

Using Social Media Technologies for Online Scientific Analysis and Collaboration

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1. Abstract

A web page that demonstrates a concept for a scientific analysis worksheet for data from experiments on the OMEGA and OMEGA EP lasers has been improved upon with the implementation of social features to create a more collaborative scientific environment for users. This interface was created with the purpose of allowing principal investigators and guest users to collaboratively analyze data in web-based live sessions and communicate with their peers through a group chat system. Users are able to connect with other principal investigators, diagnostic specialists and facility managers associated with scientific campaigns of interest. Collaborators are able to view and analyze data or develop code using Python functions. Principal investigators can invite remote colleagues to join a session to conveniently share data. The work demonstrates that features commonly found in social media can be successfully implemented into a scientific environment to promote collaborative analysis of data.

2. Introduction

The Laboratory for Laser Energetics has an informatics website that allows principal investigators (PIs) to view their laser shot and diagnostic data online in a user-friendly interface. Additionally, there are web tools available to assist in the analysis of the data, such as the ability to upload analysis routines written in Python to manipulate the data and compare data between multiple diagnostics. However, no features exist on the web page that allow PIs to share their data easily without manually sending the data to another person. **Figure 1** illustrates the current interface for exporting shot data. It provides for downloading only with no collaborative tools. For example, if a PI were to be working with a graduate student, he would need to manually download the shot data after searching for it via an identification number, and then send it to his student through email or another messenger system. The system only provides the raw data and no

analytical tools. Additionally, most OMEGA data is archived with custom formats and metadata that is unfamiliar for many and requires prior knowledge to utilize effectively. The analysis process can be tedious in that it may require going back and forth between the PI and his colleague to resolve problems, which can lead to delays. As such, social features were implemented to the LLE diagnostics web page to allow online collaboration between users directly on the web page in the form of group communication and simultaneous viewing and analysis of data.

LLE Image Archive Query Results

Select the files to download from the following list. You can use *control-click* to select multiple files or *shift-click* for groups of files. You may also choose to convert any non-SEPIA selected files. Although the conversions are generally reliable, they may not work in all cases. For information on extracting files from

Shot #	Diagnostic	Acquired	Original Data File	<i>Click on button to reorder the list</i>
82596	AWG	08/23/2016	/archive/tmp/drivers/psc/s82596fePHX.hdf	
82596	AWG	08/23/2016	/archive/tmp/drivers/psc/s82596feSSD.hdf	
82596	BLOTDR	08/23/2016	/archive/tmp/drivers/OTDR/new_bl_otdr82596.hdf	
82596	C-NEARFIELD	08/23/2016	/archive/tmp/NF_Camera/Stage_C/s82596.hdf	
82596	DRVOTDR	08/23/2016	/archive/tmp/drivers/OTDR/new_ssd_otdr82596.hdf	
82596	FF_CAMERA	08/23/2016	/archive/tmp/alignment_cameras/ff/s82596_dl-asp_p.hdf	
82596	HED	08/23/2016	/archive/tmp/hed/sn82596n.hdf	
82596	HED	08/23/2016	/archive/tmp/hed/sn82596s.hdf	
82596	IR_PULSE2	08/23/2016	/archive/tmp/ir_pulse2/s82596_ssd.hdf	
82596	IR_PULSE3	08/23/2016	/archive/tmp/ir_pulse3/s82596_dl_psm.hdf	
82596	LDED	08/23/2016	/archive/tmp/drivers/energy_diag/s82596.hdf	
82596	NEARFIELD	08/23/2016	/archive/tmp/NF_Camera/s82596.hdf	
82596	NF_CAMERA	08/23/2016	/archive/tmp/alignment_cameras/nf/s82596_dl-asp_c.hdf	
82596	NF_CAMERA	08/23/2016	/archive/tmp/alignment_cameras/nf/s82596_out_c.hdf	
82596	NF_CAMERA	08/23/2016	/archive/tmp/alignment_cameras/nf/s82596_slara_c.hdf	

Conversions only performed on SEPIA selected files:

- NONE (no format conversion)
- TIFF (Tag Image File Format; no floating point)
- HDF (Hierarchical Data Format)
- FITS (16-bit data only)
- GIF (Graphics Interchange Format; 8-bit, 2D only)

Download

Figure 1: Current LLE page to download and export shot data

3. Development

The design of the new interface was created following the familiar aesthetics of popular social media sites, such as modeling the chat system after Facebook’s messenger system to create an intuitive design. Although the LLE web site does not necessarily count as “social media,” implementing attributes from successful social media sites can be beneficial in improving the usability of the new technologies.

