Preliminary Work on a Standard for Controlling Microscopes

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Contents

- Scope of presentation
- Why a standard is desirable
- Is a “simple” standard possible?
- One implementation
- Putting together a system from different vendors based on a standard
- Who and how will benefit from a standard

Automation in Optical Microscopy

Controllable devices:

Stage (rectangular, rotational)

Focus (autofocus)

Objective changer

Condenser

Diaphragms

Light sources

Transmission filters

Excitation filters

Emission filters

Reflection turret (filter cubes)

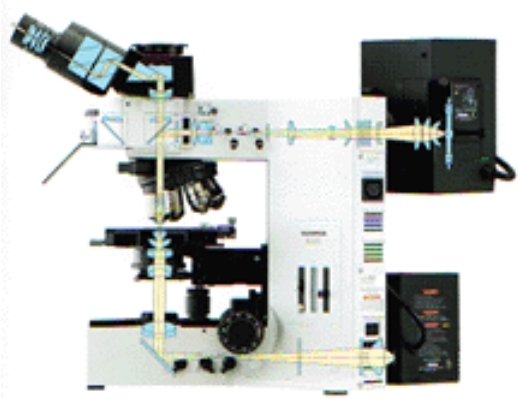
Shutters

Light path control

Environment

Micromanipulator

Microtome



Parts of the Solution

Solving a user's problem in automated microscopy involves several hardware and software components, which usually come from different vendors:

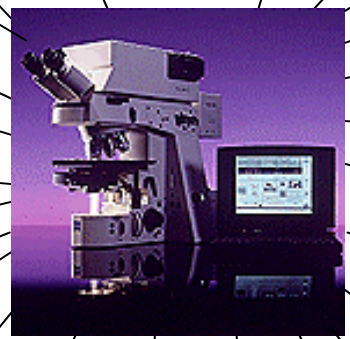
- Microscopes
- Motorized components and motor controllers
- Cameras
- Image digitizers
- Computers and standard peripherals
- Image processing and analysis
- Image printing
- Statistical data processing
- Other "standard" desktop applications

Imaging Packages and Microscope Automation

Supports two or more automation platforms,

one,

none.



QWin (LEICA)

WIT Logical Vision

ImagePro (Media Cybernetics)

IPLab (Scanalytics)

HLImage (Western Vision)

Bioquant (R&M Biometrics)

Photoshop (Adobe)

IDL (Research Systems)

Imaging plugins for Photoshop (J.Russ)

MatLab (MathWorks)

Global Lab (Data Translation)

SigmaScan Pro (SPSS)

V++ (Digital Optics)

Scion Image (Scion)

HazeBuster (VayTek)

Vision-XXL (Impulse Imaging)

LUCIA (Laboratory Imaging)

Aphelion (AAI)

Visilog (Noesis)

MetaMorph (Universal Imaging)

Imaging VIs (National Instruments)

analySIS (Soft Imaging)

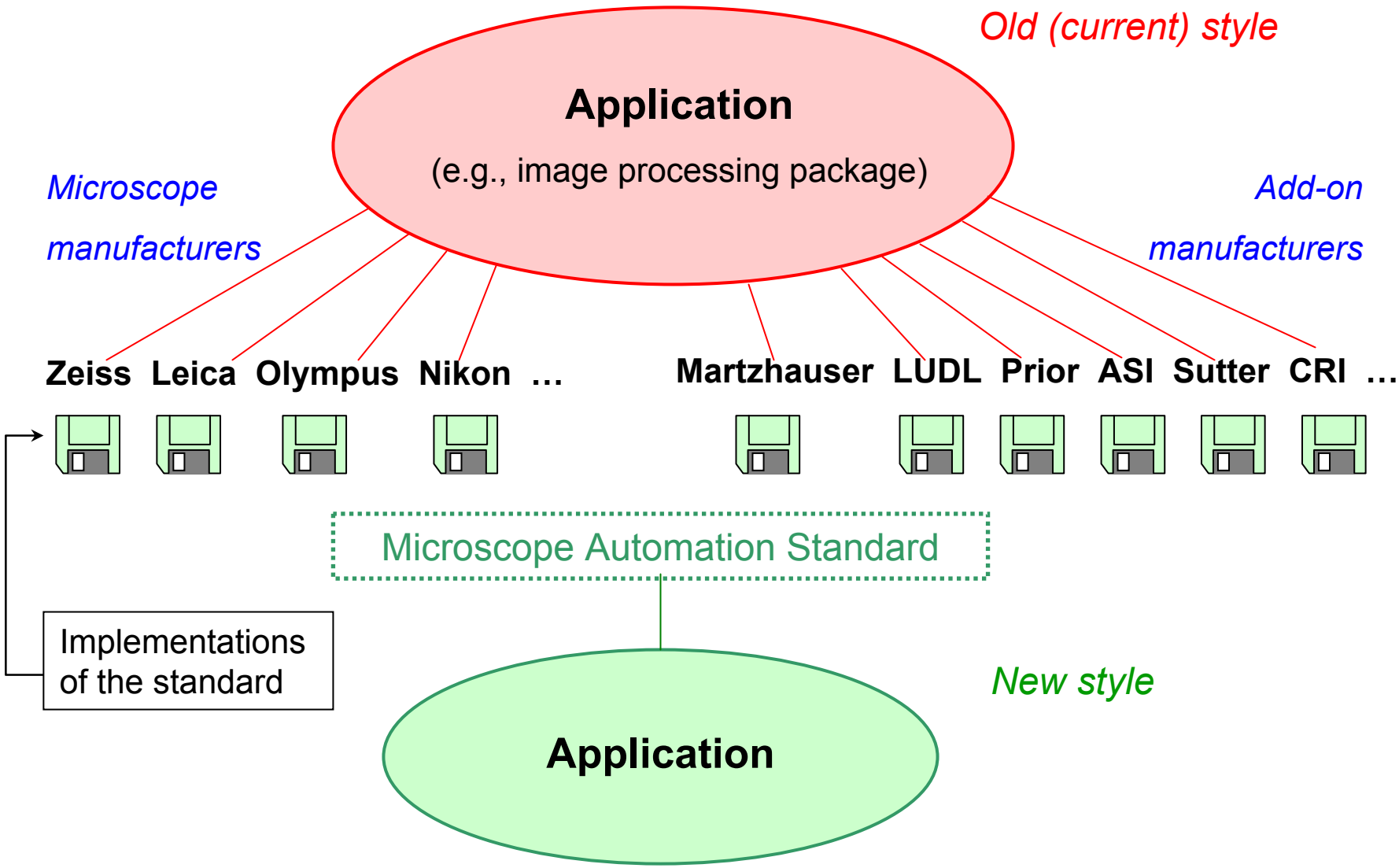
Clemex Vision (Clemex)

