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Computing Basics

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RASER Workshop 2024

演示实例

- 如何使用RASER软件进行仿真
 - 以在Windows 电脑上通过使用Linux虚拟机和VS Code为例
- 所需下载的软件
 - Oracle VM VirtualBox <https://www.virtualbox.org/>
 - Visual Studio (VS) Code <https://code.visualstudio.com/>
- 所需下载的文件（文件较大，建议提前下载）
 - 虚拟机文件：RASER_Debian.ova
 - RASER运行镜像文件：raser-2.2.sif
 - 其他文件：setup.sh, example.json
 - 下载地址
 - IHEPBox <https://ihepbox.ihep.ac.cn/ihepbox/index.php/s/e7g3ZrpVZj8oegz>
 - 夸克网盘 <https://pan.quark.cn/s/5ecbcbe9ef3e>
 - RASER_Debian.ova 在夸克网盘好像只能单独分享
 - <https://pan.quark.cn/s/d58e9cd6c2ec>



一、下载并安装所需软件

1. 下载 VirtualBox 7.0.20

- <https://download.virtualbox.org/virtualbox/7.0.20/VirtualBox-7.0.20-163906-Win.exe>

2. 安装 VirtualBox 7.0.20

3. 下载 VS Code-1.85.2

- <https://vscode.download.prss.microsoft.com/dbazure/download/stable/8b3775030ed1a69b13e4f4c628c612102e30a681/VSCodeUserSetup-x64-1.85.2.exe>

4. 安装 VS Code 1.85.2



二、下载所需文件

1. 将所需文件下载至windows电脑
 - 例如下载至D盘的RASER文件夹下
 - 文件夹的Windows路径为D:\RASER\
 - 各文件Windows路径
 - D:\RASER\RASER_Debian.ova
 - D:\RASER\raser-2.2.sif
 - D:\RASER\setup.sh
 - D:\RASER\example.json

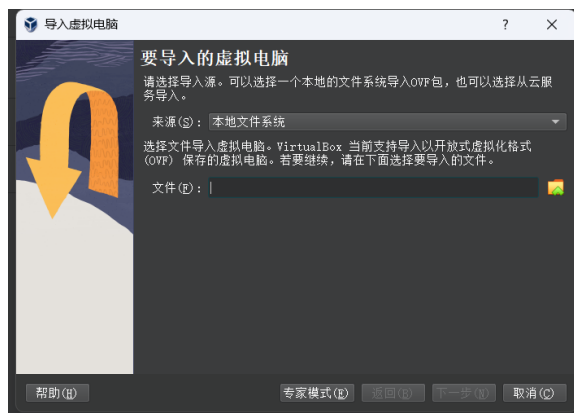
三、使用VirtualBox导入虚拟机

1. 依次点击菜单栏上的“管理”——“导入虚拟电脑”按钮



2. 在弹窗的“文件”输入框中输入虚拟机文件路径，例如D:\RASER\RASER_Debian.ova

- 或者点击输入框右侧图标按钮找到此文件



3. 点击“下一步”按钮

三、使用VirtualBox导入虚拟机

4. 在“默认虚拟电脑位置”下拉菜单中设置虚拟机安装路径



5. 点击“完成”按钮

6. 等待虚拟机导入完成

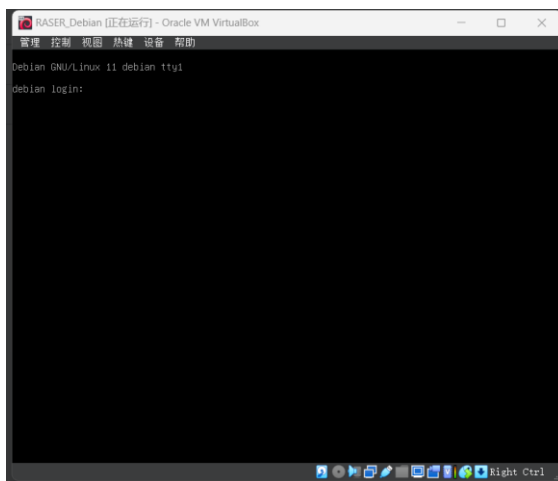


四、启动虚拟机

1. 双击虚拟机或者点击“启动”图标按钮

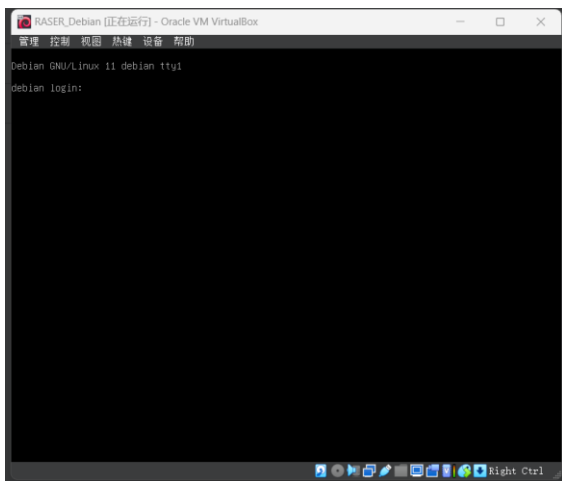


or

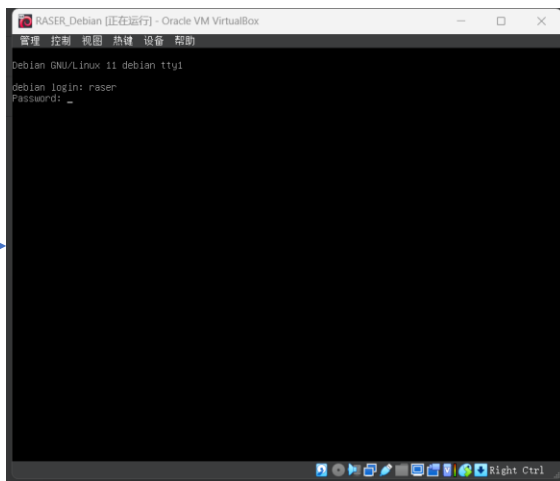


四、启动虚拟机

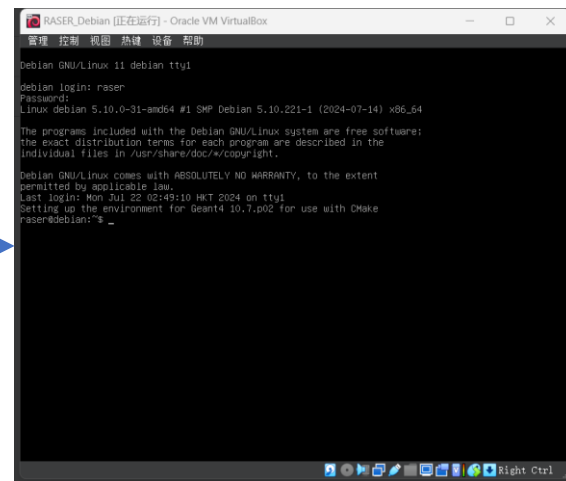
2. 输入用户名： raser
3. 按回车键
4. 输入raser用户密码： raser
5. 按回车键
6. 登录成功



```
RASER_Debian [正在运行] - Oracle VM VirtualBox
管理 控制 视图 热键 设备 帮助
Debian GNU/Linux 11 debian tty1
debian login:
```



