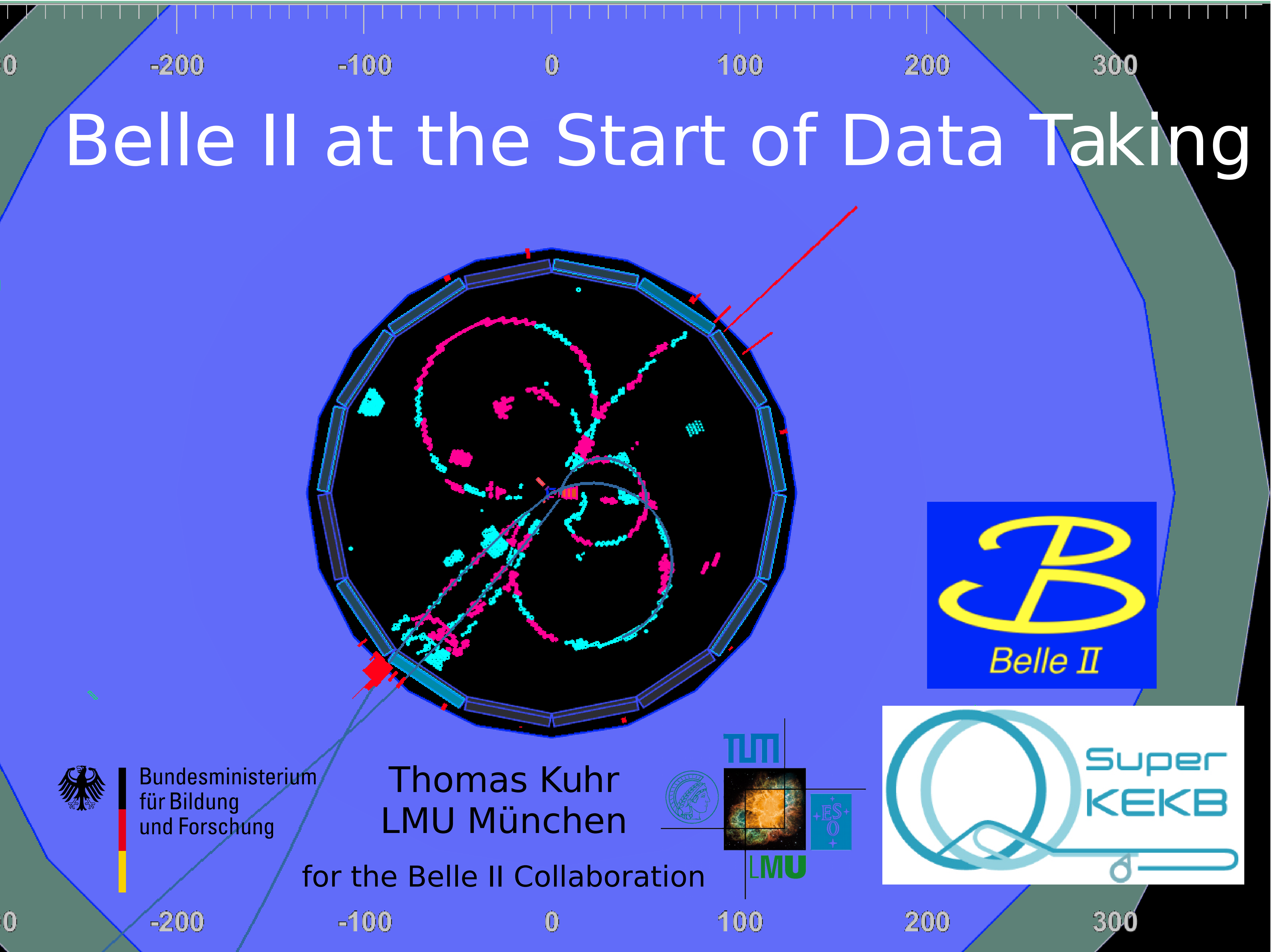
Belle II at the Start of Data Taking



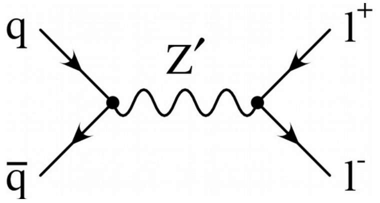
Bundesministerium
für Bildung
und Forschung

Thomas Kuhr
LMU München

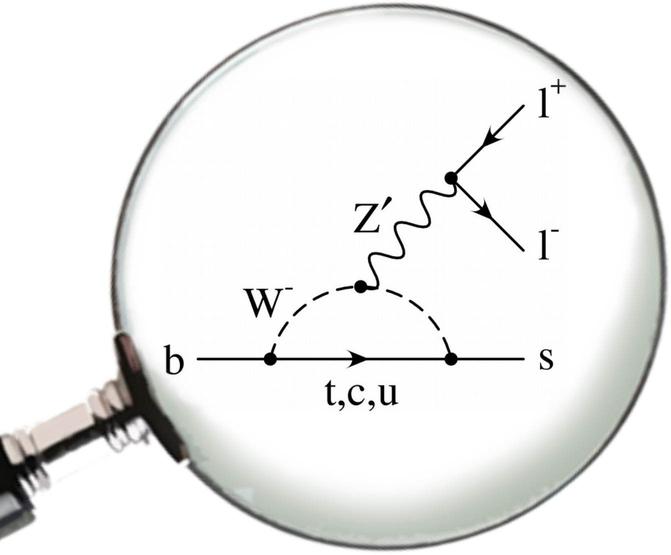
for the Belle II Collaboration

Search for New Physics

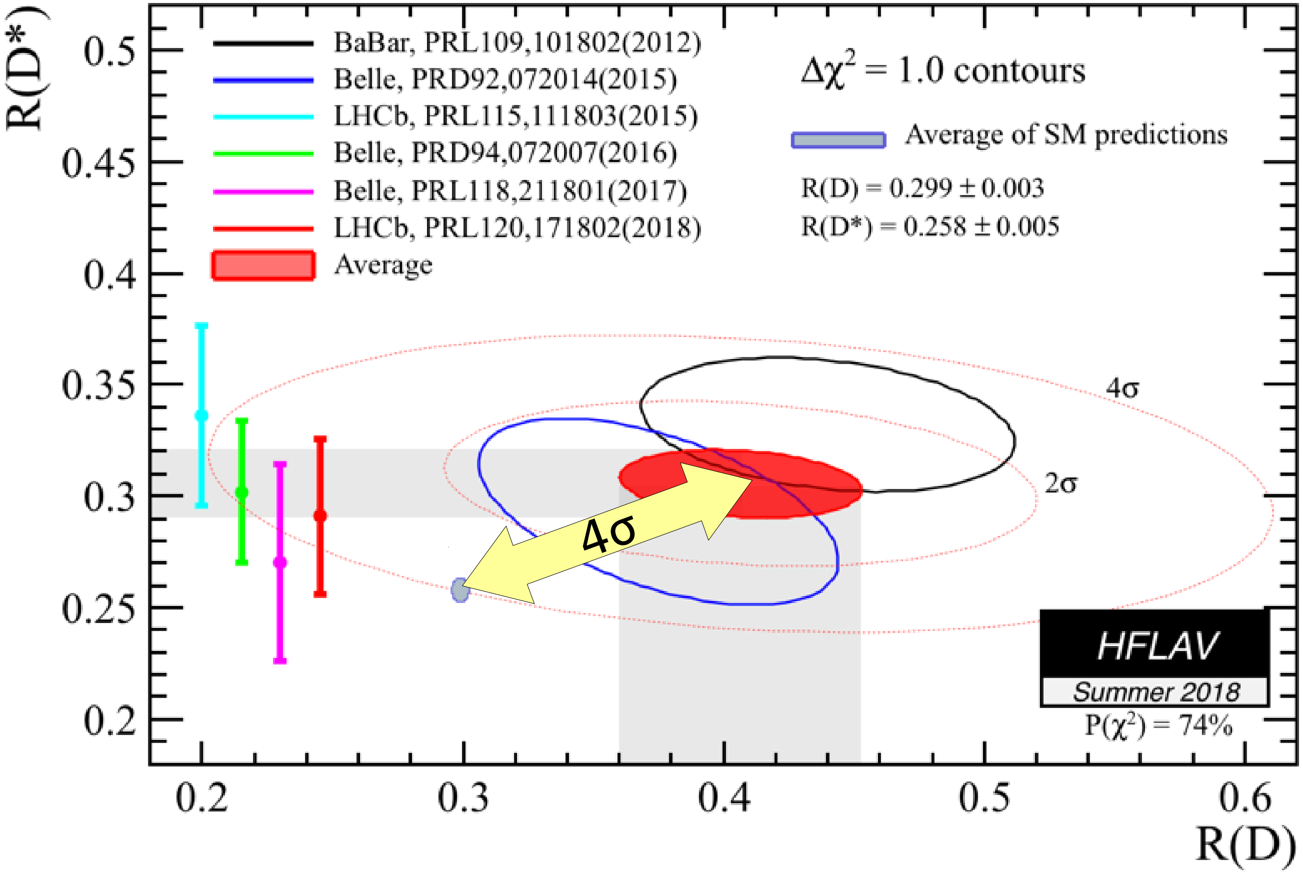
Direct search:



Indirect search:

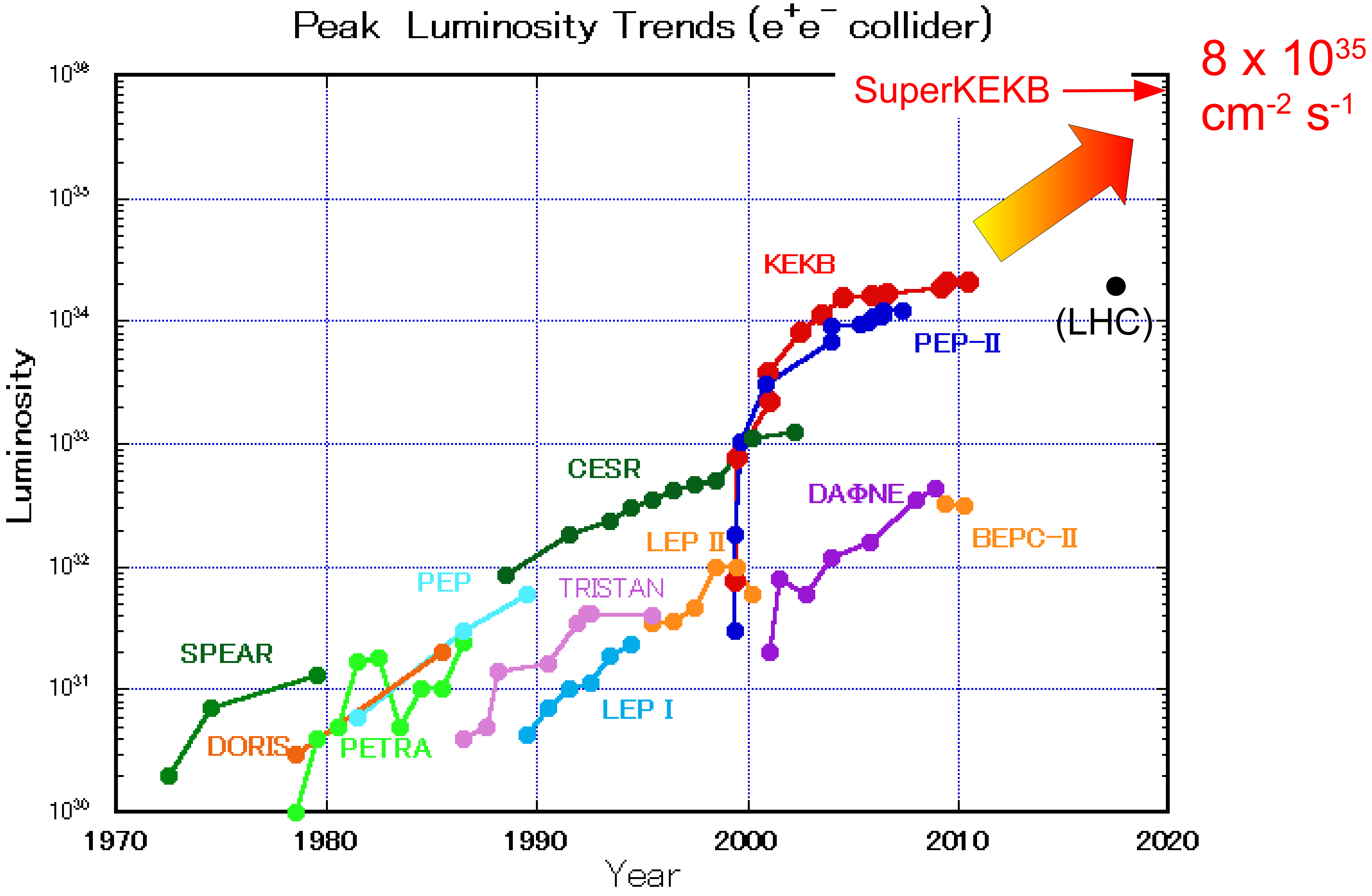


$$R_{D^{(*)}} = \frac{\mathrm{Br}(B \to D^{(*)}\tau\nu_\tau)}{\mathrm{Br}(B \to D^{(*)}\ell\nu_\ell)}$$



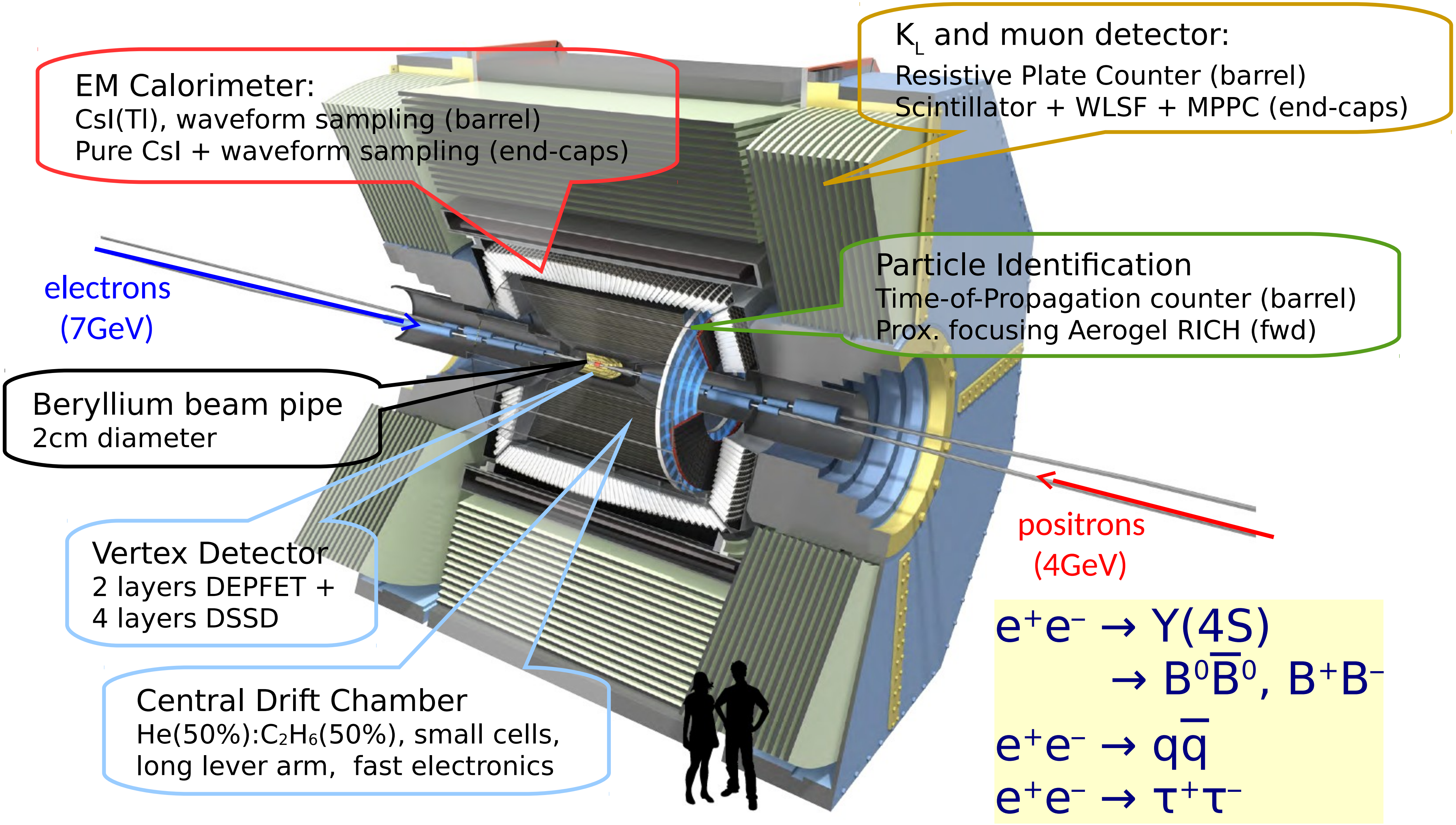
Belle II @ SuperKEKB: 50 ab^{-1}

Belle: 1 ab^{-1}



Belle II Detector

TDR: arXiv:1011.0352



K$_L$ and muon detector:
Resistive Plate Counter (barrel)
Scintillator + WLSF + MPPC (end-caps)

EM Calorimeter:
CsI(Tl), waveform sampling (barrel)
Pure CsI + waveform sampling (end-caps)

Particle Identification
Time-of-Propagation counter (barrel)
Prox. focusing Aerogel RICH (fwd)

electrons (7GeV)

Beryllium beam pipe
2cm diameter

positrons (4GeV)

