

Status, Recent Developments and Perspective of AVINE Video System.

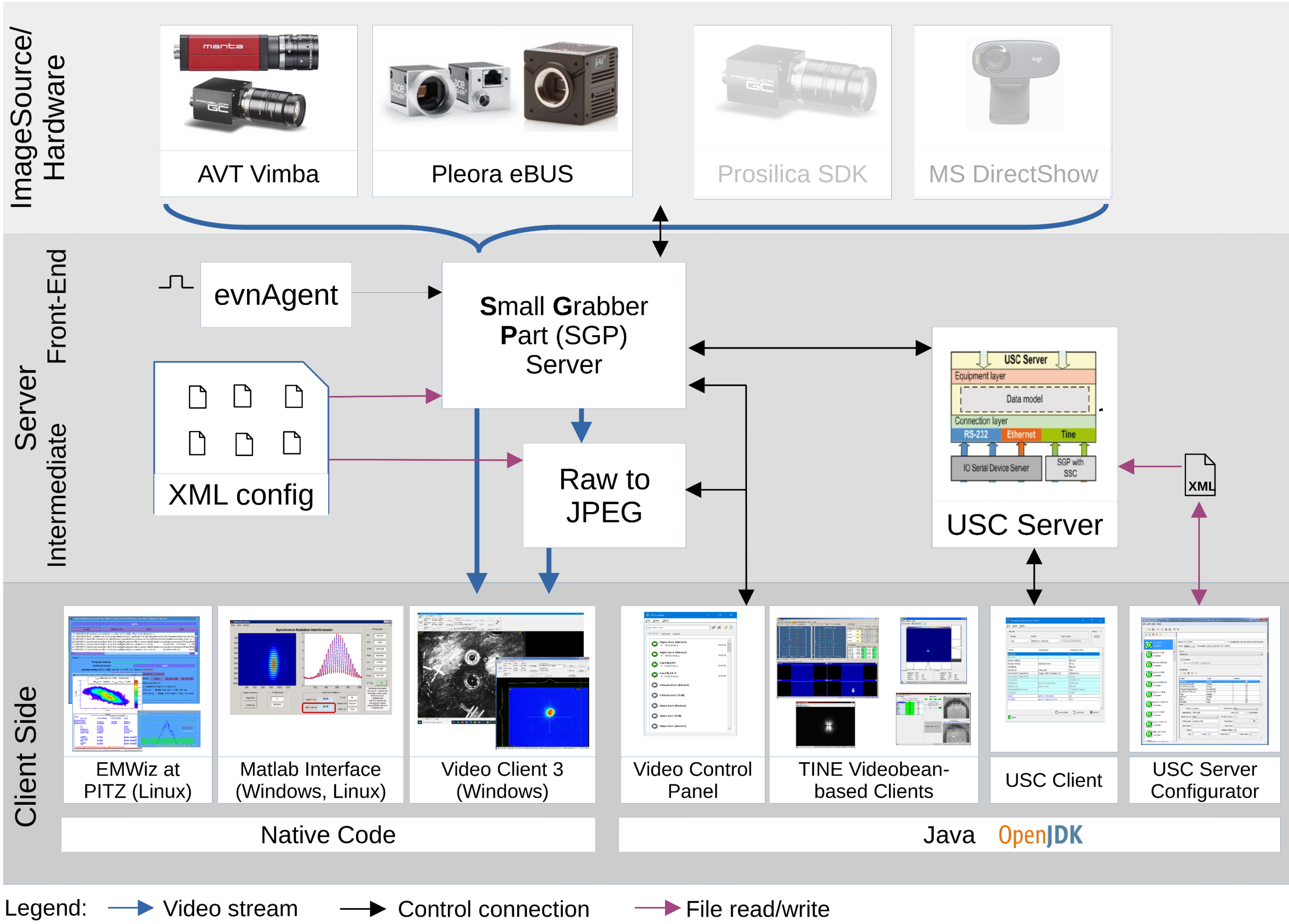


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Abstract

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



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
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- 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)
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- Slow control (adjust exposure time, gain etc.)
 - Transcoding raw to JPEG stream

