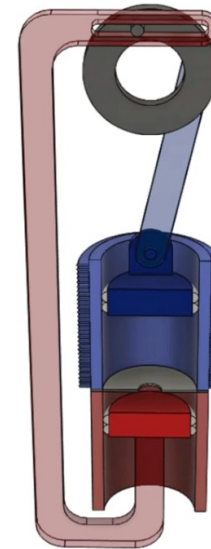


Stirling-engines: experimental studies and simulations



Zoltán CSERNOVSZKY
Kende KURUCZ



Berzsenyi Secondary School, Budapest
Budapest University of Technology and Economics

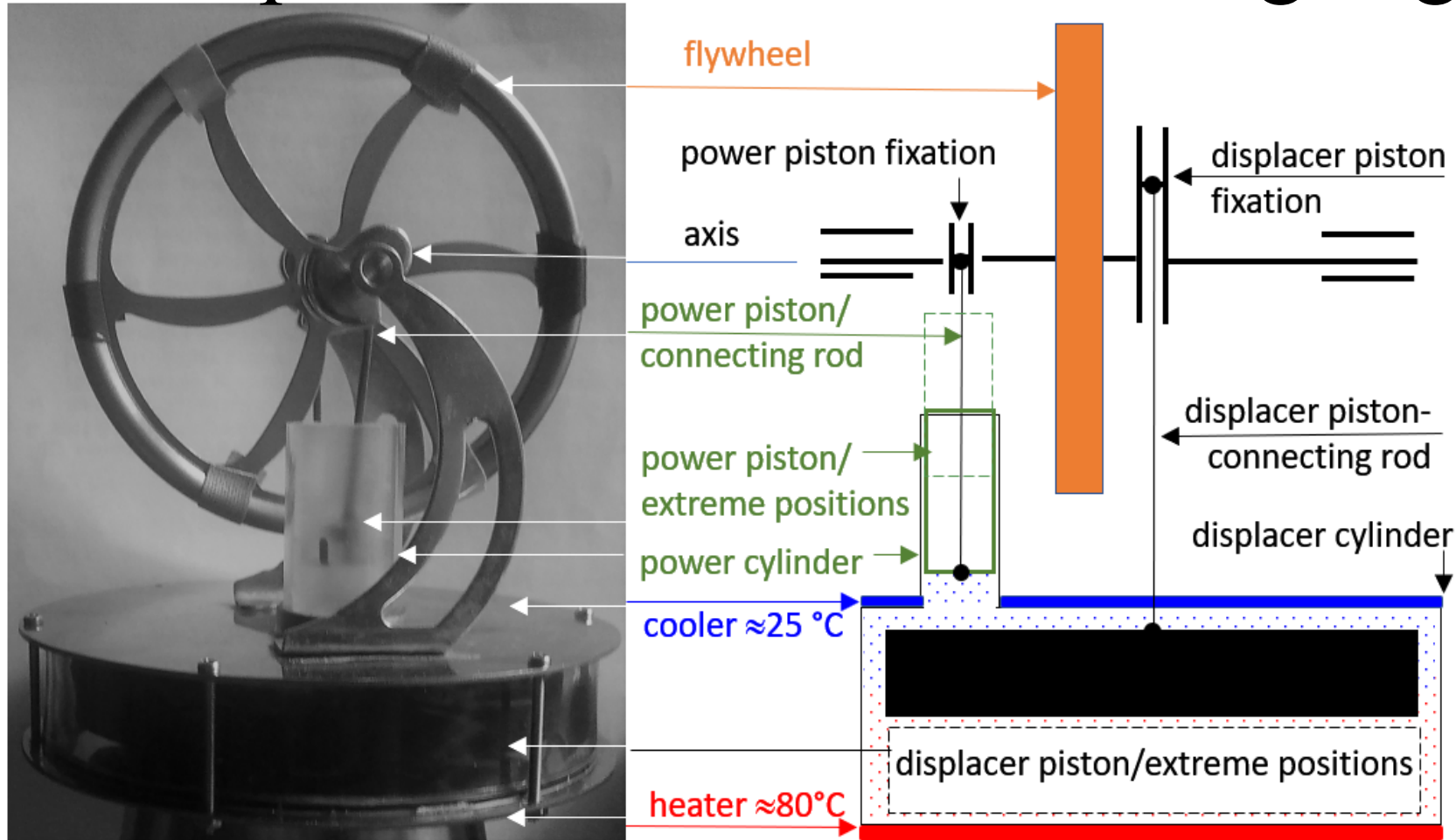
Low Temperature Differential Stirling engine



