First proton run: 19-30 September 2016

CTR Diagnostics Summary

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CTR setup: layout

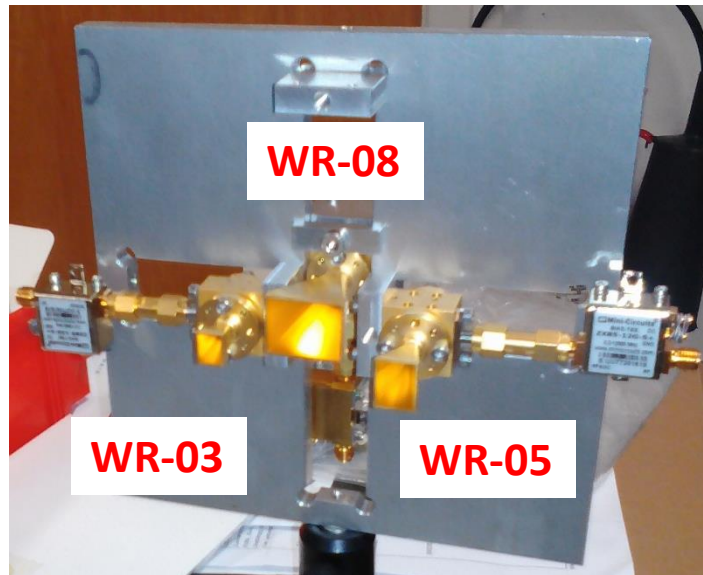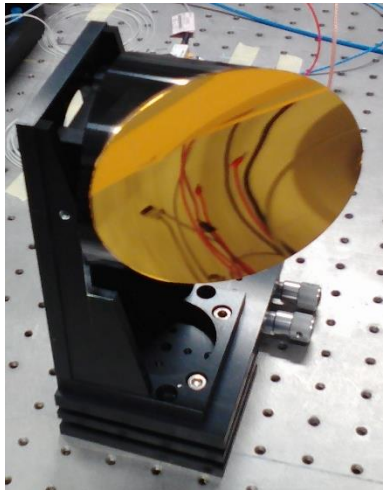Mikhail Martyanov, Max-Planck Institute for Physics, Munich, CERN AWAKE Team
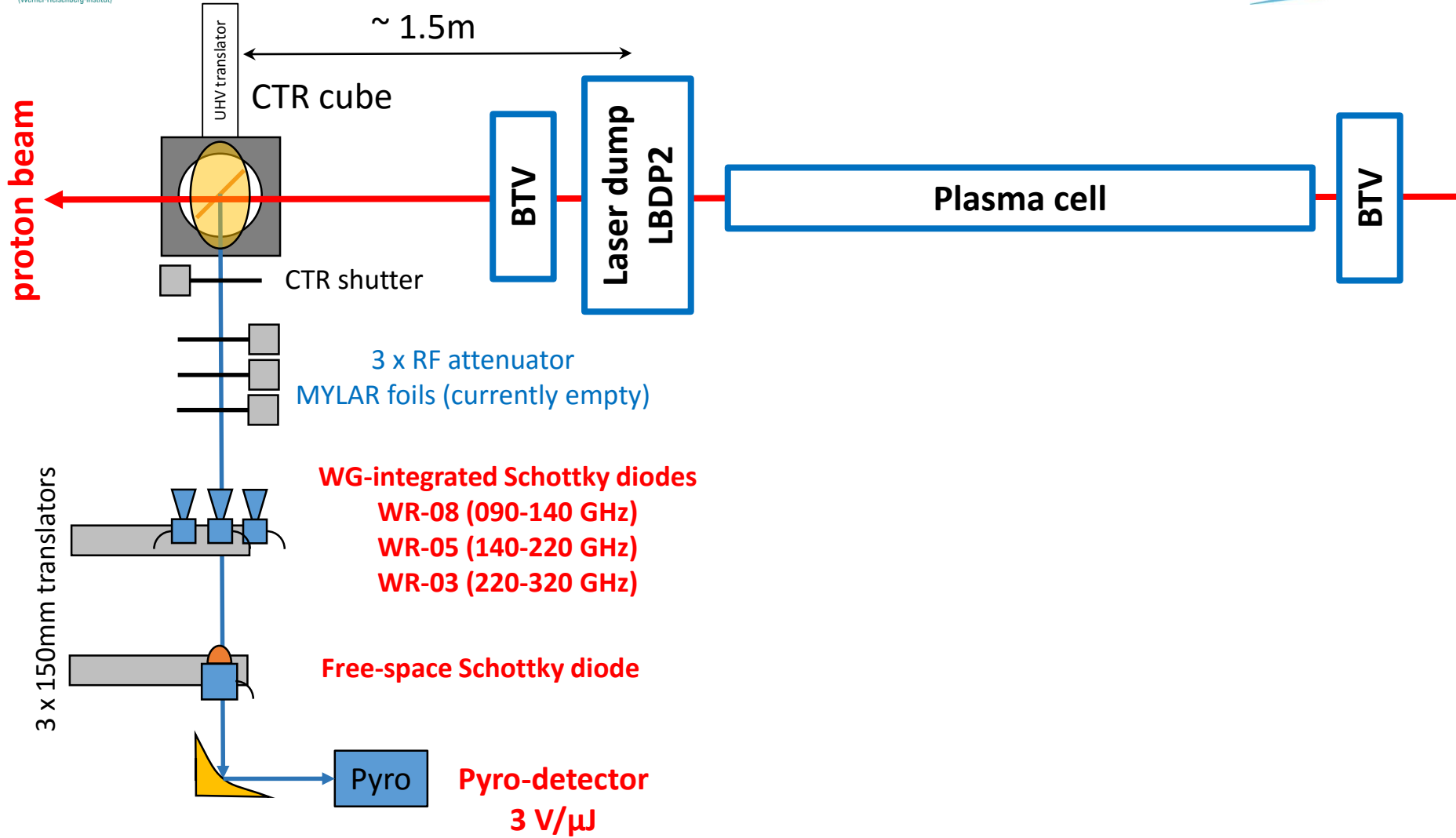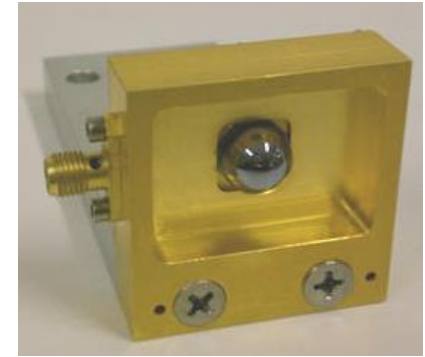
CTR setup: reality