Vertex Detector
2 layers DEPFET +
4 layers DSSD

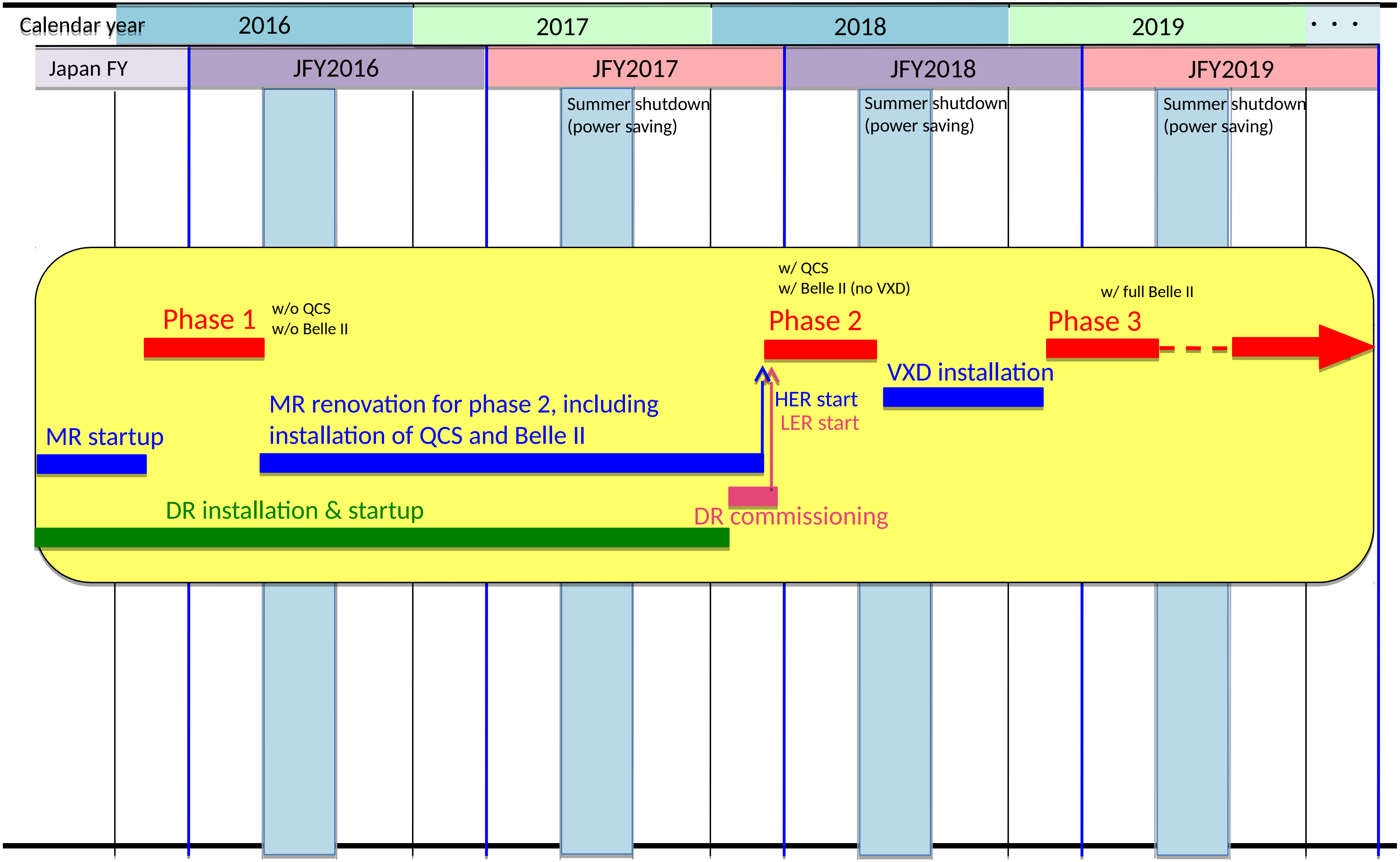
Central Drift Chamber
He(50%):C_2H_6(50%), small cells,
long lever arm, fast electronics

$$e^+e^- \to \Upsilon(4S) \to B^0\overline{B}^0,\ B^+B^-$$

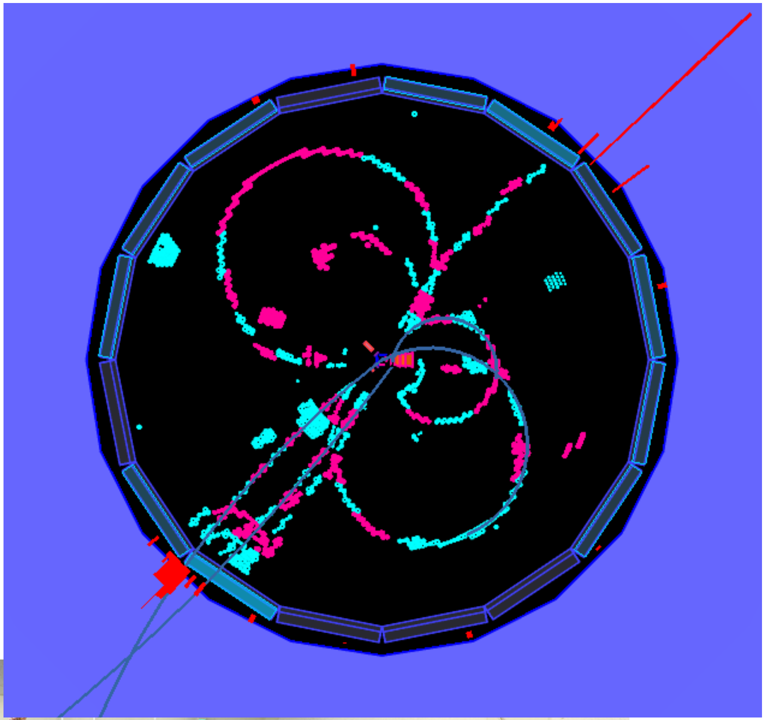
$$e^+e^- \to q\overline{q}$$

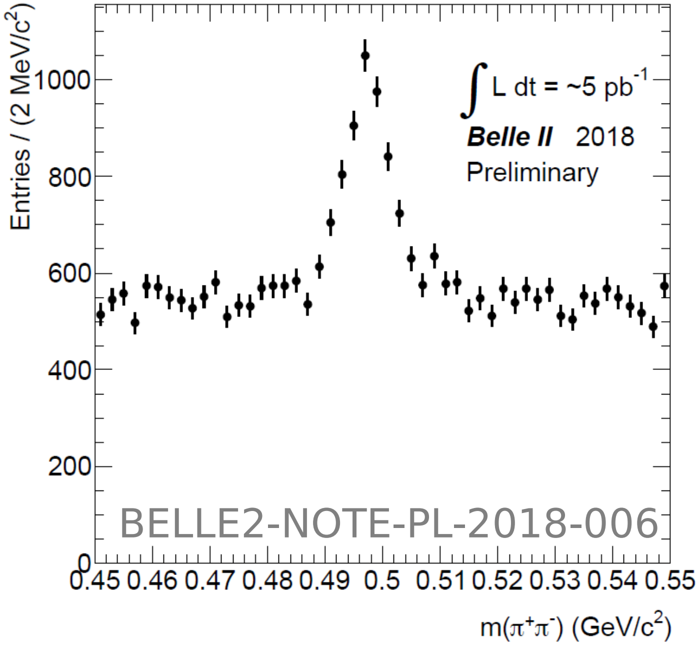
$$e^+e^- \to \tau^+\tau^-$$

Time Line

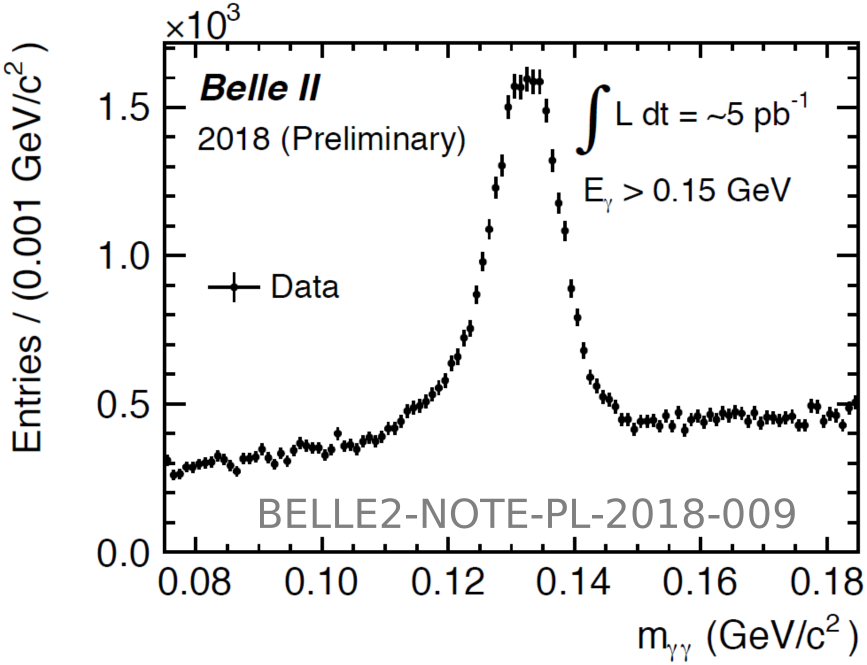

Calendar year
2016
2017
2018
2019
. . .
Japan FY
JFY2016
JFY2017
JFY2018
JFY2019
Summer shutdown (power saving)
Summer shutdown (power saving)
Summer shutdown (power saving)
Phase 1
w/o QCS
w/o Belle II
w/ QCS
w/ Belle II (no VXD)
Phase 2
w/ full Belle II
Phase 3
VXD installation
MR renovation for phase 2, including installation of QCS and Belle II
HER start
LER start
MR startup
DR installation & startup
DR commissioning

