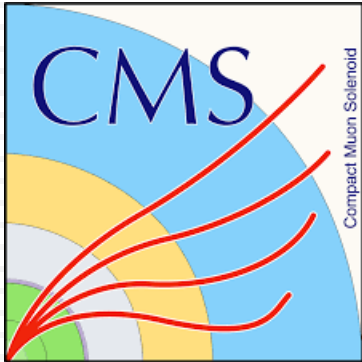


HGCAL Database – Module Production GUI



Jin Wang

Institute of High Energy Physics, CAS

Introduction

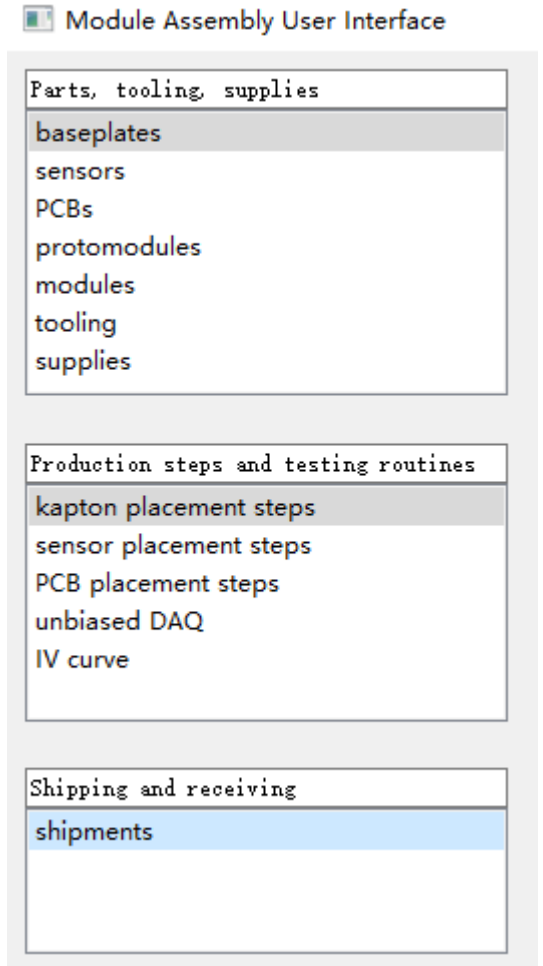
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- ⦿ HGCAL Database - an essential part of HGCAL construction
 - ⦿ record data of all steps in module production
 - ⦿ parts, module assembly, testing, connections
 - ⦿ XML files to be provided to HGCAL Database
- ⦿ Module production GUI is developed to facilitate the information transformation from module production to HGCAL Database
 - ⦿ graphic interface to record the data for different parts/steps
 - ⦿ **produce XML inputs to be uploaded to HGCAL Database**
 - ⦿ each XML session has corresponding fields in GUI
 - ⦿ link between different components
 - ⦿ check errors and consistency
 - ⦿ download necessary information from HGCAL Database
 - ⦿ user-friendly in different system
 - ⦿ Windows, Linux, MAC OS

GUI overview

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- The GUI consists of 3 sessions
 - Parts, tooling, supplies
 - 7 pages, baseplates, sensors, PCBs etc.
 - Production steps and testing routines
 - 5 pages, placement and tests
 - Shipping and receiving
 - 1 page, keep tract of the shipment



Module Assembly User Interface

Parts, tooling, supplies
baseplates
sensors
PCBs
protomodules
modules
tooling
supplies
Production steps and testing routines
kapton placement steps
sensor placement steps
PCB placement steps
unbiased DAQ
IV curve
Shipping and receiving
shipments

Baseplates

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ID format to be updated:
barcode/serial number/name tag

Module Assembly User Interface

Parts, tooling, supplies

- baseplates
- sensors
- PCBs
- protomodules
- modules
- tooling
- supplies

Production steps and testing routines

- kapton placement steps
- sensor placement steps
- PCB placement steps
- unbiased DAQ
- IV curve

