

# Resonant Spin Depolarization in Diamond Light Source

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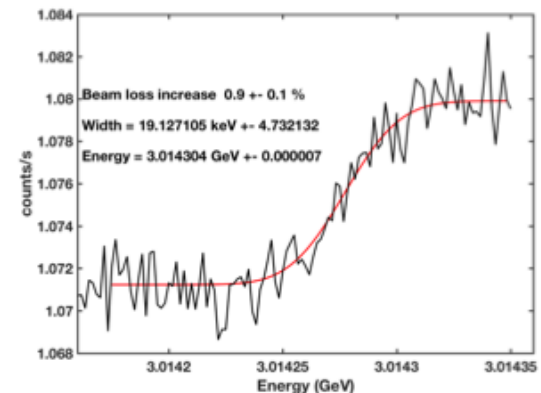


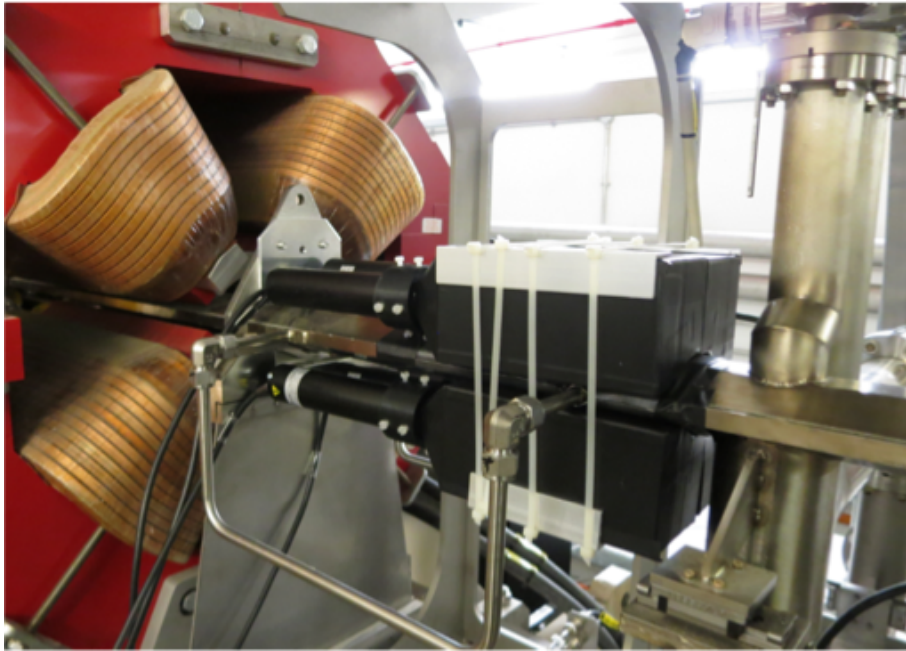
- Polarized beam
- Vertical oriented stripline is used to excite the beam.
- The magnetic field oscillates at frequencies that match the fractional part of the spin tune  $\Rightarrow$  spin starts to precess  $\Rightarrow$  Depolarization.
- The spin precession frequency depends on the beam energy:

$$\Omega_z = \omega_0(1 + \alpha\gamma)$$

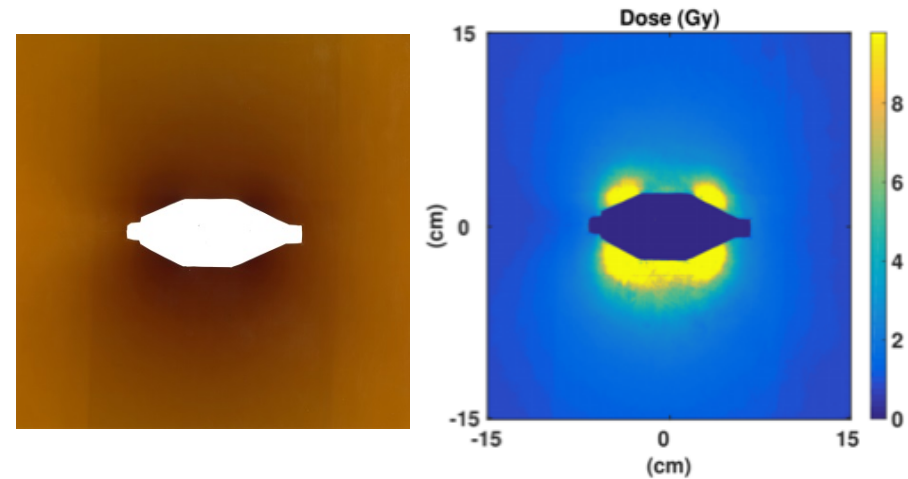
- Touschek scattering  $\Rightarrow$  electrons exceed the longitudinal acceptance limit  $\Rightarrow$  beam losses.