First Collisions on April 26





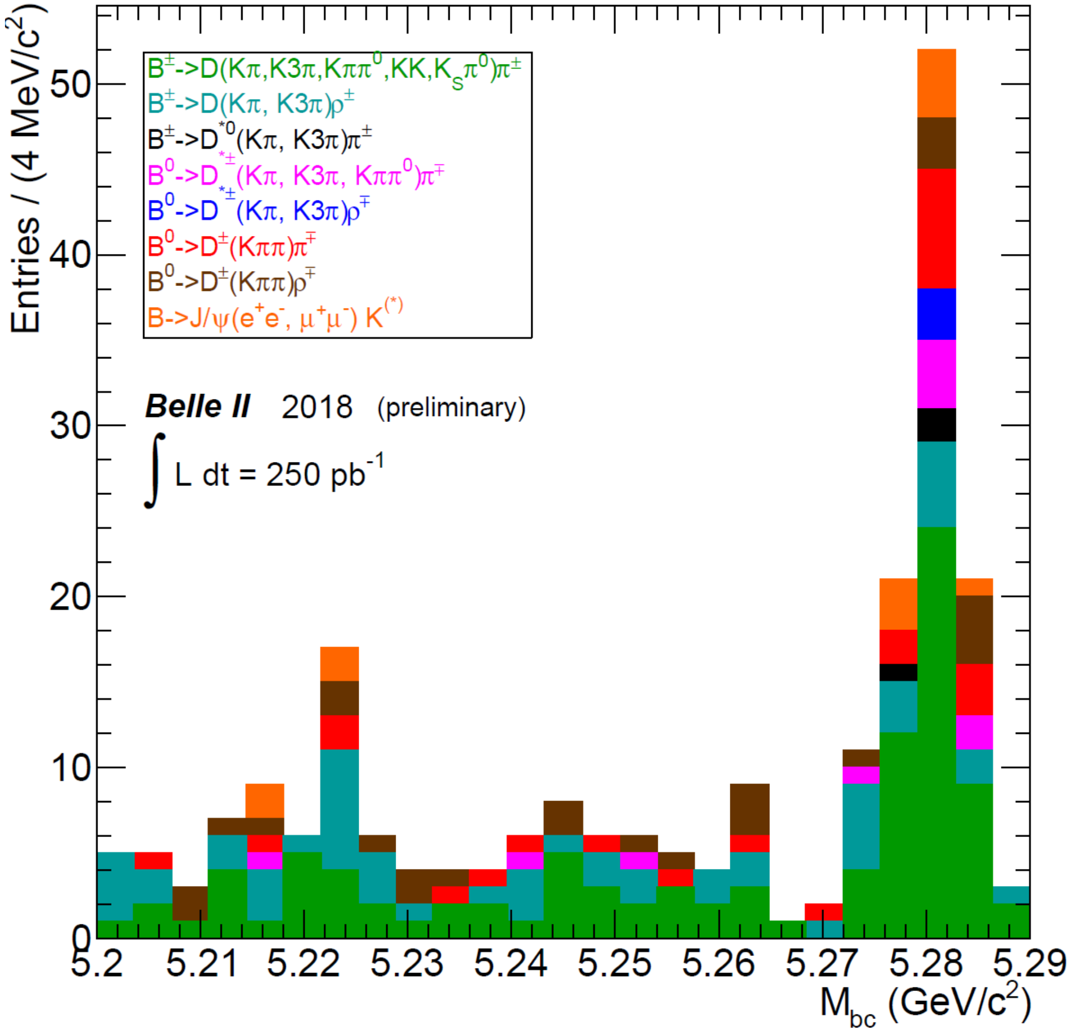
two weeks after first collisions



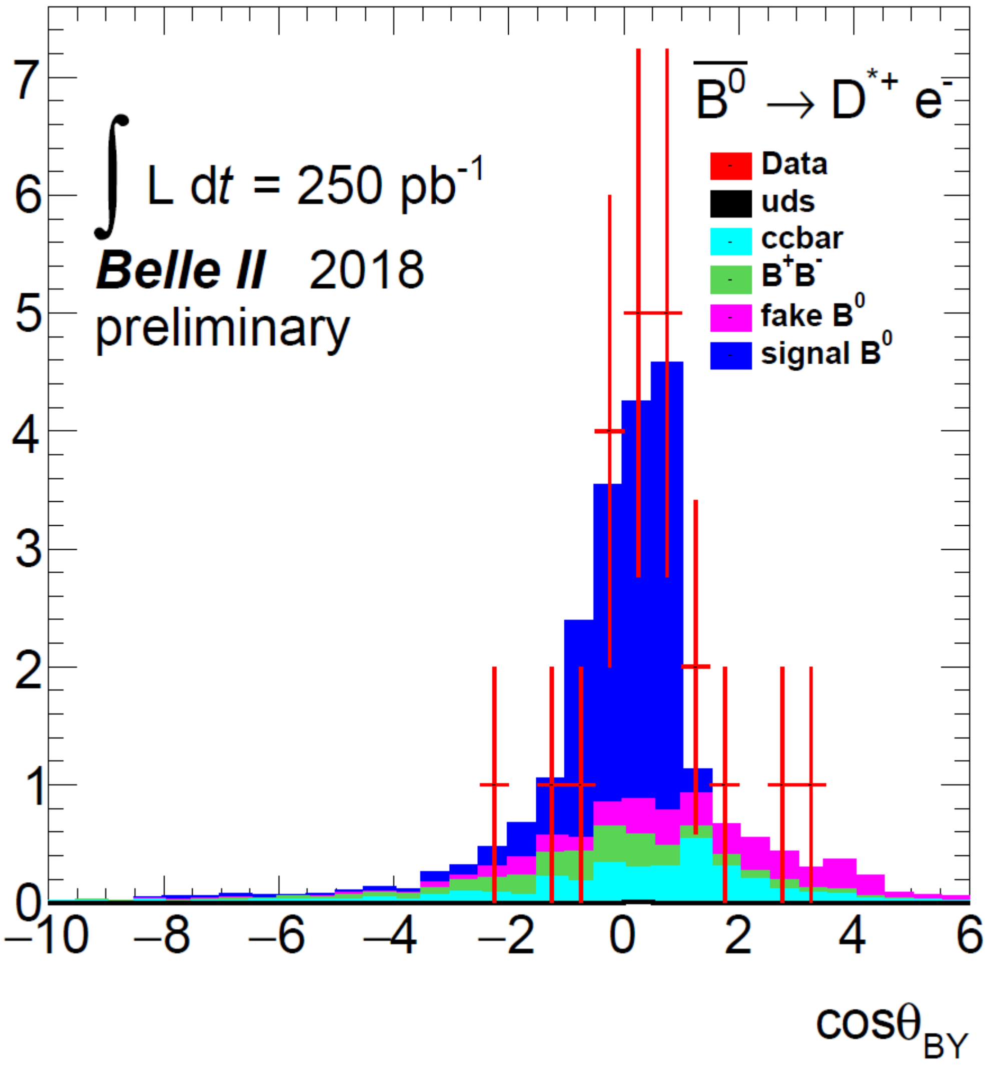
→ Thomas Hauth [464]: T1 Wed 11:30

B Mesons @ Belle II

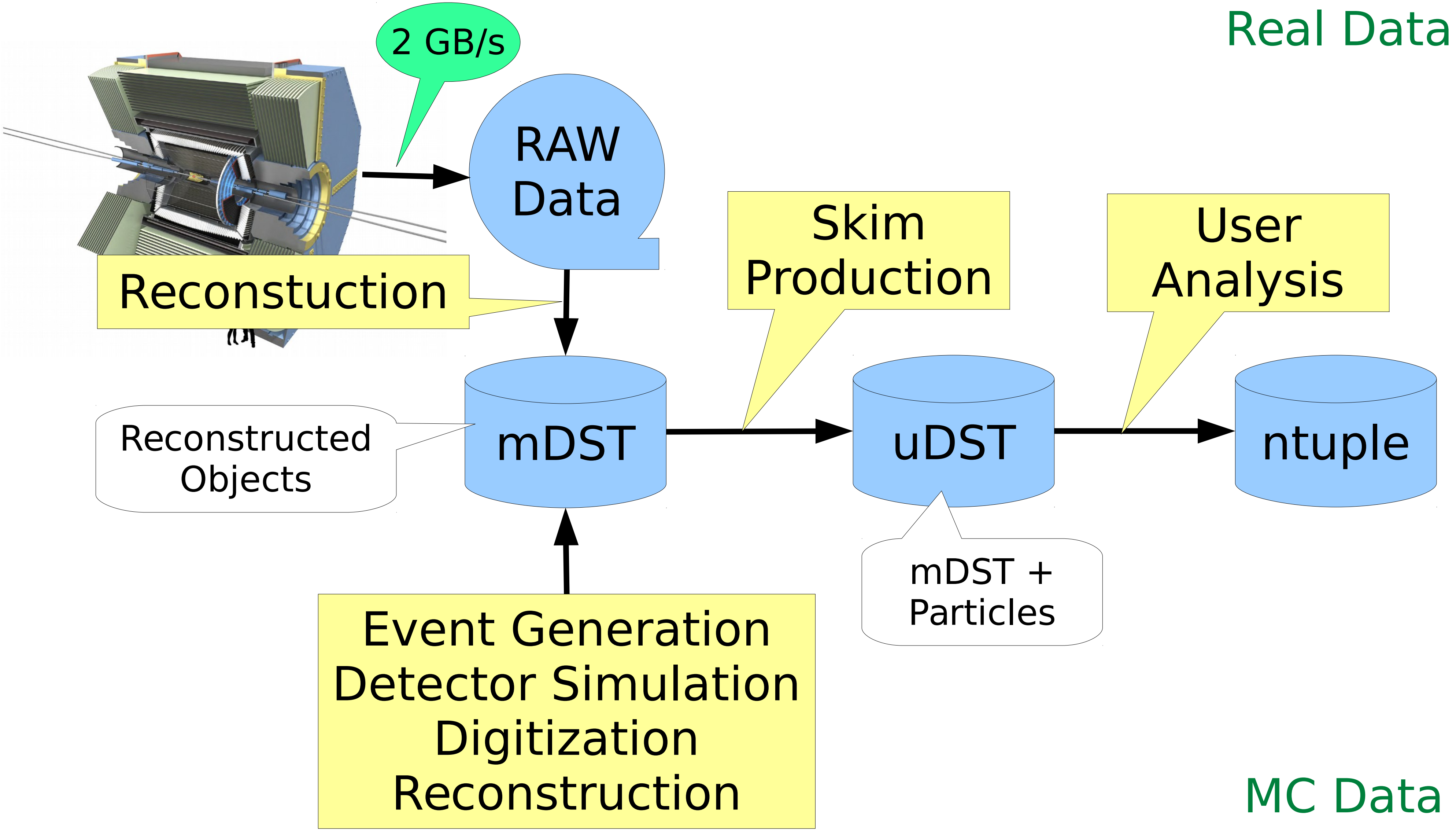
BELLE2-NOTE-PL-2018-020



BELLE2-NOTE-PL-2018-024



Data Flow



Real Data

2 GB/s

RAW Data

Reconstuction

Reconstructed Objects

mDST

Skim Production

uDST

mDST + Particles

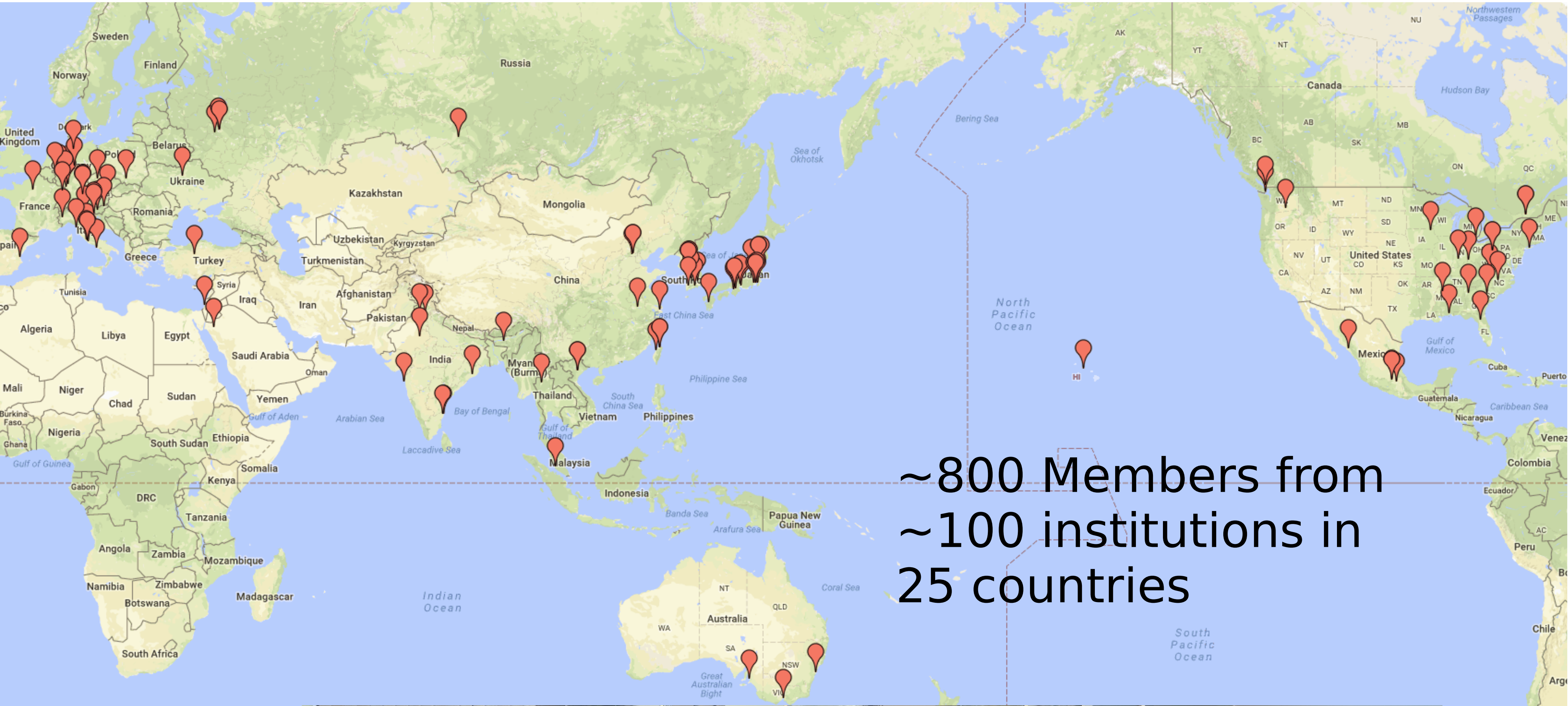
User Analysis

ntuple

Event Generation
Detector Simulation
Digitization
Reconstruction

MC Data

Belle II Collaboration

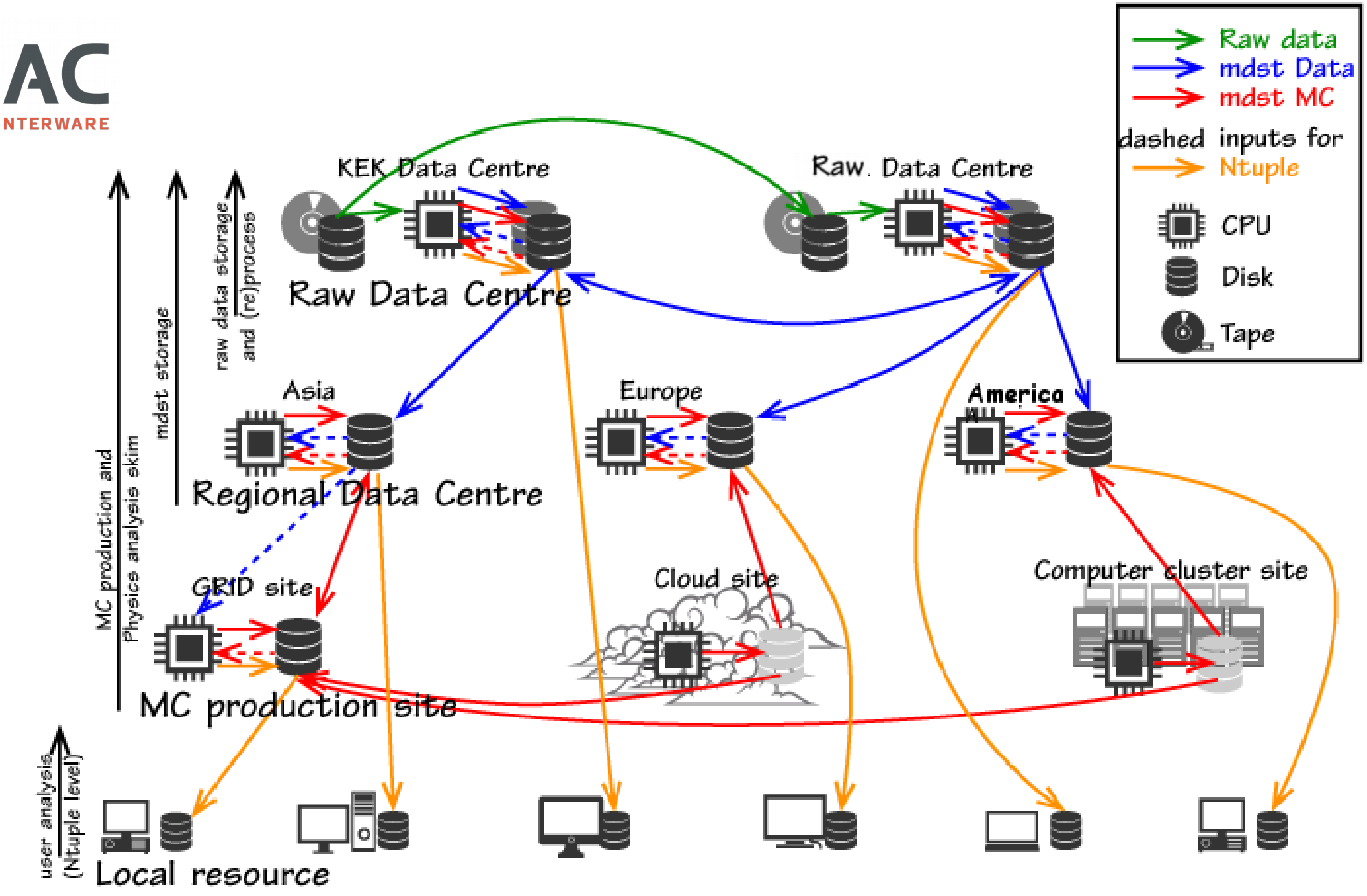


~800 Members from ~100 institutions in 25 countries

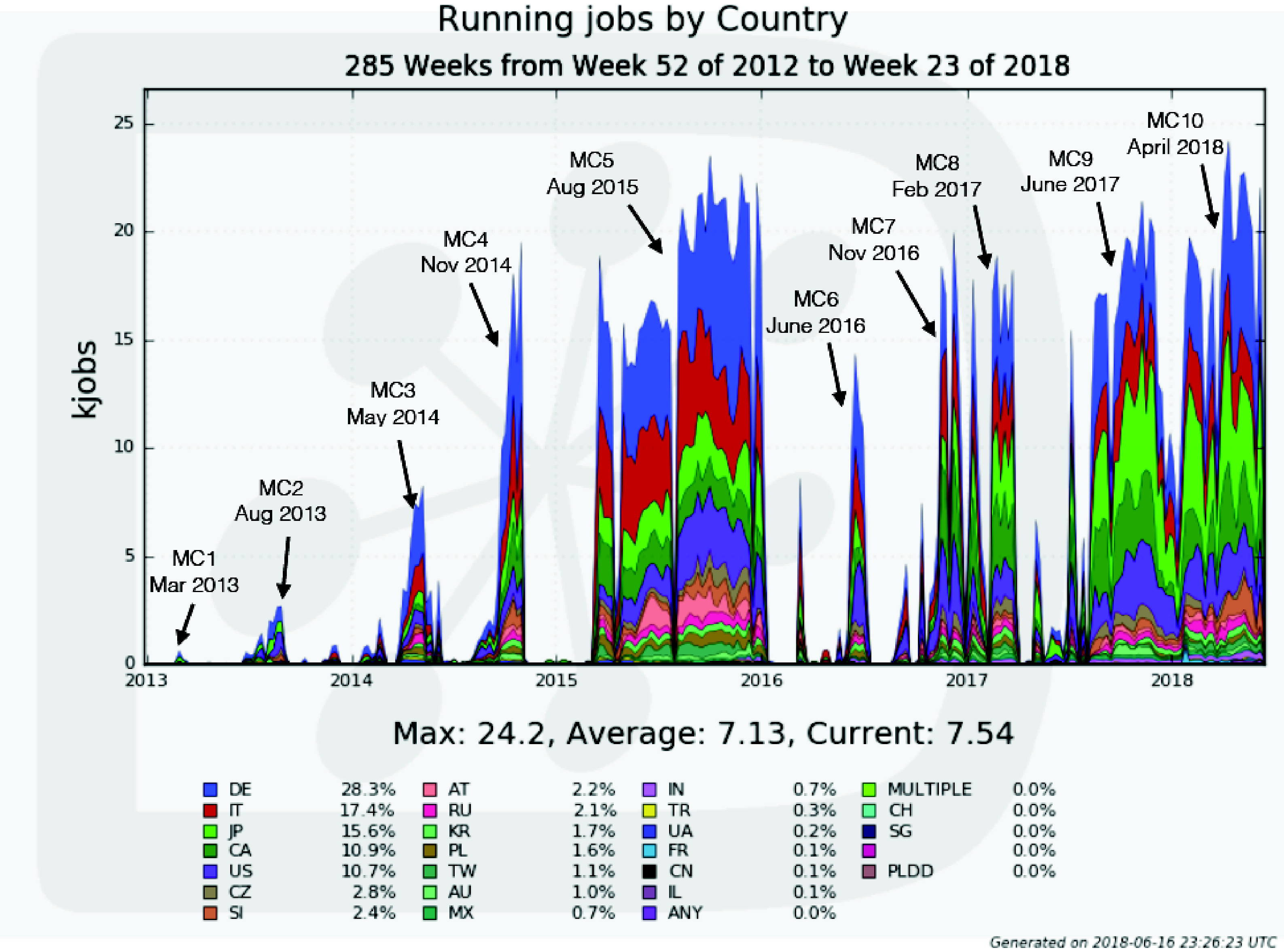
Computing

→ Yuji Kato [243]: T3, Tue 11:45
→ Silvio Pardi [593]: poster
→ Malachi Schram [434]: T4, Thu 12:00

- CVMFS
- FTS
- LFC
- AMGA



MC Production Campaigns

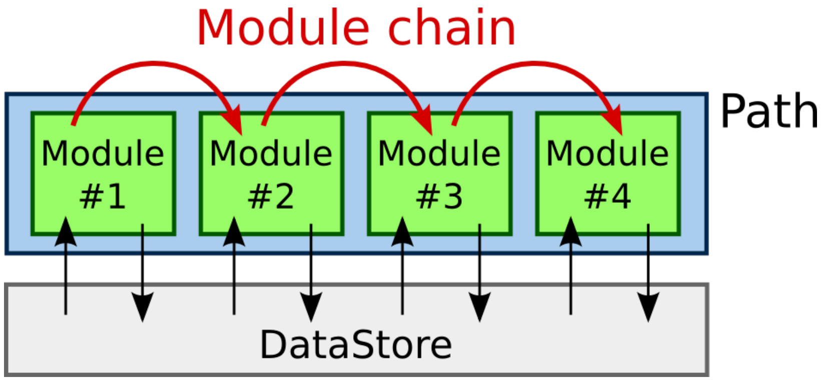


Software Framework: basf2

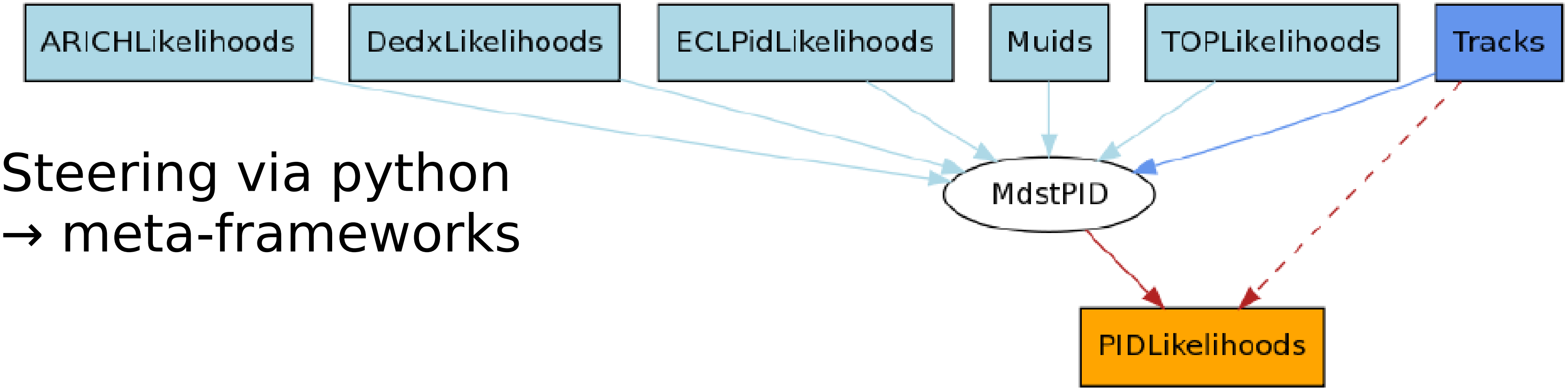
→ Thomas Hauth: PyHEP

- Used online and offline
- Dynamic loading of modules
- Data exchange via DataStore
- Relations
- Root I/O
- Belle data input (b2bii)

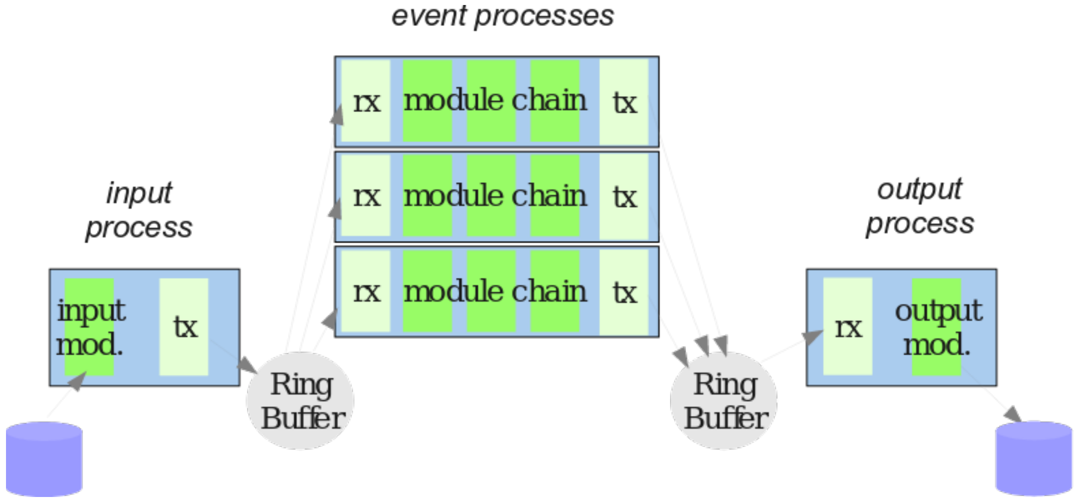
- Steering via python
  → meta-frameworks



