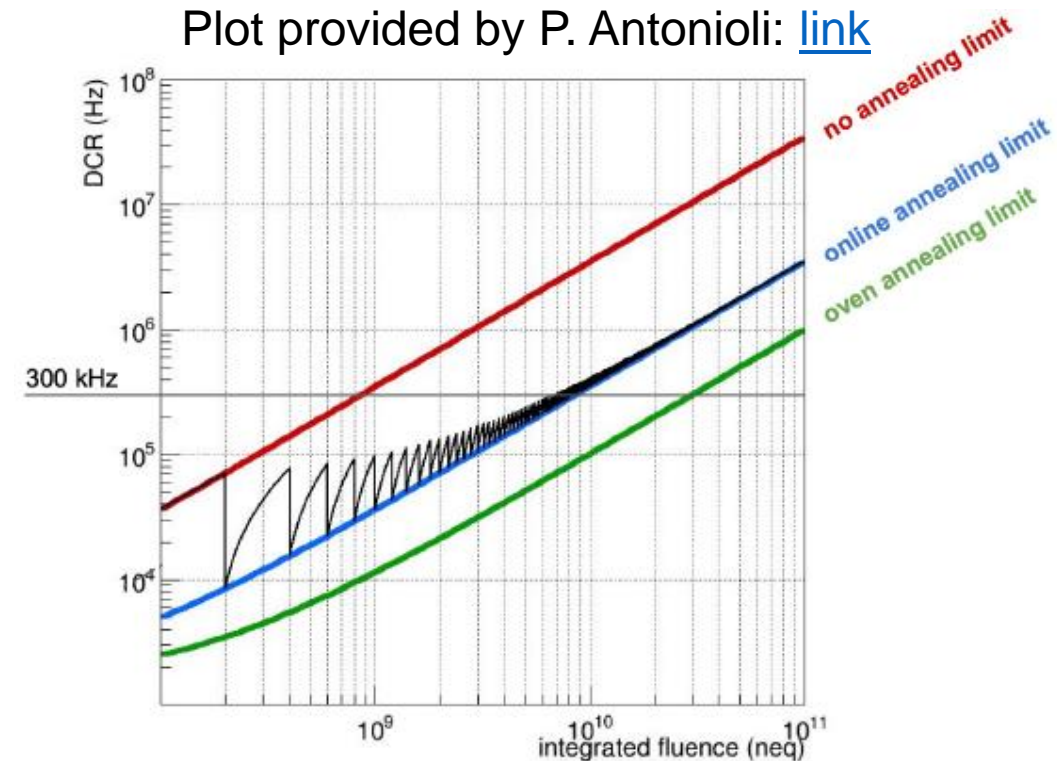# dRICH simulation – Noise

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dRICH Simulation meeting, 13/03/2023

Outline

- Implementation of the dRICH noise simulation.

- Performance study as a function of the DCR.

Plot provided by P. Antonioli: link

- Noise hits added in the PhotoMultiplierHitDigi.cc .

- Pull request:
  https://github.com/eic/EICrecon/pull/501

Algorithm
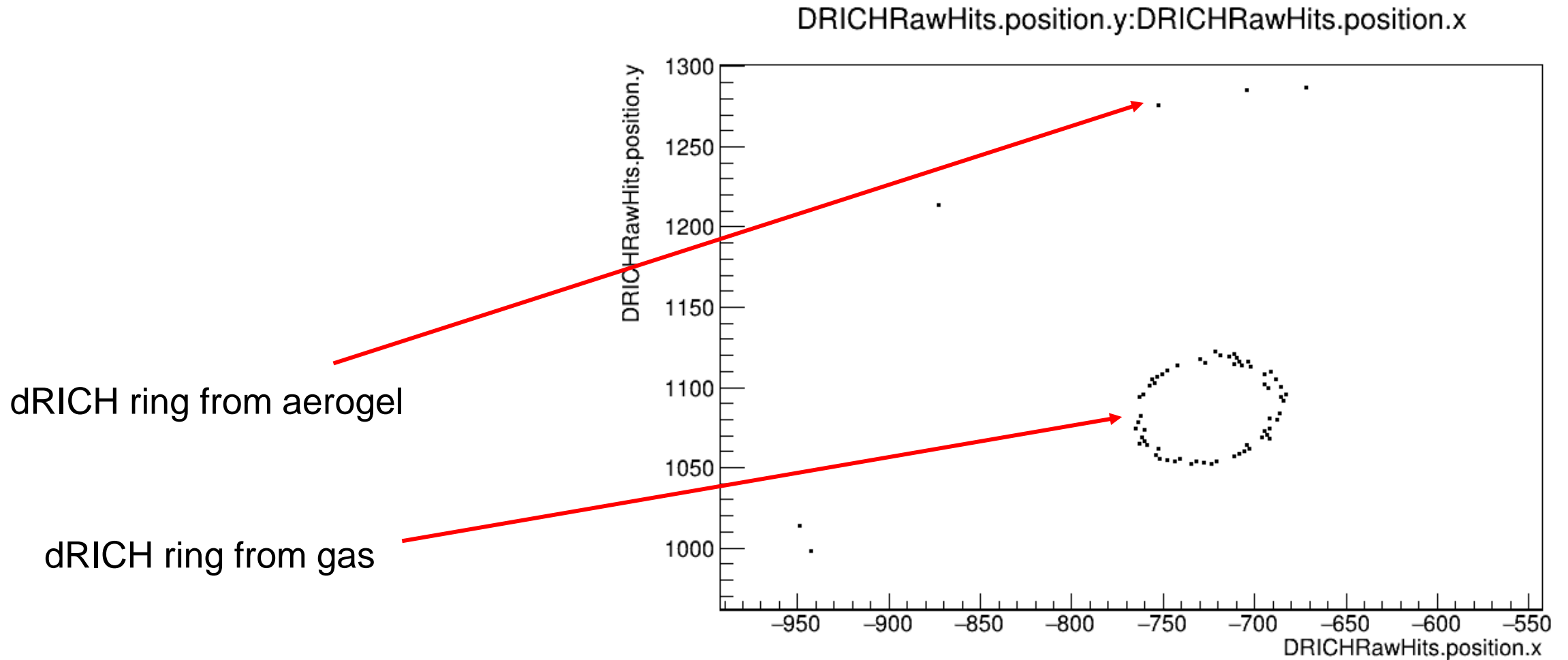
- Loop over the sensors and generate random noise hits with a configurable rate in a given time window.

