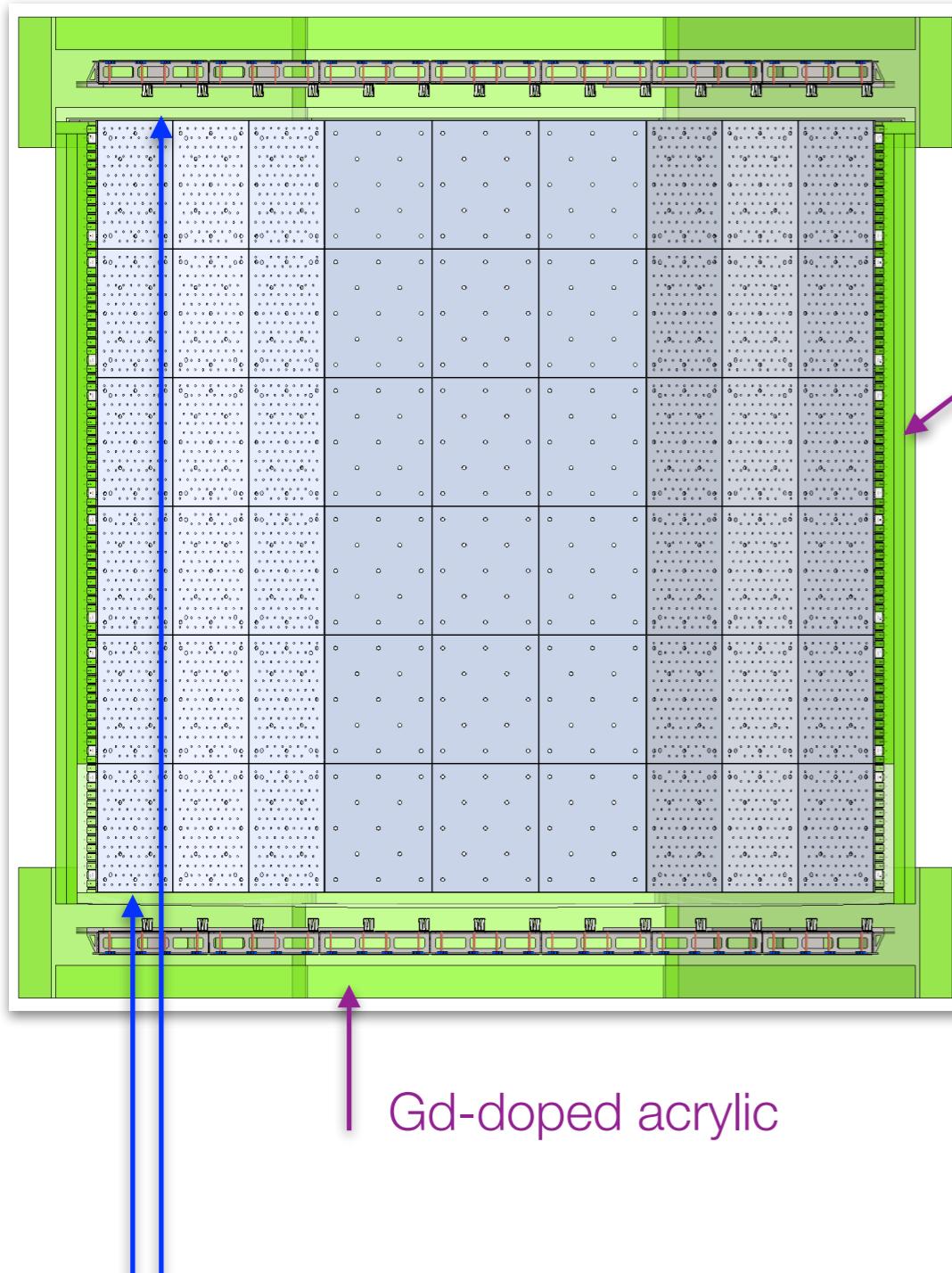


