
Making use of the International Lattice Data Grid

T. Yoshie for ILDG

CCS, Tsukuba

July 18 2008 @ Lattice 2008

- ◆ proposed in 2002
- ◆ 1st stage construction completed in 2007
- ◆ already used
 - open data to the public
 - share data within collaboration

- ◆ to invite new users to ILDG
 - ✓ Overview of the system
 - ✓ Using data on ILDG
 - ✓ Ensembles on the grid
 - ✓ Statistics
 - ✓ Summary and future

◆ Metadata Working Group

- QCDml: an XML based markup language for ensembles and configurations

P.Coddington (Adelaide), T.Yoshie (Tsukuba), D.Pleiter (DESY),
G.Andronico (INFN), C.Maynard (Edinburgh), C.DeTar (Utah),
J.Simone (FNAL), R.Edwards, B.Joo (JLAB)

◆ Middleware Working Group

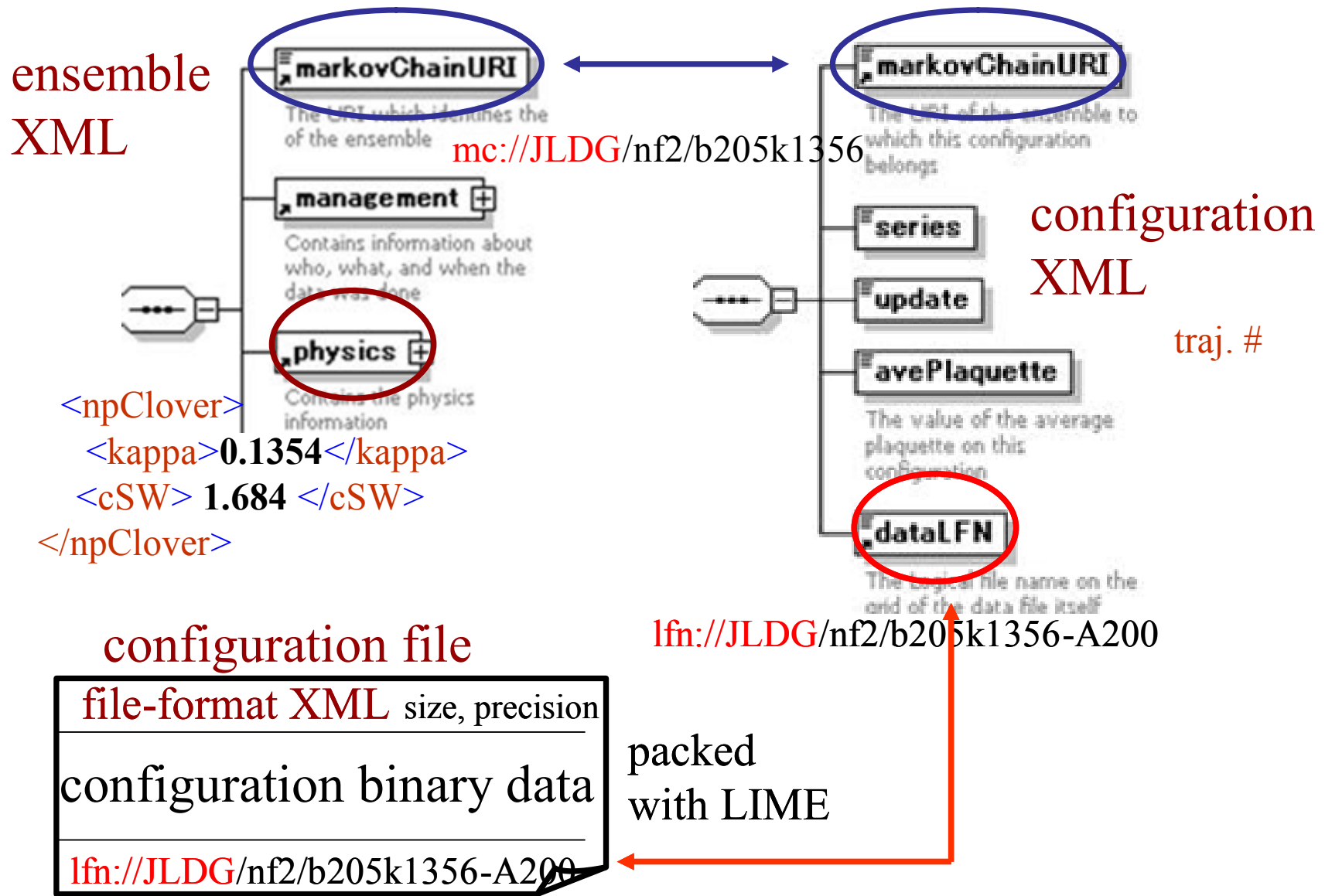
- standardize interface among RGs and develop system

P.Coddington, S.Zhang (Adelaide), T.Amagasa, N.Ishii, O.Tatebe,
M.Sato (Tsukuba), D.Melkumyan, D.Pleiter (DESY), G.Beckett,
R.Ostrowski (Edinburgh), J.Simone (FNAL), B.Joo, C.Watson (JLAB)

