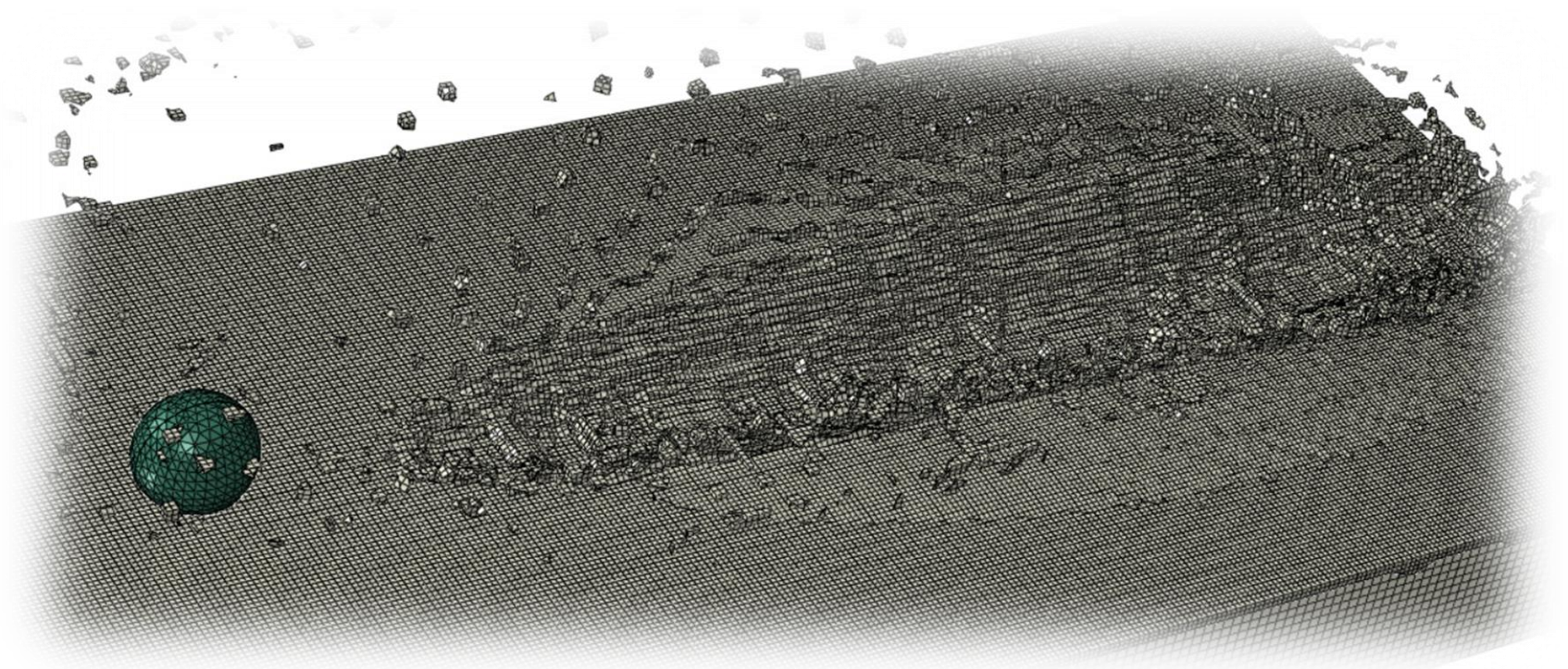


Water Ball Bounce 23

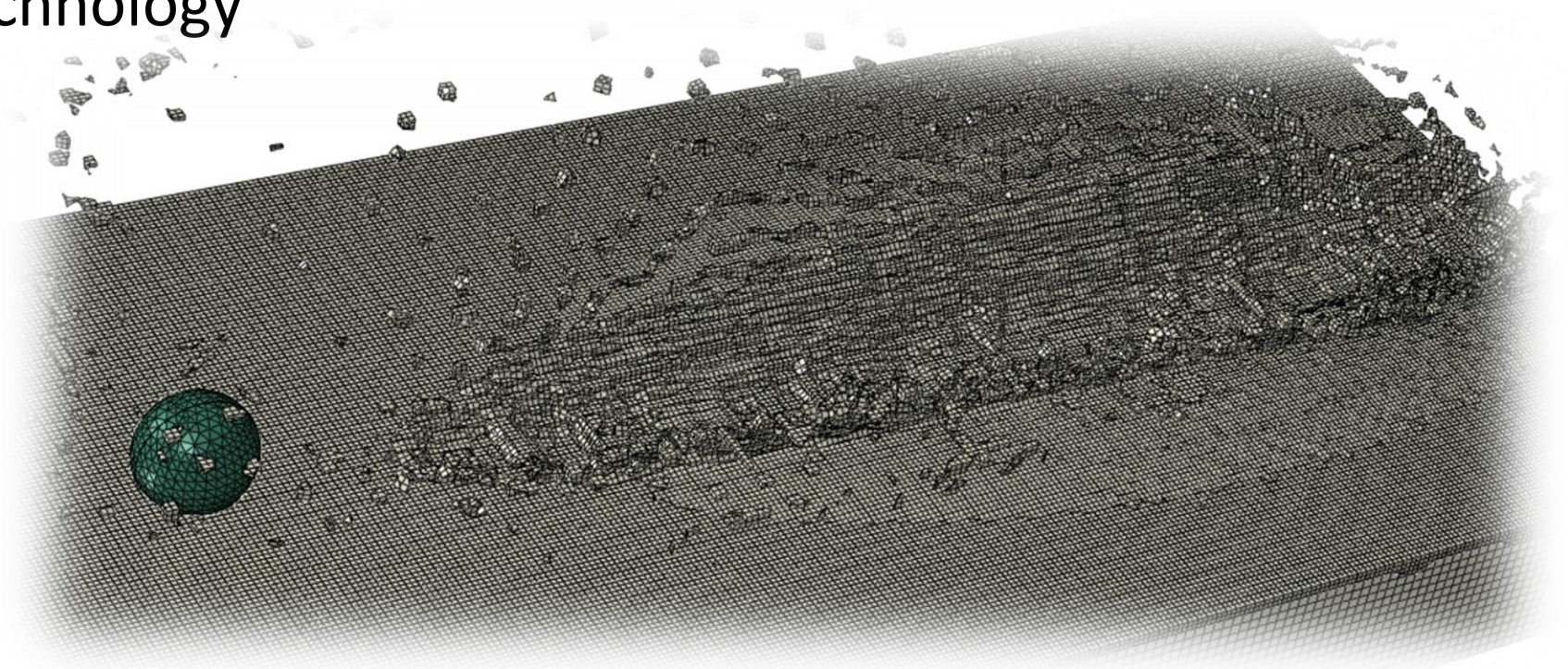
Laurence Marks

Sept 23



