

# **MPGD trackers radiation dose**

MPGD-DSC – uRwell Trackers meeting  
01/18/2024



- Detector locations

- ✓ <https://eic.jlab.org/Geometry/Detector/Detector-20231031150001.html>

- Radiation dose studies

- ✓ [https://wiki.bnl.gov/EPIC/index.php?title=Radiation\\_Doses](https://wiki.bnl.gov/EPIC/index.php?title=Radiation_Doses)

- Based on Bryce Canyon Geometry (detector locations matches with engineering drawing but not sure about support structures)
- 0.5 T STAR magnetic field, good enough for ePIC central region but not for far forward region
- New calculations end of this week bit will not change a lot.



e+p collision Physics event (10 run years with 6 months run time per year)

MPGD layers		Radiation dose (10 years Phys) EM radiation	Radiation dose (10 years Phys) Hadron radiation
Barrel	mRwell @ R ~ 72 cm	~0.054 krads – 0.3 krads	0.02 krads -- 0.112 krads
	MMG @ R ~ 50 cm	~ 0.073 krads – 0.217 krads	~ 0.042 krads -- 0.173 krads
Hadron end cap	mRwell @ z ~ 148 cm	~0.85 krads -- 51.2 krads	~ 0.23 krads -- 16.5 krads
	mRwell @ z ~ 163 cm	~0.96 krads – 52.6 krads	~ 0.26 krads – 14.1 krads
Electron end cap	mRwell @ z ~ - 112.5 cm	~0.07 krads – 3.2 krads	~ 0.032 krads – 0.2 krads
	mRwell @ z ~ -122.5 cm	~ 0.07 krads – 4.2 krads	~ 0.032 krads – 0.2 krads

MPGD layers		1 MeV neutrons equivalent fluence [cm <sup>-2</sup> ]	1 MeV protons equivalent fluence [cm <sup>-2</sup> ]
Barrel (e going to hadron going)	mRwell @ R ~ 72 cm	$9.5 \times 10^9 - 2.8 \times 10^{10}$	$1.4 \times 10^9 - 4.2 \times 10^9$
	MMG @ R ~ 50 cm	$1.1 \times 10^{10} - 2.7 \times 10^{10}$	$1.4 \times 10^9 - 9.2 \times 10^9$
Hadron end cap (outer radius to inner radius)	mRwell @ z ~ 148 cm	$2.9 \times 10^{10} - 1.2 \times 10^{11}$	$1.0 \times 10^{11} - 2.3 \times 10^{11}$
	mRwell @ z ~ 163 cm	$3.0 \times 10^{10} - 1.1 \times 10^{11}$	$6.7 \times 10^9 - 3.3 \times 10^{11}$
Electron end cap (outer radius to inner radius)	mRwell @ z ~ - 112.5 cm	$1.1 \times 10^{10} - 1.3 \times 10^{10}$	$1.9 \times 10^9 - 5.1 \times 10^8$
	mRwell @ z ~ -122.5 cm	$1.1 \times 10^{10} - 1.4 \times 10^{10}$	$9.1 \times 10^8 - 7.9 \times 10^9$

275 GeV proton beam + gas (10 run years with 6 months run time per year)

MPGD layers		Radiation dose Hadron radiation	Radiation dose EM radiation
Barrel	mRwell @ R ~ 72 cm	~ 0.006 kRads	~ 0.021 kRads
	MMG @ R ~ 50 cm	~ 0.012 kRads	~ 0.05 kRads
Hadron end cap (outer radius to inner radius)	mRwell @ z ~ 148 cm	~ 0.011 kRads – 0.23 kRads	~ 0.047 kRads – 0.91 kRads
	mRwell @ z ~ 163 cm	~ 0.011 kRads – 0.2 kRads	~ 0.053 kRads – 0.98 kRads
Electron end cap (outer radius to inner radius)	mRwell @ z ~ - 112.5 cm	~ 0.011 kRads – 0.46 kRads	~ 0.05 kRads – 2.64 kRads
	mRwell @ z ~ -122.5 cm	~ 0.012 kRads – 0.6 kRads	~ 0.05 kRads – 3.2 kRads

MPGD layers		1 MeV neutrons equivalent fluence [cm <sup>-2</sup> ]	1 MeV protons equivalent fluence [cm <sup>-2</sup> ]
Barrel	mRwell @ R ~ 72 cm	5.8 x 10 <sup>9</sup>	9.05x10 <sup>8</sup>
	MMG @ R ~ 50 cm	8.6 x 10 <sup>10</sup>	8.4 x 10 <sup>8</sup>
Hadron end cap (outer radius to inner radius)	mRwell @ z ~ 148 cm	2.1 x 10 <sup>9</sup> – 3.6 x 10 <sup>9</sup>	2.4 x 10 <sup>8</sup> – 4.9x10 <sup>9</sup>
	mRwell @ z ~ 163 cm	2.2 x 10 <sup>9</sup> – 3.6 x 10 <sup>9</sup>	2.4 x 10 <sup>8</sup> – 5.0x10 <sup>9</sup>
Electron end cap (outer radius to inner radius)	mRwell @ z ~ - 112.5 cm	8.1 x 10 <sup>9</sup> – 1.2 x 10 <sup>10</sup>	1.7 x 10 <sup>9</sup> – 6.5x10 <sup>9</sup>
	mRwell @ z ~ -122.5 cm	9. x 10 <sup>9</sup> – 1.8 x 10 <sup>10</sup>	7.9 x 10 <sup>8</sup> – 4.1x10 <sup>10</sup>

**e+p collision Physics event** (10 run years with 6 months run time per year) **neutron and proton flux for  $E_{kin} > 20$  MeV**

MPGD layers		Neutron flux [ $s^{-1} cm^{-2}$ ], $E_{kin} > 20$ MeV	Proton flux [ $s^{-1} cm^{-2}$ ], $E_{kin} > 20$ MeV
Barrel (e going to hadron going)	mRwell @ R ~ 72 cm	57 – 247	9 – 84
	MMG @ R ~ 50 cm	58 – 237	9 – 84
Hadron end cap (outer radius to inner radius)	mRwell @ z ~ 148 cm	283 - 4557	130 - 3937
	mRwell @ z ~ 163 cm	304 - 4504	139 - 4216
Electron end cap(outer radius to inner radius)	mRwell @ z ~ - 112.5 cm	57 - 79	10 - 26
	mRwell @ z ~ -122.5 cm	58 – 94	10 – 30

**275 GeV hadron beam + gas** (10 run years with 6 months run time per year) **neutron and proton flux for  $E_{kin} > 20$  MeV**

MPGD layers		Neutron flux [ $s^{-1} cm^{-2}$ ], $E_{kin} > 20$ MeV	Proton flux [ $s^{-1} cm^{-2}$ ], $E_{kin} > 20$ MeV
Barrel (e going to hadron going)	mRwell @ R ~ 72 cm	19 – 37	5 – 6
	MMG @ R ~ 50 cm	23 – 57	8 – 13
Hadron end cap (outer radius to inner radius)	mRwell @ z ~ 148 cm	21 – 113	8 – 117
	mRwell @ z ~ 163 cm	21 - 116	8 – 123
Electron end cap(outer radius to inner radius)	mRwell @ z ~ - 112.5 cm	54 – 283	12 – 264
	mRwell @ z ~ -122.5 cm	60 – 379	12 – 331