C interface to mySQL for monitoring and storing CLAS data analyses results

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1 Introduction

The CSQL is a package that allows to store characteristic results from the "cooking" of CLAS data into a mySQL database. The produced tables can be used for monitoring the cooking process as well as for post-cooking analysis of run period. CSQL has been recently statically linked to RECSIS (standard distribution) and can be activated with a TCL switche (explained later). There are two basic functionalities of CSQL: first - real time generated tables to monitor progress of the "cooking" , second - static final tables which store run related statistics in the database table.

A web interface exists for quick data displaying and table viewing.

The CSQL package can also be used as a standalone library. This document also provides CSQL API documentation to help in developing of any stand alone codes.

2 RECSIS switches and ENV variables

To activate CSQL package in RECSIS one needs to set a switche in the TCL input file. The following switche is available :

```
set lmysql=-1; // activates csql package (default is = 0;)
```

Before starting the "cooking" process one needs to set up several environment variables needed by the CSQL package. Following variables are defined:

Variable Name	Description
CSQL_DBHOST	database host name
CSQL_DB	database name
CSQL_USER	the user name of database account
CSQL_TABLE	final result table
CSQL_DDL	ddl file (for the group) to define columns for reconstruction related variables e.g. Ne,Np, Nd
CSQL_CALIB	ddl file to define column names for calibration related parameters, e.g. RF mean, RF sigma ..
CSQL_COMM	specify comment

NOTE: There is no password required. Cooking account must be without password.

CSQL package also stores information about calibration database used for the cooking. Environmental variables that are defined for RECSIS are filled into final databse for future reference. This variables are:

CLAS_CALDB_HOST	calibration database host
CLAS_CALDB_RUNINDEX	RunIndex of constants
CLAS_CALDB_TIME	time stamp

After all those variables are set, RECSIS can be run with modified TCL file. Currently there are 3 groups defined in the default table. This groups are "SYST", "CSQL" and "CALB".

- "SYST" group contains run-time system information (i.e. user name, process id, node name). A typical printout from recsis can be found in Appendix G.
- "CSQL" group contains run statistic information such as number of events processed, number of electrons reconstructed etc. (see Appendix F)
- "CALB" group contains calibration quality information for different detectors (i.e. RF mean, RF sigma, EC time resolution etc.) (see Appendix F)

Information in *"SYST"* goes from defined enviromental variables. *"CSQL"* group is filled in *"ana"* package. Values of parameters in *"CALB"* are filles in the end of the run by *"user_ana"*.

3 Viewing Database

Once you have configured and run the produced monitoring database can be viewed using either a standard WEB Browser (at http://clasweb.jlab.org/csql_db/) or ROOT

based tools which can be downloaded from the same web page.

There are some predefined graphs you can access through menu buttons of RootCSQLTools such as number of electrons reconstructed per run, RF mean and RF sigma for each run, number of files "cooked" hourly and daily etc. On Figure 1 hourly and daily "cooked" file statistics can be seen for e1d run period.

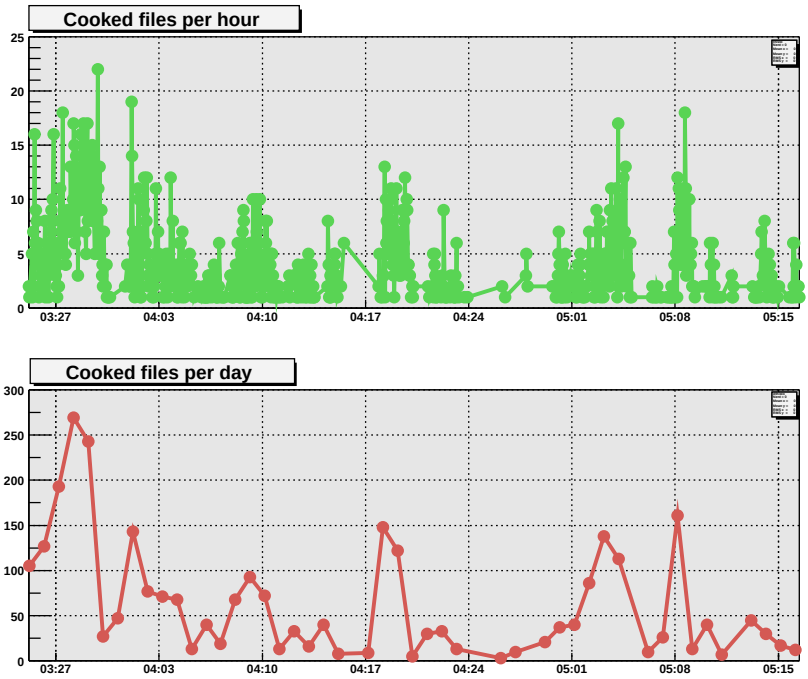


Figure 1: Time graph produced by RootCSQLTools

The web based interface has already defined database settings for each run group (to create a new one, please, contact clasdb administrator). On the Figure 2 the starting page can be seen where run group can be selected. On the next page (after hitting submit) the menu will let the user to select table within the selected database (not on the figure). After selecting a run group and the table the full set of table variables will be shown.One can select any combination of these variables to be viewed, sorted by any of the variables. The number of rows per page and column name for sorting can be pulled from given buttons (Figure 3).

On the Figure 4 the resulting table of some selection is displayed.

On the Figure 3 screen just below the table with column names and options there is a link (not in the Figure) to the page where dynamic plots can be viewed by selecting column on X axis and Y axis and adjusting some options.

