

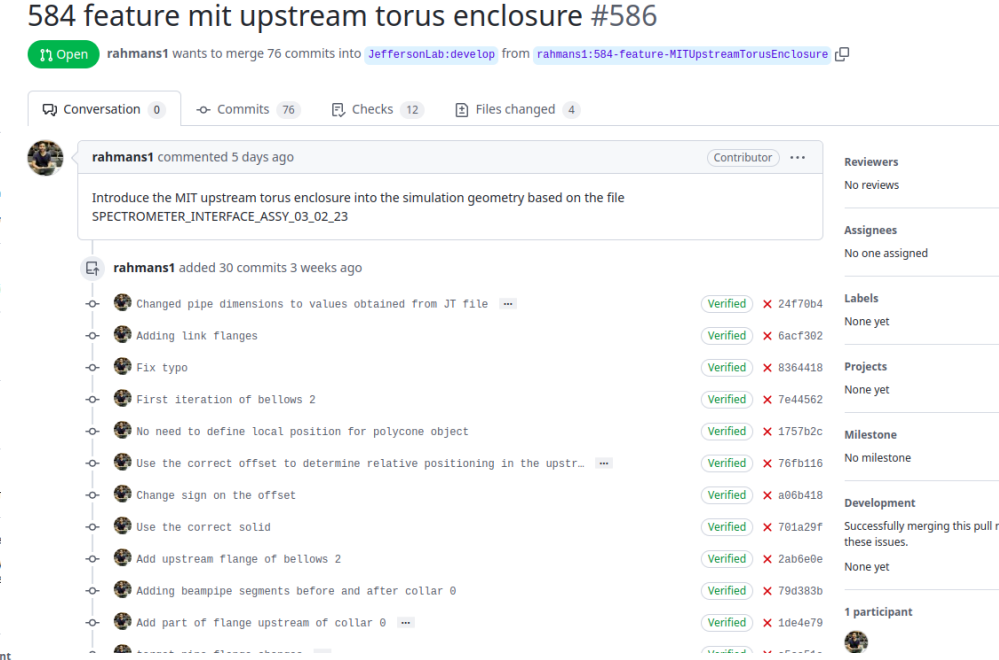
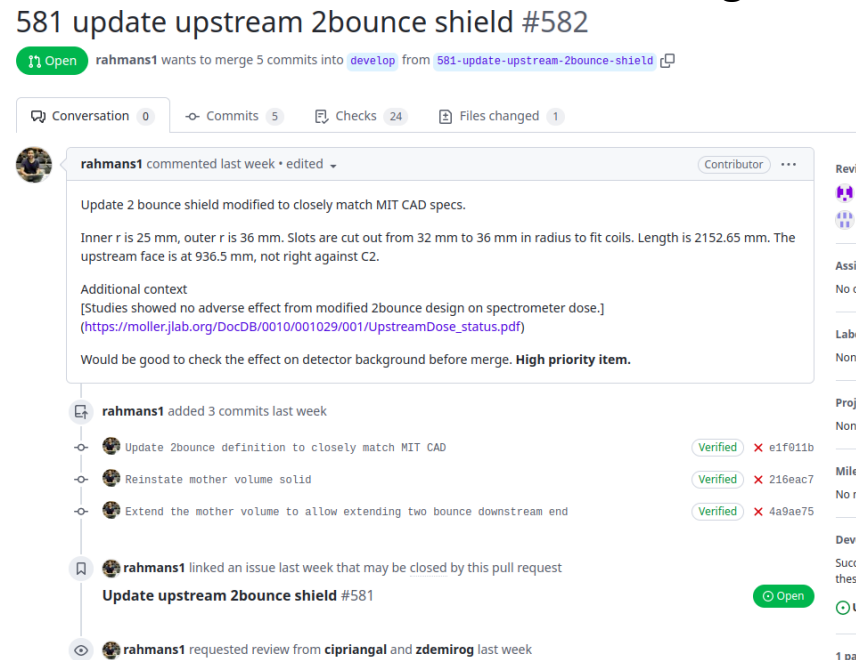
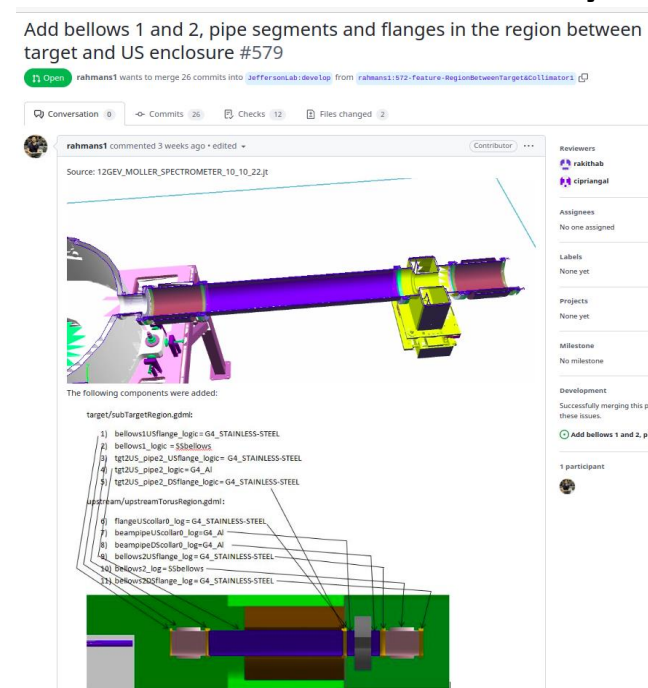
# **REMOLL PULL REQUEST (PR) VALIDATION STUDY: UPDATE**

**Sayak Chatterjee**

**UMass, Amherst**

# Objective

- Investigation of the possible effects due to the realistic material implementation (using the realistic CAD design) in the REMOLL geometry
- REMOLL Versions compared : Default (develop)
  - PR: 579
  - PR: 581
  - PR: 584 (includes 579 & 581)
  - PR: 584 (includes 579 & 581) without QUARTZ tiles
- Generators: moller, elastic, inelastic, pion, beam, elasticAI, inelasticAI, quasielasticAI
- Deconvolution analysis and Z-vertex distribution with beam generator

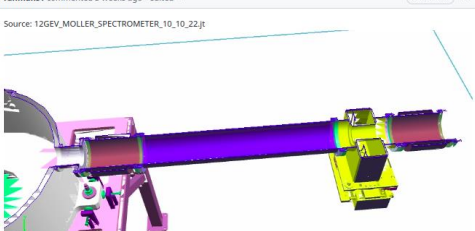


# Simulation parameters

- **REMOLL:** Default (develop), PR\_579, PR\_581, PR\_584 (includes 579 & 581), PR\_584\_wo\_tiles
- **Field map: umap:** V2U.1a.50cm.parallel.txt ; **dmap:** subcoil\_2\_3\_3mm\_full.txt ; **Detector No:** 28 (hit.r>650)
- **Generators (# events):** Elastic ( $7.5 \times 10^6$ ), Inelastic ( $7.5 \times 10^6$ ), Moller ( $5 \times 10^6$ ), ElasticAI ( $7.5 \times 10^6$ ), InelasticAI ( $7.5 \times 10^6$ ), QuasielasticAI ( $7.5 \times 10^6$ ), pion ( $5 \times 10^6$ ), beam ( $10^7$ )
- **Scripts used:** /w/halla-scsshelf2102/moller12gev/sayak/pr\_validation\_study/remoll-job-submission/simulation/macro.py  
/w/halla-scsshelf2102/moller12gev/sayak/pr\_validation\_study/remoll-job-submission/analysis/analyse.py  
/w/halla-scsshelf2102/moller12gev/sayak/pr\_validation\_study/remoll-job-submission/plot/deconvolution/deconvolution.C
- **File path:** /volatile/halla/moller12gev/sayak/

Add bellows 1 and 2, pipe segments and flanges in the region between target and US enclosure #579

rahmans1 wants to merge 26 commits into JeffersonLab:develop from rahmans1:579-Feature-RegionBetweenTargetCollimators



The following components were added:

```
target/subTargetRegion.dgmt
1) bellowsUSflange_log=G4_STAINLESS-STEEL
2) bellows1_log=S5bellows
3) tgt2US_pipe2_USflange_log=G4_STAINLESS-STEEL
4) tgt2US_pipe2_log=G4_AI
5) tgt2US_pipe2_Dofflange_log=G4_STAINLESS-STEEL
upstream/upstreamTorusRegion.dgmt:
6) flangeUScollar_log=G4_STAINLESS-STEEL
7) beampipeUScollar_log=G4_AI
8) beampipeUScollar_log=G4_AI
9) bellows2USflange_log=G4_STAINLESS-STEEL
10) bellows2_log=S5bellows
11) bellows2Dofflange_log=G4_STAINLESS-STEEL
```

## 581 update upstream 2bounce shield #582

rahmans1 wants to merge 5 commits into develop from 581-update-upstream-2bounce-shield

rahmans1 commented last week · edited

Update 2 bounce shield modified to closely match MIT CAD specs.

Inner r is 25 mm, outer r is 36 mm. Slots are cut out from 32 mm to 36 mm in radius to fit coils. Length is 2152.65 mm. The upstream face is at 936.5 mm, not right against C2.

Additional context  
[Studies showed no adverse effect from modified 2bounce design on spectrometer dose.]  
([https://moller.jlab.org/DocDB/0010/001029/001/UpstreamDose\\_status.pdf](https://moller.jlab.org/DocDB/0010/001029/001/UpstreamDose_status.pdf))

Would be good to check the effect on detector background before merge. **High priority item.**

rahmans1 added 3 commits last week

- Update 2bounce definition to closely match MIT CAD (Verified) x e1f011b
- Reinstate mother volume solid (Verified) x 216eac7
- Extend the mother volume to allow extending two bounce downstream end (Verified) x 4a9ae75

rahmans1 linked an issue last week that may be closed by this pull request

**Update upstream 2bounce shield #581** (Open)

rahmans1 requested review from cipriangal and zdemirog last week

## 584 feature mit upstream torus enclosure #586

rahmans1 wants to merge 76 commits into JeffersonLab:develop from rahmans1:584-Feature-MITUpstreamTorusEnclosure

rahmans1 commented 5 days ago

Introduce the MIT upstream torus enclosure into the simulation geometry based on the file SPECTROMETER\_INTERFACE\_ASSY\_03\_02\_23

rahmans1 added 30 commits 3 weeks ago

- Changed pipe dimensions to values obtained from JT file (Verified) x 24f70b4
- Adding Link flanges (Verified) x 6ac7382
- Fix typo (Verified) x 8364418
- First iteration of bellows 2 (Verified) x 7e44562
- No need to define local position for polycone object (Verified) x 1757b2c
- Use the correct offset to determine relative positioning in the upstr... (Verified) x 76fb116
- Change sign on the offset (Verified) x a06b418
- Use the correct solid (Verified) x 701a29f
- Add upstream flange of bellows 2 (Verified) x 2ab6e0e
- Adding beampipe segments before and after collar 0 (Verified) x 79d383b
- Add part of flange upstream of collar 0 (Verified) x 1de4e79

1 participant

# Changes within the PRs

- PR\_581 does not have the PR #580

## Develop, PR\_579, PR\_584

```
<loop for="iloop" from="0" to="6" step="1">
  <physvol>
    <volumeref ref="Coll6A logic1"/>
    <position x="0" y="0" z="1223.168-2864.764-90+136.9"/>
    <rotation unit="deg" x="0" y="0" z="iloop*360./7."/>
  </physvol>

  <physvol>
    <volumeref ref="Coll6A logic2"/>
    <position x="0" y="0" z="1305.718-2864.764-90+136.9"/>
    <rotation unit="deg" x="0" y="0" z="iloop*360./7."/>
  </physvol>
</loop>
```

## PR\_581

```
<physvol>
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  <position x="0" y="0" z="1223.168-2864.764-90"/>
  <rotation unit="deg" x="0" y="0" z="iloop*360./7."/>
</physvol>

<physvol>
  <volumeref ref="Coll6A logic2"/>
  <position x="0" y="0" z="1305.718-2864.764-90"/>
  <rotation unit="deg" x="0" y="0" z="iloop*360./7."/>
</physvol>
</loop>
```

## Redesigned bellows 4 region, adding drift pipe end #580

New issue

Merged cipriangal merged 3 commits into JeffersonLab:develop from ryanrich7:bellows4region 2 weeks ago

Conversation 1 Commits 3 Checks 0 Files changed 2

+272 -57



ryanrich7 commented 2 weeks ago

Contributor ...

Redesigned the bellows 4 region to reflect the asymmetric flanges for bellows 4. I added the drift pipe end as well. Shortened the drift pipe some to fit the cap. Also changed the lintel positions reflecting recent work done.

Redesigned bellows 4 region, adding drift pipe end

4fb6859

zdemirog requested a review from cipriangal 2 weeks ago

Ryan Richards and others added 2 commits 2 weeks ago

Lengthened Drift pipe som

760484e

Merge branch 'JeffersonLab:develop' into bellows4region

Verified

dd31c5f



cipriangal commented 2 weeks ago

Contributor ...

@zdemirog made a comparison of the geometry to develop:  
[bellow4\\_driftpipe.pdf](#)

she also confirms that there were no overlaps



cipriangal merged commit 1ed69a8 into JeffersonLab:develop 2 weeks ago

Reviewers

cipriangal

Assignees

No one assigned

Labels

None yet

Projects

None yet

Milestone

No milestone

Development

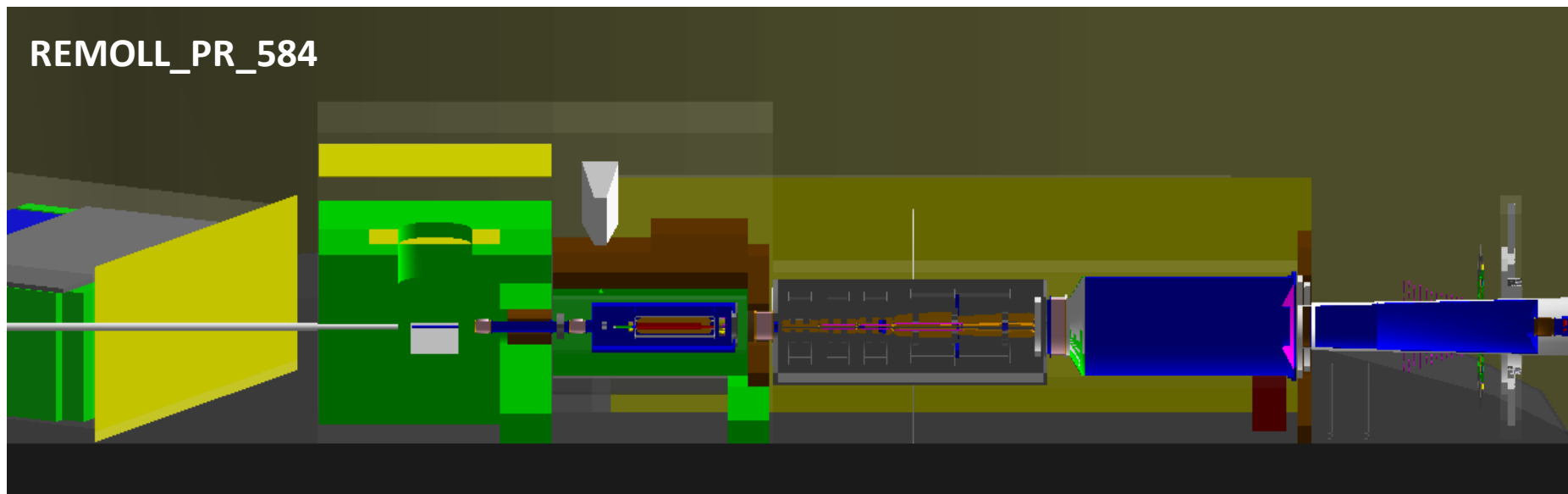
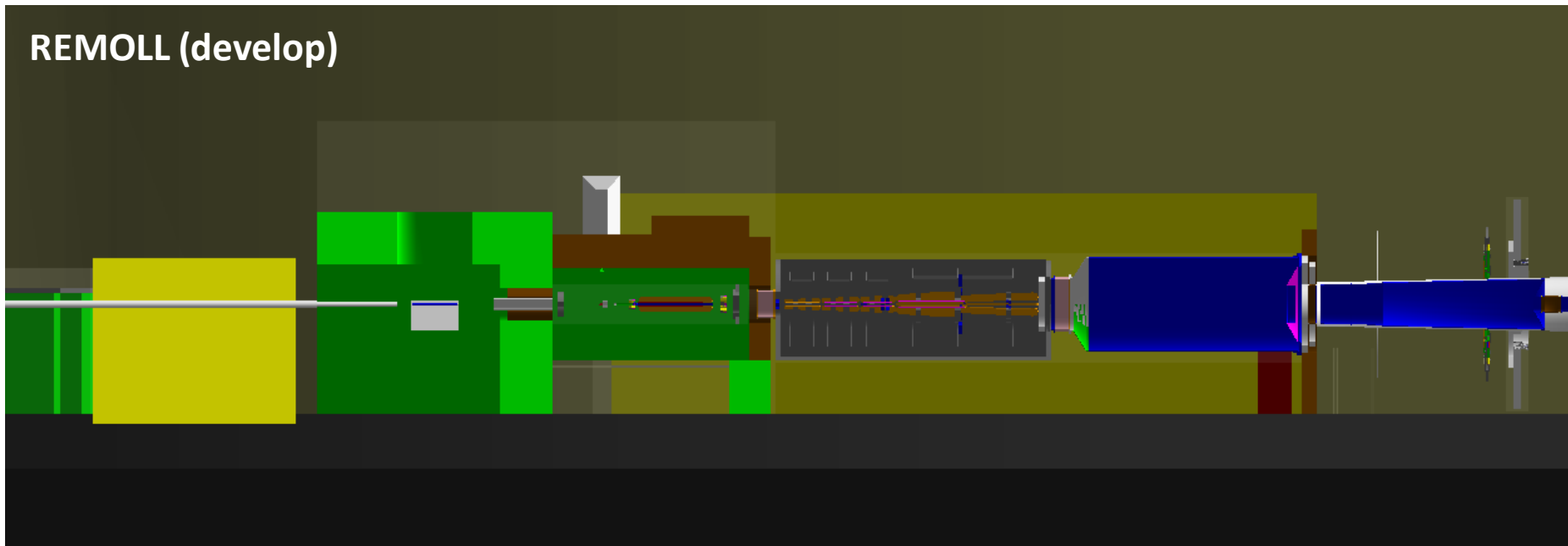
Successfully merging this pull request may close these issues.