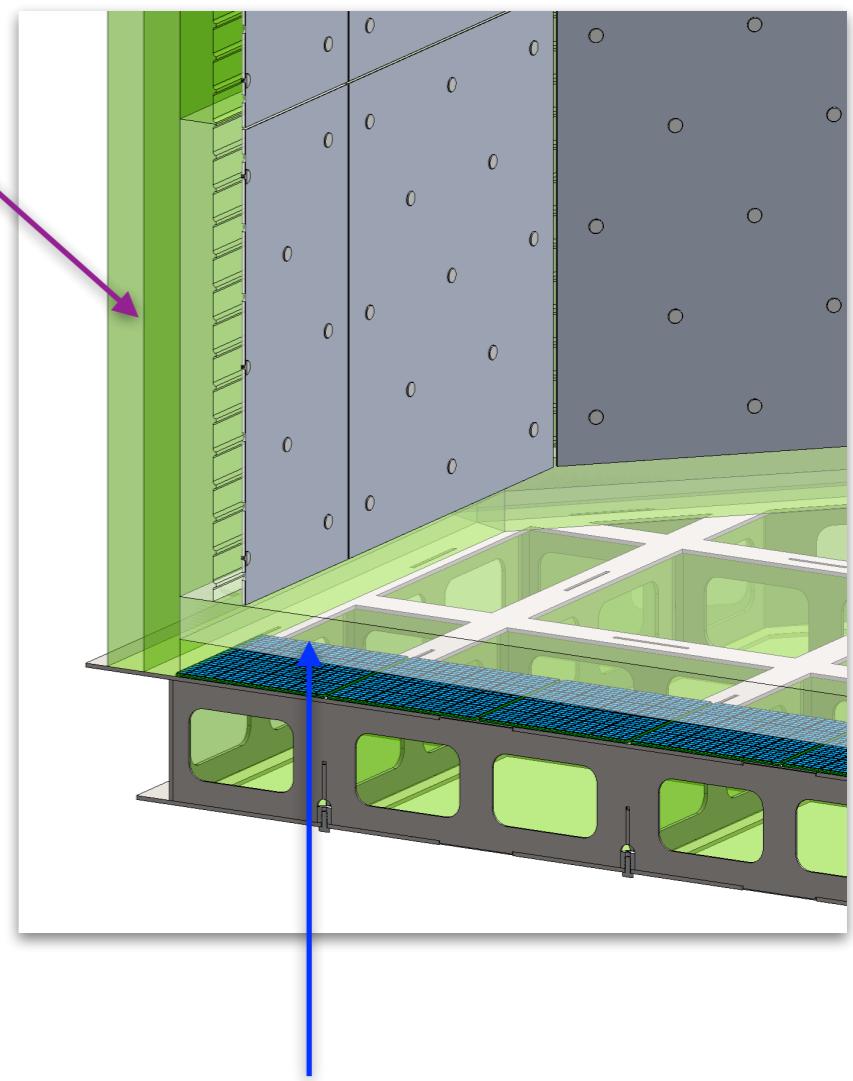


New TPC geometry CAD: “Plan-C”



