BelleII Computing
Status ed Opportunita' di Lavoro
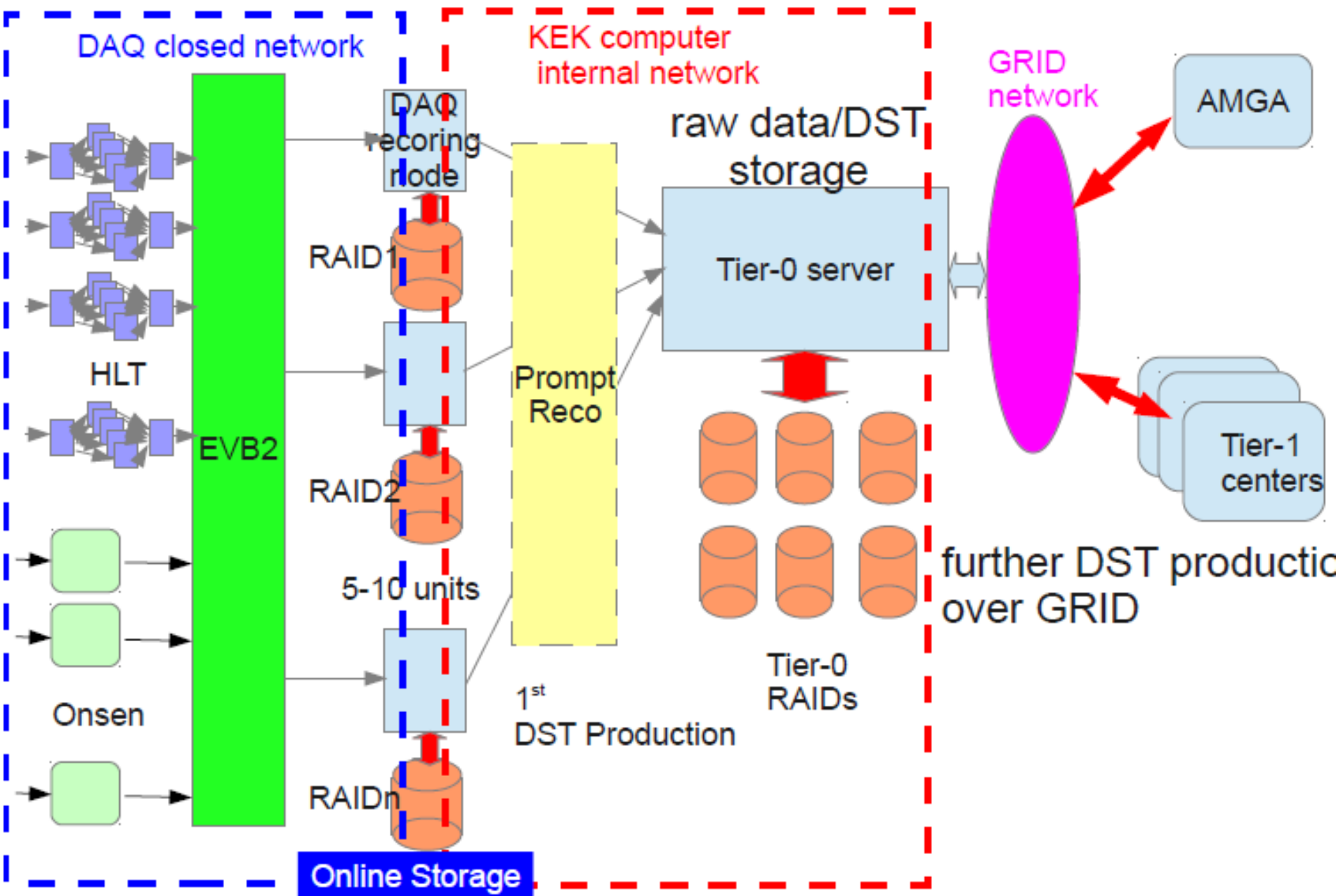
F. Bianchi

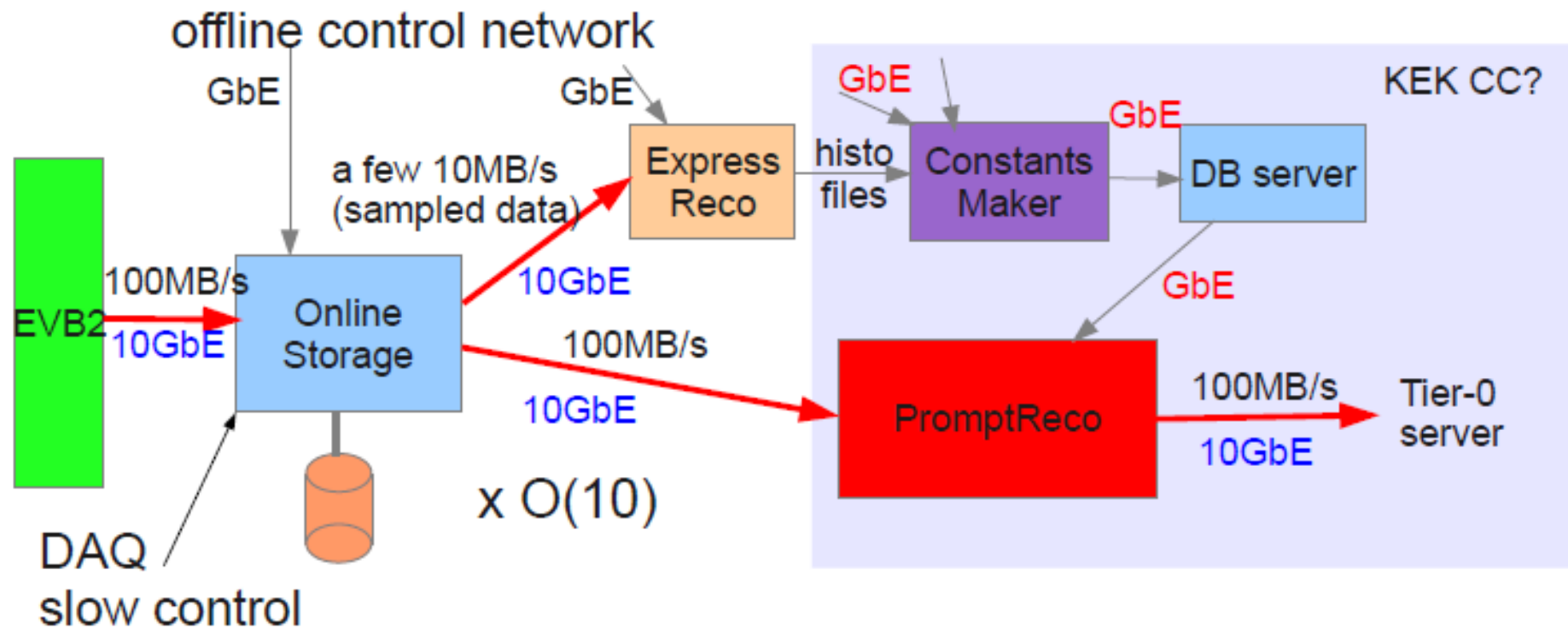Torino

Link Utili

- Web page di BelleII:
  - http://belle2.kek.jp/

- Slides collaboration meeting di marzo 2013:
  - http://kds.kek.jp/conferenceTimeTable.py?confId=11575#20130304
  - NB: password protected, ma nella finestra in cui chiede username e password vi dice anche quali sono

- BelleII twiki:
  - https://belle2.cc.kek.jp/~twiki/bin/viewauth/Computing/WebHome
  - Password protected

- Open tasks:
  - https://belle2.cc.kek.jp/~twiki/bin/view/Computing/TaskList

DAQ-Offline Inteface : Online Storage

Required network bandwidth

offline control network

GbE

GbE

a few 10MB/s
(sampled data)

KEK CC?

