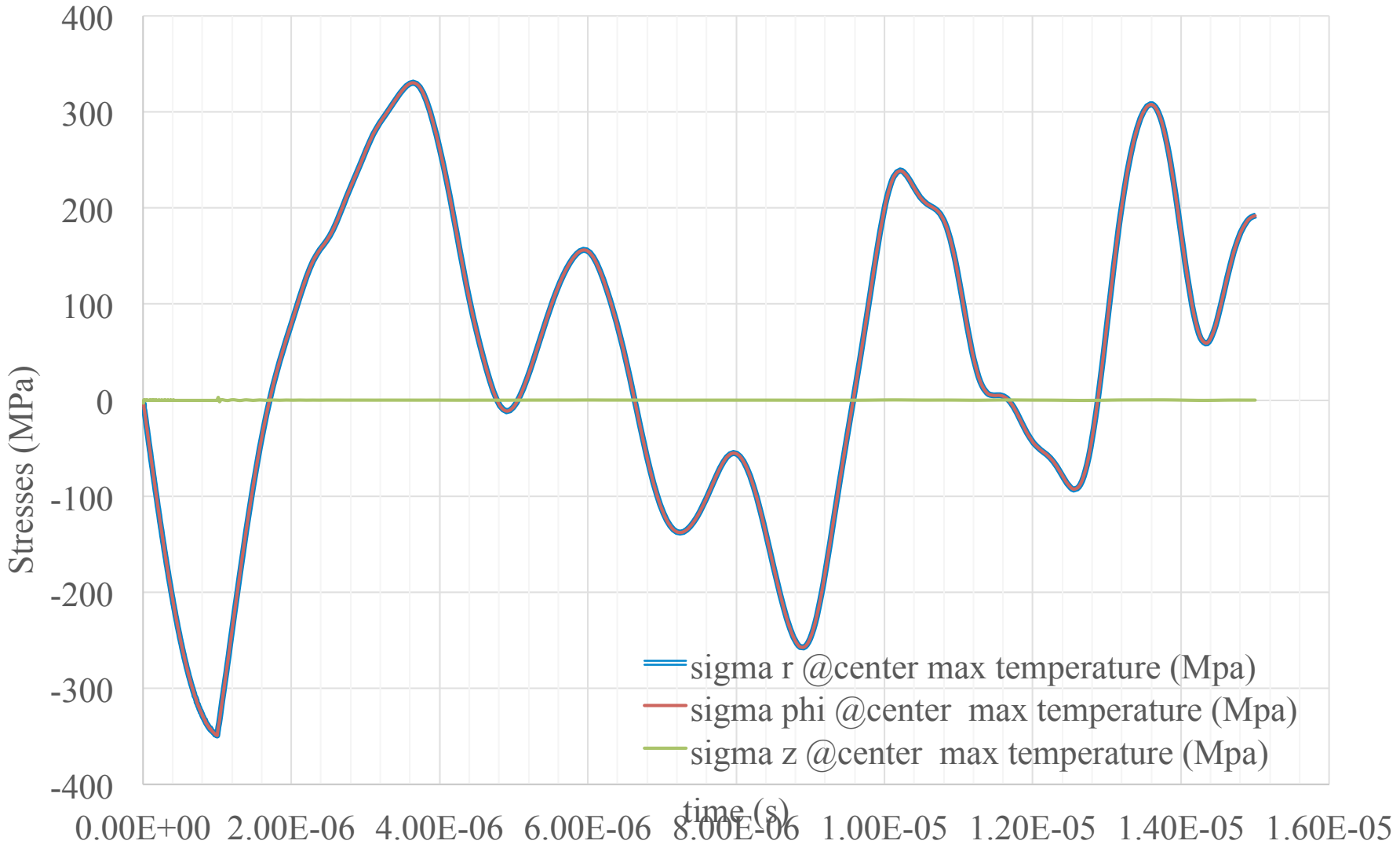








Stress persists for long time
(example: 1us pulse @point with max. temperature)