Matrox Imaging Library (Matrox)

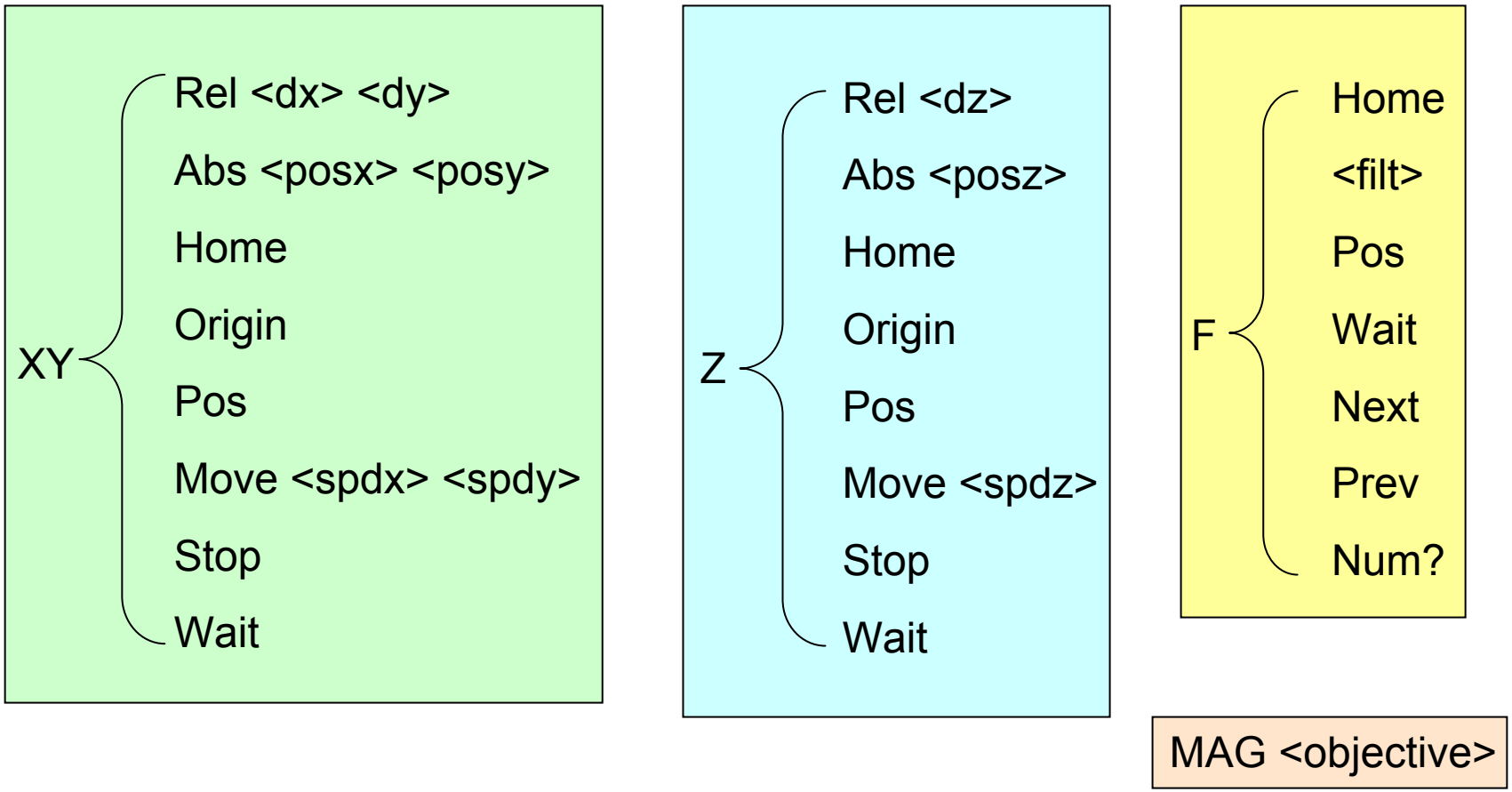
Complexity of Microscope Control

Manufacturer	*Supported devices*	*Number of commands*	*Manual*	*Program organization*
Leica DMRXA	Stage, focus, lamp, objective changer, reflector turret, light path, diaphragms, DIC turret	228	117 pages	DLLs, ActiveX
Zeiss AxioPlan	Focus, lamp, objective changer, reflector turret, light path, diaphragms, shutters, condenser, optovar zoom, filter turrets	87	90 pages	ASCII strings
Nikon Eclipse E1000	Focus, lamp, objective changer, reflector cassette, light path, diaphragms, shutters, condenser	60	25 pages	ASCII strings
Olympus AX	Focus, lamp, objective changer, reflector turret, light path, diaphragms, shutters, ND/color filters	23	56 pages	ASCII strings
LUDL MAC 2000	Stage, focus, filter wheels, shutters,	1 cmd for FW and shutters, 16 cmds per linear axis	60 pages	ASCII strings

