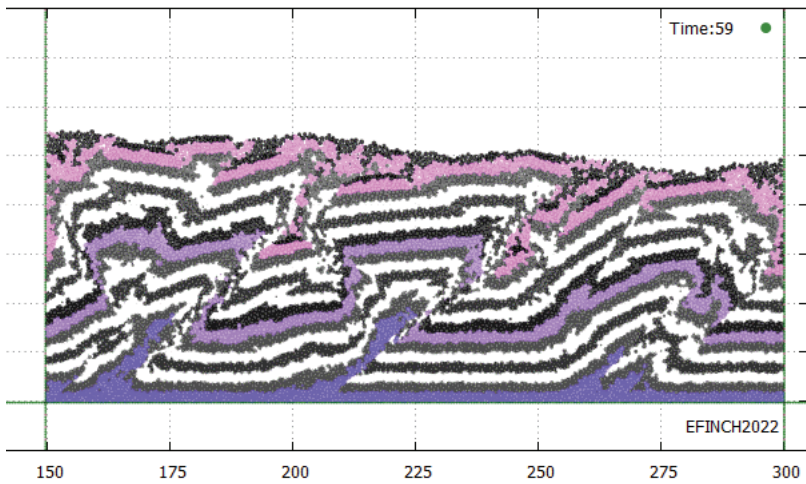# DEM: Thrusts 2. The effect of pre-kinematic strength on faulting 2

The media in these experiments contain 20664 elements in a box that is 300 x 30 units. Elements are distrubted randomly with radii of 0.5, 0.4. 0.3 and 0.2 units. The left-hand boundary is incremented to the right at 0.00005 unit/timestep to a total compression of 150 units (50%). The experiments run for 3 million timesteps with outputs every 50,000 which are presented in the movies. The media is divided into 14 layers of equal height. Colours indicate the 'strength' of the media where numbers in the file name represent the separation between elements as a function of their initial separation that is required for bonds to break. This is distinct for each bond pair where each element is assigned a breaking separation determined from the average of the strength assigned to each element.
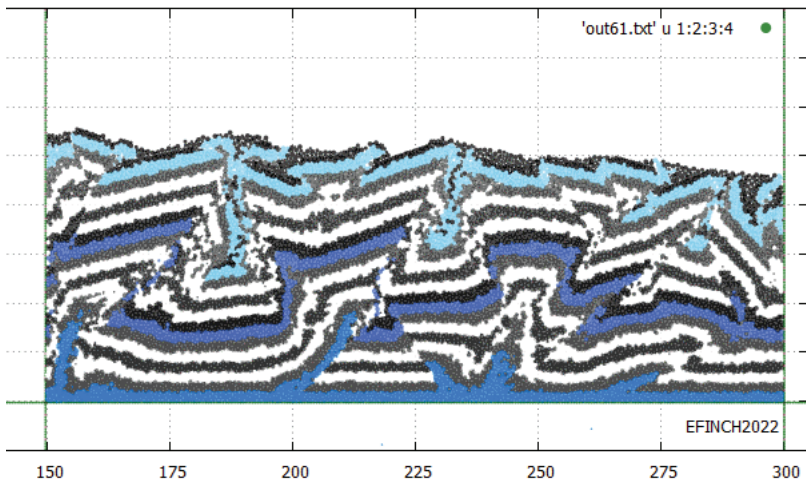
Experiments are shown where (1) layers of alternating strength (coloured/white layers - stronger : dark grey layers - weak). (2) demonstrates the effect of detaching layers at the start of the experiment focused around layer 7 (green) using the alternating 0.06_0.01 strength experiment. The yellow layer(s) are made up of the weaker material and are detached from layer 7 at the start of the experiment (all initial bonds between the layers are broken). The dotted line shows the location of the detachment; between layers 7&8 (_d78), 6&7 (_d67), and 6&7 and 7&8 (_d678). The numbers show the strength of the material compared with the 1x strength model

