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Diamond Detector Measurement at NEAR

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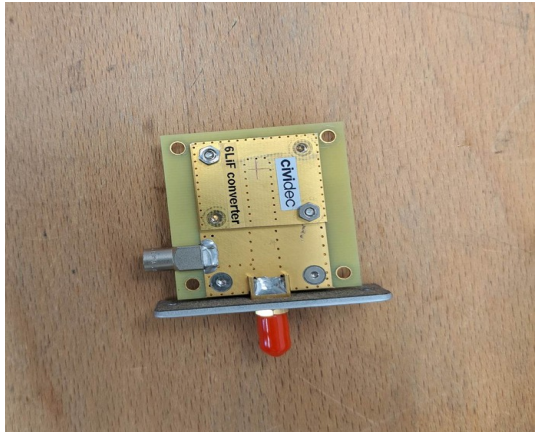
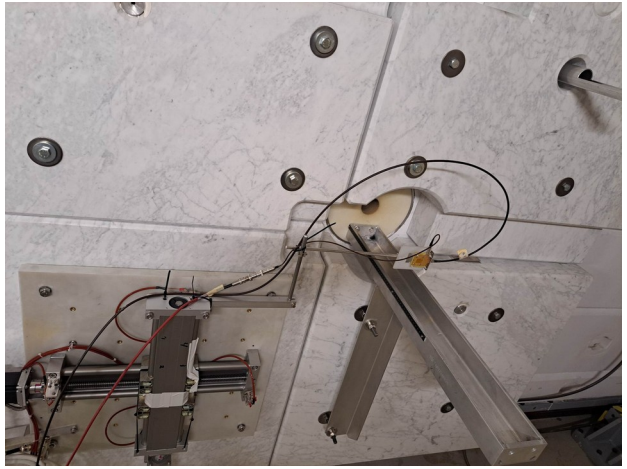
Introduction-Contents

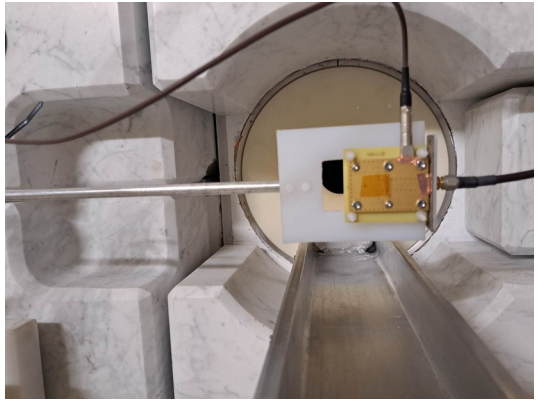


- Diamond Detector:
  - Sensor: 4 mm x 4 mm x 50 μm
  - LiF foil ~2 μm thickness
  - Li(n,t)^{4}He
- Summary and preliminary results of the NEAR tests performed in 2023:
  - April Test (3/4 - 12/4)
  - August Test (2/8 - 16/8)
  - October Test (5/10 - 17/10)

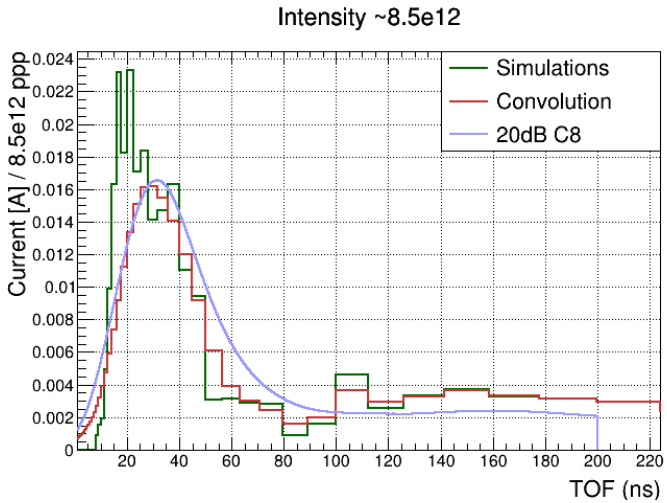
NEAR 1st Test April 2023, Set-Up

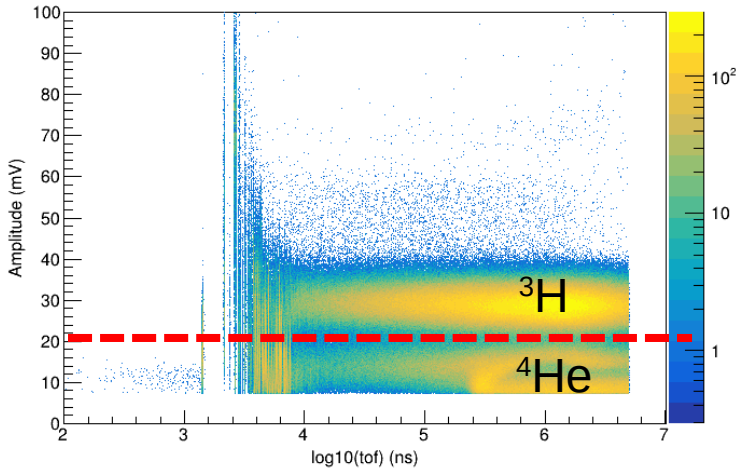
- **70 m** cable connecting the detector to the amplifiers
- Signal splitter:
  - C8 amplifier, 24 MHz + attenuators to measure the current of the detector
  - C2 amplifier, 2 GHz to measure single events from Li(n,t)^{4}He
- 10 days of irradiation





