Milo Sensors

Dear Challenge Prize Evaluators,

Say hello to PROOF™, the world's first wearable designed for continuous alcohol monitoring! PROOF™ utilizes disposable cartridges that are designed for 12 hours of continuous use. Each PROOF™ cartridge contains the enzymatic electrochemical sensor that enables noninvasive monitoring of BAC. To activate these cartridges and begin testing there are just a few simple steps, and then you will be on your way to enjoying the PROOF™ wearable! Cheers!

The necessary steps to have a successful test, from unboxing to strapping the device on your wrist, are demonstrated in our instruction video located at:

Link: https://vimeo.com/milosensors/instructions
Password: shakennotstirred

Enclosed in this package you will find:

- A PROOF™ wearable wristband
- Two disposable cartridges with activation instructions
- A USB charging cable
- An iPhone 4s (with corresponding PROOF™ app and "Testflight")
- One mass-production sample cartridge
- A USB drive with the deconvolution program. On this drive, you'll find:
    - An installer for the Matlab-based deconvolution package (Windows and Mac)
    - An Excel file to visualize the deconvoluted BAC

Mass-production sample cartridge

The mass-production sample cartridge that we included (shown right) is a **non-functional** prototype that demonstrates how our cartridges will appear in high volume.

PROOF™ App

You may use the PROOF™ App loaded on the phone. For best results, log in to the TestFlight App (you will need to contact evan@milosensor.com to get permission). TestFlight will allow you to download the latest version of the PROOF™ app for best performance. From the PROOF™ App, you will be able to easily export data.
NOTE: You must set up an email account on the provided phone. Otherwise you will not be able to export the data.

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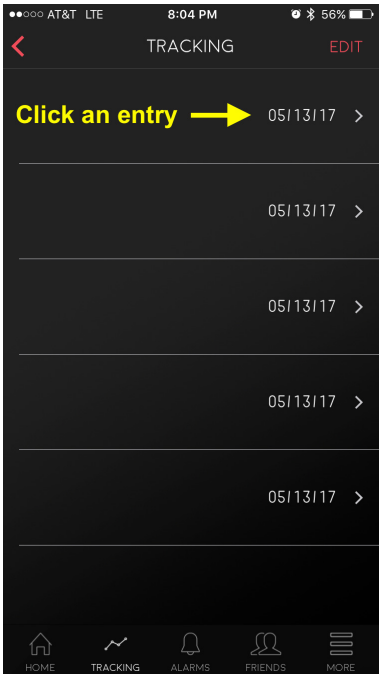
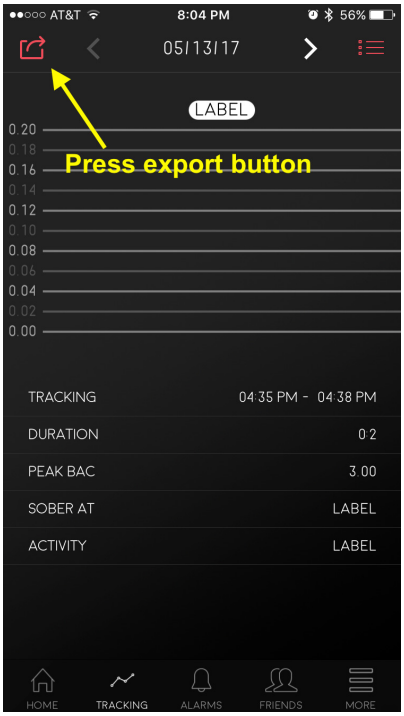
Simply follow the following steps:

