



First proton run: 19-30 September 2016

CTR Diagnostics Summary

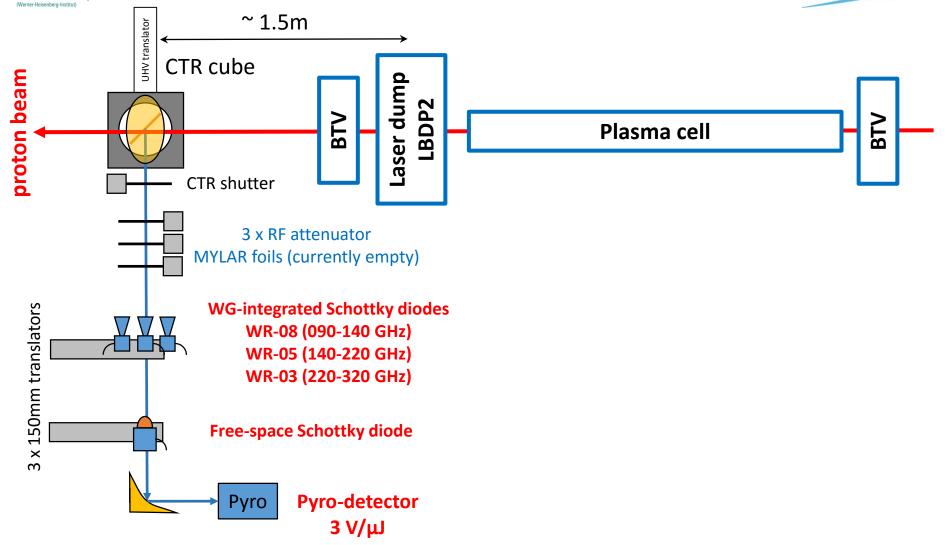
Misha Martyanov

Mikhail Martyanov, Max-Planck Institute for Physics, Munich, CERN AWAKE Team



CTR setup: layout







CTR setup: reality

Wave-guide integrated Schottky diodes

sensitivity ~100 mV/mW @ 50 Ω , <1ns response time



ACST1 free-space Schottky diode

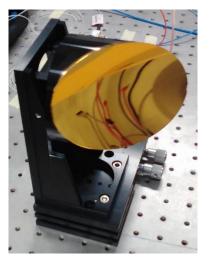
sensitivity ~10 mV/mW @ 50 Ω , <100ps response time

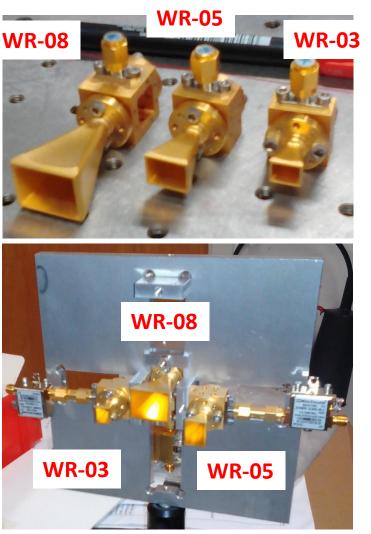


Pyro-detector sensitivity ~3 V/μJ

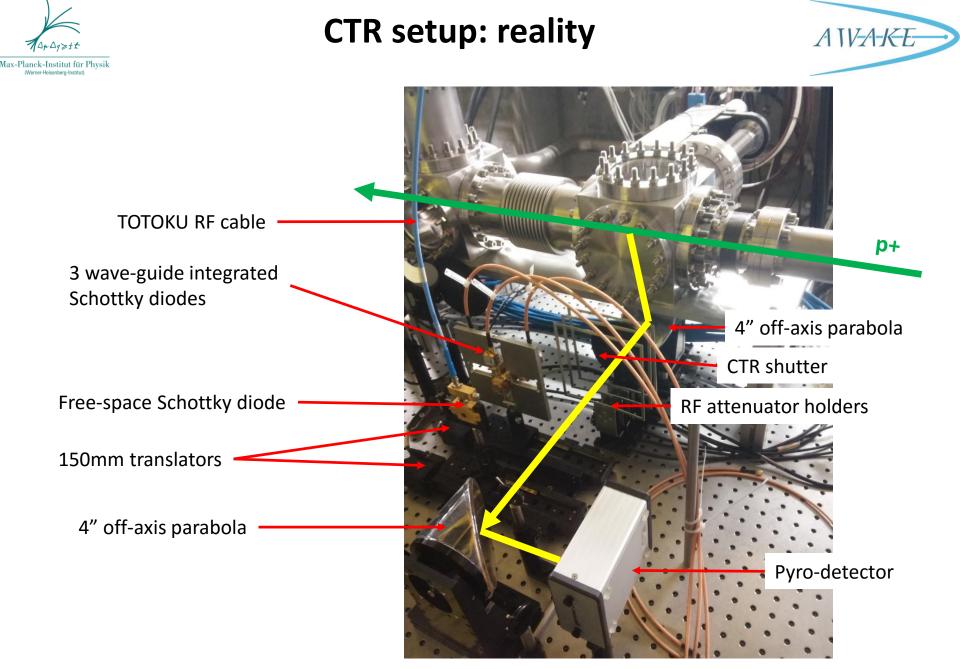


4" off-axis parabola





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Conditions of proton run. First try