Client-side

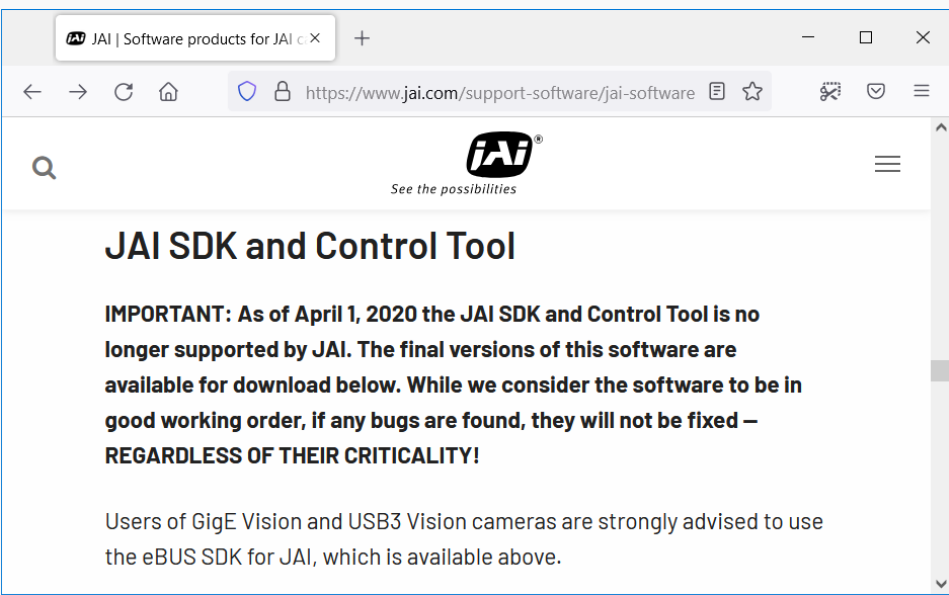
- Many Java TINE ACOP Videobean-based GUIs (Java)
 - Java Universal Slow Control Client (Java)
 - Video Client 3 (Windows)
-
- Emittance Measurement Wizard (EMWiz) on Linux
 - Matlab interface (Windows, Linux)
 - 64-bit C-Library (Windows and Linux)

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

IMC2	
File header	BINARY
Global Metadata	TEXT
Image 1	
size header	BINARY
per image metadata	TEXT
image bits (pixels)	BINARY
...	
Image N	
size header	BINARY
per image metadata	TEXT
image bits (pixels)	BINARY

