MCCL/MCPP Source, Tissue and Detector parameters (updated 220207)

Table 1: MCCL source specifications identified by their name and options. The columns refer to the independent variables provided by these sources in terms of source geometry specific definitions, location and optional translation, direction and optional rotation about principal axis, beam rotation about principal axis, polar (θ) or azimuthal (ϕ) emission, angle of convergence or divergence (θ conv or div), surface polar or azimuthal emission, source profile (Gaussian or flat, or efficiency for fiber source), and in what region is the source initiated (initial tissue region).

Source Name	geometry	location: any	location: translate	direction: any	direction: rotate	beam rotation	θ angle emission	ϕ emission	θ conv or div	surface θ emission	surface ϕ emission	source profile,efficiency	initial tissue region
DirectionalPoint	point	✓		✓									✓
DirectionalLine	length		✓		✓	✓						✓	✓
DirectionalCircular	ring radii		✓		✓	✓			✓			✓	✓
DirectionalElliptical	a,b axes		✓		✓	✓			✓			✓	✓
DirectionalRectangular	length,width		✓		✓	✓			✓			✓	✓
CustomPoint	point	✓		✓				✓					✓
CustomLine	length		✓		✓	✓		✓				✓	✓
CustomCircular	ring radii		✓		✓	✓						✓	✓
CustomElliptical	a,b axes		✓		✓	✓						✓	✓
CustomRectangular	length,width		✓		✓	✓			✓			✓	✓
CustomSurfaceEmittingSpherical	radius		✓							✓	✓		✓
CustomVolumetricEllipsoidal	a,b,c axes		✓		✓		✓	✓				✓	✓
CustomVolumetricCuboidal	length,width,height		✓		✓		✓	✓				✓	✓
IsotropicPoint	point	✓		✓									✓
IsotropicLine	length		✓									✓	✓
IsotropicVolumetricEllipsoidal	a,b,c axes		✓		✓	✓						✓	✓
IsotropicVolumetricCuboidal	length,width,height		✓		✓	✓						✓	✓
LambertianSurfaceEmittingSpherical	radius		✓										✓
LambertianSurfaceEmittingCubiodal	length,width,height		✓		✓	✓						✓	✓
LambertianSurfaceEmittingTubular	radius,height		✓		✓	✓						✓	✓
LambertianSurfaceEmittingCylindrialFiber	radius,height		✓		✓							✓	✓
FluorescenceEmissionAOfXAndYAndZ	$A(x,y,z)$												

Nomenclature

symbol	description
ρ	cylindrical rings
x, y	Cartesian coordinates
z_{max}	mean maximum depth
z_{recessed}	detector recessed in air at this height
f_x	spatial-frequency
t	time
Ω	temporal-frequency
θ	polar angle
ϕ	azimuthal angle
MT	momentum transfer
BVF	blood volume fraction in each tissue subregion
subregion	tissue subregion