Express Reco

histo files

GbE

Constants Maker

GbE

DB server

GbE

EVB2

100MB/s
10GbE

Online Storage

10GbE

100MB/s

10GbE

PromptReco

100MB/s

Tier-0 server

10GbE

x O(10)

DAQ
slow control
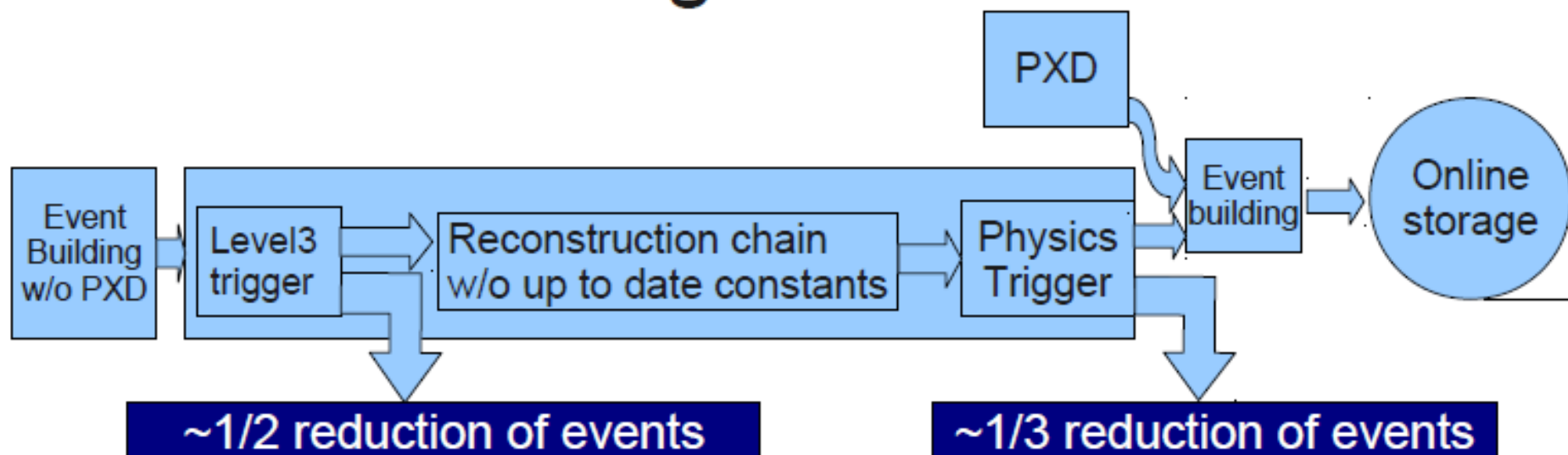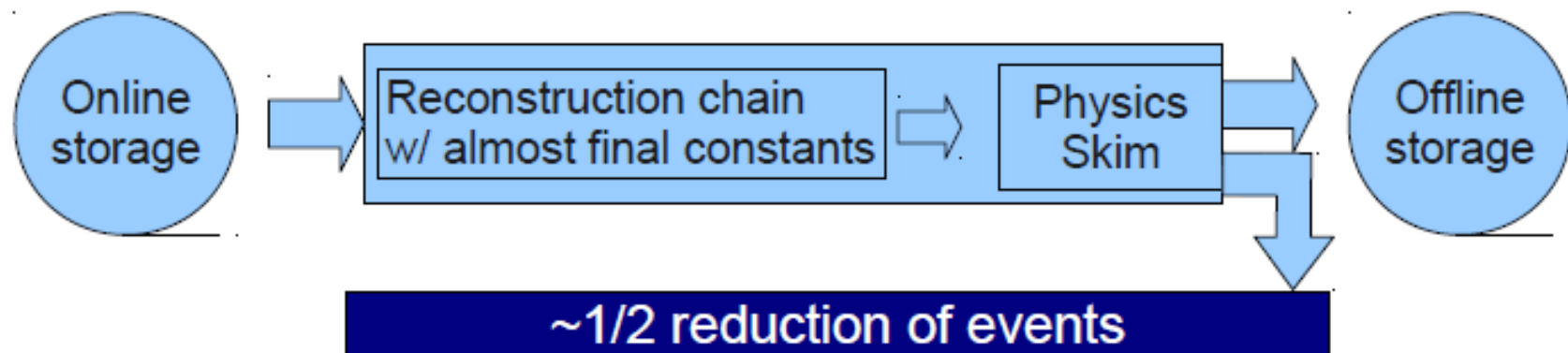
* 3 network connections from/to Online Storage node.
  - main data flow : from EVB2, to Offline (~100MB/sec over 10GbE)
  - branch to expressReco (a few 10th of MB/s over 10GbE)