April Test Preliminary Results

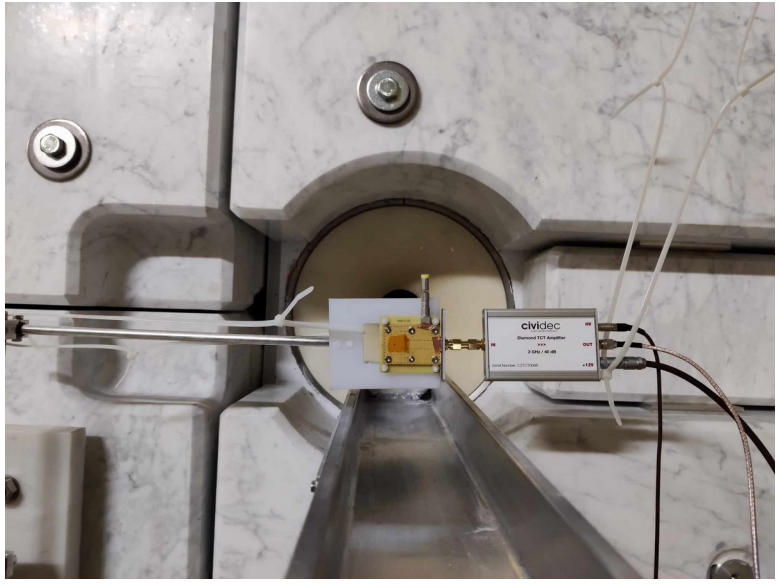




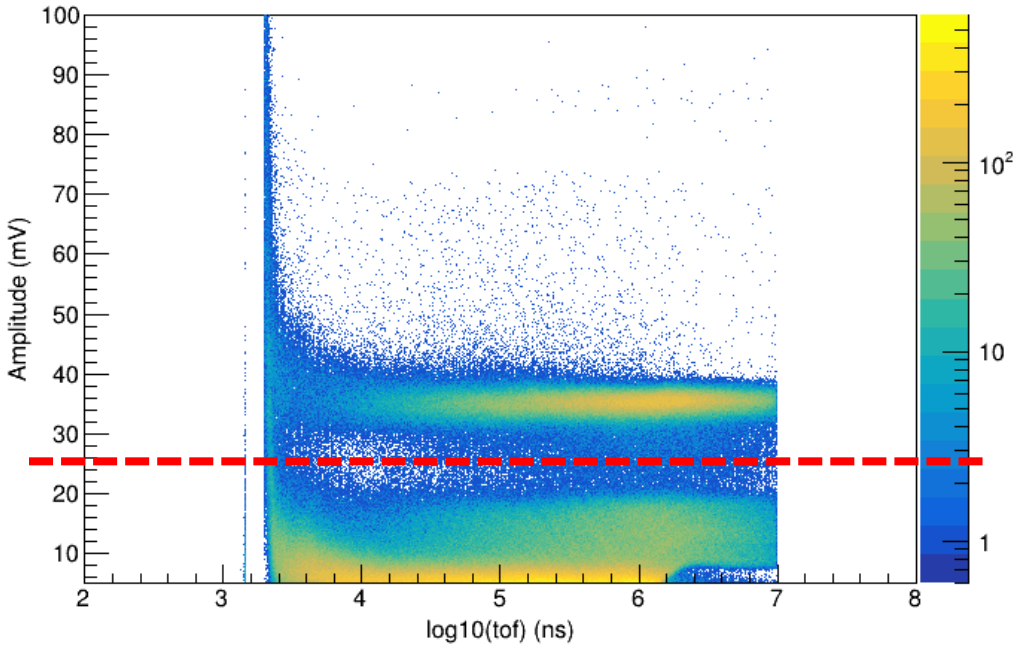
- Current detection with C8
  - Satisfactory agreement with the simulations
  - Encouraging results
- Single Events detection with C2
  - Ringing at ~30keV
  - Not clear separation of the ^{3}H and ^{4}He peaks