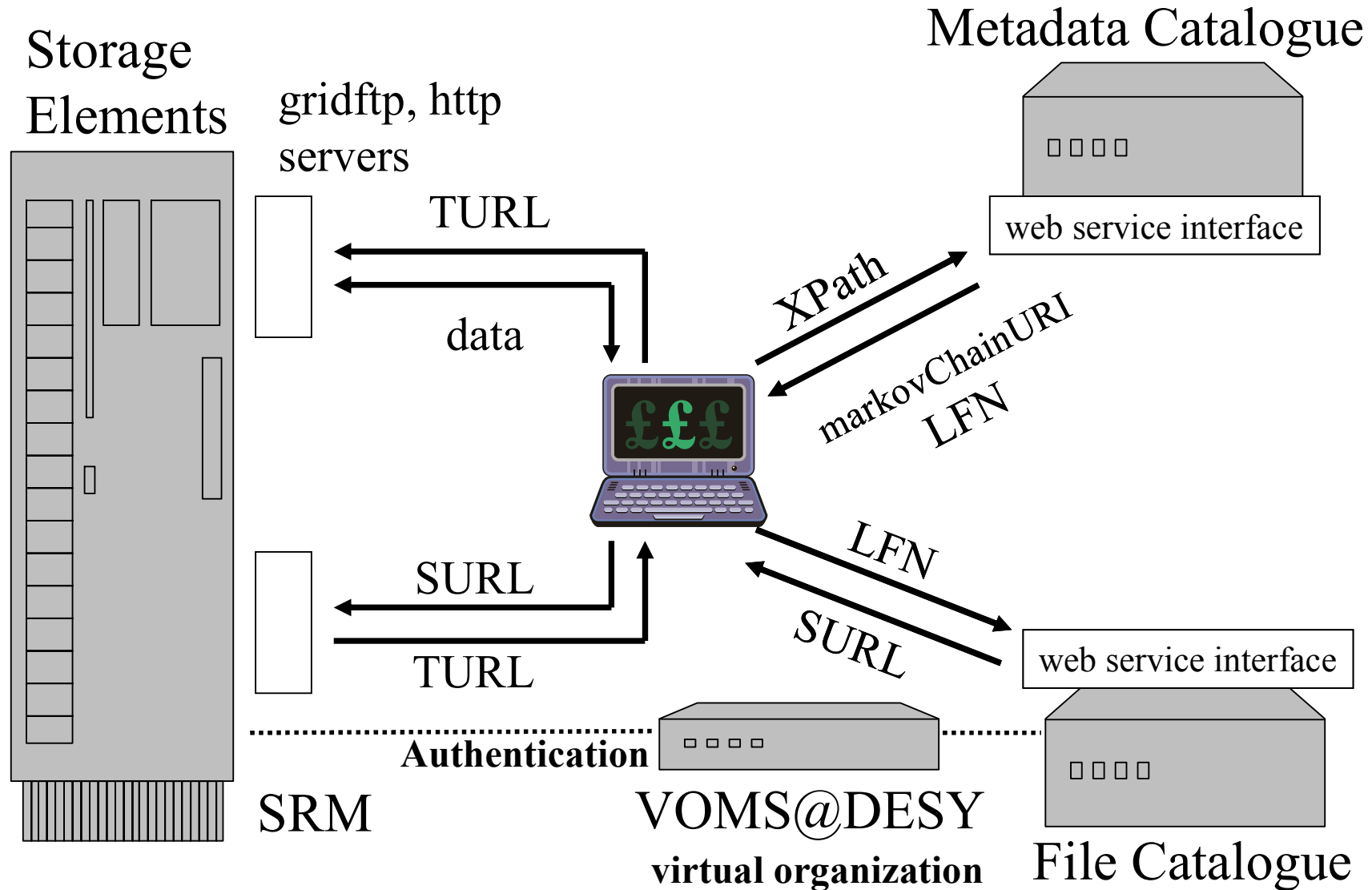
◆ ILDG board

- supervise WGs, discuss strategic issues

R.Brower (USA), K.Jansen (Germany), R.Kenway (UK, chair),
D.Leinweber (Australia), O.Pene (France), F.Di Renzo (Italy), A.Ukawa (Japan)



Middleware



- ◆ consists of five regional grids (RGs)

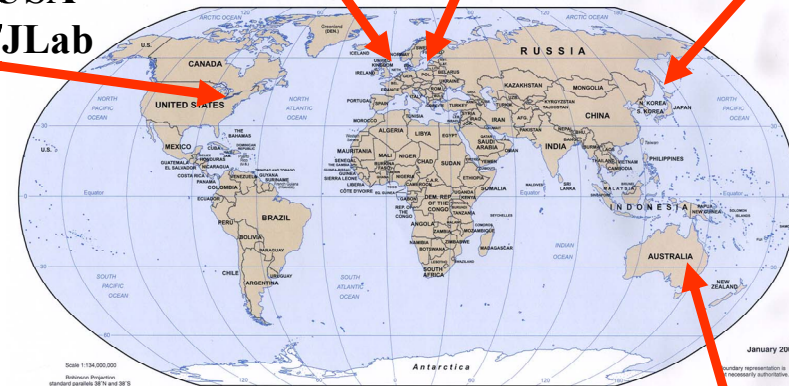
- implementations of SEs and Catalogues are different
- interoperable with common interface

**UKQCD (QCDgrid/DiGS),
UK, Edinburgh**

**LDG (LatFor),
Germany/France/Italy
DESY**

**JLDG, Japan
Tsukuba**

**USQCD, USA
Fermilab/JLab**



<http://www.lqcd.org/ildg>

- ◆ users don't have to remember details

- easy-to-use tools by Middleware WG

Using data on ILDG

- join the ILDG Virtual Organization (VO)
 - obtain a **grid certificate** from a CA (trusted by IGTF)
 - visit VOMRS to register, be approved by managers
- **find ensembles**
 - use **portals or tools** provided by regional grids (see below)
- check access policy
 - data are public / negotiable / restricted
 - contacting the collaboration is the best way
- **download configurations**
 - a standard command line tool **ildg-get**
 - RG supports different methods (uberftp, ltools, digs tools ...)
- do research and write a paper
- acknowledge the collaboration and the ILDG
 - cite **papers** specified by the collaboration
 - cite **<http://www.lqcd.org/ildg>**

◆ list ensembles and see details of ensembles

<http://usqcd.jlab.org/mdc-web-client/index.jsp>

Ensembles found at <http://usqcd.jlab.org/mdc-service/services/ILDGMDCService>

This MDC Contains the following ensembles

There are 21 ensembles here:

Ensemble: mc://USQCD/LHPC/aniso/wilson/NF2/wl_16_64_5p5_x2p38_um0p4086

Physics:

Volume: 16x16x16x64

GaugeAction:

[Anisotropic Wilson Action](#)

Beta=5.5

xi0=2.38

Aniso Direction=T

Fermion Action:

2 flavours

[Anisotropic Wilson Fermion](#)

Mass=-0.4086

Normalization=unity

xi0=2.38

nu=1

AnisoDirection=T

Management:

Producing Collaboration: LHPC

Project: SPECTRUM

Label: wl_16_64_5p5_x2p38_um0p4086

Published Alias:

Reference:

Algorithm:

Algorithm Name: [HMC 2Flavour Hasenbusch Preconditioning](#)

Reference: Comput.Phys.Commun. 174 (2006) 87-98

Algorithm Kind: This is an exact algorithm



List Ensembles

[LDG Home](#)
[List](#)
[Ensembles](#)

- ♦ mc://USQCD/LHPC/aniso/wilson/NF2/wl_16_64_5p5_x2p38_um0p4086 [usqcd]
- ♦ mc://USQCD/LHPC/aniso/wilson/NF2/wl_16_64_5p5_x2p38_um0p4125 [usqcd]
- ♦ mc://USQCD/LHPC/aniso/wilson/NF2/wl_24_64_5p5_x2p38_um0p4086 [usqcd]
- ♦ mc://USQCD/LHPC/aniso/wilson/NF2/wl_24_64_5p5_x2p38_um0p4125 [usqcd]



Show Ensemble

markovChainURI=mc://ldg/etmc/tmqcd_nf2/tlSym_b3.75_L24T48_k0.1660_mu0.0200, grid=ldg

[LDG Home](#)
[Show XML](#)
[List Configs](#)
[List Ensembles](#)

