MICROSCOPE Specifications

Instrument
ID
Name
AnnotationRef

MicroscopeBody
Manufacturer
Model
SerialNumber
LotNumber
SpecsFile
___
ID
Name
Type
EyepieceFieldNumber
AnnotationRef

MicroscopeTable
Manufacturer
Model
SerialNumber
LotNumber
SpecsFile
___
ID
Name
Type
TableWidth
TableDepth

IntensityCalibrationTool
Manufacturer
Model
SerialNumber
LotNumber
SpecsFile
___
ID
Name
Type
Description
AnnotationRef

SampleHolder
Manufacturer
Model
SerialNumber
LotNumber
SpecsFile
___
ID
Name
Type
MovementAxes
XTravelRange
YTravelRange
ZTravelRange
MaxVelocity
RotationAngle
AnnotationRef

Children Entities (choose one)
- ObjectiveTurret
- MechanicalStage
- PiezoElectricStage
- PiezoElectricObjective

Focusing-APE (IS-A)
Manufacturer
Model
SerialNumber
LotNumber
SpecsFile
___
ID
Name
MovementAxes
XTravelRange
YTravelRange
ZTravelRange
MaxVelocity
Resolution
PositionLinearityError
SettlingTime
Repetability
AnnotationRef

AutoFocus
Manufacturer
Model
SerialNumber
LotNumber
SpecsFile
___
ID
Name
Type
Description
AnnotationRef

LightSource-APE (IS-A)
Manufacturer
Model
SerialNumber
LotNumber
SpecsFile
___
ID
Name
Power
AnnotationRef

Children Entities (choose one)
- **Laser**: Type, LaserMedium, Wavelength, FrequencyMultiplication, Tuneable, Pulse, PockelCell, RepetitionRate
- **Filament**: Type
- **Arc**: Type
- **LightEmittingDiode**: Type, PeakWavelenght, LumenPower, WavelengthRange, ProjectionAngle
- **GenericExcitationSource**: (The GenericExcitationSource element is used to represent a source as a collection of key/value pairs, stored in a Map. The other lightsource objects should always be used in preference to this if possible)

Pump
ID (LightSourceID)

LightSource WavelengthRange
WavelengthCutIn
WavelengthCutOut
WavelenghtProfile

LightSourceCoupling-APE (IS-A)
Manufacturer
Model
SerialNumber
LotNumber
SpecsFile
___
ID
Name
CouplingLensRef
Transmittance
AnnotationRef

Children Entities (choose one)
- **LightGuide**: Type, Geometry, MaterialName, PeakWavelength, WavelengthRange, SingleMode, WaveguideMode, RefractiveIndex, NumericalAperture, AcceptanceAngle, Diameter, FerruleMaterial
- **Direct**: Mount, Type

LightGuide WavelengthRange
WavelengthCutIn
WavelengthCutOut
WavelenghtProfile

Optovar
Manufacturer
Model
SerialNumber
LotNumber
SpecsFile
___
ID
Name
LensType

Objective
Manufacturer
Model
SerialNumber
LotNumber
SpecsFile
___
ID
Name
Correction
NominalImmersionMedium
LensNA
LensRefractiveIndex
NominalMagnification
CalibratedMagnification
WorkingDistance
Iris
AnnotationRef

FilterSet
Manufacturer
Model
SerialNumber
LotNumber
SpecsFile
___
ID
Name
AnnotationRef

- **ExcitationFilterRef**: ID (FilterID)
- **DichroicRef**: ID (MirrorID)
- **EmissionFilterRef**: ID (FilterID)

Filter
Manufacturer
Model
SerialNumber
LotNumber
SpecsFile
___
ID
Name
Type
FilterWheel
ReflectionCoating
AnnotationRef

TransmissionRange
TransmittanceCutIn
TransmittanceCutOut
TransmittanceProfile
___
Transmittance

Lens
Manufacturer
Model
SerialNumber
LotNumber
SpecsFile
___
ID
Name
Type
Geometry
Construction
Magnification
AttenuationCoefficient
RadiusOfCurvature
FocalDistanceToObject
FocalDistanceToImage
FocalLenght
MaterialName
GlassCode
RefractiveIndex
AbbeNumber
Density
Diameter
AnnotationRef

Prism
Manufacturer
Model
SerialNumber
LotNumber
SpecsFile
___
ID
Name
Type
Geometry
WavelengthRange
Reflectance
PrismAngle
IncidenceAngle
DeviationAngle
MaterialName
GlassCode
RefractiveIndex
AbbeNumber
Density
AnnotationRef