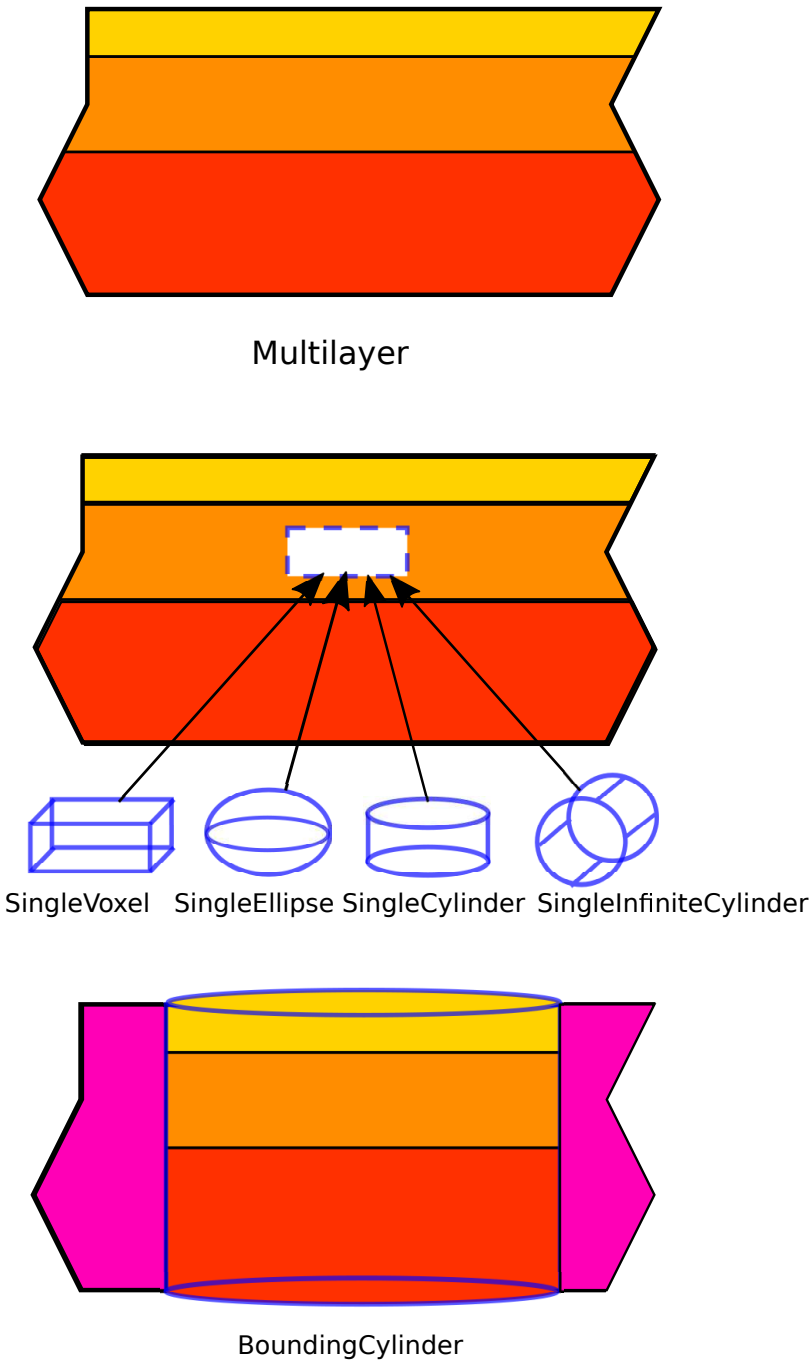

Figure 1: MCCL tissue specifications identified by their name: MultiLayer (varying optical properties in each layer), SingleVoxel (Voxel inclusion in one of the layers), SingleEllipsoid (Ellipsoid inclusion in one of the layers), SingleCylinder (cylinder with axis along z-axis in one of the layers), SingleInfiniteCylinder (infinite cylinder with axis along y-axis in one of the layers), MultiConcentricInfiniteCylinder (not shown, concentric infinite cylinders with axis along y-axis in one of the layers), and BoundingCylinder (layered tissue bounded by cylinder with axis along z-axis with different optical properties).

Table 2: MCCL/MCPP reflectance detector specifications identified by their name and options. The columns refer to the independent variables provided by these detectors in space (cylindrical coordinates:ρ, Cartesian coordinates: x, y, z), maximum depth of interogation z_{max}, detector recessed in air at z_{recessed}, spatial-frequency (f_x), time (t), temporal-frequency (Ω), or polar and azimuthal angles (θ, ϕ), momentum transfer (MT), blood volume fraction (BVF). The perturbation and differential MC reflectance detector specifications are listed below the double line.

Reflectance Detector Name	$\rho \in [0, \infty)$ [mm]	$z_{\text{max}} \in [0, \infty)$ [mm]	$z_{\text{recessed}} \in [0, \infty)$ [mm]	$x, y \in (-\infty, \infty)$ [mm]	$f_x \in [0, \infty)$ [mm^{-1}]	$t \in [0, \infty)$ [ns]	$\Omega \in [0, \infty)$ [GHz]	$\theta \in [\pi/2, \pi]$ [rad]	$\phi \in [0, 2\pi]$ [rad]	$MT \in [0, \infty)$ [unitless]	$BVF \in [0, 1]$ [unitless]	subregion
RDiffuse												
ROfAngle								✓				
ROfRho	✓											
ROfRhoRecessed	✓		✓									
ROfRhoAndAngle	✓							✓				
ROfRhoAndTime	✓					✓						
ROfRhoAndOmega	✓						✓					
ROfRhoAndMaxDepth	✓	✓										
ROfRhoAndMaxDepthRecessed	✓	✓	✓									
ROfXAndY	✓			✓								
ROfXAndYRecessed	✓		✓	✓								
ROfXAndYAndMaxDepth	✓	✓		✓								
ROfXAndYAndMaxDepthRecessed	✓	✓	✓	✓								
ROfXAndYAndTime	✓			✓		✓						
ROfXAndYAndTimeRecessed	✓		✓	✓		✓						✓
ROfXAndYAndTimeAndSubregion	✓			✓		✓						✓
ROfXAndYAndTimeAndSubregionRecessed	✓		✓	✓		✓						✓
ROfXAndYAndThetaAndPhi				✓				✓	✓			
ROfFx					✓							
ROfFxAndAngle					✓			✓				
ROfFxAndTime					✓	✓		✓				
ReflectedMTOfRhoAndSubregionHist	✓									✓		✓
ReflectedMTOfXAndYAndSubregionHist				✓						✓		✓
ReflectedDynamicMTOfRhoAndSubregionHist	✓									✓	✓	✓
ReflectedDynamicMTOfXAndYAndSubregionHist				✓						✓	✓	✓
ReflectedDynamicMTOfFxAndSubregionHist					✓					✓	✓	✓
pMCROfRho	✓											
pMCROfRhoRecessed	✓		✓								✓	
pMCROfRhoAndTime	✓					✓						
pMCROfXAndY	✓			✓								
pMCROfXAndYAndTime	✓			✓		✓						
pMCROfXAndYAndTimeAndSubregion	✓			✓		✓						✓
pMCROfXAndYAndTimeAndSubregionRecessed	✓		✓	✓		✓						✓
pMCROfFx					✓							
pMCROfFxAndTime					✓	✓		✓				
dMCdROfRhoDMua	✓											
dMCdROfRhoDMus	✓											

