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# Pygate Documentation

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**vince**

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This is the master page of *pygate* documentation



### 1.1 An python interface to GATE

#### GATE USER GUIDE

**Pygate** is a Subsystem based on python ,which runs with *GATE* simultaneously and speeds up *GATE* process. This Subsystem mainly contains two following functions,file generators and submitting experiments to Subsystem:

- file generators:
  - .mac file generator
  - .sh file generator
  - .C file generator
- submit system/experiment run system:
  - dependency system:
    - \* via slurm
    - \* easy constructing task train

*ref-1. File main.mac generates. ref-2. Submit a task to subsystem*

If you want more information,you can go to [github](#) to get Pygate.

More efforts needs to be made to perfect \*pygate\*.  
We warmly welcome whom (now just **for** external members)  
are interested **in** this program to comeforward **and** find  
out more about us,join us **and** make full use of this platfom.

*predefined First step of pygate*





### 2.1 How to get pygate and configuration

- if you want to run *pygate* locally, you should follow the steps:
  1. We put the source on the [Github](#). You may need a Github account to clone or download the files. Here is the [Github Guides](#).
  2. **Ensure your python3 version is the most current version.**
    - We recommend *Anaconda* to get *python3*. Here is the [Anaconda](#).
    - The *Anaconda* should be set into `syspath`.
    - `source ~/.bashrc` or reboot the terminal to update `bashrc`.
    - `$ python --version` and get the output `Python 3.6.4 :: Anaconda custom(64-bit) (for now)`.
  3. Install *pygate*
    - `pip install dsl-pygate`
  4. Ensure *GATE* is installed and configured already.
  5. You have already installed *pygate*. Go to the [First step of pygate](#).
- if you are an external member (you haven't gotten an account), you can run on the server:
  1. Install *Anaconda* to get latest *python3* in your work folder. The recommended path with high performance is `/mnt/Gluster_NoGPU/usr`.
  2. **Ensure your python3 version is the most current version.**
    - We recommend *Anaconda* to get *python3*. Here is the [Anaconda](#).
    - The *Anaconda* should be set into `syspath`.
    - `source ~/.bashrc` or reboot the terminal to update `bashrc`.

```
- $ python --version and get the output Python 3.6.4 :: Anaconda  
custom(64-bit) (for now).
```

3. Install *pygate*

```
- pip install dsl-pygate
```

4. **Configured GATE**

```
- source/hqlf/softwares/moudle/simu8.0.sh
```

5. You have made *pygate* ready. Go to the [First step of pygate](#).

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**Note:** We will get the environment set up and configured on each node of the server. You need to install and configure the environment in your own work folder at present.

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## First step of pygate

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In this page, we will run an example consisting of two steps;

### 3.1 1. File `main.mac` generates.

- Before a *GATE* process, we generally need to make a file of `main.mac`, in which we can set the components ( *world, system, phantom, source and digitizer etc.* ) for *GATE* simulation.
  - The question is that the definition of components is too heavy and complicated. A lot of time and energy wastes on this.
  - *Pygate* offers a function of **File Generator**. Users can configure the components easily by setting several arguments of necessary components you want in a file of `make_mac.py` (you can name it freely). A file of `mac.yml` may be needed containing some default settings of the `main.mac`, or you can set these in `make_mac.py` directly.
  - **The command for `main.mac` generating is:**
    - `$ pygate generate mac script -t make_mac.py -o main.mac -c mac.yml.`
    - `make_mac.py` and `mac.yml` should be included in current work folder.
    - Then you will find the `main.mac` in the folder.
  - The main work for this step is to code `make_mac.py`. Users can modify on the template for the first time.
- :ref:make\_mac.py

### 3.2 2. Submit a task to subsystem

- Usually there are hundreds of millions, even billions of events occurring during a *GATE* simulation, which is the reason why the process takes a long time.

- However, it is a repeatable work for a *GATE* program to generate an event. \*Pygate\* offers a method to speed up the process. \*Pygate\* divides the task into a lot of parts,
- then submits these parts to server. Each part of the original task will be distributed to no-working machine of the net by *SLurm*. Thus, we get a very high speed for *GATE* simulation.

- **Users should know the following steps to archive it:**

1. **Users should get the needed configured files by executing this command: `$ pygate ini ext`. You will get the**

- `main.mac`, you get it last in the folder.
- `GateMaterials.db`, significant file for *GATE* configuration, can't be lack.
- `Hits2CSV.C`, may needed if you want the data of *csv* format.
- `Materials.xml`
- `Surface.xml`, set the surface rendering. Or you can select volume rendering.

