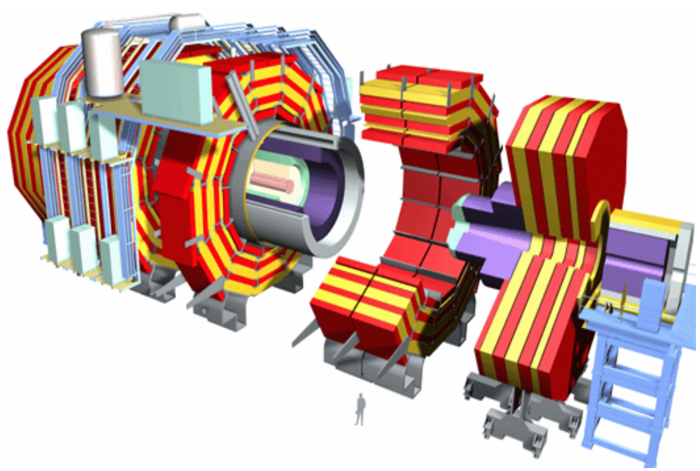
CMS-HI computing in Korea



2007 HIM@APCTP
Dec. 14, 2007

Inkyu PARK
Dept. of Physics, University of Seoul

Prof. H.S. Min, Prof. B.D. Yu, Prof. D.S. Park, Prof. J.D. Noh, …
S.G. Seo, J.W. Park, G.R. Han, M.K. Choi, S.M. Han, Y.S. Kim, …

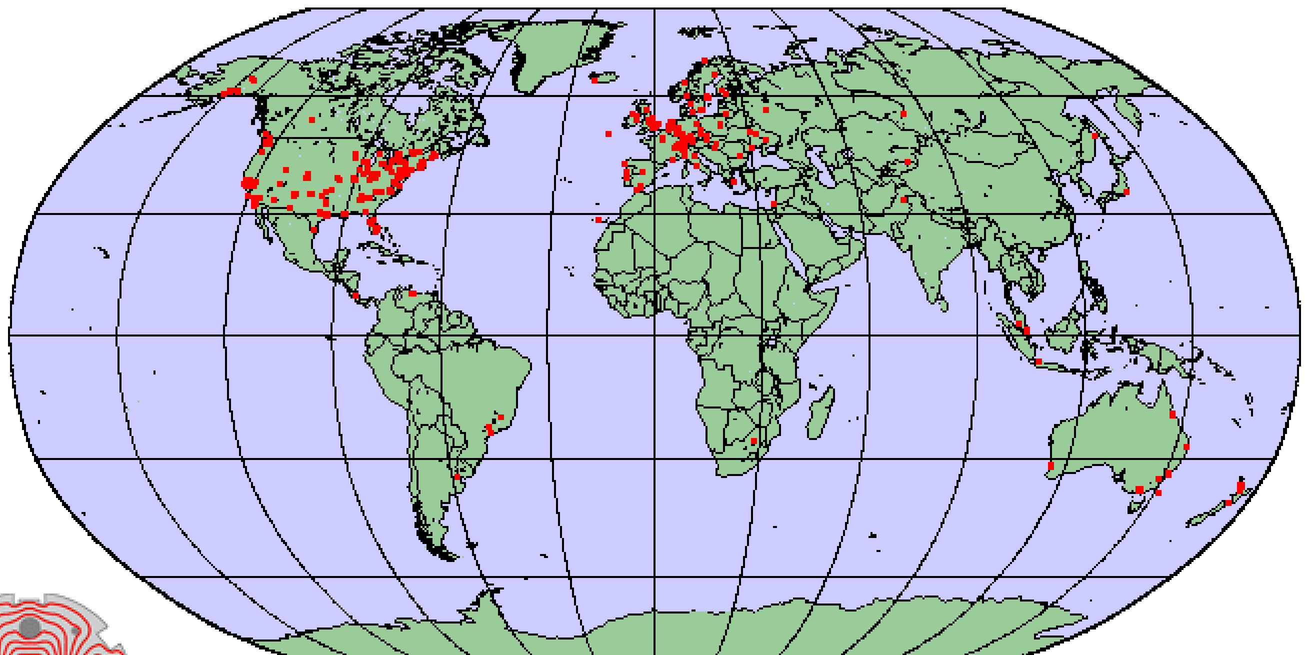
Contents

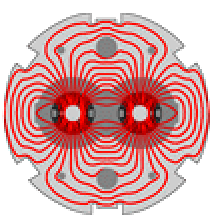
CMS Computing

Why GRID?

LHC: Another kind of Olympic game

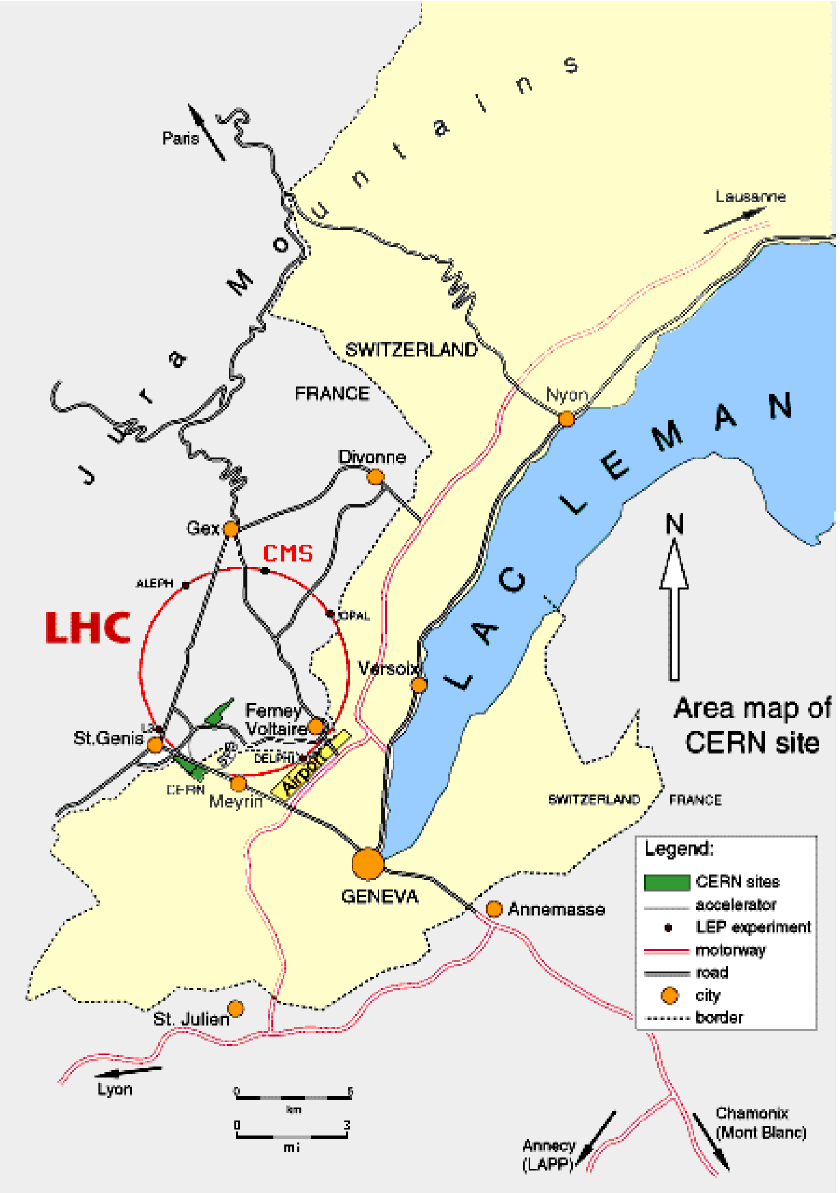
- **For the HEP and HI discoveries + more, ~ few thousands physicists work together.**
  - **7000 physicists from 80 countries!**
- **Collaborate, but at the same time compete.**





LHC Olympic game

LHC (Large Hadron Collider)

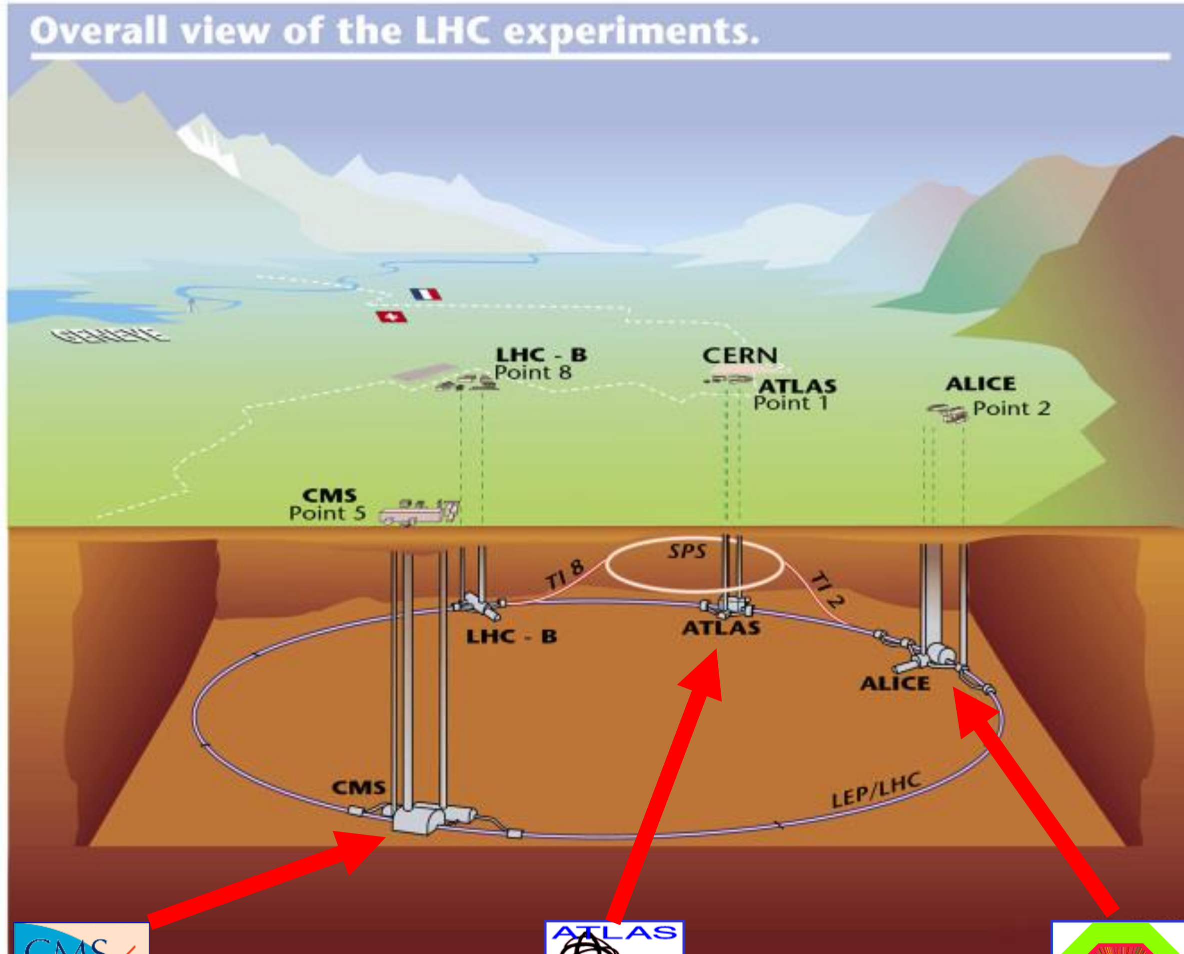


- 14TeV for pp, 5.5TeV/n for AA
- Circumference ~ 27km
- few Billion Dollars / year
- bunch crossing rate ~ 40MHz
- start running this year!!

LHC accelerator schedule

Year	p+p
2008	450+450 GeV, $5x10^{32}$
2009	14 TeV, $0.5x10^{33}$
2010	14 TeV, $1x10^{33}$
2011	14 TeV, $1x10^{34}$
…	…

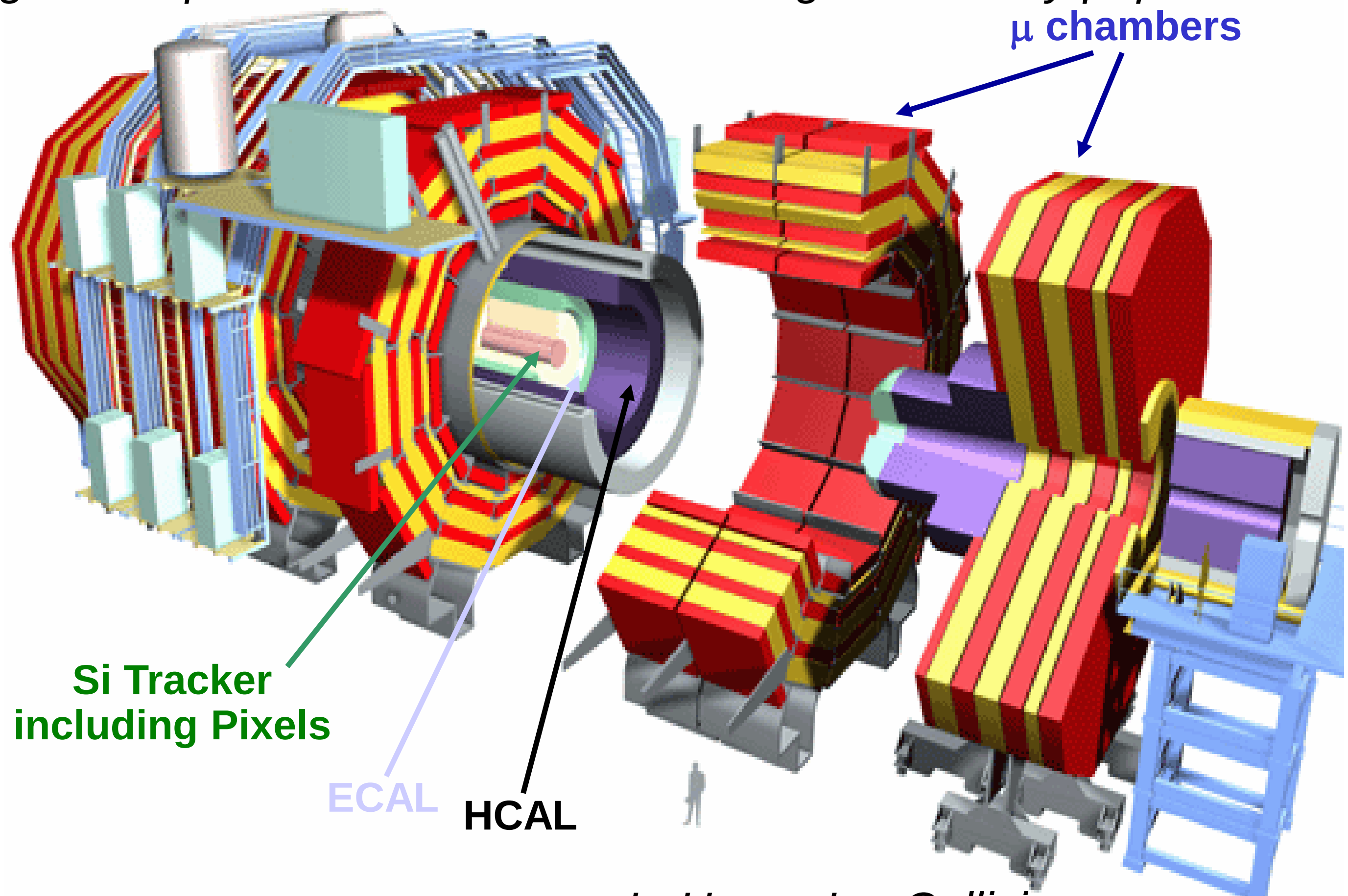
Year	HI (Pb-Pb)
2008	None
2009	5.5TeV, $5x10^{26}$
2010	5.5TeV, $1x10^{26}$
2011	5.5TeV, $1x10^{27}$
…	…

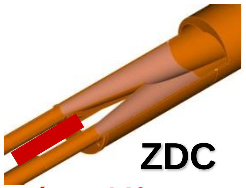


CMS ATLAS ALICE

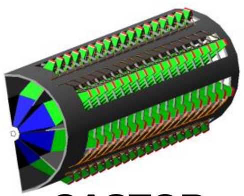
CMS Detectors

Designed for precision measurements in high luminosity p+p collisions





(z = ±140 m, |η| > 8.2 neutrals)

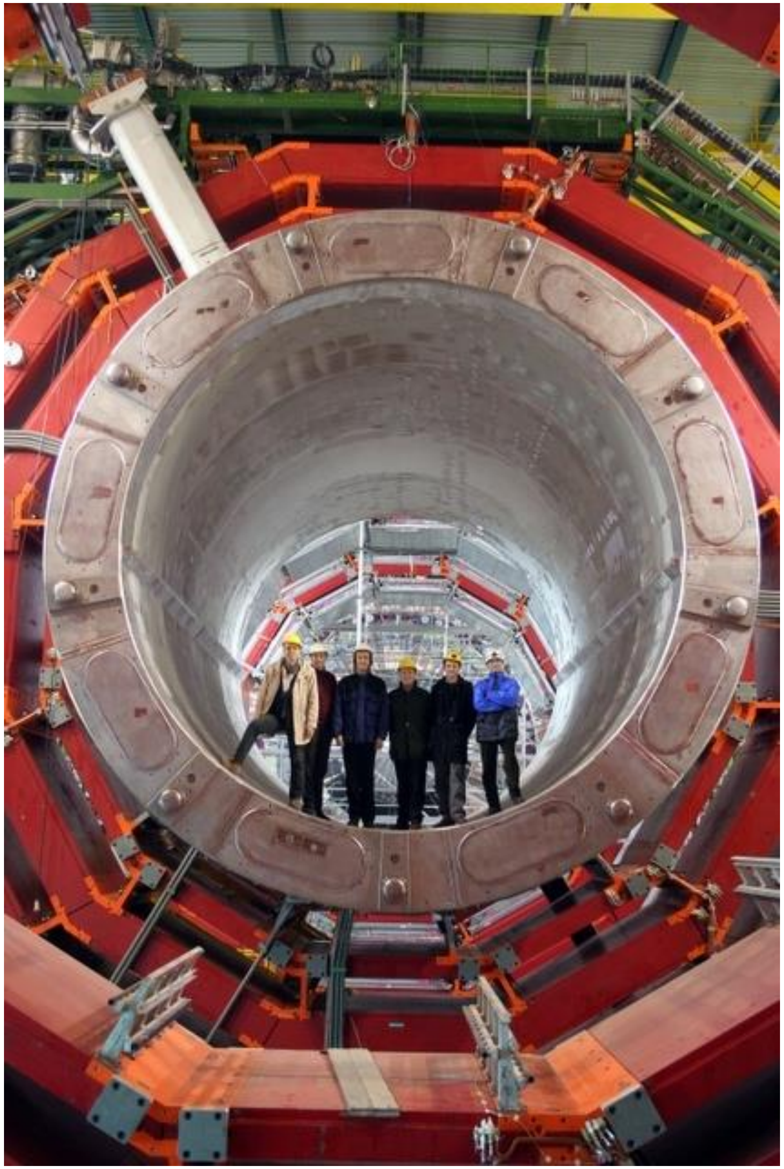


(5.2 < |η| < 6.6)