Table 3: MCCL/MCPP transmittance detector specifications identified by their name and options. The columns refer to the independent variables provided by these detectors in space (cylindrical coordinates: ρ, Cartesian coordinates: x, y, z), spatial-frequency (f_x), time (t), polar and azimuthal angles (θ, ϕ), momentum transfer (MT), blood volume fraction (BVF). The perturbation and differential MC transmittance detector specifications are listed below the double line.

Transmittance Detector Name	$\rho \in [0, \infty)$ [mm]	$x, y \in (-\infty, \infty)$ [mm]	$f_x \in [0, \infty)$ [mm^{-1}]	$t \in [0, \infty)$ [ns]	$\theta \in [0, \pi/2]$ [rad]	$\phi \in [0, 2\pi]$ [rad]	$MT \in [0, \infty)$ [unitless]	$BVF \in [0, 1]$ [unitless]	subregion
TDiffuse									
TOfAngle					✓				
TOfRho	✓								
TOfRhoAndAngle	✓				✓				
TOfXAndY	✓	✓							
TOfXAndYAndTimeAndSubregion	✓	✓		✓					✓
TOfFx			✓						
TransmittedMTOfRhoAndSubregionHist	✓						✓		✓
TransmittedMTOfXAndYAndSubregionHist		✓					✓		✓
TransmittedDynamicMTOfRhoAndSubregionHist	✓						✓	✓	✓
TransmittedDynamicMTOfXAndYAndSubregionHist		✓					✓	✓	✓
TransmittedDynamicMTOfFxAndSubregionHist			✓				✓	✓	✓
pMCTOfRho	✓								

Table 4: MCCL history detectors specifications identified by their name and options. The columns refer to the independent variables provided by these detectors in space (cylindrical coordinates: ρ, Cartesian coordinates x, y, z), spatial-frequency (f_x), time (t), temporal-frequency (Ω), and/or polar and azimuthal angles (θ, ϕ). The perturbation and differential MC history detector specifications are listed below the double line.

History Detector Name	$\rho \in [0,\infty)$ [mm]	$x,y \in (-\infty,\infty)$ [mm]	$z \in [0,\infty)$ [mm]	$f_x \in [0,\infty)$ [mm^{-1}]	$t \in [0,\infty)$ [ns]	$\Omega \in [0,\infty)$ [GHz]	$\theta \in [0,\pi]$ [rad]	$\phi \in [0,2\pi]$ [rad]
ATotal								
AOfRhoAndZ	✓		✓					
AOfXAndYAndZ		✓	✓					
FluenceOfRhoAndZ	✓		✓					
FluenceOfRhoAndZAndTime	✓		✓		✓			
FluenceOfRhoAndZAndOmega	✓		✓			✓		
FluenceOfXAndYAndZ		✓	✓					
FluenceOfXAndYAndZAndTime		✓	✓		✓			
FluenceOfXAndYAndZAndOmega		✓	✓			✓		
RadianceOfRhoAndZAndAngle	✓		✓				✓	
RadianceOfRhoAtZ	✓		✓					
RadianceOfXAndYAndZAndThetaAndPhi		✓	✓				✓	✓
RadianceOfFxAndZAndAngle			✓	✓			✓	
pMCATotal								