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EAST Real-Time VOD System Based on MDSplus

J.Y.Xia[1,2], B.J.Xiao[1,2], Fei Yang[1,3], Dan Li[1]

1.Institute of Plasma Physics, Chinese Academy of Sciences, Hefei 230031, China;
2.Hefei Research Center of Physical Science and technology，University of Science and Technology of China, Hefei 230031 ,China;
3. Department of Medical Informatics Engineering, Anhui Medical University, Hefei 230031, China

jyxia@ipp.ac.cn, bjxiao@ipp.ac.cn, lidan@ipp.ac.cn, fyang@ipp.ac.cn

ABSTRACT : As with EAST（Experimental Advanced Superconducting Tokamak） experimental data analyzed by more and more collaborators, the experimental videos which directly reflect the real status of vacuum attract more and more researchers' attention. The real-time VOD（Video On Demand） system based on MDSplus allows users reading the video frames in real time as same as the signal data which is also stored in the MDSplus database. User can display the plasma discharge videos and analyze videos frame by frame through jScope or our VOD web station. The system mainly includes the frames storing and frames displaying. The frames storing application accepts shot information by using socket TCP communication firstly, then reads video frames through disk mapping, finally stores them into MDSplus. The displaying process is implemented through B/S(Browser/Server) framework, it uses PHP and JavaScript to realize VOD function and read frames information from MDSplus. The system offers a unit way to access and backup experimental data and video during the EAST experiment, which was of great benefit to EAST experimenter than the formal VOD system in VOD function and real-time performance.

Introduction

1. EAST experimental data is shared and analyzed by more and more collaborators in recent years, especially the experimental videos which directly reflect the real status of inner vacuum.
2. The original VOD system need to be improved in video storing and displaying to make the system more user-friendly.
3. MDSplus is a set of software tools for data acquisition and storage which is already used in EAST experiment. MDSplus allows all data from an experiment or simulation code to be stored into a single, self-descriptive, hierarchical structure.
4. Therefore, the EAST VOD system based on MDSplus is built, allowing users read the video frame in real time as same as the signal data which is also stored in the MDSplus database.
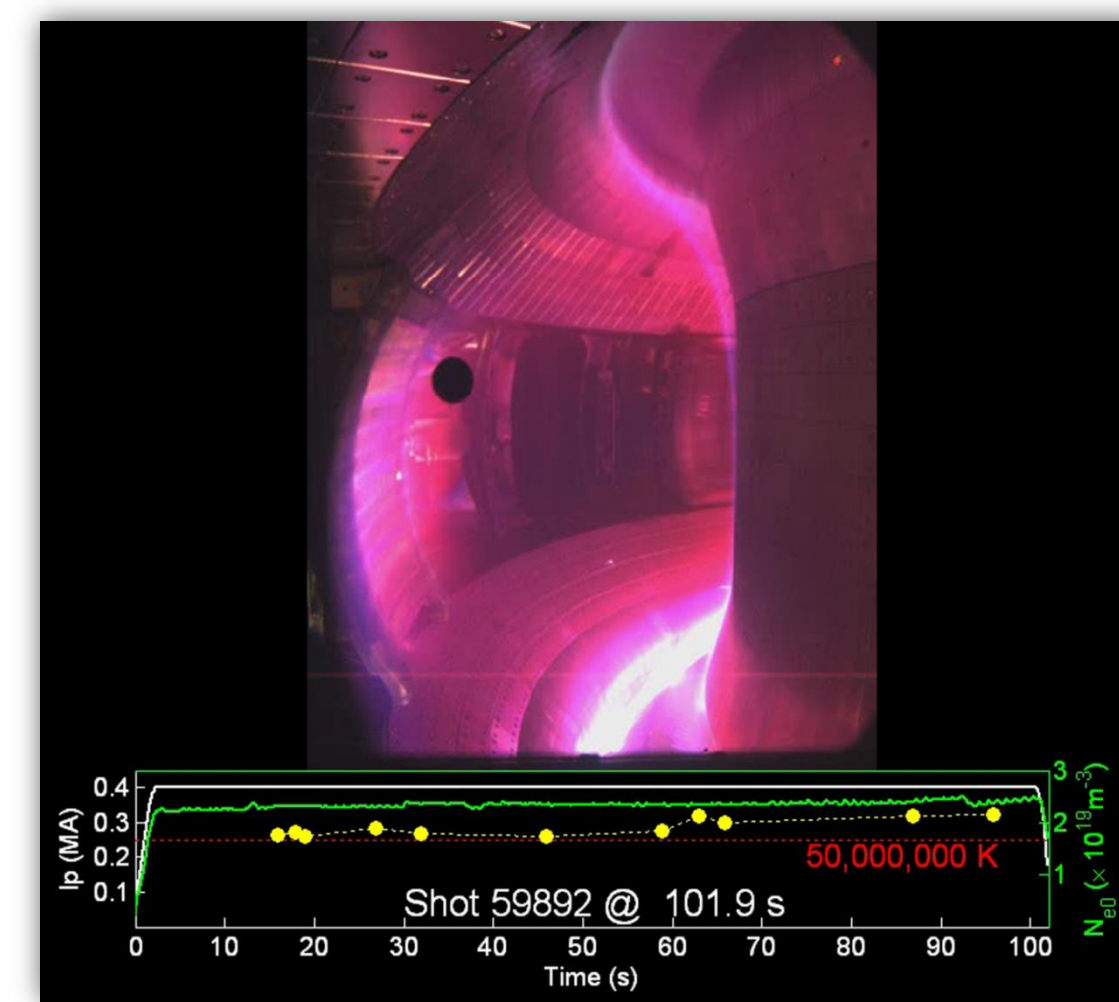