Running at P+ intensity 1.4e11

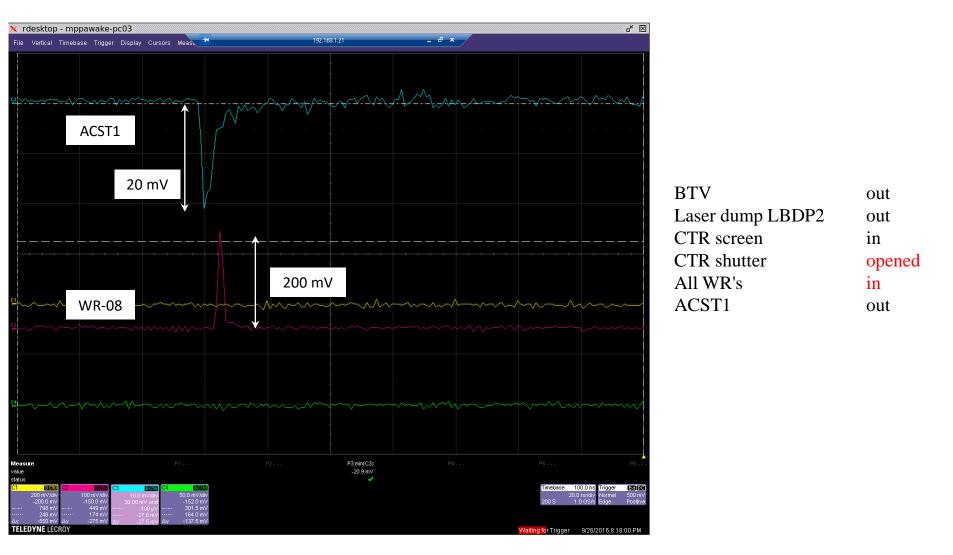
LeCroy 500MHz Scope (installed in streak room)