On Figure 5 (in the Appendix E) an example plot can be seen. Simply choose column name in the *"X axis"* and *"Y axis"* menu and press submit. One can also

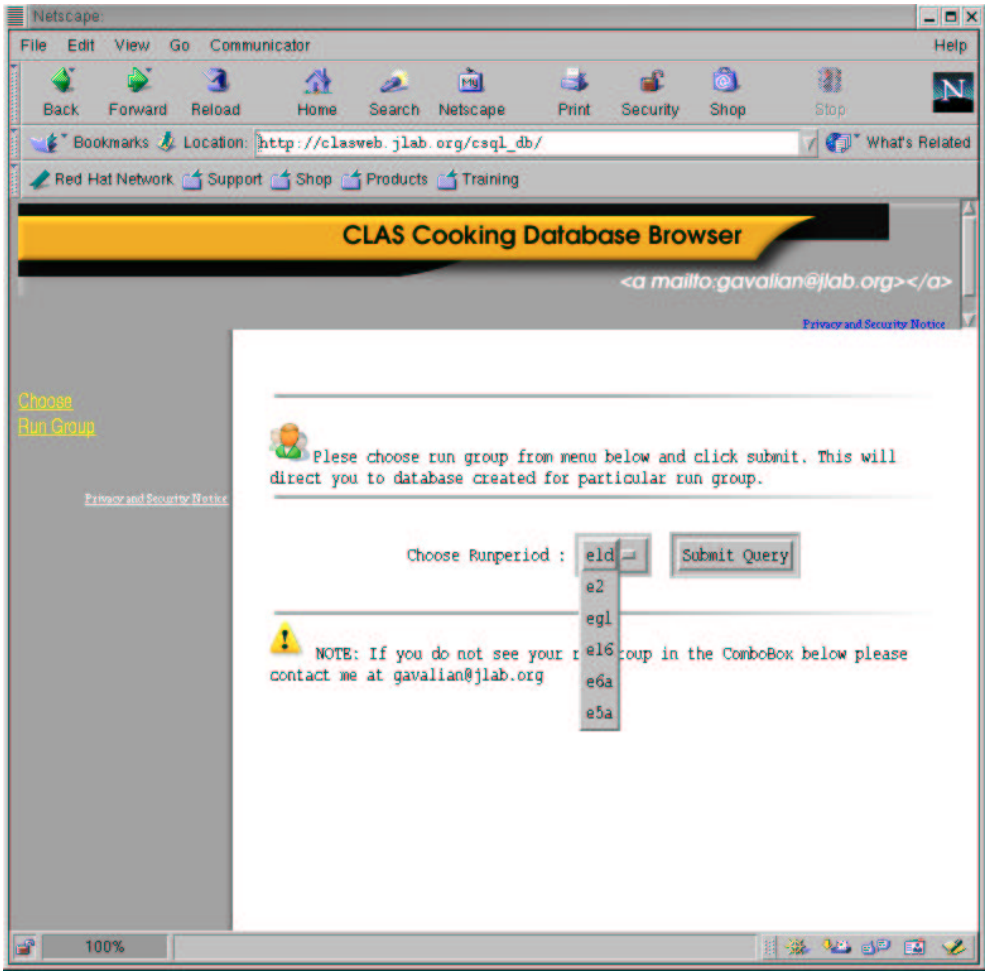


Figure 2: Web Based cooking database viewer

normalize *"Y axis"* value to other column in the table. In the case of Figure 5 number of reconstructed electrons were normalized to number of processed triggers (*NPROC*). The scale of the graph can be changed if desired. Just enter minimum and maximum values of *"Y axis"* in the input boxes then press *"Submit"*.

4 CSQL Package description

CSQL package can be obtained from any CUE account at JLAB by checking out from CLAS CVS tree *(use: cvs co c_sql)*. The TOP_DIR environment variable should be set to point to the directory where the compiled libraries will appear. The package is written in C and has wrappers for FORTRAN code.

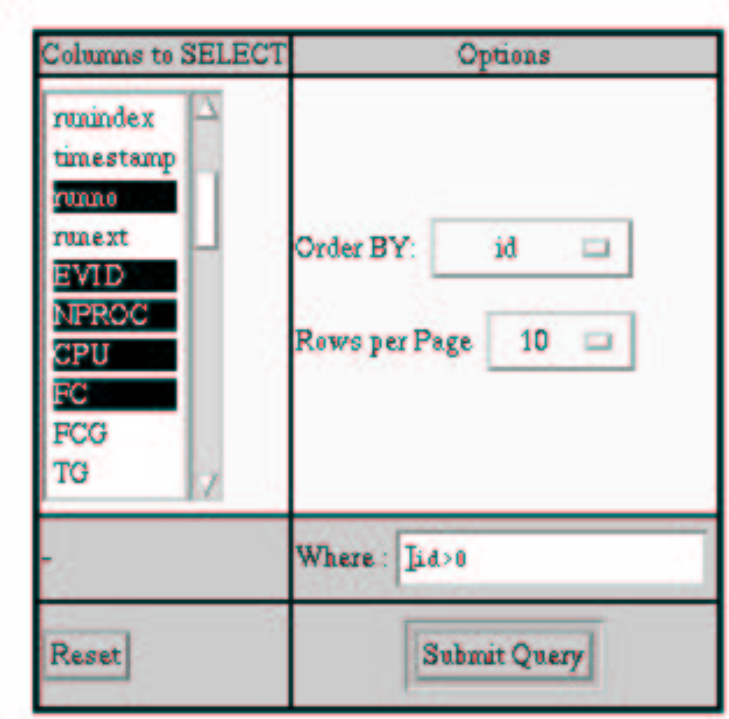


Figure 3: This page allows to chose columns from the selected tables and display them in the Browser