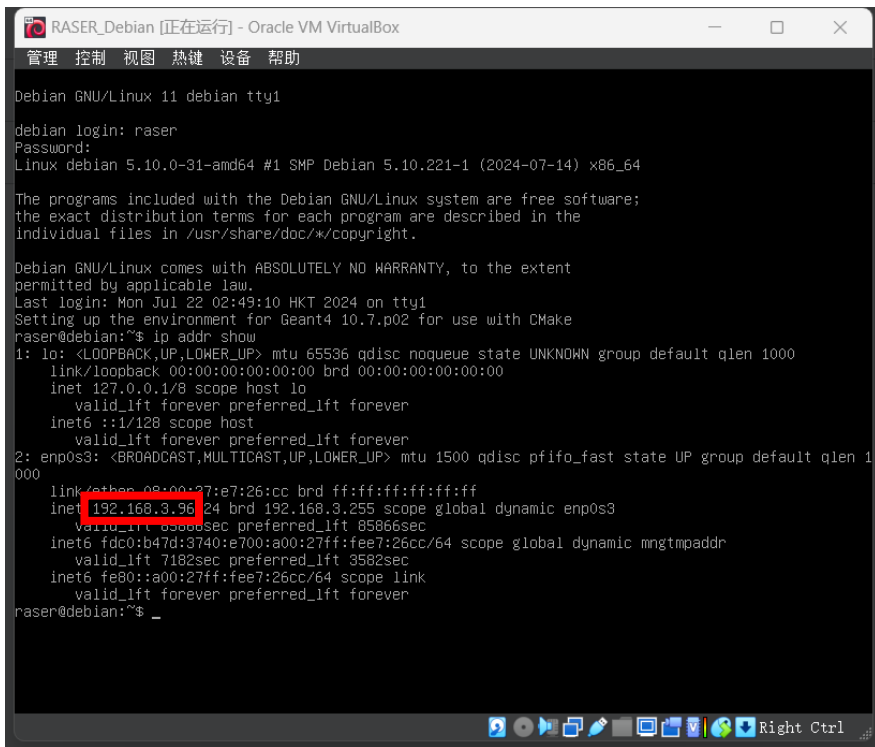
```
RASER_Debian [正在运行] - Oracle VM VirtualBox
管理 控制 视图 热键 设备 帮助
Debian GNU/Linux 11 debian tty1
debian login: raser
Password: _
```



```
RASER_Debian [正在运行] - Oracle VM VirtualBox
管理 控制 视图 热键 设备 帮助
Debian GNU/Linux 11 debian tty1
debian login: raser
Password:
Linux debian 5.10.0-31-amd64 #1 SMP Debian 5.10.221-1 (2024-07-14) x86_64
The programs included with the Debian GNU/Linux system are free software;
the exact distribution terms for each program are described in the
individual files in /usr/share/doc/*/copyright.
Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent
permitted by applicable law.
Last login: Mon Jul 22 02:49:10 HKT 2024 on tty1
Setting up the environment for Geant4 10.7.p02 for use with DMake.
raser@debian:~$
```


五、查询虚拟机IP地址

1. 在虚拟机命令行输入：ip addr show



```
RASER_Debian [正在运行] - Oracle VM VirtualBox
管理 控制 视图 热键 设备 帮助

Debian GNU/Linux 11 debian tty1
debian login: raser
Password:
Linux debian 5.10.0-31-amd64 #1 SMP Debian 5.10.221-1 (2024-07-14) x86_64

The programs included with the Debian GNU/Linux system are free software;
the exact distribution terms for each program are described in the
individual files in /usr/share/doc/*/copyright.

Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent
permitted by applicable law.
Last login: Mon Jul 22 02:49:10 HKT 2024 on tty1
Setting up the environment for Geant4 10.7.p02 for use with CMake
raser@debian:~$ ip addr show
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group default qlen 1000
    link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
    inet 127.0.0.1/8 scope host lo
        valid_lft forever preferred_lft forever
    inet6 ::1/128 scope host
        valid_lft forever preferred_lft forever
2: enp0s3: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc pfifo_fast state UP group default qlen 1000
    link/ether 08:00:27:e7:26:cc brd ff:ff:ff:ff:ff:ff
    inet 192.168.3.96/24 brd 192.168.3.255 scope global dynamic enp0s3
        valid_lft 85866sec preferred_lft 85866sec
    inet6 fdc0:b47d:3740:e700:a00:27ff:fee7:26cc/64 scope global dynamic mngtmpaddr
        valid_lft 7182sec preferred_lft 3582sec
    inet6 fe80::a00:27ff:fee7:26cc/64 scope link
        valid_lft forever preferred_lft forever
raser@debian:~$ _
```

