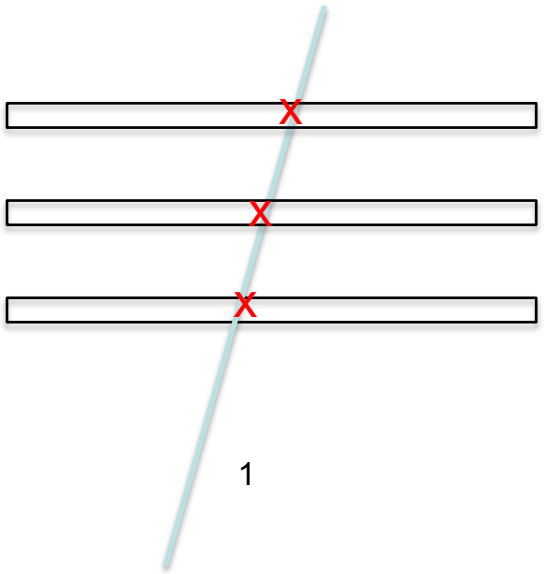
EMC MC Information

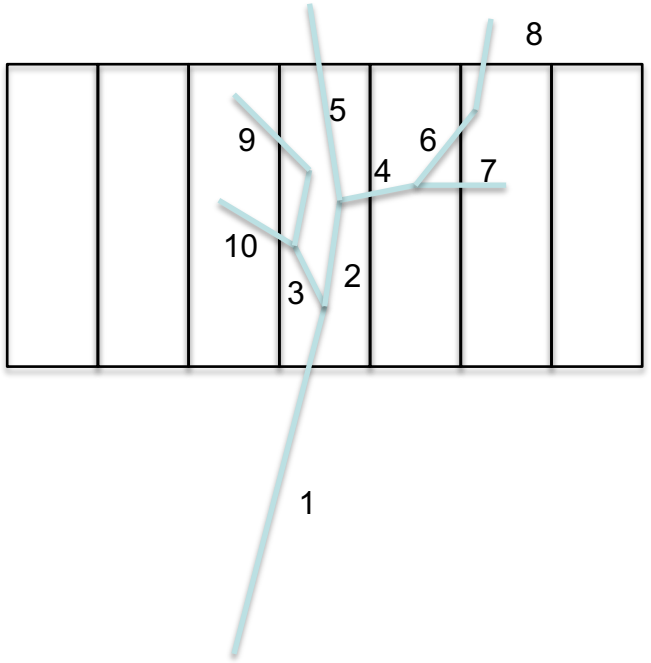
15. Mai 2020 | Tobias Stockmanns

EMC – a special case

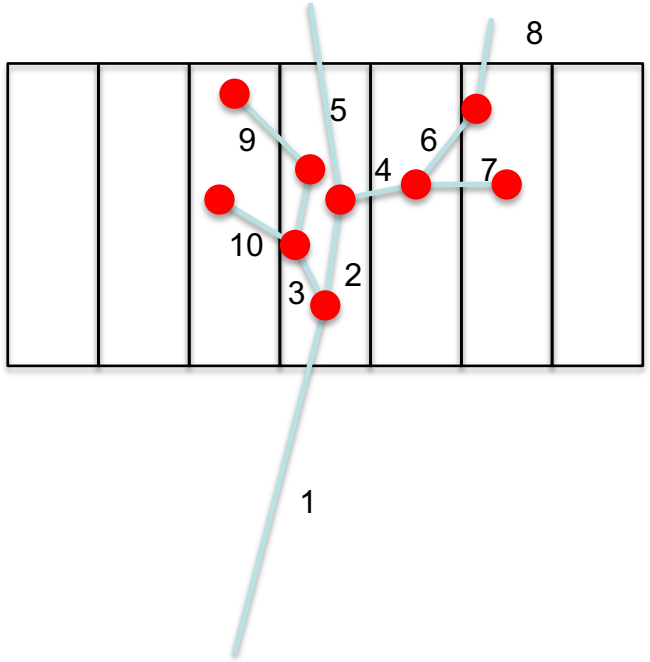
Tracking Detectors



EMC

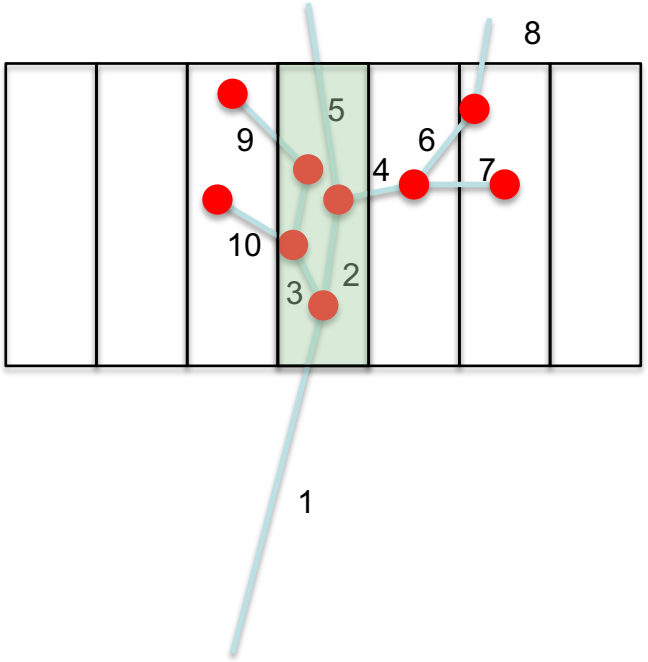


Current Implementation – EMC Nomenclature



Emc Point

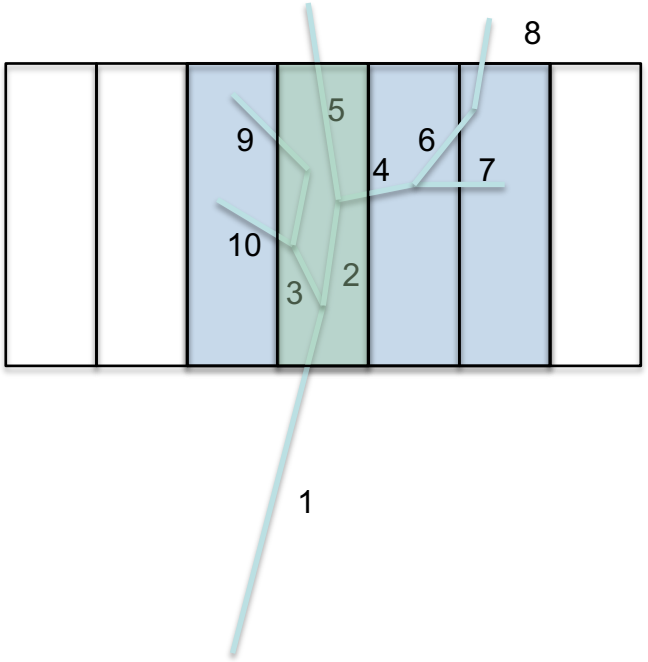
Current Implementation – EMC Nomenclature