Management

Collaboration: etmc
 Project name: tmqcd_nf2
 Archive History: action = add; participant = Carsten Urbach (University of Liverpool); date = 2006-07-02T17:28:47+02:00;

Physics

Size: X = 24; Y = 24; Z = 24; T = 48;
 Gluon: treelevel Symanzik improved action
 beta = 3.75 c0 = 1.6666666700000001; c1 = -0.08333333329999999
 Quark [#1]: Twisted mass action
 kappa = 0.166; mu = 0.02; numberOfFlavours = 2

Algorithm

Name: mtHMC
 Glossary: <http://www-zeuthen.desy.de/latfor/ldg/algorithmGlossaries/mtHMC.pdf>
 Reference: Comp.Phys.Commun. Vol 174/2 pp 87-98
 Exact: true
 Parameters: integrationScheme = Sexton-Weingarten

<http://www-zeuthen.desy.de/latfor/ldg/mdc/>

◆ search ensembles by specifying action names and other physics parameters

<http://cssm.sasr.edu.au/ildg/>

International Lattice Data Grid (ILDG)

Web portal for the ILDG Lattice QCD Data Archive

Home

Search

XPathQuery

CSSM Portal

About

Ensemble Search on ILDG records

Collaboration: CSSM UKQCD USQCD LDG JLDG

Lattice Size: =

Gluon Action

Beta:

Gauge Group Type:

Action Type:

- GeneralGluonAction
 - plaquetteGluonAction
 - SixLinkGluonAction
 - DBW2GluonAction
 - treelevelSymanzikGluonAction
 - LuescherWeiszGluonAction
 - tpLuescherWeiszGluonAction
 - iwasakiRGGluonAction
 - anisotropicGluonAction
 - anisotropicWilsonGluonAction
 - anisotropicTpWilsonGluonAction

Quark Action (No Quark Action)

NumberOfFlavours: =

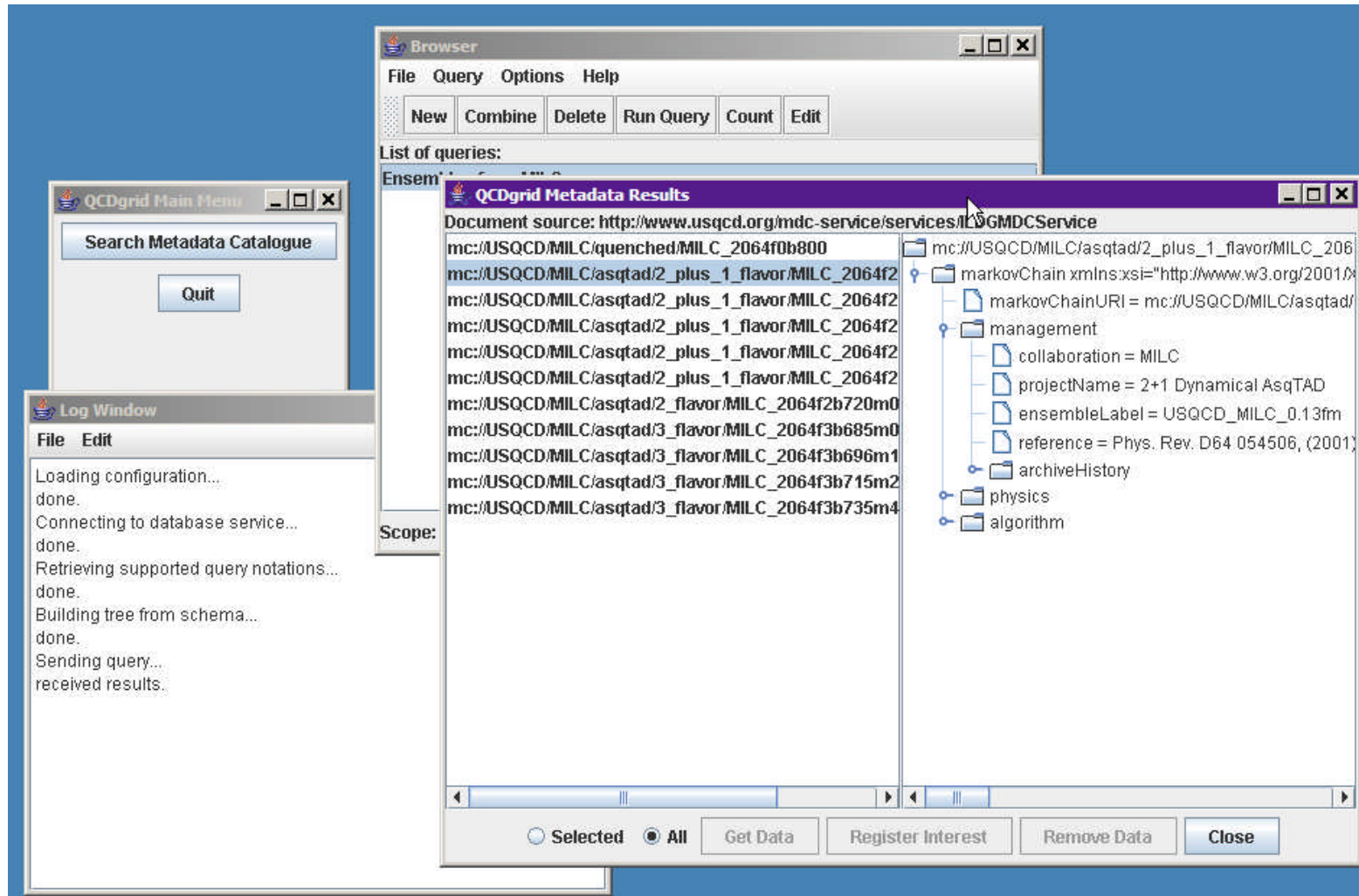
Kappa: =

Action Type:

- GeneralQuarkAction
 - wilsonQuarkAction
 - cloverQuarkAction
 - tpCloverQuarkAction
 - npCloverQuarkAction
 - fatLinkIrrelevantCloverQuarkAction
 - wilsonTmQuarkAction
 - KSQuarkAction
 - asqTadQuarkAction
 - generalOverlapQuarkAction
 - domainWallQuarkAction
 - anisotropicQuarkAction
 - anisotropicWilsonQuarkAction
 - anisotropicCloverQuarkAction

◆ semantic search based on XML

<http://www.gridpp.ac.uk/qcdgrid/>



The screenshot displays the UKQCD ildg-browser application interface. It features a main menu window with a "Search Metadata Catalogue" button and a "Quit" button. A log window shows the following status messages:

```

File Edit
Loading configuration...
done.
Connecting to database service...
done.
Retrieving supported query notations...
done.
Building tree from schema...
done.
Sending query...
received results.
    
```