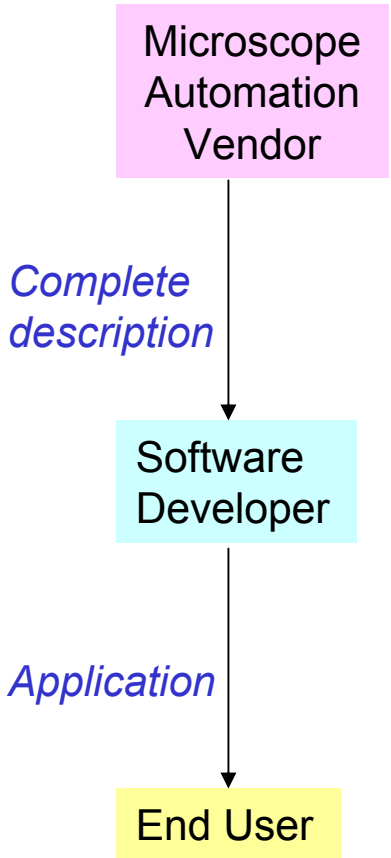
Interfaces


Old (current) style
Application
(e.g., image processing package)
Microscope manufacturers
Add-on manufacturers
Zeiss Leica Olympus Nikon …
Martzhauser LUDL Prior ASI Sutter CRI …
Microscope Automation Standard
Implementations of the standard
New style
Application

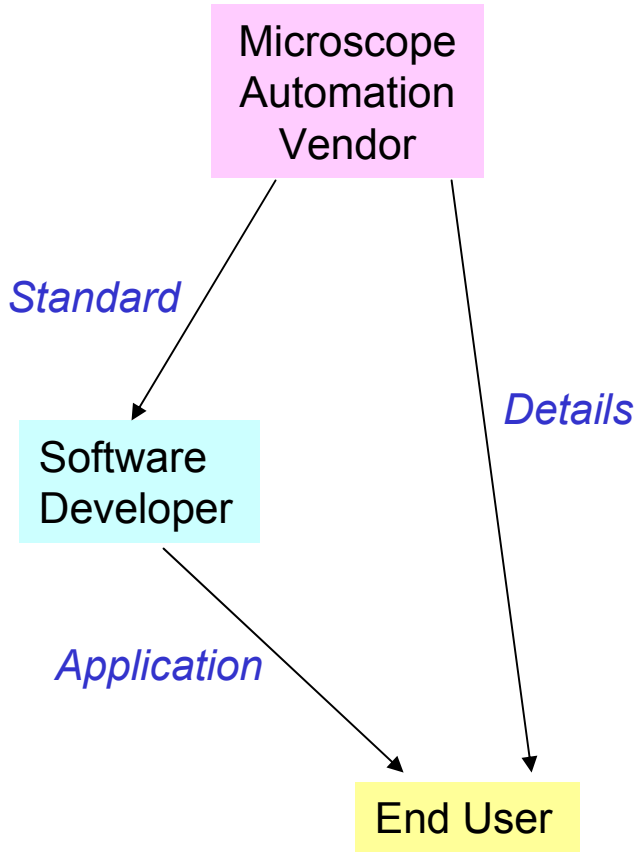
Commands for Device Control



Distribution of complexity



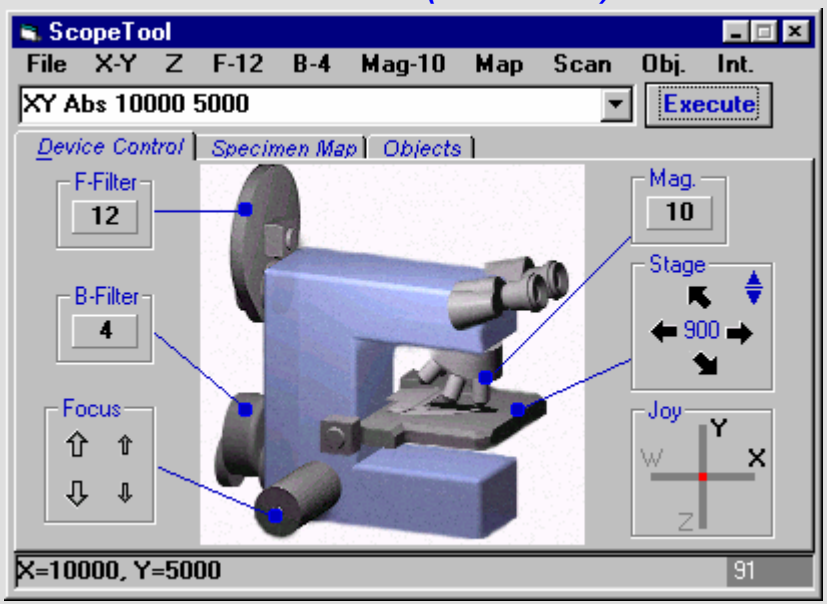
Traditional approach



Suggested approach

One Implementation

ScopeTool™ - microscope automation server (ActiveX)