Wave-guide integrated Schottky diodes
sensitivity ~100 mV/mW @ 50Ω, <1ns response time

ACST1 free-space Schottky diode
sensitivity ~10 mV/mW @ 50Ω,
<100ps response time

4" off-axis parabola

WR-05
WR-08
WR-03

WR-08

WR-03
WR-05

Pyro-detector
sensitivity ~3 V/µJ

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CTR setup: reality

TOTOKU RF cable

3 wave-guide integrated Schottky diodes

Free-space Schottky diode

150mm translators

4" off-axis parabola

p+

4" off-axis parabola

CTR shutter

RF attenuator holders

Pyro-detector

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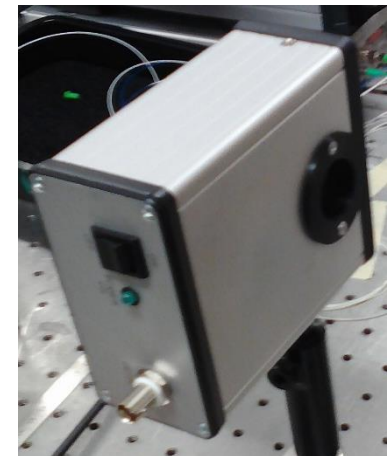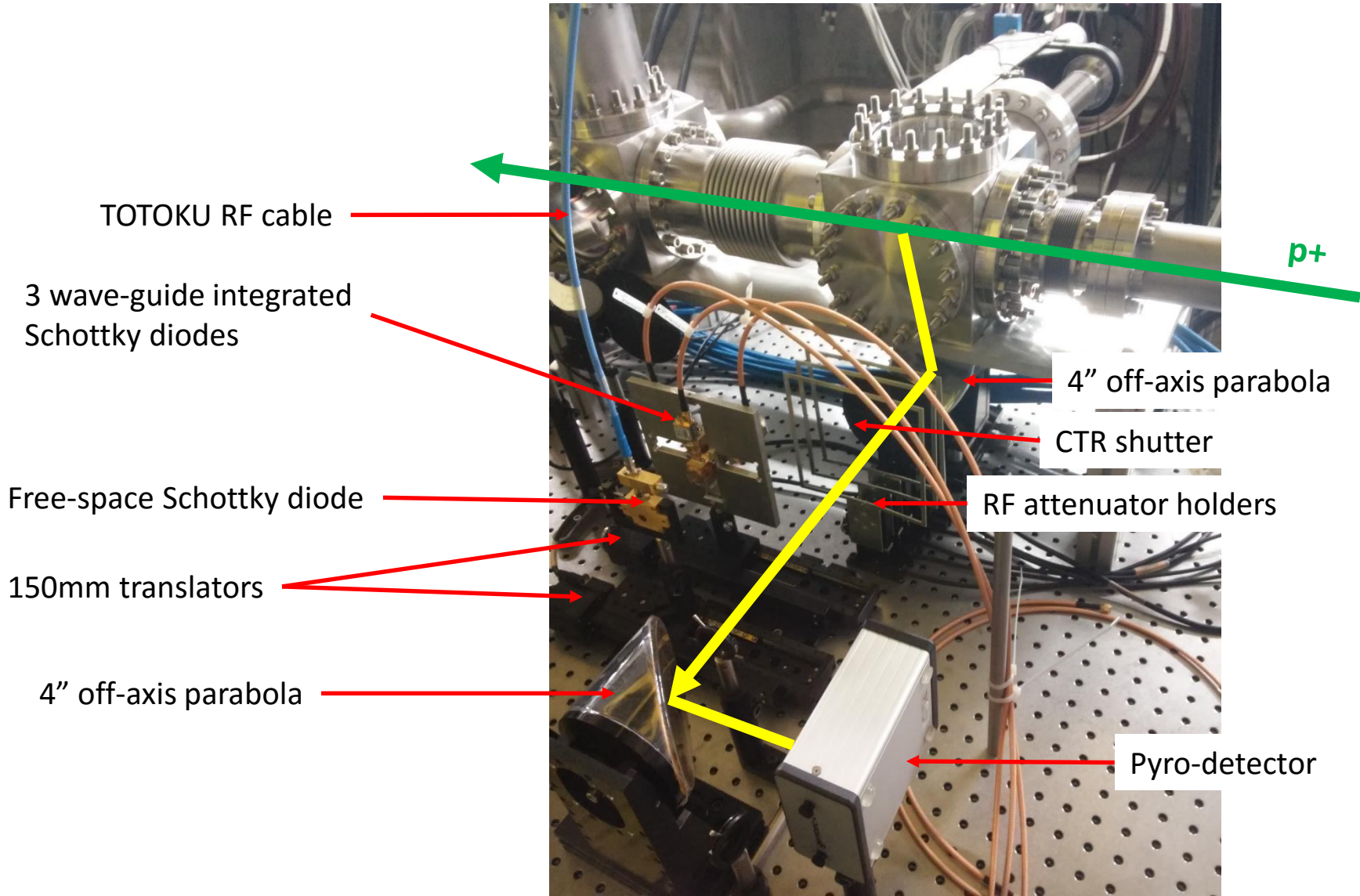
Conditions of proton run.
First try

