Status, Recent Developments and Perspective of AVINE Video System.
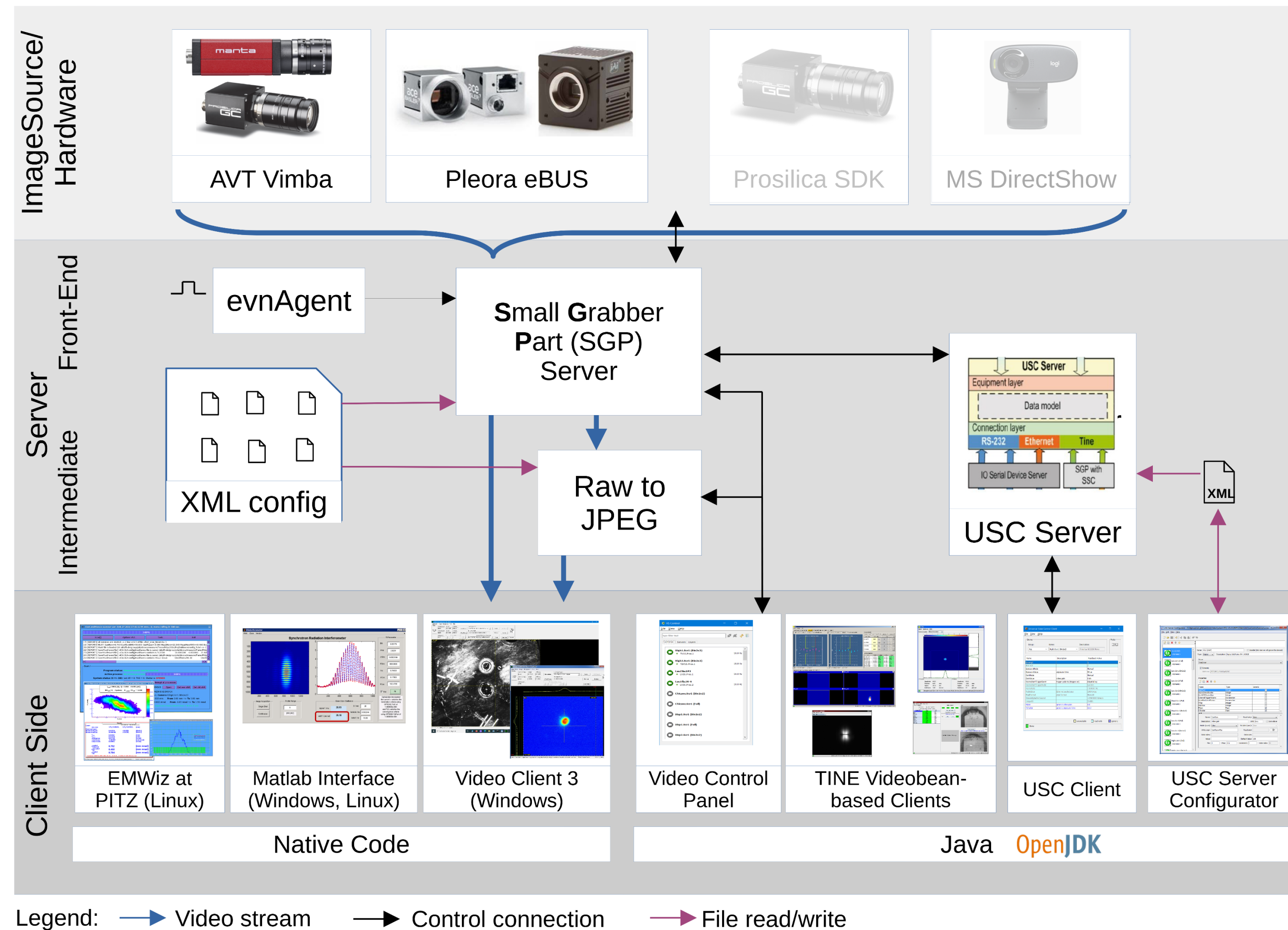
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Abstract

DESY's TINE-powered Video System, originally released in 2002, was last presented in 2011 at ICALEPCS, at this time not yet known under the name Advanced Video and Imaging Network Environment (AVINE). AVINE provides a framework and toolkit for operators, physicists and technicians related to, but not limited to, Ethernet-based imaging at accelerator facilities. Over the past decade, the major emphasis was put on extended support, incorporating user requests, migrating to the latest Windows and Linux operating systems and the latest Java Virtual Machine, all while replacing legacy GigE Vision APIs in order to support past, current and future camera hardware. In this contribution, the current status, layout, recent developments and perspective of AVINE is described. The focus will be on experience migrating to future-oriented (still under vendor support) GigE Vision APIs, the recently upgraded image (sequence) file format, and first experiences on Windows 11.