Shipping and receiving

- shipments

Baseplate ID: 0

New Save Cancel Edit

Location: shipments go to selected

baseplate qualification & preparation

- Corner height 0 (mm)
- Corner height 1
- Corner height 2
- Corner height 3
- Corner height 4
- Corner height 5
- Flatness (mm)
- kapton tape applied
- thickness (mm)

sensor application

- sensor step Go to
- On protomodule Go to

module

- On module Go to

Identifier

Manufacturer

Material

Nominal thickness (mm)

Size (inches)

Shape

Chirality

Rotation

number of kapton layers

Comments delete selected

add comment

kapton application

- kapton step Go to

kaptonized baseplate qualification

- check leakage current
- check surface
- check edges firm
- check glue spillage
- kapton flatness (mm)

for double kapton baseplates

second kapton application

- kapton step Go to

double kapton baseplate qualification

- check leakage current
- check surface
- check edges firm
- check glue spillage
- kapton flatness (mm)

label sequence to be defined

corner numbering reference

Diagram showing a hexagonal baseplate with corner numbering reference (0-5).

Sensors

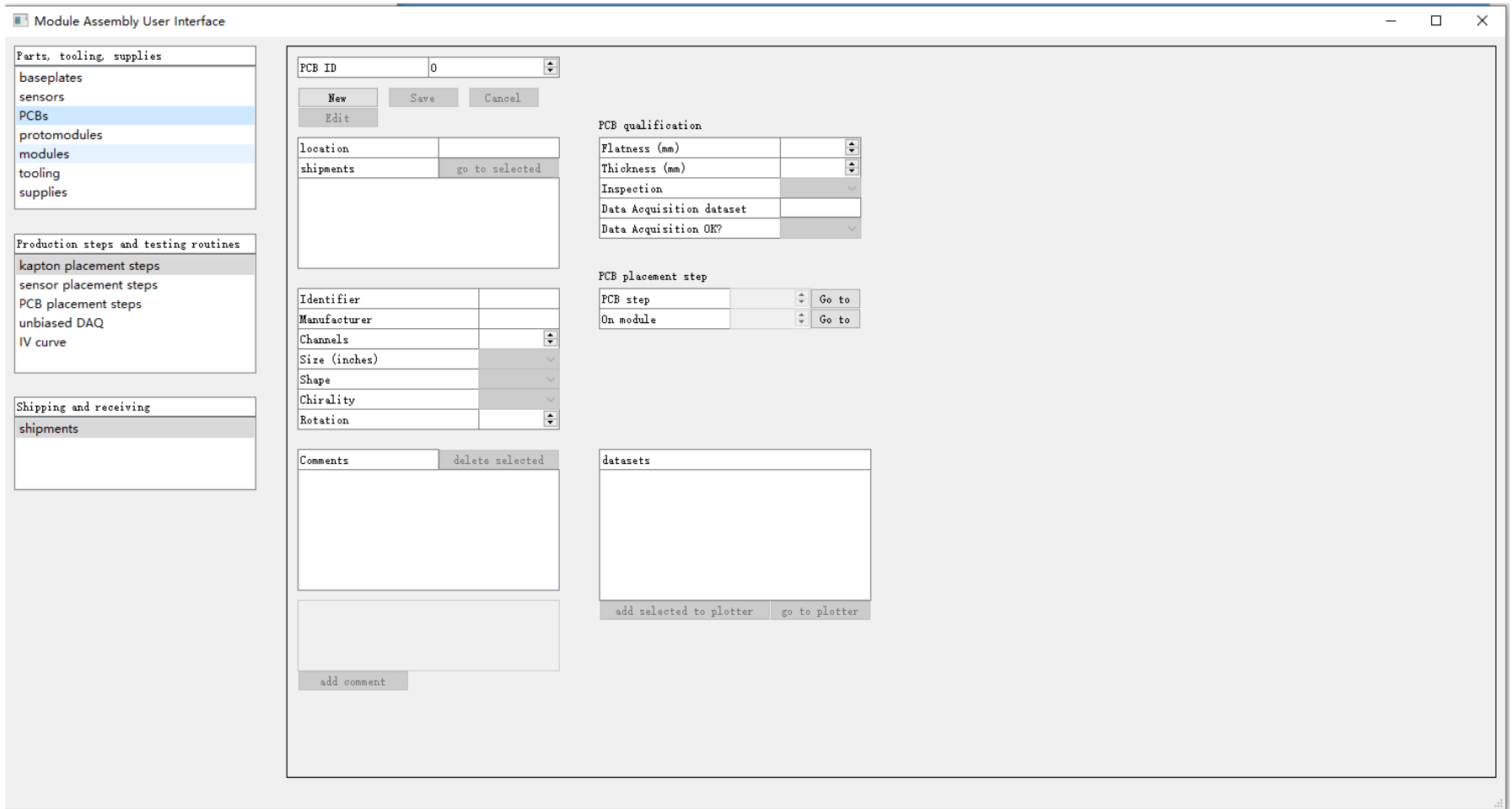
5

The screenshot displays the 'Module Assembly User Interface' window. On the left, there are three navigation panels: 'Parts, tooling, supplies' with 'sensors' selected; 'Production steps and testing routines' with 'sensor placement steps' selected; and 'Shipping and receiving' with 'shipments' selected. The main area is divided into several sections: 'Sensor ID' (0) with 'New', 'Save', 'Cancel', and 'Edit' buttons; 'location' and 'shipments' (with 'go to selected' button); 'sensor qualification' (visual inspection); 'sensor placement' (Placement step and On protomodule, each with 'Go to' buttons); 'module' (On module, with 'Go to' button); and a 'Comments' section with a 'delete selected' button and an 'add comment' button at the bottom.

connection to placement

PCBs

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Protomodules

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The screenshot displays the 'Module Assembly User Interface' window. On the left, there are three vertical panels: 'Parts, tooling, supplies' with 'protomodules' selected; 'Production steps and testing routines' with 'kapton placement steps' selected; and 'Shipping and receiving' with 'shipments' selected. The main area contains a 'Protomodule ID' field set to '0' with 'New', 'Save', 'Cancel', and 'Edit' buttons. Below this is a table with 'location' and 'shipments' (with a 'go to selected' button). Further down are fields for 'number of kapton layers', 'Thickness (mm)', 'Channels', 'Size (inches)', 'Shape', 'Rotation', and 'Chirality'. A 'Comments' section with a 'delete selected' button and an 'add comment' button is at the bottom. On the right, there are three sections: 'sensor placement' with 'Placement step', 'sensor', and 'baseplate' fields and 'Go to' buttons; 'protomodule qualification' with 'translational offset (µm)', 'rotational offset (°)', 'flatness (mm)', 'check for cracks', and 'check glue spillage' fields; and 'PCB placement' with 'PCB step' and 'On module' fields and 'Go to' buttons. A blue text overlay on the right reads 'connection between parts and steps'.

Modules

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associated with tests:
unbiased DAQ and IV curve