In order to implement the live web sessions that would allow PIs to work collaboratively, Node.js was chosen as the base platform. Node.js is a cross-platform runtime environment that can process inputs asynchronously on the server side without performance loss, an important aspect of the live web session's functionality. This means that multiple inputs are processed separately from each other, which allows them to be executed simultaneously and processed quickly. With JavaScript being the primary language that the web page was already written in, Node.js allows easy integration into the preexisting code. Node.js has also built up a reputation of being used by some of the biggest technology companies in the world. For instance, social media site LinkedIn is entirely built on Node.js and allows its users to connect and build professional relationships, while serving external applications that can be embedded in LinkedIn's framework. Google also uses Node.js to connect its social media Google+ accounts to its other services, allowing users to share documents and data, join circles to organize users, and even stream media. Most importantly, Google uses Node.js to allow the simultaneous editing of files seamlessly by users on their Google Docs, Sheets, and Slides platforms.

4. Interface Capabilities

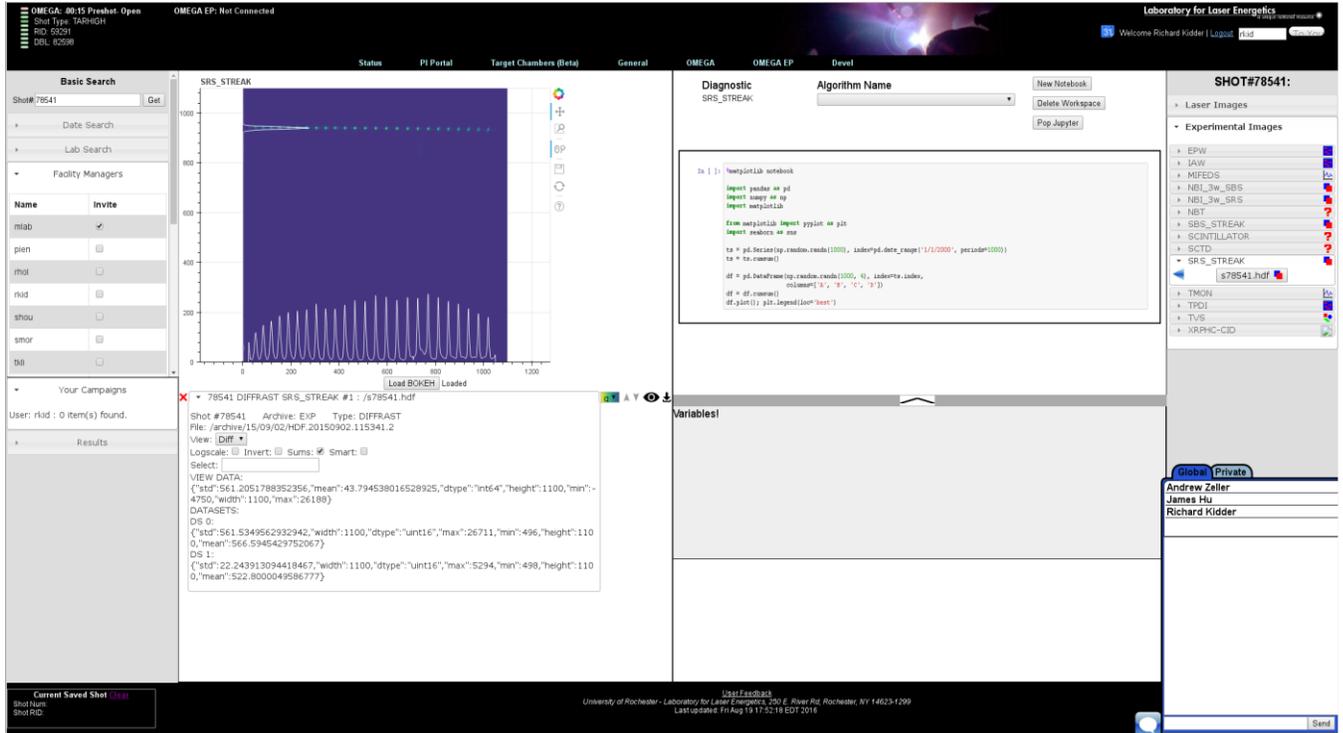


Figure 2: Example of the diagnostics web page in use

At LLE, Node.js was used to develop ways to enable users to interact on the informatics website and specifically on the diagnostics page. The web-based live sessions on the diagnostics page will not only allow collaborators to be able to simultaneously view the data, but also allow users to simultaneously write Python code in the embedded Jupyter notebook, seen in the upper right box in **Figure 2**, similar to how Google Docs functions. Furthermore, users will be able to upload their code routines to the web page so that their code will be saved onto their account on the server and no longer need to be transferred locally.

A new interface was added to display online users, who can be invited to another user's live session with a simple click. If they are online, denoted by whether or not the circle next to their user ID is green, they will receive an invitation to join the session and have the option of accepting or declining. There is a list of facility support personnel who are not directly associated

with any specific diagnostic, but are there for general assistance regarding any of the diagnostics, seen in **Figure 3**.



Name		Invite
mlab	●	<input type="checkbox"/>
pien	●	<input type="checkbox"/>
