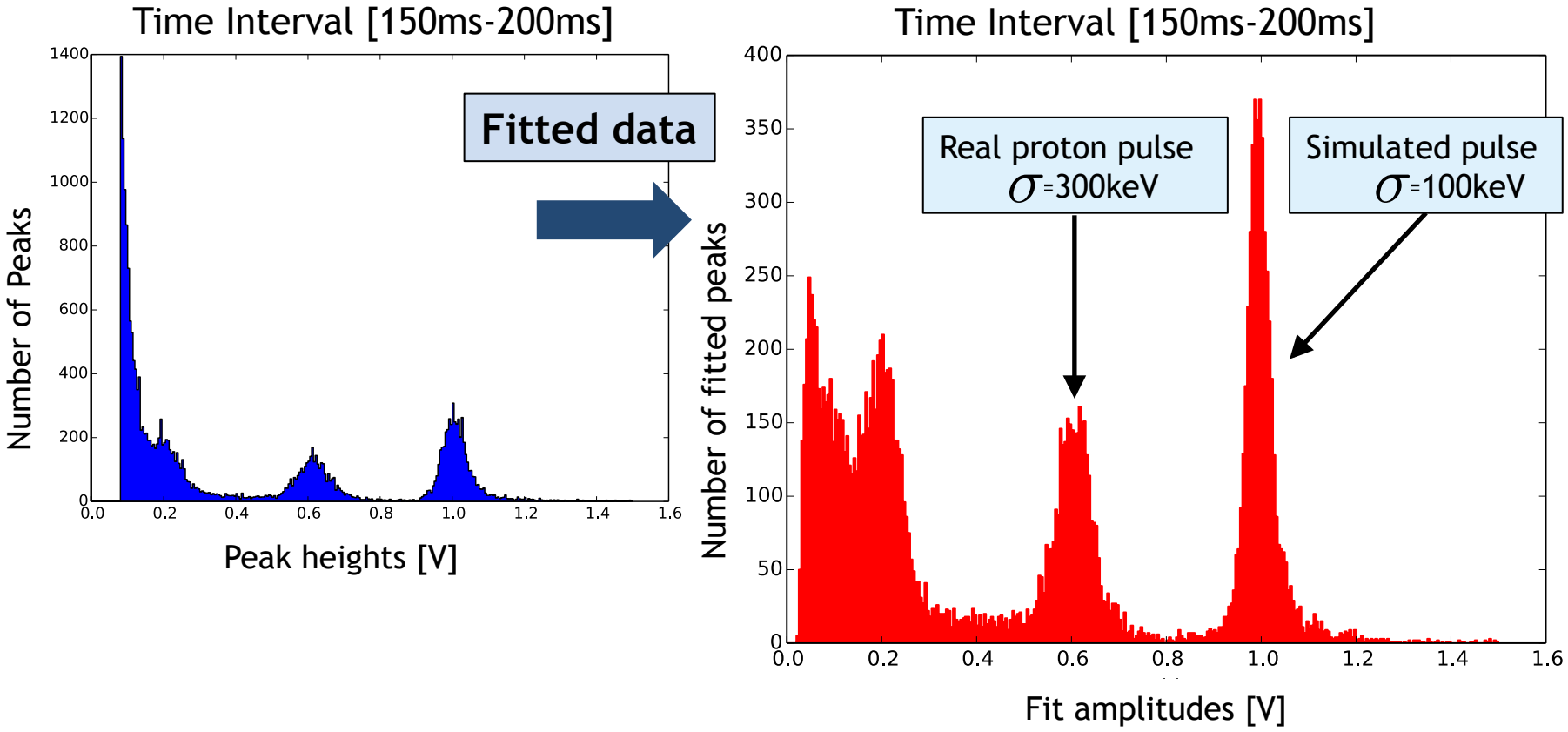
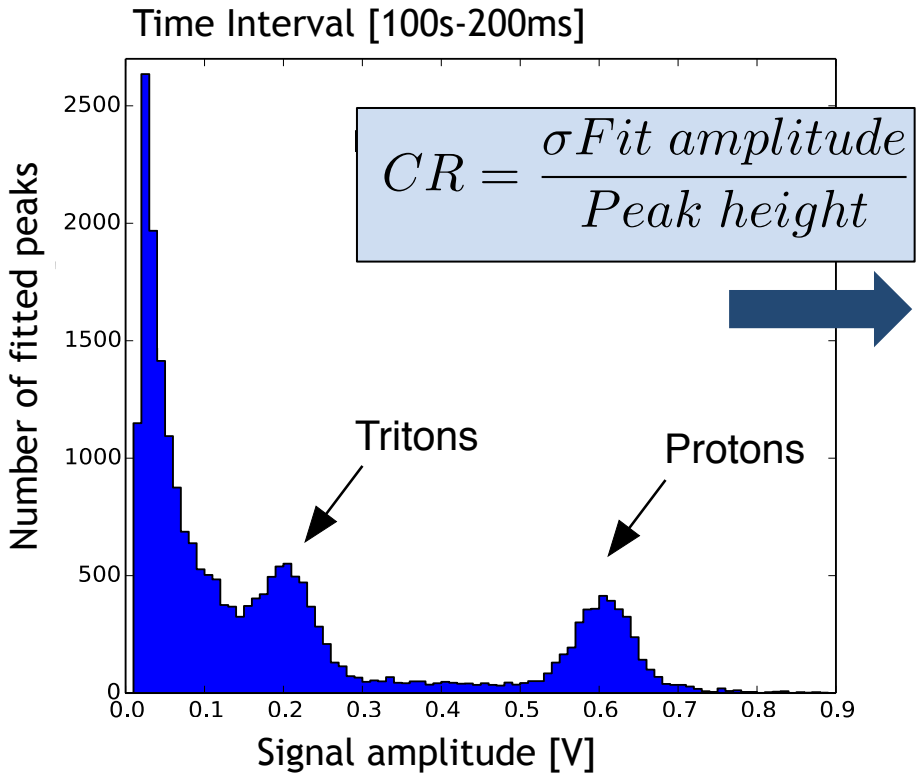
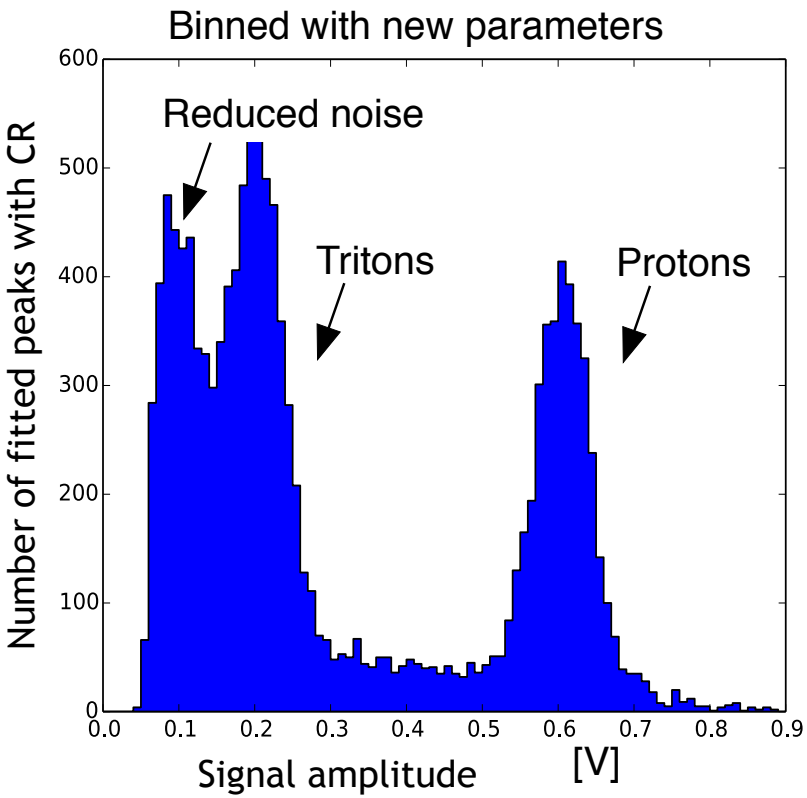
Pulse height spectra with fitted data