Emc Point

Emc Hit –
All points in one crystal

Current Implementation – EMC Nomenclature

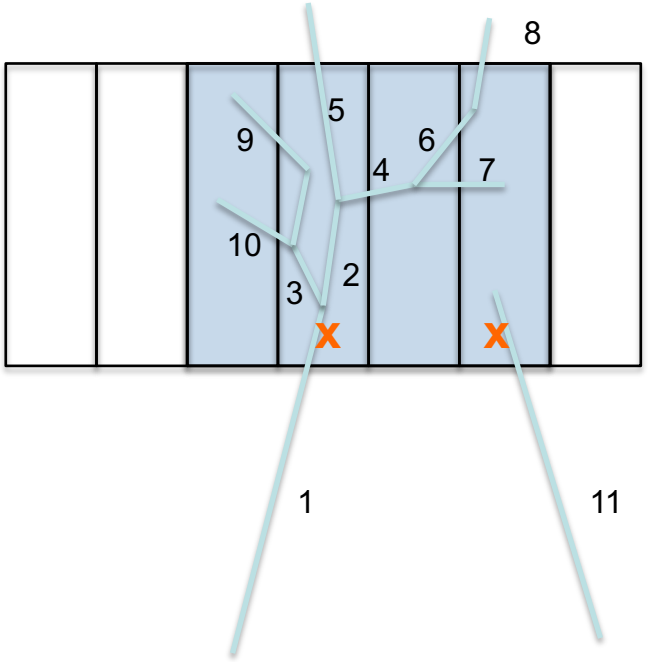


Emc Point

Emc Hit –
All points in one crystal

Emc Cluster –
All hits in neighboring crystals

Current Implementation – EMC Nomenclature



Emc Point

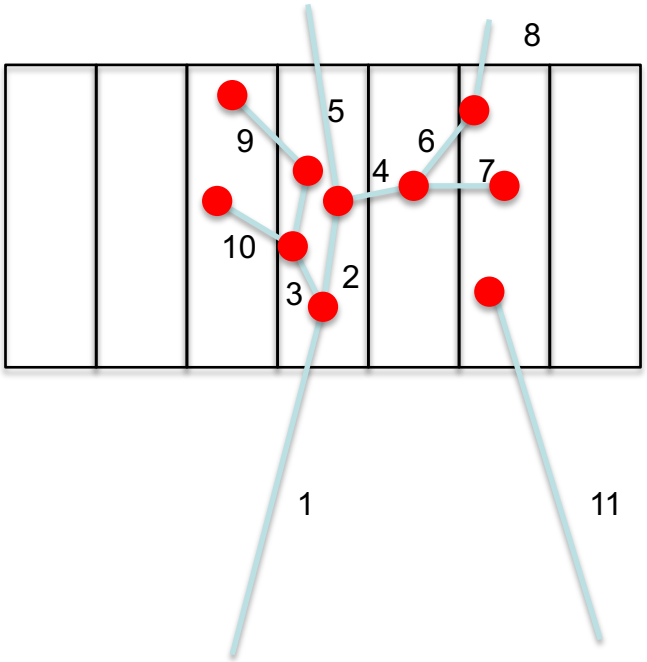
Emc Hit –
All points in one crystal

Emc Cluster –
All hits in neighboring crystals

X Emc Bump –
Subdivision of Cluster for multiple particles

Current Implementation

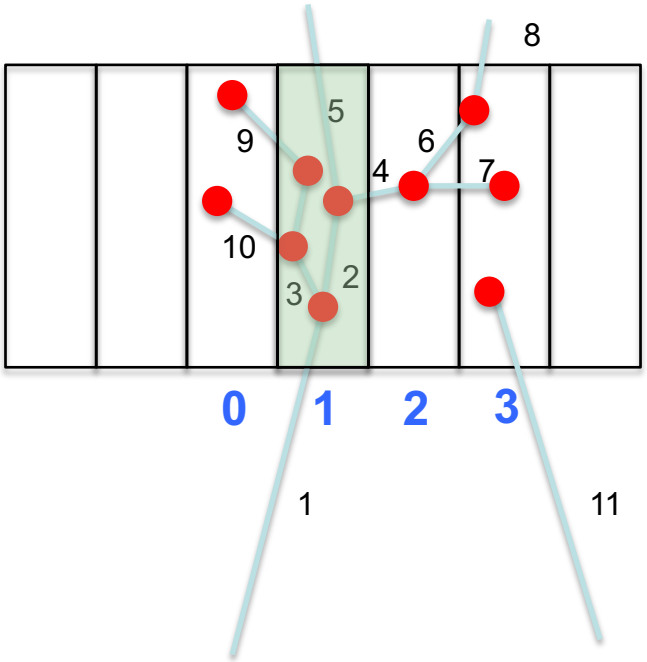
- For each EmcPoint entering and exiting track is stored in each crystal



EmcPoint: entering: 1, 11, 4, 6, 7, 9 ,10
exiting: 4, 5, 6, 7, 8, 9, 10

Current Implementation

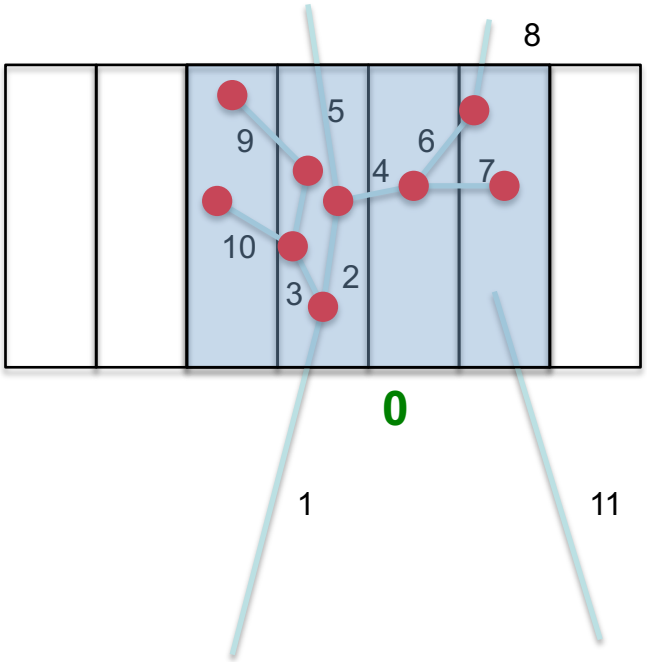
- For each EmcPoint if track is entering / exiting the crystal is stored
- Each EmcHit stores tracks entering and exiting



EmcHit **0**: in: 9 ,10 out -
1: in: 1 out 4, 5, 9, 10
2: in: 4 out 6, 7
3: in 6, 7, 11 out 8

Current Implementation

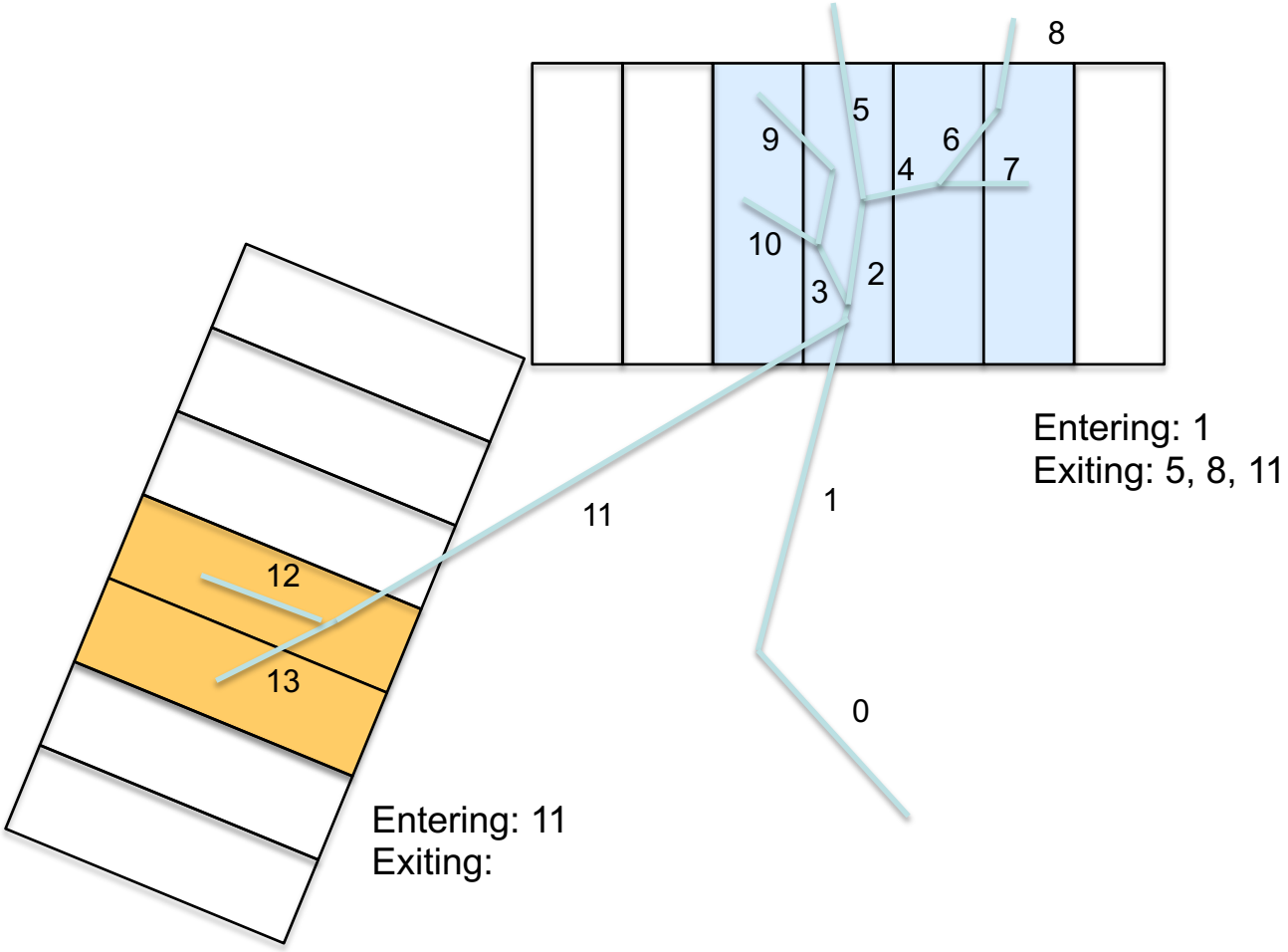
- For each EmcPoint if track is entering / exiting the crystal is stored
- Each EmcHit stores tracks entering and exiting
- Each EmcCluster stores tracks entering and exiting



EmcHit **0**: in: ~~9~~ ,~~10~~ out -
1: in: 1 out ~~4~~, 5, ~~9~~, ~~10~~
2: in: ~~4~~ out ~~6~~, ~~7~~
3: in ~~6~~, ~~7~~, 11 out 8

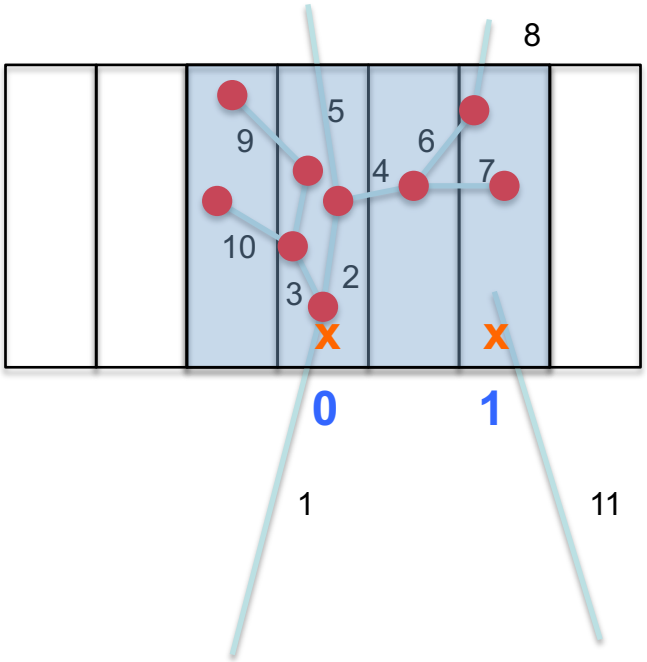
EmcCluster **0**: in 1,11 out 5, 8

3rd Implementation – Entering Exiting



Current Implementation

- For each EmcPoint if track is entering / exiting the crystal is stored
- Each EmcHit stores tracks entering and exiting
- Each EmcCluster stores tracks entering and exiting
- Each EmcBump stores nearest track entering (not implemented yet)

