NSTX

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NSTX ssNPA diagnostic

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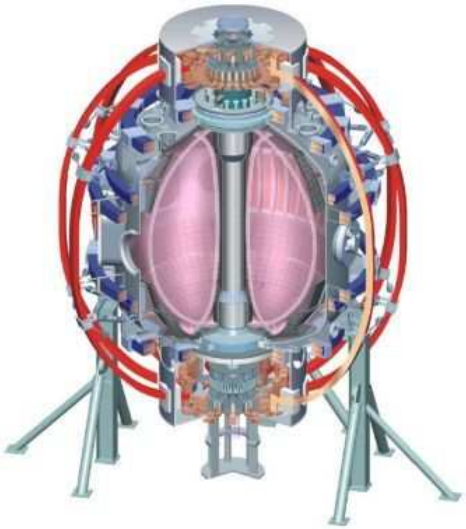
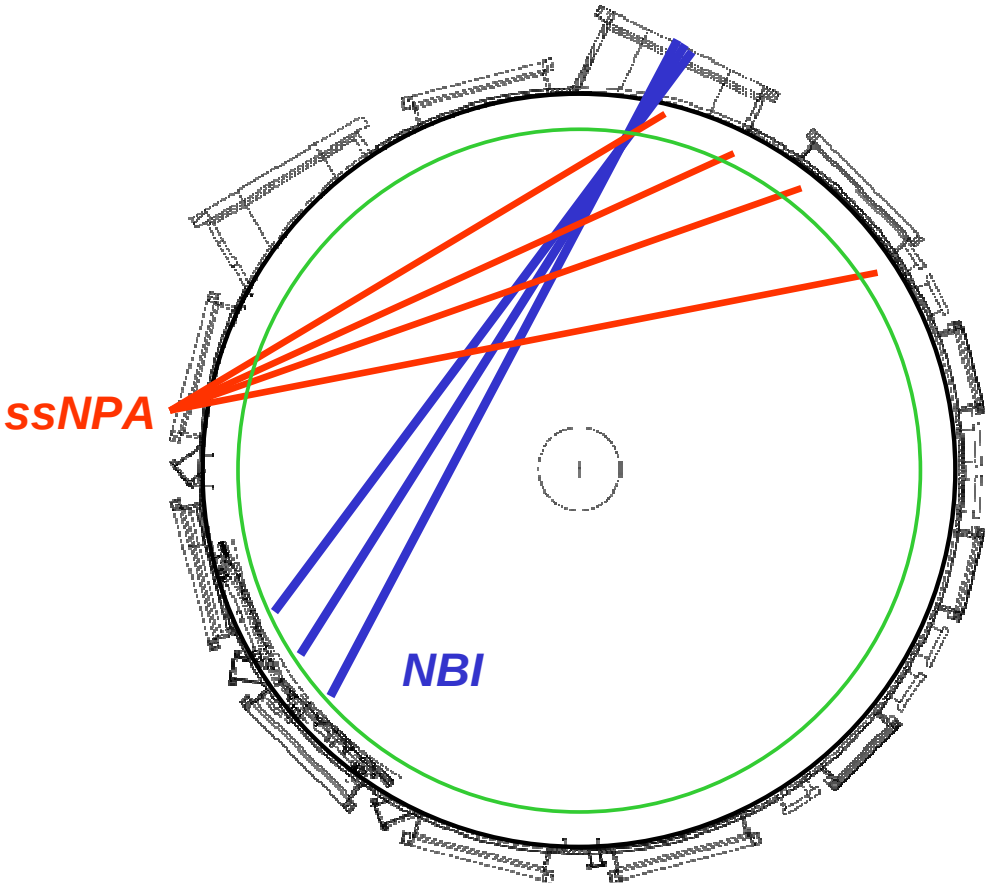
2010 NSTX Results and Theory Review
PPPL
December 2nd 2010