None yet

2 participants



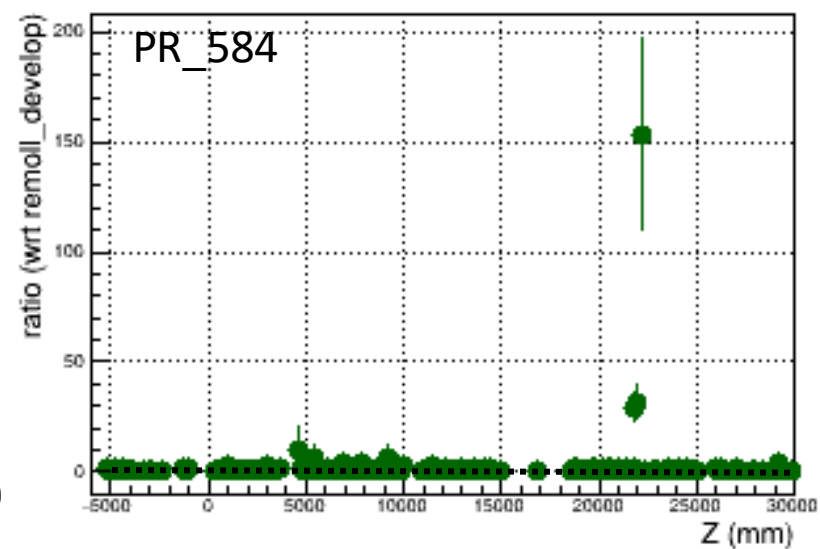
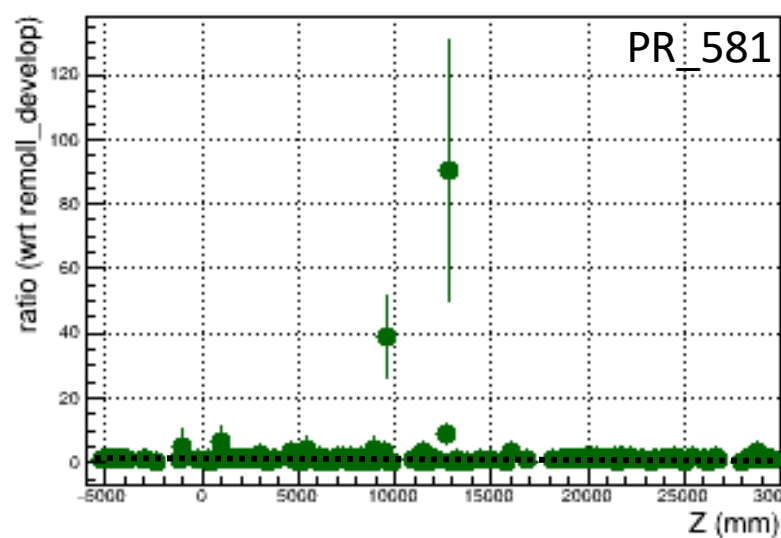
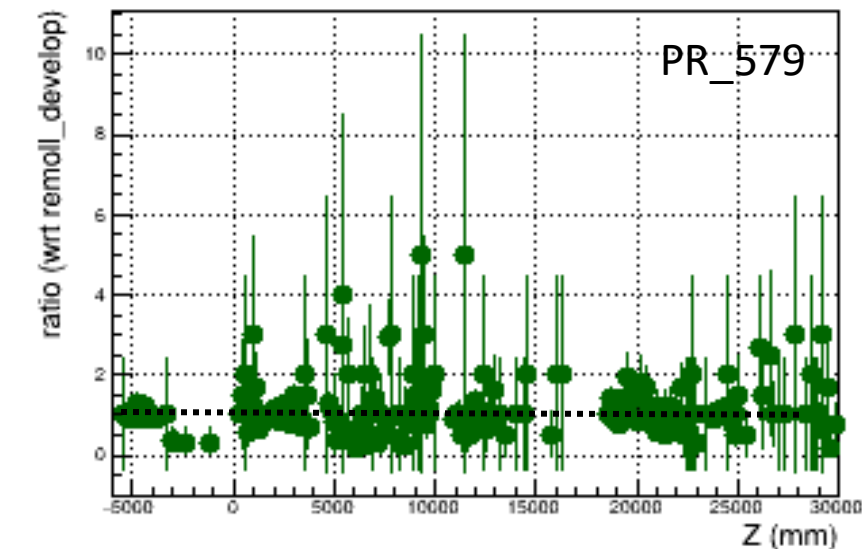
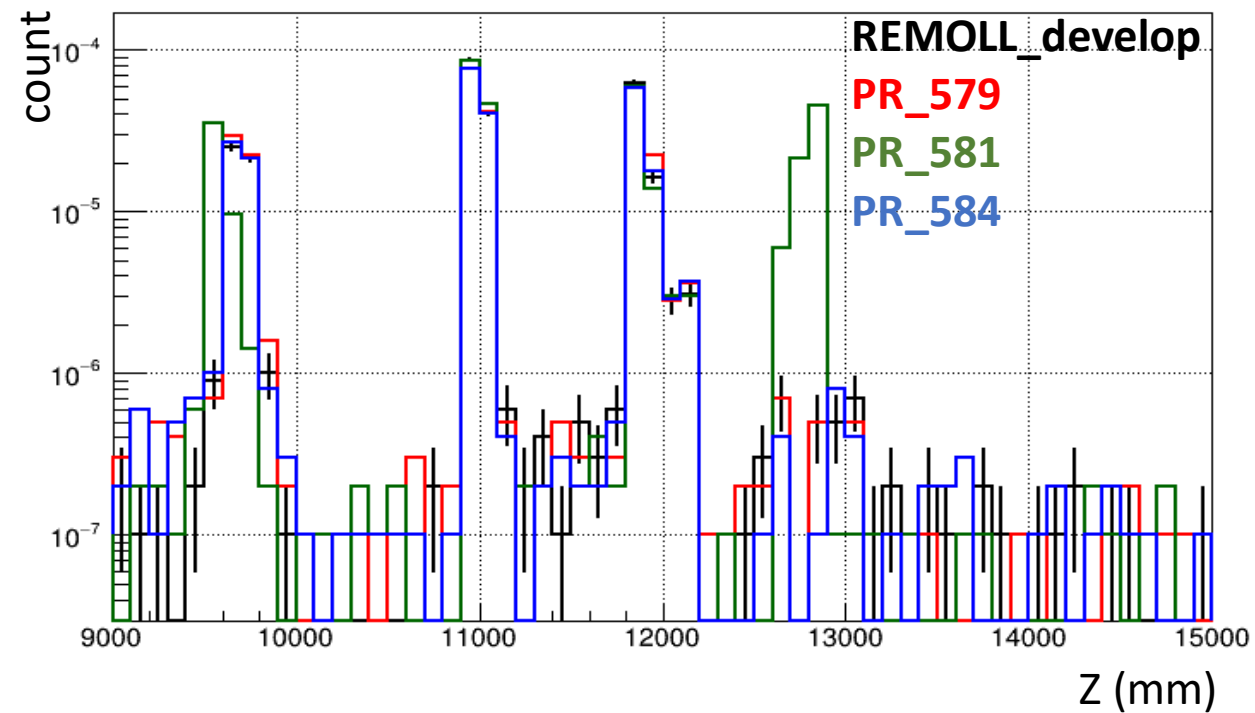
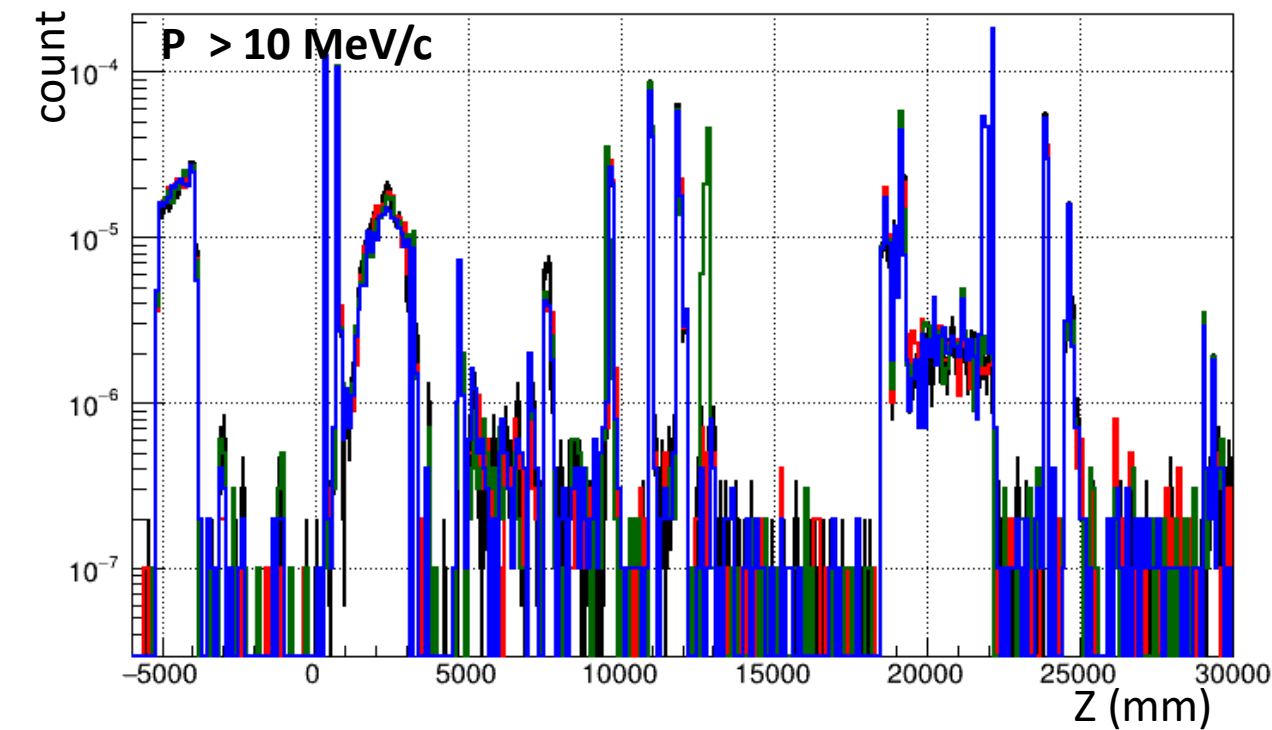
# Geometry visualization