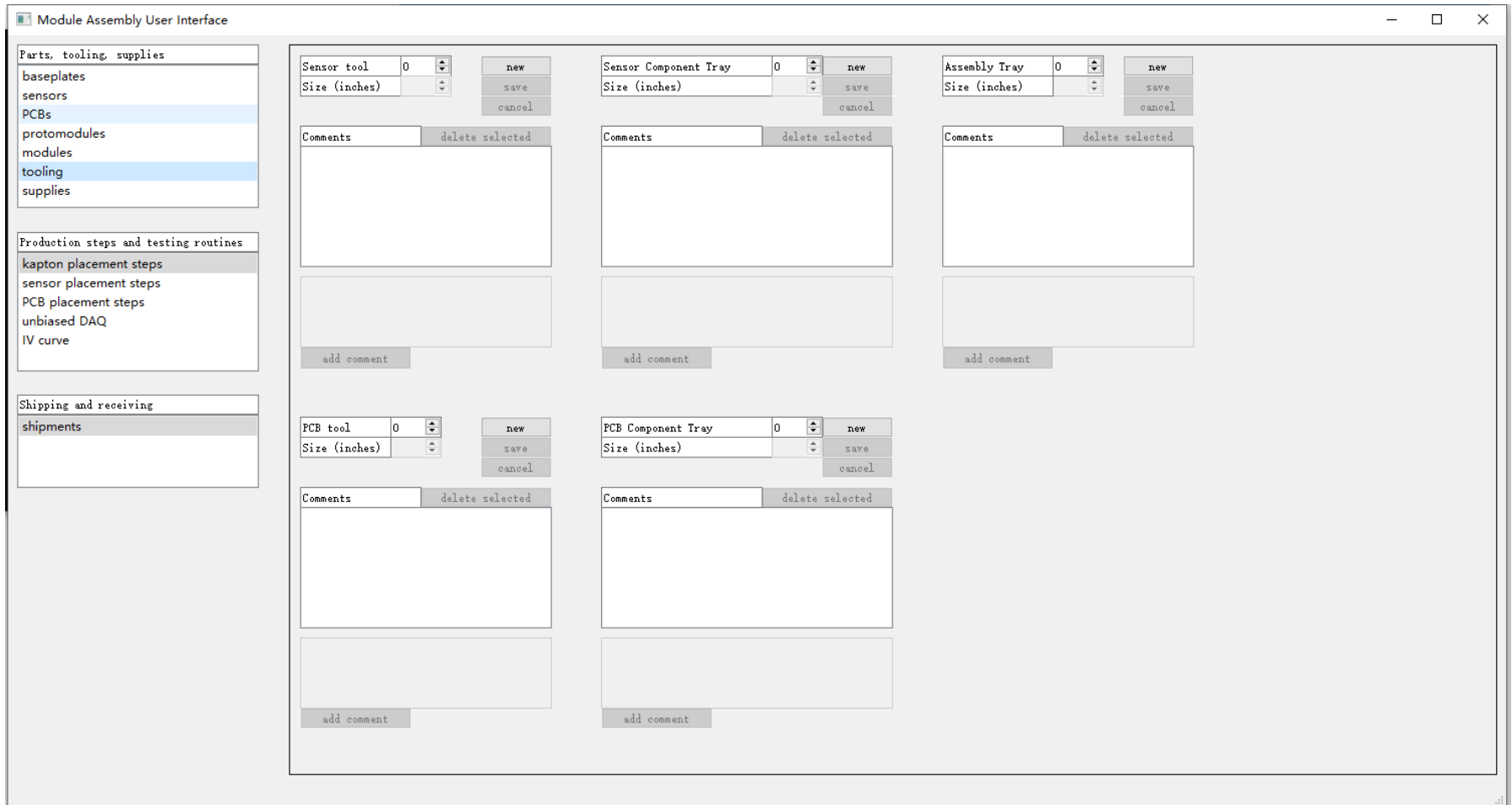
The screenshot displays the 'Module Assembly User Interface' with the following sections:

- Navigation:** A sidebar on the left contains categories: 'Parts, tooling, supplies' (baseplates, sensors, PCBs, protomodules, modules, tooling, supplies), 'Production steps and testing routines' (kapton placement steps, sensor placement steps, PCB placement steps, unbiased DAQ, IV curve), and 'Shipping and receiving' (shipments).
- Module ID:** A dropdown menu is set to '0', with 'New', 'Save', and 'Cancel' buttons below it.
- Location and Shipments:** Fields for 'location' and 'shipments' with a 'go to selected' button.
- Channels:** Fields for 'Thickness (mm)', 'number of kapton layers', 'Size (inches)', 'Shape', 'Chirality', and 'Rotation', each with a 'Go to' button.
- Kapton Placement:** Fields for 'Kapton placement step', 'Kapton placement step 2', 'Sensor placement step', and 'PCB placement step', each with a 'Go to' button.
- Identification:** Fields for 'Baseplate ID', 'Sensor ID', 'PCB ID', and 'Protomodule ID', each with a 'Go to' button.
- Comments:** A text area with a 'delete selected' button and an 'add comment' button at the bottom.
- Pre-wirebonding qualification:** A table with rows for 'check edge contact', 'check glue spillage', 'Unbonded DAQ dataset', 'Unbonded DAQ user', and 'Unbonded DAQ OK?'.
- Wirebonding:** Fields for 'Wirebonding performed', 'Wirebonding user', and 'Unbonded sites'. It includes checkboxes for 'Is test bond module', 'Test bonds pulled', and 'Test bonds rebonded', each with a corresponding 'OK?' dropdown.
- Wirebonds:** Checkboxes for 'Wirebonds inspected (list damaged below)' and 'Wirebonds repaired (list below)', with a 'Wirebonds repaired user' field.
- Wirebonding qualification:** Fields for 'Final inspection done', 'Final inspection user', and 'Final inspection OK?'.
- Encapsulation:** Fields for 'Encapsulation done', 'Encapsulation user', 'cure start' (2000/1/1 0:00), 'cure stop' (2000/1/1 0:00), and 'Post-curing inspection'. 'cure start' and 'cure stop' have 'set to now' buttons.
- Finished module qualification:** Fields for 'HV cables attached', 'HV cable attachment user', 'Unbiased DAQ dataset', 'Unbiased DAQ user', 'Unbiased DAQ OK?', 'IV dataset', 'IV user', 'IV OK?', 'Biased DAQ dataset', 'Biased DAQ voltage', and 'Biased DAQ OK?'.
- IV datasets:** A list area with an 'add selected to plotter' and 'go to plotter' button.
- DAQ datasets:** A list area with an 'add selected to plotter' and 'go to plotter' button.