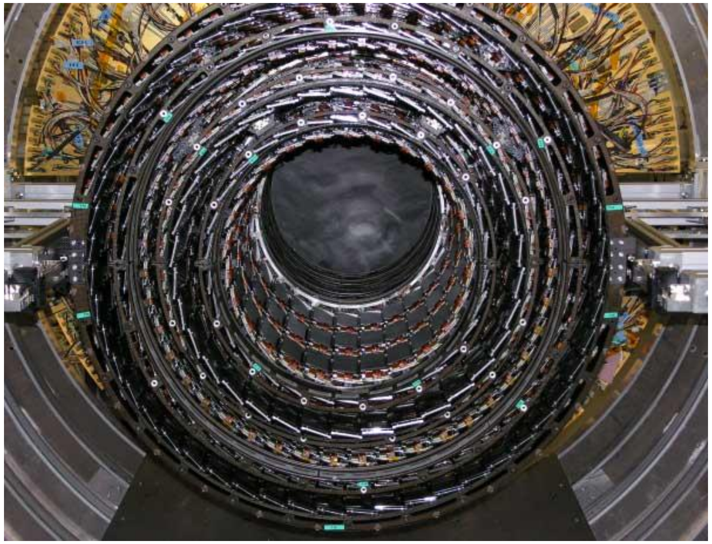
Hermetic Calorimetry
Large acceptance Tracker
Excellent Muon Spectrometer

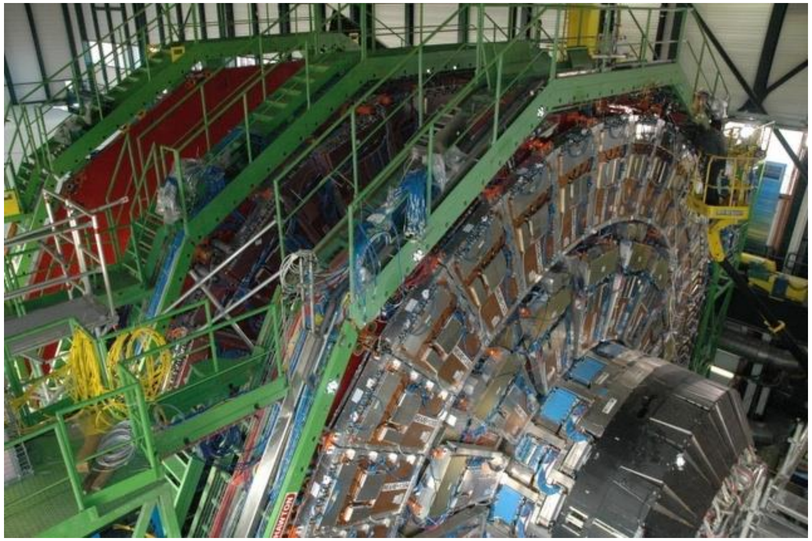
In Heavy Ion Collisions:
Functional at highest expected multiplicities
Detailed studies at ~$dN_{ch}/d\eta$ ~3000
cross-checks up to 7000-8000

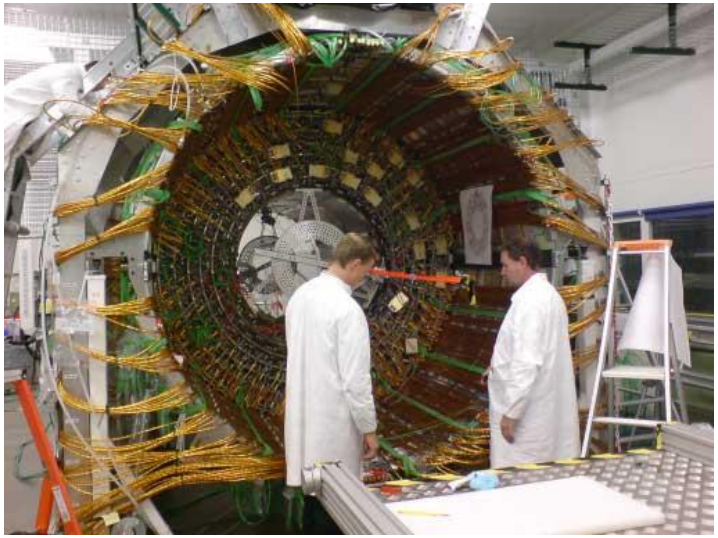
Gigantic detectors



Wires everywhere!

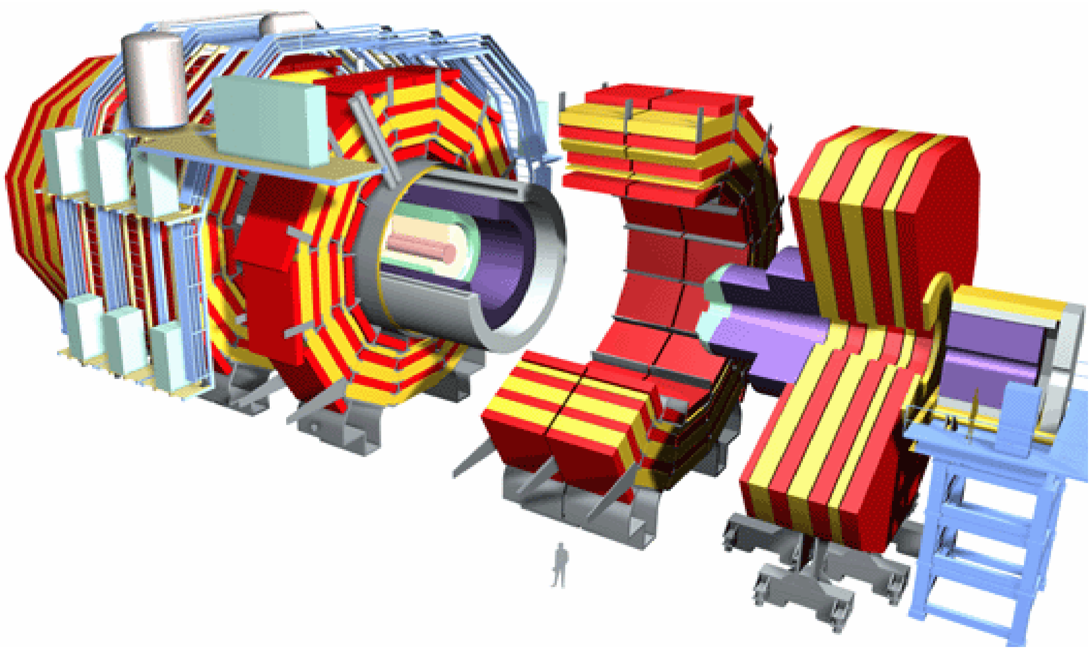






Theoretically,
# of wires = # of channels
16M wires, soldering, etc…

CMS, raw data size

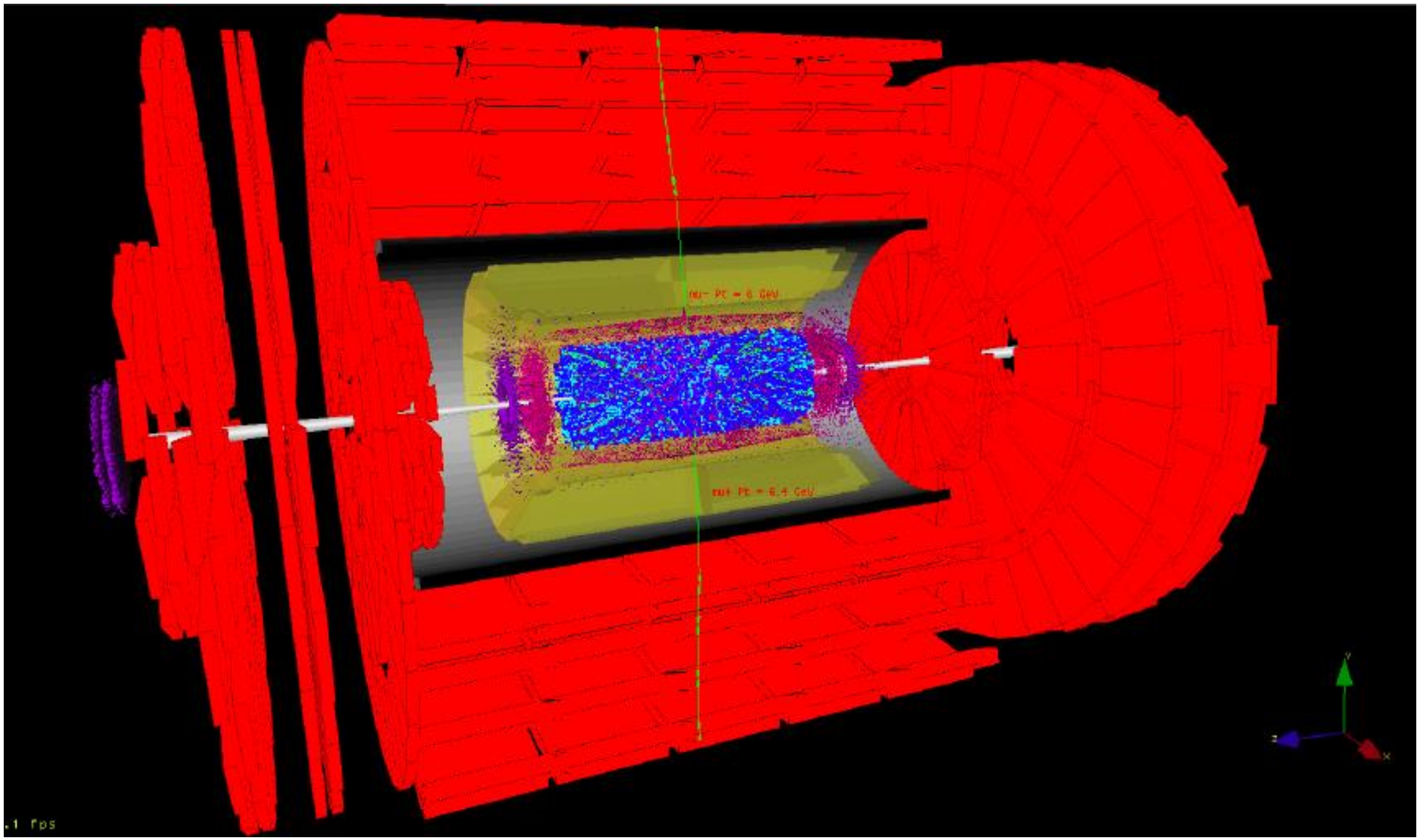


Event data structure		
EDM	Data	MC
	FEVT	SimFEVT
RAW	Digitized detector	Generated, simulated
RECO	Reconstructed	
AOD	Physics extracted	

- **16 million channels → ADC (12-16bit) → Zero suppression → 2MBytes raw data (p+p)**
- **Data containers:**
  - **Run header, Event header, RAW data, Reconstruction data, AOD, calibration, slow control, etc.**

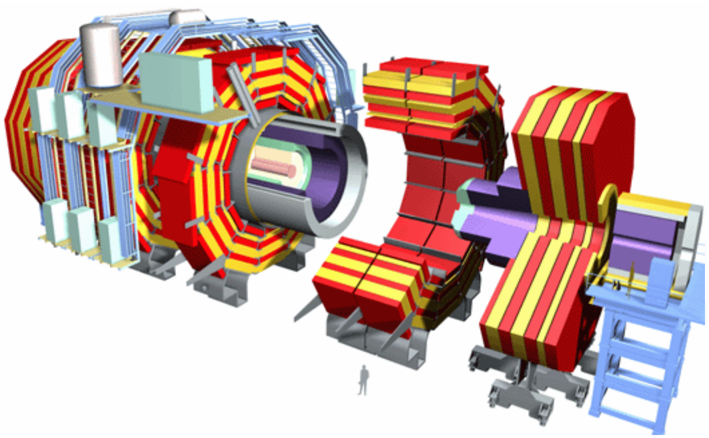
AA → hot ball + Υ → μ+ μ-

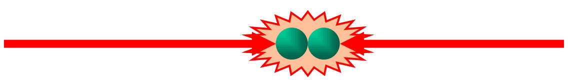
Pb+Pb event (dN/dy = 3500) with $\Upsilon \to \mu^+\mu^-$



Pb+Pb event display: Produced in pp software framework (simulation, data structures, visualization)

Not only data but also MC data





Sensor
→ ADC
→ digitize
→ trigger
→ record

GEANT4
detector
simulation

Event reconstruction

Real data

MC data

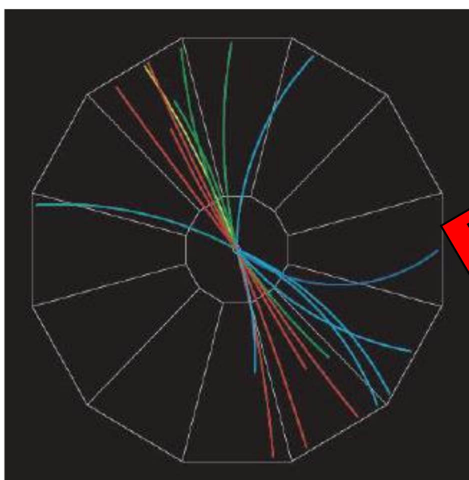
Physics reconstruction

Data AOD

MC AOD

Data size

Estimation	pp	AA
Beam time / year (s)	10^7	10^6
Trigger rate	150Hz	70Hz
# of events	$1.5x10^9$	$0.7x10^8$
Event size	2.5MB	5MB
Data produced / year	3.75 PB	0.35 PB
10 years LHC run	40 PB	4 PB
MC data required	= PB	= PB
Order of magnitude	~ 100 PB	



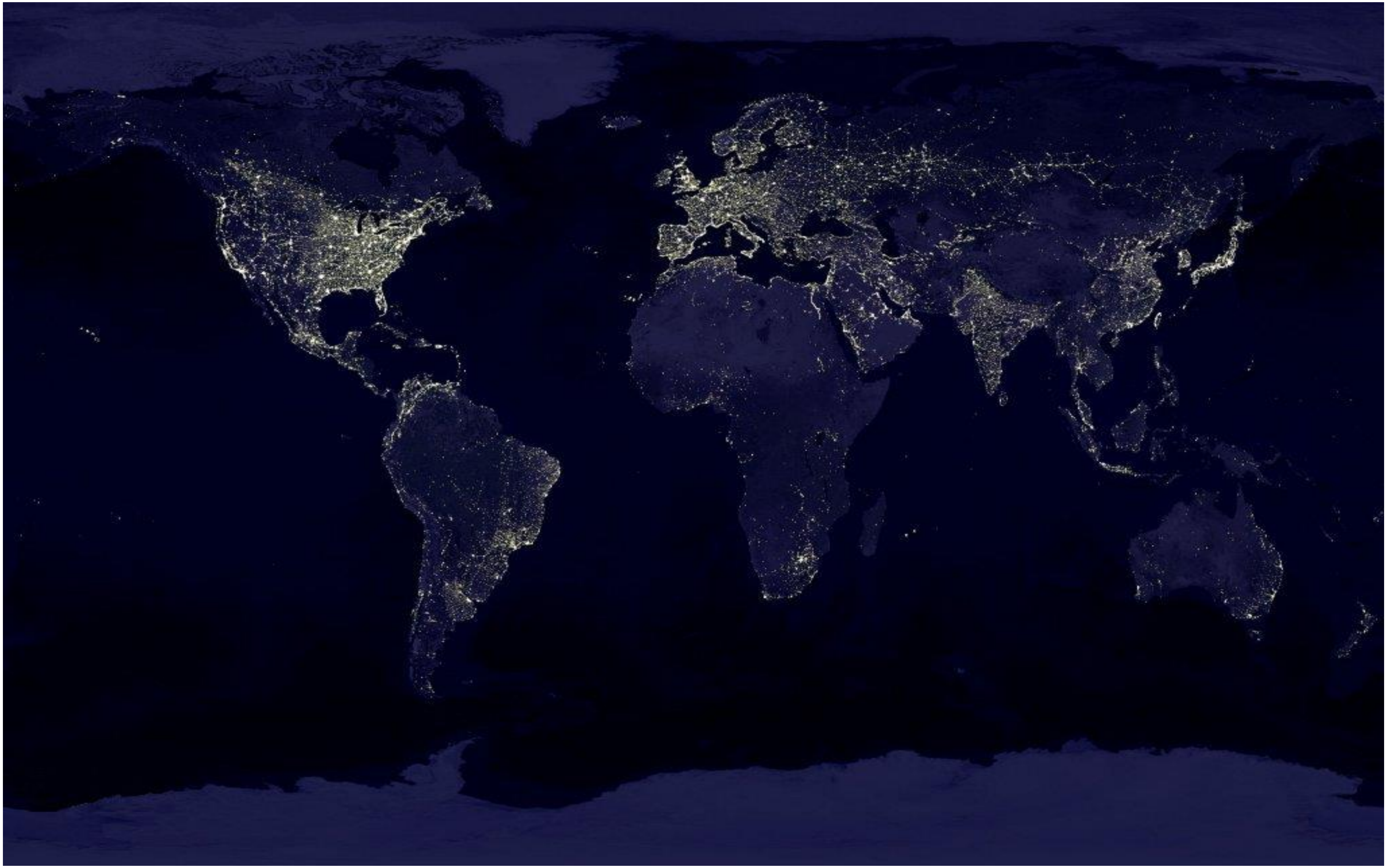
Who can save us?