Collection of Components

Legend: → Video stream → Control connection → File read/write

Recent Developments

API Migration

- Continuing support for already installed GigE Vision/ GenICam legacy (CCD) and modern (CMOS) cameras

JAI SDK

Prosilica PvAPI

File format IMC2

- Image file format with metadata
- Single image or image sequences in one file
- Stores metadata inside file, encoded in human readable ASCII text
- Loss-less compression of image bits (zlib)
- Loading and saving from/to Matlab
- Integrated into Video Client 3
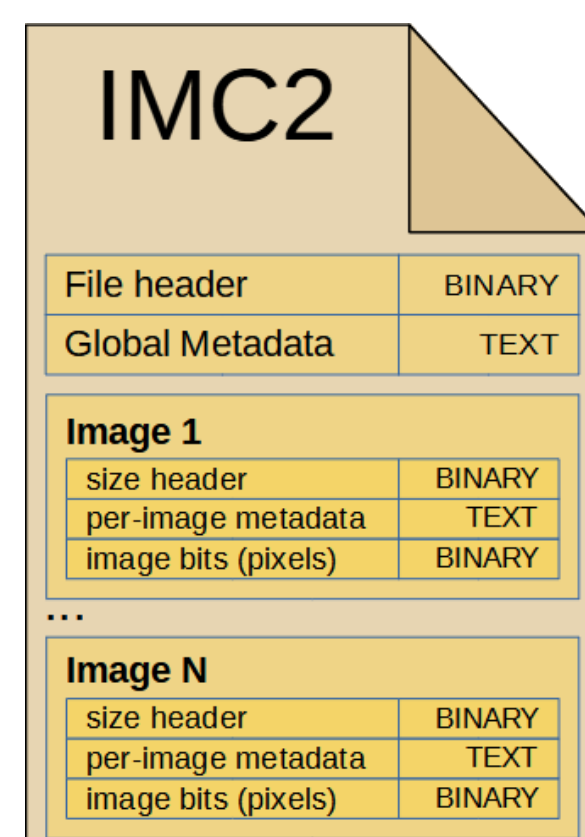

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scale_y_mm/px=0.131100       source_format=GRAY
source_width_px=1360         image_format=GRAY
source_height_px=1024        image_rotation=0.000000
aoi_width_px=-1              scale_x_offset=-1.000000
aoi_height_px=-1             scale_y_offset=-1.000000
x_start_px=0                 camera_port_name=High3.Scr2 (Full)
y_start_px=0                 camera_port_id=184

