MD using IRRAD Diode

Slow extracted bunched beams

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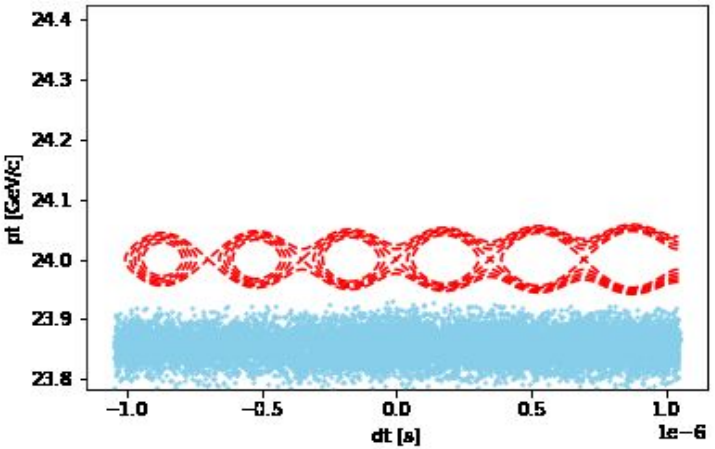
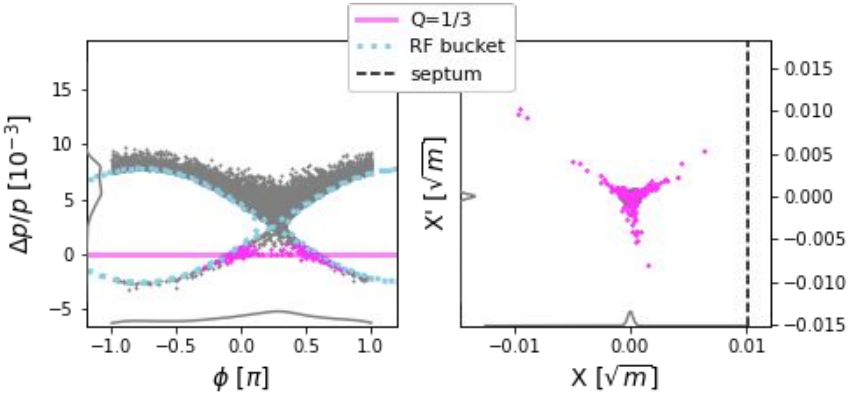
Motivation and mechanism

- In some fixed target experiments neutrinos have same signature as hidden sector particles.
- Neutrinos travel at (almost) the speed of light -> discriminate by time of flight using bunched slow extraction.

Particles can be bunched at a specific moment in time

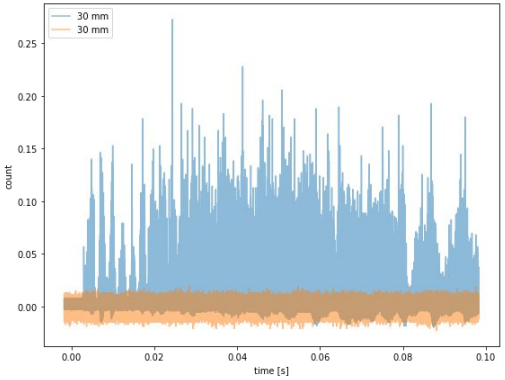


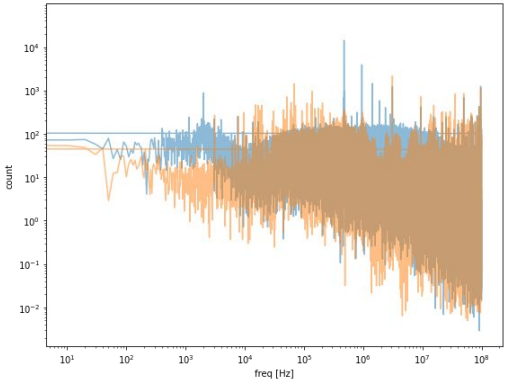
We can combine this bunching with a resonance to extract a bunched beam