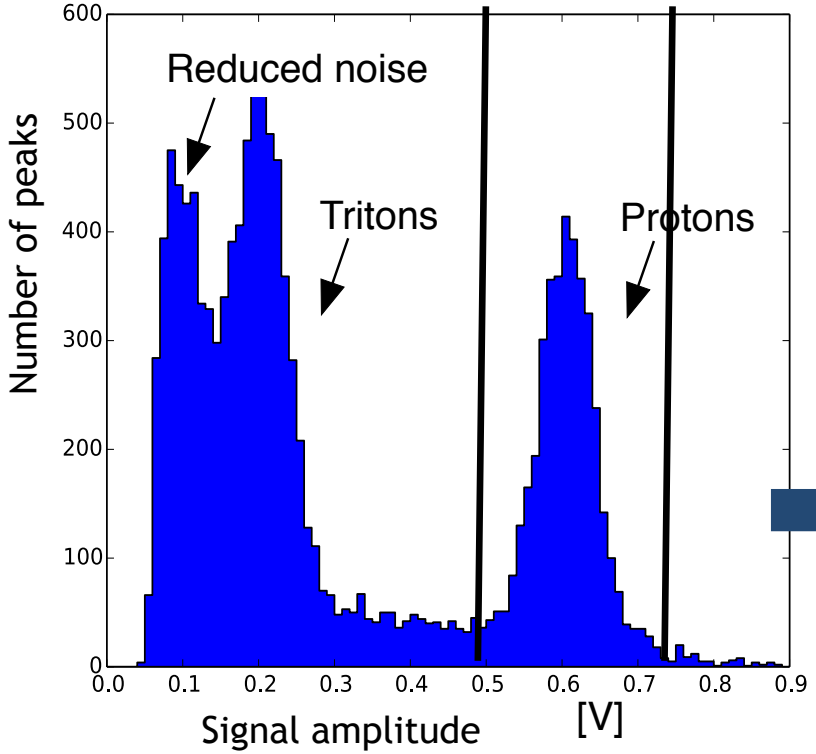
- Now use figure of merit, CR, to suppress noise and low energy signals

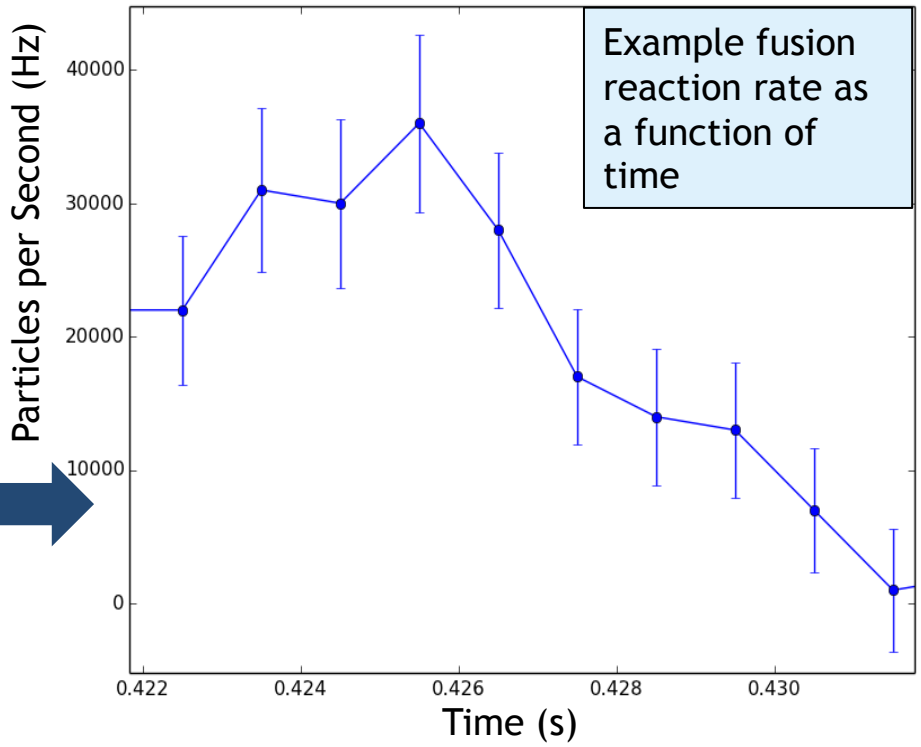
Pulse height spectra with further criteria