Storage Process
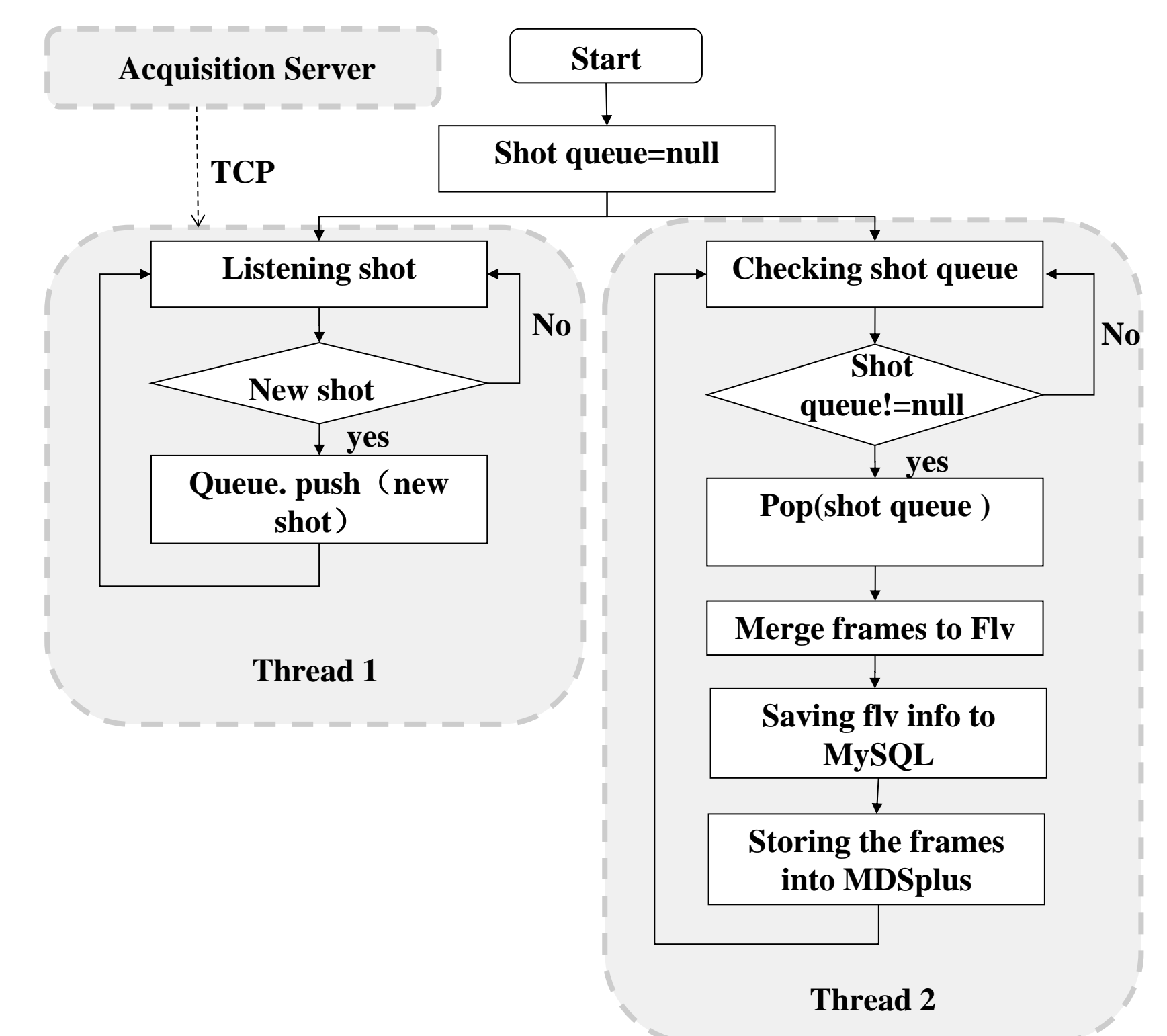
1. **Thread1**
   - Accept the shot massage from acquisition server through TCP communication and save the shot number into a queue;
2. **Thread2**
   - Check the shot queue and store the videos and frames into database.
   - FFmpeg is a complete, cross-platform solution to synthetic the frames to a flv video.
   - MDSplus segments are useful to store sequences of images (frames) into MDSplus.