Solid State NPA diagnostic on NSTX



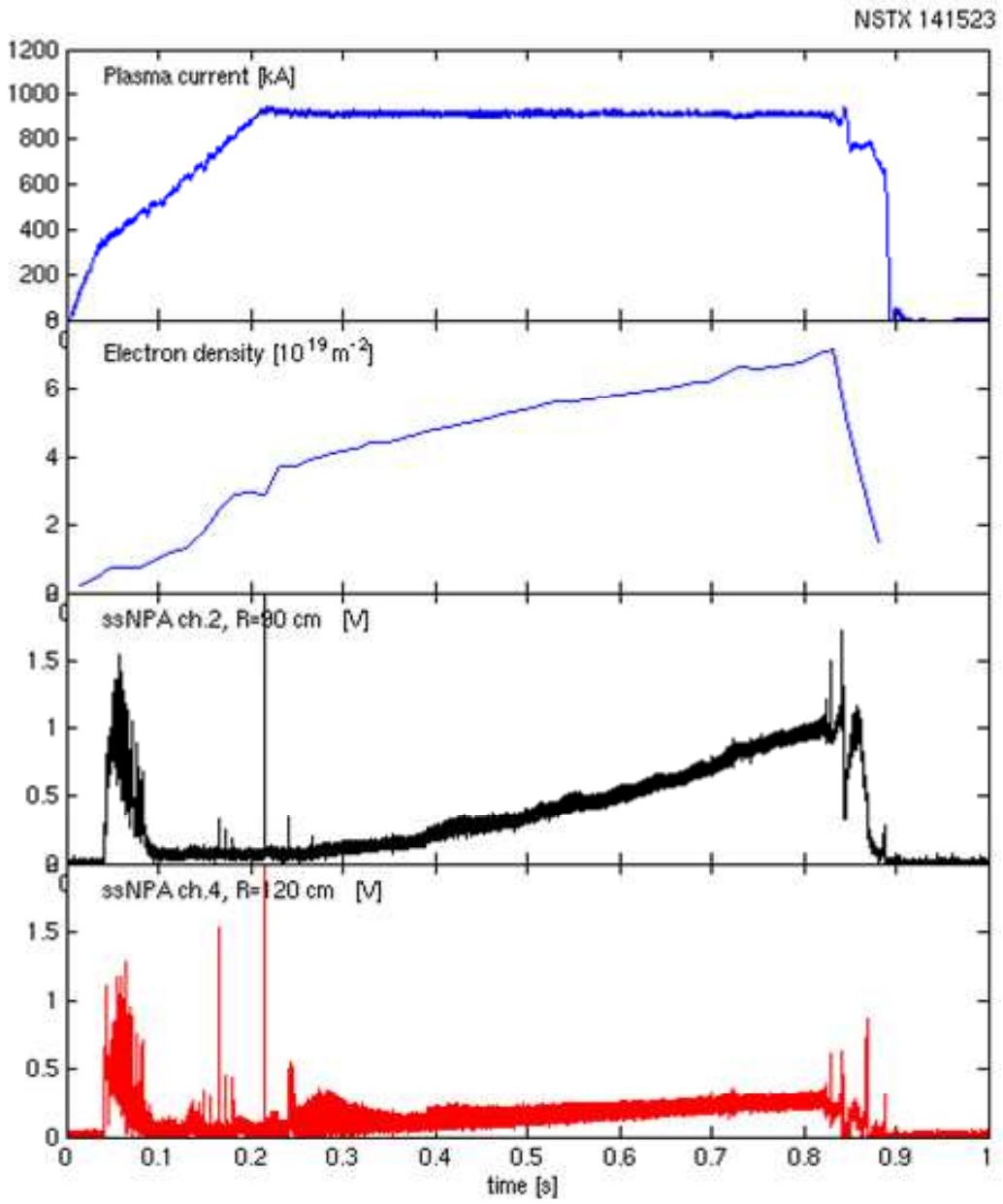
- Measurement of flux of energetic neutrals
- 4 lines of sight on the NBI
  - R_{tan} = 60, 90, 100, 120 cm
- Pinhole & Silicon photodiode detector (AXUV)
- Aluminum foil (150nm) blocks light, SXR, low energy neutrals (<10 keV)
- Detected neutrals generated by Charge Exchange of fast ions with **beam** and/or **edge** neutrals

