5th Belle II Starter Kit Workshop - Belle II Computing, Data production, and hands on gbasf2 tutorial

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ありがとうございました

- Many thanks to the people who have given previous computing, data production, and gbasf2 talks, whose slides I have ~~stolen~~ borrowed from:
  - Takanori Hara (KEK),
  - Samuel Cunliffe (DESY),
  - Jake Bennett (Mississipi),
  - Kunxian Huang (NTU),
  - Michel Hernandez Villanueva (Mississipi).

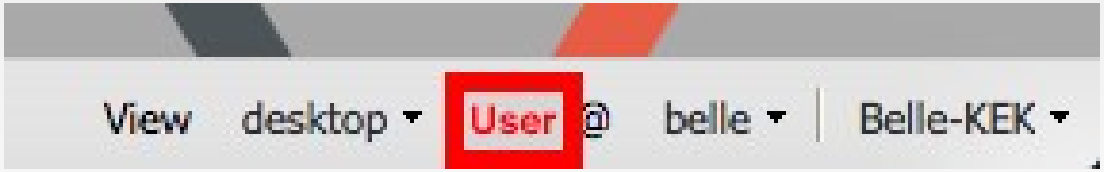
Outline

- *Preparation (Wednesday evening)*
- **Setup of gbasf2**
- Introduction to the grid
- **Running your first gbasf2 jobs**
- Belle II computing and data production
- **Submitting your analysis to the grid (work with tutors during the workshop)**

Bold = hands-on

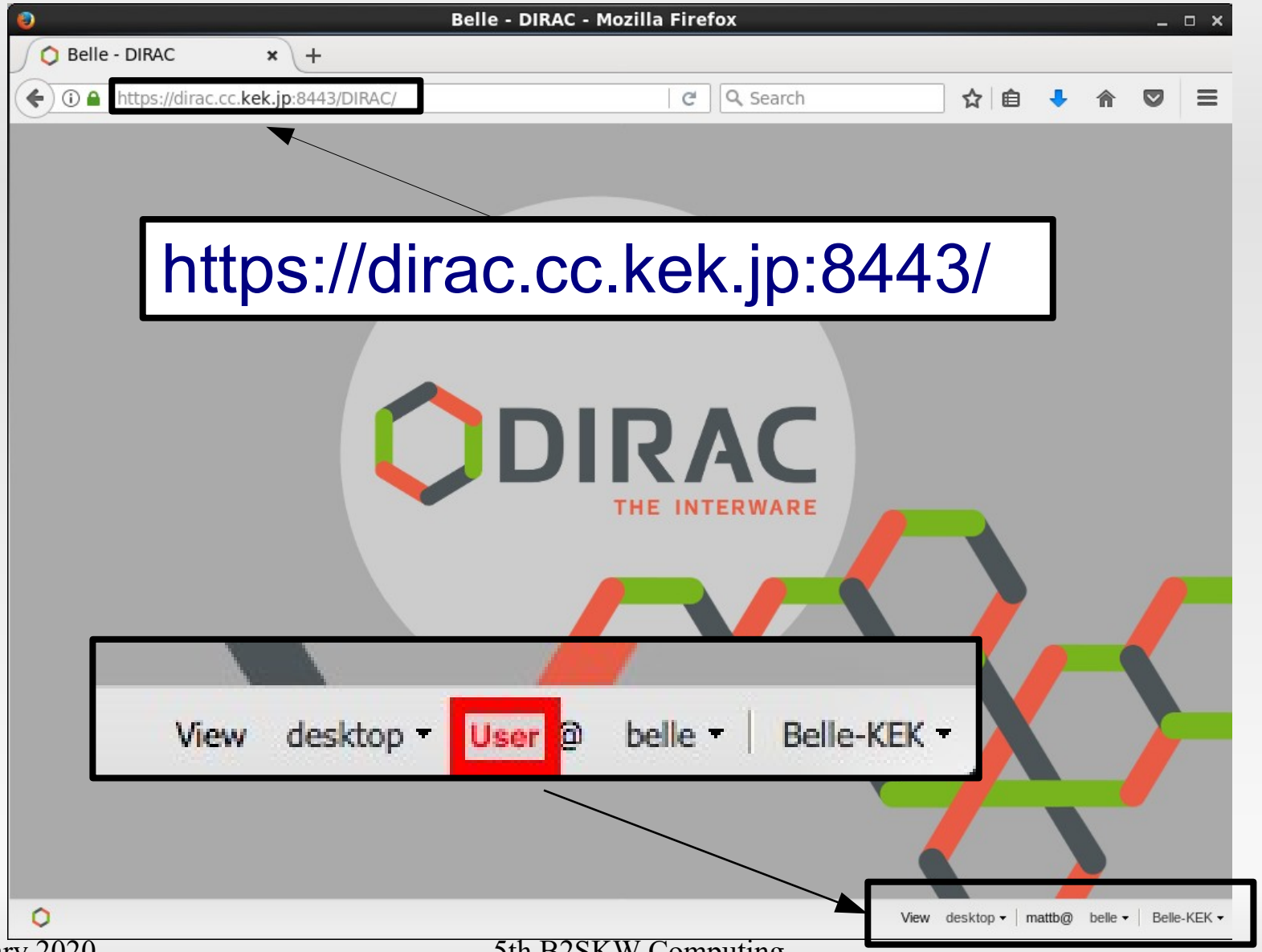
Prerequisites for hands-on

- You should hopefully have completed the steps given here:
  - https://confluence.desy.de/display/BI/Computing+GettingStarted
- To check go to:
  - https://dirac.cc.kek.jp:8443/
- If you see your user name, you are all set.

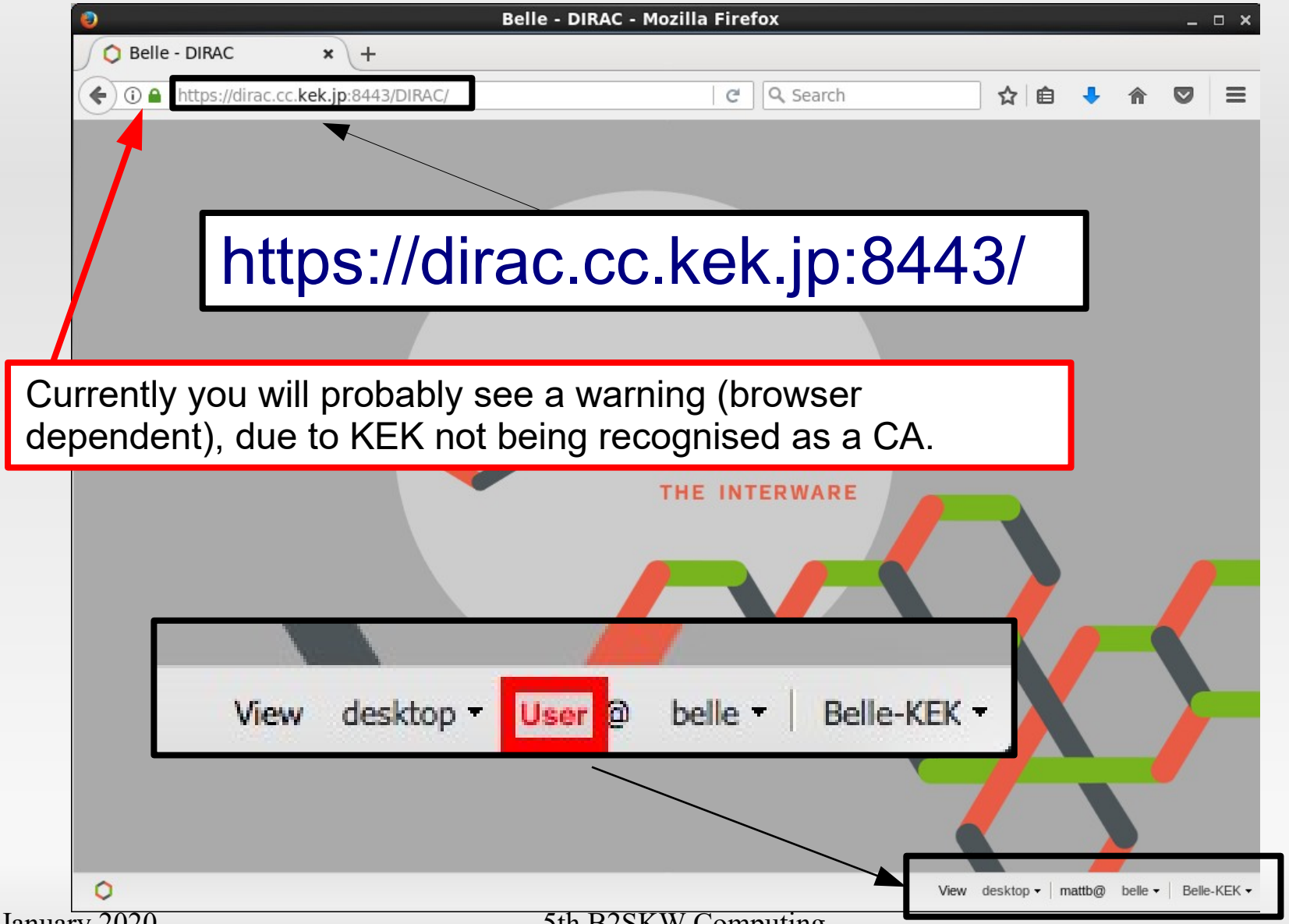


- If not, speak with a tutor now.

Do you see your username?



Do you see your username?



Converting p12 to PEM

- Copy your certificate, e.g. `myCert.p12`, to the computer (e.g. KEKCC) where you will run `gb2_proxy_init`.
- If this is the first time, you may not have the directory .globus, then make it:
  - `mkdir -p $HOME/.globus`
- Extract the certificate. You need to execute the two commands to extract both `usercert.pem` and `userkey.pem`:
  - `openssl pkcs12 -in myCert.p12 -clcerts -nokeys -out $HOME/.globus/usercert.pem`
  - `openssl pkcs12 -in myCert.p12 -nocerts -out $HOME/.globus/userkey.pem`
- You must set the mode of your `userkey.pem` file to read/write only by the owner, otherwise `voms-proxy-init` will not use it:
  - `chmod go-rw $HOME/.globus/userkey.pem`
- Delete the `myCert.p12` file from KEKCC to avoid security issues.

Installing gbasf2

- This exercise assumes you will run gbasf2 on KEKCC.
  - Only SL6 is supported (for gbasf2 client).
- Make sure you do not have basf2 setup
  - You cannot run basf2 and gbasf2 from the same terminal session.
  - If you automatically setup basf2 (i.e. source /cvmfs/.../b2setup release-04-0X-0Y) on login, disable this now.

Installing gbasf2

https://confluence.desy.de/display/BI/Computing+GBasf2

```
$ mkdir gbasf2KEK
$ cd gbasf2KEK
$ wget -N http://belle2.kek.jp/~dirac/dirac-install.py
$ python dirac-install.py -V Belle-KEK
$ source bashrc              # or cshrc if you use csh.
$ dirac-proxy-init -x        # enter certificate password
$ dirac-configure defaults-Belle-KEK.cfg
$ source BelleDIRAC/gbasf2/tools/setup
$ gb2_proxy_init -g belle # enter certificate password
```

Installing gbasf2

To use gbasf2 in future, you need only do:

```
$ mkdir gbasf2KEK
$ cd gbasf2KEK
$ wget -N http://belle2.kek.jp/~dirac/dirac-install.py
$ python dirac-install.py -V Belle-KEK
$ source bashrc              # or cshrc if you use csh.
$ dirac-proxy-init -x        # enter certificate password
$ dirac-configure defaults-Belle-KEK.cfg
$ source BelleDIRAC/gbasf2/tools/setup
$ gb2_proxy_init -g belle # enter certificate password
```

gbasf2 version

- Run `gb2_check_release` to see what version you are running:

```
$ gb2_check_release
****************************************
* Local BelleDIRAC release : v4r6p5
* Master timestamp: 2019-10-12 09:48:01
* Local timestamp: 2019-10-04 13:45:03
****************************************
Your installation is up-to-date: v4r6p5

Available basf2 releases:
release-04-01-01
release-04-00-03
release-04-00-01
release-04-00-00
release-03-02-04
...
```

gbasf2 version

- Run `gb2_check_release` to see what version you are running:

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$ gb2_check_release
****************************************
* Local BelleDIRAC release : v4r6p5
* Master timestamp: 2019-10-12 09:48:01
* Local timestamp: 2019-10-04 13:45:03
****************************************
Your installation is up-to-date: v4r6p5

Available basf2 releases:
release-04-01-01
release-04-00-03
release-04-00-01
release-04-00-00
release-03-02-04
...
```

You should see version v4r6p5.

gbasf2 version

- Run `gb2_check_release` to see what version you are running:

```
$ gb2_check_release
****************************************
* Local BelleDIRAC release : v4r6p5
* Master timestamp: 2019-10-12 09:48:01
* Local timestamp: 2019-10-04 13:45:03
****************************************
Your installation is up-to-date: v4r6p5