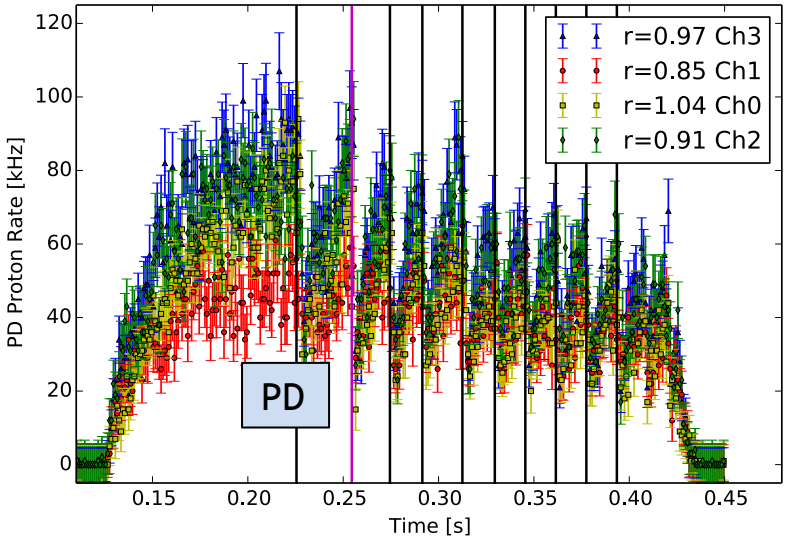


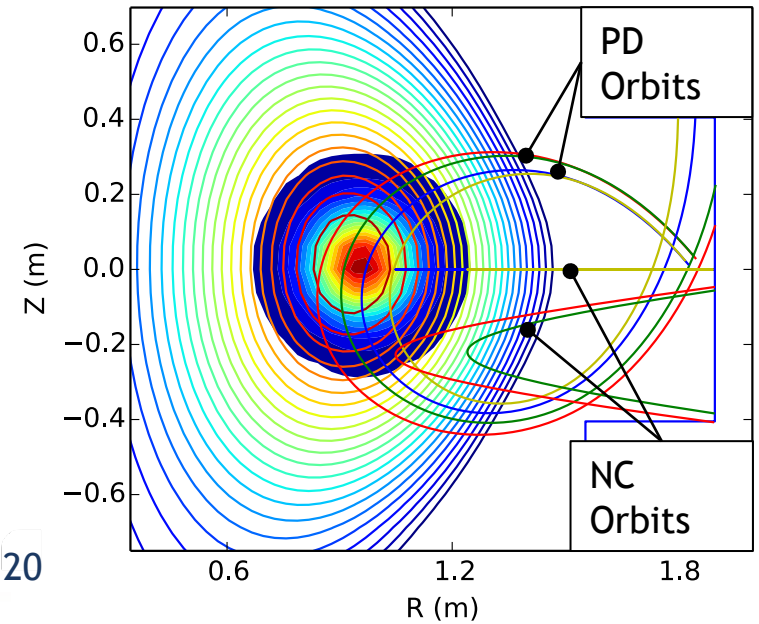
Proton Production Rates

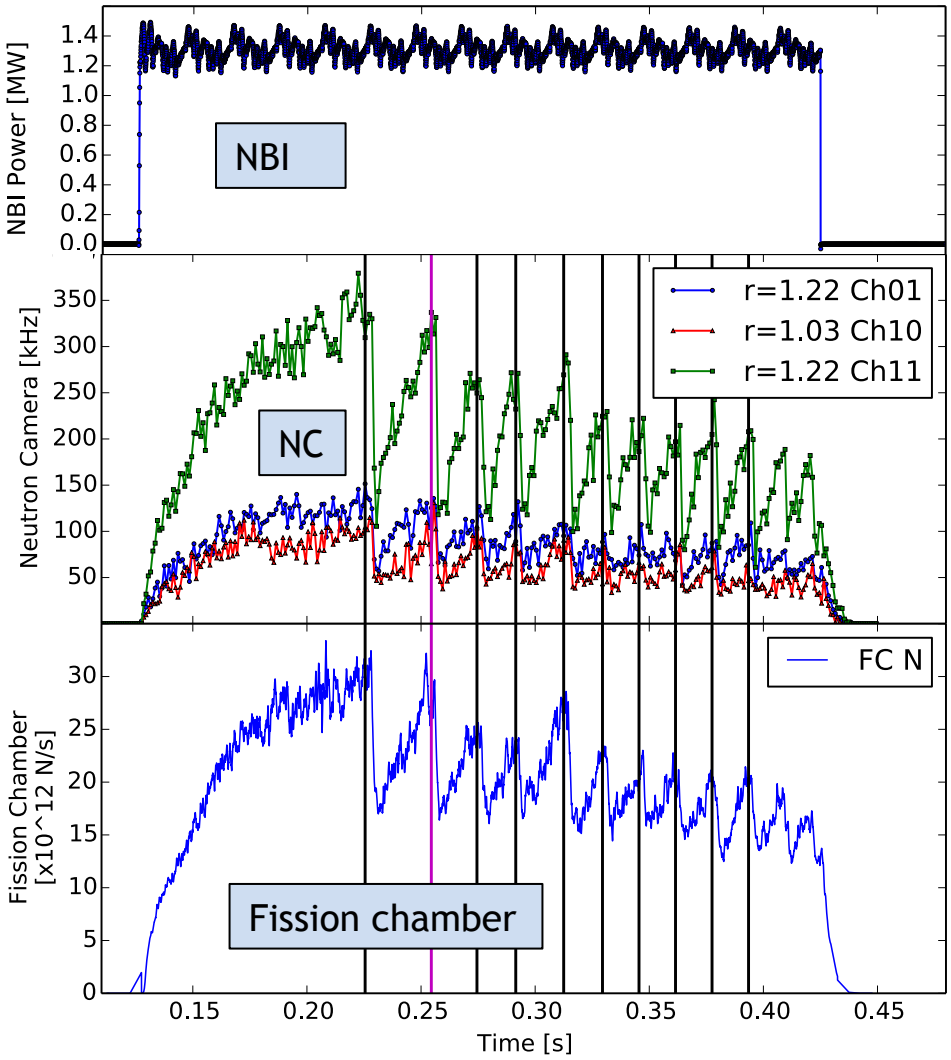




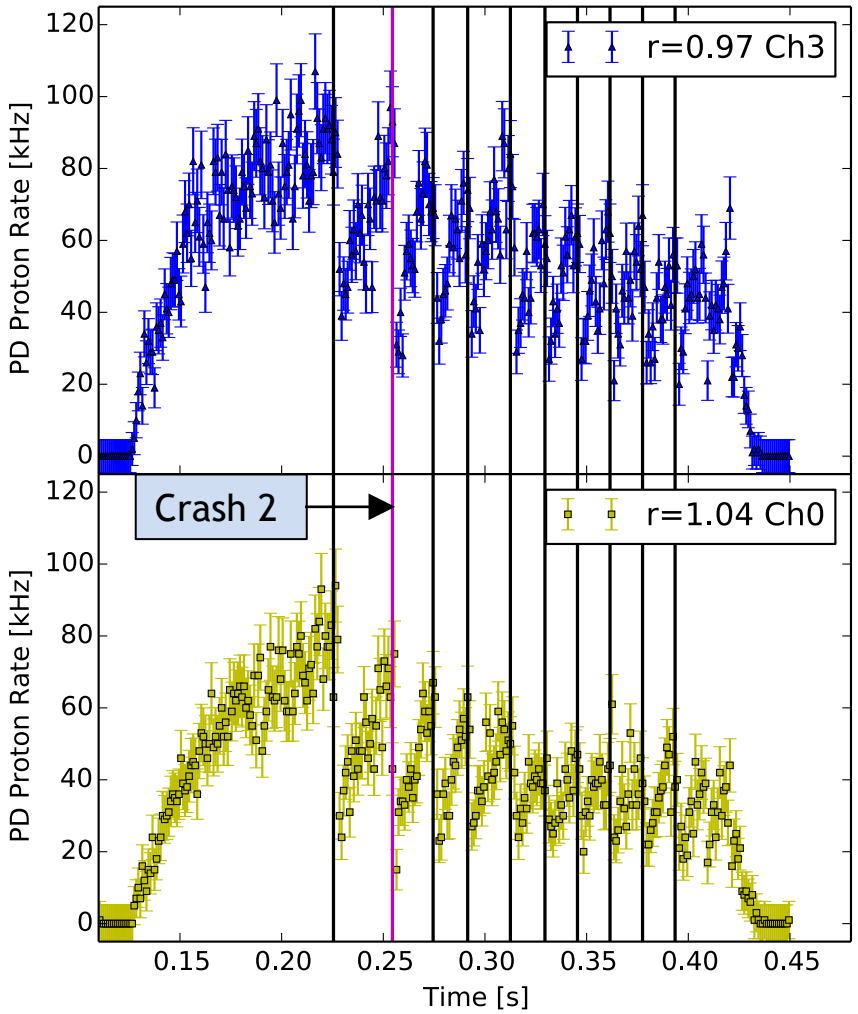
Sawtooth crashes in complementary diagnostics