The main browser window, titled "Browser", has a menu bar with "File", "Query", "Options", and "Help". Below the menu bar are buttons for "New", "Combine", "Delete", "Run Query", "Count", and "Edit". A "List of queries:" section is visible. The primary window, "QCDgrid Metadata Results", displays the following document source and XML metadata:

```

Document source: http://www.usqcd.org/mdc-service/services/ILDGMDCService
mc://USQCD/MILC/quenched/MILC_2064f0b800
mc://USQCD/MILC/asqtad/2_plus_1_flavor/MILC_2064f2
mc://USQCD/MILC/asqtad/2_plus_1_flavor/MILC_2064f2
mc://USQCD/MILC/asqtad/2_plus_1_flavor/MILC_2064f2
mc://USQCD/MILC/asqtad/2_plus_1_flavor/MILC_2064f2
mc://USQCD/MILC/asqtad/2_plus_1_flavor/MILC_2064f2
mc://USQCD/MILC/asqtad/2_flavor/MILC_2064f2b720m0
mc://USQCD/MILC/asqtad/3_flavor/MILC_2064f3b685m0
mc://USQCD/MILC/asqtad/3_flavor/MILC_2064f3b696m1
mc://USQCD/MILC/asqtad/3_flavor/MILC_2064f3b715m2
mc://USQCD/MILC/asqtad/3_flavor/MILC_2064f3b735m4
    
```

The XML metadata is structured as follows:

- mc://USQCD/MILC/asqtad/2_plus_1_flavor/MILC_2064f2
 - markovChain xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xsi:type="markovChain"
 - markovChainURI = mc://USQCD/MILC/asqtad/2_plus_1_flavor/MILC_2064f2
 - management
 - collaboration = MILC
 - projectName = 2+1 Dynamical AsqtAD
 - ensembleLabel = USQCD_MILC_0.13fm
 - reference = Phys. Rev. D64 054506, (2001)
 - archiveHistory
 - physics
 - algorithm

At the bottom of the browser window, there are radio buttons for "Selected" and "All", and buttons for "Get Data", "Register Interest", "Remove Data", and "Close".

◆ narrowing search by faceted navigation

– facets: categories of XML documents

QCDml Faceted Navigation

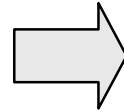
- [rgrid](#)
- [ossim \(22\)](#)
- [ildg \(6\)](#)
- [JLDG \(42\)](#)
- [ldg \(76\)](#)
- [ukqcd \(9\)](#)
- [USQCD \(21\)](#)
- [www.lqcd.org \(1\)](#)
- collaboration**
- [CP-PACS \(12\)](#)
- [CP-PACS+JLQCD \(30\)](#)
- [CSSM \(22\)](#)
- [dik \(2\)](#)
- [etmc \(27\)](#)
- [gral \(9\)](#)
- [LHFC \(8\)](#)
- [MILC \(13\)](#)
- [godsf \(24\)](#)
- [RBC-UKQCD \(9\)](#)
- [sesam \(8\)](#)
- [theta \(4\)](#)
- [txl \(2\)](#)
- [UKQCD \(7\)](#)
- projectName**
- [2+1 DWF \(9\)](#)
- [2+1 Dynamical AsqTAD \(13\)](#)

Generated SQL (for debug)

```
select m.property, m.value, count(
m.property, m.value order by m.pr
```

List of Ensembles (177)

- No. 1 [12/12/12/24] mc://JLDG
iwasakiRGGluonAction (b=1.800
tpCloverQuarkAction (k=0.1409
- No. 2 [12/12/12/24] mc://JLDG
iwasakiRGGluonAction (b=1.800
tpCloverQuarkAction (k=0.1430
- No. 3 [12/12/12/24] mc://JLDG
iwasakiRGGluonAction (b=1.800
tpCloverQuarkAction (k=0.1445
- No. 4 [12/12/12/24] mc://JLDG
iwasakiRGGluonAction (b=1.800
tpCloverQuarkAction (k=0.1464
- No. 5 [16/16/16/32] mc://JLDG
iwasakiRGGluonAction (b=1.950
tpCloverQuarkAction (k=0.1375
- No. 6 [16/16/16/32] mc://JLDG



QCDml Faceted Navig

- [rgrid](#)
- [JLDG \(30\)](#)
- collaboration**
- [CP-PACS+JLQCD \(30\)](#)
- projectName**
- [RCNF2+1 \(NF=2+1 full QCD with iwasaki RG gauge and non-perturbatively O\(a\) improved wilson \(clover\) quark action\) \(30\)](#)
- date**
- [2007 \(30\)](#)
- size**
- [16/16/16/32 \(10\)](#)
- [20/20/20/40 \(10\)](#)
- [28/28/28/56 \(10\)](#)
- numberOfFlavours**
- [2+1 \(30\)](#)
- gluon**
- [iwasakiRGGluonAction \(30\)](#)
- quark**
- [npCloverQuarkAction \(60\)](#)
- beta**
- [1.8300000000 \(10\)](#)
- [1.9000000000 \(10\)](#)
- [2.0500000000 \(10\)](#)
- kappa**

Generated SQL (f

```
select m.property, m.v
(select * from mc whe
c0 on m.uri = c0.uri joi
'collaboration' and valu
c1.uri group by m.prop
```

List of Ensembles

- No. 1 [16/16/16/32]
mc://JLDG/CP-PAC
iwasakiRGGluonAct
npCloverQuarkActic
- No. 2 [16/16/16/32]
mc://JLDG/CP-PAC
iwasakiRGGluonAct
npCloverQuarkActic
- No. 3 [16/16/16/32]
mc://JLDG/CP-PAC
iwasakiRGGluonAct
npCloverQuarkActic
- No. 4 [16/16/16/32]

- ◆ you can use portals without joining ILDG VO
 - please visit and try all portals freely

- ◆ Starting points
 - tutorial session (Carsten Urbach, Chris Allton)
<http://people.physik.hu-berlin.de/~urbach/ildg-2.html>
 - <http://www.usqcd.org/ildg/>

- ◆ procedure of submitting data depends on RG
 - ask RG WG members

Ensembles on the grid

what is on the grid and what will appear

- ◆ to help you find ensembles
- ◆ apologies:
 - asked several people and compiled replies
 - not a complete list, biased due to my queries
- ◆ will try to
 - describe new ensembles, new status (shown in red in following tables)
 - point out what is (will be) public, what is negotiable (ask each collaboration for confirmation)

| flavors | fermion/ gluon action (year) | machine collaboration | a(fm) | lattice | pi (MeV) | approx #configs | status and comment |
|---------|------------------------------------|--------------------------|-------|---------|----------|--------------------|-----------------------|
|---------|------------------------------------|--------------------------|-------|---------|----------|--------------------|-----------------------|

| flavors | fermion/ gluon action (year) | machine collaboration | a(fm) | lattice | pi (MeV) | approx #configs | status and comment |
|---------|------------------------------------|--------------------------|-------|---------------------|----------|--------------------|-----------------------|
| 0 | /tpLW,DBW2... | CSSM | | | | ~1500 | available |
| 2 | FLIC/ tpLW | Corvus CSSM | 0.096 | 16 ³ x32 | 820 | 50 | available |
| 2 | FLIC/ tpLW | APAC CSSM | 0.125 | 20 ³ x40 | >300 | | in production |