Available basf2 releases:
release-04-01-01
release-04-00-03
release-04-00-01
release-04-00-00
release-03-02-04
...
```

Note: gbasf2 and basf2 versions are independent of each other.

basf2, gbasf2, and Python

- Note: basf2 and gbasf2 are incompatible.
  - You cannot have both setup in the same terminal.

- Also note: basf2 uses python3.
- Gbasf2 is built on a framework called DIRAC that uses python2.
  - Python2 reaches its end of life in 2020.
  - DIRAC and gbasf2 are being migrated to python3.

The grid

- What is the grid?

The grid

- What is the grid? Definitions from the O.E.D.

grid, *n.*

1.

a. An arrangement of parallel bars with openings between them; a grating.

http://www.oed.com/view/Entry/81373

The grid

- What is the grid? Definitions from the O.E.D.

grid, *n.*

1.

a. An arrangement of parallel bars with openings between them; a grating.

8.

a. A network of high-voltage transmission lines and connections that supply electricity from a number of generating stations to various distribution centres in a country or a region, so that no consumer is dependent on a single station.

1926—1971

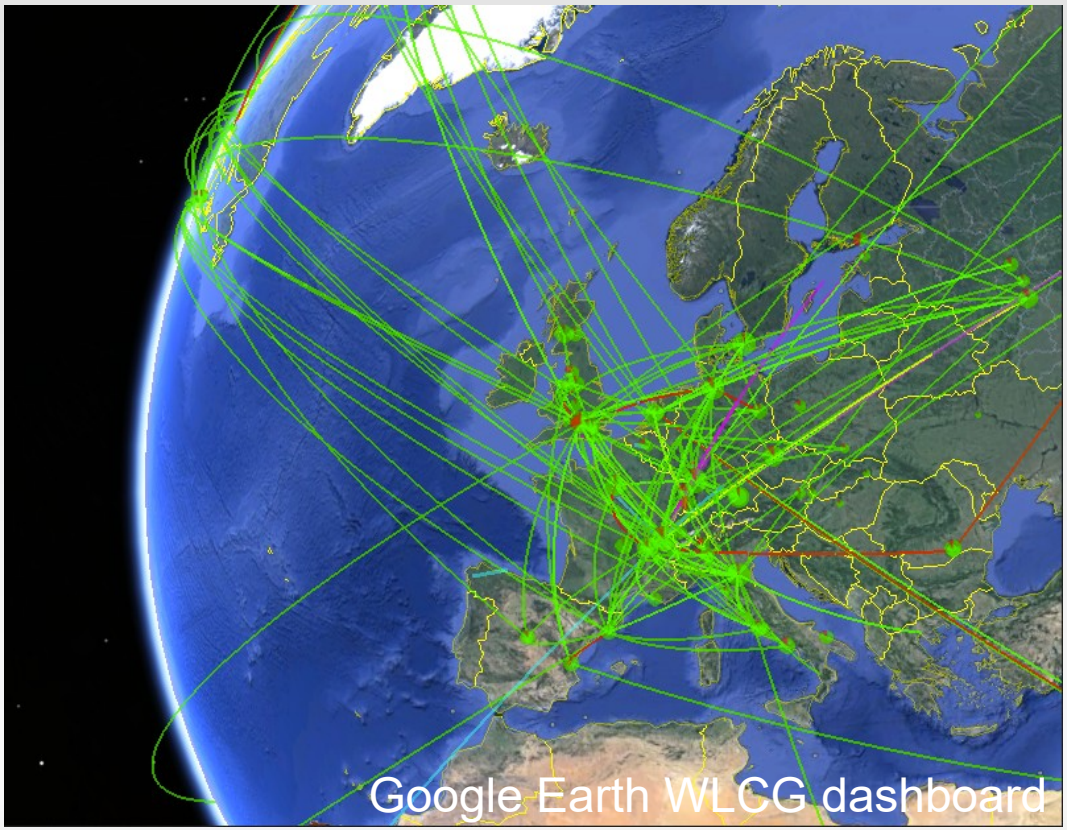
b. Used of any network that serves a similar purpose for other services.

1943—1970

http://www.oed.com/view/Entry/81373

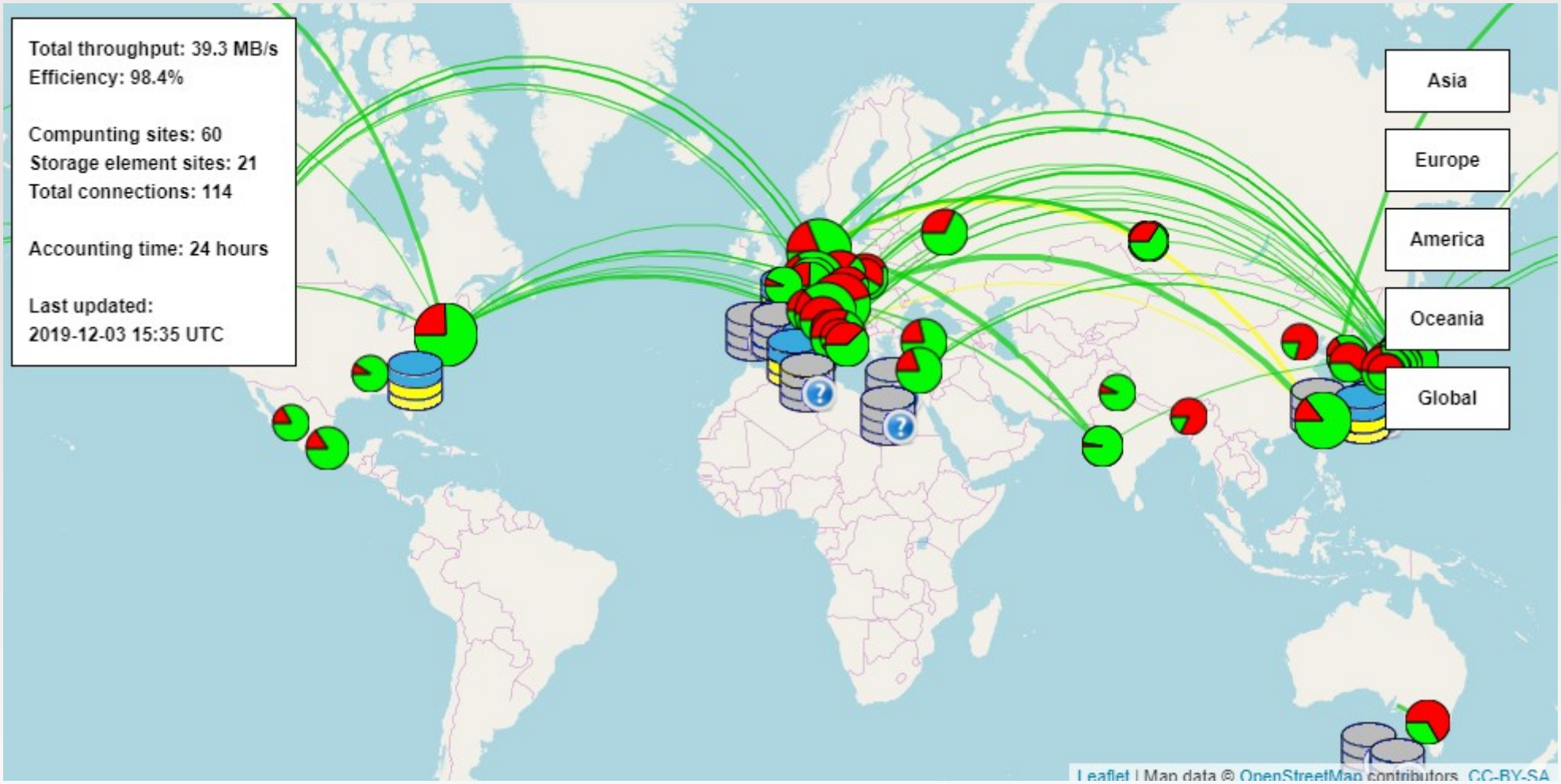
The grid

- The grid is a distributed computing system utilised by Belle II, and many other particle physics experiments, to make use of the computing resources of the many universities and institutions worldwide (that are involved in particle physics research).
- Modern particle physics experiments (will) collect many tens of petabytes of data ...
  - … and even more tens of petabytes of MC.
- Processing all data/MC at a single site, even a national laboratory, is not longer a sustainable model.
- Heavily used by the LHC experiments.



http://wlcg-public.web.cern.ch/resources

Belle II Grid

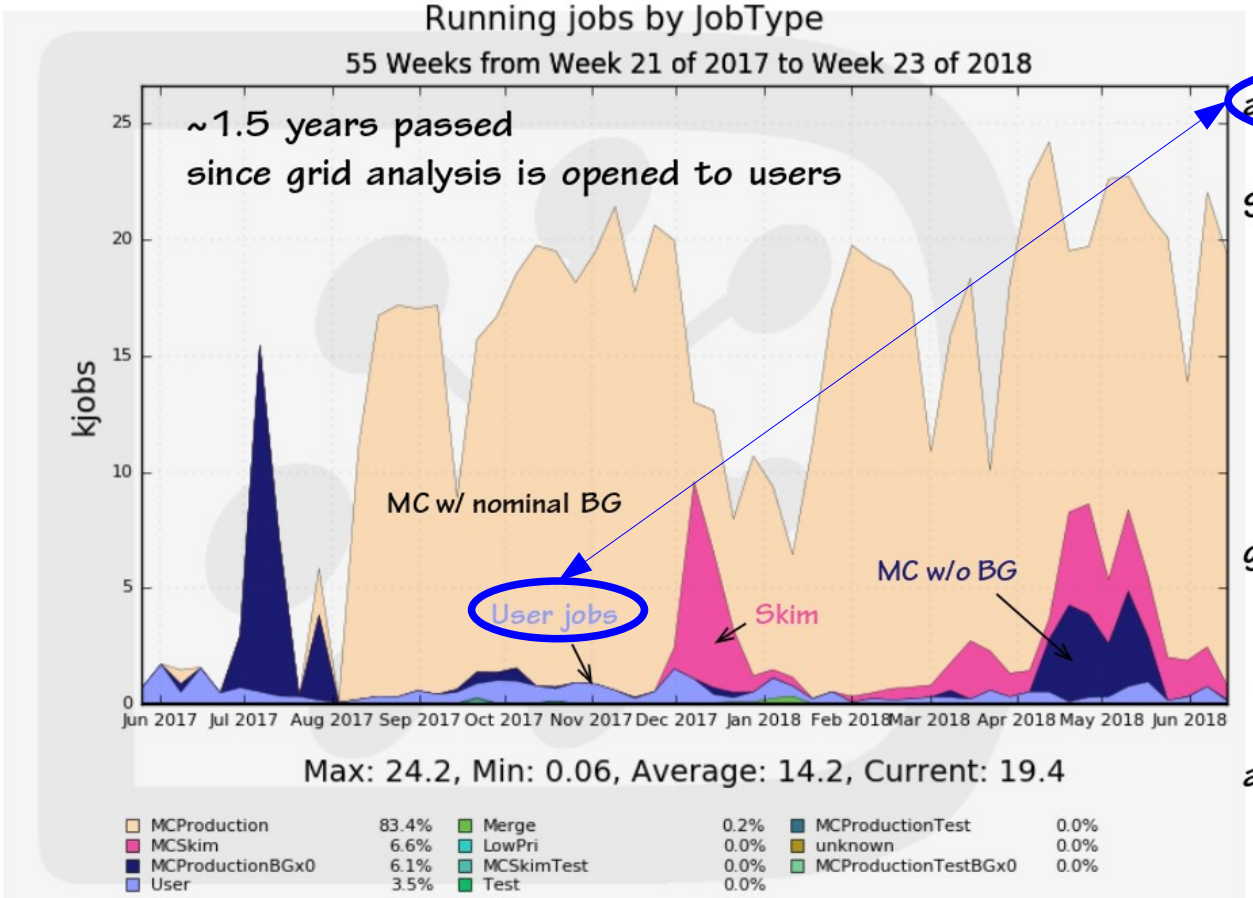


Interactive version: https://belle2.jp/computing/

Belle II grid

- Belle II grid used for MC production, reprocessing, skimming and user analysis.

GRID user analysis



a few % level usage of total CPU power

Some data replica is not distributed

+ automatic data distribution is not ready yet
  → manual work
+ site problem
  storage becomes inaccessibe
  because of accident / incident / trouble
→ long waiting time to start jobs and fail

gbasf2 is still under development / improvement stage

+ it takes long time to download the output
+ gbasf2 parameters not tuned in old release

available library on GRID is limited

+ only "release" version so far

https://kds.kek.jp/indico/event/27570/session/52/contribution/29/material/slides/0.pdf

Grid Jargon

- Even more new Jargon to learn!

- Computing glossary on confluence: https://confluence.desy.de/display/BI/Computing+Glossary
  - In addition to main glossary: https://confluence.desy.de/display/BI/Main+Glossary
- If you hear a term used that you think should be added, add it (and tag @mattb or one of the tutors)!

Are we missing anything?
If there is a term you don't find on this page: please add an entry with a blank definition, and tag @Ueda Ikuo and yourself [type '@' and your username].

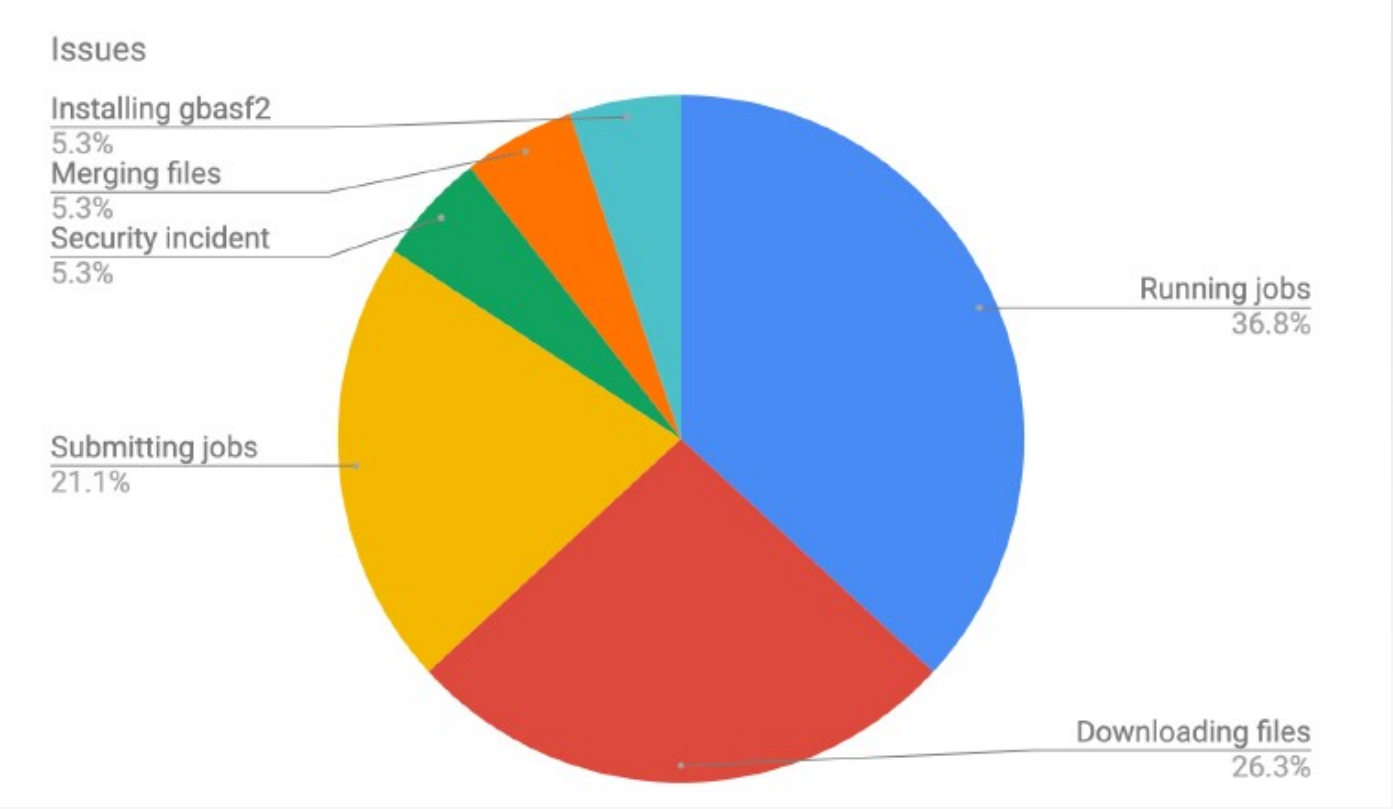
Picture borrowed from https://kds.kek.jp/indico/event/27669/contribution/4/material/slides/0.pdf

Where to get help

- Attend a Belle II starter kit workshop or summer school (you already have!).
- https://questions.belle2.org/questions/
- You can always email: comp-users-forum@belle2.org
  - It is a forum for discussion between users, please feel free to participate.
  - Sign up to receive emails: https://lists.belle2.org/sympa/info/comp-users-forum
- chat.belle2.org, e.g. https://chat.belle2.org/channel/starterkit-workshop
- Documentation on confluence:
  - e.g. https://confluence.desy.de/display/BI/Computing+GBasf2
- Other issues, look here:
  - https://confluence.desy.de/display/BI/Belle+II+Support+Contacts

comp-users-forum@belle2.org

- The main place to get help with computing issues.
  - Supplemented by questions.belle2.org.



https://indico.belle2.org/event/971/contributions/4719/attachments/2736/4135/gb2_users_B2GM.pdf

The basic idea of gbasf2

- To run an analysis job with gbasf2 in the same way as you would with basf2 in a terminal (you cannot fully use gbasf2 with Jupyter notebooks (yet)).
- If you run basf2:
  - `basf2 myAnalysisScript.py`
- You would like to run:
  - `gbasf2 myAnalysisScript.py`
- It is almost this simple!
- You need to specify two additional options: a basf2 release and a project name (and optionally but usually the input dataset).
  - `gbasf2 myAnalysisScript.py -s basf2-release -p myProject -i myInputDataSet`
- The gbasf2 code is independent of the basf2 release.

Release names

- Reminder: The gbasf2 code is independent of basf2 code.
  - You can specify that you want your analysis script to run with any specified basf2 release.

```
$ gb2_check_release
****************************************
* Local BelleDIRAC release : v4r6p5
* Master timestamp: 2019-10-12 09:48:01
* Local timestamp: 2019-10-04 13:45:03
****************************************
Your installation is up-to-date: v4r6p5

Available basf2 releases:
release-04-01-01
release-04-00-03
...
```

Project names

- Your project contains a number of analysis jobs,
  - e.g. if you have 1000 files in your input dataset, you would by default run 1000 analysis jobs.
  - (Hint: you can use the `-n` option to specify using *n* input files per job.)

- The project name is a label used to keep track of all of the jobs in the project.
- Please choose a meaningful name.
- Don't use names greater than 32 characters; these have caused problems in the past, and gbasf2 will now stop you from using such a name.
- Please also avoid using special characters in project names (see next slide).

Naming Files and projects

- Some sites and the database have had some problems with file names containing certain special characters.
  - Please do not use the following in output file names or project names: #DontUseTheseSymbols #ChooseMeaningfulNames

# octothorpe/hash	? question mark
% percent	/ forward slash
& ampersand	blank spaces
{ left curly bracket	$ dollar sign
} right curly bracket	! exclamation point
\ back slash	' single quotes
< left angle bracket	" double quotes
> right angle bracket	: colon
* asterisk	@ at sign

Submitting your first grid job

- **Very Important** – always check that your script works successfully with **basf2** before submitting it to the grid.

- We will use a simple example:
  `/cvmfs/belle.cern.ch/sl6/releases/release-04-01-01/reconstruction/examples/example.py`
  - You should check that you can run this script with basf2.
  - MB checked that this script works this morning.
  - This script will generate 10 MC events.

example.py

```
#!/usr/bin/env python3
# -*- coding: utf-8 -*-

#########################################################
# This steering file generates, simulates, and reconstructs
# a sample of 10 BBbar events.
#
# Usage: basf2 example.py
#
# Input: None
# Output: output.root, mdst.root
#
# Example steering file - 2017 Belle II Collaboration
#########################################################

from basf2 import *
from simulation import add_simulation
from L1trigger import add_tsim
from reconstruction import add_reconstruction, add_cdst_output
from mdst import add_mdst_output

# create path
main = create_path()

# specify number of events to be generated
main.add_module('EventInfoSetter', evtNumList=[10])

# print event numbers
main.add_module('EventInfoPrinter')
```

```
# generate BBbar events
main.add_module('EvtGenInput')

# detector simulation
add_simulation(main)
# or add_simulation(main, components) to simulate a
selection of detectors

# trigger simulation
add_tsim(main)

# reconstruction
add_reconstruction(main)
# or add_reconstruction(main, components) to run the
reconstruction of a selection of detectors

# full output
main.add_module('RootOutput', outputFileName='output.root')

# mdst output
add_mdst_output(main)

# cdst output (for calibration)
# add_cdst_output(main)

# process events and print call statistics
process(main)
print(statistics)
```

Submitting to the grid

```
$ gbasf2
```

Submitting to the grid

```
$ gbasf2 -s release-04-01-01
```

Submitting to the grid

```
$ gbasf2 -s release-04-01-01 -p B2SKW2020Jan_mattb
```

Submitting to the grid

```
$ gbasf2 -s release-04-01-01 -p B2SKW2020Jan_mattb
/cvmfs/belle.cern.ch/sl6/releases/release-04-01-01/reconstruction/
examples/example.py
```

Submitting to the grid

```
$ gbasf2 -s release-04-01-01 -p B2SKW2020Jan_mattb
/cvmfs/belle.cern.ch/sl6/releases/release-04-01-01/reconstruction/
examples/example.py
**********************************************
*************** Project summary ****************
** Project name: B2SKW2020Jan_mattb
** Dataset path: /belle/user/mattb/B2SKW2020Jan_mattb
** Steering file: /cvmfs/belle.cern.ch/sl6/releases/release-04-01-
01/reconstruction/examples/example.py
** Job owner: mattb @ belle (23:52:47)
** Preferred site / SE: None / None
** Input files for first job: None
** Processed events: 10 events
** Estimated CPU time per job: 1 min
**********************************************
Are you sure to submit the project?
Please enter Y or N:
```

Submitting to the grid

```
**********************************************
Are you sure to submit the project?
Please enter Y or N: Y
Initialize metadata for the project:
No attribute. Initialize Dataset...
Dataset initialization: OK
Dataset metadata attributes already exist (30): OK
Successfully finished.
<=====v4r6p5=====>
JobID = 132899566
```

Checking you job

- Use `gb2_job_status`:
  - You must specify a project name with `-p`;
  - Or Job id with `-j`.

```
$ gb2_job_status -p B2SKW2020Jan_mattb
1 jobs are selected.

