Status, Applicability and Perspective of TINE-powered Video System, Release 3.

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Abstract

Experience has shown that imaging software and hardware installations at accelerator facilities needs to be changed, adapted and updated on a semi-permanent basis. On this premise, the component-based core architecture of Video System 3 was founded. In design and implementation, emphasis was, is, and will be put on flexibility, performance, low latency, modularity, interoperability, use of open source, ease of use as well as reuse, good documentation and multi-platform capability. Special effort was spent on shaping the components so that they can easily fit into small-scale but also into area-wide installations.

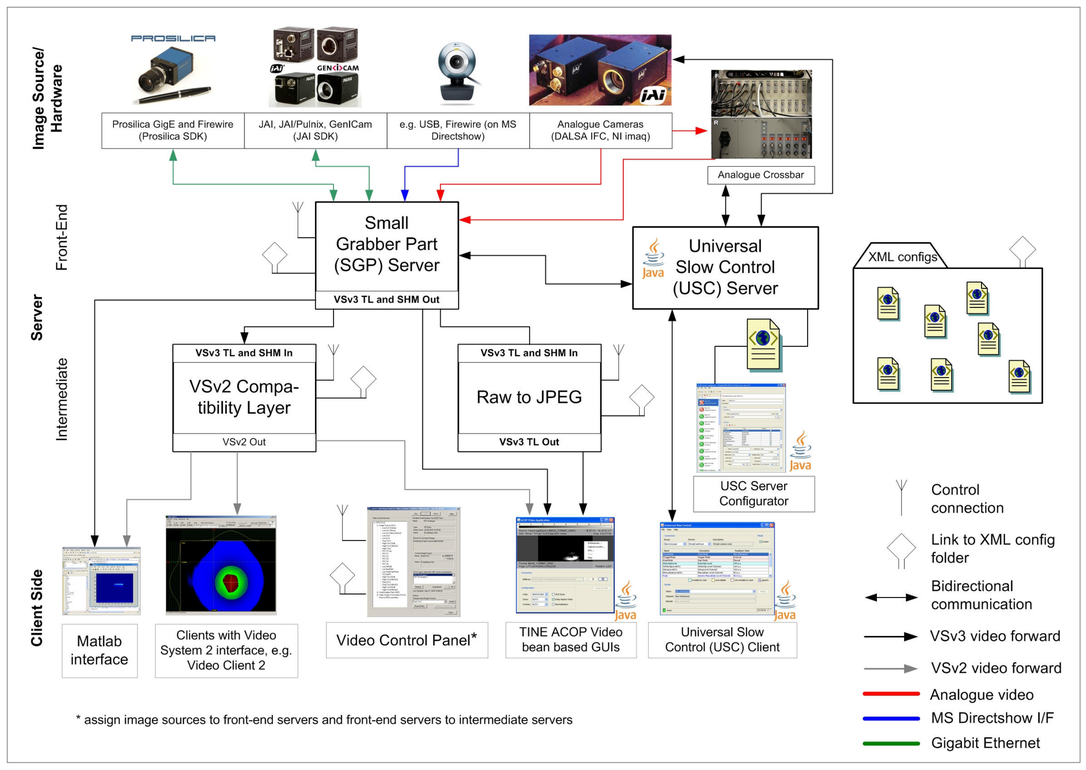
Here, we describe the current status of the redesigned, almost feature-complete Video System, Release 3.
Individual production-level use-cases at Hasylab, PITZ and Petra III diagnostic beamline will be outlined, demonstrating the applicability at real world installations. Finally, the near and far future expectations will be presented.

Last but not least it must be mentioned that although the implementation of Release 3 is integrated into the TINE control system, it is modular enough so that integration into other control systems can be considered.

Key characteristics/ capabilities:

- raw grayscale images up to 16 bits per pixel
- raw colour images (24 bit RGB)
- integrated JPEG compression/decompression (gray and colour)
- production-level interfaces and experience in operation of: Prosilica GigE cameras, analogue cameras, JAI GigE cameras, JAI/Pulnix GigE cameras and equipment possible to attach using MS Directshow interface (Webcams e.g.)
- high-bandwidth possible
- low latency possible (what you steer is what you get)
- 1.4 megapixel transfer, 16 bit gray, at 10 Hz update rate in production-level
- up to 30 frames per second can easily be reached
- Area of Interest (AOI)-only transfer
- shared memory interconnection of server-side components
- multicasting of video images