2. 如图所示位置即为虚拟机IP地址

- 例如这里是 192.168.3.96

3. 将虚拟机放置后台

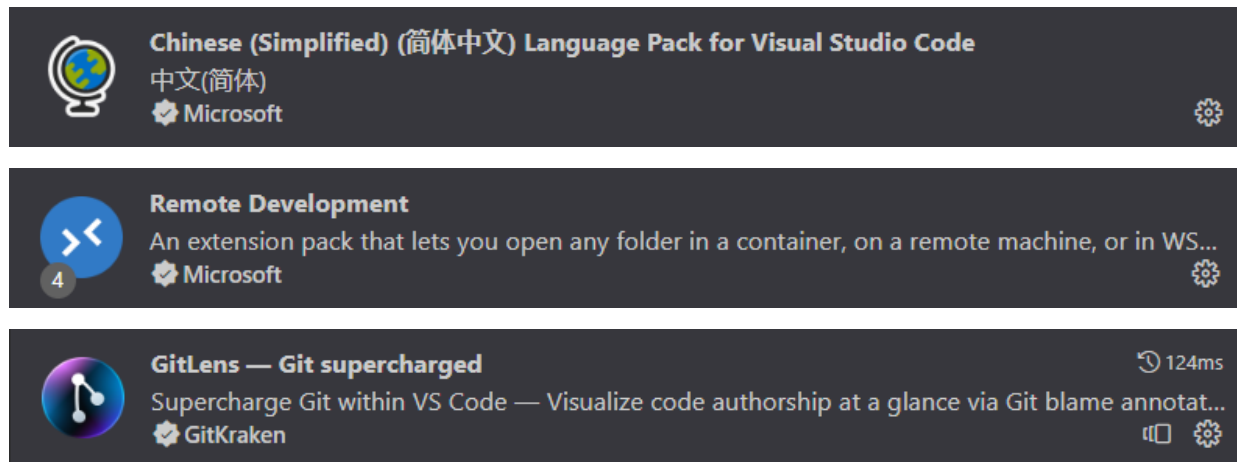
六、打开VS Code、配置并连接虚拟机

1. 点击左侧“插件”图标按钮



2. 搜索栏中依次搜索以下插件并安装

- Chinese (Simplified) (简体中文) Language Pack for Visual Studio Code
- Remote Development
- GitLens — Git supercharged

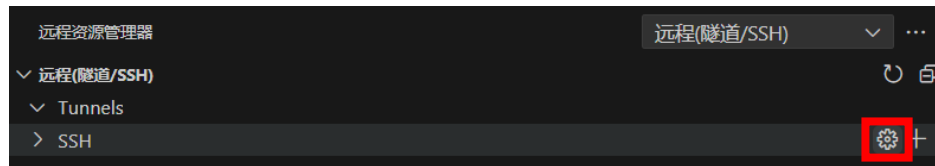


六、打开VS Code、配置并连接虚拟机

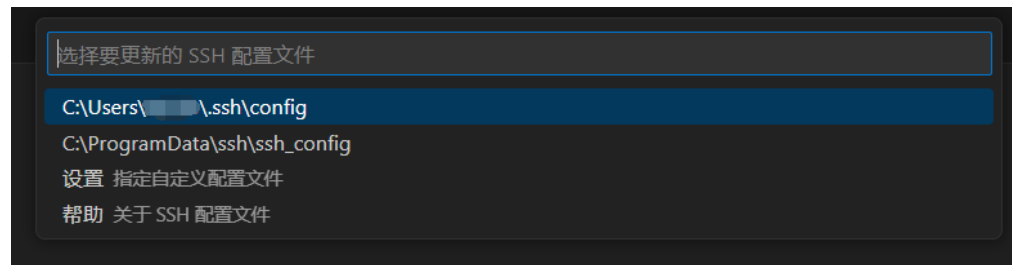
3. 点击左侧“远程资源管理器”图标按钮



4. 点击“打开SSH配置文件”按钮



5. 点击第一个SSH配置文件



六、打开VS Code、配置并连接虚拟机

6. 如图添加所需SSH配置

- Host和HostName处为查询得到的虚拟机IP地址
- User处为虚拟机用户名： raser

```
config x
C: > Users > [redacted] > .ssh > config
1 Host 192.168.3.96
2 HostName 192.168.3.96
3 User raser
```

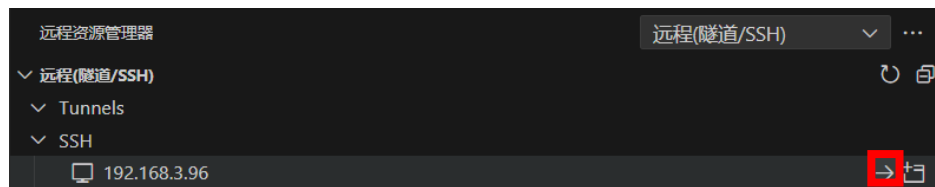
7. 按“ctrl+s” 保存SSH配置文件

8. 点击“刷新”图标按钮

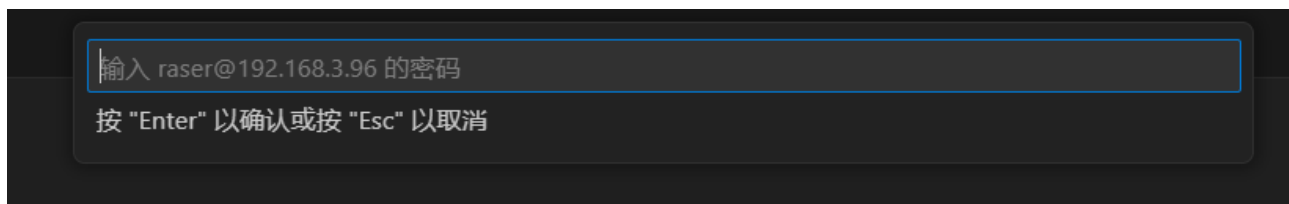


六、打开VS Code、配置并连接虚拟机

9. 点击“在当前窗口中连接”图标按钮

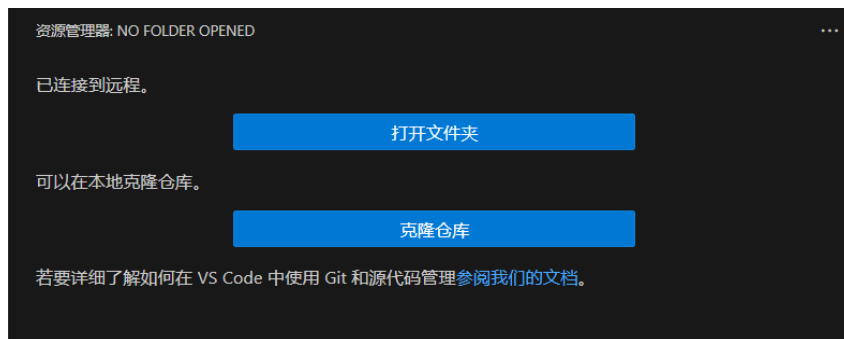


10. 在输入框中输入raser用户密码: raser, 并按回车键 (可能需要重复多次输入密码)