Standard

Details

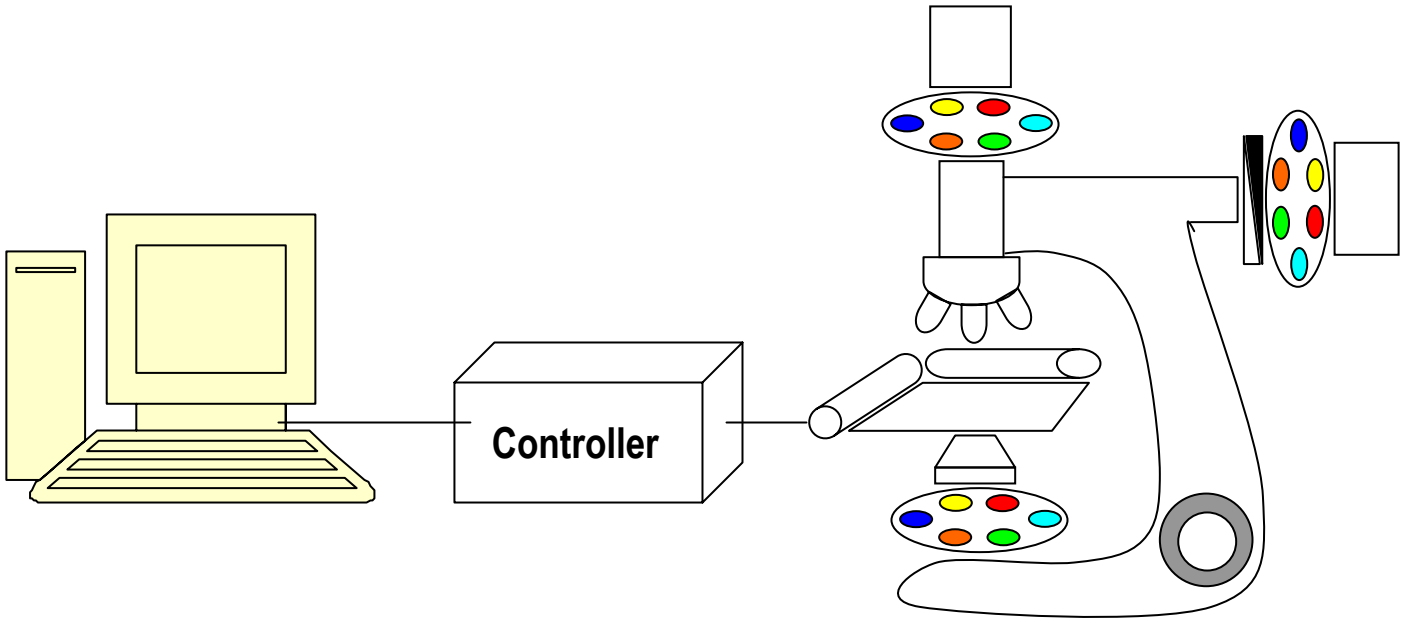
"XYCONTRX",X	"XYCONTRY",U
"XYSCREWLEAD",1.0	"XYMOTORSTEPS",200
"XYSTEPDIVIDE",4	"XYHOLDCURRENT",1
"XYRUNCURRENT",15	"XYSLEWVELOCITY",15000
"XYINITVELOCITY",400	"XYACCELERATION",10
"XYDECELERATION",10	"XYJOGSPEEDLOW",20
"XYJOGSPEEDHIGH",200	"XYBACKLASHX",2
"XYBACKLASHY",4	"XYHOMESPEED",-10000
"XYMOVEOUT",6000	"XYJUMPSIZE",10

res_string = ScopeToolCmd("XY Abs 10000 5000")

Application

User

Desired Configuration



Controlled devices

XY Stage

Focus

Condenser

Objective changer

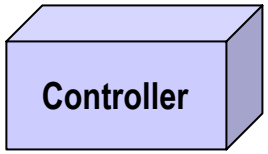
Excitation filter wheel

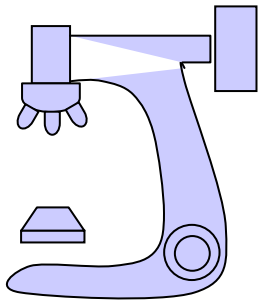
Transmission filter wheel

Emission filter wheel

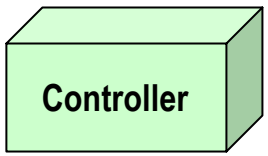
Shutter

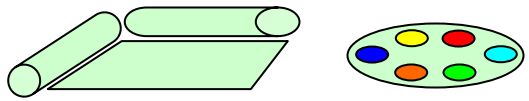
Availability



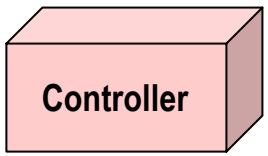


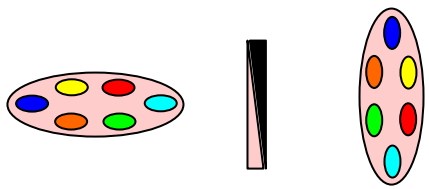
Microscope, Focus, Condenser, Objective changer