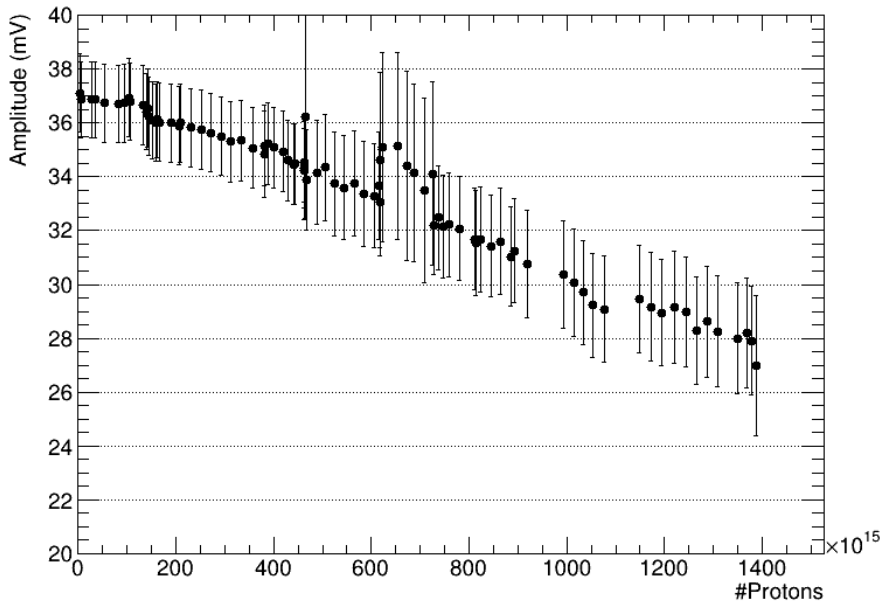
August 2023 Test Set-Up

- **0 m** cable between the diamond detector and amplifier, directly connected
- Attempt to reduce the noise
- C2 amplifier, 2 GHz, to measure single events from Li(n,t)^{4}He
- 15 days of irradiation



August Test Preliminary Results

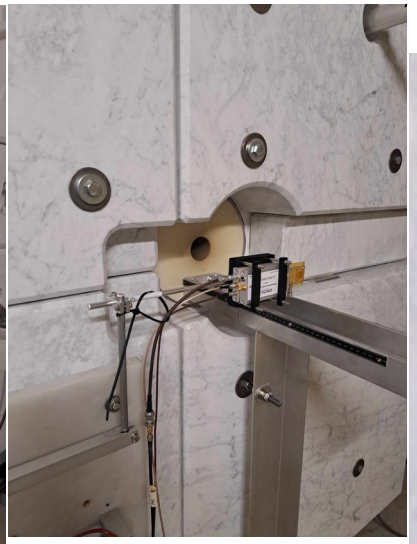




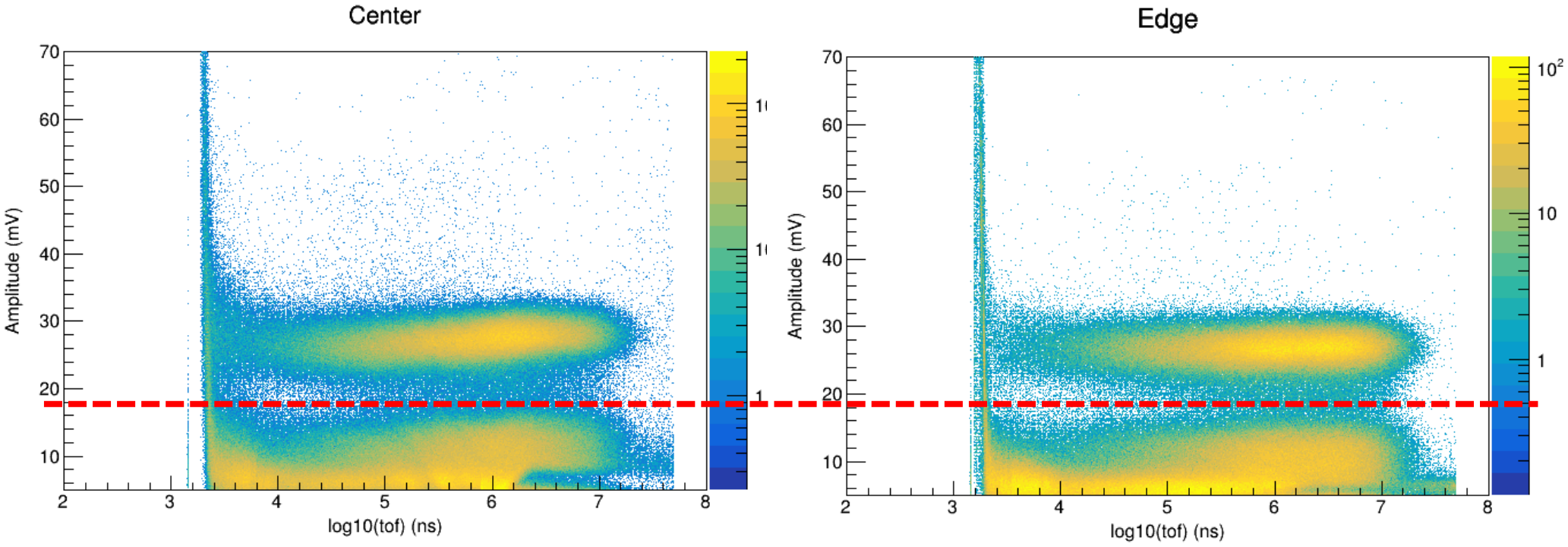
- No ringing due to the 0 m cable
- More clear separation between the ^{3}H and ^{4}He peaks
- Amplitude degradation due to radiation damage

October 2023 Test Set-Up

- **0 m** cable between detector and amplifier
- x-y table to scan the beam profile
- 12 cm distance from the marble wall
- Due to the rail: limitations on scanning the y- axis
- C2, 2 GHz amplifier
- Unsuccessful attempt to measure with the C8 amplifier
- 8 days of irradiation