2. **When you get the necessary files in the work folder, you need to divide the task into parts.**

- `$ pygate init subdir -n --INTEGER -f --STR`, you can set the number of parts and the name of subdirectories as you want. The default option is "sub.[10]" and you will get 10 subdirectories of "sub.[x]" (x~[0-10]).
- `$ pygate init bcast`, broadcast the files to subdirectories made last step.
- `$ pygate generate shell`, generate `run.sh` for *SLurm* to distribute the task and `post.sh` to merge the results of each parts.
- `$ pygate submit`, submit the task to subsystem. *SLurm* will do the distribution. The details information of distribution will print on the screen. You can easily know which machine each part run.
- **There are two procedures before getting results:**
  - \* First, the machines absorb the mission and complete it, then feedback the results to subdirectories. `run.sh` is for this step.
  - \* Then the results from subdirectories are merged into one file of `optical.root`, containing all collected data of Hits. `post.sh` is for this.

You can refer the detail of commands in [Here is the command list of pygate](#)

*pygate docomentions' index*

## 4.1 pygate introduction

## 4.2 analysis

- `_init_.py`
- `results.py`

## 4.3 api

- **cli**
  - `_init_.py`
  - `base.py`
  - `commands.py`
- `_init_.py`

## 4.4 archive

- **macs**
  - `mct2d_source.mac`
- `_init_.py`

- mac\_templates.yml
- maxdepth\_bash\_sample.sh
- map\_bash.sh
- map\_zsh.sh
- merge\_bash.sh
- merge\_bash\_zsh.sh
- pygate.yml

## 4.5 components

- **geometry**
  - **camera**
    - \* \_init\_.py
    - \* camera.py
    - \* system.py
  - \_init\_.py
  - geometry.py
  - phantom.py
  - surface.py
  - volume.py
- templates
- \_init\_.py
- base.py
- digitizer.py
- misc.py
- parameter.py
- physics.py
- simulation.py
- source.py
- utils.py

## 4.6 predefined

- \_init\_.py
- \_camera.py
- \_sources.py
- cameras.py

- digitizers.py
- parameters.py
- phantoms.py
- physice.py
- simulations.py
- source.py

## 4.7 routine

- \_init\_.py
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- base.py
- cleaner.py
- initialize.py
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- `strs.py`
- `typing.py`

pygate

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  - `results.py`
- **api**
  - **cli**
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    - \* `base.py`
    - \* `commands.py`
  - `_init_.py`
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  - **macs**
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  - `mac_templates.yml`
  - `maxdepth_bash_sample.sh`
  - `map_bash.sh`
  - `map_zsh.sh`
  - `merge_bash.sh`
  - `merge_bash_zsh.sh`
  - `pygate.yml`
- **componets**
  - **geometry**
    - \* **camera** `_init_.py` `camera.py` `system.py`
    - \* `_init_.py`
    - \* `geometry.py`
    - \* `phantom.py`
    - \* `surface.py`
    - \* `volume.py`
  - `templates`



- `_init_.py`
- `base.py`
- `digitizer.py`
- `misc.py`
- `parameter.py`
- `physics.py`
- `simulation.py`
- `source.py`
- `utils.py`

- **predefined**

- `_init_.py`
- `_camera.py`
- `_sources.py`
- `cameras.py`
- `digitizers.py`
- `parameters.py`
- `phantoms.py`
- `physice.py`
- `simulations.py`
- `source.py`

- **routine**

- `_init_.py`
- `analysis.py`
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- `submit.py`
- `utils.py`

- **scripts**

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- `helper.py`
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- `configs.py`
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- `service.py`
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- `utils.py`

### 5.1 for each file

#### 5.1.1 analysis

#### 5.1.2 api

#### 5.1.3 archive

#### 5.1.4 components

#### 5.1.5 predefined

#### 5.1.6 routine

#### 5.1.7 scripts

#### 5.1.8 tests

#### 5.1.9 utils

### 5.2 Here is the command list of *pygate*

- **pygate**
  - **analysis**
    - \* predefined
    - \* script

```
- clean
- generate
    * cfg
    * mac
        · predefined
        · script
    * mac_template
    * shell
- init
    * auto
    * bcast
    * ext
    * subdir
- merge
- submit
```

### 5.2.1 \$ pygate

Usage: pygate [OPTIONS] COMMAND [ARGS]...

**Options:**

<b>-c, --config TEXT</b>	config file name
<b>--no-config</b>	ignore config file
<b>--dryrun</b>	Do not do anything, just show expected results.
<b>--help</b>	Show this message and exit.

**Commands:**

```
analysis
clean
generate
init
merge
submit
```

### 5.2.2 \$ pygate analysis

Usage: pygate analysis [OPTIONS] COMMAND [ARGS]...