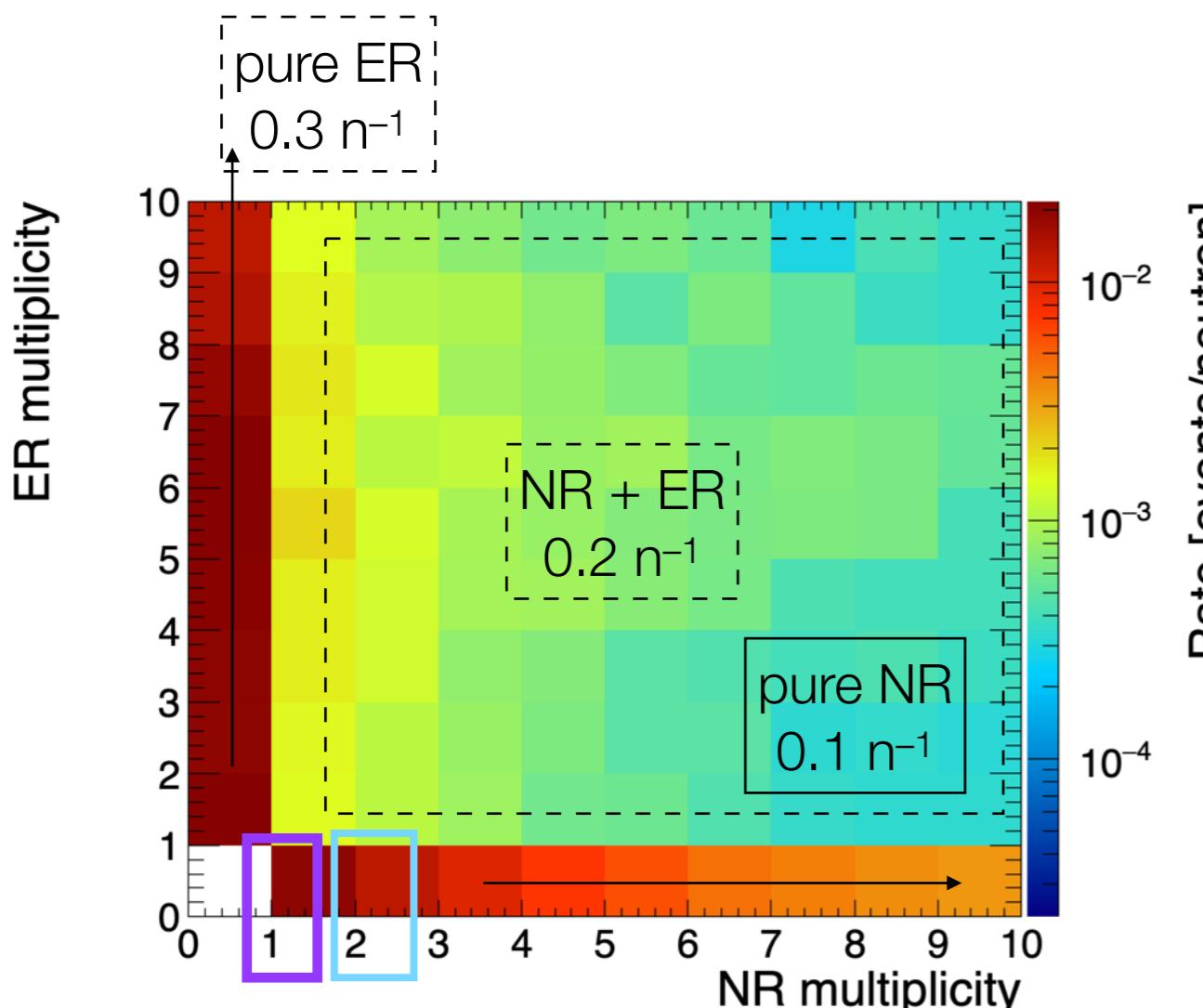
Pure acrylic is only at the top and bottom of the TPC