* In addition to data flow, control network connection (GbE) is required.
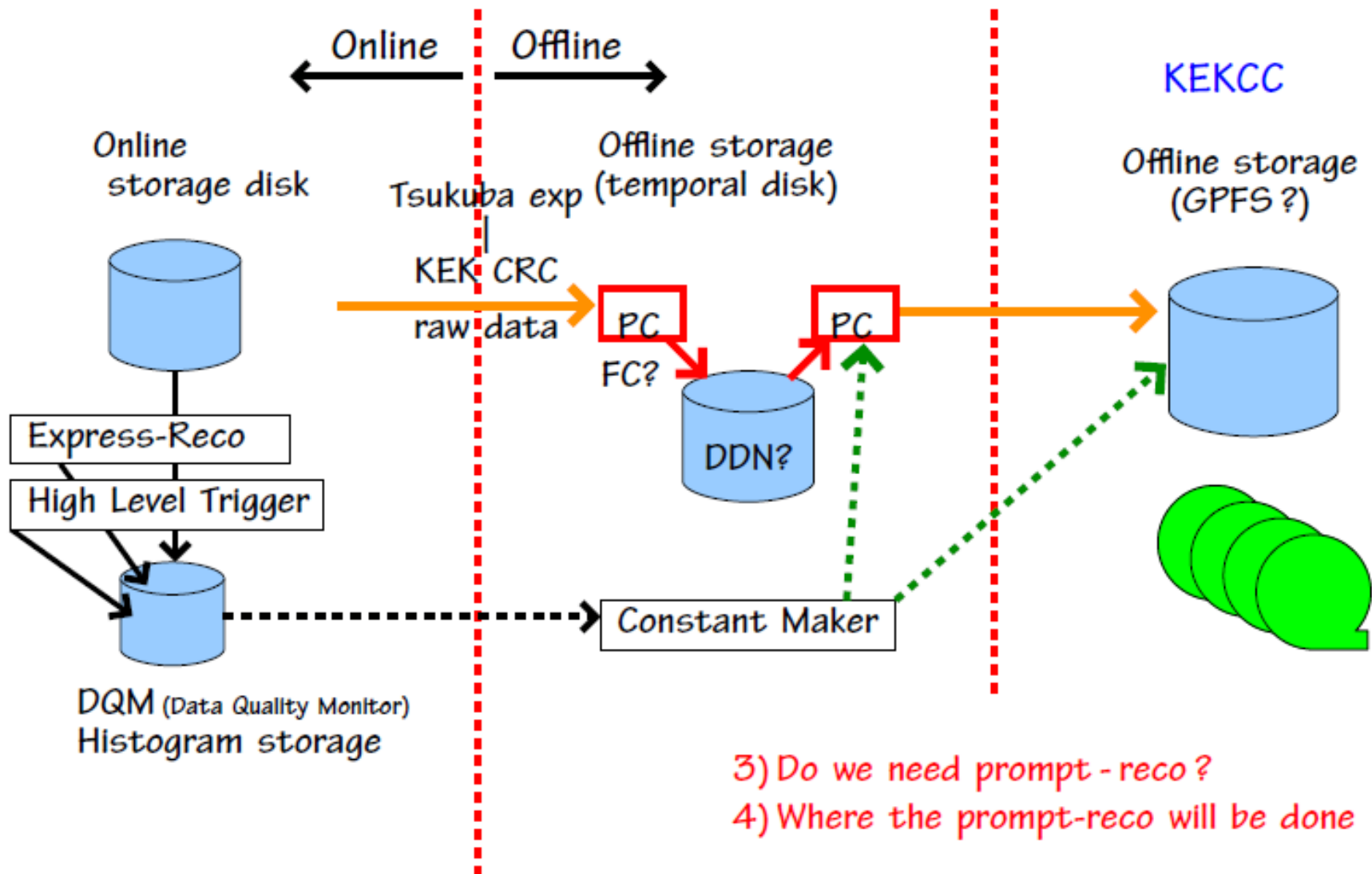
Current design of the data flow

- Physics trigger is applied at the end of the online reconstruction chain
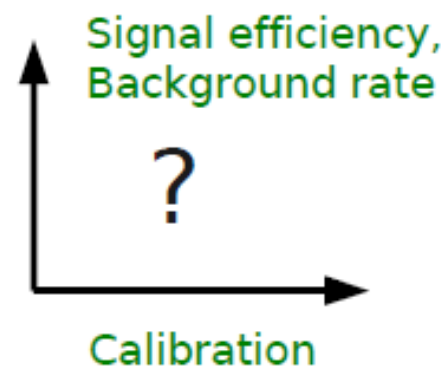- Calibration constants are not tuned → loose event selection(~1/3 reduction)

- Reconstruction w/ PXD+SVD+CDC tracking, and w/ almost final calib. constants
- Expect ~1/2 reduction by Physics skims

Prompt-reco ?

Online ← | → Offline

KEKCC

Online storage disk

Offline storage (temporal disk)

Offline storage (GPFS ?)

Tsukuba exp
KEK CRC
raw data

PC
FC?

PC

DDN?

Express-Reco

High Level Trigger

Constant Maker

DQM (Data Quality Monitor) Histogram storage

3) Do we need prompt - reco ?
4) Where the prompt-reco will be done

Prompt Reco

- HLT uses reconstruction with coarse calibration constants

- Express reco:
Selected events are used for monitoring and to execute automatic calibration procedures

- Prompt reco: Run reconstruction with refined constants a few days after data was taken

  - ✗ Preliminary data quickly available for analyses
    → not so useful

  - ✗ Monitoring of full events
    → already provided by express reco

  - ➢ Trigger with refined constants (EHLT)
    → More quantitative studies needed

Signal efficiency, Background rate

?

Calibration

Physics Trigger @HLT

Overview:

A physics event selection (like the event classification in Belle),
but events that do not satisfy the criteria will not be stored
(even for raw data).
In this sense, it behave as a "trigger"

So we need to be very careful not to discard the events
that contain physics information.

