

Job submission

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- 1 Standard submission (JDL)
 - ▶ Submit generic job
 - ▶ Submit JUNO jobs
- 2 JSUB
 - ▶ Submit JUNO jobs
- 3 Production tool
 - ▶ Not covered in this presentation – see DocDB-8164
 - ▶ To use production tool need to be in production group in VOMS

Part #1

Standard submission (JDL)

Submitting your first job

```
myscript.sh
```

```
#!/bin/sh  
  
echo "====_ _Begin_ _===="  
date  
echo "The_program_is_running_on_$HOSTNAME"
```

```
test.jdl
```

```
JobName = "mysimplejob";  
Executable = "/bin/bash";  
Arguments = "myscript.sh";  
StdOutput = "stdout.out";  
StdError = "stderr.err";  
InputSandbox = { "myscript.sh" };  
OutputSandbox = { "stdout.out", "stderr.err" };  
VirtualOrganisation = "vo.juno.ihep.ac.cn";
```

- Create the `myscript.sh` and `test.jdl` files
- Submit job:

```
% dirac-wms-job-submit test.jdl  
JobID = 5923594
```

Job status

% dirac-wms-job-submit test.jdl

JobID = 5923594

% dirac-wms-job-status 5923594

JobID=5923593 Status=Waiting; MinorStatus=Pilot Agent
Submission; Site=ANY;

% dirac-wms-job-status 5923594

JobID=5923594 Status=Done; MinorStatus=Execution
Complete; Site=CLOUD.IHEPCLOUD.cn;

% dirac-wms-job-get-output 5923594

Job output sandbox retrieved in /afs/ihep.ac.cn/users/j/
jpandre/dirac/5923594/

% cat 5923594/stdout.out

===== Begin =====

Sun Jul 21 10:01:13 CST 2019

The program is running on idirac-20190721-095925-12
c787ff

DIRAC API (advanced)

- DIRAC API written in python
- Python API provides more flexibility than pre-made commands
- CLI tools written in python
 - ▶ possible to read/adapt them

```
#!/usr/bin/env python
```

```
from DIRAC.Core.Base import Script
Script.parseCommandLine(ignoreErrors=False)
from DIRAC.Interfaces.API.Job import Job
from DIRAC.Interfaces.API.Dirac import Dirac
```

```
dirac = Dirac()
```

```
j = Job()
j.setCPUTime(500)
j.setExecutable('/bin/echo_Begin')
j.setExecutable('/bin/date')
j.setExecutable('/bin/hostname')
j.setExecutable('/bin/echo_End')
j.setName('test-API')
```

```
#j.setNumberOfProcessors(2)
```

```
jobID = dirac.submitJob(j)
print("Submission_result:", jobID)
if jobID['OK']:
    print("status:", dirac.getJobStatus(jobID['JobID']))
```

Exercise: Submitting JUNO jobs

- Now we can start to submit JUNO jobs...
- Can you modify the previous JDL & script to submit a short simulation job?
- Remember:
 - ▶ Given job might run anywhere you **cannot** use any “local” file paths!
 - ▶ CVMFS is your friend
 - ▶ Alternative put tar-ball in DFC and download & extract it before using software.
- Add `OutputData = { "*.root" };` to JDL file
 - ▶ What happens if you don't put it?
 - ▶ Did you find your ROOT output files?
- JDL files support many more options still...
 - ▶ This tutorial is **not** meant to cover them all
 - ▶ and I don't know them all either...
 - ▶ <https://dirac.readthedocs.io/en/latest/UserGuide/GettingStarted/UserJobs/JDLReference/index.html>

Submitting JUNO jobs (solution)

run_detsim.sh

```
#!/bin/bash
```

```
export CMTCONFIG=amd64_linux26
```

```
source /cvmfs/juno.ihep.ac.cn/centos7_amd64_gcc830/  
Pre-Release/J22.1.0-rc4/setup.sh
```

```
python ${TUTORIALROOT}/share/tut_detsim.py gun
```

run_detsim.jdl

```
JobName = "run_detsim";
```

```
Executable = "/bin/bash";
```

```
Arguments = "run_detsim.sh";
```

```
StdOutput = "stdout.out";
```

```
StdError = "stderr.err";
```

```
InputSandbox = { "run_detsim.sh" };
```

```
OutputSandbox = { "stdout.out", "stderr.err" };
```

```
OutputData = { "*.root" };
```

```
VirtualOrganisation = "vo.juno.ihep.ac.cn";
```

```
FC:/juno/user/j/jpandre/11186/11186429>ls
```

```
sample_detsim.root
```

```
sample_detsim_user.root
```