CH1 (yellow)	laser photodiode
CH2 (red)	WR-08
CH3 (cyan)	ACST1
CH4 (green)	n/c



LeCroy 500MHz scope signals, p+ 1.4e11

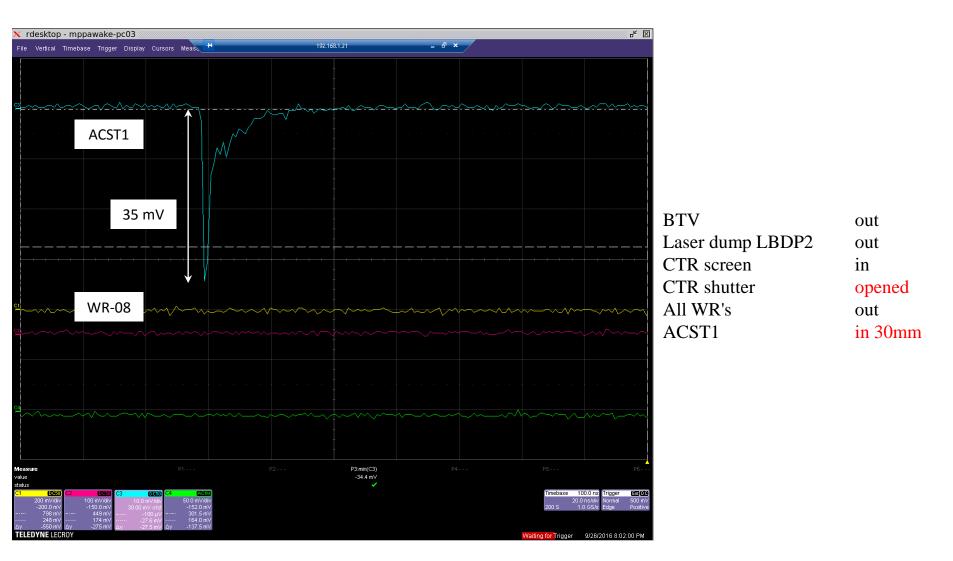






LeCroy 500MHz scope signals, p+ 1.4e11







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





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

BTVoutLaser dump LBDP2outCTR screeninCTR shutterclosedAll WR'sinACST1out



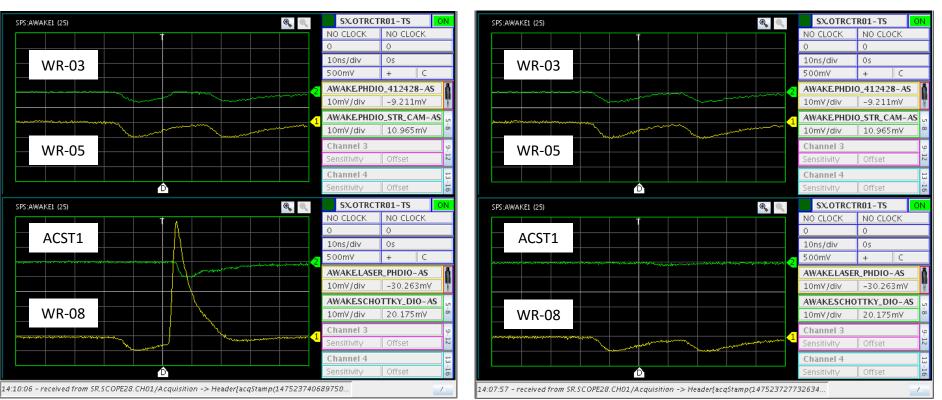
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BTV	out
	out
Laser dump LBDP2	in
CTR screen	in
CTR shutter	opened
All WR's	in
ACST1	out

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







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

BTVoutLaser dump LBDP2outCTR screeninCTR shutterclosedAll WR'soutACST1in 20mm

SPS:AWAKE1 (25)	🔍 🔍 SX.OTRCTR01-TS ON	SPS:AWAKE1 (25)	🔍 🔍 SX.OTRCTR01-TS	ON
	NO CLOCK NO CLOCK		NO CLOCK NO CLOCK	
	0 0		0 0	
WR-03	10ns/div 0s	WR-03	10ns/div Os	
VVII-03	500mV + C		500mV + C	-
	AWAKEPHDIO_412428-AS		AWAKEPHDIO_412428-/	AS
	10mV/div -9.211mV		10mV/div -9.211mV	
	م AWAKEPHDIO_STR_CAM-AS	and the second s	AWAKEPHDIO_STR_CAM	-AS
تتركينا تتبيت وحدي وتقتل وتعم محد المراج	10mV/div 10.965mV ^e		10mV/div 10.965mV	/ •
WR-05	Channel 3 🤠	WR-05	Channel 3	ų
VVI 05	Sensitivity Offset 🌄 🀱	WIX 83	Sensitivity Offset	12
	Channel 4 🔛		Channel 4	5
	Sensitivity Offset 🖁	<u> </u>	Sensitivity Offset	10
SPS:AWAKE1 (25)	🛞 🔍 SX.OTRCTR01-TS ON	SPS:AWAKE1 (25)	🔍 🔍 SX.OTRCTR01-TS	ON
	NO CLOCK NO CLOCK		NO CLOCK NO CLOCK	
ACST1	0 0	ACST1	0 0	
ACJII	10ns/div Os	710311	10ns/div Os	
man and a second a	2 500mV + C	······································	2 500mV + C	1
	AWAKELASER_PHDIO-AS		AWAKELASER_PHDIO-AS	s [
	AWAKELASER_PHDIO-AS 10mV/div -16.228mV		AWAKELASER_PHDIO-AS 10mV/div -16.228m	
	10 III III III III III III III III III I			۱V
	10mV/div -16.228mV		10mV/div -16.228m	1∀ - AS
	10mV/div -16.228mV AWAKESCHOTTKY_DIO-AS u		10mV/div -16.228m AWAKESCHOTTKY_DIO-	1∀ - AS
WR-08	10mV/div -16.228mV • AWAKESCHOTTKY_DIO-AS • • 1 10mV/div 20.175mV •	WR-08	10mV/div -16.228m AWAKESCHOTTKY_DIO- - 1 10mV/div 20.175mV	1∀ - AS
WR-08	10mV/div -16.228mV AWAKESCHOTTKY_DIO-AS γ 1 10mV/div 20.175mV Channel 3 φ	WR-08	10mV/div -16.228m AWAKESCHOTTKY_DIO- 1 10mV/div 20.175mV Channel 3 2	nV -AS (