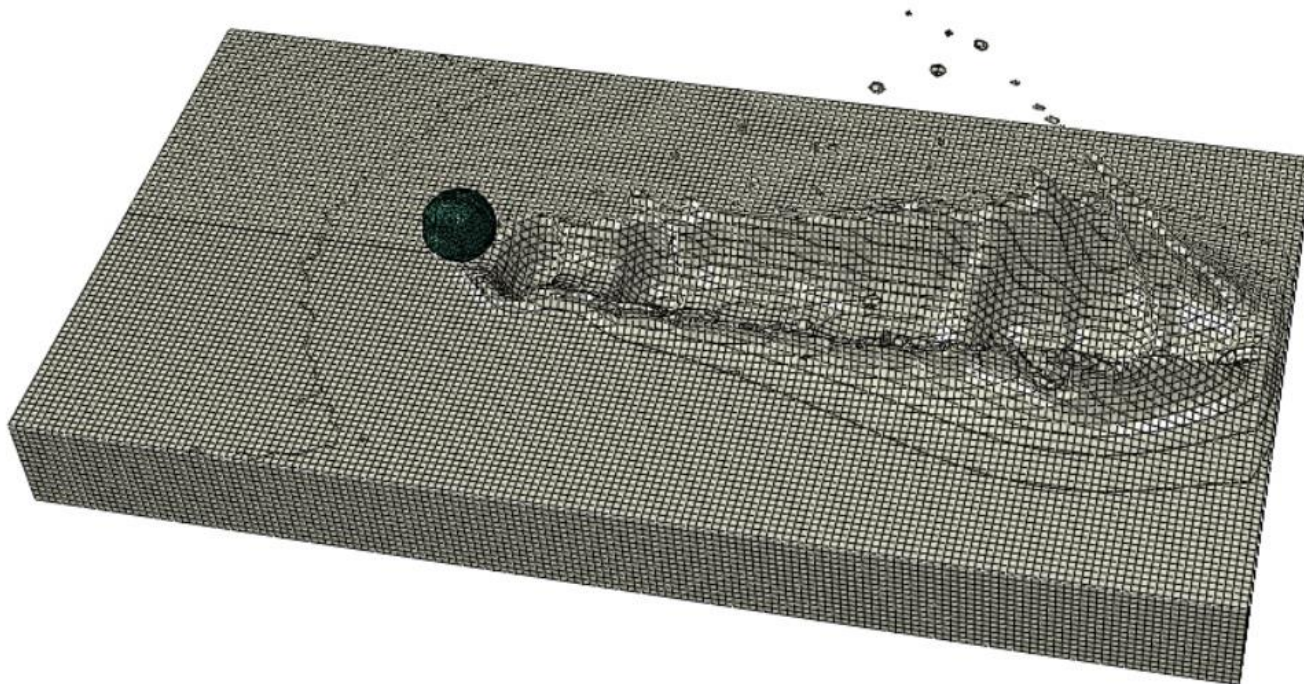
Water Ball Bounce 23

- Get some better images with decent post processing
- Investigate adaptive technology
- Single bounce only