$$R_{norm} = \frac{1}{I(t)^2} \frac{dN}{dt} \propto f_1 + f_2 P(t)^2$$





Radiochromic film

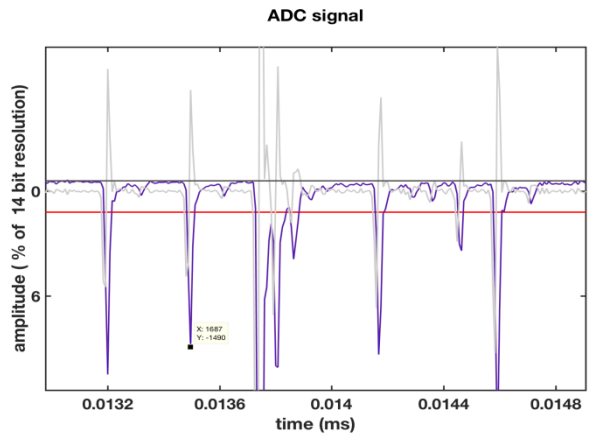
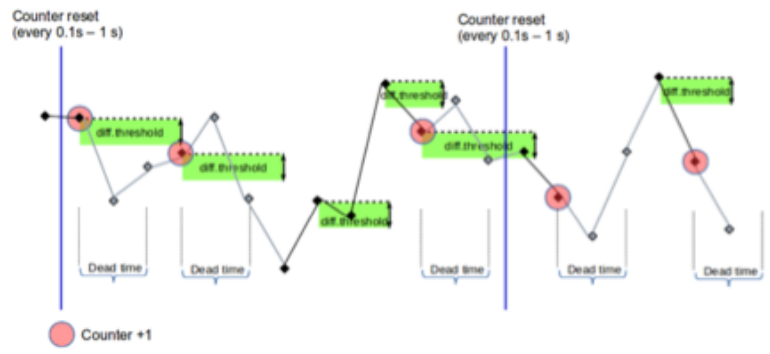


- Detectors are covered with a lead layer of 1.3 mm thick to be protected by X-rays.
- 4 detectors  $\Rightarrow$  more counts  $\Rightarrow$  limited only by Poisson statistics.

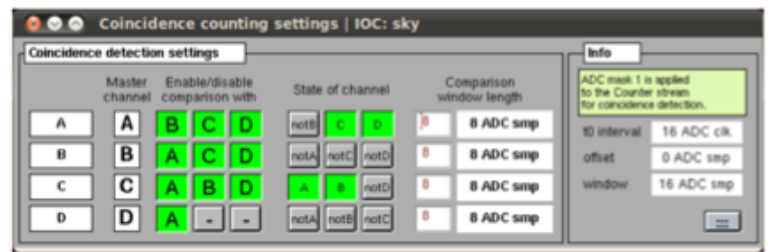
- The detectors are connected with a Libera instrument with two hardware interfaces:
  - 4 SMA coaxial connectors for signal output.
  - External triggering.
  - Reference clock for sampling clock and ADC masks.
  - 4 RJ-25 pinouts for: 1) power supplying  
2) gain control voltage