Running at P+ intensity 1.4e11

LeCroy 500MHz Scope (installed in streak room)

CH1 (yellow)   laser photodiode

CH2 (red)   WR-08

CH3 (cyan)   ACST1

CH4 (green)   n/c
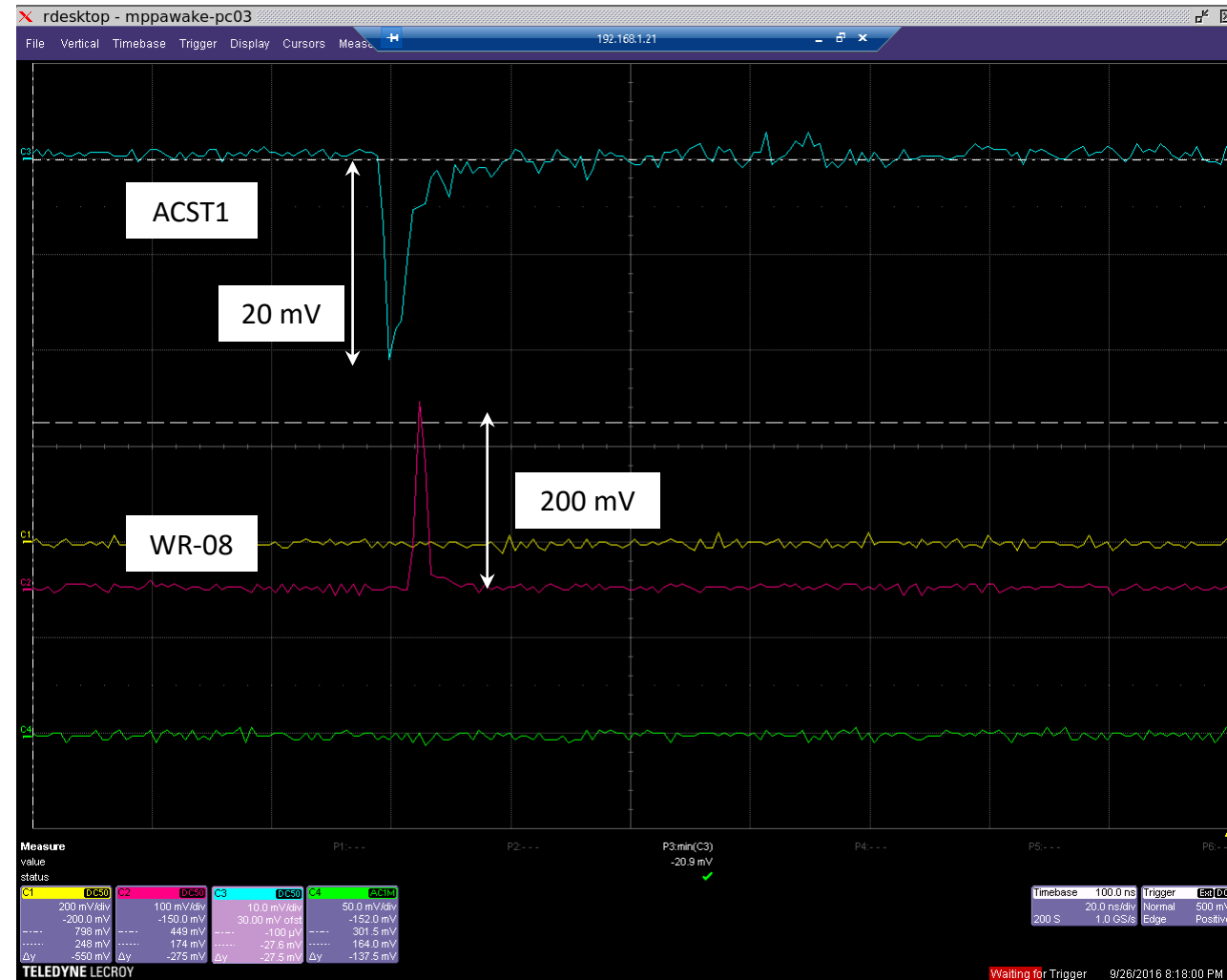
LeCroy 500MHz scope signals, p+ 1.4e11

BTV	out
Laser dump LBDP2	out
CTR screen	in
CTR shutter	opened
All WR's	in
ACST1	out

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BTV   out
Laser dump LBDP2   out
CTR screen   in
CTR shutter   opened
All WR's   out
ACST1   in 30mm

Conditions of proton run.
Second try

Running at full P+ intensity 3e11

OASIS configuration: 4 cards x 2 channels, 2GHz bandwidth each

Currently 2 cards have combined channels resulting in 4GHz bandwidth

So, for now, in total we have: 4 channels at 2GHz and 2 channels at 4 GHz

OASIS is installed far-far away in the rack RA0047.