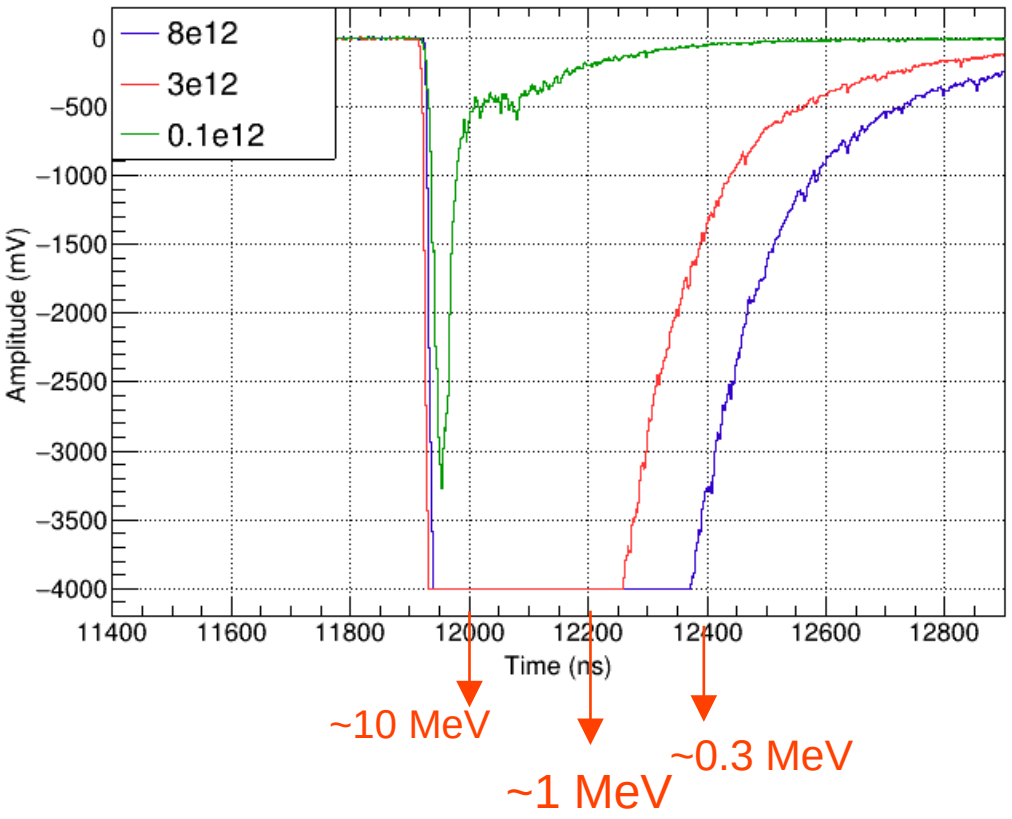


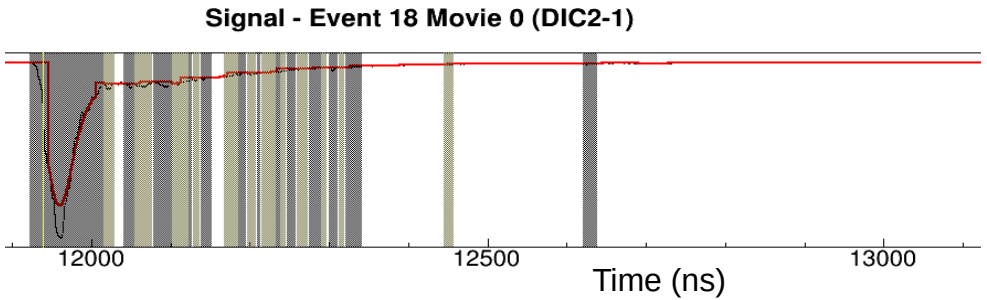
October Test, Preliminary Results



- No ringing due to 0 m cable
- Good Separation of the ^{3}H peak in all positions