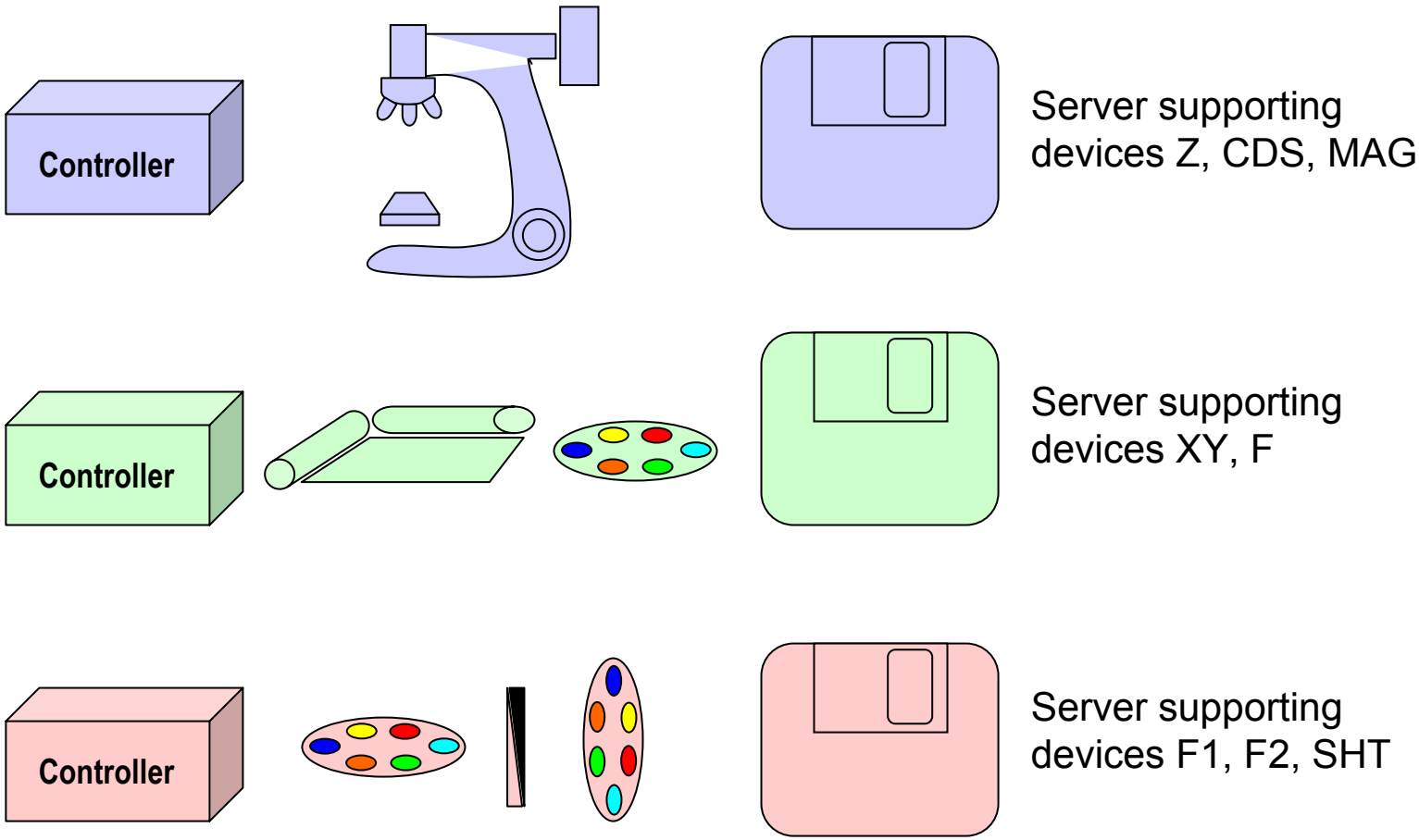
XY Stage, Transmission filter wheel



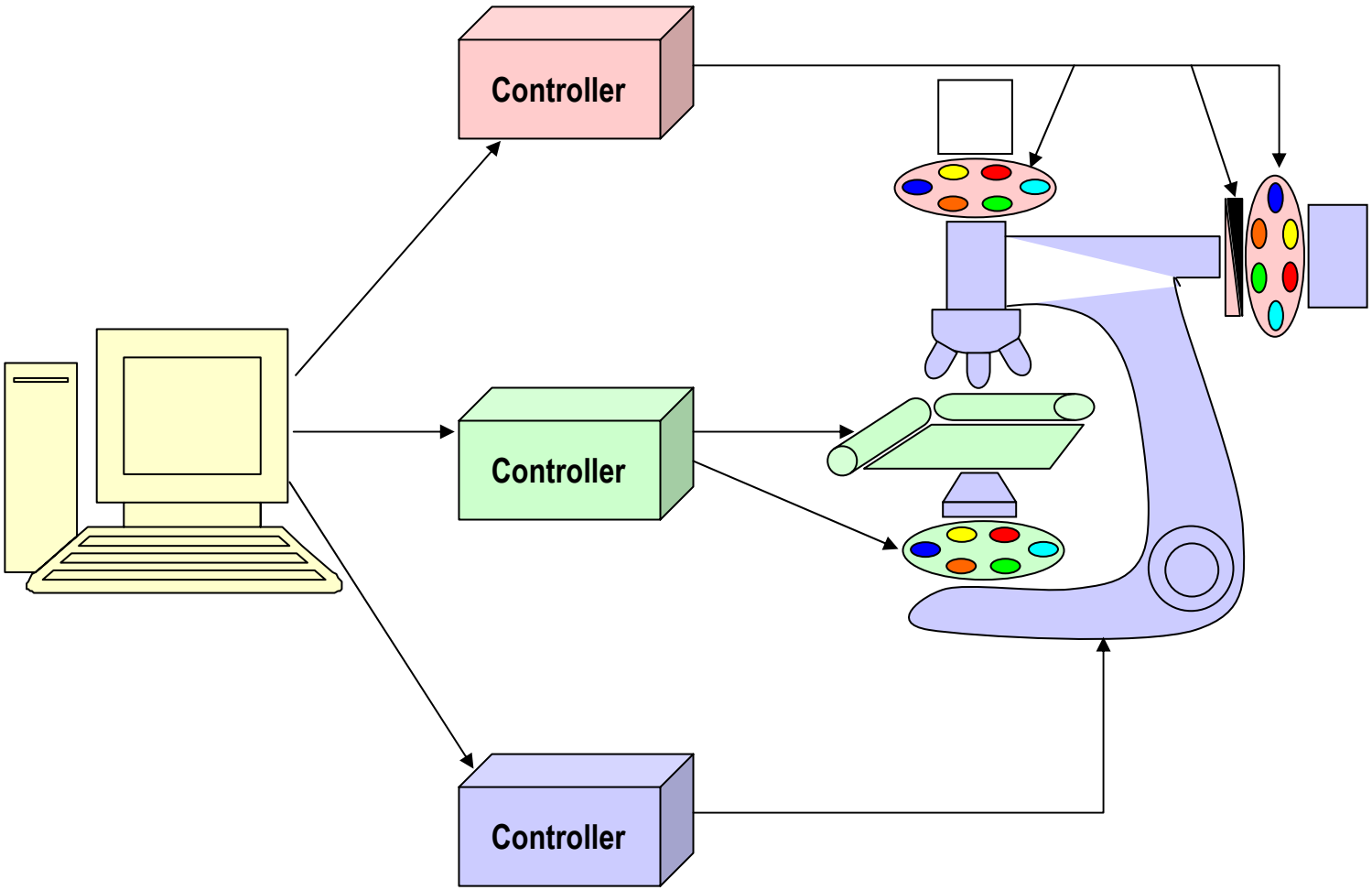


Emission filter wheel, Shutter, Excitation filter wheel

Delivery


Controller
Server supporting devices Z, CDS, MAG
Controller
Server supporting devices XY, F
Controller
Server supporting devices F1, F2, SHT