Exercise: Submitting JUNO jobs 2

- In previous exercise we ran `detsim`
 - ▶ No input needed \Rightarrow easier to handle
- Now, let's try to run a job using an input!
 - ▶ for example, run `elecsim` on previous output
- Option 1:
 - ▶ Add `InputData` field to JDL file
 - ★ path should correspond to DFC path!
- Option 2 (advanced!):
 - ▶ Use `xrootd` for local access
 - ▶ Need to know where the file is
 - ▶ Need to know `xrootd` path for each cluster

```
root :// junoeos01.ihep.ac.cn:1094//eos/juno/dirac
root :// xfer-archive-03.cr.cnaf.infn . it :1094//
      dirac
root :// ccxrootdegee.in2p3.fr:1094//pnfs/in2p3.fr
      /data/juno/dirac
root :// eos.jinr .ru:1094//eos/juno/dirac
```

- ▶ Add `Site` field to JDL file with location

Submitting JUNO jobs 2 (solution, opt #1)

```
#!/bin/bash
```

```
export CMTCONFIG=amd64_linux26
```

```
source /cvmfs/juno.ihep.ac.cn/centos7_amd64_gcc830/  
Pre-Release/J21v1r0-Pre0/setup.sh
```

```
python ${TUTORIALROOT}/share/tut_det2elec.py
```

```
JobName = "run_elecsim";
```

```
Executable = "/bin/bash";
```

```
Arguments = "run_elecsim.sh";
```

```
StdOutput = "stdout.out";
```

```
StdError = "stderr.err";
```

```
InputSandbox = { "run_elecsim.sh" };
```

```
OutputSandbox = { "stdout.out", "stderr.err" };
```

```
InputData = { "/juno/user/j/jpandre  
/10093/10093688/sample_detsim.root" };
```

```
OutputData = { "*.root" };
```

```
VirtualOrganisation = "vo.juno.ihep.ac.cn";
```

```
FC:/juno/user/j/jpandre/10094/10094023>ls
```

```
sample_detsim.root
```

```
sample_elecsim.root
```

```
sample_elecsim_user.root
```

Submitting JUNO jobs 2 (solution, opt #2)

```
#!/bin/bash
```

```
export CMTCONFIG=amd64_linux26
```

```
source /cvmfs/juno.ihep.ac.cn/centos7_amd64_gcc830/  
Pre-Release/J21v1r0-Pre0/setup.sh
```

```
python ${TUTORIALROOT}/share/tut_det2elec.py --input  
test:root://eos.jinr.ru:1094//eos/juno/dirac/juno/user/j/  
jpandre/10093/10093688/sample_detsim.root --rate  
test:1.0
```

```
JobName = "run_elecsim_opt2";  
Executable = "/bin/bash";  
Arguments = "run_elecsim_opt2.sh";  
StdOutput = "stdout.out";  
StdError = "stderr.err";  
InputSandbox = { "run_elecsim_opt2.sh" };  
OutputSandbox = { "stdout.out", "stderr.err" };  
OutputData = { "*.root" };  
VirtualOrganisation = "vo.juno.ihep.ac.cn";  
Site = "GRID.JINR-CONDOR.ru";
```

```
FC:/juno/user/j/jpandre/10094/10094091>ls  
sample_elecsim.root  
sample_elecsim_user.root
```

More exercise ideas!

If you've completed previous exercises, try finding out how you'd like to do a few different things & test them out:

- Send job to specific site
- Send output to specific SE
- Submit many similar jobs
(ie, change only random seed)
- Group multiple jobs
- Put output in specified folder

More exercise ideas!

If you've completed previous exercises, try finding out how you'd like to do a few different things & test them out:

- Send job to specific site
 - ▶ Add `Site` to JDL
- Send output to specific SE
 - ▶ Add `OutputSE` to JDL
- Submit many similar jobs
(ie, change only random seed)
 - ▶ Use parametric jobs!
 - ▶ Add to `jdl`: `Parameters`, `ParameterStart`, `ParameterStep`, ...
 - ▶ Change `Arguments` to include parameter
 - ▶ Change script to take in CLI option
- Group multiple jobs
 - ▶ Add `JobGroup` to JDL
 - ▶ Use `-g` flag in various commands
(check their help!)
- Put output in specified folder
 - ▶ Add `OutputPath` to JDL
 - ▶ Note: folder is relative path to your user folder!