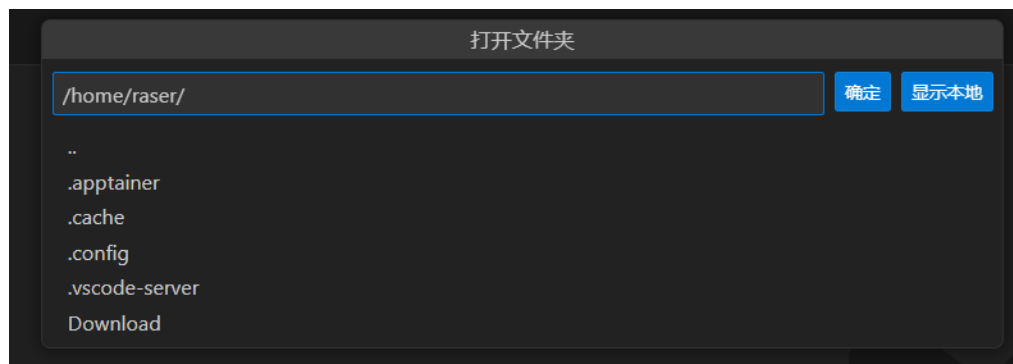
六、打开VS Code、配置并连接虚拟机

11. 点击“打开文件夹”按钮



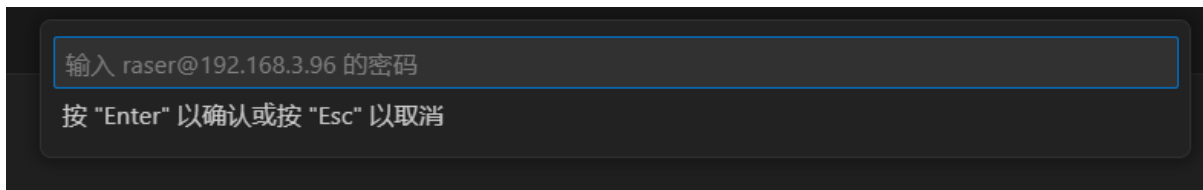
12. 点击“确定”按钮

- 打开虚拟机/home/raser文件夹

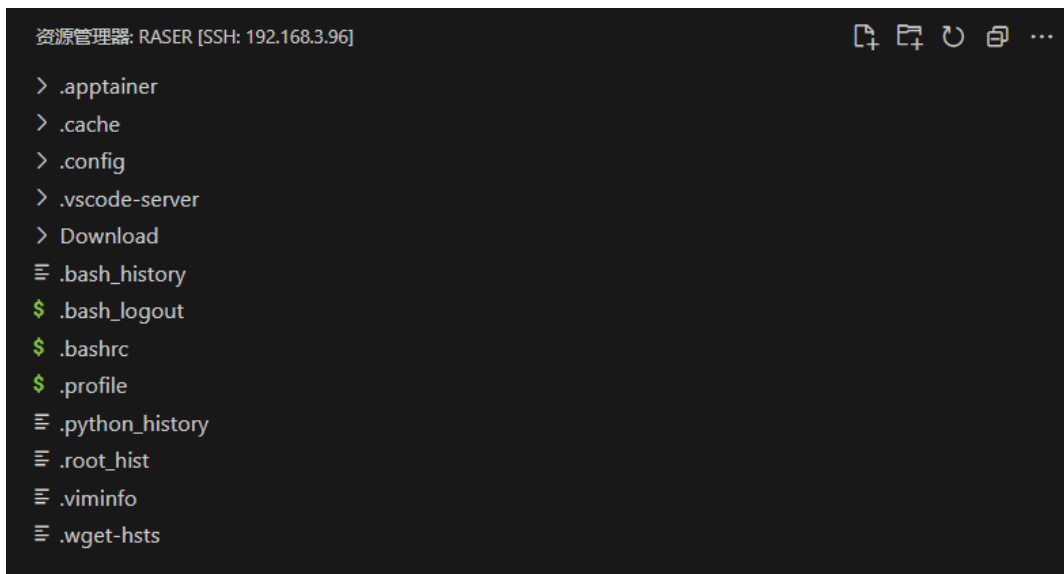


六、打开VS Code、配置并连接虚拟机

13. 在输入框中输入raser用户密码： raser， 并按回车键（可能需要重复多次输入密码）



14. 资源管理器所示即为虚拟机/home/raser路径下文件



六、打开VS Code、配置并连接虚拟机

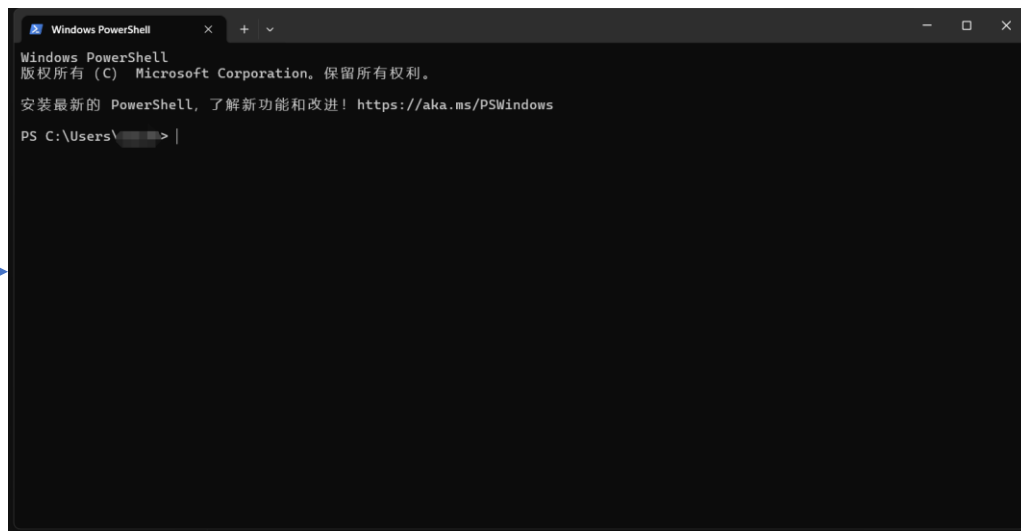
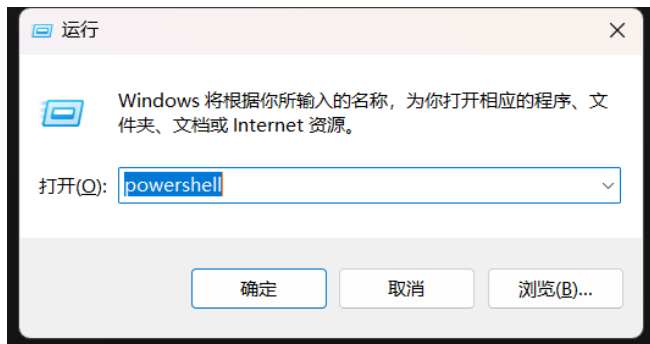
15. 点击“终端”按钮或者按“ctrl+`”打开虚拟机终端



```
问题 输出 调试控制台 终端 端口
Setting up the environment for Geant4 10.7.p02 for use with CMake
raser@debian:~$
```