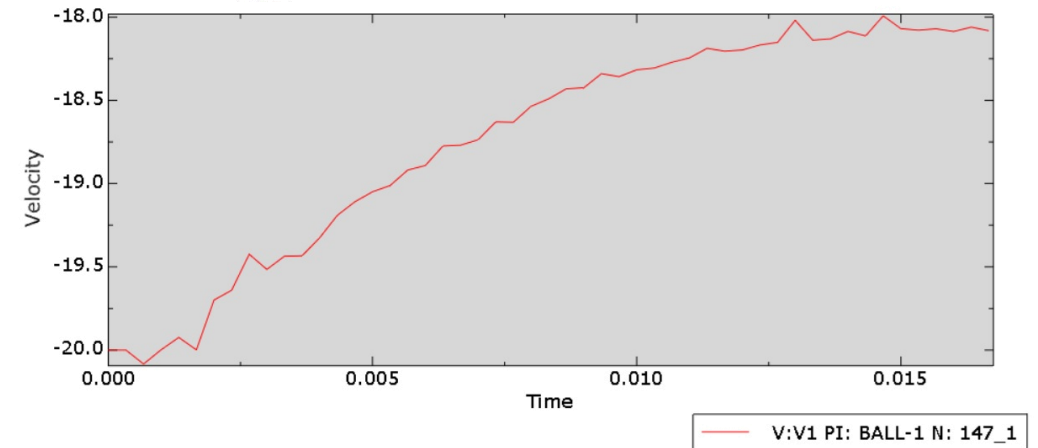
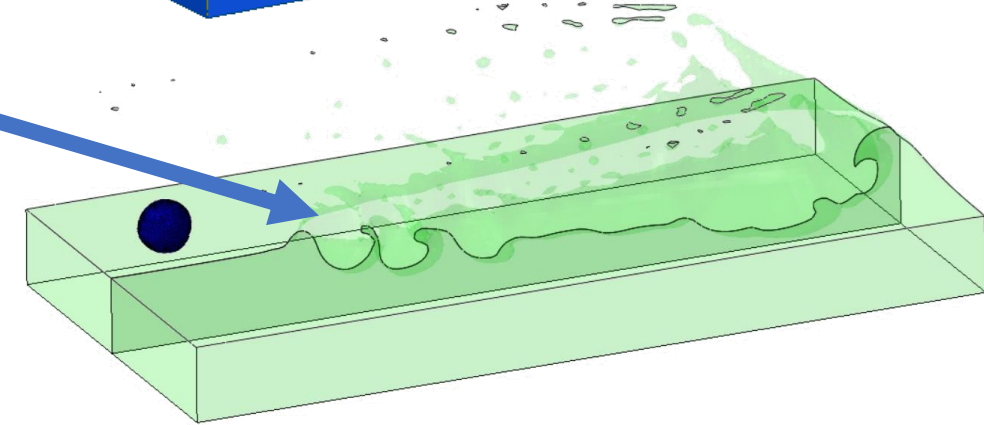
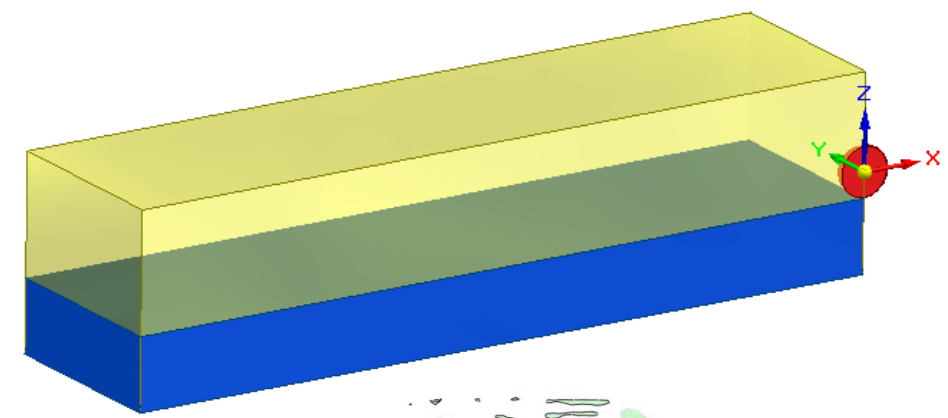


Config_1 to Config_4

- Base case, no adaptivity
- Ball – 25mm steel
- Eulerian domain – 400 x 100 x 100mm
- Ball initial conditions – 20m/s horizontal, 1m/s downwards
- Total step time = 0.02s
- General contact, rough



Is this profile real or is it the contact exploding like CEL does?