For comparison, the 1x and 6x strength models are shown below. The 2x, 4x and 8x models can be found at doi: 10.48420/19236939
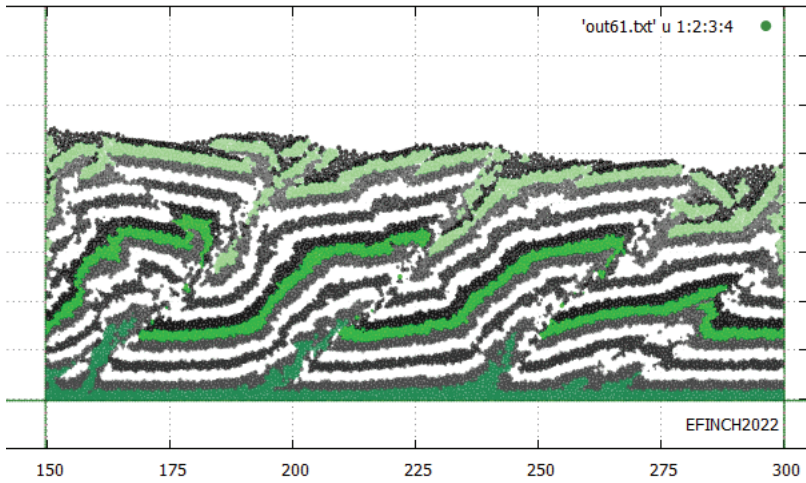