- continue to tune parameters for light quark
- plan to quantify the advantages of FLIC

◆ Computer Resources

- **Corvus: SGI Altix (6TF)**
(25-50% for LQCD)
- **APAC NF: SGI Altix (11TF)**
(<10% for LQCD)

◆ Regional Grid

- dCache
- Catalogue @ CSSM

◆ Storage Elements

- 7TB disk on Corvus
- 20TB tape system



| flavors | fermion/ gluon action (year) | machine collaboration | a(fm) | lattice | pi (MeV) | approx #configs | status and comment |
|---------|--|--|-------|---------------------|----------|--------------------|---|
| 2 | Wioson-clover/ Iwasaki (2001) | CP-PACS /Tsukuba CP-PACS | 0.22 | 12 ³ x24 | 1060-490 | 1000x4 | available public |
| | | | 0.16 | 16 ³ x32 | 1270-540 | 1000x4 | |
| | | | 0.11 | 24 ³ x48 | 1160-540 | 800x4 | |
| 2 | Wilson-clover/ Plaquette (2002) | SR8000/KEK JLQCD | 0.09 | 20 ³ x48 | 1370-600 | 1200x5 | in prep. public soon |
| 2+1 | Wilson-clover/ Iwasaki (2006) | ES/JAMSTEC SR8000/KEK CP-PACS /Tsukuba CP-PACS+JLQCD | 0.12 | 16 ³ x32 | 1200-620 | 800x5x2 | available public |
| | | | 0.10 | 20 ³ x40 | 1100-650 | 800x5x2 | |
| | | | 0.07 | 28 ³ x56 | 1030-630 | 600x5x2 | |
| 2 | overlap/ Iwasaki (2006-2007) | BG/L/KEK JLQCD | 0.12 | 16 ³ x32 | 750-290 | 500x6 | in prep. public soon |
| 2+1 | overlap/ Iwasaki (2007-2008) | BG/L/KEK JLQCD | 0.11 | 16 ³ x48 | 800-310 | 500x5x2 | available date not decided (after spectrum paper) |
| 2+1 | Wilson-clover/ Iwasaki (2007-2008) | PACS-CS PACS-CS | 0.09 | 32 ³ x64 | 702-156 | 400x4 800x2 | in production public 6 months after spectrum paper |

◆ Computer Resources

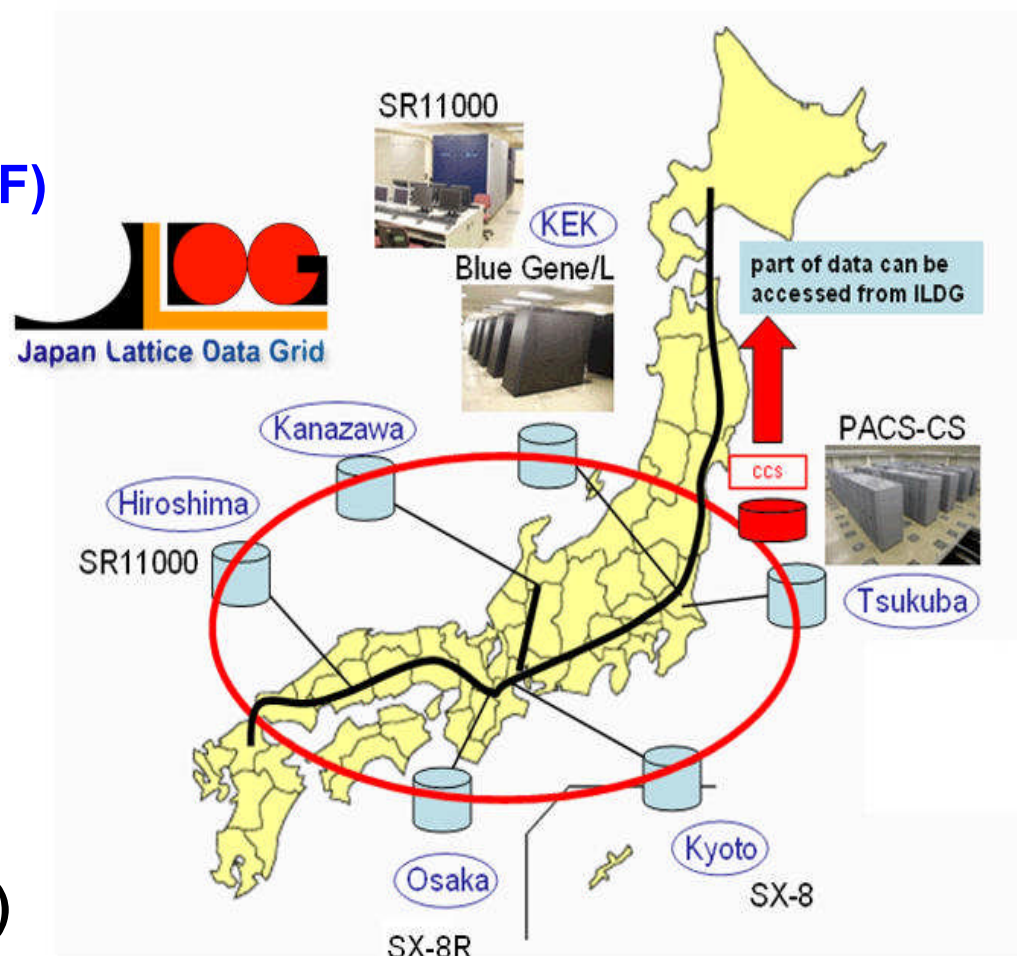
- **BG/L @ KEK (57TF)**
- **PACS-CS @Tsukuba (14TF)**
- **T2K-Tsukuba (95TF)**
- **T2K-Tokyo (145TF)**