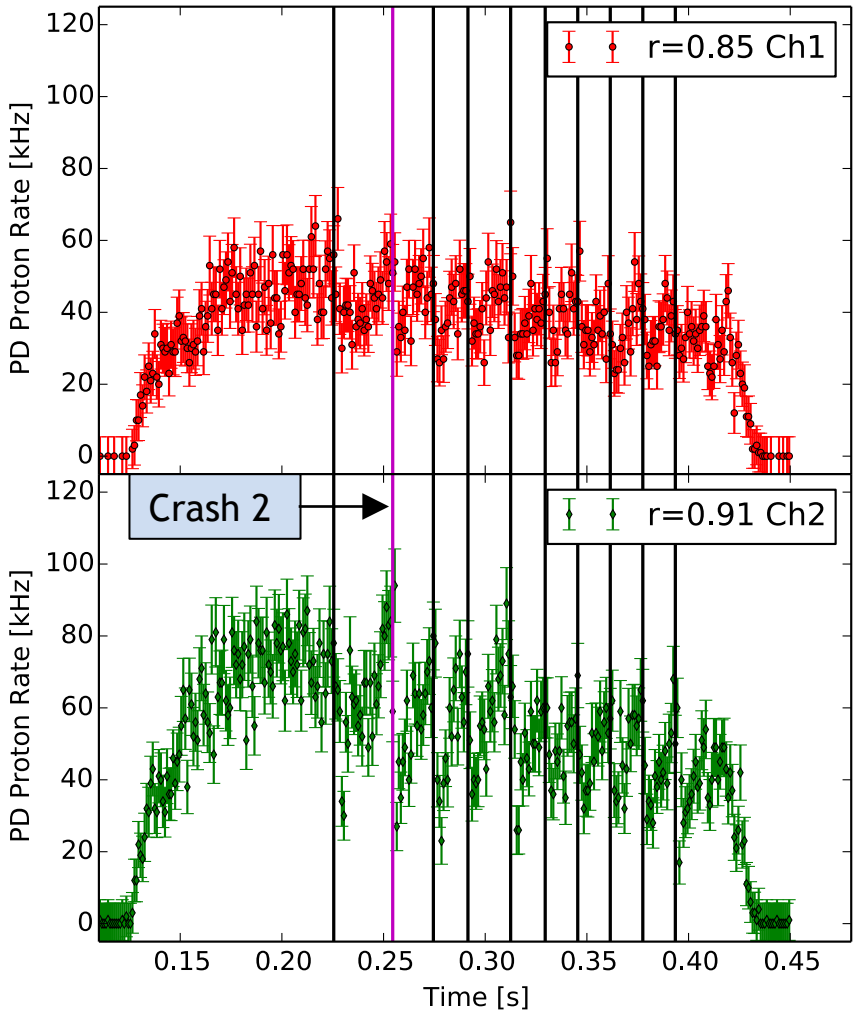






Sawtooth crash effects on proton emission





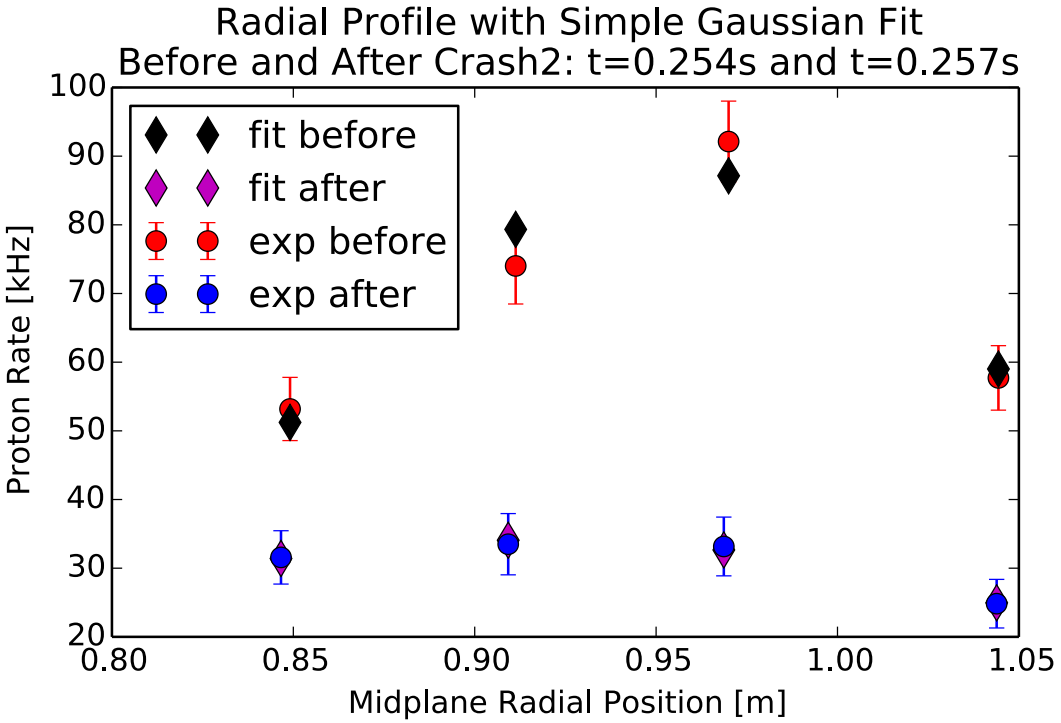
little change in radial positions calculated from EFIT reconstructions before and after the crash

Proton radial profile before and after crash 2

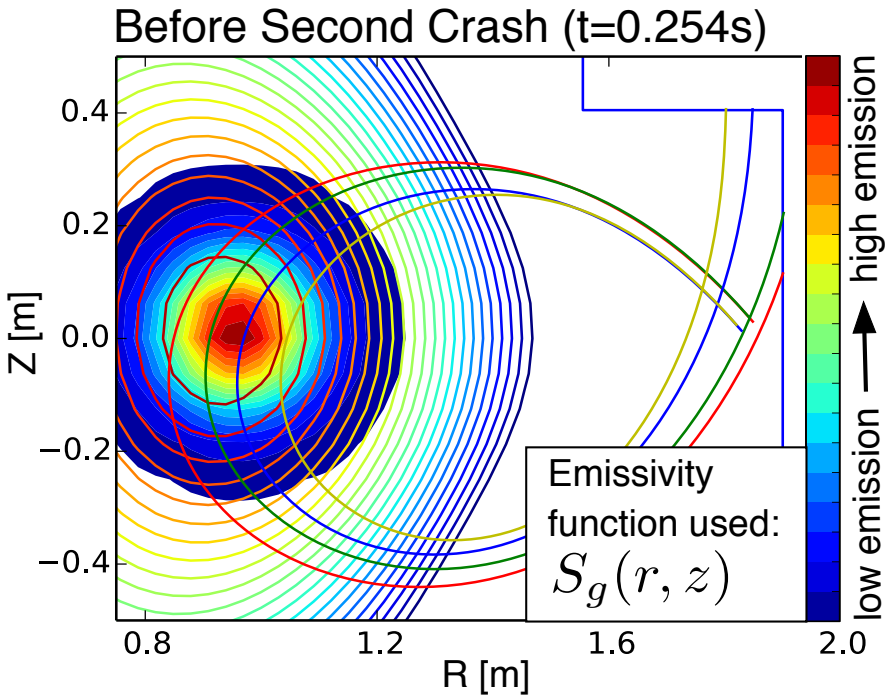
Emission profile model function (simple gaussian):

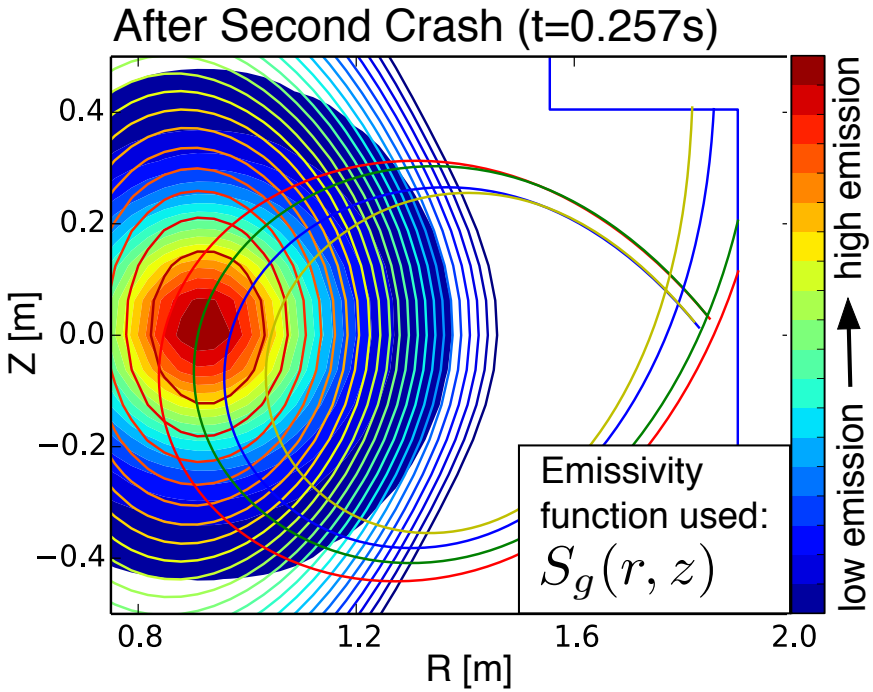
$$S_g(r,z) = Ae^{-\frac{((r-r_0)^2+z^2)}{\sigma^2}}$$

- r ,z: position in the R-Z plane (with with respect to magnetic axis)
- A , σ , r_0: fit parameters
- arbitrary units

