Science & Technology Facilities Council

Technical Report
RAL-TR-2016-002

JournalViewer: A desktop application for viewing and interrogating ISIS instrument journal files

TGA Youngs

March 2016

Enquiries concerning this report should be addressed to:

RAL Library
STFC Rutherford Appleton Laboratory
Harwell Oxford
Didcot
OX11 0QX

Tel: +44(0)1235 445384
Fax: +44(0)1235 446403
email: libraryral@stfc.ac.uk

Science and Technology Facilities Council reports are available online at: http://epubs.stfc.ac.uk

ISSN 1358-6254

JournalViewer

A desktop application for viewing and interrogating ISIS instrument journal files

Tristan G. A. Youngs

ISIS Facility, STFC Rutherford Appleton Laboratory

Harwell Campus, Didcot, Oxfordshire, OX11 0RT

Abstract

JournalViewer is a graphical desktop application which allows run data for any ISIS instrument to be easily viewed and interrogated, by parsing the relevant XML data available on the local network. It provides at-a-glance information on the title, timing, and user information associated to each run, which can be sorted, grouped by RB number or user ownership, and filtered according to several criteria. Moreover, JournalViewer also parses sample environment data contained with the *log* or *nxs* files associated with each run, and allows any logged value to be plotted as a function of time. JournalViewer can also work on 'offline' data stored in local directories, extracting run information in order to (re)create a bespoke journal file, permitting users to make use of the program at their home institutions.

Contents

1. Introduction

The availability of basic run information collected on a given ISIS instrument is a basic requirement for an operational beamline. Metadata for each individual run is captured automatically by the underlying system and stored in 'journal' files – XML-formatted files which are local to each instrument. The data contained therein is viewable through the "Journal Viewer" page within the Sample Environment Control Interface (SECI), providing information such as run number, run title, and user information. The subject of this technical report, JournalViewer, is a standalone desktop application designed for use outside of SECI, and which aims to provide better access to the information contained within the instrument journal files, adding additional functionality such as sorting, grouping and filtering of this data. Beyond this, it also allows interrogation of the run data itself, along with the associated log file containing instrument and sample environment data block values captured within SECI, and provides graphing capabilities for this data.

2. Code Overview

JournalViewer is written entirely in C++, and uses the **Qt** toolkit for user interface and network access functionality. Reading of instrument raw files is performed through use of **libget** by F. Akeroyd, which is encapsulated in a C++ wrapper for ease of use throughout the code. Reading of *nxs* files is achieved through the **HDF5** library, again using a custom C++ wrapper to provide easy insertion within the code. The source code is not publicly-available, but installers are available for Windows, OSX, and some Linux variants.

3. Operation

While local to each 'NDH' instrument computer, the journal files for every beamline are also mirrored to a network filestore location (http://data.isis.rl.ac.uk/journals). It is these files that JournalViewer reads from the network, parses, and displays, as its primary function. This means that, while on the local network (potentially via VPN) every stored journal file for every beamline is available within JournalViewer from any computer. Moreover, if the location of the ISIS data archive is set, JournalViewer will also be able to plot block value data from any run file detailed within the journal. The journal files accessed can optionally be saved to a specified local directory, meaning basic run information can be viewed even when off-site (without VPN) or offline. JournalViewer is also able to traverse through directories of run data (i.e. *raw*, *log*, and/or *nxs* files) stored on a local machine, permitting block value interrogation to be performed offline as well. This is of particular use to external users who wish to use the software to process / view the run data associated with their experiments, and a cut-down version of the software exists for distribution outside of ISIS. This version removes any ability to access journals via the network, and only allows selection / interrogation of local data stored on the user's machine. Otherwise the functionality remains the same

4. Main Interface

The main window displays the contents of the current instrument / journal target, and allows filtering of this data through controls located at the top of the main table (Figure 1). A single journal file or, optionally, the complete history of all available journal files available for a single instrument can be selected and viewed with the **Instrument** and **Cycle** controls (**1**). If local data is also present then this is accessible via the **Instrument** list through the '**LOCAL**' entry. In this case the **Cycle** control will display all individual groups of local data that are available.