4.1 Initializing the library

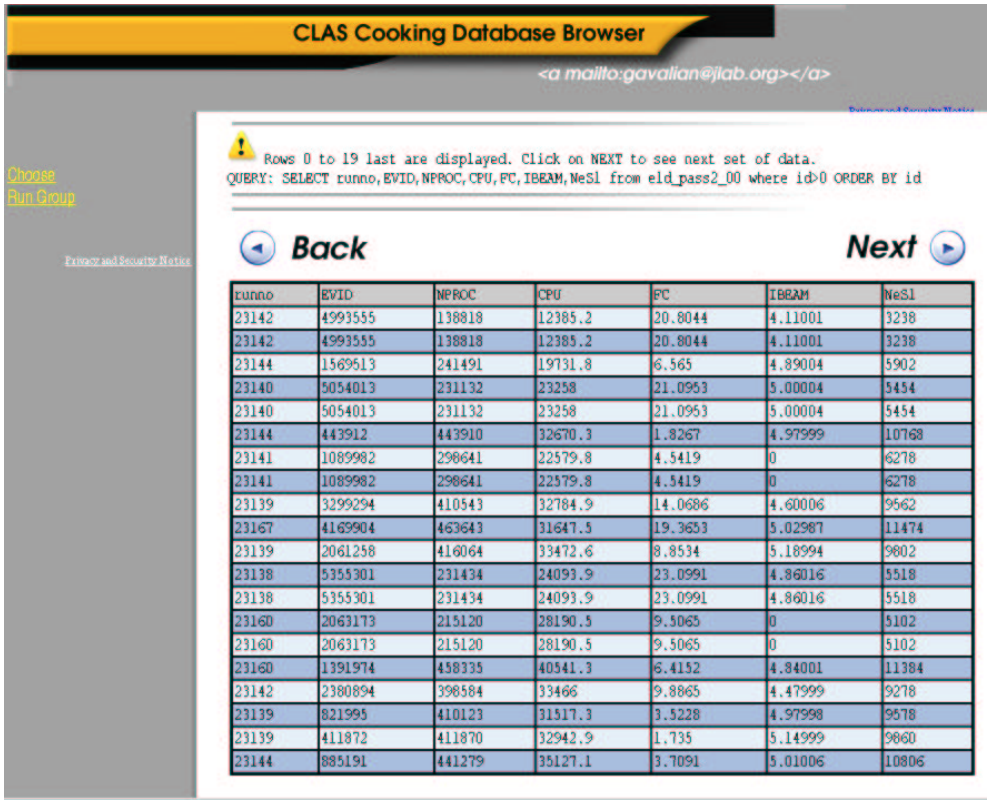
Once the library has been compiled the CSQL package must be initialized the library before any call to its functions is made. It is done by calling `init_csql()` functions.

NOTE: If one is using this library as a stand alone or on network other than JLAB one should set database parameters (i.e. host, database, user) by calling `set_database(char *hostname,char *username, char *password,char *DB_name)` since init_csql() sets default values (for JLAB users) and one may get execution error trying to connect to databases without having permission.

When using as part of CLAS software `init_clas()` function can be used to initialize library from environmental variables (see section RECSIS switches and ENV variables).

4.2 Creating Groups

Groups are collection of related variables. Each of them can contain different number and types of variable. For instance, BEAM group can contain information



runno	EVID	NPROC	CPU	FC	IBEAM	NeSl
23142	4993555	138818	12385.2	20.8044	4.11001	3238
23142	4993555	138818	12385.2	20.8044	4.11001	3238
23144	1569513	241491	19731.8	6.565	4.89004	5902
23140	5054013	231132	23258	21.0953	5.00004	5454
23140	5054013	231132	23258	21.0953	5.00004	5454
23144	443912	443910	32670.3	1.8267	4.97999	10768
23141	1089982	298641	22579.8	4.5419	0	6278
23141	1089982	298641	22579.8	4.5419	0	6278
23139	3299294	410543	32784.9	14.0686	4.60006	9562
23167	4169904	463643	31647.5	19.3653	5.02987	11474
23139	2061258	416064	33472.6	8.8534	5.18994	9802
23138	5355301	231434	24093.9	23.0991	4.86016	5518
23138	5355301	231434	24093.9	23.0991	4.86016	5518
23160	2063173	215120	28190.5	9.5065	0	5102
23160	2063173	215120	28190.5	9.5065	0	5102
23160	1391974	458335	40541.3	6.4152	4.84001	11384
23142	2380894	398584	33466	9.8865	4.47999	9278
23139	821995	410123	31517.3	3.5228	4.97998	9578
23139	411872	411870	32942.9	1.735	5.14999	9860
23144	885191	441279	35127.1	3.7091	5.01006	10806

Figure 4: Table viewer

about the beam energy, the beam current e.t.c., ECCH parameters related to EC (Electromagnetic Calorimeter). The names of groups are limited to 4 characters (following BOS convention).

After the package has been initialized one can create groups. It is done by `add_group( const char *name)` where `''name''` is a 4-character string. During one session one can create as many as 20 groups (hard coded limitation, that can be changed in the source code). After creating groups one can print them out at execution time with `print_all_groups();` which will display all runtime defined groups.