Part #2

JSUB

What is JSUB

- Goal: make JUNO DCI (user) job submission easier & more efficient
- Tool developed by Xianghu Zhao and Yifan Yang (postdoc @IHEP)
- Resources from Yifan:
 - ▶ DocDB-7303: JSUB tutorial
 - ▶ <https://jsubpy.github.io/>
- Examples in CVMFS:
`/cvmfs/dcomputing.ihep.ac.cn/frontend/jsub/1.2/install/jsub/examples/juno/`
- On the down side original developers finished their postdocs...
 - ▶ For now things work, and we will try maintain it...
 - ▶ But current DCI manpower is very limited...
- Let us know if you'd like to help maintain JSUB!

Getting started with JSUB

- JSUB config file (`~/ .jsubrc`):

```
package: [jsub_juno, jsub_dirac]
```

```
taskDir:
```

```
  location: /path/to/my/jsub/manager/folder
```

```
  #location: /home/jp/jsub
```

```
backend:
```

```
  default: dirac
```

- Activate JSUB:

```
% source /cvmfs/dcomputing.ihep.ac.cn/frontend/  
  jsub/activate.sh -e juno
```

Getting started with JSUB 2

% **jsub --help**

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

Options:

- jsubrc TEXT Configuration file to run JSUB with.
- help Show this message and exit.

Commands:

- create Create a task from a task description file .
- getlog Retrieve log files of selected subjobs.
- jobvar View the values of jobvar lists
- ls List all tasks.
- package Show active packages.
- register Upload files to SE and register them to DFC.
- remove Delete a task.
- rename Rename a task.
- reschedule Reschedule selected subjobs.
- resubmit Equivalent to 'jsub submit -r' command
- run Create from a task profile , and submit.
- show Show detailed description of a task.
- status Show the backend status of a task.
- submit Submit a task to backend.
- version Show the version of the software.

JUNO simulation – job definition file

based on 101_detsim.yaml example from Yifan
detsim.yaml

```
taskName: juno_sim
experiment: juno
#softVersion: 'centos7_amd64_gcc830/Pre-Release
  /J20v1r0-Pre2'
softVersion:
  arch: 'centos7_amd64_gcc830/'
  release: 'J20v1r0-Pre2'

backend:
  type: dirac
  outputSubDir: 'temporary_jsub_tests'

splitter :
  mode: splitByEvent
  evtMaxPerJob: 5
  njobs: 2

workflow:
  steps: [detsim]

  detsim:
    seed: 1
    additionalArgs: 'gun'
```

JUNO simulation – submitting job

2 options for submitting job:

- create job, then submit:
 - ▶ Gives the chance to check if that was indeed the job you wanted to submit

```
% jsub create detsim.yaml
```

```
Task created successfully
```

```
- ID          : 1  
- Name       : juno_sim  
- Job Number : 2
```

```
% jsub submit 1
```

```
Submitting task 1
```

```
[2022-05-15 22:05:21.442 +0200 CEST][JSUB|INFO  
]: 2 jobs successfully submitted to backend.
```

- Submit in a single step:

```
% jsub run detsim.yaml
```

```
[2022-05-15 22:13:40.400 +0200 CEST][JSUB|INFO  
]: 2 jobs successfully submitted to backend.
```

```
Task submitted successfully
```

```
- ID          : 2  
- Name       : juno_sim  
- Job Number : 2
```

Job management with JSUB

```
% jsub ls
```

```
[2022-05-15 22:20:16.003 +0200 CEST][JSUB|INFO]:
```

```
  Fetching backend status info update for tasks. May  
  take some time.
```

```
Task ID  Name      Experiment Backend Status (D|F|R|W|  
O) Creation Time (UTC) Info Updated (UTC)
```

```
-----  
-----  
-----  
1      juno_sim juno      dirac      2|0|0|0|0  
          2022-05-15 20:03:32 2022-05-15  
20:20:20  
2      juno_sim juno      dirac      2|0|0|0|0  
          2022-05-15 20:13:32 2022-05-15  
20:20:23
```

```
% jsub getlog 1 -s D
```

```
  Fetching the log files of task 1
```

```
  Specifying job status: D
```

```
[2022-05-15 22:21:25.596 +0200 CEST][JSUB|INFO]:
```

```
  Retrieved log files of 2 subjobs
```

```
% ls ~/jsub/1/logfiles
```

```
0/ 1/
```

```
% ls ~/jsub/1/logfiles/0/unit/detsim
```

```
detsim.log
```

JSUB output ROOT files

```
FC:/juno/user/j/jpandre/temporary_jsub_tests/juno_sim/  
detsim>ls  
detsim_1.root  
detsim_2.root  
detsim_user_1.root  
detsim_user_2.root
```

- Saves file in DFC based on `taskName` and `outputSubDir`
- Easier to know what corresponds to each file
- Better natural organization between `detsim/elecsim/...`
- Note: possible to do that with JDL also, but in JSUB it gets done automatically

Exercise: Submit a detsim+elecsim job

- Modify the previous YAML script to run also `elecsim`
- Bonus: change some configuration from `elecsim`
- How are the output files organized?
- How are the log files organized?