七、创建演示实例

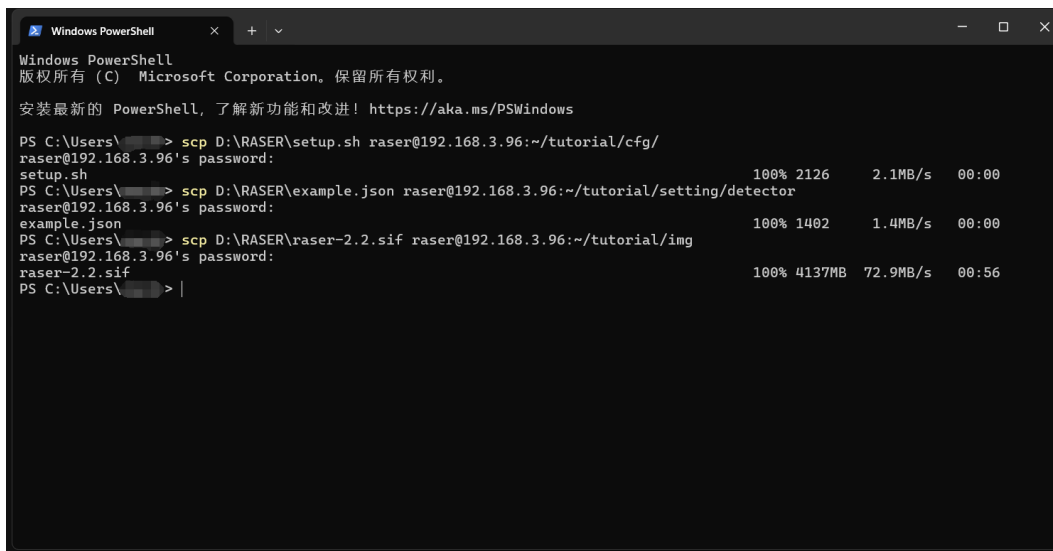
1. 在虚拟机终端中输入以下命令，创建演示实例所需文件夹路径
 - mkdir ~/tutorial
 - cd ~/tutorial
 - mkdir cfg ext img paras setting tests
 - mkdir setting/absorber setting/detector setting/electronics
2. 按“win+r”打开Windows电脑“运行”窗口
3. 输入“powershell”并按“确定”按钮打开Windows PowerShell



七、创建演示实例

4. 在Windows PowerShell中输入以下命令

- `scp <path_to_setup.sh> raser@<IP>:~/tutorial/cfg/`
- `scp <path_to_example.json> raser@<IP>:~/tutorial/setting/detector`
- `scp <path_to_raser-2.2.sif> raser@<IP>:~/tutorial/img`
- 其中<path_to_setup.sh>,<path_to_example.json>和<path_to_raser-2.2.sif>分别替换为三个文件的Windows路径, <IP>替换为虚拟机IP地址, 例如这里是
 - `scp D:\RASER\setup.sh raser@192.168.3.96:~/tutorial/cfg/`
 - `scp D:\RASER\example.json raser@192.168.3.96:~/tutorial/setting/detector`
 - `scp D:\RASER\raser-2.2.sif raser@192.168.3.96:~/tutorial/img`
- 每执行一次scp都要输入虚拟机raser用户密码: raser



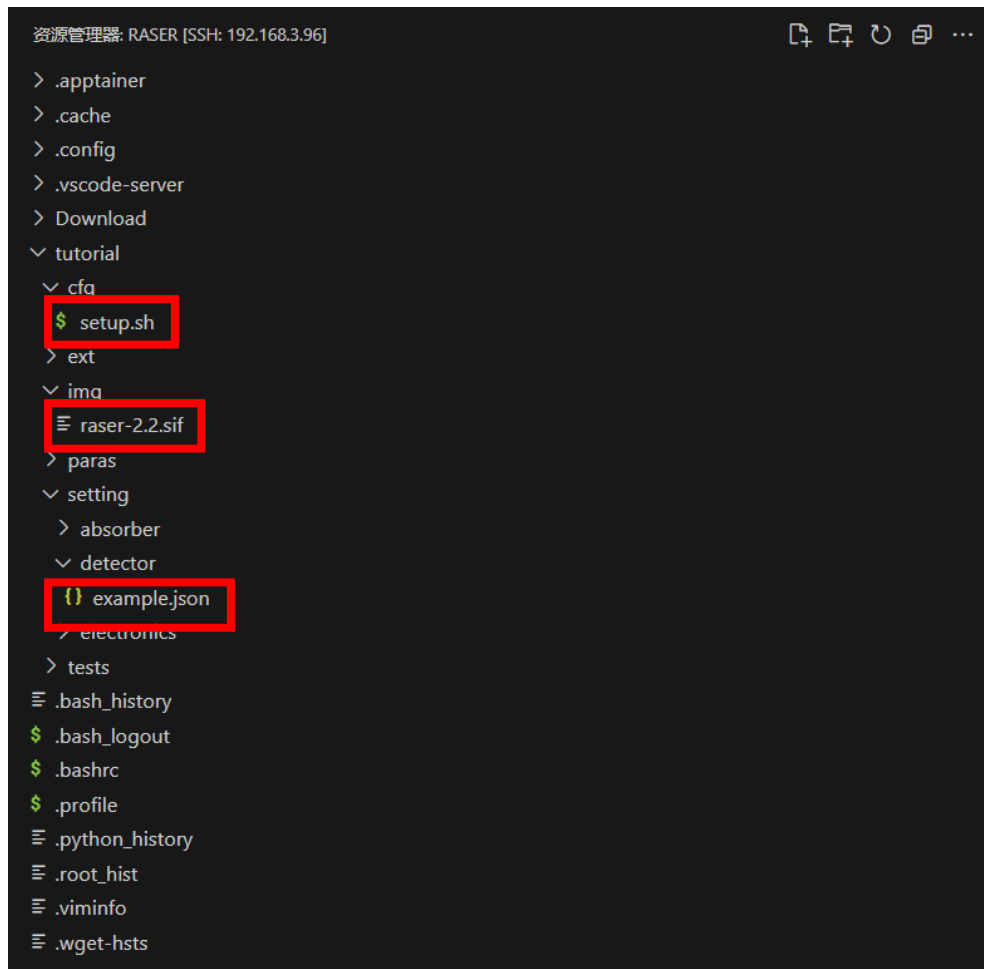
```
Windows PowerShell
版权所有 (C) Microsoft Corporation. 保留所有权利。

安装最新的 PowerShell, 了解新功能和改进! https://aka.ms/PSWindows

PS C:\Users\ > scp D:\RASER\setup.sh raser@192.168.3.96:~/tutorial/cfg/
raser@192.168.3.96's password:
setup.sh
100% 2126 2.1MB/s 00:00
PS C:\Users\ > scp D:\RASER\example.json raser@192.168.3.96:~/tutorial/setting/detector
raser@192.168.3.96's password:
example.json
100% 1402 1.4MB/s 00:00
PS C:\Users\ > scp D:\RASER\raser-2.2.sif raser@192.168.3.96:~/tutorial/img
raser@192.168.3.96's password:
raser-2.2.sif
100% 4137MB 72.9MB/s 00:56
PS C:\Users\ > |
```