Groups can also be created from a file in DDL format (DDL is a format used at CLAS for formating BOS banks). For more information about creating groups from DDL file see the next section.

Example 1:

```
/* this example demonstrates how to create groups and view them on the
screen */
#include ''sdtio.h''
#include ''csql.h''
```

```
int main(){
init_csql();
add_group(``BEAM'');
add_group(``SYST'');
print_all_groups();
}
```

4.3 Creating Columns

Columns are variables within a group. Each group can contain as many as 52 columns (elements). Each column is associated with one group and specified by name, type (integer, float or character) and mode. Mode defines weather the variable will be created and written in the table, and it can be changed at run time. There are two following ways of creating a new column :

1.`add_column(const char *group, const char *colname)`,

where the ``group'' is the group name that column will be associated with and ``colname`` is the name of the column.

NOTE: The column names do not have 4 character length limitation. They can be declared within 64 character length.

2.`init_column(const char *group, const char *colname, const char *type, int itype, int mode)`

This call will create a new column with within group ``group'' with name ``colname'' with given type and mode. The variable ``type'' is a character string according to mySQL syntax (see documentation of mysql) defining the type of the variable that will be used for the column in the database. Type commonly used by mySQL are "INT","FLOAT" and CHAR(32) (*means character string with 32 length*)

As mentioned above, the groups and columns can be created from a file. The file must be written in DDL format. By calling

```
n_columns = read_ddlfile2(const char *filename)
```

the package will parse ``filename'' and create group with a name specified in the file, and initialize all columns contained in the file within the created group.

The results of this can be seen by calling

```
print_group(char *grpname)
```

which will produce table type output on the display with content (columns) of the group with its types and values.

Example 2:

```
#include ``stdio.h''
#include ``csql.h''
int main(){
init_csql();
add_group(``BEAM'');
init_column(``BEAM'',''Energy'',''FLOAT'',COL_TYPE_FLOAT,COL_CW_TBL);
init_column(``BEAM'',''RunNo'',''INT'',COL_TYPE_INT,COL_CW_TBL);
init_column(``BEAM'',''Comment'',''CHAR(32)'',32,COL_CW_TBL);
print_group(``BEAM'');
}
```

4.4 Storing results in columns

The simplest way to set the column value is to call one of these three functions

```
set_column_int(char *group, char *col, int value)
set_column_float(char *group, char *col, float value)
set_column_char(char *group, char *col, char *value)
```

It is important to remember the type of declared variables. If one declares it as an `INTEGER`, then tries to assign it value with `set_column_float(...)`, the value of the column will not be changed.

If one is using CSQL package with BOS files (like RECSIS) one can also assign values to all columns within a ``group'' if the group has been initialized from a DDL file (see `read_ddlfile2(....)`). One needs to pass a pointer to the first element of the array containing data. This works only if there are `INT` and `FLOAT` columns in the group.

Example 3:

```
/* This example will create a group and columns in the group
then assign values to the columns and print them on the screen
*/
#include ``stdio.h''
#include ``csql.h''

int main(){
    init_csql();
```

```
  add_group(``BEAM'');
  init_column(``BEAM'',''Energy'',''FLOAT'',COL_TYPE_FLOAT,COL_CW_TBL);
  init_column(``BEAM'',''RunNo'',''INT'',COL_TYPE_INT,COL_CW_TBL);
  init_column(``BEAM'',''Comment'',''CHAR(32)'',32,COL_CW_TBL);

/* after creating columns let's assign them values */

set_column_int(``BEAM'',''RunNo'',32456);
set_column_float(``BEAM'',''Energy'',12.05); // in couple of years
set_column_char(``BEAM'',''Comment'',''Upgraded CLAS setup'');
print_group(``BEAM'');
}
```

Here is an example how to initialize a group from DDL file, then fill it from an array or BOS bank. It is not required to use a BOS bank as source of data, one can also define an array which contains the given structure.

Example 4:

Here is an example of DDL file (/home/joe/csql.ddl)

```
!               ---
!               BANKname   BANKtype   !Comments
TABLE           CSQL       B32        !  Data bank for mySQL
!
!COL ATT-name   FMT        Min        Max !Comments
1 EVID          I          1          100000 !  Event ID (number of triggers)
2 NPROC         I          1          100000 !  Number of processed triggers
3 CPU           F          0.         99999.!  CPU used (sec)
4 FC            F          0.         999.!  Faraday Cup (K)
5 FCG           F          0.         999.!  Faraday Cup Gated (K)
6 TG            F          0.         999.!  Clock Gated
7 IBEAM         F          0.         999.!  Beam current
!
END TABLE
```

The lines with *!* at the first column are ignored by the parser.The third line defines GROUP with name CSQL (B32 tells BOS that 32 bit format to be used). Then variables are listed with following "I" or "F" (INTEGER or FLOAT). Min and Max columns are ignored.

For the FORTRAN code examples see Appendix.

4.5 Writing Data to Database

Once all necessary GROUPS and COLUMNS have been created and data is assigned to COLUMNS, one can transfer the data into a database table. The CSQL package provides routines to write data into existing table in the database as well as to create a new one according to GROUP information defined run-time. If one tries to write data into an existing table only columns which names coincide with ones defined in the table will be exported into database, other will be omitted.

```
fill_table(const char *tablename, const char *group_list)
```

exports data from GROUPS given by ``group_list'' into a table ``tablename''. `groups_list` is a list of groups (i.e. "BEAMCSQLECPC").