 Job id      Status    MinorStatus   ApplicationStatus      Site
==========================================================================
132899566   Running   Application   Uploading           OSG.BNL.us

--- Summary of Selected Jobs ---
Completed:0  Deleted:0  Done:0  Failed:0  Killed:0  Running:1
Stalled:0  Waiting:0
```

Checking your job/project

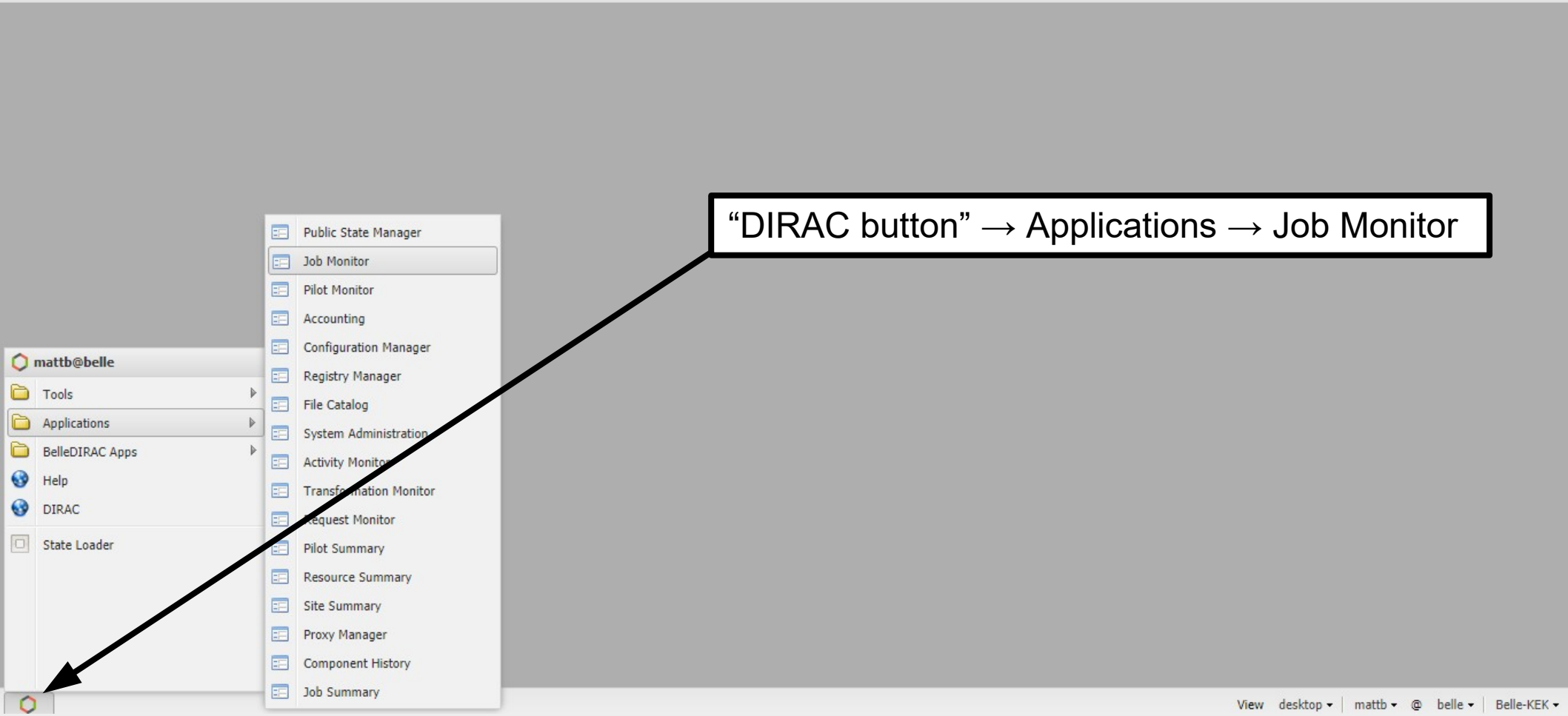
- Or use `gb2_project_summary`:
- By default shows all your (current) projects;
- Use `-p projectname` to show only specified project

```
$ gb2_project_summary
         Project             Owner   Status    Done   Fail   Run   Wait   Submission Time(UTC)   Duration
=============================================================================================================
B2SKW2020Jan_mattb           mattb   Good      1      0      0     0      2020-01-27 01:34:17    00:07:05
B2SKW2020Jan_mattb_example2  mattb   Running   0      0      1     0      2020-01-27 02:34:59    00:00:33


$ gb2_project_summary -p B2SKW2020Jan_mattb_example2
         Project             Owner   Status   Done   Fail   Run   Wait   Submission Time(UTC)   Duration
=============================================================================================================
B2SKW2020Jan_mattb_example2  mattb   Good     1      0      0     0      2020-01-27 02:34:59    00:05:18
```

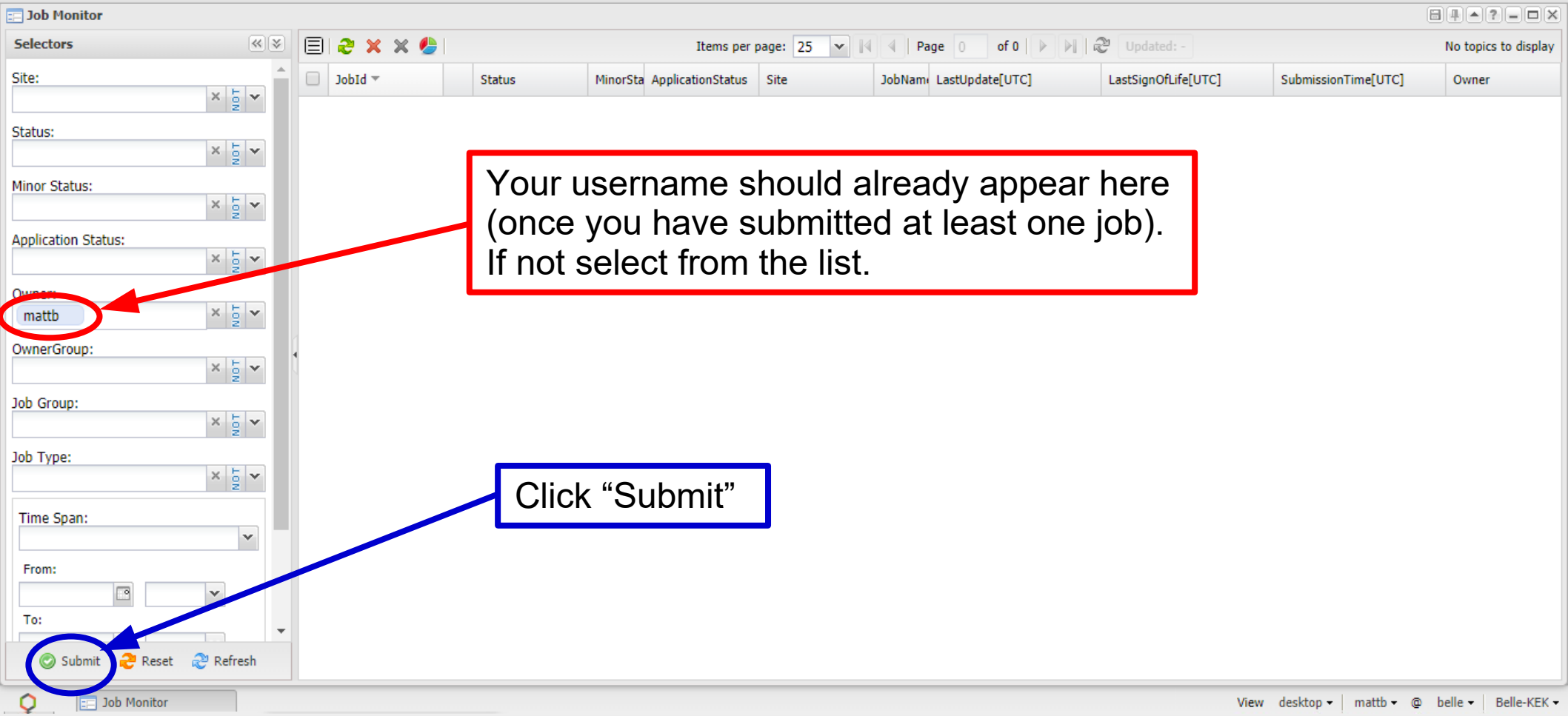
Using the GUI to check

- https://dirac.cc.kek.jp:8443/



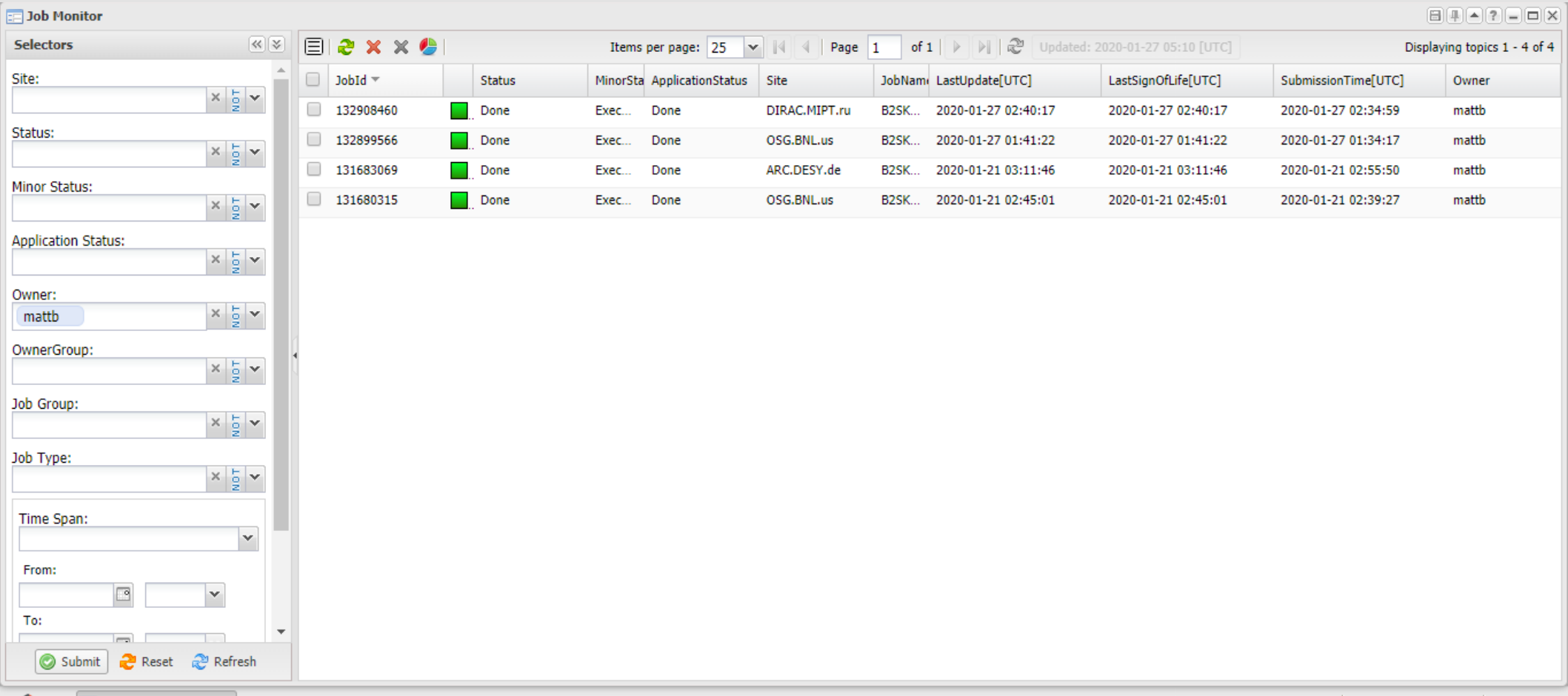
Using the GUI to check

- https://dirac.cc.kek.jp:8443/



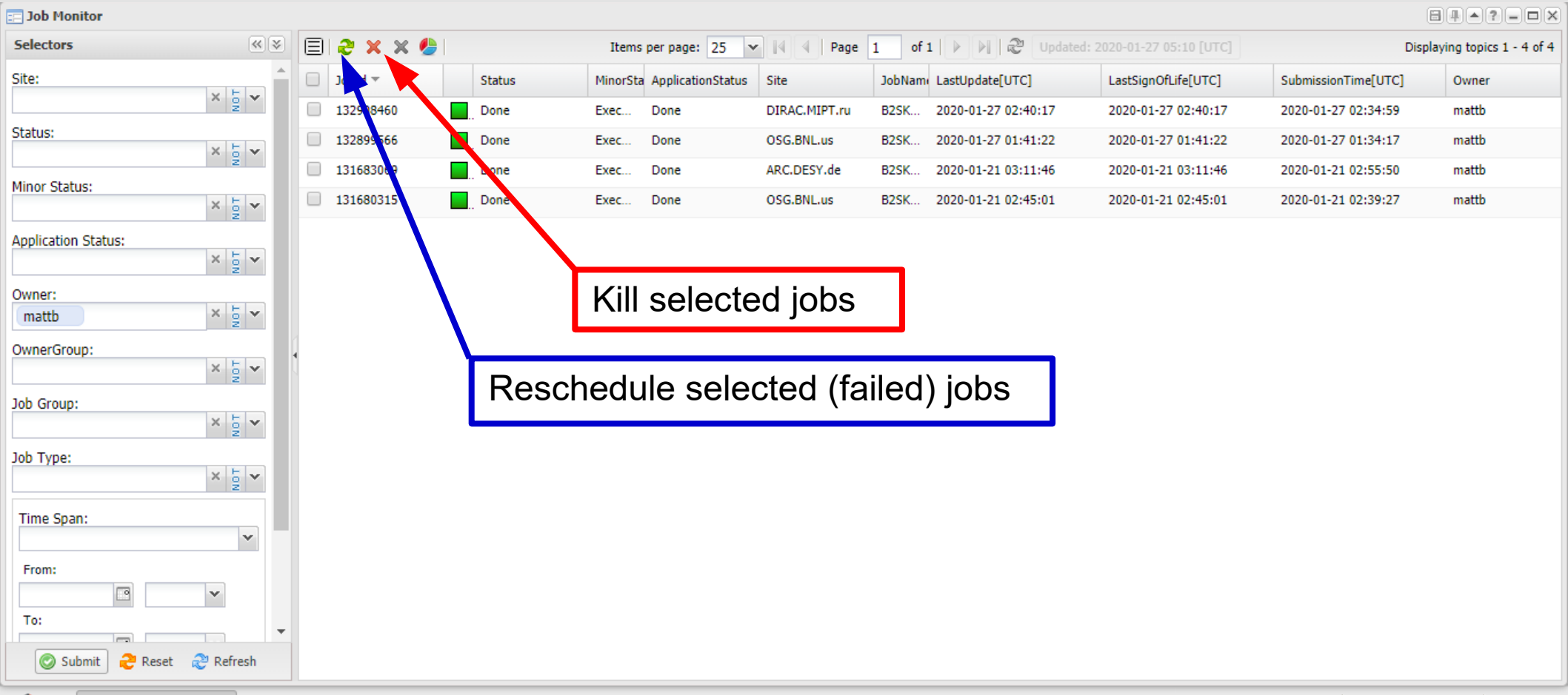
Using the GUI to check

- https://dirac.cc.kek.jp:8443/



Using the GUI to check

- https://dirac.cc.kek.jp:8443/



Your New Dataset

- You have now created a new dataset
  - It contains a file `output.root` with 10 MC events.
  - You can view your datasets using `gb2_ds_list`:

```
$ gb2_ds_list
/belle/user/mattb/B2SKW2020Jan_mattb
/belle/user/mattb/B2SKW2020Jan_mattb_example2
...
```

  - This will only work after you job has finished successfully.
  - Your dataset path: `/belle/user/<user name>/<project name>`

Retrieving your datasets

```
$ gb2_ds_get /belle/user/mattb/B2SKW2020Jan_mattb
```

Retrieving your datasets

```
$ gb2_ds_get /belle/user/mattb/B2SKW2020Jan_mattb
Skip directory /belle/user/mattb/B2SKW2020Jan_mattb/mdst
Files to download to
/gpfs/home/belle2/mattb/gbasf2_Jan2020B2SKW_Test/B2SKW2020Jan_mattb :
/belle/user/mattb/B2SKW2020Jan_mattb/output.root
Do you want to download files:
Please type [Y] or [N]:
```

Retrieving your datasets

```
$ gb2_ds_get /belle/user/mattb/B2SKW2020Jan_mattb
Skip directory /belle/user/mattb/B2SKW2020Jan_mattb/mdst
Files to download to
/gpfs/home/belle2/mattb/gbasf2_Jan2020B2SKW_Test/B2SKW2020Jan_mattb :
/belle/user/mattb/B2SKW2020Jan_mattb/output.root
Do you want to download files:
Please type [Y] or [N]: Y

Download 1 files from SE
Trying to download
srm://dcblsrm.sdcc.bnl.gov:8443/srm/managerv2?SFN=/pnfs/sdcc.bnl.gov/data/
belletiskdata/TMP/belle/user/mattb/B2SKW2020Jan_mattb/output.root to
/gpfs/home/belle2/mattb/gbasf2_Jan2020B2SKW_Test/B2SKW2020Jan_mattb/output.root

Successfully downloaded files:
/belle/user/mattb/B2SKW2020Jan_mattb/output.root in
/gpfs/home/belle2/mattb/gbasf2_Jan2020B2SKW_Test/B2SKW2020Jan_mattb


Failed files:
```

gbasf2 commands

- Hint: hint all the gbasf2 commands (other than `gbasf2`) start with `gb2_` so you can use tab completion to see a list of them.

```
$ gb2_
gb2_admin_fts_monitor          gb2_ds_sync                gb2_prod_downloadFile
gb2_admin_fts_submit           gb2_ds_verify              gb2_prod_extend
gb2_admin_remove_amga_dir      gb2_job_delete             gb2_prod_listFile
gb2_check_downtime             gb2_job_kill               gb2_prod_register
gb2_check_release              gb2_job_output             gb2_prod_restart
gb2_ds_du                      gb2_job_parameters         gb2_prod_showTransfer
gb2_ds_generate                gb2_job_reschedule         gb2_prod_status
gb2_ds_get                     gb2_job_status             gb2_prod_stop
gb2_ds_list                    gb2_job_test               gb2_prod_summary
gb2_ds_query_datablock         gb2_list_destse            gb2_prod_uploadFile
gb2_ds_query_dataset           gb2_list_queue             gb2_project_analysis
gb2_ds_query_file              gb2_list_se                gb2_project_summary
gb2_ds_register_dataset_meta   gb2_list_service           gb2_proxy_destroy
gb2_ds_rep                     gb2_list_site              gb2_proxy_info
gb2_ds_rm                      gb2_pilot_summary          gb2_proxy_init
gb2_ds_rm_rep                  gb2_postInstall            gb2_req_summary
gb2_ds_sanitize                gb2_prod_approve           gb2_site_analysis
gb2_ds_set_dataset_meta        gb2_prod_cancel            gb2_site_summary
gb2_ds_set_file_meta           gb2_prod_cancelInputFile   gb2_transformation_summary
gb2_ds_siteForecast            gb2_prod_chains            gb2_update
```

gbasf2 commands

- Hint: hint all the gbasf2 commands (other than `gbasf2`) start with `gb2_` so you can use tab completion to see a list of them.