七、创建演示实例

5. 文件通过scp复制到虚拟机以后，可以在资源管理器中查看



```
资源管理器: RASER [SSH: 192.168.3.96]
> .apptainer
> .cache
> .config
> .vscode-server
> Download
v tutorial
v cfa
$ setup.sh
> ext
v ima
≡ raser-2.2.sif
> paras
v setting
> absorber
v detector
{} example.json
> electronics
> tests
≡ .bash_history
$ .bash_logout
$ .bashrc
$ .profile
≡ .python_history
≡ .root_hist
≡ .viminfo
≡ .wget-hsts
```

八、下载raser代码到虚拟机

1. 在虚拟机终端中输入以下命令，使用git下载raser到虚拟机tutorial文件夹下
 - `cd ~/tutorial`
 - `git clone https://code.ihep.ac.cn/raser-team/raser.git`

```
● raser@debian:~/tutorial$ git clone https://code.ihep.ac.cn/raser-team/raser.git
Cloning into 'raser'...
remote: Enumerating objects: 197, done.
remote: Counting objects: 100% (87/87), done.
remote: Compressing objects: 100% (51/51), done.
remote: Total 197 (delta 36), reused 82 (delta 35), pack-reused 110 (from 1)
Receiving objects: 100% (197/197), 183.69 KiB | 8.35 MiB/s, done.
Resolving deltas: 100% (44/44), done.
○ raser@debian:~/tutorial$ █
```

九、运行演示实例

1. 配置raser运行环境

- 在虚拟机终端中输入以下命令
 - `cd ~/tutorial`
 - `source cfg/setup.sh`

```
● raser@debian:~/tutorial$ source cfg/setup.sh
  Setting up raser ...
○ raser@debian:~/tutorial$ █
```

九、运行演示实例

2. 生成数据库文件

- 在虚拟机终端中输入以下命令
 - raser field gen_devsim_db
 - (目前还有环境配置WARNING, 请暂时忽略)

```
raser@debian:~/tutorial$ raser field gen_devsim_db
WARNING: Environment variable PYTHONPATH already has value [/home/raser/tutorial/raser:/usr/local/share/root_install/lib:/cvmfs/common.ihep.ac.cn/software/geant4/10.7.p02/install/lib64/python3.6/site-packages:/usr/local/share/acts_build/python], will not forward new value [/cvmfs/sft.cern.ch/lcg/app/releases/ROOT/6.26.06/x86_64-ubuntu20-gcc94-opt/lib] from parent process environment
WARNING: Environment variable ROOTSYS already has value [/usr/local/share/root_install], will not forward new value [/cvmfs/sft.cern.ch/lcg/app/releases/ROOT/6.26.06/x86_64-ubuntu20-gcc94-opt] from parent process environment
The SICAR database is created.
The SICAR database is saved.
raser@debian:~/tutorial$
```