Then `fill_table(...)` is called it first looks up the database to see weather table with a given name exists or not. If not, it will create one using column names and the types from the specified groups. If table exists it will extract column names from existing table and will compare with ones in the given GROUPS. Only those column values will be transfered to the existing table which have corresponding column name in the already existing table.

Exampl 5:

```
/* add the following lines in the end of Example 3 and the program will
write the output into database
*/
...
...
...
fill_table(``mytable'',''BEAM'');
}
```

4.6 Monitoring tables

As mentioned above the CSQL package can also be used for monitoring running processes to extract dynamic data for long lasting jobs. In the package the is a default table name defined constructed from node name and process id of currecnt job. There is a prefix *"mon_"* added to default table name. *Exmaple:* If is is running a job on host "farml2.min.edu" the default table name will be *"mon_famrl2_3456"* (where 3456 is the process id). Since there can never be 2 jobs running on the same machine with the same process id the default table name is always unique. This tables must be deleted after job finished to aviod later confusions.

The monitoring tables are usefull if one has long lasting job running and would like to monitor its progress. The table must be updated from the code.

The

```
fill_mon_table(char *group_list)
```

function creates a table with default name (if it does not exist) and then fill content of groups given by *"group_list"* into the table.

To delete created monitoring table one may use :

```
delete_mon_table()
```

This will delete table with default name from the database if such exists.

5 Function Reference

- `void add_column(const char *group, const char *colname)`

  Adds a column with name "colname" to the group "group" and initializes it with default parameters *type="INT", mode=COL_CW_TBL*

- `void init_column(const char *group, const char *colname, const char *type, int itype, int mode)`

  Adds column to the Group and sets up the type and the mode of the column.

- `void add_group(const char *name)`

  Creates a new *GROUP* with given name. Group name follow 4 character length convention. If *"name"* is nore than 4 characters only first 4 will be used as a group name.

- `int connect_mSQL_server(MYSQL *mysql,char *DB_hostname, char *DB_username,char *DB_name,char *DB_passwd)`

  Creates a connection with a database and returns 1 if successfull, -1 otherwise.

- `void disconnect_mSQL_server(MYSQL *mysql)`

  Disconnects from the database.

- `void create_table(const char *tablename, const char *group_list)`

  Creates table in the database already defined runtime (*see* `set_database(...)`) with given name.

- `int is_table(const char *tablename)`

  Checks default database for existance of a table with name *"tablename"*. Returns 1 if table exists and -1 otherwise.

- `void delete_table(const char *tablename)`

  Deletes table with given name from default database.

- `void fill_table(const char *tablename,const char *group_list)`

  fills table from groups given by *"group_list"*. If table does not exist, one will be created with column names corresponding to columns in the groups. If table already exists, only column from *"group_list"* that have corresponding column names in the table will be inserted into table.

- `void fill_mon_table(const char *group_list)`

  fills a defualt monitoring table from groups given by *"group_list"*. The table name will be mon_[node name]_[process id].

- `void init_clas(int runno, int runext, const char *jobname)`

  This function initialyses CSQL package, then creates a new group called *"SYST"* which contains enviromental variable values described earlier in the document neccesary to run RECSIS, also user id, node name. After you have called this routine you can check its content with `print_group("SYST")`

- `void init_csql()`

  Initializes CSQL package enviroment. This function must be called before you reffer to any other function in this package.

- `void set_database(char *hostname,char *username, char *password,char *DB_name)`

  This function is used to set default database host, user name, password and database name for the package. *NOTE:* Most of the function in the package use this parameters to connect to database and read and write from it. So this must be probably the second call after init_csql() before one starts to read from database or write into one.

- `void print_all_params()`

  Prints on the display all internal parameter variables. Very usefull to have it printed out before connecting to database to make sure you have set them up properly.

- `int read_ddlfile2(const char *filename)`

  Reads DDL file and creates a *"GROUP"* with a group name and columns specified in the DDL file.

- `void set_column_int(const char *group, const char *col, int value)`

  Sets the value of column *"col"* in the group *"group"* to *"value"*. *NOTE:* The package does not chack if you call this function for a variable of INT type so you have to take care to not make a mistake there.

- `void set_column_float(const char *group, const char *col, float value)`

  Sets the value of column *"col"* in the group *"group"* to *"value"*. *NOTE:* The package does not chack if you call this function for a variable of FLOAT type so you have to take care to not make a mistake there.

- `void set_column_char(const char *group, const char *col, const char *value)`

  Sets the value of column *"col"* in the group *"group"* to *"value"*. *NOTE:* The package does not chack if you call this function for a variable of CHAR type so you have to take care to not make a mistake there.

- `void set_group(char *grpname, char *buffer)`

  This function is used in conjuction with BOS. First a group must be initialized with `read_ddlfile2(...)` then the pointer to the first element of BOS data should be passed to the routine. It will automatically fill the columns in the group with values from a buffer. Only INT and FLOAT types are supported for this operation.

- `void get_user_name(char *u_name)`

  This function returns user name of the process owner.The *"u_name"* must be initialized before this call and has to have at least 9 characters in length (one might use even longer string to be safe).