image_start=image 1 of 20
timestamp_utc=2022-07-07  2:12:51.753025 PM UTC
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GLOBAL_TIMESTAMP
framenumber=5564
eventnumber=1424213860
```

Windows 11

- Components briefly tested and working (no modification needed).
- eBUS v6.1 and Vimba SDK 6.0 (also deprecated PvAPI and JAI SDK v3)
- C++ Video servers SGP and Raw2Jpeg
- OpenJDK 18.0.1.1
- Universal Slow Control Server, Client and Server Configurator
- Video Client 3
- TINE Video bean inside TINE Instant Client
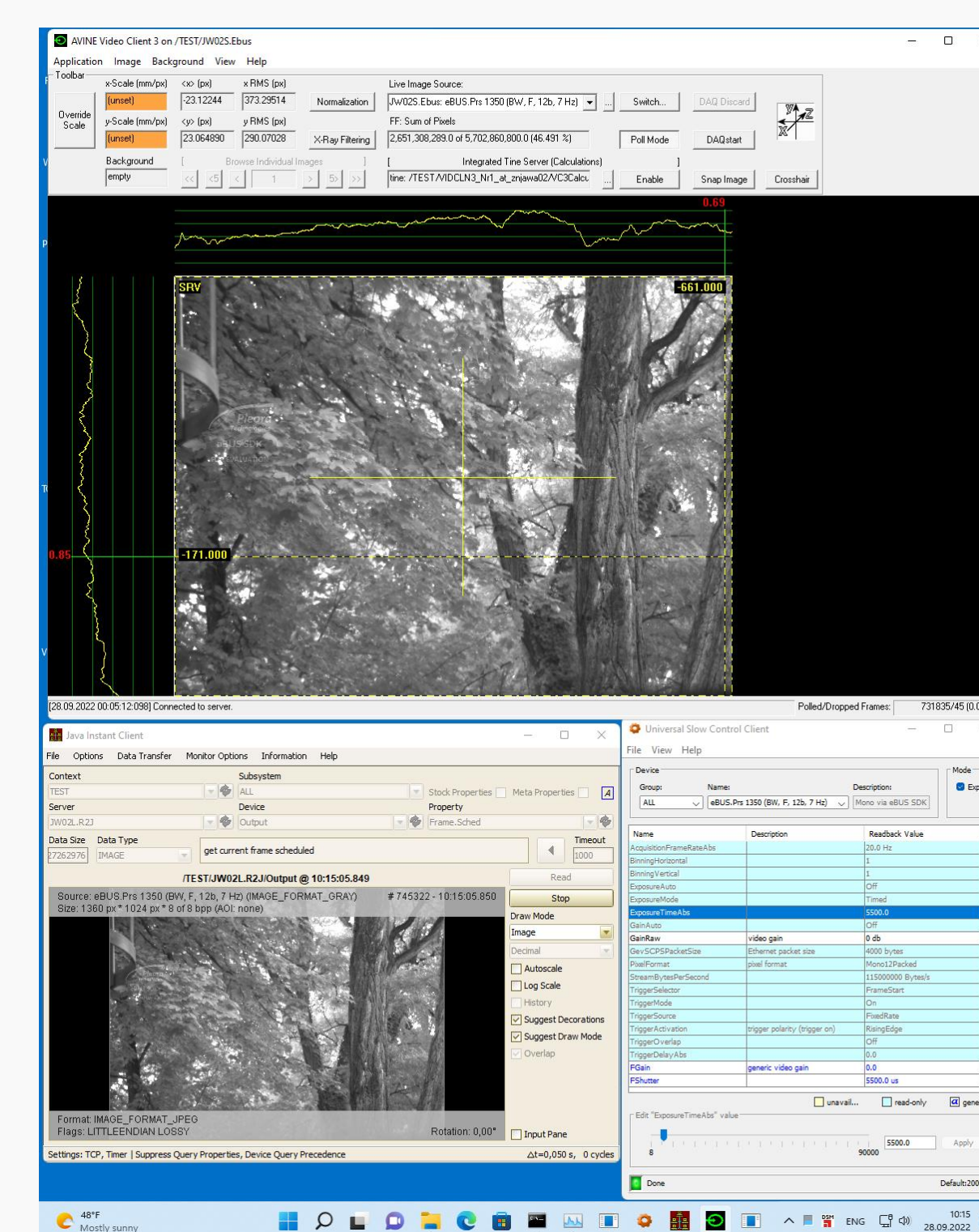
Tests done on 21H2 2022-08 / 2022-09

Selected Use Cases
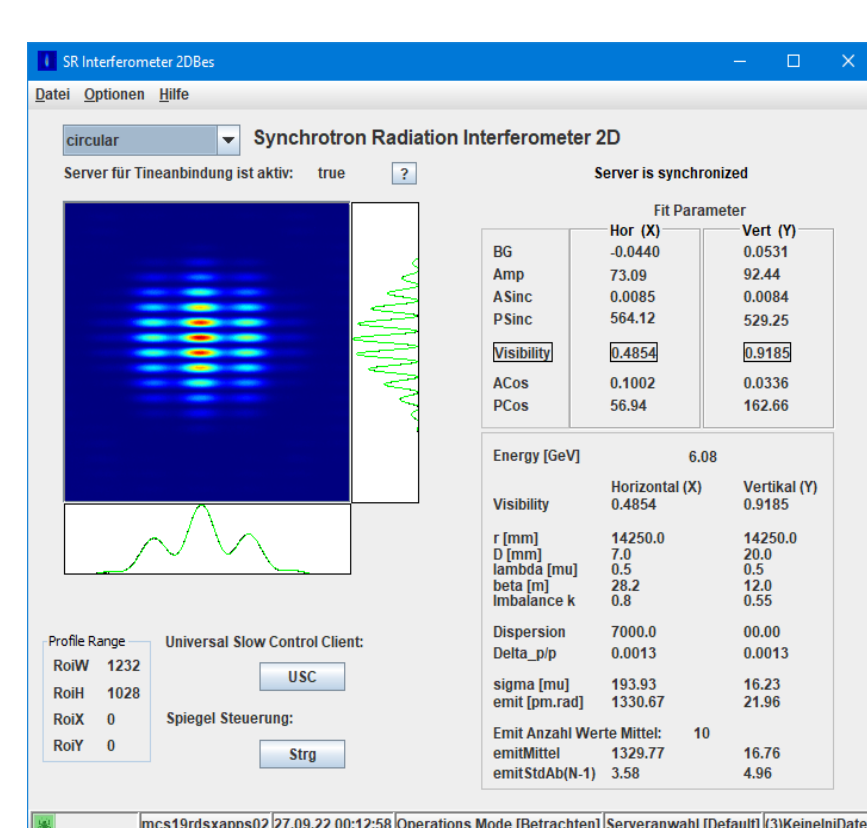