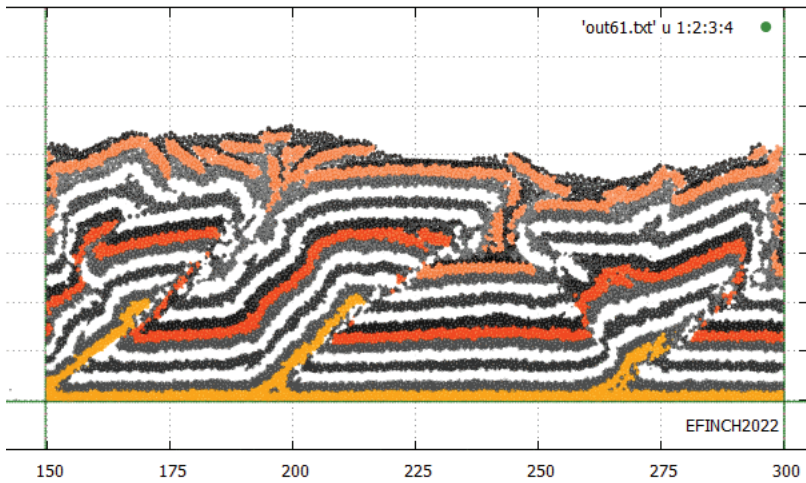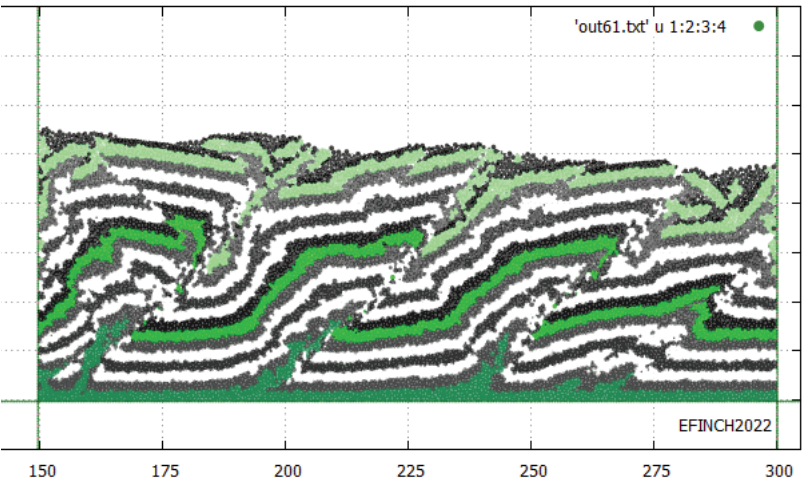## 1. Layers with alternating strength
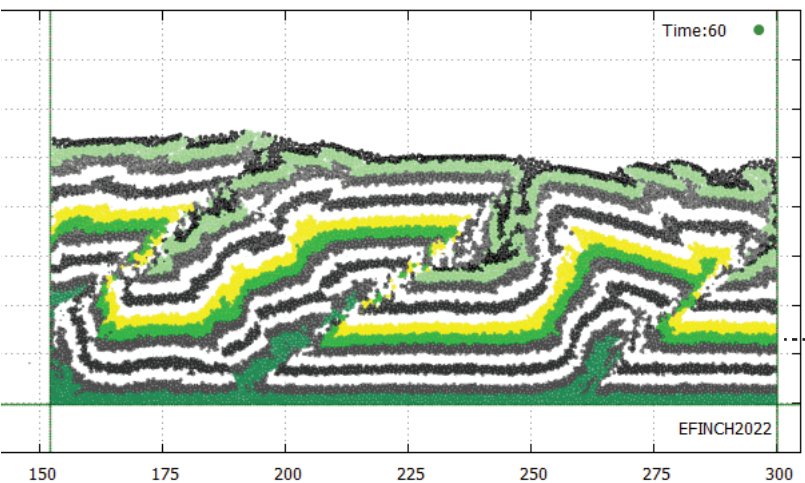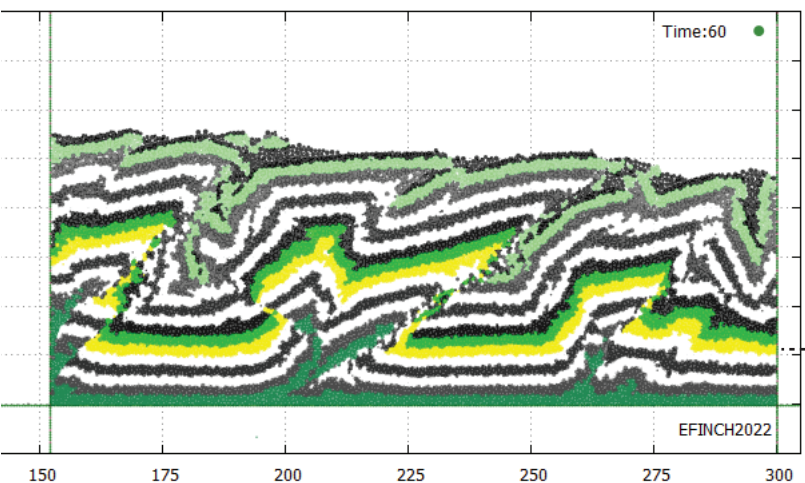