```
$ gb2_
gb2_admin_fts_monitor          gb2_ds_sync                gb2_prod_downloadFile
gb2_admin_fts_submit           gb2_ds_verify              gb2_prod_extend
gb2_admin_remove_amga_dir      gb2_job_delete             gb2_prod_listFile
gb2_check_downtime             gb2_job_kill               gb2_prod_register
gb2_check_release              gb2_job_output             gb2_prod_restart
gb2_ds_du                      gb2_job_parameters         gb2_prod_showTransfer
gb2_ds_generate                gb2_job_reschedule         gb2_prod_status
gb2_ds_get                     gb2_job_status             gb2_prod_stop
gb2_ds_list                    gb2_job_test               gb2_prod_summary
gb2_ds_query_datablock         gb2_list_destse            gb2_prod_uploadFile
gb2_ds_query_dataset           gb2_list_queue             gb2_project_analysis
gb2_ds_query_file              gb2_list_se                gb2_project_summary
gb2_ds_register_dataset_meta   gb2_list_service           gb2_proxy_destroy
gb2_ds_rep                     gb2_list_site              gb2_proxy_info
gb2_ds_rm                      gb2_pilot_summary          gb2_proxy_init
gb2_ds_rm_rep                  gb2_postInstall            gb2_req_summary
gb2_ds_sanitize                gb2_prod_approve           gb2_site_analysis
gb2_ds_set_dataset_meta        gb2_prod_cancel            gb2_site_summary
gb2_ds_set_file_meta           gb2_prod_cancelInputFile   gb2_transformation_summary
gb2_ds_siteForecast            gb2_prod_chains            gb2_update
```

Submitting your project

- When you try submitting your own analysis code to the grid (as you may do so with your tutor in this workshop)
  - **Always** test with a central release of `basf2` before submitting to the grid!