- Before FY2010 ssNPA operational in **pulse detection** mode
  - 10 keV energy resolution
  - 5 ms time resolution

- In FY2010 ssNPA configured for **current mode** operation
  - pinhole enlarged (50 μm ⇒ 5 mm)
  - no energy resolution
  - new preamplifiers (same acquisition hardware)
  - fast acquisition rates (up to 20 MHz – BP ~ 1 MHz)

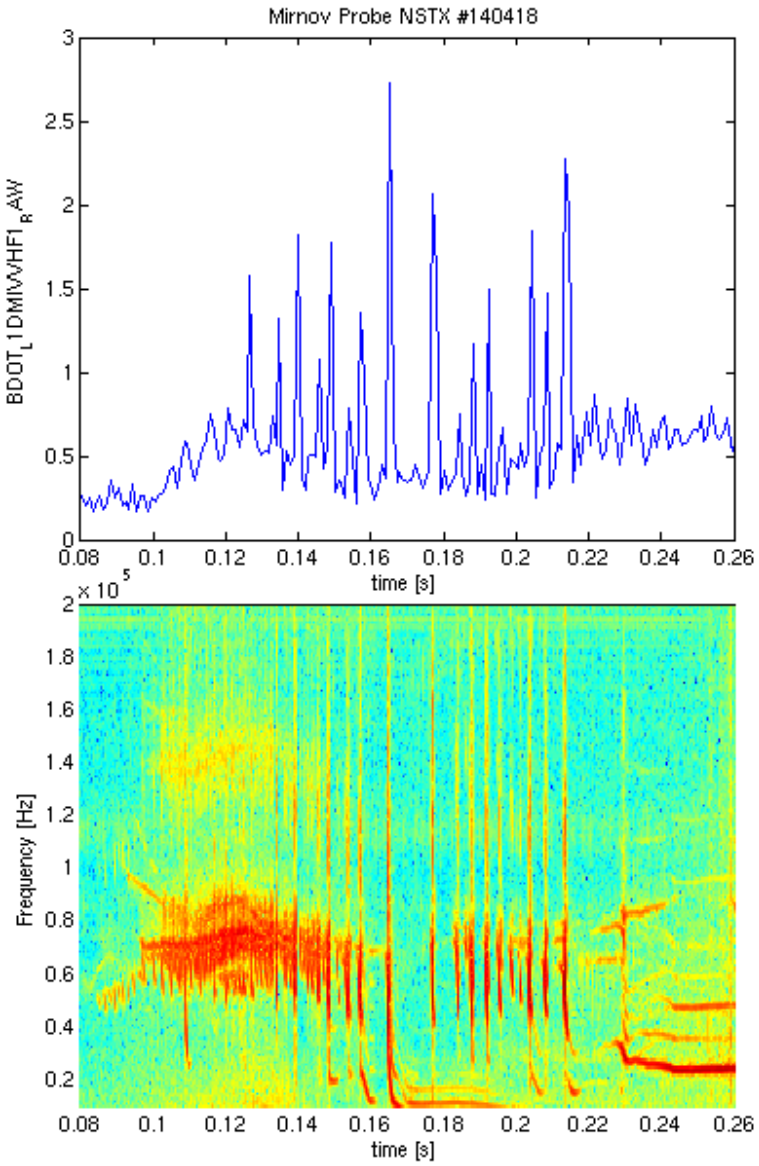
- ssNPA measurement routinely performed throughout the run
  - Digitalization issue affects one of the two PCI acquisition cards: channels 3 and 4 are often compromised