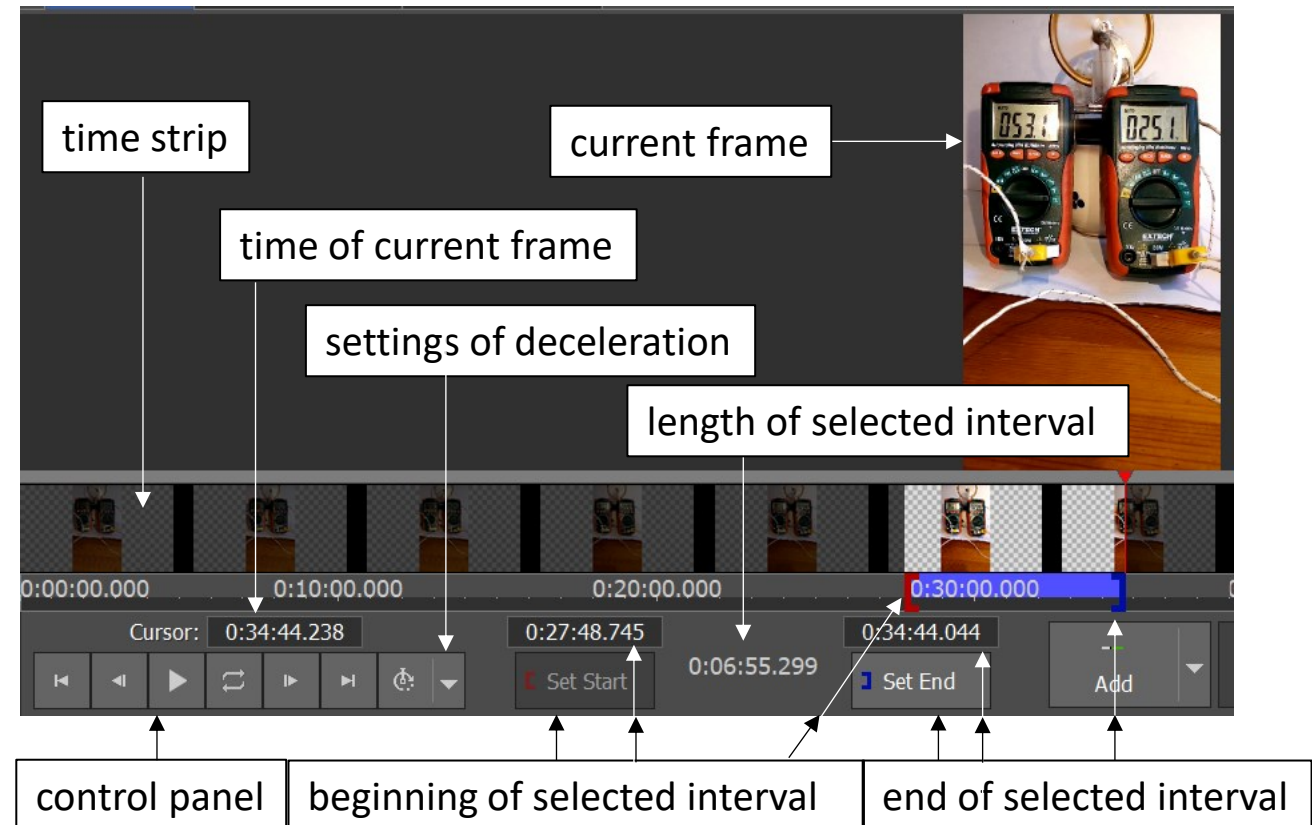
Bauer, Marosi, Balogh, Kerényi

Tóth, Döbrögi, Szenner

2023



VideoPad Video Editor



time strip

current frame

time of current frame

settings of deceleration

length of selected interval

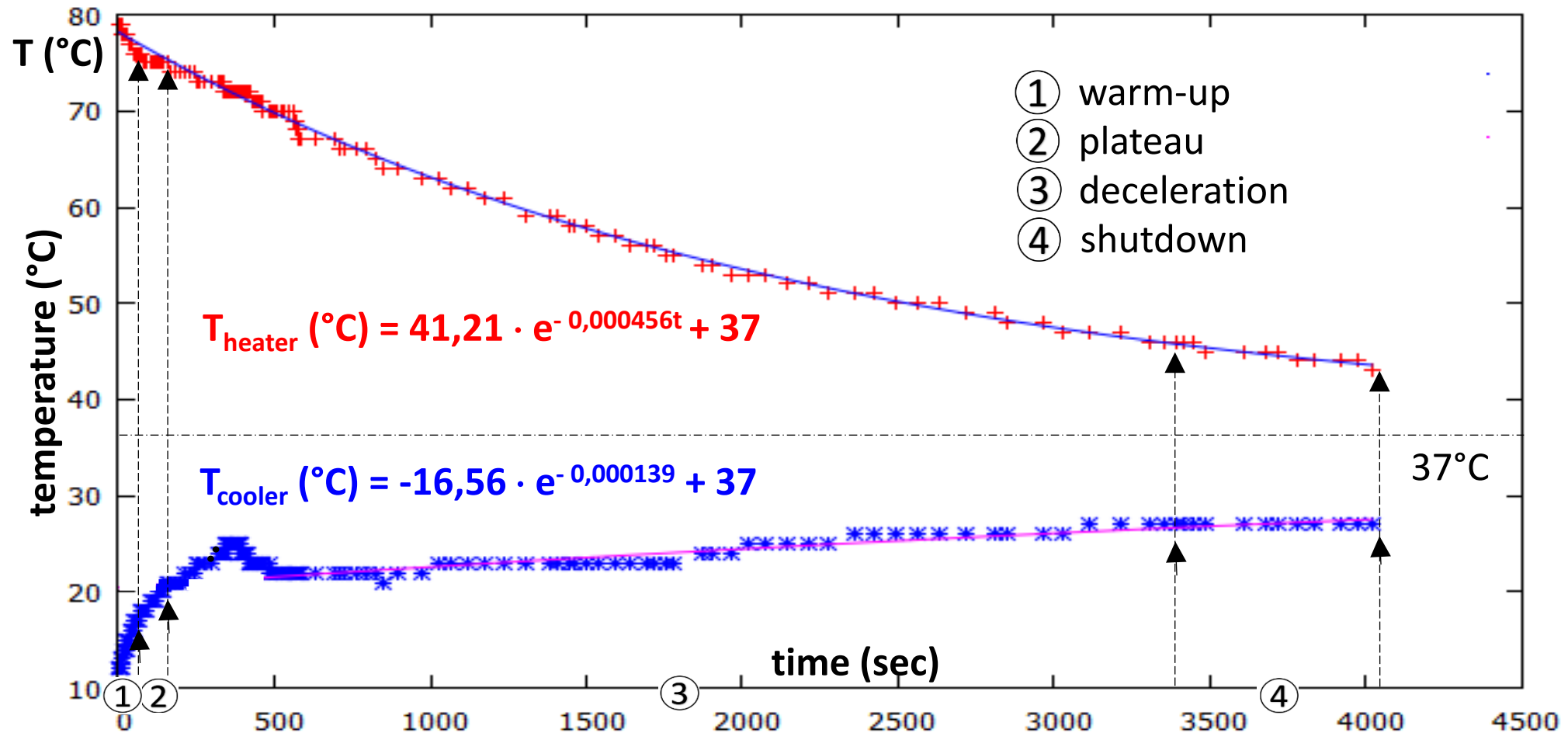
0:00:00.000 0:10:00.000 0:20:00.000 0:30:00.000

Cursor: 0:34:44.238 0:27:48.745 0:06:55.299 0:34:44.044

control panel beginning of selected interval end of selected interval

Set Start Set End Add

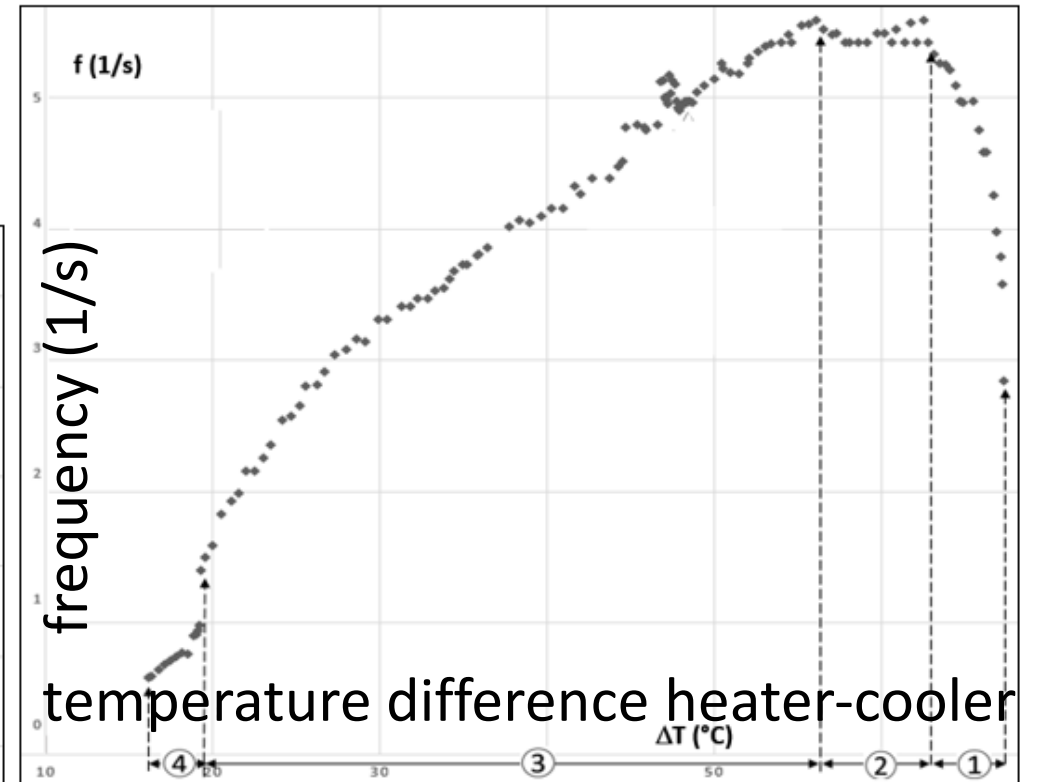
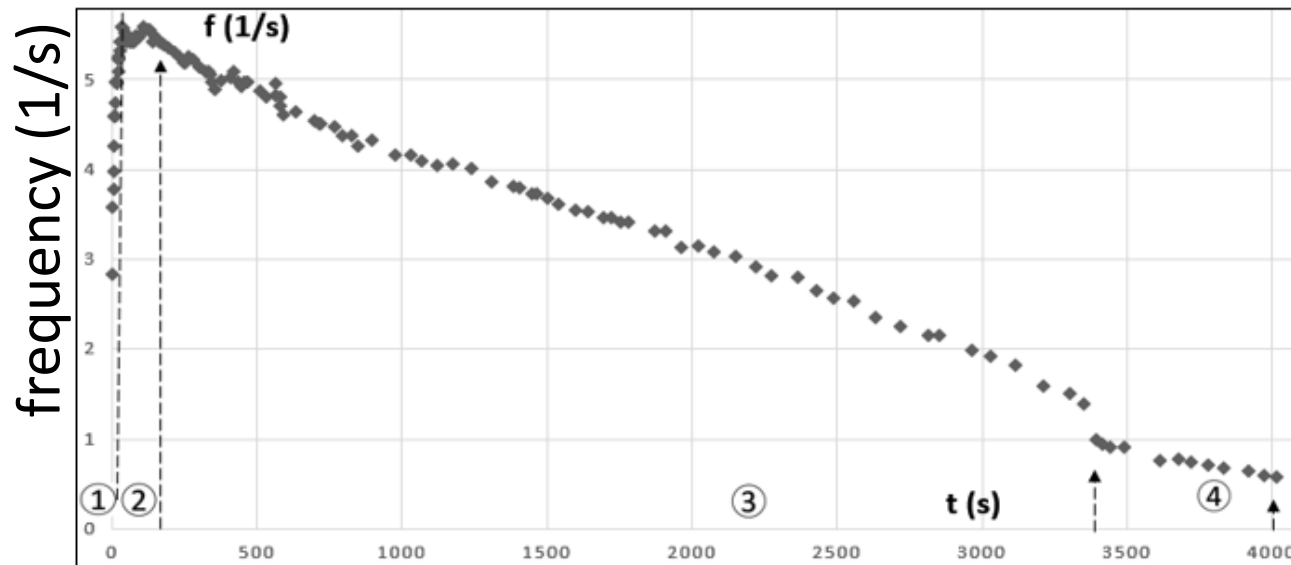
Temperature of cooler / heater