A_0.02



A_0.04



A_0.06



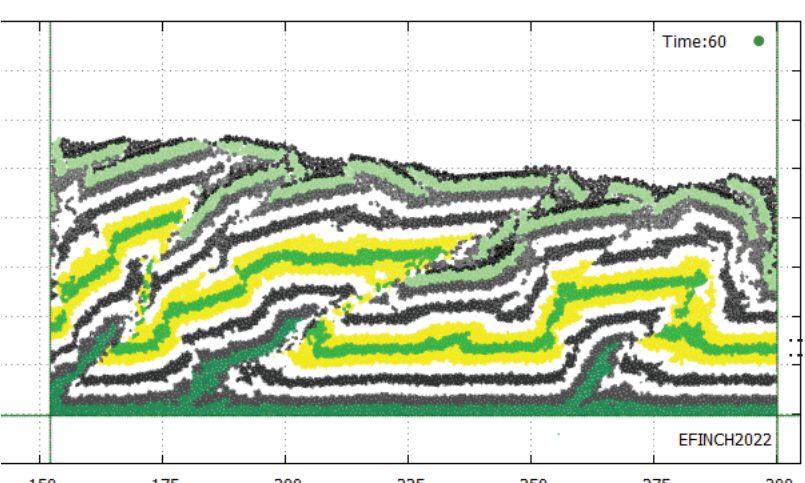A_0.08

## 2. Layers with alternating strength and detachments

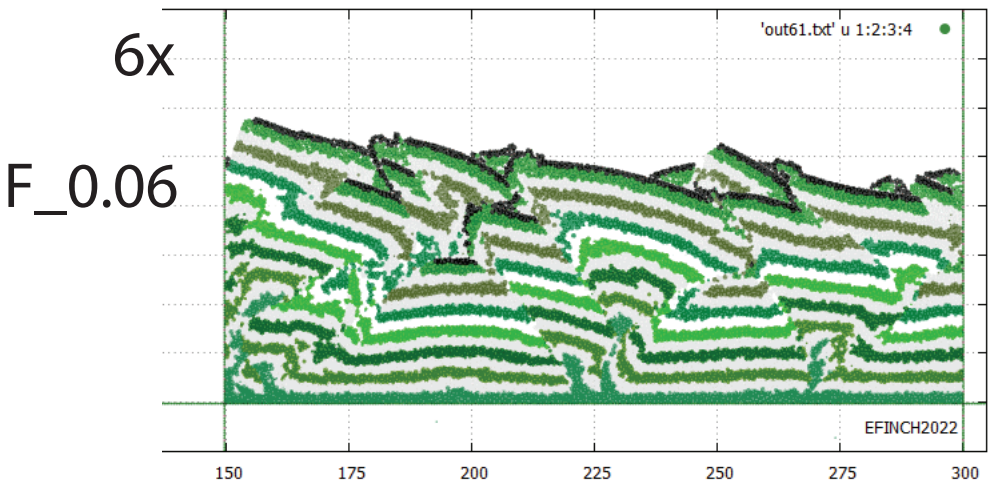

A_0.06



A_0.06_d78



A_0.06_d67
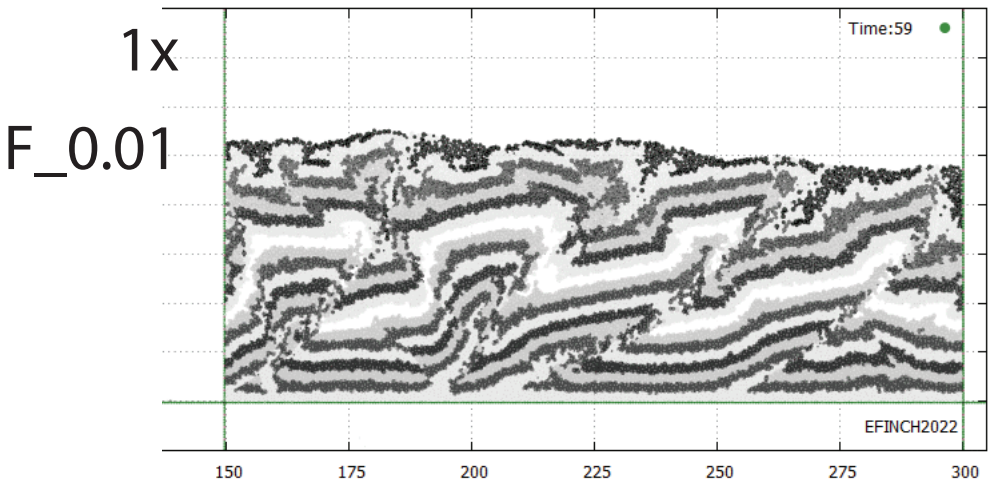


A_0.06_d678



1x

F_0.01



6x

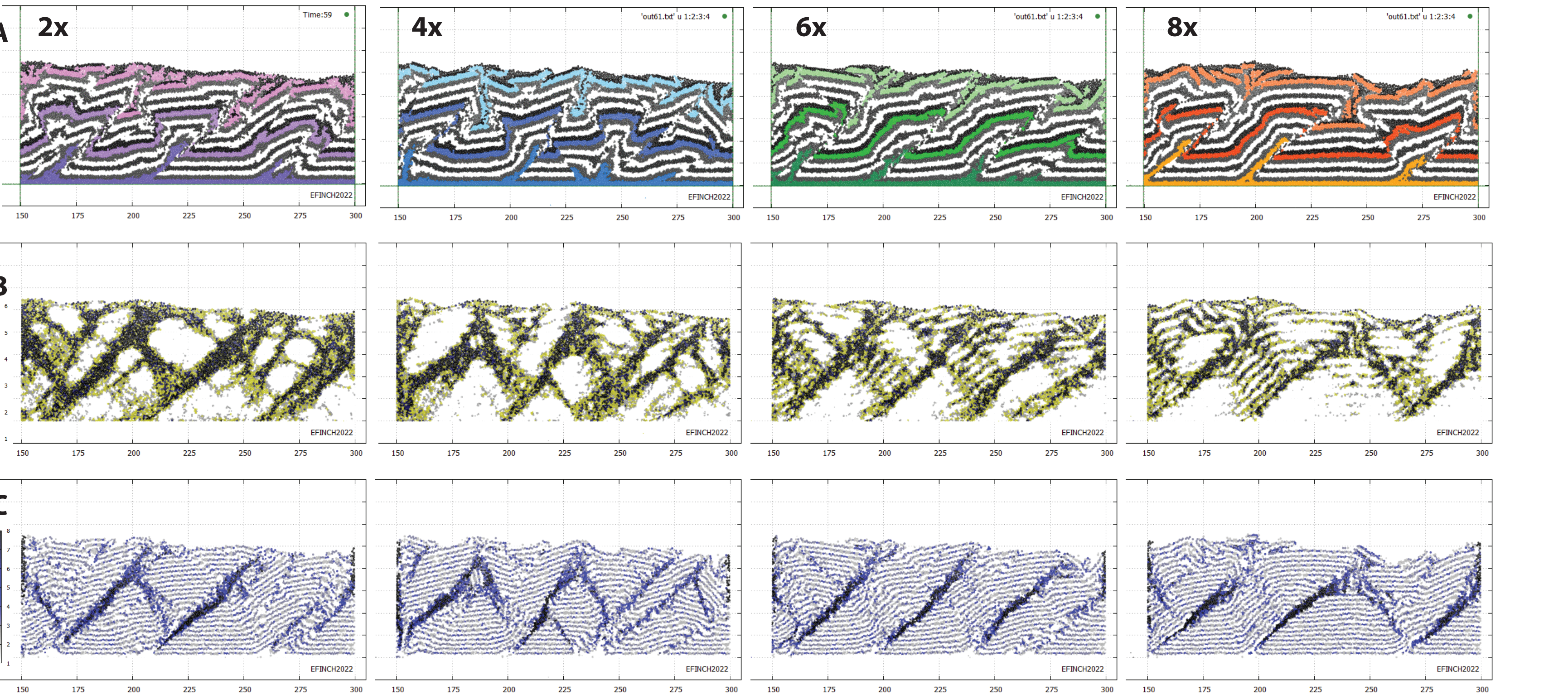F_0.06

There are three outputs shown on these pages to demonstrate the failure of the media at the end of the experiment. (A) The layers in the model coloured according to their 'strength', (B) Elements coloured according to the broken bonds between them and their neighbours from white (0) through yellow to black (6+) , and (C). A coherence plot where an element is coloured according to the difference between its layer number and that of the element immediately below it. Elements within layers are white and fault locations are highlighted as the colour darkens.

## 1. Alternating strength models, contrasting strength

In these experiments the layers alternate between weak (grey, 1x) and stronger (coloured/white). In experiments with a low contrast between strengths, the bonds mainly break across layers but not within layers ((B) 2x and 4x) as the strength contrast increases, failure on the less competent layers dominates, shown by bonds breaking along the weaker layers, with the stronger layers remaining intact (white/black striping (B) 6x and 8x).



## 2. Alternating strength models, detached layers

In these experiments the layers alternate between weak (grey, 1x) and stronger (coloured/white). The yellow layers are made up of the weaker material but all bonds between them and the adjacent green layer are broken at the start of the experiment forming a detached layer. The experiment without the detachment is included for comparison.