BTV	(
Laser dump LBDP2	i
CTR screen	i
CTR shutter	(
All WR's	(
ACST1	j

out in in opened out in 20mm

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

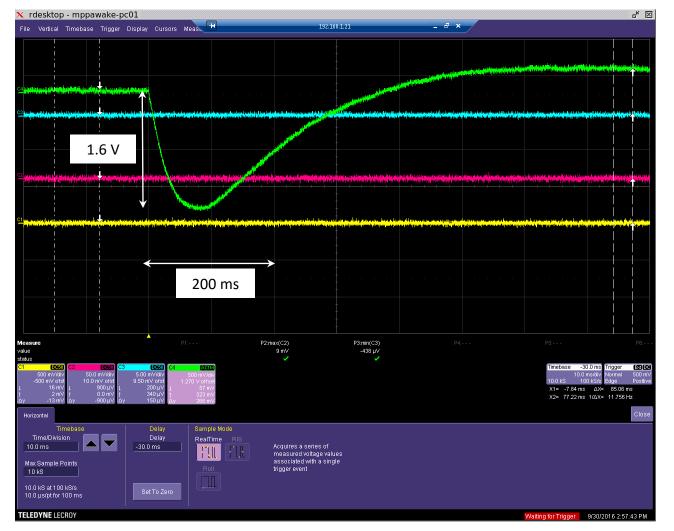
SPS:AWAKE1 (25)	🔍 🔍 SX.OTRCTR01-TS 🛛 ON SPS:AWAKEI (25)	🔍 🔍 SX.OTRCTR01-TS 🚺
	NO CLOCK NO CLOCK	NO CLOCK NO CLOCK
		0 0
WR-03	10ns/div 0s WR-03	10ns/div 0s
	500mV + C	500mV + C
	AWAKEPHDIO_412428-AS	AWAKEPHDIO_412428-AS
	10mV/div -9.211mV	10mV/div -9.211mV
	AWAKEPHDIO_STR_CAM-AS	AWAKEPHDIO_STR_CAM-AS
	10mV/div 10.965mV *	10mV/div 10.965mV
WR-05	Channel 3 WR-05	Channel 3
WIK 05	Sensitivity Offset	Sensitivity Offset
	Channel 4	Channel 4
D D	Sensitivity Offset 😽	D Sensitivity Offset
SPS:AWAKE1 (25)	🔍 🔍 SX.OTRCTR01-TS 🚺 ON SPS:AWAKEI (25)	🛞 🔍 SX.OTRCTR01-TS 🔤 0
	NO CLOCK NO CLOCK	NO CLOCK NO CLOCK
ACST1	0 0 ACST1	0 0
ACSTI	10ns/div 0s ACST1	10ns/div Os
www.wareaunite	2 500mV + C	2 500mV + C
	AWAKELASER_PHDIO-AS	AWAKELASER_PHDIO-AS
	10mV/div -30.263mV 🚏	10mV/div -30.263mV
	AWAKESCHOTTKY_DIO-AS	AWAKESCHOTTKY_DIO-AS
WR-08	10mV/div 20.175mV 👛 WR-08	10mV/div 20.175mV
	Channel 3	Channel 3
	Sensitivity Offset	Sensitivity Offset
	Channel 4	Channel 4
Ď	Sensitivity Offset	D Sensitivity Offset

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Pyro signal, p+ 3e11





on LeCroy 500MHz scope, AC 1 M\Omega termination

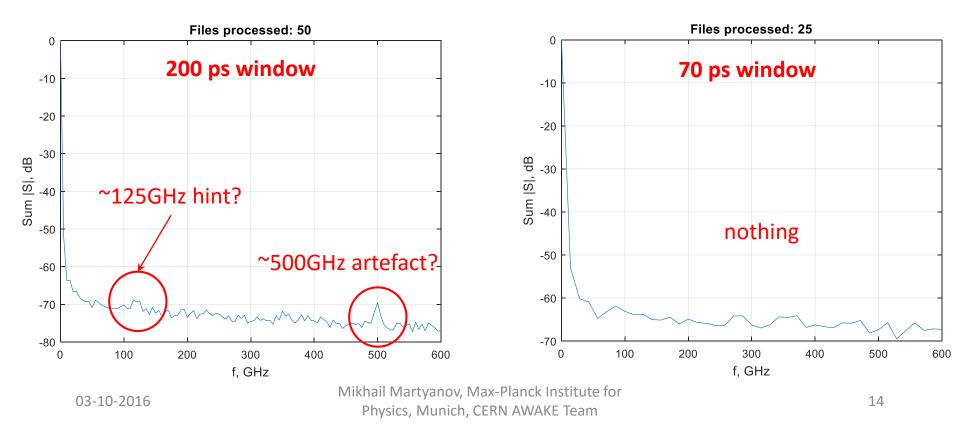
BTV	out
Laser dump LBDP2	out
CTR screen	in
CTR shutter	opened
All WR's	out
ACST1	in 30mm



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





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...