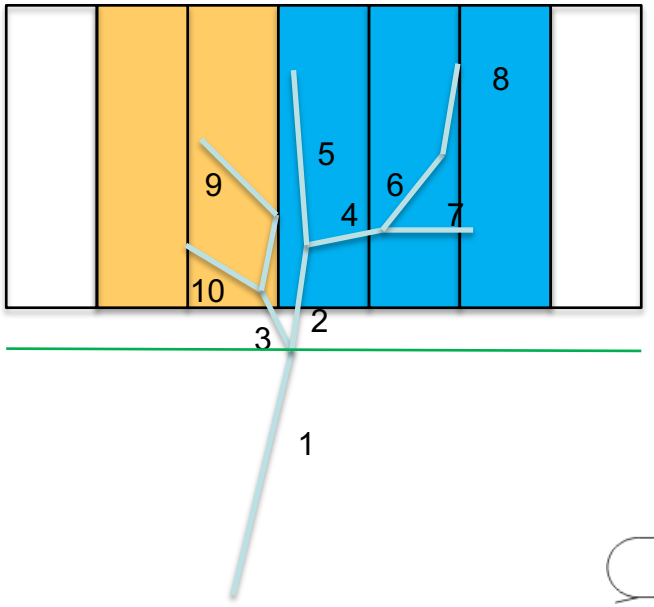


EmcBump **0**: in: 1
1: in 11

Problem

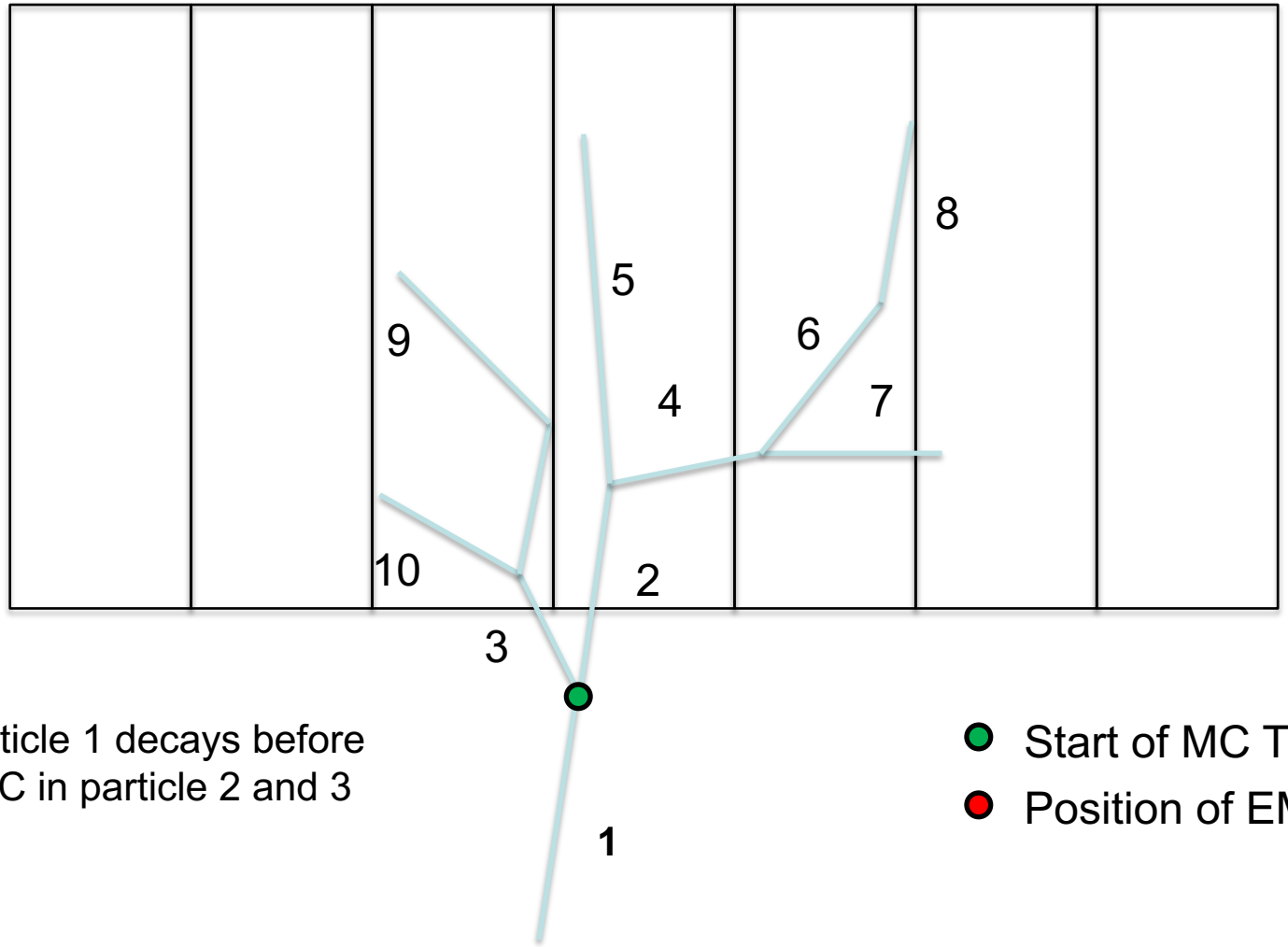
1. The information which particle created the cluster is only available after clusterization but not on an EmcHit level
   - Problem if you need MC truth information for clustering algorithms or ML
2. What about particles decaying right in front of the EMC
   - No cluster information available