# Z-vertex distribution (All particles; Generator: Beam)

pr\_all\_all\_pgreater10MeV\_out\_vz rate-weighted vertex, Generator=beam

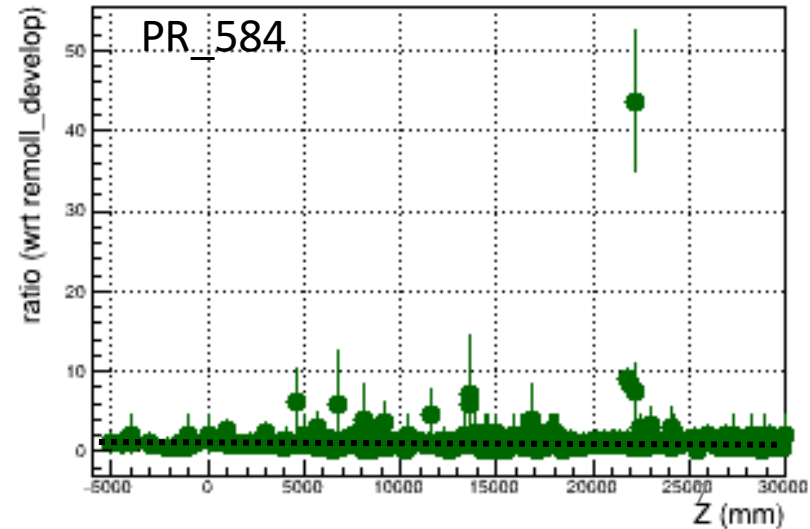
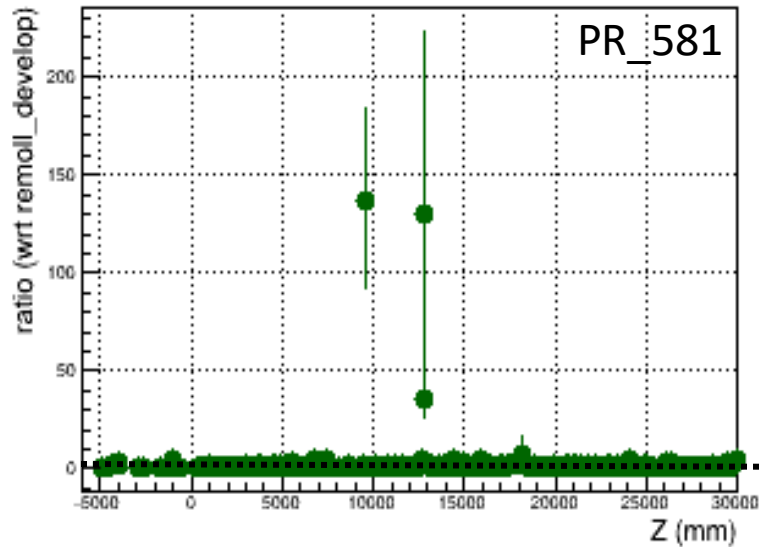
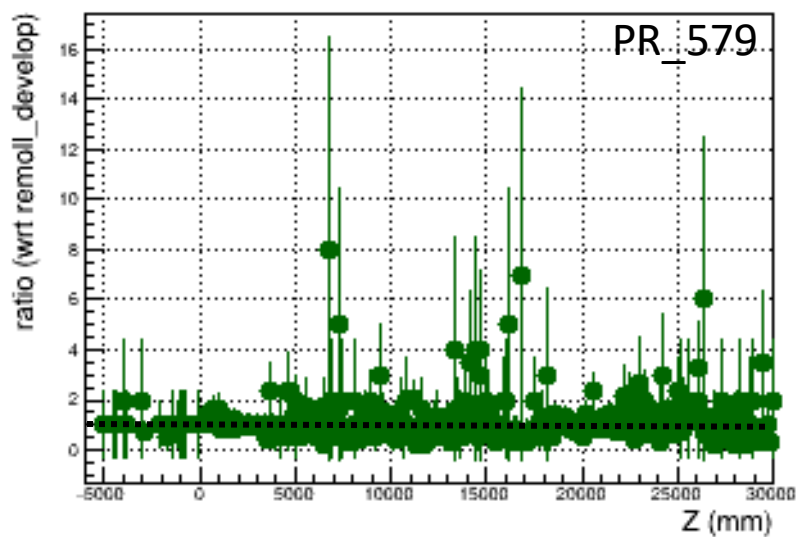
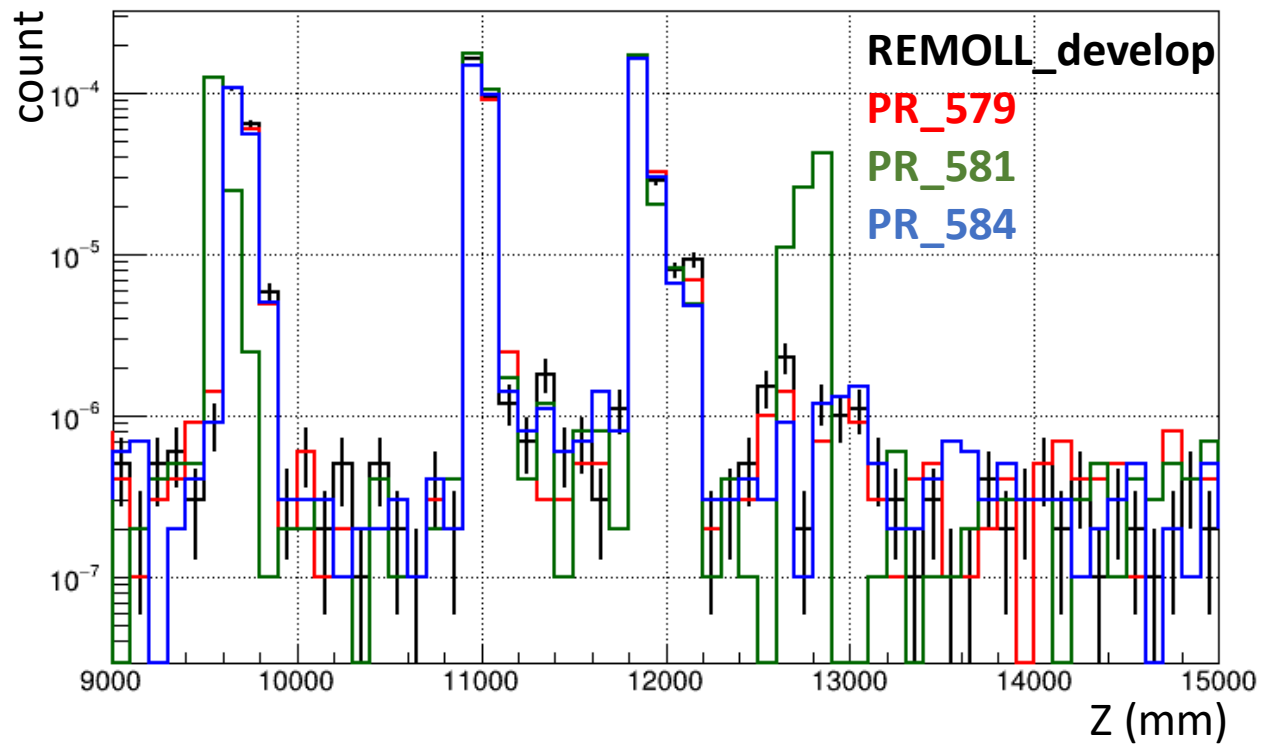
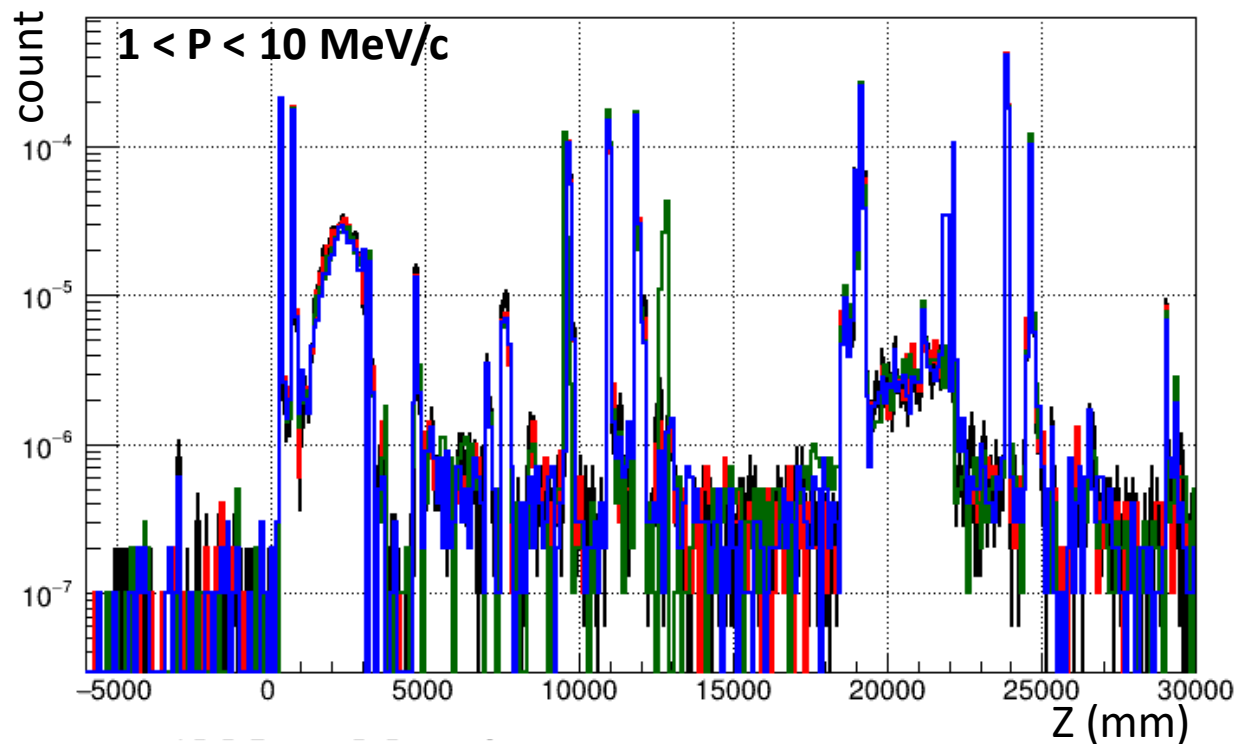
pr\_all\_all\_pgreater10MeV\_out\_vz rate-weighted vertex, Generator=beam



# Z-vertex distribution (All particles; Generator: Beam)

pr\_all\_all\_p1to10MeV\_out\_vz rate-weighted vertex, Generator=beam

pr\_all\_all\_p1to10MeV\_out\_vz rate-weighted vertex, Generator=beam

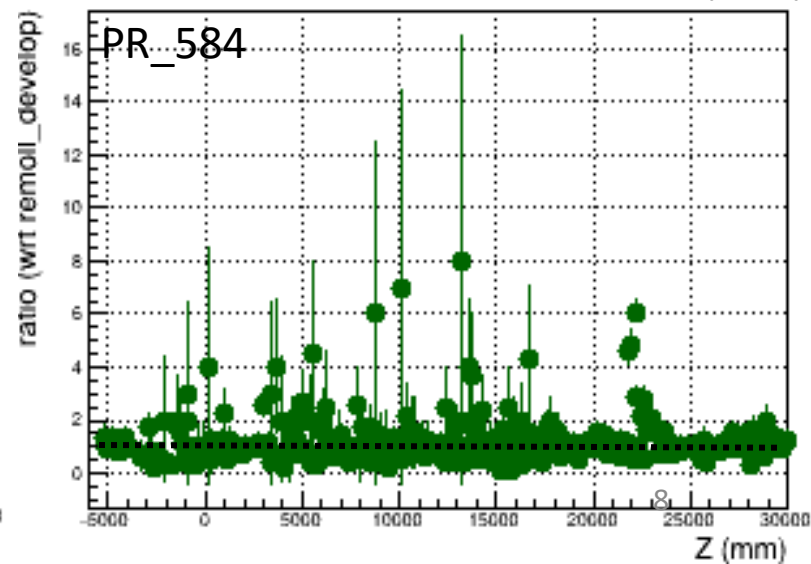
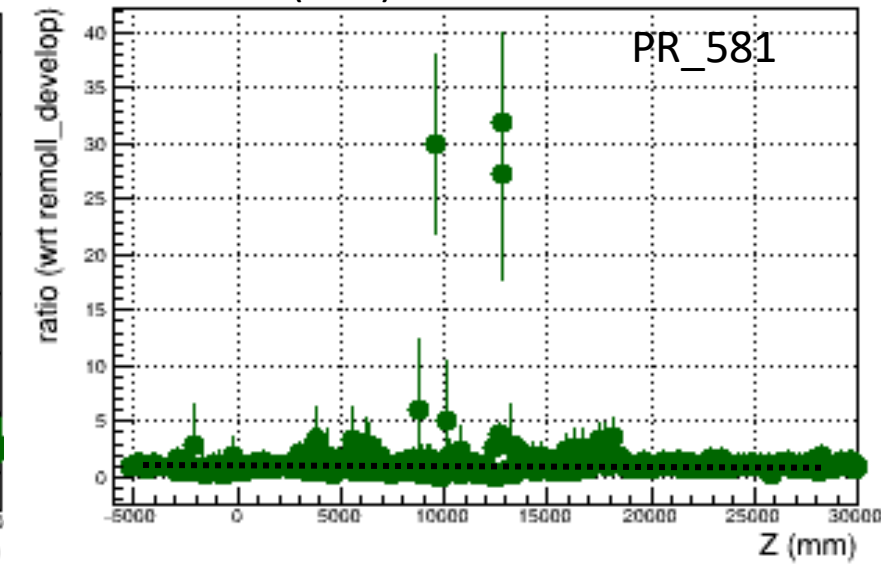
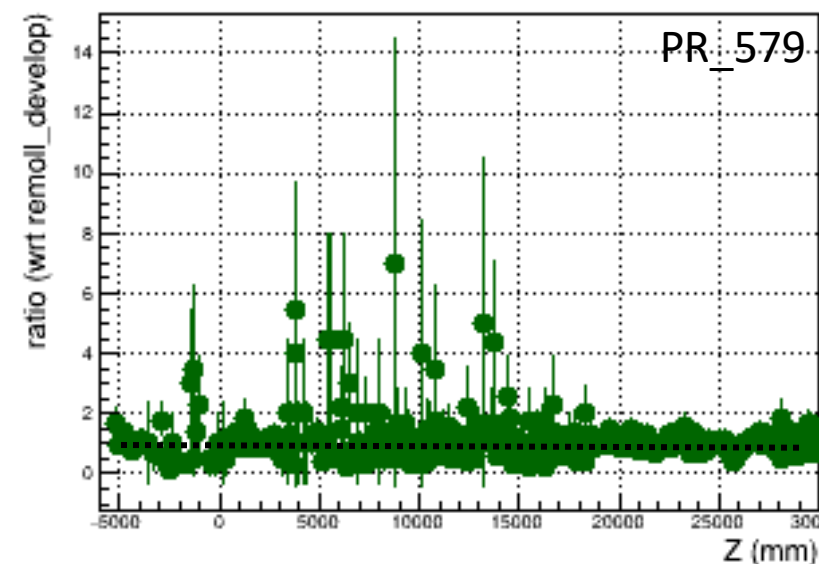
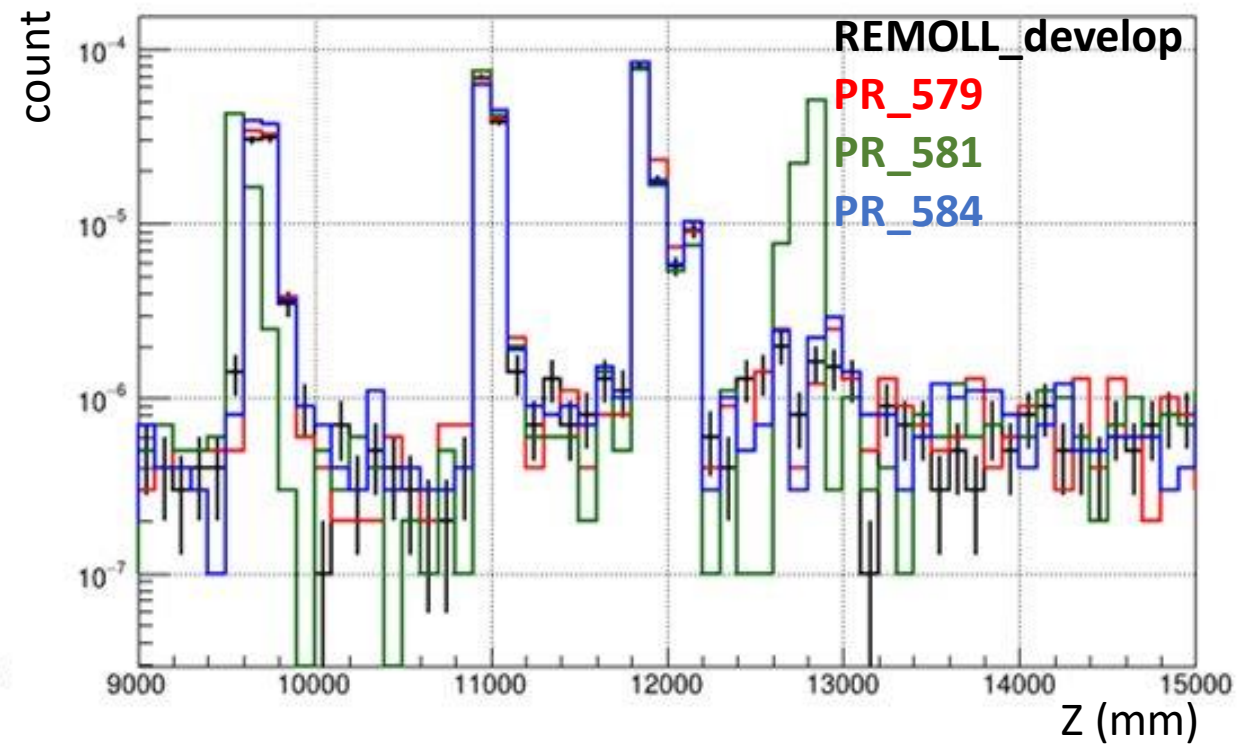
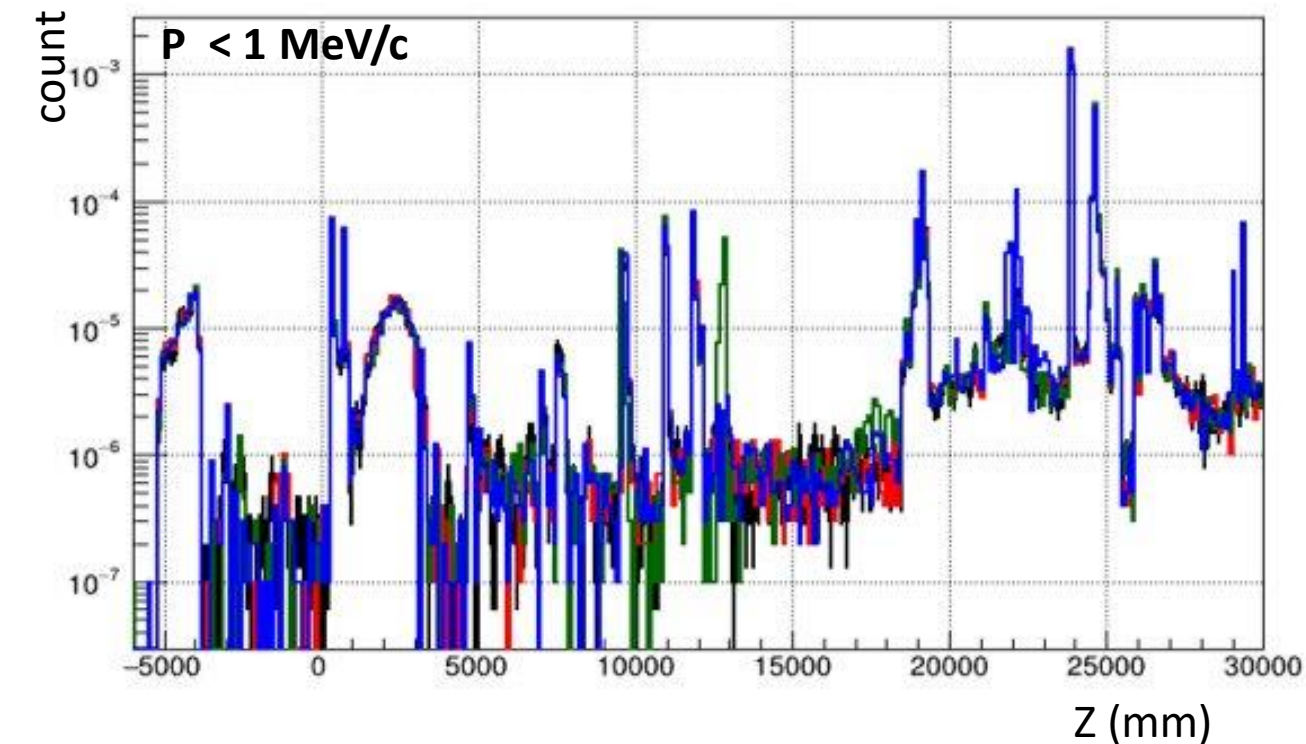




