The Camera Acquisition system in the SPARC control system

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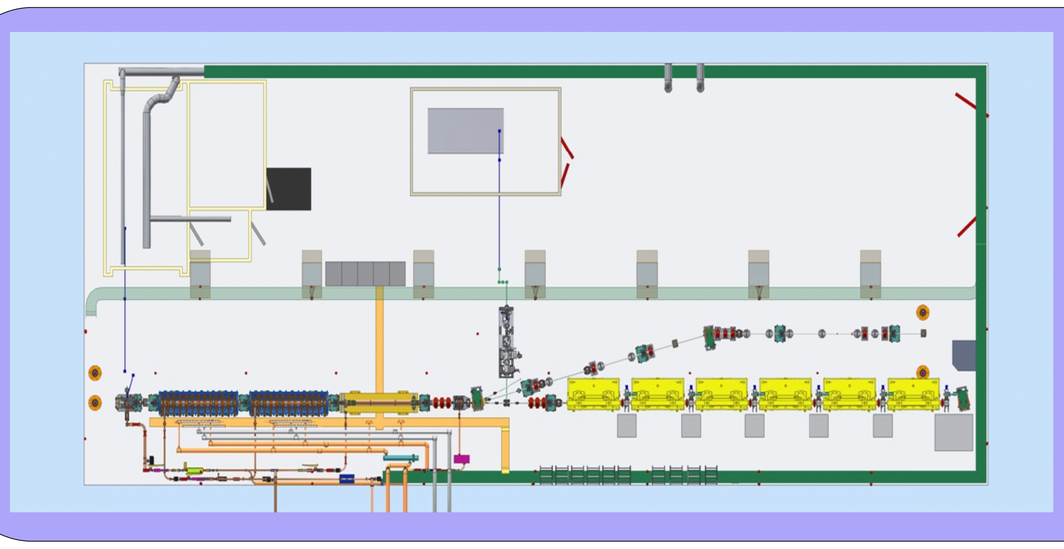
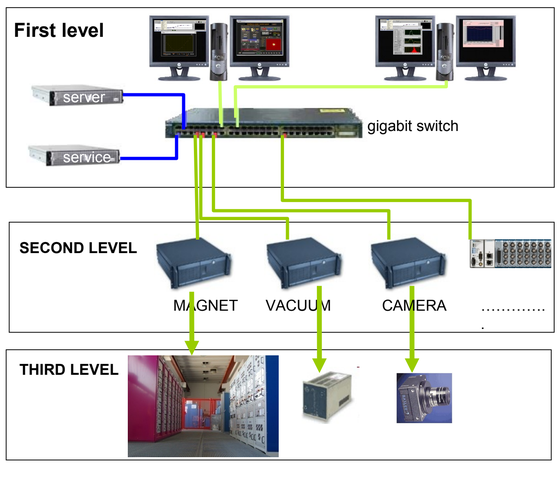
Abstract
One of technical challenge in many physics experiments is to capture and process images. There are many solutions in this domain. In the SPARC injector we use mainly IEEE1394 cameras but we also start to introduce some gigaVision Ethernet cameras. Both types of cameras are easily connected with the PCs. We present solution about cameras' integration into the SPARC control system to allow the development of high level program without know the type of camera used.



SPARC

The SPARC (Sorgente Pulsata e Amplificata di Radiazione Coerente, Self-Amplified Pulsed Coherent Radiation Source) project is to promote an R&D activity oriented to the development of a high brightness photo injector to drive SASE-FEL experiments at 500 nm and higher harmonics generation. Proposed by the research institutions ENEA, INFN, CNR with collaboration of Universita` di Roma Tor Vergata and INFM-ST, it has been funded in 2003 by the Italian Government with a 3 years time schedule. The machine is under installation at Laboratori Nazionali di Frascati (LNF-INFN). It is composed of an RF gun driven by a Ti:Sa laser to produce 10-ps flat top pulses on the photocathode, injecting into three SLAC accelerating.

