

diffusion simulations: work-in-progress

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January 5th, 2012

from last meeting

next steps

- ~~Define the distributions: ring of n sigma. What about sigma_y? And dnn?~~
 - ✓ ~~probably is better to keep same amplitude in both transverse, for n sigma = 2.00 .. 0.2 .. 10.00, gaussian in normalized radius)~~
- Define the simulation cases
 - test: no random noise and beam beam.
 - ✓ input prepared. 10k particles, 300 steps/10k turns each
 - storage ring mode: random noise but no beam beam. What are the appropriate values for the random kicks?
 - which effects must be added? IBS and? (space charge negligible?)
- Collimators?

DONE

from last meeting

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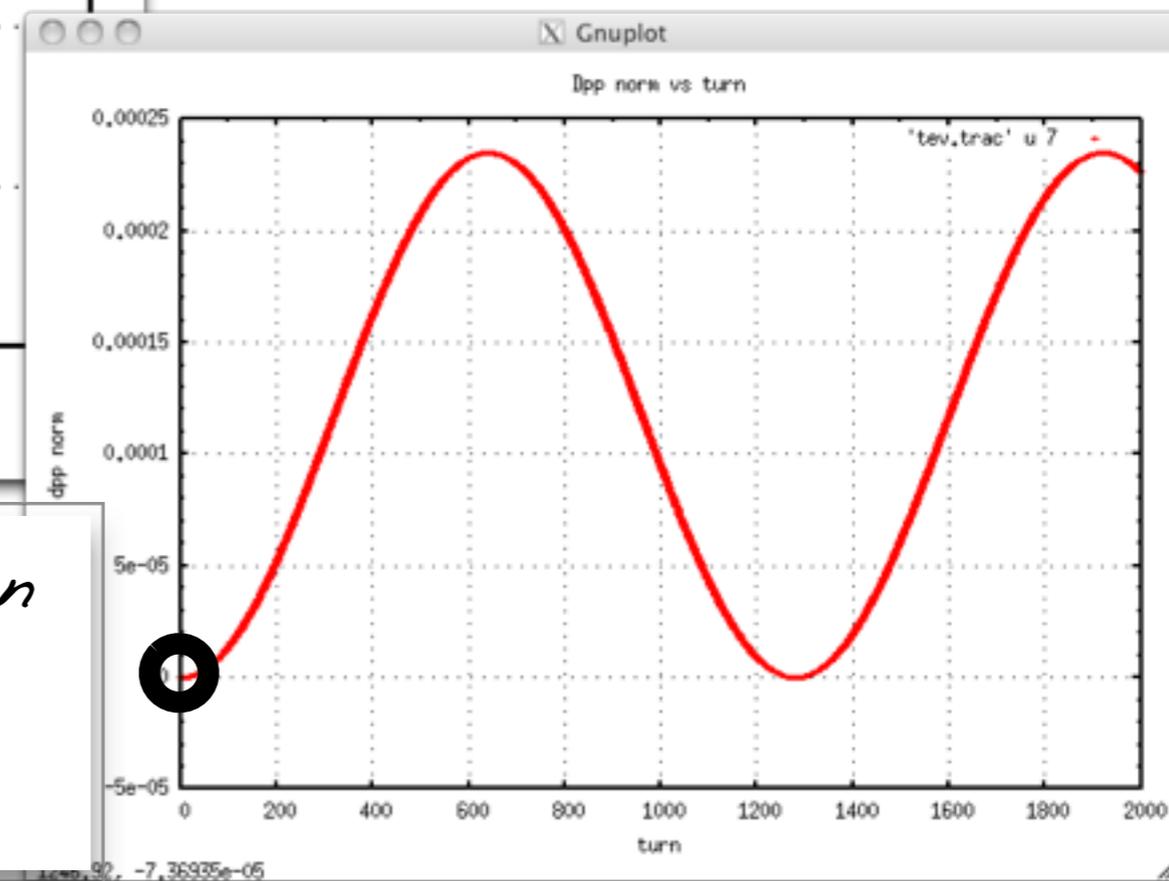
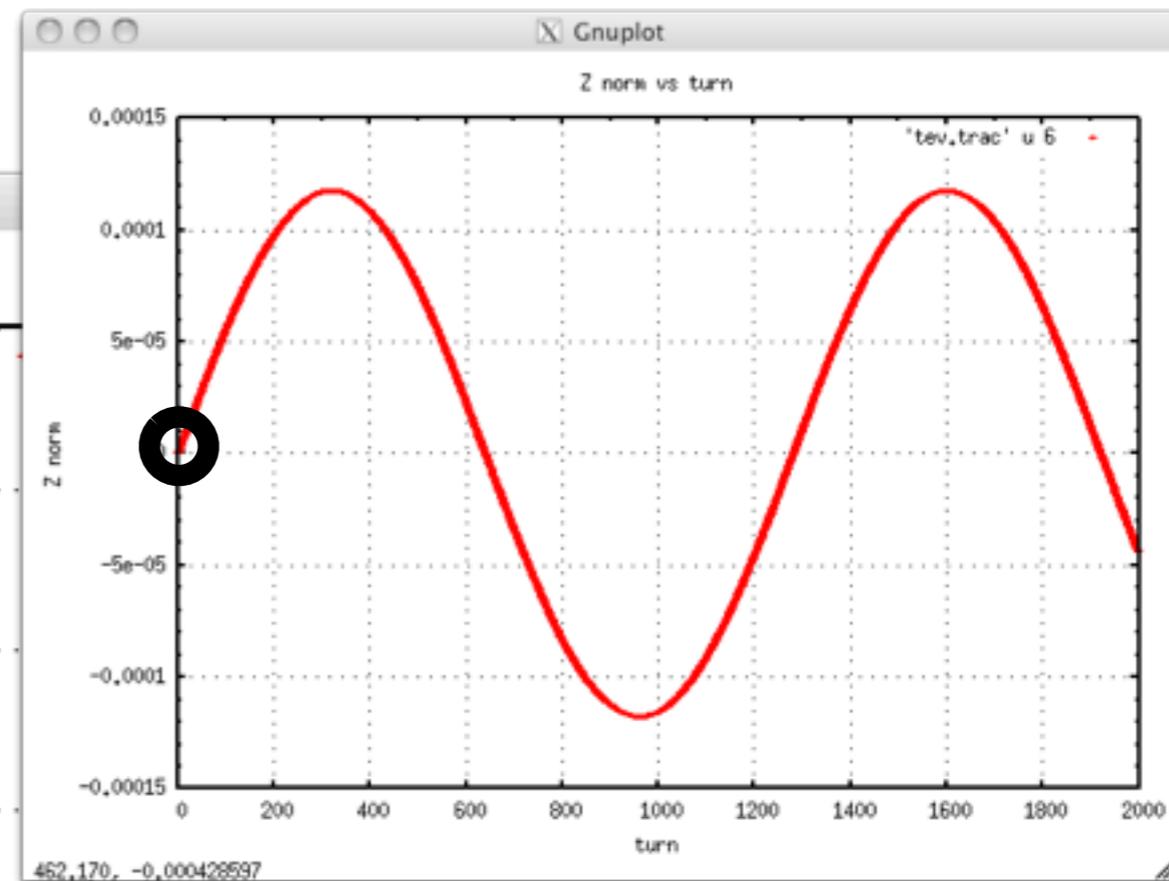
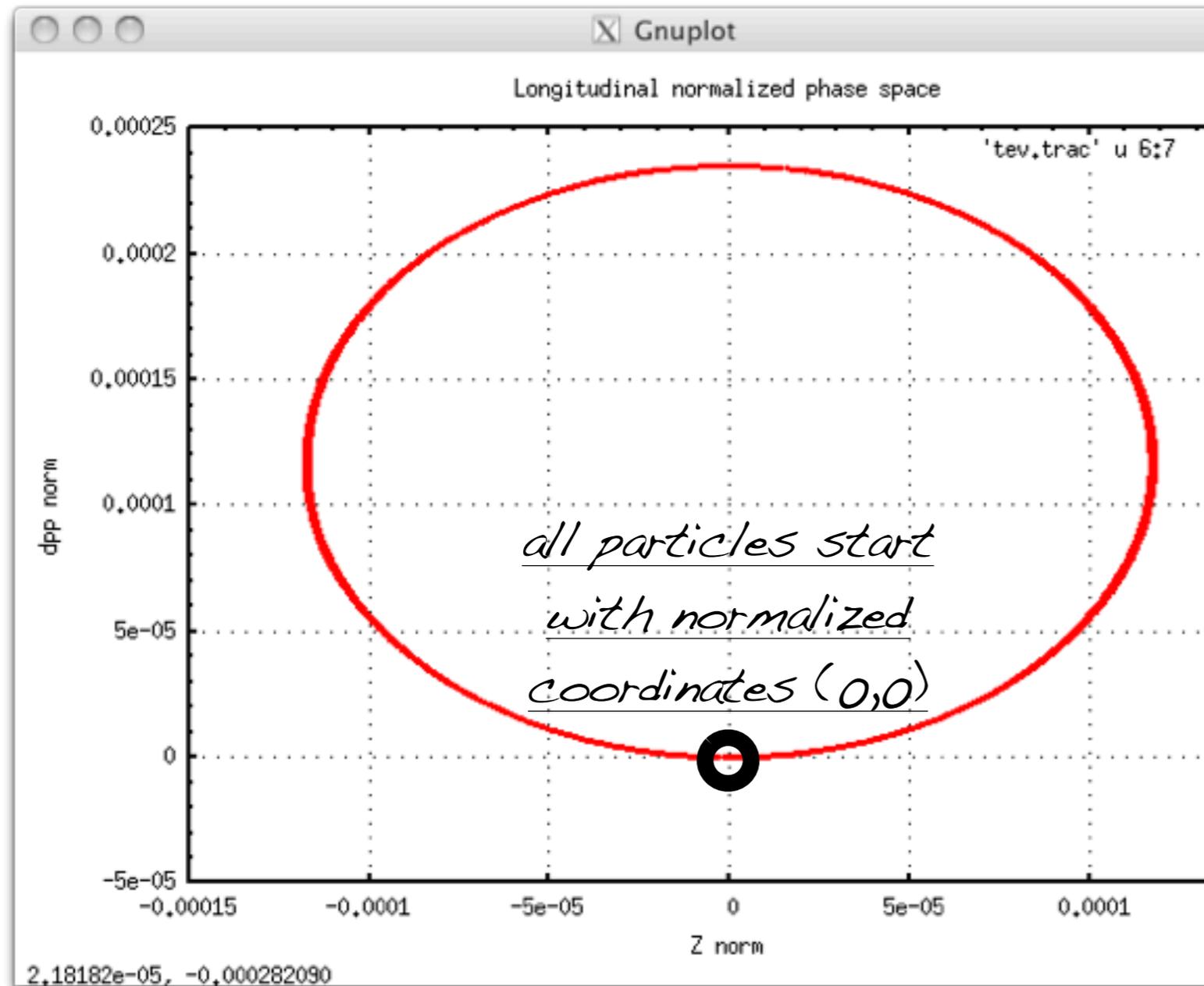
DONE