Yearly computing size

- 10 PB : Compact Disc (700MB)
  - 150 millions CD
- each CD is 1mm thick
  - 150 km !!
- with DV... 20 km
- wi... D → 1,000,000

- ...simulate AA
  - 1-6 hours/events
  - ~ 10^8 hours to create AA MC
  - ~ 10^4 CPU needed
- To reconstruct Data & MC
- Reprocessing
- Data analysis etc.
- Needs few tens of MSI2K
  - newest CPU ~ 1000SI2K
- pp + AA→ Order of ~10^5 CPUs

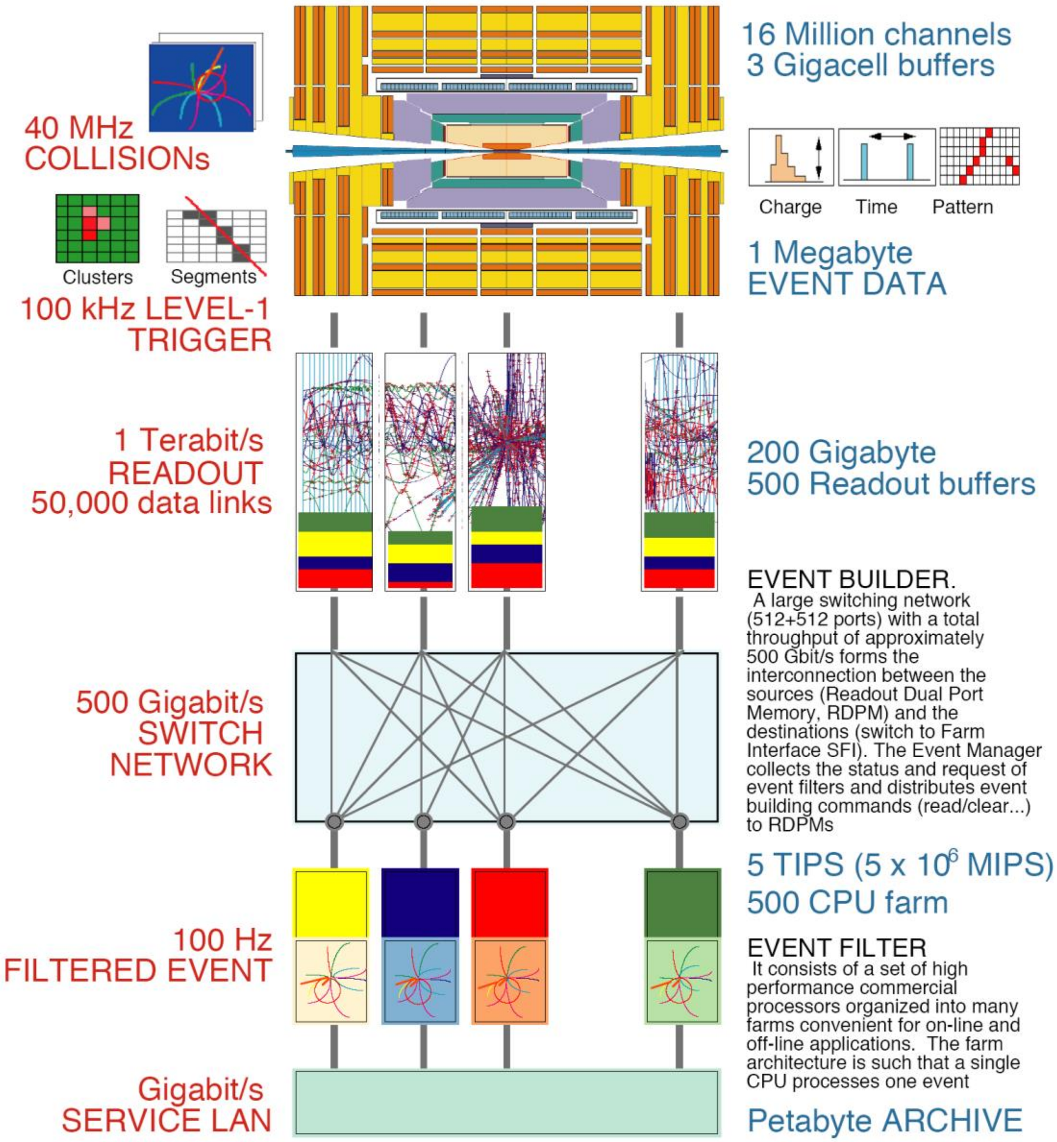
Grid computing : E-Science



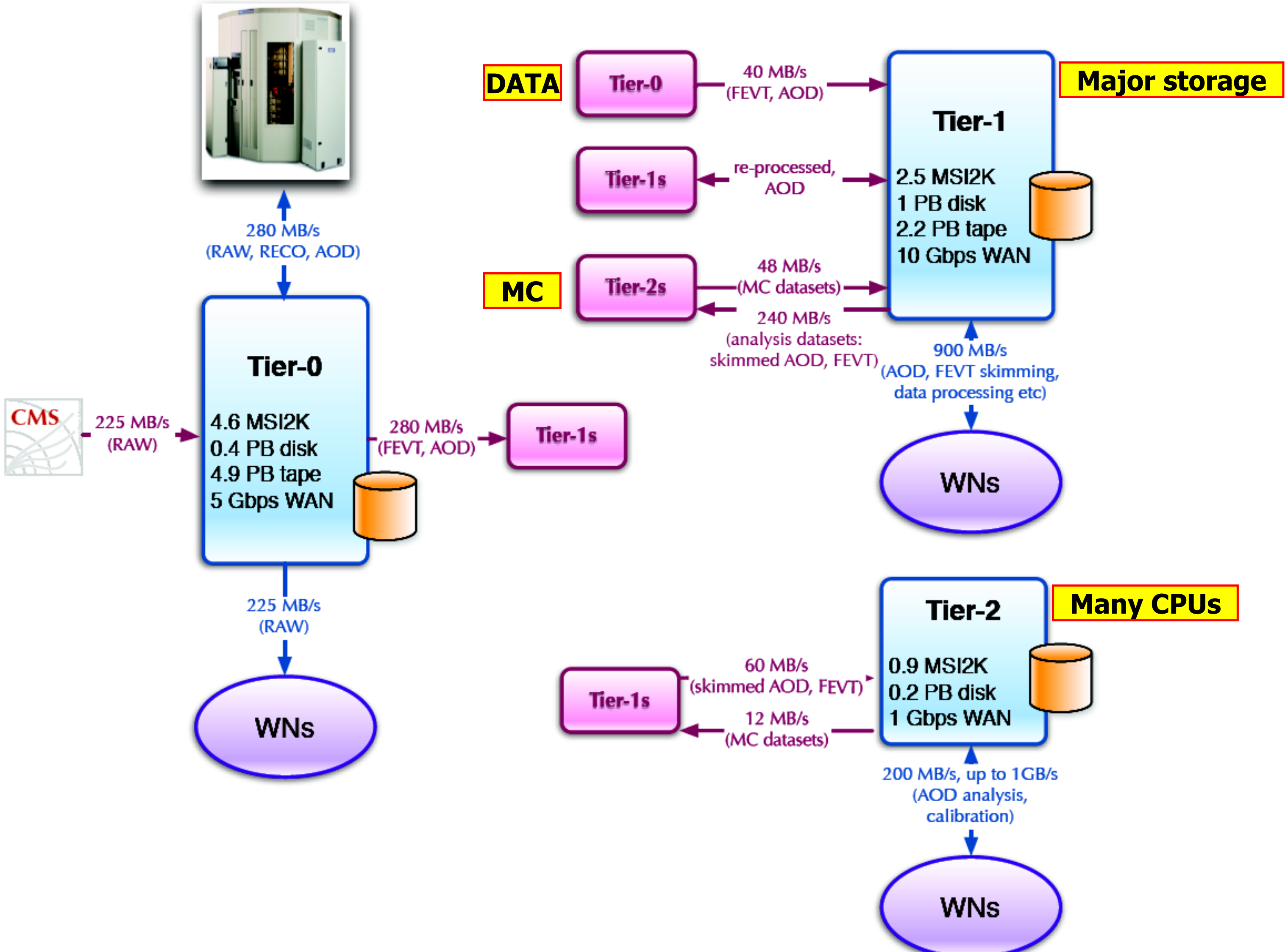
CMS computing:

Tier structure

What happens at Tier0

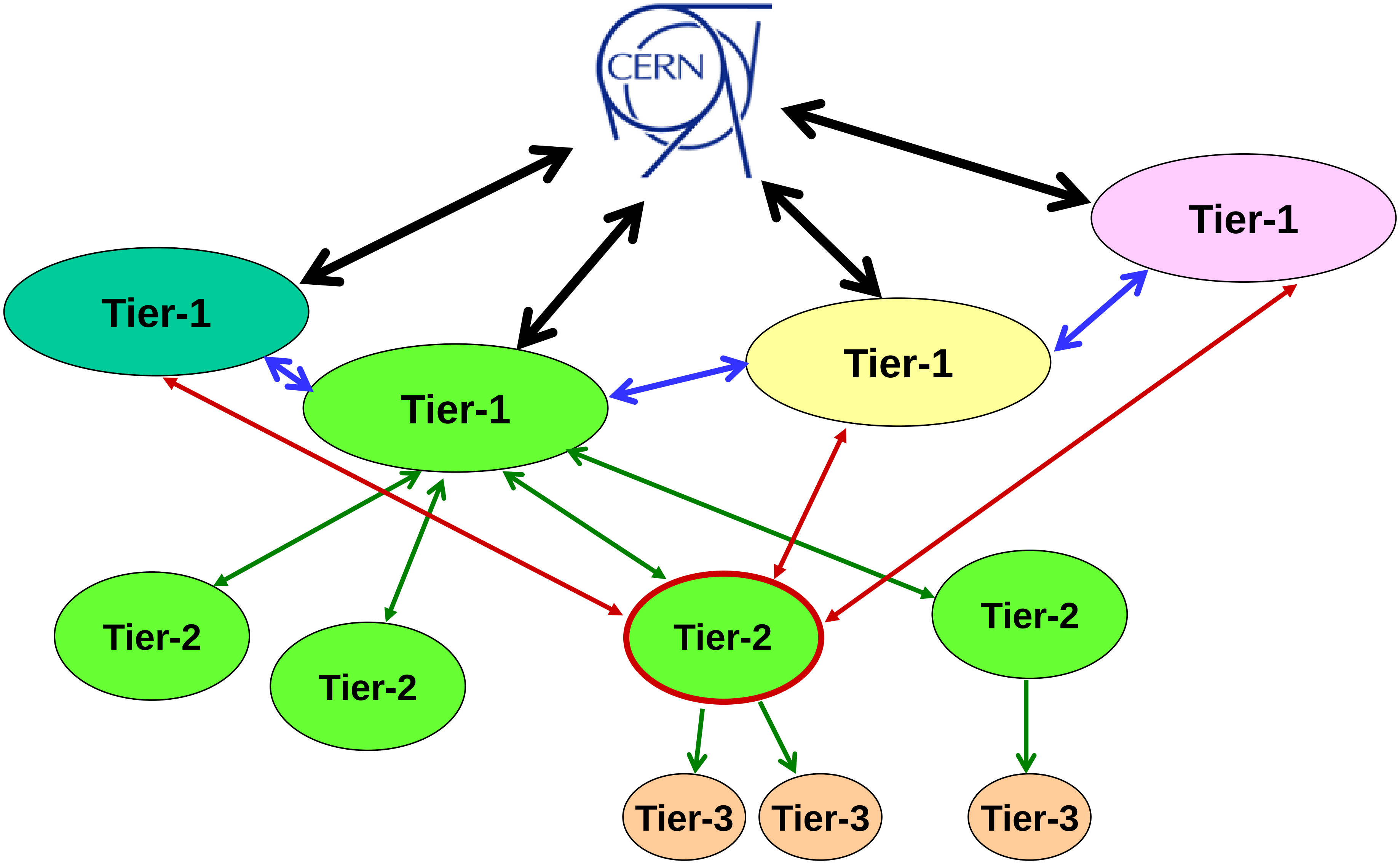


Tier 0 ←→ Tier 1 ←→ Tier 2

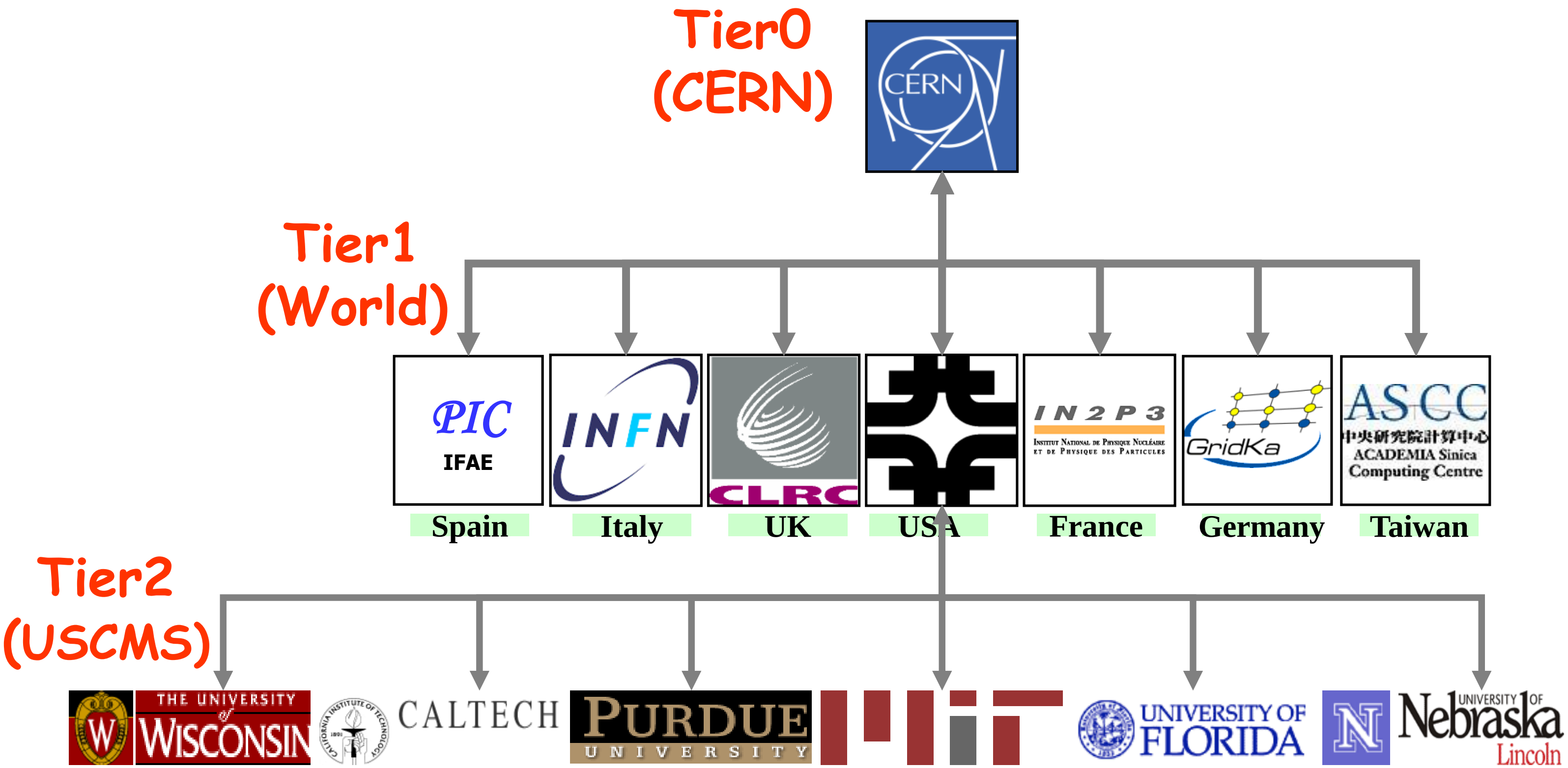


% LAT Bauerdick, 2006

Connection topology

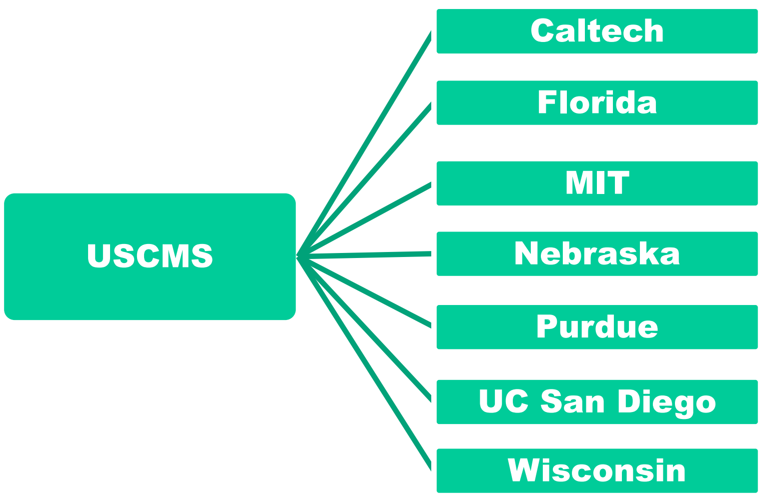


CMS Computing Tier structure



US CMS tier2 case

- Total 48 universities
- 7 have Tier2, others have Tier3
- CE: 200-3000CPUs (400-1000kSI2K)
- SE: > 100TB
- Network infra: 1-10Gbps

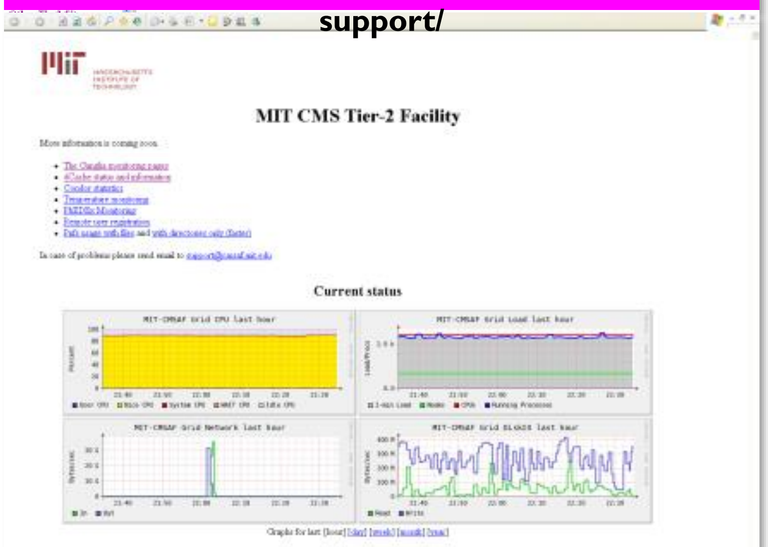


Site	CPU (kSI2K)	Disk (TB)	WAN (Gbit/s)
Caltech	586	60	10
Florida	519	104	10
MIT	474	157	1
Nebraska	650	105	10
Purdue	743	184	10
UCSD	932	188	10
Wisconsin	547	110	10