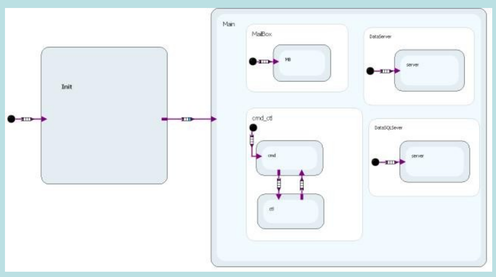


The control system of SPARC is based on architecture of distributed client-server type that helped us to easily integrate the camera system this choice has partly solved the problems of distance and allowed us to develop fully integrated software in the control system.
The choice between various buses is linked to the characteristics of cameras required.
Acquisition of images is necessary to have a camera with the following characteristics:
Size of Senor least ½ inch
Trigger
Black and White color
8 or 16 bit per pixel
More than one camera in acquisition per controller
These features of the camera led us initially to base the solution on the IEEE1394 bus.
The IEEE1394 allow us to choose between a high numbers of cameras with different characteristics from standard camera but you can find also streak camera.
From the table we see that the maximum distance that can be achieved between the camera and the server and 4.5m this distance is certainly too small for the installation of cameras along the machine. The possible solution is to use a series of hubs but we find some problem the number to reach a camera can be raised eg. for a distance of about 10 m requires a minimum of 3 hubs with standard lengths. Our previous experience in the FLASH machine we understand that can use cables of 10m, even if they are not standard, with no loss of performance. The dimension of SPARC bunkers near 40m this allows usdecided to use maximum 2 10m cables and 1 hub. We have installed more servers in order to minimize the number of hubs.

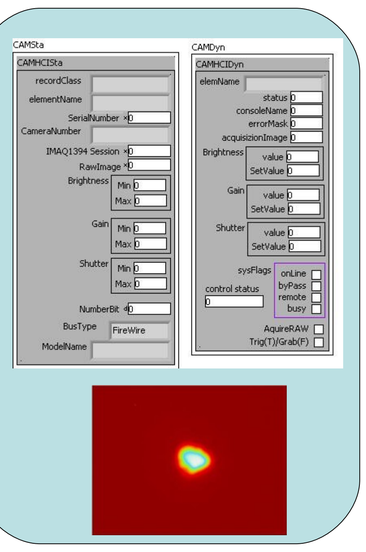
Type	CPU Interface	Speed (MB/s)	Cable length (m)	Connected camera
IEEE1394 a	Standard board	400	4.5	Max 63
Camera link	Frame grabber	700	10	Point to point
GigaVision	Standard board	1000	100	128 +

Front-end

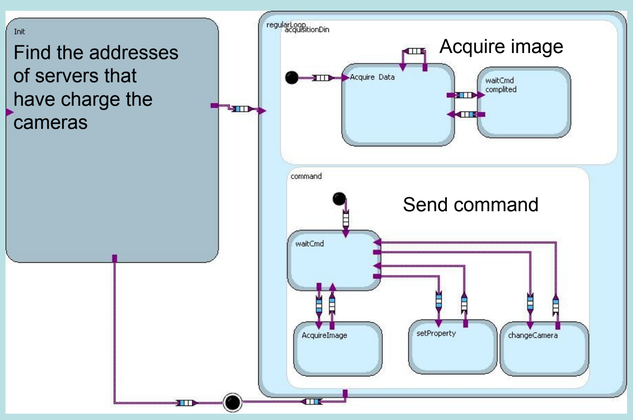
Initializing the program and the cameras. Require, from the database of the control system, information on the cameras that should be under control.
The program acquires serial numbers of cameras linked to computers and its parameter.
Assign the correct reference number of the camera



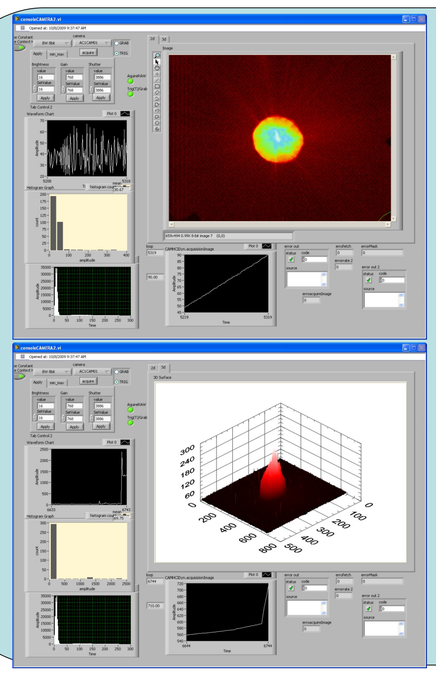
Commands:
•ACQR <camera_name> GRAB/TRIG put the camera in image acquisition with or without trigger.
•CHNG <camera_name> stop acquisition camera
•SETP <camera_name> shut/gain/brigh <value> set the shutter, gain or brightness value

