Beam pipe in SPD

Artem Ivanov
JINR, Dubna

Physics Weekly Meeting
24.05.2022

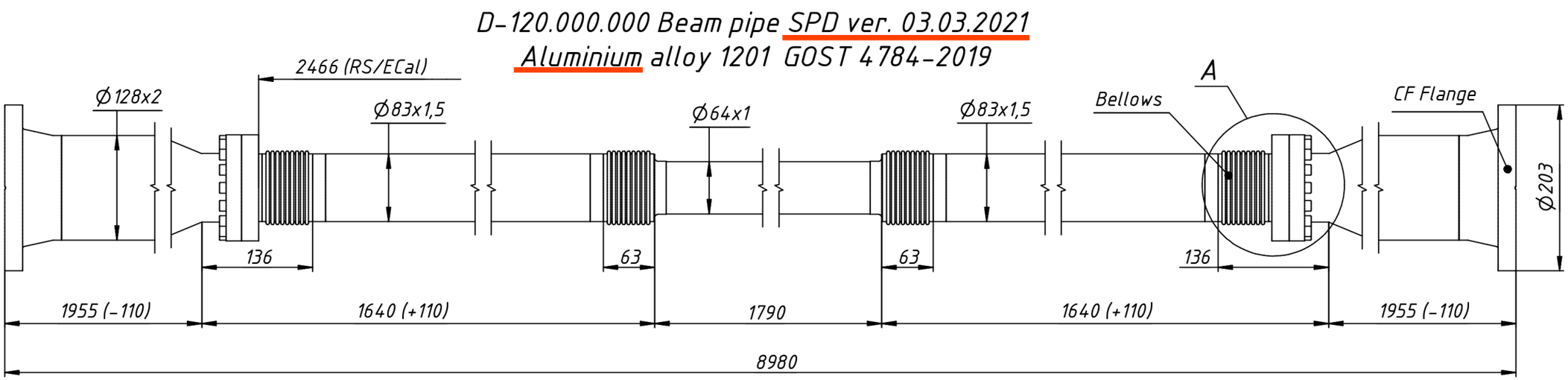
The purpose of the study

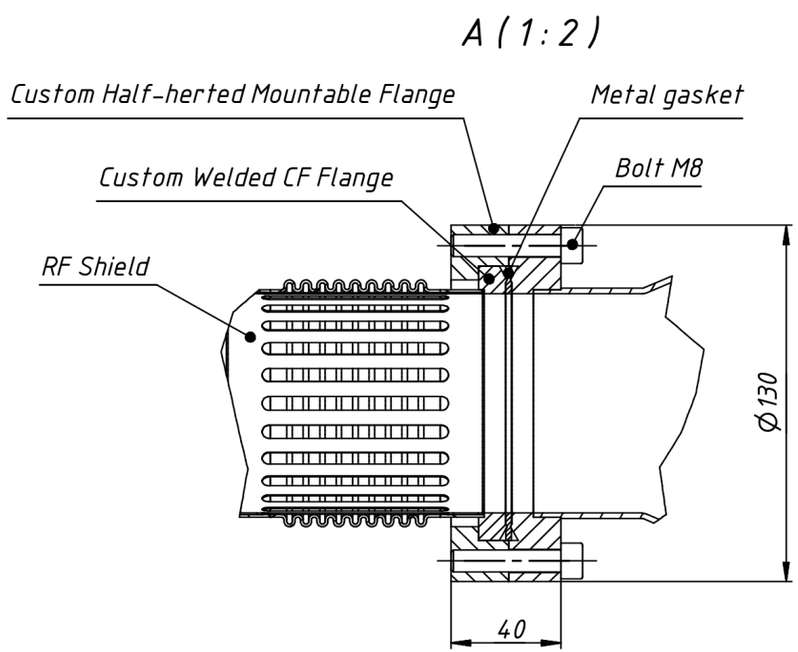
1) To modify geometry of the beam pipe in SpdRoot based on latest design of its

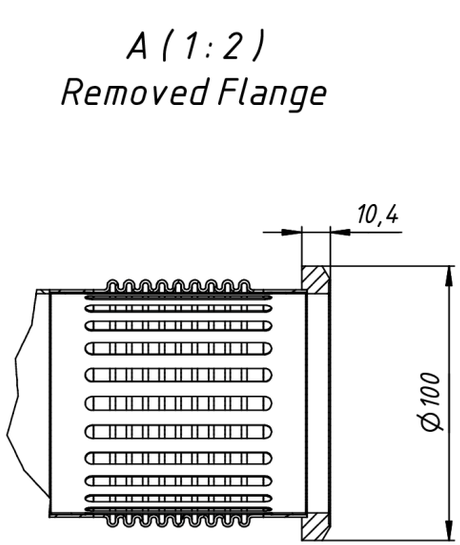
2) To find out the number of secondary interactions in the beam tube that could potentially contaminate the event with tertiary produced particles

3) In view of the new demountable design of the pipe, evaluate how much it is possible to thicken its walls in order to make the design more reliable and cheaper