- `void get_table_name(char *tbl_name, char *nodename, int max_len)`

  This function is used for monitoring puposes. It returns a unique table name constructed from node name, user name and process id. So if one's running different jobs on same or different machnies and would like to monitor them runtime by creating a table for each job to view progress of the programs this routine might coma handy in defining different table names for each process. **Input parameters are :** *"nodename"* - character string representing the host, *"max_len"* maximum length of the table name. **Output :** *"tbl_name"* - table name to be used. *NOTE:* variable *"tbl_name"* must be initialized with length *"max_len"* before calling this function.

6 Appendix A: Column Types and Modes

Here is the list of column types and various modes used in the CSQL package with their numerucal values and descriptions. This constants are used when initializing column parameters (*see init_column(...)*). The names of this variables are defined in the C include file hence can not be used from fortran code. One has to use numerical values from FORTRAN code.

Types:

Constant name	Num Value	Description
COL_TYPE_INT	1	column of an integer type
COL_TYPE_FLOAT	3	column of a float type

NOTE!: If CHARACTER type column is defined the type must be set to be equal to length of the CHAR string. See examples for more details.

Defined modes :

Constant name	Num Value	Description
COL_C_TBL	1	Column will be created in the table but will not the value of it will not be written in the table (*Used for TIMESTAMP variables*)
COL_CW_TBL	2	Column will be created and filled into table
COL_PRIKEY	3	Column will be declared as a PRIMARY KEY
COL_PRIKEY_AUTO	4	Column will be declared as a PRIMARY KEY and will be assigned values automaticaly

7 Appendix B: Example of C code

A slightly more complicated example of C code that includes all basic types of GROUP-COLUMN operations.

```
#include <stdio.h>
#include "csql.h"


int main(){

  // This part defines an array of integers that can
```

```
  // store integers and floats at the same time.
  // This is same as FORTRAN's EQUIVALENT command

int    data[4];
float *data_f = (float *) &data[0];

//  Now we set values in the array. Of course one needs to know
// structure of the DDL file that will be used to initialize this group.
//

data[0]   = 12000;
data_f[1] = 4.53;
data[2]   = 8000;
data_f[3] = 145.678;

init_csql();
set_database("clasdb","offline_e1d","","e1d_offline");

 add_group("TORS"); // group to describe Torus run-tim parameters
 add_group("BEAM");  // Beam characteristics
 add_group("SYST");  // Group containing run-time system information



 // Adding columns in the TORS group

 add_column("TORS","Setting");
 add_column("TORS","Status");

 // Adding columns in the BEAM group

 add_column("BEAM","Energy");
 add_column("BEAM","Current");
 add_column("BEAM","Comment");

 // Adding columns in the SYST group

 add_column("SYST","system");

 // now initializing columns with types and modes

 init_column("TORS","Setting","FLOAT",COL_TYPE_FLOAT,COL_CW_TBL);
```

```
 init_column("TORS","Status","INT",COL_TYPE_INT,COL_CW_TBL);

 init_column("BEAM","Energy","FLOAT",COL_TYPE_FLOAT,COL_CW_TBL);
 init_column("BEAM","Current","FLOAT",COL_TYPE_FLOAT,COL_CW_TBL);
 init_column("BEAM","Comment","CHAR(20)",20,COL_CW_TBL);

 init_column("SYST","system","CHAR(32)",32,COL_CW_TBL);

 set_column_float("TORS","Setting",2550.3);
 set_column_int("TORS","Status",4);

 set_column_float("BEAM","Energy",4.182);
 set_column_float("BEAM","Current",7.5);
 set_column_char("BEAM","Comment","e1d run period");

 set_column_char("SYST","system","Red Hat 7.3");

 // Example of defining a group from the DDL file and then setting
 // values of it from an already defined array

 read_ddlfile2("test.ddl");
 set_group("DDLF",(char *) &data[0]);

 // Printing all group onto screen

print_all_groups();

// and finally let as write a table into datavase that we have
// already selected in the beginning of the code

fill_table("my_first_table","SYSTBEAMTORSDDLF");

return 0;
}
```

8 Appendix C: Example of FORTRAN code

Example in FORTRAN that reads group from the DDL file (see appendix D), fills columns with values then exports them into a database table.

NOTE!: when compiling a FORTRAN code on Linux one needs to use "-fno-second-underscore" flag.

```
      PROGRAM CSQL_TEST

      REAL    RW(4)
      INTEGER IW(4)
      EQUIVALENCE (IW(1),RW(1))
C- Declaring two arrays INT and FLOAT in the same memory block
      WRITE(*,*)'Starting CSQL test program'
C- Setting initial values

      IW(1) = 45670
      IW(3) = 32890
      RW(2) = 45.6
      RW(4) = 134.567
C- Firrst the CSQL package needs to be initialized
      CALL INIT_CSQL
C- Reading DDL file. See Appendix for DDL file printout
      CALL READ_DDLFILE2('test.ddl')
C- At this point all variables in the group will have
C- values set to 0
      CALL PRINT_ALL_GROUPS()
C- now let's copy values from array into columns
      CALL SET_GROUP('DDLF',IW(1))
C- Print it again to make sure values were transfered OK.
      CALL PRINT_ALL_GROUPS()
      CALL FILL_TABLE('my_fort_table','DDLF')
      END
```