Sample adaptive code from Dre and Docs

- Sample code used in helicopter ditching project

```
1, 1565, 1
*Elset, elset=RigidBody_All, instance=LUH-NMG_FloatRear-2, generate
1, 1565, 1
** Constraint: RigidBody_Assembly_All
*Rigid Body, ref node=LUH-NMG_Fuselage.RP_CofG, elset=RigidBody_All
*End Assembly
*ADAPTIVE MESH REFINEMENT, LEVEL=2, ELSET=Water.CEL_Volume, RATIO=16, COARSENING=YES
CONT, MAT
*Amplitude, name=Amp-3, definition=SMOOTH STEP
0., 0., 5., 1.
*Amplitude, name=amp_gravity, time=TOTAL TIME, definition=SMOOTH STEP
0., 0., 5., 1.
*Amplitude, name=amp_rotation
0., 0., 30., 1.
*Amplitude, name=amp_vel, definition=SMOOTH STEP
0., 0., 15., 0., 16., 1.
**
** MATERIALS
**
```

```
E *Nset, nset=qa_test_nout, instance=Part-1-1
6052,
A *End Assembly
*Adaptive Mesh Refinement, ratio=2.0, elset=Part-1-1._PickedSet2
peeq,0.1
**
```



Documentation - Adaptive

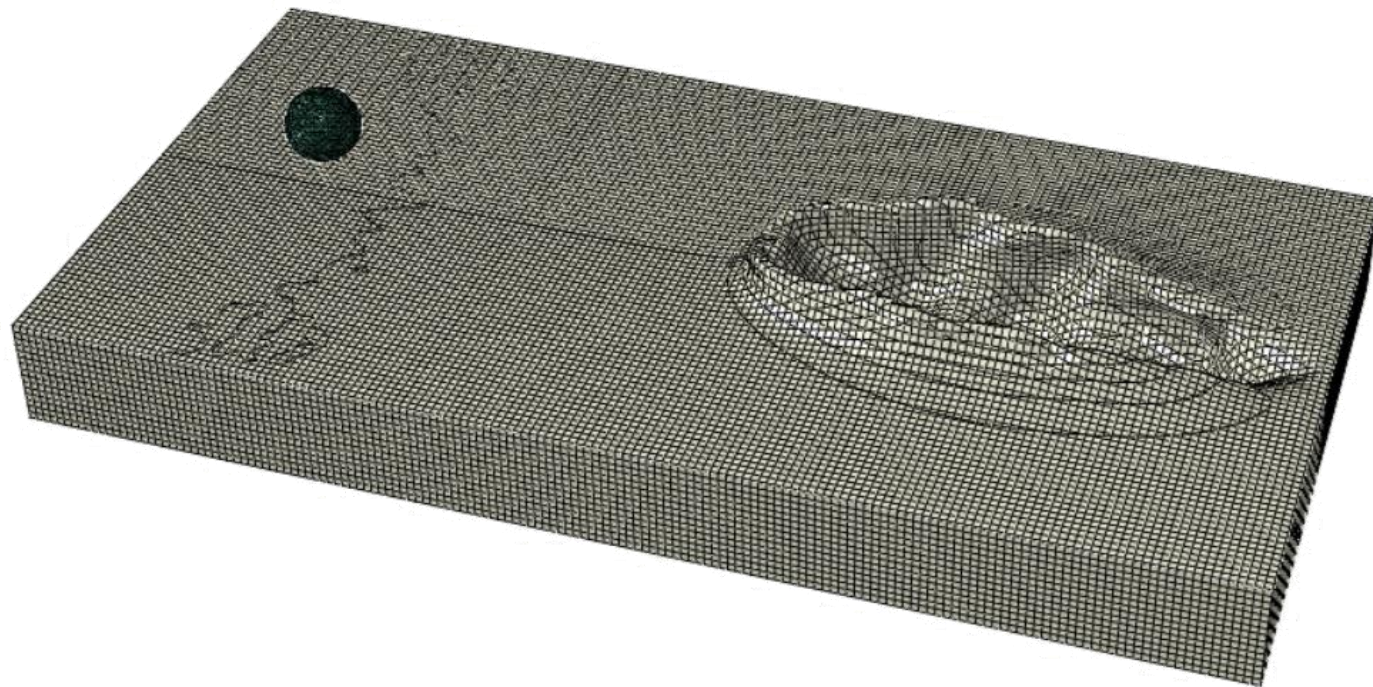
Table 14.1.4–1 Refinement criteria.