Synchrotron Radiation Interferometer at Petra III
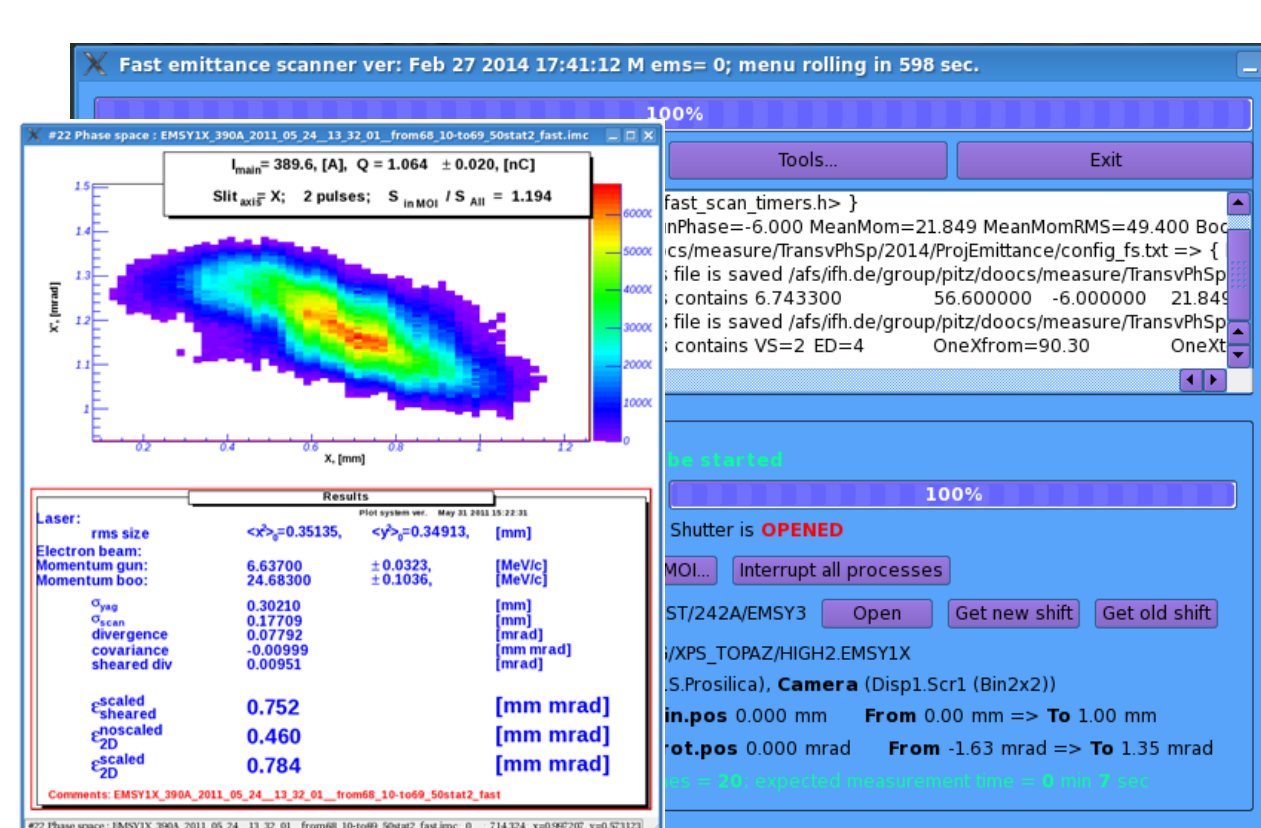
Emittance Measurement Wizard (EMWiz) at PITZ

Observing shape of UV laser beam at PITZ

Monitoring Electron-beam Welding at Mechanics Workshop

Key Facts

- Flexible image source interface, focused to Gigabit Ethernet cameras

- Raw greyscale images of 8 to 16 bits per pixel
- Raw colour images (RGB24)
- Network transport via TINE using TCP
- High bandwidth (tens of megabytes per second)
- Low latency (tens of milliseconds)
- Integrated JPEG transport (colour and grey)
- Loss-less acquisition, transport, analysis and file storage
- Well-defined image type with metadata, integrated into TINE control system