Current design of the data flow

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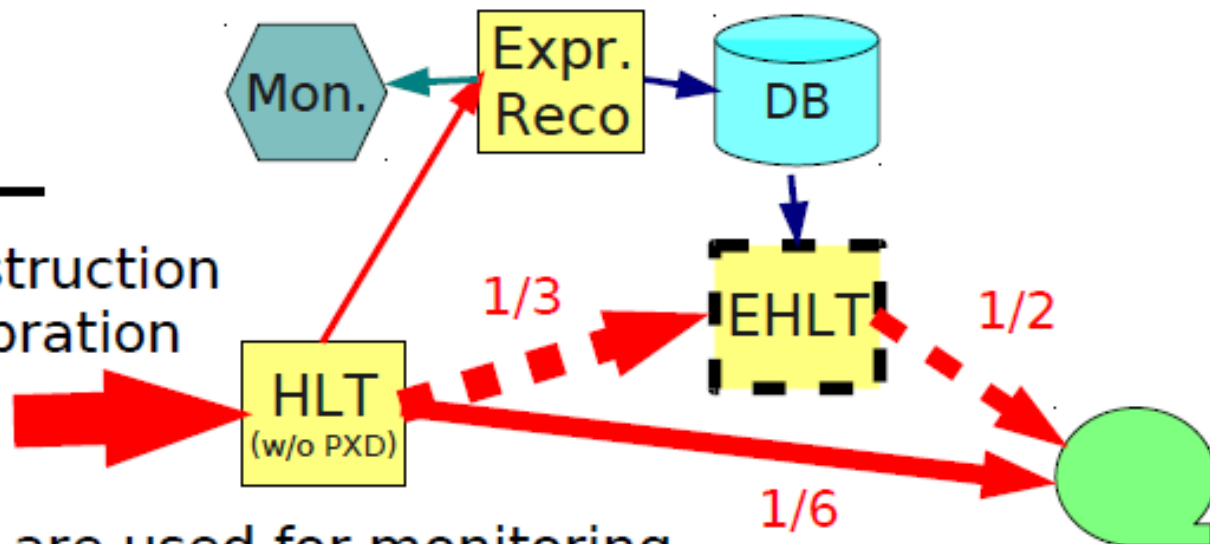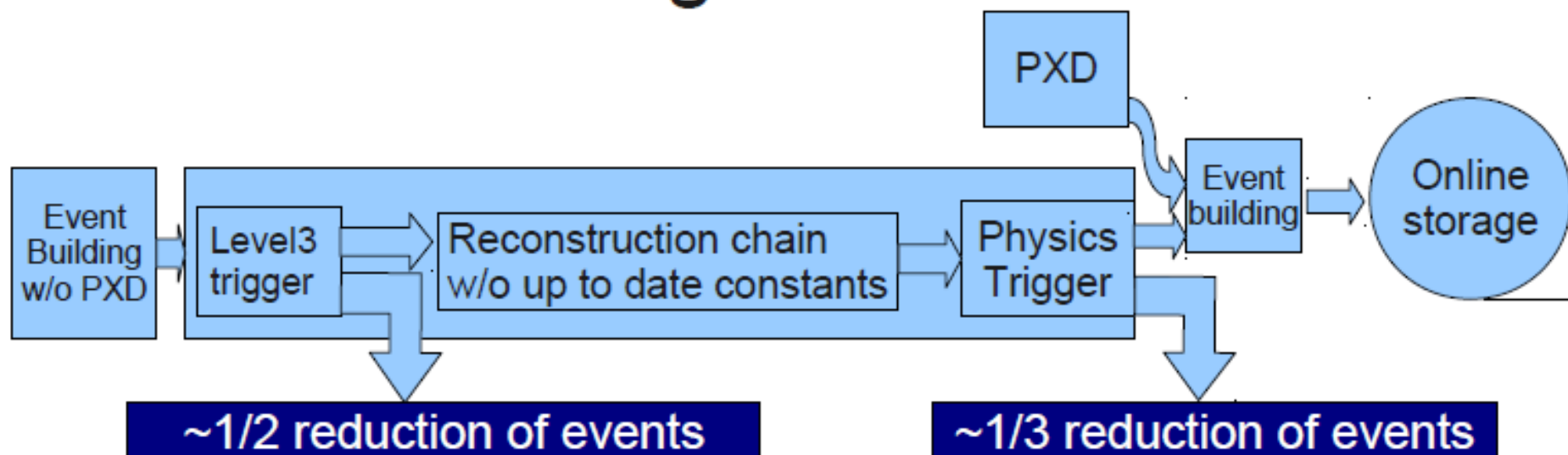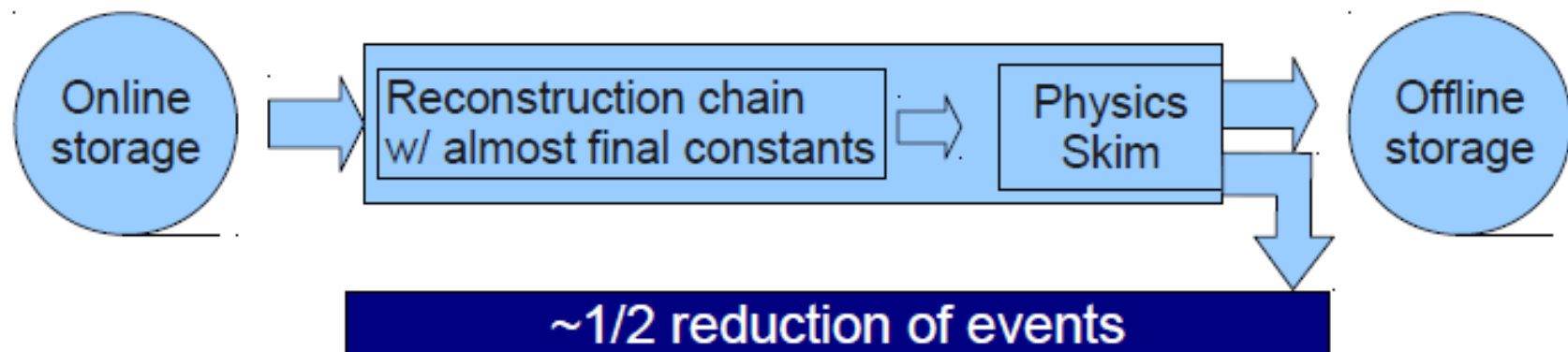- Calibration constants are not tuned → loose event selection(~1/3 reduction)

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Physics trigger @ HLT (cont'd)

Problem:
The efficiency of the physics trigger cannot be estimated using MC well.
← Inefficiency can be ascribed to the imperfect calibration constants of tracking, PID.
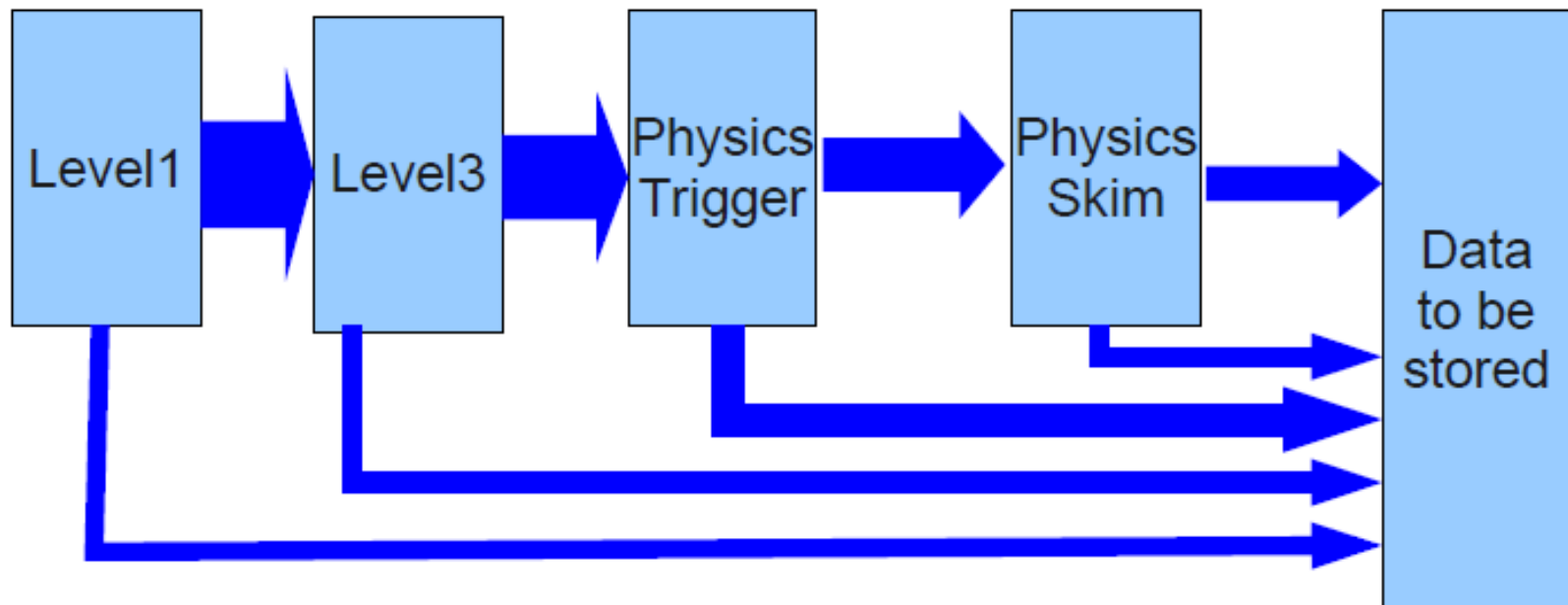
Salvaging events are important for estimating the efficiency of physics trigger

Want to have ~10% of event salvage at early stage of the Belle II experiment

Prepare a tool for estimating trigger efficiency that can work with signal MC and that can include efficiency drop by imperfect constants