九、运行演示实例

3. 运行演示仿真实例

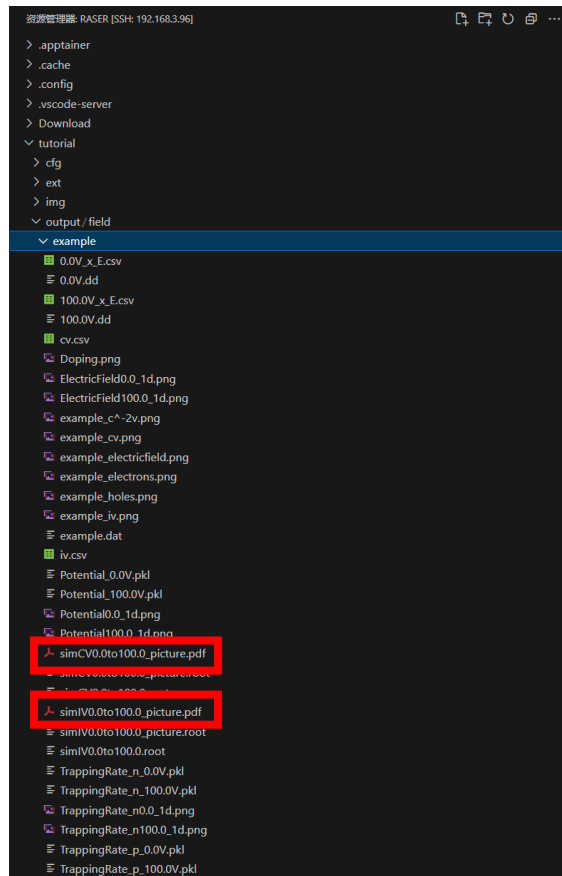
- 在虚拟机终端中输入以下命令
 - raser field -cv example
 - (目前还有环境配置WARNING, 请暂时忽略)

```
Device "example" shadows global parameter update top_bias
Iteration: 11
Device: "example" RelError: 1.08984e-03 AbsError: 1.47670e+10
Region: "example" RelError: 1.08984e-03 AbsError: 1.47670e+10
Equation: "ElectronContinuityEquation" RelError: 5.96658e-04 AbsError: 1.47634e+10
Equation: "HoleContinuityEquation" RelError: 3.33398e-05 AbsError: 5.61659e+06
Equation: "PotentialEquation" RelError: 4.59847e-04 AbsError: 4.61670e-02
Circuit: RelError: 5.04356e-01 AbsError: 1.67649e-09
Device "example" shadows global parameter update top_bias
Iteration: 12
Device: "example" RelError: 9.98728e-04 AbsError: 1.48499e+10
Region: "example" RelError: 9.98728e-04 AbsError: 1.48499e+10
Equation: "ElectronContinuityEquation" RelError: 5.97526e-04 AbsError: 1.48442e+10
Equation: "HoleContinuityEquation" RelError: 3.34475e-05 AbsError: 5.64893e+06
Equation: "PotentialEquation" RelError: 1.67546e-04 AbsError: 3.69309e-02
Circuit: RelError: 2.11628e+00 AbsError: 2.25682e-09
Device "example" shadows global parameter update top_bias
Iteration: 13
Device: "example" RelError: 8.66400e-04 AbsError: 1.40000e+10
Region: "example" RelError: 8.66400e-04 AbsError: 1.40000e+10
Equation: "ElectronContinuityEquation" RelError: 5.59791e-04 AbsError: 1.39987e+10
Equation: "HoleContinuityEquation" RelError: 3.44235e-05 AbsError: 9.32629e+06
Equation: "PotentialEquation" RelError: 2.75180e-04 AbsError: 2.60701e-02
Circuit: RelError: 9.35574e-01 AbsError: 5.15844e-10
Device "example" shadows global parameter update top_bias
Iteration: 14
Device: "example" RelError: 6.60629e-04 AbsError: 1.13188e+10
Region: "example" RelError: 6.60629e-04 AbsError: 1.13188e+10
Equation: "ElectronContinuityEquation" RelError: 4.47212e-04 AbsError: 1.13125e+10
Equation: "HoleContinuityEquation" RelError: 2.52347e-05 AbsError: 4.39498e+06
Equation: "PotentialEquation" RelError: 1.88807e-04 AbsError: 1.88974e-02
Circuit: RelError: 2.57219e-01 AbsError: 1.12841e-10
Device "example" shadows global parameter update top_bias
Iteration: 15
Device: "example" RelError: 3.04534e-04 AbsError: 7.50122e+09
Region: "example" RelError: 3.04534e-04 AbsError: 7.50122e+09
Equation: "ElectronContinuityEquation" RelError: 2.88867e-04 AbsError: 7.49837e+09
Equation: "HoleContinuityEquation" RelError: 1.64637e-05 AbsError: 2.85300e+06
Equation: "PotentialEquation" RelError: 2.63189e-04 AbsError: 1.16568e-07
Circuit: RelError: 2.87970e-01 AbsError: 1.77355e-10
Device "example" shadows global parameter update top_bias
Iteration: 16
Device: "example" RelError: 9.32278e-10 AbsError: 2.75383e+03
Region: "example" RelError: 9.32278e-10 AbsError: 2.75383e+03
Equation: "ElectronContinuityEquation" RelError: 3.36468e-11 AbsError: 2.75278e+03
Equation: "HoleContinuityEquation" RelError: 8.98635e-10 AbsError: 1.04716e+00
Equation: "PotentialEquation" RelError: 9.65697e-16 AbsError: 4.18086e-14
Circuit: RelError: 2.79508e-08 AbsError: 1.71184e-17
top: 100.0 5.14162471192166e-10 1.7183103737786808e-12 5.158807815659459e-10
AC Iteration:
number of equations 872
replacing Edge Model xmid in region example of material Silicon
Info in c:\Canvas:\Print>: png file /home/raser/tutorial/output/field/example/potential100.0_1d.png has been created
Info in c:\Canvas:\Print>: png file /home/raser/tutorial/output/field/example/Electricfield100.0_1d.png has been created
Info in c:\Canvas:\Print>: png file /home/raser/tutorial/output/field/example/Trapupdate_100.0_1d.png has been created
Info in c:\Canvas:\Print>: png file /home/raser/tutorial/output/field/example/Trapupdate_3100.0_1d.png has been created
Replacing Edge Model xmid in region example of material Silicon
Info in c:\Canvas:\saveAs>: ROOT file /home/raser/tutorial/output/field/example/simV0.0to100.0_picture.root has been created
Info in c:\Canvas:\Print>: pdf file /home/raser/tutorial/output/field/example/simV0.0to100.0_picture.pdf has been created
Info in c:\Canvas:\saveAs>: ROOT file /home/raser/tutorial/output/field/example/simCV0.0to100.0_picture.root has been created
Info in c:\Canvas:\Print>: pdf file /home/raser/tutorial/output/field/example/simCV0.0to100.0_picture.pdf has been created
程序运行时间: 35.31642228062459
raser@debian:~/tutorial$
```