Setup - Hardware



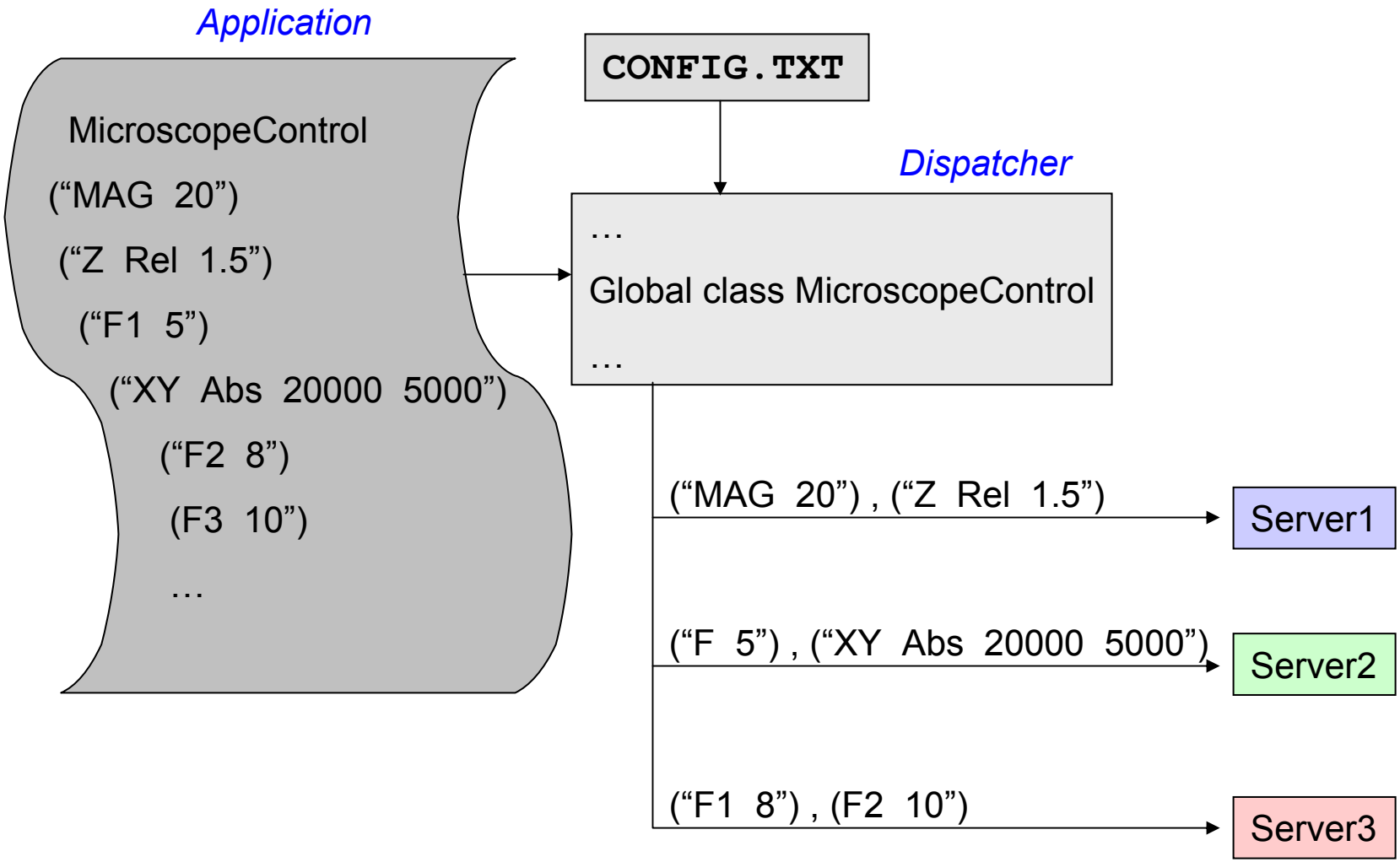
Setup - Software

CONFIG.TXT

Logical device name	*Executable name*	*Class name*	*Physical device name*
Z	Server1	Class1	Z
CDS	Server1	Class1	CDS
MAG	Server1	Class1	MAG
XY	Server2	Class2	XY
F1	Server2	Class2	F
F2	Server3	Class3	F1
F3	Server3	Class3	F2
SHT	Server3	Class3	SHT

Customer creates the table according to purchased configuration

Execution



Logical device names are translated into physical device names, and commands are sent to appropriate servers

Benefits - 1

to the end user

- Get the best solution, not a solution that for historical reasons can work together.
- Get the best price - standards allow competition in components, not systems.
- Get a solution that is not locked into a manufacturer, but can grow in time.
- Procedures and results can be reproduced by a larger audience of peers.
- Easier to commercialize developed procedures and applications.

to the dealer / distributor

- Can provide added value to the customer because the components are Windows standard and are fully and easily programmable.
- Can mix and match different equipment to provide the most appropriate solution because all components are software compatible.
- Not locked into representing particular vendors. Their added value can be transferred to other vendors.

Benefits - 2

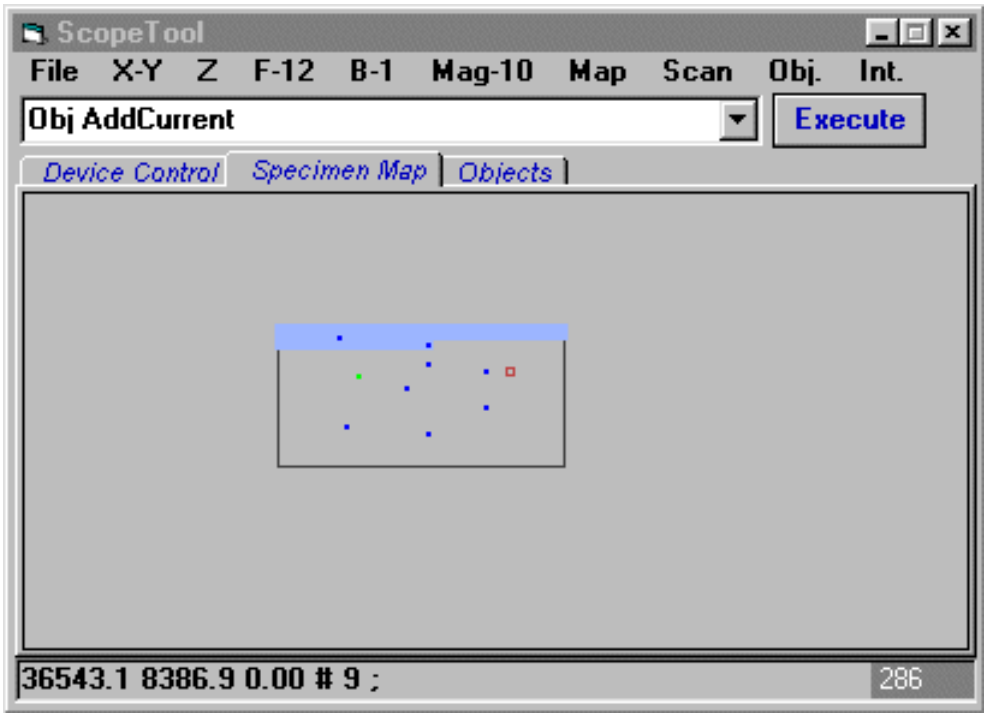
To the application developer

• Do not have to support all automation means, just one standard.

to the vendor of microscope automation equipment

• By providing the microscope automation server their equipment becomes compatible with all applications (e.g., image processing packages) that need to control it.