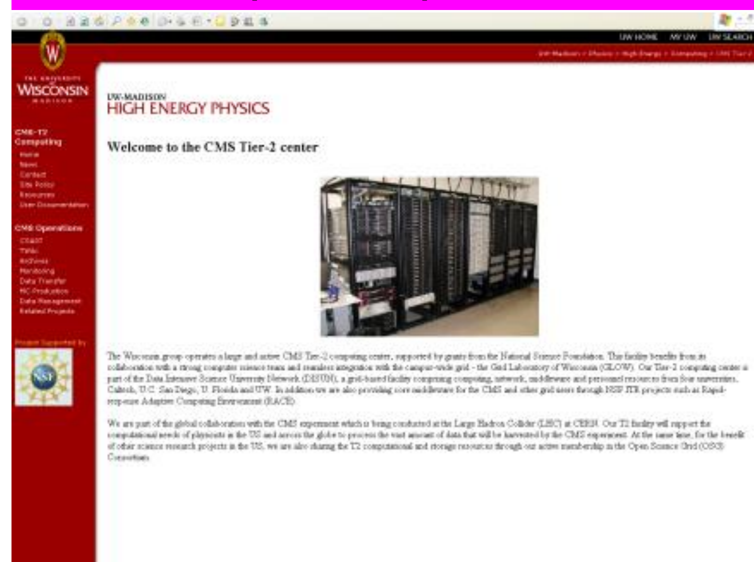
US-Tier2 homes

http://www.cacr.caltech.edu/projects/tier2-support/

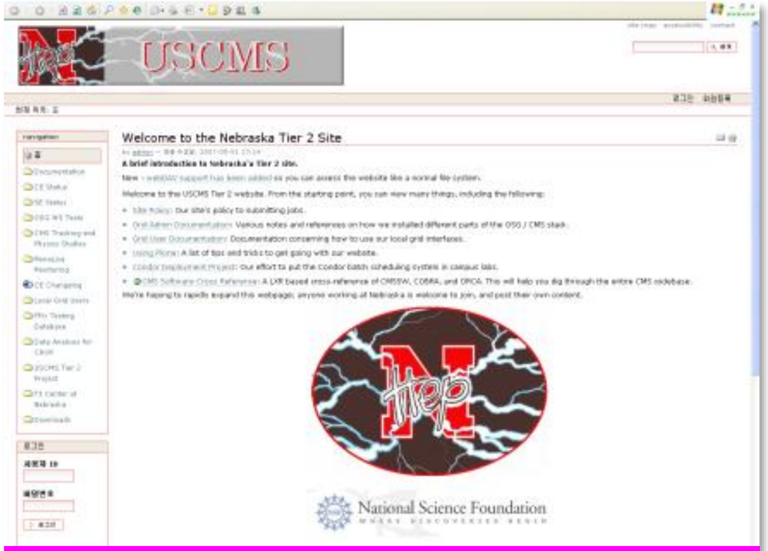
http://tier2.ihepa.ufl.edu/



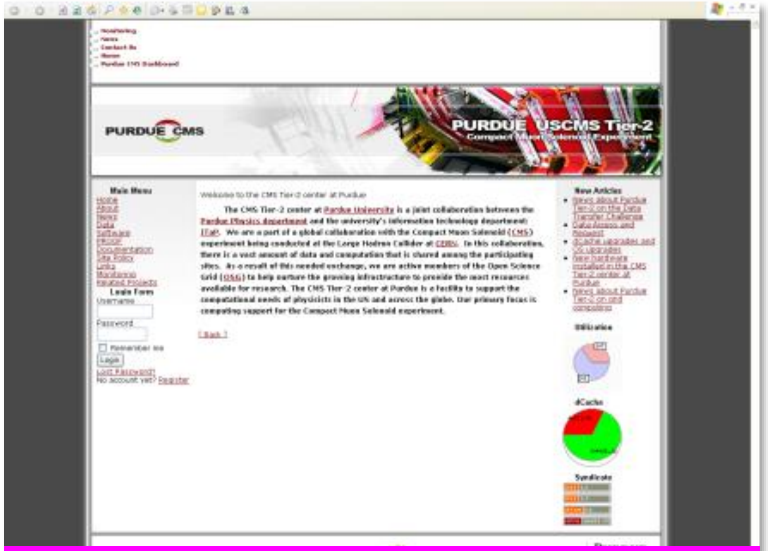
http://www.cmsaf.mit.edu/ (MIT공과대학)



http://www.hep.wisc.edu/cms/comp/



http://t2.unl.edu/cms



http://www.physics.purdue.edu/Tier2/

https://tier2.ucsd.edu/zope/UCSDTier2/

Manpower

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Check points

- Centers: 7-8 universities → 1 or 2 centers
- CE: 400kSI2K
- SE: minimum of 100TB
- Network infra: 1Gbps minimum
  - Need national highways, KREONET / KOREN
- 1 director, 2 physicists who knows what to do
  - + 3-4 operational staffs
- support CMSSW, Condor, dCache, + more

Korea CMS Tier2 guideline

CMS Tier2센터 구성요소	최소설치용량 (추천용량)	실사 및 평가 방법
CE (Computing Element)	최소 400kSI2K (800kSI2K 추천)	- 개인용 PC숫자는 제외하고 순수히 계산용으로 설치된 것을 확인
	ganglia모니터링 설치운영 필수	- ganglia모니터링과 Condor 모니터링을 통해 클러스터링 및 배치잡 수행성을 확인
	Condor 배치시스템 설치 운영필수	- 각각의 CPU의 SI2K 확인
SE (Storage Element)	최소 100TB (200TB 추천)	- 사용자 디스크 (user disk)는 제외 - dCache 모니터링을 통해 스토리지로 사용 할 수 있는지를 실사함
	dCache 서버 설치 운용 필수	
Network	최소 1Gbps (10Gbps추천)	- KREONET또는 KOREN 연동 확인
Location and equipments	물리학과내 냉방능력을 갖춘 독립 공간 필수 (독립 센터 추천)	- 실사를 통해 공간을 확인
	최소 50kW 급 전력 수급필수	- 전력수급확인 필수
	최소 20RT급 항온항습장치 필수	- 항온항습 시설 확인 필수
Human resource	LHC/CMS 입자물리 전공자의 운영 책임자 참여 필수	- 운영책임자의 CMSSW 사용능력여부 확인
	국내/외국 CMS 물리학자들과의 공동연구 능력 확인	- 운영책임자의 LHC/CMS 실험 파악 정도 확인
	운영팀과 행정조직 보유 필수	- 운영팀 인적구성 및 행정인력 확인

WLCG

EGEE and OSG

World wide LHC Computing Grid

Grid Projects Collaborating in LHC Computing Grid

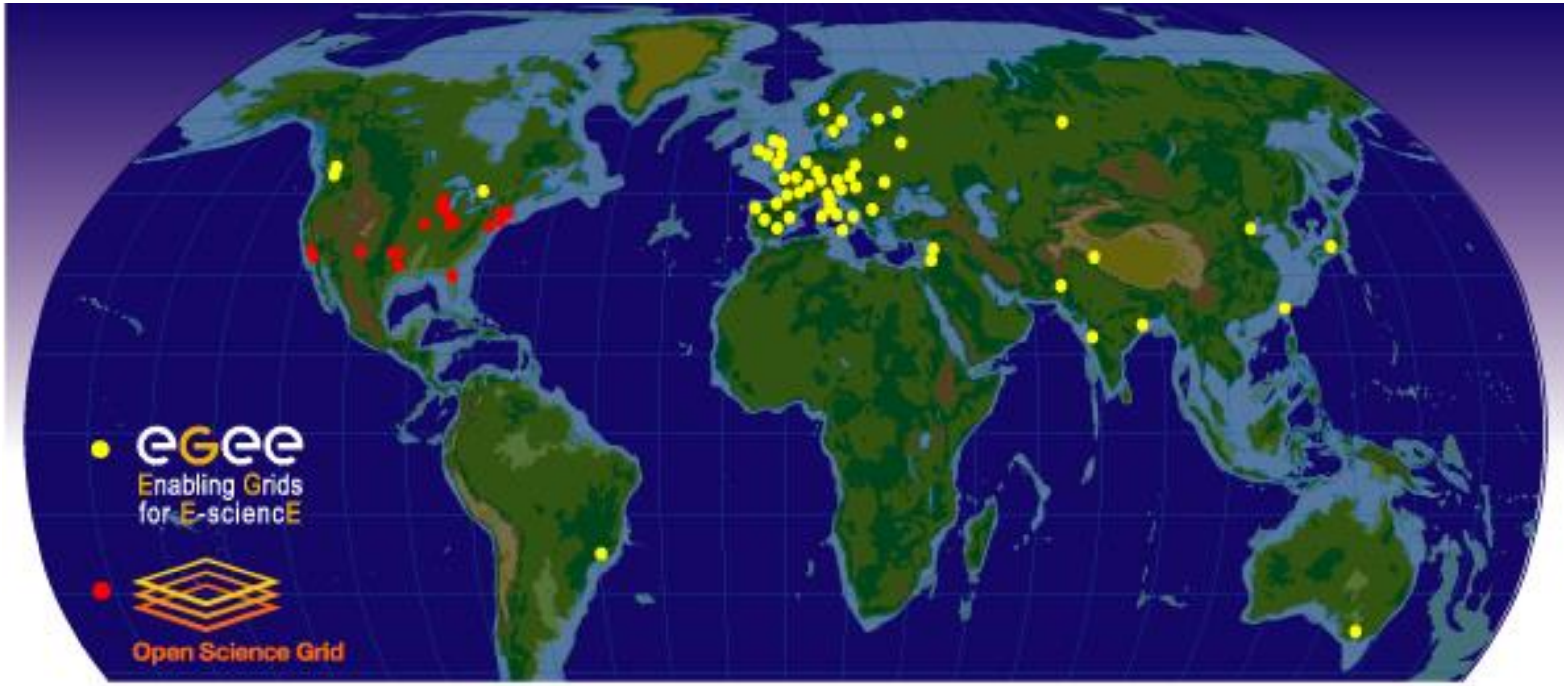
EGEE Operations Information	
Active Sites	177
Available CPU	30230
Available Storage (TB)	14393

LastBuild:Sun Apr 8 15:16:01 BST 2007 GstatQuery:2006-12-15

Click the picture.

LCG uses three major grid solutions

- **EGEE : most of European CMS institutions**
  - **open mixed with LCG… (LCG ~ EGEE)**
- **OSG : all of US-CMS institution**
- **NorduGrid : Northern European contries**



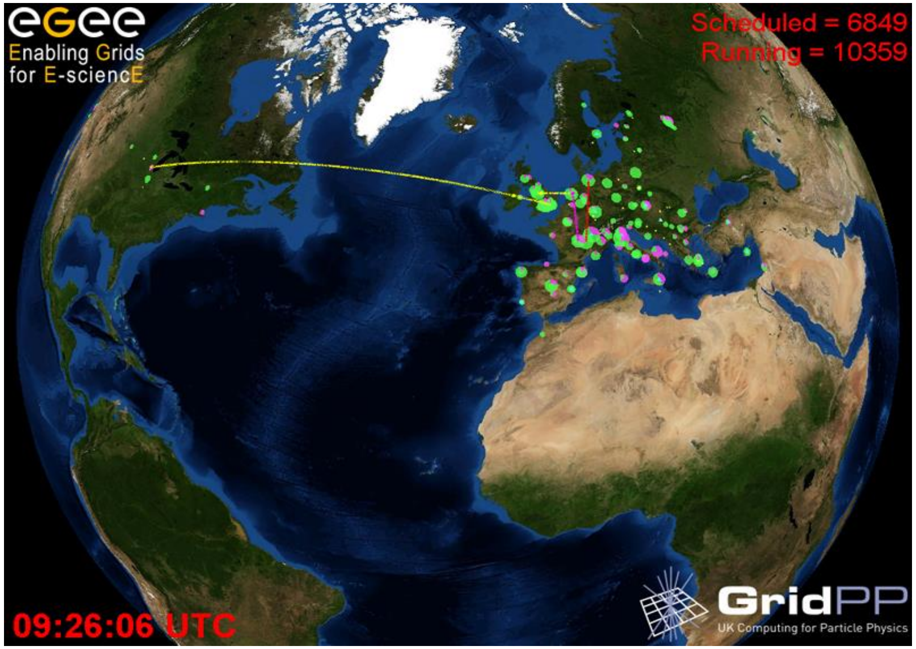
A map of the worldwide LCG infrastructure operated by EGEE and OSG.

OSG in USA

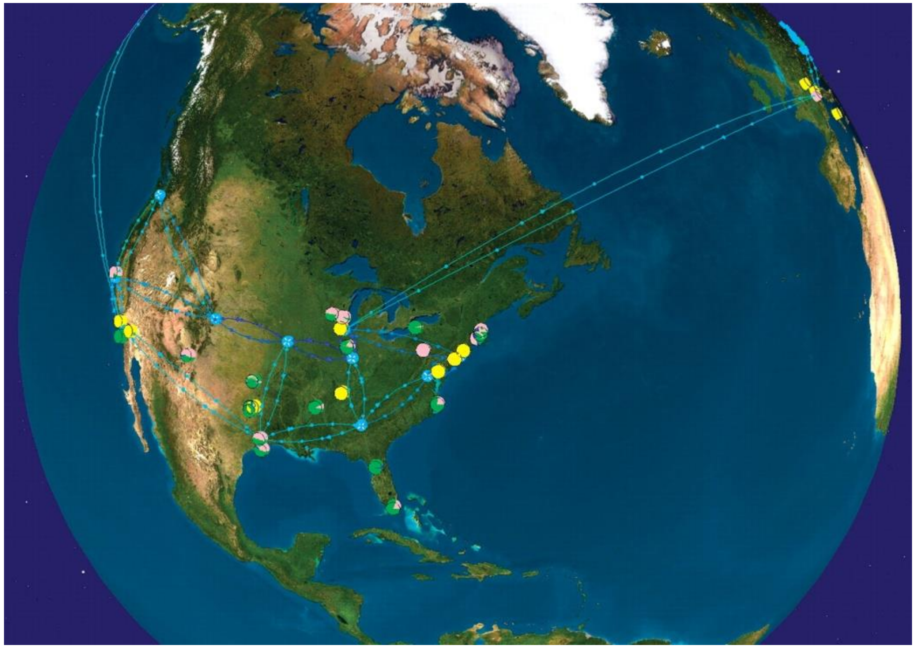
Europe

USA

Most of European CMS institutions



Most of American CMS institutions



OSG-EGEE compatibility

- Common VOMS
  - Virtual Organization Management System
- Condor-G interfaces
  - multiple remote job execution services (GRAM, Condor-C).
- File Transfers using GridFTP.
- SRM for managed storage access.
  - Storage Resource Manager
- Publish OSG BDII to shared BDII for Resource Brokers to route jobs across the two grids.
  - Berkeley Database Information Index. c.f. GIIS, GRIS
- Active Joint Security groups: leading to common policies and procedures.
- Automate ticket routing between GOCs.

Software in OSG (installed by VDT)

- **Job Management**
  - Condor (including Condor-G & Condor-C)
  - Globus GRAM
- **Data Management**
  - GridFTP (data transfer)
  - RLS (replication location)
  - DRM (storage management)
  - Globus RFT
- **Information Services**
  - Globus MDS
  - GLUE schema & providers
- **Security**
  - VOMS (VO membership)
  - GUMS (local authorization)
  - mkgridmap (local authorization)
  - MyProxy (proxy management)
  - GSI SSH
  - CA CRL updater
- **Accounting**
  - OSG Gratia
- **Monitoring**
  - MonaLISA
  - gLite CEMon
- **Client tools**
  - Virtual Data System
  - SRM clients (V1 and V2)
  - UberFTP (GridFTP client)
- **Developer Tools**
  - PyGlobus
  - PyGridWare
- **Testing**
  - NMI Build & Test
  - VDT Tests
- **Support**
  - Apache
  - Tomcat
  - MySQL (with MyODBC)
  - Non-standard Perl modules
  - Wget
  - Squid
  - Logrotate
  - Configuration Scripts

OSG based CMS-Tier2
@
Seoul Supercomputer Center (SSCC)

CMS Tier 2 requirement (OSG)

- **Network: 2-10Gbps**
  - Gbps intranet → 2 Gbps out bound
- **CPU: 1 M SI2K**
  - ~1000 CPU
- **Storage: 200TB**
  - dCache system
- **OSG middle ware**
  - CE, SE
- **Batch system**
  - Condor + PBS
- **CMS softwares**
  - CMSSW et al. at $OSG_APP

None of Korean institutions have this amount of facilities for CMS Tier2

%KISTI → ALICE Tier 2

Seoul SuperComputer Center

- SSCC (Seoul Supercomputer Center), established in 2003 with a funding of ~$1M$
- Upgrade 2007: funding of ~$0.2M$
- Total of 256 CPUs + Giga switches + KOREN2

2007 upgrade

- + 10Giga bps switch
- SE: Storage of 120TB
  - ~ 400 HDD of 300GB
- CE: 128 CPUs
  - MC generation
- + new 64bit HPC
- + KREONET
- Operate OSG

Center organization

- **Spokesperson, Director**
- **3 Ph.D. researchers**
- **4 admins/operators, 2 application managers, 2 staffs**

Deputy spokesperson
Prof. Hyunsoo Min

Director
Prof. Inkyu Park




System	Software	Web	User support
J.W. Park	G.R. Hahn	M.K. Choi	Y.S. Kim

CMS TIER2 TIER3 setup

SSCC

dCache pool (200TB)

Nortel Passport 8800(Gb) 2ea

Extream BlackDiamond 8810(10Gb/Gb)

Foundry BigIron16(Gb) 2ea

Condor Computing pool(+120 CPUs)

Gate, Web, Condor-G dCache/gFTP, Ganglia

- 120 TB storage
  - dCache
- 0.1M SI2K
- 2 Gbps network
- OSG

KREONET (GLORIAD) KOREN (APII, TEIN)

1-2 Gbps

SPCC

64bit cluster (+100CPUs)

Extream BlackDiamond 8810(10Gb/Gb)