TPC wall
15cm thick
Gd-doped acrylic



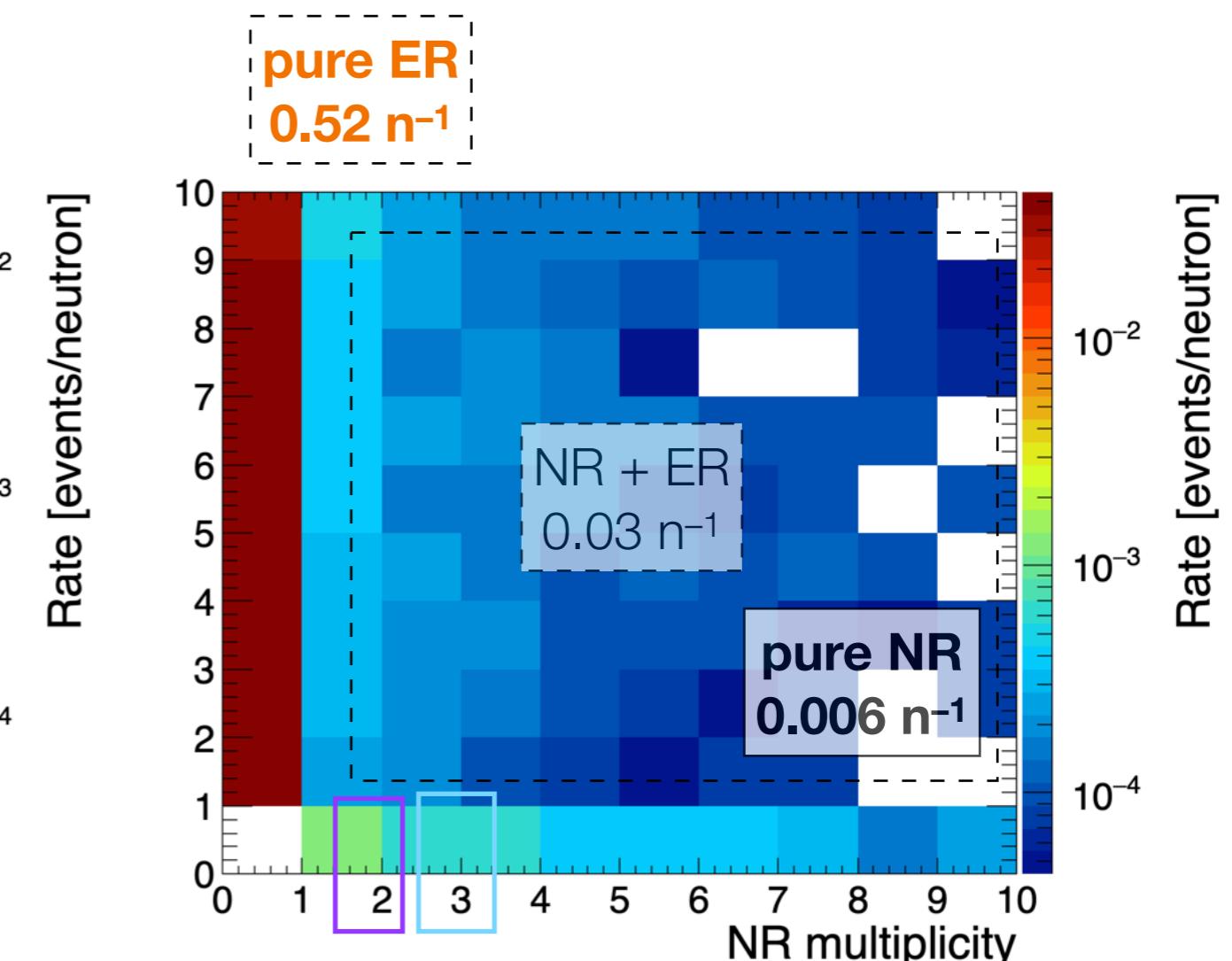
Neutron calibration with DD generator: Event Topology

- Baseline **Plan-A** simulation
- 5 cm pure acrylic** TPC wall
- DD neutron generator



0.02 n^{-1} single neutron scatter
 0.013 n^{-1} double neutron scatter

- Baseline **Plan-C** simulation
- 15 cm Gd-doped acrylic** TPC wall
- DD neutron generator



0.001 n^{-1}
 0.0007 n^{-1}

- 20 times lower rate of useful events going from baseline Plan-A to Plan-C
- Signal rate is dominated by **pure ER events** due to neutron capture



Neutron calibration with DD generator



- Simulations for the calibration source placed 3cm from the outer TPC wall
- DD gun, mono-energetic neutrons 2.45 MeV

pure single scatter nuclear recoils in the fiducial volume

pure single scatter nuclear recoils in the fiducial volume with energy $30\text{--}200 \text{ keV}_{\text{nr}}$