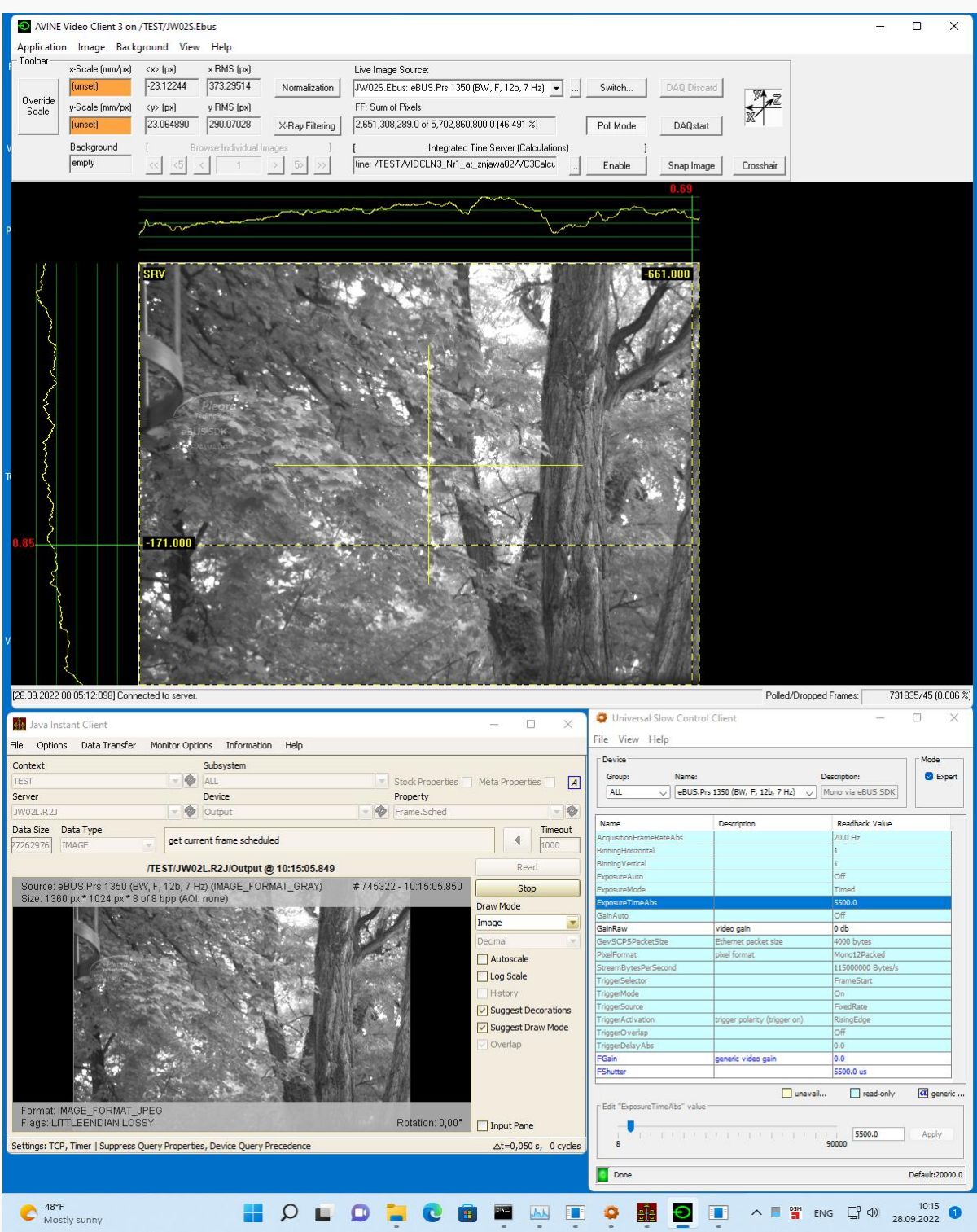
```
number_of_images=20
width_px=1360
height_px=1024
scale_x_mm/px=0.131100
scale_y_mm/px=0.131100
source_width_px=1360
source_height_px=1024
aoi_width_px=-1
aoi_height_px=-1
x_start_px=0
y_start_px=0

image_start=image 1 of 20
timestamp_utc=2022-07-07 12:51.753025 PM UTC
image_flags=LITTLE_ENDIAN LOSSLESS XYSTART_ZERO_BASED
GLOBAL_TIMESTAMP
framenum=5564
eventnumber=1424213860

bytes_per_pixel=2
effective_bits_per_pixel=12
horizontal_binning=0
vertical_binning=0
source_format=GRAY
image_format=GRAY
image_rotation=0.000000
scale_x_offset=-1.000000
scale_y_offset=-1.000000
camera_port_name=High3.Scr2 (Full)
camera_port_id=184
```