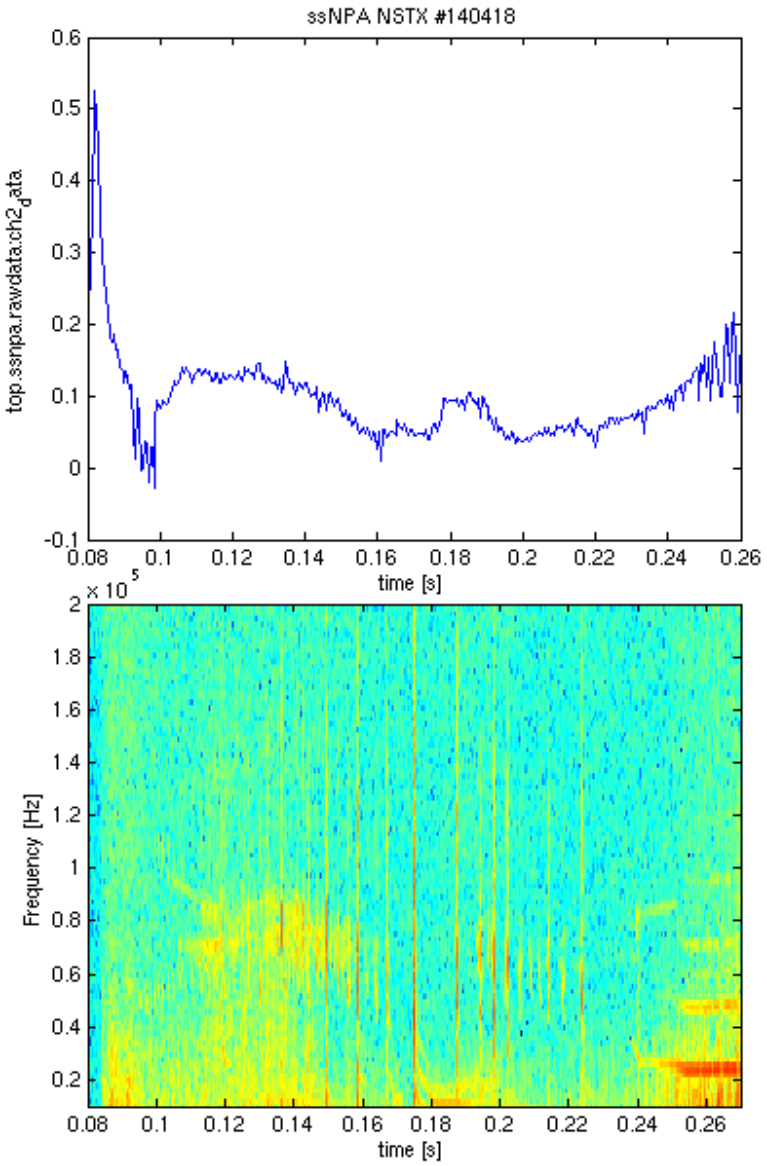
Example of ssNPA traces



- ELM-free H-mode
  Ip = 900 kA, P_{NBI}= 4 MW
- Typical acquired signal ~1V ~ 10 μA on the detector
- Spikes associated with burst of Fast Ion losses