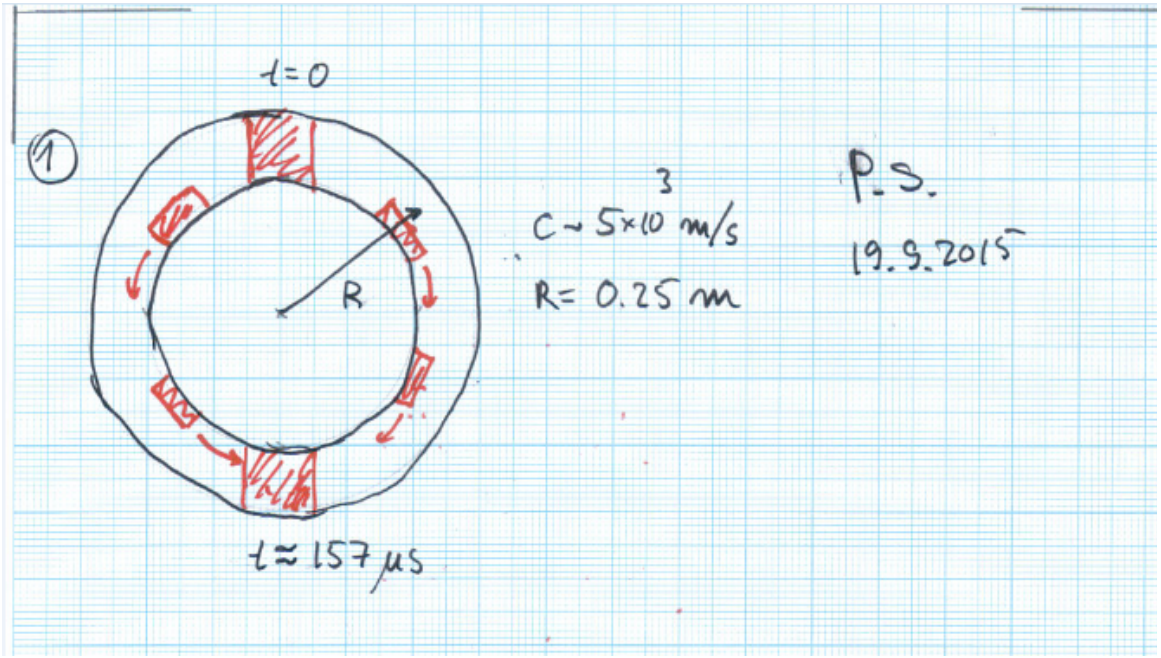


Conclusion

- For 1us pulse, the maximum stress will be under 500MPa in 1 miro-s;
- However, due to the reflection at free upstream and downstream end faces, the axial stress wave can be persistent after 15 micro-s. We need to be care of it in further study.
- The stresses are much larger comparing with previous studies on granular target with 2mm spheres, where the stresses were only about 30MPa. Target size and boundary conditions influence strongly the stress fields.

Further

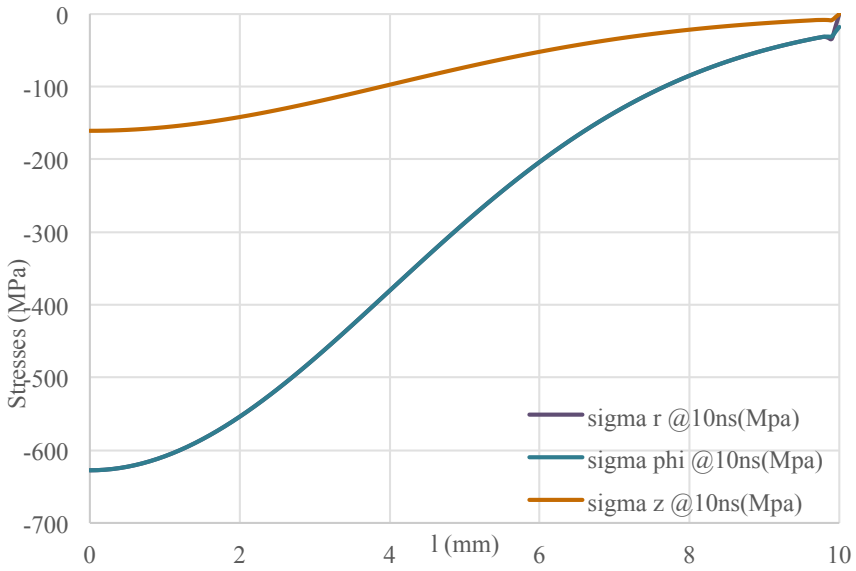
- Studies will be made with the geometry of W-target wheel.