1. Go to “tracking” page on the PROOF™ app, and click an entry



2. Press the “export” icon on the top-left of the screen



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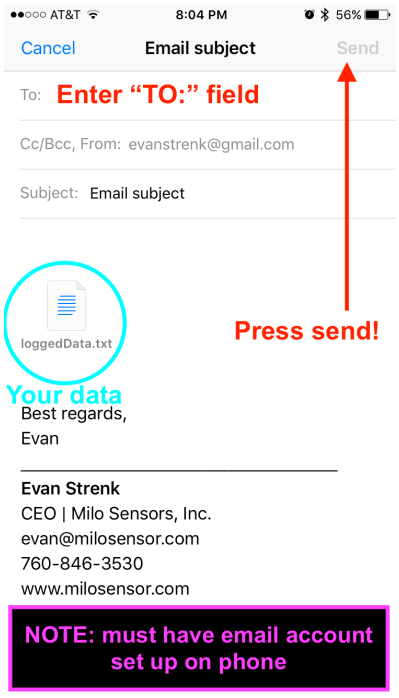
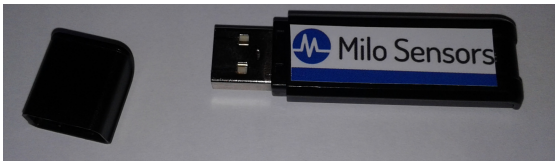
3. Enter the “TO:” field, enter your email subject, and click send!



Deconvolution of PROOF™ data

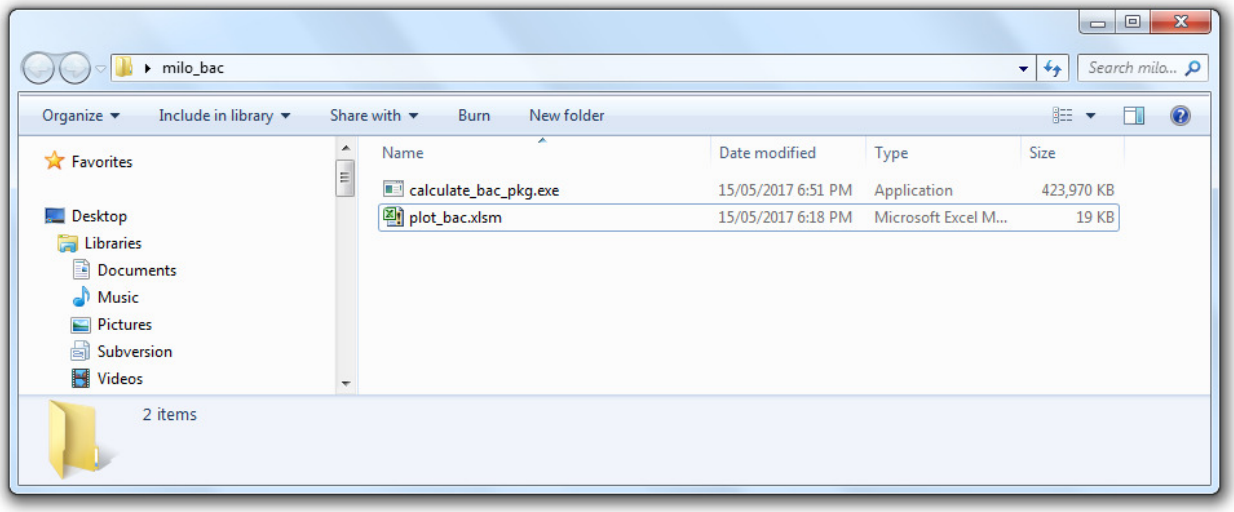
Alcohol passes through the skin in a diffusive process. PROOF™ measures transdermal alcohol flux, which can be modeled as a convolution of BAC with a skin-response function. Deconvolution is the process of converting the convoluted signal (transdermal alcohol flux) back into a closer-to-real-time estimate of BAC. In this instructional package, we will share some of the exciting developments we have made to better estimate real-time BAC from transdermal alcohol flux. The process of deconvoluting the transdermal alcohol flux into an estimate of BAC involves a series of steps and we have made improvements in each of these steps allowing us to reduce the response time by roughly an hour. First, the signal needs to be filtered to remove high-frequency noise and increase the accuracy of the BAC estimate. Using Fourier techniques, we have been able to produce a much more stable and reliable estimate. Next, the alcohol flux measured on the outside of the membrane needs to be deconvoluted into BAC measured on the inside of the membrane. Using the actual diffusion equation and a clever choice of basis, we have been able to explicitly solve the deconvolution problem and recover an estimate of BAC using a highly computationally efficient algorithm.

