Abstract—We demonstrate a desktop platform which has the ability of fully characterizing RRAM crossbar arrays while not compromising on ease-of-use. The setup consists of our bespoke PCB system connected to a local PC (laptop), on which a Python interface allows the user to directly interact with individual RRAM cells packaged in either crossbar or stand-alone configurations. The platform is capable of current-compliant forming among other exotic pulsing schemes, used for exposing IV and switching characteristics or utilising the devices for a wide range of applications. These operations can be applied on one, or several cells, in an automated fashion, drastically accelerating data acquisition.

I. INTRODUCTION

RRAM cells, also known as memristors, have shown great promise towards implementation in future commercial memory technologies. What makes memristors valuable represents their ability to act like non-volatile, electronically programmable variable resistors. This characteristic fuels a strong research focus towards exploiting them in many other applications, including neuromorphic engineering or conventional analogue electronics [1]. However, there is large variability in behavior among similar cells, most probably due to non-optimal manufacturing methods. Furthermore, there is a lack of an accessible and automated method of acquiring the right biasing parameters which can expedite reliable and repeatable resistive switching (RS) in RRAM cells.

Our dedicated platform is tailor-made to work with crossbars or arrays of stand alone RRAM cells [2]. It facilitates the researcher by giving direct access to individual devices and obtaining characterisation results or extracting their biasing parameters automatically at a click of a button. Write pulsing capabilities of up to \( \pm 12 \) V amplitude and down to 50 ns pulse width, and accurate current reading capabilities down to 1 nA are possible, including current cut-off at down to 1 nA in maximum 500 ns. These operations can be performed in quick succession, opening a wealth of possible pulsing sequences to be designed with ease and applied to a range of devices in an automated fashion. This versatile data acquisition process is complemented by a Python interface which controls the hardware platform. The overall software framework is designed in a modular fashion, which allows for easy implementation of custom routines, such as adaptive algorithms that extract the biasing parameters of RRAM cells [3].

II. DEMONSTRATION DESCRIPTION

The experimental set-up (Fig. 1) consists of a PC running a dedicated Python interface, a USB-connected PCB hosting the bespoke hardware platform and packaged memristor samples.

III. VISITOR EXPERIENCE

During the demonstration, the user can interact directly with individual memristor cells and apply a range of possible pulsing sequences, such as: simple reads and writes, electro-forming using current compliance, and an adaptive parameter finder algorithm which outputs biasing parameters. The user can observe the dynamics of individual RRAM cells in real time and has the choice of performing their own experiment by demonstrating a memristor imply logic gate.

The visitor will therefore have hands-on experience with memristive devices, a feat normally only possible in controlled laboratory environments, and witness the growing potential of RRAM technology.

REFERENCES