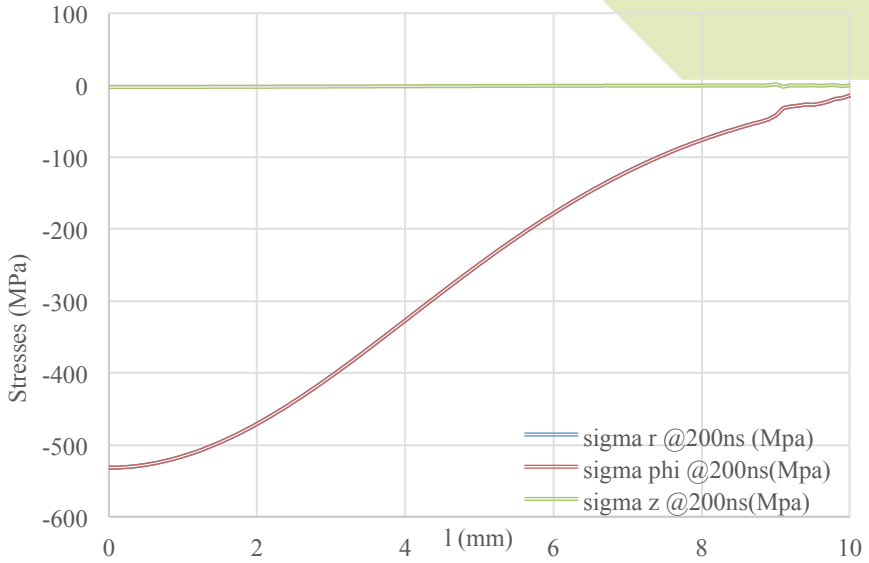


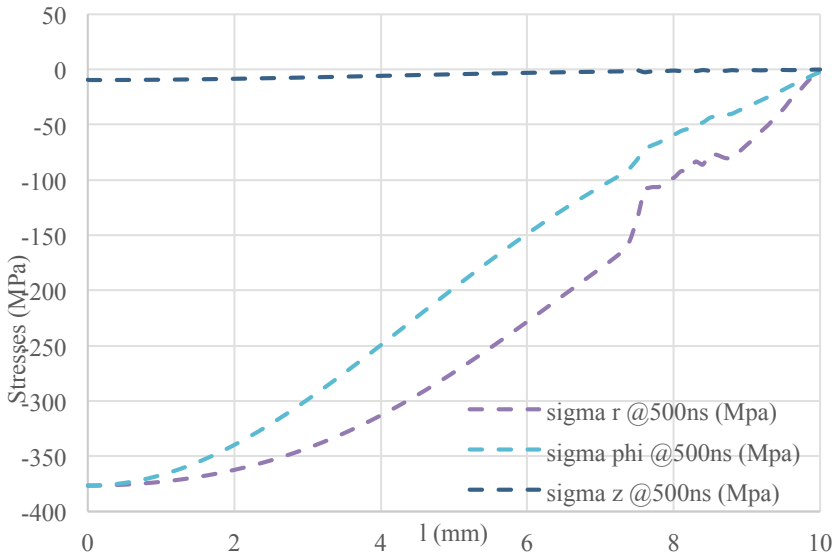
Thanks for your attention!