OASIS Scope2

CH1(yellow) - WR-05   2 GHz

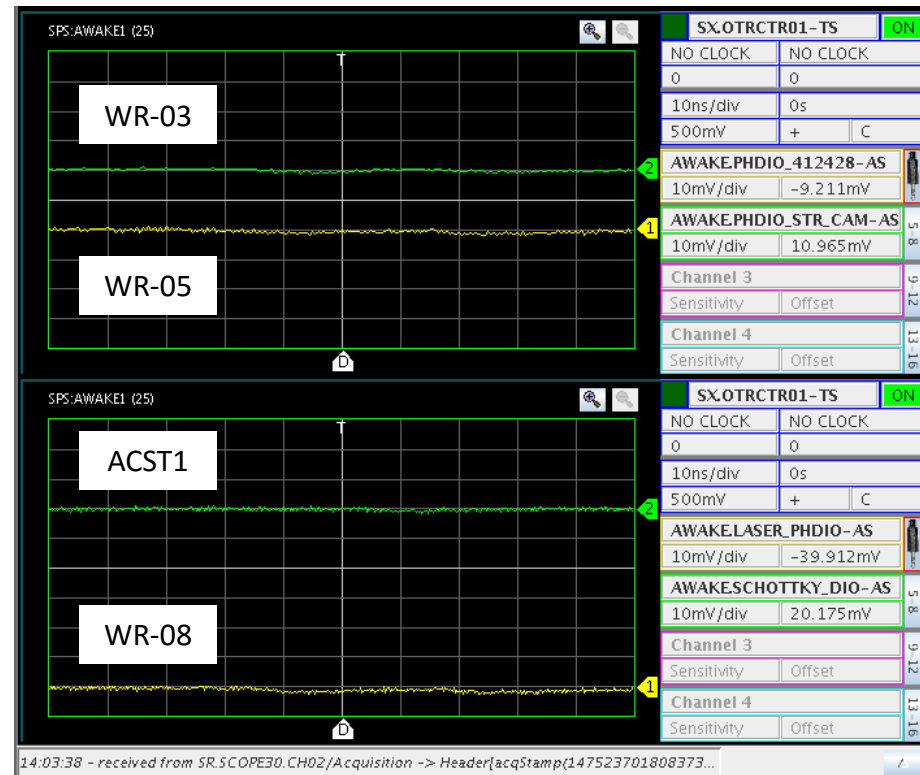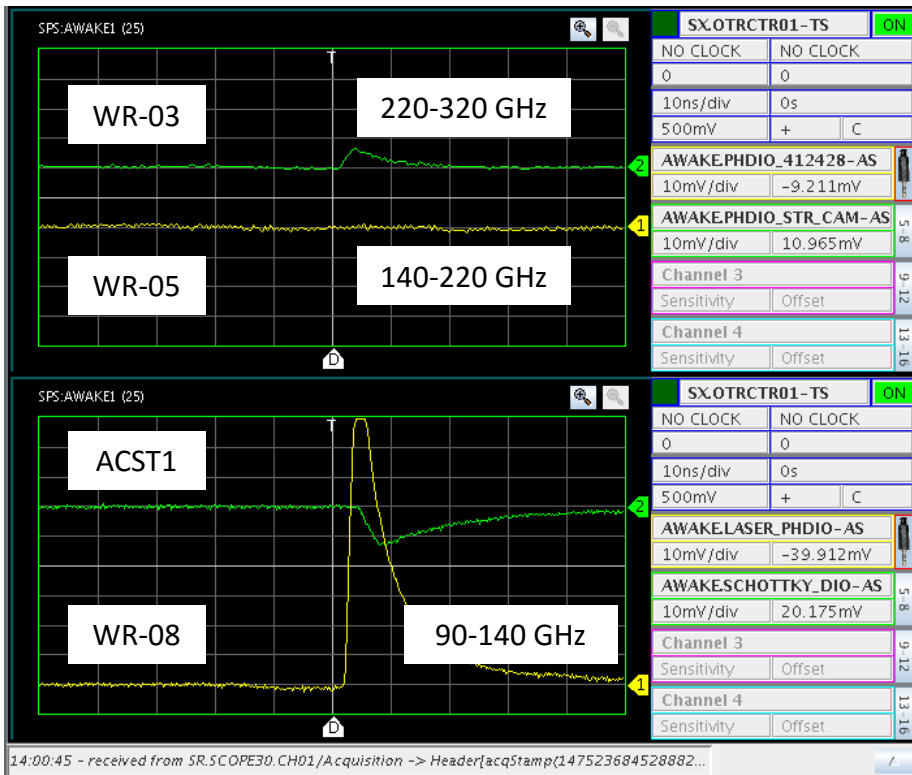CH2(green) - WR-03   2 GHz

OASIS Scope3

CH1(yellow) - WR-08,   4 GHz

CH2(green) - ACST1   4 GHz

OASIS signals, p+ 3e11

BTV	out
Laser dump LBDP2	out
CTR screen	in
CTR shutter	opened
All WR's	in
ACST1	out

BTV	out
Laser dump LBDP2	out
CTR screen	in
CTR shutter	closed
All WR's	in
ACST1	out