Toolings

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different tool IDs and locations



Supplies

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different supply IDs and locations

The screenshot displays the 'Module Assembly User Interface' with a sidebar on the left and a main content area. The sidebar contains three sections: 'Parts, tooling, supplies' (with 'supplies' selected), 'Production steps and testing routines', and 'Shipping and receiving'. The main area is a grid of six forms, each for a different supply type. Each form includes a table with 'batch', 'Received', and 'Expires' fields, each with a dropdown menu and a 'new', 'save', or 'cancel' button. Below each table is a 'Comments' section with a 'delete selected' button and an 'add comment' button.

Supply Type	Batch	Received	Expires	Buttons
Araldite	0	2000/1/1	2000/1/1	new, save, cancel
Sylgard (thick)	0	2000/1/1	2000/1/1	new, save, cancel
Bond wire	0	2000/1/1	2000/1/1	new, save, cancel
Lectite	0	2000/1/1	2000/1/1	new, save, cancel
Sylgard (thin)	0	2000/1/1	2000/1/1	new, save, cancel

Kapton placement

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associated sensor and baseplates

Module Assembly User Interface

Parts, tooling, supplies

- baseplates
- sensors
- PCBs
- protomodules
- modules
- tooling
- supplies

Production steps and testing routines

- kapton placement steps**
- sensor placement steps
- PCB placement steps
- unbiased DAQ
- IV curve

Shipping and receiving

- shipments

Kapton step ID: 0

New Save Cancel Edit

position	sensor tool ID	baseplate ID	kapton inspected	who performed step
1	go to	go to	<input type="checkbox"/> passed	
2	go to	go to	<input type="checkbox"/> passed	
3	go to	go to	<input type="checkbox"/> passed	
4	go to	go to	<input type="checkbox"/> passed	
5	go to	go to	<input type="checkbox"/> passed	
6	go to	go to	<input type="checkbox"/> passed	

date performed	2000/1/1	set to today
cure start	2000/1/1 0:00	set to now
cure stop	2000/1/1 0:00	set to now
cure duration		
cure temperature		
cure humidity		

component tray (sensor)	go to
assembly tray	go to
araldite batch	go to

will check errors and consistency here

Status:

Sensor placement

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associated sensor, baseplates and protomodules

The screenshot displays the 'Module Assembly User Interface' window. On the left is a navigation tree with categories: 'Parts, tooling, supplies' (containing baseplates, sensors, PCBs, protomodules, modules, tooling, supplies), 'Production steps and testing routines' (containing kapton placement steps, sensor placement steps, PCB placement steps, unbiased DAQ, IV curve), and 'Shipping and receiving' (containing shipments). The 'sensor placement steps' item is selected. The main area features a 'Sensor step ID' field set to 0, with 'New', 'Save', 'Cancel', and 'Edit' buttons. Below this is a table with columns: position, sensor tool ID, sensor ID, baseplate ID, protomodule ID assigned, Type, who performed step, and date performed. The table has 6 rows. To the right of the table is a 'cure' section with fields for cure start, cure stop, cure duration, cure temperature, and cure humidity, each with a 'set to now' button. Below the table is a 'go to' section with fields for component tray (sensor), assembly tray, araldite batch, and loctite batch. A large blue text box in the center reads 'will check errors and consistency here'. At the bottom left, there is a 'Status:' label and an empty text field.