Frequency of the flywheel

$$f = n / \Delta t$$

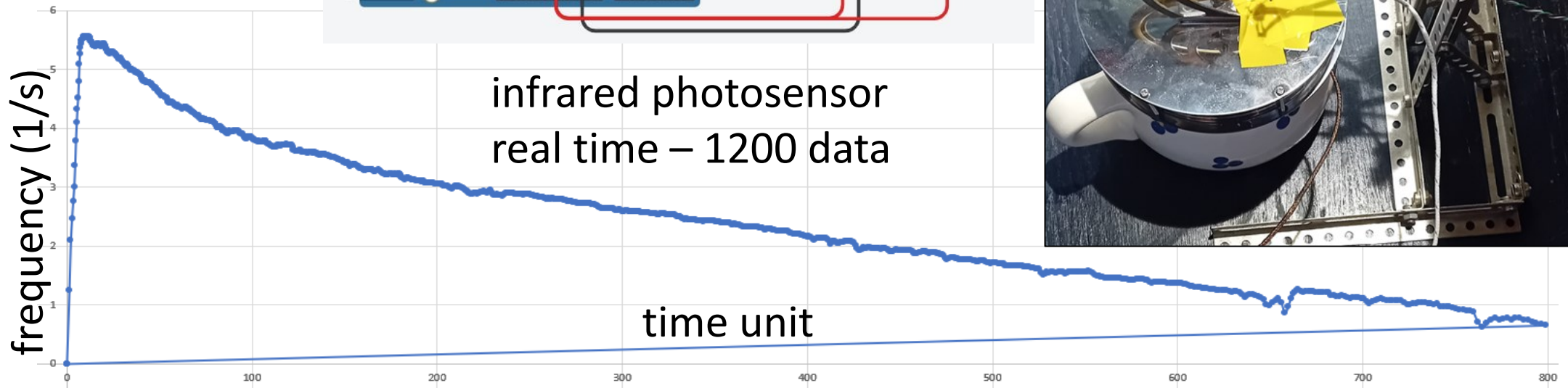
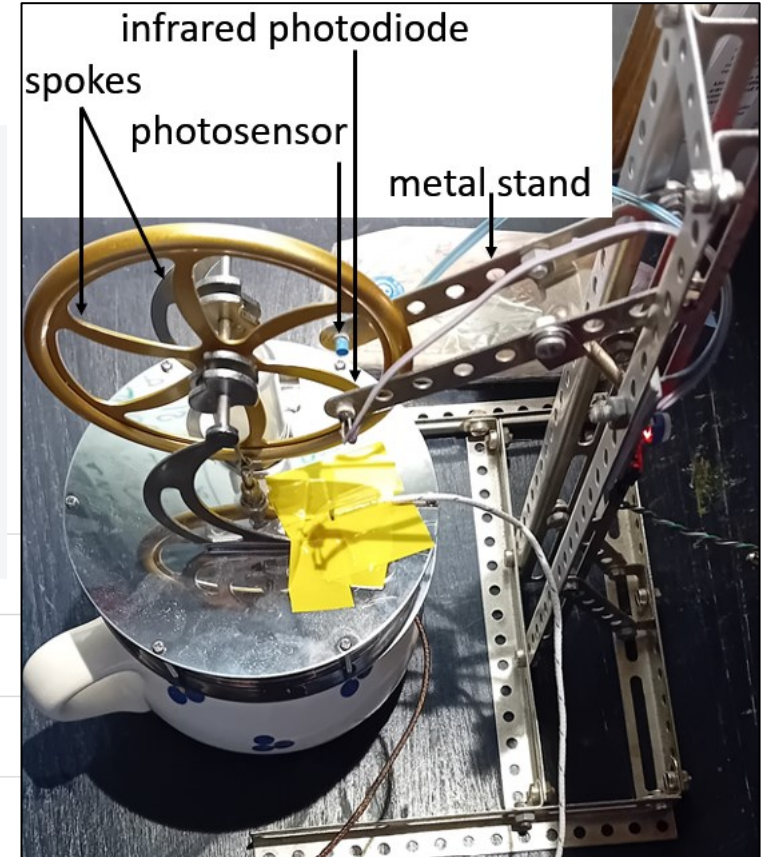
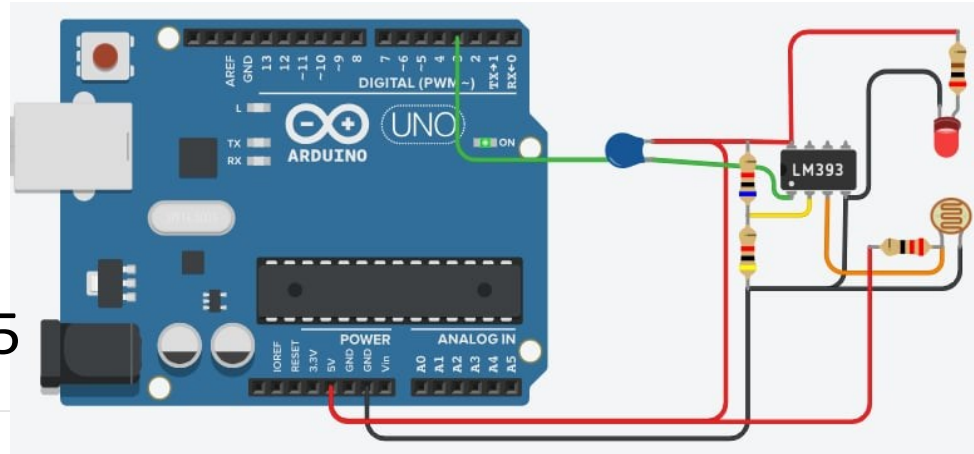
- ① warm-up
- ② plateau
- ③ deceleration
- ④ shutdown