Submit a detsim+elecsim job (solution)

```
taskName: juno_sim_elec
experiment: juno
#softVersion: 'centos7_amd64_gcc830/Pre-Release
/J20v1r0-Pre2'
softVersion:
  arch: 'centos7_amd64_gcc830/'
  release: 'J20v1r0-Pre2'

backend:
  type: dirac
  outputSubDir: 'temporary_jsub_tests'

splitter :
  mode: splitByEvent
  evtMaxPerJob: 5
  njobs: 2

workflow:
  steps: [detsim, elecsim]

  detsim:
    seed: 1
    additionalArgs: 'gun'
```

Simulating multiple similar configurations

- This is very useful if you want to simulate many similar jobs with varying inputs
- Change splitter from `splitByEvent` to `splitByJobvar` for more flexibility
- `splitByJobvar` also creates variables that can be used when configuring jobs
 - ▶ a list of isotopes can be provided
 - ▶ some of those informations used to define filename
 - ▶ any other variable (like a seed) could be added. . .

Simulating multiple similar configurations

```
# [...]
```

```
splitter :
```

```
mode: splitByJobvars
```

```
maxSubJobs: 5
```

```
evtMaxPerJob: 10
```

```
jobvarLists:
```

```
nuclear:
```

```
type: enumerate
```

```
list : [ 'U-238', 'Th-232' ]
```

```
group: nuclear
```

```
subjob:
```

```
type: range
```

```
group: same_nuclear
```

```
workflow:
```

```
steps: [detsim]
```

```
detsim:
```

```
output: '$(nuclear).$(subjob).detsim.root'
```

```
userOutput: '$(nuclear).$(subjob).user.detsim.  
root'
```

```
additionalArgs: 'gendecay_--nuclear_$(nuclear  
)_--volume_pTarget_--material_LS'
```


Exercise: Submit an elecsim job

- Now, if you had to run `elecsim` from the `detsim` generated, how would you do?
 - ▶ For simplicity consider the files produced by the first `detsim` with JSUB
- Option 1:
 - ▶ Pass an `input:` to `elecsim`
- Option 2 (advanced):
 - ▶ Use the file catalog to know which files to use as input!
 - ▶ Need to use file metadata to pick files

Submit an elecsim job (solution, opt. #1)

```
taskName: juno_sim
experiment: juno
softVersion: 'centos7_amd64_gcc830/Pre-Release/
  J20v1r0-Pre2'

backend:
  type: dirac
  outputSubDir: 'temporary_jsub_tests'

splitter :
  mode: splitByJobvars
  maxSubjobs: 2
  jobvarLists:
    idx:
      type: range

workflow:
  steps: [elecsim]

  elecsim:
    input: '/juno/user/j/jpandre/
      temporary_jsub_tests/juno_sim/detsim/
      detsim_$(idx).root'
    rate: 1.0
```

Submit an elecsim job (solution, opt. #2.1)

```
FC:/juno/user/j/jpandre/temporary_jsub_tests/juno_sim/  
detsim>meta set detsim_1.root userdata 0  
/juno/user/j/jpandre/temporary_jsub_tests/juno_sim/  
detsim/detsim_1.root {'userdata': '0'}
```

```
FC:/juno/user/j/jpandre/temporary_jsub_tests/juno_sim/  
detsim>meta set detsim_2.root userdata 0  
/juno/user/j/jpandre/temporary_jsub_tests/juno_sim/  
detsim/detsim_2.root {'userdata': '0'}
```

```
FC:/juno/user/j/jpandre/temporary_jsub_tests/juno_sim/  
detsim>meta set detsim_user_2.root userdata 1  
/juno/user/j/jpandre/temporary_jsub_tests/juno_sim/  
detsim/detsim_user_2.root {'userdata': '1'}
```

```
FC:/juno/user/j/jpandre/temporary_jsub_tests/juno_sim/  
detsim>meta set detsim_user_1.root userdata 1  
/juno/user/j/jpandre/temporary_jsub_tests/juno_sim/  
detsim/detsim_user_1.root {'userdata': '1'}
```