OASIS signals, p+ 3e11

BTV   out
Laser dump LBDP2   in
CTR screen   in
CTR shutter   opened
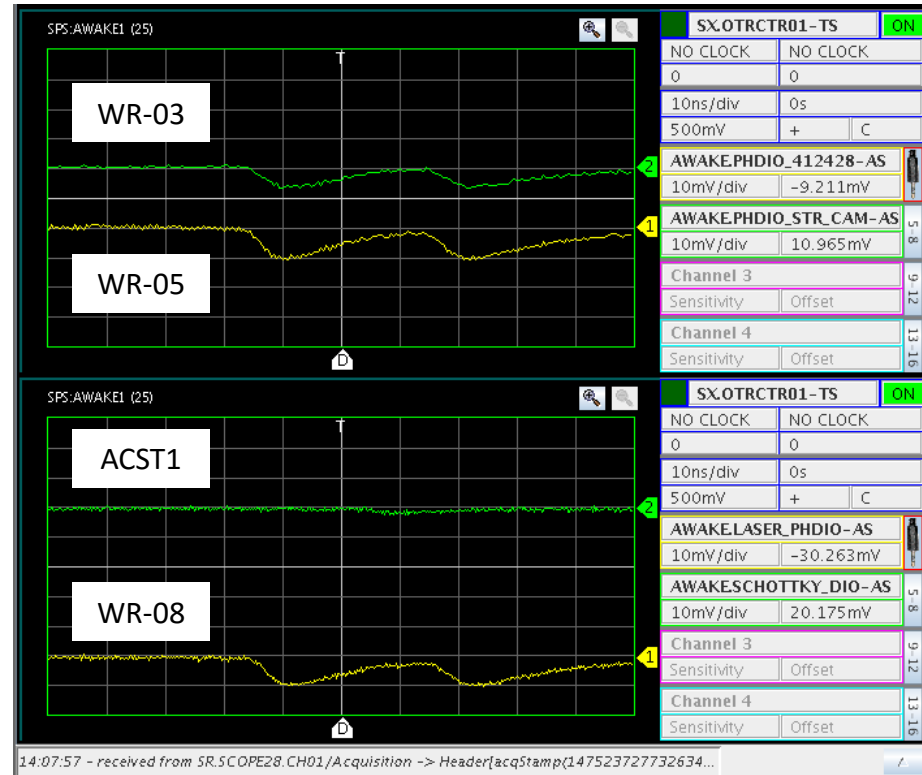