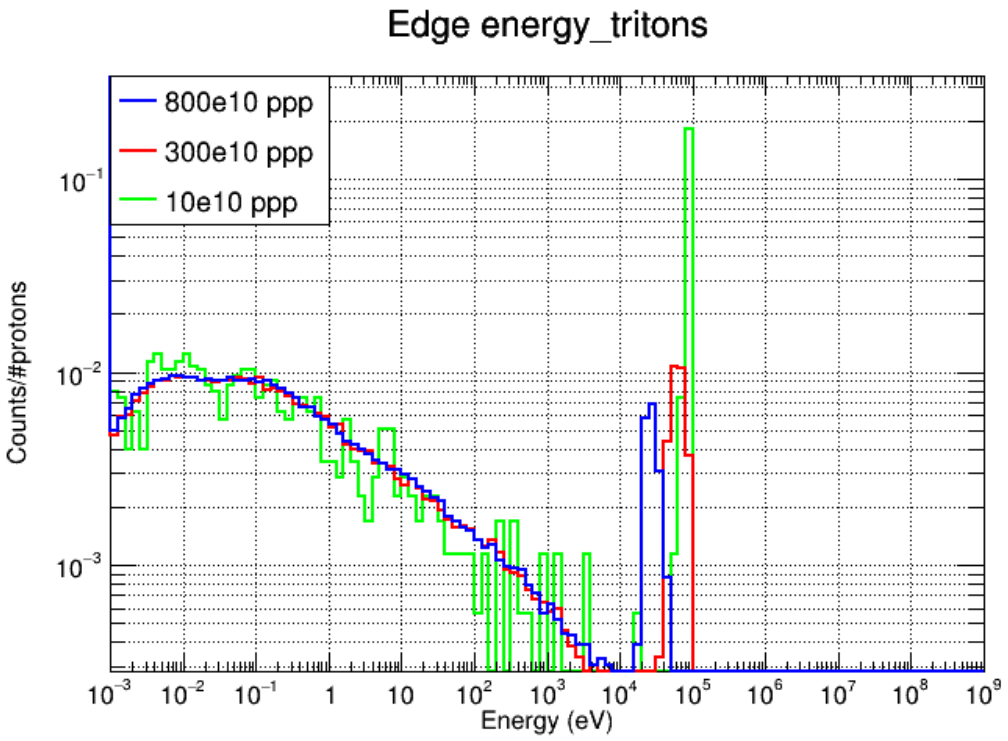
Signals for Dedicated, Parasitic and Low Intensity



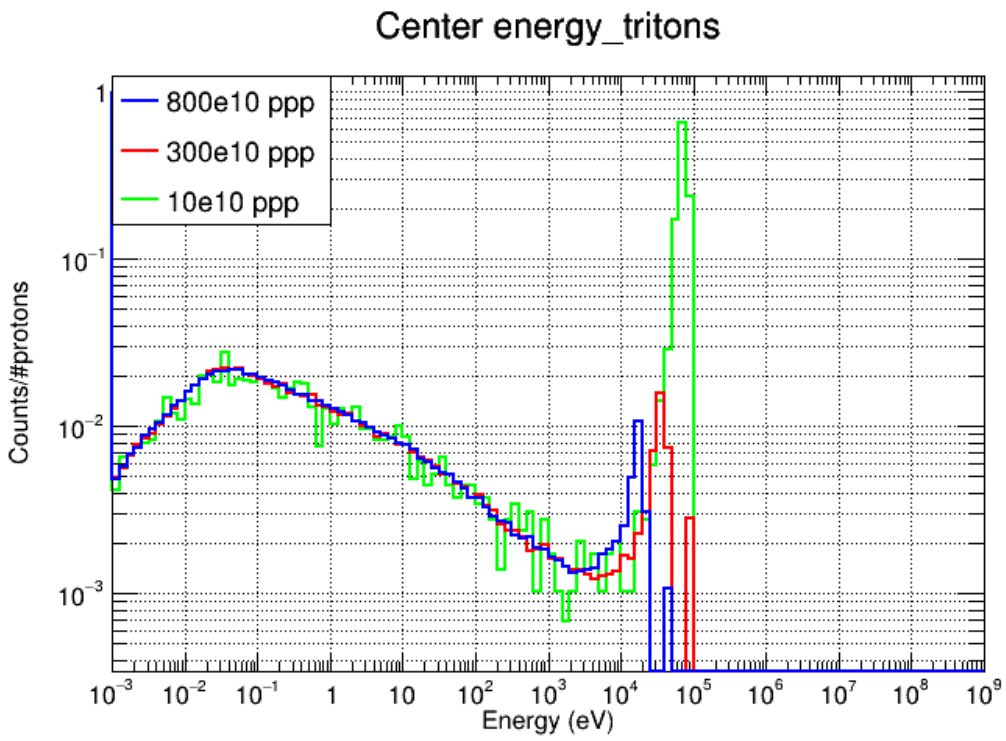


- Resolved energy up to ~0.1 MeV
- For low intensity pulses possibility to resolve higher neutron energies