# Z-vertex distribution (All particles; Generator: Beam)

pr\_all\_all\_pless1MeV\_out\_vz rate-weighted vertex, Generator=beam

pr\_all\_all\_pless1MeV\_out\_vz rate-weighted vertex, Generator=beam

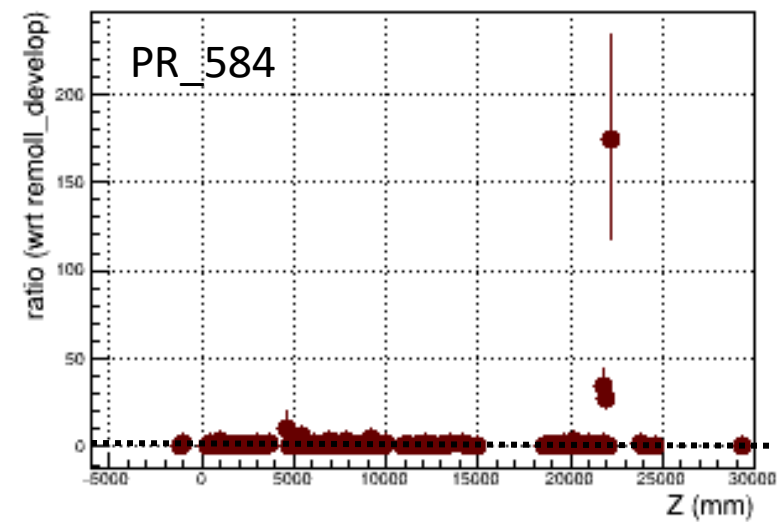
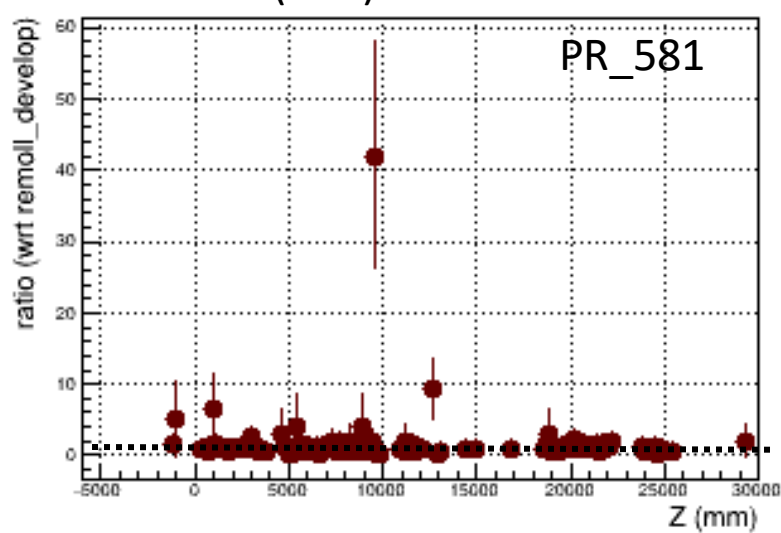
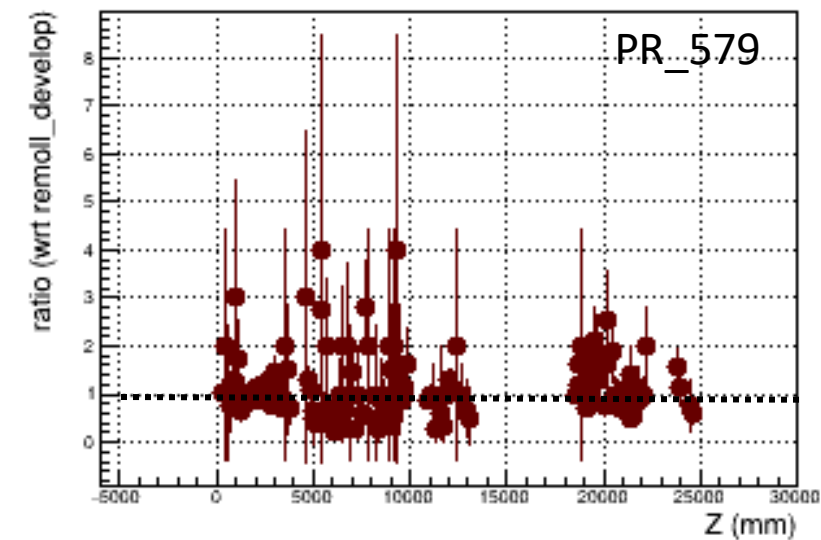
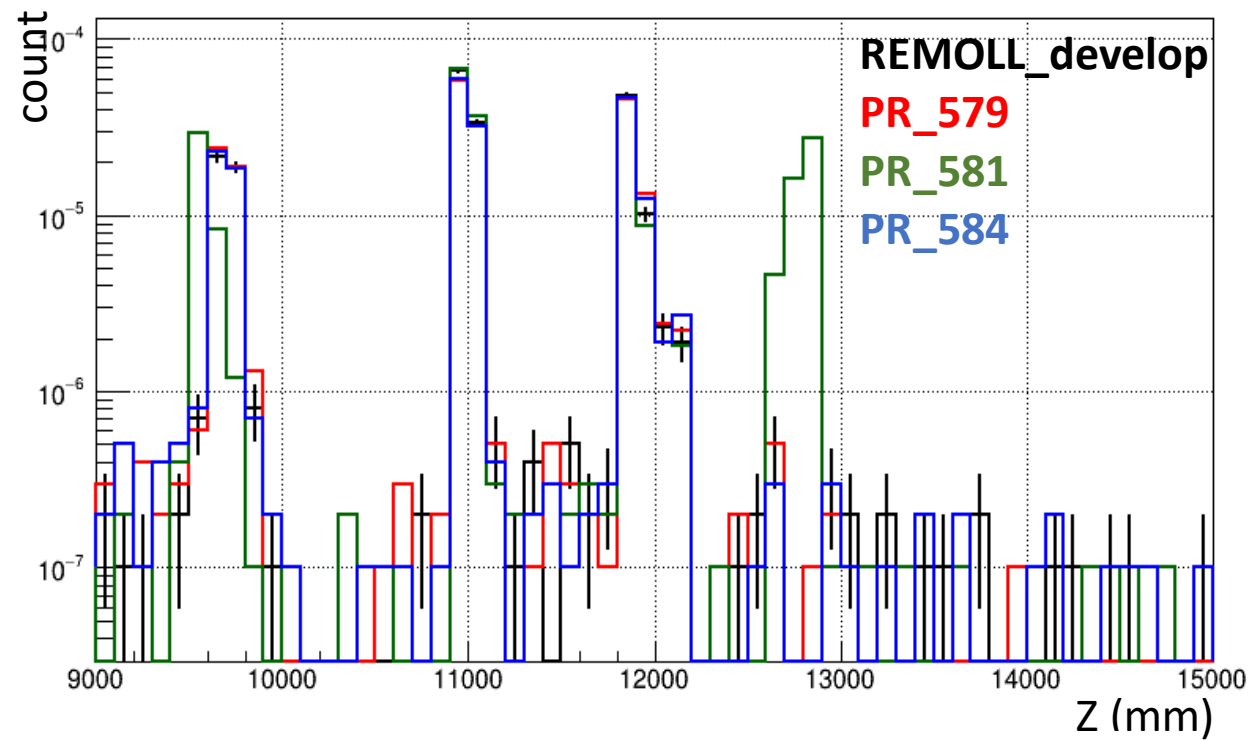
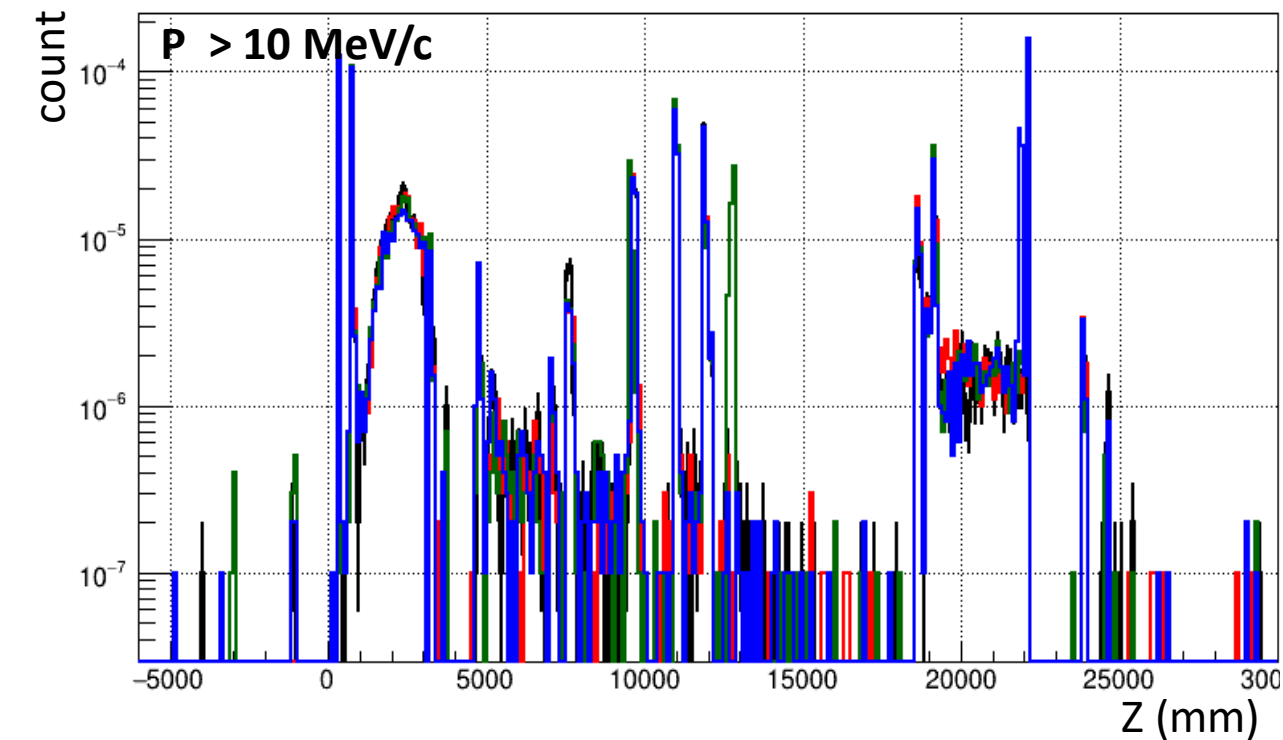




# Z-vertex distribution (Photons; Generator: Beam)

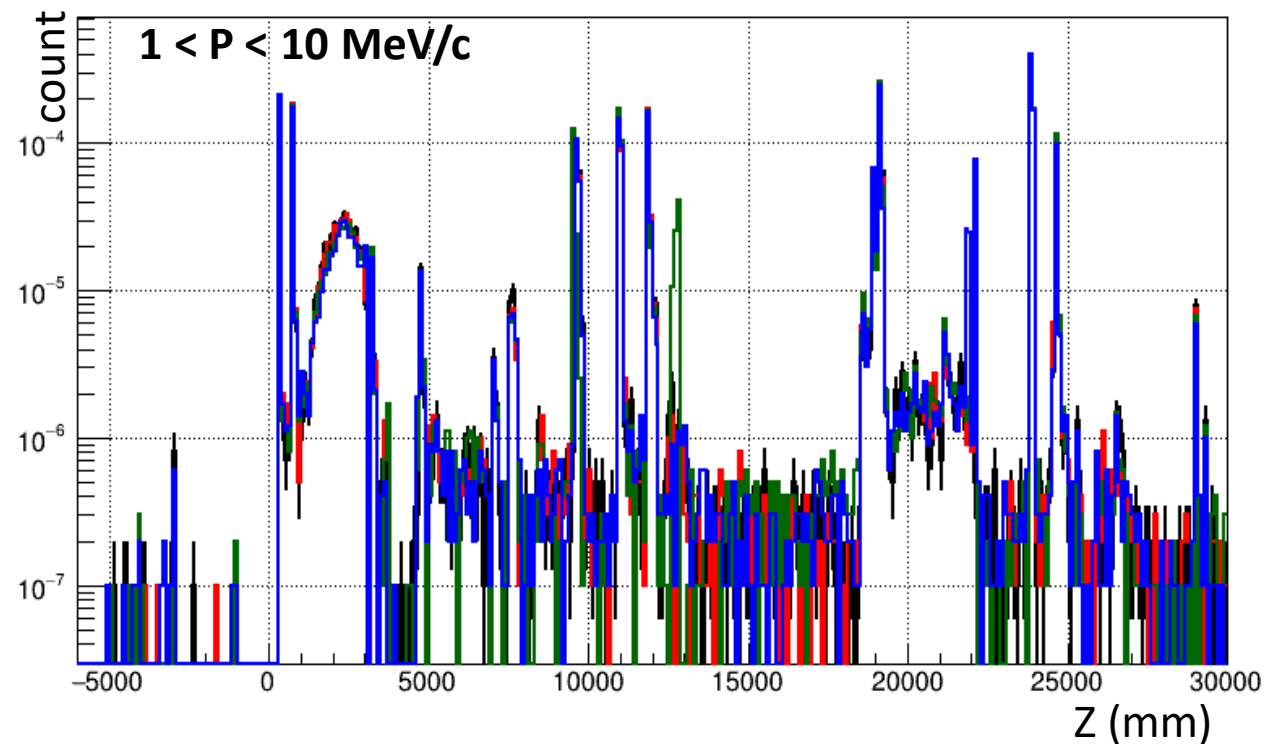
pr\_all\_photon\_pgreater10MeV\_out\_vz rate-weighted vertex, Generator=beam

pr\_all\_photon\_pgreater10MeV\_out\_vz rate-weighted vertex, Generator=beam

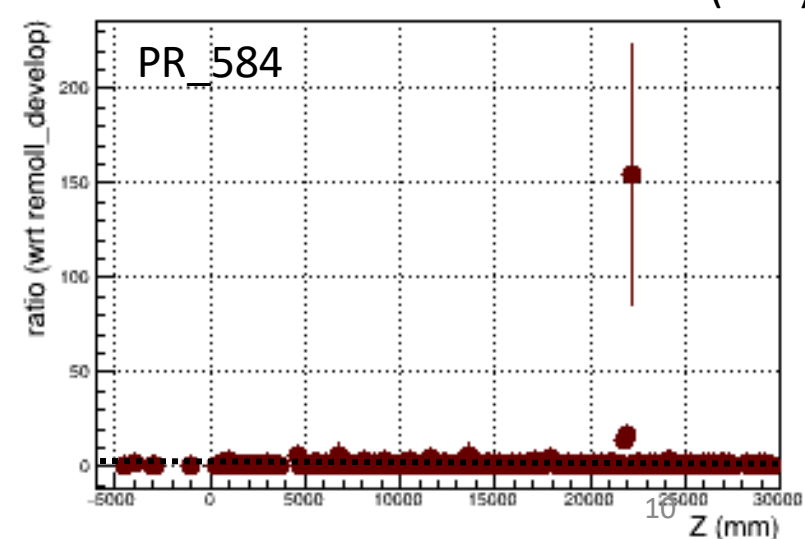
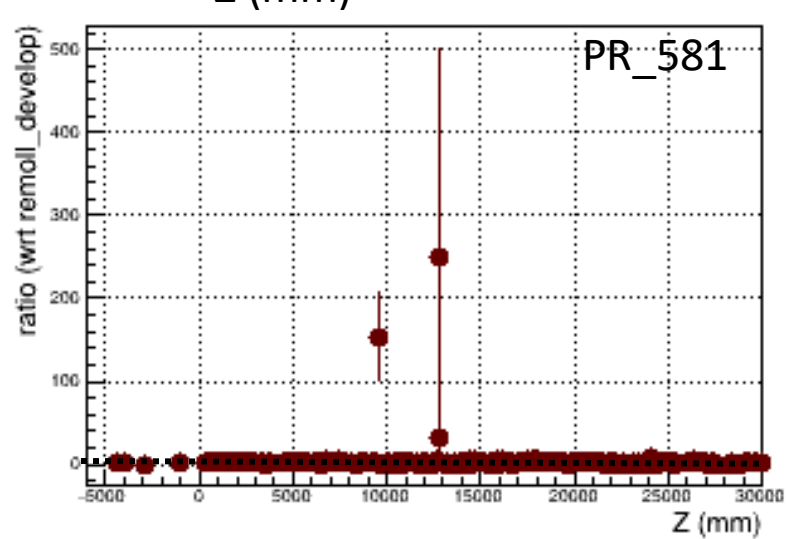
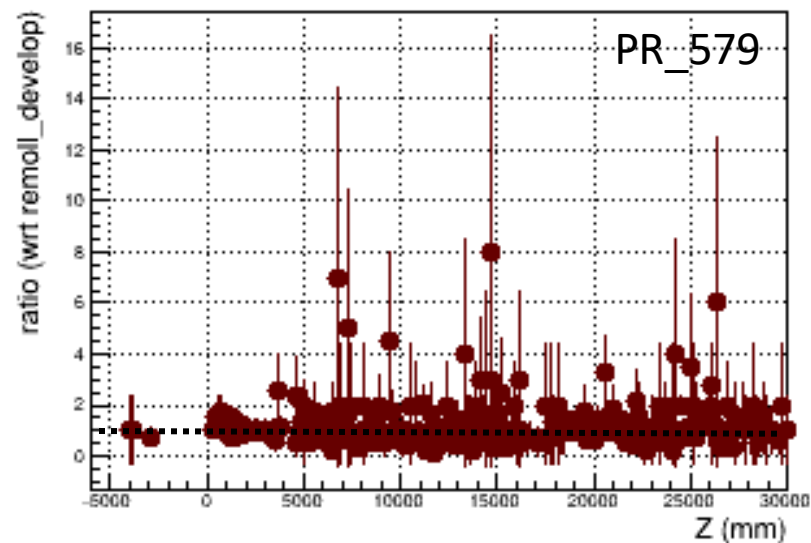
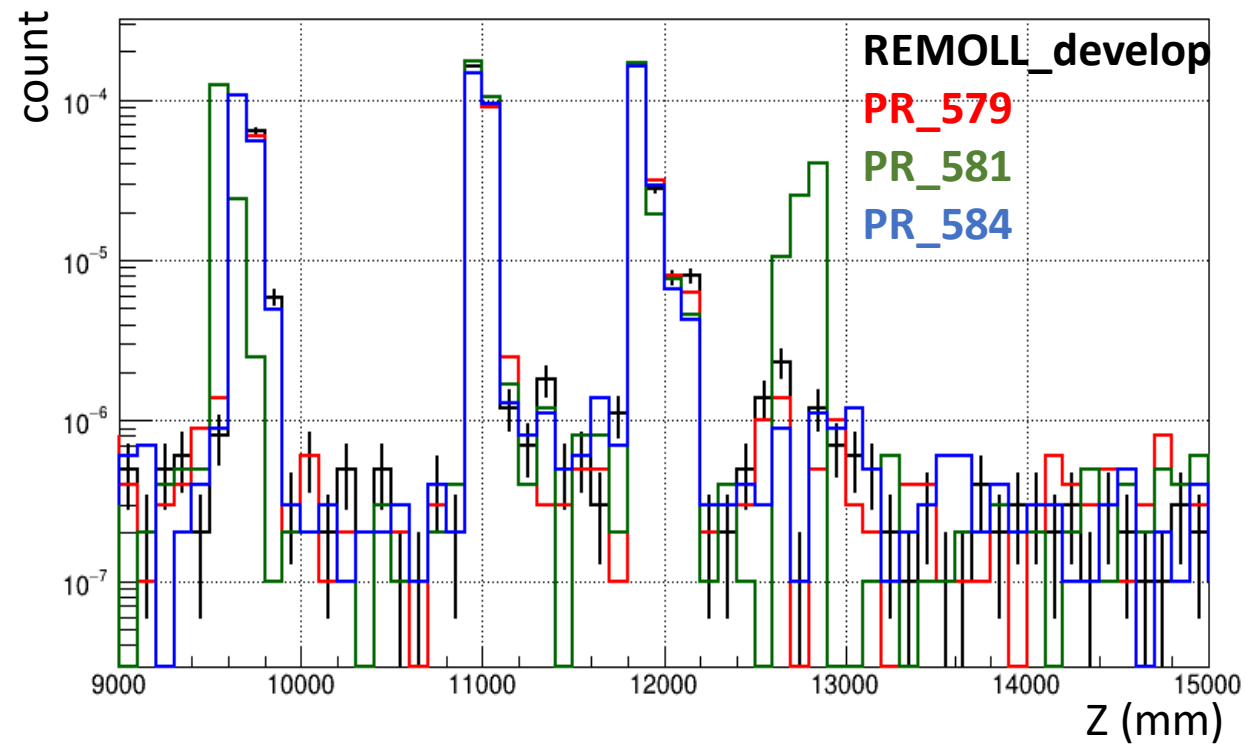