9 Appendix D: DDL file used in the example codes

! ! TABLE DDLF B32 ! Comment ! 1 NPROC I 1 10000 ! 2 CPU F 0. 999. ! 3 NRec I 1 1000 ! 4 FCUP F 0. 999. ! ! END TABLE

10 Appendix E: Plot generated on the CSQL WEB Page

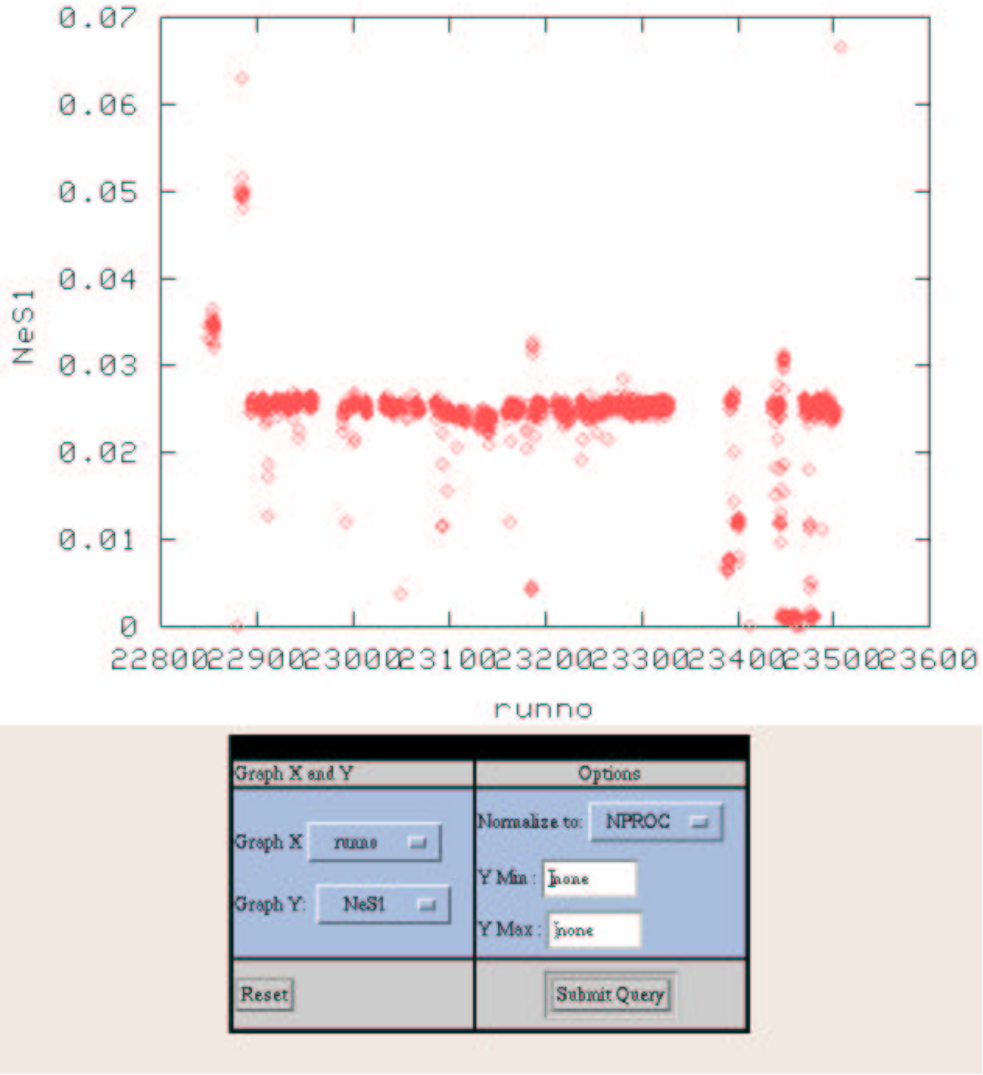


Figure 5: Plot Run number vs number of reconstructed electron per triger

11 Appendix F: CSQL and CALB DDL files used in RECSYS

This ddl files can be found on JLAB CUE nodes in *$CLAS_PARMS* directory.
CSQL DDL file:

```
!-------------------------------------------------------------------
!       BANKname BANKtype      !Comments
 TABLE   CSQL   B32   ! create write display delete ! Data bank for mySQL
!
!COL ATT-name FMT Min    Max   !Comments
   1 EVID     I    1    100000 ! Event ID (number of triggers)
   2 NPROC    I    1    100000 ! Number of processed triggers
   3 CPU      F    0.    99999.! CPU used (sec)
   4 FC       F    0.      999.! Faraday Cup (K)
   5 FCG      F    0.      999.! Faraday Cup Gated (K)
   6 TG       F    0.      999.! Clock Gated
   7 IBEAM    F    0.      999.! Beam current
   8 NeS1     I    0    100000 !  Number of electrons in sect 1
   9 NeS2     I    0    100000 !  Number of electrons in sect 2
  10 NeS3     I    0    100000 !  Number of electrons in sect 3
  11 NeS4     I    0    100000 !  Number of electrons in sect 4
  12 NeS5     I    0    100000 !  Number of electrons in sect 5
  13 NeS6     I    0    100000 !  Number of electrons in sect 6
  14 Nhb      I    0   1000000 ! Number of HB
  15 Ntb      I    0   1000000 ! Number of TB
  16 Nprot    I    0   1000000 ! Number of protons
  17 Npip     I    0   1000000 ! number of pip
  18 Ndeut    I    0   1000000 ! number of deutrons
  19 Nphot    I    0   1000000 ! number of photons
  20 Nelhp    I    0   1000000 ! Number of electrons at pos. Helic.
  21 Nelhn    I    0   1000000 ! Number of electrons at neg. helic.
!
 END TABLE
```