Software Structure

1. The center control system will trigger the high-speed cameras to start work when the EAST experiment is beginning.
2. Then the camera starts to record the raw experimental video, split the video to image frames and save timestamps into a file. Meanwhile，it sends the shot number to storage server throw TCP communication.
3. The videos are stored in the server with RAID（Redundant Array of Inexpensive Disks），the frames and timestamps are saved into MDSplus, and the shot information for webpage is stored in MySQL database.
4. Finally, the VOD server reads frames from MDSplus and displays the video and frames on the web browser.
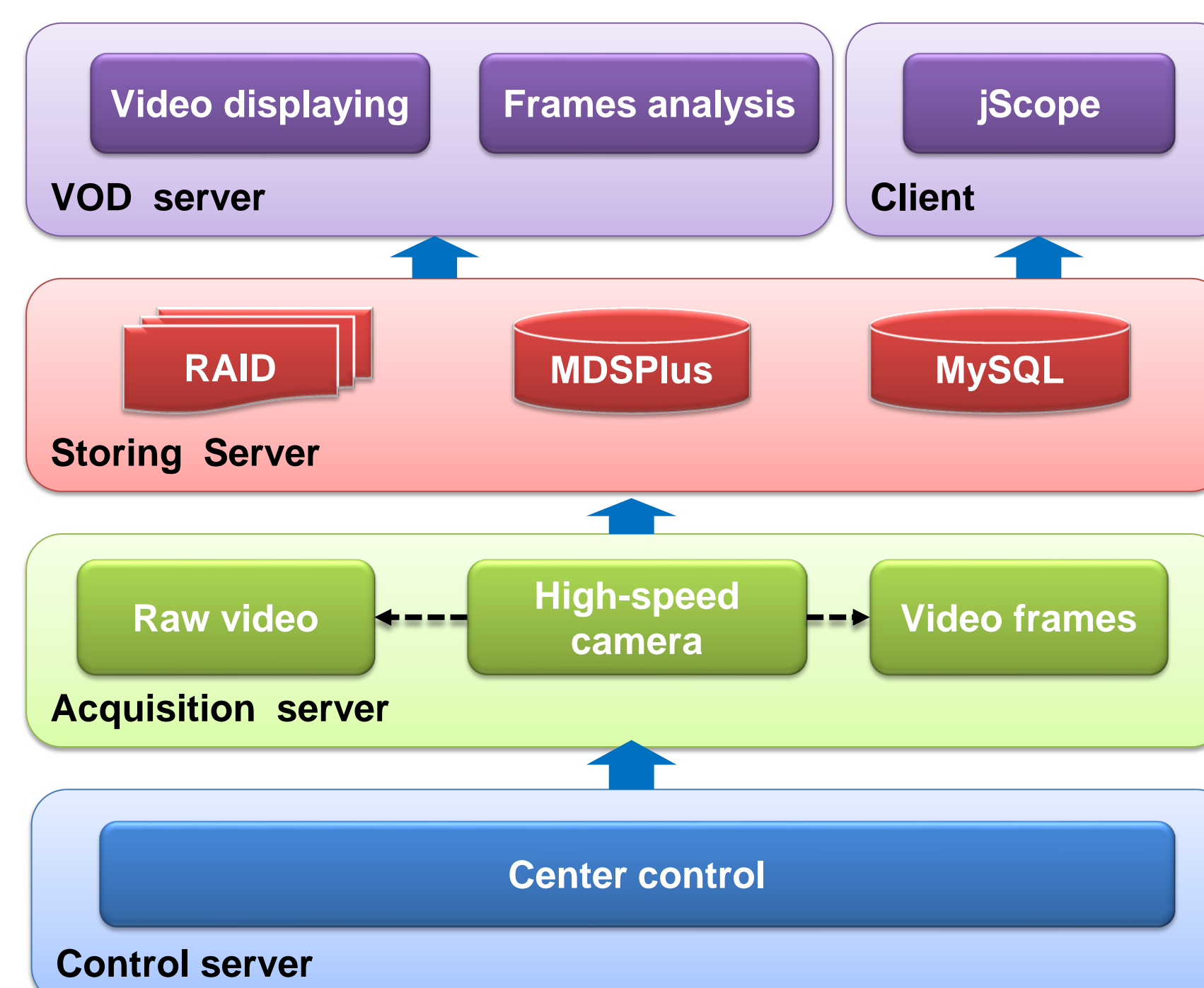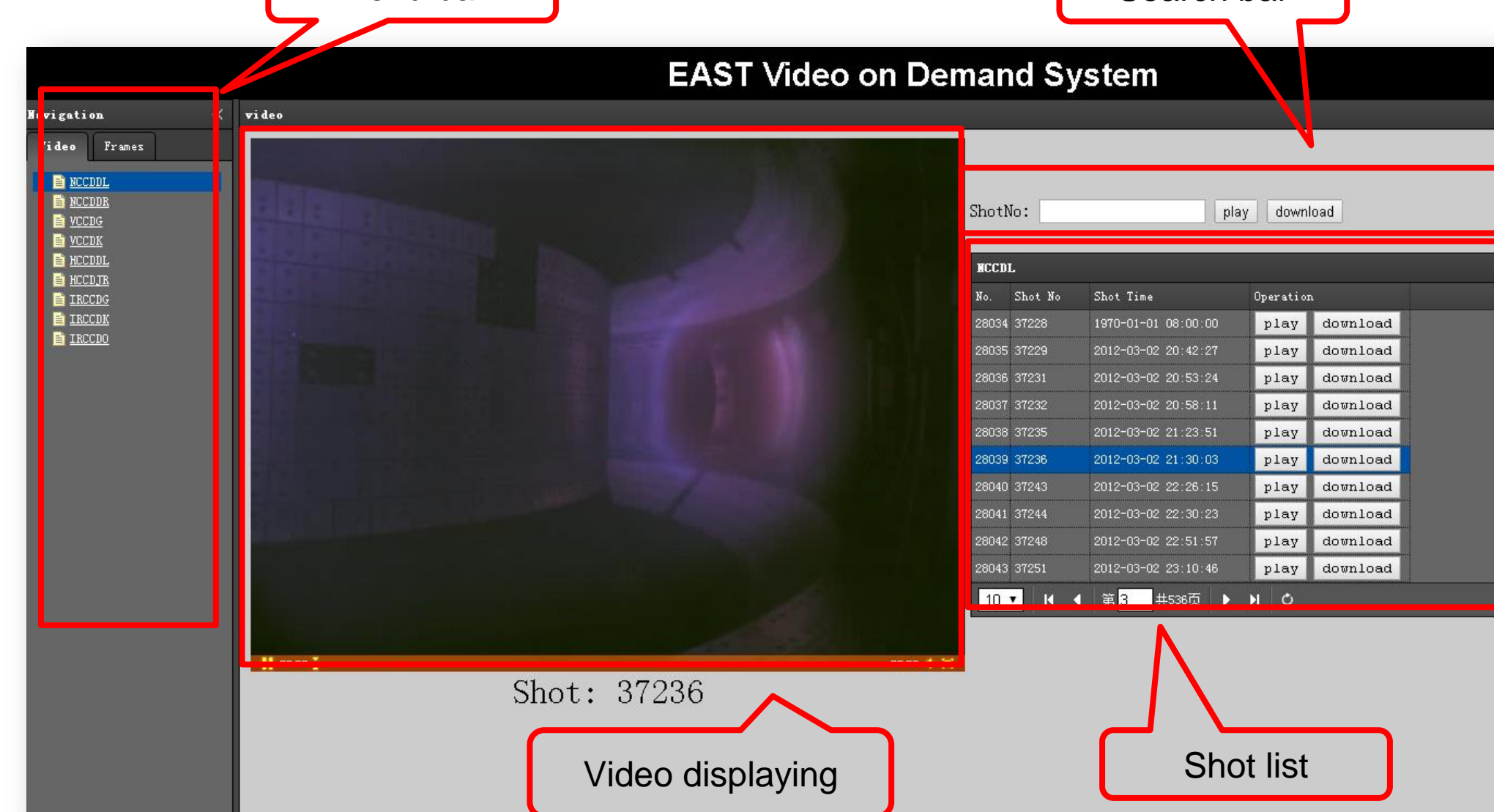