# Z-vertex distribution (Photons; Generator: Beam)

pr\_all\_photon\_p1to10MeV\_out\_vz rate-weighted vertex, Generator=beam



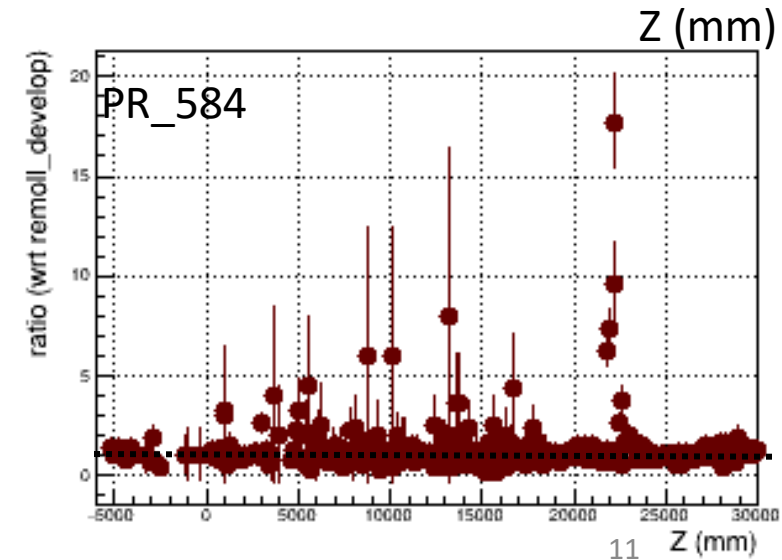
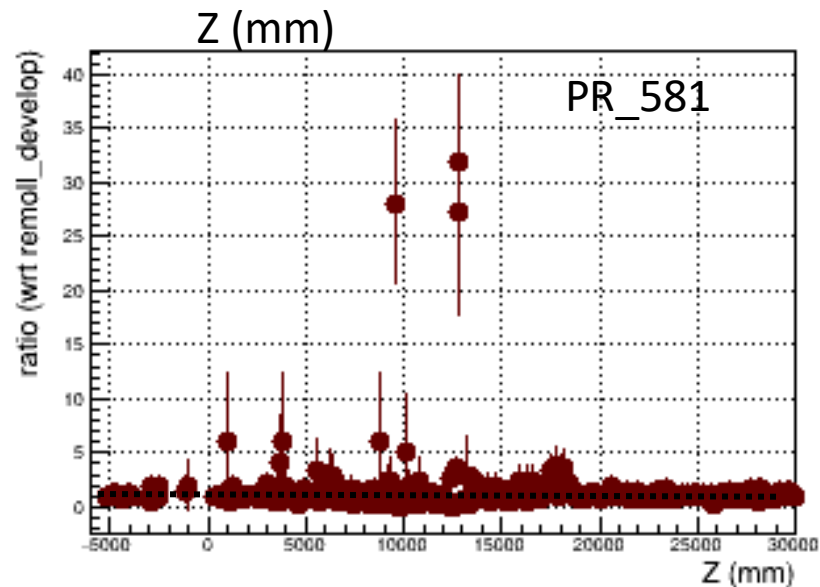
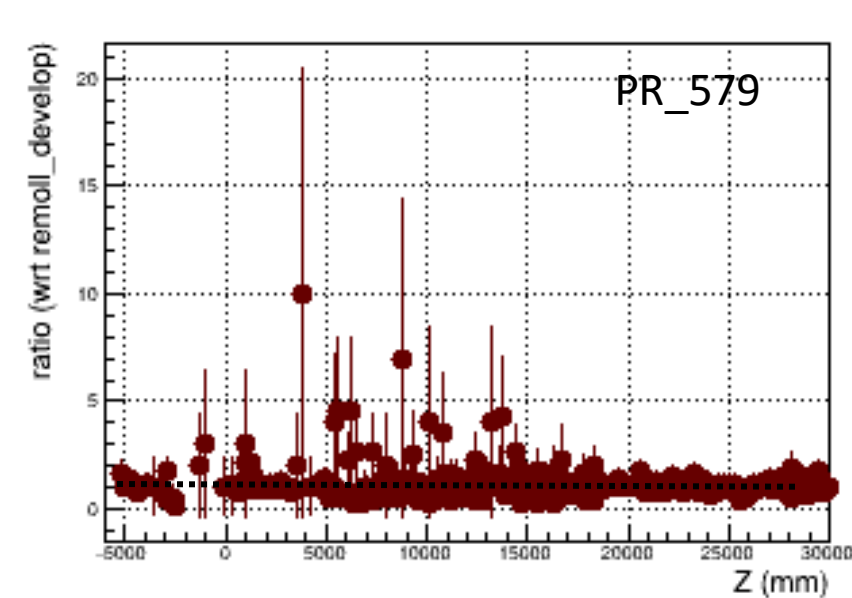
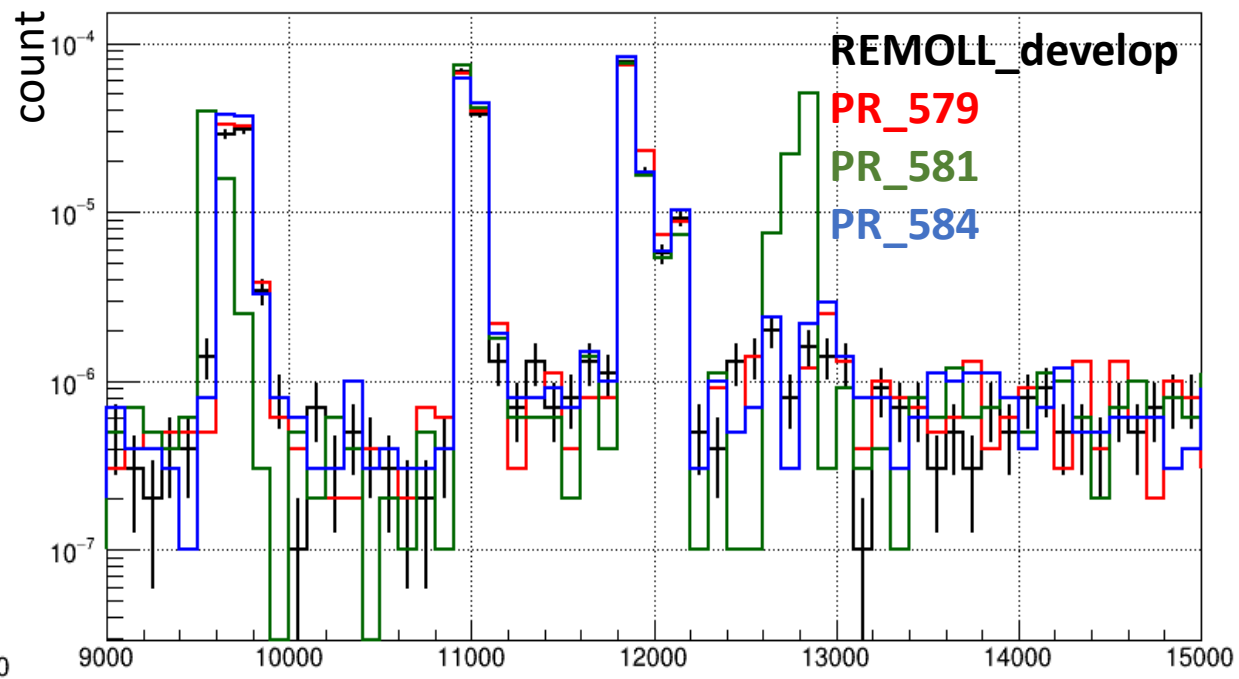
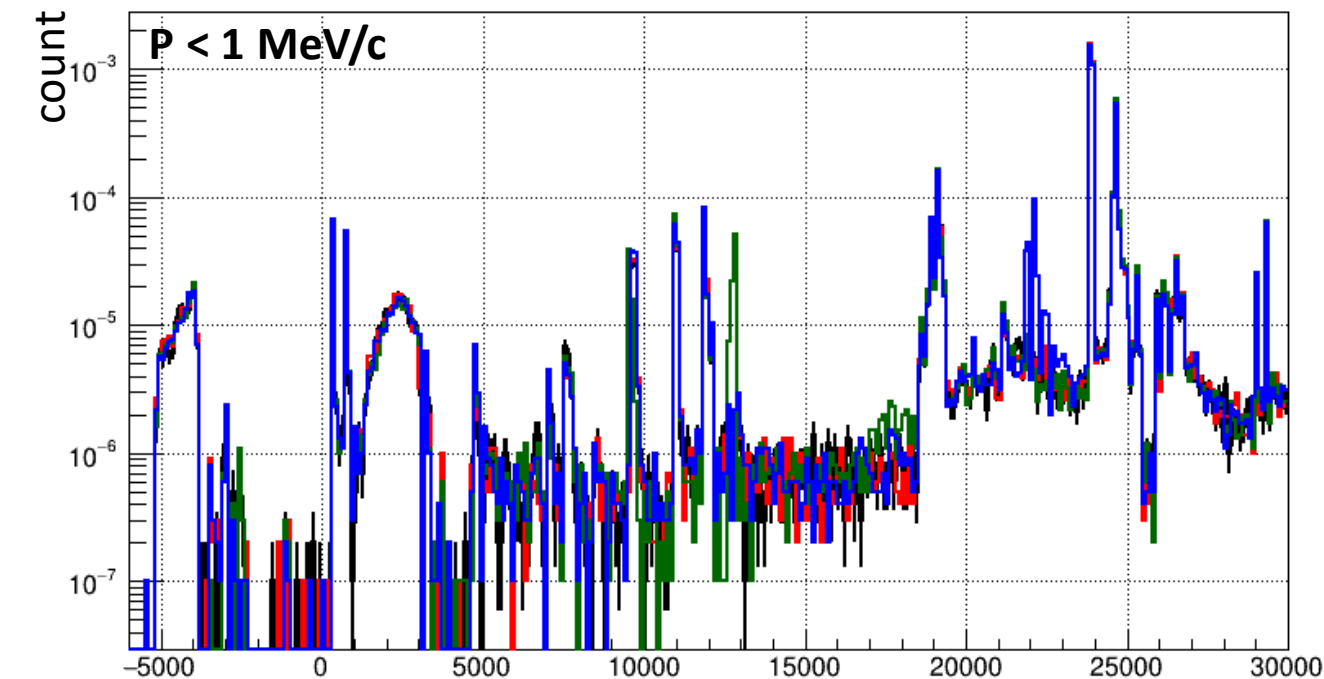
pr\_all\_photon\_p1to10MeV\_out\_vz rate-weighted vertex, Generator=beam