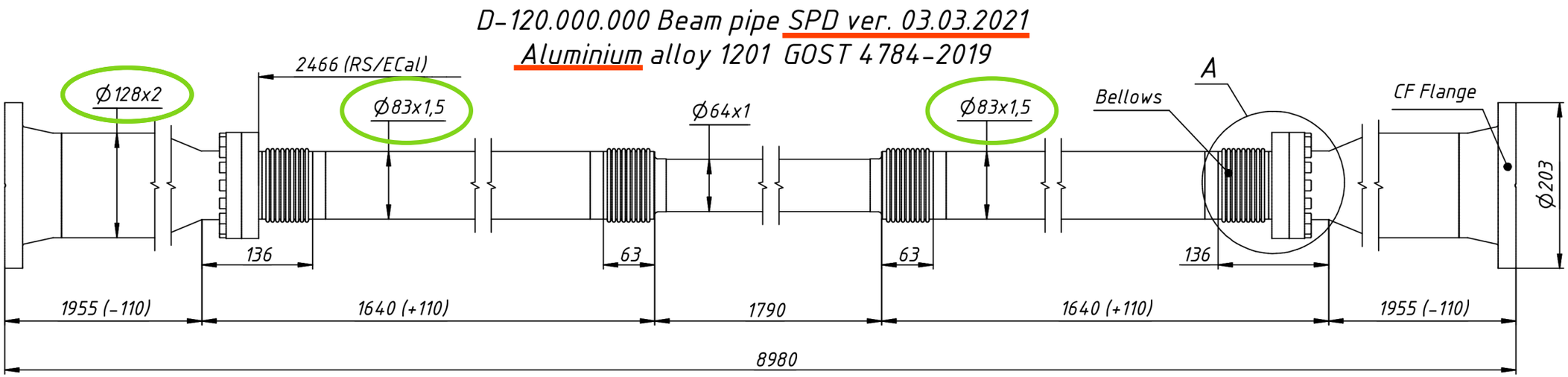
Beam pipe in SPD





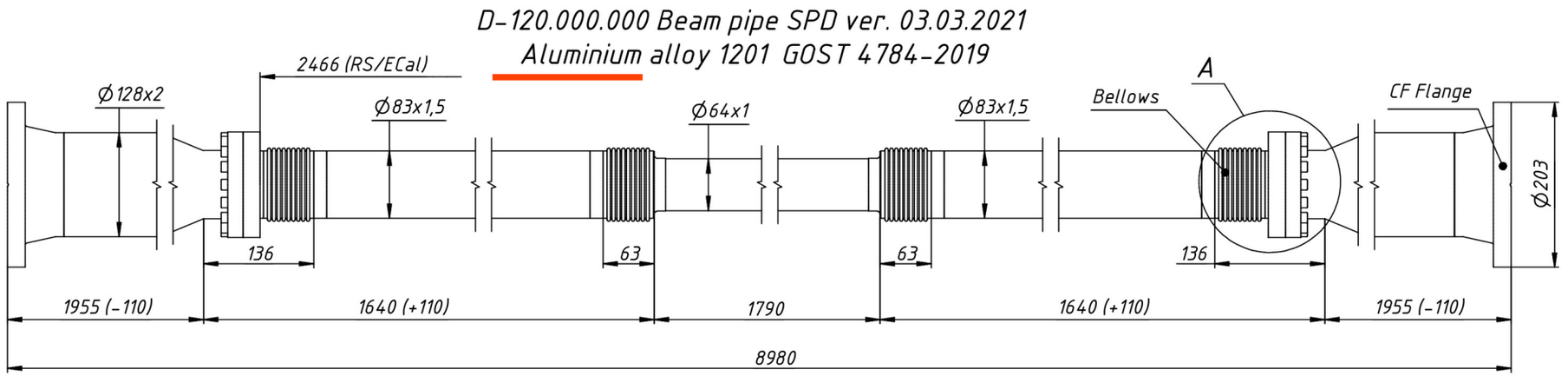


Beam pipe in SPD



How much it is possible to thicken beam pipe walls?