rhol	●	<input type="checkbox"/>
rkid	●	<input type="checkbox"/>
shou	●	<input type="checkbox"/>
smor	●	<input type="checkbox"/>
tkli	●	<input type="checkbox"/>
zuegel	●	<input type="checkbox"/>
ehil	●	<input type="checkbox"/>
jkwi	●	<input type="checkbox"/>

Your Campaigns

Results

Figure 3: List of facility support staff who are always displayed under the tab “Facility Managers”

When a shot is looked up by its identification number, it will display two tabs, one for laser images and one for experimental images. Within each tab there are diagnostics, each of which has its own sets of data. For each diagnostic, a list of staff members associated with the diagnostic will appear when the arrow is clicked on, and they too can be invited by simply checking the box under the “Invite” column, illustrated in **Figure 4**. This allows the staff list to be organized in a logical manner, as users will most likely want to collaborate with internal users who are associated with

the specified shot. However, if internal users want to collaborate with external users, meaning personnel not affiliated with LLE, the process is different.

			SHOT#23826:
Name	Position	Invite	▶ Laser Images
asor ●	Instrument Specialist Technician	<input checked="" type="checkbox"/>	▼ Experimental Images
cmil ●	Instrument Specialist	<input type="checkbox"/>	▶ EMPMON 
pnil ●	Diagnostic PI	<input type="checkbox"/>	▼ PJX 
uhxr ●	Diagnostic PI	<input type="checkbox"/>	▶ s23826_pjx2.hdf 
			▶ TMON 
			▶ TVS 

Figure 4: Example of a list of personnel associated with a diagnostic

Previously, colleagues who are not in the LLE system could not use the web page at all because they simply did not have access. This was resolved by allowing internal users to invite external guest users to view their live session temporarily. In order for external users to join a live session, an internal user must give the external users a randomly generated link that will expire after a set duration. It is important to maintain a high level of security when allowing external users to collaborate, as there is confidential data that should not be seen by unwanted personnel. When an external user joins, he will be set as a guest by default and will have restricted access to the features of the web page, such as not being able to change the diagnostic, as seen in **Figure 5**. On the other hand, the web page for an internal user is seen in **Figure 6**, where he has full access to all the shot data. This is an important security feature, as only the internal user should have control over what data is being shown in order to provide another level of security.