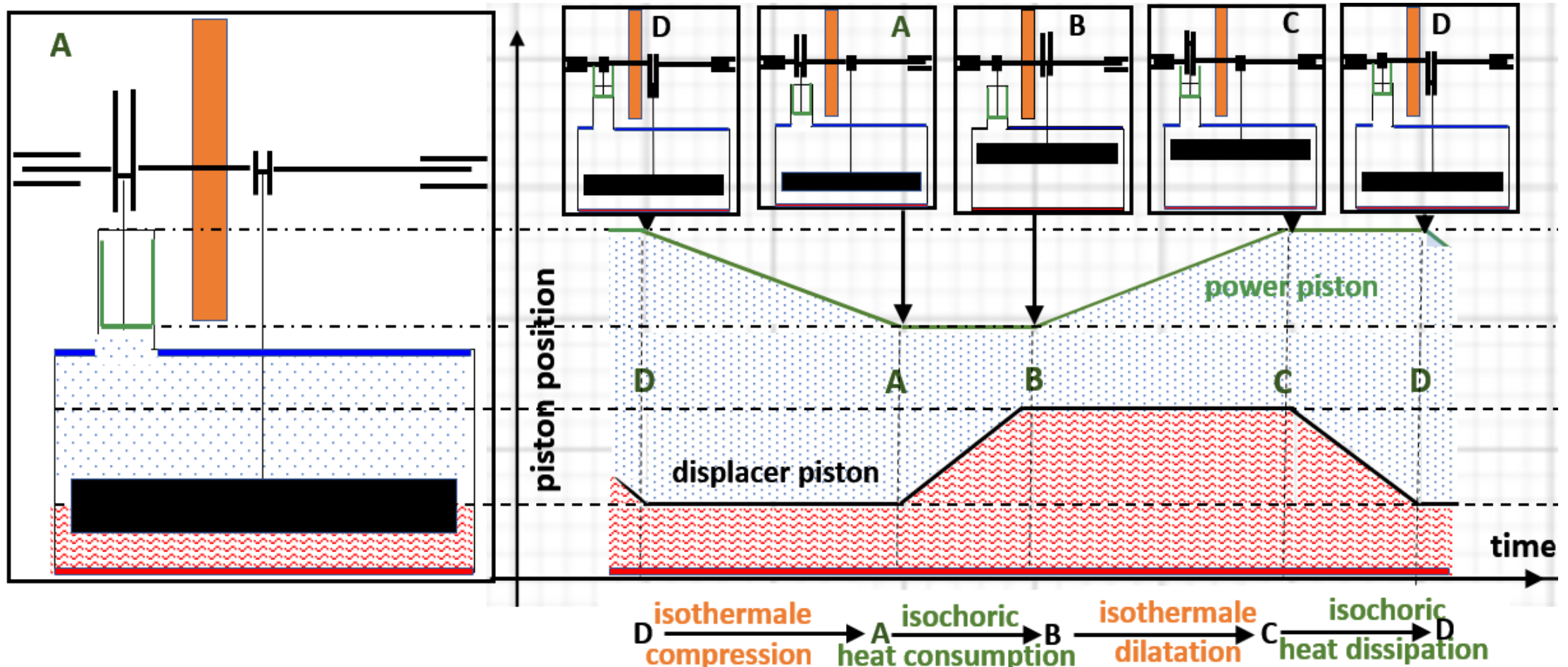
Arduino directed measures



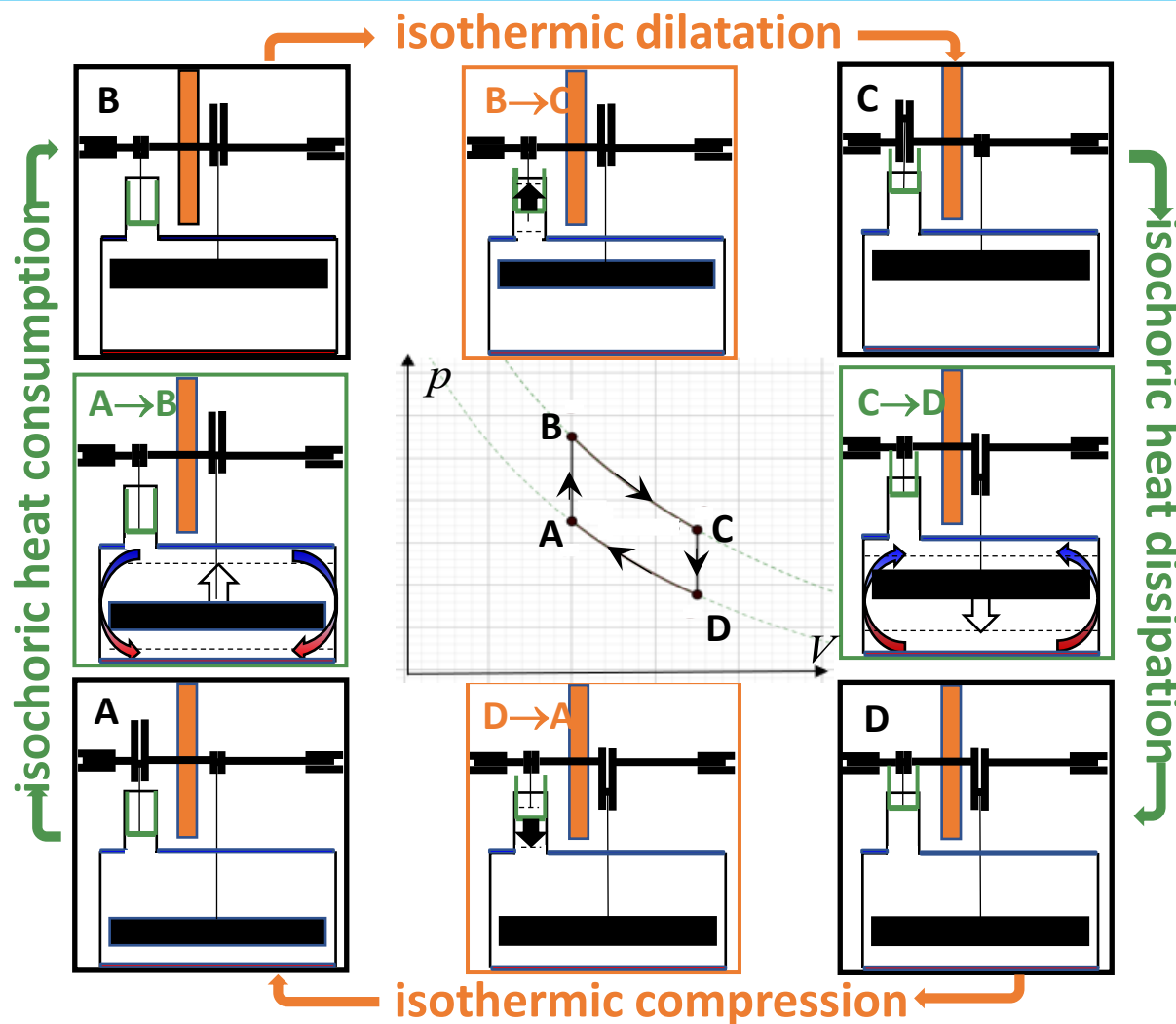
K KURUCZ, 2025



Variable gas volumes - idealisation



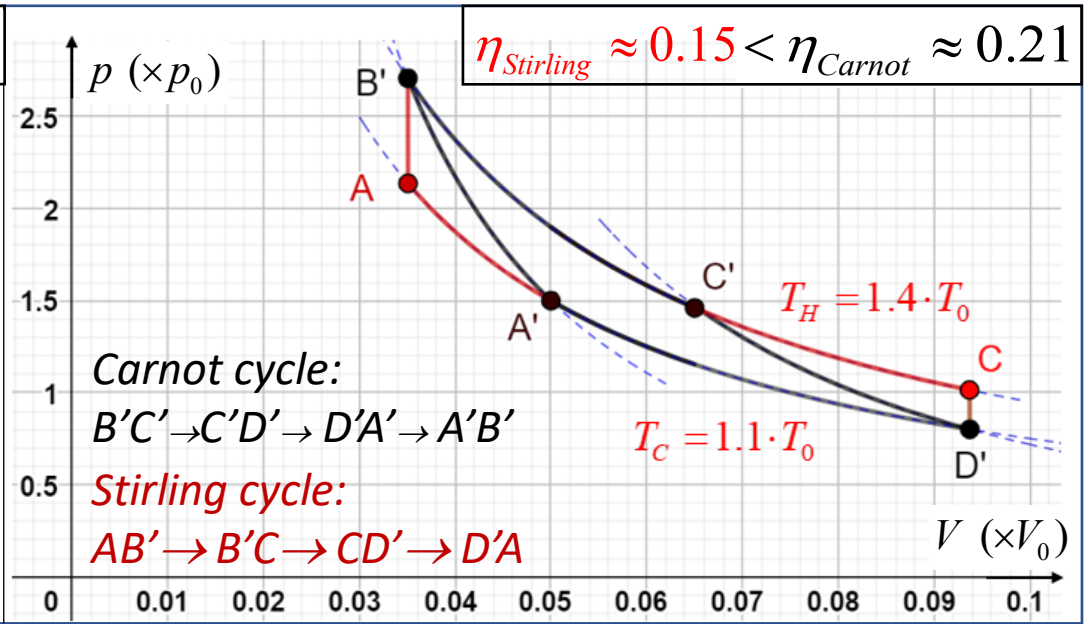
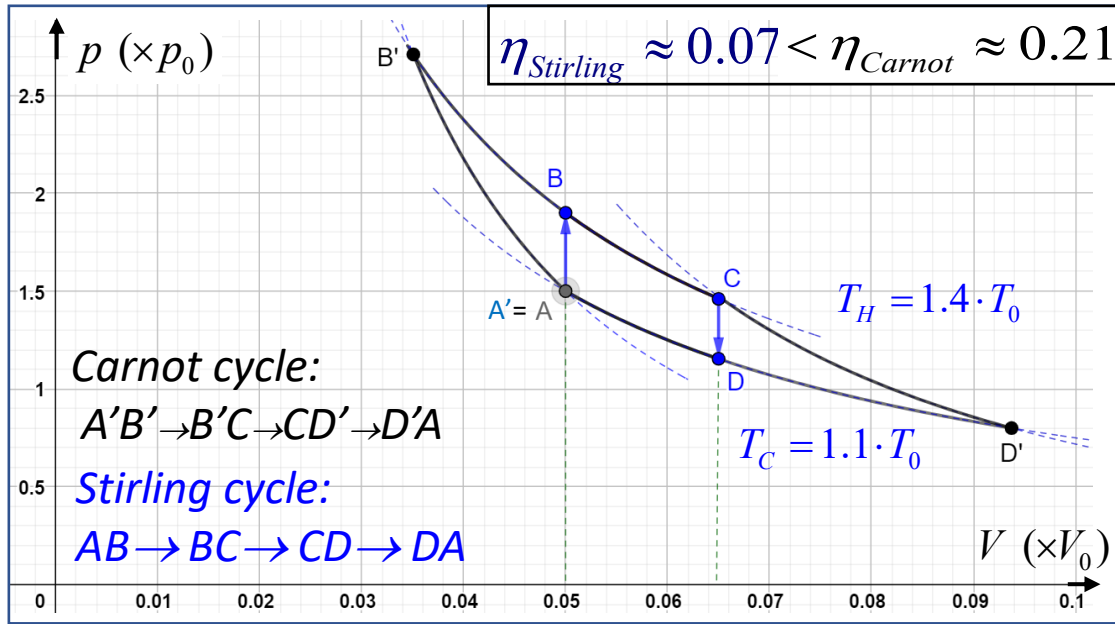
Stirling cycle