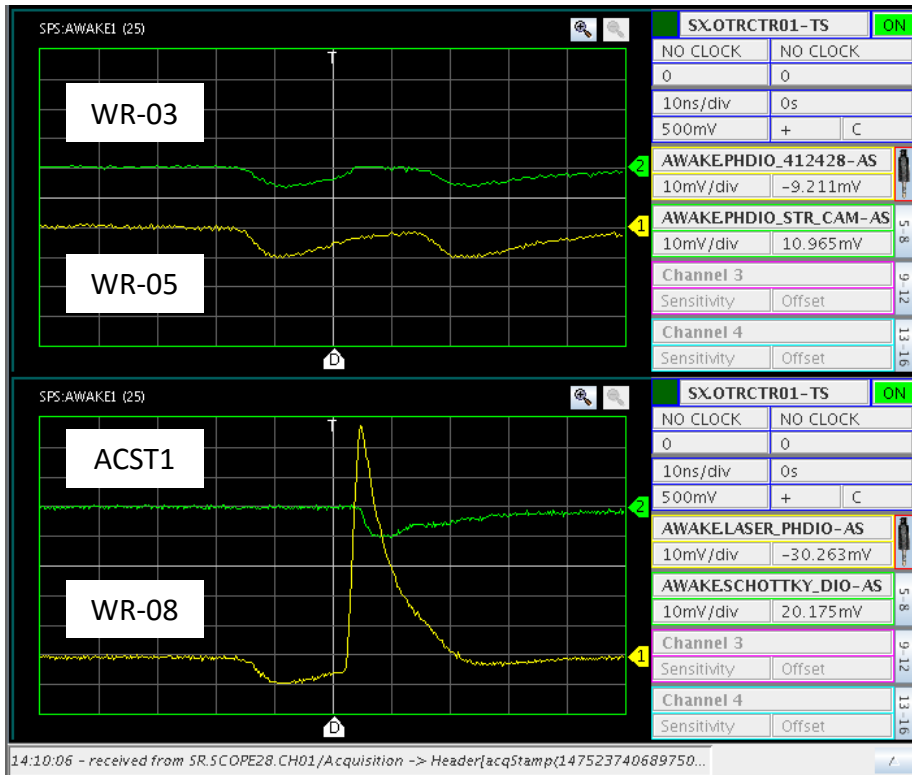All WR's   in
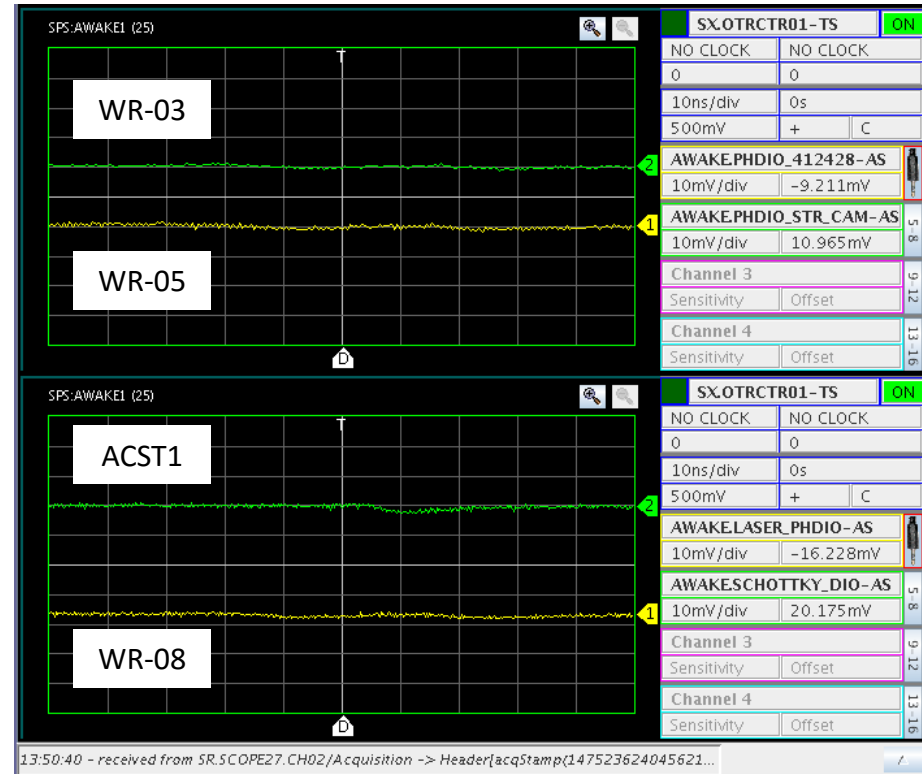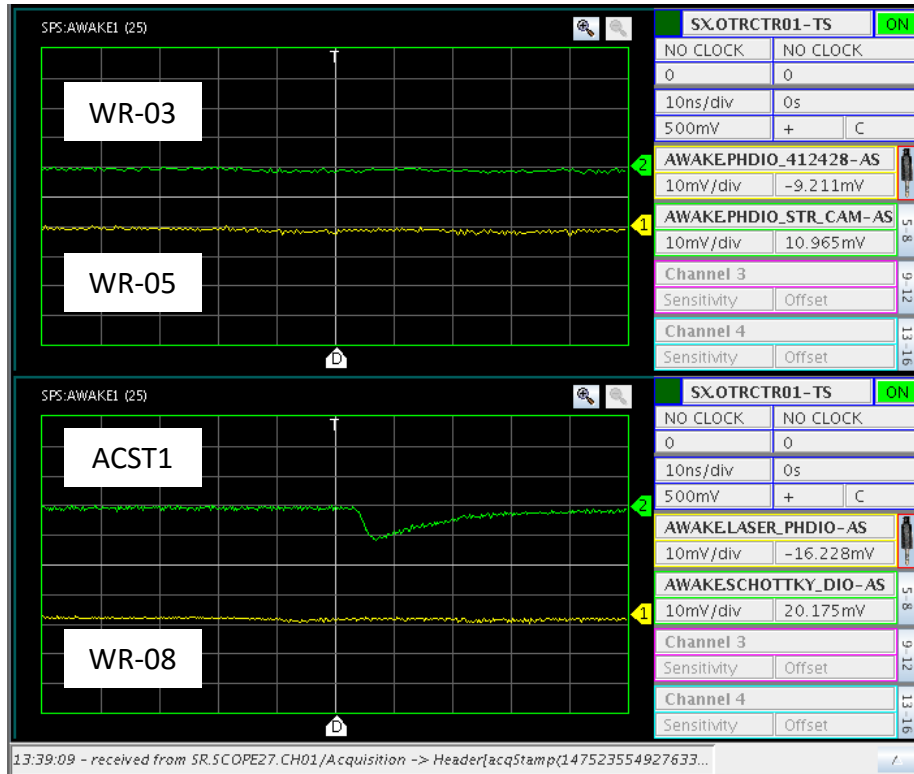ACST1   out