Refinement criterion description	Refinement criterion label	User-specified values
Refine elements containing material interfaces	VF	N/A
Refine elements that are in contact with Lagrangian bodies	CONT	You can specify the value ALL to refine all elements intersecting the Lagrangian surfaces even if contact has not occurred; using this option avoids frequent refining and coarsening with chattering contact. You can also specify the value MAT to refine only elements containing materials that are in contact with the Lagrangian surfaces. If no values are specified, MAT will be used except for materials with Mie-Grüneisen equations of state.
Refine elements in which significant plastic deformation occurs. Not supported for the critical state (clay) plasticity model.	PEEQ	Critical value of the equivalent plastic strain
Refine elements near a sharp density gradient	DENSITY	You can specify two values for this criterion. The first value is the critical value of the density gradient, computed as the ratio between the change of density across element faces and the density of the material inside the element; the second value is the critical density. For an element to be selected, both the density and the density gradient must exceed the critical value.
Refine elements near a sharp pressure gradient	PRESS	You can specify two values for this criterion. The first value is the critical value of the pressure gradient, computed as the ratio between the change of pressure across element faces and the pressure of the material inside the element; the second value is the critical pressure. For an element to be selected, both the pressure and the pressure gradient must exceed the critical value.

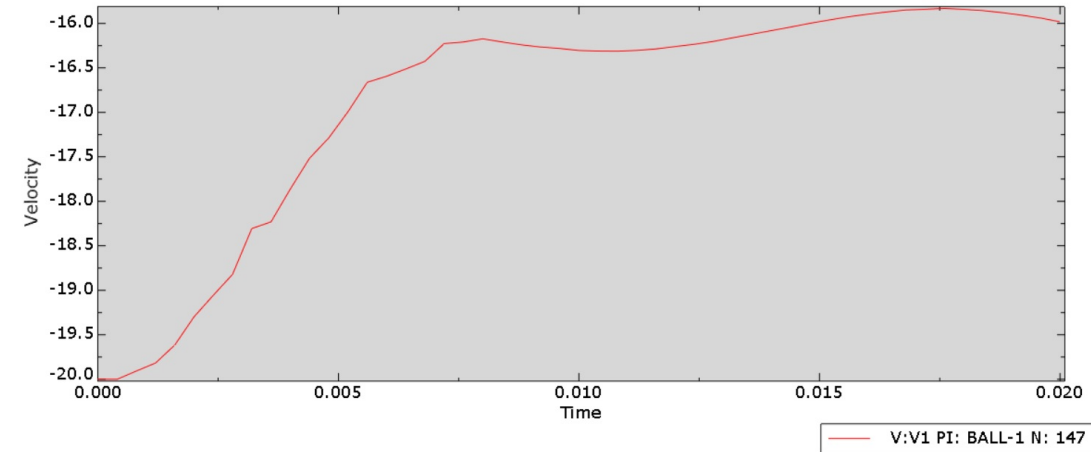
Input File Usage: **ADAPTIVE MESH REFINEMENT,*
refinement criteria label, value of the criteria

Config_5 – Initial adaptive attempt

- Default level 1
- All other inputs as previous configs



```
Edit keywords, Model: ball_cfg_1_4
*Elset, elset=SET-1, instance=EULERIAN_DOMAIN-1
*Nset, nset=SET-2, instance=EULERIAN_DOMAIN-1
*Elset, elset=SET-2, instance=EULERIAN_DOMAIN-1
*Nset, nset=SET-3, instance=BALL-1, generate
*Elset, elset=SET-3, instance=BALL-1, generate
*End Assembly
*Adaptive mesh refinement, ratio=2, elset=EULERIAN_DOMAIN-1.SET-1
CONT, MAT
**
** MATERIALS
**
```