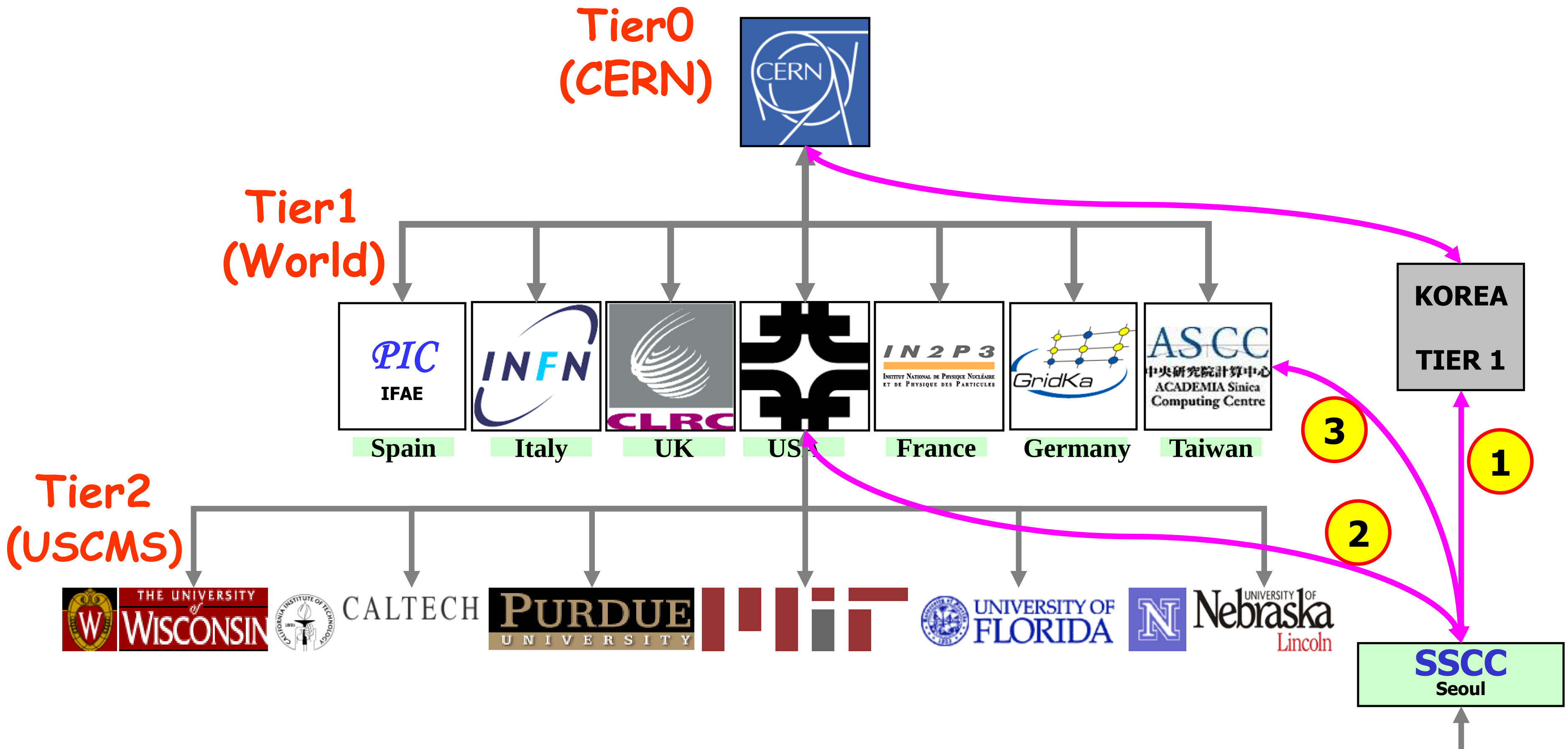
Nortel Passport 8800(Gb)

D-Link L3 Switch(Gb)

- 64bit 3GHz CPU
  - 64 machines
- 32bit 2GHz CPU
  - 32 machines
- 8TByte storage

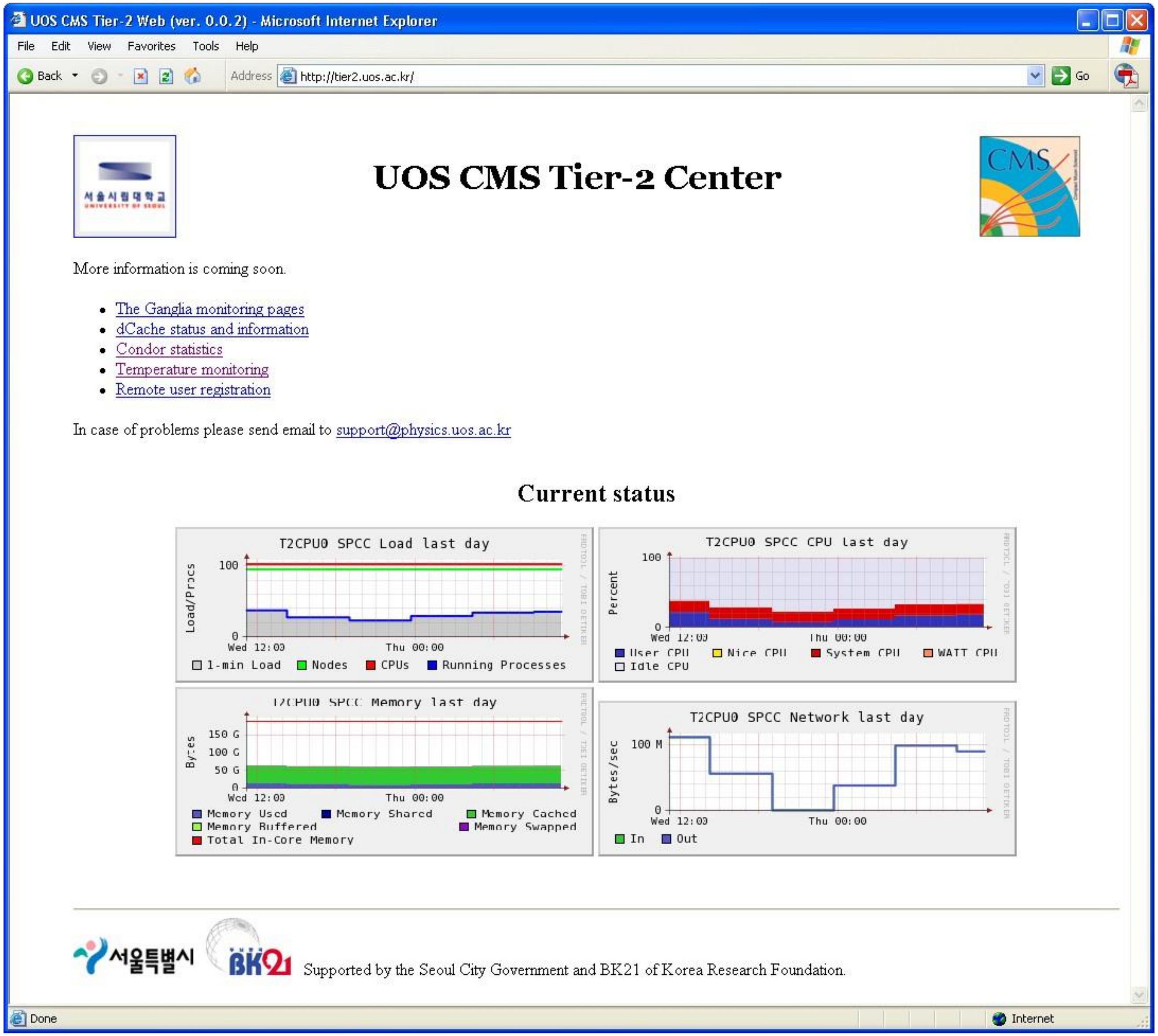
CMS-HI Tier 2 ⟷ 20Gbps ⟷ **Analysis Tier 3**

Tier 2 connection



1. We hope, but we need Tier1 first
2. <u>Current approach!</u>
3. Geographical distance doesn't really matter.

Current Tier2 status



CE and SE status

intel64.spcc.uos	0.00	nodeb024.spcc.uos	0.00	nodeb049.spcc.uos	0.00	nodeb074.spcc.uos	0.00
nodeb001.spcc.uos	1.00	nodeb025.spcc.uos	0.00	nodeb050.spcc.uos	0.00	nodeb075.spcc.uos	0.00
nodeb002.spcc.uos	1.00	nodeb026.spcc.uos	0.00	nodeb051.spcc.uos	0.00	nodeb076.spcc.uos	0.04
nodeb003.spcc.uos	1.00	nodeb027.spcc.uos	0.00	nodeb052.spcc.uos	0.00	nodeb077.spcc.uos	0.00
nodeb004.spcc.uos	1.00	nodeb028.spcc.uos	0.00	nodeb053.spcc.uos	0.00	nodeb078.spcc.uos	0.00
nodeb005.spcc.uos	1.00	nodeb029.spcc.uos	0.00	nodeb054.spcc.uos	0.00	nodeb079.spcc.uos	0.00
nodeb006.spcc.uos	1.00	nodeb030.spcc.uos	0.00	nodeb055.spcc.uos	0.00	nodeb080.spcc.uos	0.00
nodeb007.spcc.uos	1.00	nodeb031.spcc.uos	0.00	nodeb056.spcc.uos	0.00	nodeb081.spcc.uos	0.00
nodeb008.spcc.uos	1.00	nodeb032.spcc.uos	0.02	nodeb057.spcc.uos	0.00	nodeb082.spcc.uos	0.00
nodeb009.spcc.uos	1.00	nodeb033.spcc.uos	0.00	nodeb058.spcc.uos	0.00	nodeb083.spcc.uos	0.00
nodeb010.spcc.uos	1.00	nodeb034.spcc.uos	0.00	nodeb059.spcc.uos	0.00	nodeb084.spcc.uos	0.00
nodeb011.spcc.uos	0.00	nodeb035.spcc.uos	0.00	nodeb060.spcc.uos	0.00	nodeb085.spcc.uos	0.00
nodeb012.spcc.uos	0.00	nodeb036.spcc.uos	0.00	nodeb061.spcc.uos	0.00	nodeb086.spcc.uos	0.00
nodeb013.spcc.uos	0.00	nodeb037.spcc.uos	0.08	nodeb062.spcc.uos	0.00	nodeb087.spcc.uos	0.00
nodeb014.spcc.uos	0.00	nodeb038.spcc.uos	0.00	nodeb063.spcc.uos	0.00	nodeb088.spcc.uos	0.00
nodeb015.spcc.uos	0.00	nodeb039.spcc.uos	0.00	nodeb064.spcc.uos	0.00	nodeb089.spcc.uos	0.00
nodeb017.spcc.uos	0.00	nodeb040.spcc.uos	0.00	nodeb065.spcc.uos	0.00	nodeb090.spcc.uos	0.00
nodeb018.spcc.uos	0.00	nodeb041.spcc.uos	0.00	nodeb066.spcc.uos	0.00	nodeb091.spcc.uos	0.00
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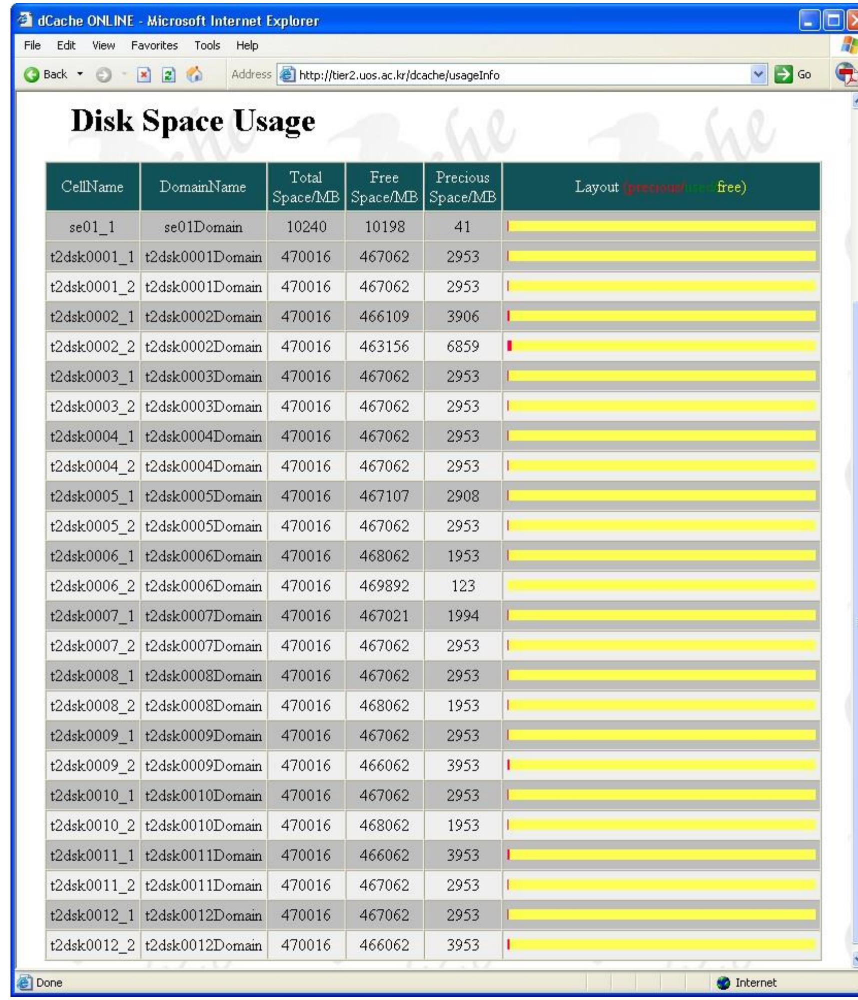
nodeb023.spcc.uos	0.00	nodeb046.spcc.uos	0.00	nodeb071.spcc.uos	0.00		
		nodeb047.spcc.uos	0.00	nodeb072.spcc.uos	0.00		
		nodeb048.spcc.uos	0.00	nodeb073.spcc.uos	0.00		



CellName	DomainName	Total Space/MB	Free Space/MB	Precious Space/MB	Layout (precious/used/free)
se01_1	se01Domain	10240	10198	41	
t2dsk0001_1	t2dsk0001Domain	470016	467062	2953	
t2dsk0001_2	t2dsk0001Domain	470016	467062	2953	
t2dsk0002_1	t2dsk0002Domain	470016	466109	3906	
t2dsk0002_2	t2dsk0002Domain	470016	463156	6859	
t2dsk0003_1	t2dsk0003Domain	470016	467062	2953	
t2dsk0003_2	t2dsk0003Domain	470016	467062	2953	
t2dsk0004_1	t2dsk0004Domain	470016	467062	2953	
t2dsk0004_2	t2dsk0004Domain	470016	467062	2953	
t2dsk0005_1	t2dsk0005Domain	470016	467107	2908	
t2dsk0005_2	t2dsk0005Domain	470016	467062	2953	
t2dsk0006_1	t2dsk0006Domain	470016	468062	1953	
t2dsk0006_2	t2dsk0006Domain	470016	469892	123	
t2dsk0007_1	t2dsk0007Domain	470016	467021	1994	
t2dsk0007_2	t2dsk0007Domain	470016	467062	2953	
t2dsk0008_1	t2dsk0008Domain	470016	467062	2953	
t2dsk0008_2	t2dsk0008Domain	470016	468062	1953	
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t2dsk0009_2	t2dsk0009Domain	470016	466062	3953	
t2dsk0010_1	t2dsk0010Domain	470016	467062	2953	
t2dsk0010_2	t2dsk0010Domain	470016	468062	1953	
t2dsk0011_1	t2dsk0011Domain	470016	466062	3953	
t2dsk0011_2	t2dsk0011Domain	470016	467062	2953	
t2dsk0012_1	t2dsk0012Domain	470016	467062	2953	
t2dsk0012_2	t2dsk0012Domain	470016	466062	3953	

SE : currently 12TB

CE : currently 102 CPUs

Documentation by Twiki

Korea CMS

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Main

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- CmsTier2
- DAQ
- HeavyIon
- Main
- MuonReco
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r48 - 10 Sep 2007 - 10:05:58 - JunghwanGoh

Korea CMS Collaboration

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Institutions & Participants

Sub-group	Institution	Participants
Muon Reconstruction	SKKU	Y.I. Choi, I.T. Yu, S.Y. Choi, J.S. Lee, J.H. Goh
RPC	Korea Univ.	S.K. Park, E.I. Won, K.S. Lee, S.H. Ahn
	Konkuk Univ.	J.T. Lee
DAQ&Trigger	Kyungbuk Nat'l Univ.	D.C. Son, D.H. Kim, G.N. Kim, S.Y. Ro, H.K. Park, J.C. Kim
	Konkuk Univ.	S.K. Oh
Heavy Ion	Korea Univ.	K. S. Sim, B. Hong, G. Sood, D.H. Moon, J.H. Kim
	Univ. of Seoul	I.C. Park, G.B. Kim, J.W. Park, G.R. Hahn, M.K. Choi, Y.S. Kim