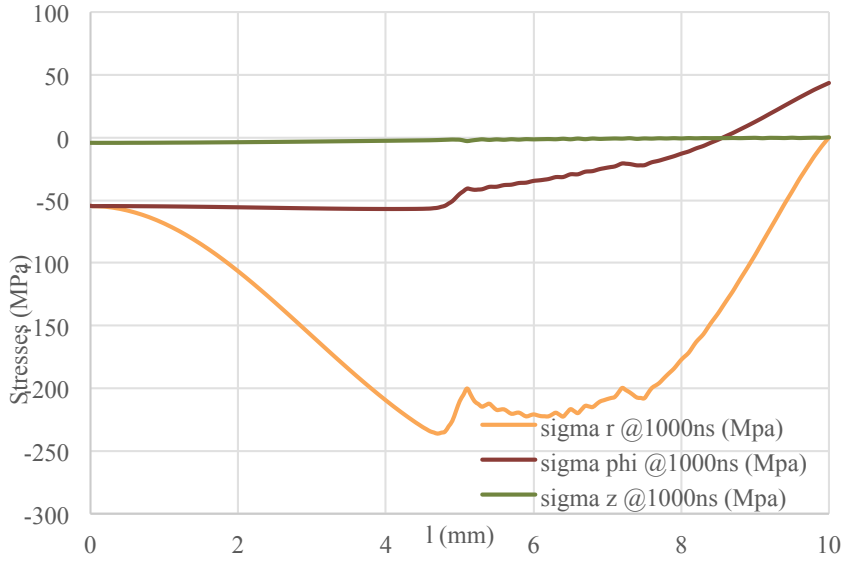
❖Backups

10ns pulse along r

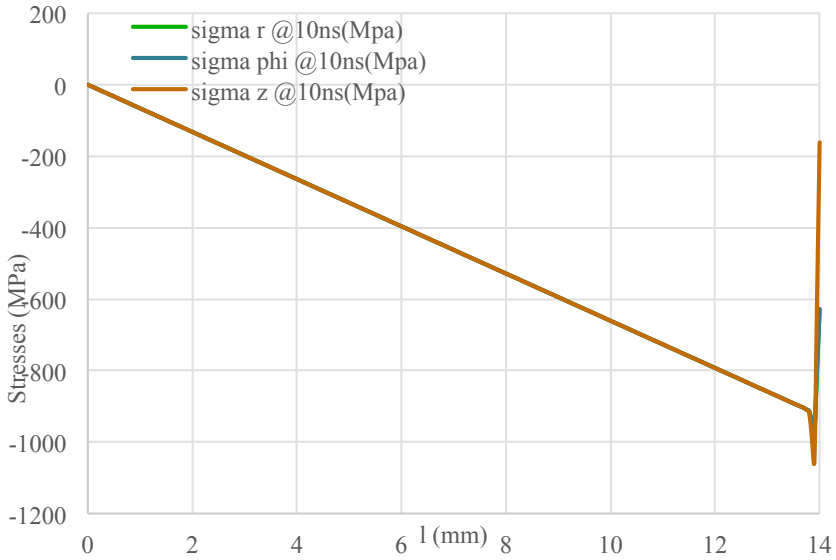


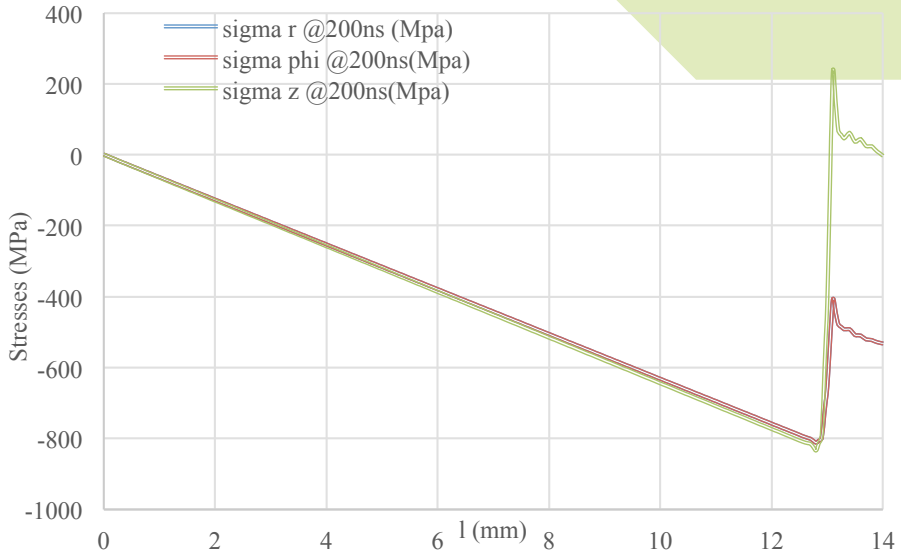