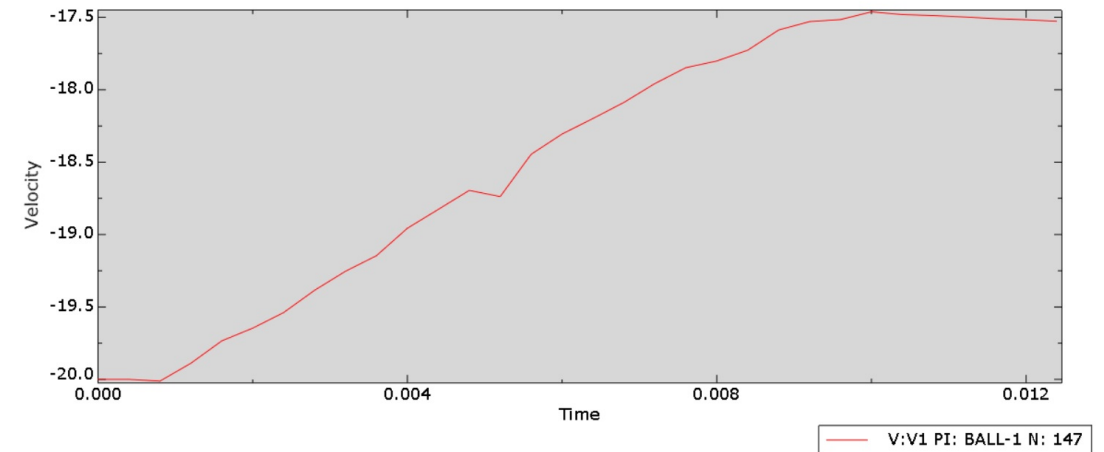
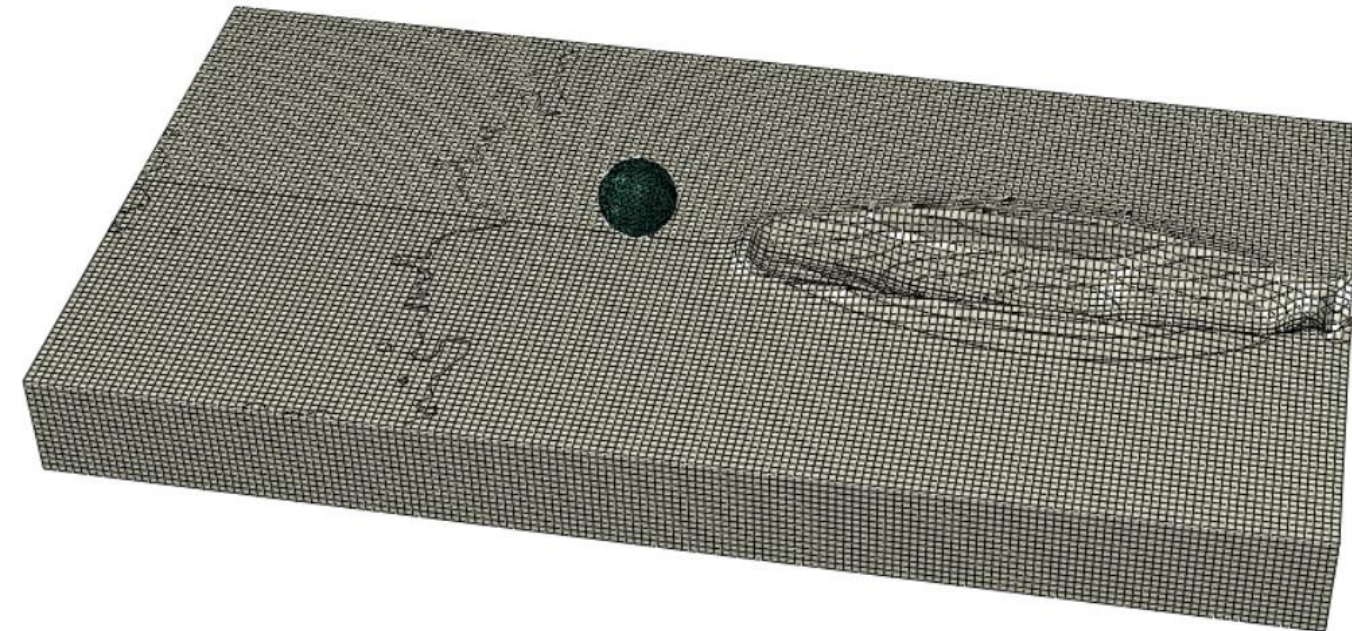


Config_6 – Adaptive level 2

- As config_5 but another level of mesh refinement.