BTV   out
Laser dump LBDP2   in
CTR screen   in
CTR shutter   closed
All WR's   in
ACST1   out

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BTV	out
Laser dump LBDP2	out
CTR screen	in
CTR shutter	opened
All WR's	out
ACST1	in 20mm

BTV	out
Laser dump LBDP2	out
CTR screen	in
CTR shutter	closed
All WR's	out
ACST1	in 20mm

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OASIS signals, p+ 3e11

BTV	out
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CTR shutter	opened
All WR's	out
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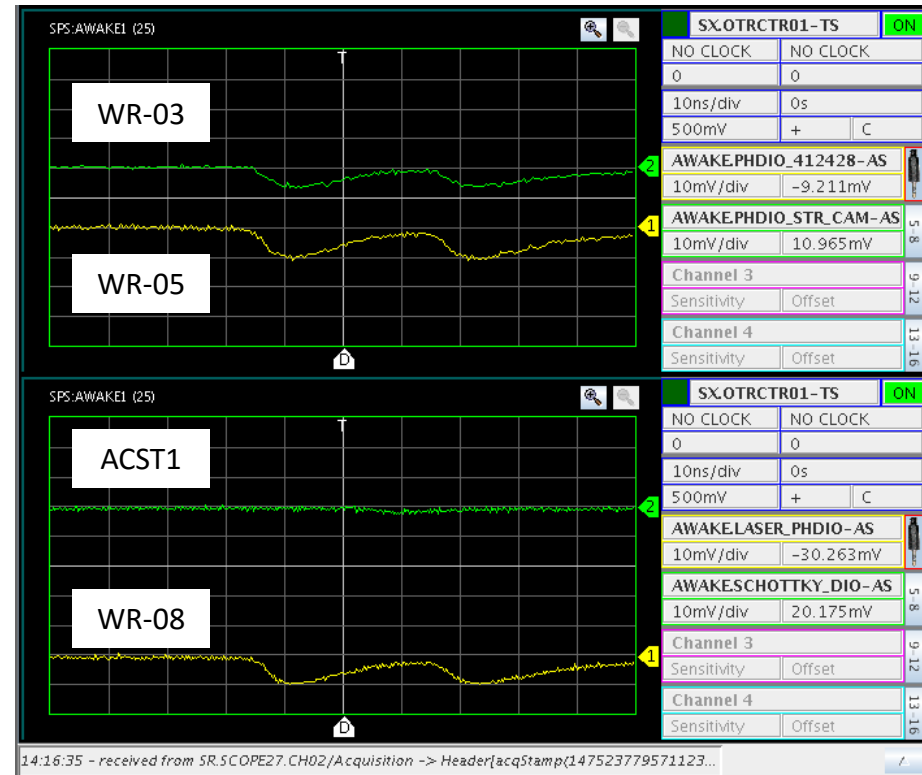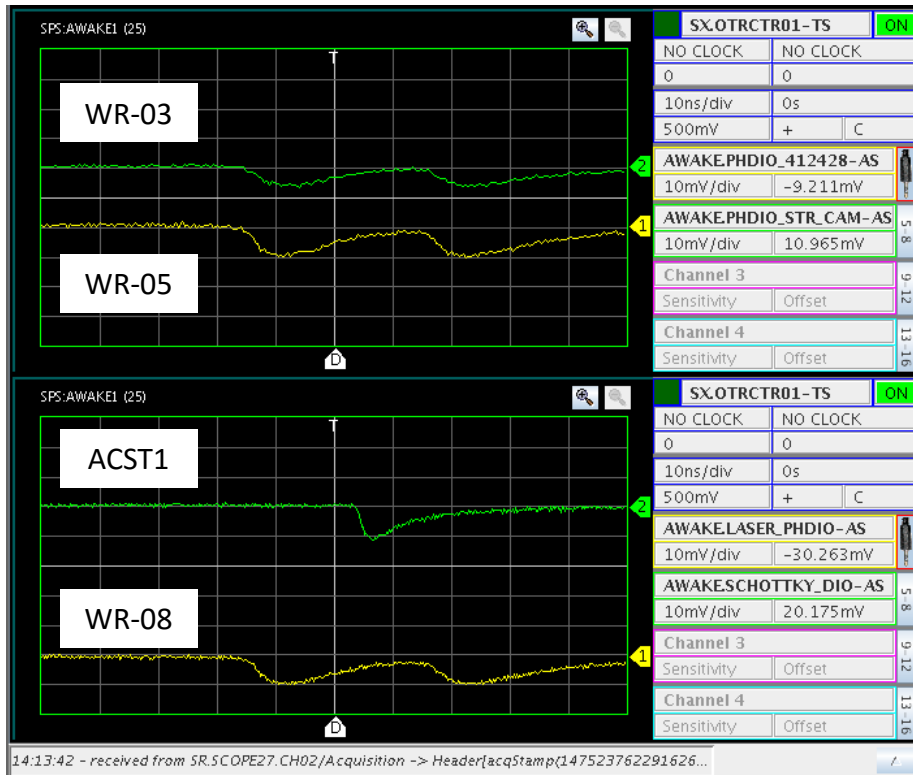
Pyro signal, p+ 3e11
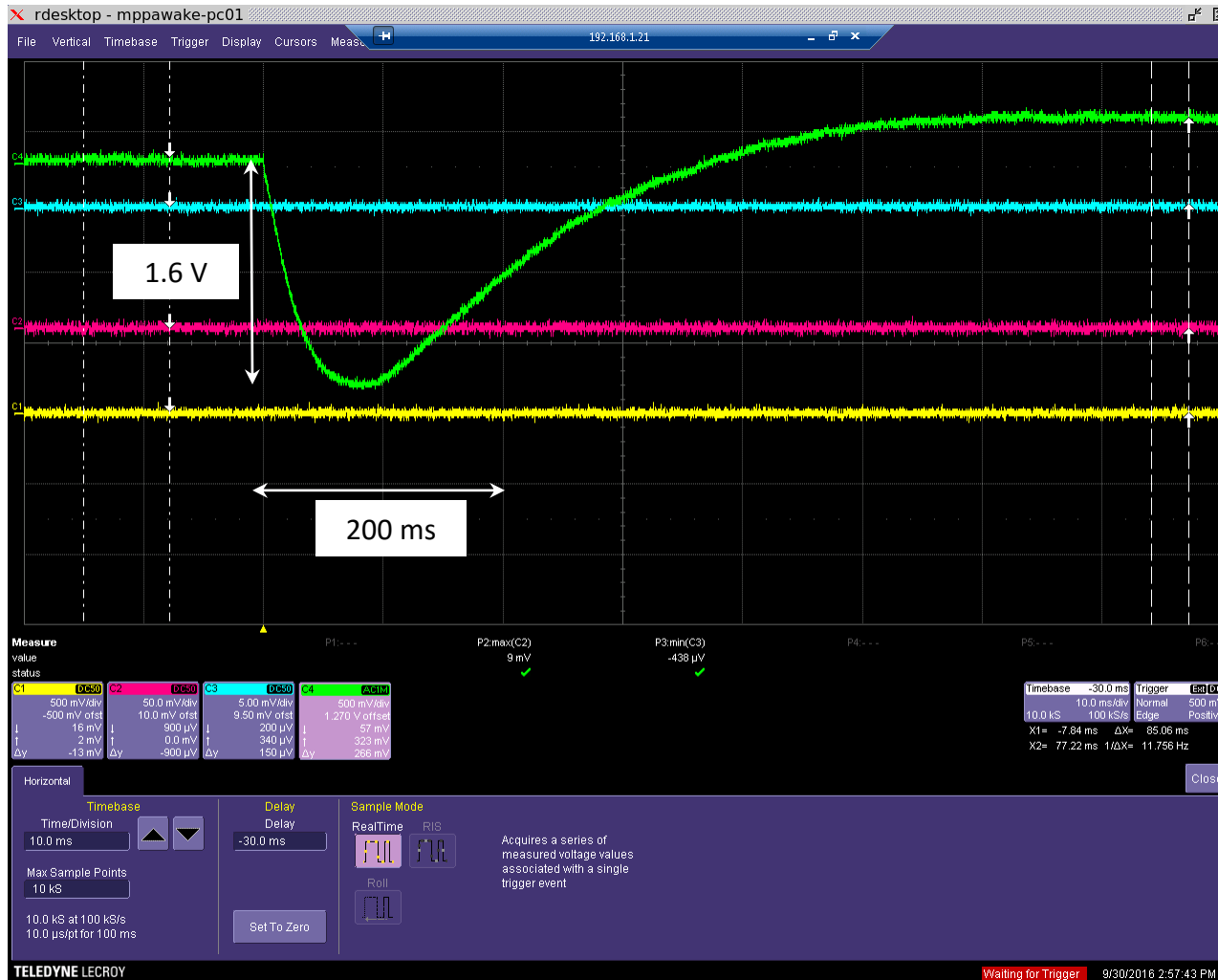
on LeCroy 500MHz scope,
AC 1 MΩ termination