System Realization

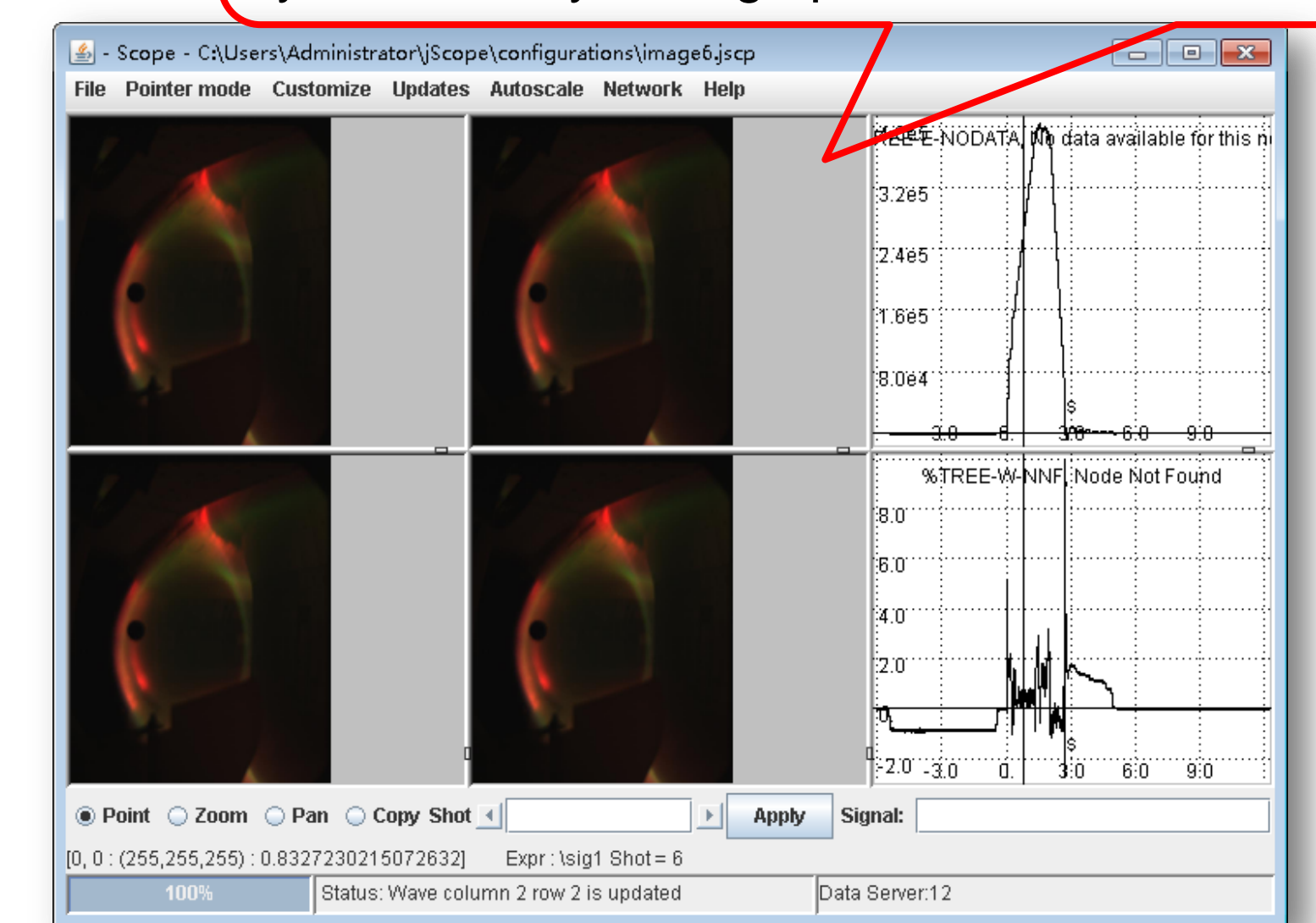sliding the frames by setting the sliding speed.