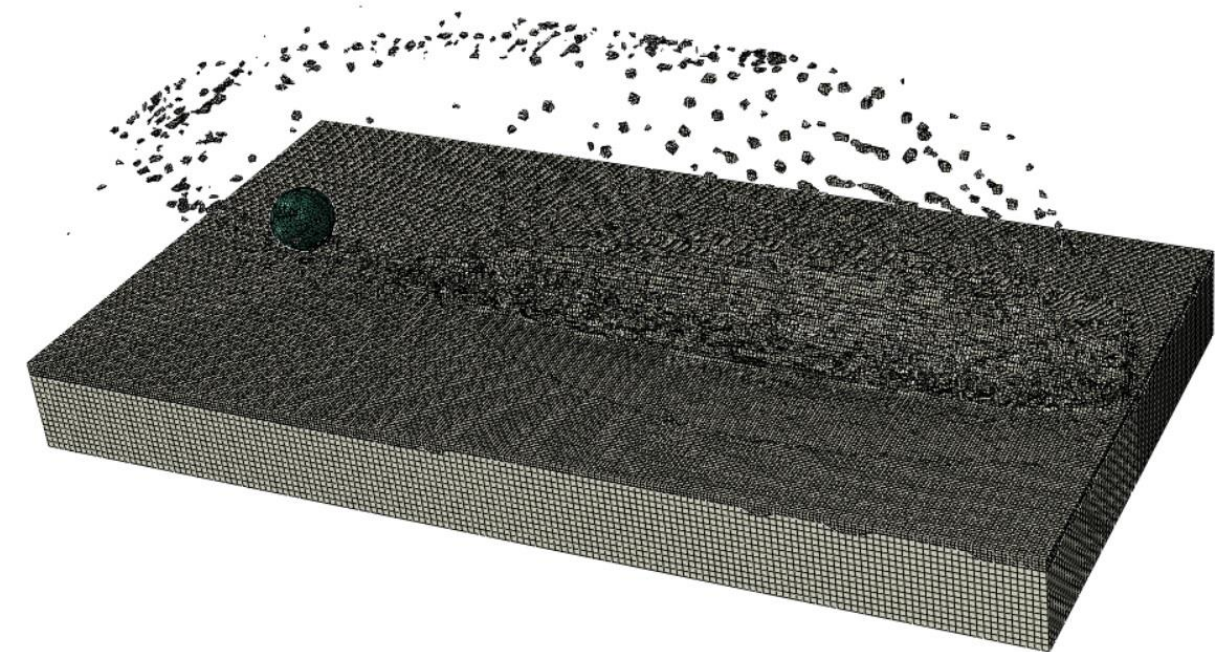
*End Assembly

*Adaptive mesh refinement, level=2, ratio=2, elset=EULERIAN_DOMAIN-1.SET-1
CONT, MAT

