Effect of resolution on computed stresses

The following comments apply to any numerical simulation of stress, including Scan&Solve™.

Numerical simulation approximates an idealized theoretical model of physical behavior by breaking up the model or space into small pieces called finite elements. In principle, as elements get smaller and smaller (increasing their number and resolution), the numerical simulation should get closer and closer to the theoretically exact answer. At some point, the simulation gets so close to the exact answer that increasing resolution does not visibly improve the results. In technical jargon, we say that the numerical solution has "converged".

So why not just always use the maximum resolution? There are at least three important reasons.

1. You may run out of memory and/or will have to wait for a long time to get your solution, which will still only be a numerical approximation of an idealized model of physical reality.
2. To see if the solution is converging, you need to compare the solutions at several different resolutions.
3. Remember, we are approximating a theoretical model, not physical reality. Every model has its limitations. For example, the linear theory of elasticity (used by every structural analysis software, including the present version of Scan&Solve) predicts infinite stresses near "wedges," re-entrant corners, interfaces between different materials, and so on. In physical reality, this cannot happen, because the material simply deforms more "plastically" (as opposed to "elastically"). But in the computer simulation, this means that at some points in your model, stresses will never converge – they will just get bigger and bigger as you increase the resolution. The more complex your model is, the more likely you will have some points like that.

Generally speaking, predicted values of displacement are always more accurate than predicted values of stresses, for both theoretical and implementation reasons.