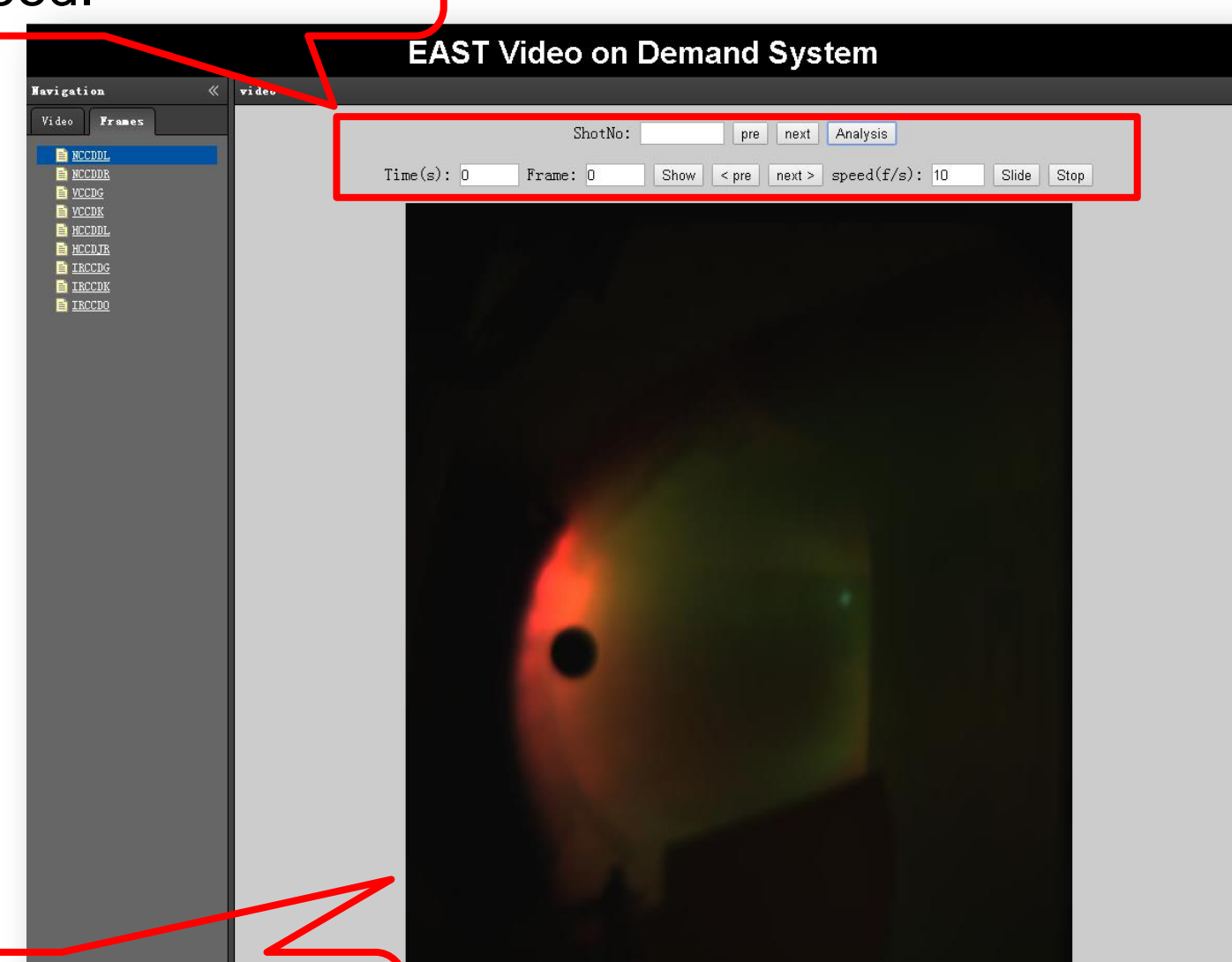
Reading the frames and time points from MDSplus