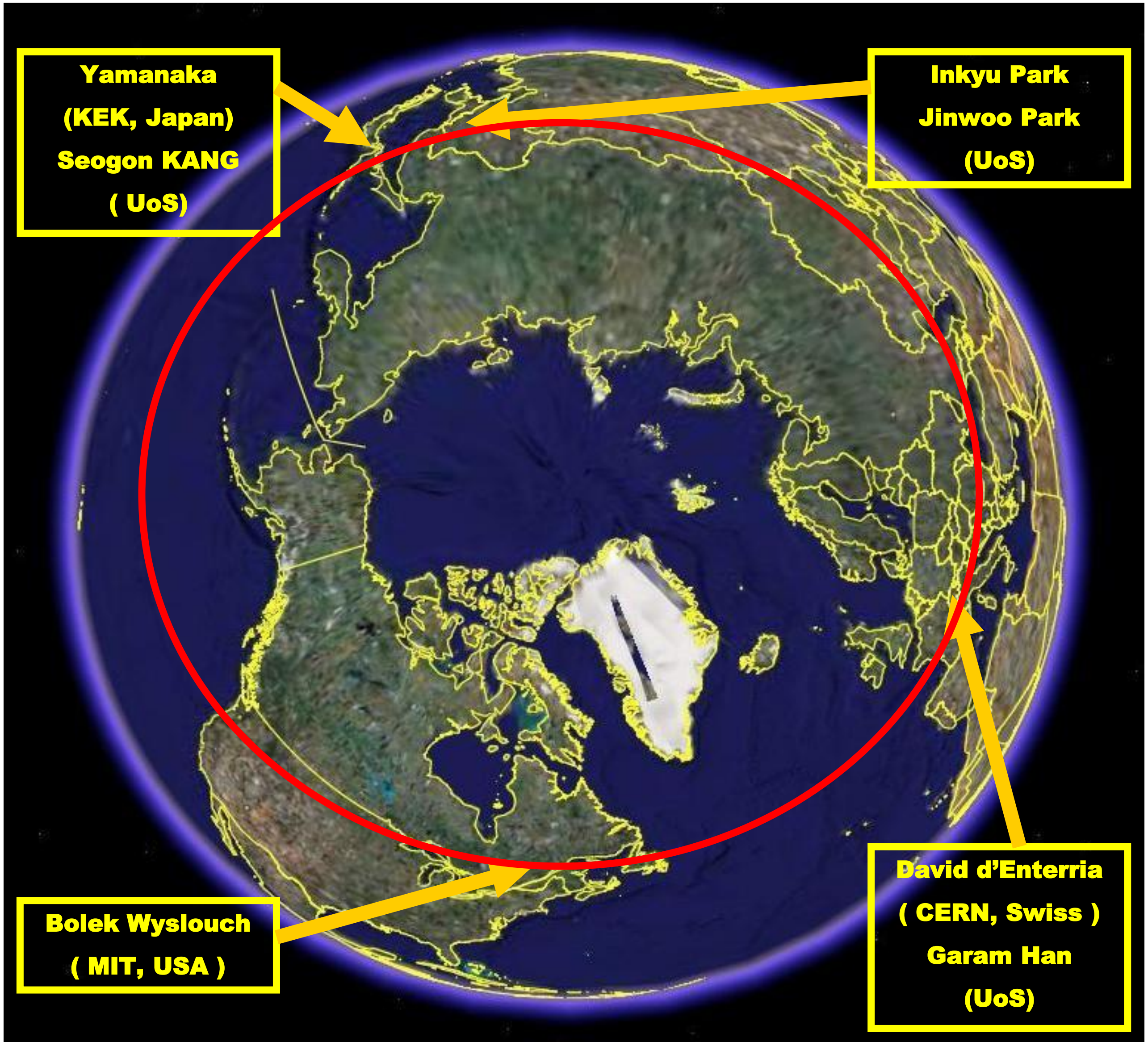
- Any suggestions and comments are very much welcome to this site!! garam.hahn@gmail.com

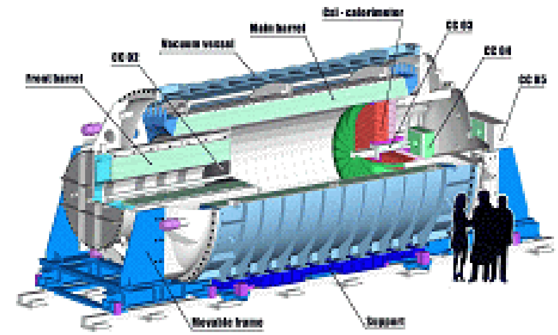
Group Apartment at CERN

- General Information
  - Location
  - Rules
- More Information (Members Only)
  - Location, address (zoom in)
  - Pictures
  - How to survive here!
- Reservation & Booking status (Members Only)
  Currently we don't have any automatic reservation system. Please write your request to Prof. Y.I. Choi and cc to Prof. Inkyu Park.

Network readiness

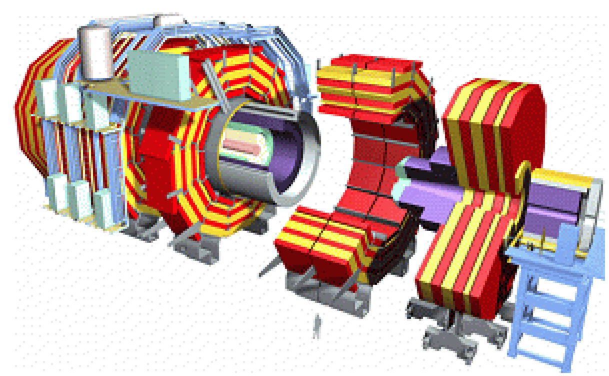
Thanks to this project…



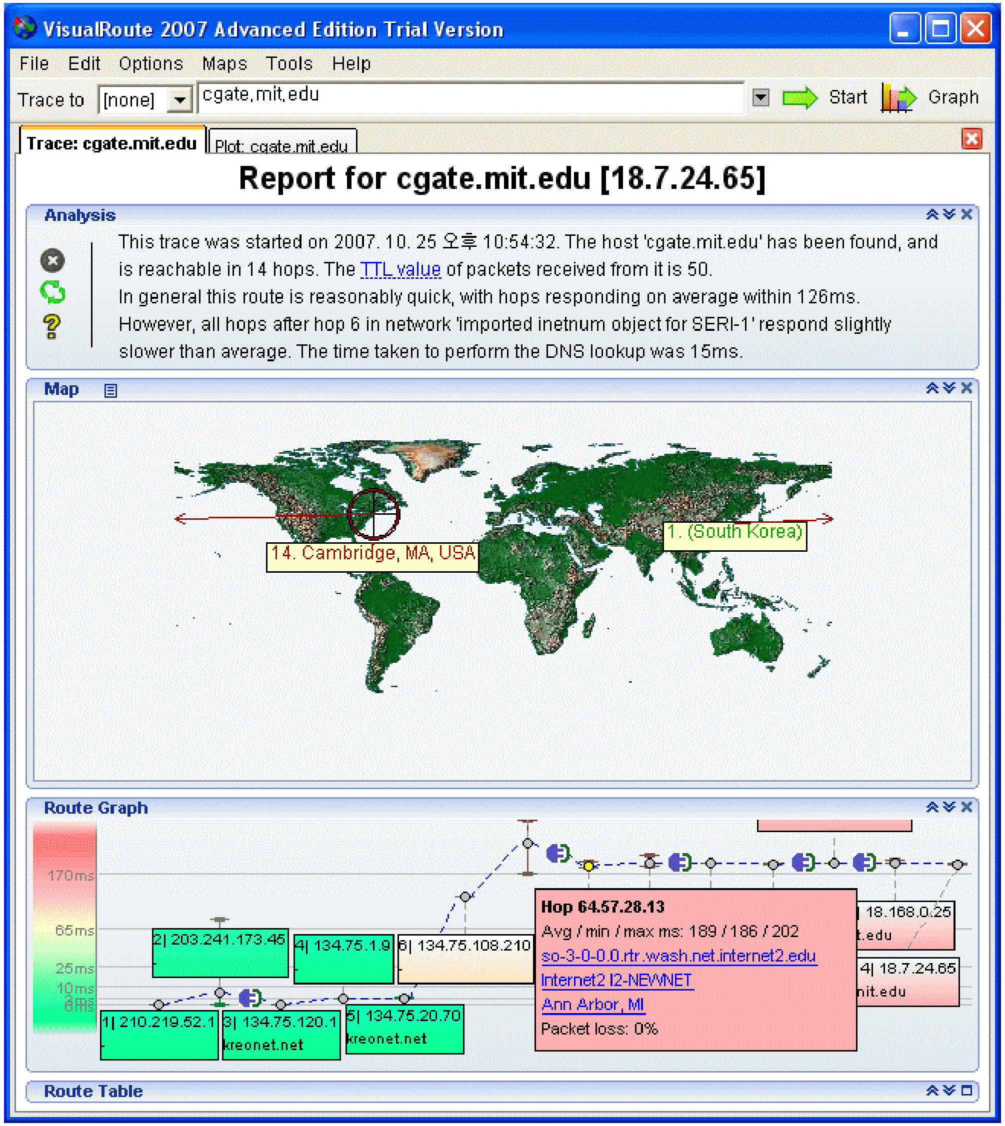


JPARC E391a

CMS-HI

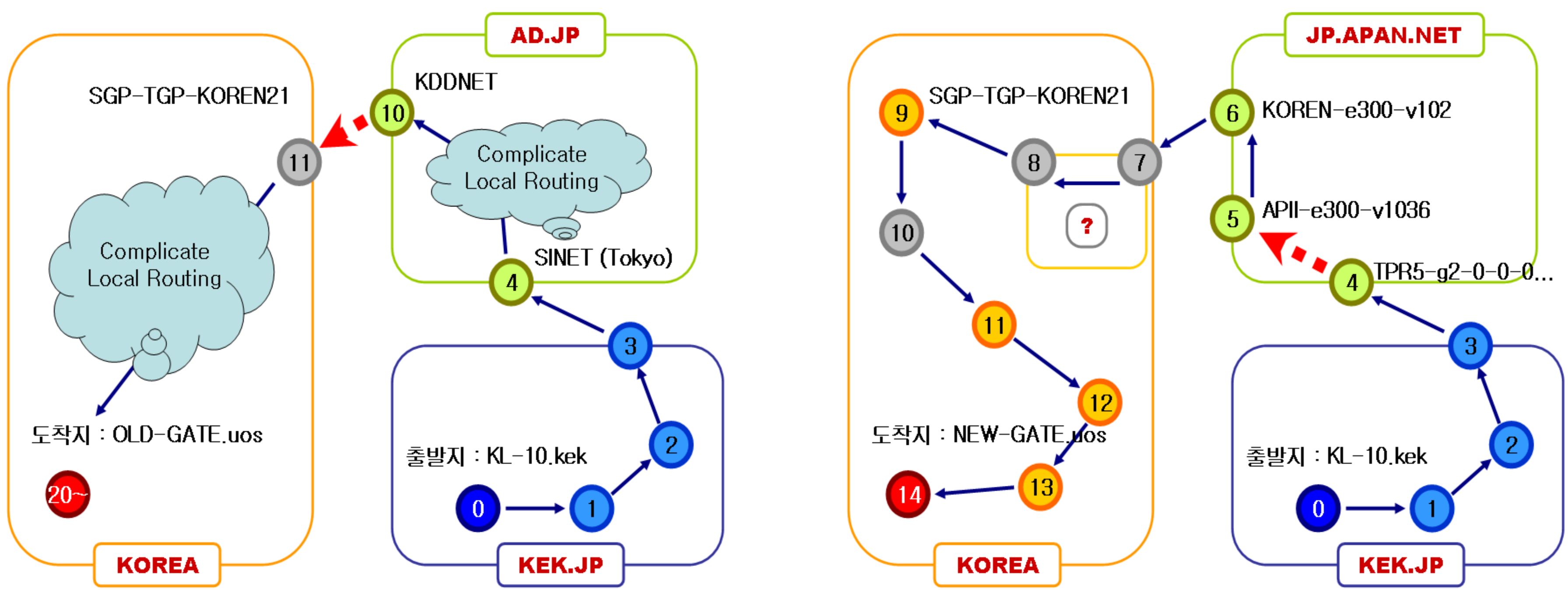


Traceroute example



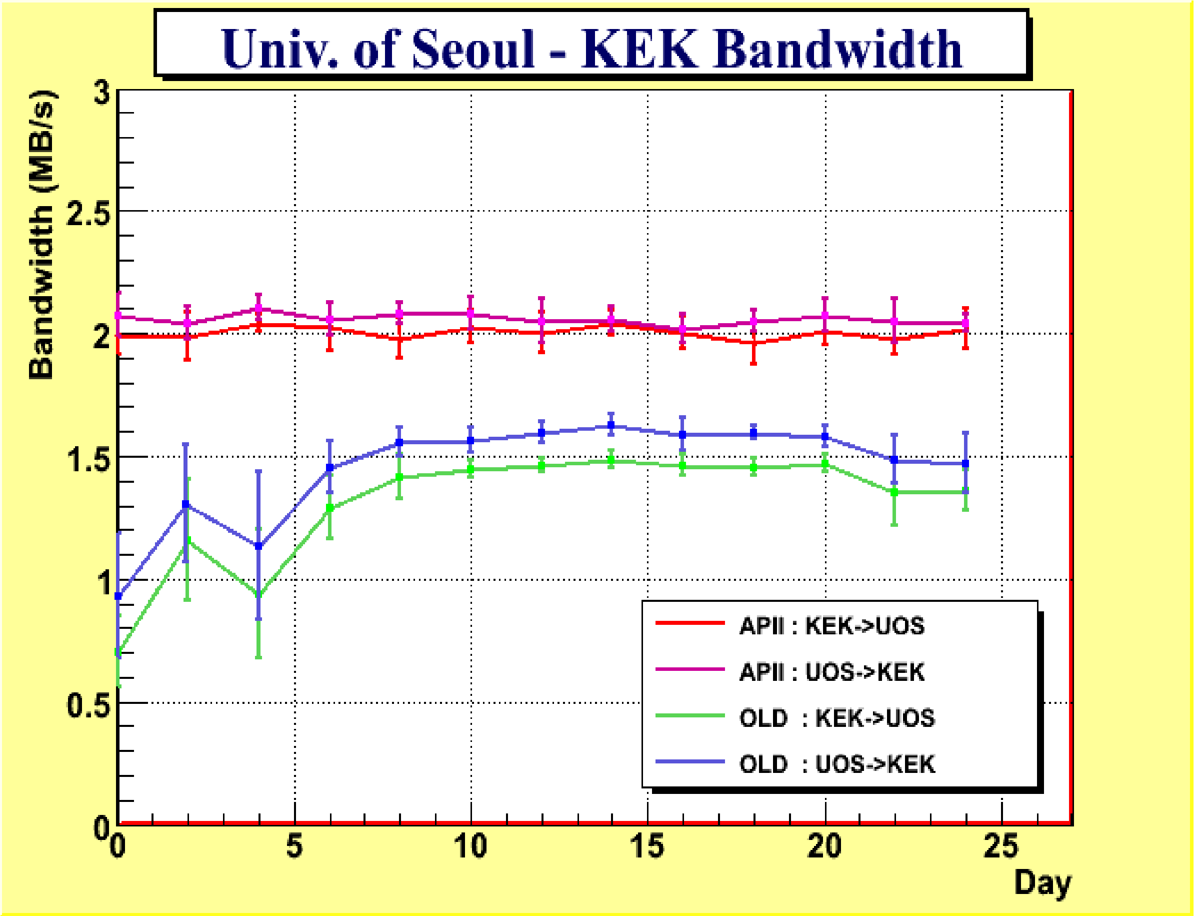
Between UoS and KEK

Traceroute KL-10.kek to OLD-GATE.uos | **Traceroute KL-10.kek to NEW-GATE.uos**



- ***Existing: KEK→AD.JP→KDDNET→UoS***
  - ***20 hops: hop between 9 and 10 takes 40ms.***
- ***KEK→APII→KOREN→UoS***
  - ***14 hops : hop beween 4 and 5 takes 30ms, which is 90% of total delay time***

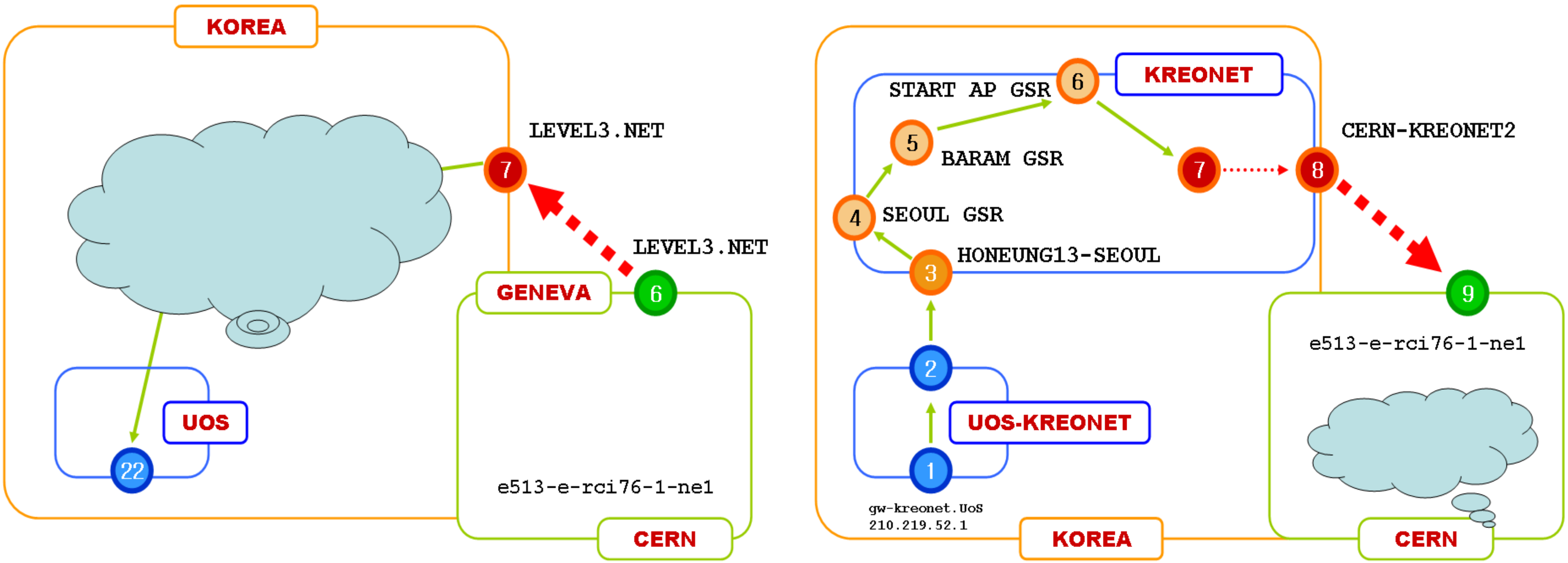
Bandwidth test between UoS and KEK



- **100Mbps at KEK, while 1G in UoS**
- **About a gain of 1.3, but need a correct KOREN usage**
- **Need more info and works**