Carnot-cycle and Stirling-cycle

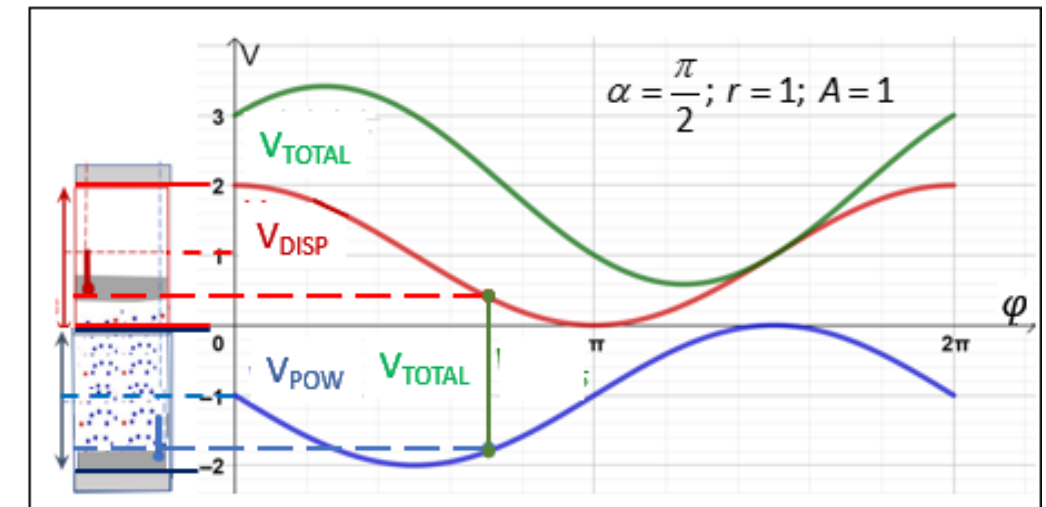
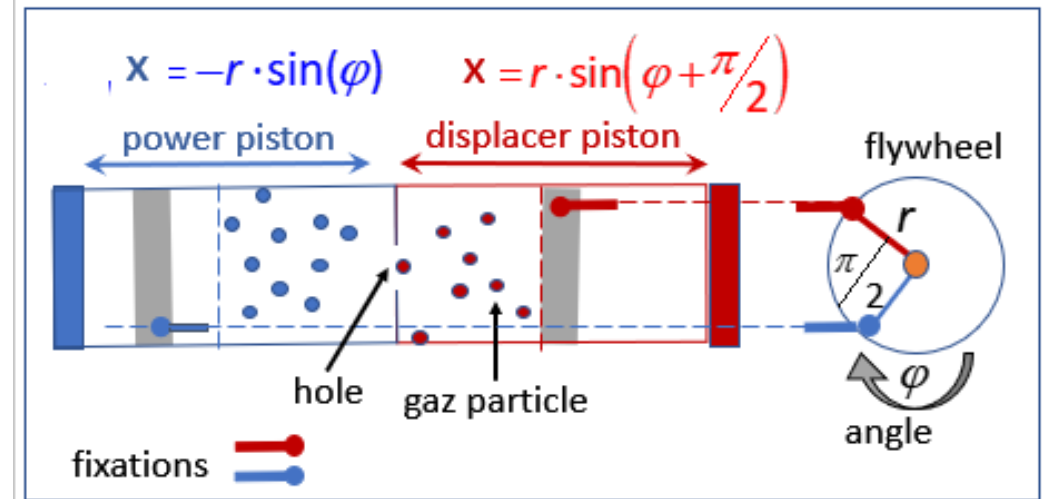
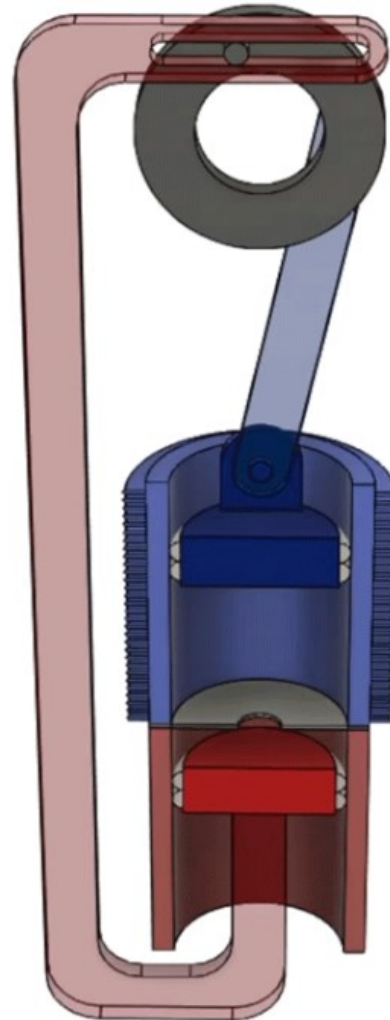
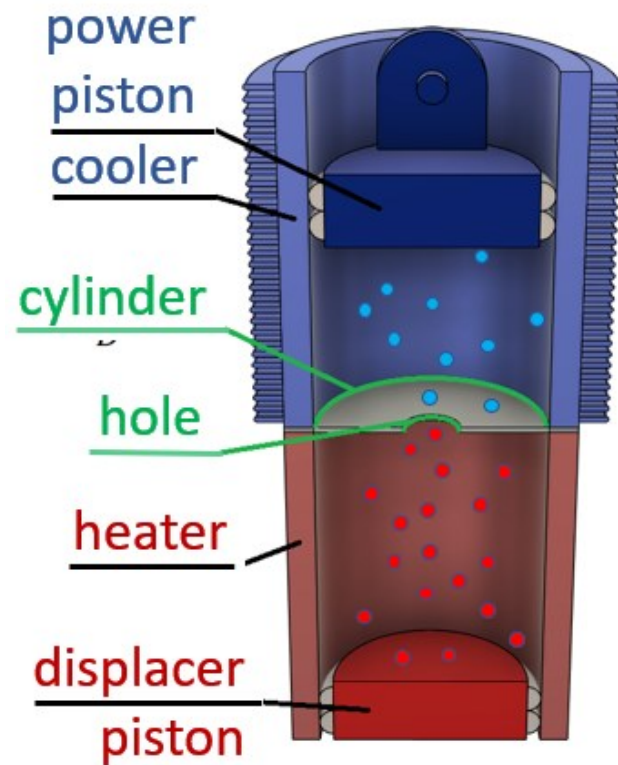
$$\eta_{Carnot} = \frac{\Delta T}{T_{hot}} = \eta_{max}$$