15cm Gd-Acrylic

allTPC	=	0.55459
pureNR	=	0.00617
pureNR_SS	=	0.00132
pureNR_SS_FV	=	0.00093
pureNR_SS_E	=	0.00062
pureNR_SS_FV_E	=	0.00054
pureNR_DS	=	0.00068
pureNRwithER	=	0.03302
pureER	=	0.5154

if all acrylic is pure,
no Gd-doping

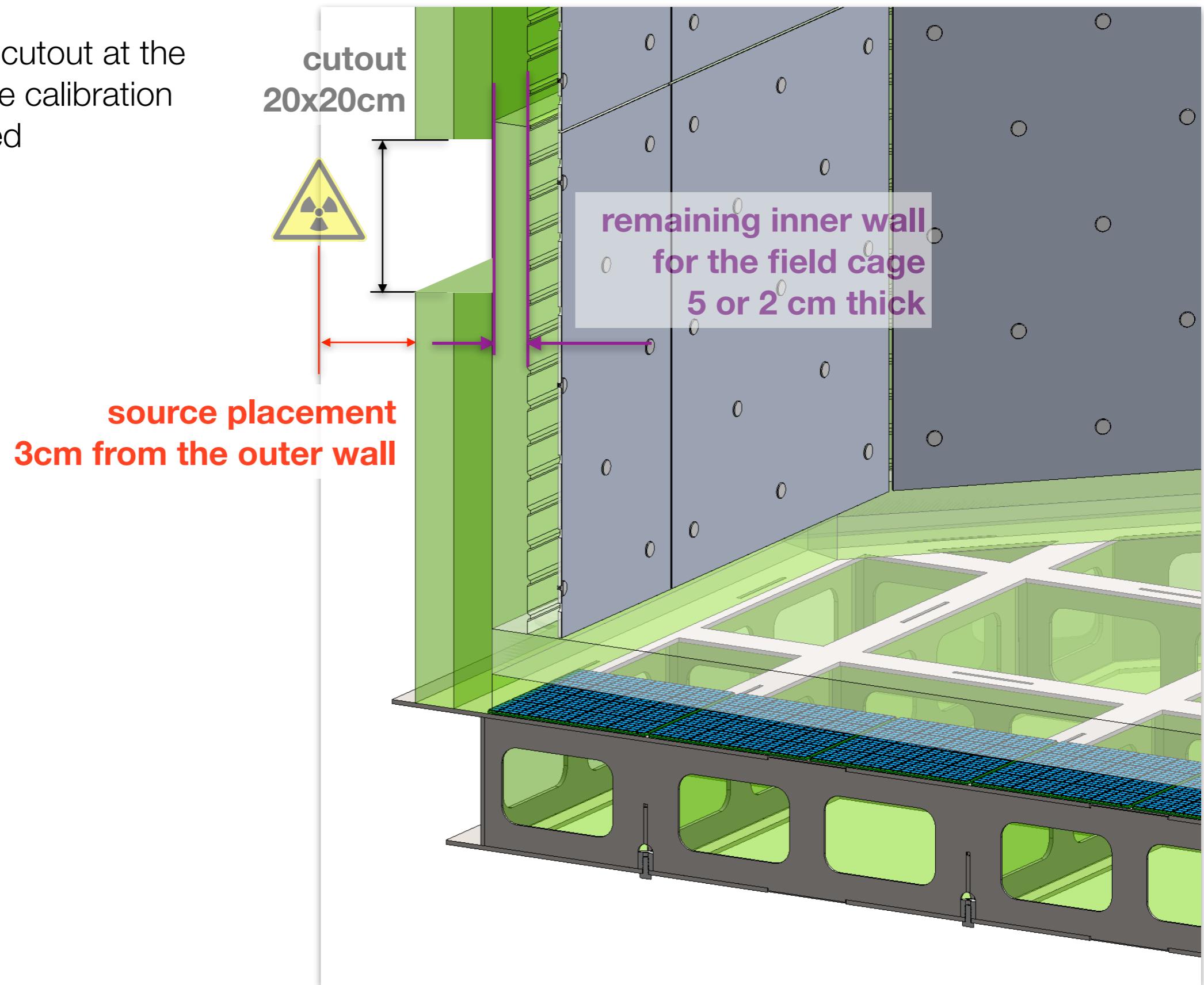
x2 higher rate

15cm Pure Acrylic

allTPC	=	0.41535
pureNR	=	0.00948
pureNR_SS	=	0.00211
pureNR_SS_FV	=	0.00161
pureNR_SS_E	=	0.00108
pureNR_SS_FV_E	=	0.00099
pureNR_DS	=	0.00124
pureNRwithER	=	0.02897
pureER	=	0.3769

Neutron calibration with DD generator

Introduce a blind cutout at the position where the calibration source is deployed





Neutron calibration with DD generator

- Calibration source placed 3cm from the outer TPC wall
- Square cutout 20x20cm
- Scaling to one emitted neutron

pure single scatter nuclear recoils in the fiducial volume

pure single scatter nuclear recoils in the fiducial volume with energy 30–200 keV_{nr}

15cm Gd-Acrylic

allTPC	=	0.55459
pureNR	=	0.00617
pureNR_SS	=	0.00132
pureNR_SS_FV	=	0.00093
pureNR_SS_E	=	0.00062