- ➔ new MC algorithm



Dead mate

New Algorithm

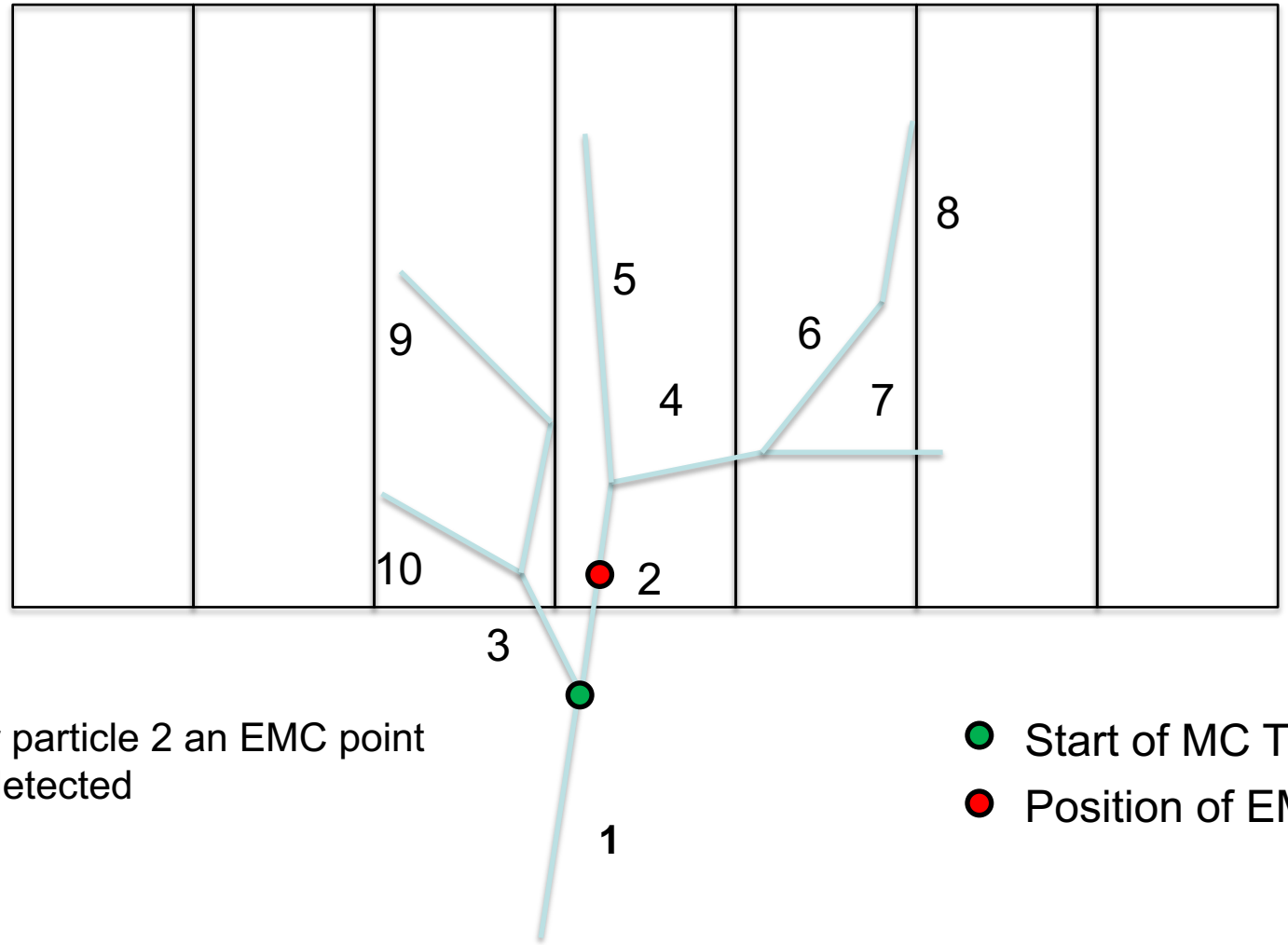


- Particle 1 decays before EMC in particle 2 and 3

Start of MC Track

Position of EMCPoint

New Algorithm

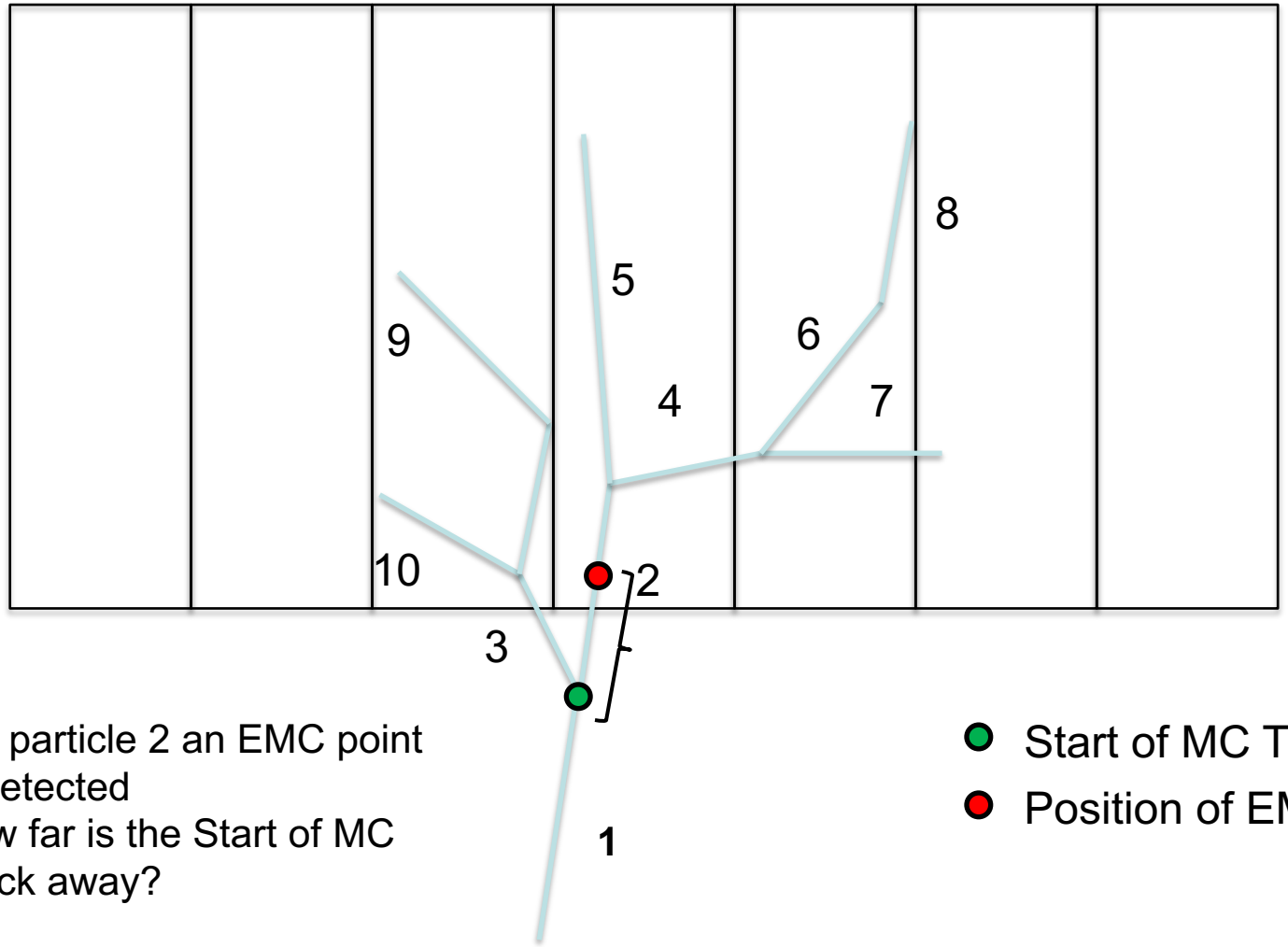


- For particle 2 an EMC point is detected

Start of MC Track

Position of EMCPoint

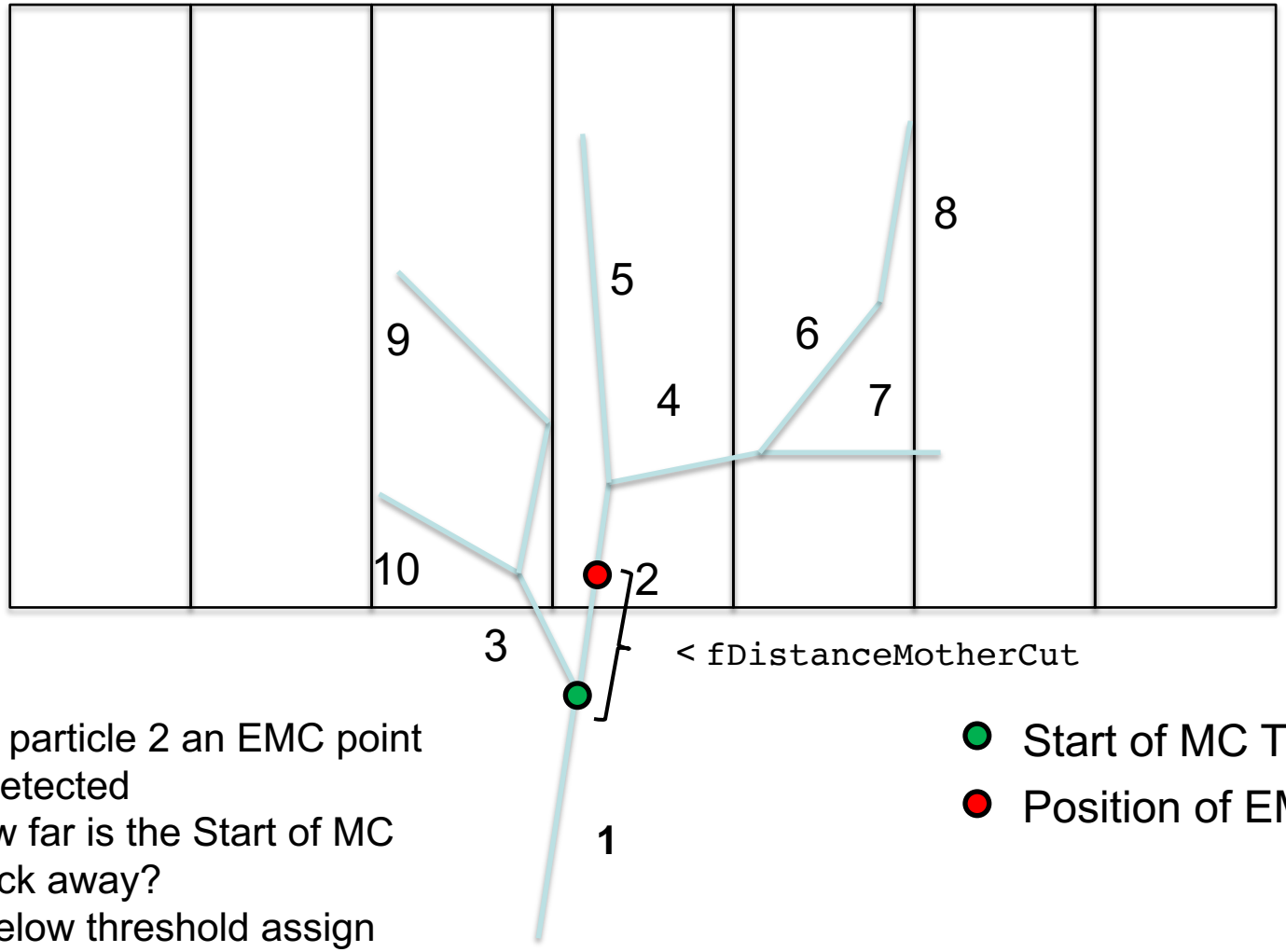
New Algorithm



- For particle 2 an EMC point is detected
- How far is the Start of MC Track away?

- Start of MC Track
- Position of EMCPoint

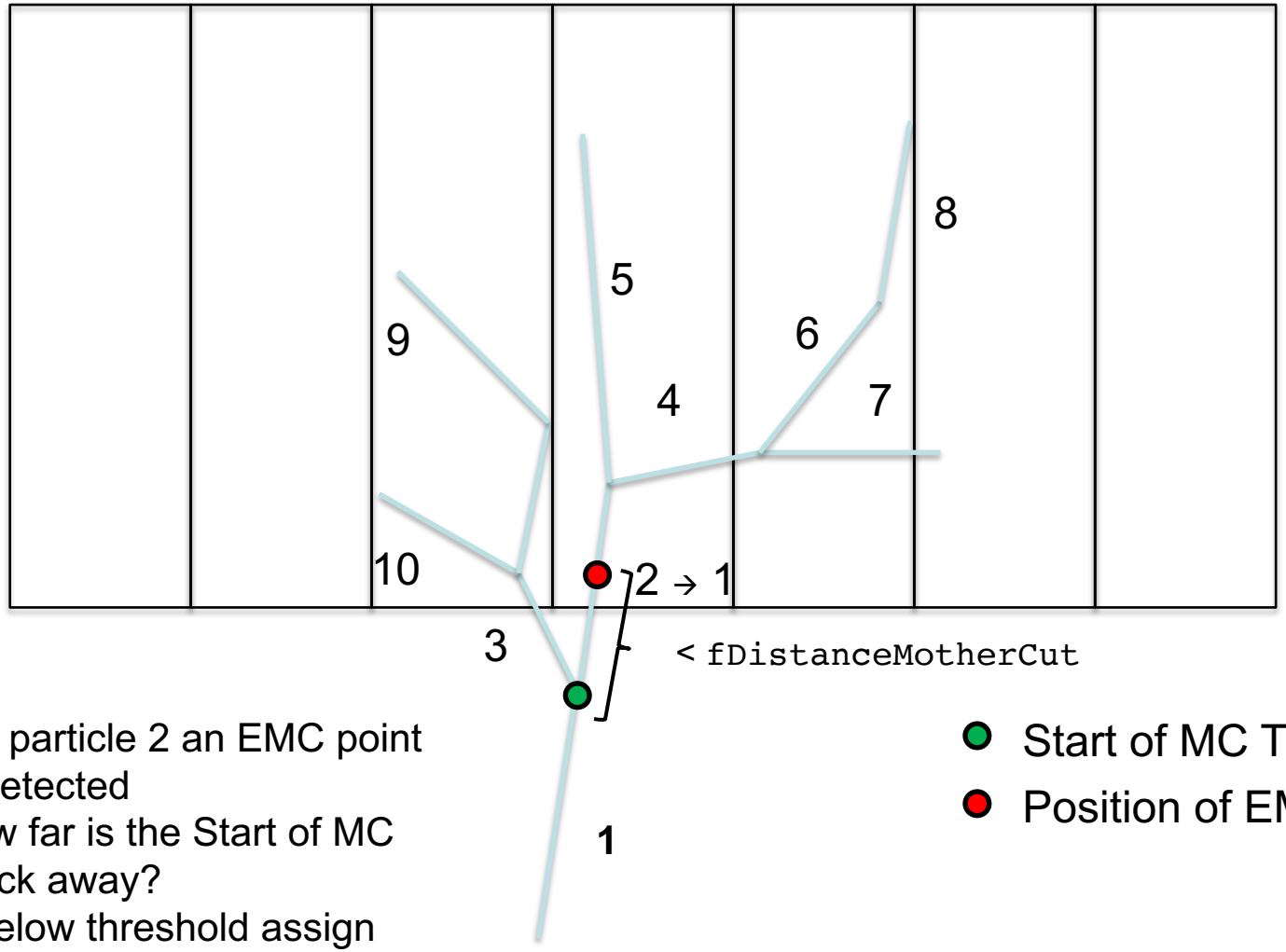
New Algorithm



- For particle 2 an EMC point is detected
- How far is the Start of MC Track away?
- If below threshold assign Mother ID to EMC point
- Otherwise keep Track ID