Some Very Wise Words from Hara-san

GRID is NOT the local computing system like KEKCC

Once you submit jobs, your jobs will be assigned to the computing systems around the world.

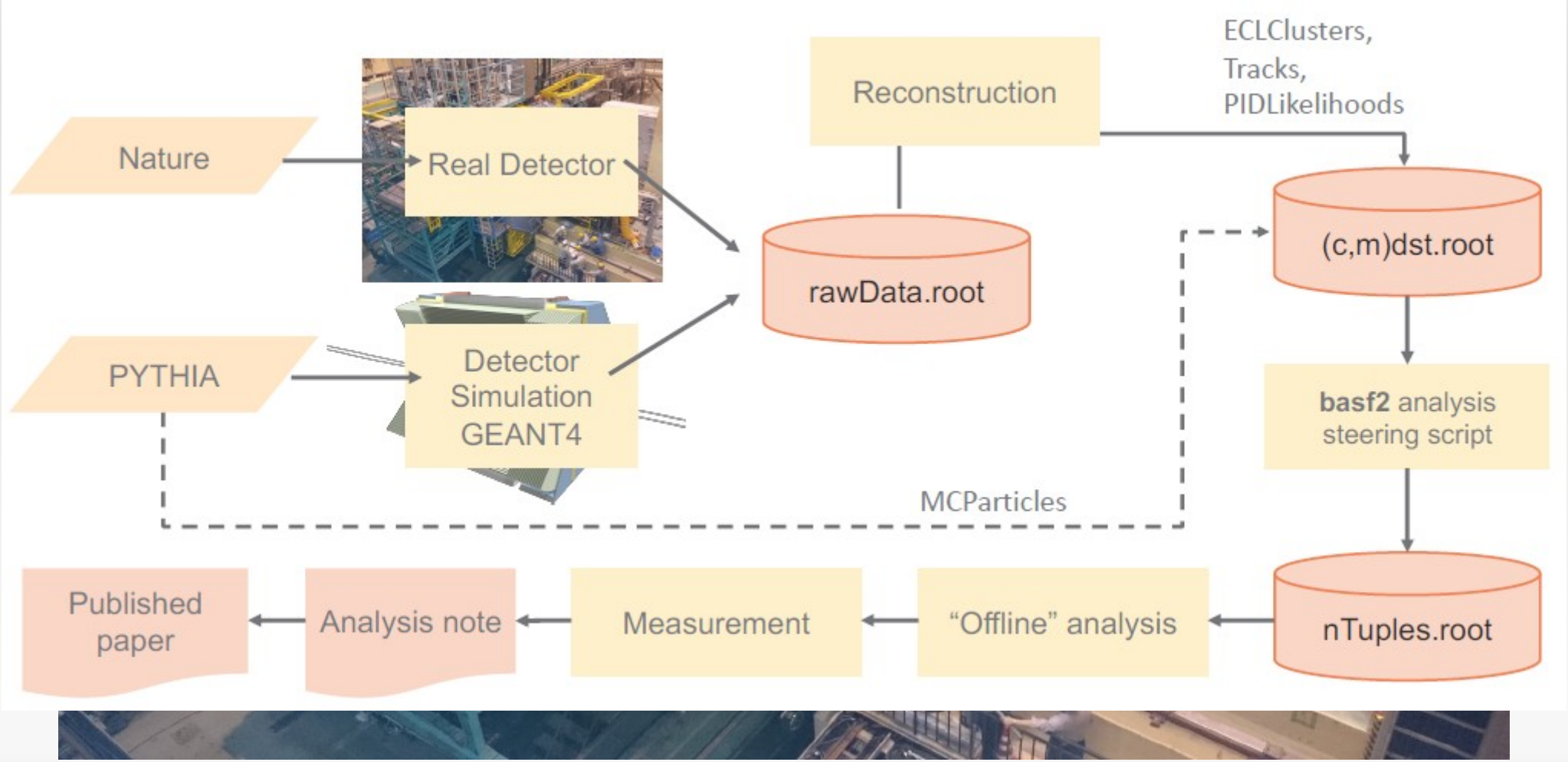
If your job is a problematic one, it will be distributed to the world
and all sites will be affected.

Therefore, you have to check your jobs with local computing system, e.g. in KEKCC carefully
before you submit jobs to GRID.

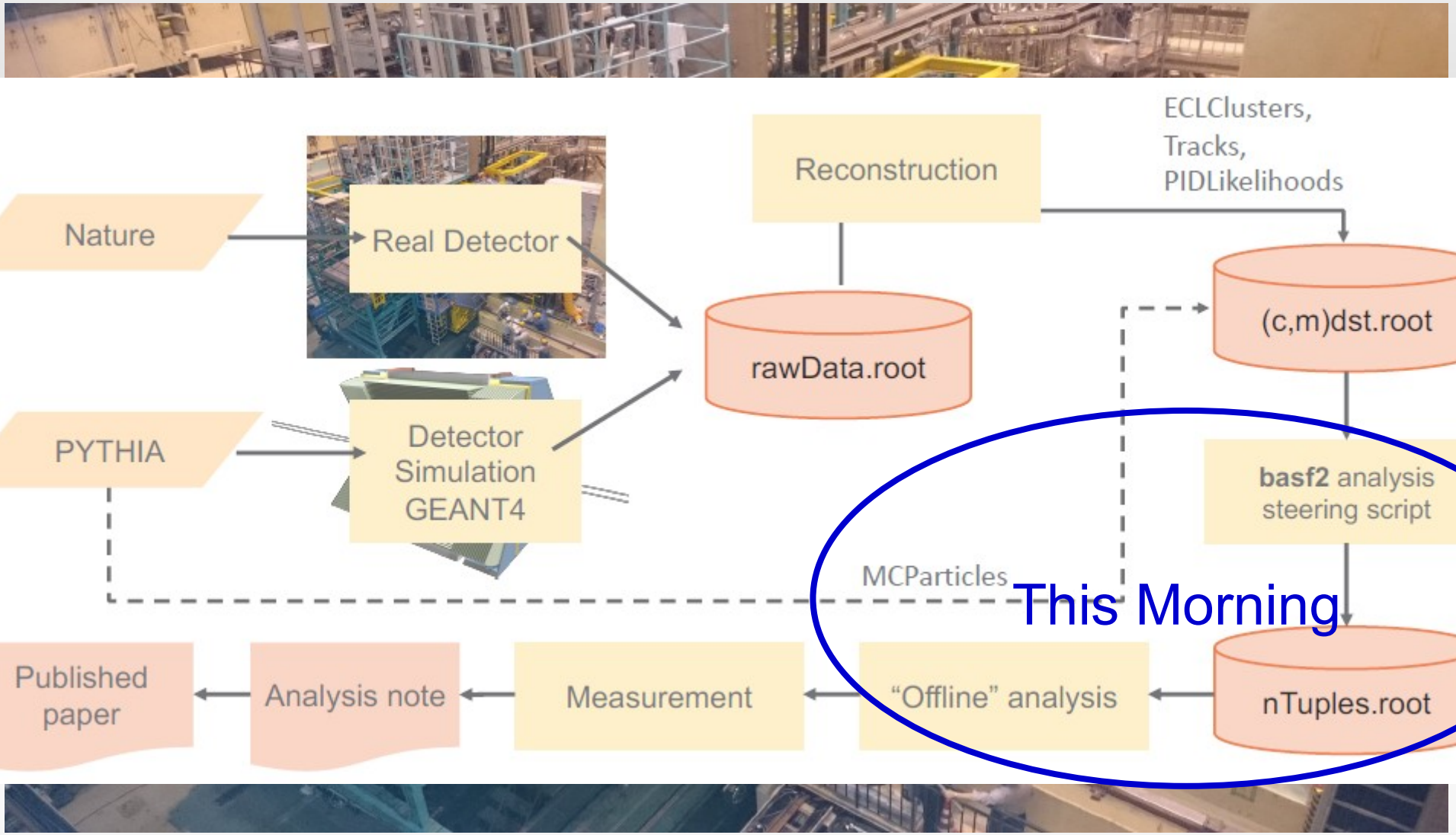
+ maximum size of the output log from each job must be less than 30MB
+ maximum memory comsumption of each job must be less than 2GB

Belle II big picture

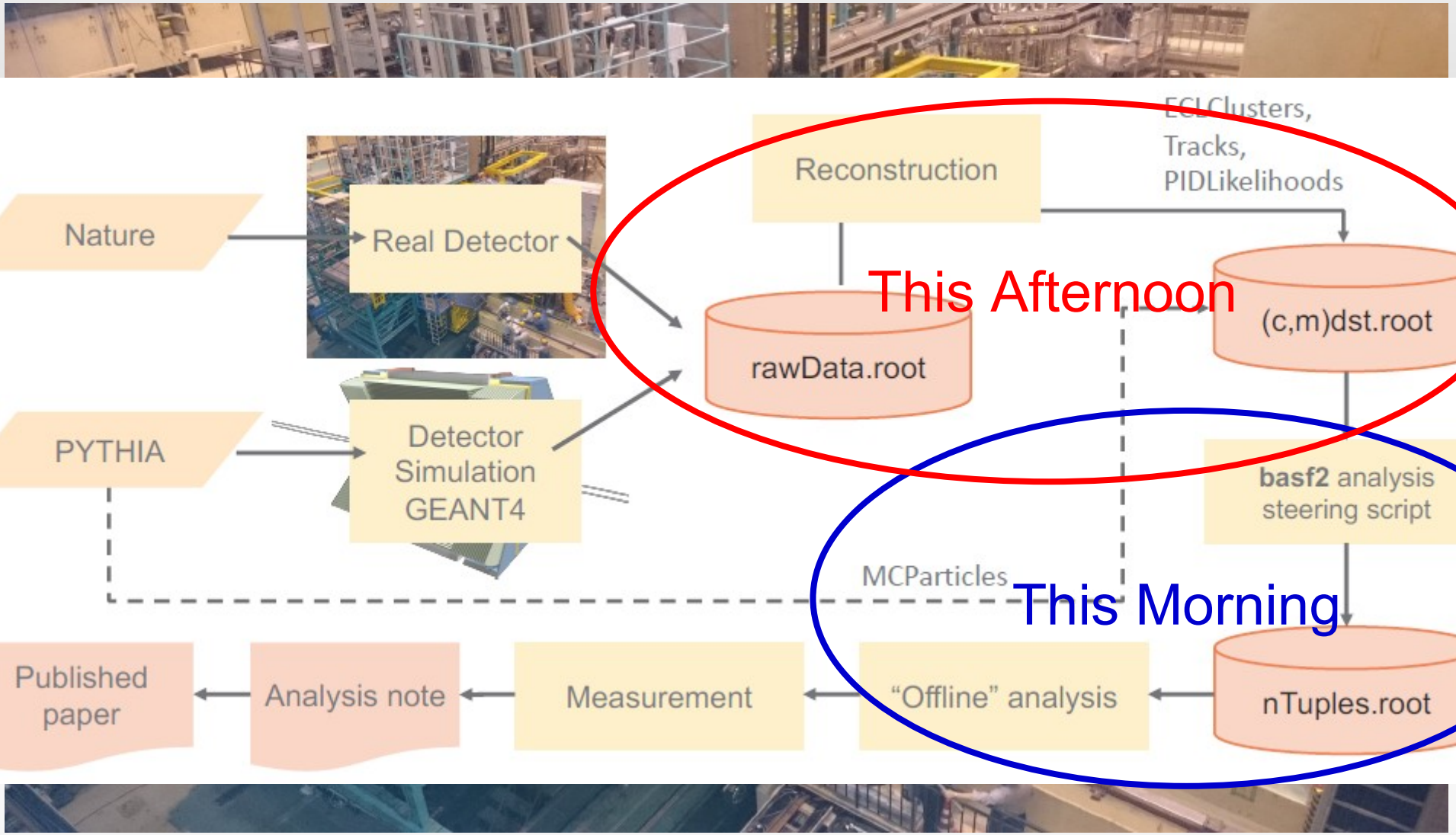
Belle II big picture



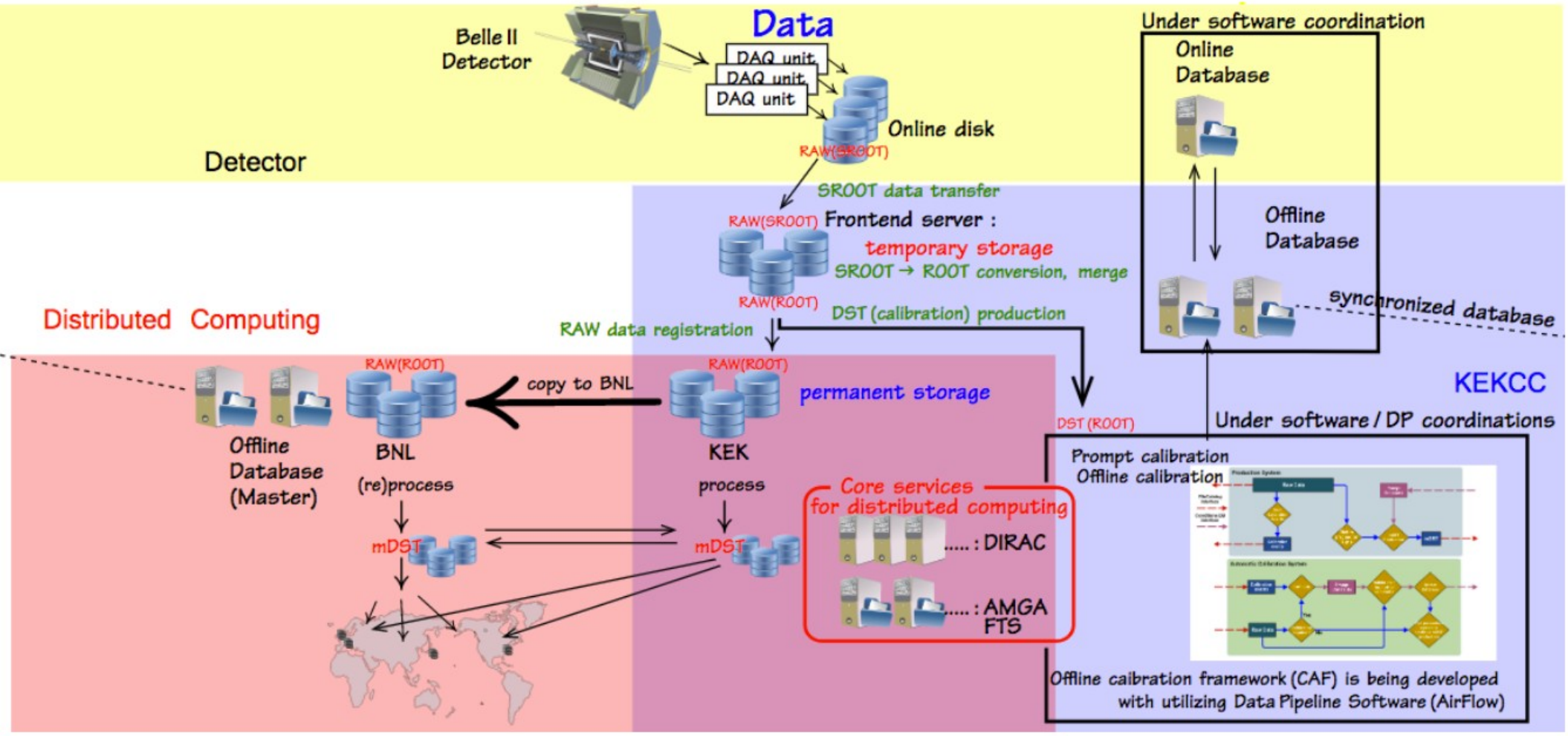
Belle II big picture



Belle II big picture

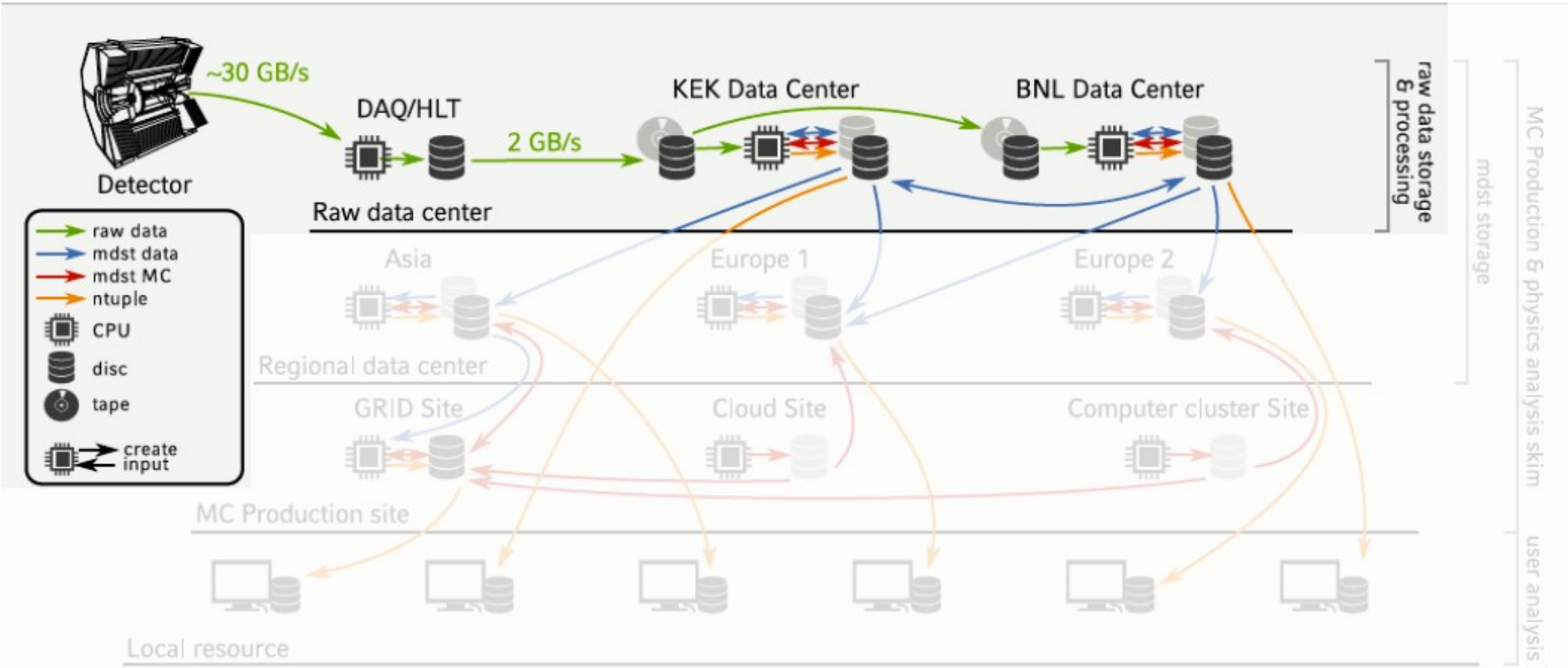


Belle II Data Flow



Belle II Data Flow

- Raw data storage and reprocessing at KEKCC and BNL - Raw data centers
- mDST storage on GRID storage elements (SE) - Regional data centers
- Skimming and analysis on GRID computing elements (CE) - MC production sites
- nTuple analysis on local resources - Local resources



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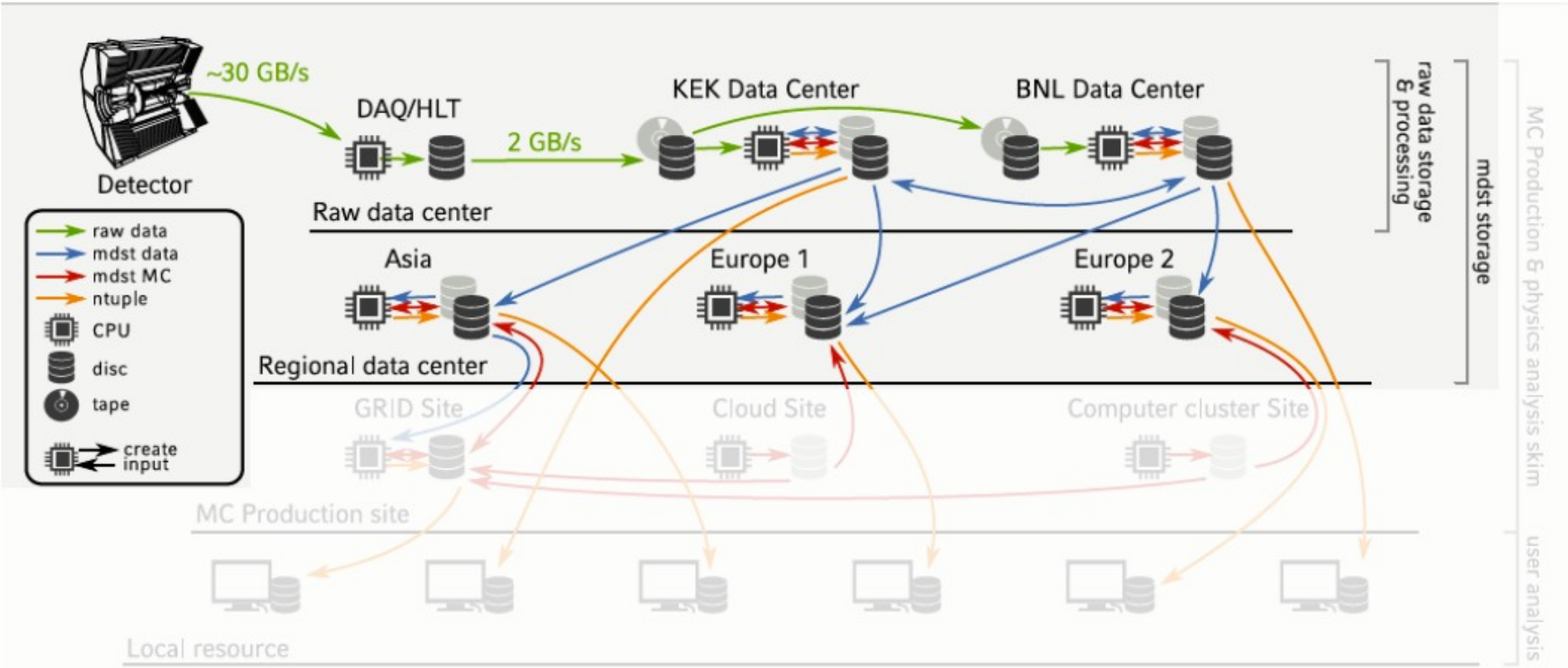

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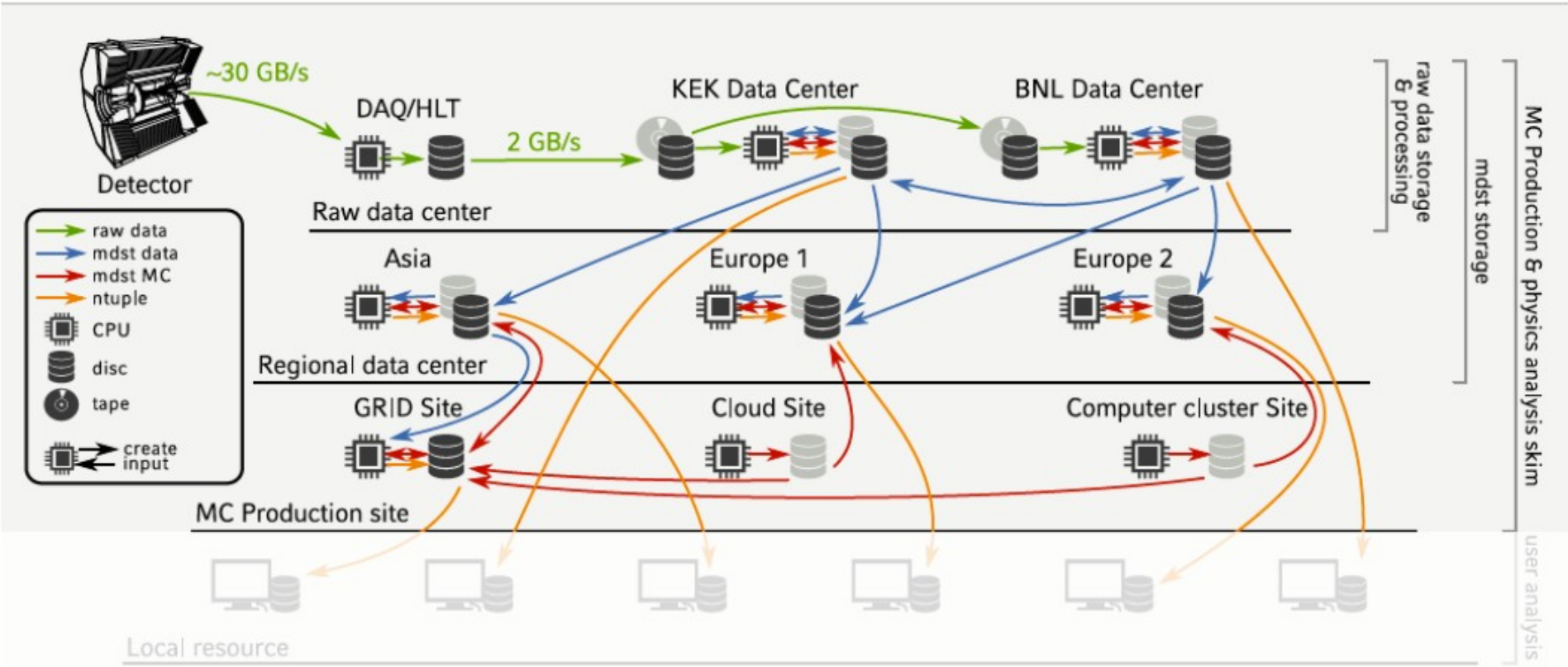

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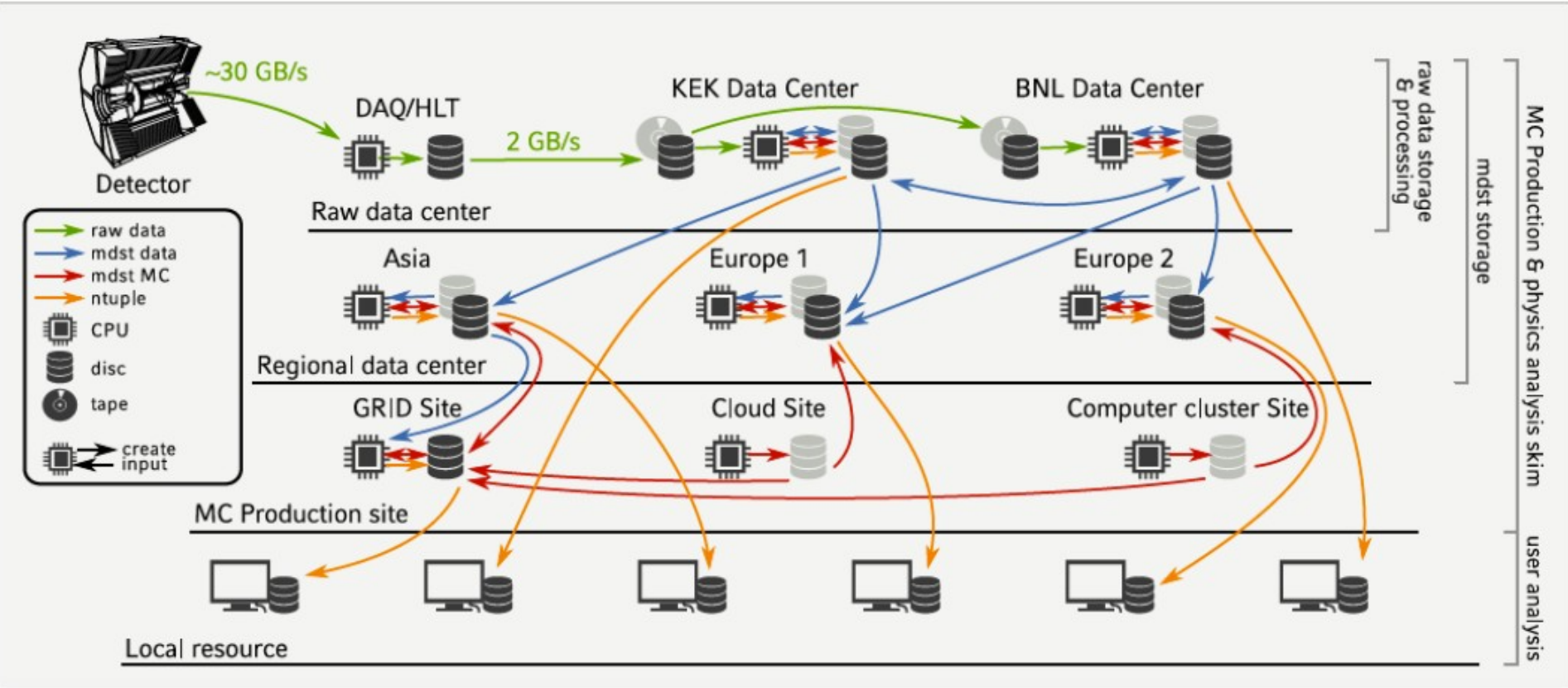
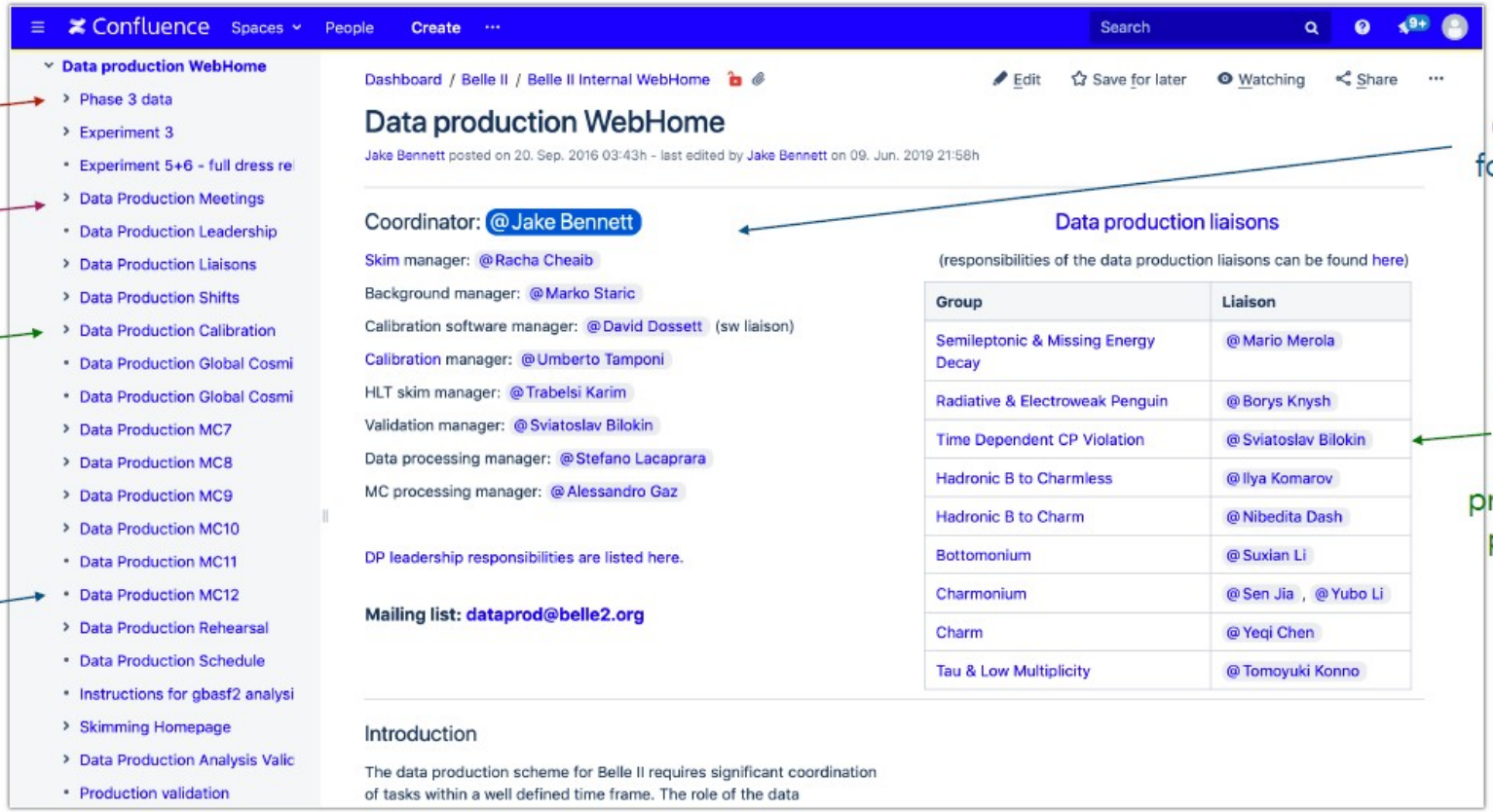


Belle II Data Production

- The data production page is a one-stop shop for all of the data processing and MC production details for Belle II



https://confluence.desy.de/display/BI/Data+production+WebHome

Belle II Data Production

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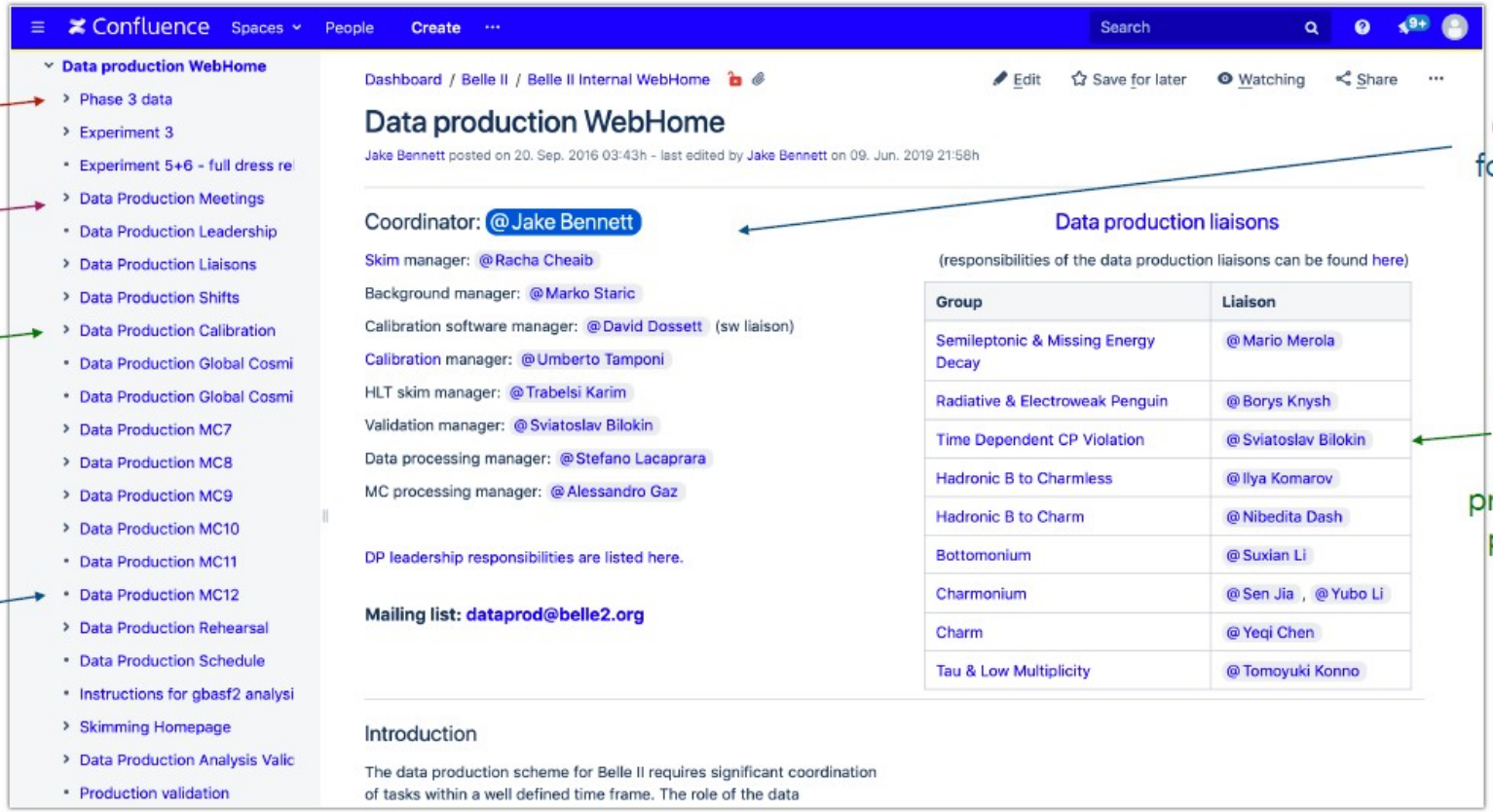