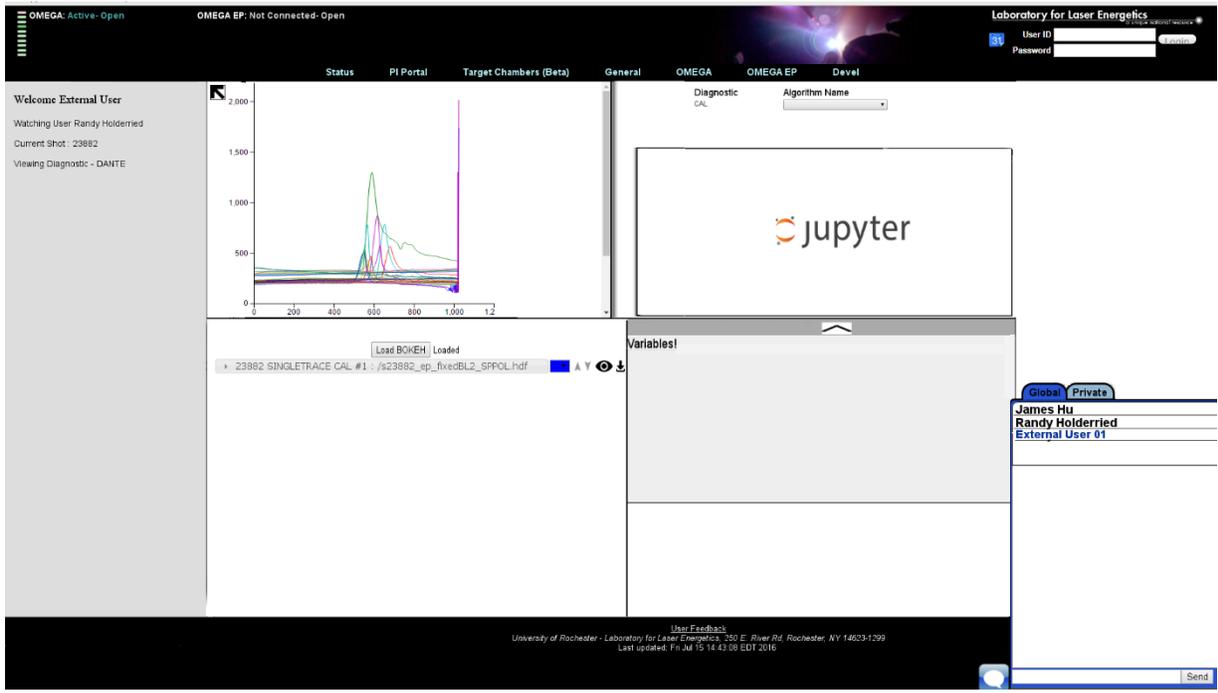


Figure 5: Diagnostics page for an external user, who has restricted access to the features of the web page