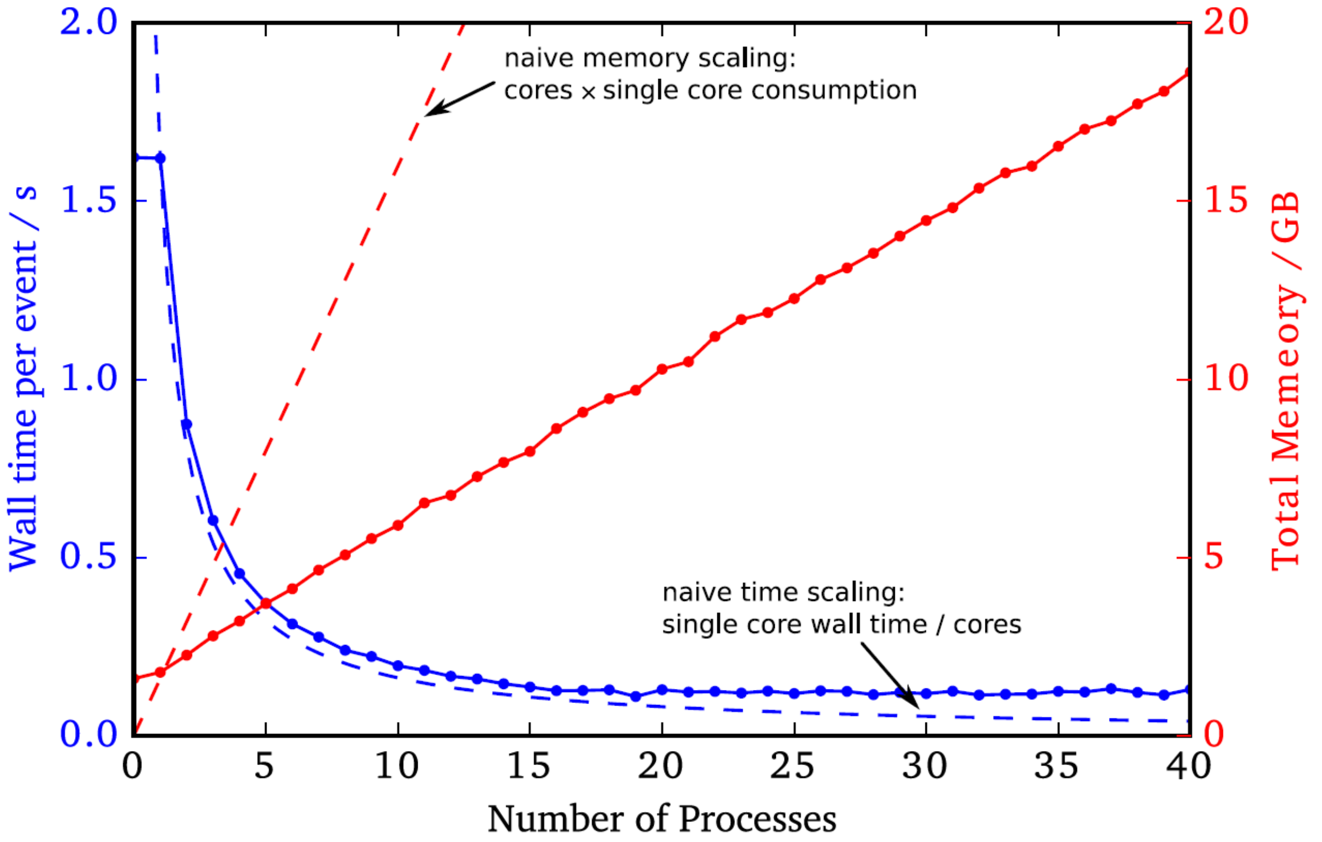
```
StoreArray<Track> tracks;
for (const Track& track: tracks) {
  const PIDLikelihood* pid =
    track->getRelated<PIDLikelihood>();
}
```



Parallel Processing



- Distribution of events to forked processes
- No thread-safety required
- Overhead from (de)serialization
- Memory saving due to copy on write



naive memory scaling:
cores × single core consumption

naive time scaling:
single core wall time / cores

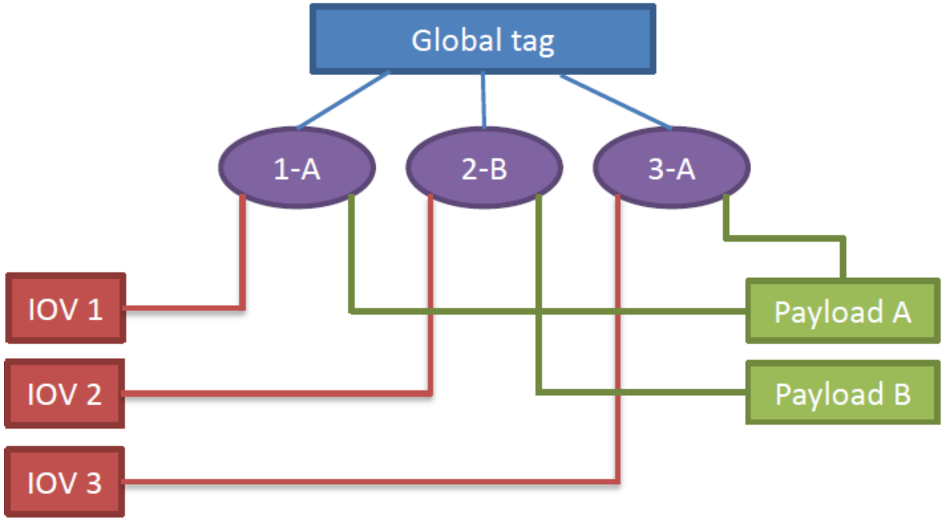
Conditions Database

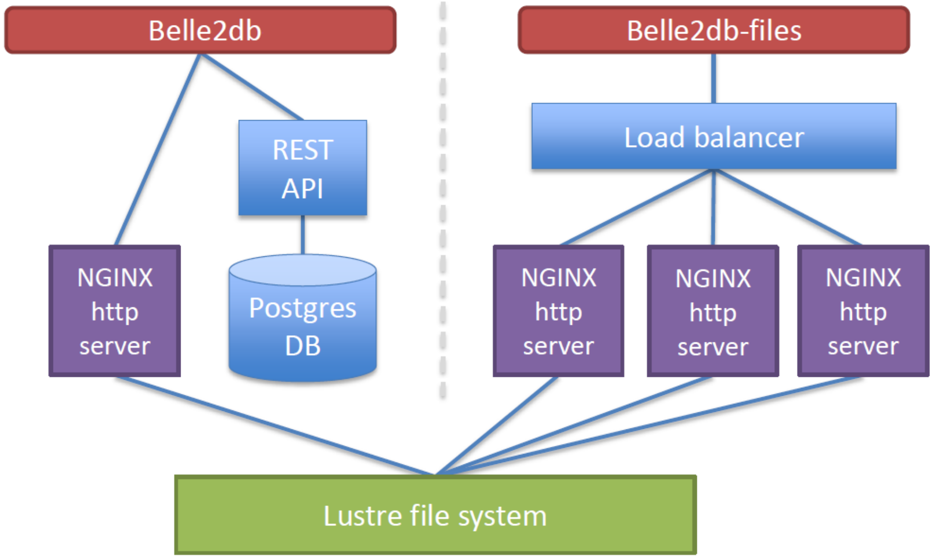
→ Lynn Wood [285]: T4 Tue 11:15

- User interface similar to DataStore interface

```
DBObjPtr<BeamParameters> beams;
double E = beams->getEnergy();
```

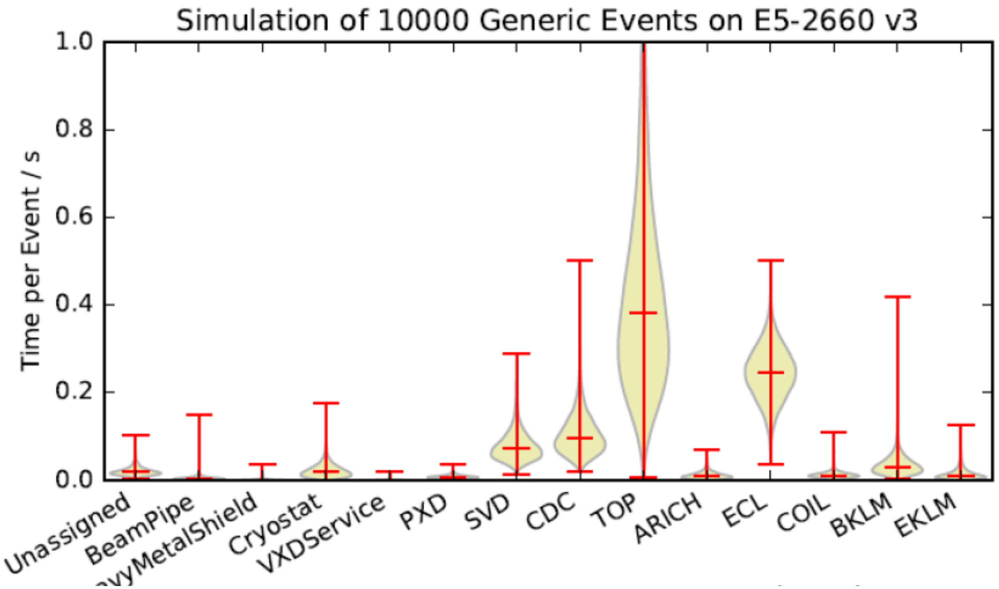
- Global tag: Assignments of intervals of validity (IoV) to payloads → Database
- Conditions data stored in objects in root files (payloads) → Provided via CVMFS or downloaded from server

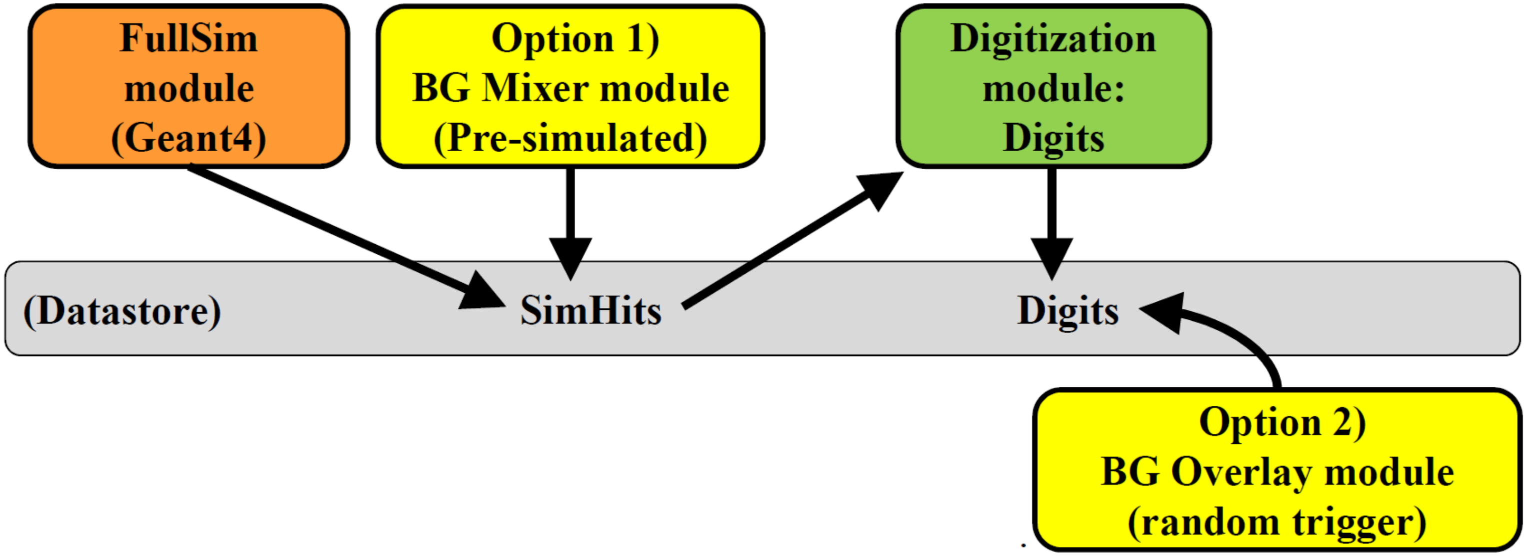




Simulation

- Event generators: EvtGen, KKMC, BABAYAGA.NLO, AAFH
- Detector geometry implemented in Geant4
- Machine background included via mixing or overlay




FullSim module (Geant4)

Option 1) BG Mixer module (Pre-simulated)

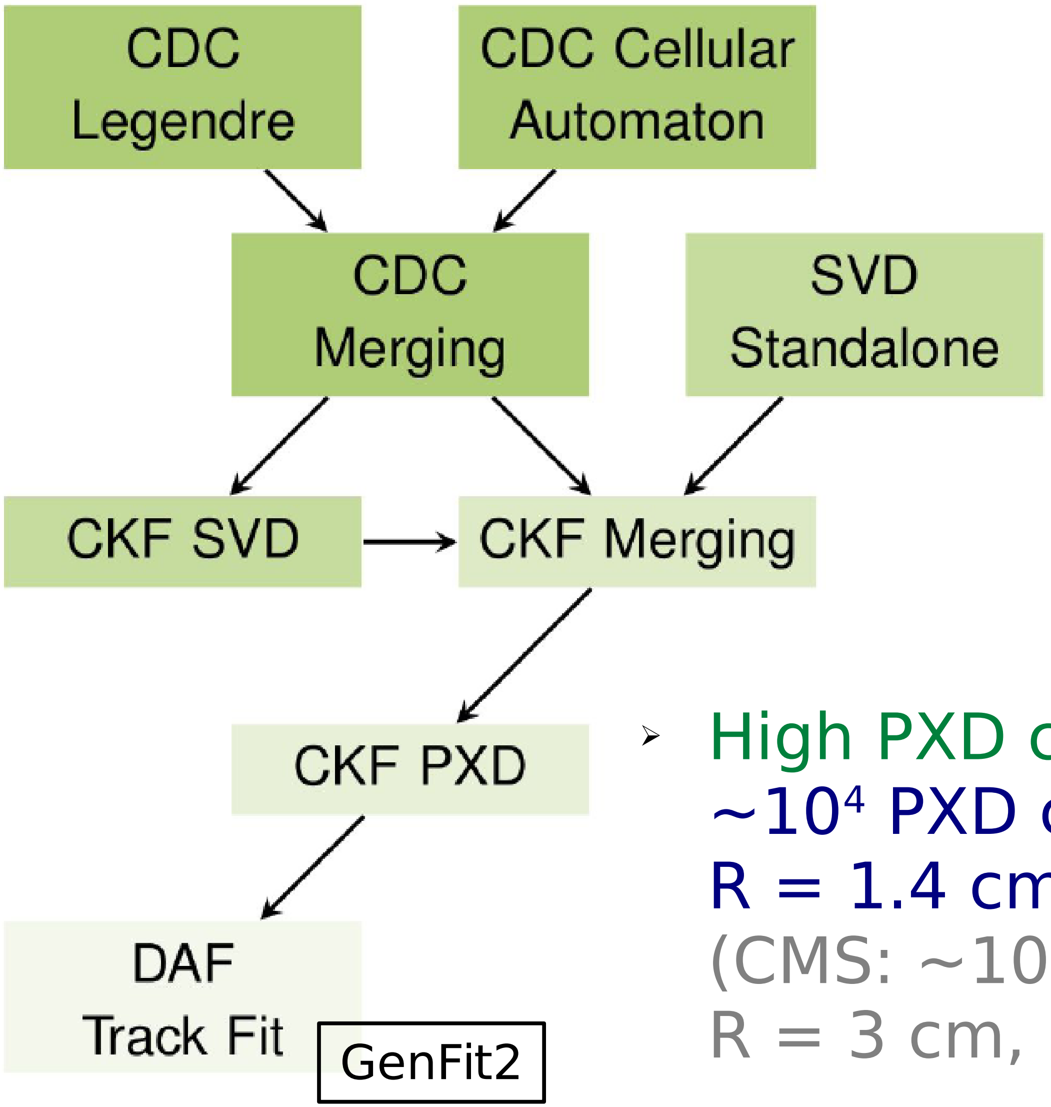
Digitization module: Digits

(Datastore) SimHits Digits

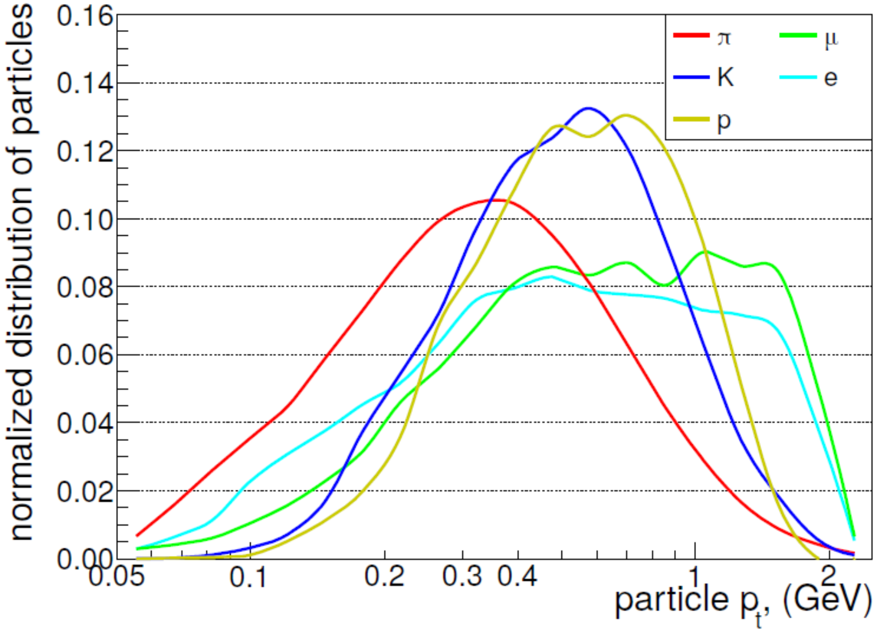
Option 2) BG Overlay module (random trigger)

Tracking

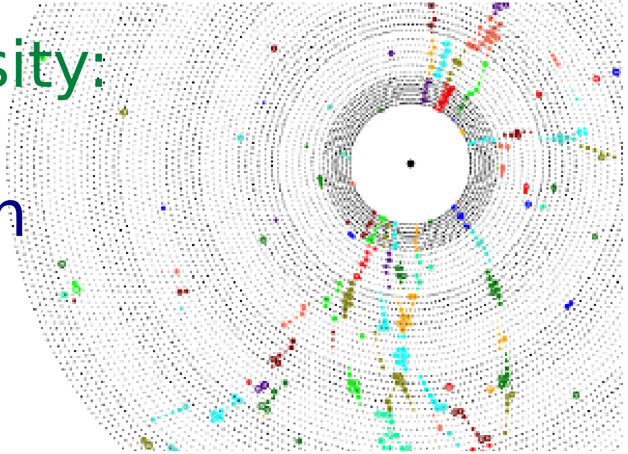
→ Thomas Hauth [463]: T2 Tue 15:00
→ Stefano Spataro [506]: T2 Tue 15:15