- Start of MC Track
- Position of EMCPoint

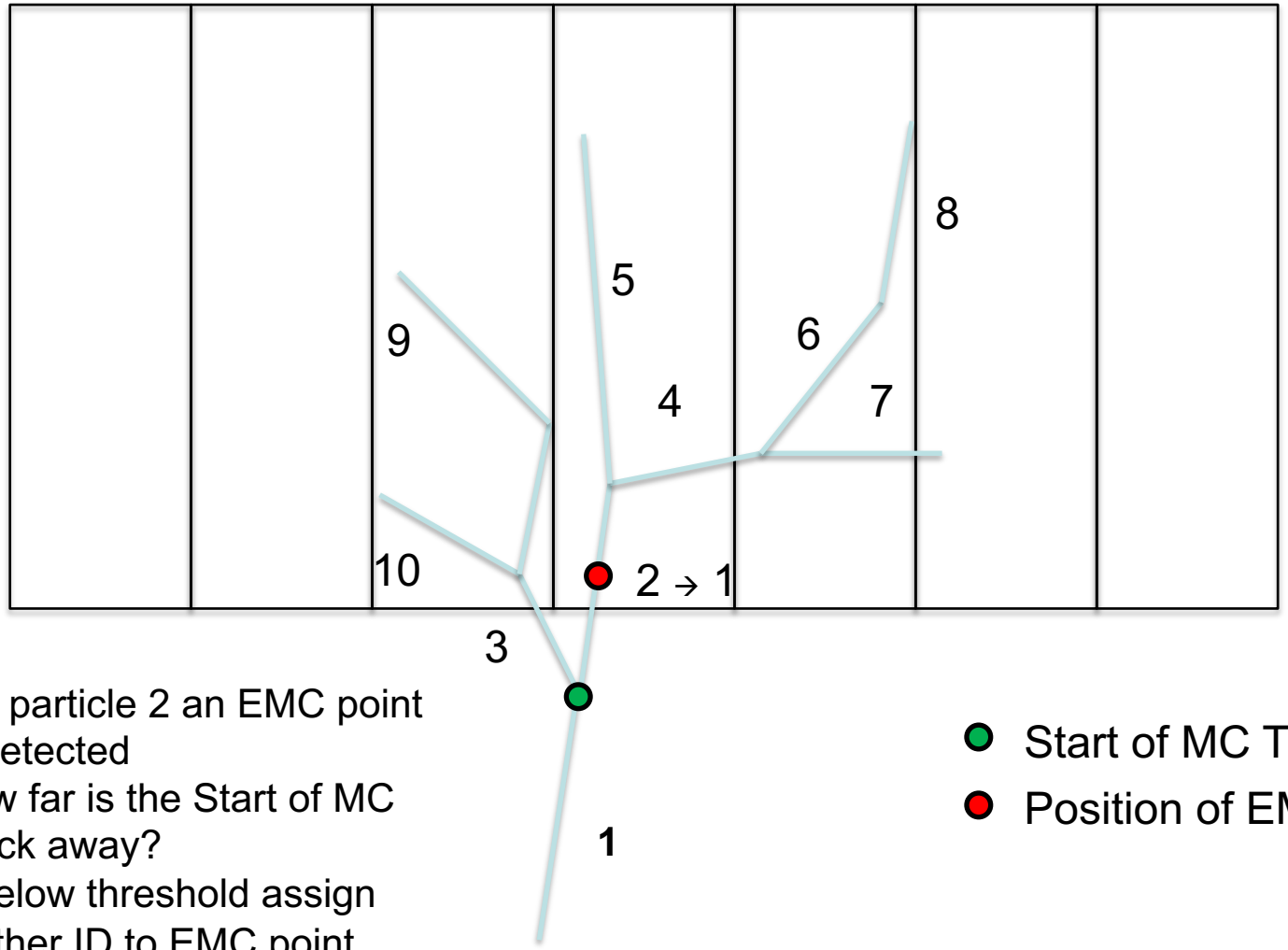
New Algorithm



- For particle 2 an EMC point is detected
- How far is the Start of MC Track away?
- If below threshold assign Mother ID to EMC point
- Otherwise keep Track ID

- Start of MC Track
- Position of EMCPoint

New Algorithm

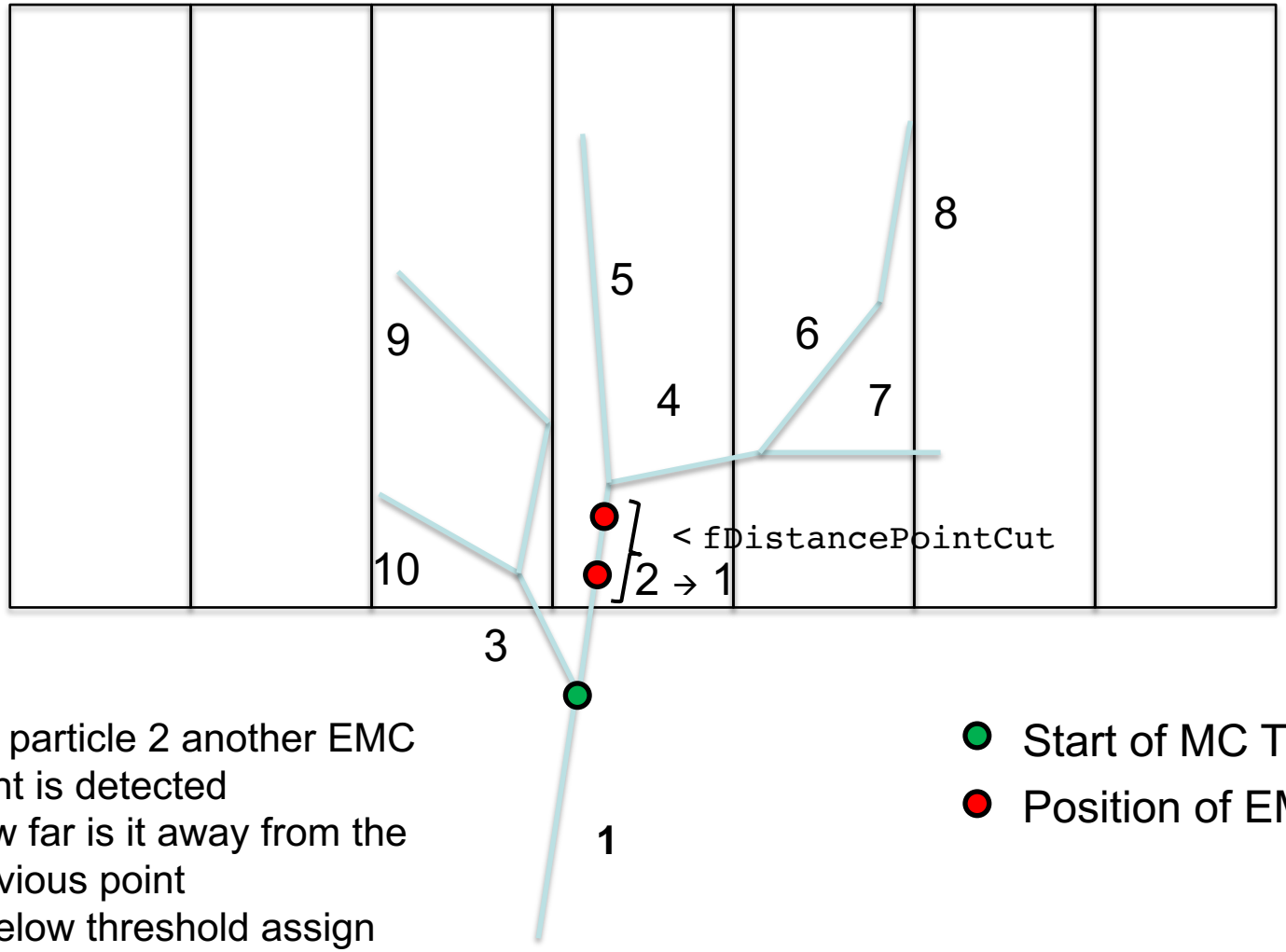


- For particle 2 an EMC point is detected
- How far is the Start of MC Track away?
- If below threshold assign Mother ID to EMC point (recursive)
- Otherwise keep Track ID