Beam pipe in SpdRoot



current

-4490 *mm* -2535 *mm* -895 *mm* 895 *mm* 2535 *mm* 4490 *mm*

r64x2 *mm* | r41,5x1.5 *mm* | r32x1 *mm* | r41,5x1.5 *mm* | r64x2 *mm*

deprecated

master branch

aluminium beryllium aluminium

r65x1.5 *mm* | r41,5x1.5 *mm* | r32x1 *mm* | r41,5x1.5 *mm* | r65x1.5 *mm*

-6250 *mm* -2500 *mm* -850 *mm* 850 *mm* -2500 *mm* -6250 *mm*

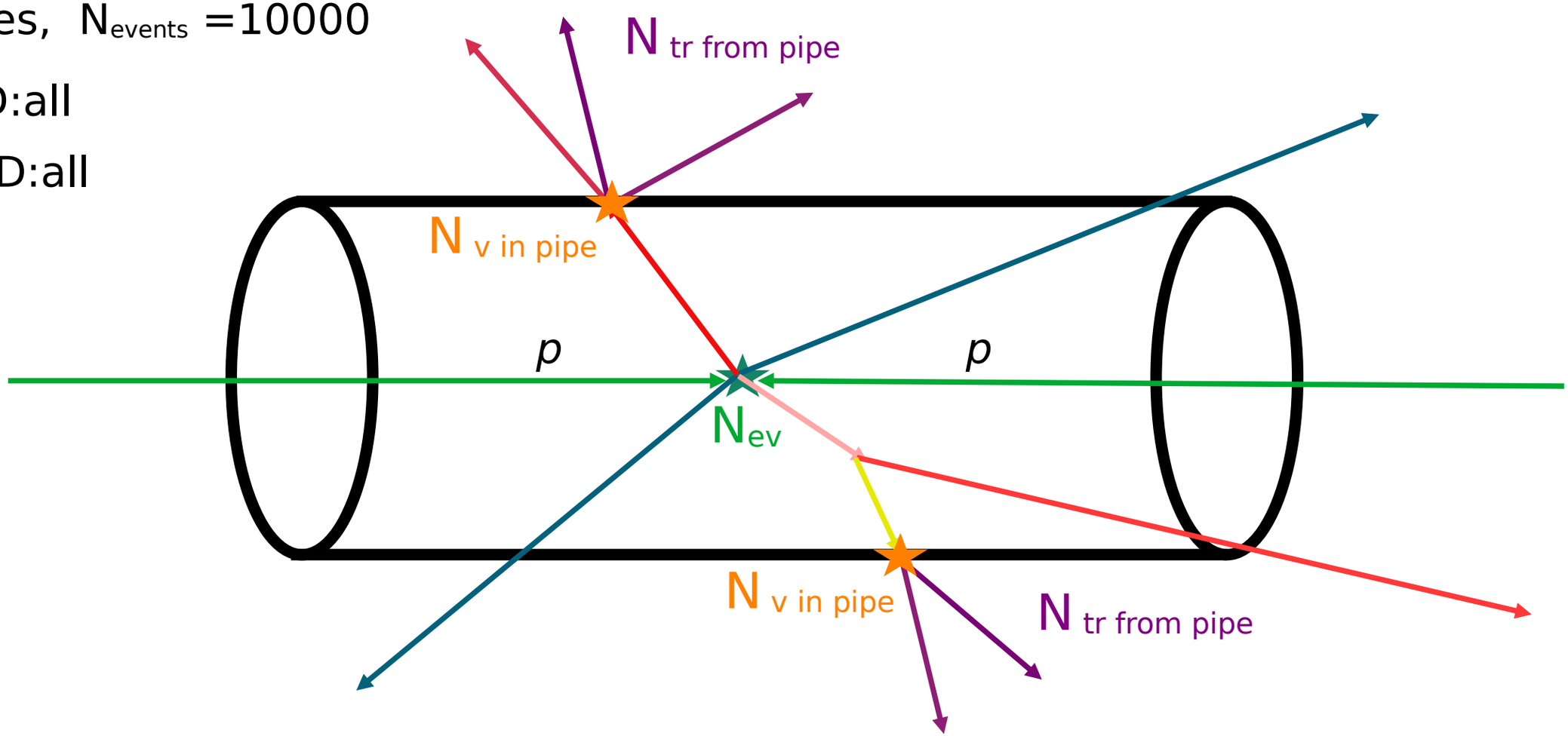
Study of beam pipe

$pp, \sqrt{s} = 27\,GeV, Pythia\,8$

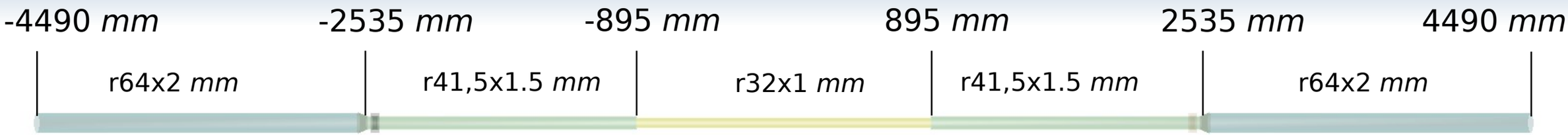
Two samples, N_{events} =10000

1) SoftQCD:all