- Low momentum tracking



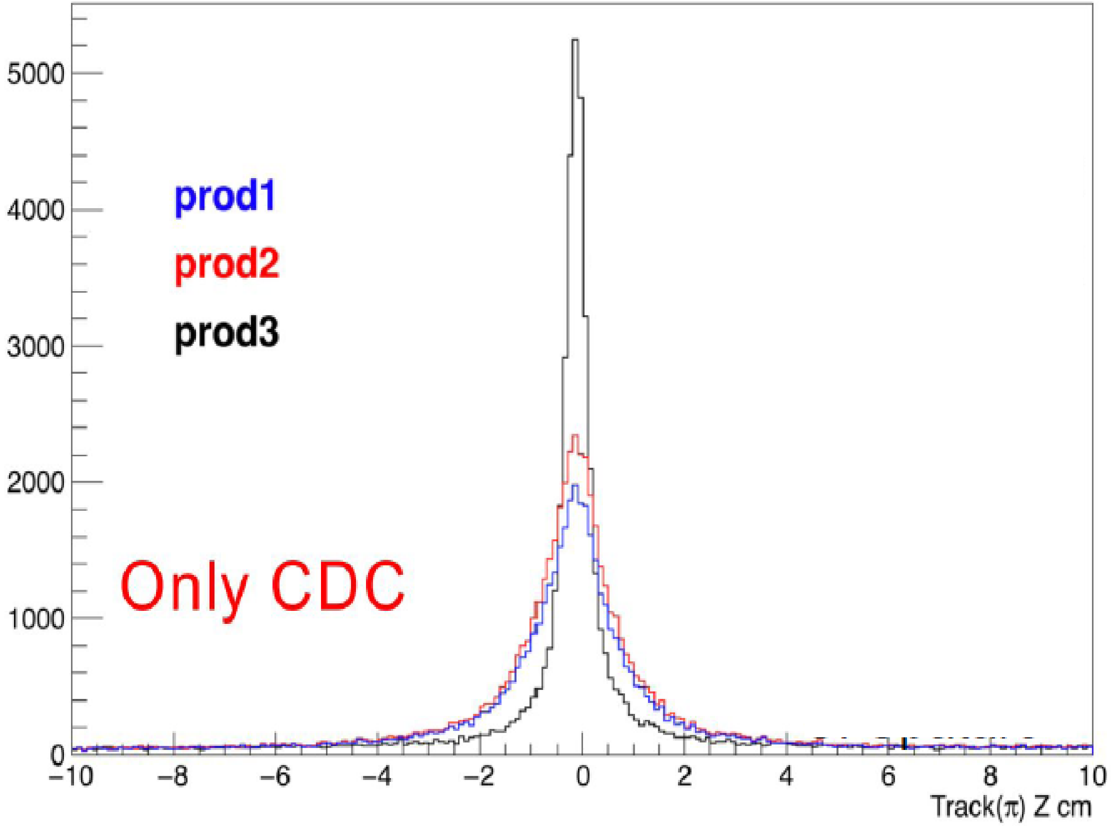
- High PXD cluster density: ~10^4 PXD clusters at R = 1.4 cm, L = 10 cm (CMS: ~10^3 tracks at R = 3 cm, L = 60 cm)



Alignment and Calibration

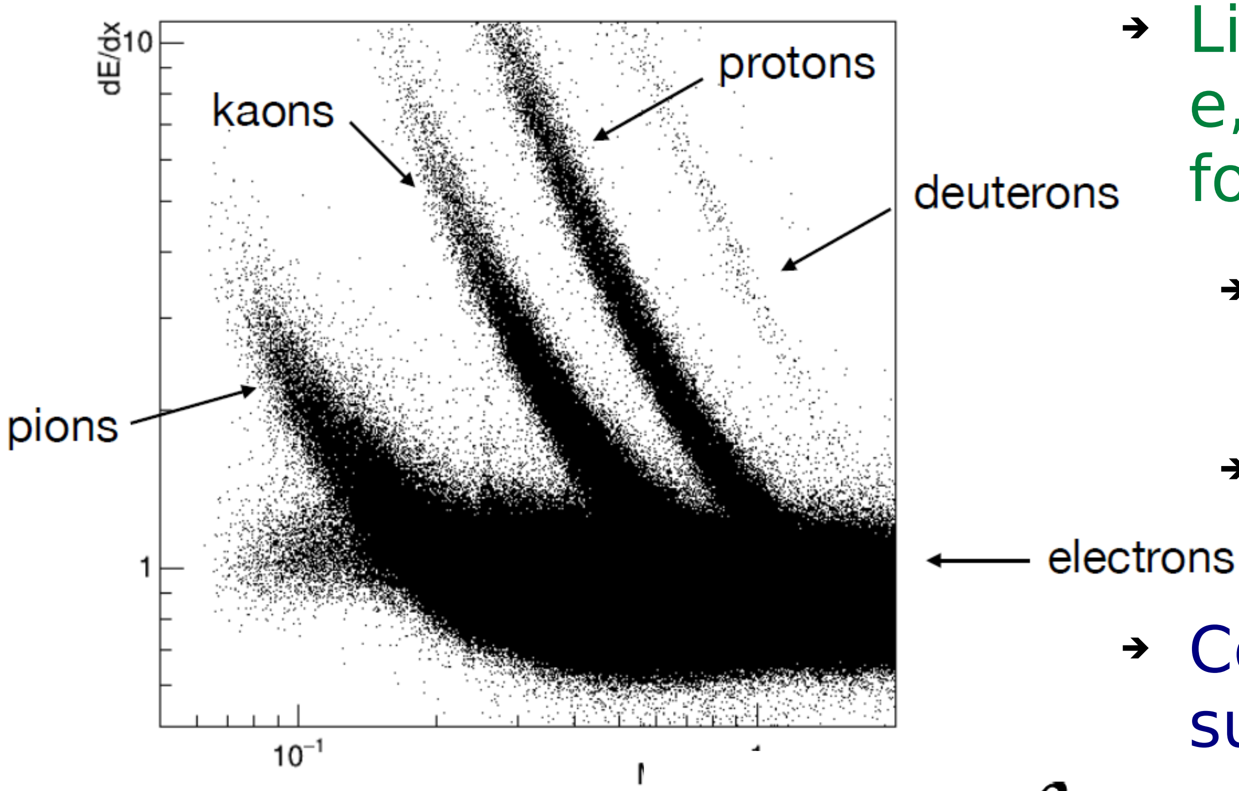
→ Tadeas Bilka [467]: T1 Tue 11:15
→ David Dosset [500]: poster

- Millepede for simultaneous alignment of multiple detectors
- Calibration Framework (CAF), automation with AirFlow



Particle Identification

→ Leo Piilonen [35]: poster

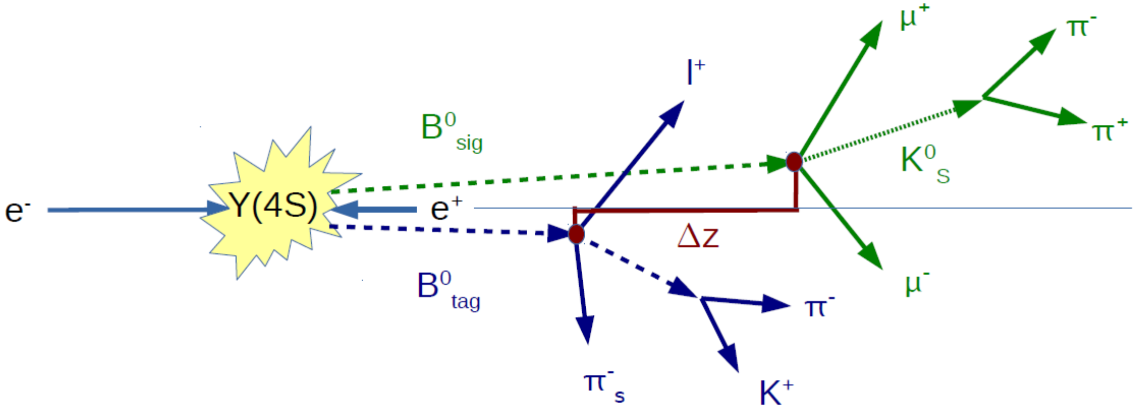


- Likelihoods for e, μ, π, K, p, d for each PID detector
  - Independent of analysis
  - Implemented by detector experts
- Combination of detectors: sum of log likelihoods

- Normalized LH: $p(i) = \frac{\mathcal{L}_i}{\sum_j \mathcal{L}_j}$

- Analysis and kinematic dependent priors to be implemented

Modular Analysis



```
inputMdst(...)

# create "mu+:loose" ParticleList (and c.c.)
stdLooseMu()

# create Ks -> pi+ pi- list from V0
# keep only candidates with 0.4 < M(pipi) < 0.6 GeV
fillParticleList('K_S0:pipi', '0.4 < M < 0.6')

# reconstruct J/psi -> mu+ mu- decay
# keep only candidates with 3.0 < M(mumu) < 3.2 GeV
reconstructDecay('J/psi:mumu -> mu+:loose mu-:loose', '3.0 < M < 3.2')

# reconstruct B0 -> J/psi Ks decay
# keep only candidates with 5.2 < M(J/PsiKs) < 5.4 GeV
reconstructDecay('B0:jspiks -> J/psi:mumu K_S0:pipi', '5.2 < M < 5.4')

# perform B0 kinematic vertex fit using only the mu+ mu-
# keep candidates only passing C.L. value of the fit > 0.0 (no cut)
vertexRave('B0:jspiks', 0.0, 'B0 -> [J/psi -> ^mu+ ^mu-] K_S0')

# build the rest of the event associated to the B0
buildRestOfEvent('B0:jspiks')

# perform MC matching (MC truth asociation)
matchMCTruth('B0:jspiks')

# calculate the Tag Vertex and Delta t (in ps)
# breco: type of MC association.
TagV('B0:jspiks', 'breco')

# create and fill flat Ntuple with MCTruth, kinematic information and D0 FlightInfo
toolsDST = ['EventMetaData', '^B0']
toolsDST += ['MCTruth', '^B0 -> [^J/psi -> ^mu+ ^mu-] [^K_S0 -> ^pi+ ^pi-]']
toolsDST += ['Vertex', '^B0 -> [^J/psi -> mu+ mu-] [^K_S0 -> pi+ pi-]']
toolsDST += ['DeltaT', '^B0']
toolsDST += ['MCDeltaT', '^B0']

# write out the flat ntuples
ntupleFile('B2A410-TagVertex.root')
ntupleTree('B0tree', 'B0:jspiks', toolsDST)
```

➢ Analysis on steering file level using decay strings

✔ Particle reconstruction and selection

✔ MC matching

✔ Vertex fits

✔ Flavor tagging

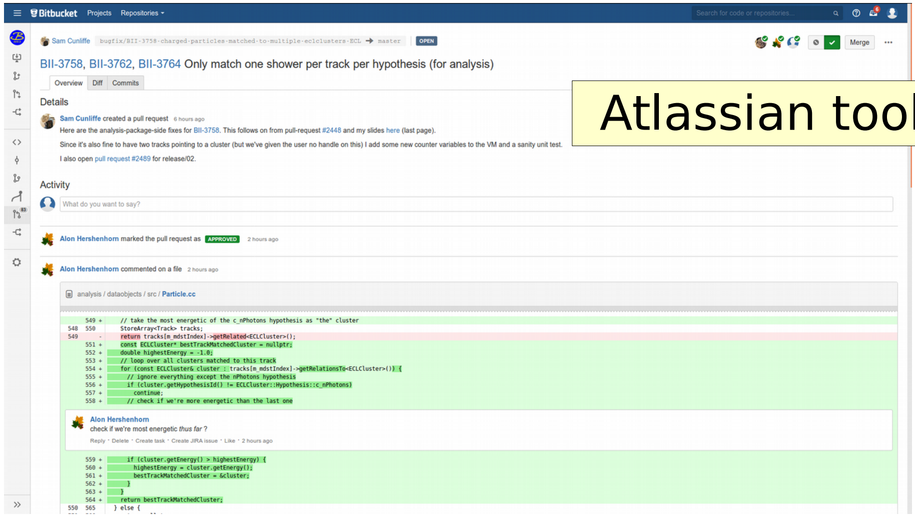
✔ Continuum suppression

→ Fernando Abudinen [31]: T6 Wed 12:00

→ Francesco Tenchini [405]: poster

Code Organization

- Tools: scripts for installation and environment setup
- Externals: products like ROOT, Geant4, EvtGen, etc.
- Software: Belle II code, mainly C++ (14) and Python 3
  - Librarians and authors of a package can push changes of it to master
  - Everybody can create a feature branch and make a pull request



Sam Cunliffe bugfix/BII-3758-charged-particles-matched-to-multiple-eclclusters-ECL → master OPEN

BII-3758, BII-3762, BII-3764 Only match one shower per track per hypothesis (for analysis)

Details

Sam Cunliffe created a pull request 6 hours ago

Here are the analysis-package-side fixes for BII-3758. This follows on from pull-request #2448 and my slides here (last page).

Since it's also fine to have two tracks pointing to a cluster (but we've given the user no handle on this) I add some new counter variables to the VM and a sanity unit test.

I also open pull request #2489 for release/02.

Activity

What do you want to say?

Alon Hershenhorn marked the pull request as APPROVED 2 hours ago

Alon Hershenhorn commented on a file 2 hours ago

analysis / dataobjects / src / Particle.cc

```
+   // take the most energetic of the c_nPhotons hypothesis as "the" cluster
    StoreArray<Track> tracks;
-   return tracks[m_mdstIndex]->getRelated<ECLCluster>();
+   const ECLCluster* bestTrackMatchedCluster = nullptr;
+   double highestEnergy = -1.0;
+   // loop over all clusters matched to this track
+   for (const ECLCluster& cluster : tracks[m_mdstIndex]->getRelationsTo<ECLCluster>()) {
+     // ignore everything except the nPhotons hypothesis
+     if (cluster.getHypothesisId() != ECLCluster::Hypothesis::c_nPhotons)
+       continue;
+     // check if we're more energetic than the last one
```

Alon Hershenhorn
check if we're most energetic *thus far* ?
Reply · Delete · Create task · Create JIRA issue · Like · 2 hours ago

```
+     if (cluster.getEnergy() > highestEnergy) {
+       highestEnergy = cluster.getEnergy();
+       bestTrackMatchedCluster = &cluster;
+     }
+   }
+   return bestTrackMatchedCluster;
  } else {
```

Atlassian tools

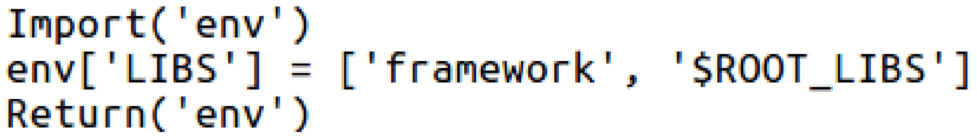
- About two major releases per year
- Automated monthly builds
- Light releases containing only packages for analysis

Available on CVMFS

Build System

- SCons
  - Configuration in python
  - 1-step build process
  - Parallel builds

➢ Only configuration needed is list of linked libraries

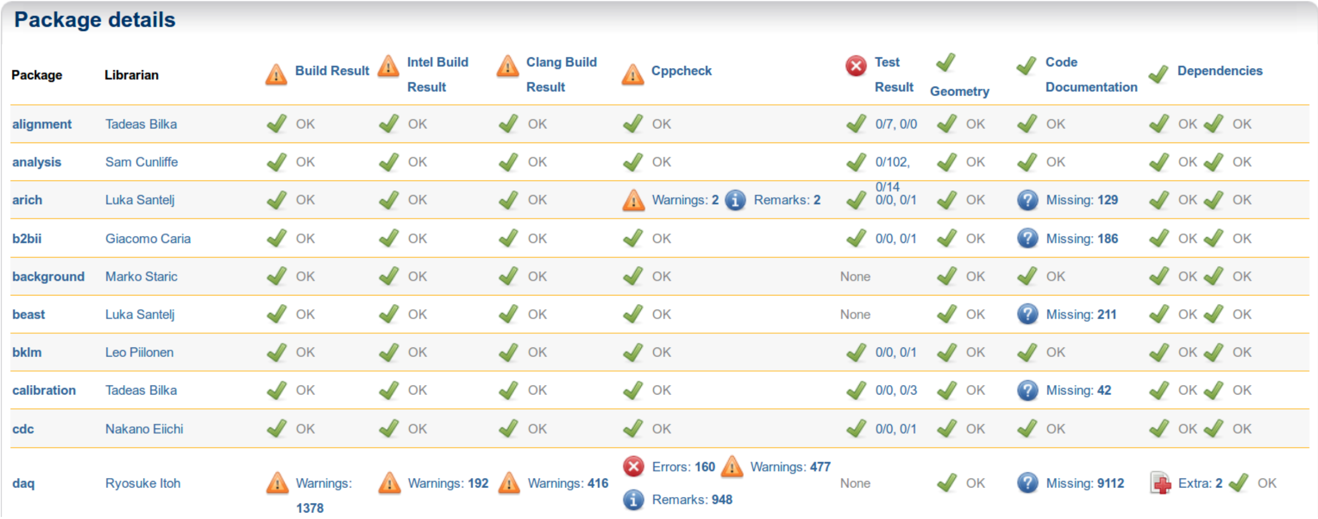


```
Import('env')
env['LIBS'] = ['framework', '$ROOT_LIBS']
Return('env')
```

➢ Everything else is done by folder name convention:
e.g. for libraries, modules, executables, tests, validation

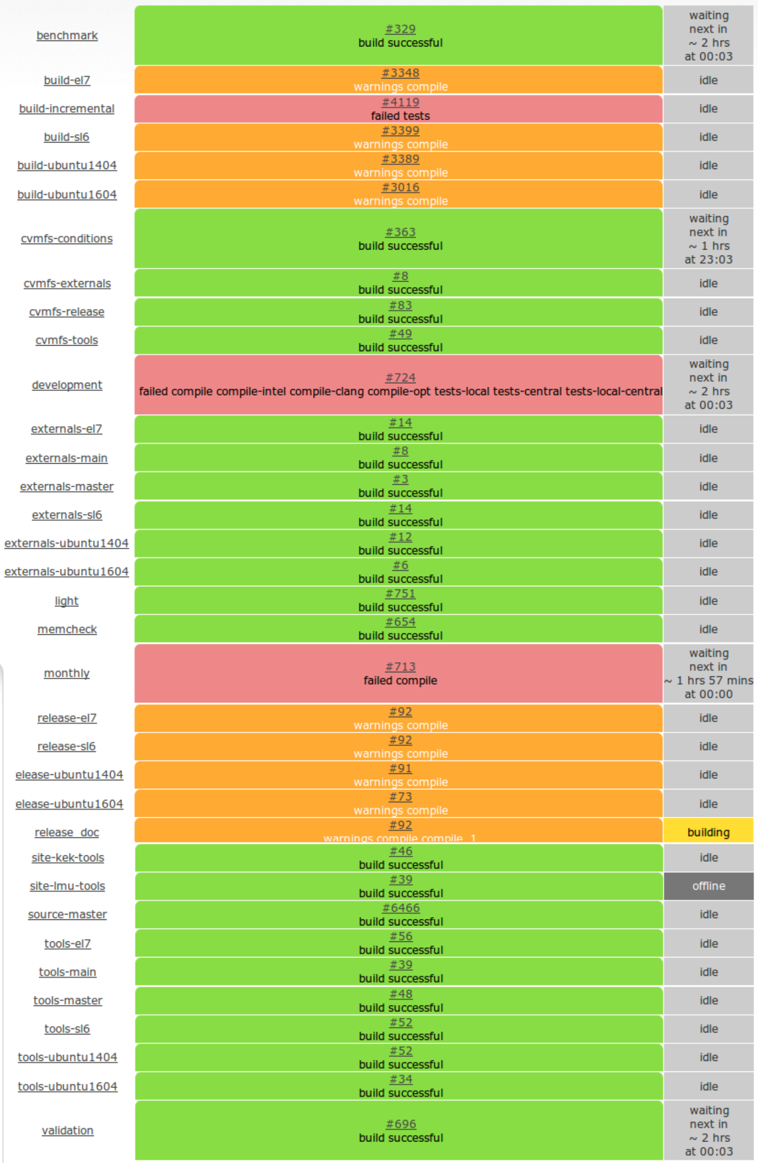
Software Quality

- Commit hooks (local and central): style (astyle/pep8), file size, access
- Unit and script tests
- Continuous integration (bamboo, buildbot)
- Automated nightly validation
- Release validation