Start of MC Track

Position of EMCPoint

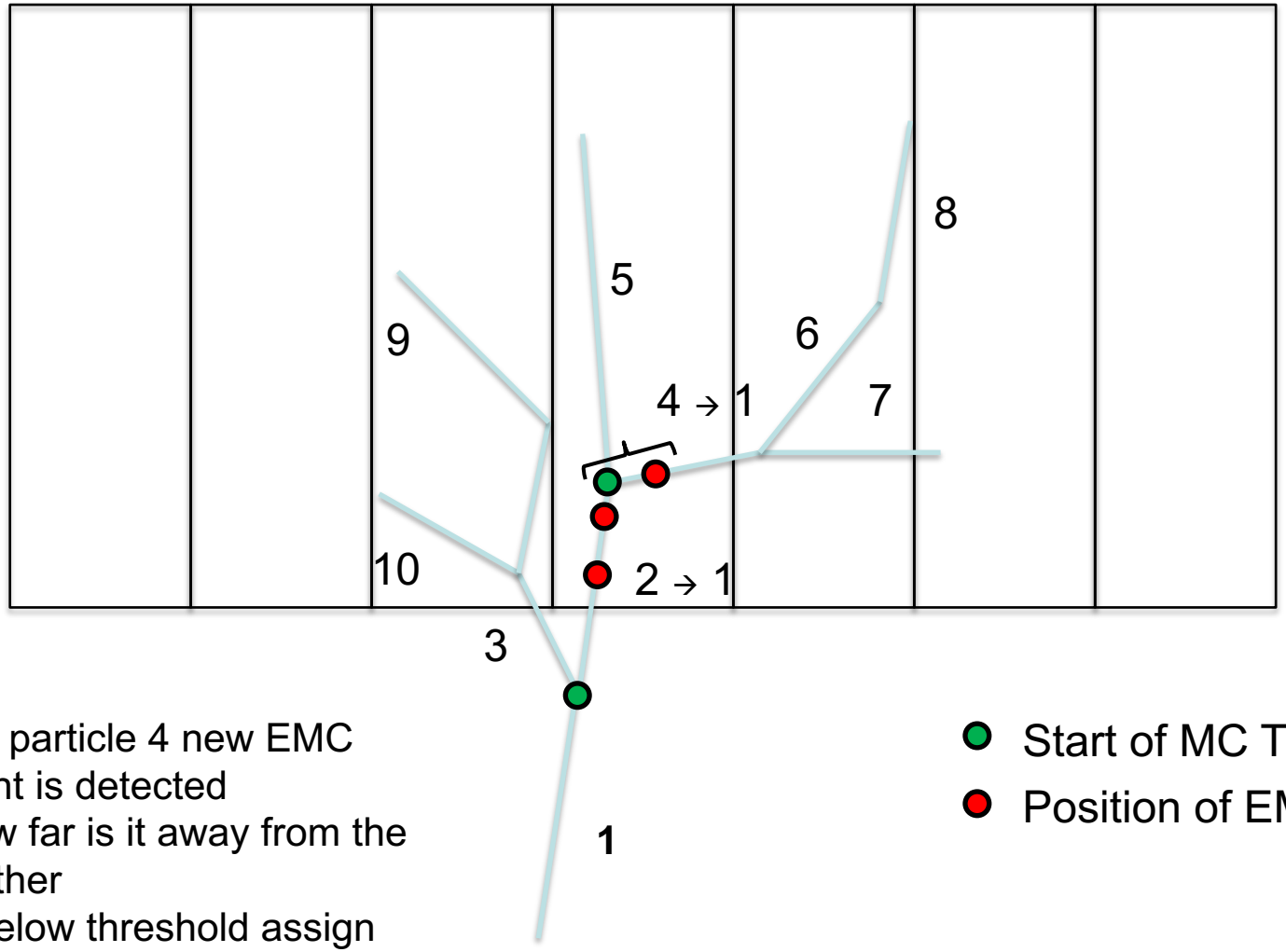
New Algorithm



- For particle 2 another EMC point is detected
- How far is it away from the previous point
- If below threshold assign MC ID of previous point
- Otherwise keep Track ID

- Start of MC Track
- Position of EMCPoint

New Algorithm

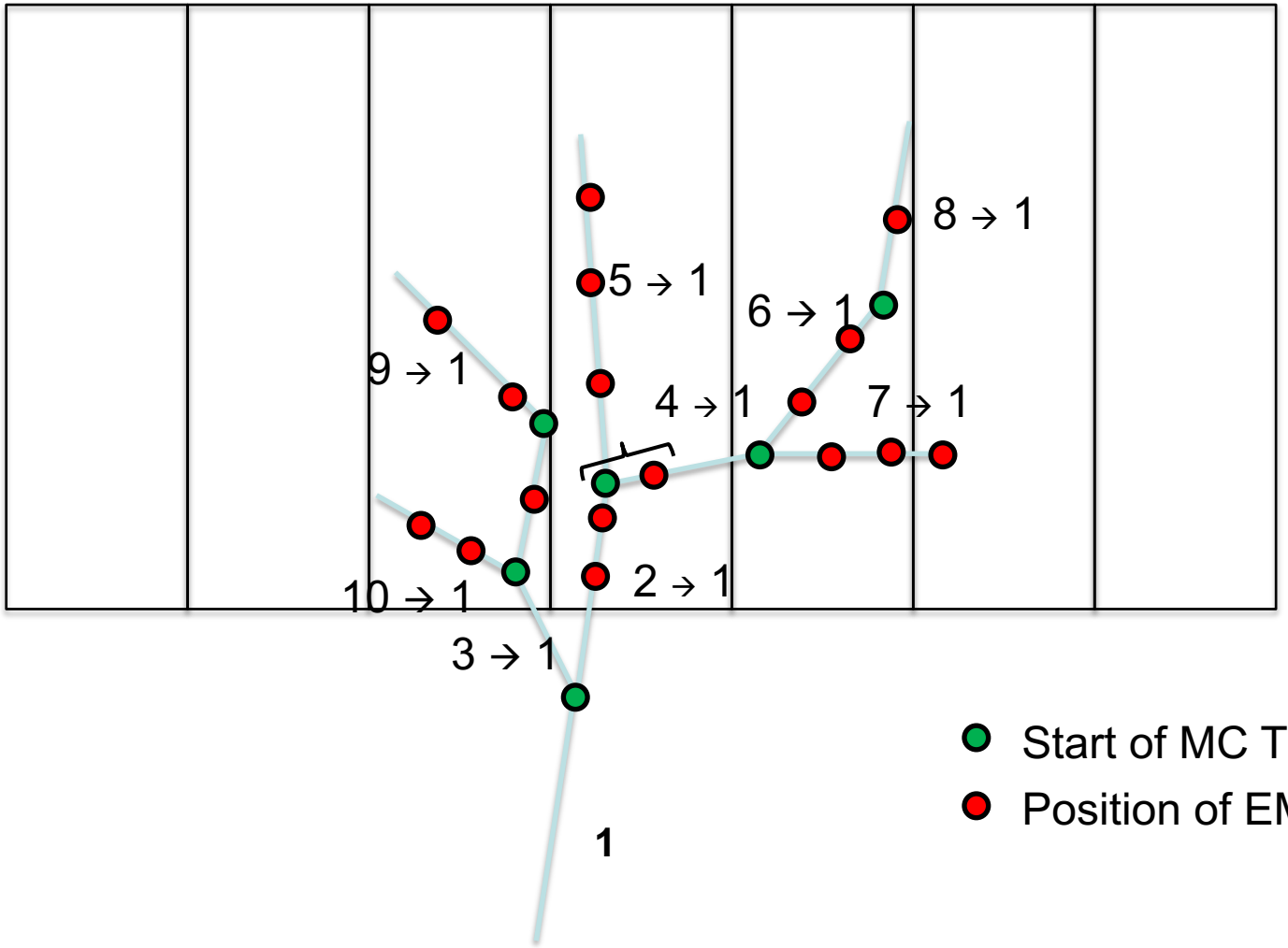


- For particle 4 new EMC point is detected
- How far is it away from the mother
- If below threshold assign MC ID of previous point
- Otherwise keep Track ID