pureNR_SS_FV_E	=	0.00054
pureNR_DS	=	0.00068
pureNRwithER	=	0.03302
pureER	=	0.5154

5 cm inner Gd wall

allTPC	=	0.59224
pureNR	=	0.01576
pureNR_SS	=	0.00361
pureNR_SS_FV	=	0.00302
pureNR_SS_E	=	0.00188
pureNR_SS_FV_E	=	0.0018
pureNR_DS	=	0.00179
pureNRwithER	=	0.09631
pureER	=	0.48017

2 cm inner Gd wall

allTPC	=	0.60234
pureNR	=	0.02104
pureNR_SS	=	0.00495
pureNR_SS_FV	=	0.00407
pureNR_SS_E	=	0.00279
pureNR_SS_FV_E	=	0.00249
pureNR_DS	=	0.00268
pureNRwithER	=	0.1202
pureER	=	0.4611

baseline Plan-A

x3 higher NR rate

x4 higher NR rate



Neutron calibration with DD generator



- Calibration source placed 3cm from the outer TPC wall
- Square cutout **10x10cm**
- Scaling to one emitted neutron

pure single scatter nuclear recoils in the fiducial volume

pure single scatter nuclear recoils in the fiducial volume with energy 30–200 keV_{nr}

20x20cm cutout

allTPC	=	0.60234
pureNR	=	0.02104
pureNR_SS	=	0.00495
pureNR_SS_FV	=	0.00407
pureNR_SS_E	=	0.00279
pureNR_SS_FV_E	=	0.00249
pureNR_DS	=	0.00268
pureNRwithER	=	0.1202
pureER	=	0.4611