Neutron Flux, First Results



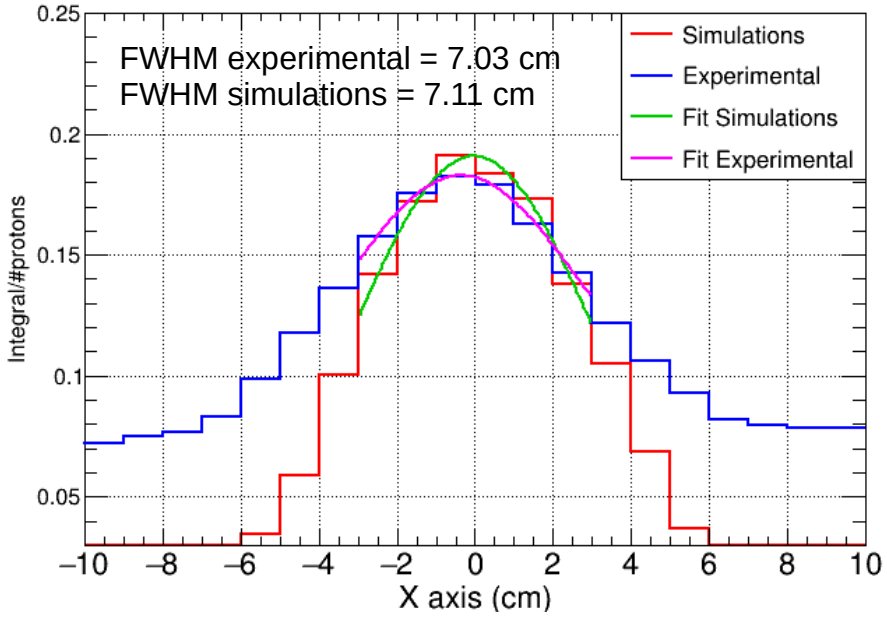
high$_{En}$/low$_{En}$=19.9

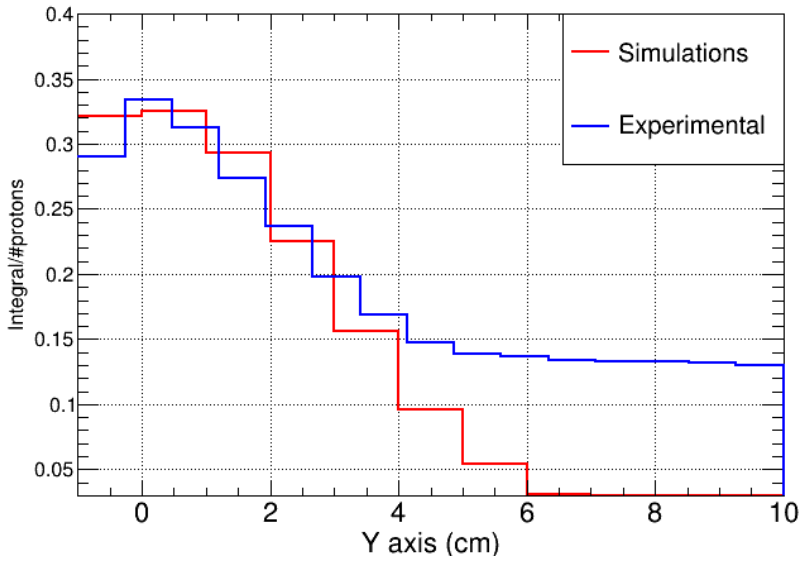


high$_{En}$/low$_{En}$=306.6

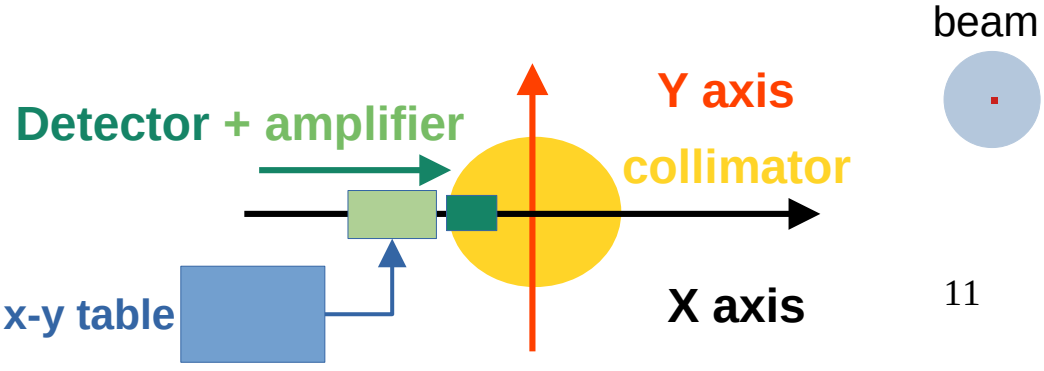
- Low intensity pulses show more counts for high neutron energies in all positions
- On the edge we observe higher contribution of the low energy neutrons

