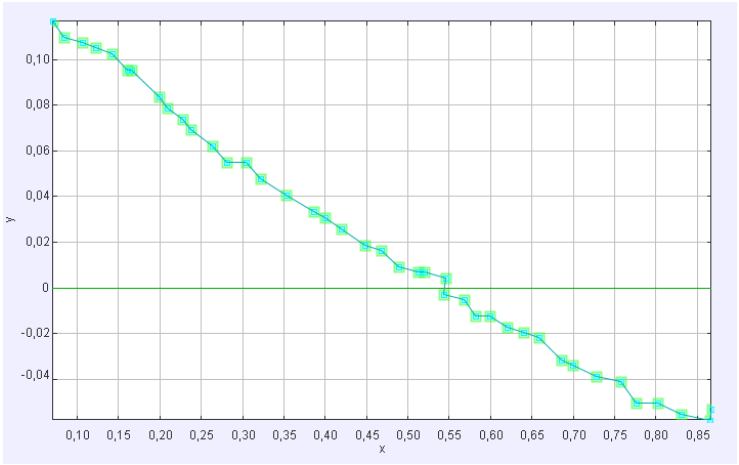
VRIJE ASO.SCHOOL

Let's go for a ride! The physics of roller-coasters

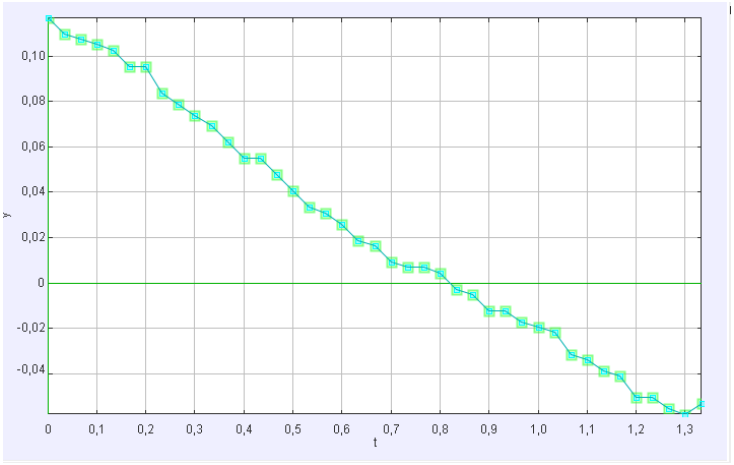
Creating a scale model and performing measurements on the model

Belgium: Niagara

y(x)



y(t)



Potential energy

$E_{pot} = m*g*h$

at the beginning (we started our measurements at the highest point of our scalemodel) (h= 0,17 m)	$E_{pot} = 0,025 * 9,81 * 0,17 = 0,047$ J
in the middle	$E_{pot} = 0,025 * 9,81 * 0,085 = 0,021$ J
at the end (h= 0m)	$E_{pot} = 0,025 * 9,81 * 0 = 0$ J

Speed & kinetic energy

$v_x(t)$
$v_y(t)$

$$v = \sqrt{vx2 + vy2}$$

➔ $E_{kin} = \frac{m*v^2}{2}$

(at the beginning, in the middle and at the end)

at the beginning (t=0,0666)	$v= \sqrt{(0,575^2 + (-0,0718^2)}$ = 0,579 m/s	$E_{kin} = (0,025 * 0,579^2)/2$ = 0,0042 J
in the middle (t=0,667)	$v= \sqrt{(0,611)^2 + (-0,144)^2}$ = 0,628 m/s	$E_{kin} = (0,025 * 0,628^2)/2$ = 0,0049 J
at the end (t=1,267)	$v= \sqrt{(0,934)^2 + (-0,108)^2}$ = 0,940 m/s	$E_{kin} = (0,025 * 0,940^2)/2$ = 0,011 J

