

Phase	Application
I. Scope Definition	<p><b><u>Software Entity Class:</u></b> Python programming language</p> <p><b><u>Software Entities (SE):</u></b> Interpreted &amp; DTV, Interpreted &amp; STV, Py_compile &amp; DTV, Py_compile &amp; STV, Nuitka &amp; DTV, Nuitka &amp; STV.</p> <p><b><u>Test cases:</u></b> Ten algorithms of the Computer Language Benchmarks Game (CLBG): Binary trees, Fannkuch-redux, Fasta, Mandelbrot, K-nucleotide, N-body, Pi-digits, Reverse-complement, Regex-redux and Spectral-norm.</p> <p><b><u>Run test cases:</u></b> Each algorithm in the different ways of executing and programming the Python language.</p>
II. Measurement Environment Setting	<p><b><u>Hardware measuring instrument:</u></b> EET (Energy Efficiency Tester)</p> <p><b><u>Device Under Test (DUT):</u></b> Monitor: Philips 170s6fs LCD Motherboard: ASUS Prime B460-Plus Processor: Intel i7 10700 2900MHz RAM: 2 modules of 16GB Kingston Hiperx Fury DDR4 Graphics card: Sapphire ATI Radeon X1950 GT, 256mb RAM DDR3 Hard disk: Western Digital Blue 500GB SSD Power supply: 360 PS5805 – 580W O.S.: Gnu/Linux Ubuntu 20.4 LTS</p> <p><b><u>Measures:</u></b> Execution time DUT Energy Consumption Processor energy consumption Graphics Card energy consumption</p>
III. Measurement Environment Preparation	<p><b><u>Before starting the measurements:</u></b> Install the Nuitka compiler in the version corresponding to Python 3.11.</p> <p><b><u>For each Python executing way under study:</u></b> Clean the DUT Check that there is not any software running in the background.</p>
IV. Performing the measurement	<p><b><u>For Python interpreted:</u></b> Execute the algorithms using CPython interpreter.</p> <p><b><u>For py_compile:</u></b> Compile the algorithms using py_compile. Execute the compiled algorithms using CPython interpreter. Delete _pycache_ folder between measurements.</p> <p><b><u>For Nuitka:</u></b> Compile the algorithms using Nuitka. Execute the compiled algorithms.</p>
Phases III and IV are repeated for each one of the algorithms	
V. Test Case Data Analysis	Analyse the energy consumption data for each test case. Check that the measurements are correct (outliers, wrong executions and so on) and eliminate the wrong measures if it its necessary.
VI. Software Entity Data Analysis	<p>For each SE: Calculate the mean of the energy consumption for each algorithm and for each component (DUT, processor, and graphic card).</p> <p>Calculate the mean of the energy consumption for each SE considering the mean of energy consumption of all the algorithms. State conclusions (see “Results” section)</p>
VII. Reporting the result	This paper