- Interface to Matlab

- Integrated Universal Slow Control solution (a pretty good show on its own)

Image Source

- Any device with 2d matrix data which is updated at regular intervals can be integrated.
- GigE Vision / GenICam compatible cameras, e.g.
  - Allied Vision Prosilica GM/GC
  - Basler acA2440-20gm, 1300-30gm
  - JAI BM141, CM-140, RM1405GE
  - Spiricon Ophir PyroCam III HR (THz)
- Frequency of about 1 to 20 Hz

Server-side

- Runs on Microsoft Windows
- Component-based design
- XML configuration files
- TINE remote control interface, high-bandwidth low-latency video transport
- Image stream acquisition
- Image pre-processing (e.g. orientation adjustment)
- Attach metadata to image (e.g. general event number)

- Slow control (adjust exposure time, gain etc.)

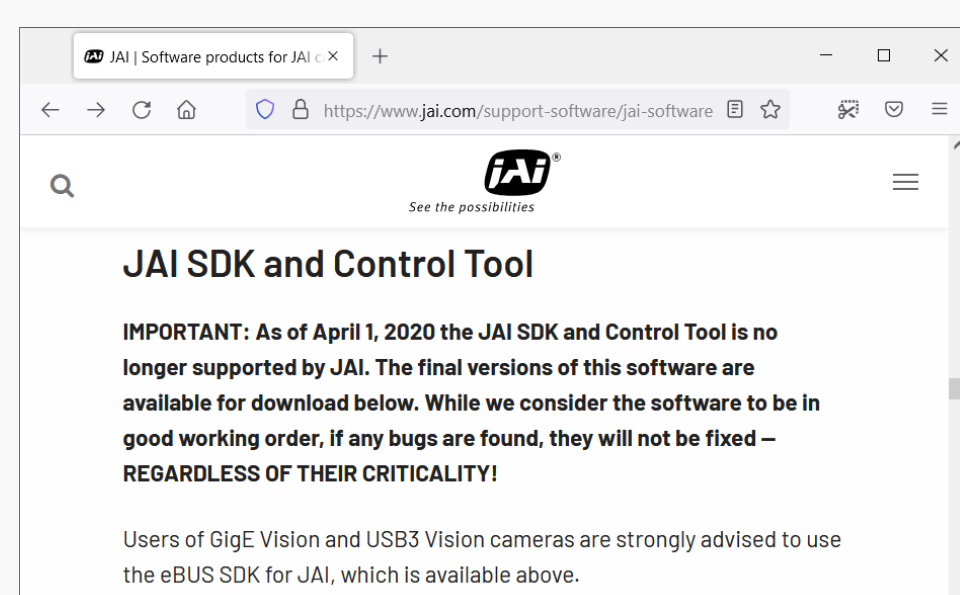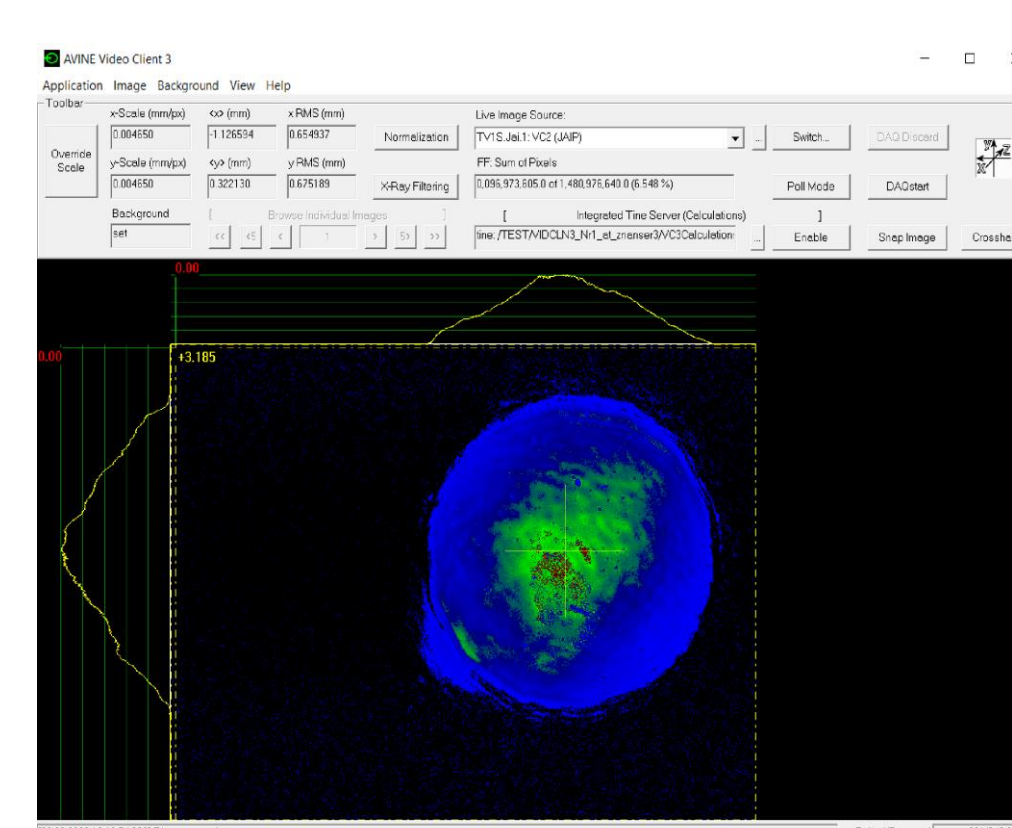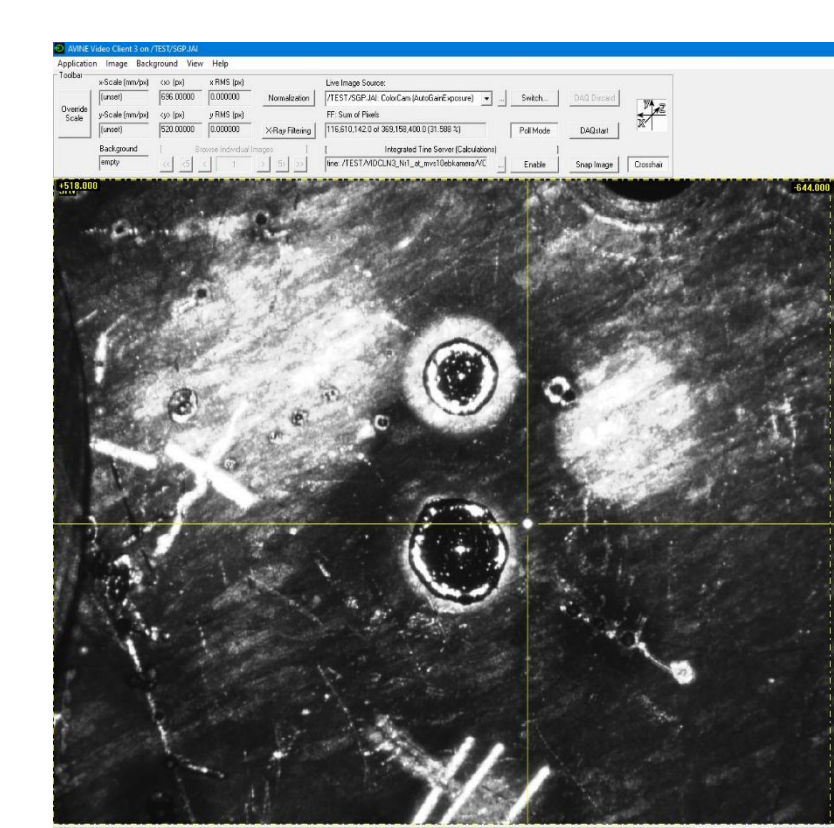- Transcoding raw to JPEG stream

Client-side

- Many Java TINE ACOP Videobean-based GUIs (Java)
- Java Universal Slow Control Client (Java)
- Video Client 3 (Windows)

- Emittance Measurement Wizard (EMWiz) on Linux

- Matlab interface (Windows, Linux)
- 64-bit C-Library (Windows and Linux)

Perspective

- Integrate file format IMC2 into Matlab and Video Client 3
- Implement Vimba-based video server
- Attempt migration from TINE to DOOCS