九、运行演示实例

4. 查看仿真结果

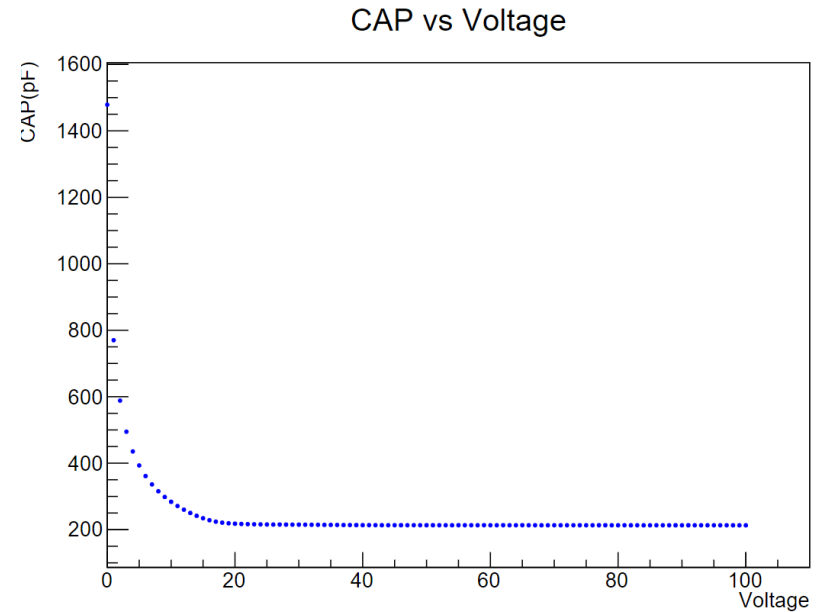
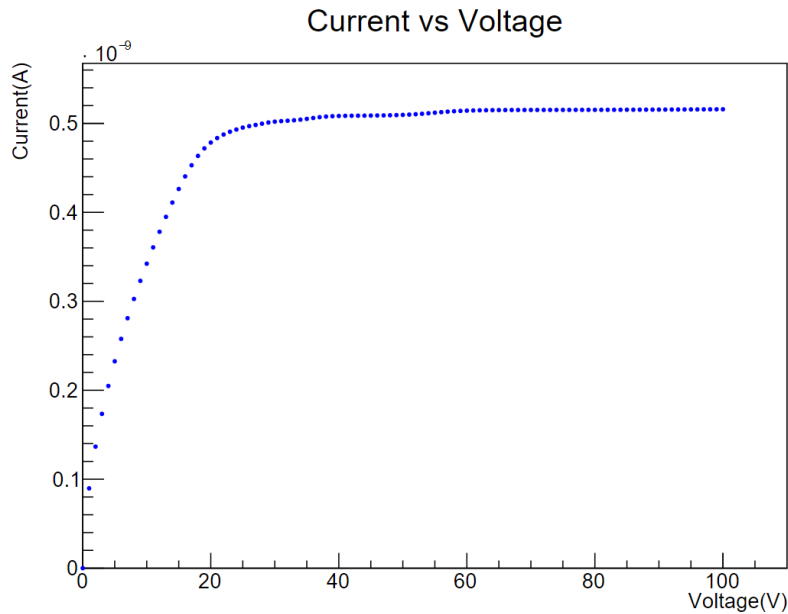
- 结果保存在~/tutorial/output/field/example路径下
- 可在资源管理器中点击查看
 - 例如查看IV和CV仿真结果



九、运行演示实例

4. 查看仿真结果

- 结果保存在~/tutorial/output/field/example路径下
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Thanks!

Hands-On Practice

Backup

Linux电脑如何直接使用RASER软件进行仿真

1. 下载所需文件

- RASER运行镜像文件: raser-2.2.sif
- 其他文件: setup.sh, example.json

2. 安装所需软件并配置环境

- Python <https://www.python.org/>
 - 要求版本: Python 3.9.2
- CVMFS <https://cernvm.cern.ch/fs/>
 - 可使用CVMFS配置所需ROOT和Geant4
- ROOT <https://root.cern/>
 - 要求版本: ROOT 6.26/06
- Geant4 <https://geant4.web.cern.ch/>
 - 要求版本: Geant4 10.7.2
- Apptainer <https://apptainer.org/>

Linux电脑如何直接使用RASER软件进行仿真

2.1 以安装Debian虚拟机并配置环境为例

- Debian版本: 11.7 (下载链接 <https://mirror.accum.se/cdimage/archive/11.7.0/amd64/iso-cd/debian-11.7.0-amd64-netinst.iso>)

2.2 换清华软件源 (root用户下)

- `cp -a /etc/apt/sources.list /etc/apt/sources.list.bak`
- `vi /etc/apt/sources.list`
- 写入清华软件源镜像地址配置 (参考 <https://mirrors.tuna.tsinghua.edu.cn/help/debian/>)

2.3更新软件 (root用户下)

- `apt update`
- `apt upgrade`

2.4 安装所需软件 (root用户下)

- `apt install sudo vim git wget build-essential`

Linux电脑如何直接使用RASER软件进行仿真

2.5 给raser用户添加sudo权限（root用户下）

- `sudo visudo`
- 添加一行
 - `raser ALL=(ALL:ALL) ALL`
- 之后操作都在raser用户下

2.6 安装apptainer（参考 <https://apptainer.org/docs/admin/main/installation.html>）

- `wget`
`https://github.com/apptainer/apptainer/releases/download/v1.3.3/apptainer_1.3.3_amd64.deb`（可能需要开代理下载）
- `sudo apt install -y ./apptainer_1.3.3_amd64.deb`

Linux电脑如何直接使用RASER软件进行仿真

2.7 安装cvmfs (参考 <https://cvmfs.readthedocs.io/en/stable/cpt-quickstart.html>)

- `wget https://ecsft.cern.ch/dist/cvmfs/cvmfs-release/cvmfs-release-latest_all.deb`
- `sudo apt install -y ./cvmfs-release-latest_all.deb`
- `sudo apt install -y cvmfs` (下载可能比较慢)
- `sudo cvmfs_config setup`
- `sudo vim /etc/cvmfs/default.local`
 - 将下列三行写入
 - `CVMFS_REPOSITORIES=cvmfs-config.cern.ch,sft.cern.ch,geant4.cern.ch`
 - `CVMFS_CLIENT_PROFILE=single`
 - `CVMFS_HTTP_PROXY=DIRECT`
- `sudo cvmfs_config probe`

2.8 安装所需root和geant4对应的g++-9

- 添加所在软件源
 - `sudo vim /etc/apt/sources.list`
 - 将以下两行写入
 - `deb http://deb.debian.org/debian/ buster main`
 - `deb-src http://deb.debian.org/debian/ buster main`
- `sudo apt update`
- `sudo apt install g++-9`
- `sudo update-alternatives --install /usr/bin/g++ g++ /usr/bin/g++-9 90`

2.9 配置root和geant4

- `sudo vim /etc/bash.bashrc`
- 将以下两行写入
 - `source /cvmfs/geant4.cern.ch/geant4/10.7.p02/x86_64-centos7-gcc9-optdeb/CMake-setup.sh`
 - `source /cvmfs/sft.cern.ch/lcg/app/releases/ROOT/6.26.06/x86_64-ubuntu20-gcc94-opt/bin/thisroot.sh`

3. 创建并运行演示实例（与Windows电脑步骤七至步骤九相似）

3.1 创建tutorial文件夹

- `mkdir ~/tutorial`
- `cd ~/tutorial`
- `mkdir cfg ext img paras setting tests`
- `mkdir setting/absorber setting/detector setting/electronics`

3.2 将下载的文件复制到tutorial文件夹下

- `cp setup.sh ~/tutorial/cfg`
- `cp example.json ~/tutorial/setting/detector`
- `cp raser-2.2.sif ~/tutorial/img`

3.3 下载raser git repository

- `git clone https://code.ihep.ac.cn/raser-team/raser.git`

3.4 运行实例

- `source cfg/setup.sh`
- `raser field gen_devsim_db`
- `raser field -cv example`