checked evolution in time, both longitudinal and transverse planes

test job: longitudinal emittance

checked the evolution in time of transverse and longitudinal phase space:

- the transverse emittance seems to be stable over 3 million turns.
- the longitudinal emittance is NOT conserved - even though the values are very low.



(my) first hypothesis: synchrotron motion

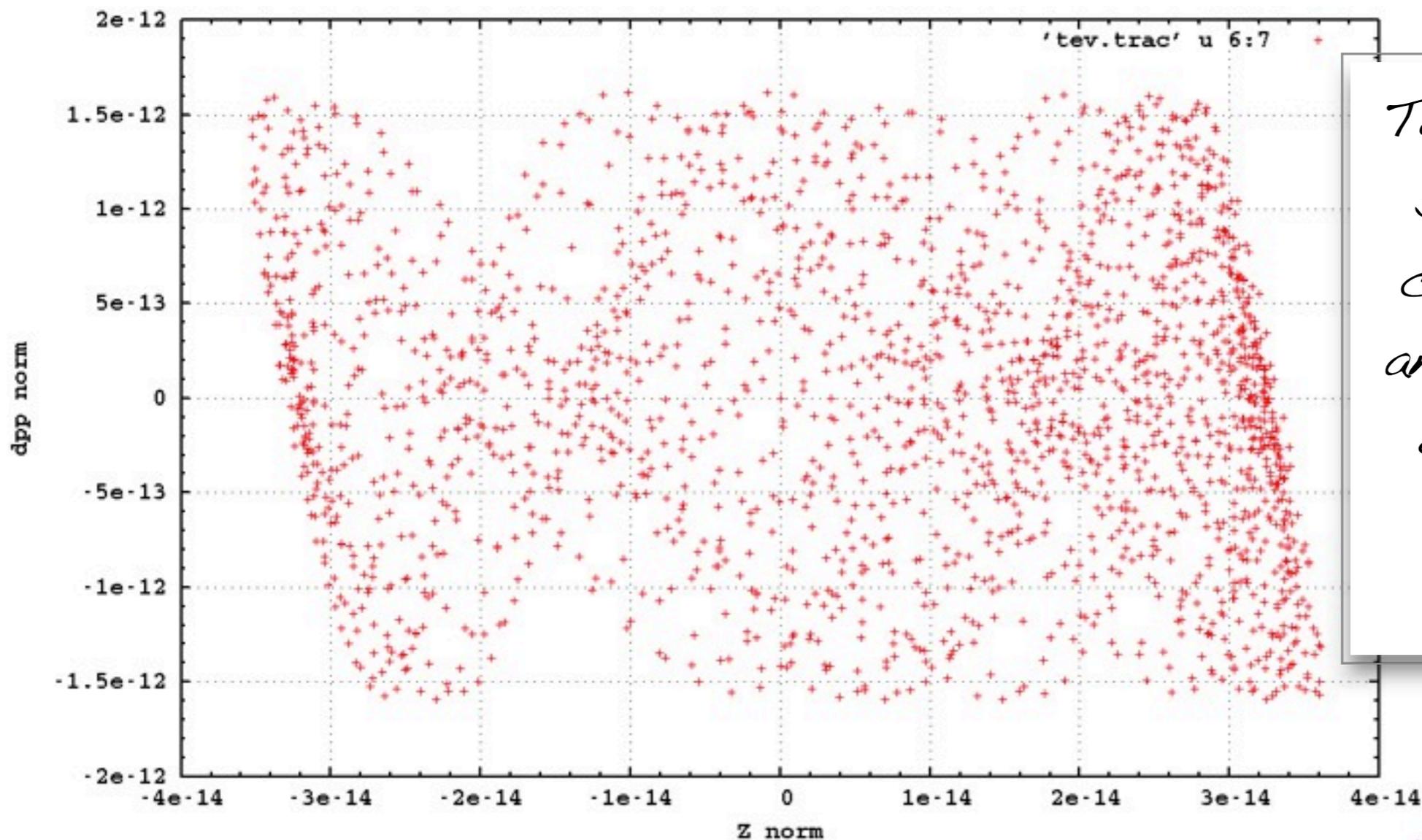
WRONG!!!!

synchrotron damping is not included

Removing chromatic elements

IP_Chrom_x IP_Chrom_y LIN_Chrom

"I think, the reason is that there is a nonlinear longitudinal-transverse coupling in the chromaticity elements. The normalized amplitudes correspond to linear lattice only, so if you have any nonlinearity, the normalized amplitudes do not conserve. If you exclude the chromaticity (just for testing) I expect the problem will disappear.." [Dmitry]



*Test to verify Dmitry suggestion: remove chromatic elements and see the evolution of the longitudinal plane...
RIGHT!*

from last meeting

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- Define the simulation cases
 - test: no random noise and beam beam. DONE
 - ✓ input prepared. 10k particles, 300 steps/10k turns each
 - ~~storage ring mode: random noise but no beam beam. What are the appropriate values for the random kicks?~~
 - which effects must be added? IBS and? (space)
 - Collimators?

Summary &
Preliminary results

simulation summary table

	Noise but no BB	Noise and BB
job details	2 nodes, 24 cores	
turns	300 steps every 20k steps, for a total simulated time of 2 minutes with data every 2 seconds	
computing time	~ 1 day	~ 2 days
output data size	~ 250 MB each job	
input distributions	circle in normalized phase space. Same radius for both transverse planes. (0,0) in longitudinal plane. Input prepared for 3, 3.2, 3.4 .. 10 sigma	
problems	cannot run for amplitudes larger than 7 sigma!!?	cannot run for amplitudes larger than 8 sigma!!?

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→ *check "walltime" variable!*

→ *expected total data: 20 Gb for the moment, selection of the input distributions: 3, 4, 5, 6, 7, 8, 9, 10 sigma.*

→ *???*

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should I run the jobs on more nodes?

check "walltime" variable!

expected total data: 20 Gb for the moment, selection of the input distributions: 3, 4, 5, 6, 7, 8, 9, 10 sigma.