Event salvage @ each trigger levels

```
┌─────────┐      ┌─────────┐      ┌─────────┐      ┌─────────┐      ┌─────────┐
│         │ ───▶ │         │ ───▶ │ Physics │ ───▶ │ Physics │ ───▶ │         │
│ Level1  │      │ Level3  │      │ Trigger │      │  Skim   │      │  Data   │
│         │      │         │      │         │      │         │      │ to be   │
└────┬────┘      └────┬────┘      └────┬────┘      └────┬────┘      │ stored  │
     │                │                │                └──────────▶│         │
     │                │                └──────────────────────────▶│         │
     │                └───────────────────────────────────────────▶│         │
     └────────────────────────────────────────────────────────────▶│         │
                                                                    └─────────┘
```

With number of trigger levels, salvaged events for efficiency monitor can occupy non-negligible fraction

Propose to have relatively large fraction for physics trigger than others

-Level 3: use robust constants and also the efficiency can be measured using MC
-Physics trigger: constants are unstable. Efficiency cannot be estimated well using MC
-Physics skim: constants are almost final and efficiency that is measured using MC
Should be almost correct

MDST for Belle II

T. Hara

1) track
 +) fitted result
  = helix, error matrix, p-value

  Interface defined, complete implementation during BGM

2) TOP / ARICH
 +) TOPLikelihood
 +) ARICHLikelihood

  Available in PIDLikelihood

3) Shower/γ/πO
 +) MdstShower
 +) MdstGamma ?
 +) MdstPiO ?

  Available

4) dE/dx
 +) CDC
 +) VXD

  → PIDLikelihood CDC/VXD combined

5) MUID/KLID
 +) MUID
 +) KLID

  $<\sim$1kB

  MUID after BPAC, KLID implemented

6) Ks, Λ vertex
 +) Vee
 +) Vee_daughters

  Not yet

7) Eid   Not yet

$\sim$25kB → $\sim$20kB
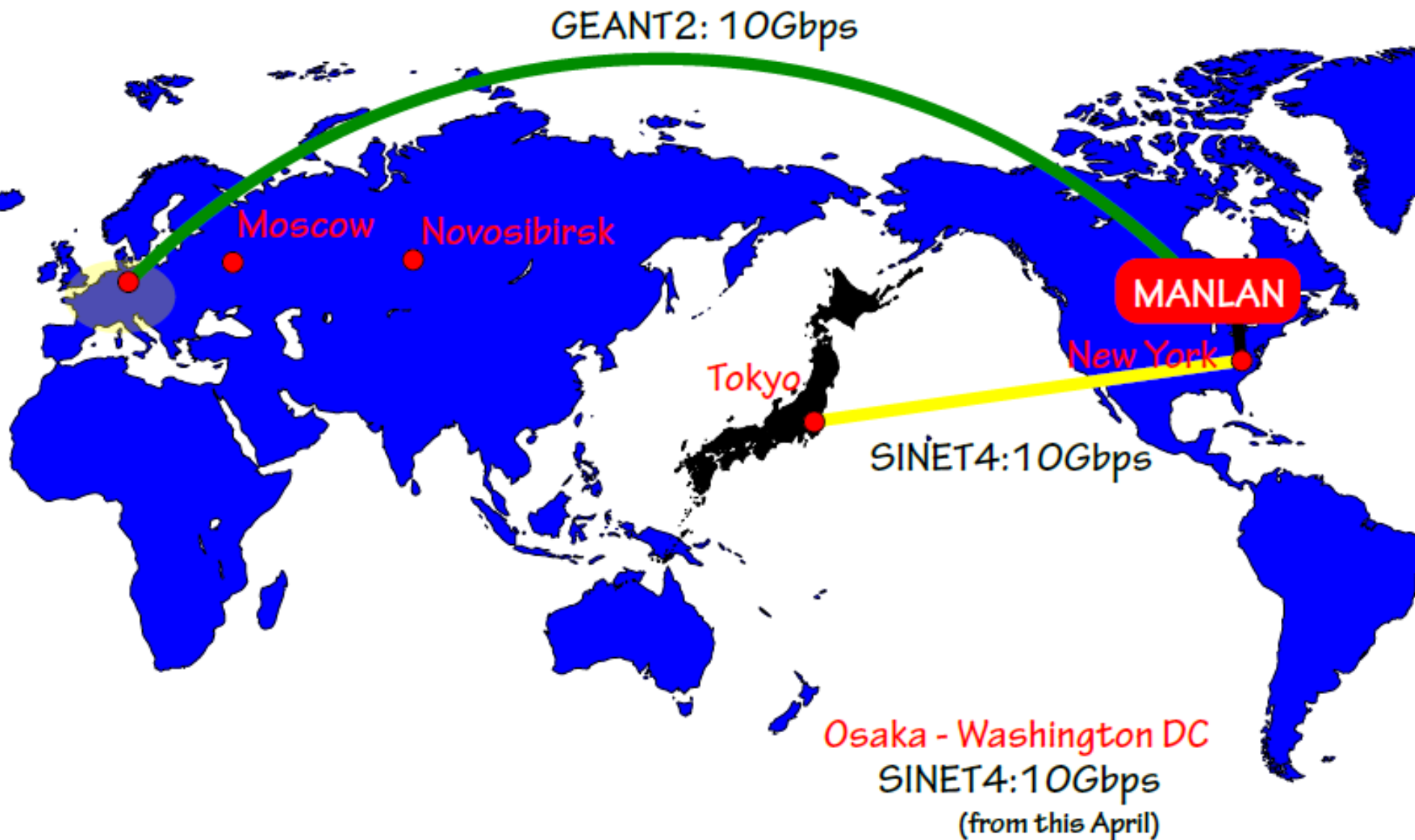
Currently 100kB (mainly MCParticles)