To properly deconvolute, all the relevant programs are in the attached USB stick (shown right)



Installing pre-requisite files

Copy the folder 'milo_bac' from the provided USB drive into any local folder of the computer. Our installation files are for Windows only. Once opened, the folder should look like this:



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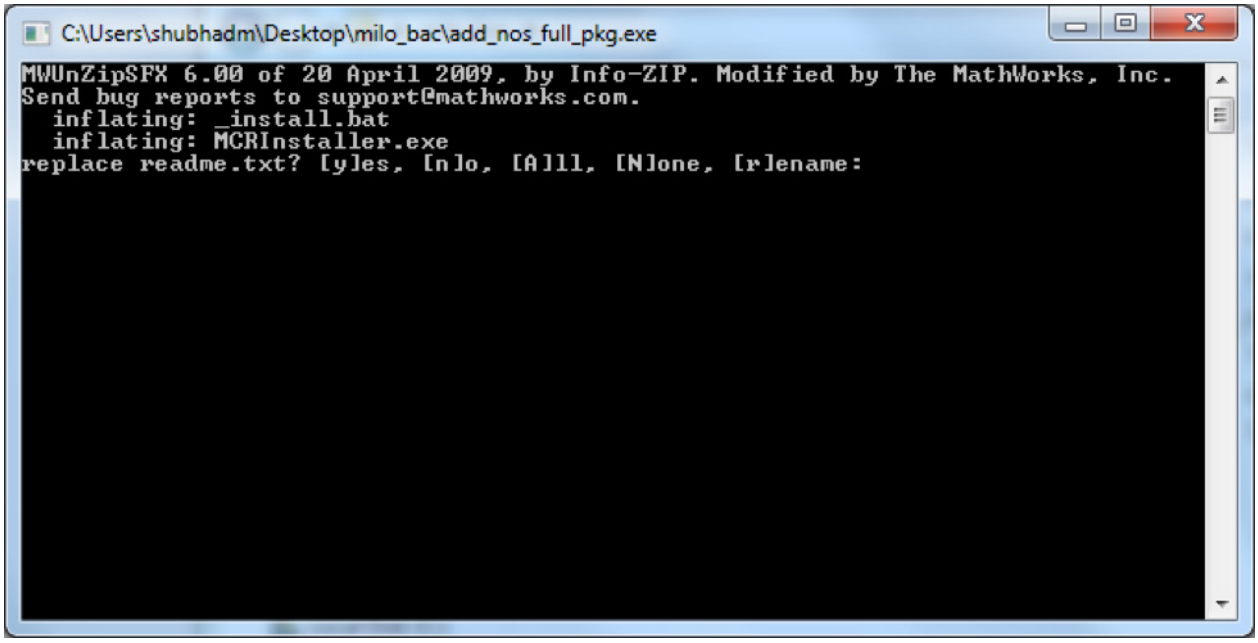
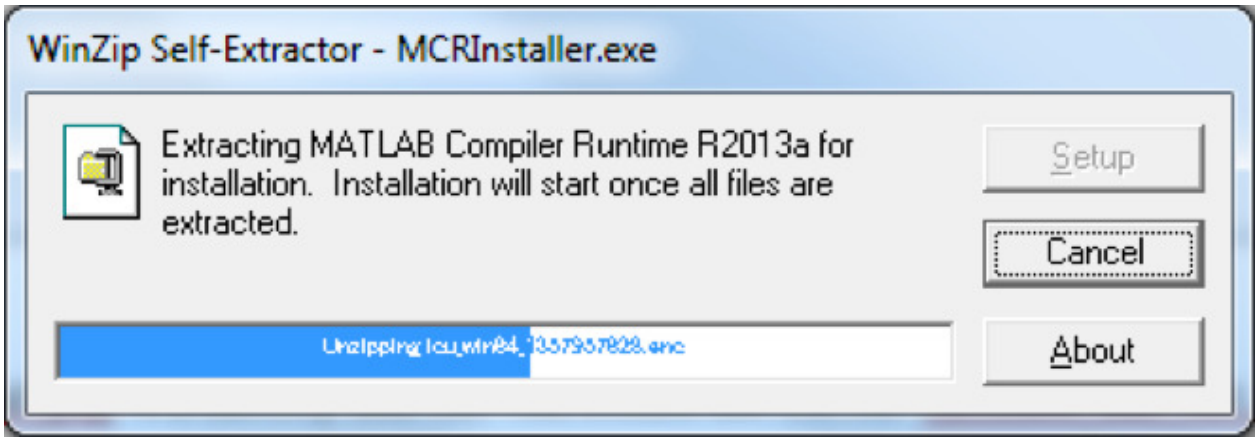
File transfer