◆ Regional Grid

- **gfarm**
- **Catalogue @ Tsukuba**

◆ Storage Elements

- **6 sites in the figure (35TB)**
- **~100TB off-line**



| flavors | fermion/ gluon action (year) | machine collaboration | a(fm) | lattice | pi (MeV) | approx #configs | status and comment |
|---------|------------------------------------|--------------------------|---------------------|---------------------|--------------|--|--|
| 2 | wilson-tm/ Symanzik | several ETMC | 0.100 | 20 ³ x48 | 700-300 | 2000x4 | negotiable become publicly available probably by end of 2008 |
| | | | | 24 ³ x48 | 700-300 | 2000x5 | |
| | | | 0.085 | 24 ³ x48 | 700-300 | 2500x5 | |
| | | | | 32 ³ x64 | 300-250 | 2500x2 | |
| | | | 0.066 | 20 ³ x48 | 400-280 | 3000x2 | |
| | | | | 24 ³ x48 | 350 | 3000 | |
| | | | 32 ³ x48 | 700-280 | 2500x4 | | |
| 2+1+1 | wilson-tm/ Iwasaki | several ETMC | 0.090 | 24 ³ x48 | 700-300 | O(1000) | in progress |
| 2 | npClover/ wilson | QCDSF | 0.11 | 16 ³ x32 | 1200- 250 | 19 ens. ~20000 (based on MDC) | negotiable |
| | | | 0.07 | 40 ³ x64 | | | |
| 2+1 | SLiNC/tree-level Symanzik | QCDSF | 0.08 | 48 ³ x64 | 500-200 | | in progress |

- Data from other collaborations (SESAM, TXL, gral, dik, theta...)
- ALPHA: no plan to submit data, BMW: not decided yet

◆ Computer Resources

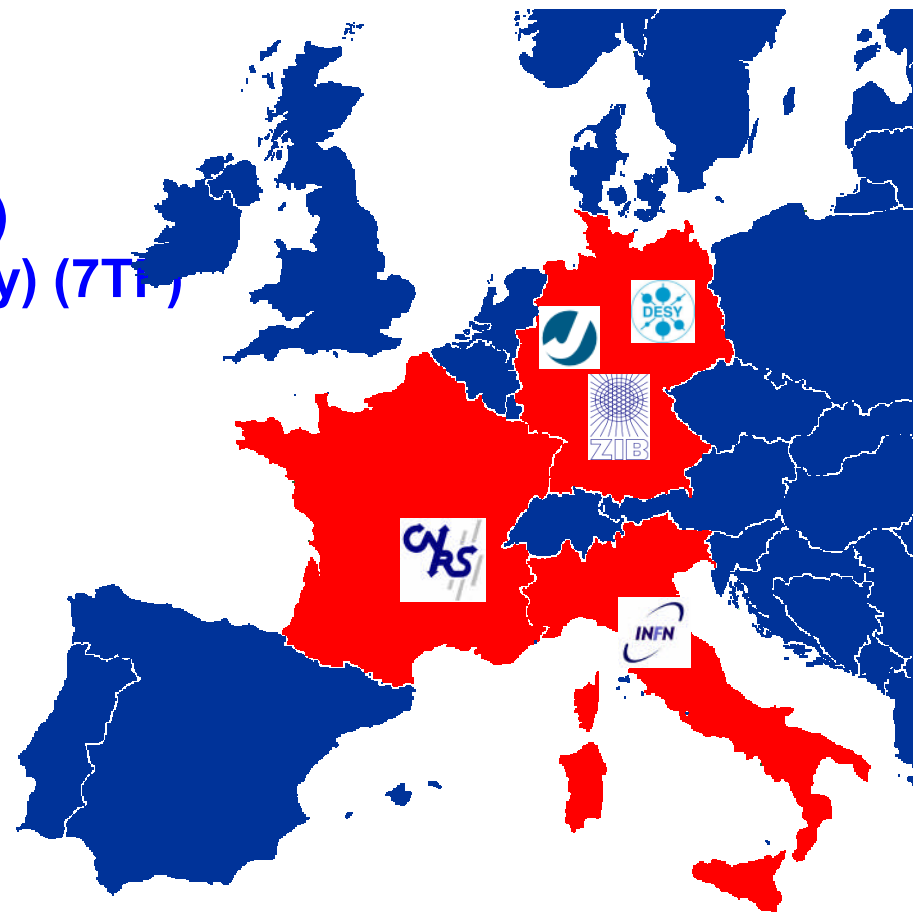
- BG/P@ JSC (223TF)
- SGI ICE @ ZIB Berlin (70TF)
- SGI Altix@ LRZ Berlin (62TF)
- BG/P@IDRIS(France) (139TF)
- apeNEXT@NEXT Center (Italy) (7TF)

◆ Regional Grid

- dCache
- Catalogue @ DESY

◆ Storage Elements

- DESY (Hamburg+Zeuthen),
JSC (Julich), ZIB (Berlin),
CC-IN2P3 (Lyon),
INFN Parma (Parma)
- have tape back-end without a fixed
storage quota



| flavors | fermion/ gluon action (year) | machine collaboration | a(fm) | lattice | pi (MeV) | approx #configs | status and comment |
|---------|------------------------------------|--------------------------|-------|----------------------------|----------|--------------------|--|
| 2+1 | Domain Wall/ Iwasaki | QCDOC UKQCD/RBC | 0.12 | 16 ³ x32 x16 | 630 | 1517 | available public |
| | | | | | 530 | 810 | |
| | | | | | 400 | 832 | |
| | | | 0.12 | 24 ³ x64 x16 | 670-330 | 800x4 | restricted will consider release |
| | | | 0.08 | 32 ³ x64 x16 | 400-280 | | in production |
| 0.08 | 48 ³ x64 x16 | ~220 | | in production | | | |
| 2+1 | asqtad/ tpSym | UKQCD | 0.12 | 24 ³ x64 | 290 | 5081 | available public |
| | | | 0.09 | 32 ³ x64 | 360 | 700 | negotiable |

◆ Computer Resources

- QCDOC @ BNL, Edinburgh
- BG/P @ ANL
- BG/P in UK (future)

◆ Regional Grid

- DiGS
- Catalogue @ Edinburgh

◆ Storage Elements

- 7 sites in the figure
- 80TB (as of 2007/03)