**Options:**

<b>--help</b>	Show this message and exit.
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**Commands:**

```
predefined
script
```

### 5.2.3 \$ pygate analysis predefined

Usage: pygate analysis predefined [OPTIONS]

**Options:**

<b>-n, --name TEXT</b>	Predefined analysis type name.
<b>-s, --source TEXT</b>	Analysis source data filename.
<b>-o, --output TEXT</b>	Analysis target data filename.
<b>--help</b>	Show this message and exit.

### 5.2.4 \$ pygate analysis script

Usage: pygate analysis script [OPTIONS]

**Options:**

<b>-t, --target TEXT</b>	Analysis .py filename.
<b>-s, --source TEXT</b>	Analysis source data filename.
<b>-o, --output TEXT</b>	Output filename.
<b>--help</b>	Show this message and exit.

### 5.2.5 \$ pygate clean

Usage: pygate clean [OPTIONS]

**Options:**

<b>-d, --subdirectories</b>	remove subdirectories
<b>-f, --root-files TEXT</b>	remove files in work directory
<b>-s, --slurm-outputs</b>	remove *.out *.err files
<b>--help</b>	Show this message and exit.

### 5.2.6 \$ pygate generate

Usage: pygate generate [OPTIONS] COMMAND [ARGS]...

**Options:**

<b>--help</b>	Show this message and exit.
---------------	-----------------------------

**Commands:**

cfg	Generate initial config file.
mac	Generate mac file.
mac_template	
shell	Generate shell script, pre run <b>or</b> post run.

### 5.2.7 \$ pygate generate cfg

Usage: pygate generate cfg [OPTIONS]

Generate initial config file.

**Options:**

- t, --target TEXT** Config file name.
- f, --format TEXT** Format of config file, json or yml
- help** Show this message and exit.

### 5.2.8 \$ pygate generate mac

Usage: pygate generate mac [OPTIONS] COMMAND [ARGS]...

Generate mac file.

**Options:**

- help** Show this message and exit.

**Commands:**

predefined	Generate mac file by predefined system.
script	Generate mac file by running a .py file.

### 5.2.9 \$ pygate generate mac predefined

Usage: pygate generate mac predefined [OPTIONS]

Generate mac file by predefined system.

**Options:**

- p, --predefined TEXT** Name of predefined system to generate mac file.
- c, --config TEXT** config filename to generate macs.
- t, --target TEXT** MAC filename, will passed to script or predefined method.
- help** Show this message and exit.

### 5.2.10 \$ pygate generate mac script

Usage: pygate generate mac script [OPTIONS]

Generate mac file by running a .py file.

**Options:**

- t, --target TEXT** Filename of script to run to generate mac file.
- c, --config TEXT** config filename to generate macs.
- o, --output TEXT** MAC filename, will passed to script or predefined method.
- help** Show this message and exit.

### 5.2.11 \$ pygate generate mac\_template

Usage: pygate generate mac\_template [OPTIONS]

**Options:**

**-f, --filename TEXT** Show the file name.  
**--help** Show this message and exit.

### 5.2.12 \$ pygate generate shell

Usage: pygate generate shell [OPTIONS]

Generate shell script, pre run or post run.

**Options:**

**--help** Show this message and exit.

### 5.2.13 \$ pygate init

Usage: pygate init [OPTIONS] COMMAND [ARGS]...

**Options:**

**--help** Show this message and exit.

Commands:

```
auto
bcast
ext      Copy external files.
subdir
```

### 5.2.14 \$ pygate init auto

Usage: pygate init auto [OPTIONS]

**Options:** **-mac-auto** **-mac-no-create** **-mac-force-create** **-help** Show this message and exit.

### 5.2.15 \$ pygate init bcast

Usage: pygate init bcast [OPTIONS]

**Options:**

**-t, --target INTEGER** Files to broadcast to subdirectories.  
**-e, --no-ext** Include all external files.  
**--help** Show this message and exit.

### 5.2.16 \$ pygate init ext

Usage: pygate init ext [OPTIONS]

Copy external files.

**Options:**

**--help** Show this message and exit.

### 5.2.17 \$ pygate init subdir

Usage: pygate init subdir [OPTIONS]

**Options:**

**-n, --nb-split INTEGER** Number of subdirectories.

**-f, --sub-format TEXT** Subdirectories format str.

**--help** Show this message and exit.

### 5.2.18 \$ pygate merge

Usage: pygate merge [OPTIONS]

**Options:**

**-t, --target TEXT** Target str.

**-m, --method TEXT** Method str.

**--help** Show this message and exit.

### 5.2.19 \$ pygate submit

Usage: pygate submit [OPTIONS]

**Options:**

**-b, --broadcast TEXT** Broadcast file str.

**-s, --single TEXT** Single str.

**--help** Show this message and exit.

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## CHAPTER 6

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### Indices and tables

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- `modindex`
- `search`