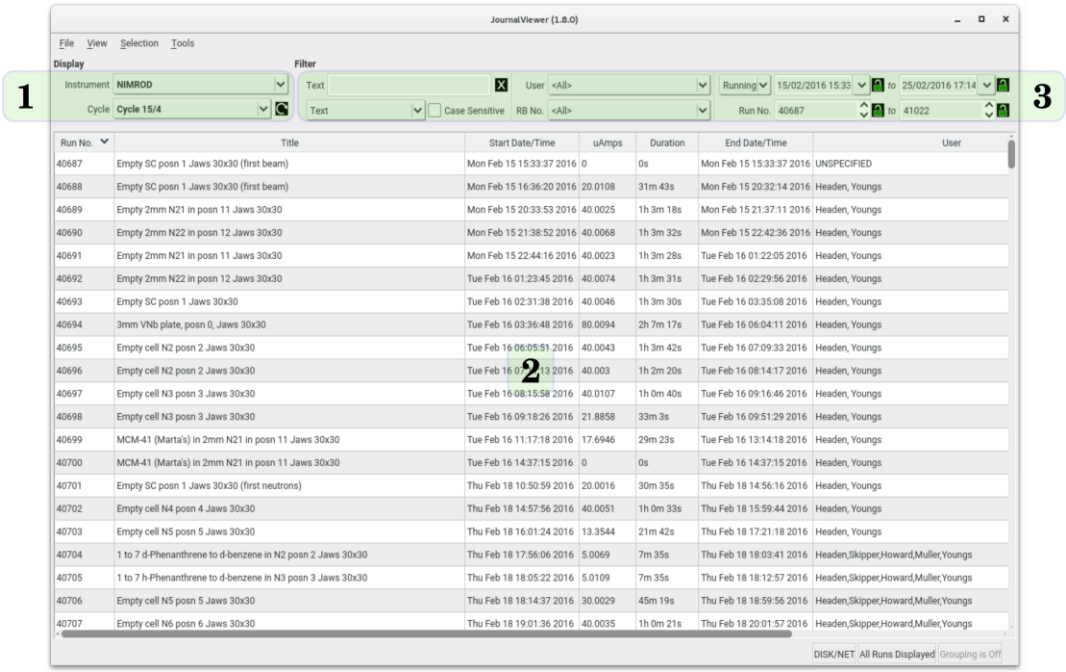


Figure 1 – JournalViewer's main window

4.1. Main View

The main view (**2**) displays in tabular form the available run data in the current journal. Run data are, by default, listed in order of increasing run number, but the quantity by which visible data are sorted can be changed by clicking on the header for the relevant column. The visible columns can be adjusted through the **View** menu. The visibility and ordering of columns in the main view also affects the format of the output from the CLI interface (see Chapter 8).

4.2. Filtering

The **Filter** group (**3**) at the top of the main window allows limits on the visible run data for the current instrument/journal selection to be tailored to suit – by default all runs from the current journal target(s) are shown. Run data may be filtered by any combination of: a) text, wildcard, or regular expression (Perl style) search of the run Title; b) available User and RB No. data (extracted from the available runs); c) start / running time and date, and; d) run number limits. For the latter criteria, these limits may be made persistent across refreshes of the journal data by enabling the padlock icon next to the relevant quantity.

4.3. Grouping

Instead of sorting runs by one of the displayed quantities, runs possessing the same title may be listed together in continuous chunks by enabling grouping (**Tools→Enable Grouping**, or **Ctrl-G**). Selecting the option a second time will disable grouping and revert to the previous sort order. This feature facilitates simplified transfer of associated measurement data into data reduction and processing packages.

4.4. Item Selection

Left-clicking an item or range of items selects them for further action. Right-clicking on a (selected) item brings up a context menu with additional options:

Select Similar	Selects all runs with the same Title as the clicked item
Sample Report	Generates a brief report on the selected items, stating total μAh accumulated for each unique sample name, etc.
Copy as Gudrun File List	Copies the selected items to the clipboard as a block of formatted text suitable for pasting into a Sample section in a Gudrun input file.[1]

Double-clicking on an item (or pressing **F1**) will attempt to load SECI log information from either the **.log* file associated with the run or, if not found, the associated **.nxs* file. Alternatively, the **Selection** menu allows explicit usage of either **.log* or **.nxs* files as the plot data source. If data is successfully loaded, a **Run Data** window is opened allowing the data to be plotted (see Chapter 5, *Sample Environment Data Plotting*). Several **Run Data** windows may be opened simultaneously by returning to the main window and selecting different (or the same) run entries from the table in the same manner. The **Selection** menu also allows the column contents for the current item selection to be copied as text to the clipboard.

A quick text search of the visible run data titles can be made through **Tools→Find** (or pressing **Ctrl-F**), and allows the user to cycle through successive matches of the search string in both forward and reverse order (**F3** and **Shift-F3** respectively. Note that any current selection will be lost.