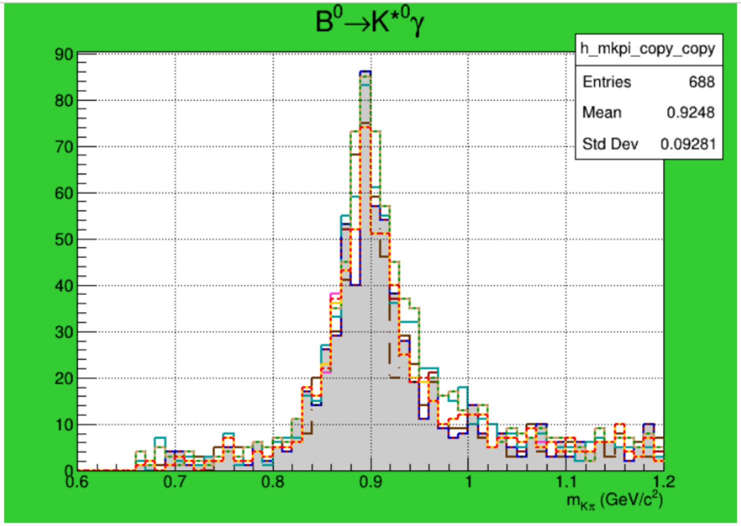
Package details

Package	Librarian	⚠ Build Result	⚠ Intel Build Result	⚠ Clang Build Result	⚠ Cppcheck	✗ Test Result	✓ Geometry	✓ Code Documentation	✓ Dependencies
alignment	Tadeas Bilka	✓ OK	✓ OK	✓ OK	✓ OK	✓ 0/7, 0/0	✓ OK	✓ OK	✓ OK ✓ OK
analysis	Sam Cunliffe	✓ OK	✓ OK	✓ OK	✓ OK	✓ 0/102, 0/14	✓ OK	✓ OK	✓ OK ✓ OK
arich	Luka Santelj	✓ OK	✓ OK	✓ OK	⚠ Warnings: 2 ℹ Remarks: 2	✓ 0/0, 0/1	✓ OK	? Missing: 129	✓ OK ✓ OK
b2bii	Giacomo Caria	✓ OK	✓ OK	✓ OK	✓ OK	✓ 0/0, 0/1	✓ OK	? Missing: 186	✓ OK ✓ OK
background	Marko Staric	✓ OK	✓ OK	✓ OK	✓ OK	None	✓ OK	✓ OK	✓ OK ✓ OK
beast	Luka Santelj	✓ OK	✓ OK	✓ OK	✓ OK	None	✓ OK	? Missing: 211	✓ OK ✓ OK
bklm	Leo Piilonen	✓ OK	✓ OK	✓ OK	✓ OK	✓ 0/0, 0/1	✓ OK	✓ OK	✓ OK ✓ OK
calibration	Tadeas Bilka	✓ OK	✓ OK	✓ OK	✓ OK	✓ 0/0, 0/3	✓ OK	? Missing: 42	✓ OK ✓ OK
cdc	Nakano Eiichi	✓ OK	✓ OK	✓ OK	✓ OK	✓ 0/0, 0/1	✓ OK	✓ OK	✓ OK ✓ OK
daq	Ryosuke Itoh	⚠ Warnings: 1378	⚠ Warnings: 192	⚠ Warnings: 416	✗ Errors: 160 ⚠ Warnings: 477 ℹ Remarks: 948	None	✓ OK	? Missing: 9112	Extra: 2 ✓ OK

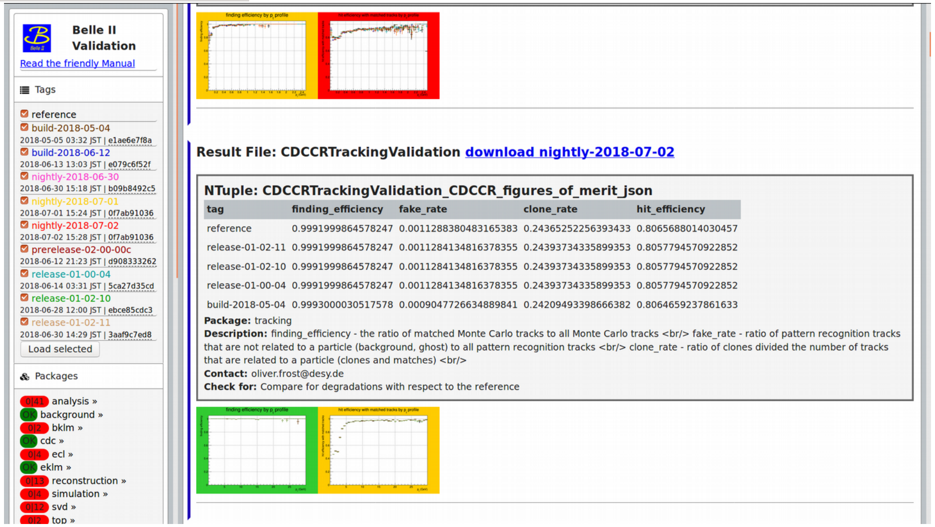


benchmark	#329 build successful	waiting next in ~ 2 hrs at 00:03
build-el7	#3348 warnings compile	idle
build-incremental	#4119 failed tests	idle
build-sl6	#3399 warnings compile	idle
build-ubuntu1404	#3389 warnings compile	idle
build-ubuntu1604	#3016 warnings compile	idle
cvmfs-conditions	#363 build successful	waiting next in ~ 1 hrs at 23:03
cvmfs-externals	#8 build successful	idle
cvmfs-release	#83 build successful	idle
cvmfs-tools	#49 build successful	idle
development	#724 failed compile compile-intel compile-clang compile-opt tests-local tests-central tests-local-central	waiting next in ~ 2 hrs at 00:03
externals-el7	#14 build successful	idle
externals-main	#8 build successful	idle
externals-master	#3 build successful	idle
externals-sl6	#14 build successful	idle
externals-ubuntu1404	#12 build successful	idle
externals-ubuntu1604	#6 build successful	idle
light	#751 build successful	idle
memcheck	#654 build successful	idle
monthly	#713 failed compile	waiting next in ~ 1 hrs 57 mins at 00:00
release-el7	#92 warnings compile	idle
release-sl6	#92 warnings compile	idle
elease-ubuntu1404	#91 warnings compile	idle
elease-ubuntu1604	#73 warnings compile	idle
release_doc	#92 warnings compile compile_1	building
site-kek-tools	#46 build successful	idle
site-lmu-tools	#39 build successful	offline
source-master	#6466 build successful	idle
tools-el7	#56 build successful	idle
tools-main	#39 build successful	idle
tools-master	#48 build successful	idle
tools-sl6	#52 build successful	idle
tools-ubuntu1404	#52 build successful	idle
tools-ubuntu1604	#34 build successful	idle
validation	#696 build successful	waiting next in ~ 2 hrs at 00:03

Validation and Monitoring



Package: analysis
Description: K#pi invariant mass distrubtion of K*(892)^{0} from B0 -> K*0 gamma
ROOT file: 1110021001_Validation.root
Chi^2 Test: Performed Chi^2-Test between reference and nightly-2018-07-02 (Chi^2 = 28.571377896011814 NDF = 52 Chi^2/NDF = 0.5494495749233042)
Comparison p-value: 0.9966211678976623 (Warning below 0.7 | Error below 0.05)
Contact: S. Cunliffe (sam.cunliffe@desy.de), S. Sandilya (saurabhsandilya@gmail.com), M. Schram (malachi.schram@desy.de)
Check for: Distribution should be a Breit-Wigner shape centred at 0.896 GeV/c^{2}.


Belle II
Belle II Validation
Read the friendly Manual
Tags
Load selected
Packages
finding efficiency by p_t profile
hit efficiency with matched tracks by p_t profile

☑ reference
☑ build-2018-05-04
2018-05-05 03:32 JST | e1ae6e7f8a
☑ build-2018-06-12
2018-06-13 13:03 JST | e079c6f52f
☑ nightly-2018-06-30
2018-06-30 15:18 JST | b09b8492c5
☑ nightly-2018-07-01
2018-07-01 15:24 JST | 0f7ab91036
☑ nightly-2018-07-02
2018-07-02 15:28 JST | 0f7ab91036
☑ prerelease-02-00-00c
2018-06-12 21:23 JST | d908333262
☑ release-01-00-04
2018-06-14 03:31 JST | 5ca27d35cd
☑ release-01-02-10
2018-06-28 12:00 JST | ebce85cdc3
☑ release-01-02-11
2018-06-30 14:29 JST | 3aaf9c7ed8

0|41 analysis »
OK background »
0|2 bklm »
OK cdc »
0|4 ecl »
OK eklm »
0|13 reconstruction »
0|4 simulation »
0|12 svd »
0|2 top »

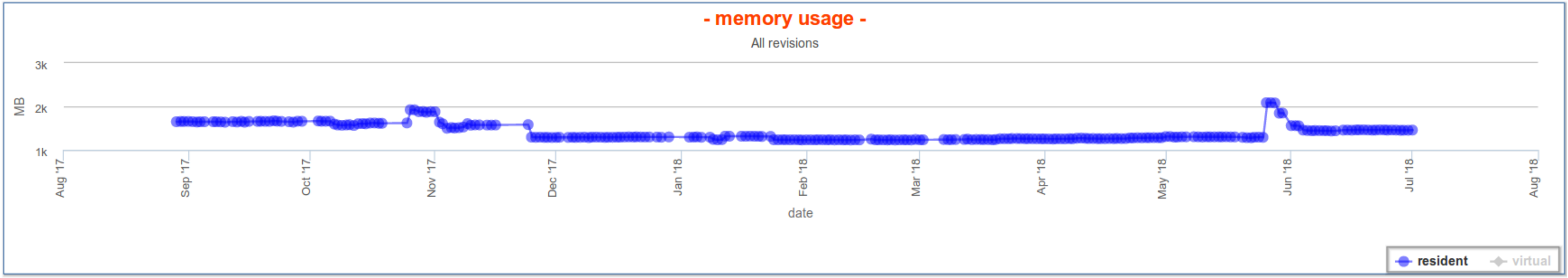
Result File: CDCCRTrackingValidation download nightly-2018-07-02

NTuple: CDCCRTrackingValidation_CDCCR_figures_of_merit_json

tag	finding_efficiency	fake_rate	clone_rate	hit_efficiency
reference	0.9991999864578247	0.0011288380483165383	0.24365252256393433	0.8065688014030457
release-01-02-11	0.9991999864578247	0.0011284134816378355	0.24393734335899353	0.8057794570922852
release-01-02-10	0.9991999864578247	0.0011284134816378355	0.24393734335899353	0.8057794570922852
release-01-00-04	0.9991999864578247	0.0011284134816378355	0.24393734335899353	0.8057794570922852
build-2018-05-04	0.9993000030517578	0.0009047726634889841	0.24209493398666382	0.8064659237861633

Package: tracking
Description: finding_efficiency - the ratio of matched Monte Carlo tracks to all Monte Carlo tracks <br/> fake_rate - ratio of pattern recognition tracks that are not related to a particle (background, ghost) to all pattern recognition tracks <br/> clone_rate - ratio of clones divided the number of tracks that are related to a particle (clones and matches) <br/>
Contact: oliver.frost@desy.de
Check for: Compare for degradations with respect to the reference

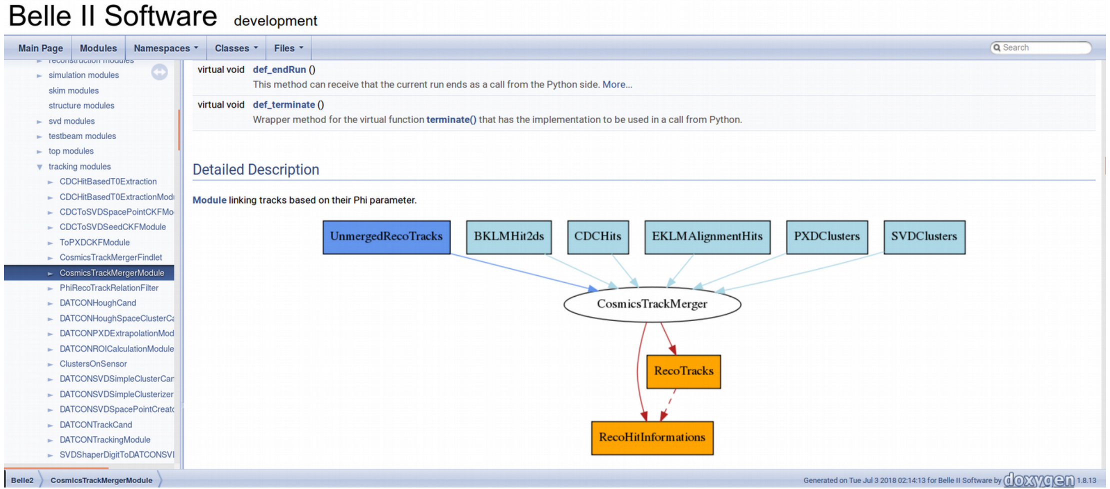
Software Quality Shifts



Documentation

→ Martin Ritter [589]: poster

- Doxygen
  - Automated check for missing documentation
  - Not well suited for python code
- TWiki → Confluence
- Migration to Sphinx
- Askbot for user support
- StarterKit (w/ jupyter)
- Documentation and Training group



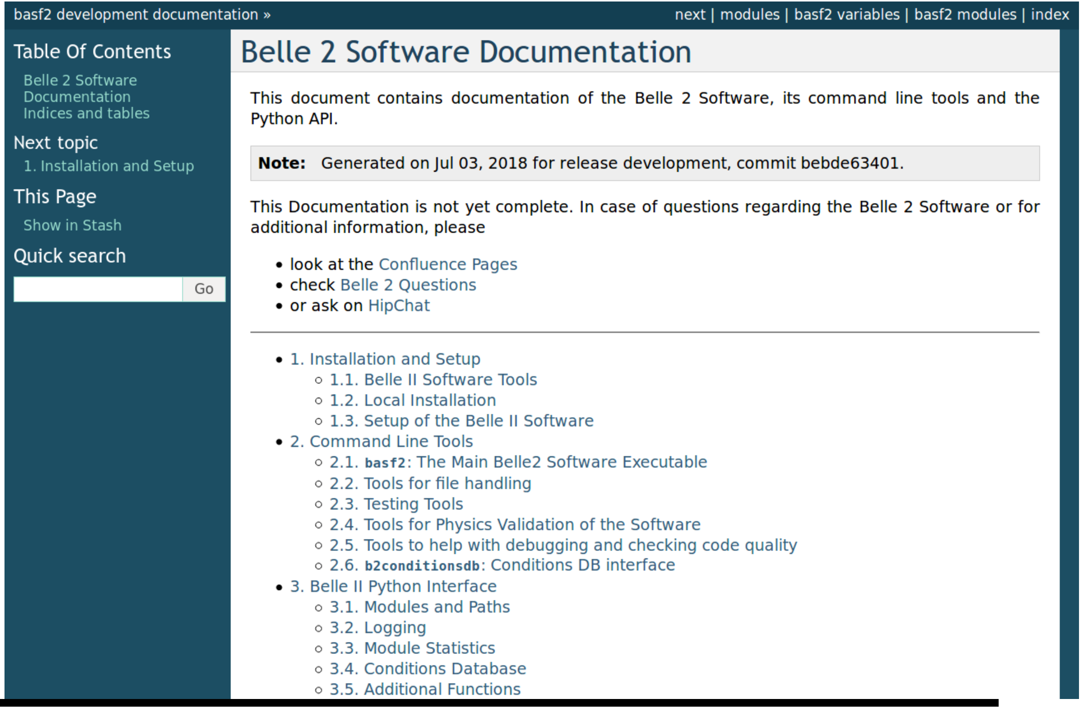
virtual void def_endRun ()
This method can receive that the current run ends as a call from the Python side. More...

virtual void def_terminate ()
Wrapper method for the virtual function terminate() that has the implementation to be used in a call from Python.

Detailed Description

Module linking tracks based on their Phi parameter.

Generated on Tue Jul 3 2018 02:14:13 for Belle II Software by doxygen 1.8.13


basf2 development documentation »
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Belle 2 Software Documentation

This document contains documentation of the Belle 2 Software, its command line tools and the Python API.

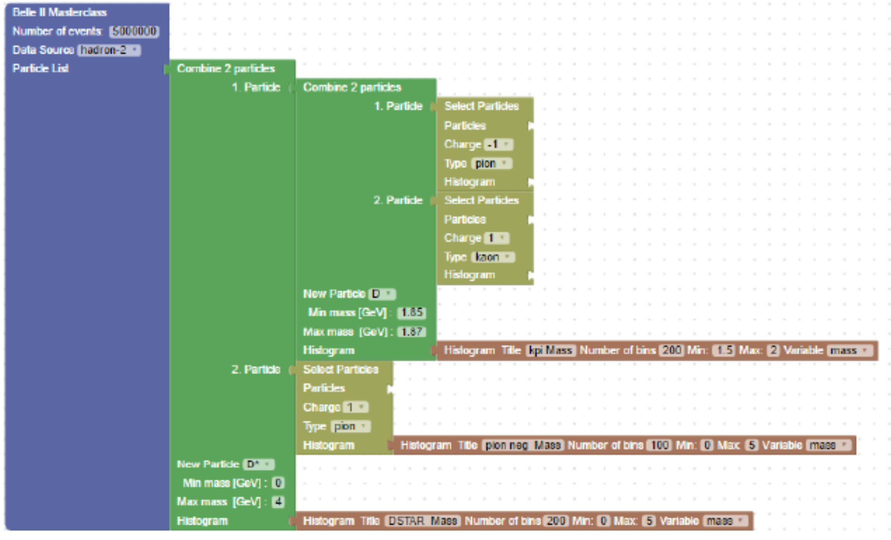
Note: Generated on Jul 03, 2018 for release development, commit bebde63401.