2) HardQCD:all

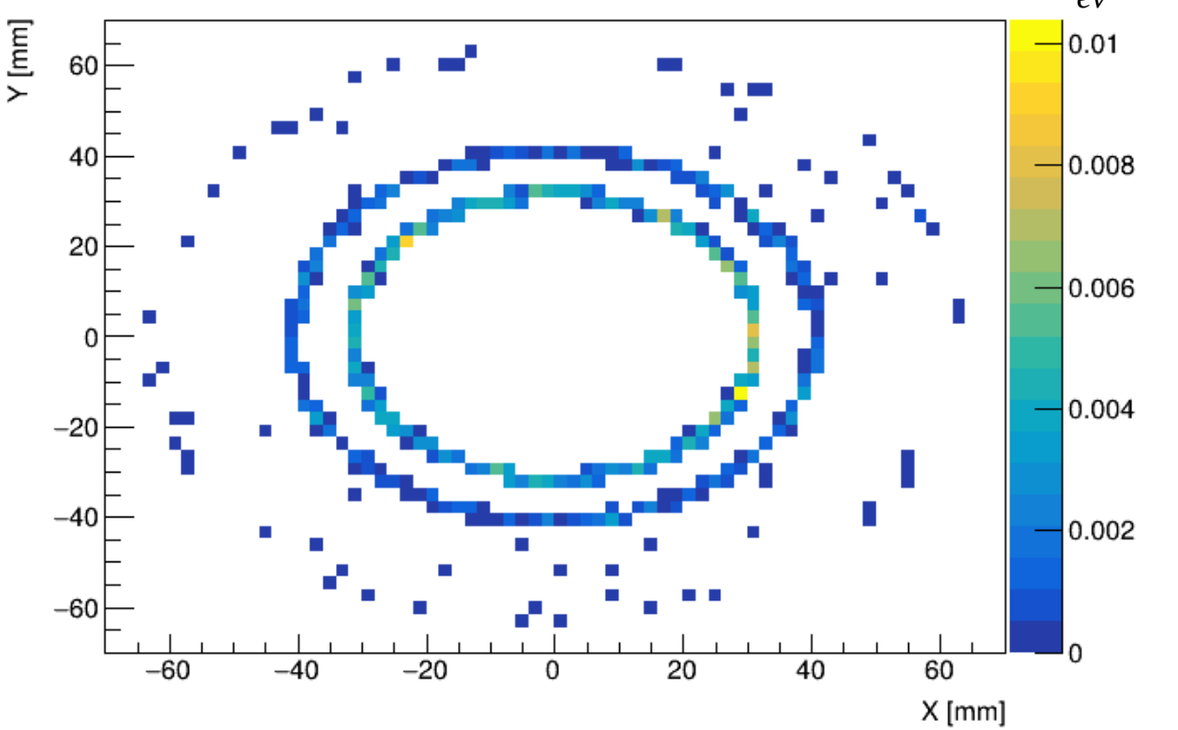


Beam pipe: XY-distribution

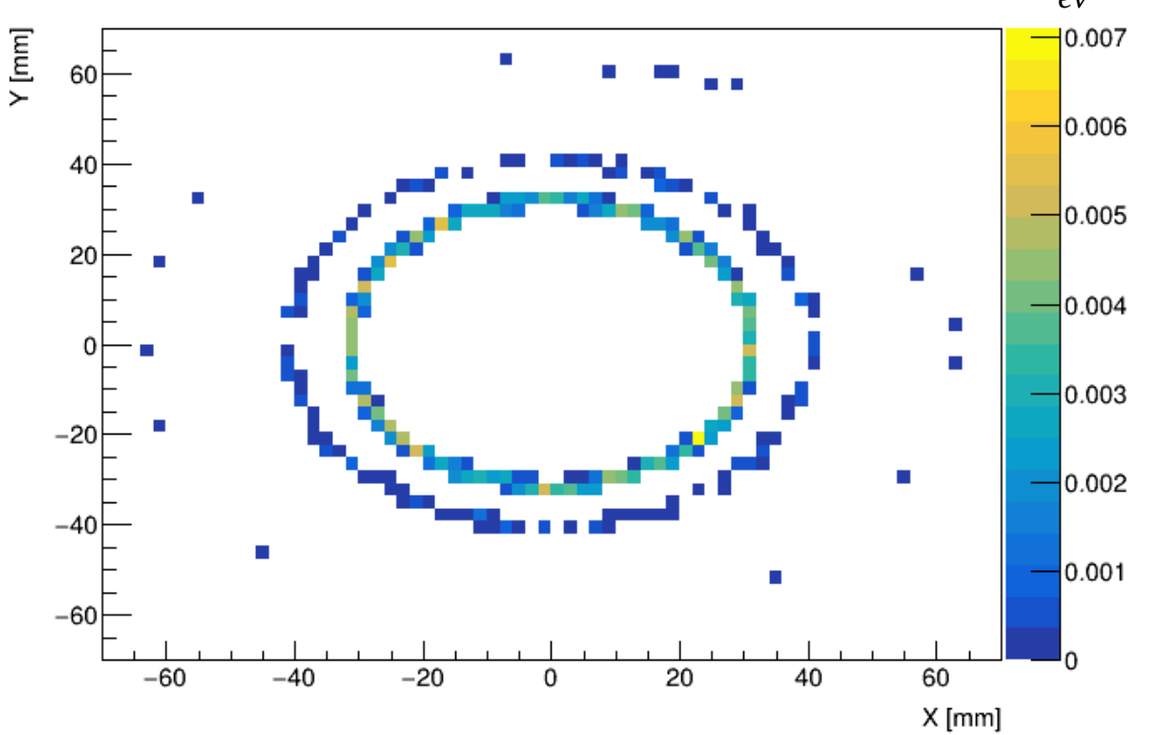


$$pp, N_{events} = 10000, \sqrt{S} = 27 \ \ GeV$$

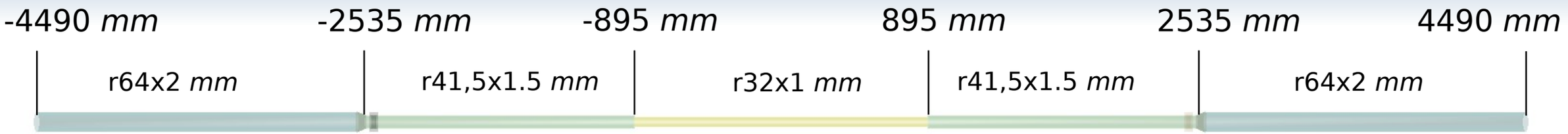
SoftQCD:all



HardQCD:all

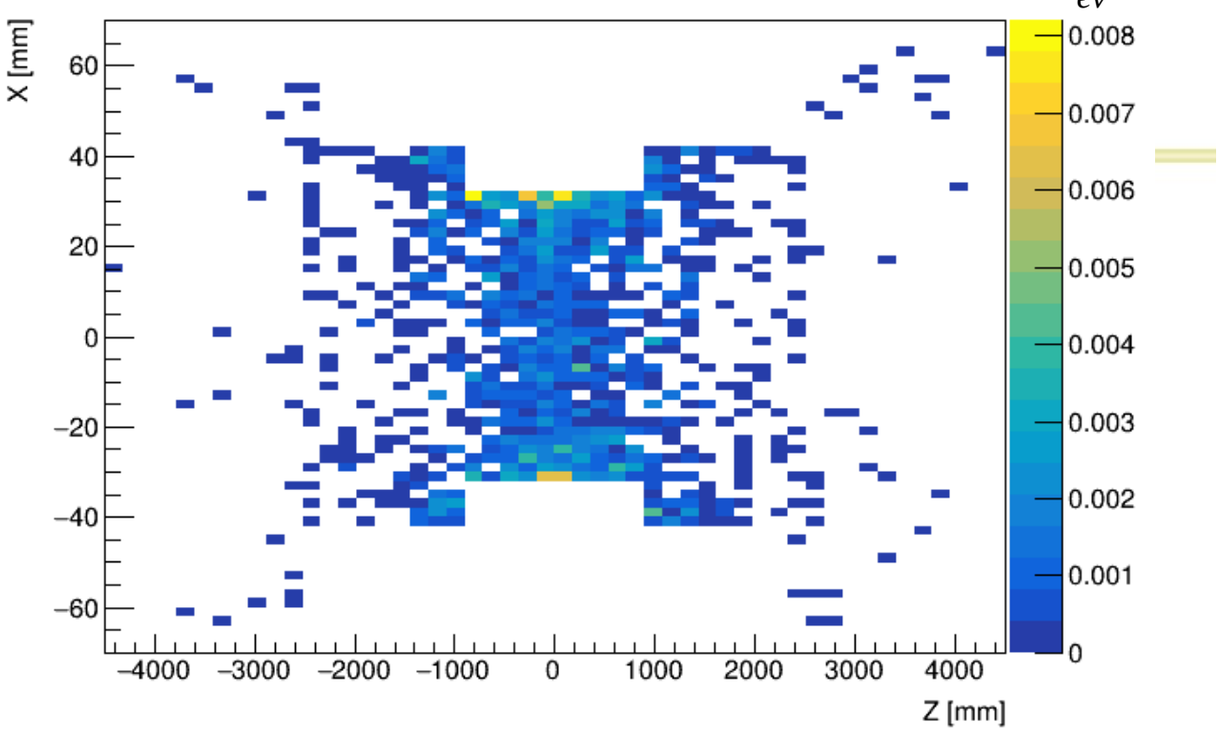


Beam pipe:XZ-distribution

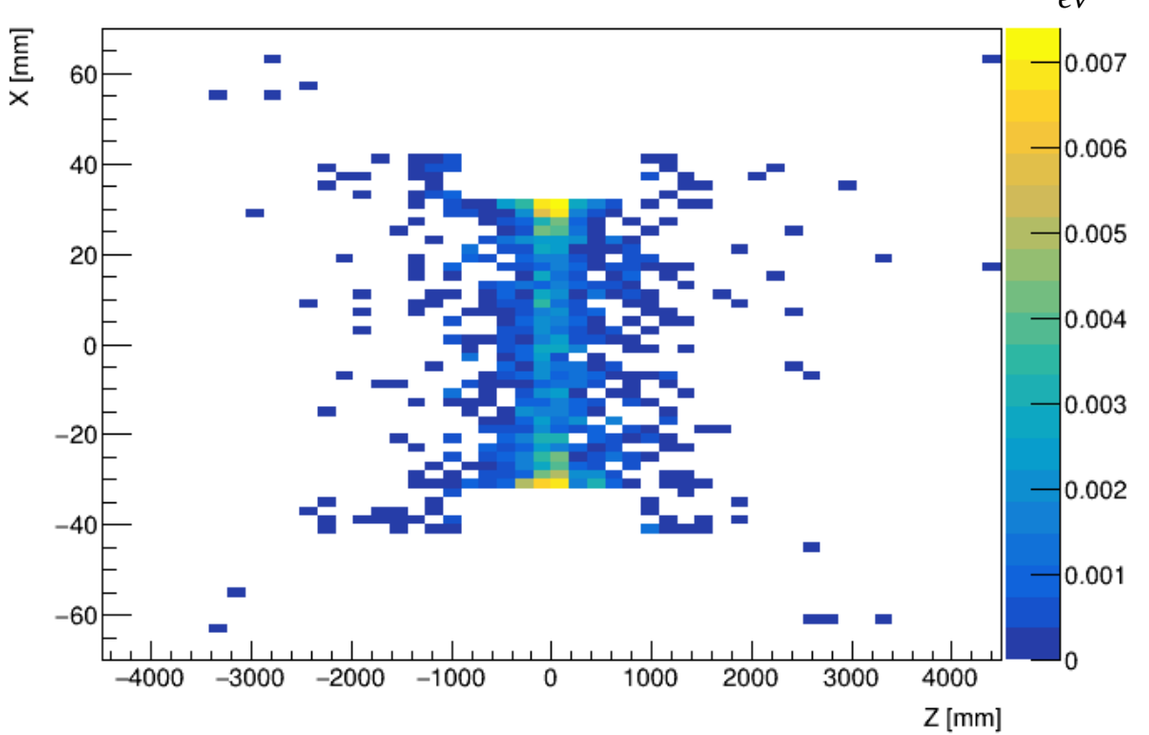


$$pp, N_{events} = 10000, \sqrt{S} = 27 \ \ GeV$$

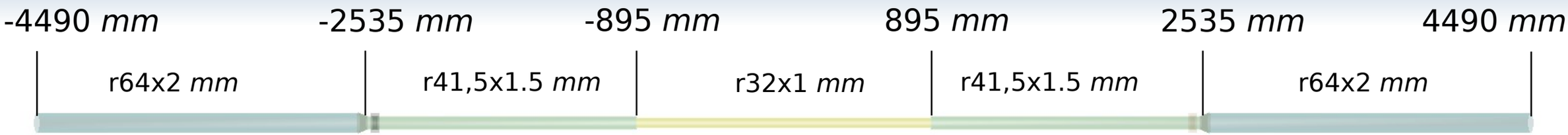
SoftQCD:all



HardQCD:all



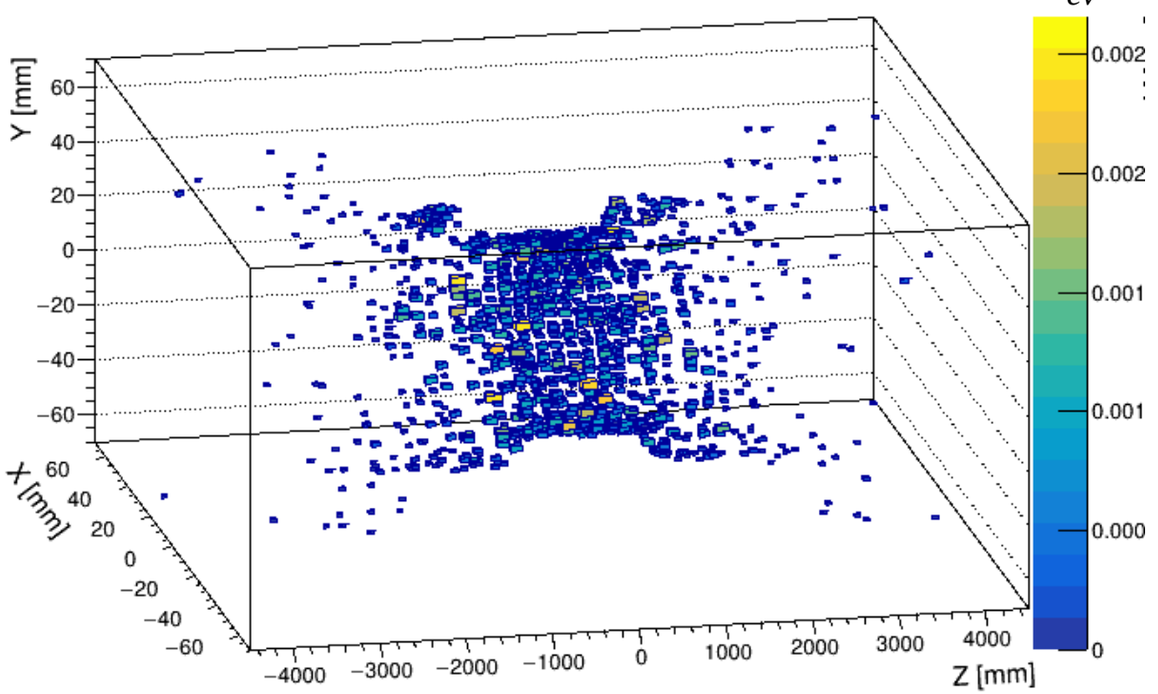
Beam pipe:XYZ-distribution