Acceleration

$a_x(t)$
$a_y(t)$

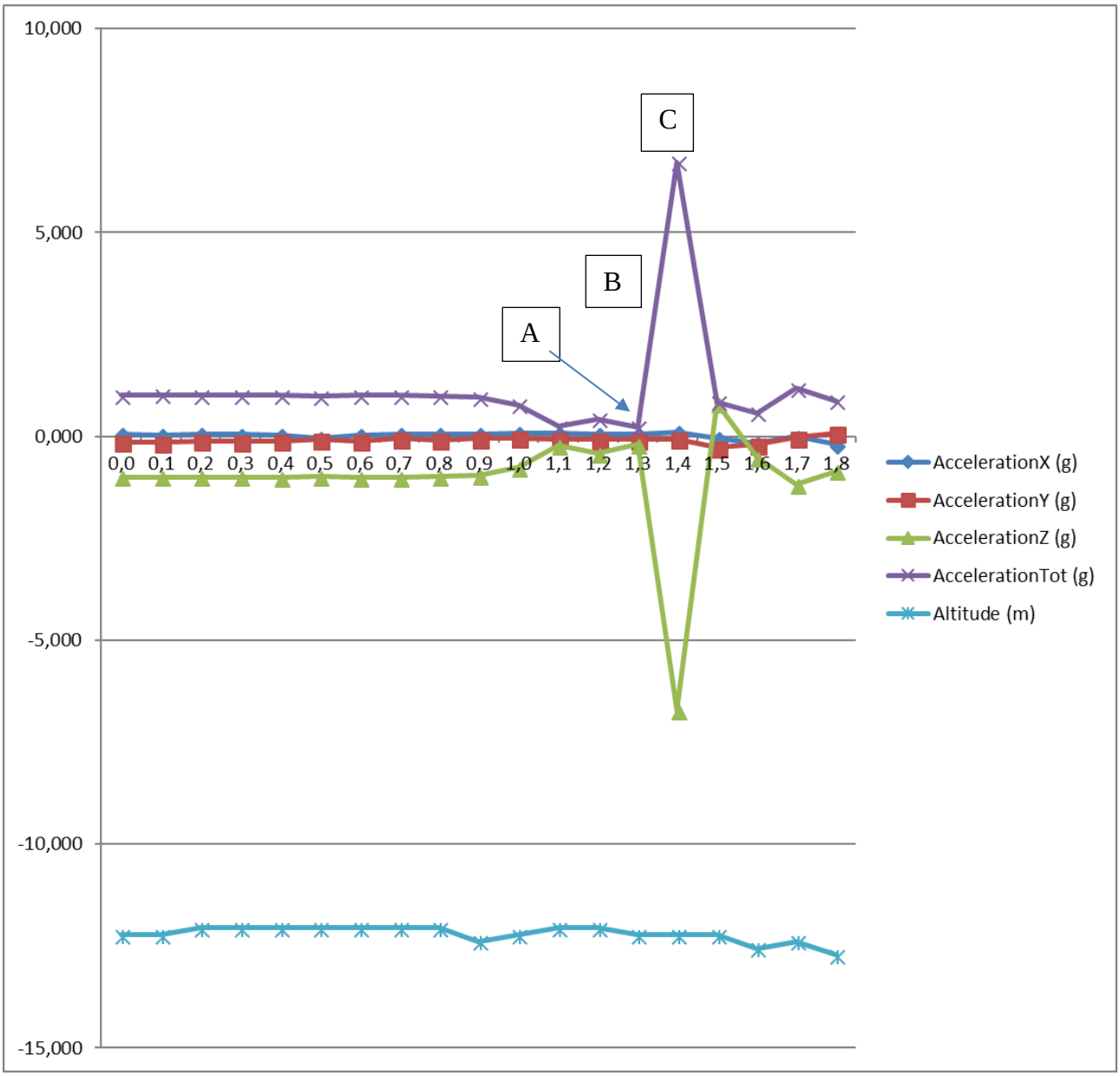
$a = \sqrt{ax2 + ay2}$

at the beginning (t=0,0578)	$a = \sqrt{ax2 + ay2}$ = √(0,161² + (-1,125)²) = 1,14 m/s²
in the middle (t=0,533)	$a = \sqrt{ax2 + ay2}$ = √(1,607²+(-0,482)²) = 1,68 m/s²
at the end (t=1,2)	$a = \sqrt{ax2 + ay2}$ = √(3,053²+(-0,643)²) = 3,12 m/s²

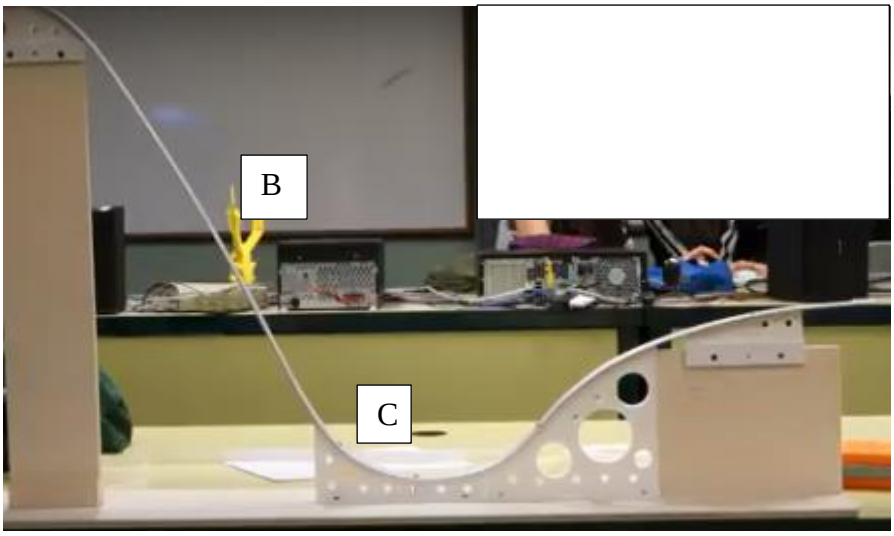
Italian: El Dorado Falls

Time	Altitude (m)	AccelerationX (g)	AccelerationY (g)	AccelerationZ (g)	AccelerationTot(g)
0,0	-12,222	0,055	-0,135	-1,001	1,012
0,1	-12,222	0,041	-0,145	-1,003	1,014
0,2	-12,059	0,057	-0,113	-1,003	1,011
0,3	-12,059	0,048	-0,119	-1,003	1,011
0,4	-12,059	0,038	-0,113	-1,006	1,013
0,5	-12,059	-0,034	-0,074	-0,980	0,983
0,6	-12,059	0,030	-0,117	-1,004	1,011
0,7	-12,059	0,055	-0,052	-1,006	1,009
0,8	-12,059	0,058	-0,085	-0,989	0,994
0,9	-12,391	0,060	-0,047	-0,955	0,958
1,0	-12,222	0,086	-0,042	-0,762	0,768
1,1	-12,059	0,088	-0,060	-0,224	0,248
1,2	-12,059	0,057	-0,079	-0,418	0,429
1,3	-12,222	0,060	-0,081	-0,204	0,228
1,4	-12,222	0,111	-0,058	-6,722	6,723
1,5	-12,222	-0,034	-0,271	0,808	0,853
1,6	-12,555	-0,156	-0,196	-0,522	0,579

1,7	-12,391	0,003	-0,020	-1,182	1,182
1,8	-12,724	-0,204	0,089	-0,849	0,878



A



A : Highest point

B: During the slope with an inclination of 60°

C : max acceleration