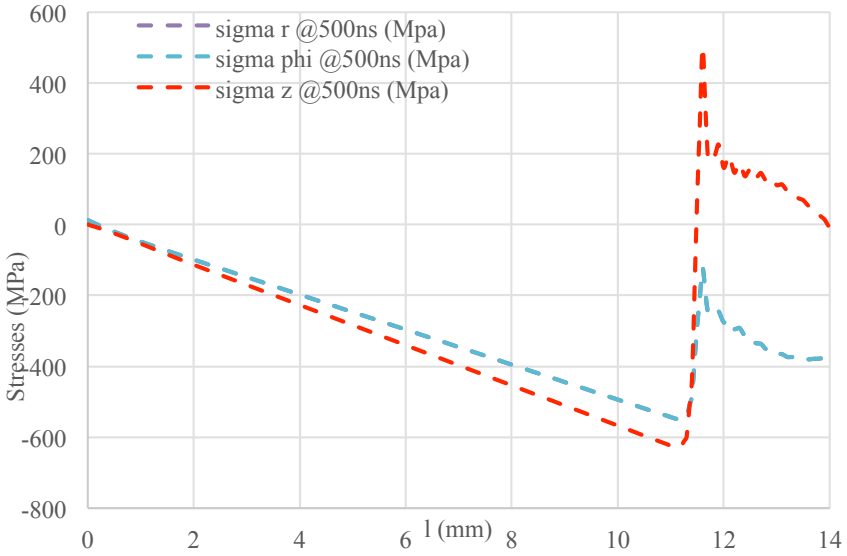


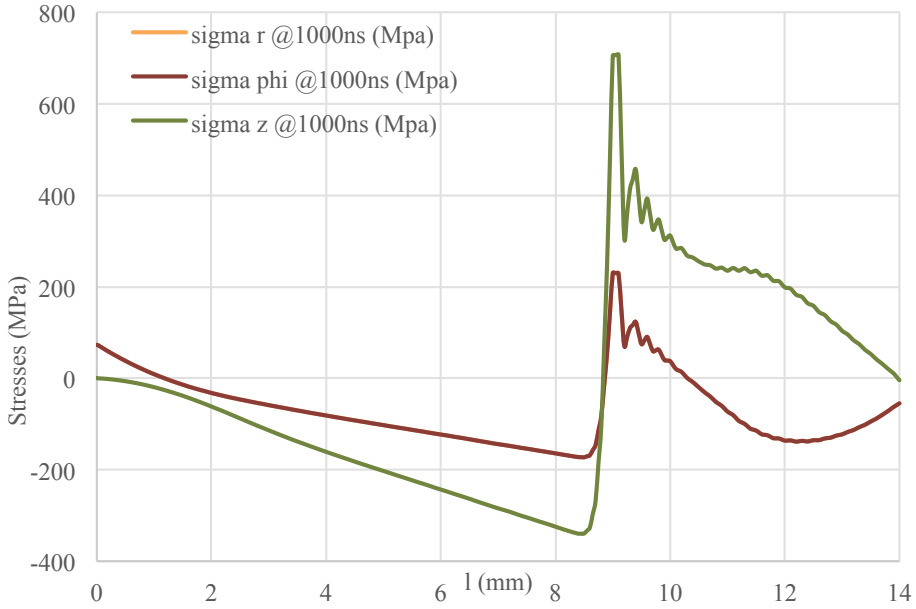


10ns pulse along z

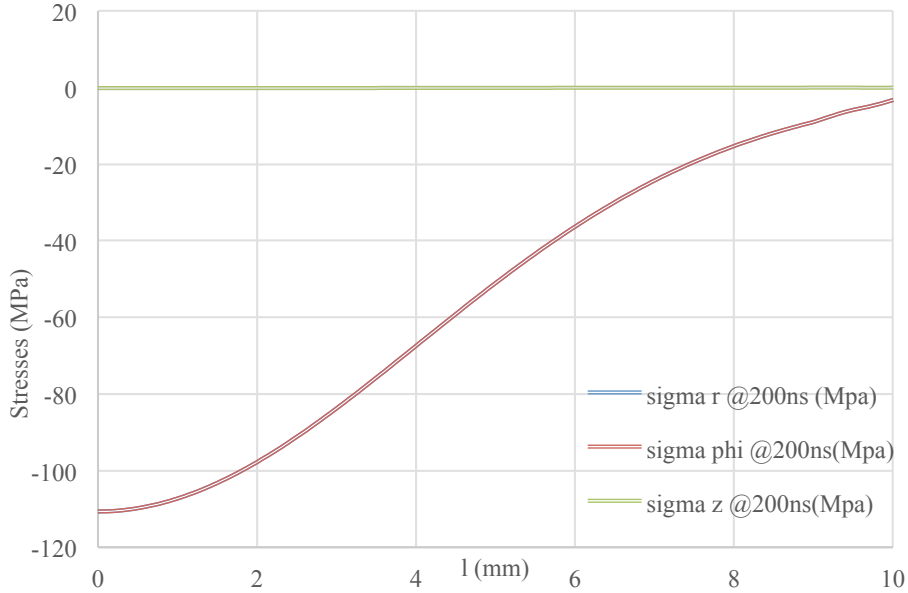