07. 25, 2012 @ Bad Aibling

Network da KEK

- Connessioni con:
  - Corea (2.5 Gbps -> 10 Gbps)
  - Hong Kong (2.5 Gbps -> 10 Gbps)
  - US, L.A. (10 Gbps)
  - Australia via US (10 Gbps to LA, 10 Gbps da USA ad Australia, 20 Gbps dentro USA)
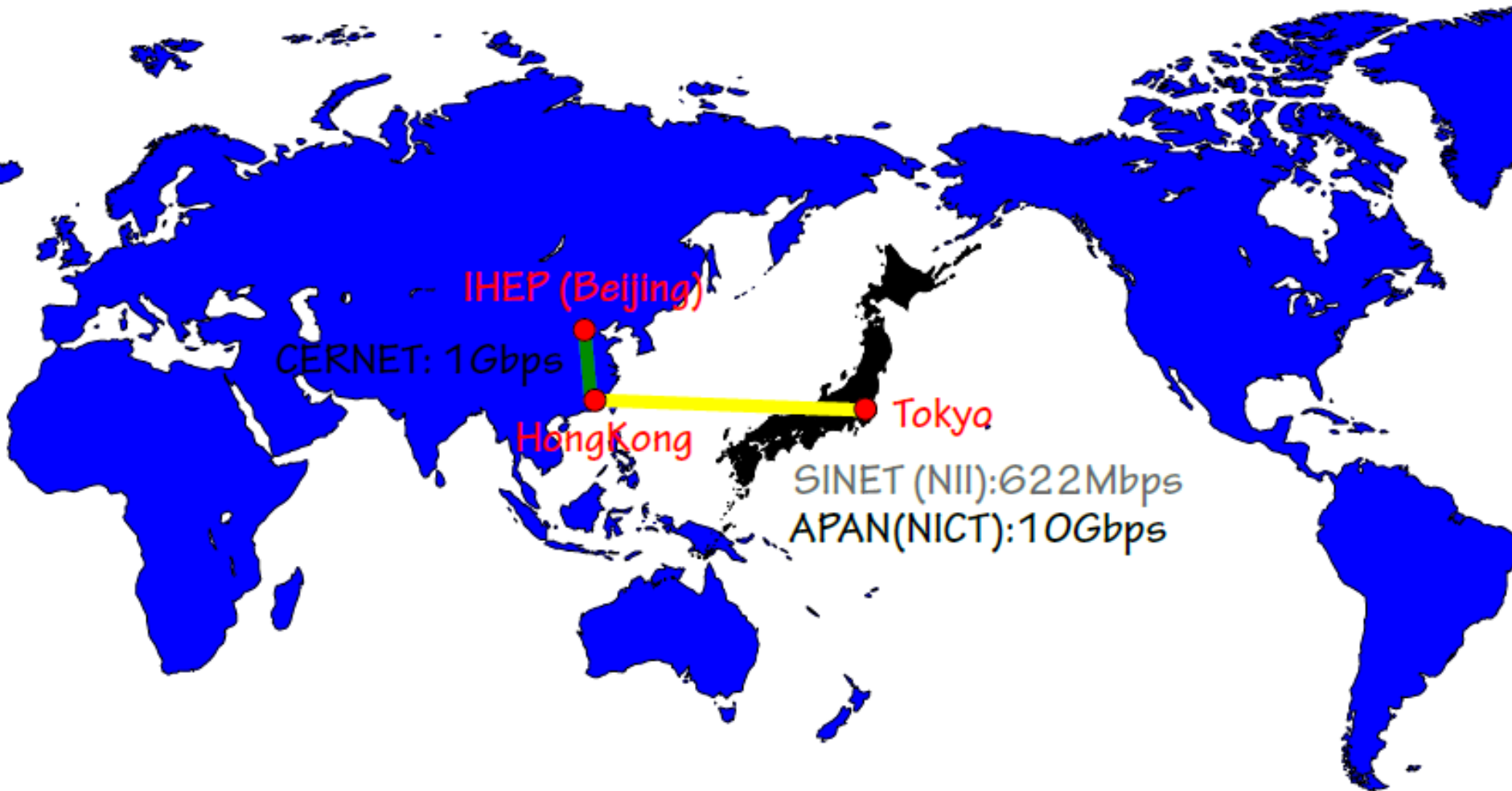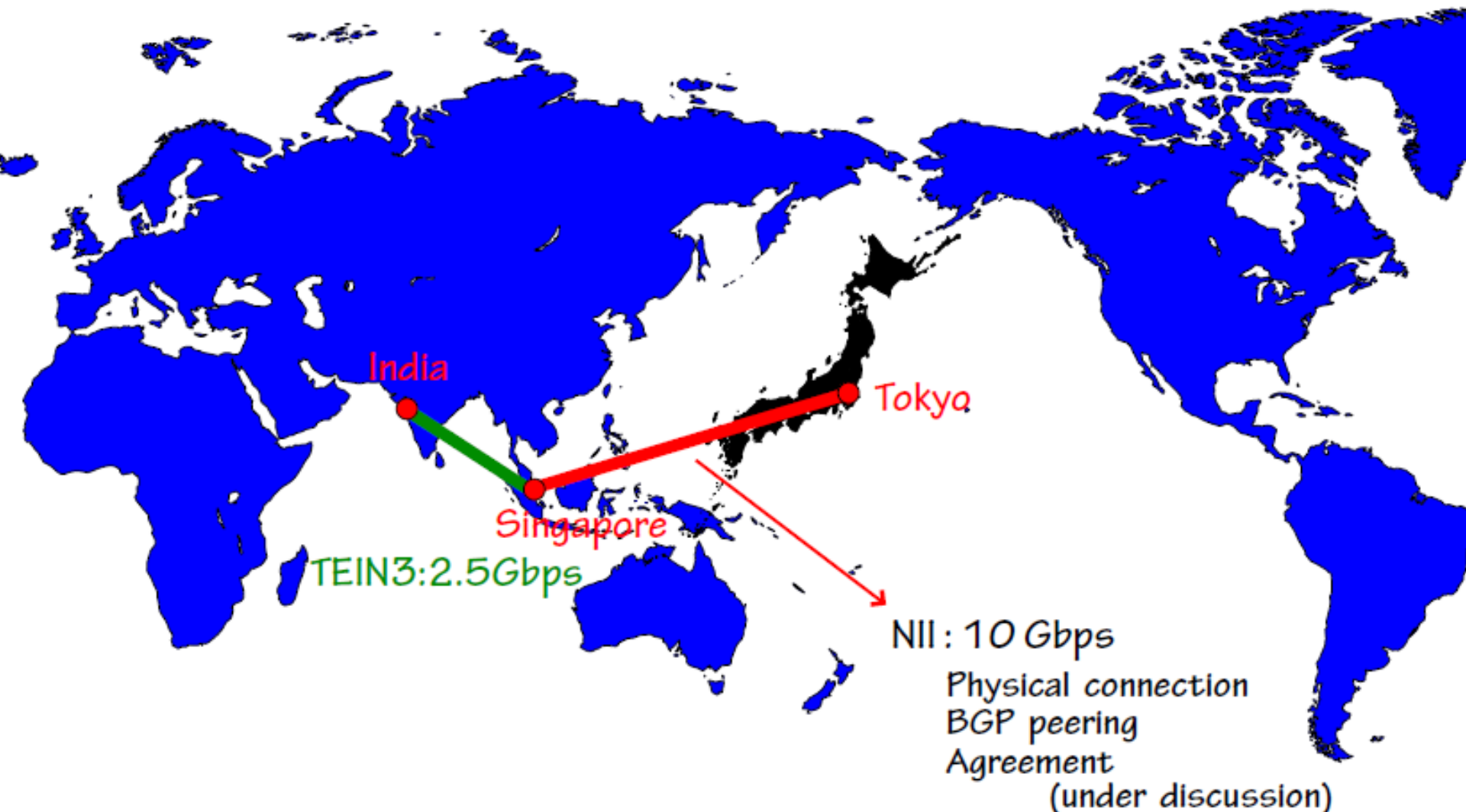 - Europa via USA

Problema

- In generale banda non sufficiente

- In particolare con Europa:
  - trasferimento dati di Belle KEK-> DESY solo a 100 Mbps
  - E' un problema anche per noi

- Pero' si puo' fare di meglio:
  - Trasferiti dati BESIII da Pechino a Torino: 700 Mbps
  - Esplorare altre opzioni

Network route

from KEK/Japan

India

Tokyo

Singapore

TEIN3:2.5Gbps

NII : 10 Gbps

Physical connection
BGP peering
Agreement
  (under discussion)

1st MC campaign

- The 1st iteration of MC mass production using Belle II software and GRID architecture
  - Prove Belle II software on GRID
  - Prove our GRID design
  - Wash out our possible bottle-neck at everywhere
  - Observe what happens during massive resource consumption and share the information
    - GRID sites, network, DIRAC, AMGA, and gbasf2 UI