Submit an elecsim job (solution, opt. #2.2)

```
taskName: juno_sim
experiment: juno
softVersion: 'centos7_amd64_gcc830/Pre-Release/
  J20v1r0-Pre2'
backend:
  type: dirac
  outputSubDir: 'temporary_jsub_tests'

splitter :
  mode: splitByJobvars
  jobvarLists:
    input_filename:
      type: find_lfns
      path: '/juno/user/j/jpandre/
        temporary_jsub_tests/juno_sim/detsim'
      metaspec: "userdata=0"
    seed:
      type: range

workflow:
  steps: [elecsim]
  elecsim:
    input: '$(input_filename)'
    rate: 1
```

More exercise ideas!

If you've completed previous exercises, try finding out how you'd like to do a few different things & test them out:

- Submit job to specific site
- Submit 'gun' with specific positions along z axis
- Provide input file to JSUB
- Run an executable from CVMFS (like Muon.exe)
- Create a user defined task

More exercise ideas!

If you've completed previous exercises, try finding out how you'd like to do a few different things & test them out:

- Submit job to specific site
 - ▶ Add `site` to backend
- Submit 'gun' with specific positions along z axis
 - ▶ `splitByJobvar` should allow this configuration
- Provide input file to JSUB
 - ▶ Add `input` section before `workflow`
- Run an executable from CVMFS (like `Muon.exe`)
 - ▶ Create a block in `workflow` of type `junosoft`
 - ▶ Need to provide `software`, `arguments` and `outputUpload`
- Create a user defined task
 - ▶ Create a block in `workflow` of type `user_script`
 - ▶ Need to provide `file` to run and `args`
 - ▶ Note: could be a bit tricky to get a root output from this step though...

One final example...

```
# [...]
```

input:

```
run-elecsim-1_jsub.sh: run-elecsim-1_jsub.sh  
fileLists.tgz: fileLists.tgz  
tut_det2elec_hx.py: tut_det2elec_hx.py
```

workflow:

```
steps: [elecsim, my_elecsim]
```

```
# JP: I needed to include elecsim so it adds the  
output rootfiles to the list of files to be  
uploaded
```

elecsim:

```
fullArgs: '--help'
```

```
input: '/juno/user/j/jpandre/jsub_test_2022/  
rad_v2/detsim/K-40.1.detsim.root'
```

```
output: 'elecsim'
```

```
user_output: ''
```

my_elecsim:

```
type: user_script
```

```
file: 'run-elecsim-1_jsub.sh'
```

```
args: ''
```

Part #3

Production Tool

Introduction

- As I mentioned before, this requires your VOMS to have production role

```
% dirac-proxy-init -U -g juno_production -M  
Generating proxy...  
Enter Certificate password:  
Added VOMS attribute /juno/Role=production  
[...]  
DIRAC group : juno_production  
[...]  
VOMS fqan : [ '/juno/Role=production', '/juno' ]  
[...]
```

- It is meant for large scale production
 - ▶ less flexible than JSUB or JDL
 - ▶ however tuned to work with large datasets
- Getting started:

```
% ihepdirac-juno-make-productions --example  
> production.ini
```

- Submitting jobs:

```
% ihepdirac-juno-make-productions --ini  
myprod.ini --dryrun  
  
% ihepdirac-juno-make-productions --ini  
myprod.ini
```

Note: I've never used the production system. . .

Production example

I just stripped the comments of the example file by Xiaomei

```
[ all ]  
process = Chain  
softwareVersion = centos7_amd64_gcc830/Pre-Release/  
    J21v2r0-Pre0  
prodName = JUNOProdTest  
transGroup = JUNO_prod_test  
outputType = user  
outputSubDir = positron/prd_2021  
outputMode = closest  
moveTargetSE = IHEP-STORM CNAF-STORM
```

```
[Chain]  
seed = 42  
evtmax = 2  
njobs = 10  
max2dir = 10000  
tagParser = (.*)(.*) MeV  
tags = e+_0.0MeV e+_1.398MeV e+_4.460MeV  
workflow = detsim elecsim_rec  
moveType = detsim  
userOutput = 0  
detsim-mode = gun --particles {0} --momentums {1} --  
    positions 0 0 0  
elecsim_rec-mode = --rate 0.001 --enableWP --  
    enableWPDarkPulse --no-evtrec
```

The end

Thank you for your attention!