position	sensor tool ID	sensor ID	baseplate ID	protomodule ID assigned	Type	who performed step	date performed
1	go to	go to	go to	go to			2000/1/1
2	go to	go to	go to	go to			
3	go to	go to	go to	go to			
4	go to	go to	go to	go to			
5	go to	go to	go to	go to			
6	go to	go to	go to	go to			

component tray (sensor)	go to
assembly tray	go to
araldite batch	go to
loctite batch	go to

cure start	2000/1/1 0:00	set to now
cure stop	2000/1/1 0:00	set to now
cure duration		
cure temperature		
cure humidity		

Status:

PCB placement

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associated PCBs with protomodels and modules

The screenshot displays the 'Module Assembly User Interface' window. On the left, there is a navigation pane with three sections: 'Parts, tooling, supplies' (containing baseplates, sensors, PCBs, protomodels, modules, tooling, supplies), 'Production steps and testing routines' (containing kapton placement steps, sensor placement steps, PCB placement steps, unbiased DAQ, IV curve), and 'Shipping and receiving' (containing shipments). The 'PCB placement steps' item is selected. The main area features a 'PCB step ID' dropdown set to 0, with 'New', 'Save', 'Cancel', and 'Edit' buttons. Below this is a table with columns: position, PCB tool ID, PCB ID, Protomodel ID, and Module ID assigned. Each cell in the table contains a dropdown menu and a 'go to' button. To the right of the table are several input fields: 'who performed step', 'date performed' (set to 2000/1/1 with a 'set to today' button), 'cure start' (set to 2000/1/1 0:00 with a 'set to now' button), 'cure stop' (set to 2000/1/1 0:00 with a 'set to now' button'), 'cure duration', 'cure temperature', and 'cure humidity'. Below the table are three more 'go to' buttons for 'component tray (PCB)', 'assembly tray', and 'araldite batch'. A large white box in the center contains the text 'will check errors and consistency here'. At the bottom left, there is a 'Status:' label followed by an empty input field.

Unfinished pages

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Unbiased DAQ and IV curve pages are not implemented yet.

Module Assembly User Interface

Parts, tooling, supplies

- baseplates
- sensors
- PCBs
- protomodules
- modules
- tooling
- supplies

Production steps and testing routines

- kapton placement steps
- sensor placement steps
- PCB placement steps
- unbiased DAQ
- IV curve

Shipping and receiving

- shipments

PCB step ID: 0

New Save Cancel Edit

position	PCB tool ID	PCB ID	Protomodule ID	Module ID assigned	who performed step
1	go to	go to	go to	go to	
2	go to	go to	go to	go to	
3	go to	go to	go to	go to	
4	go to	go to	go to	go to	
5	go to	go to	go to	go to	
6	go to	go to	go to	go to	