- Generate 50M BB event (B→Dpi, B→generic)
  - 1st stage: EvtGen~Full simulation+digitization (100TB)
  - 2nd stage: Reconstruction (before "ext") (100TB)
    - Generated data→usable for coming Data challenge
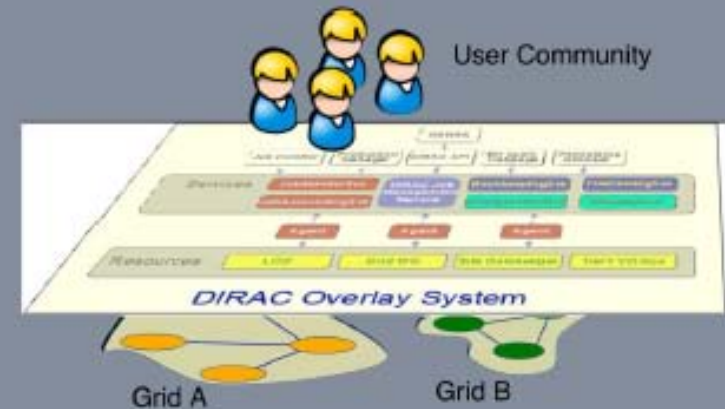
  - 2 weeks+1 week for buffer

Belle II GRIDs

4 DIRAC server + LCG sites
3 AMGA server   OSG sites

DIRAC

THE INTERWARE

- **D**istributed **I**nfrastructure with **R**emote **A**gent **C**ontrol
  - Software framework for distributed computing

  Developed by LHCb
  → Independent project since 2010 :
  ILC, BES, biomedical…

User Community

DIRAC Overlay System

Grid A   Grid B

- Main feature
  - Pilot jobs
  - Workload management overall VO
  - Extendible (modular structure)
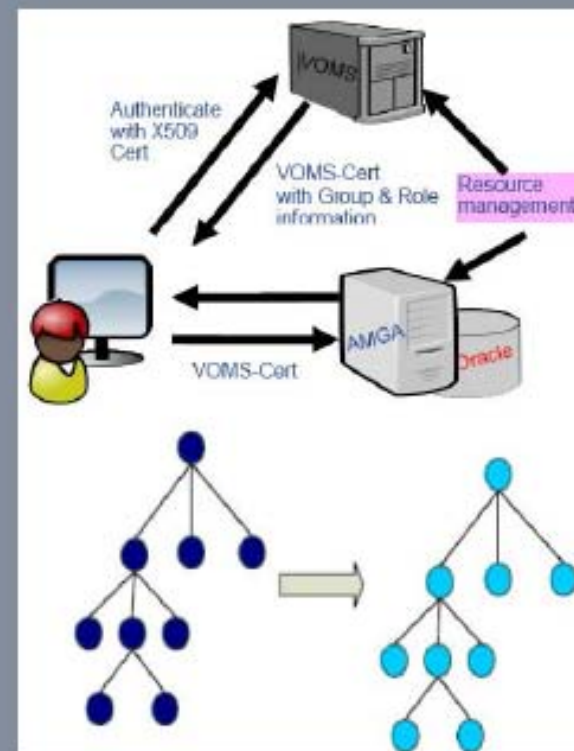
  → GRID, cloud, and local cluster

  LCG   OSG

- **Provide unified UI**

AMGA

- **A**RDA **M**etadata **G**rid **A**pplication
  - Metadata server for GRID environment

Metadata: data of data

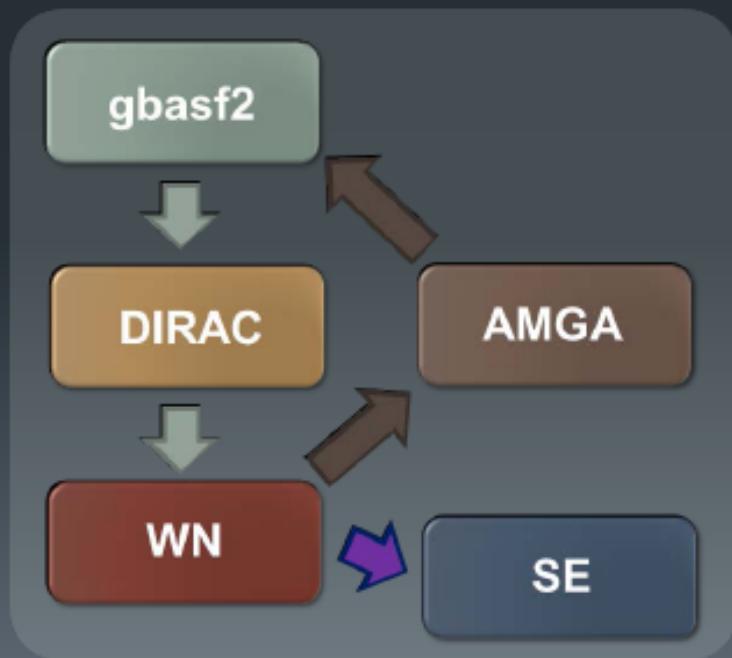LFN, run range, software version...

- Main feature
  - Integration with GRID security
  - Secure connection using SSL
  - Replication of data
    - Asynchronous and hierarchical

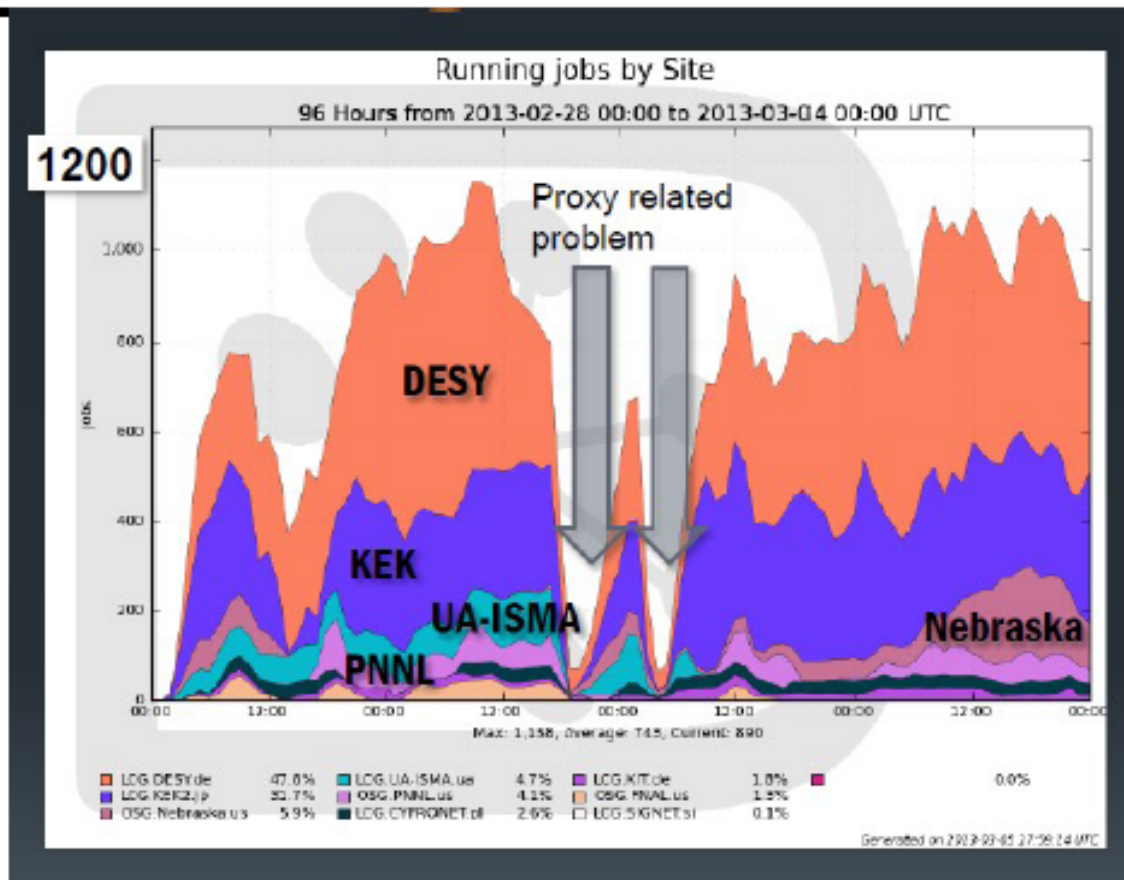e.g. replication of specific data set or run period for a GRID site