Allowing to play the different frame animations and the experimental data wave synchronously through pointer mode.

Menu bar

Search bar

Video displaying

Shot list

Video displaying

Frame analysis

jScope: version:7.4.5

System comparison

1. The old system saves the image frames in RAID and save the timestamp in a *.xml file in windows system.
2. The new system saves the image frames and timestamp in MDSplus database in linux system.
3. According to the real-time comparison table，the new system is neally three times faster than the old system, expecially the long pulse shot in EAST experiment, such as "73999".

Shot No.	Video length(s)	Video size(KB)	Frames	Old Time (s)	New time (s)
77212	0.78	1.02M	97	7.9735	1.0145
77213	9.79	30.9M	1198	30.002	10.518
77214	5.31	15.3M	650	16.787	4.896
77215	9.37	31.7M	1146	26.226	9.368
77216	9.48	31.8M	1160	29.376	8.778
73999	104.78	169.8M	12810	271.607	91.875

Real-time comparison table

Conclusions

Eventually, the EAST real-time VOD system based on Mdsplus is an user-friendly system. On one hand, it offers a more highly-interactive interface for scientists to view the plasma discharge videos and analysis the video frame by frame. On the other hand, it allows users to store and read the frames through the same way as experimental data through MDSplus.

Compared with the former system, the new system shows some optimization and improvement in expansibility and real-time.

The next step will be to enhance the VOD function and improve real timing, for example, adding the function of various videos synchronous display and reducing the time of video synthesis.