Prism WavelengthRange
WavelengthCutIn
WavelengthCutOut
WavelenghtProfileFile

PolarizationOptics
Manufacturer
Model
SerialNumber
LotNumber
SpecsFile
___
ID
Name
Function
Construction
Fabrication
WavelengthRange
Retardation
MaterialName
GlassCode
AnnotationRef

Polarizer WavelengthRange
WavelengthCutIn
WavelengthCutOut
WavelenghtProfile

Mirror-APE (IS-A)
Manufacturer
Model
SerialNumber
LotNumber
SpecsFile
___
ID
Name
Type
Geometry
Reflectance
ReflectionAngle
RadiusOfCurvature
MaterialName
GlassCode
AnnotationRef

Detector-APE (IS-A)
Manufacturer
Model
SerialNumber
LotNumber
SpecsFile
___
ID
Name
Mount
RelayLensRef
ReadNoise
NoiseModel
DarkCurrentRate
PeakWavelength
QuantumEfficiencyatPeakWavelength
WavelengthRange
AmbientOperatingTemperature
AbientOperatingHumidity
AnnotationRef

Detector WavelengthRange
WavelengthCutIn
WavelengthCutOut
WavelenghtProfile

Children Entities (choose one)
- **Reflector**
- **Beamsplitter**: Transmittance, TranmissionAngle
- **Dichroic**: Type, FilterWheel, TransmittanceRange, ReflectanceRange, Polarization

TransmittanceRange
TransmittanceCutIn
TransmittanceCutOut
TransmittanceProfile
___
Transmittance

ReflectanceRange
ReflectanceCutIn
ReflectanceCutOut
ReflectanceProfile
___

Children Entities (choose one)
- **PhotoMultiplier**: Type (PMT, Photodiode, APD), RadiantSensitivity
- **Camera-APE** (IS-A): Illumination, ArrayWidth, ArrayHeight, PixelWidth, PixelHeight, ImageWidth, ImageHeight, PixelWellCapacity, RegisterWellCapacity, VerticalClockSpeed, MaximumFrameRate, MaximumReadoutRate
- **GenericDetector**: (The GenericDetector element is used to represent a source as a collection of key/value pairs, stored in a Map. The other lightsource objects should always be used in preference to this if possible.)

Children Entities (choose one)
- **CCD**: Type (Conventional, EMCCD, Interline)
- **IntensifiedCCD**: Type (Conventional, EBCCD)
- **AnalogVideo**
- **CMOS**: Type (Conventional, Scientific), ReadOutMode

Notes	Legend
Units are omitted for simplicity sake. APE, Abstract Parent Entity AnnotationRef: This element always refers to a Comment/ Annotation element as described for Channel. However for simplicity sake most Comment/Annotation elements have been omitted and the AnnotationRef has been inserted in the referring element as an attribute. For questions or comments please contact: caterina.strambio@umassmed.edu	This is a graphical representation of a possible extension of the OME data model developed by members of the Imaging Working Group of the 4D Nucleome consortium. The graph utilizes the Entity-Relationship formalism. In this formalism information about a real world situation/thing (in our case a Microscope and an image acquired using that instrument) are represented by three types of model elements: 1) Entities = Boxes; 2) Relationships = lines connecting boxes; 3) Attributes = fields within boxes When describing a real life situation/thing: 1)ENTITIES corresponds to NOUNS = the things we want to collect information about. 2) RELATIONSHIPS corresponds to VERBS = actions/state/occurrence that connect Entities with each other 3) ATTRIBUTES corresponds to ADJECTIVES = the actual information about each Entity we want to collect In order to read the schema please start from INSTRUMENT and from and IMAGE for the Specifications and Settings section respectively. Then follow the lines to the connected boxes and think something like: 1) An Instrument has a Microscope_Body, might rest on a Microscope_Table, and has a Light_Source etc.; 2) An Image was produced as part of a specific Experiment, was collected in a specific Imaging_Environment, was collected using specific Microscope_Settings etc.

IMAGE ACQUISITION Settings

ImagingEnvironment
Temperature
AirPressure
Humidity
CO2Percent

MicroscopeSettings
ID (MicroscopeID)
FieldOfView
OptovarMagnification
TotalEffectiveMagnification

TIRFSettings
ID
ThroughLens
Angle
Geometry
AnnotationRef

Description
A description for the TIRFsettings [plain-text multi-line string]

ObjectiveSettings
ID (ObjectiveID
CorrectionCollar
ImmersiumMedium
ImmersionRefractiveIndex
MeasuredRefractiveIndex
Temperature

Image Data
TiffData
IFD
FirstZ
FirstT
FirstC
PlaneCount
UUID

Description
A description for the Microbeam Manipulation [plain-text multi-line string]

LightSourceSettings
ID (LightSourceID)
Attenuation
Wavelenght
WavelengthUnit
OutputPower
PowerAtSample