5. Sample Environment Data Plotting

The **Run Data Window** (Figure 2, accessed by double-clicking an entry in the main table, or by using options on the **View** menu) allows interrogation of the data contained within the log and Nexus files associated with each experimental run. This data essentially encompasses all block values defined in the current SECI session, written at frequencies defined on a per-value basis, and can include beamline information such as jaw settings, ISIS status variables such as the current being delivered to the target stations, and any values being read out from sample environment equipment currently installed. JournalViewer allows all this information to be quickly and easily plotted as a function of time, and across multiple runs.

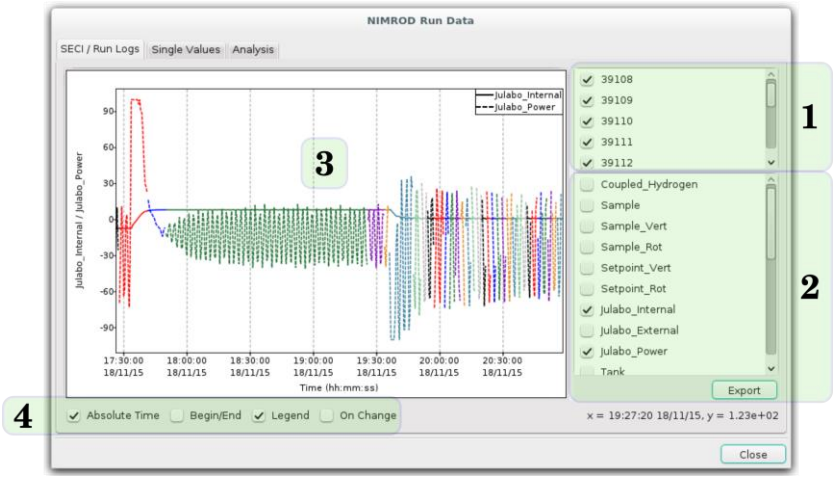


Figure 2 – The Run Data Window

For a set of plotted data files, the **SECI / Run Logs** tab gives a list of those run numbers at the top-right (**1**), and a list of the available SECI block values across all those run numbers at the bottom-right of the window (**2**). By default, all runs are selected when the window is shown – properties of interest may then be plotted on the graph area by selecting them from the lower list. The selected run numbers / run data may be exported to a text file with the **Export** button at the lower-right of the window. The **Single Values** tab lists various parameters such as SECI configuration name, wiring table file etc. (note that this information is extracted only from the *nxs* file, so this table will be empty if plotting from the *log* file), while the **Analysis** tab lists each run property in turn, and gives the total number of available points, the global minimum and maximum values, and the literal average of those values for each run.

The main graphing area (**3**) on the left of the **SECI / Run Logs** tab displays the currently-selected data – datasets from individual runs are drawn in different colours, while run properties are differentiated by different line styles (solid, dashed, etc.). Several options (**4**) affect how the data is plotted:

Option	Description
Absolute Time	If ticked (the default) then the x-axis on the graph will use date/time values as markers, typically giving a continuous plot of the run property as a function of time. If unticked then the data for each run will be plotted against hours, minutes and seconds *relative to the starting time of each data collection period* (i.e. when the **BEGIN** command was issued within SECI). As such, negative

	time indicates SECI log values that were collected before the **BEGIN** command.
Begin/End	Toggles display of vertical blocks defining the exact start and end times of the run (i.e. corresponding to when the **BEGIN** and **END** commands were issued to the DAE).
Legend	Toggles display of a legend listing each run property being displayed.
On Change	Controls how lines between datapoints are drawn. If not enabled, the data is assumed to represent a continuously-changing variable, and draws lines directly between each consecutive point. However, this is not necessarily the case, and SECI allows datapoints to be logged only if the value has changed beyond a specified threshold limit. Enabling the *On Change* option will draw strict horizontal and vertical lines between points, so as not to 'embellish' the data.

The main graph is fully controllable with the mouse, and several keyboard shortcuts also exist. The current position of the mouse in data-space coordinates is always displayed at the bottom-right of the tab.