$$\eta_{Stirling} = \frac{\Delta T \cdot \ln \frac{V_{max}}{V_{min}}}{\frac{f}{2} \cdot \Delta T + T_{hot} \cdot \ln \frac{V_{max}}{V_{min}}}$$

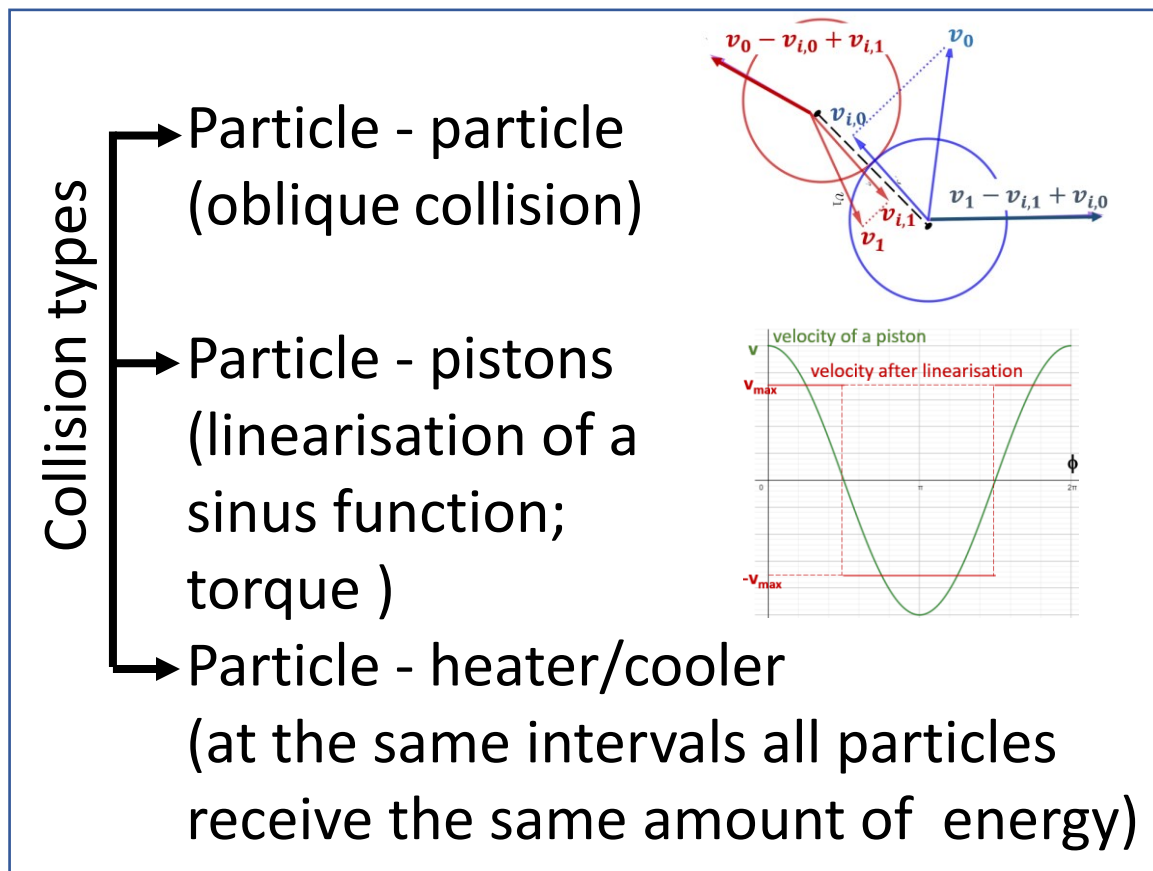
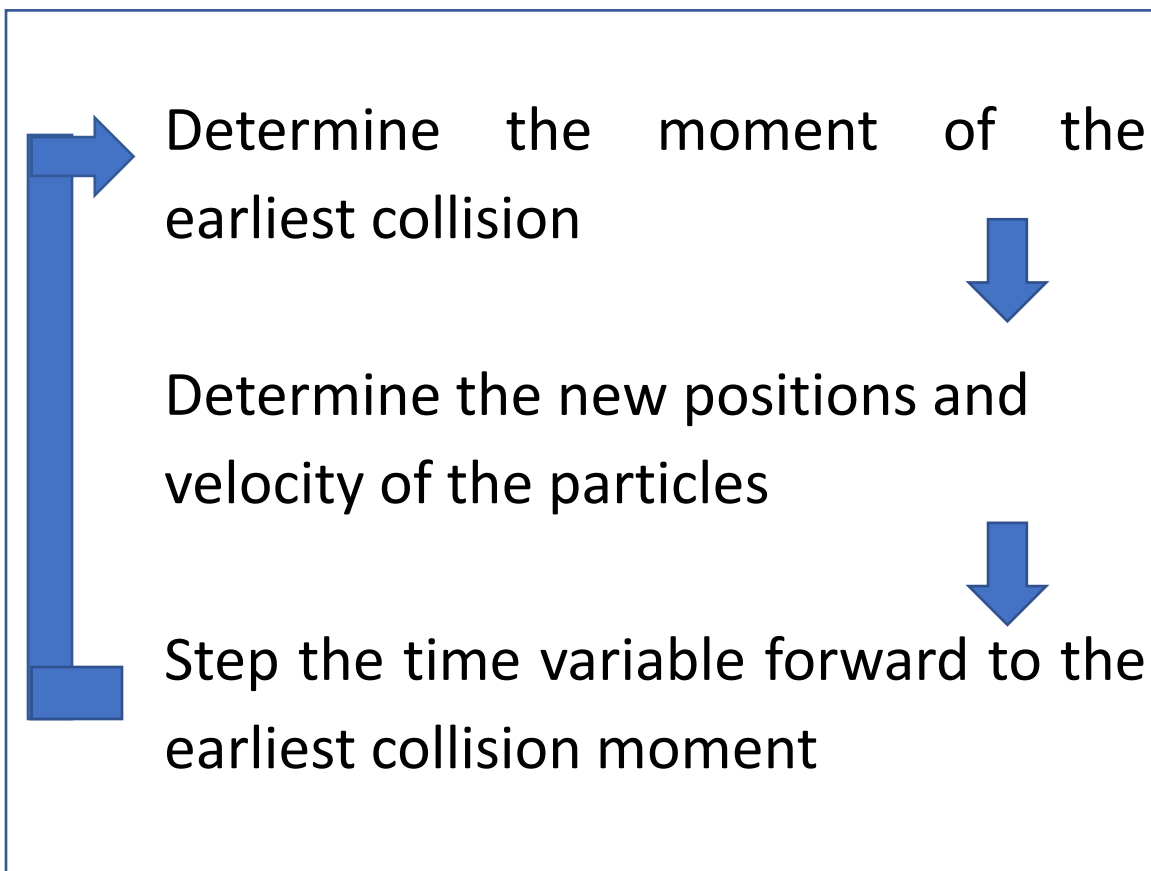