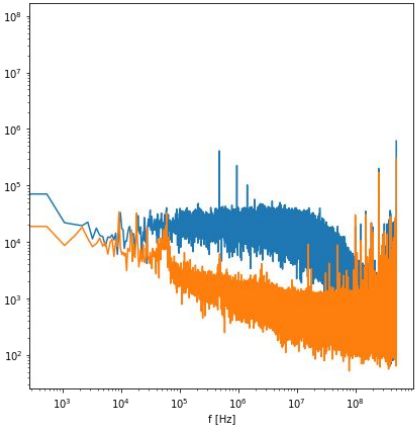


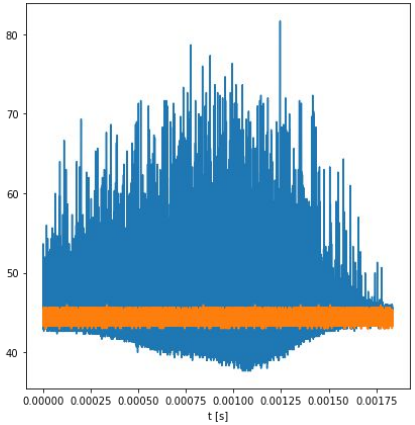
Noise vs. beam

Oscilloscope







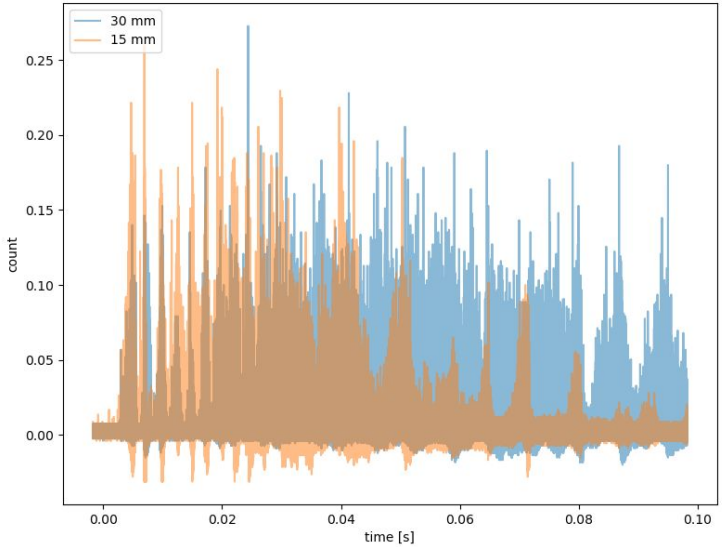


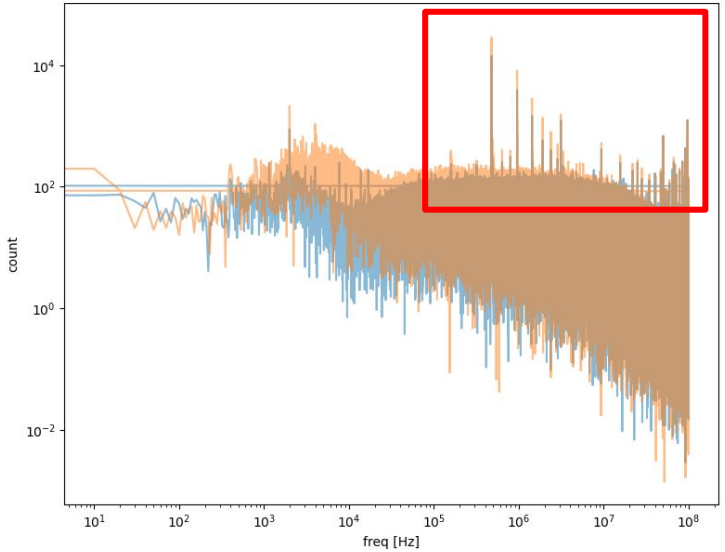
Digitizer

Why are they so different?