???

MEMO:

needing more storage space

large amplitude jobs

generated output files

```
st_out.txt  tev.coor.0  tev.coor.1  
tev.coor.2  tev.err    tev.ltr    tev.tsk
```

from "st_out" file

```
Errors detected, see relevant *.err file for more information  
05-Jan-2012  03:56:54.62  CPU= 00:00:00.13  Task finished
```

from "ERR" file

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a.N  -01          5: IP_2074  
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large amplitude jobs

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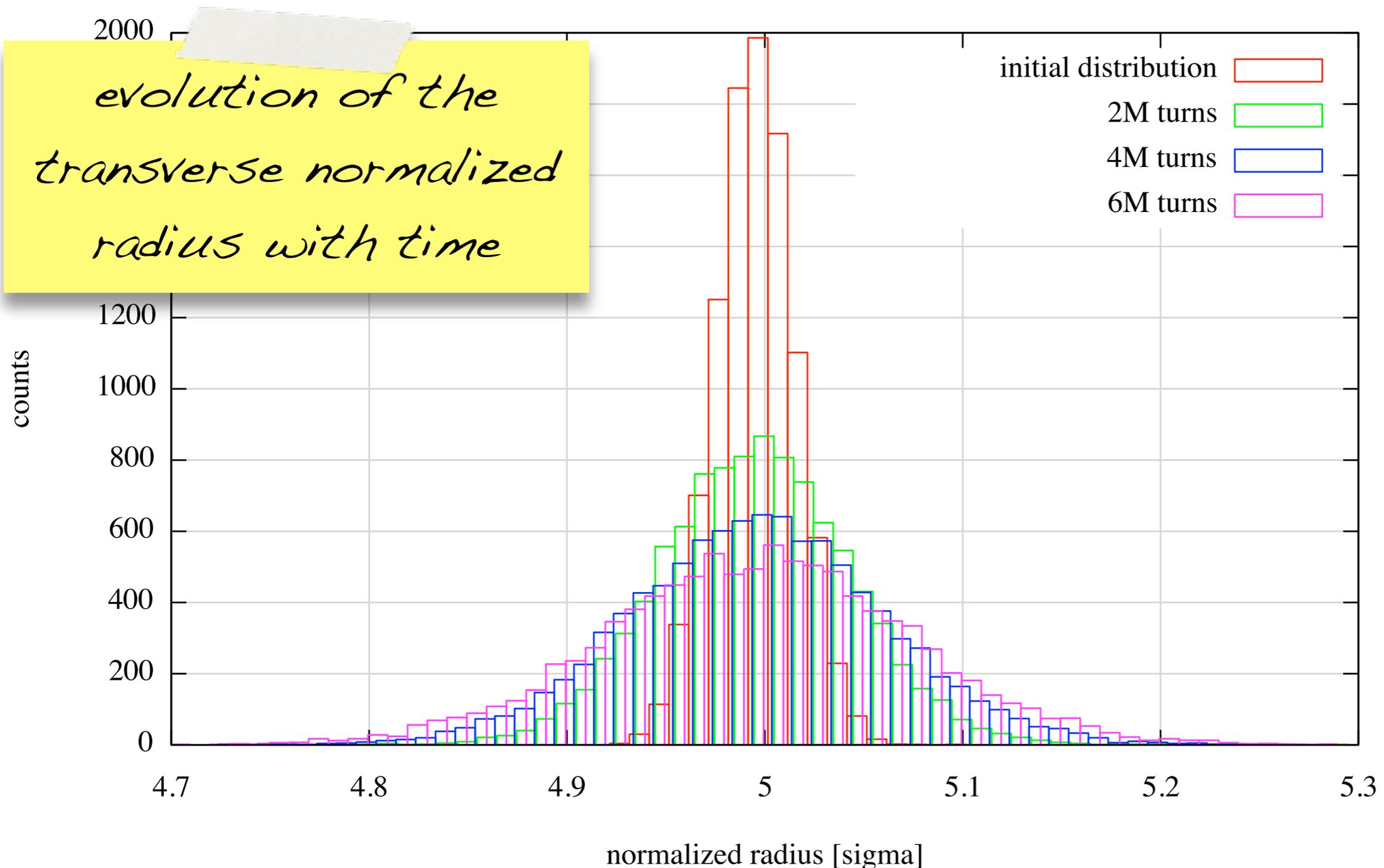
```
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```

*still have to
investigate better...
any idea?*

preliminary results: only noise

some simulations still to be finished/analyzed!!

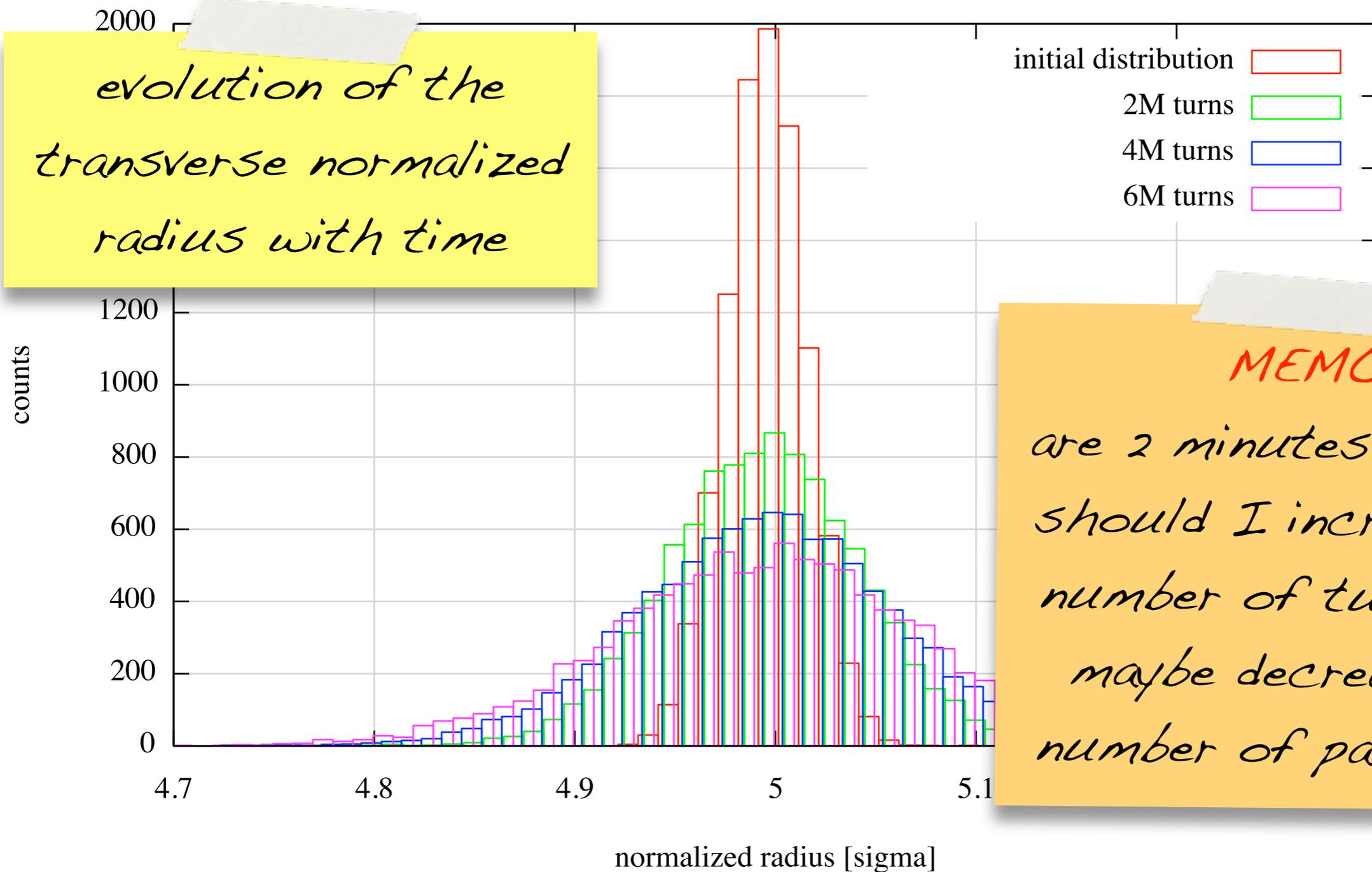
Storage mode: noise, no beam beam



preliminary results: only noise