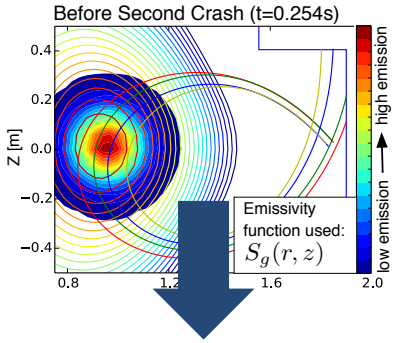


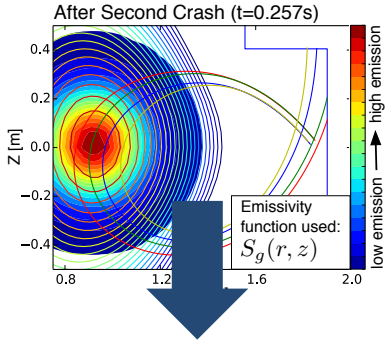
Proton emissivity (r, z) before and after crash 2

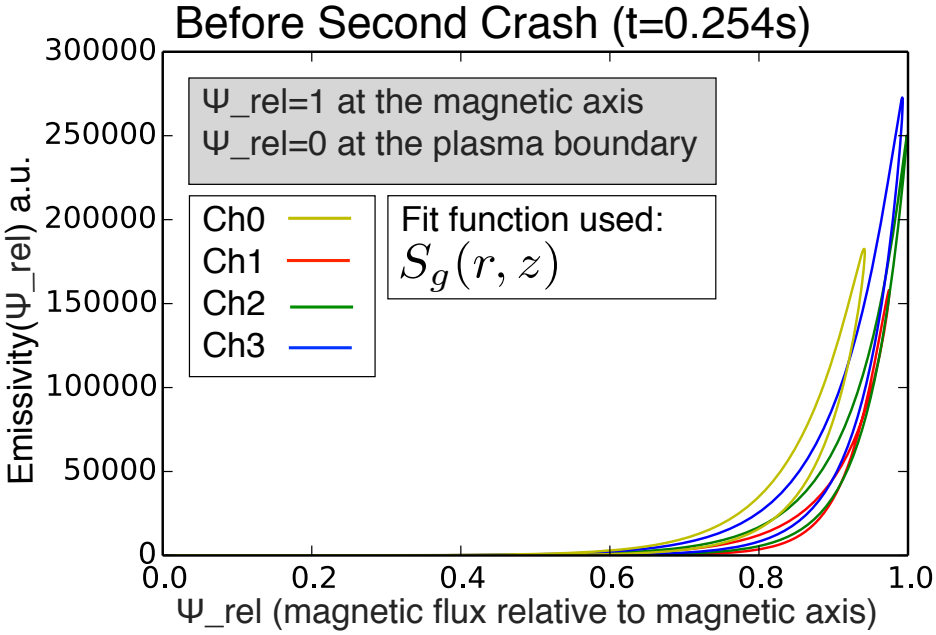


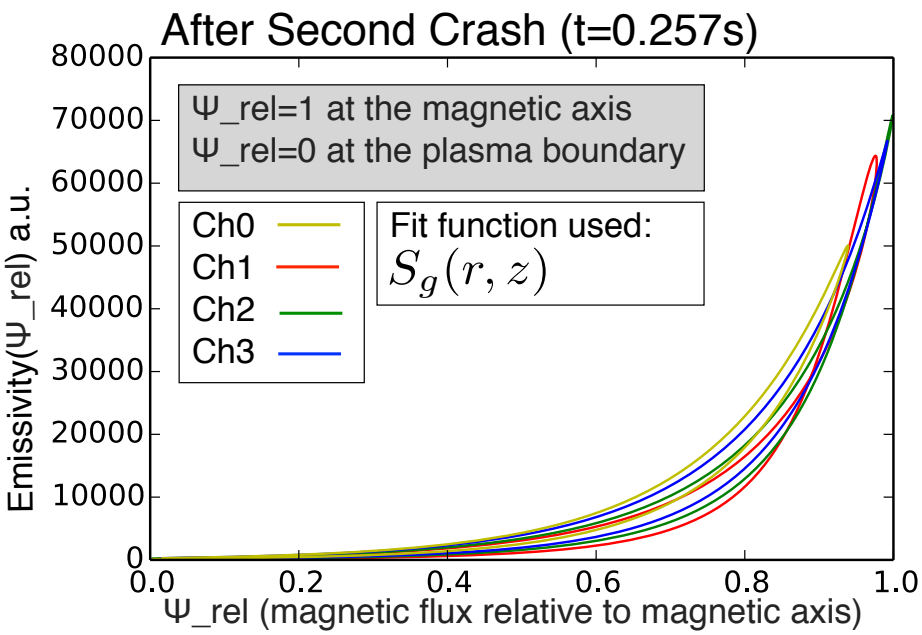


Proton emissivity as a function of ψ_rel



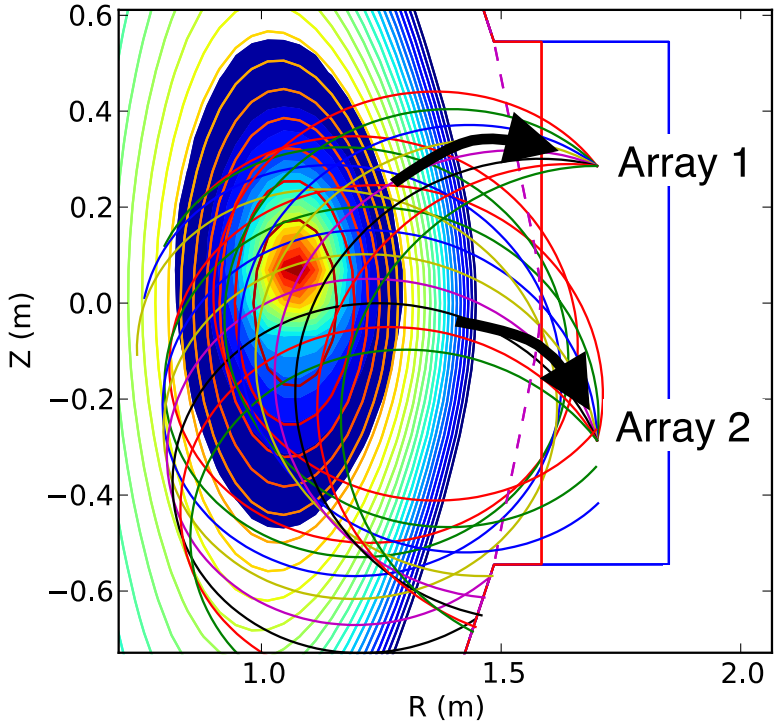






Summary: Proof of concept diagnostic

- First direct measurements of 3MeV protons in a spherical tokamak
- Advantages: size and cost
- Similar and complementary information to NC
- Combined analysis with NC for more detailed emission profile
- More advanced analysis needed to fit the triton emissivity



Future Work

- Design and build 16-channel system for NSTX-U, MAST-U (same size or smaller)
- Implement techniques for mitigating noise

Thank you for your time!