$$pp, N_{events} = 10000, \sqrt{S} = 27 \ \ GeV$$

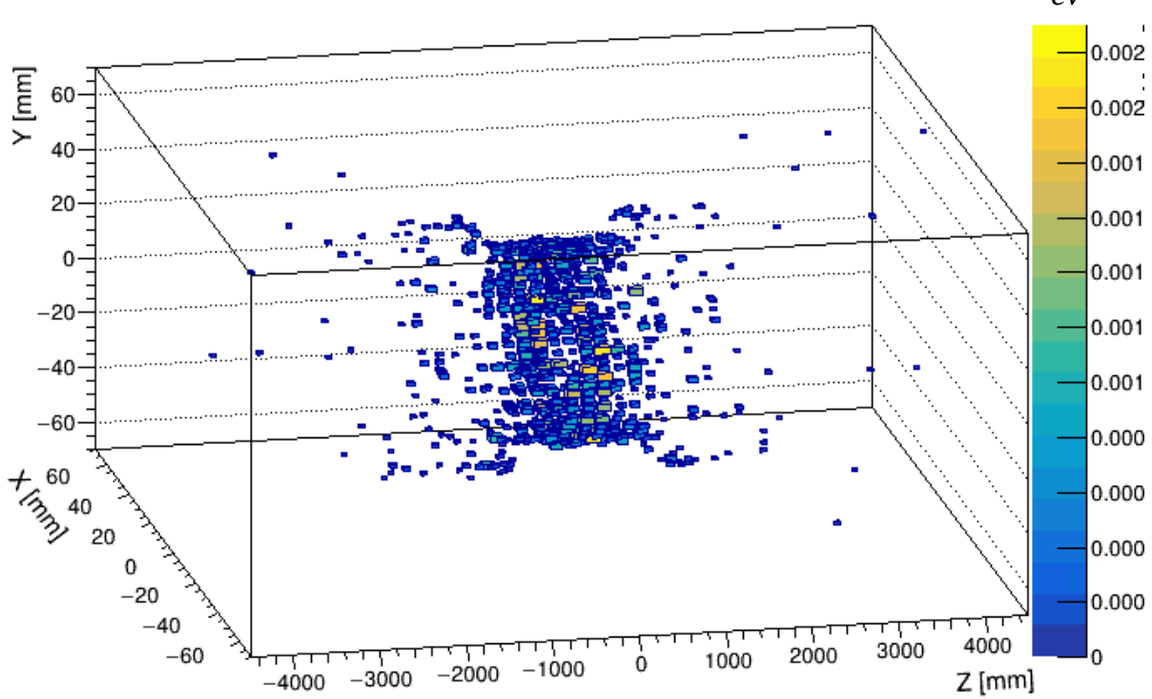
SoftQCD:all

$\frac{N_{tr\ \text{from}\ pipe}}{N_{ev}}$



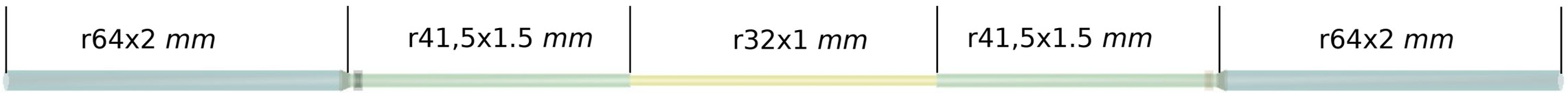
HardQCD:all

$\frac{N_{tr\ \text{from}\ pipe}}{N_{ev}}$

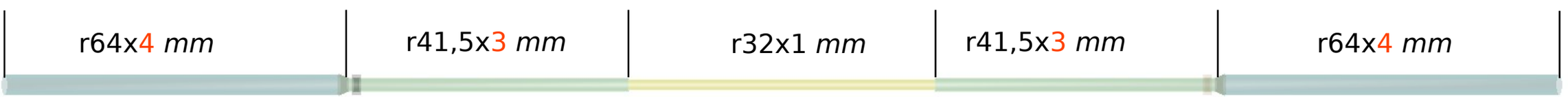


Comparison

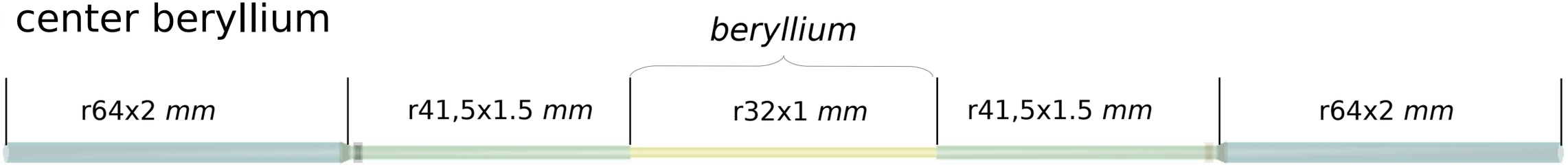
1) standard



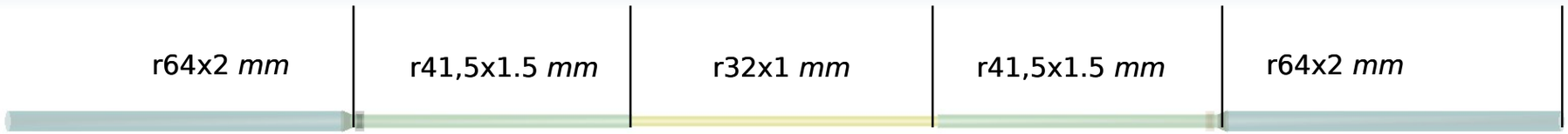
2) double thickness

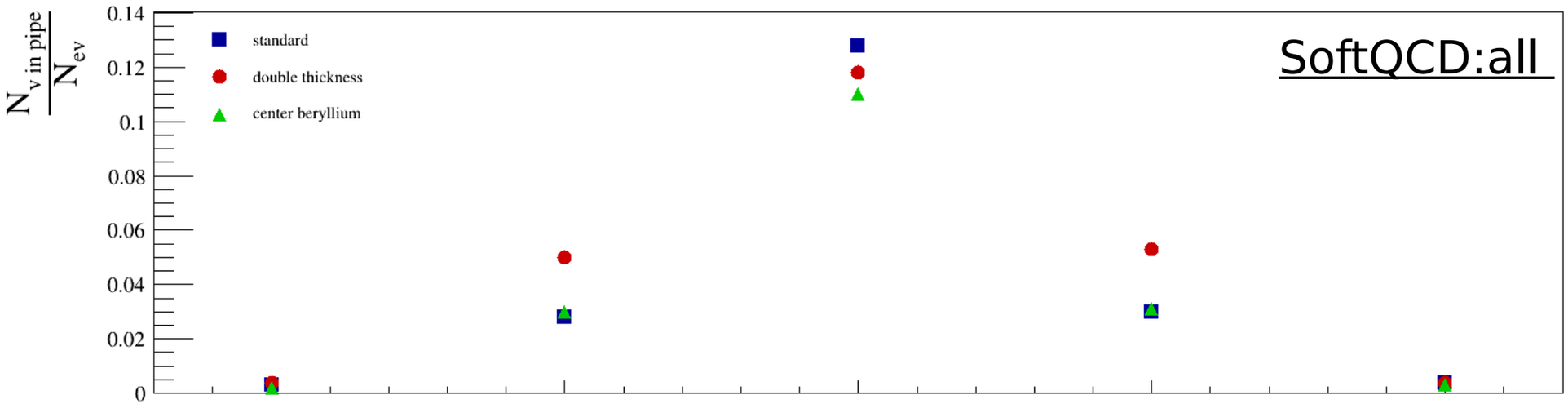


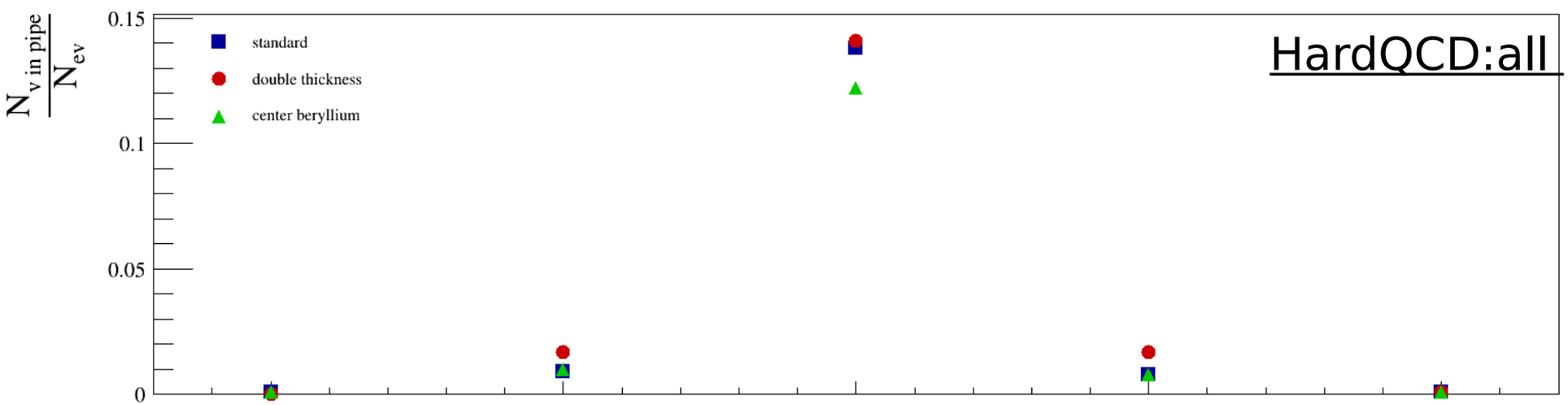
3) center beryllium



