

Calculating with ILDG lattices

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An ancient lattice database?: Nine Mile Canyon, Utah, USA (ca 1200 CE)

Outline

- How to use the ILDG
- How to build the MILC code with SciDAC packages so we can read ILDG lattices.
- How to use the MILC code to do a calculation with an ILDG lattice

International Lattice Data Grid (ILDG)

- A confederation of regional grids (founded ~2000)
 - CSSM (Australia)
 - JLQCD (Japan)
 - LatFOR (Europe)
 - UKQCD (UK)
 - USQCD (US)
- Provides for storage and exchange of gauge configuration files.

Logical Organization of Files

- Each ensemble has a Markov chain (MC) name
 - Ensemble URI (Universal resource identifier) e.g.
`mc://USQCD/MILC/asqtad/2_plus_1_flavor/1648f21b6572m0097m0484`
- Each file within an ensemble has a logical file name (LFN)
 - File URI e.g.
`lfn://USQCD/MILC/asqtad/2_plus_1_flavor/1648f21b6572m0097m0484/series_0/l1648f21b6572m0097m0484.1040`

Overview of ILDG usage

- Metadata catalogs (MDC) list the ensembles and the files. You don't need a grid certificate to browse the catalogs.
- The regional grids have copies of each other's metadata catalogs.
- Files are downloaded based on their LFN's. They can be anywhere on the grid.
- Downloads require a grid certificate.

ILDG tools

- To browse the MDC requires only a web browser.
- To download the file requires grid tools. The free ILDG tool set from DESY is very convenient. It has a self-contained set of grid tools for managing grid permissions.

```
% grid-proxy-init  
Passphrase: <your grid password>  
% ildg-get <fileLFN>
```

Tutorial 2 Objectives

- Browse a metadata catalog to find an ensemble MC identifier.
- Find the file LFN
- Build the MILC code with the QIO and QMP packages
- Use the MILC code to compute the J/ψ and η_c correlators with clover-improved valence quarks on a lattice downloaded from the ILDG.

MILC Makefile Options for SciDAC

- You need the SciDAC QIO and QMP packages to read ILDG lattices.
- Modify the MILC Makefile as follows

```
WANTQIO = true
WANTQMP = true
```

```
# Parallel version
QMPPAR = ${SCIDAC}/qmp
QIOPAR = $(SCIDAC)/qio
# Single processor version
QMPSNG = ${SCIDAC}/qmp-single
QIOSNG = $(SCIDAC)/qio-single
```

Mesons with clover quarks

- The MILC code application is “clover_invert2”
- The MILC compilation target is “su3_clov”

```
cd clover_invert2  
make su3_clov
```

Input parameters: preamble

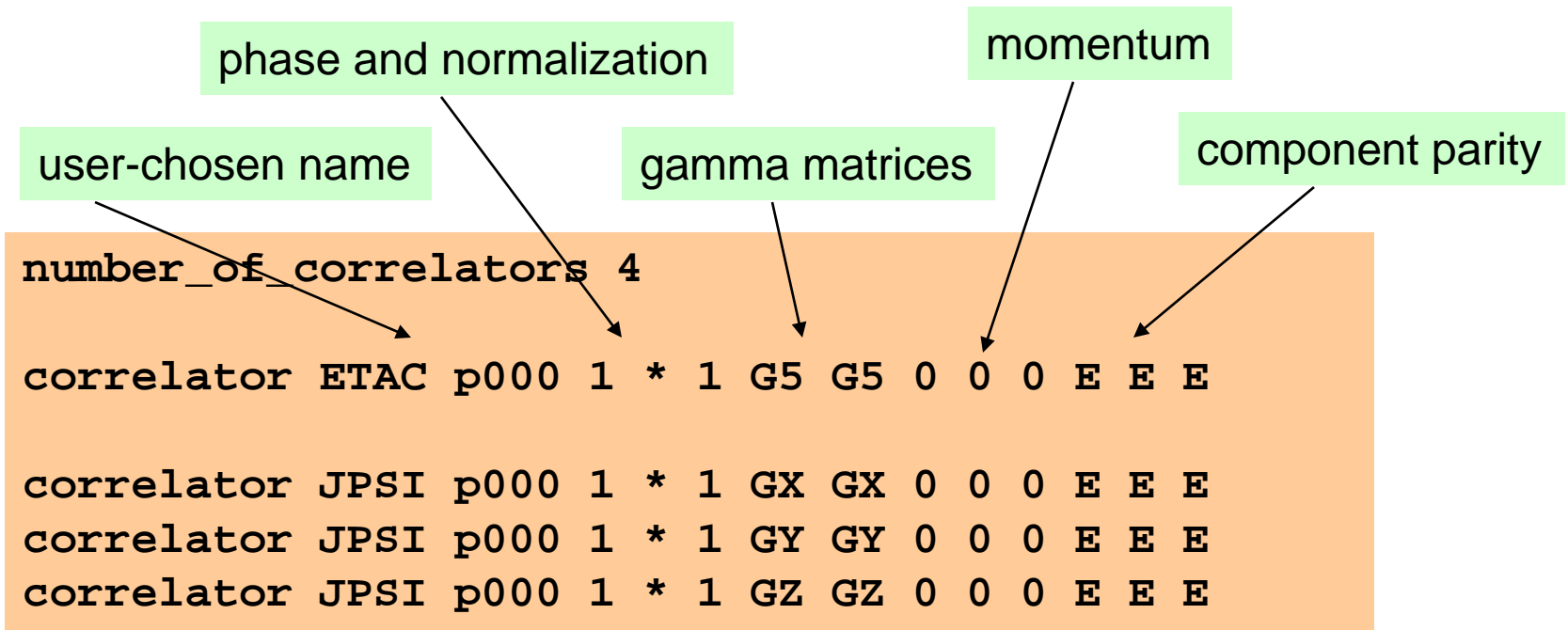
```
prompt 0
nx 16
ny 16
nz 16
nt 48
job_id xxxx
# Gauge field description
reload_serial 11648f21b6572m0097m0484.1040
u0 0.8604
no_gauge_fix
forget
staple_weight 0
ape_iter 0
... etc ...
```

Input parameters: propagators

- “Propagators” are solutions to the Dirac equation with a specific source. A wide variety of sources is available.
- “Quarks” are propagators (or other quarks) with a sink treatment applied to it (e.g. smearing or derivative). A wide variety of sink operators is available.
- Meson correlators tie together pairs of quarks based on source/sink gamma matrices and total momentum assignments.

Input parameters: correlators

- Meson correlator definitions



- Groups with the same name are averaged

Summary

- We have seen how to locate a lattice on the ILDG.
- We have seen how to build the MILC code with the SciDAC packages.
- We have seen how to use the MILC code to do a calculation with a downloaded ILDG lattice.