Acknowledgements:

- U.S. Department of Energy Contract Numbers DESC0001157 and DEAC0209CH11466
- RCUK Energy Programme, Grant number EP/I501045, The views and opinions expressed herein do not necessarily reflect those of the European Commission
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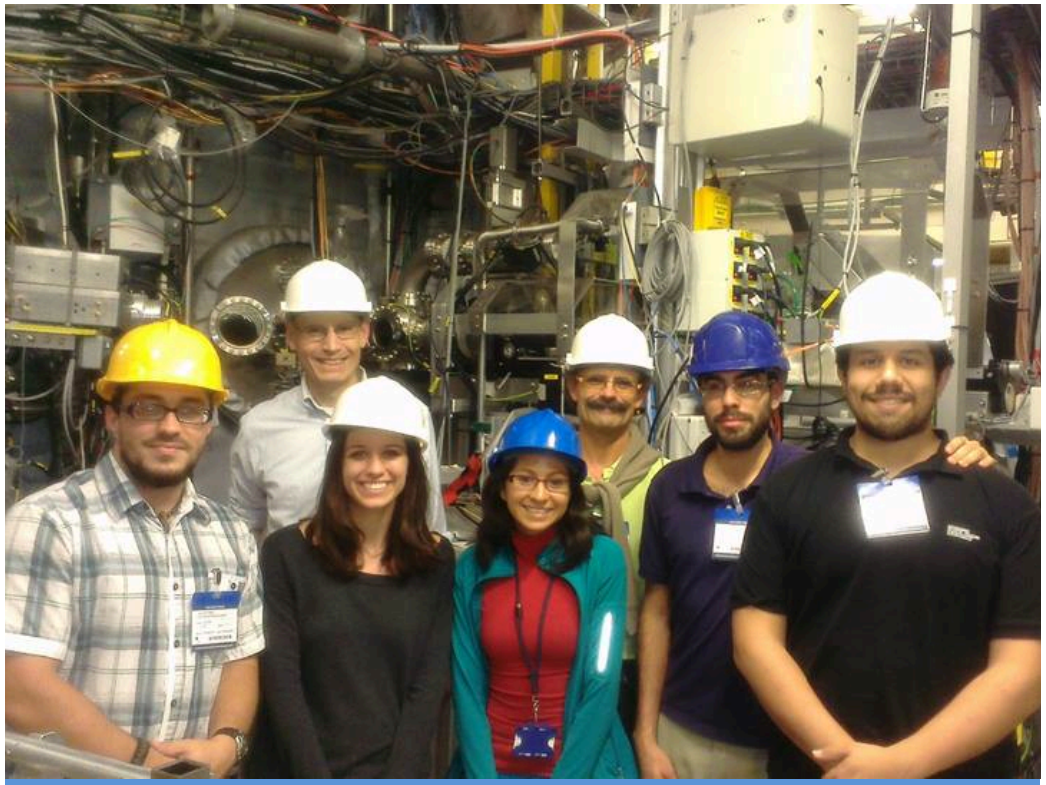
- European Unions Horizon 2020 Programme under grant agreement number 210130335
- FIU GPSC Research Travel Grant, FIU Ronald E. McNair Post-Baccalureate Achievement Program
- Nigel Thomas-Davies and the MAST Team



http://phy.fiu.edu/twiki/bin/view/Twiki/FEPP

rvale006@fiu.edu, boeglinw@fiu.edu

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- M. Cecconello, et. al., Nucl. Instr. Meth. Phys. Res. A 753, 72-83 (2014)
- O. M. Jones, et. al. Plasma Phys. Control. Fusion 55, 085009 (2013)
- Original figure on slide 2 from Cecconello *et al*. Nucl. Fusion **52**, (2012) 094015. FIG 1. MAST vessel equatorial mid-plane cut

Extra slides if needed to answer questions

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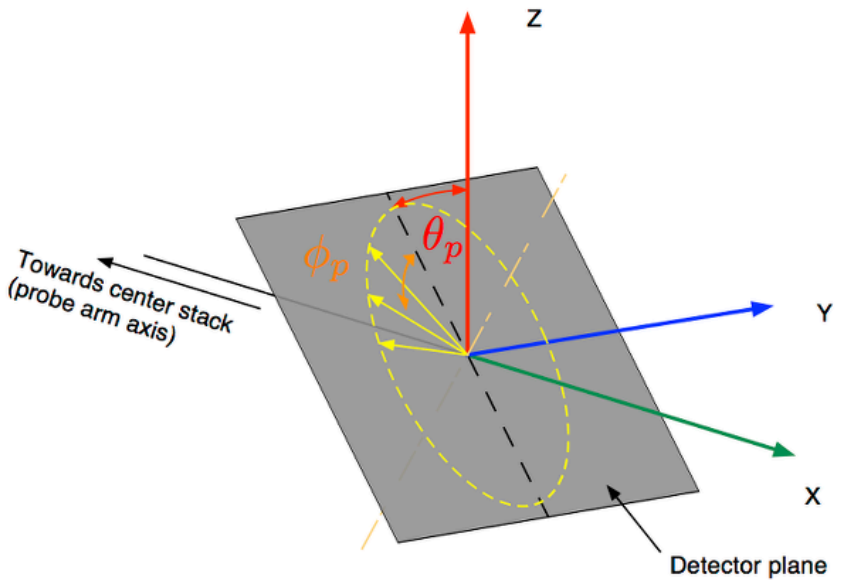
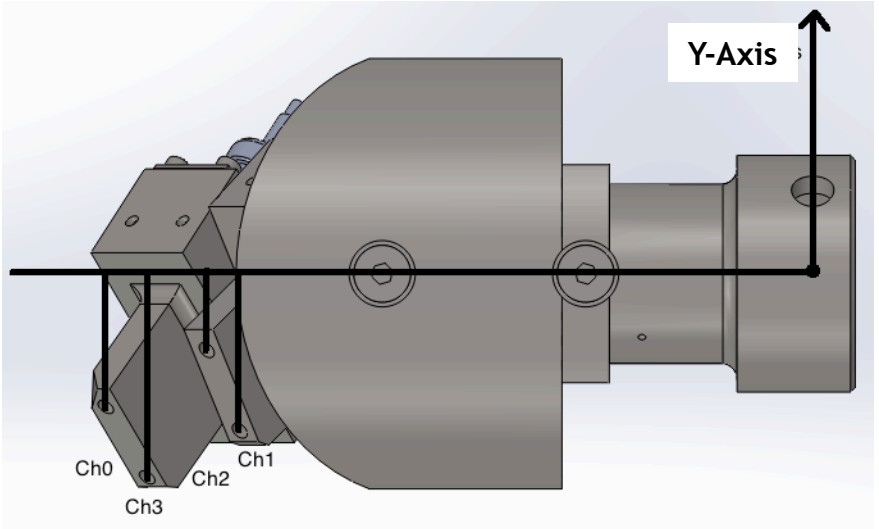
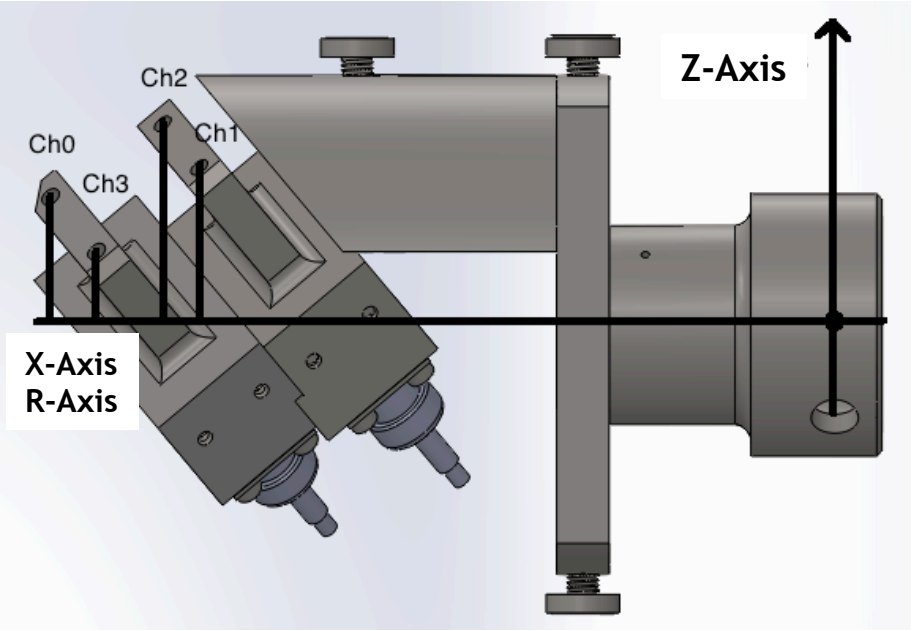
Individual detector orientations