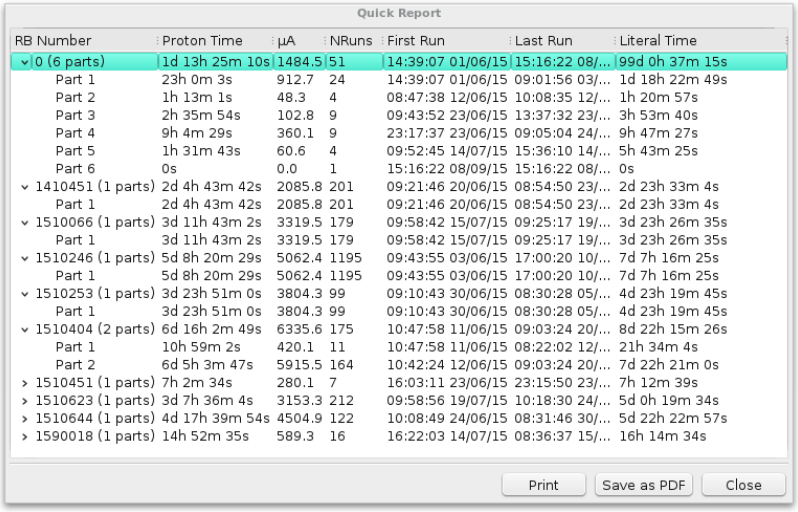
Action	Description
Left-Click	Shifts the viewport of the graph, without changing the scale of the x and y axes. The direction and magnitude of the shift is defined by the vector between the centrepoint of the graph and the current mouse position.
Left-Click-Drag	Allows a portion of the graph to be zoomed in to, as defined by the rectangle drawn by the mouse.
Middle-Click-Drag	Slides the visible area of the graph with the mouse.
Right-Click	Raises a context menu with several options. **Show All** resets the x and y axes to display all of the data for the currently-selected runs / properties. **Copy to Clipboard** places an image of the current graph (at its current size) on the clipboard for quick pasting elsewhere.

The available keyboard shortcuts are as follows:

Key	Description
A	Expand the limits of the graph on X and Y to encompass all of the data currently being displayed.
K	Toggle between logarithmic and normal x axis
L	Toggle between logarithmic and normal y axis

6. Generating Quick Reports

Selecting **Tools→Create Quick Report** opens up a window displaying various information collected for each distinct RB number present (used) in the currently loaded journal(s), Figure 3. For each RB number, the total proton time used, total proton current collected, number of runs made etc. is given. Since there is no guarantee that all runs for a given experiment will be performed back-to-back, JournalViewer tries to take account of this by partitioning the runs into 'parts', reflecting the contiguous chunks of data accumulation under a single RB number performed on the instrument. Thus, the total proton time is a reasonable reflection of accelerator time 'spent' on an experiment, while the literal time gives a straight measure of time elapsed between the start of the first run and end of the last run.



Quick Report

RB Number	Proton Time	µA	NRuns	First Run	Last Run	Literal Time
0 (6 parts)	1d 13h 25m 10s	1484.5	51	14:39:07 01/06/15	15:16:22 08/...	99d 0h 37m 15s
Part 1	23h 0m 3s	912.7	24	14:39:07 01/06/15	09:01:56 03/...	1d 18h 22m 49s
Part 2	1h 13m 1s	48.3	4	08:47:38 12/06/15	10:08:35 12/...	1h 20m 57s
Part 3	2h 35m 54s	102.8	9	09:43:52 23/06/15	13:37:32 23/...	3h 53m 40s
Part 4	9h 4m 29s	360.1	9	23:17:37 23/06/15	09:05:04 24/...	9h 47m 27s
Part 5	1h 31m 43s	60.6	4	09:52:45 14/07/15	15:36:10 14/...	5h 43m 25s
Part 6	0s	0.0	1	15:16:22 08/09/15	15:16:22 08/...	0s
1410451 (1 parts)	2d 4h 43m 42s	2085.8	201	09:21:46 20/06/15	08:54:50 23/...	2d 23h 33m 4s
Part 1	2d 4h 43m 42s	2085.8	201	09:21:46 20/06/15	08:54:50 23/...	2d 23h 33m 4s
1510066 (1 parts)	3d 11h 43m 2s	3319.5	179	09:58:42 15/07/15	09:25:17 19/...	3d 23h 26m 35s
Part 1	3d 11h 43m 2s	3319.5	179	09:58:42 15/07/15	09:25:17 19/...	3d 23h 26m 35s
1510246 (1 parts)	5d 8h 20m 29s	5062.4	1195	09:43:55 03/06/15	17:00:20 10/...	7d 7h 16m 25s
Part 1	5d 8h 20m 29s	5062.4	1195	09:43:55 03/06/15	17:00:20 10/...	7d 7h 16m 25s
1510253 (1 parts)	3d 23h 51m 0s	3804.3	99	09:10:43 30/06/15	08:30:28 05/...	4d 23h 19m 45s
Part 1	3d 23h 51m 0s	3804.3	99	09:10:43 30/06/15	08:30:28 05/...	4d 23h 19m 45s
1510404 (2 parts)	6d 16h 2m 49s	6335.6	175	10:47:58 11/06/15	09:03:24 20/...	8d 22h 15m 26s
Part 1	10h 59m 2s	420.1	11	10:47:58 11/06/15	08:22:02 12/...	21h 34m 4s
Part 2	6d 5h 3m 47s	5915.5	164	10:42:24 12/06/15	09:03:24 20/...	7d 22h 21m 0s
1510451 (1 parts)	7h 2m 34s	280.1	7	16:03:11 23/06/15	23:15:50 23/...	7h 12m 39s
1510623 (1 parts)	3d 7h 36m 4s	3153.3	212	09:58:56 19/07/15	10:18:30 24/...	5d 0h 19m 34s
1510644 (1 parts)	4d 17h 39m 54s	4504.9	122	10:08:49 24/06/15	08:31:46 30/...	5d 22h 22m 57s
1590018 (1 parts)	14h 52m 35s	589.3	16	16:22:03 14/07/15	08:36:37 15/...	16h 14m 34s