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Storage mode: noise, no beam beam



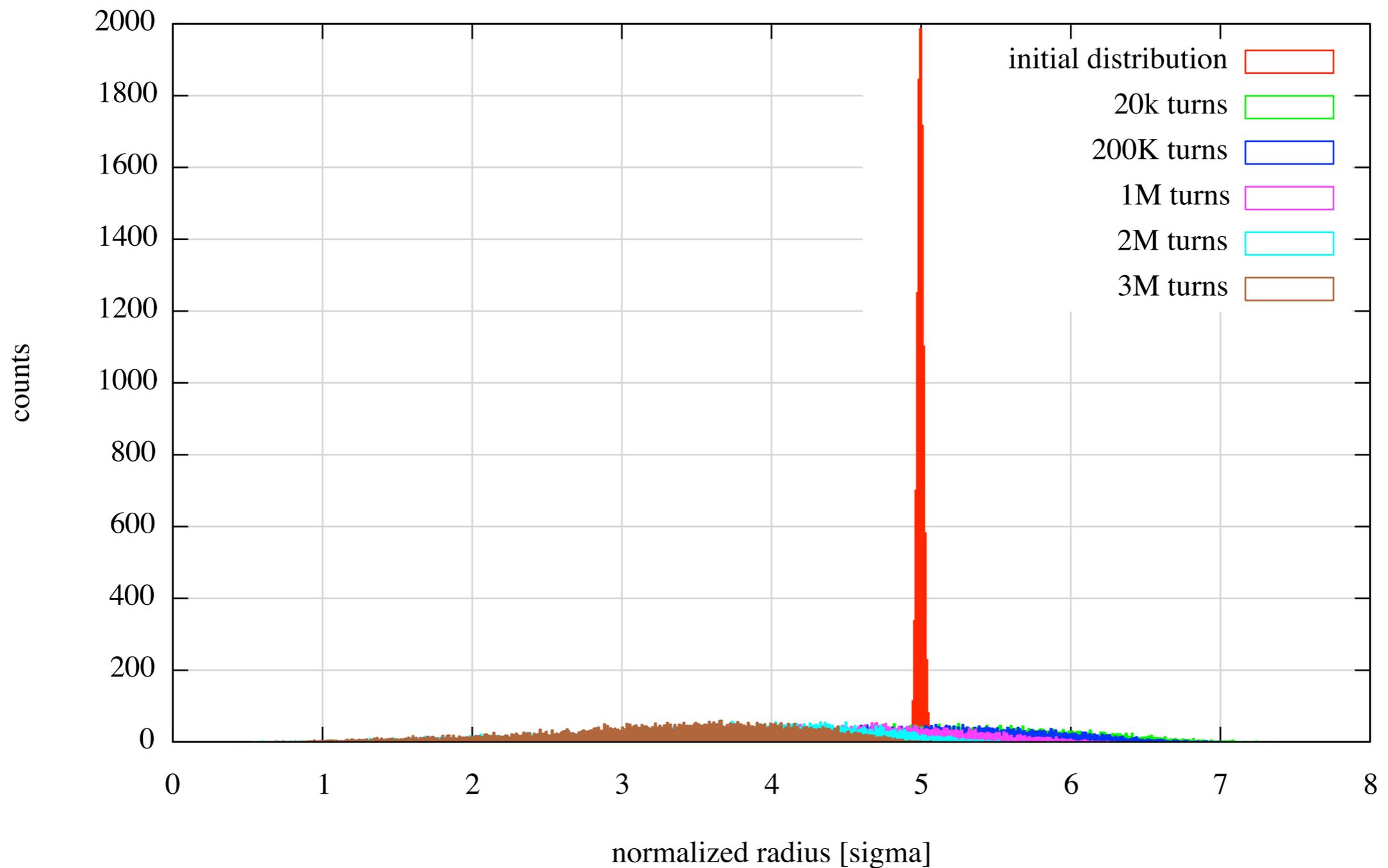
evolution of the transverse normalized radius with time

MEMO:
*are 2 minutes enough?
should I increase the number of turns (and maybe decrease the number of particles?)*

preliminary results: noise + BB

some simulations still to be finished/analyzed!!

Collider mode: noise and beam beam

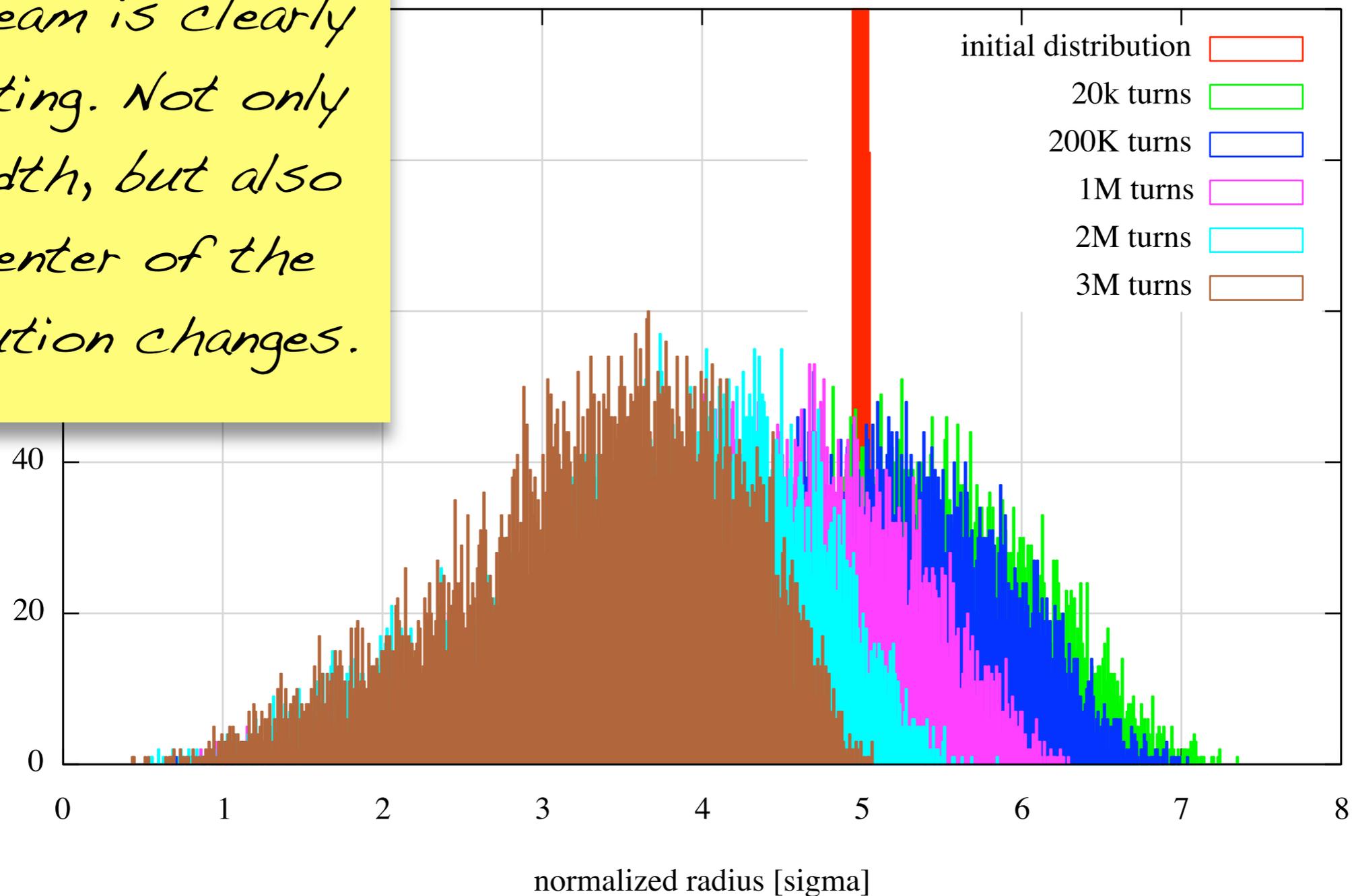


preliminary results: noise + BB

some simulations still to be finished/analyzed!!

Collider mode: noise and beam beam

beam beam is clearly dominating. Not only the width, but also the center of the distribution changes.



next steps

- understand the problems for high amplitude distributions
- Finish to run all the cases
- Analyze simulation results and calculate diffusion coefficients
- Improve diffusion description in Lifetrack. Which effects must be added? IBS and? (space charge negligible?)
- Collimators?