$n = 0.0675 \text{ mol}; f = 5; p_0 = 1.013 \cdot 10^5 \text{ Pa}; V_0 = 22.41 \text{ l}; T_0 = 273.15 \text{ K}; p_A = 1.5 \cdot p_0; V_A = 0.050 \cdot V_0; T_A = 1.1 \cdot T_0$

Simulations: configuration



Simulations: event driven dynamics



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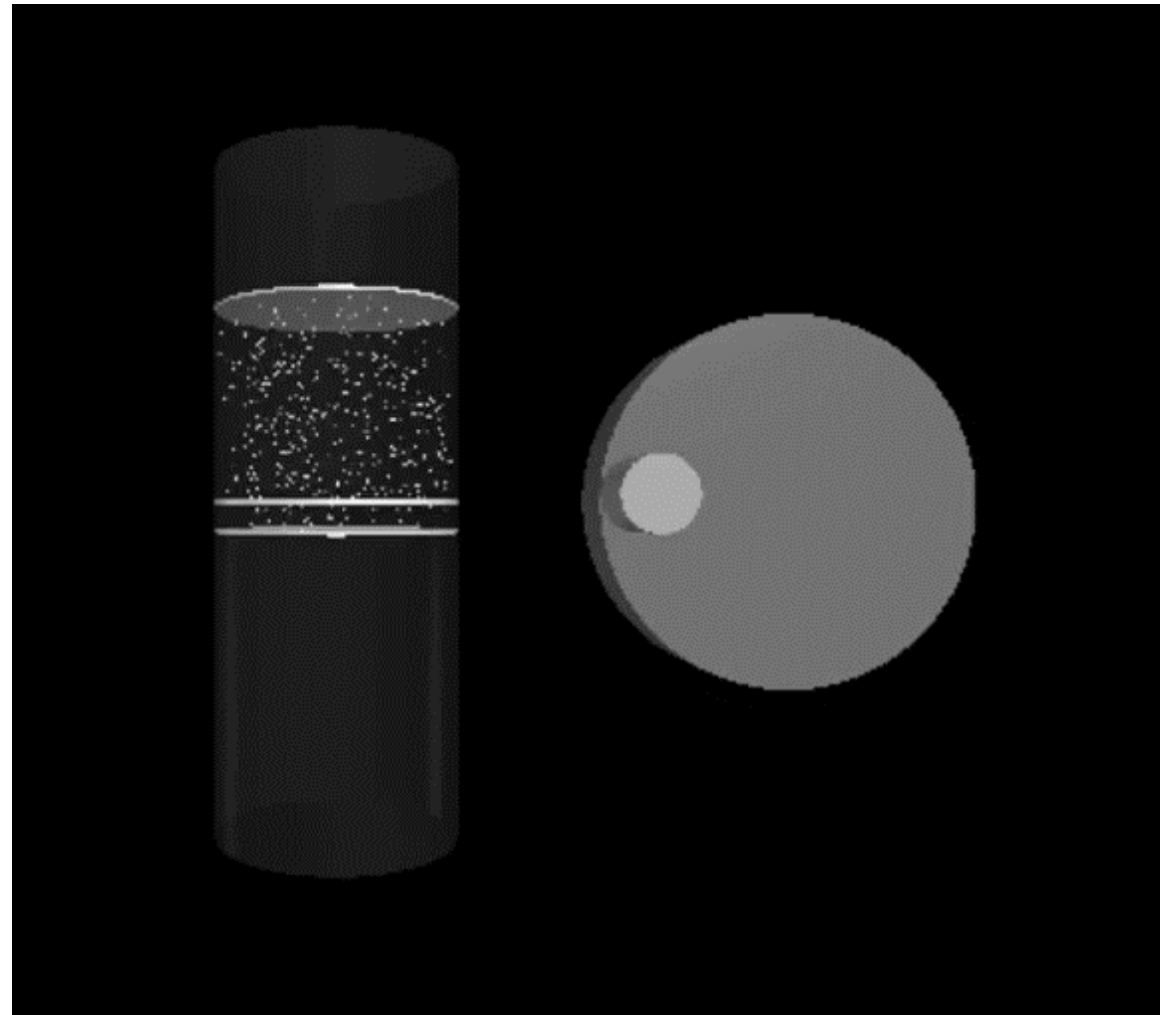


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Simulation in Python



M TÖRÖK, 2021



National Scientific Student Association High School Section (OTDK)