Print Save as PDF Close

Figure 3 – The Quick Report window, summarising each RB number in the current journal(s)

7. Generating Experiment Reports

A more comprehensive report for a single RB number can be generated in a so-called experiment report, accessed through **Tools→Create Experiment Report**. The experiment report window then offers several options guiding the content of the resulting report, the main body of which contains the details of every run collected during that experiment.

7.1. Experiment

A single RB number must first be selected on the **Experiment** tab, Figure 4, and which will be the target of the report. The list of available RB numbers (**1**) is taken from the current journal(s). The *User* string is taken from the first run number from the experiment, but may be edited here (e.g. to put full names of experimenters in etc.) (**2**). Optionally, the experiment report may be 'tagged' to state that this is one part of a multi-part experiment using the *Part* controls. Note that 'parts' in this context are distinct from those determined in a *quick report*.

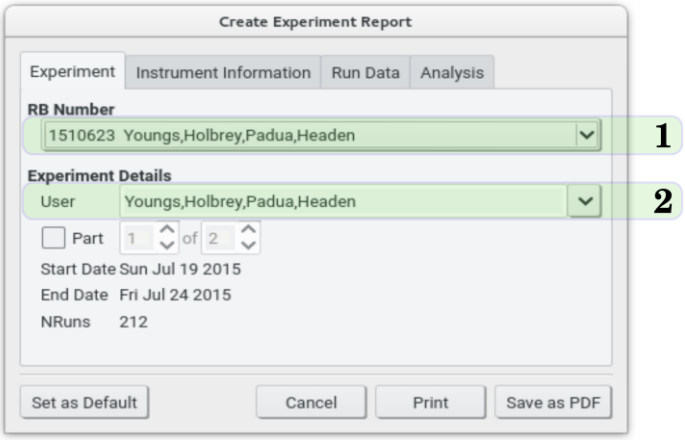


Figure 4 – Selection of a target RB number in the Experiment Report window

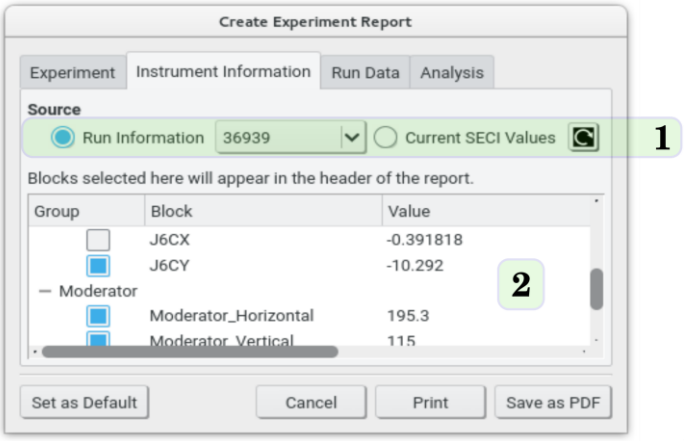


Figure 5 – Selection of beamline parameters to be included in an experimental report

7.2. Instrument Information

It is often useful to store beamline-related information along with the experiment, and the *Instrument Information* tab, Figure 5, allows single block values taken from a specified run in the

experiment or, optionally, the *Current SECI Values*, (**1**) to be added to the header of the report. Any item checked in the list (**2**) will appear in the header of the final report.

7.3. Run Data

In much the same way as the visible columns of the main table may be changed, so the properties for each run to be output may be modified on the *Run Data* tab. The left list represents the available properties, while the right list shows those that are currently selected for output in the final report. Selecting one and clicking the appropriate left / right arrow will move the properties between the two lists, and the final ordering of the displayed properties can be changed with the up / down arrows.