Distance has small impact on spectrum at ~MHz

Two scope shots

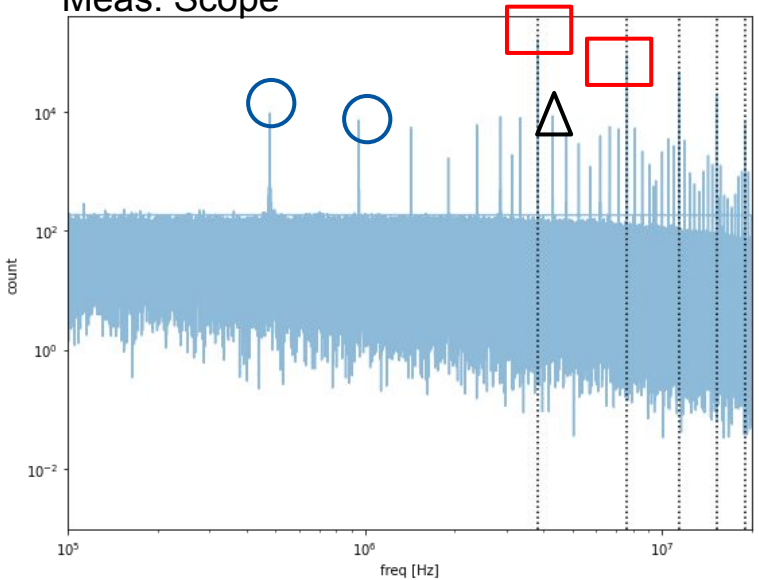




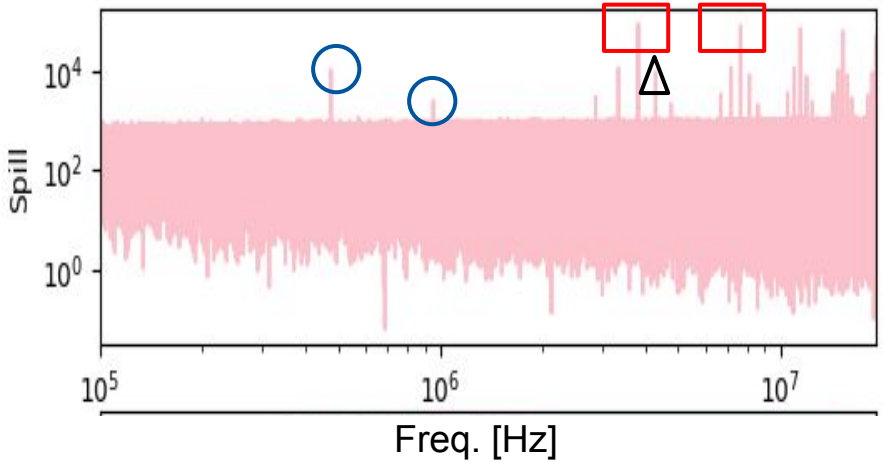
SloEx bunched beams example:

A. H1 and harmonics coming from imperfect debunching in the ring.
B. H8 and harmonics coming from the empty bucket channelling.
C. H8 +-1 H1 and and harmonics coming from couplings.

Meas: Scope



Sim: parameters not identical to meas



Conclusions

- Expected phenomena observed in the diode and in simulation.
- More analysis to be done.
- Noise spectrum difference to be understood.
- Info: https://codimd.web.cern.ch/spLTReYsSCykFPWTF9ER0Q#

EXTRA

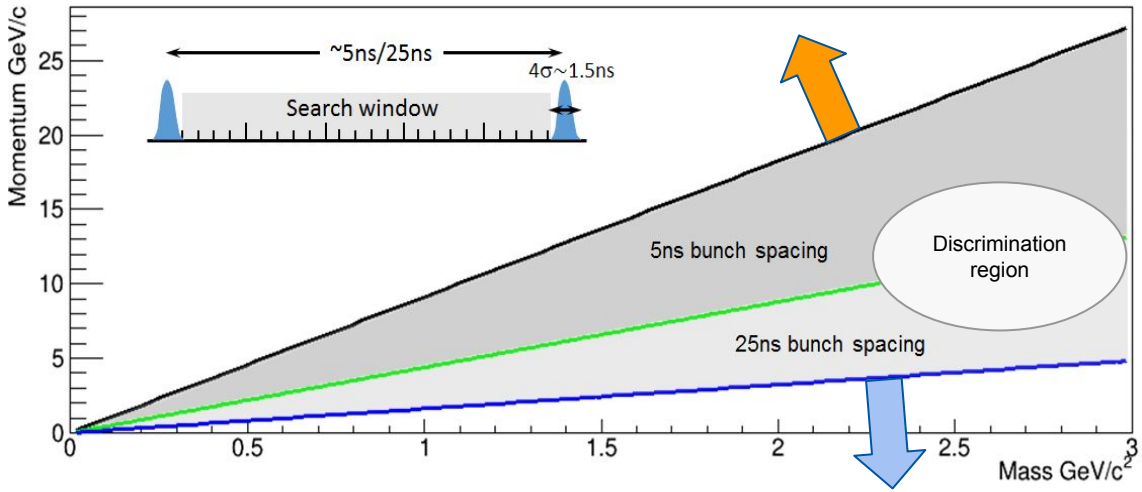
Physics motivation

In some fixed target experiments neutrinos have same signature as hidden sector particles.
Neutrinos travel at (almost) the speed of light -> discriminate by time of flight!

Courtesy of R. Jacobsson

Basic guidelines

- Shorter bunches (σ) -> can resolve particles travelling closer to the speed of light
- Longer gaps (Δt) -> can resolve slower particles



AND we must reach 4e19 protons on target per year!