x4 higher NR rate

10x10cm cutout

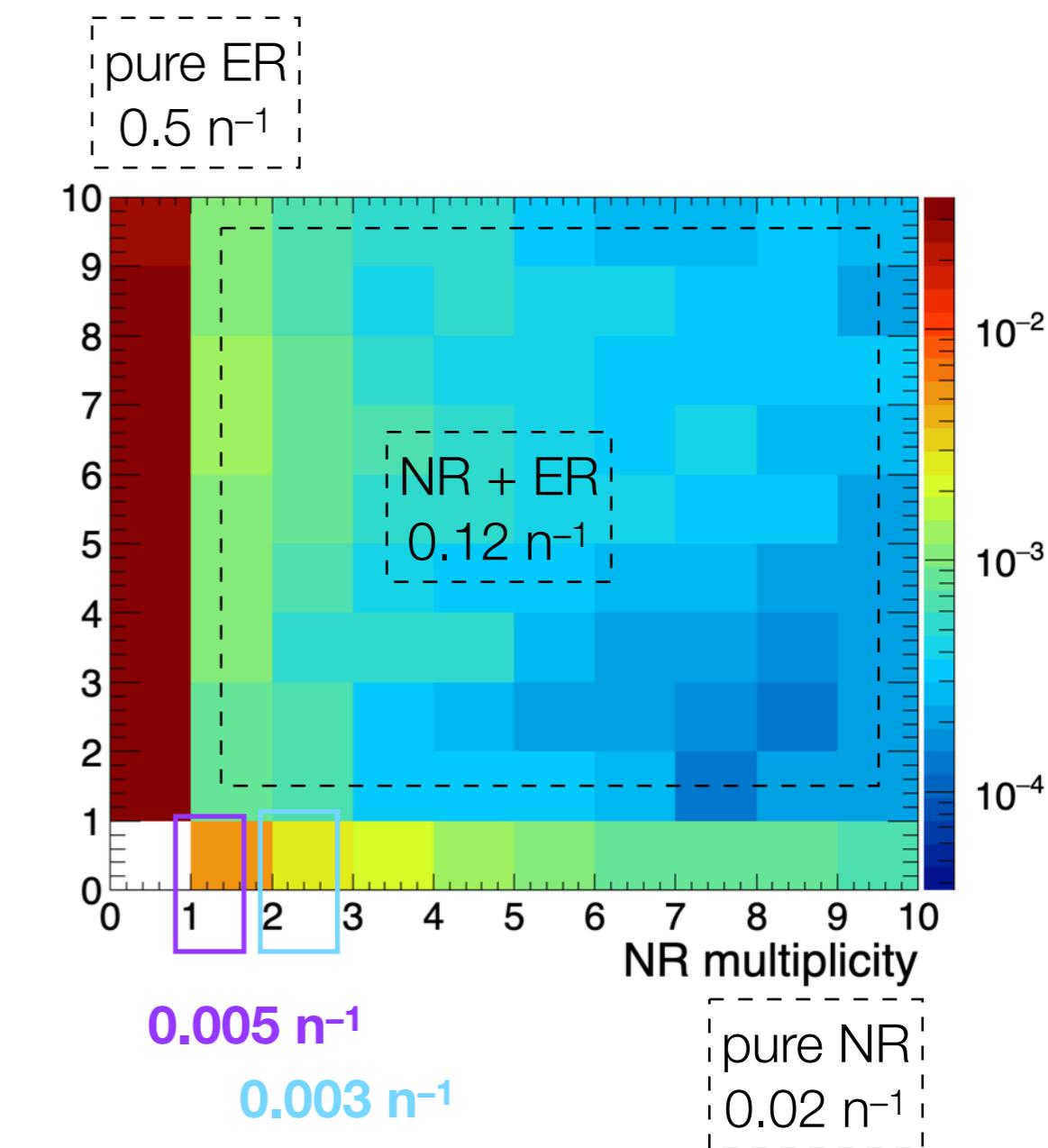
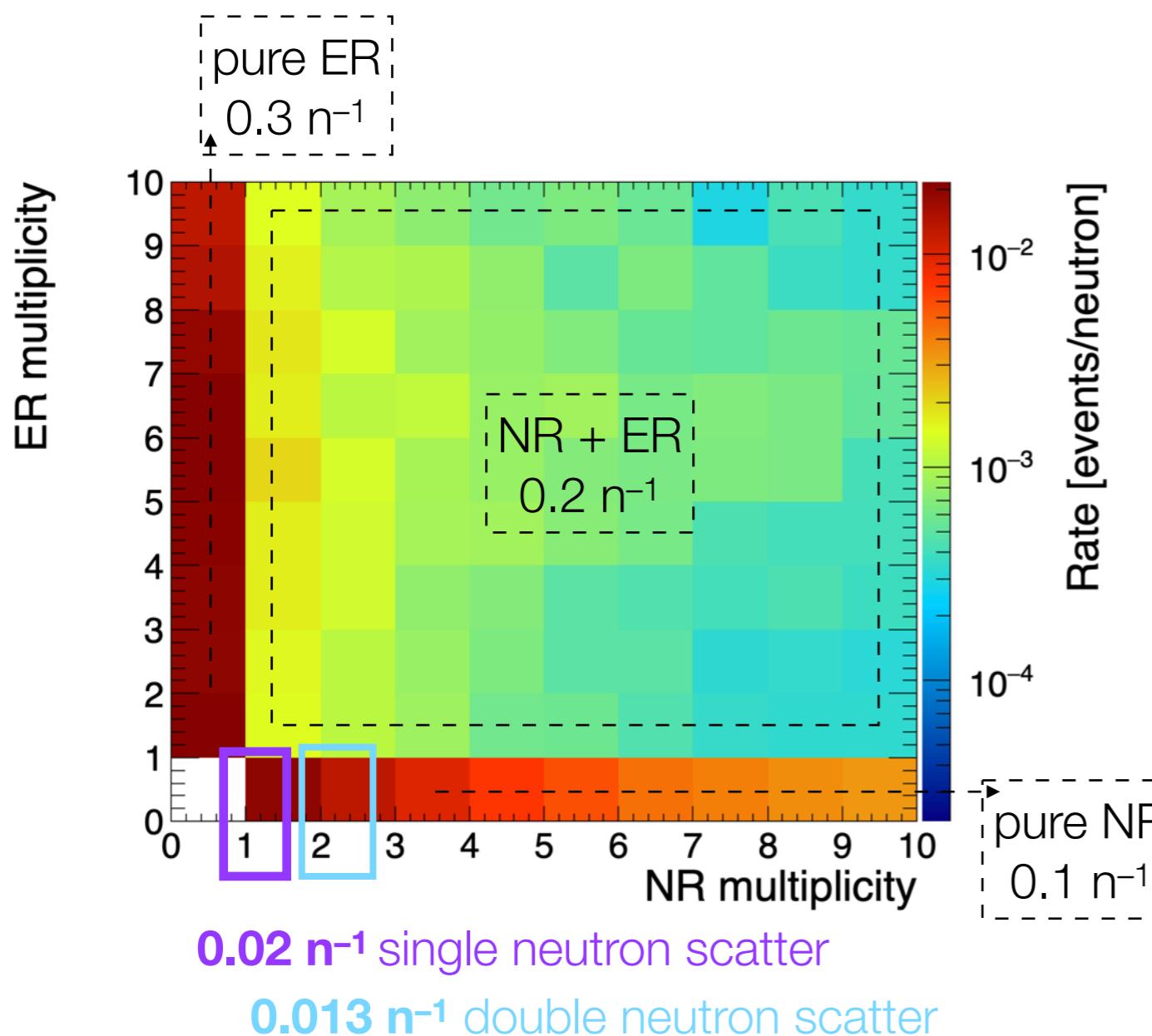
allTPC	=	0.57455
pureNR	=	0.01192
pureNR_SS	=	0.0026
pureNR_SS_FV	=	0.00205
pureNR_SS_E	=	0.00144
pureNR_SS_FV_E	=	0.00129
pureNR_DS	=	0.00146
pureNRwithER	=	0.0695
pureER	=	0.49313

x2 higher NR rate with respect to baseline

Neutron calibration with DD generator: Event Topology

- Baseline Plan-A simulation
- 5 cm pure acrylic TPC wall
- DD neutron generator

- Plan-C simulation
- Cutout 20x20cm
- with inner 2 cm Gd-acrylic wall



→ only 4 times lower calibration efficiency