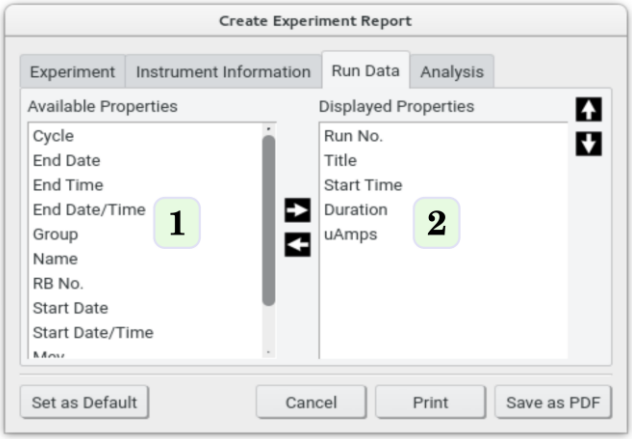


Figure 6 – Output parameter selection for the individual run data to be placed in an experimental report

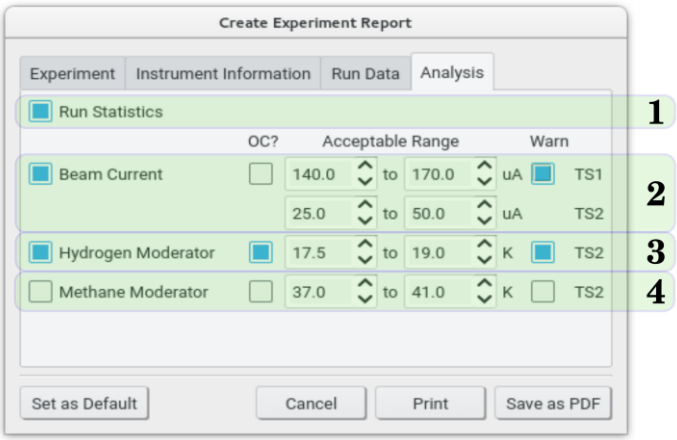


Figure 7 – Optional analysis graphs to be output at the start of the experimental report

7.4. Analysis

Finally, the report may be enhanced with time analysis of the runs taken in the experiment (**1**) and graphs of the primary ISIS parameters (beam current and moderator temperatures) over the course of the experiment (**2**,**3**), Figure 7. These graphs, if selected, will appear at the start of the report. Optionally, warning marks may be printed on the graphs where the parameters go outside of a specified range (designed to be related to the vetoes present on the instrument used to collect the data) by selecting the relevant *Warn* checkboxes. As with the **Run Data** window

(Chapter 5) these parameters are plotted as if they were continuously changing variables, but may be plotted in the alternative discrete style by selecting the *OC?* ('on change') checkboxes.

8. Command-Line Interface

Occasionally it is useful to perform a quick search of journal data without loading the user interface, and for this purpose JournalViewer has a basic command-line interface. Run without any command-line arguments, JournalViewer will always start up with the GUI. Available command-line options are:

Option	Description
–a	List all run data for the current journal
–c columns	Set the run property columns to display for search output. If the option is omitted the current columns visible in the main GUI table are used. Otherwise, a string of characters representing the required *columns* can be given, selected from the following: a Accumulated current in μAmps b RB number c Cycle d Duration of run e End date/time of run m Accumulated Mevents r Run number s Start date/time of run t Title of run u User
–h	Display help for all available command-line options (i.e. the contents of this table)
–i instrument	Change target instrument to that provided. Long (e.g. SANDALS) or short (e.g. SLS) names may be provided. If the option is omitted the default instrument is used.
–j cycle	Change target journal to the ISIS operating cycle provided. Note that only the YY/N part should be given (e.g. '15/4'). The string 'All' is also accepted, and targets all available cycles in the subsequent search. If the option is omitted the journal for the most recent cycle is used.
–l	Lists all available journals for the current instrument and exit
–r "regular expression"	Perform a regular expression search of the run titles in the current journal, printing those that match.
–s "plaintext string"	Perform a plain text search of the run titles in the current journal, printing those that match.
–w "wildcard string"	Perform a wildcard text search of the run titles in the current journal, printing those that match.
–v	Display version information and exit

8.1. Usage Examples

To search the current (most recent) journal for the current instrument, looking for the word 'Vanadium' in the title:

```
bob@pc:~>  jv –s Vanadium
```

To search for any 'Empty' run in a cryostat (for instance):

```
bob@pc:~>  jv –w "Empty*cryostat"
```

For a set of sample cells labelled N1 through to N10, display all empty cell runs for the current instrument / journal, excluding those for N4 through to N9, using a regular expression search:

```
bob@pc:~>  jv –r "Empty N[^4–9]"
```

Change the current instrument to IRIS, the current cycle to 11/2, and display all runs for that journal:

```
bob@pc:~>  jv –i IRIS –j 11/2 –a
```

For the current instrument, change to cycle 09/5, and display the run number, title, start/end date/times, and accumulated current, for all runs in that journal:

```
bob@pc:~>  jv –j 09/5 –c rtse –a
```

9. Settings

General setup and program preferences are contained in the **Settings** window (**Tools→Settings** or **Ctrl-T**). Some critical options affecting the bulk of JournalViewer's abilities are set here, so it is worth checking that they are correct, especially for non-Windows systems.