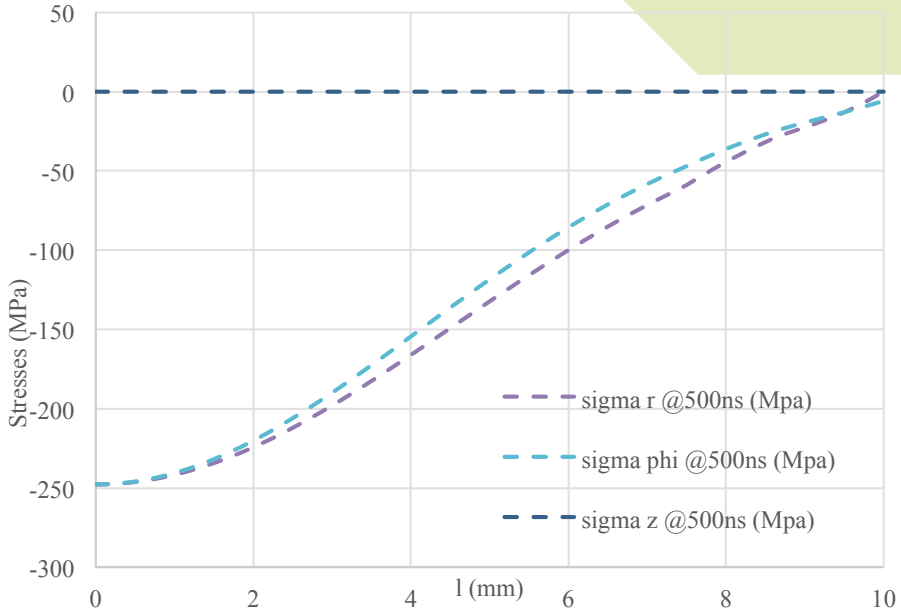


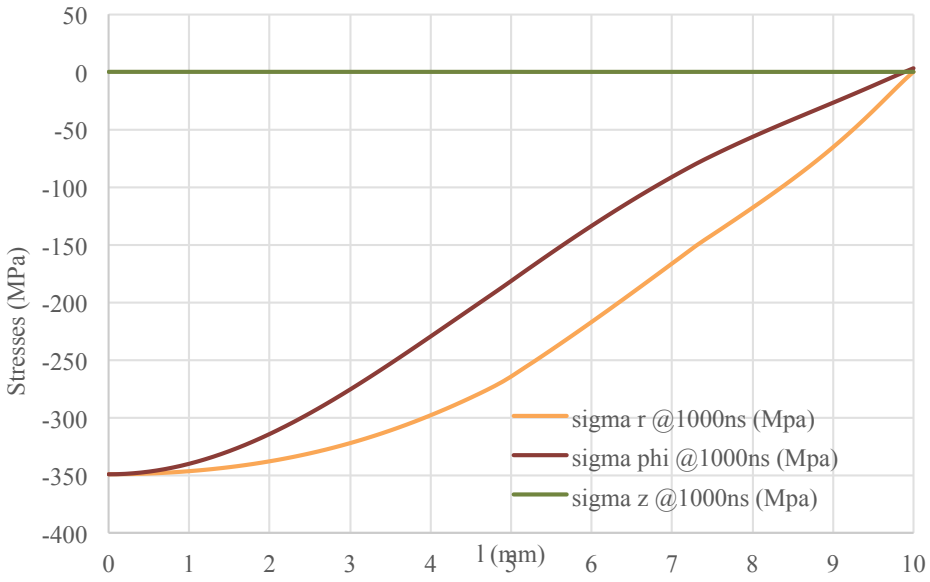




1us pulse along r







1us pulse (along z)