Once you have your “loggedData.txt” file succesfully emailed to your account, copy and paste it into your ‘milo_bac’ folder. The deconvolution program will search for this file.

Double-click the file ‘calculate_bac_pkg.exe’. The following screen should appear:



If you are prompted to replace any file , press ‘y’ and then the enter key. The following screen should appear automatically followed by the MATLAB Runtime Installer.



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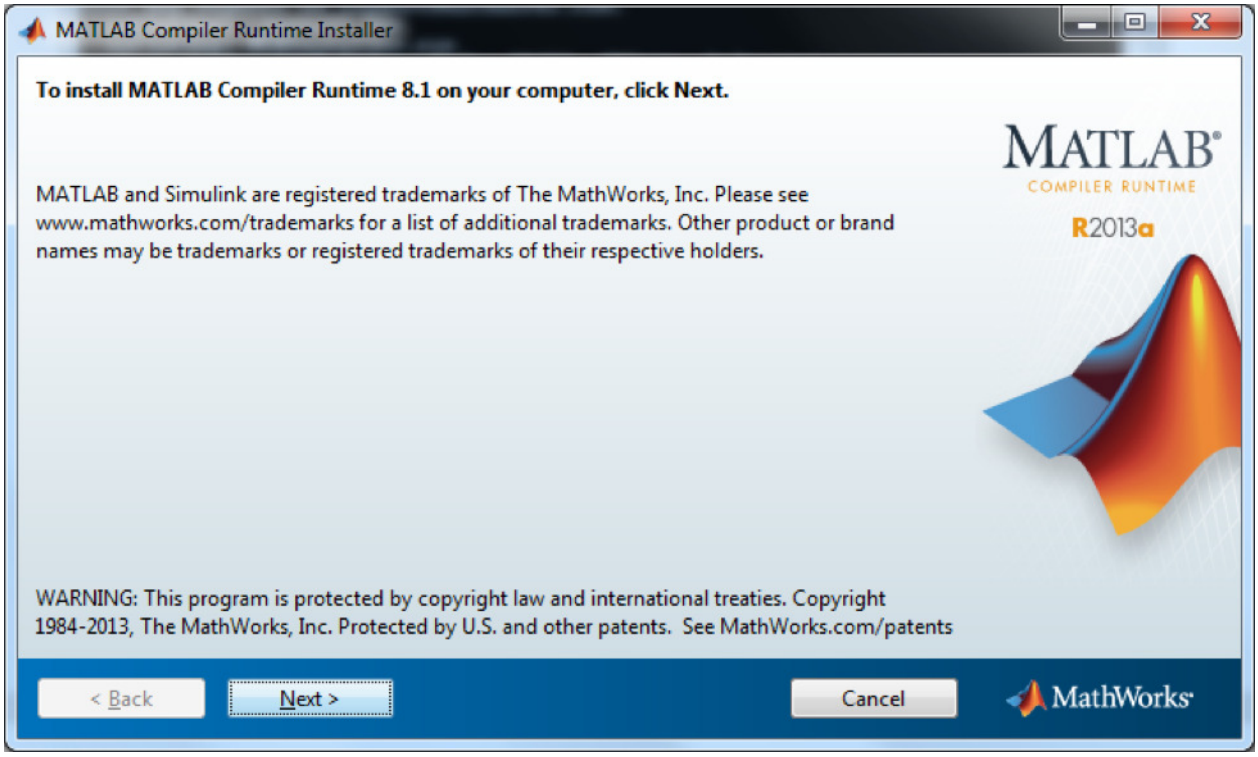
MATLAB Runtime Installer