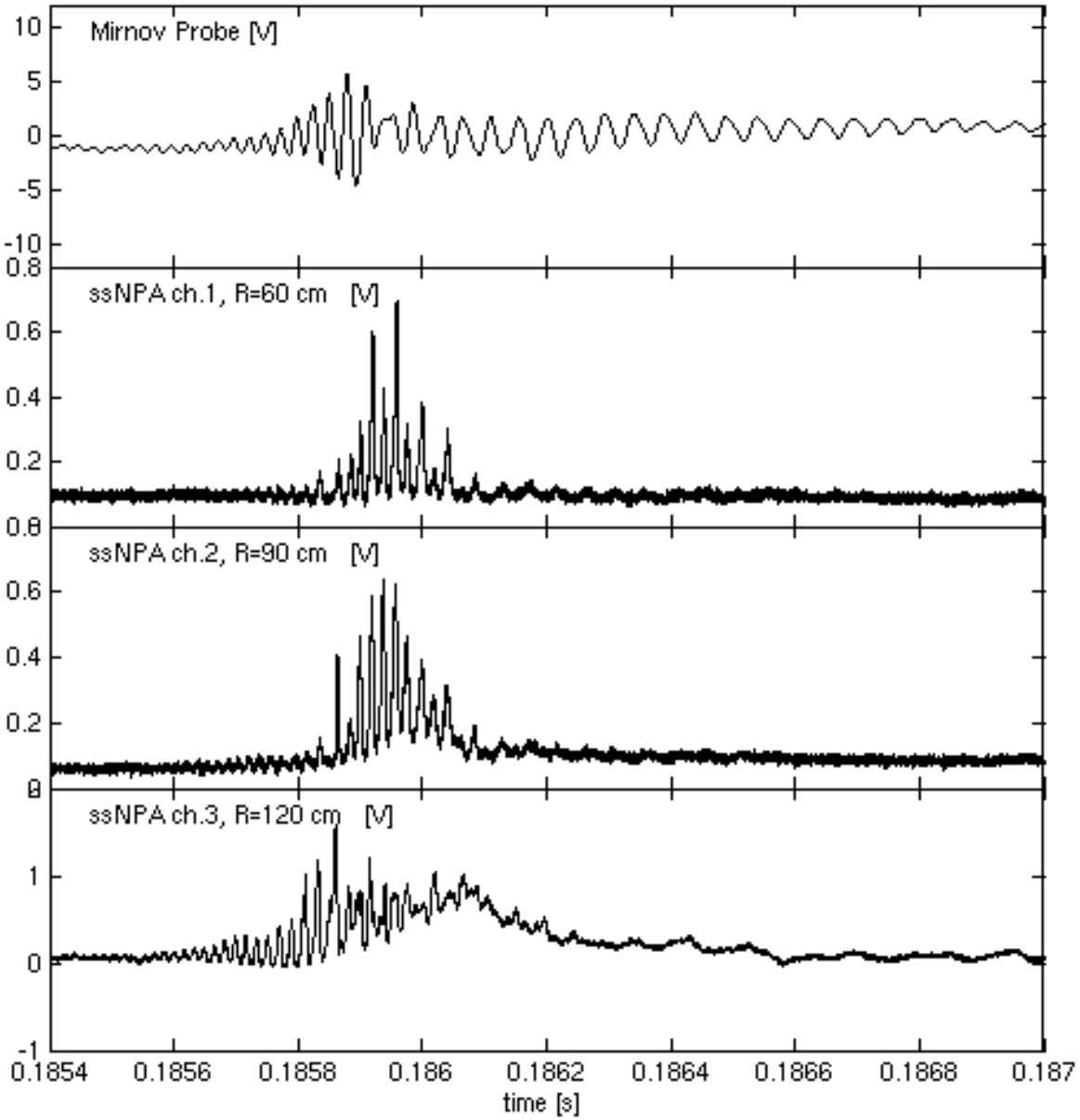
Mode activity detected on ssNPA data





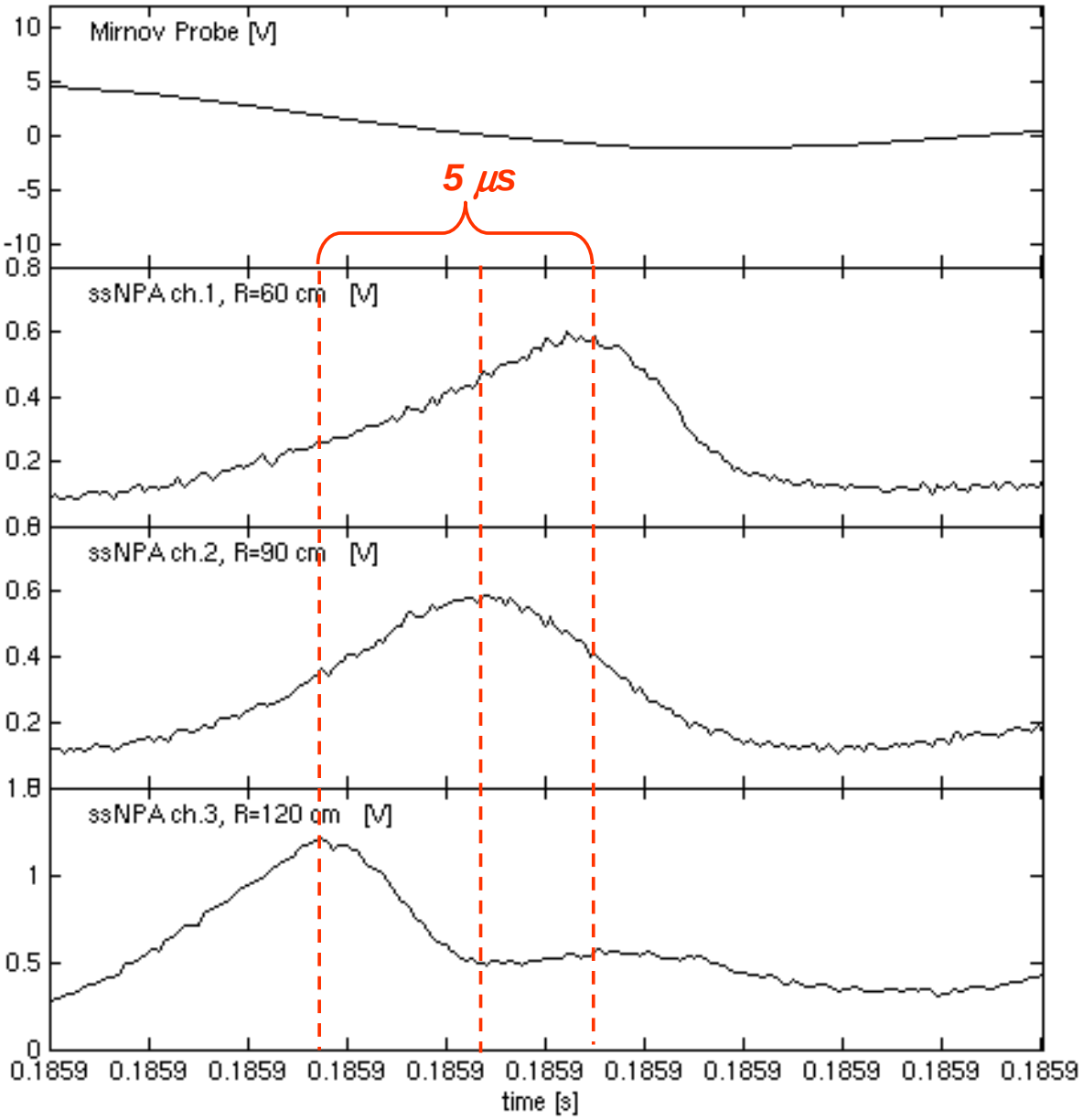
- MHD and Alfvénic activity appear on ssNPA data
- Likely to be associated with Fast Ion losses

The ‘fishbone beacon’



- Fast frequency chirping instabilities (e.g. TAE) accompanied by periodic bursts in ssNPA signals
- Fast ion loss cone, rotating in phase with the mode

The ‘fishbone beacon’



- Fast frequency chirping instabilities (e.g. TAE) accompanied by periodic bursts in ssNPA signals
- Fast ion loss cone, rotating in phase with the mode
- Burst appear at different phases in different channels

Conclusions

- ssNPA has been operated routinely in current mode throughout the 2010 NSTX run
- raw data (in Volts) are stored on MDS in the following nodes
  - \particles::ssnpa.rawdata:ch1_data
  - \particles::ssnpa.rawdata:ch2_data
  - (\particles::ssnpa.rawdata:ch3_data)
  - (\particles::ssnpa.rawdata:ch4_data)
- reference scope: /u/abortolo/scope/ssnpa_survey.dat
- pick up signal at frequencies ~1.6-1.8 MHz may be present in the measured signal
- Ask A. Bortolon for data validation