- Noise function:

```cpp
bool  eicrecon::PhotoMultiplierHitDigi::Noise_Digits(float noiseRate, int timeWindow) const
{
  return (m_rngUni() < (noiseRate*timeWindow*dd4hep::ns));
}
```

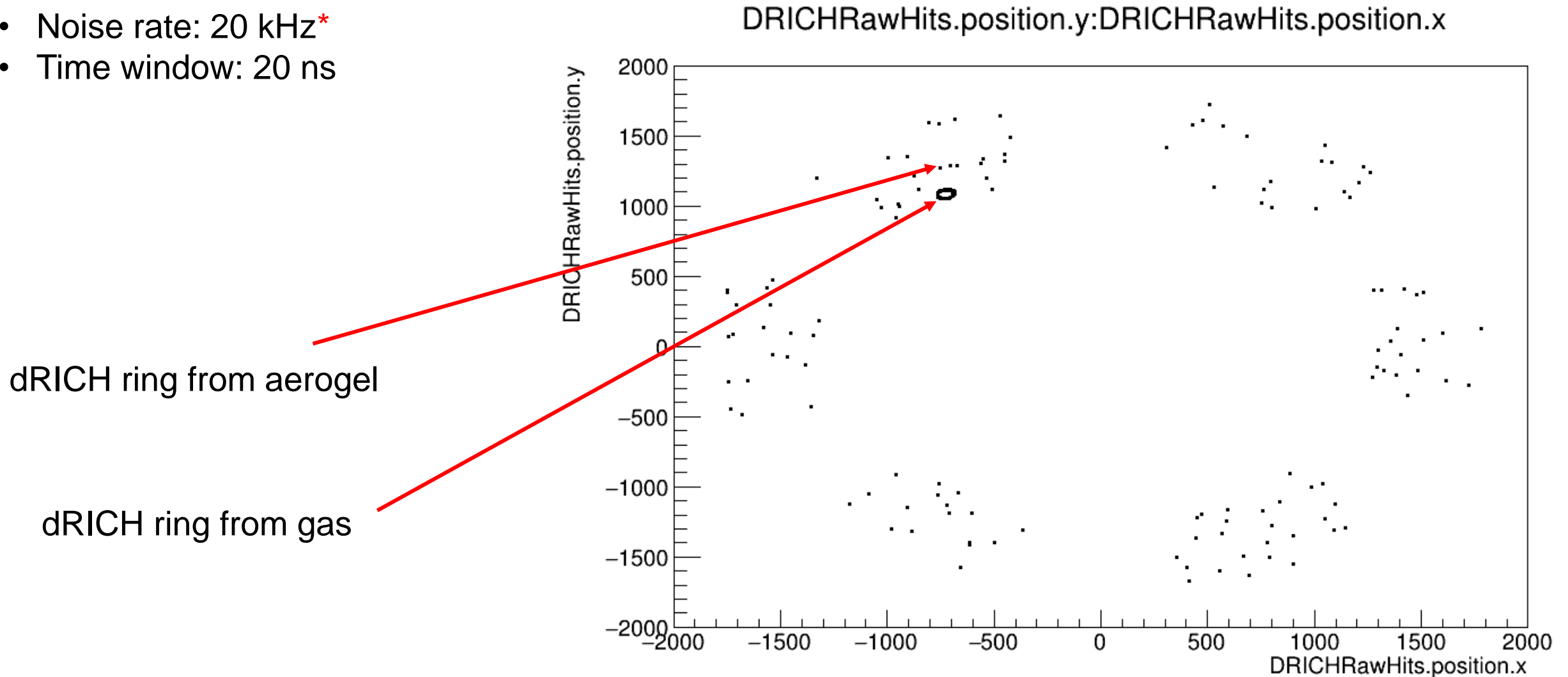- When the outcome of the Noise function is true, a noise hit is added to the raw hits:

```cpp
if (Noise_Digits(m_cfg.noiseRate, m_cfg.timeWindow)){
  // cell time, signal amplitude
  double amp = m_cfg.speMean + m_rngNorm()*m_cfg.speError;
  double time = m_cfg.timeWindow*m_rngUni();
  auto pos_hit_global = m_cellid_converter->position(cellID);