Beam Profile for 0.001 eV < En < 0.01 eV

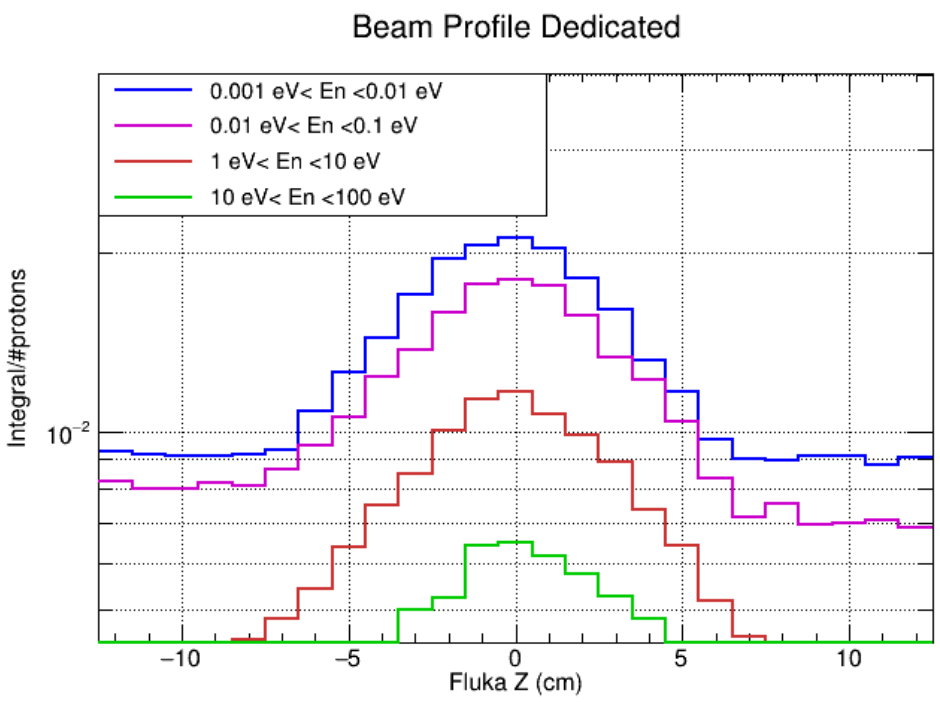


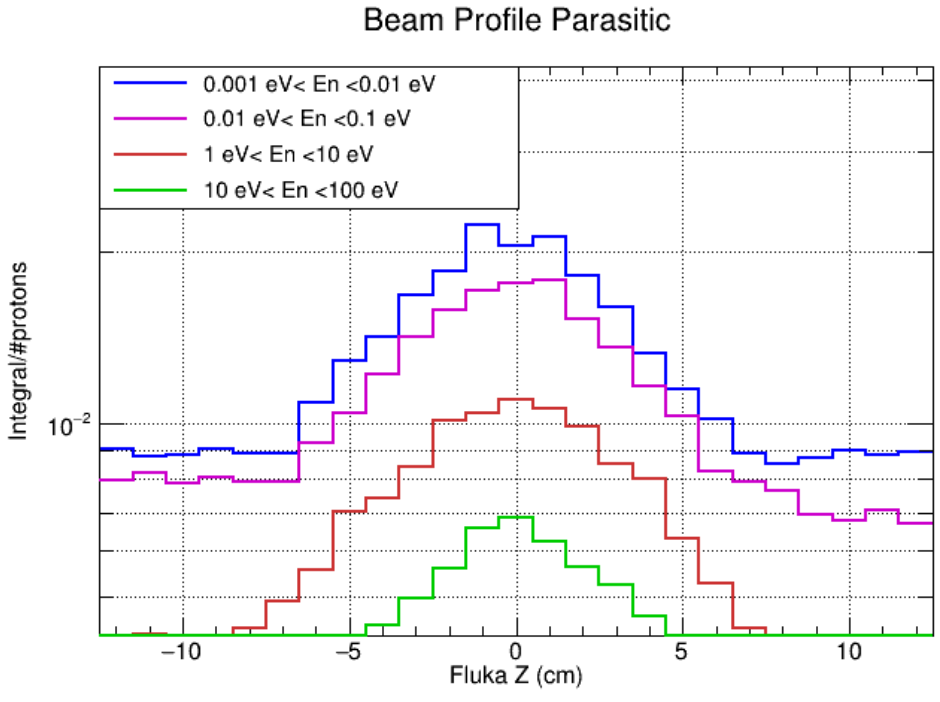


- Peak Shape Profile
- Agreement with simulations for ~6 cm
- Corrections for simulations (transport code which includes all neutron energies)
- Deviation in left and right edge due to electronics in beam



Beam Profile for Different Neutron Energies





- Similar behavior for the beam profile for Dedicated and Parasitic for different neutron energy intervals
- Higher values for low energy interval due to the shape of the shape of then neutron flux

Conclusions

- Three tests with the diamond detector at the NEAR station
- Implementing a 0 m cable provides a good separation of the peaks and reduced noise
- Amplitude degradation due to irradiation damage
- With the x-y table able to extract a beam profile for NEAR station

Future Perspectives

- Analysis is ongoing for all three experiments
- PSA parameters, Refinement of the simulations, ..
- NEAR measurement with new diamond detector, C8 amplifier and filters (B4C, Au, Fe)

Thank you for your attention!

Thanks to all of the n_TOF local team!