CALB DDL file:

```
!-------------------------------------------------------------------
!       BANKname BANKtype      !Comments
 TABLE   CALB   B32   ! create write display delete ! Monhist fit results for mySQL
```

```
!
!COL ATT-name FMT Min    Max   !Comments
   1 meanRFe  F   -2.       2. ! RF offset for electrons (all sectors)
   2 sigmaRFe F    0.      20. ! Time resolution for electrons (RF)
   3 sigmaRFh F    0.      20. ! Time resolution for pions
   4 sigmaECt F    0.      20. ! Time resolution of EC, tEC(e)-tSC(e)
   5 SFECe    F    0.       1. ! Sampling fraction E_EC(e)/p(e)
   6 sigmaSF  F    0.       1. ! width of the sampling fraction
   7 ResSL1   F    0.   10000. ! DC residuals in R1 (all sectors)
   8 ResSL2   F    0.   10000. ! DC residuals in R2 (all sectors)
   9 ResSL3   F    0.   10000. ! DC residuals in R3 (all sectors)
  10 ResSL4   F    0.   10000. ! DC residuals in R1 (all sectors)
  11 ResSL5   F    0.   10000. ! DC residuals in R2 (all sectors)
  12 ResSL6   F    0.   10000. ! DC residuals in R3 (all sectors)
!
 END TABLE
```

12 Appendix G: RECSIS output with csql switch on

Here is a typical output produced by RECSIS-CSQL

```
Programs Initialized with following parameters..
======>>>>>
PAR=> DATABASE HOST   : clasdb.jlab.org
PAR=> DATABASE USER   : offline_e2b
PAR=> DATABASE DB     : e2b_offline
PAR=> MONITOR TABLE   : mon_ifarml1_11150
PAR=> DEFAULT TABLE   : e2b_pass0_00
PAR=> DDL FILENAME    : /group/clas/builds/PRODUCTION/packages/bankdefs/csql.ddl
PAR=> CALIB DATABASE  : default
PAR=> CALIB RUNINDEX  : calib_user.RunIndexe2b
PAR=> CALIB TIMESTAMP : 20370101220926
======>>>>>
+-------------------------------------------------------------+
| Group [SYST] Columns | Column Type | TYPE |      Value      |
+-------------------------------------------------------------+
|                  time|TIMESTAMP(14)|     1|                 |
|                  user|     CHAR(12)|     2|           clase2|
|               jobname|     CHAR(32)|     2|    pass0_cooking|
|                  node|     CHAR(32)|     2|          ifarml1|
```

```
|               calibdb|     CHAR(64)|     2|          default|
|              runindex|     CHAR(32)|     2|calib_user.RunIndexe2b|
|             timestamp|     CHAR(16)|     2|   20370101220926|
|                 runno|          INT|     2|            32973|
|                runext|          INT|     2|                1|
+-------------------------------------------------------------+
| GROUP [SYST] has          9 columns                         |
+-------------------------------------------------------------+
+-------------------------------------------------------------+
| Group [CSQL] Columns | Column Type | TYPE |      Value      |
+-------------------------------------------------------------+
|                  EVID|          INT|     2|                0|
|                 NPROC|          INT|     2|                0|
|                   CPU|        FLOAT|     2|         0.000000|
|                    FC|        FLOAT|     2|         0.000000|
|                   FCG|        FLOAT|     2|         0.000000|
|                    TG|        FLOAT|     2|         0.000000|
|                 IBEAM|        FLOAT|     2|         0.000000|
|                  NeS1|          INT|     2|                0|
|                  NeS2|          INT|     2|                0|
|                  NeS3|          INT|     2|                0|
|                  NeS4|          INT|     2|                0|
|                  NeS5|          INT|     2|                0|
|                  NeS6|          INT|     2|                0|
|                   Nhb|          INT|     2|                0|
|                   Ntb|          INT|     2|                0|
|                 Nprot|          INT|     2|                0|
|                  Npip|          INT|     2|                0|
|                 Ndeut|          INT|     2|                0|
|                 Nphot|          INT|     2|                0|
|                 Nelhp|          INT|     2|                0|
|                 Nelhn|          INT|     2|                0|
+-------------------------------------------------------------+
| GROUP [CSQL] has         21 columns                         |
+-------------------------------------------------------------+
+-------------------------------------------------------------+
| Group [CALB] Columns | Column Type | TYPE |      Value      |
+-------------------------------------------------------------+
|                meanRFe|        FLOAT|     2|         0.000000|
|               sigmaRFe|        FLOAT|     2|         0.000000|
|               sigmaRFh|        FLOAT|     2|         0.000000|
|               sigmaECt|        FLOAT|     2|         0.000000|
```

```
|                  SFECe|        FLOAT|     2|         0.000000|
|                sigmaSF|        FLOAT|     2|         0.000000|
|                 ResSL1|        FLOAT|     2|         0.000000|
|                 ResSL2|        FLOAT|     2|         0.000000|
|                 ResSL3|        FLOAT|     2|         0.000000|
|                 ResSL4|        FLOAT|     2|         0.000000|
|                 ResSL5|        FLOAT|     2|         0.000000|
|                 ResSL6|        FLOAT|     2|         0.000000|
+-----------------------------------------------------------------+
| GROUP [CALB] has         12 columns                             |
+-----------------------------------------------------------------+
 Booking seb histos
 ++++++++++++++++++++++  EC1 booking ++++++++++++++
 Read EC pedestals from Map - Run  32973
```