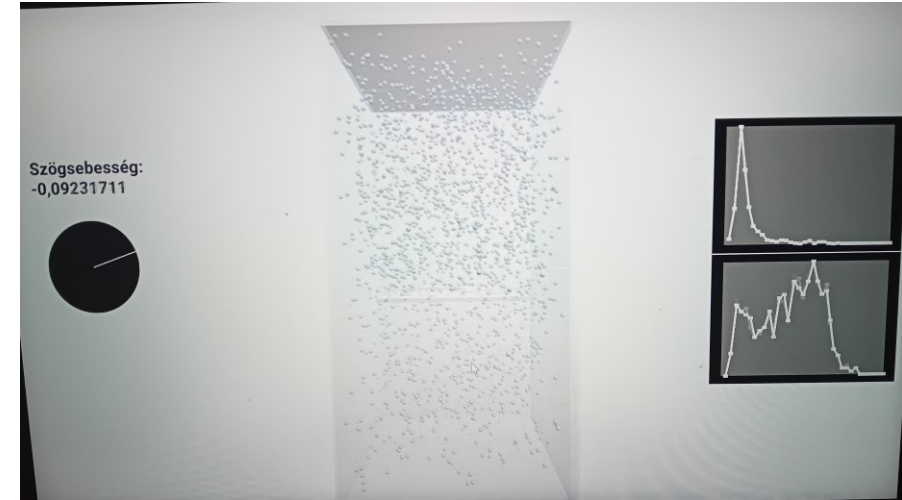


CSERNOVSZKY, Á HORVÁTH, ELTE

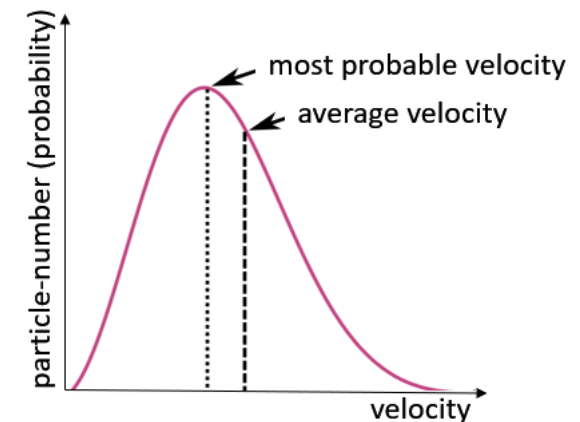
Simulation in Unity



ZHENG CHENG, 2021



Maxwell-Boltzmann
distribution



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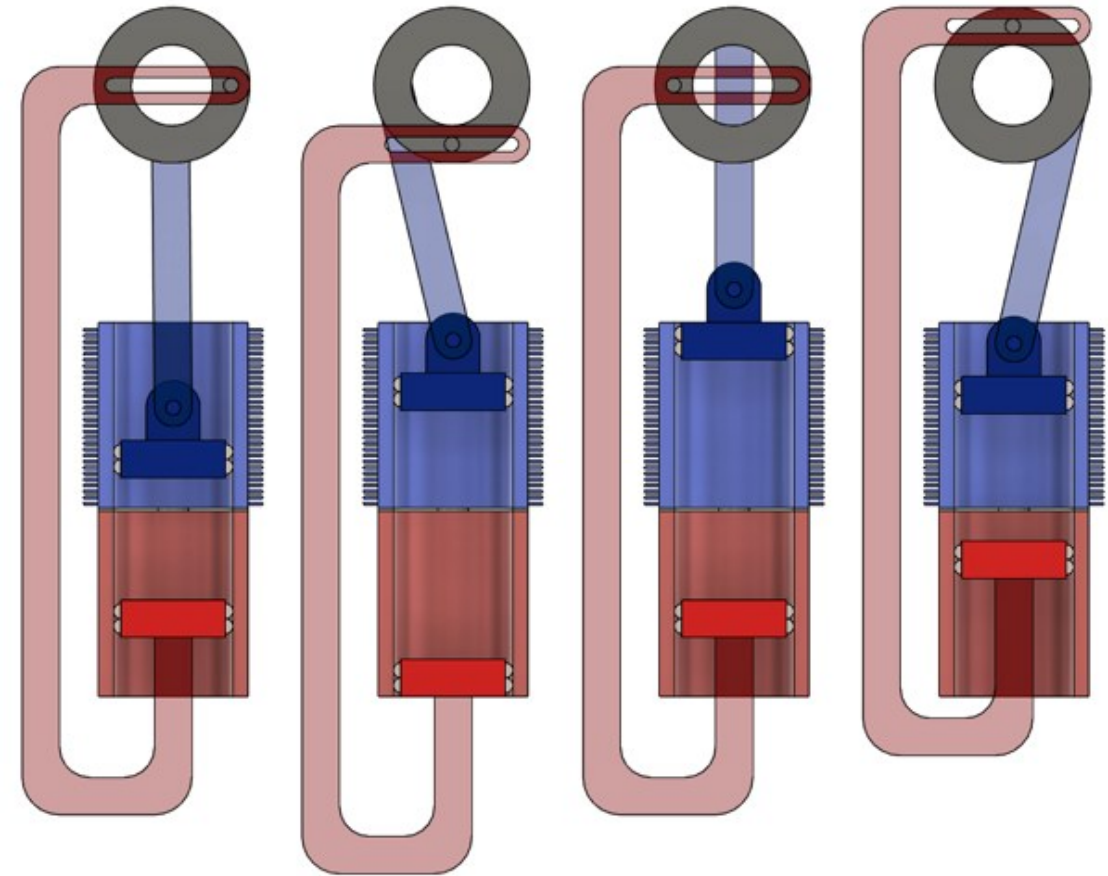


CSERNOVSZKY, Á HORVÁTH, ELTE

Simulation in C++



CSAJÁGI / FARAGÓ , 2023



This study was funded by the Content Pedagogy Research Programme of the Hungarian Academy of Sciences

PHYSICS CAMP OF BERZSENYI SECONDARY SCHOOL



DÖBRÖGI, SZENNER, TÓTH, KURUCZ

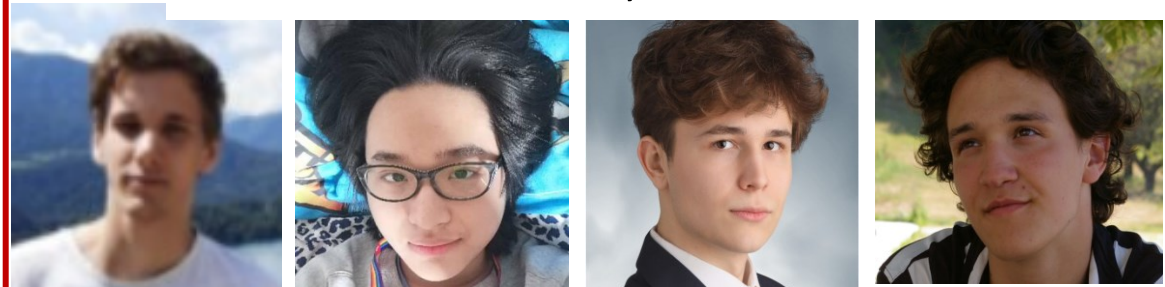


BAUER, MAROSI, BALOGH, KERÉNYI
2023-2025

National Scientific Student Association High School Section (OTDK)



CSERNOVSZKY, HORVÁTH



TÖRÖK, ZHENG CHENG, CSAJÁGI, FARAGÓ
2021 2023

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