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

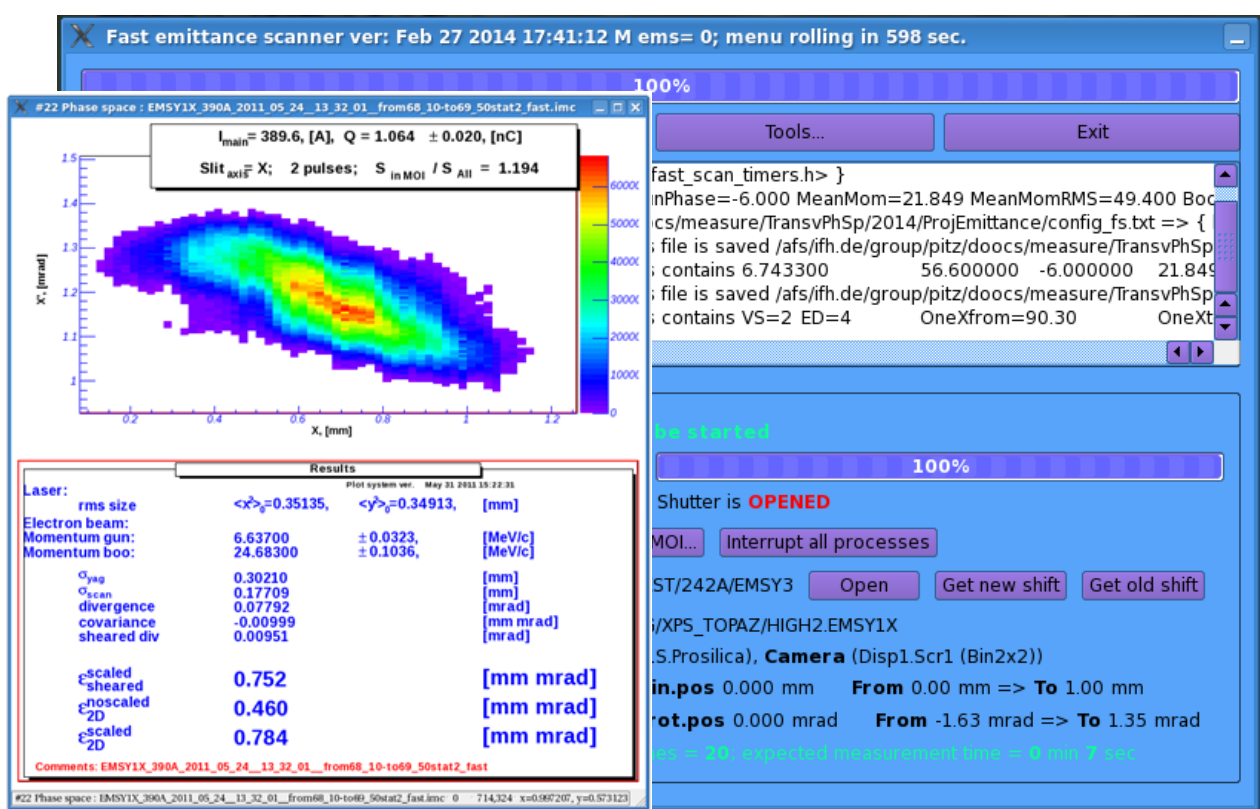


Tests done on 21H2 2022-08 / 2022-09

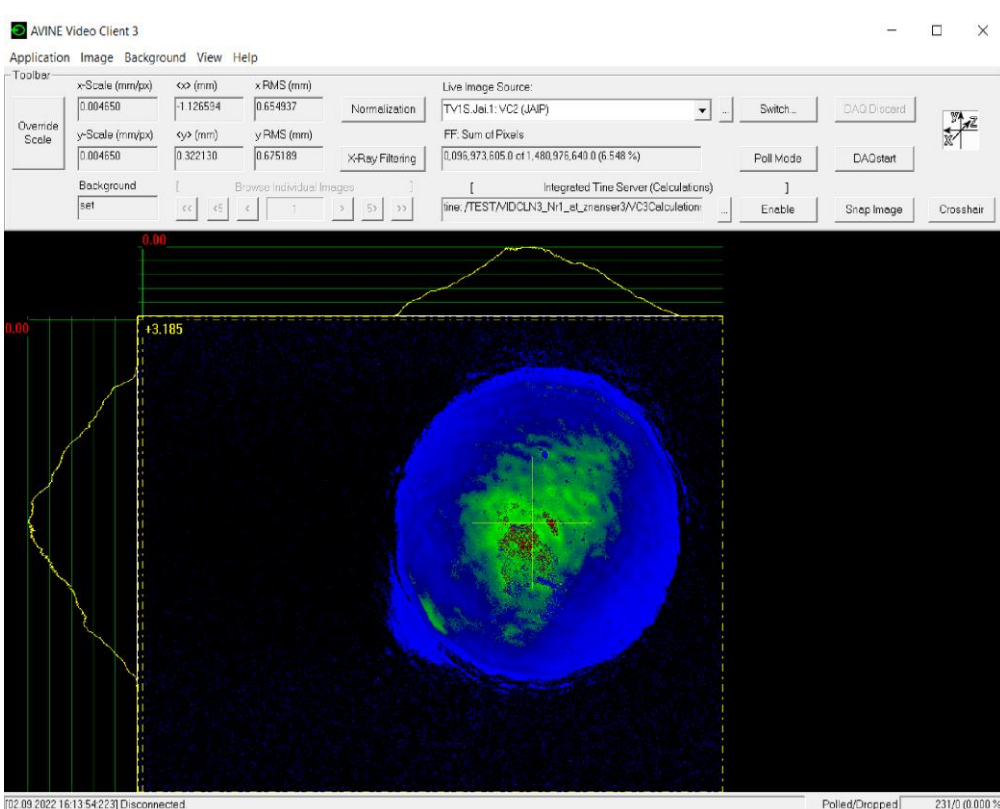
Selected Use Cases



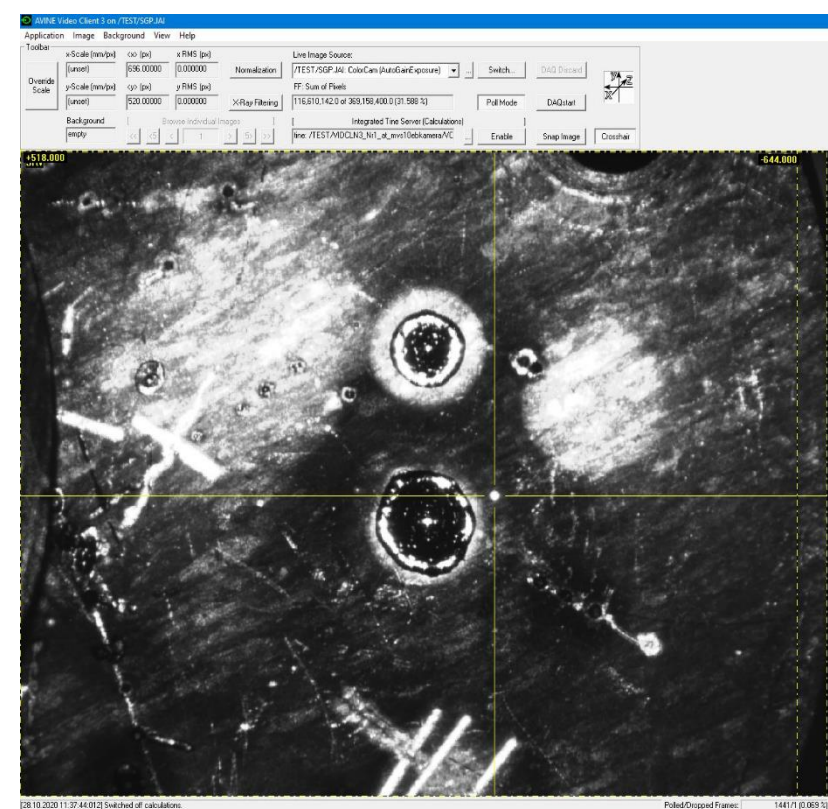
Synchrotron Radiation Interferometer at Petra III



Emittance Measurement Wizard (EMWiz) at PITZ



Observing shape of UV laser beam at PITZ



Monitoring Electron-beam Welding at Mechanics Workshop

Perspective

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