# Z-vertex distribution (Photons; Generator: Beam)

pr\_all\_photon\_pless1MeV\_out\_vz rate-weighted vertex, Generator=beam

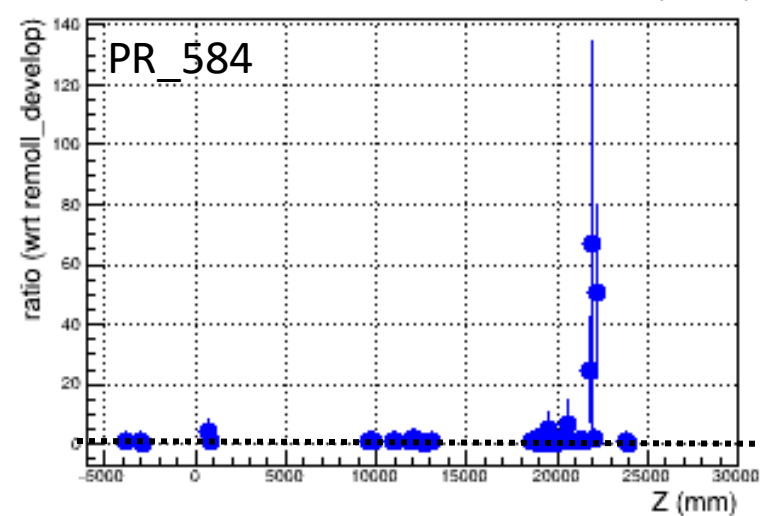
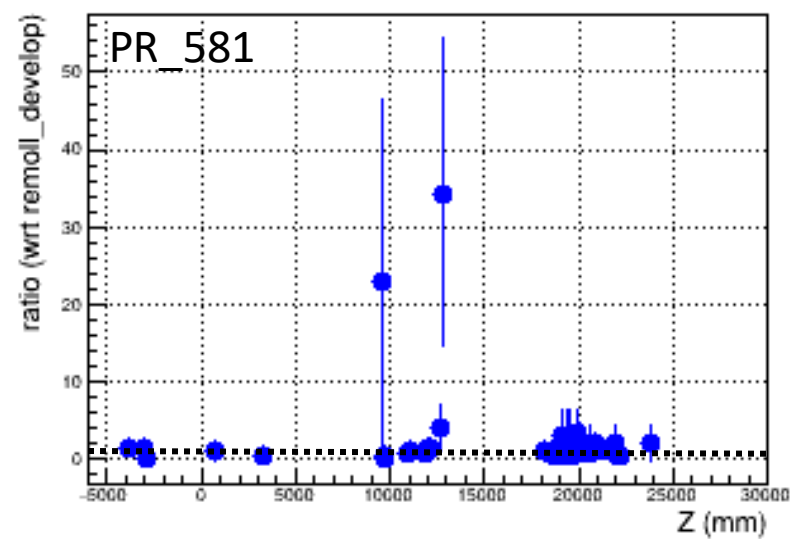
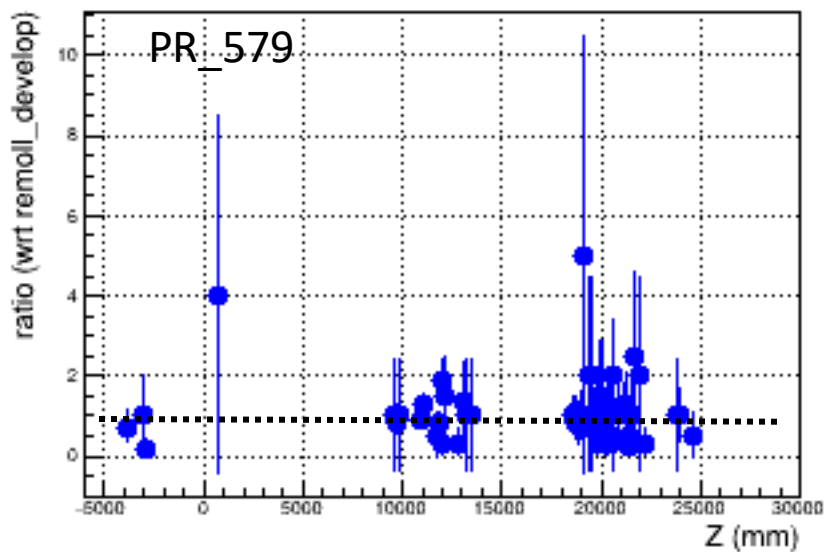
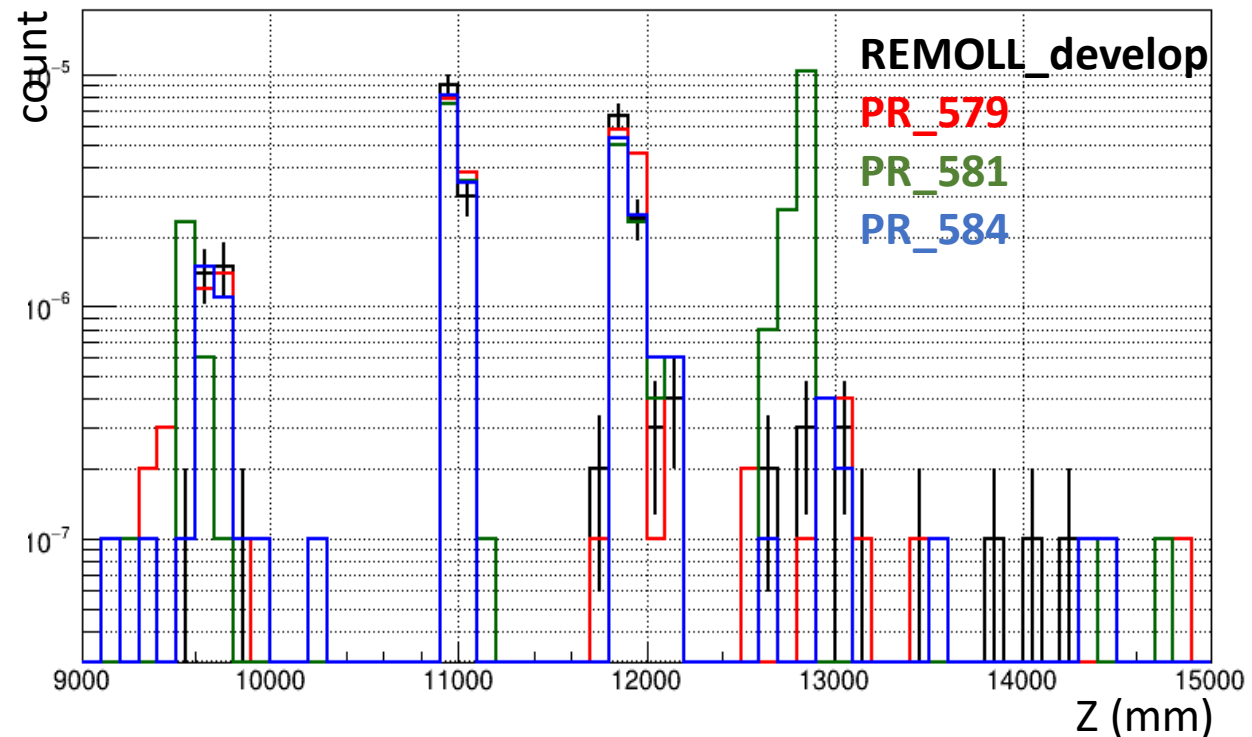
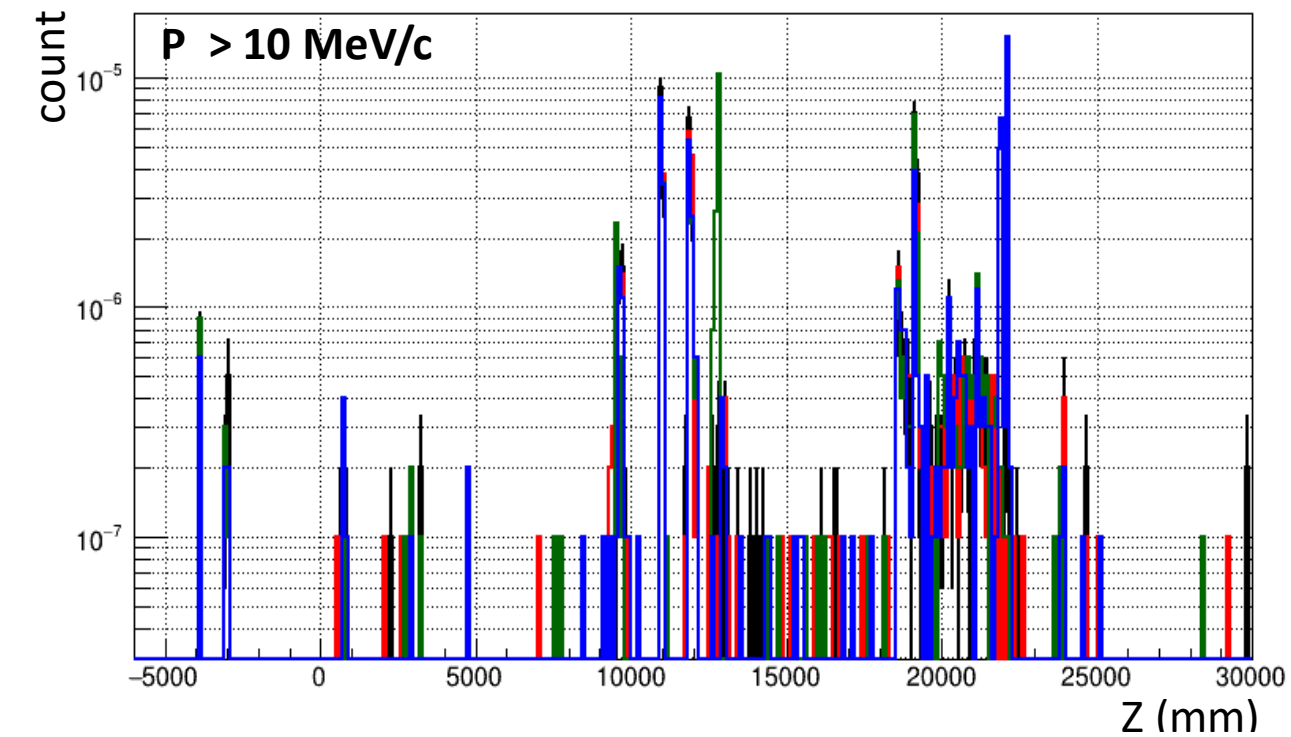
pr\_all\_photon\_pless1MeV\_out\_vz rate-weighted vertex, Generator=beam



# Z-vertex distribution (secondary electrons; Generator: Beam)

pr\_all\_secondary\_electron\_pgreater10MeV\_out\_vz rate-weighted vertex, Generator=beam

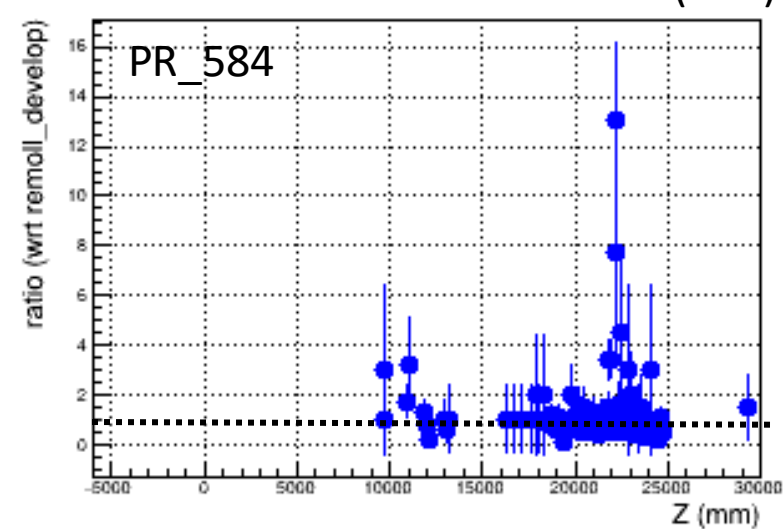
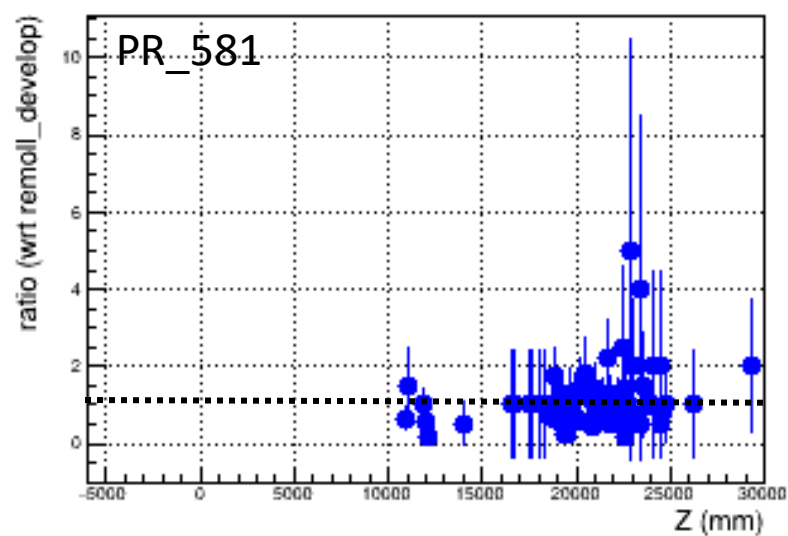
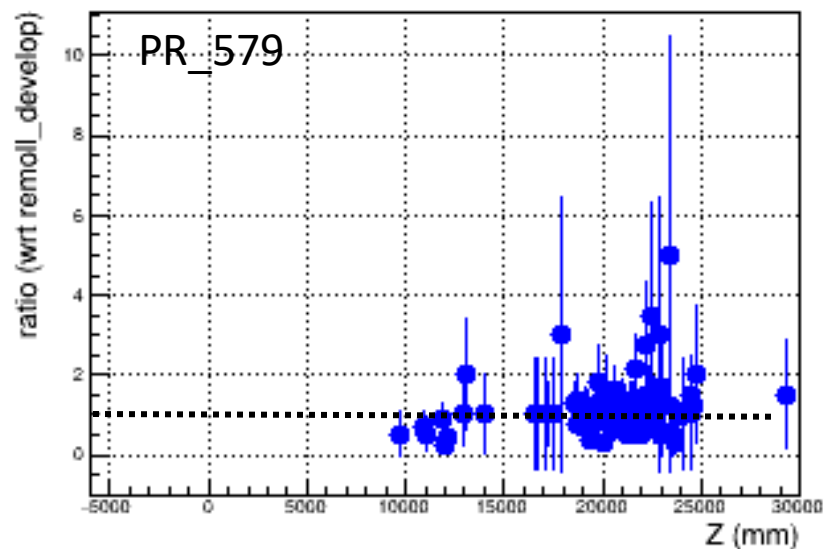
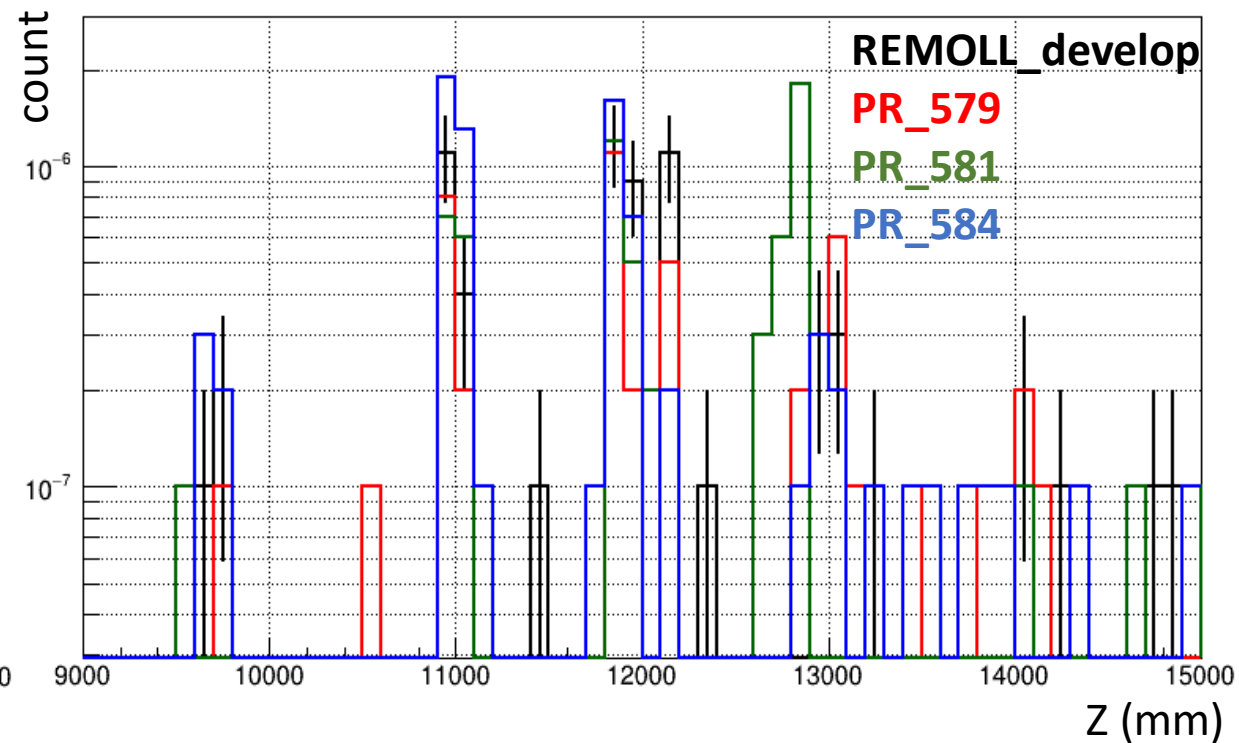
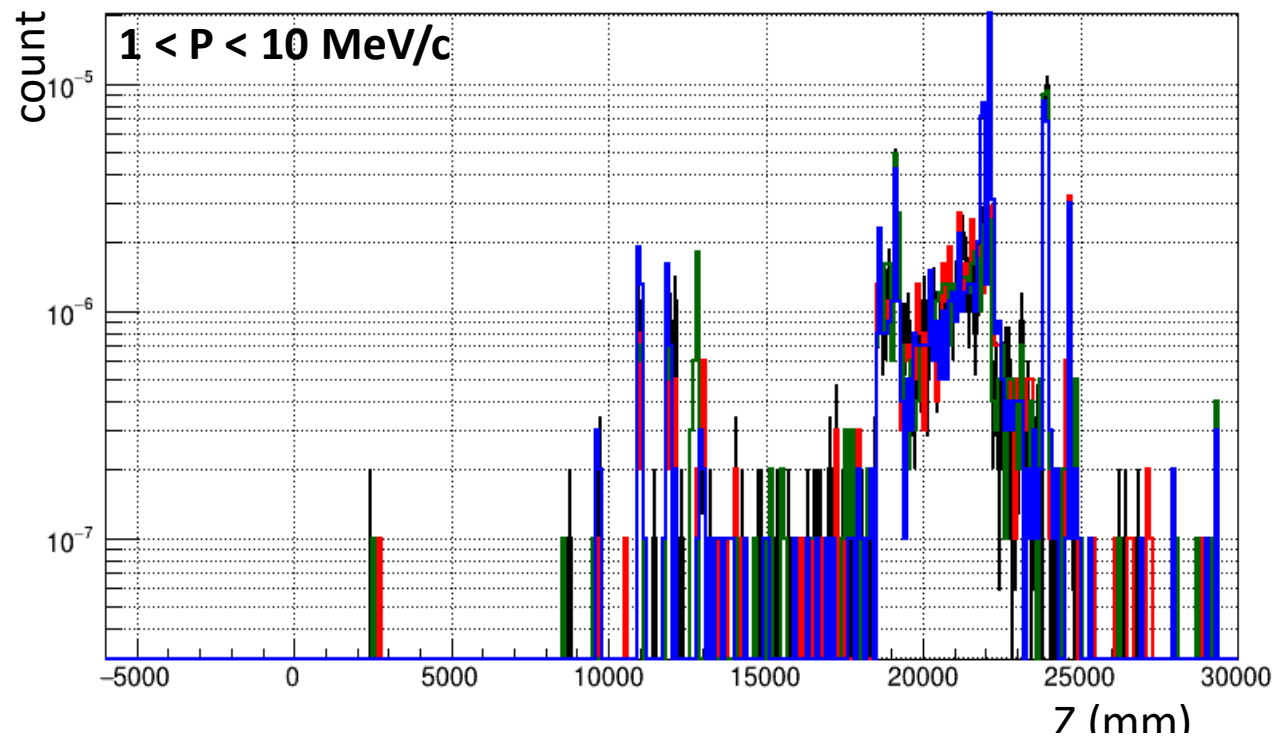
pr\_all\_secondary\_electron\_pgreater10MeV\_out\_vz rate-weighted vertex, Generator=beam