You will need to have administrator privileges to continue with the installation. It may be that you have administrator privileges already in which case the above Matlab window should open automatically. If you do not have administrator privileges to run the MCRInstaller.exe file, the best way to change this is to right-click on the MCRInstaller.exe file (now present in the milo_bac folder following the previous step) and clicking 'Run as Administrator'. Once the above window appears, follow the on-screen instructions and click the 'Next' buttons to install. The default folder for the installation should be 'C:\Program Files\MATLAB\MATLAB Compiler Runtime'.

Running the application

Once installed, copy the 'loggedData.txt' file into the 'milo_bac' folder'click the file 'calculate_bac.exe' main folder. If there are no pop-up windows with errors, a new file 'bac_deconv.csv' should appear in the same folder.

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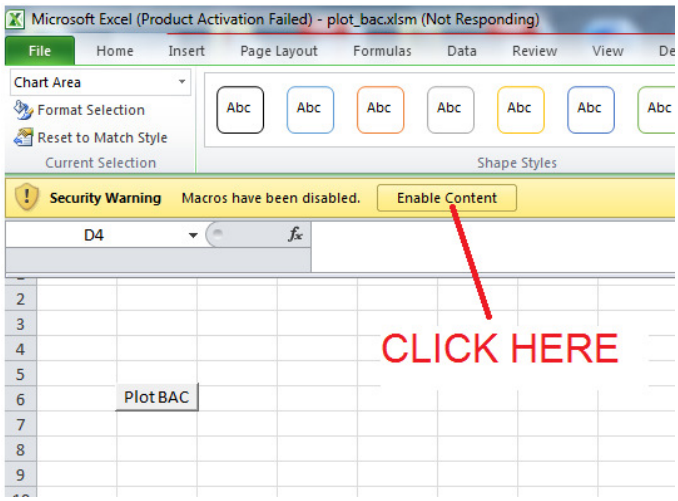
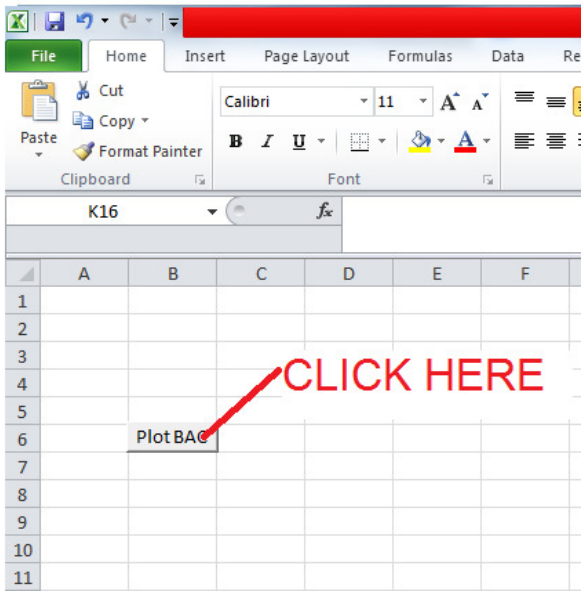
Plotting the deconvoluted BAC data

Open the file ‘plot_bac.xls’ and click the ‘Plot BAC’ button in Sheet 1. Columns A-C will be populated with data and a chart should be created with two data sets - Deconvoluted BAC (blue) and Unprocessed BAC (orange).





Questions? Please do not hesitate to contact bob@milosensor.com and evan@milosensor.com if you encounter any problems or confusion.