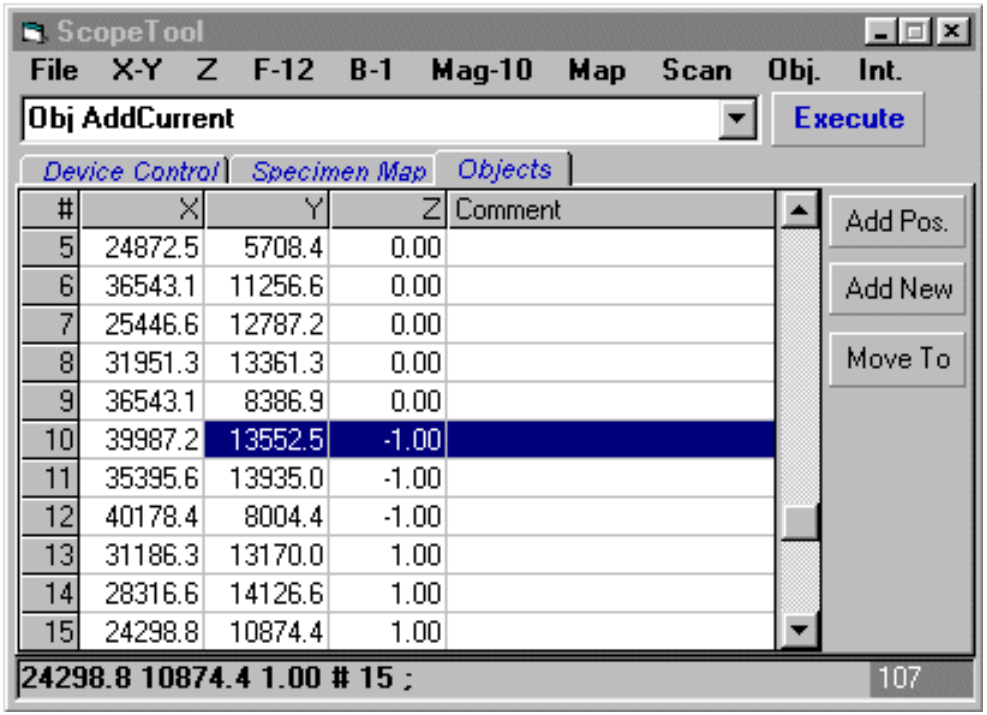
Additional capabilities - 1



Scan
- FirstField
- LastField
- NextField
- PreviousField
- GetNumFields
- GetCurrentField

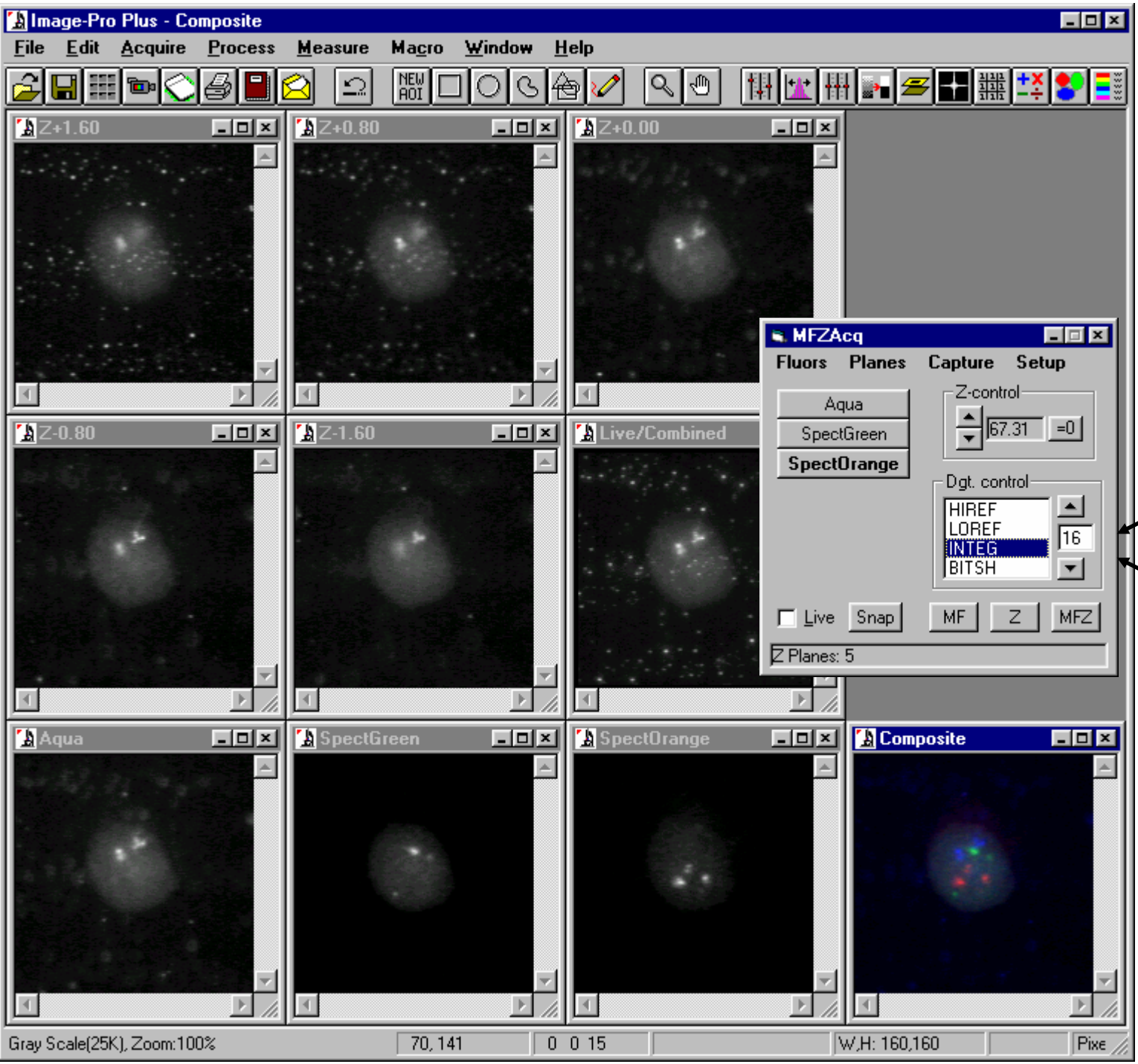
Area Set / Area Move
- TopLeft
- BotRight
- Top
- Bot
- Left
- Right

Additional capabilities - 2



Obj

- AddCurrent {?<comment>}
- Add <x> <y> <z> {?<comment>}
- {GetNum | ListClear | ListDraw }
- {ListRead | ListWrite} <filename>
- {GoTo | Draw } <objnum>



Multifilter multiplane image acquisition into ImagePro

Microscope automation server (Runs invisible in this session).

Image acquisition server (Runs invisible in this session).