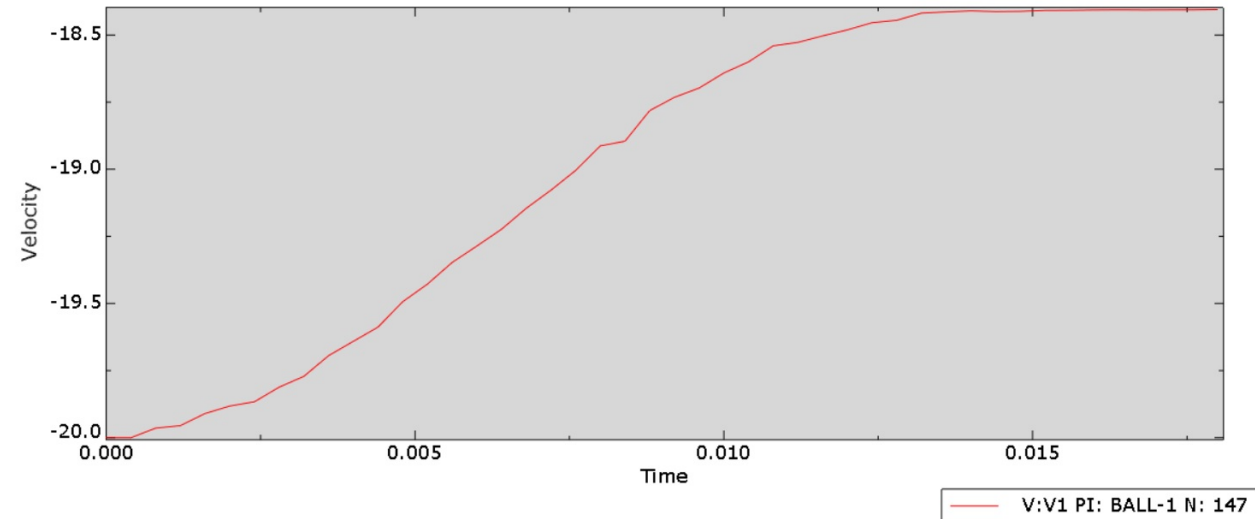


Config_7 – VF

- Level 1 – level 2 blew the memory up

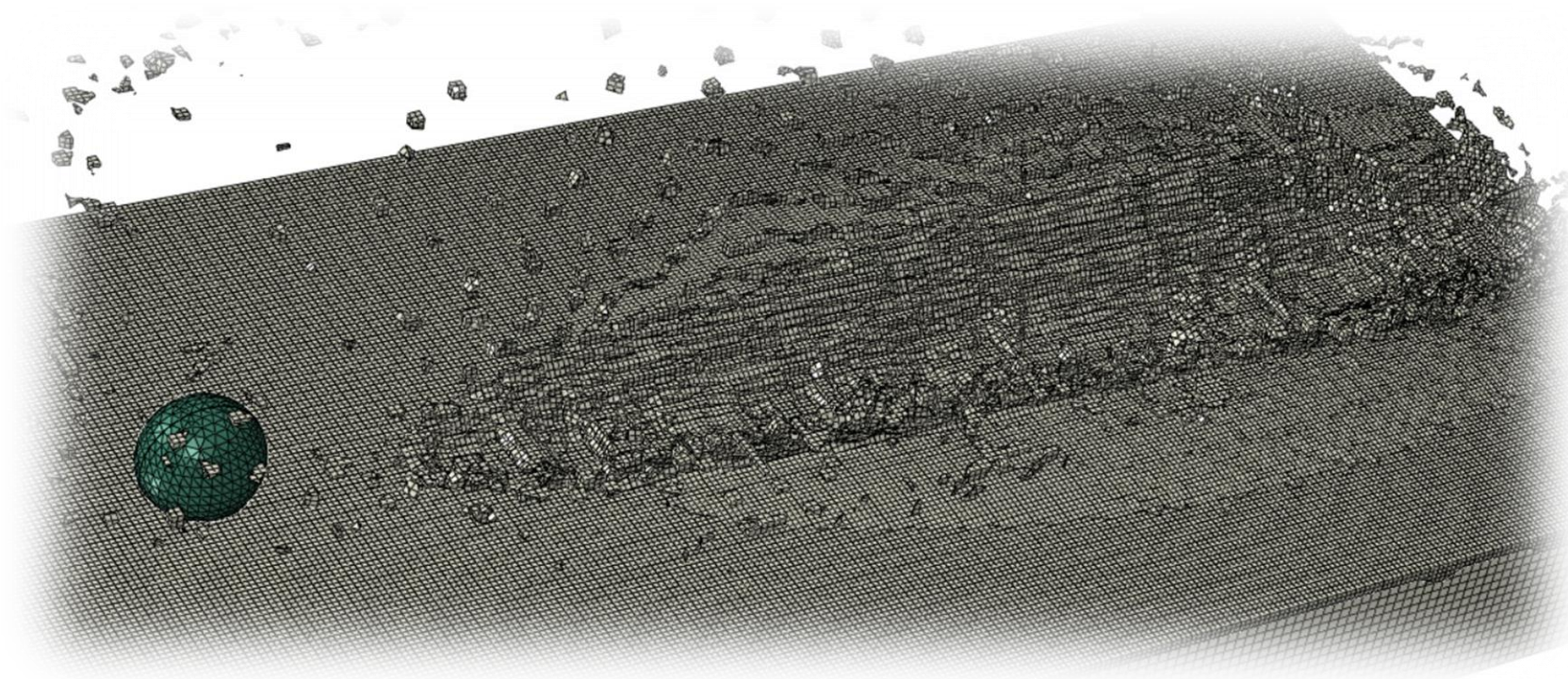
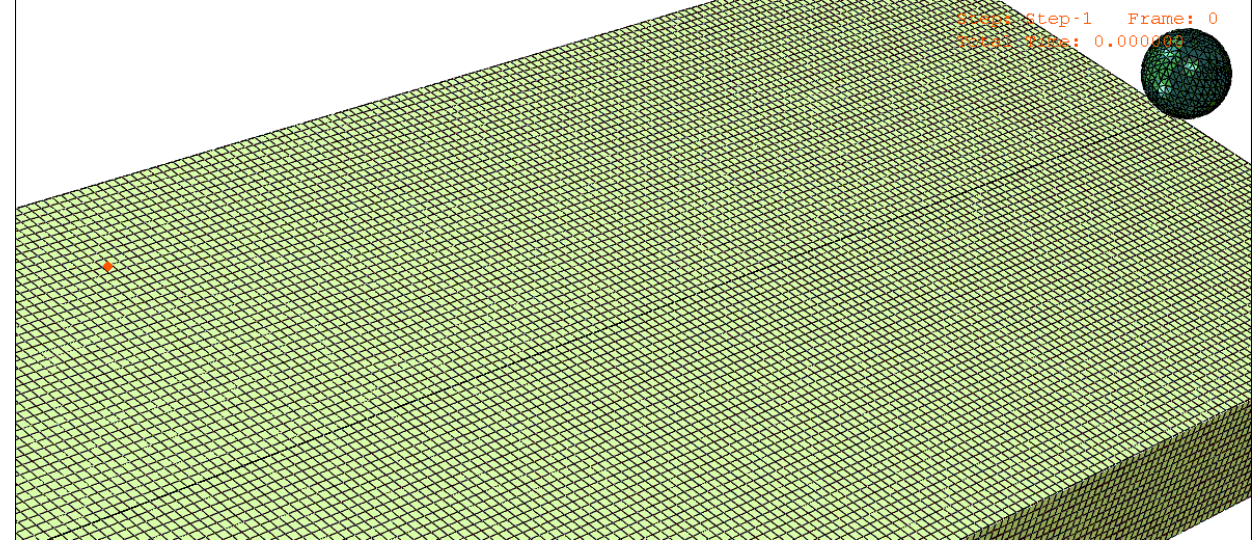


*Adaptive mesh refinement, level=1, ratio=2, elset=EULERIAN_DOMAIN-1.SET-1
VF



Config_7 – VF

- Level 1 – level 2 blew the memory up



Comparison of adaptive options

- Results

- No adaptivity
- Contact, MAT, level 1
- Contact, MAT, level 2
- VF, level 1