date performed: 2000/1/1 set to today

cure start: 2000/1/1 0:00 set to now

cure stop: 2000/1/1 0:00 set to now

cure duration

cure temperature

cure humidity

component tray (PCB) go to

assembly tray go to

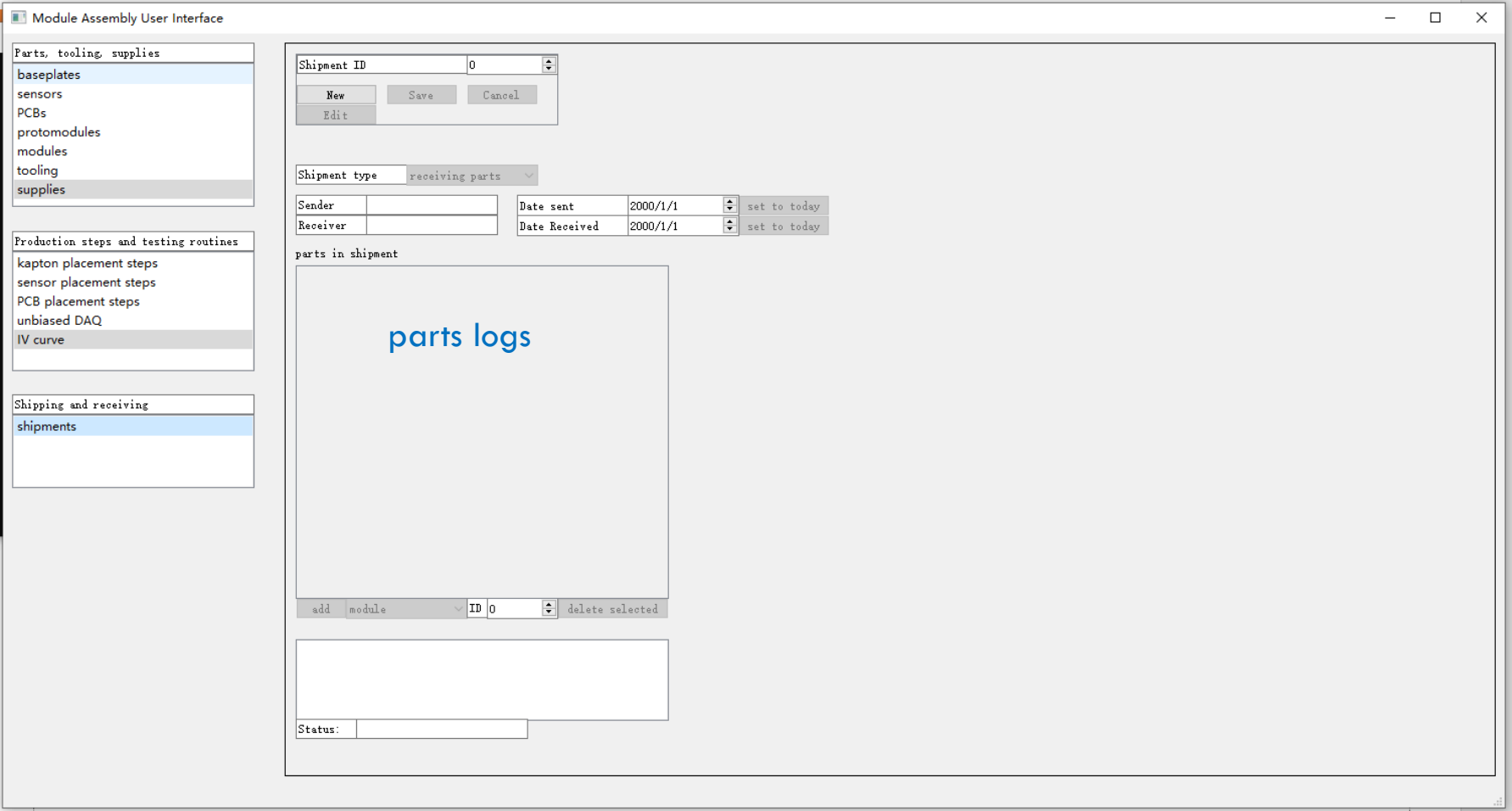
araldite batch go to

will check errors and consistency here

Status:

Shipment

Keep track of shipments, identify inconsistency

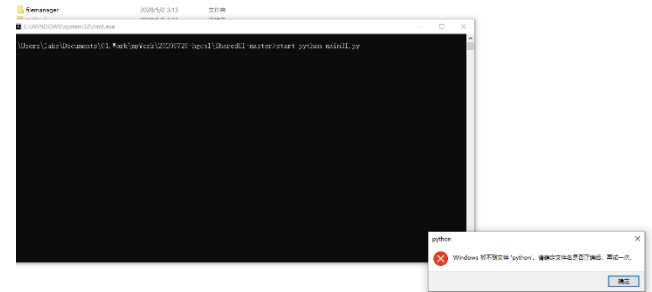


Installation

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Windows installation instructions