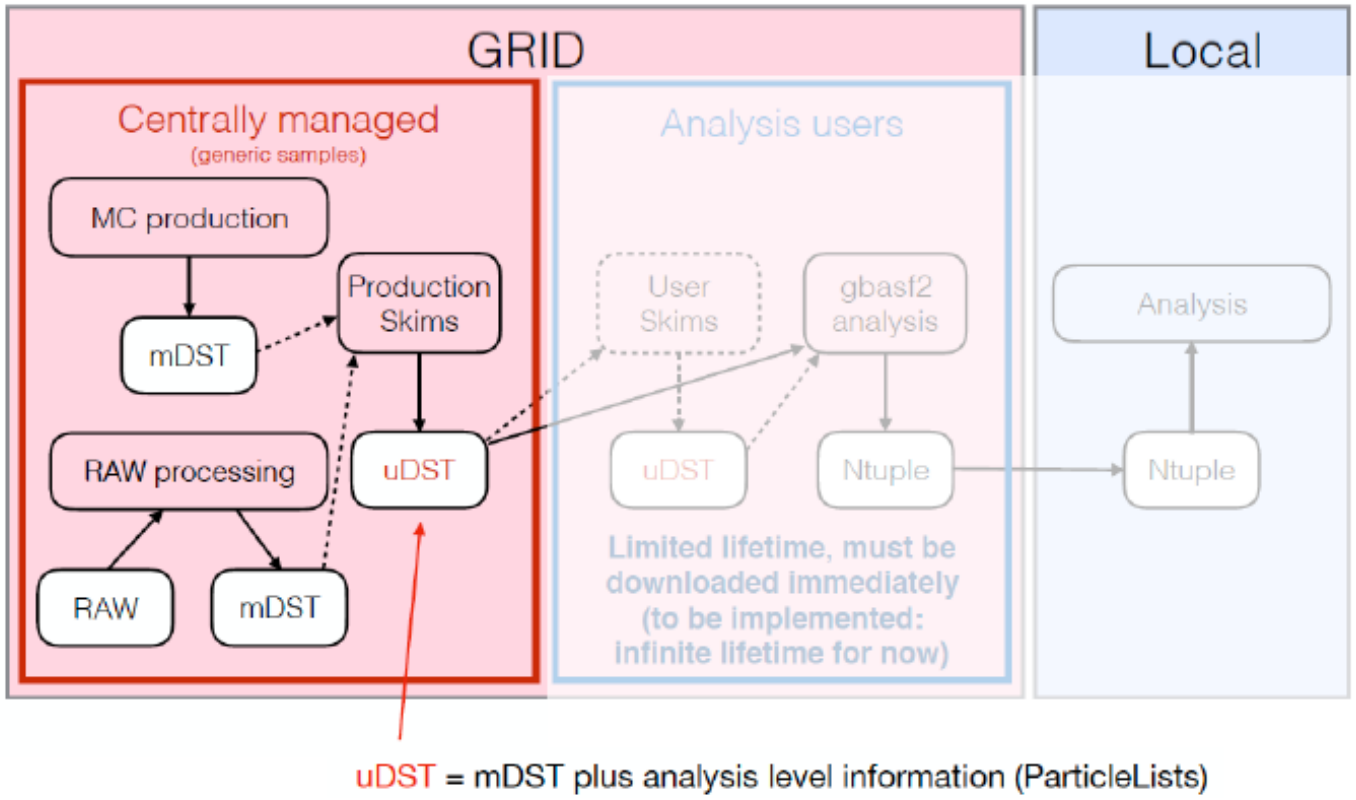


https://confluence.desy.de/display/BI/Data+production+WebHome

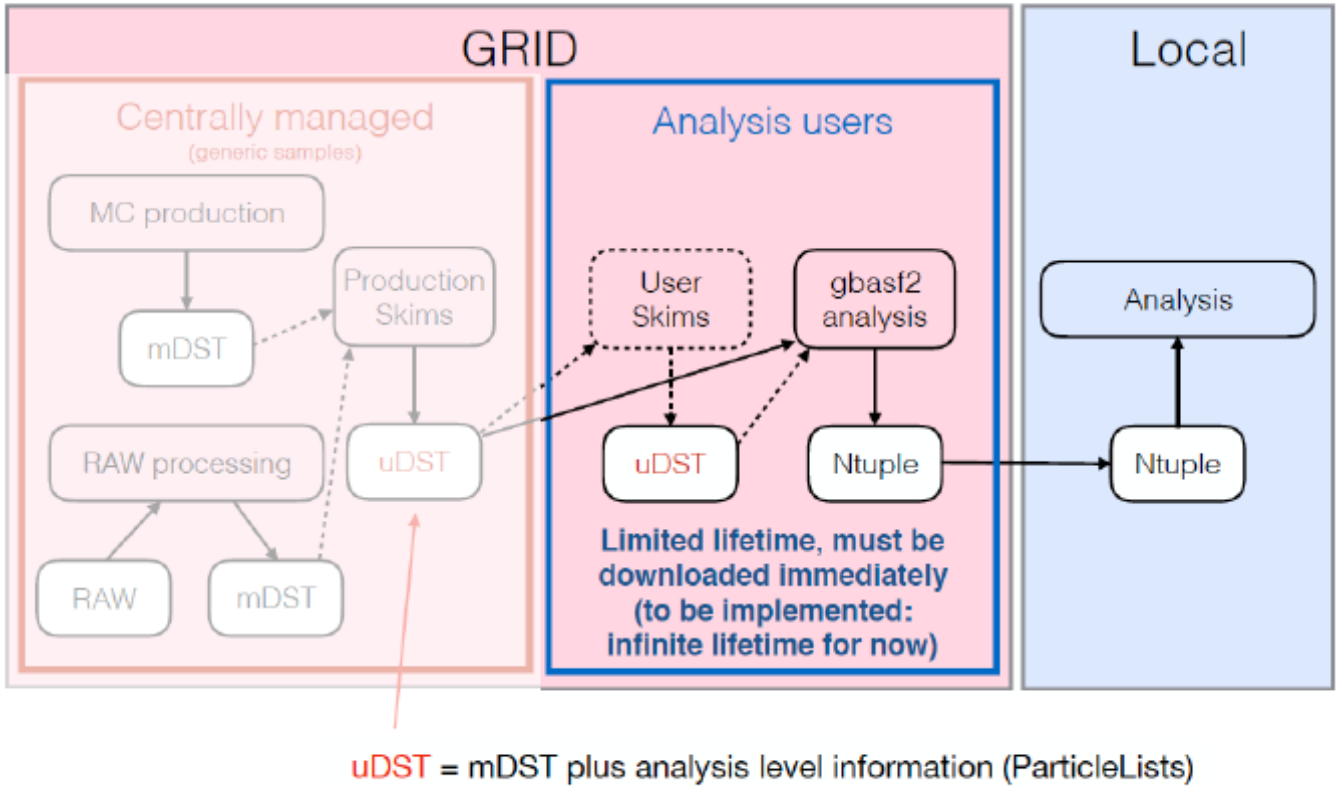
Data Production/analysis scheme

- Simulation and processing for official data and MC samples is performed centrally
  - This is the primary purpose of the data production group
  - Though you are certainly free to produce test samples on your own - *don't use them for publishable physics analyses!*
  - Requests for MC samples can be made to the DP liaison in your physics working group
  - Skimming is also centrally performed - each physics working group has a skim liaison as well



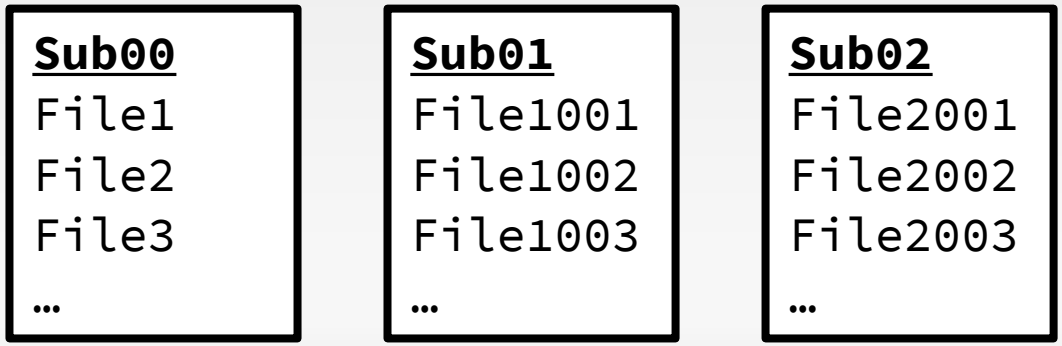
Data Production/analysis scheme

- The default place to run your analysis jobs is on the grid
  - After official skimming, uDST files are available for grid-based analysis
  - Users can either perform another skim on the official skim samples or run an analysis directly on the uDSTs
- Transfer your ntuple files to local resources for the rest of your analysis
  - Fitting, plotting, etc.
  - Files on the grid (will) have a limited lifetime, so ntuple files must be downloaded to local resources as quickly as possible!



What is a dataset/datablock?

- `gbasf2` does not work on data files!
  - It works on input data blocks.
- A dataset contains a (large) number of data files.
- A dataset is organised into a number of sub-blocks, each containing up to 1000 files.
- Large generic MC datasets may contain many sub-blocks.
- Signal MC datasets may typically contain ~10 files in a single sub-block (`sub00`).



How to Specify the datablock?

- You can specify the input data block via the command line when creating your `gbasf2` project:

```
$ gbasf2 myAnalysisScript.py -s release-04-01-01
-p myProject -i /some/input/data/block/sub00
```

- Note - this is different from `basf2`:
  - In `basf2`, `-i` specifies an input file.
  - In `gbasf2`, `-i` specifies an input data block.

What datasets should I use?

- That depends on your analysis.
- In general there are generic samples
  - `uubar, ddbar, ssbar, ccbar, mixed` ($B^0/\overline{B}^0$), `charged` (B^+/B^-), `taupair;`
  - And signal samples (e.g. $B \to J/\psi\, K_S^0$).
- Work with tutors, instructors, working groups to decide .
- You may need to request new signal samples for your analysis.
  - Requests handled by working group contact.

What datasets should I use?

- That depe
- In genera
  - uubar
    charge
  - And sig
- Work with
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  analysis.
  - Reques

ed $(B^0/\overline{B}^0)$,

to decide .

s for your

ct.

Data production liaisons

(responsibilities of the data production liaisons can be found here)

Group	Liaison
Semileptonic and Missing Energy Decays	@ Mario Merola
Radiative & Electroweak Penguin	@ Borys Knysh , @ Filippo Dattola
Time Dependent CP Violation	@ Sviatoslav Bilokin
Hadronic B to Charmless	@ Diego Tonelli (temporary)
Hadronic B to Charm	@ Nibedita Dash
Bottomonium	@ Suxian Li
Charmonium	@ Yang Li , @ Yubo Li
Charm	@ Emma Oxford
Tau & Low Multiplicity	@ Tomoyuki Konno , @ Michel Hernandez Villanueva

How to find datasets

- Find the information on confluence,

How to find datasets

- Find the information on confluence,

  or

- Use the dataset searcher.

MC12 on confluence

- https://confluence.desy.de/display/BI/Data+Production+MC12

MC12 samples

VERY IMPORTANT: Always check the LPN of your files using 'gb2_ds_list' before submitting jobs to make sure the files exist where you expect them!

** The LPN for MC12 samples begins with '/belle/MC/release-03-00-00/DB00000487/MC12/' unless otherwise noted

*** For productions with both BGx1 and BGx0, the LPN is given for the BGx1 sample. The LPN for the BGx0 sample is identical except for the production ID.

Priority is noted as follows: 0 - trivial, 1 - minor, 2 - major, 3 - critical, 4 - blocker

Note that if you are working with files at KEKCC, the ghi disk system (anything starting /ghi or /hsm) will automatically purge files from the disk and move them to tape when there is not enough space available. You can check the files with ghils (https://kekcc.kek.jp/service/kekcc/html/Eng/HSM20System.html#s49cb0a0) and request that they be staged with hstage (https://kekcc.kek.jp/service/kekcc/html/Eng/HSM20System.html#d100fc92.

Key	Scripts committed, ready for production	Jobs submitted	Released for analysis use	BGx0 ready, BGx1 processing	Not produced or removed

MC12 on confluence

- https://confluence.desy.de/display/BI/Data+Production+MC12

Block1:

Sample	Number of events (10^6)	Ratio without/with background	Production ID without/with background	LPN***	Link to json file	JIRA ticket	Estimated size (TB)
mixed	53.5	0.2/0.8	7393/7392	/belle/MC/release-03-01-00/DB00000547/MC12b/prod00007392/s00/e1003/4S/r00000/mixed/mdst/sub00		~~BIDP-1226~~ - Phase III Y(4S) generic samples RESOLVED	0.66
charged	56.5	0.2/0.8	7395/7394	/belle/MC/release-03-01-00/DB00000547/MC12b/prod00007394/s00/e1003/4S/r00000/charged/mdst/sub00			0.70
uubar	160.5	0.2/0.8	7397/7396	/belle/MC/release-03-01-00/DB00000547/MC12b/prod00007396/s00/e1003/4S/r00000/uubar/mdst/sub00			1.52
ddbar	40.1	0.2/0.8	7399/7398	/belle/MC/release-03-01-00/DB00000547/MC12b/prod00007398/s00/e1003/4S/r00000/ddbar/mdst/sub00			0.38
ssbar	38.3	0.2/0.8	7401/7400	/belle/MC/release-03-01-00/DB00000547/MC12b/prod00007400/s00/e1003/4S/r00000/ssbar/mdst/sub00			0.36
ccbar	132.9	0.2/0.8	7403/7426	/belle/MC/release-03-01-00/DB00000547/MC12b/prod00007426/s00/e1003/4S/r00000/ccbar/mdst/sub00			1.44
taupair	91.9	0.2/0.8	7405/7404	/belle/MC/release-03-01-00/DB00000547/MC12b/prod00007404/s00/e1003/4S/r00000/taupair/mdst/sub00			0.62
Total	**573.7**						**5.68**

MC12 on confluence

- https://confluence.desy.de/display/BI/Data+Production+MC12

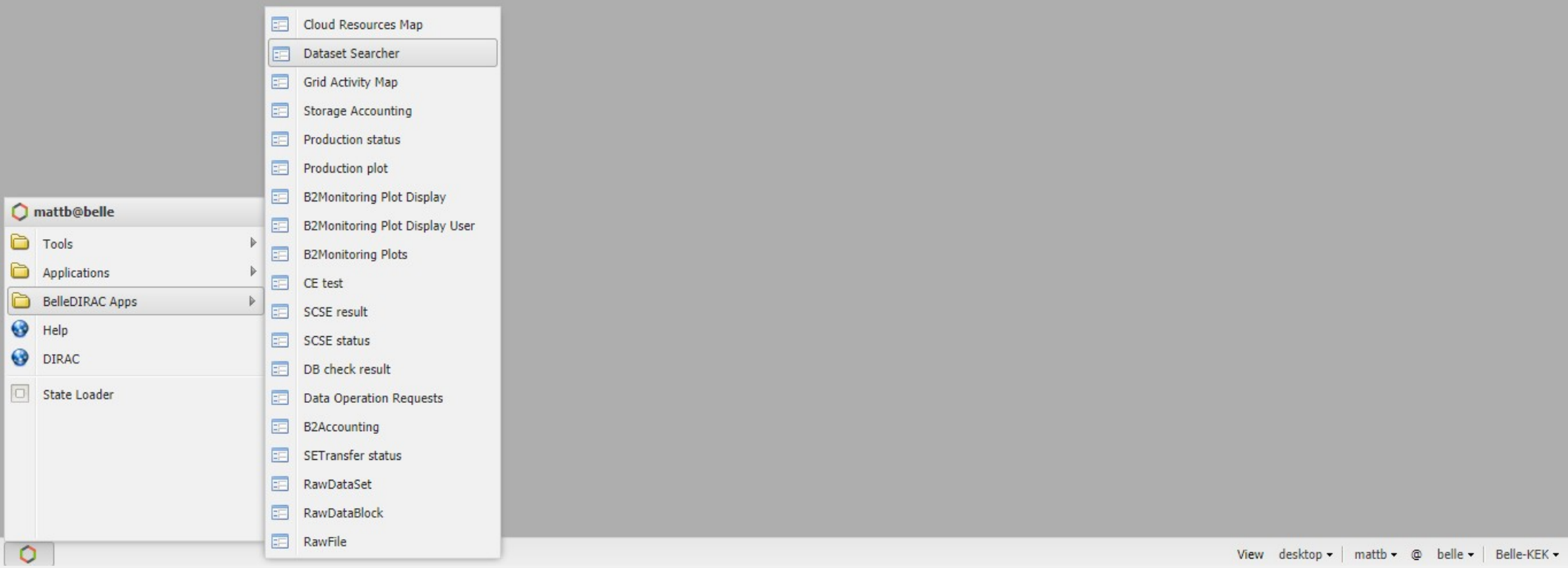
Block1:

Sample	Number of events (10^6)	Ratio without/with background	Production ID without/with background	LPN***	Link to json file	JIRA ticket	Estimated size (TB)
mixed	53.5	0.2/0.8	7393/7392	/belle/MC/release-03-01-00/DB00000547/MC12b/prod00007392/s00/e1003/4S/r00000/mixed/mdst/sub00		~~BIDP-1226~~ - Phase III Y(4S) generic samples RESOLVED	0.66
charged	56.5	0.2/0.8	7395/7394	/belle/MC/release-03-01-00/DB00000547/MC12b/prod00007394/s00/e1003/4S/r00000/charged/mdst/sub00			0.70
uubar	160.5	0.2/0.8	7397/7396	/belle/MC/release-03-01-00/DB00000547/MC12b/prod00007396/s00/e1003/4S/r00000/uubar/mdst/sub00			1.52
ddbar	40.1	0.2/0.8	7399/7398	/belle/MC/release-03-01-00/DB00000547/MC12b/prod00007398/s00/e1003/4S/r00000/ddbar/mdst/sub00			0.38
ssbar	38.3	0.2/0.8	7401/7400	/belle/MC/release-03-01-00/DB00000547/MC12b/prod00007400/s00/e1003/4S/r00000/ssbar/mdst/sub00			0.36
ccbar	132.9	0.2/0.8	7403/7426	/belle/MC/release-03-01-00/DB00000547/MC12b/prod00007426/s00/e1003/4S/r00000/ccbar/mdst/sub00			1.44
taupair	91.9	0.2/0.8	7405/7404	/belle/MC/release-03-01-00/DB00000547/MC12b/prod00007404/s00/e1003/4S/r00000/taupair/mdst/sub00			0.62
Total	**573.7**						**5.68**

Dataset Searcher

- https://questions.belle2.org/question/7244/what-is-the-dataset-searcher/
  - The Dataset Searcher is a BelleDIRAC application that is used to identify the details needed to run over data and MC samples stored on the grid. You should be able to access it here: shorturl.at/ehLQ1. [Y]ou need a valid grid certificate.
  - The basic idea is that the gb2 tools (e.g. gb2_ds_list) are rather slow and the AMGA metadata catalogue used to manage grid productions was not intended to be used to search for data. The solution was to build a lightweight database that can be easily used to search for samples on the grid. Sample details are added by the data production team as productions are finalized, so if you don't see a sample you are expecting, contact your DP liaison or the DP managers directly.
- There should be a talk “Status and plans for dataset searcher” at the B2GM.
  - Link will be added when available.

Dataset Searcher



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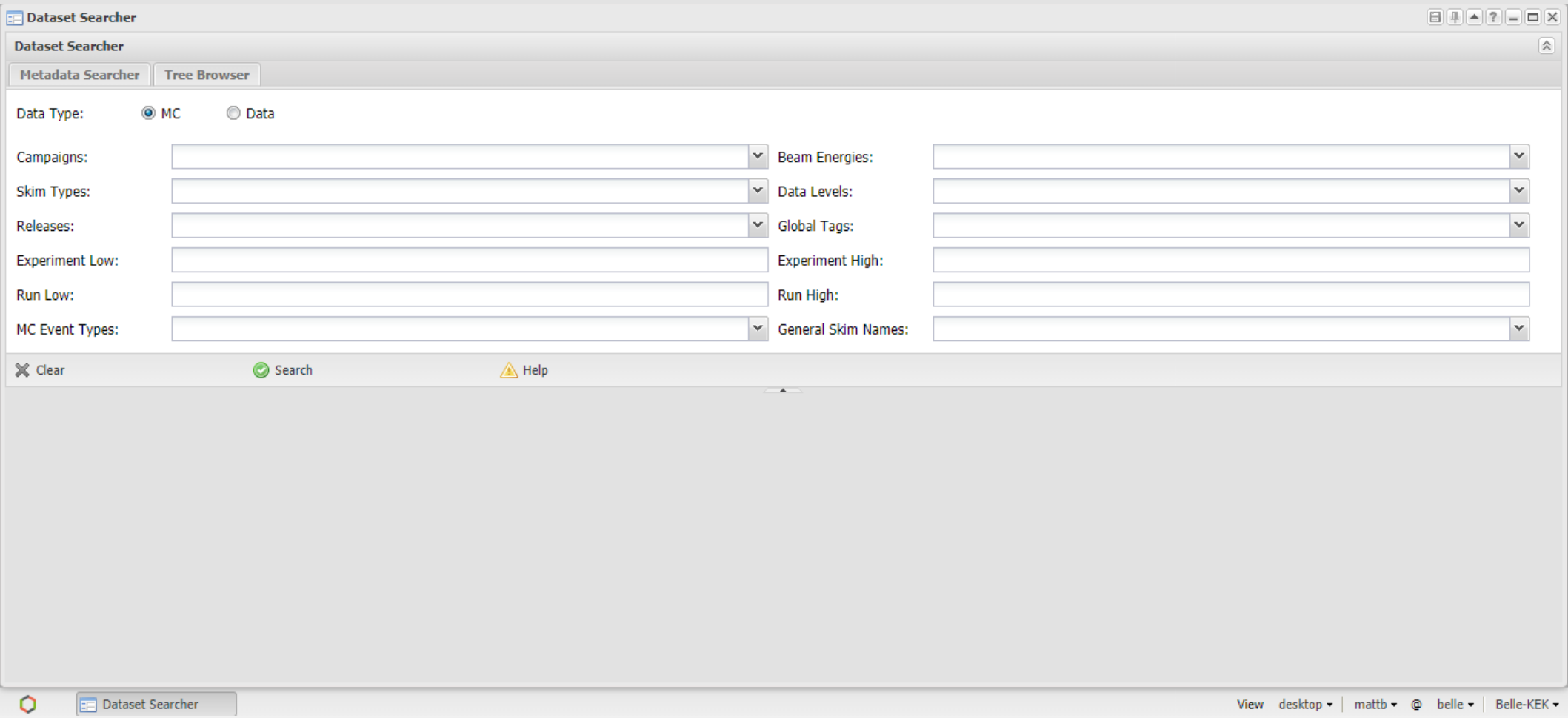

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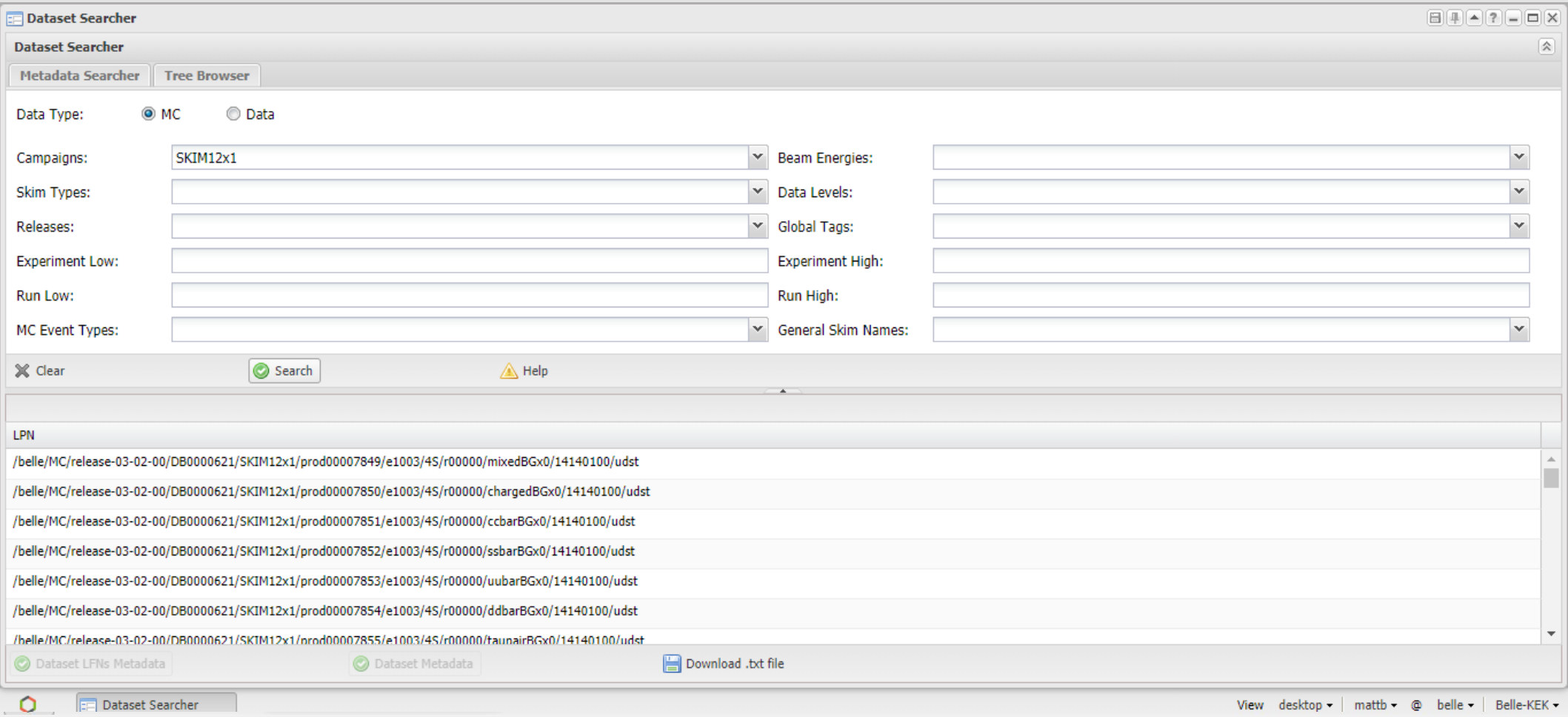


Datasets and What is an LPN?

- The LPN is the **L**ogical **P**ath **N**ame.
- The physical location of a file is different on every grid site, but the LPN is universal for all sites.
- When gbasf2 runs on a remote site, the LPN is used to find the location at that site.
- (Generally) The LPNs for MC12 have two parts, the first for all datasets, e.g. `/belle/MC/release-03-00-00/DB00000487/MC12/` and the second for each specific dataset:
  - (If using confluence) Add these two to get the full LPN.
  - You can you gb2_ds_list (ds = dataset) to look at the contents of your dataset.
- VERY IMPORTANT: Always check the LPN of your files using 'gb2_ds_list' before submitting jobs to make sure the files exist where you expect them!

File Types

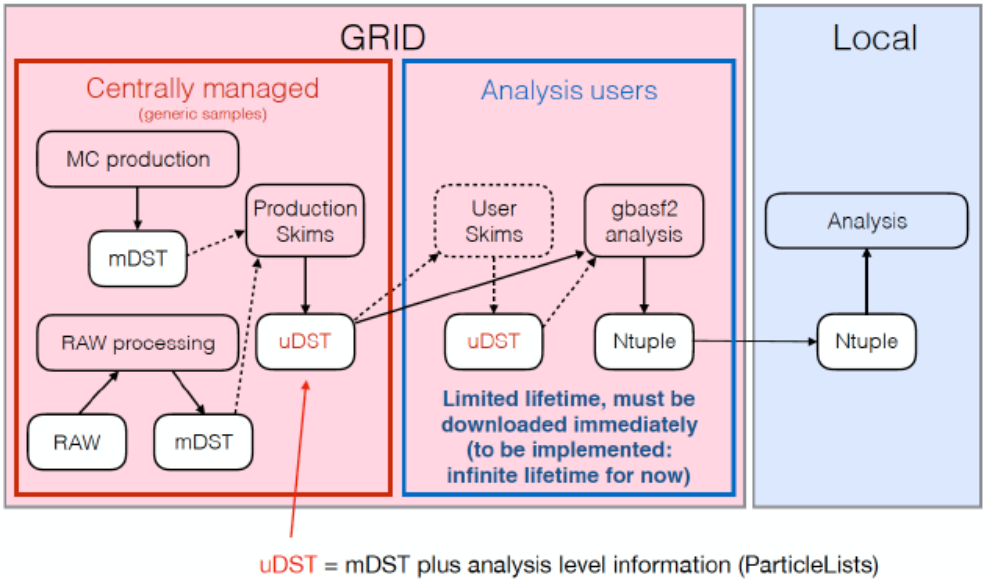
- In general, Belle II output is stored in ROOT files containing various subsets of dataobjects, dbobjects, nTuples, etc

- **RAW**: raw data containing detector information
- **DST**: data summary table
  - all available dataobjects (from reprocessing) are included
  - not generally produced or used as it contains everything (and is huge)
- **mDST***: mini data summary table
  - strictly controlled version of a DST file
  - only a subset of available processed dataobjects are included
  - sufficient information for analysis use
- **cDST**: calibration data summary table
  - mDST objects, plus additional dataobjects useful for calibration
- **uDST**: user data summary table
  - mDST objects, plus analysis objects (ParticleLists)
  - produced from skims - reduce time needed to run analysis jobs
  - these are the samples you should be using for analysis!

***mDST Storage: ~61 M¥ per additional kB**

Skims

- Keep in mind that you will not be able to touch mDST files for much longer!
  - After processing, the mDST samples are skimmed to reduce the number of events and provide analysis dataobjects directly - reduces the CPU time for your jobs
  - Analysts should be using uDST files, not mDST!
  - If your skim is not available, you won't be able to perform your analysis!
    - Contact your skim liaison and/or start developing



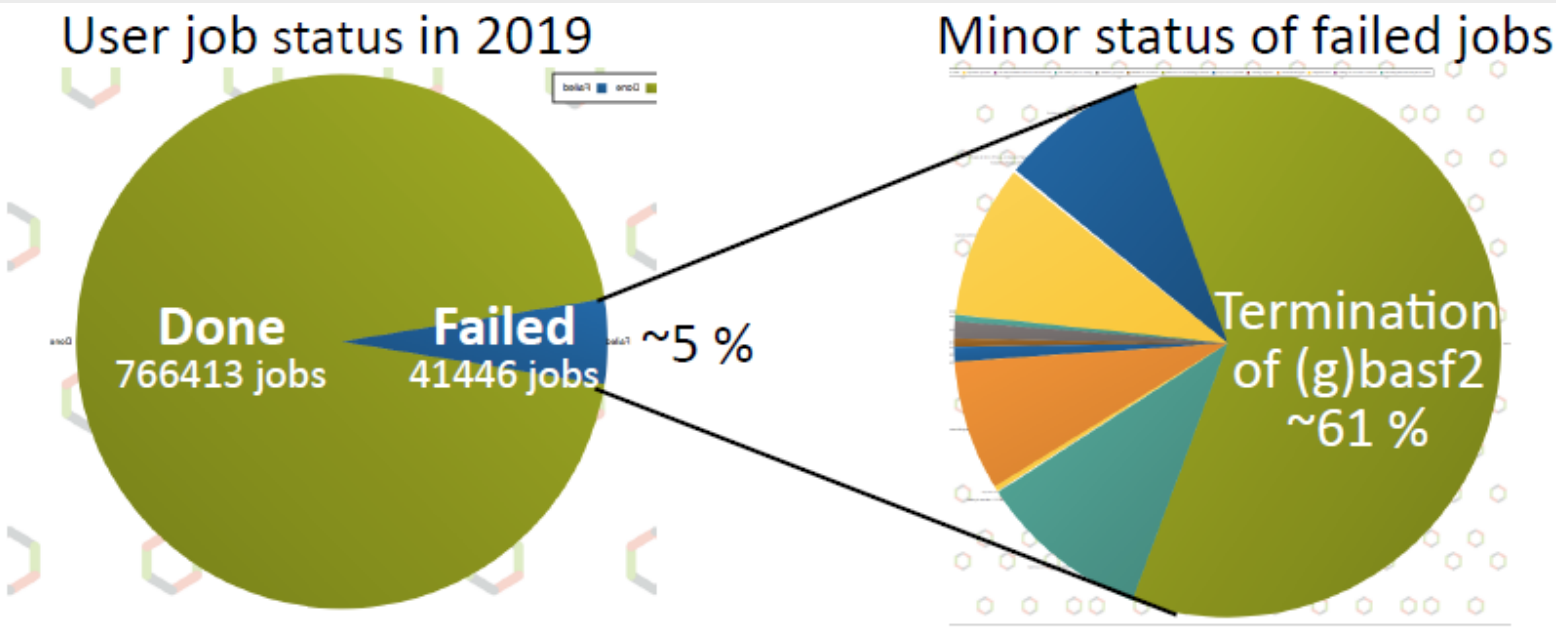
uDST = mDST plus analysis level information (ParticleLists)

The skim production manager is @Racha Cheaib .

Physics Working Group	Member	Status
BtoCharm WG	@Niharika Rout	Ph.D student, IITM
BtoCharmless WG	@Kim Hai Smith	Ph.D student
TCPV WG	@Reem Rasheed	Ph.D student
EWP WG	@Justin Tan	Ph.D. Student
Charm WG	@Guanda Gong	Ph.D. Student
Charmonium WG	@Sen Jia	Ph.D student
Bottomonium WG	@Sen Jia	Ph.D student
SL + Missing Energy WG	@Sophie Hollitt @Hannah Marie Wakeling @Philip Grace	Ph.D Student Ph.D Student Ph.D Student
Dark and Low Multiplicity WG	@Sam Cunliffe	Postdoctoral fellow
Tau WG	@Kenji Inami	Staff

https://confluence.desy.de/display/BI/Skimming+Homepage

Failed grid jobs



- Most of failed user jobs are caused by (g)basf2 termination.