Between UoS and CERN

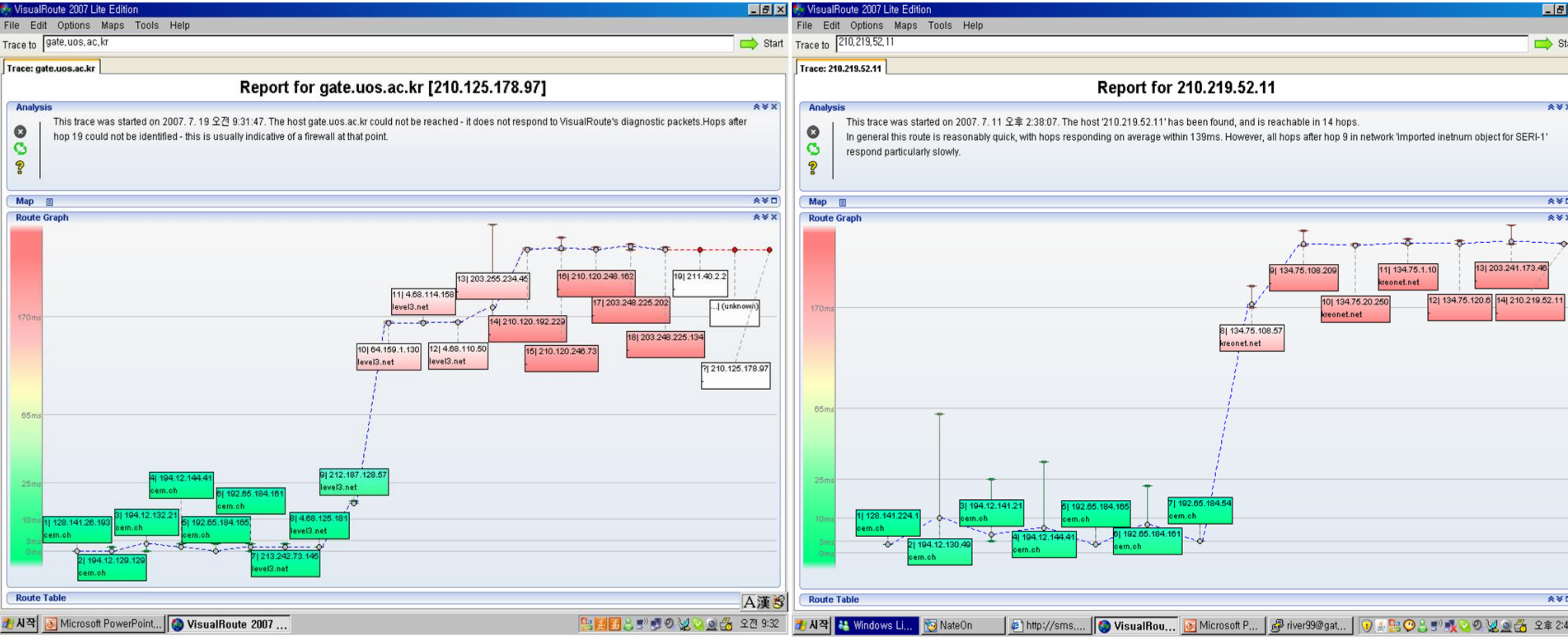
Route Between LXPLUS.cern & OLD-GATE.uos	Route Between LXPLUS.cern & NEW-GATE.uos



170ms delay in both

- *We didn't have time to correct this problem by the time of this review.*

Between UoS and CERN



- ***Still unclear status***
  - ***Somehow we couldn't see TEIN2***

National KOREN Bandwidth

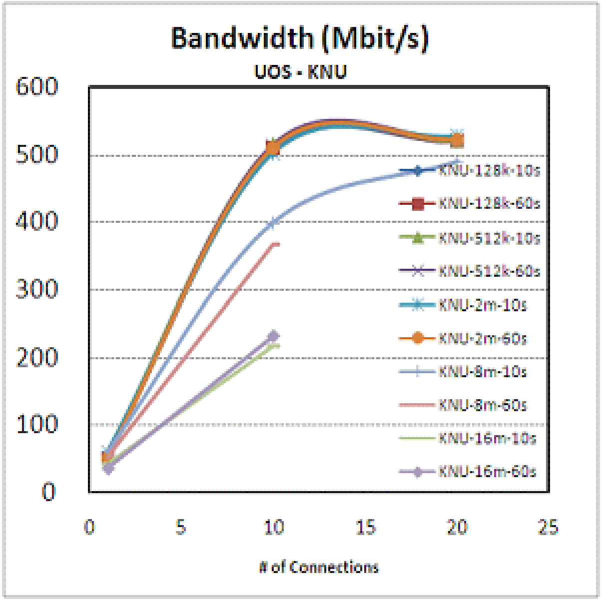
- Bandwidth between SSCC and KNU
- Bandwidth between SSCC and KU
- Bandwidth between SSCC and SKKU
- Iperf was used for the check of TCP/UDP performance

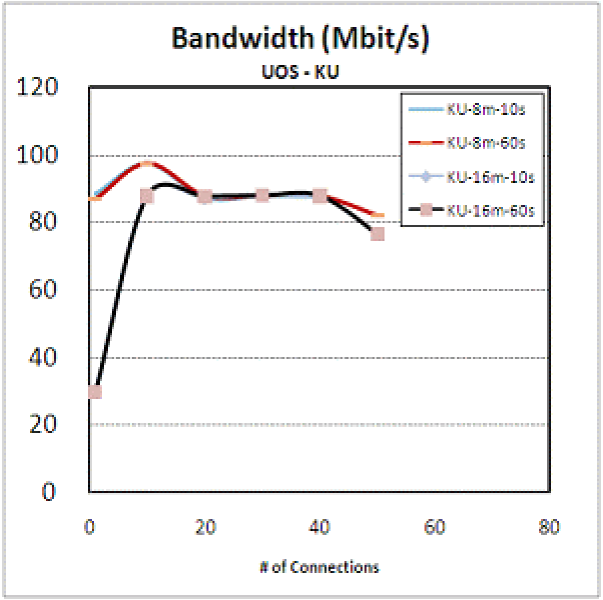
Network 벤치마크 기관	KOREN 연동 속도
서울시립대-고려대학교	99Mbps
서울시립대-경북대학교	520Mbps
서울시립대-성균관대학교	100Mbps

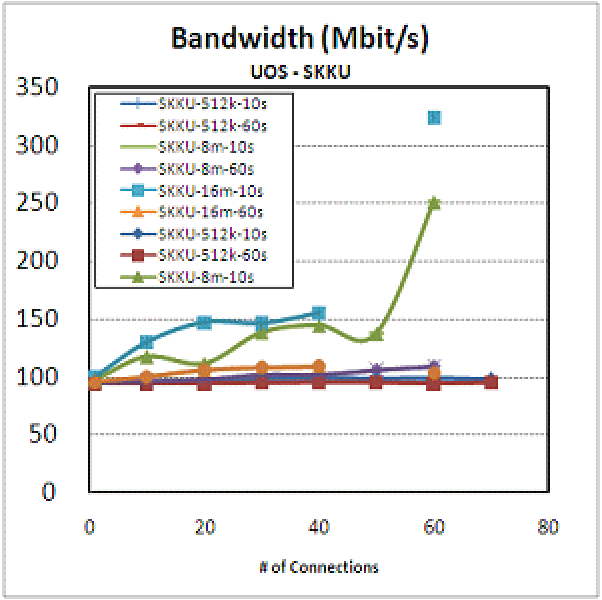
National KOREN Bandwidth

NAME	Number of connections(threads) at the same time								UNIV_NAME	W_SIZE	TIME
	1	10	20	30	40	50	60	70			
KNU-128k-10s	53.9	506.0	520.0						KNU	128k	10
KNU-128k-60s	51.8	510.0	520.0						KNU	128k	60
KNU-512k-10s	58.6	515.0	521.0						KNU	512k	10
KNU-512k-60s	52.3	514.0	522.0						KNU	512k	60
KNU-2m-10s	60.4	503.0	528.0						KNU	2m	10
KNU-2m-60s	52.4	511.0	523.0						KNU	2m	60
KNU-8m-10s	59.9	399.0	490.0						KNU	8m	10
KNU-8m-60s	53.6	367.0							KNU	8m	60
KNU-16m-10s	42.6	218.0							KNU	16m	10
KNU-16m-60s	36.4	232.0							KNU	16m	60
KU-8m-10s	88.5	97.4	87.4	88.0	87.7				KU	8m	10
KU-8m-60s	87.0	97.4	87.9	88.1	88.0	82.2			KU	8m	60
KU-16m-10s	29.7	87.8	87.2	88.0	87.7				KU	16m	10
KU-16m-60s	29.7	88.0	87.8	88.1	88.0	76.6			KU	16m	60
SKKU-512k-10s	94.1	95.6	96.1	98.3	98.9	98.1	98.7	97.6	SKKU	512k	10
SKKU-512k-60s	94.1	94.3	94.3	94.7	94.9	94.9	94.1	94.9	SKKU	512k	60
SKKU-8m-10s	97.3	117.0	111.0	138.0	144.0	137.0	251.0		SKKU	8m	10
SKKU-8m-60s	94.7	96.5	97.9	102.0	102.0	106.0	109.0		SKKU	8m	60
SKKU-16m-10s	100.0	130.0	147.0	146.0	155.0		324.0		SKKU	16m	10
SKKU-16m-60s	95.2	100.0	106.0	108.0	109.0		103.0		SKKU	16m	60

Bandwidth results







- **SSCC-KNU shows 500Mbps connection**
- **500Mbps is our test machine maximum**

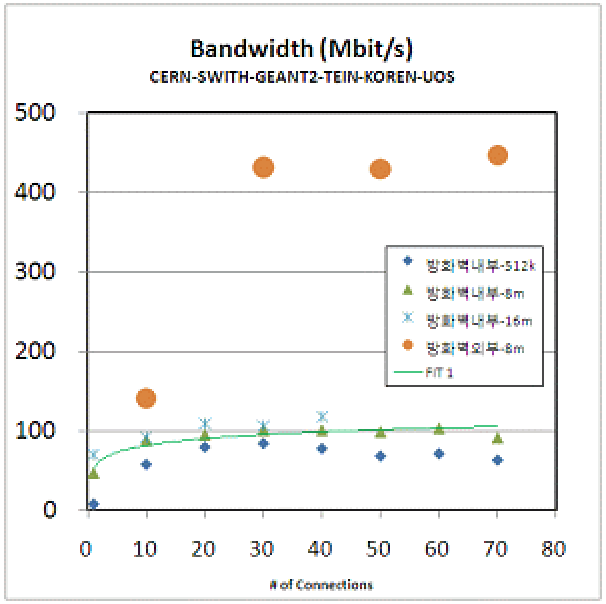
Optimized APII and TEIN2

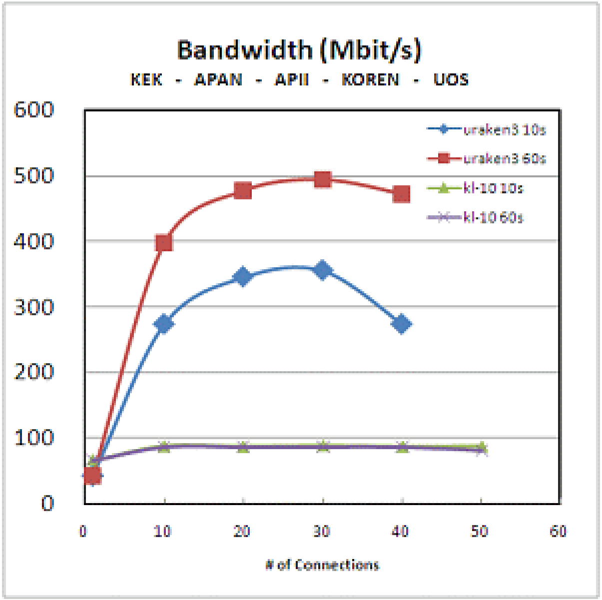
- **Maximun TEIN2 connection is 622Mbps**
  - **AS559 - SWITCH Swiss Education and Research Network**
  - **AS20965 - GEANT IP Service**
  - **AS24490 - TEIN2 Trans-Eurasia Information Network**
  - **AS9270 - Asia Pacific Advanced Network Korea (APAN-KR)**
- **APII connection is 10Gbps (uraken3.kek.jp = 1G)**

NAME-W_SIZE-S	Number of threads(connections) at the same time								NAME	SIZE	TIME
	1	10	20	30	40	50	60	70			
CERN-512k-10s	7.9	30.0	32.2	39.9					CERN	512k	10
CERN-512k-60s	7.7	57.4	79.1	83.6	77.2	67.8	70.8	62.8	CERN	512k	60
CERN-8m-10s	5.9	78.8	112.0	119.0	92.5				CERN	8m	10
CERN-8m-60s	47.5	88.2	95.0	101.0	101.0	98.8	103.0	91.4	CERN	8m	60
CERN-16m-10s	20.0	96.9	130.0	112.0					CERN	16m	10
CERN-16m-60s	69.8	92.0	109.0	106.0	118.0				CERN	16m	60
CERNNF-8m-Hs		141.0		431.0		429.0		446.0	CERNNF	8m	H
CERNNF-512k-Hs		113.0		193.0		340.0		442.0	CERNNF	512k	H
KEK-512k-10s	42.6	274.0	346.0	356.0	274.0				KEK	512k	10
KEK-512k-60s	43.6	398.0	478.0	495.0	473.0				KEK	512k	60
KEK-512k-10s	42.6	274.0	346.0	356.0	274.0				KEK	512k	10
KEK-512k-60s	43.6	398.0	478.0	495.0	473.0				KEK	512k	60

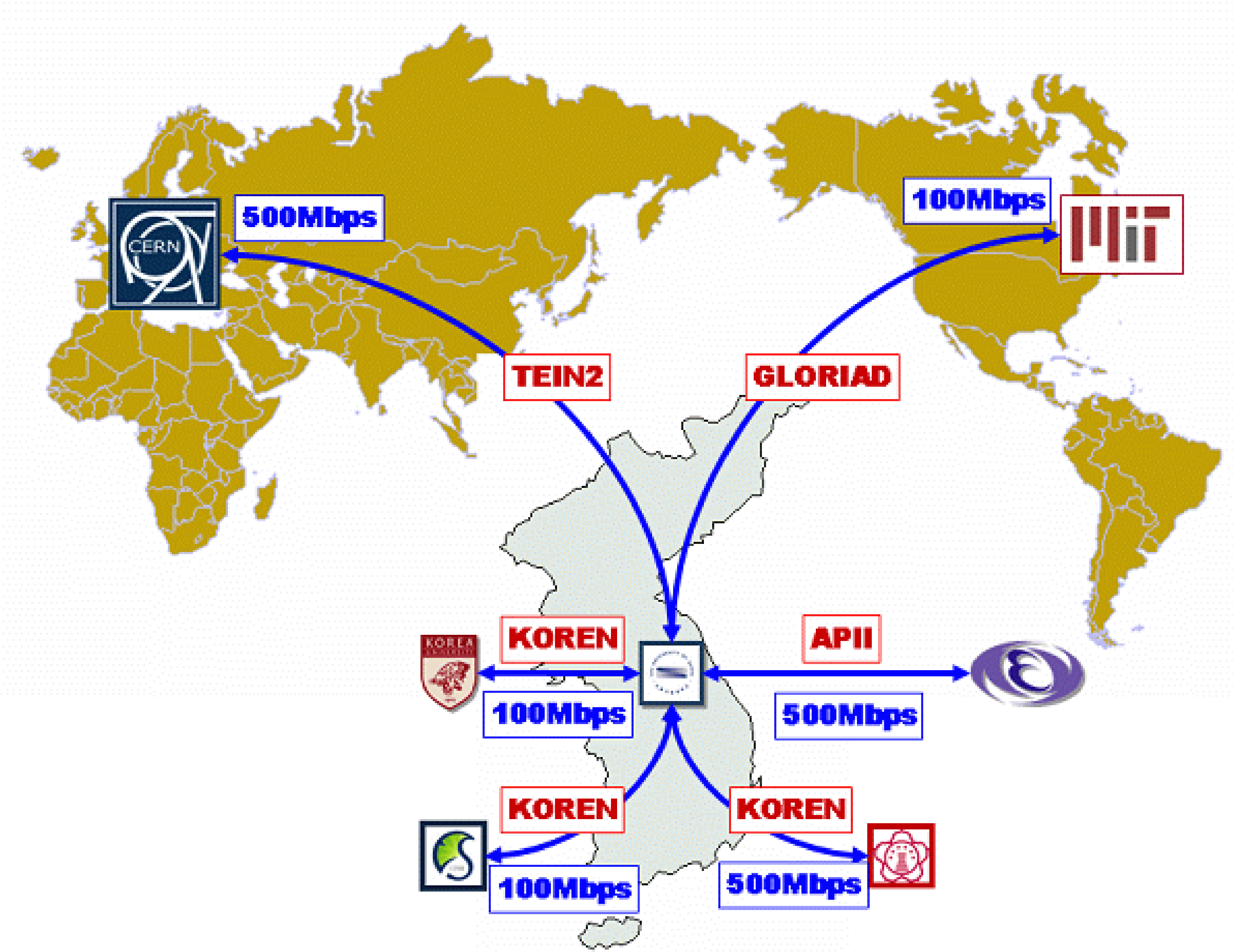
Results

- **Network to both institutions has been optimized, and shows 500Gbps**





Final network map



Remarks & Summary

Brief history so far, now, and tomorrow

- **2006 summer: visit CERN, work with CMSSW.0.7.0 to 0.8.0, implement libraries.**
  - **Work with HIROOT too**
- **2006 fall: CMS-KR Heavy-Ion team was formed**
  - **Mainly work in reconstruction software (Jet, muon)**
- **2007 winter: Our team visited MIT. OSG installed, dCache tested, Monitoring system tested.**
- **2007 spring: Upgrade for SSCC, ~$0.2M**
  - **Not enough to be a standard CMS Tier2, but good for a physics program, CMS-HI**
- **2007 summer: Tier2 in test operation, visit CERN**
  - **1 graduate student will stay at CERN**
- **2007 winter: Full size CMS-HI tier2 are being built**
  - **Starting from 2008, MOST will support a Tier2 center**

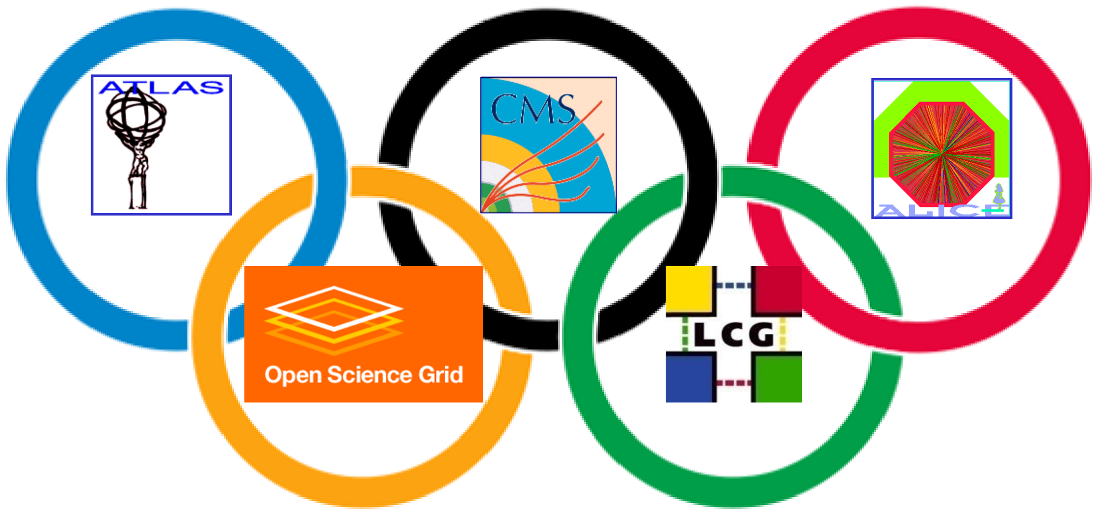
Remarks

- The only solution for LHC/CMS Computing is Grid.
- HEP again leads the next computing technology, as it did in WWW.
- LCG(EGEE) and OSG will be the ones!
- Expect lots of industrial by-products
- SSCC at Univ. of Seoul starts CMS-Tier2 based on OSG
  - Due to its limited resource, we only run CMS-HI Tier2 for now.
  - Plugged in to US-CMS TIER1 for now.
- We should not loose this opportunity if we want to lead IT & Science.
  - We need to do Korea Tier2 or Tier1, now.