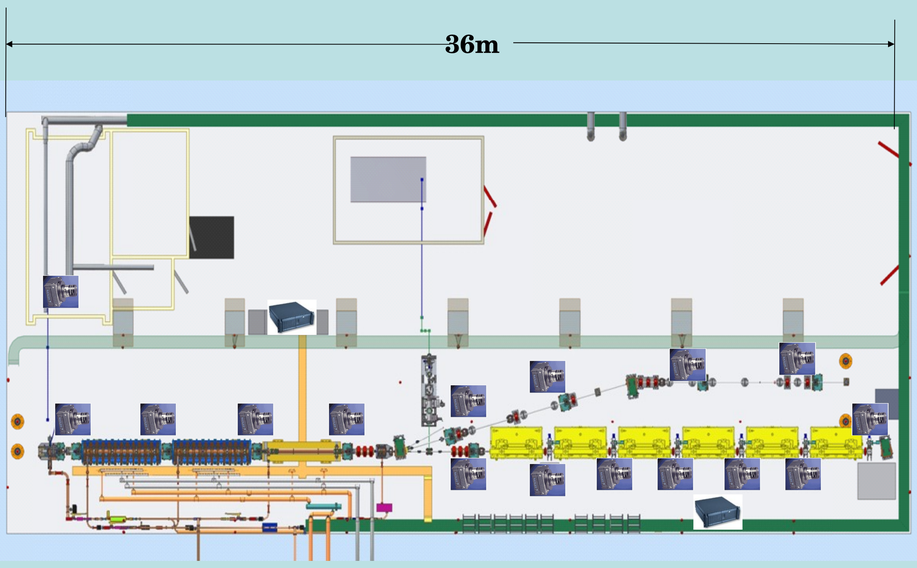


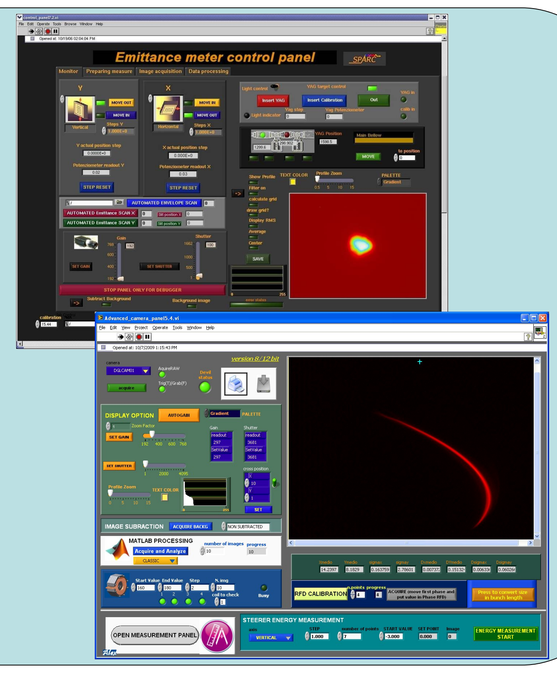
Console



Console windows

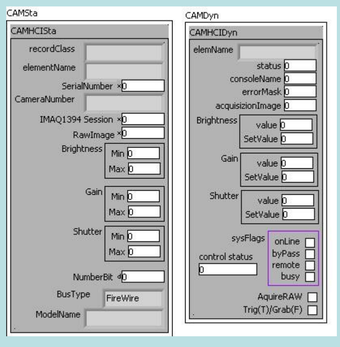






Static Data

•Serial number allows unique identification of the camera
•Camera number is the number of the camera inside the PC.
•Bus type identifies the type of bus for the communication of the camera
•Number bit number of bits per pixel (0=8bit BW, 1=16bit BW and 2=color
•The minimum and maximum value of gain, shutter and brightness values are acquired from the camera.



Dynamic Data

•Acquisition image is increased every acquisitions image
•Read and set value of gain, shutter and brightness
•Camera is in acquisition
•Triggered or free grab the camera must acquire with o without trigger.