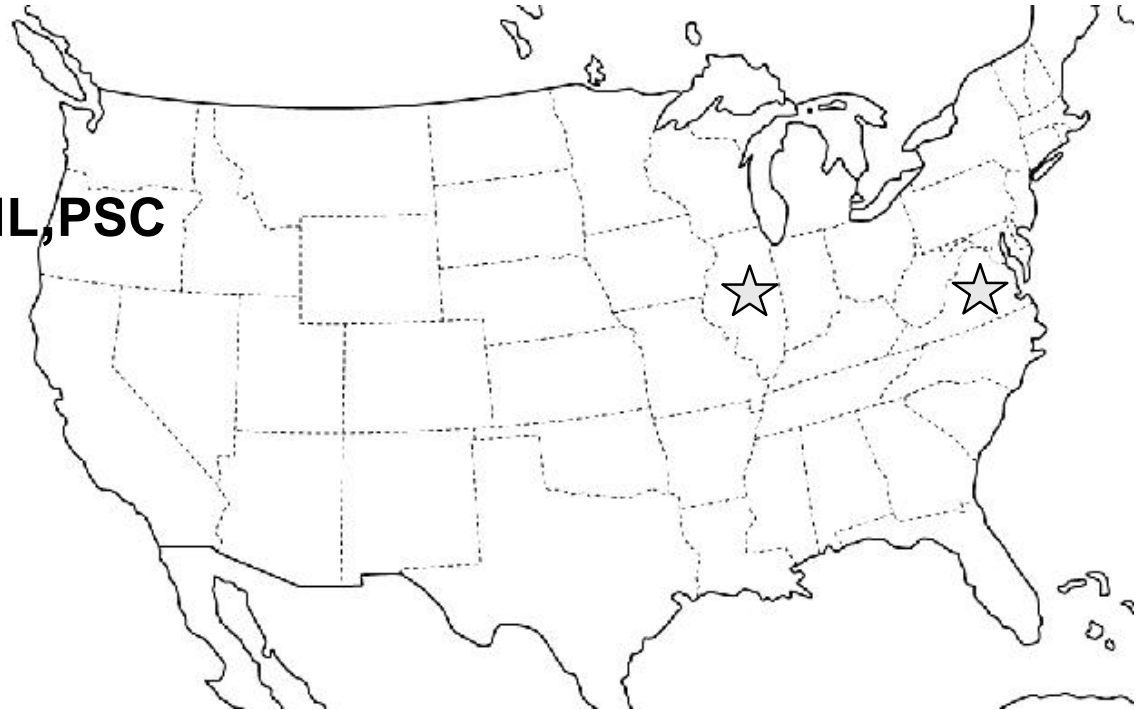
<http://www.gridpp.ac.uk/qcdgrid/>

| flavors | fermion/ gluon action (year) | machine collaboration | a(fm) | lattice | pi (MeV) | approx #configs | status and comment |
|---------|---|--------------------------------------|-------|------------------------------|----------|--------------------|-------------------------------|
| 2+1 | Asqtad/ tpLW (2001-2008) | MILC | 0.15 | (16-20) ³ x48 | 711-235 | 600x4 | available |
| | | | 0.12 | (20-24) ³ x64 | 500-260 | 1700x4 | |
| | | | | 32 ³ x64 | ~260 | | in production |
| 2+1 | Asqtad/ tpLW (2004-2008) | MILC | 0.09 | (28-40) ³ x96 | 480-240 | 1100x6 | available in production |
| | | | | 40 ³ x96 | ~240 | | in production |
| 2+1 | Asqtad/ tpLW (2006-2008) | MILC | 0.06 | (48-64) ³ x144 | 430-220 | 600x4 | available in production |
| 2+1 | Asqtad/ tpLW (2008) | MILC | 0.045 | 64 ³ x192 | TBD | 300 | available in production |
| 2 | aniso wilson/ aniso wilson (2006-2007) | QCDOC/BNL Cray XT3/4/ORNL LHPC | 0.11 | 16 ³ x64 | 600 | 861 | public |
| | | | | 24 ³ x64 | 600,440 | 871,1535 | |
| 2+1 | aniso clover/ tl-tad improved (2007-2008) | Cray XT /ORNL LHPC | 0.12 | 24 ³ x128 | 330 | 2000 | in preparation coming soon |

all MILC data will be open as soon as they are created (visit also <http://qcd.nersc.gov/>)

◆ Computer Resources

- **BG/P @ ALCF Argonne**
- **Cray XT4 @ NCCS**
Oak Ridge (250TF)
- **QCDOC @ BNL**
- **Cray @ NERSC, ORNL, PSC**
- **BG/L @ SDSC**