- Differential counting system

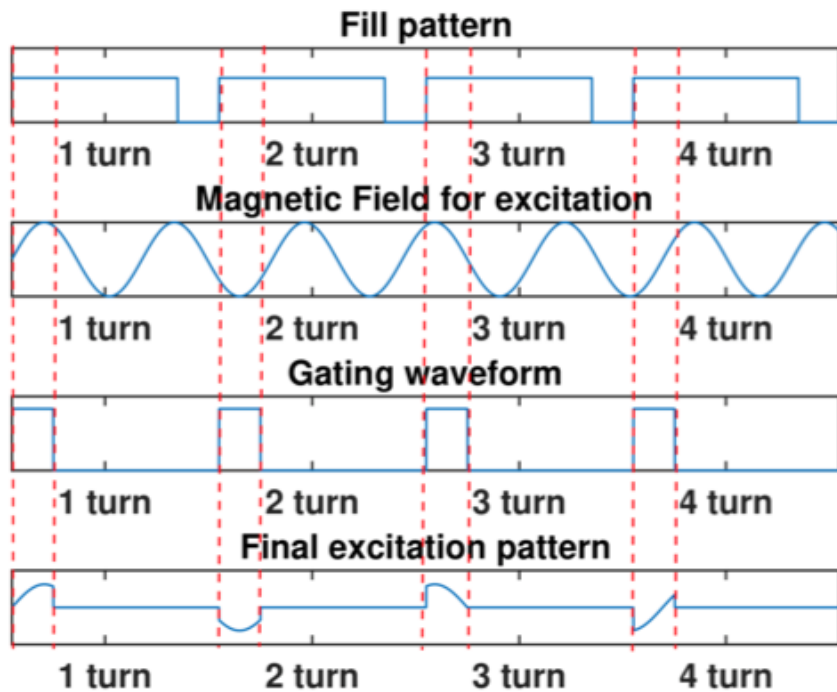


- Coincidence counting
- Masks

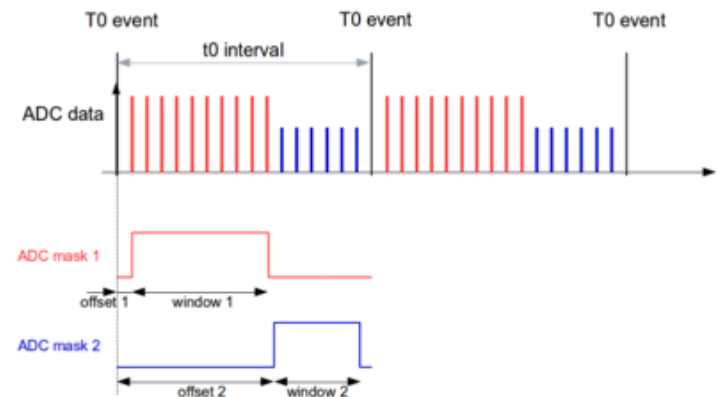
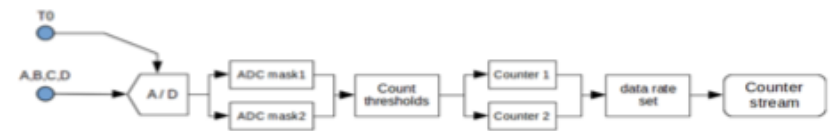


## Advanced Resonant Spin Depolarization : Energy measurements during user operation

### Excitation



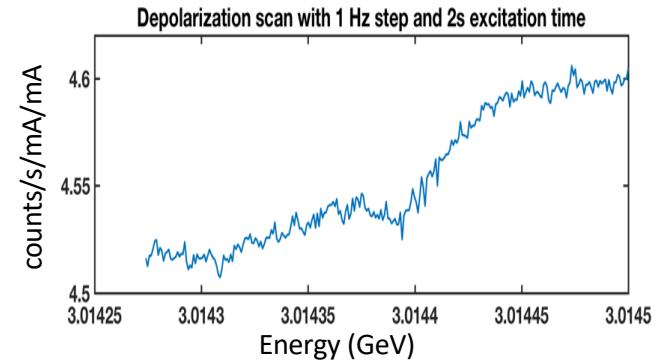
### Counting system with masks



## SLIM simulation

Thanks to SOLEIL for providing the code!

- 3x3 spin transfer matrix attached to the trajectory closed orbit to study the spin on the beam center.
- Calculation of imperfection and intrinsic depolarization resonances.
- Why do we have only 2% increase in beam losses?
- Do we have enough polarization?
- Do the horizontal and vertical tunes affect the polarization level of the beam?



## FESTA simulation

Thanks to ESRF for providing the code!

- Festa tracks the spin of many particles as they propagate in the storage ring while being exciting by an oscillating magnetic field.
- How the kicker strength and excitation time affect the measurement?
- What is the width of the depolarization resonance dependent on?