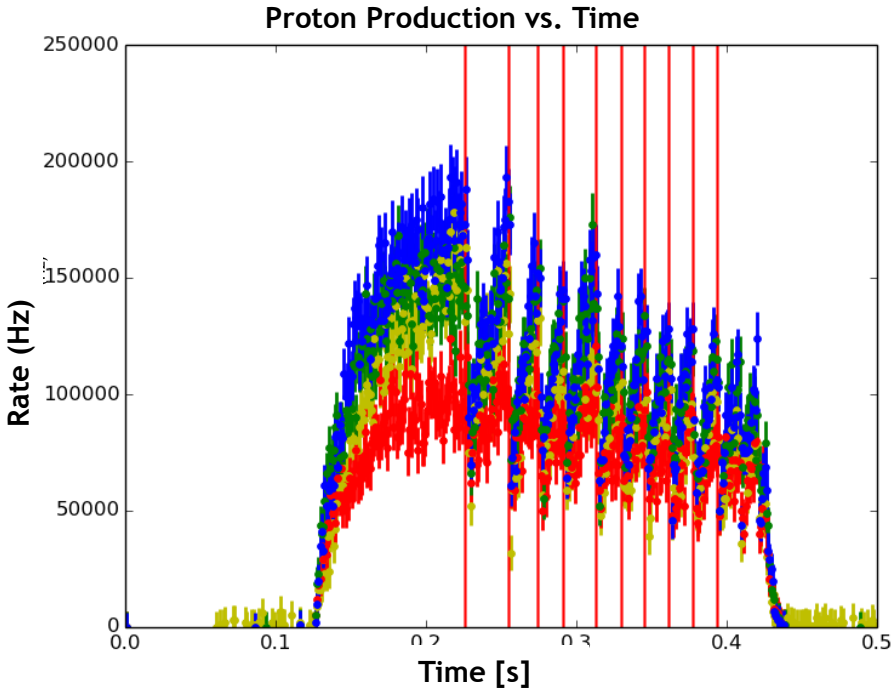


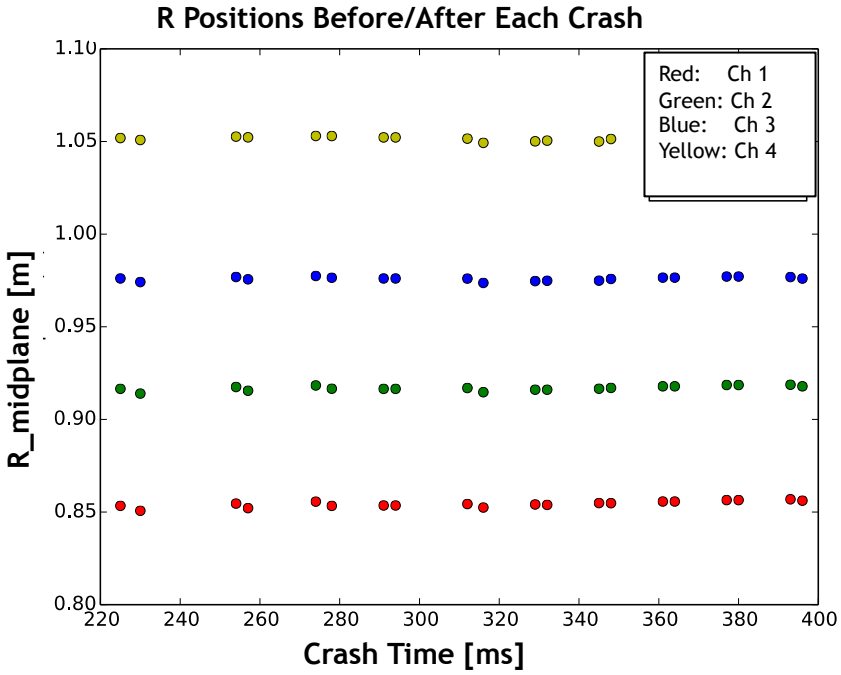
Data Channel #	Detector Positions	Angular Orientation
0	4	Phi -45deg, Theta 40deg
1	1	Phi -30deg, Theta 40deg
2	2	Phi -35deg, Theta 40deg
3	3	Phi -40deg, Theta 40deg