BTV	out
Laser dump LBDP2	out
CTR screen	in
CTR shutter	opened
All WR's	out
ACST1	in 30mm

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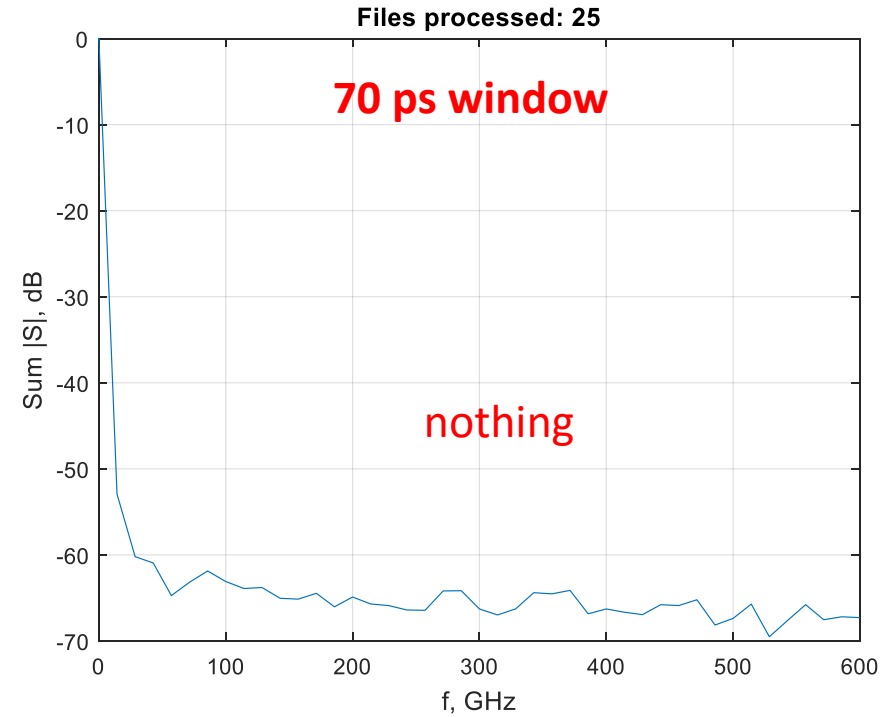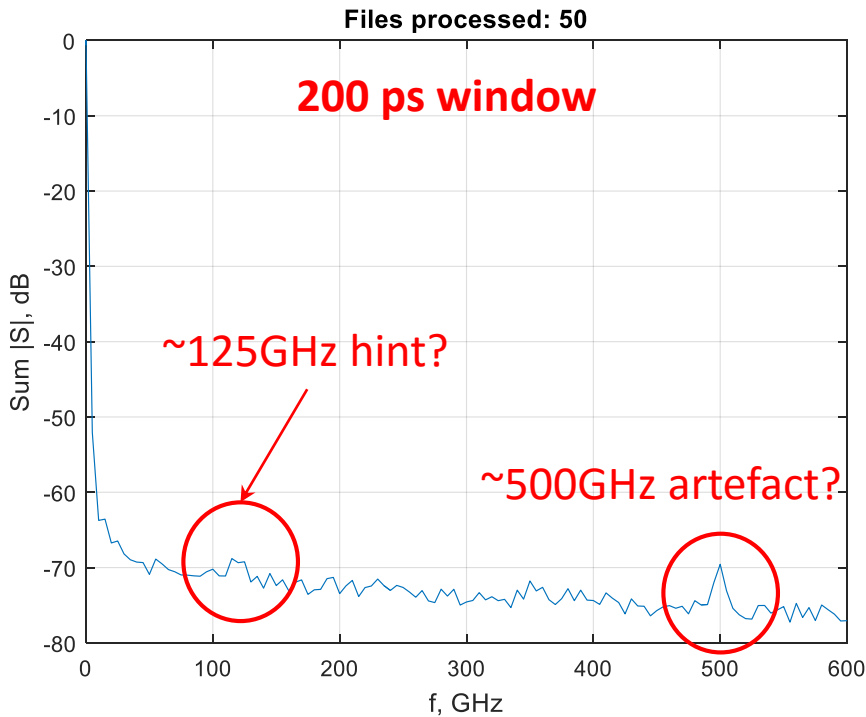
Proton bunch is suspected to be modulated within 110-140 GHz

Looking at WR's signals, we saw signals from WR-08 (90-140GHz)

and WR-03 (220-320GHz), but not from WR-05 (140-220GHz)

This suggest that modulation is likely to be within 110-140GHz

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Summary

- Given OASIS is installed far away (RA0047), signals got attenuated and distorted , so we cannot benefit from having OASIS acquisition at 2-4 GHz bandwidth

- Possible solution: move OASIS to our rack RA01-MUNICH in the streak room

- All devices (WR's, ACST's, Pyro) are affected by radiation produced by laser dump LBDP2. To be understood how it affects the measurements…

- For WR's radiation seemed not to be a problem because of different pulse response

- For Pyro radiation seemed not to be a problem because of the response time difference (signal ~1ms, radiation ~ 100ms) and different polarity

- For ACST radiation from LBDP2 seemed not visible, but there is a strange emission from CTR foil, which gives negative response (while an RF signal gives positive). It looks like a lot of high-frequency photons captured by ACST. To be confirmed…

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