9.1. Access Settings

The Access tab of the Settings window, Figure 8, specifies the network and disk locations of the target journal files, and also defines how data is accessed.

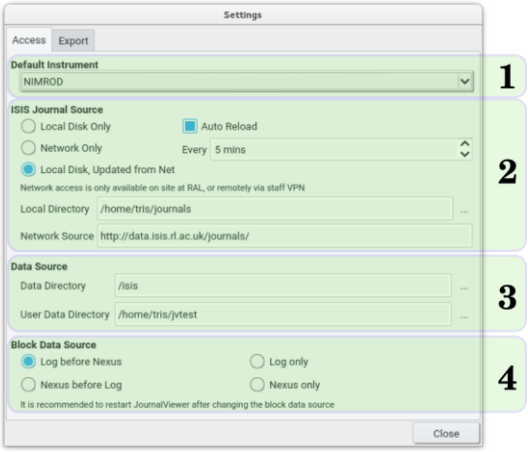


Figure 8 – Access settings

Setting	Description
Default Instrument (**1**)	A specific instrument whose journal files should be loaded immediately on startup (or **LOCAL** for the local user data, or **<None>** to use the first instrument in the list).
ISIS Journal Source (**2**)	The location from which to acquire journal data for all instruments. **Local Disk Only** means only previously-saved local journals will be available, while **Network Only** reloads journal files from the **Network Source** every time. **Local Disk, Updated from Net** will check for local copies of journals first, reloading out-of-date journals from the network, and storing updated journals on disk as it proceeds. The **Local Directory** should be set to a location on the user's hard disk, and will be used to store updated journals retrieved from the network. The **Network Source** should be set to the location of the journal xml files accessible by HTTP (currently `http://data.isis.rl.ac.uk/journals/`). Automatic reloading of the currently-displayed journal file can be enabled with the **Auto Reload** feature, with a corresponding poll interval time (in minutes).
Data Source (**3**)	The two locations here represent the areas to search when attempting to load **.log* or **.nxs* files (when plotting data etc.). The **Data Directory** should point to the network share location that holds all instrument run data. Note that this setting is heavily operating

	system-dependent. The **User Data Directory** may point to a disk-based location where raw, log, and nxs files exist, and which JournalViewer treats as data for the **LOCAL** instrument.
Block Data Source (**4**)	When reading block (sample environment) data for a given run there are two possible sources of data: the *log* file, or the *nxs* file. These options allow control of which source(s) to use when loading data for plotting (by double-clicking on the main table or using the **F1** shortcut).

9.2. Export Settings

The controls on the **Export** tab, Figure 9, allow tweaking of the style in which exported pdf documents are displayed, including setting margins. The settings do not affect text document export, save for the ability to set the margins for such documents separately.

Setting	Description
Appearance (**1**)	Colours used for header text and background in exported tables in pdf documents. If **Highlighting** is enabled, alternate rows will use the specified highlight colours. Normal, non-highlighted rows are always written using black text on a white background.
Font (**2**)	Specified the particular font to use for text in exported documents, and for graphs in the **Run Data** window (Chapter 5) and in generated experimental reports (Chapter 7).
Data Format (**3**)	When exporting a list of runs from the main table, selects between a 'simple' list of run data, or an 'indented' form. A simple list puts all data items for a given run on one line, while in the latter the run number and title are written on a 'header' line of their own, followed by additional data on the next (indented) line. Additionally, if grouping of runs is enabled, runs with similar titles will appear under the same heading.
Margins (**4**)	Sets the margins, in centimetres, to use in both plain exported data and for experimental reports.