This Documentation is not yet complete. In case of questions regarding the Belle 2 Software or for additional information, please

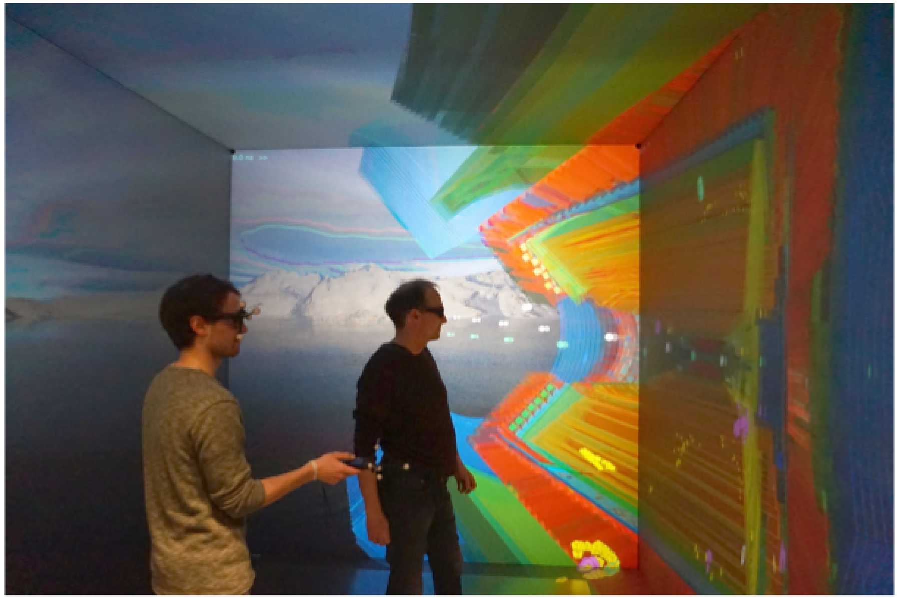
- look at the Confluence Pages
- check Belle 2 Questions
- or ask on HipChat

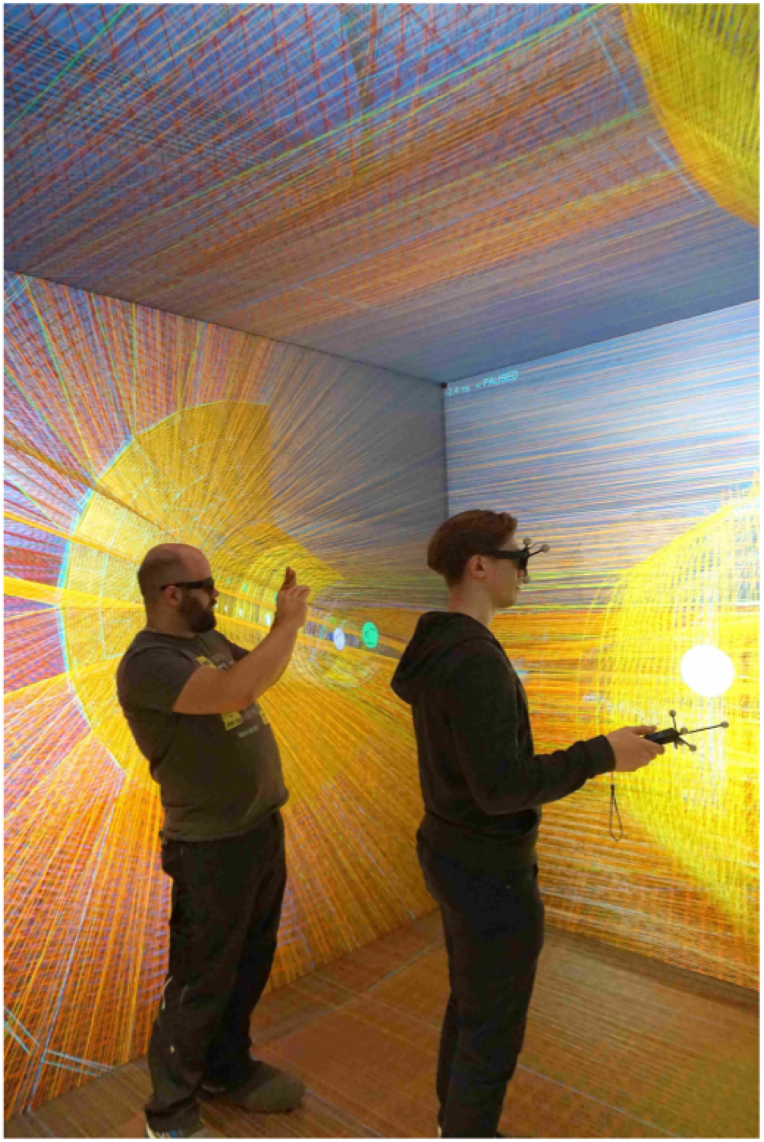
Outreach

→ Michael Bender [91]: T2 Thu 14:30
→ Leo Piilonen [36]: poster
→ Rok Pestotnik [235]: poster



```
Belle II Masterclass
Number of events: 5000000
Data Source hadron-2
Particle List   Combine 2 particles
                  1. Particle   Combine 2 particles
                                  1. Particle   Select Particles
                                                Particles
                                                Charge -1
                                                Type pion
                                                Histogram
                                  2. Particle   Select Particles
                                                Particles
                                                Charge 1
                                                Type kaon
                                                Histogram
                                New Particle D
                                 Min mass [GeV] : 1.85
                                Max mass [GeV] : 1.87
                                Histogram       Histogram Title kpi Mass Number of bins 200 Min: 1.5 Max: 2 Variable mass
                  2. Particle   Select Particles
                                Particles
                                Charge 1
                                Type pion
                                Histogram       Histogram Title pion neg Mass Number of bins 100 Min: 0 Max 5 Variable mass
                New Particle D*
                 Min mass [GeV] : 0
                Max mass [GeV] : 4
                Histogram       Histogram Title DSTAR Mass Number of bins 200 Min: 0 Max: 5 Variable mass
```





Where Can We Still Improve?

- ✗ Documentation
- ✗ Global tag management procedures
- ✗ Release validation
- ✗ License
- ✗ Integration with online and distributed computing system
- ✗ Interaction with community
- ✗ Publications

Lessons Learned: What is Important?

- Skilled and motivated people and good communication
- Developers identify with the project and care about its success
  → open development processes
  → low threshold for contributions
  → sharing of responsibility
- Developers do not identify with their own code too much, but see it as contribution to a collaborative effort
  → pull request workflow
  → clear and commonly accepted rules and procedures

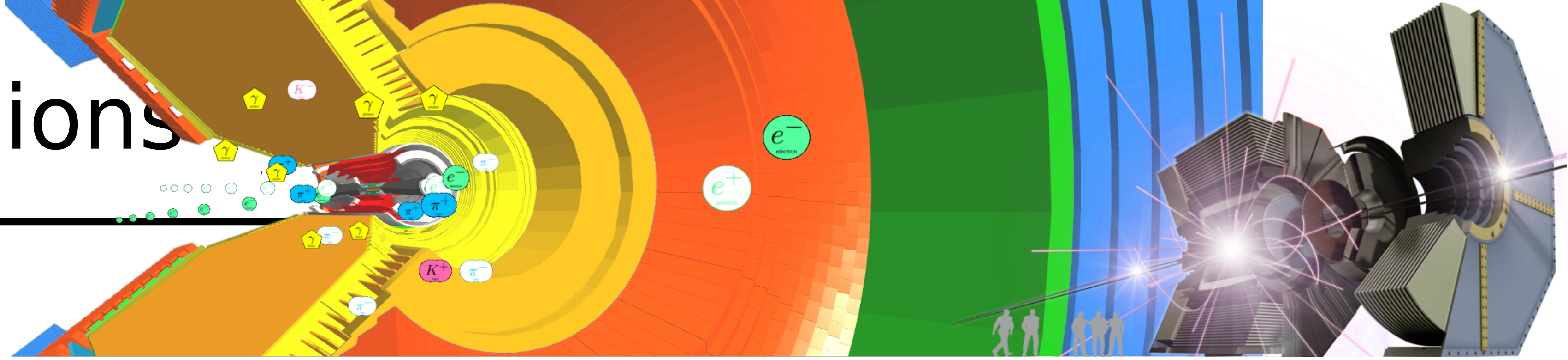
Lessons Learned: What is Important?

- Make it easy to contribute
  → easy installation and development on different systems
  → everybody can make pull requests
  → make it easy to follow rules
  → quick feedback

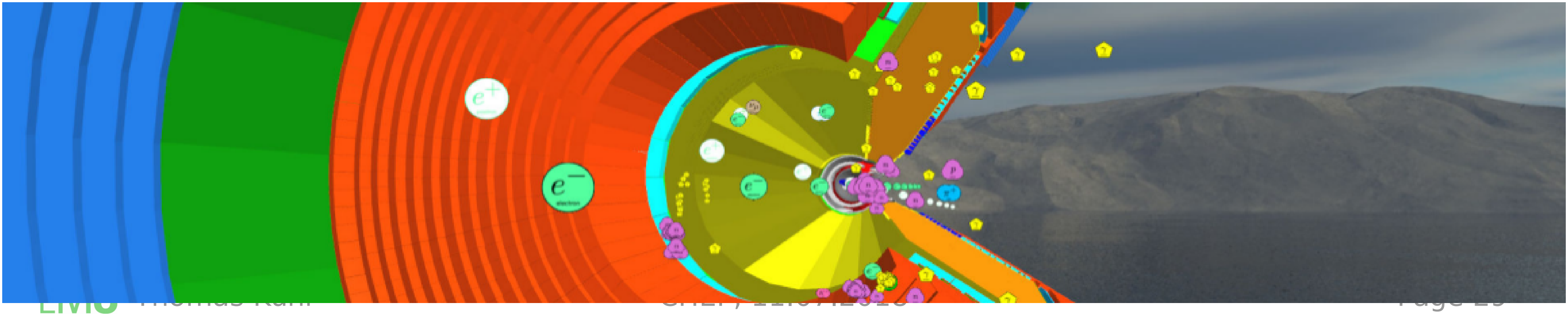
- Pay attention to code quality, resource usage, documentation, and validation
  → continuous integration with automated tests
  → pull request reviews
  → release validation procedures

- Make it easy to use
  → take users perspective
  → effective user communication channels

Conclusions



- Exciting physics potential with 50 ab^{-1} at Belle II
- Now in transition from simulation only to real data
  → Quick reaction on valuable feedback from first data
  → Very successful in providing first data for analysis
- Challenge: Keep skilled and motivated team for software development and support
- Looking forward to address challenges in collaboration with community



Backup

What Worked Well?

✔ Procedures for contributions from developers with different levels of skills and engagement
→ Pull request workflows

✔ Continuous integration and build processes

✔ Support of different linux versions

✔ Distribution via precompiled binaries and CVMFS

✔ SCons based build system

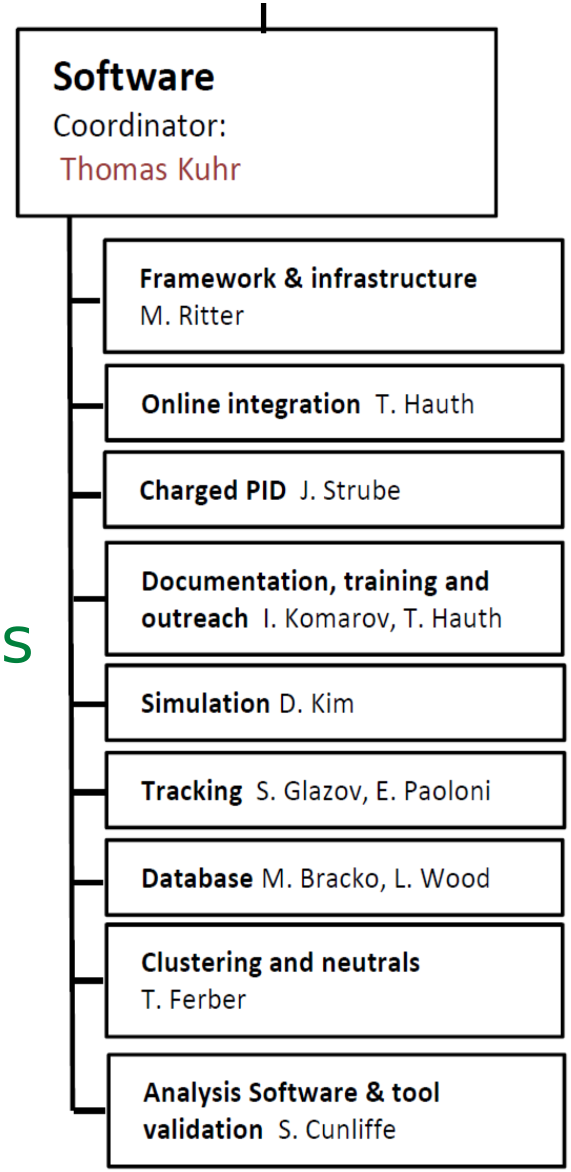
✔ Migration from svn to git

✔ Software framework

✔ Modular analysis

Software Group Structure

- Subgroups
- Liaisons with detector groups
- Librarians
- Contributions from O(300) individuals



Software Coordinator: Thomas Kuhr

Framework & infrastructure M. Ritter

Online integration T. Hauth

Charged PID J. Strube

Documentation, training and outreach I. Komarov, T. Hauth

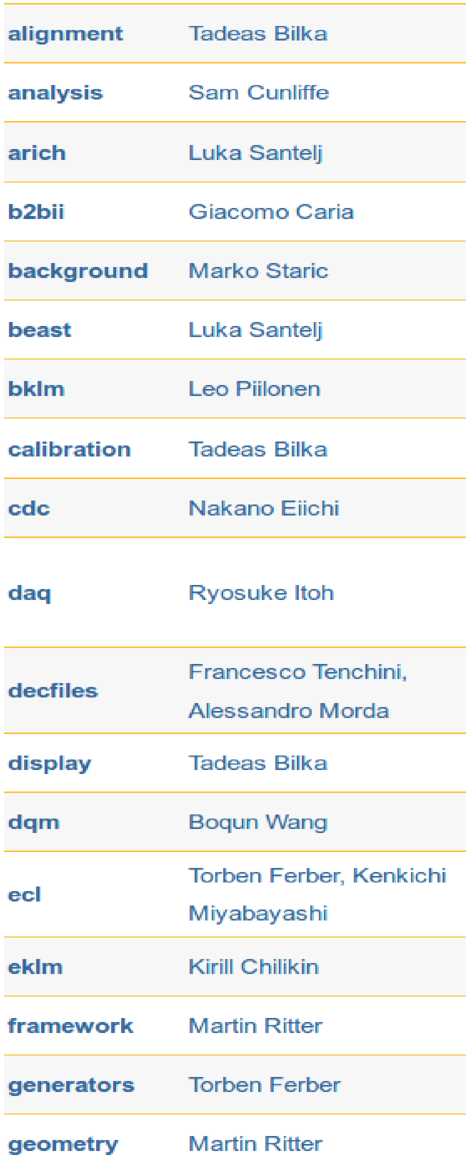
Simulation D. Kim

Tracking S. Glazov, E. Paoloni

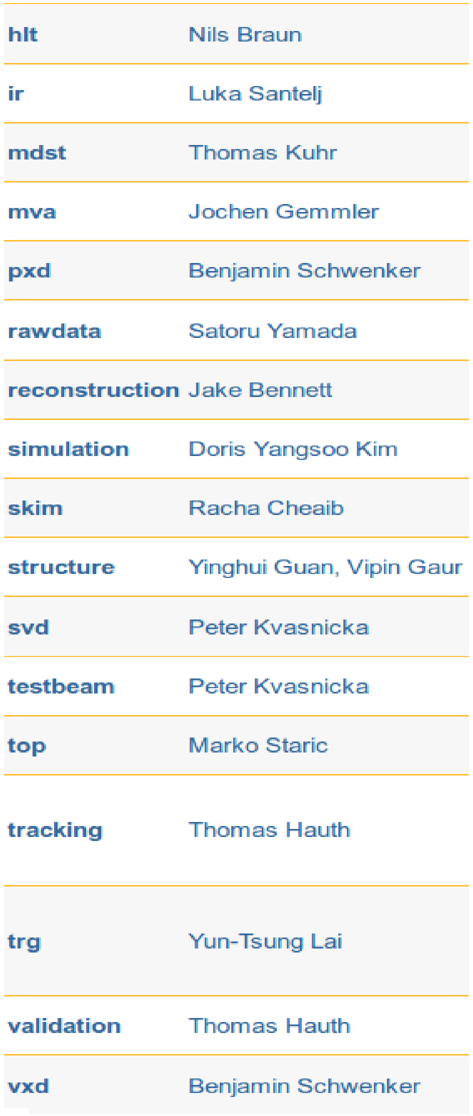
Database M. Bracko, L. Wood

Clustering and neutrals T. Ferber

Analysis Software & tool validation S. Cunliffe



alignment	Tadeas Bilka
analysis	Sam Cunliffe
arich	Luka Santelj
b2bii	Giacomo Caria
background	Marko Staric
beast	Luka Santelj
bklm	Leo Piilonen
calibration	Tadeas Bilka
cdc	Nakano Eiichi
daq	Ryosuke Itoh
decfiles	Francesco Tenchini, Alessandro Morda
display	Tadeas Bilka
dqm	Boqun Wang
ecl	Torben Ferber, Kenkichi Miyabayashi
eklm	Kirill Chilikin
framework	Martin Ritter
generators	Torben Ferber
geometry	Martin Ritter



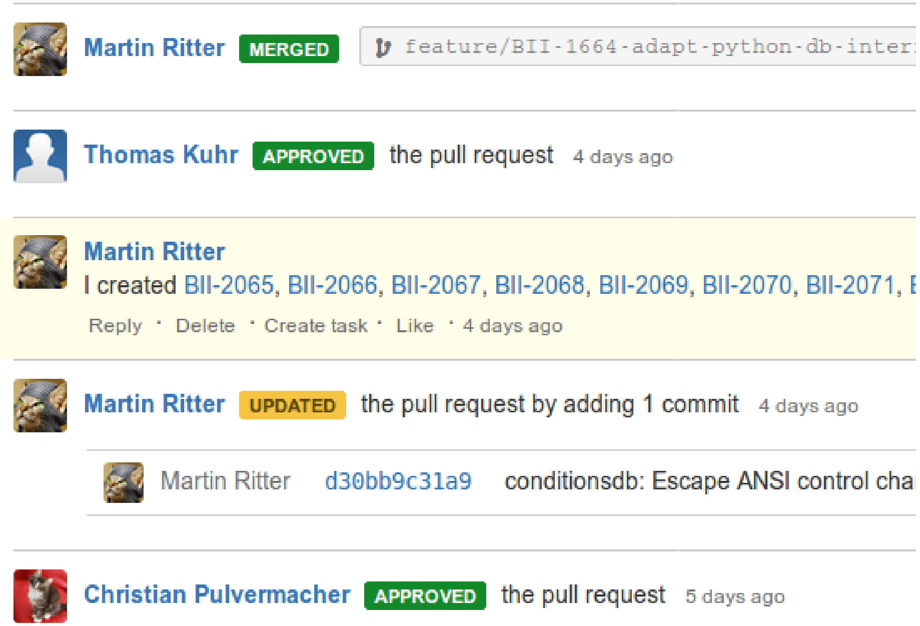
hlt	Nils Braun
ir	Luka Santelj
mdst	Thomas Kuhr
mva	Jochen Gemmler
pxd	Benjamin Schwenker
rawdata	Satoru Yamada
reconstruction	Jake Bennett
simulation	Doris Yangsoo Kim
skim	Racha Cheaib
structure	Yinghui Guan, Vipin Gaur
svd	Peter Kvasnicka
testbeam	Peter Kvasnicka
top	Marko Staric
tracking	Thomas Hauth
trg	Yun-Tsung Lai
validation	Thomas Hauth
vxd	Benjamin Schwenker