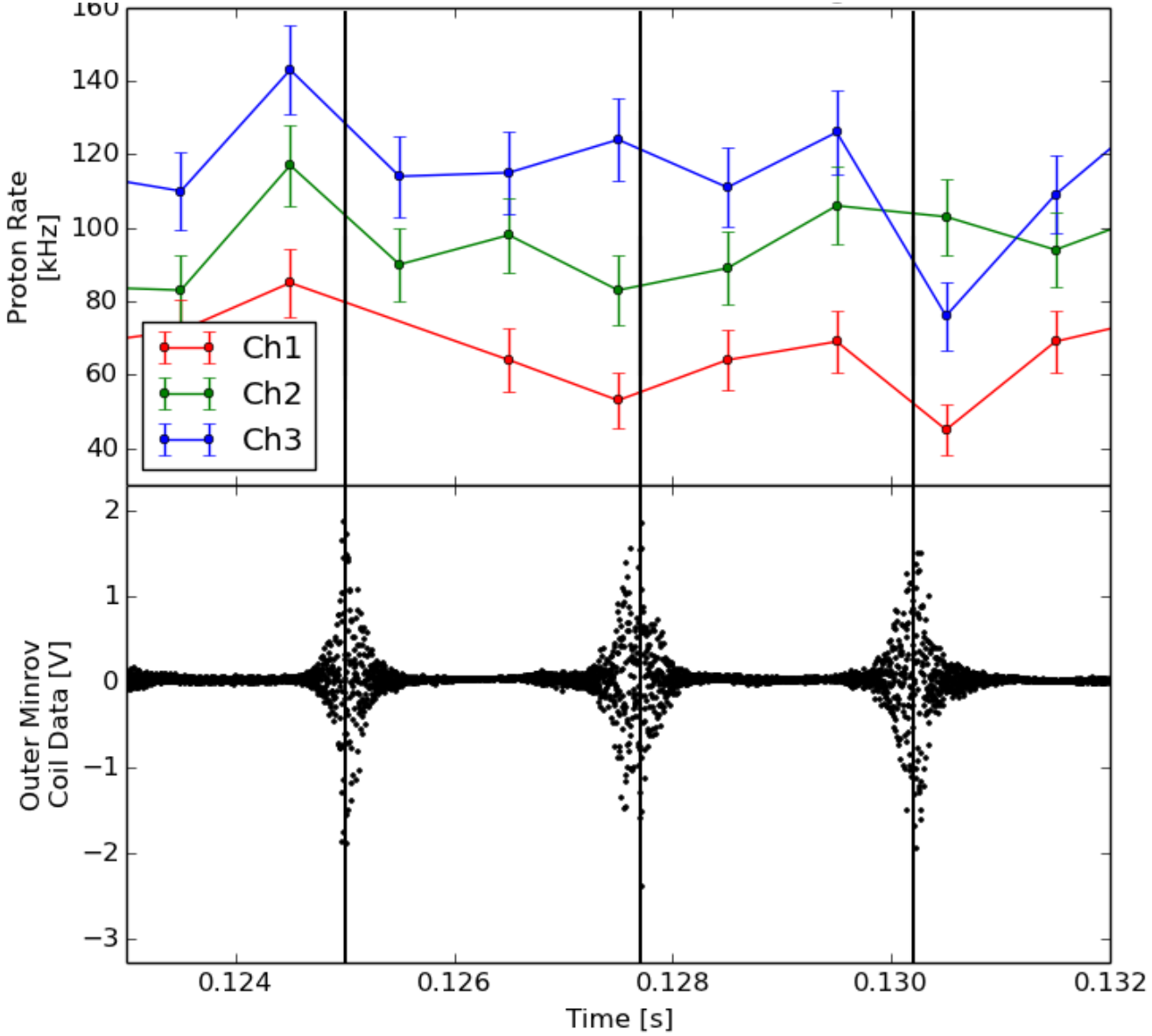
Sawtooth crash



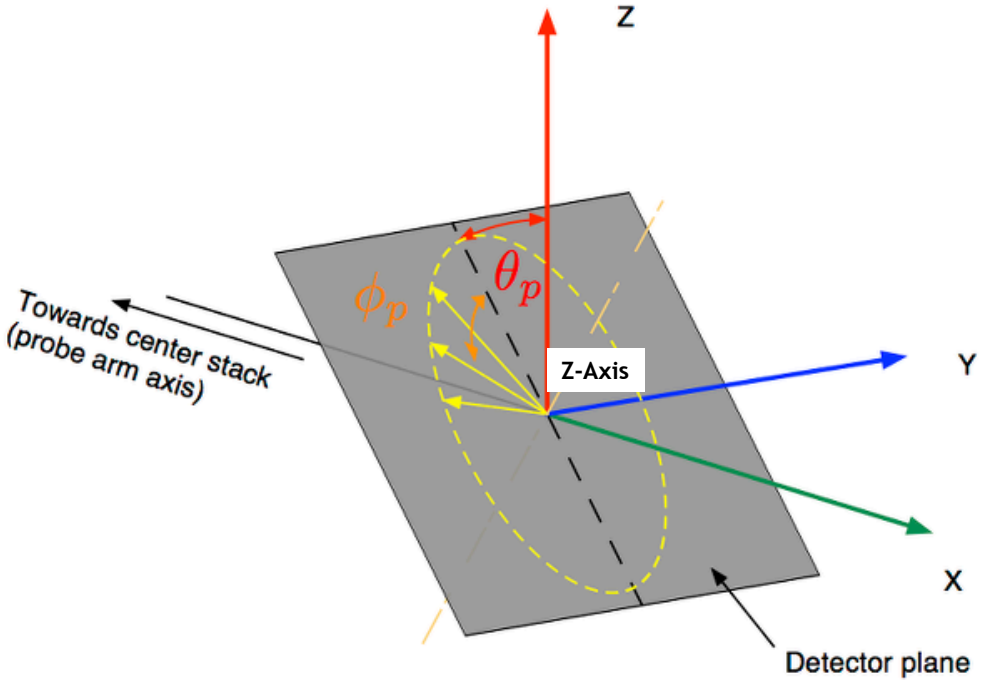


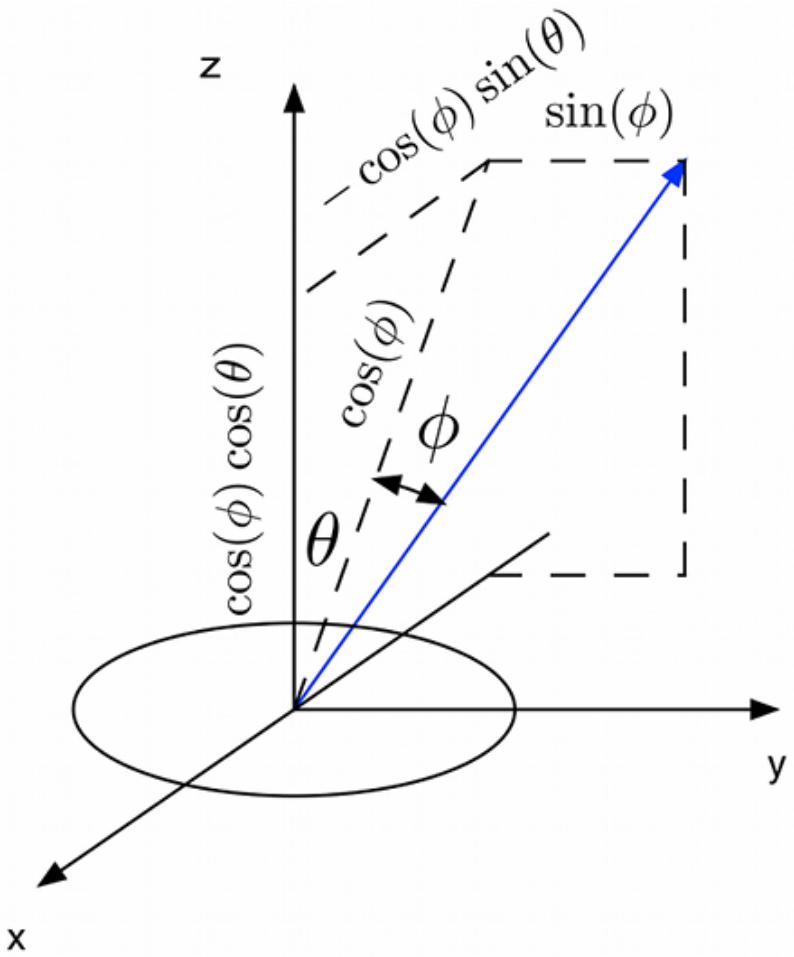
0.005m or 5mm change in radial position or less between before and after the crash

Fishbone events

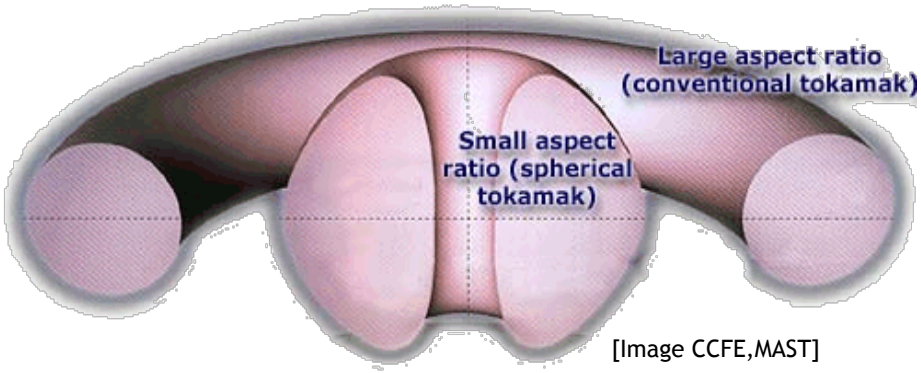


Detector Orientations





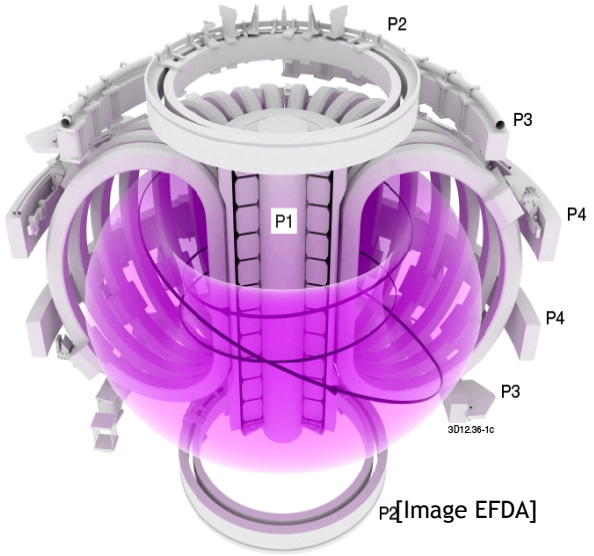
Spherical Tokamaks



[Image CCFE,MAST]

- Aspect Ratio: R/a
- MAST Aspect Ratio:
  - 0.85m/0.65m = 1.31

[Image CCFE,MAST]



[Image EFDA]