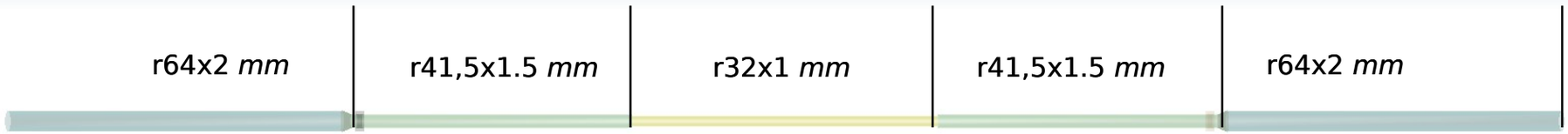
$N_{v\ in\ pipe}/N_{ev}$

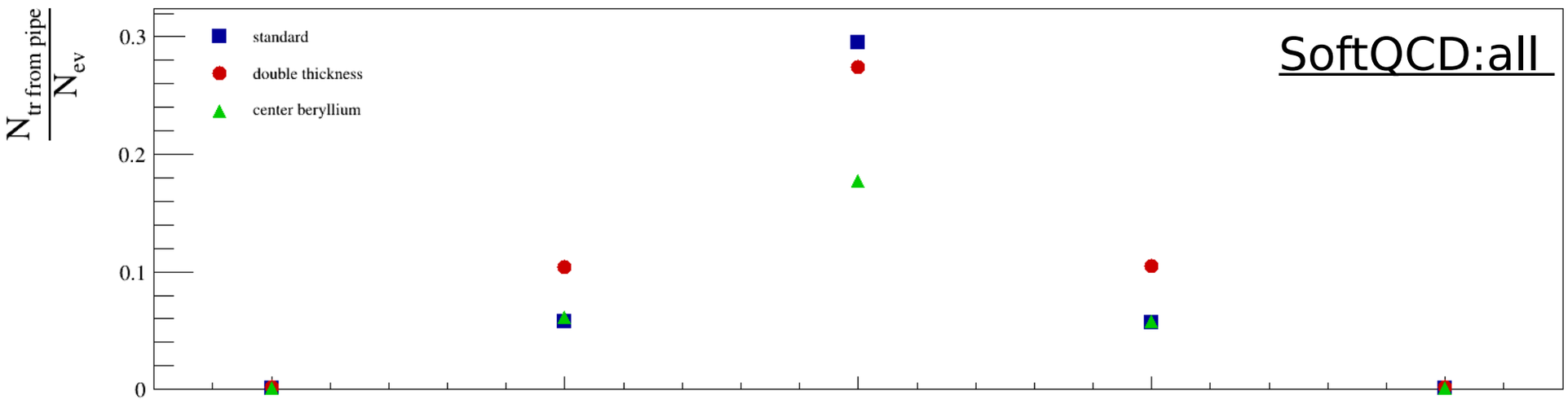






$N_{tr\ from\ pipe}/N_{ev}$





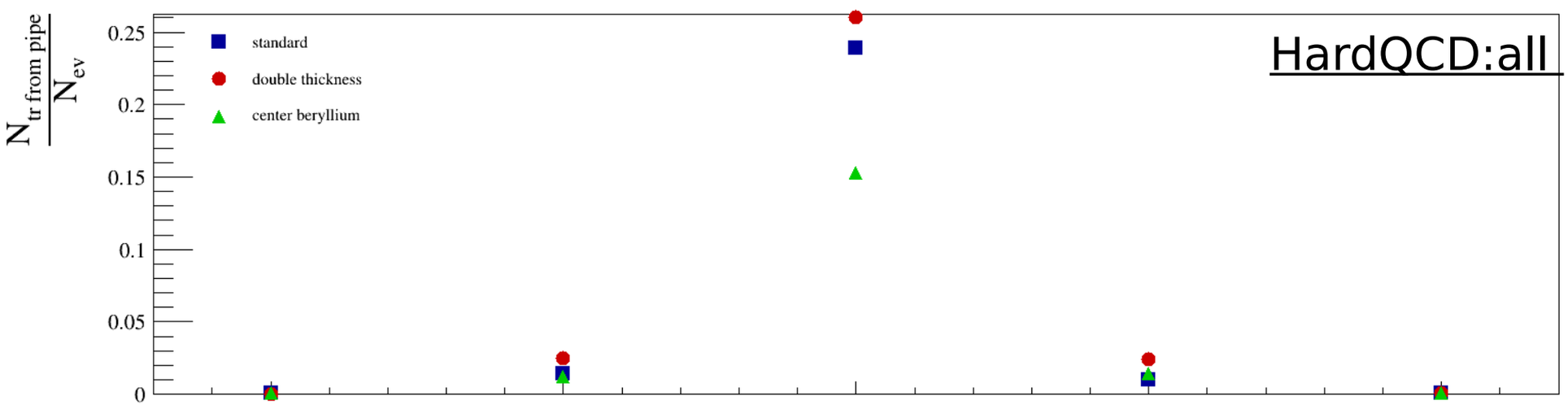


Table of $N_{v \text{ in pipe}}/N_{ev}$ and $N_{tr \text{ from pipe}}/N_{ev}$

SoftQCD $\frac{N_{v \text{ in pipe}}/N_{ev}}{N_{tr \text{ from pipe}}/N_{ev}}$	0.003	0.028	0.128	0.030	0.004
	0.001	0.058	0.295	0.057	0.001
HardQCD $\frac{N_{v \text{ in pipe}}/N_{ev}}{N_{tr \text{ from pipe}}/N_{ev}}$	0.001	0.009	0.138	0.008	0.001
	0.001	0.014	0.239	0.010	0.001