◆ Regional Grid

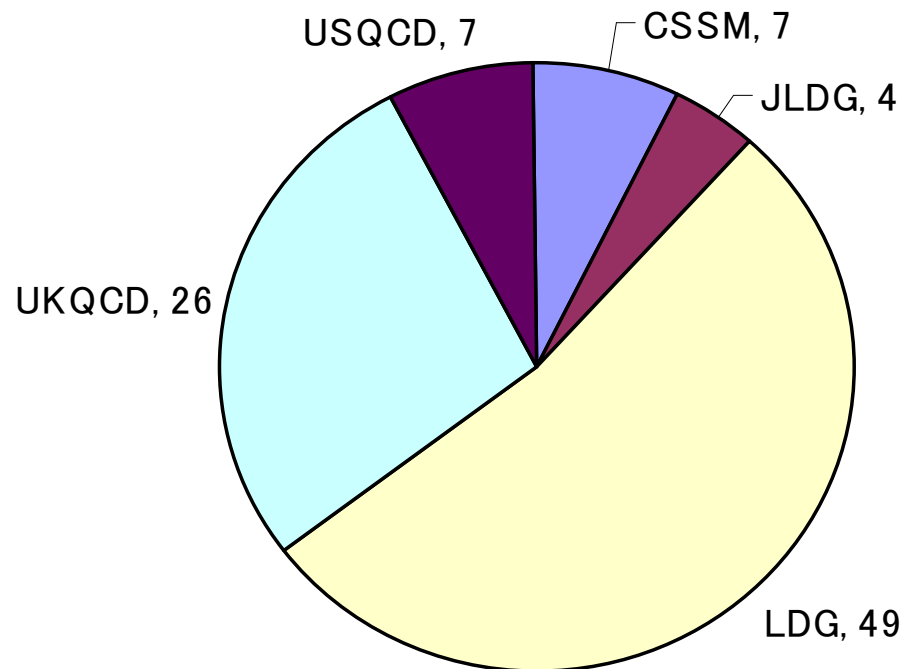
- dCache
- Catalogue @ Jlab

◆ Storage Elements

- Fermilab
- a part of huge disk/tape
- no limitation set

<http://www.usqcd.org/>

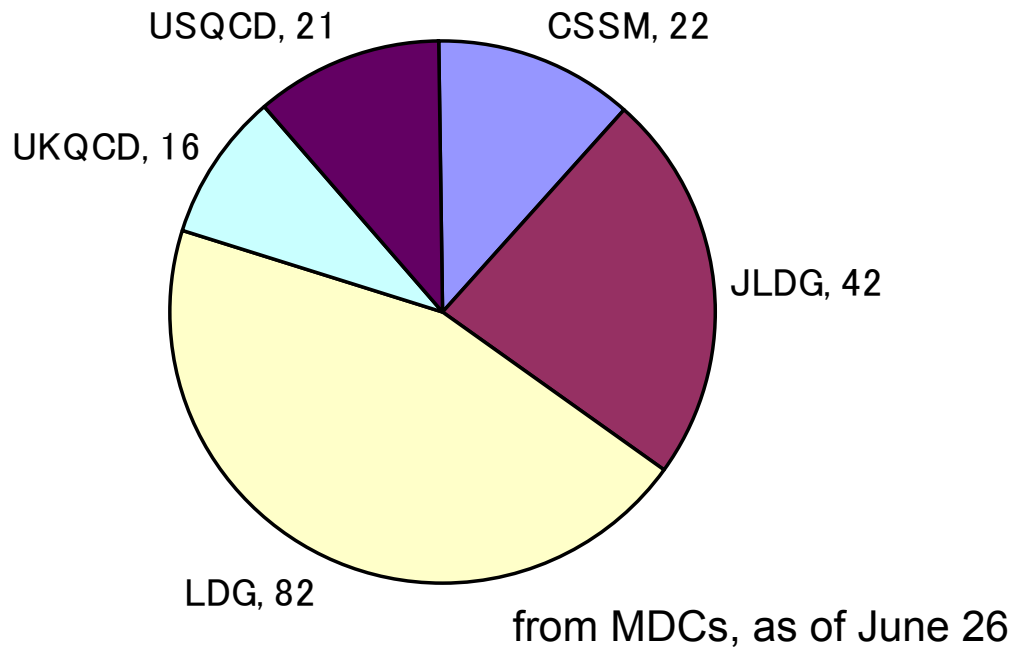
ILDG VO members



from VOMRS@DESY, as of June 26
count once the user who belongs to many RG

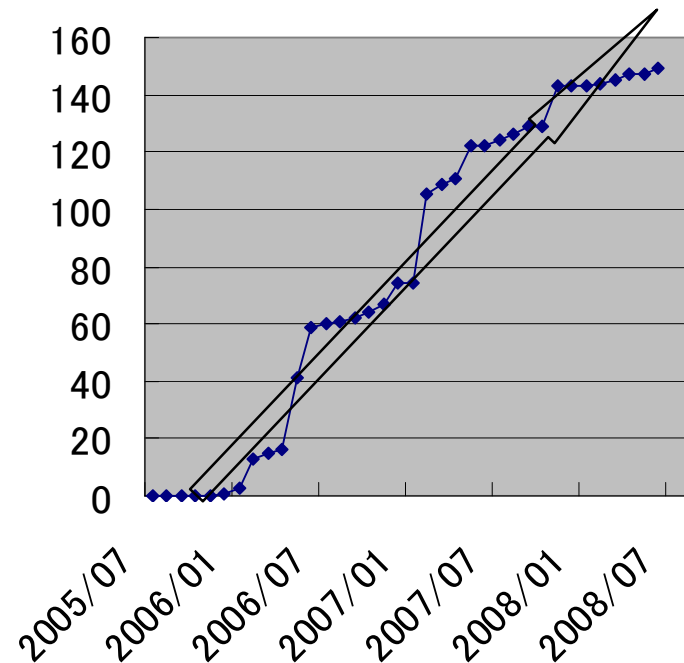
- ◆ **93 members**
- ◆ **LDG and UKQCD have many users**
 - ILDG as an important infrastructure
- ◆ **CSSM and USQCD**
 - have genuine users
- ◆ **JLDG**
 - has only admin users
 - 32 Japanese users still use LQA (old system)
 - will move to ILDG/JLDG

Ensembles



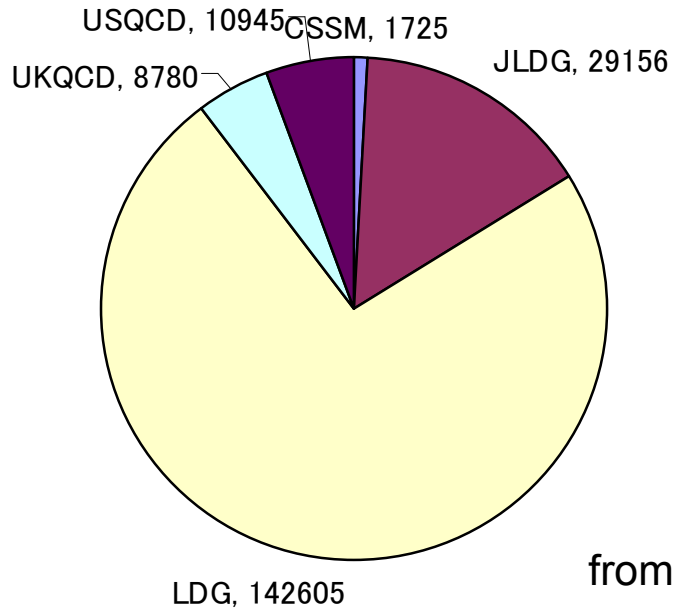
- ◆ # increases almost linearly since Jan 2006
- ◆ 183 ensembles, now

Ensembles vs. year/month

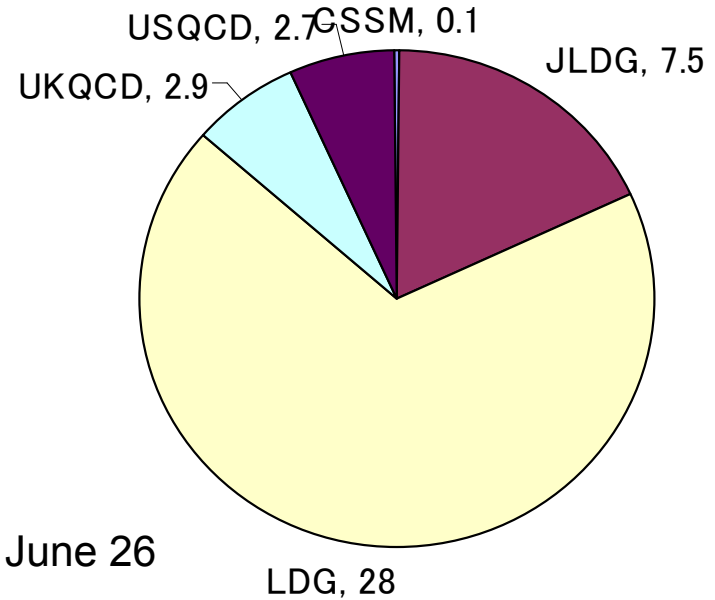


— recording submission date is not mandatory. ignored if not recorded

Configurations



data size (TB)



from MDCs, as of June 26

◆ 193K config's

- some part of them are restricted to collab.

◆ 41 TB

Summary and future

- ◆ ILDG continues stable operation and has already accumulated a lot of valuable configurations
- ◆ ILDG is easy to use
- ◆ ILDG is becoming an important research infrastructure

- ◆ Some future directions
 - quark propagator sharing (Metadata WG)
 - replication of data among regional grids (to support more dynamic collaboration, to speed-up downloading) (Middleware WG)
 - making it easy to submit data