# Z-vertex distribution (secondary electrons; Generator: Beam)

pr\_all\_secondary\_electron\_p1to10MeV\_out\_vz rate-weighted vertex, Generator=beam

pr\_all\_secondary\_electron\_p1to10MeV\_out\_vz rate-weighted vertex, Generator=beam

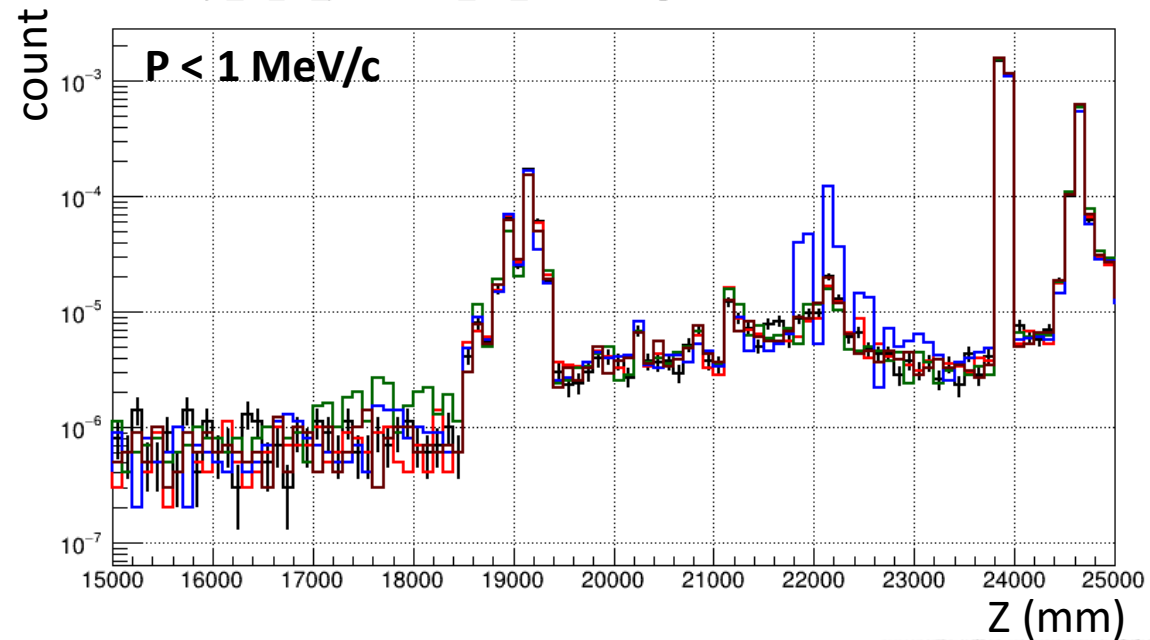




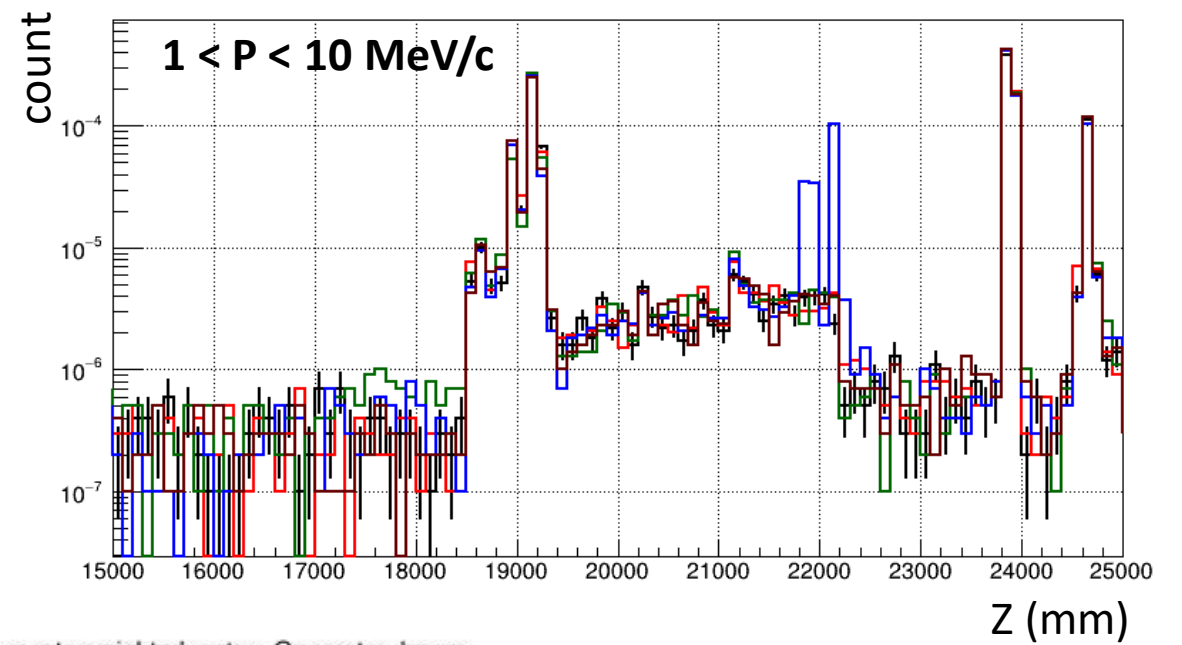
## **Z-vertex distribution for PR\_584 with and without QUARTZ tiles**

# Z-vertex distribution (All particles; Generator: Beam)

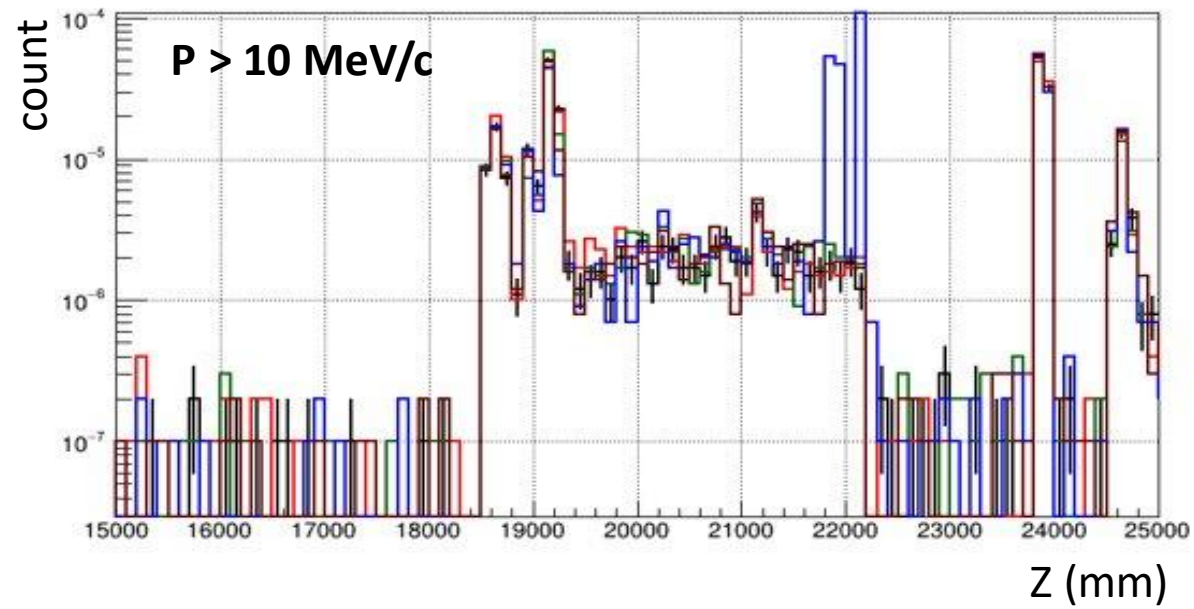
pr\_all\_all\_pless1MeV\_out\_vz rate-weighted vertex, Generator=beam



pr\_all\_all\_p1to10MeV\_out\_vz rate-weighted vertex, Generator=beam



pr\_all\_all\_pggreater10MeV\_out\_vz rate-weighted vertex, Generator=beam



REMOLL\_develop

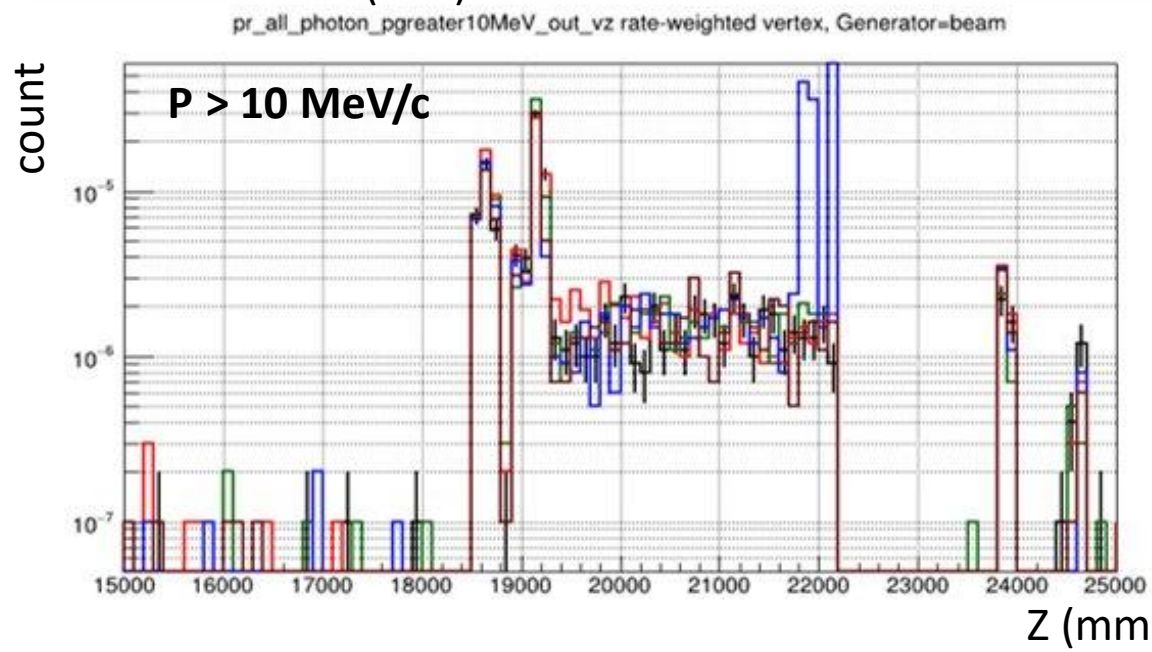
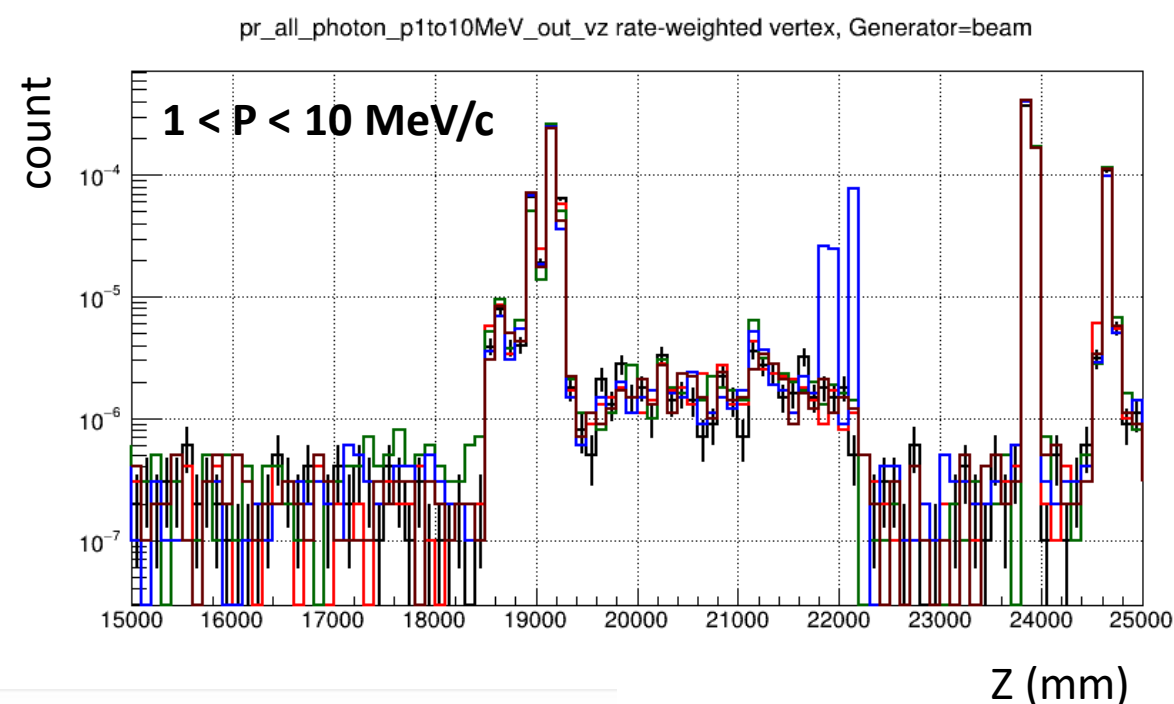
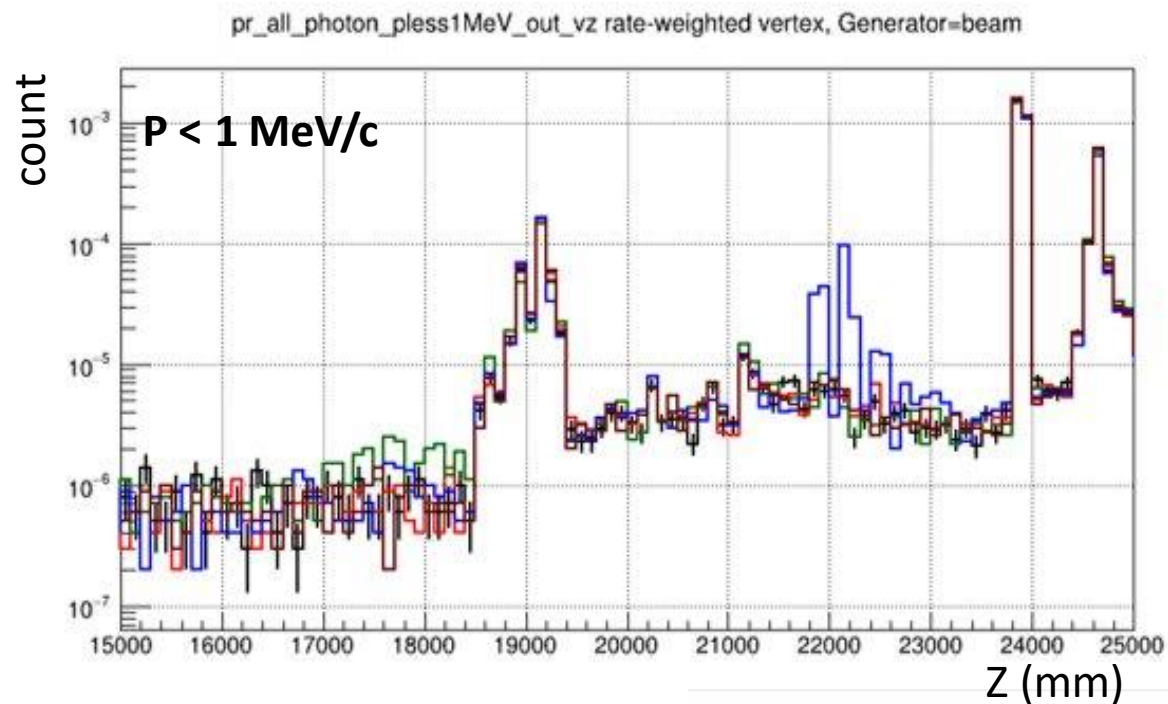
PR\_579