beryllium

SoftQCD $\frac{N_{v \text{ in pipe}}/N_{ev}}{N_{tr \text{ from pipe}}/N_{ev}}$	0.002	0.030	0.110	0.031	0.003
	0.001	0.061	0.177	0.058	0.001
HardQCD $\frac{N_{v \text{ in pipe}}/N_{ev}}{N_{tr \text{ from pipe}}/N_{ev}}$	0.001	0.010	0.122	0.008	0.001
	0.001	0.012	0.153	0.014	0.001

double thickness | double thickness

SoftQCD $\frac{N_{v \text{ in pipe}}/N_{ev}}{N_{tr \text{ from pipe}}/N_{ev}}$	0.004	0.050	0.118	0.053	0.004
	0.002	0.104	0.274	0.105	0.002
HardQCD $\frac{N_{v \text{ in pipe}}/N_{ev}}{N_{tr \text{ from pipe}}/N_{ev}}$	0.000	0.017	0.141	0.017	0.001
	0.000	0.025	0.260	0.024	0.001

Conclusion

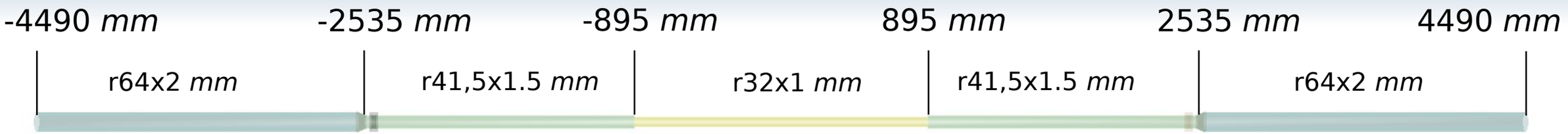
1) New geometry of the beam pipe was implemented in SpdRoot (fork).
Next step is to add to master branch.

2) The results of study:

		$N_{v \text{ in } pipe} / N_{ev}$		$N_{tr \text{ from } pipe} / N_{ev}$	
		HardQCD	SoftQCD	HardQCD	SoftQCD
center	standard	0.138	0.128	0.239	0.295
	beryllium	0.122	0.110	0.153	0.177
right (1 sector)	standard	0.008	0.030	0.010	0.057
	Double thickness	0.017	0.053	0.024	0.105