Summary

- ***Seoul SuperComputing Centre (SSCC) becomes an OSG based CMS Tier2 centre***
  - *CE :102 CPUs → 200CPUs*
  - *SE: 12 TB → 140TB*
- ***Network to CERN and KEK via APII and TEIN2 has been optimized***
  - *UoS-KEK : 500Mbps*
  - *UoS-CERN: 500Mbps*
- ***Everything went smoothly. Further upgraded needed soon.***
  - *OSG, LCG Tier2 center needs a connection of 2Gbps – 10Gbps*
  - *Further KOREN /KREONET support is important*
- ***An official launching of CMS Tier2 are coming***
  - *MOST will launch a program to support a CMS Tier2 center*
  - *Many thanks to our HEP and HIP communities.*

Finale!



OLYMPIC 2008

Supplementary Slides

BC 5c: Atom

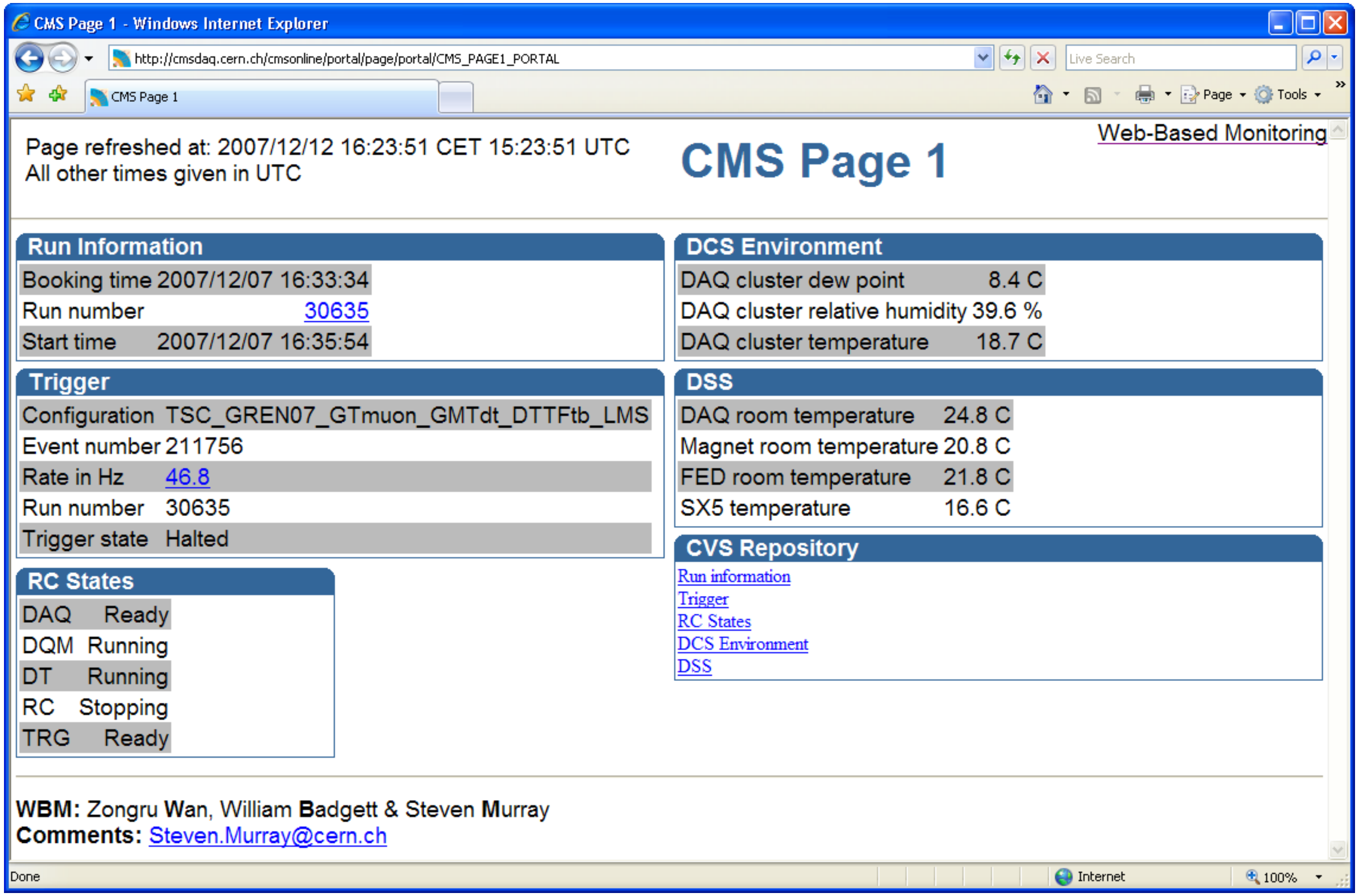
- Korea CMS-HI uses the Open Science Grid (OSG) to provide a shared infrastructure in Korea to contribute to the WLCG.
  - Mostly US Tier-1 and all US Tier-2s are part of the OSG.
- Integration with and interfacing to the WLCG is achieved through participation in many management, operational and technical activities.
- In 2006 OSG has effectively contributed to CSA06 and CMS simulation production.
- In 2007 OSG plans are to improve the reliability and scalability of the infrastructure to meet LHC needs, as well as add and support needed additional services, sites and users.

Web-Based Monitoring

Web-Based Monitoring: home

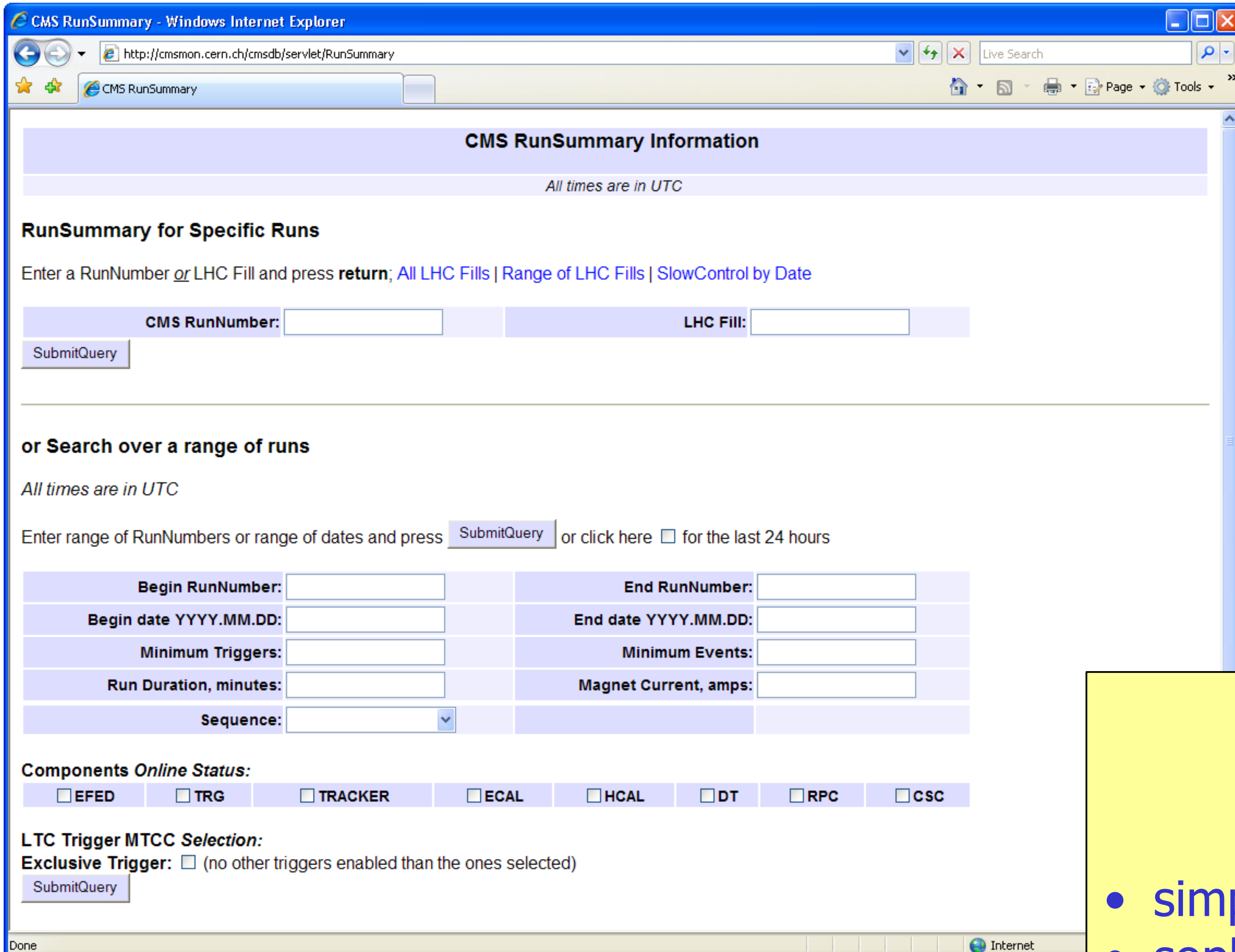
- tools for remote status display
- easy to use, flexible, interactive
- work with firewall and with security
-

Web-Based Monitoring : page1



- Run info and overall detector status can be seen

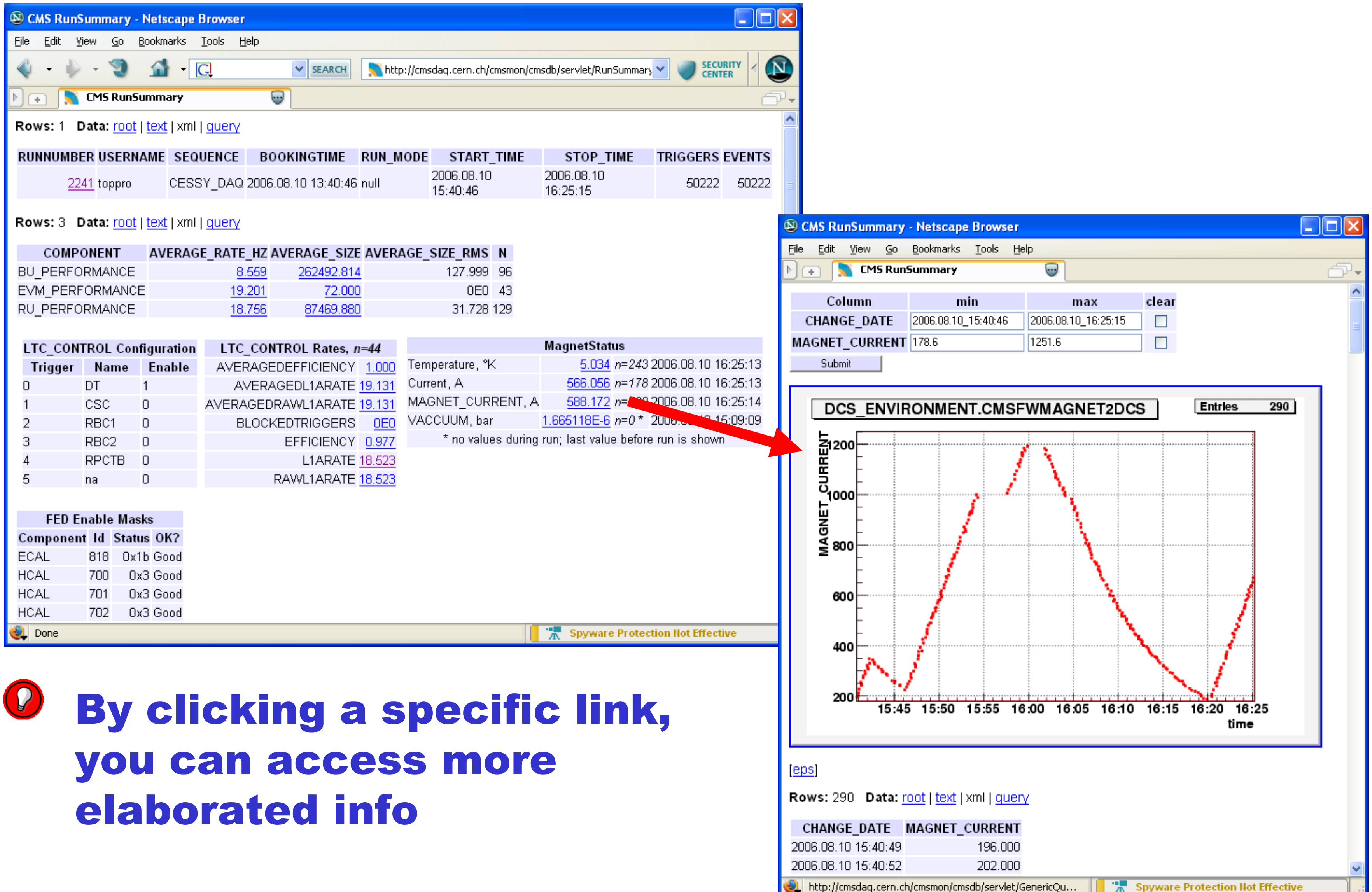
Web-Based Monitoring : Run summary



Query

- simple query
- sophisticated query

Web-Based Monitoring



Rows: 1 **Data:** root | text | xml | query

RUNNUMBER	USERNAME	SEQUENCE	BOOKINGTIME	RUN_MODE	START_TIME	STOP_TIME	TRIGGERS	EVENTS
2241	toppro	CESSY_DAQ	2006.08.10 13:40:46	null	2006.08.10 15:40:46	2006.08.10 16:25:15	50222	50222

Rows: 3 **Data:** root | text | xml | query

COMPONENT	AVERAGE_RATE_HZ	AVERAGE_SIZE	AVERAGE_SIZE_RMS	N
BU_PERFORMANCE	8.559	262492.814	127.999	96
EVM_PERFORMANCE	19.201	72.000	0E0	43
RU_PERFORMANCE	18.756	87469.880	31.728	129

LTC_CONTROL Configuration		
Trigger	Name	Enable
0	DT	1
1	CSC	0
2	RBC1	0
3	RBC2	0
4	RPCTB	0
5	na	0

LTC_CONTROL Rates, n=44	
AVERAGEDEFFICIENCY	1.000
AVERAGEDL1ARATE	19.131
AVERAGEDRAWL1ARATE	19.131
BLOCKEDTRIGGERS	0E0
EFFICIENCY	0.977
L1ARATE	18.523
RAWL1ARATE	18.523

MagnetStatus			
Temperature, °K	5.034	n=243	2006.08.10 16:25:13
Current, A	566.056	n=178	2006.08.10 16:25:13
MAGNET_CURRENT, A	588.172	n=[illegible]	2006.08.10 16:25:14
VACCUUM, bar	1.665118E-6	n=0 *	[illegible] 15:09:09

* no values during run; last value before run is shown

FED Enable Masks			
Component	Id	Status	OK?
ECAL	818	0x1b	Good
HCAL	700	0x3	Good
HCAL	701	0x3	Good
HCAL	702	0x3	Good

Column	min	max	clear
CHANGE_DATE	2006.08.10_15:40:46	2006.08.10_16:25:15	☐
MAGNET_CURRENT	178.6	1251.6	☐

Submit

Rows: 290 **Data:** root | text | xml | query

CHANGE_DATE	MAGNET_CURRENT
2006.08.10 15:40:49	196.000
2006.08.10 15:40:52	202.000

By clicking a specific link, you can access more elaborated info

CMS computing bottom line

- Fast reconstruction codes
- Streamed Primary Datasets
- Distribution of Raw and Reconstructed data
- Compact data formats
- Effective and efficient production reprocessing and bookkeeping systems

중성자의 발견

The event display and data quality monitoring visualisation systems are especially crucial for commissioning CMS in the imminent CMS physics run at the LHC. They have already proved invaluable for the CMS magnet test and cosmic challenge. We describe how these systems are used to navigate and filter the immense amounts of complex event data from the CMS detector and prepare clear and flexible views of the salient features to the shift crews and offline users. These allow shift staff and experts to navigate from a top-level general view to very specific monitoring elements in real time to help validate data quality and ascertain causes of problems. We describe how events may be accessed in the higher level trigger filter farm, at the CERN Tier-0 centre, and in offsite centres to help ensure good data quality at all points in the data processing workflow. Emphasis has been placed on deployment issues in order to ensure that experts and general users may use the visuslisation systems at CERN, in remote operations and monitoring centers offsite, and from their own desktops.

- CMS offline software suite uses a layered approach to provide several different environments suitable for a wide range of analysis styles.
- At the heart of all the environments is the ROOT-based event data model file format.
- The simplest environment uses "bare" ROOT to read files directly, without the use of any CMS-specific supporting libraries. This is useful for performing simple checks on a file or plotting simple distributions (such as the momentum distribution of tracks). The second environment supports use of the CMS framework's smart pointers that read data on demand, as well as automatic loading of the libraries holding the object interfaces. This environment fully supports interactive ROOT sessions in either CINT or PyROOT. The third environment combines ROOT's TSelector with the data access API of the full CMS framework, facilitating sharing of code between the ROOT environment and the full framework. The final environment is the full CMS framework that is used for all data production activities as well as full access to all data available on the Grid. By providing a layered approach to analysis environments, physicists can choose the environment that most closely matches their individual work style.