Migration svn → git

- Belle II decided 2016 to migrate collaborative services from KEK to DESY

➢ We used that opportunity to switch from svn to git

➔ Adjustment of procedures and tools required



Martin Ritter MERGED feature/BII-1664-adapt-python-db-inter

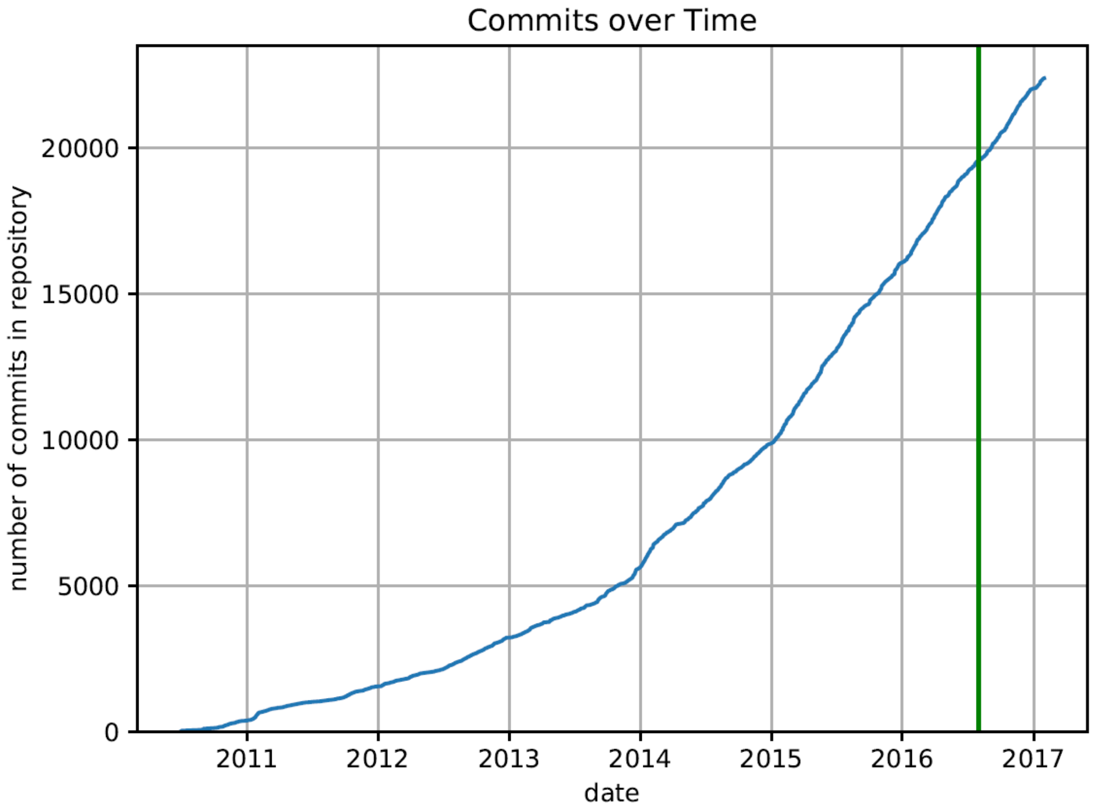
Thomas Kuhr APPROVED the pull request 4 days ago

Martin Ritter
I created BII-2065, BII-2066, BII-2067, BII-2068, BII-2069, BII-2070, BII-2071, B
Reply · Delete · Create task · Like · 4 days ago

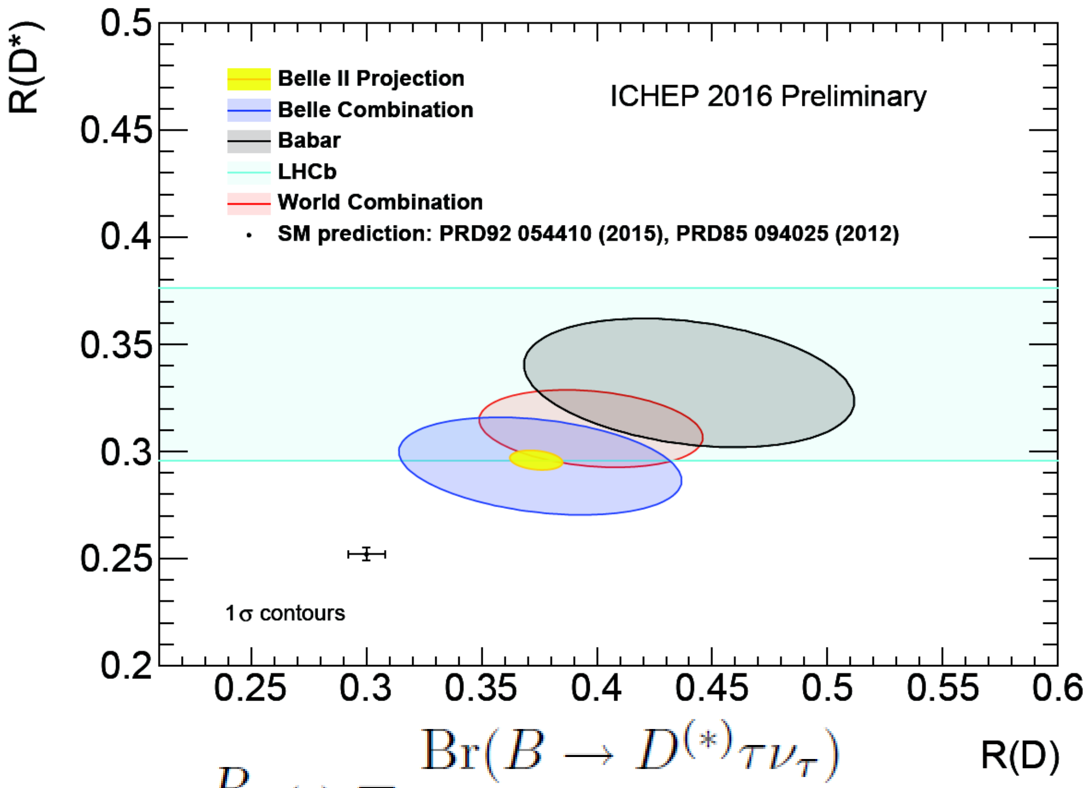
Martin Ritter UPDATED the pull request by adding 1 commit 4 days ago

Martin Ritter d30bb9c31a9 conditionsdb: Escape ANSI control cha

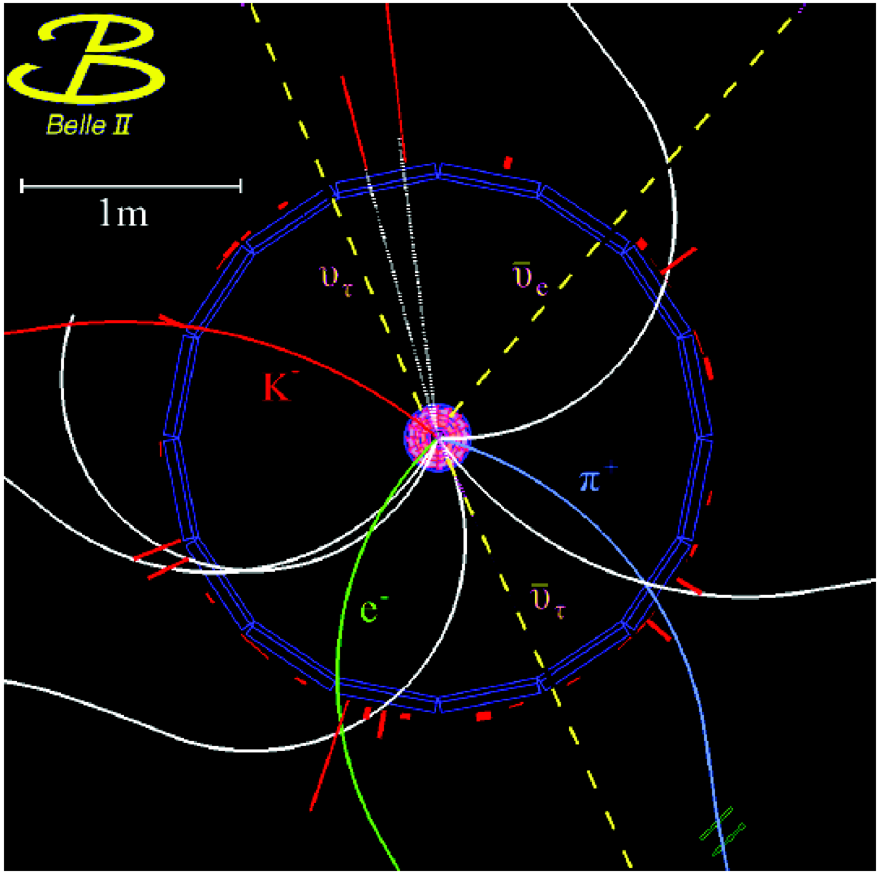
Christian Pulvermacher APPROVED the pull request 5 days ago



$B \rightarrow D^{(*)}\tau\nu$ @ Belle II

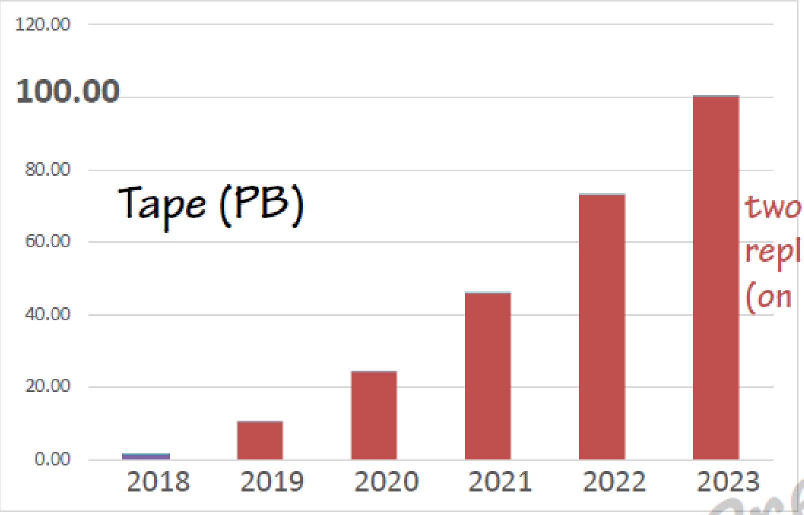


$$R_{D^{(*)}} = \frac{\mathrm{Br}(B \to D^{(*)}\tau\nu_\tau)}{\mathrm{Br}(B \to D^{(*)}\ell\nu_\ell)}$$

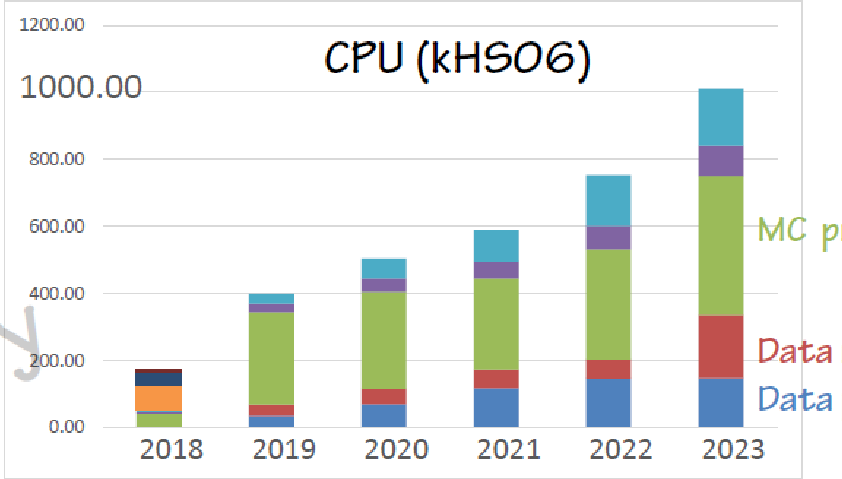


- Knowledge of B kinematics and detector hermicity exploited in reconsturction of decays with neutrinos

Resource Estimates



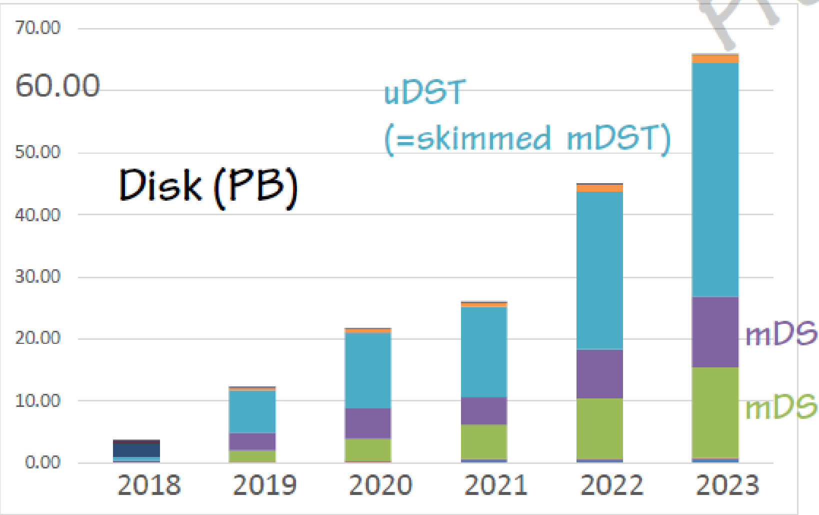
two RAW data replicas (on the globe)



MC prod.

Data reprocess

Data process



uDST (=skimmed mDST)

mDST (MC)

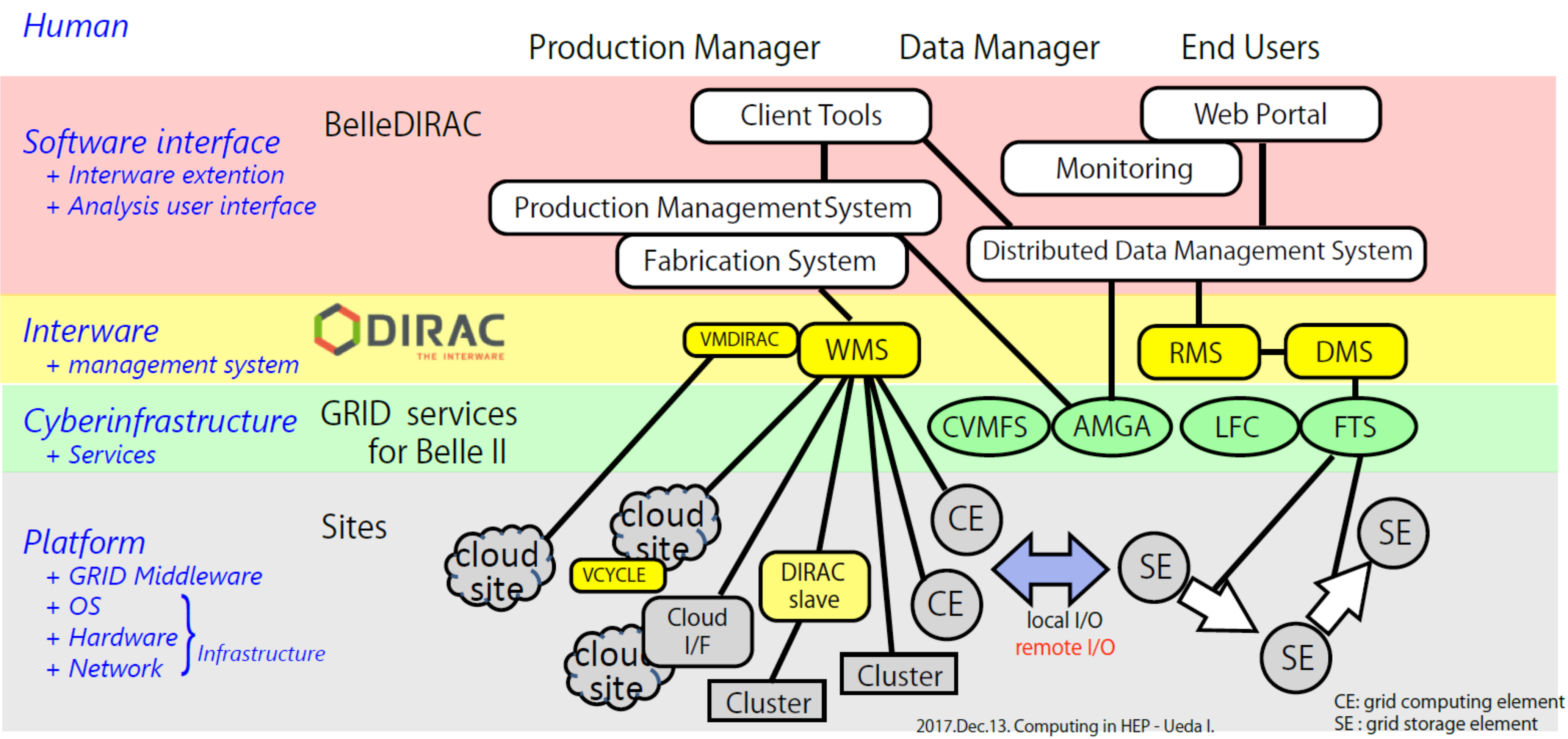
mDST (Data)

Updates
- Realistic software
- Detailed requests from physics
- Concrete analysis framework
- Updated data distribution strategy

Uncertainies
- Luminosity profile
- Background level
- etc...

Looks similar to LHC experiments in Run1

Computing System



Human

Software interface
- *Interware extention*
- *Analysis user interface*

Interware
- *management system*

Cyberinfrastructure
- *Services*

Platform
- *GRID Middleware*
- *OS*
- *Hardware*
- *Network*

Infrastructure

2017.Dec.13. Computing in HEP - Ueda I.

CE: grid computing element
SE : grid storage element