  -- Syntax error, spelling miss of basf2 module and so on.
- Some users do not test if the script works at local or grid environment, before submitting huge jobs.
- Instantaneous huge failed jobs sometimes affect other jobs.

https://kds.kek.jp/indico/event/32146/contributions/158526/attachments/126678/150328/gbasf2_hirata_20191018.pdf

Failed grid jobs

- If you submit 1000 jobs and there is an error in your python script:

Failed grid jobs

- If you submit 1000 jobs and there is an error in your python script:
  - All 1000 jobs will fail!

Failed grid jobs

- If you submit 1000 jobs and there is an error in your python script:
  - All 1000 jobs will fail!
- Proposed features in future versions of `gbasf2`:
  - Valid python code checker.
  - Scout jobs – run a small number of jobs (with fewer events) first, before main jobs submitted.
  - These cannot catch every error – **Always** check your code works with `basf2` before submitting to the grid.

If you have failed grid jobs

- You should always check the output (see next slide).
- If only a handful of jobs have failed:
  - Try resubmitting them, using `gb2_job_reschedule` or the DIRAC GUI.
- If more than a handful have failed:
  - Investigate – check your code with basf2 again.
  - Is there a pattern to failed jobs, e.g. same site(s)?
  - Report issues to comp-users-forum@belle2.org.

Getting the job output/logs

- You can use the command gb2_job_output, e.g.

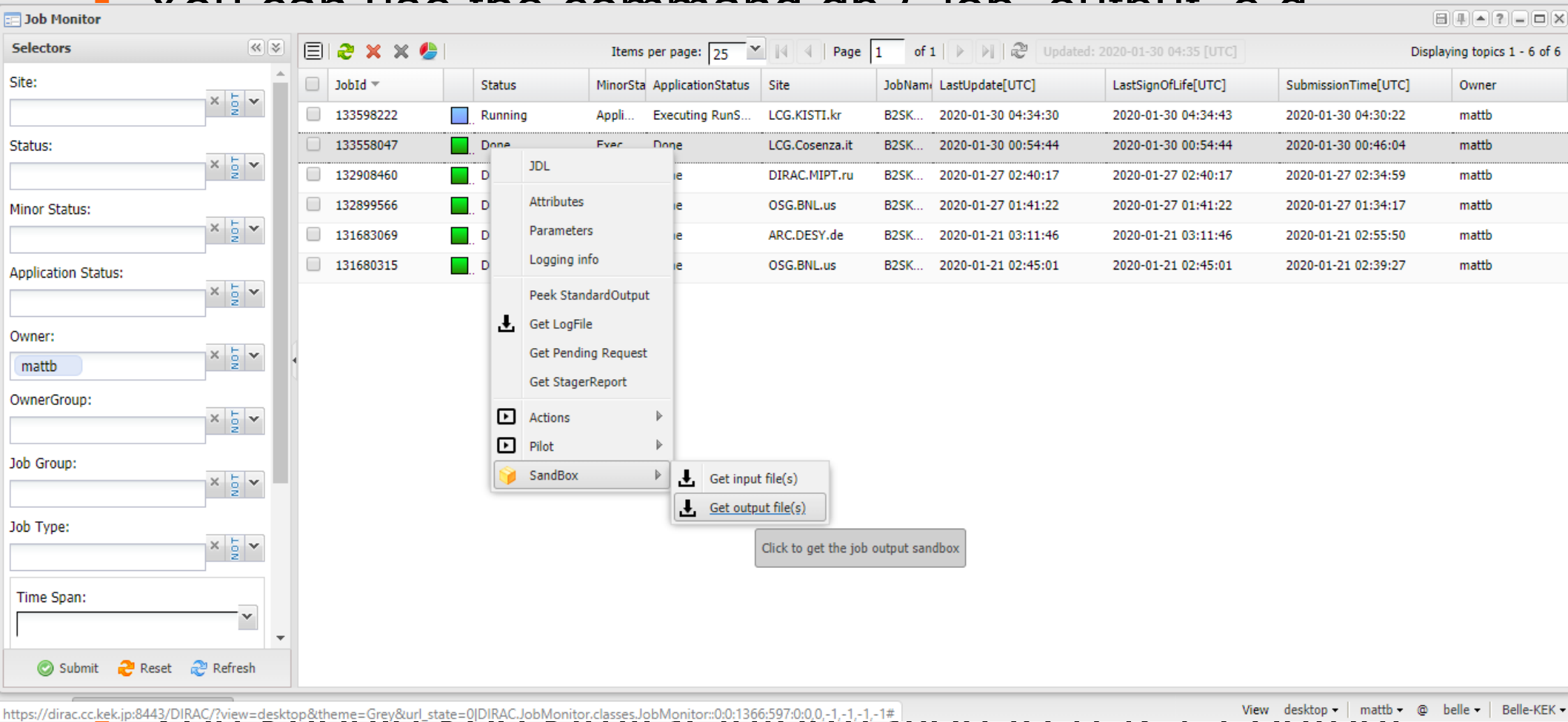
```
$ gb2_job_output -p myProject --status Failed
```

- Or you can use the DIRAC GUI.

- You should find several files for each job, including one called something like: `Script1_basf2helper.py.log`.
- You should see similar information to `basf2` output.

Getting the job output/logs

- You can use the command gb2_job_output, e.g.



- You should see similar information to basf2 output:

Summary of gbasf2

- The grid is a distributed computing network that is used by Belle II for many purposes including MC production and user analysis.
- You have to have a grid certificate and be registered with DIRAC in order to use the grid.
- Your `basf2` python scripts should run on the grid using `gbasf2`.
  - `gbasf2` uses data blocks (collections of files) as input rather than individual files (or lists or files).
- But **always** check that they do run successfully with a central release version of `basf2` before submitting them to the grid!

Data Production shifts

- Do you want to learn more about Belle II computing?

Data Production shifts

- Do you want to learn more about Belle II computing?
- Do you want to help the Belle II Data Production?

Data Production shifts

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- Do you want to help the Belle II Data Production?
- Yes – you are in luck! You can do both!
  - https://confluence.desy.de/display/BI/Data+Production+Shifts

Data Production shifts

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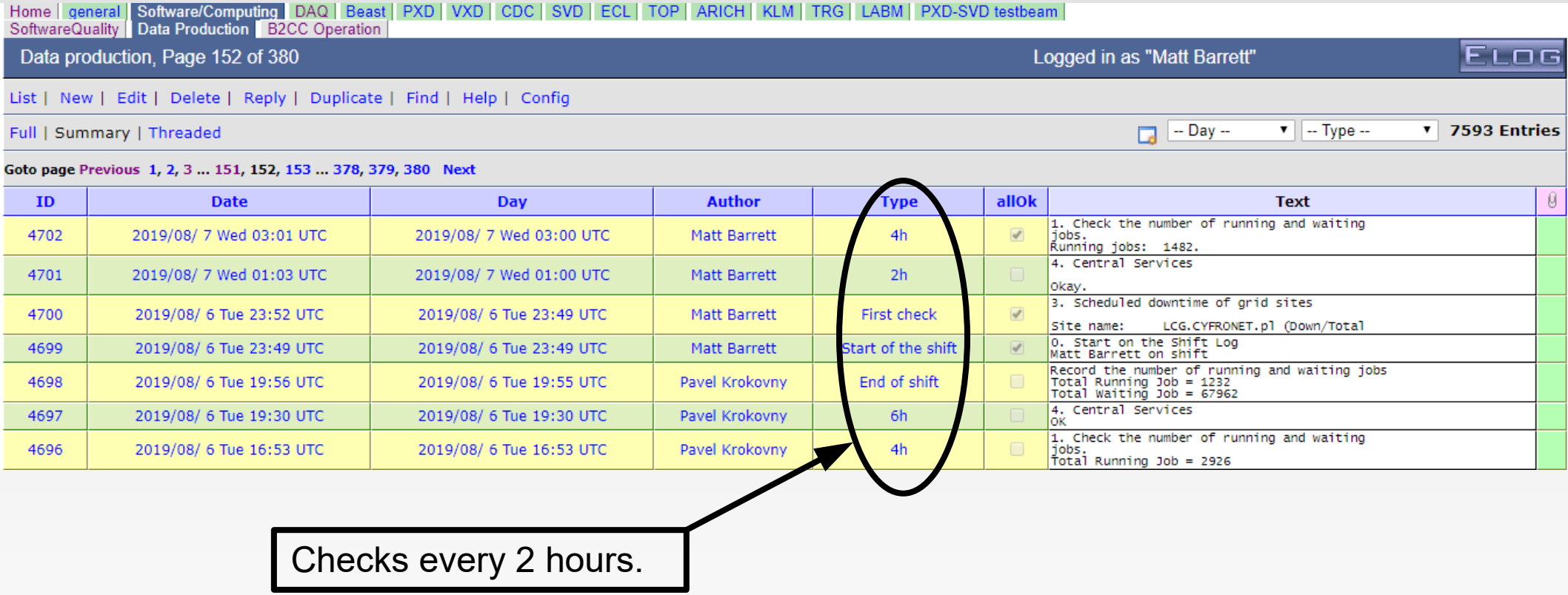
- Do you want to help the Belle II Data Production?
- Yes – you are in luck! You can do both!
  - https://confluence.desy.de/display/BI/Data+Production+Shifts
- Responsibilities of the shifter:
  - (1) monitoring the production status through web portals,
  - (2) reporting problems or issues to the experts,
  - (3) filling out the shift elog and updating the shift summary
- Shifts are booked in blocks of three or four days, and can be done from anywhere in the world – every shift is a day shift!
- If you can access the DIRAC webpage, you can take a shift.

Data Production Shifts

- https://elog.belle2.org/elog/Data+Production/



Home | general | Software/Computing | DAQ | Beast | PXD | VXD | CDC | SVD | ECL | TOP | ARICH | KLM | TRG | LABM | PXD-SVD testbeam
SoftwareQuality | Data Production | B2CC Operation

Data production, Page 152 of 380 — Logged in as "Matt Barrett" — ELOG

List | New | Edit | Delete | Reply | Duplicate | Find | Help | Config

Full | Summary | Threaded — -- Day -- — -- Type -- — 7593 Entries

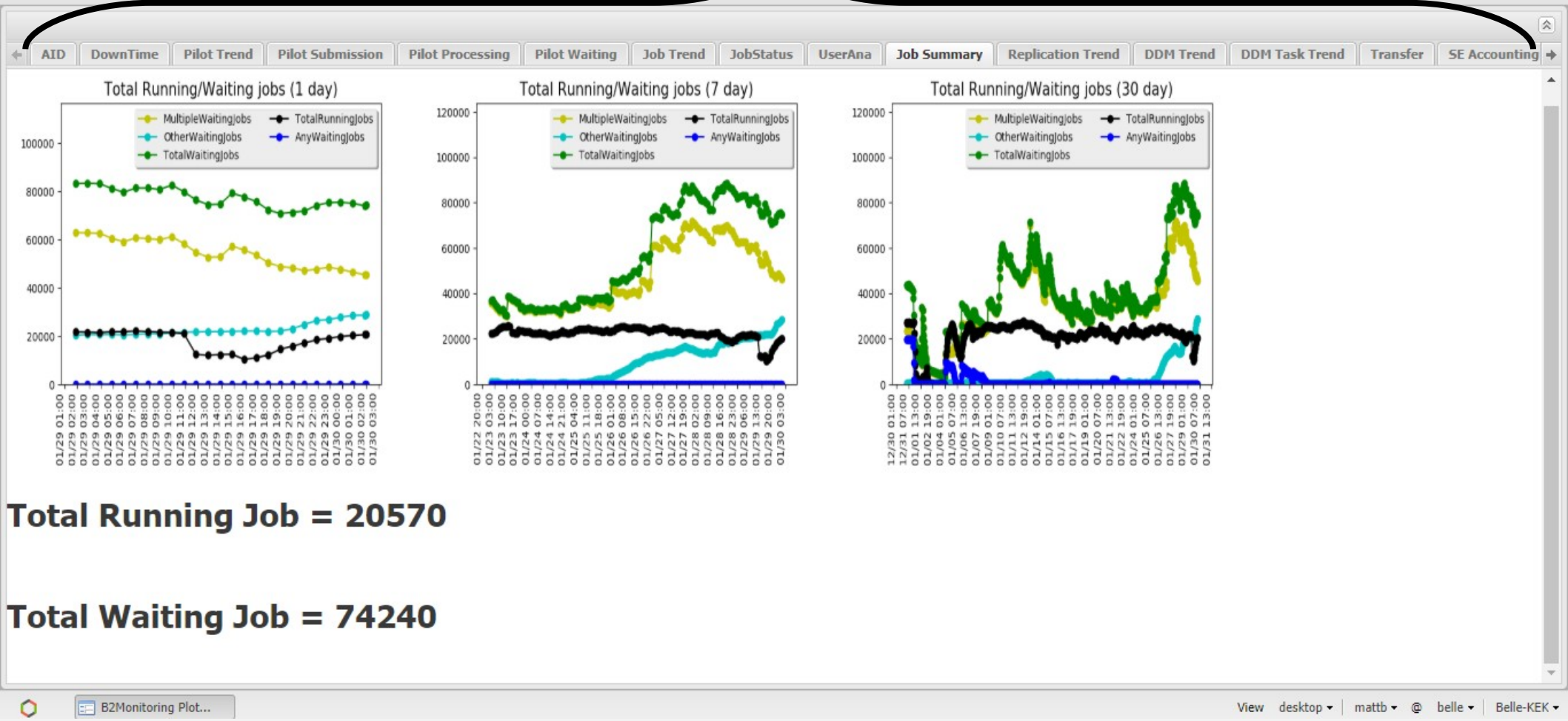
Goto page Previous 1, 2, 3 ... 151, 152, 153 ... 378, 379, 380 Next

ID	Date	Day	Author	Type	allOk	Text
4702	2019/08/ 7 Wed 03:01 UTC	2019/08/ 7 Wed 03:00 UTC	Matt Barrett	4h	☑	1. Check the number of running and waiting jobs. Running jobs: 1482.
4701	2019/08/ 7 Wed 01:03 UTC	2019/08/ 7 Wed 01:00 UTC	Matt Barrett	2h	☐	4. Central Services Okay.
4700	2019/08/ 6 Tue 23:52 UTC	2019/08/ 6 Tue 23:49 UTC	Matt Barrett	First check	☑	3. Scheduled downtime of grid sites Site name: LCG.CYFRONET.pl (Down/Total
4699	2019/08/ 6 Tue 23:49 UTC	2019/08/ 6 Tue 23:49 UTC	Matt Barrett	Start of the shift	☑	0. Start on the Shift Log Matt Barrett on shift
4698	2019/08/ 6 Tue 19:56 UTC	2019/08/ 6 Tue 19:55 UTC	Pavel Krokovny	End of shift	☐	Record the number of running and waiting jobs Total Running Job = 1232 Total Waiting Job = 67962
4697	2019/08/ 6 Tue 19:30 UTC	2019/08/ 6 Tue 19:30 UTC	Pavel Krokovny	6h	☐	4. Central Services OK
4696	2019/08/ 6 Tue 16:53 UTC	2019/08/ 6 Tue 16:53 UTC	Pavel Krokovny	4h	☐	1. Check the number of running and waiting jobs. Total Running Job = 2926

Checks every 2 hours.

Data Production Shifts

Most monitoring can be done from these tabs (on the DIRAC page).



Reminder

- When you try submitting your own analysis code to the grid (as you may do so with your tutor in this workshop)
  - **Always** test with a central release of `basf2` before submitting to the grid!

Some Very Wise Words from Hara-san

GRID is NOT the local computing system like KEKCC

Once you submit jobs, your jobs will be assigned to the computing systems around the world.

If your job is a problematic one, it will be distributed to the world
and all sites will be affected.

Therefore, you have to check your jobs with local computing system, e.g. in KEKCC carefully
before you submit jobs to GRID.

+ maximum size of the output log from each job must be less than 30MB
+ maximum memory comsumption of each job must be less than 2GB

Starter Kit workshop

- If you were unable to try the hands on exercises today:
  - Please feel free to try them later in the workshop and ask me (or other tutors and instructors) any questions.

Backup

More Information

- https://www.belle2.org/
- chat: https://chat.belle2.org
- questions: https://questions.belle2.org
- calendar: http://superb.kek.jp/meetings/calendar.html
- glossary: https://confluence.desy.de/display/BI/Main+Glossary
- sympa (email lists): https://lists.belle2.org/sympa/home
- SpeakApp: https://speakapp.link/
  - https://confluence.desy.de/display/BI/Main+AudioVideoConferencing
- git/stash: https://stash.desy.de/
  - https://confluence.desy.de/pages/viewpage.action?pageId=35832648
  - https://confluence.desy.de/pages/viewpage.action?pageId=35819226
- JIRA: https://agira.desy.de
- basf2: https://b2-master.belle2.org/software/development/sphinx/index.html
- gbasf2: https://confluence.desy.de/display/BI/Computing+GBasf2
  - https://confluence.desy.de/display/BI/Instructions+for+gbasf2+analysis
- Documentation, training and outreach: https://confluence.desy.de/display/BI/Documentation%2C+Training+and+Software+outreach
- Data production: https://confluence.desy.de/display/BI/Data+production+WebHome
  - Phase 2 data: https://confluence.desy.de/display/BI/Experiment+3
  - Phase 3 data: https://confluence.desy.de/display/BI/Phase+3+data
- KEK user site: https://krs.kek.jp/uskek/ui/UI_00000E.do

Jargon

Acronym	Stands for	Actually means
basf	Belle Analysis Software Framework	The name of the software for the Belle experiment.
basf2	Belle 2 Analysis Software Framework (why not b2asf ? … I've no idea)	The name of the software for the Belle 2 experiment. See the pre-B2GM tutorials for more information.
gbasf2	Belle 2 Grid Analysis Software Framework	The name of user-side software tools for running basf2 code on the grid.
DIRAC	Distributed Infrastructure with Remote Agent Control	Software to manage jobs and files on the grid http://diracgrid.org/
Belle2DIRAC	Belle II extensions for the DIRAC system	Belle II custom things for the above software.
OSG	Open Science Grid	The worldwide grid of computing resources. Not just for HEP (also astronomy, molecular science…)
(W)LCG	(Worldwide) LHC Computing Grid	The computing grid for CERN experiments.
VO	Virtual Organisation	The name of the group of users who share infrastructure (like a HEP experiment). Confusingly, our VO is called 'belle' (with no '2').
VOMS	Virtual Organisation Membership Service	A system of managing authorisation for certificates with a VO.
LPN	Logical Path Name	Virtual path to a dataset.
FPN	Physical Path Name	The real path to a dataset at a specific site (you should never need to care about this).
MC9	Monte-Carlo (campaign) 9	The ninth campaign for Belle II to generate samples of simulated fake data (MC).

Previous Tutorials

	Date	Basf2 release used	Location
Kunxian Huang	Feb 2018 1st Starter Kit	release-00-09-01	https://kds.kek.jp/indico/event/26297/session/0/contribution/13
Sam Cunliffe, Jake Bennett, Takanori Hara	October 2017	release-00-09-01	https://kds.kek.jp/indico/event/25459/session/58/?slotId=0#20171013
Takanori Hara	June 2017	release-00-08-00	https://kds.kek.jp/indico/event/24563/session/45/?slotId=0#20170623
Takanori Hara	February 2017	release-00-07-02	https://kds.kek.jp/indico/event/23336/session/54/material/4/2.pdf https://kds.kek.jp/indico/event/23336/session/54/material/4/0.pdf