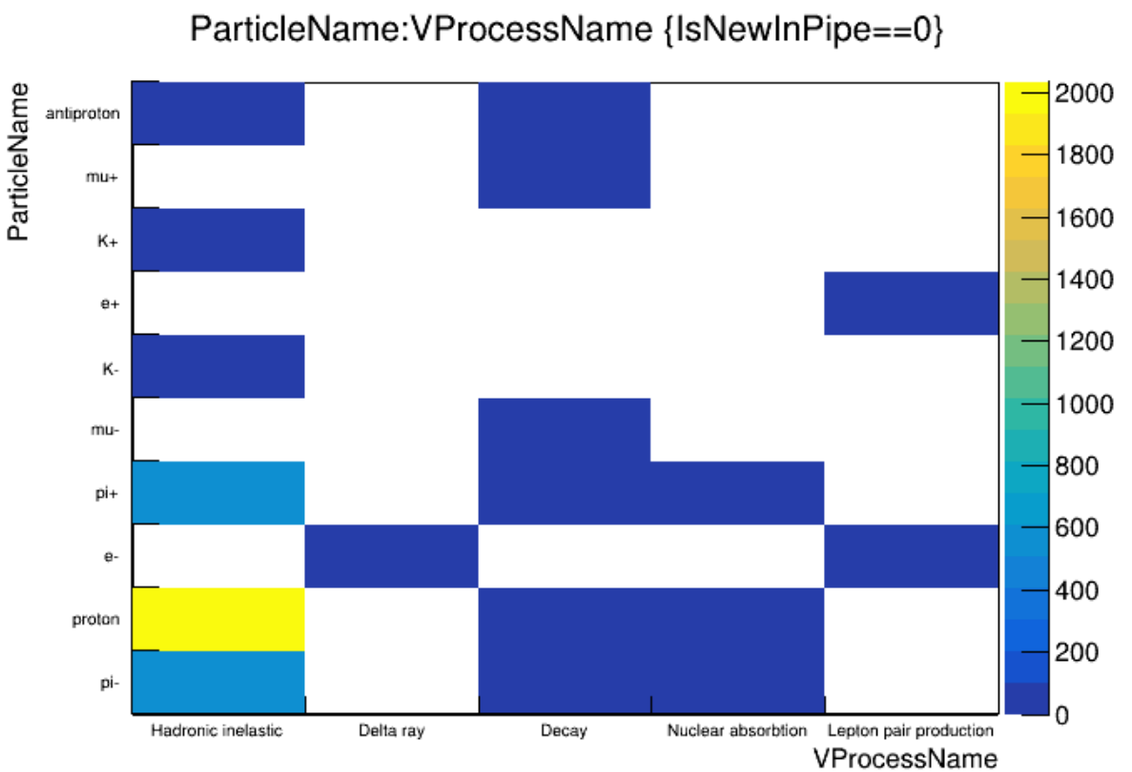
Back-up

Beam pipe: Particle vs process name

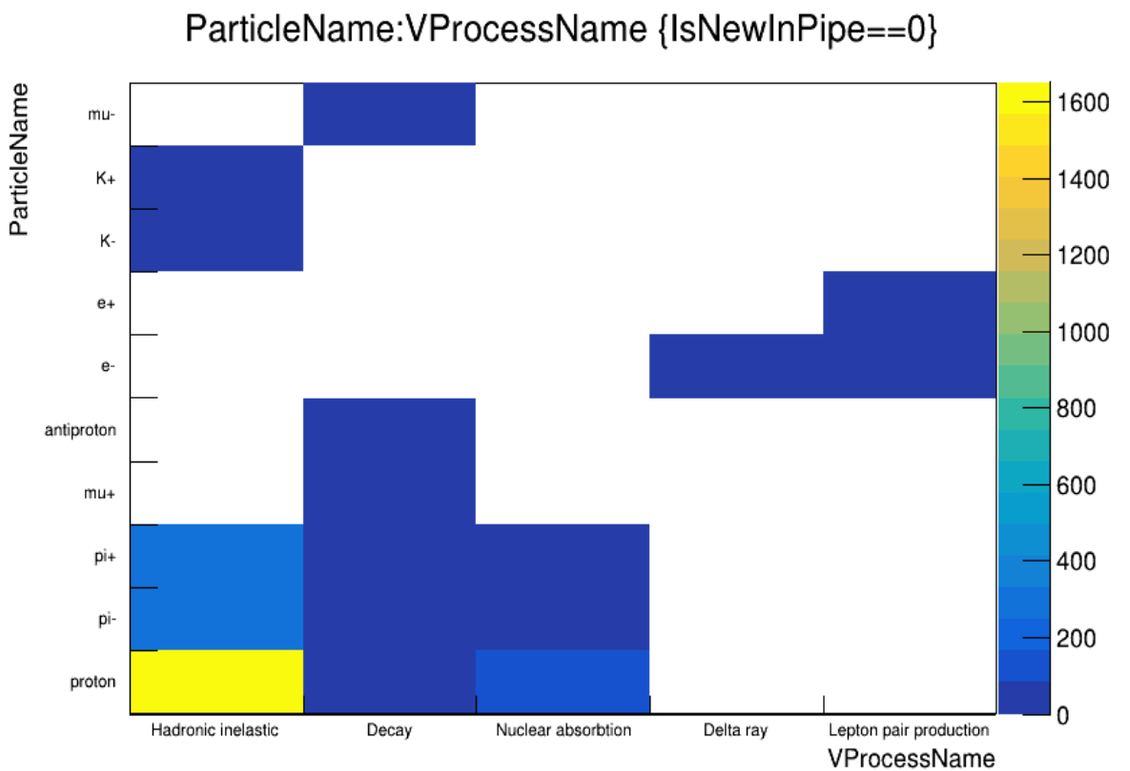


$$pp, N_{events} = 10000, \sqrt{S} = 27 \ \ GeV$$

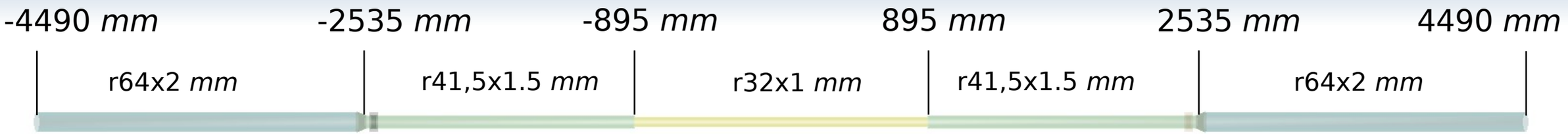
SoftQCD:all



HardQCD:all

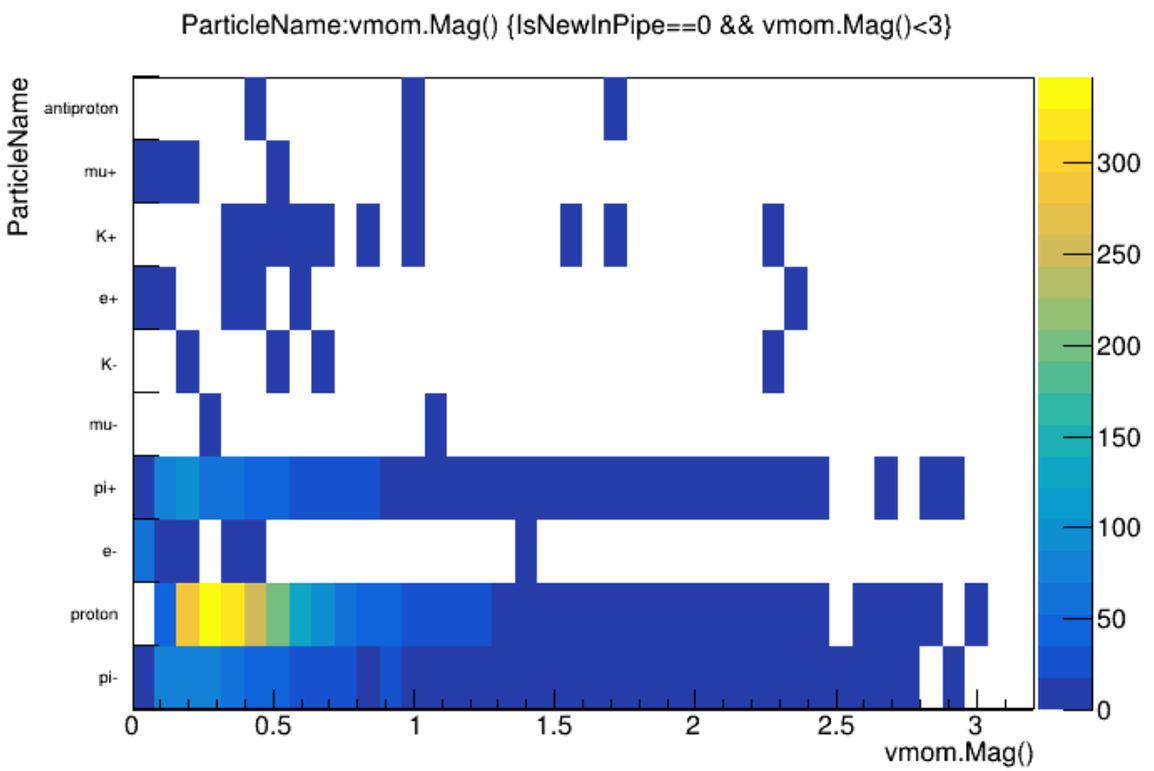
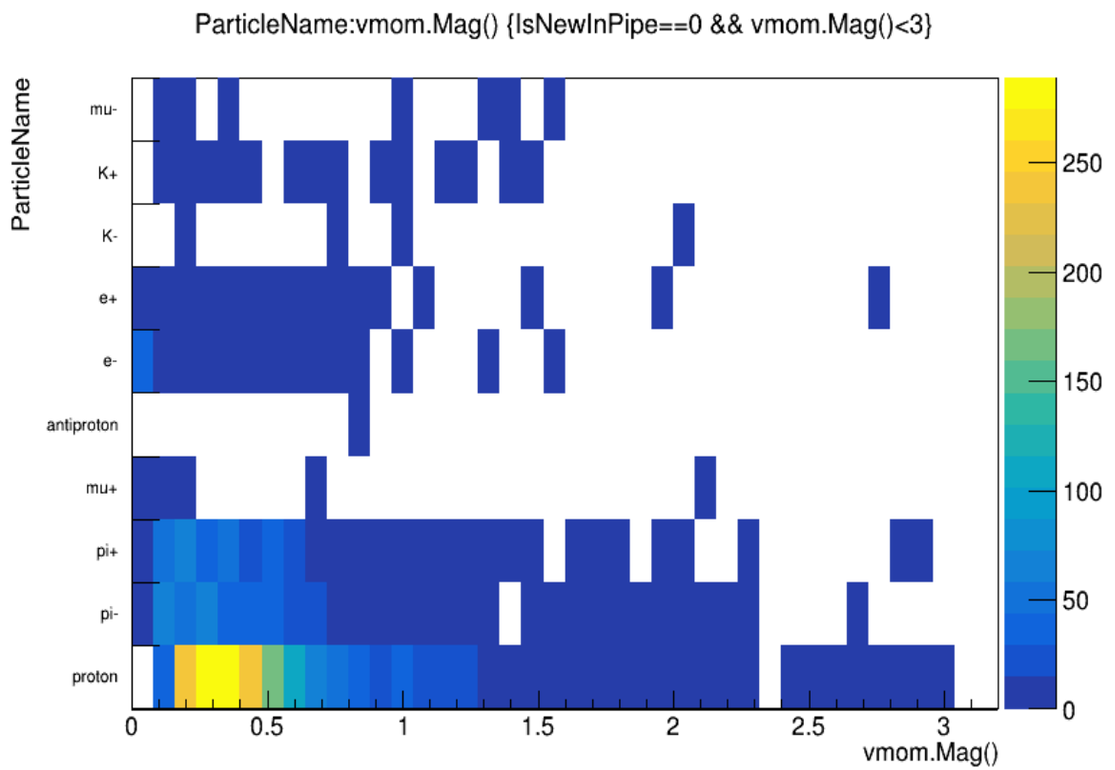


Beam pipe: Particle vs p



$$pp, N_{events} = 10000, \sqrt{S} = 27 \ \ GeV$$

SoftQCD:all



HardQCD:all