MicrobeamManipulation
ID
Type
ExperimenterRef
ROIRef

Description
A description for the experiment [plain-text multi-line string]

Experiment
ID
Name
Type
LabellingMethod
ExperimenterRef

Sample
ID
Name
MountingMedium
MountingMediumRefractiveIndex
AnnotationRef

Image
Name
AcquisitionDate
ExperimenterRef
ExperimentGroupRef
ExperimentRef
InstrumentRef
ROIRef
MicroBeamManipulationRef
SizeX
SizeY
SizeZ
SizeC
SizeT
PhysicalSizeX
PhysicalSizeY
PhysicalSizeZ
TimeIncrement
DimensionOrder
ChannelOrder
PixelType
SignificantBit
Interleaved
BigEndian
Image/Description
AnnotationRef

Planes
Plane
TheZ
TheT
TheC
Timestamp
ExposureTime
HashSHA1
AnnotationRef

Channels
Channel
ID
Name
SamplesPerPixel
IlluminationType
PinholeSize
AcquistionMode
ContrastMethod
ExcitationWavelenght
EmissionWavelength
Fluorophore
NDFilter
PockelCellSetting
Color

SamplePosition
ID
Name
SamplePositionX
SamplePositionY
SamplePositionZ
SampleHolderRef

StageFocalPosition
ID
Name
StagePositionZ
FocusingRef
AutoFocusRef

LightSourceSettings
ID (LightSourceID)
Attenuation
Wavelenght
WavelengthUnit
OutputPower
PowerAtSample

LightPath
ID
Name
AnnotationRef

DetectorSettings-APE (IS-A)
ID (DetectorID)
EffectiveOffset
Integration
CameraFieldOfView

AnnotationRef
ID (AnnotationID)

FlatFieldImageRef
ID (ImageID)

LightSourceCouplingRef
ID (CouplingID)

FilterSetRef
ID (FilterSetID)

ExcitationFilterRef
ID (FilterID)

DichroicRef
ID (MirrorID)

EmissionFilterRef
ID (FilterID)

AdditionalOptics
ID
Name
AnnotationRef

AdditionalLensRef
ID (LensID)

PrismRef
ID (PrismID)

PolarizationOpticsRef
ID (PolarizationOpticsID)

AdditionalFilterRef
ID (FilterID)

AdditionalMirrorRef
ID (MirrorID)
ActualMountedAngle

Children Entities (choose one)
- **CameraSettings**: Binning, AnalogToDigitalConverter, EMCain, ReadoutRate, FrameRate, OperatingTemperature
- **PhotoMultiplierSettings**: PMTGain, PMTVoltage, EffectiveZoom

CommentAnnotation
ID
Namespace
Annotator (ExperimenterID)

Description
A description for the annotation. [plain-text multi-line string]

AnnotationRef
ID (AnnotationID)

Value
[string]

ColoredBeads
Manufacturer
Model
SerialNumber
LotNumber
SpecsFile
___
ID
Name
BeadSize
BeadsConcentration
BeadColor (array?)
Type

3DColoredBeads ImageRef
ID (ImageID)

Optical(or PSF) CalibrationReport
ID (FileURI)

ImagingStandard
Manufacturer
Model
SerialNumber
LotNumber
SpecsFile
___
ID
Name
Type

Optical(PSF)Calibration
ID
Date
OpticalCalibrationSoftware
FWHMmedianBeadSize
FWHMmedianTheoretical
FWHMminBeadSize
FWHMminTheoretical
FWHMmaxBeadSize
FWHMmaxTheoretical
FWHMzBeadSize
FWHMzTheoretical
Planarity
Asymmetry
AsymmetryWeightedTheta
LateralChromaticShift
AxialChromaticShift
Description
AnnotationRef

IntensityCalibration-APE (IS-A)
ID
Date
Description
AnnotationRef

IntensityCalibrationTool Settings
ID (CalibrationToolID)
Settings_1
Settings_2
Settings_3
AnnotationRef

FieldCalibration
ID
Date
Description
AnnotationRef

Children Entities (choose one)
- **ExcitationCalibration**: ObservedExcitationWavelength, ObservedExcitationPower
- **DetectorCalibration**

DetectorReadMap
ID (FileURI)

DetectorConversionMap
ID (FileURI)

Deprecated_Calibration + NOTES
Orphan Attributes
DarkValue
PhotometricConversion
ReadNoise
ImagingStandard

_____
Additional Notes
Generalize ImagingStandard and have Beads as one child

Software used to interface with CalibrationTool?
OpticalCalibrationSoftware ??

Use MIAPTE model to describe the software tool (which can also be used for Acquisition Software