gBasf2

- Not only job submitter but a collection of job and data management tools
  - Job monitoring, tracking, handling, rescheduling
  - Dataset creation, replication, deletion
  - Integrated with BelleDIRAC (as explained by Rafal)

- Detailed explanation can be found from the Twiki page
- For this MC campaign, some new commands added
  - gb2_ds_du
  - gb2_ds_sanitize
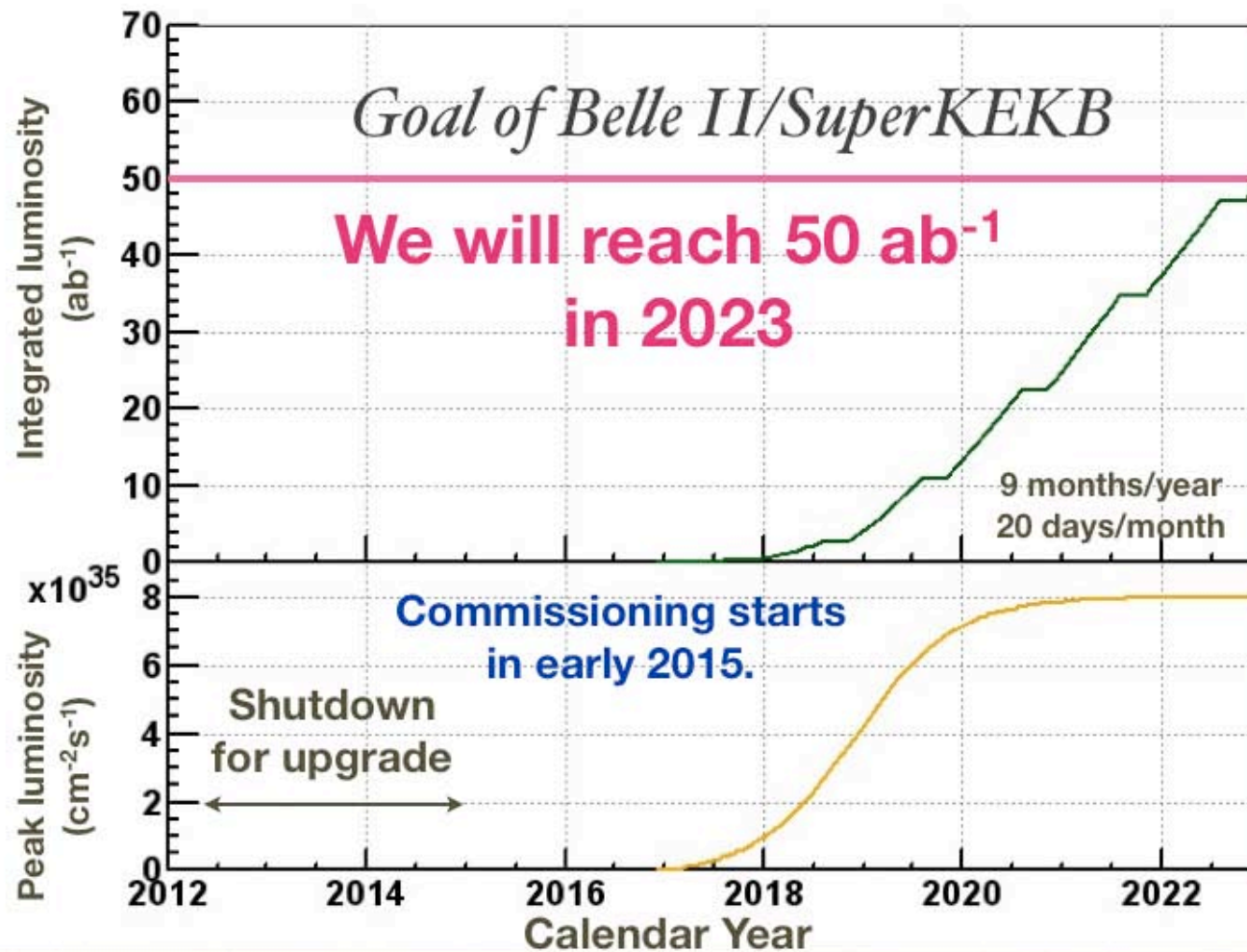 - gb2_ds_gather (still private)

MC Production on the Grid

Running jobs by Site
96 Hours from 2013-02-28 00:00 to 2013-03-04 00:00 UTC

- LCG   - OSG
  - KEK   - PNNL
  - CYFRONET   - FNAL
  - GridKa   - Nebraska
  - DESY   - VPI
  - SiGNET
  - UA-ISMA

Potremmo abilitare i siti italiani

➤ Thanks to the grid sites for providing resources
➤ Thanks to the site contacts/admins for their help

SuperKEKB luminosity projection

Come Potremmo Contribuire ?

- Tempi brevi:
  - Attivare BelleVO sui siti INFN + RECAS
  - Investigare networking tra KEK ed Europa, in particolare con Italia
  - Meditare sui punti critici del computing model di BelleII
  - Physics Trigger, Prompt Reco, Skimming, MDST format
  - Farsi carico di qualche task scoperto in: https://belle2.cc.kek.jp/~twiki/bin/view/Computing/TaskList

- Tempi medi:
  - Vedere se i risultati di qualcuna delle R&D di SuperB possono essere di utilita' per BelleII

Prossimi Appuntamenti

- ## Belle II Computing/Software Workshop:
  - 13-17 Maggio, Leinsweiler Hof vicino a Karlsruhe
  - http://kds.kek.jp/conferenceDisplay.py?confId=11545
  - Nostra partecipazione gradita. Registrarsi al piu' presto !

- ## BelleII General Meeting:
  - 4-7 luglio, 2013, VPI, US

(Potential) New Collaborators

- Active participation from (potential) new collaborators
    - Very useful input

- Looking forward to enforcement of software and computing group from Italy, Canada, France
- Computing workshop 2014 in Italy?