Collection of Components



Acronyms:

VSv3	Video System 3
VSv2	Video System 2
TINE	Three-fold Integrated Networking Environment
TL	Transport Layer
USC	Universal Slow Control
ACOP	Advanced Component Oriented Programming
I/F	Interface
SHM	Shared Memory

Image sources

- Prosilica **GigE**
- **JAI** and **JAI/Pulnix GigE**
- GEN<i>CAM -compatible cameras
- Devices supported by MS Directshow API
- Analogue cameras via • **Dalsa PCVision card**
  • **National Instruments imaq**

In principle any device with 2d matrix data which is constantly updated can be integrated.

Server-side

- component-based design
- Small Grabber Part (editions using Prosilica SDK, JAI SDK, Directshow API, PCVision API...)
  - image acquisition
  - image preprocessing (orientation change, metadata attachment)
    - control infrastructure
    - functionality to (dis-)connect/switch available image sources
    - output interface
- JPEG compression component Raw2JPEG
- VSv2 Compatibility Layer for legacy VSv2 clients
- Universal slow control (USC) (not only cameras)
- high-bandwidth low-latency video data output
- shared memory-interconnection
- collection of configuration files
  - default settings of cameras, addresses, system layout, restrictions, names, properties

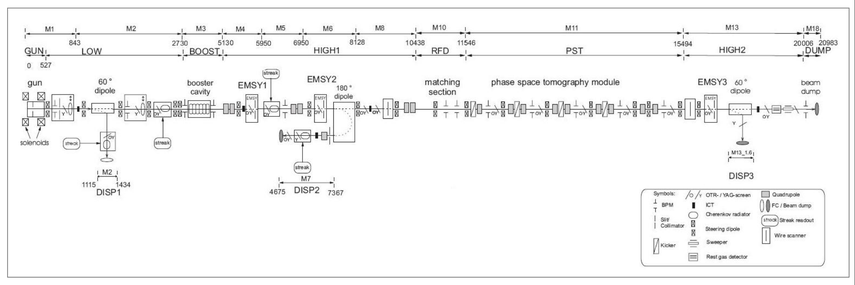
Client-side

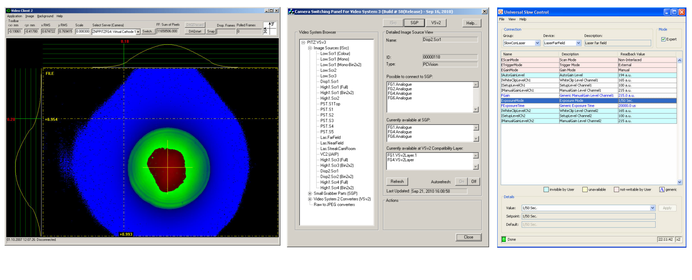
- legacy VSv2 clients (Video Client 2, PITZ measurement programs like EMWiz, MAMA)
- 'building block' component Java TINE ACOP Video bean
  - display and analysis control of server infrastructure
  - assign sources to front-end servers, assign front-end to intermediate servers
- interfaces to third-party client software
- API for users and operators
- Java Universal Slow Control client

Applicability

PITZ

- FEL linear accelerator
- studying and conditioning e-gun and photo injector
- test facility



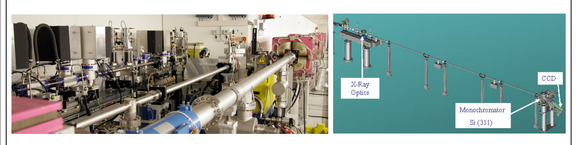


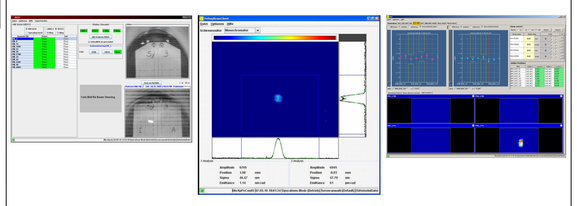
- monitoring and measuring of laser and electron beam
- precise measuring of emittance of electron beam

- about 25 Gigabit Ethernet (Prosilica, JAI/Pulnix) and Analogue Cameras (JAI)
- mixing panel provided to operators in order to route video signals from source to destination
- heterogeneous client side (native clients, Matlab scripts, Java clients), semiautomatic measurement clients
- lossless video, low latency, triggered acquisition