- 1. install python3
 - best version python3.7
 - python version has to be above 3.5, below 3.8
 - <https://www.python.org/ftp/python/3.7.8/python-3.7.8.exe>
- 2. install PyQt5
 - need to run CMD with administrator rights
 - update “pip” if necessary
 - `python -m pip install --upgrade pip`
 - pip install PyQt5
- 3. install numpy
 - need to find the right version corresponding the version of python
 - [numpy-1.19.0-cp37-cp37m-win32.whl](https://pypi.org/project/numpy/#files)
 - put it under the “script” directory of python
 - pip install numpy-1.19.0-cp37-cp37m-win32.whl
- 4. install the GUI package
 - run.bat with <https://github.com/p-masterson/SharedUI.git>



```
C:\WINDOWS\system32\cmd.exe
Microsoft Windows [版本 10.0.18363.959]
(c) 2019 Microsoft Corporation. 保留所有权利。

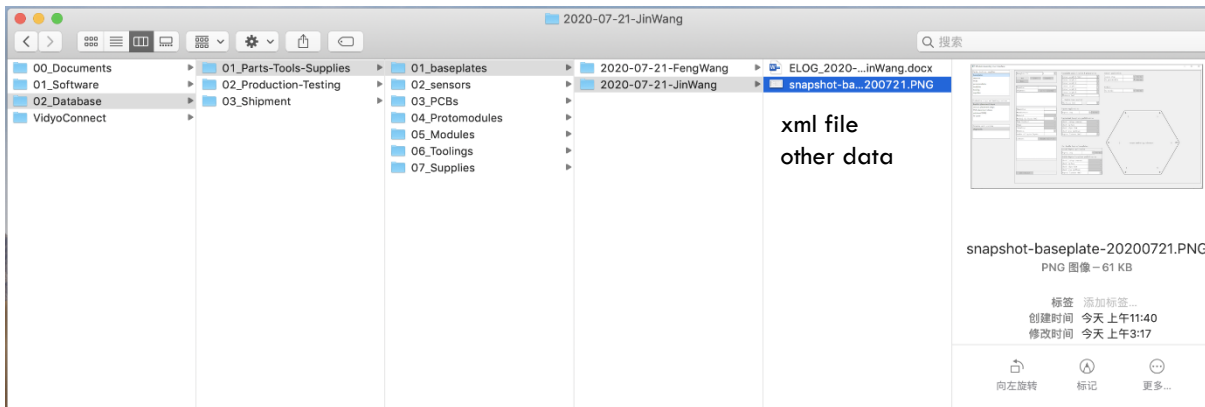
C:\Users\lake>pip install pyqt5
Collecting pyqt5
  Downloading PyQt5-5.15.0-5.15.0-cp35-cp36-cp37-cp38-none-win_amd64.whl (64.5 MB)
  |-----| 64.5 MB 3.2 MB/s
Collecting PyQt5-sip<13,>=12.8
  Downloading PyQt5_sip-12.8.0-cp38-cp38-win_amd64.whl (63 kB)
  |-----| 63 kB 2.2 MB/s
Installing collected packages: PyQt5-sip, pyqt5
Successfully installed PyQt5-sip-12.8.0 pyqt5-5.15.0
```

```
C:\Users\lake\AppData\Local\Programs\Pyth
Setting up main UI ...
Finished setting up main UI.
Initializing file manager...
Finished initializing file manager.
Setting up pages' UI...
Finished setting up pages' UI.
Initializing pages...
Finished initializing pages.
```


Local database for module production

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- Windows: RAID1 cloud e-log storage
 - archive corresponding parts/placement/tests logs
 - dates, responsible person, summary and necessary data
 - updates with module production GUI pages, and the output XML files
 - data stored locally with RAID1 disks
 - cloud storage with automatic backups?
 - can work remotely
 - can work in parallel



- Linux: similar idea with systems like web-based or git-based repository
 - easier to maintain
 - storage limited

Summary and Future work

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- Test, maintain, update of the GUI, follow up on the development, connect GUI outputs with HGICAL Database
 - the beta version is not ready yet, to be released to all MACs
 - current outputs of GUI are partial XML, partial json file, to be completed
 - DAQ/IV curve test are not in place, need to interface with testing hardware
 - some ID formats and label definition to be determined
 - some functions are not implemented
- Will install the necessary infrastructure for module production GUI and HGICAL Database in the local laptop/desktop in the lab
 - hardware dedicated to record/archive the module production data
- Instruct individuals to get familiar with and use the module production GUI
- Communicate with developers on potential issues, feedbacks, requirements etc.