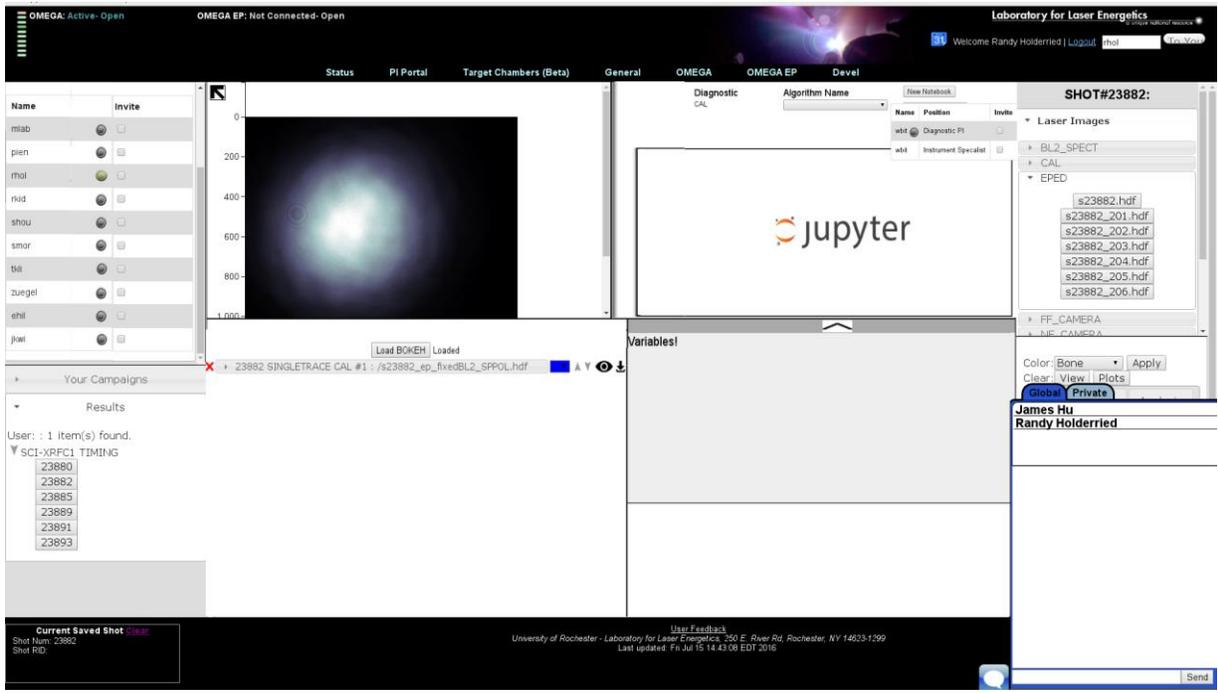


Figure 6: Diagnostics page for an internal user, who has complete access to all shot data and web features

Formerly there was only one chat, which meant that anybody online could see what was being typed, which would not be ideal for a live collaboration. As such, the chat system was revamped to allow users of a particular live session to communicate in a group chat, but to also allow private messages between individual online users. A messaging system is an important piece of any collaborative tool, and, using the chat system, users can see when others are available and can communicate when reviewing data. Although the chat system is quite simple, seen in **Figure 7** which displays both the private and group (global) chat, updates will be made to improve the usability and clarity of the chat.

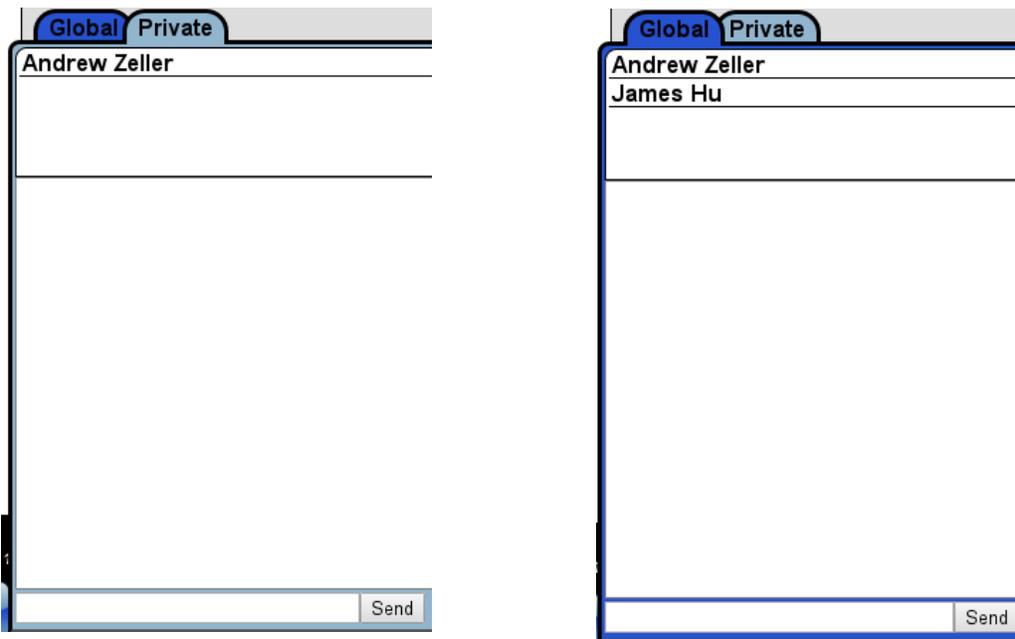


Figure 7: Chat system

6. Conclusion

Live web-based sessions with a private chat system have been implemented to help PIs with their collaborative endeavors in analyzing diagnostic data. Accessibility to shot data for guest users has been added while maintaining an adequate level of security. The ability for internal users to collaborate with their external colleagues directly on the web page is beneficial to PIs as they

no longer have to go through a longer and more difficult process to analyze data collectively. The features added demonstrate the practicality of social features and their advantageous role in a scientific environment. Social technologies can be implemented into a scientific environment to promote collaborative analysis of data.

7. Acknowledgements

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