PETRA III

- high brilliance synchrotron light source, controlled by expert operators
- feeds user experiments with high brilliance beam
- user facility





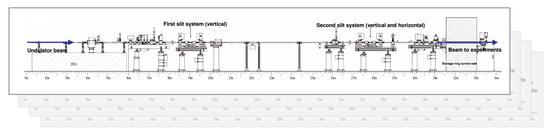
- monitoring, adjustment and optisimation of beam route at beam distribution paths
- monitoring and measuring of synchrotron beam (emittance)

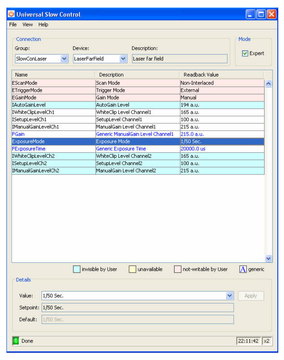
- 2 Prosilica cameras GC1350 at diagnostic beamline
- analogue cameras routed via remotely controllable crossbar for beam monitoring at pre-accelerators and beam path

- custom-built rich Java clients
- use of Java video image analysis*

HASYLAB

- provides infrastructure at PETRA III for user experiments further downstream
- user facility



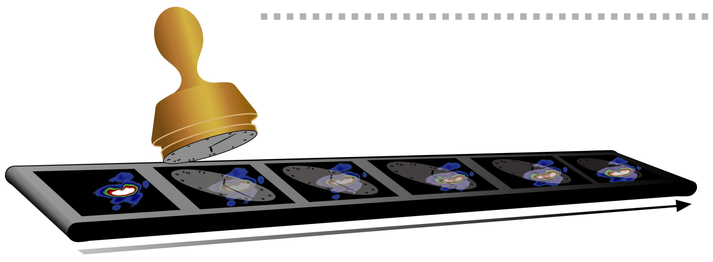


- online undulator beam position monitoring and adjustment between synchrotron and user experiment setup

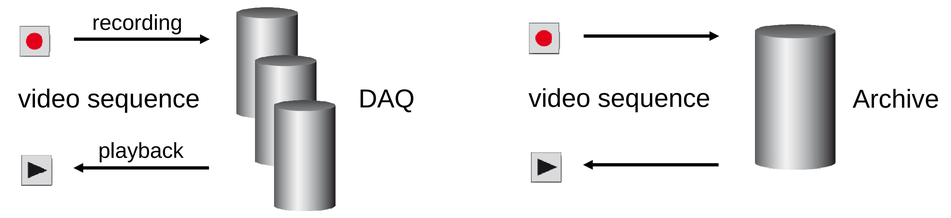
- 45 Gigabit Ethernet cameras of Prosilica type at 14 beamlines
- all video signals are available in parallel at slow update rate
- on client side Java technology is used exclusively

Perspective

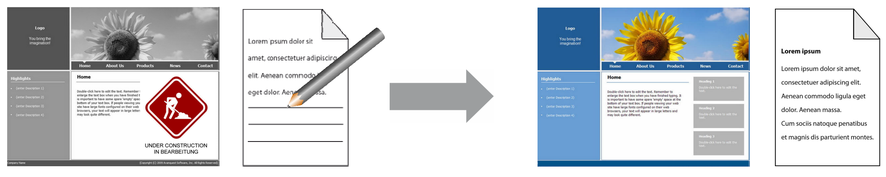
Finish adding of central synchronized timestamp to each subsequent video frame



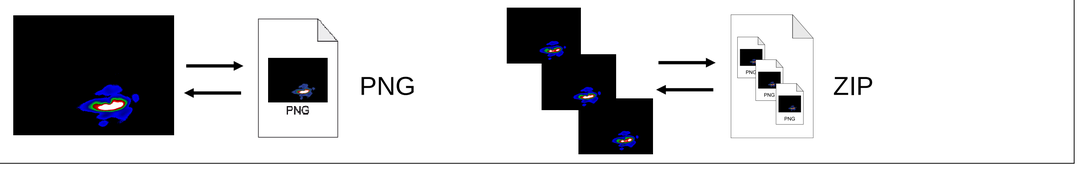
Storing and retrieval of image sequence to DAQ / Archive Server



Update website, enlarge documentation



Finish and release load and save of image datatype to PNG file format implement and release load and save of image sequences to PNG files in ZIP container



* made by Cosylab