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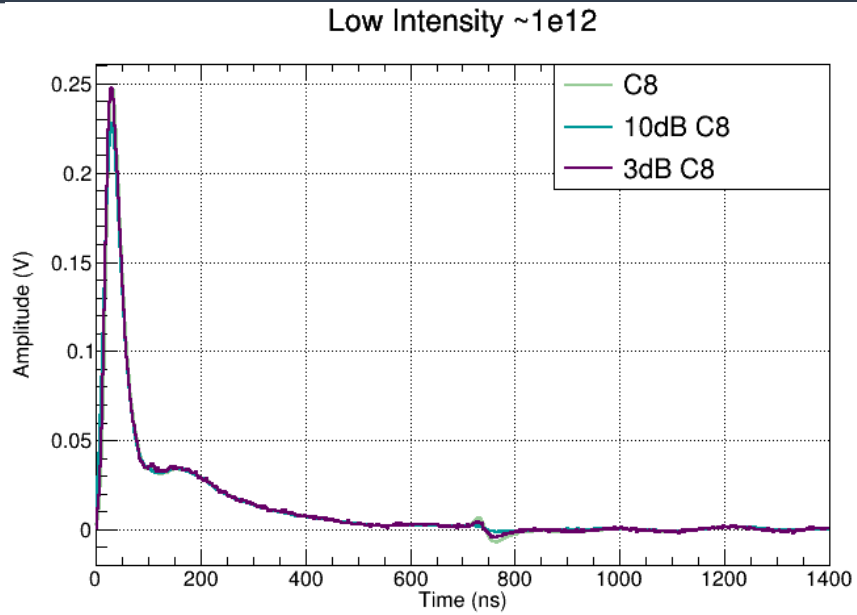
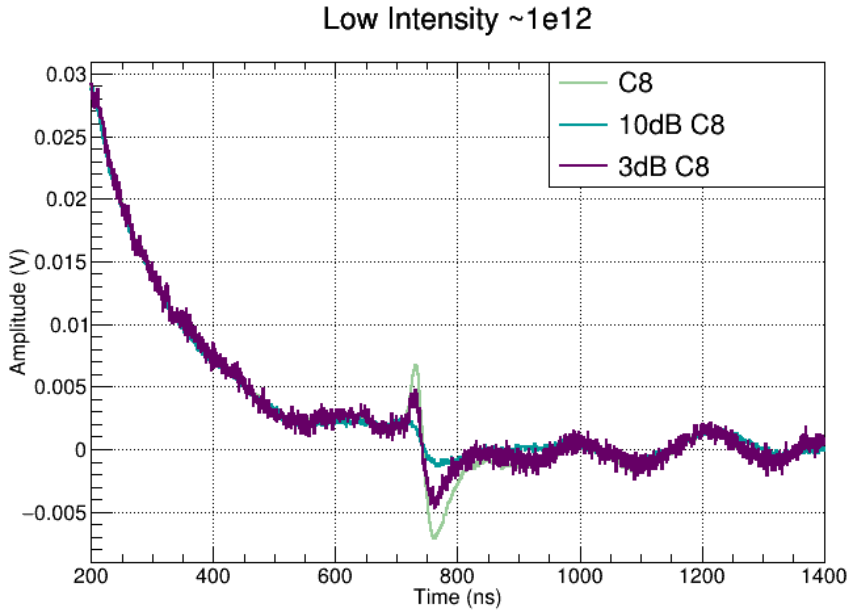
April NEAR Test, C8 Results : Reflection

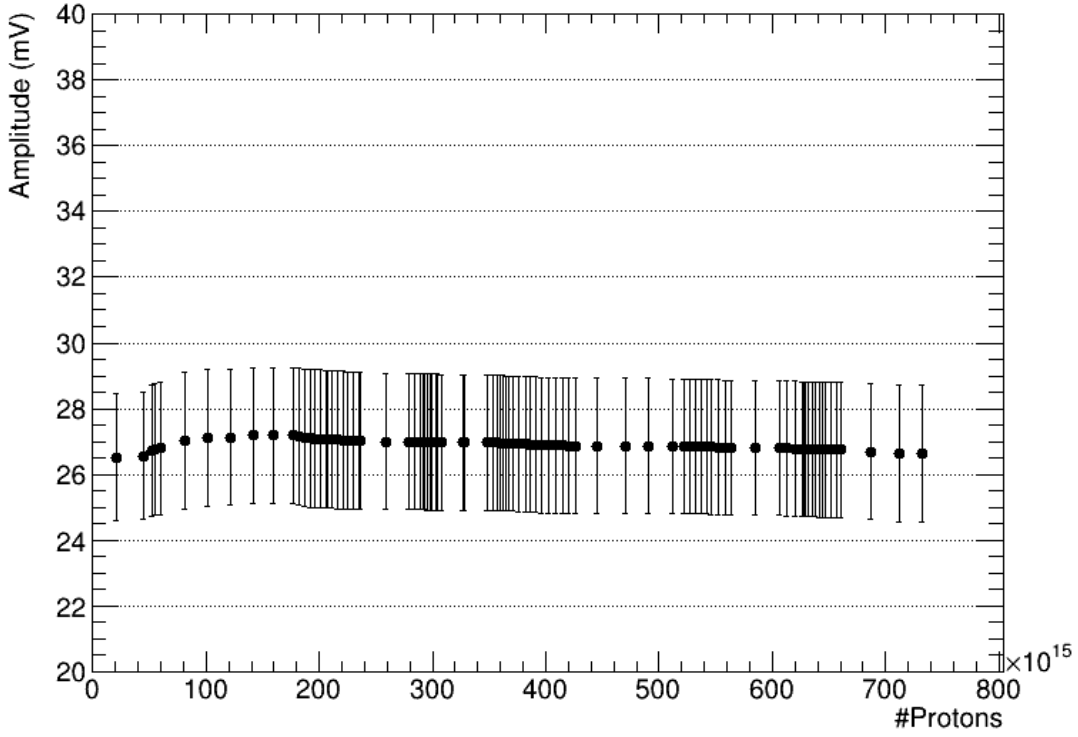




- Relative impact of reflection is suppressed
- Prevent saturation at full intensity
- Measurements with 10dB, 20dB (higher intensities) attenuators

Attenuation	Reflection/ maximum
No attenuation	0.026
3dB	0.018
10dB	0.009

Amplitude degradation October



- Correction on number of neutrons+ protons
- Steady behavior of the amplitude

Fits for Profile