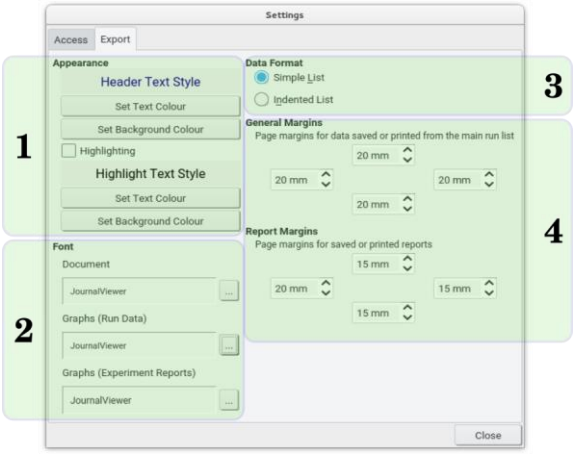


Figure 9 – Export settings

9.3. Accessing the ISIS Data Directory

For Windows machines on the STFC network it should be sufficient to use `\\isis\inst$` as the **Data Directory**, provided the current user is authenticated with a suitable federal ID. For OSX machines it is necessary to first mount the correct Windows share:

1) From the Finder tool select **Go→Connect to Server**

2) Enter `smb://isis/inst$` as the **Location**

3) Click **Connect** and you will be prompted for your federal ID and password

4) Once successfully authorised the data should be accessible through `\\Volumes\\isis$`

5) In JournalViewer, enter `\\Volumes\\isis$` as the **Data Directory**

For Linux systems the process is similar, but the variety present within the available distributions makes a comprehensive guide impossible. From the command line the procedure is as follows on an OpenSuSE 13.1 system:

1) As root, create a directory mount point for the Windows share, e.g. `/isisdata`

2) As root, mount the Windows share with the following command, replacing `abc12345` with your federal ID:

```
bob@pc:~> mount -t cifs //isisdata/inst$ -o "user=abc12345,sec=ntlm" /isisdata
```

3) Enter the password associated to your federal ID

4) In JournalViewer, enter `/isisdata` as the **Data Directory**

9.4. Using JournalViewer on Local Data

As well as retrieving journal and run data from network locations (i.e. when connected to the STFC network as an authenticated user) JournalViewer is able to probe and manage data stored locally in the **User Data Directory**. The intended purpose of this is to allow facility users to make use of JournalViewer's functionality on their collected data after having returned to their

home institution, where no access to the original ISIS journal data is available. The layout of the directory should be as follows – assuming that the location is set to `C:/Users/abc12345/MyExperimentData`, then one may organise user data as follows:

```
🗁 C:/Users/abc12345/MyExperimentData
    🗁 RB1220486/
        🗎 NIMROD00014136.log
        🗎 NIMROD00014136.raw
        🗎 NIMROD00014137.log
        🗎 NIMROD00014137.raw
          ...
    🗁 RB1310475/
        🗎 NIMROD00018606.nxs
        🗎 NIMROD00018606.raw
        🗎 NIMROD00018607.nxs
        🗎 NIMROD00018607.raw
          ...
    🗎 SLS41093.raw
    🗎 SLS41094.raw
    🗎 SLS41095.raw
          ...
    🗁 WaterData/
        🗎 NIMROD00026207.nxs
        🗎 NIMROD00026207.raw
        🗎 NIMROD00026208.nxs
        🗎 NIMROD00026208.raw
          ...
```

The basic principle here is to store the files related to each distinct experiment in their own separate directories, the names of which will be displayed as individual entries in the **Data** selector (which replaces the **Cycle** selector when the instrument is set to **LOCAL**). For the example given above, the entries will be 'RB1220486', 'RB1310475', and 'WaterData'. Note that there are also some 'loose' files in the root of the user directory (SLS41093.raw etc.) – any files found in this directory will be added to a journal entry called 'Top'.

Before this data is available within JournalViewer, index files must be created by selecting **Tools→Regenerate Local Journals**. JournalViewer will then search through all subfolders in the specified user directory, extracting the necessary information from the *nxs* or *raw* files in order to build journals for them. Since this operation can be quite time consuming, it is never run automatically – as such, if files are changed, moved, or new *raw* or *nxs* files are added, the index files must be updated manually by selecting **Tools→Regenerate Local Journals**.

10. Outlook

JournalViewer offers the ability for instrument scientists, technical staff, and facility users alike to easily search through journal data for any ISIS instrument over any available cycle. Sample environment block values may be extracted and plotted using built-in graphing capabilities, and exported to graphical images or raw text data. In addition, JournalViewer allows reports to be generated for individual RB numbers, offering facile take-home document generation for users.

Future developments may cover the extraction and plotting of individual spectra (e.g. monitors) from the associated data, enhanced block value plotting capabilities (e.g. value vs. value), and basic data analysis routines.

11. References

1) RAL-TR-2011-013 "GudrunN and GudrunX: Programs for correcting raw neutron and X-ray diffraction data to differential scattering cross section", A. K. Soper (2011)