  hit_groups_noise[cellID] = {HitData{1, amp + m_cfg.pedMean + m_cfg.pedError*m_rngNorm(), time, pos_hit_global}};
}
```
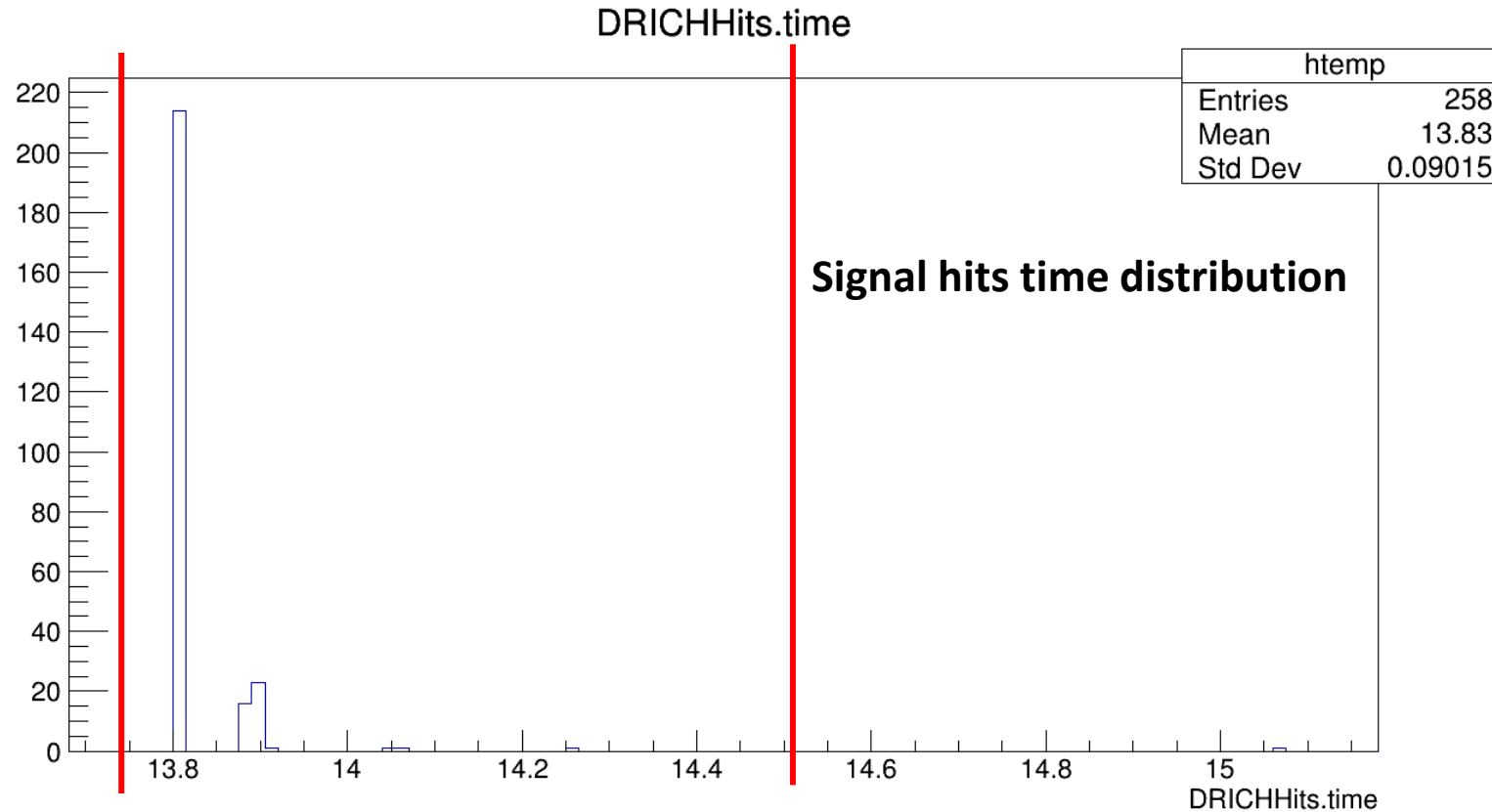
Rings without noise

DRICHRawHits.position.y:DRICHRawHits.position.x

dRICH ring from aerogel

dRICH ring from gas

Rings with noise

- Noise rate: 20 kHz*
- Time window: 20 ns

dRICH ring from aerogel

dRICH ring from gas

*Numbers provided by P. Antonioli: [link](#)

Time shutter

- Reduce the noise with a "time shutter".

Outlook

- Implementation of the missing features.

- Test the performance at different noise rate, time windows, time shutter.