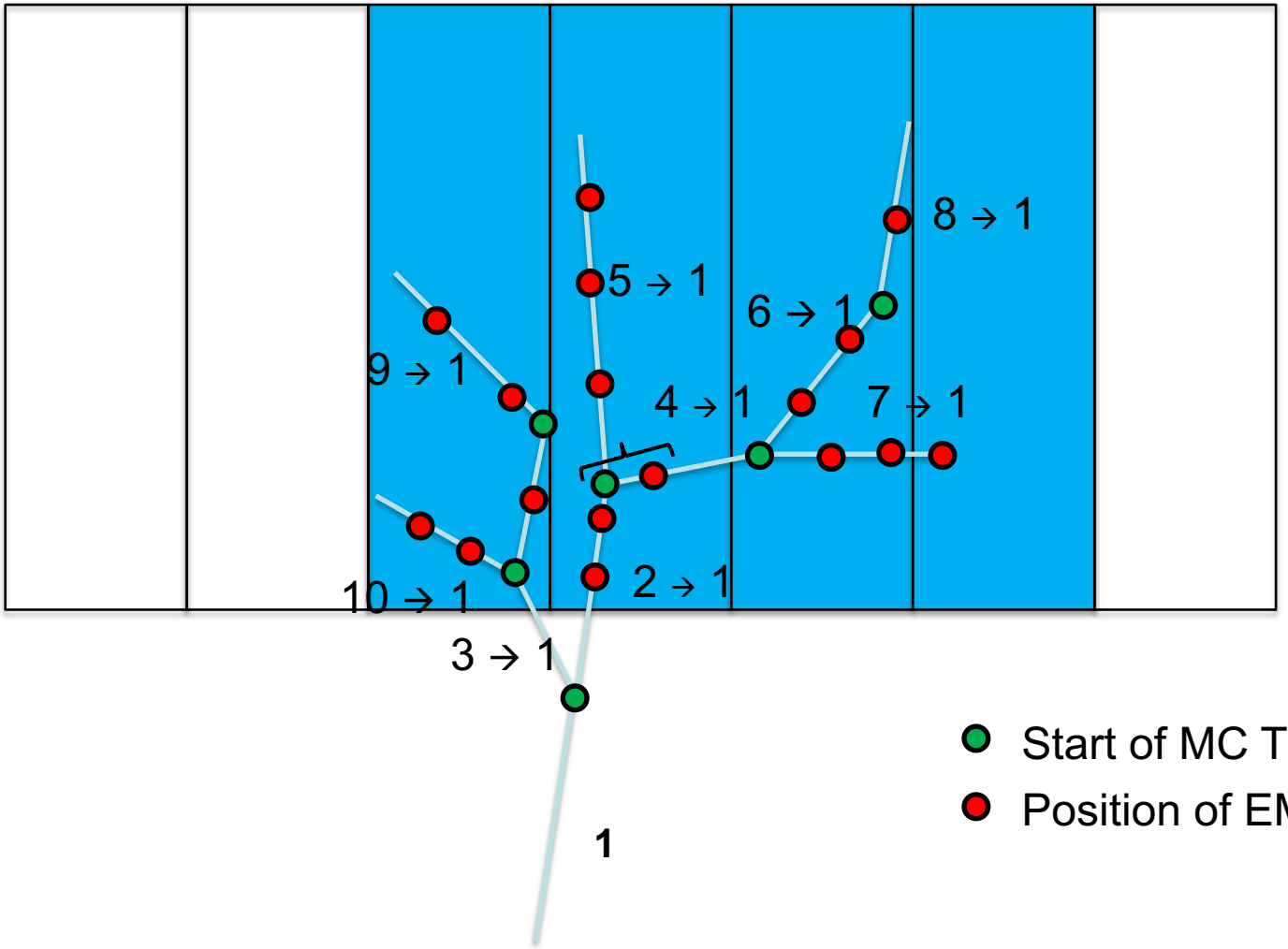
Start of MC Track

Position of EMCPoint

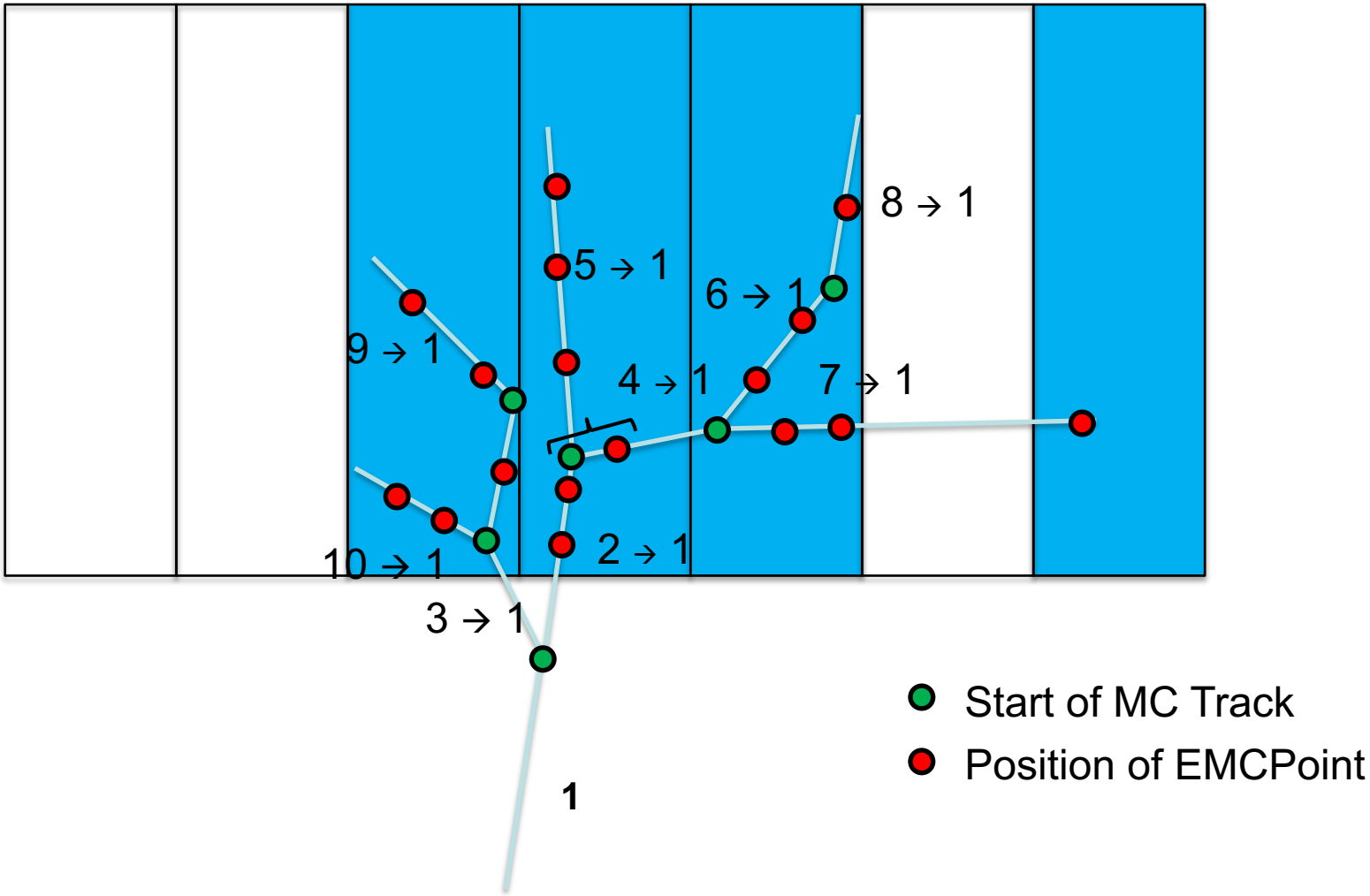
New Algorithm



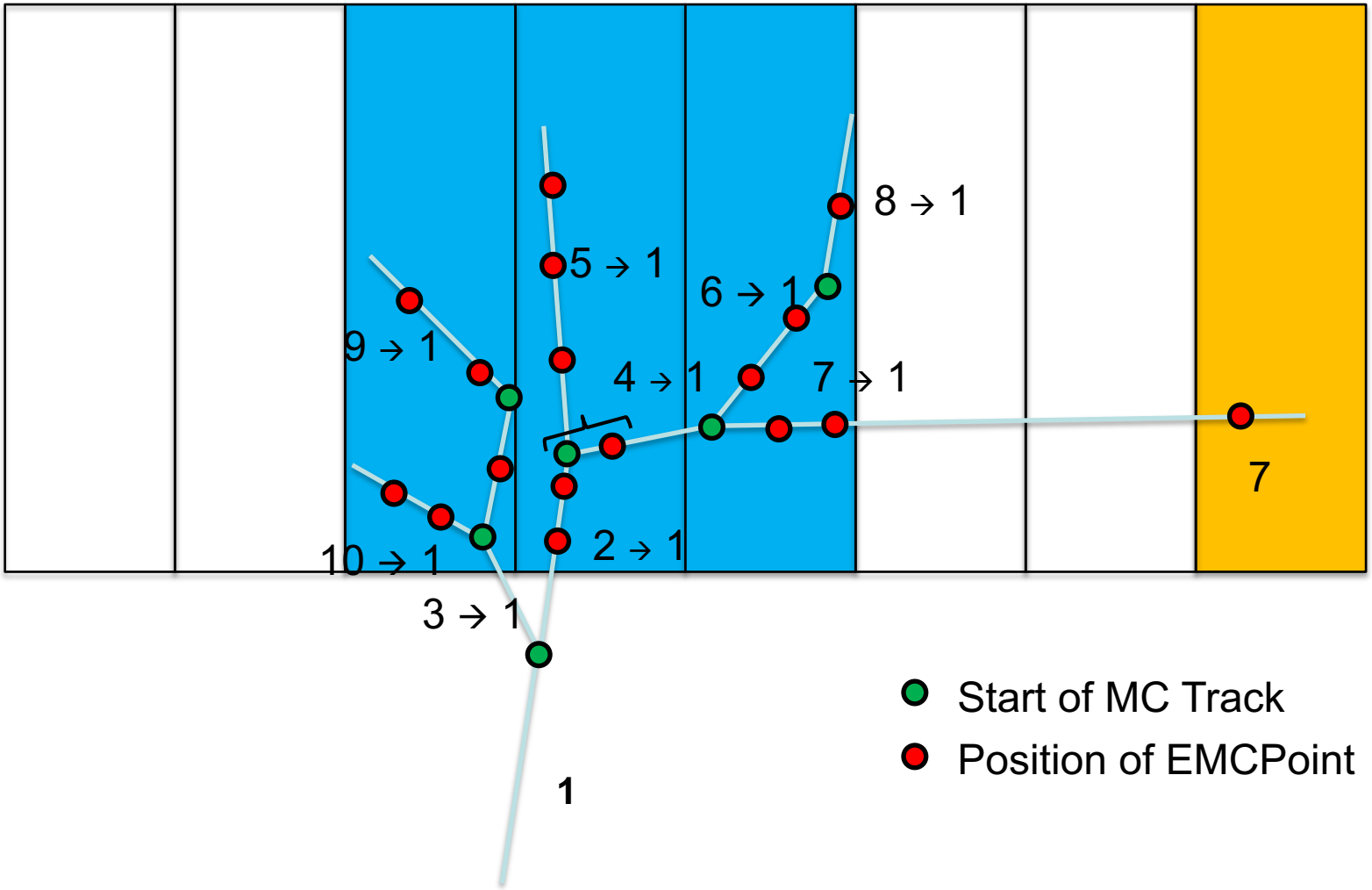
New Algorithm



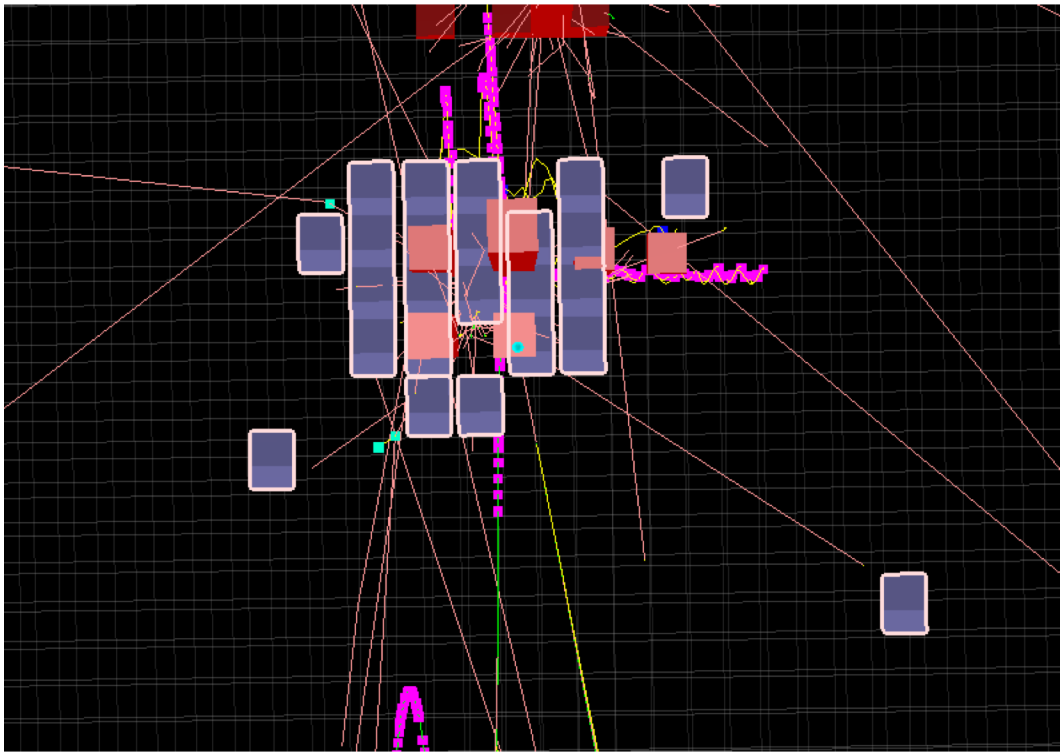
New Algorithm



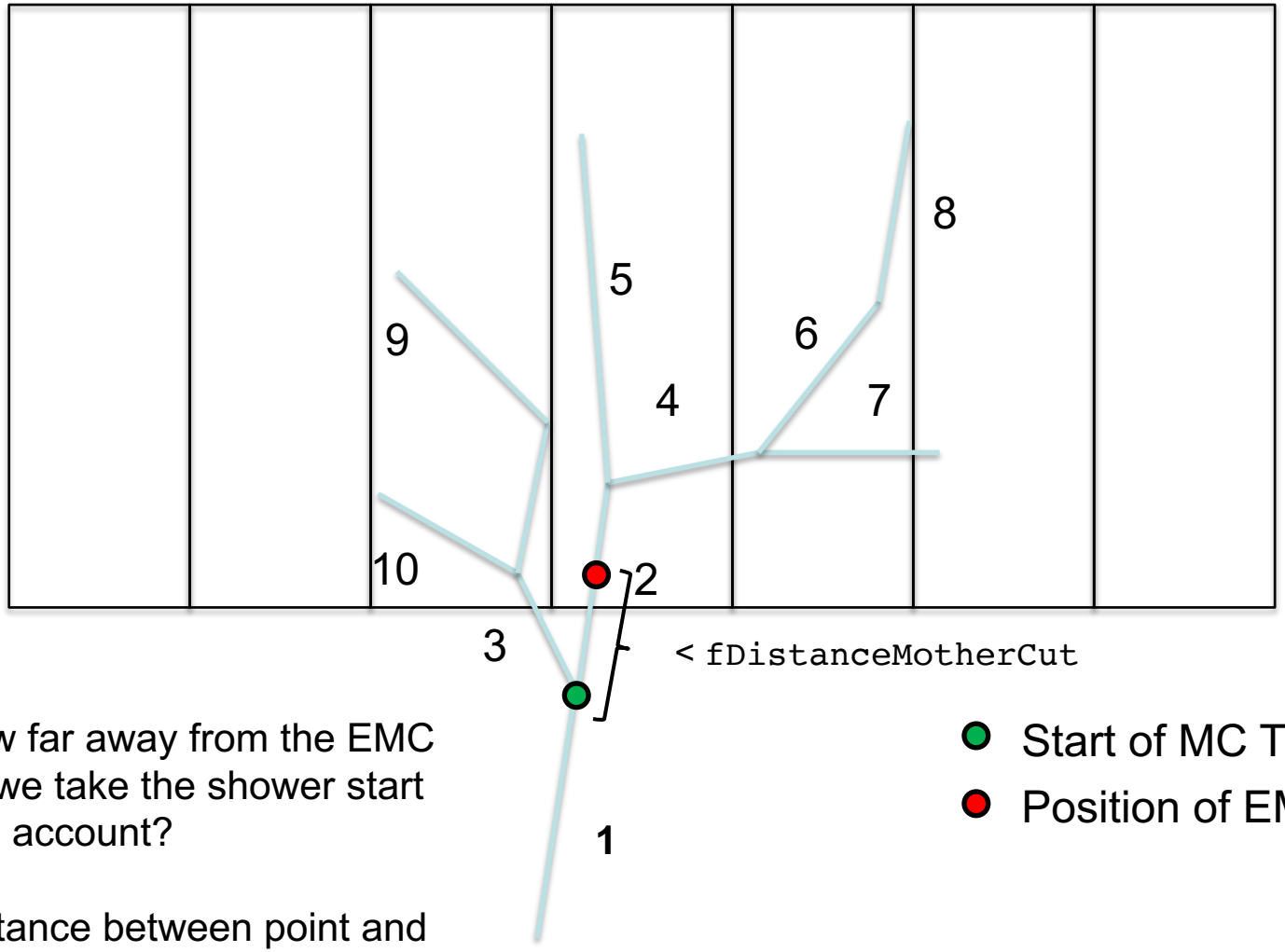
New Algorithm



Example Picture



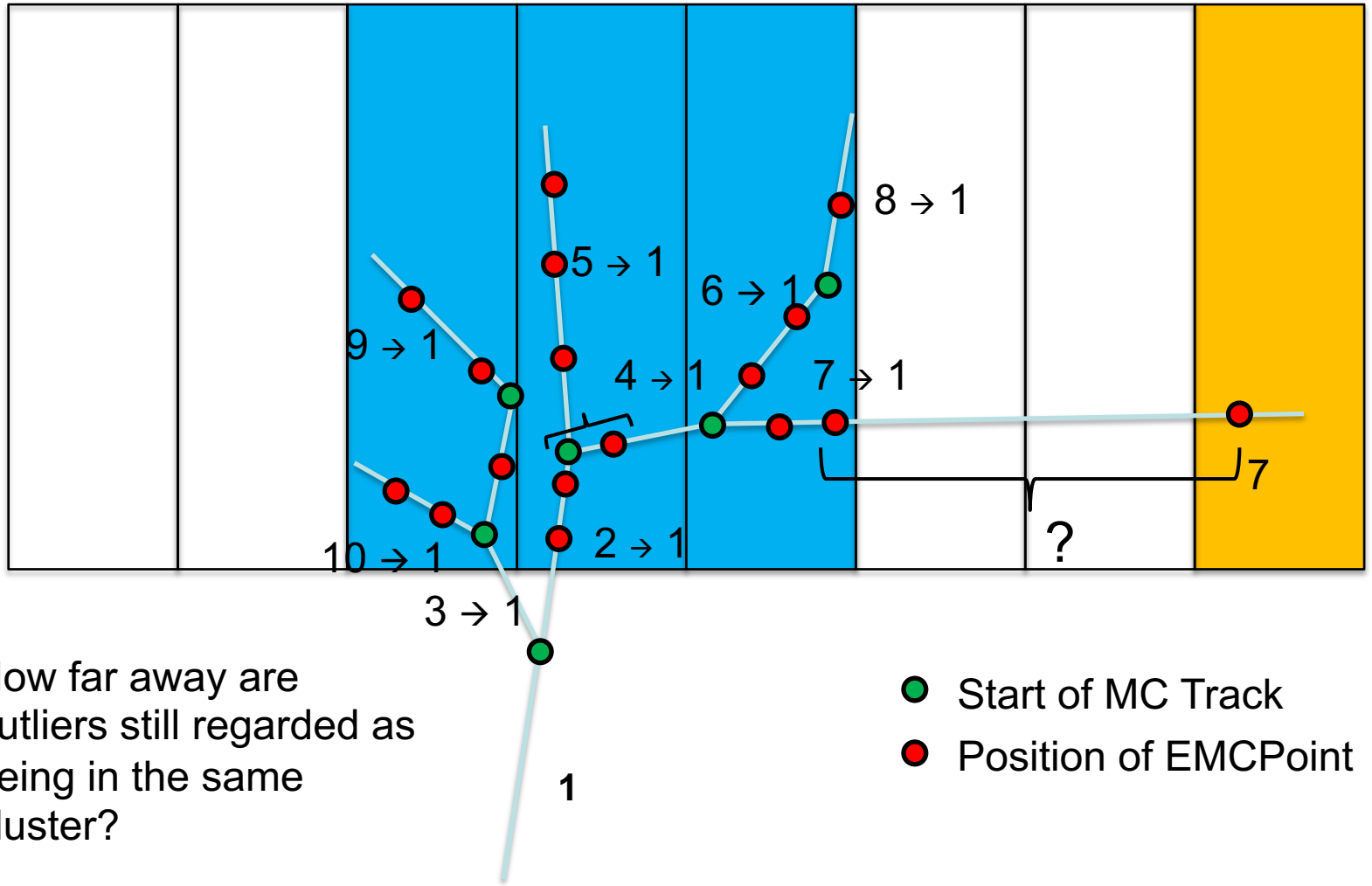
Questions: Mothers?



- How far away from the EMC do we take the shower start into account?
- Distance between point and mother not ideal

- Start of MC Track
- Position of EMCPoint

Questions: Outliers?



- How far away are outliers still regarded as being in the same cluster?

Start of MC Track

Position of EMCPoint

Summary

- New method to assign MC truth information to EMC Hits presented
- Selection/Tuning of parameters still open

- Questions:
  - Up to which distance should a mother been taken into account?
  - How to deal with outliers?