PR\_581

PR\_584

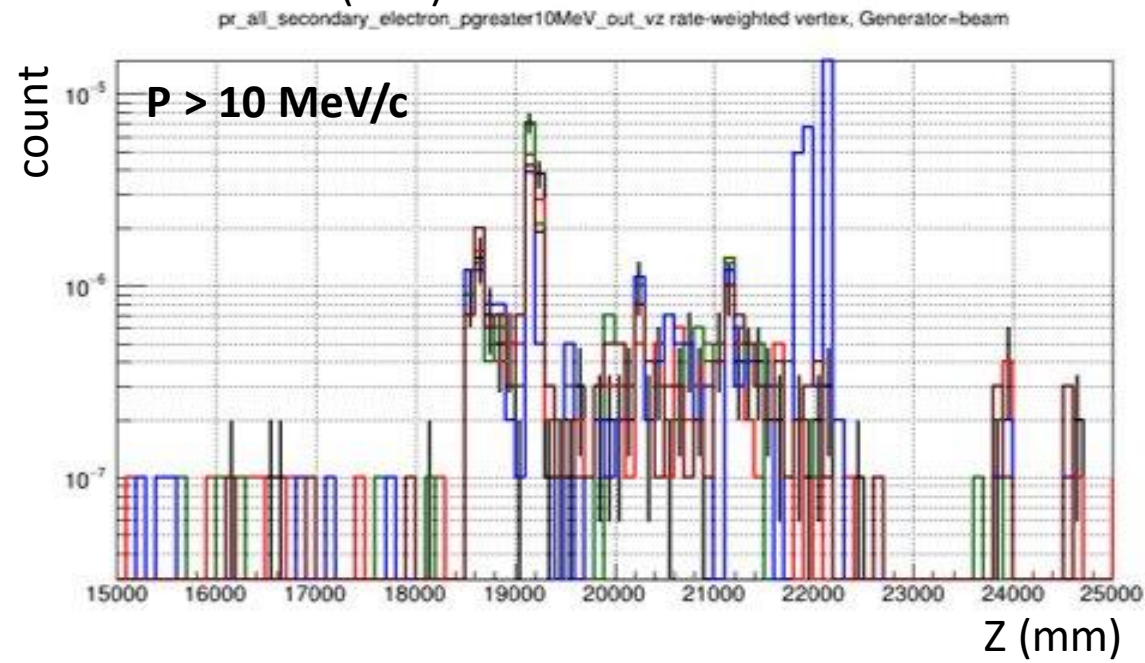
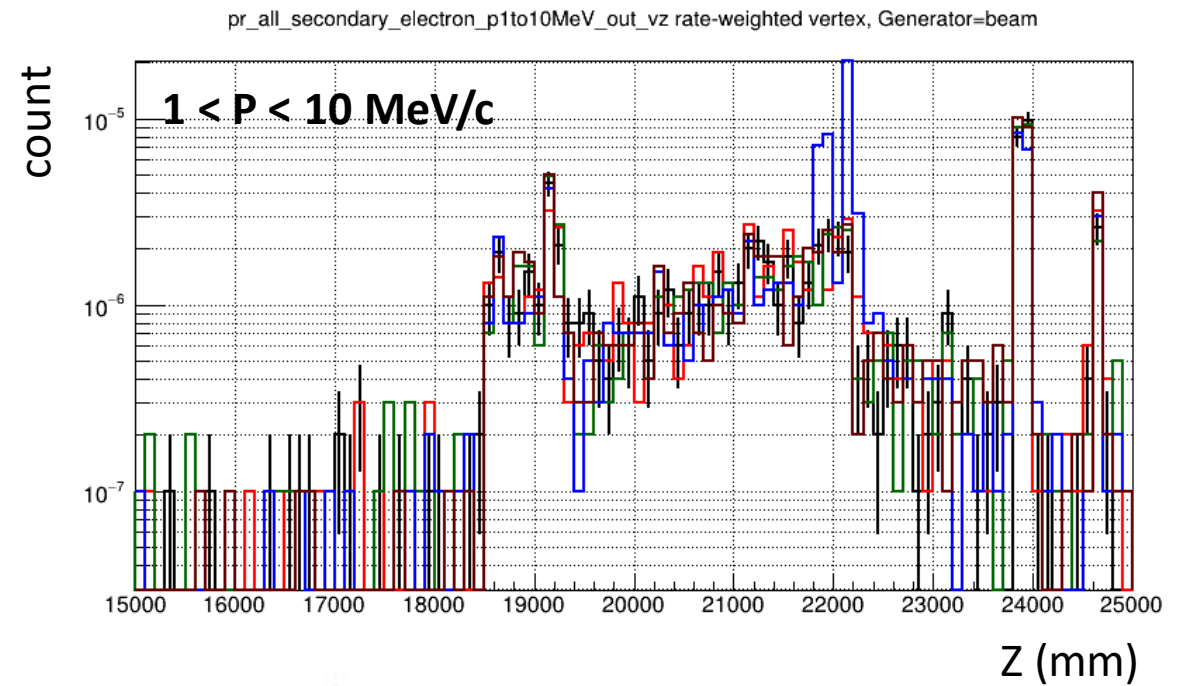
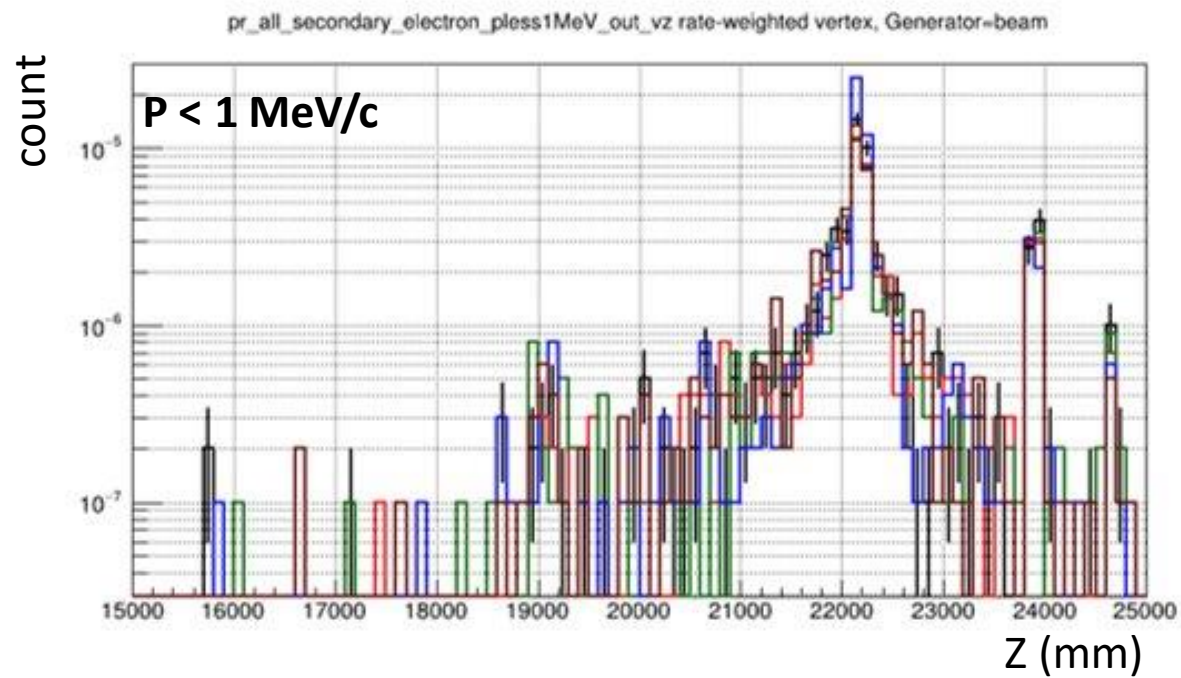
PR\_584\_wo\_tiles

# Z-vertex distribution (photons; Generator: Beam)



REMOLL\_develop  
PR\_579  
PR\_581  
PR\_584  
PR\_584\_wo\_tiles

# Z-vertex distribution (secondary electrons; Generator: Beam)



REMOLL\_develop

PR\_579

PR\_581

PR\_584

PR\_584\_wo\_tiles

# **Deconvolution analysis summary**



# Deconvolution analysis summary (primary)

## Measured asymmetry in ppb

R	S	A measured [ppb]	A measured [ppb]	A measured [ppb]	A measured [ppb]
0	0	-195.315	-615.533	-262.664	-143.314
0	1	-170.275	-85.4106	-67.0433	-182.924
0	2	-8.39957	-2.13386	-1.72265	-2.34048
1	0	-532.058	-509.855	-526.688	-539.656
1	1	-348.591	-351.605	-344.697	-353.642
1	2	-86.7467	-86.6614	-86.8664	-85.518
2	0	-498.144	-544.686	-504.439	-503.457
2	1	-220.682	-222.896	-223.091	-227.729
2	2	-109.589	-110.24	-111.48	-109.615
3	0	-247.084	-236.035	-252.721	-252.972
3	1	-158.777	-160.72	-154.556	-158.74
3	2	-54.6404	-53.1635	-54.0587	-53.6599
4	0	-31.0771	-31.1277	-31.1225	-31.0898
4	1	-35.1114	-35.1053	-35.1022	-35.2768
4	2	-35.8554	-35.8331	-35.9992	-35.874
5	0	-29.509	-30.6749	-29.9482	-30.4282
5	1	-28.6645	-28.3913	-28.4994	-28.5266
5	2	-26.5449	-26.4787	-26.5206	-26.1222
		Develop (primaries)	PR_579 (primaries)	PR_581 (primaries)	PR_584 (primaries)

# Deconvolution analysis summary (primary+secondary)

## Measured asymmetry in ppb

R	S	A measured [ppb]	A measured [ppb]	A measured [ppb]	A measured [ppb]
0	0	-36.0848	-45.2333	-39.7085	-36.8348
0	1	-40.7606	-33.1745	-33.2682	-33.9657
0	2	-29.9472	-27.5065	-26.7455	-25.071
1	0	-303.479	-279.207	-295.508	-315.34
1	1	-292.478	-297.228	-291.107	-302.25
1	2	-85.4556	-85.4339	-85.6885	-84.2339
2	0	-272.214	-283.492	-268.152	-286.08
2	1	-197.405	-200.033	-198.063	-204.93
2	2	-106.442	-107.42	-108.752	-106.817
3	0	-123.152	-119.137	-122.032	-121.894
3	1	-114.176	-115.028	-109.655	-111.877
3	2	-53.3431	-51.6743	-52.5071	-51.9099
4	0	-31.3407	-31.1423	-31.1606	-31.2272
4	1	-35.0184	-34.9301	-34.9428	-34.9695
4	2	-35.7511	-35.7468	-35.8356	-35.6056
5	0	-30.4501	-28.1894	-30.8025	-31.0982
5	1	-29.1037	-28.8352	-28.9047	-28.6692
5	2	-26.9334	-26.7452	-26.8559	-26.3002
		Develop (primary+secondary)	PR_579 (primary+secondary)	PR_581 (primary+secondary)	PR_584 (primary+secondary)

# Deconvolution analysis summary (primary)

## Total rate

R	S	Total rate	Total rate	Total rate	Total rate
0	0	2.87E+06	706670	3.30E+06	2.50E+06
0	1	6.75E+06	8.99E+06	1.49E+07	3.72E+06
0	2	6.35E+07	6.23E+07	7.54E+07	7.18E+07
1	0	3.91E+08	3.91E+08	3.91E+08	3.81E+08
1	1	3.64E+09	3.57E+09	3.61E+09	3.48E+09
1	2	1.61E+10	1.62E+10	1.63E+10	1.61E+10
2	0	4.14E+08	3.75E+08	4.11E+08	4.21E+08
2	1	5.79E+09	5.76E+09	5.75E+09	5.74E+09
2	2	1.07E+10	1.09E+10	1.08E+10	1.10E+10
3	0	6.19E+08	6.36E+08	6.11E+08	6.33E+08
3	1	3.34E+09	3.27E+09	3.35E+09	3.32E+09
3	2	1.32E+10	1.33E+10	1.32E+10	1.32E+10
4	0	2.43E+10	2.43E+10	2.43E+10	2.42E+10
4	1	5.11E+10	5.10E+10	5.11E+10	5.10E+10
4	2	6.02E+10	6.02E+10	6.02E+10	6.01E+10
5	0	2.48E+09	2.51E+09	2.48E+09	2.42E+09
5	1	1.27E+10	1.28E+10	1.26E+10	1.27E+10
5	2	1.42E+10	1.41E+10	1.42E+10	1.42E+10
		Develop (primaries)	PR_579 (primaries)	PR_581 (primaries)	PR_584 (primaries)

# Deconvolution analysis summary (primary+secondary)

## Total rate

R	S	Total rate	Total rate	Total rate	Total rate
0	0	1.65E+08	1.53E+08	1.66E+08	1.48E+08
0	1	3.32E+08	3.63E+08	3.68E+08	3.07E+08
0	2	2.31E+08	2.61E+08	2.56E+08	2.37E+08
1	0	7.28E+08	7.58E+08	7.42E+08	6.91E+08
1	1	4.42E+09	4.32E+09	4.37E+09	4.16E+09
1	2	1.66E+10	1.66E+10	1.67E+10	1.65E+10
2	0	8.11E+08	7.69E+08	8.31E+08	7.87E+08
2	1	6.63E+09	6.58E+09	6.63E+09	6.52E+09
2	2	1.11E+10	1.14E+10	1.13E+10	1.15E+10
3	0	1.49E+09	1.51E+09	1.52E+09	1.55E+09
3	1	5.23E+09	5.12E+09	5.32E+09	5.28E+09
3	2	1.43E+10	1.43E+10	1.43E+10	1.45E+10
4	0	2.55E+10	2.56E+10	2.55E+10	2.76E+10
4	1	5.37E+10	5.36E+10	5.38E+10	5.82E+10
4	2	6.17E+10	6.17E+10	6.18E+10	6.77E+10
5	0	3.29E+09	3.67E+09	3.33E+09	3.67E+09
5	1	1.47E+10	1.47E+10	1.45E+10	1.68E+10
5	2	1.52E+10	1.52E+10	1.53E+10	1.76E+10
		Develop (primary+secondary)	PR_579 (primary+secondary)	PR_581 (primary+secondary)	PR_584 (primary+secondary)

# Backup



# Deconvolution analysis summary (primary)

REMOLL version	Name	Overall Asymmetry	Uncert [ppb]	Relative_uncer [ppb]
develop	moller	-34.9516	0.6974	-0.02
	epElastic	-29.4638	1.6685	-0.0566
	epInelasticW1	-505.6043	71.8656	-0.1421
	epInelasticW2	-504.0259	36.6481	-0.0727
	epInelasticW3	-441.204	71.6735	-0.1624
PR_579	moller	-34.9582	0.6964	-0.0199
	epElastic	-29.8153	1.5936	-0.0534
	epInelasticW1	-507.6467	67.8588	-0.1337
	epInelasticW2	-500.2045	35.0691	-0.0701
	epInelasticW3	-438.6046	72.4066	-0.1651
PR_581	moller	-34.9433	0.6956	-0.0199
	epElastic	-29.9681	1.6301	-0.0544
	epInelasticW1	-499.5619	69.1947	-0.1385
	epInelasticW2	-532.5514	36.6626	-0.0688
	epInelasticW3	-445.053	69.3921	-0.1559
PR_584 (includes 579 & 581)	moller	-34.9738	0.6958	-0.0199
	epElastic	-28.9905	1.3265	-0.0458
	epInelasticW1	-469.5039	54.4726	-0.1096
	epInelasticW2	-534.2601	38.6965	-0.0724
	epInelasticW3	-441.4811	71.8965	-0.1629

# Deconvolution analysis summary (primary+secondary)

REMOLL version	Name	Overall Asymmetry	Uncert [ppb]	Relative_uncer [ppb]
develop	moller	-34.8024	0.7024	-0.0202
	epElastic	-29.3726	1.9057	-0.0649
	epInelasticW1	-533.3223	93.0372	-0.1744
	epInelasticW2	-525.8179	47.6535	-0.0906
	epInelasticW3	-442.3088	97.4269	-0.2203
PR_579	moller	-34.8261	0.7015	-0.0201
	epElastic	-29.4873	1.6395	-0.0556
	epInelasticW1	-546.3624	78.7975	-0.1442
	epInelasticW2	-519.3174	42.9004	-0.0826
	epInelasticW3	-439.1995	93.686	-0.2133
PR_581	moller	-34.7931	0.7006	-0.0201
	epElastic	-29.4764	1.7439	-0.0592
	epInelasticW1	-523.153	83.5513	-0.1597
	epInelasticW2	-549.4868	46.2278	-0.0841
	epInelasticW3	-444.7298	93.3069	-0.2098
PR_584 (includes 579 & 581)	moller	-34.8203	0.6738	-0.0194
	epElastic	-28.2636	1.3913	-0.0492
	epInelasticW1	-490.6256	60.2303	-0.1228
	epInelasticW2	-555.5897	46.1106	-0.083
	epInelasticW3	-443.0935	94.2091	-0.2126