Basic Guide of FireCR SPARK

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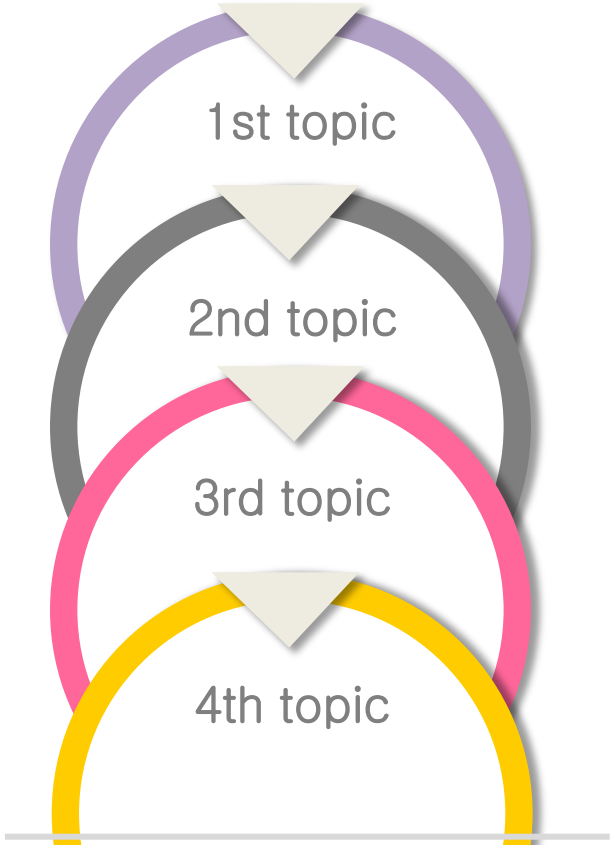
Training Contents



- FireCR Spark Scanner Installation
- Imaging Plate
- How Spark scanner works
- Common Issues.

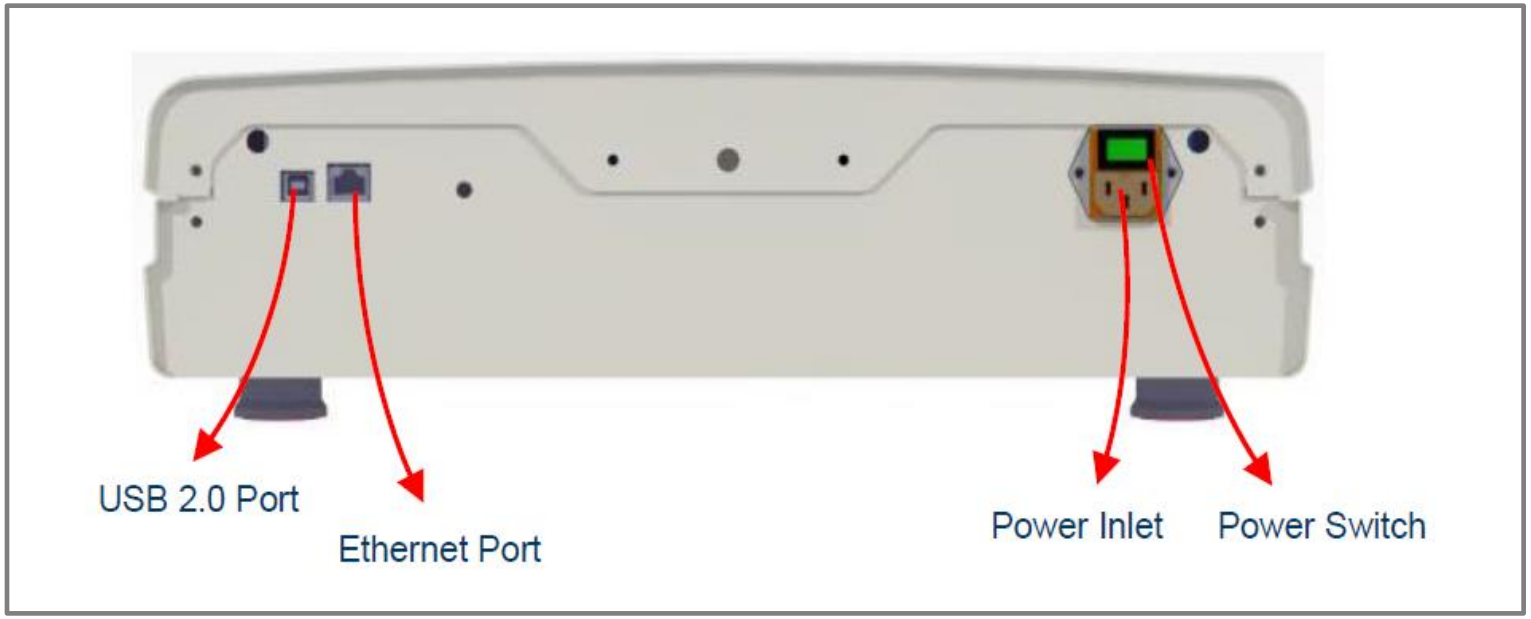
❖SPARK scanner installation

1. Take out a Flash Scanner and accessories in the box.
   - Components

Item	Quantity
FireCR Spark Scanner	1
Power Cord	1
Dust Cover	1
USB 2.0 Interface Cable	1
Cassette 35 x 43 cm	1
Cassette 24 x 30 cm	1
Cassette 18 x 24 cm (Option)	1
Extractor	1
Dongle (Option)	1
Speed Plate (Option)	1

2. Check all components that are in the box.
3. Take out FireCR Spark scanner.
4. The FireCR Spark scanner must be placed on the flat desk with at least 50 cm free space on the front side.
   Free space of 20 cm back side.

4. Connect power cord and USB cable on the back of FireCR Spark scanner.
   - Connection



Note: You must connect USB cable to USB port 2.0 of PC.
3DISC doesn't officially support the USB 3.0.

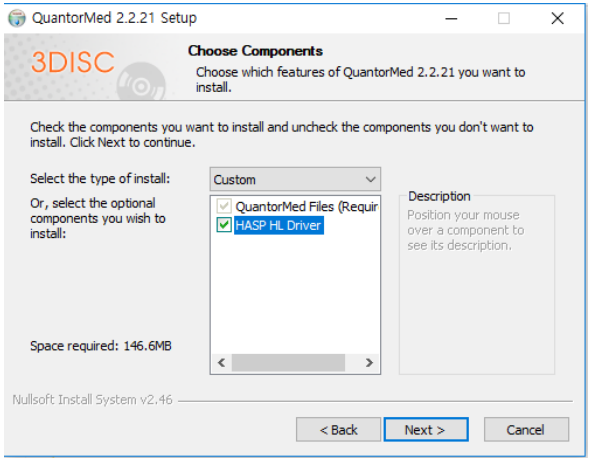
5. Connect a dongle to PC. (Q dongle)
6. Download and install Quantor software. Please refer to the below website

http://www.3discimaging.com/installation-files/

http://www.3disc.com/partner-area/partner-login/?ret=10
(User name: quantor3, PW: quantor3)

7. Quantor software installation
   - Log on a PC with an administrator account.
   - Connect the Q USB dongle to a USB port.
   - Launch software file, “QuantorMed 2.x.x Setup.exe”
   - Click the “Next” button.

   - Choose all components and click the “Next” button.



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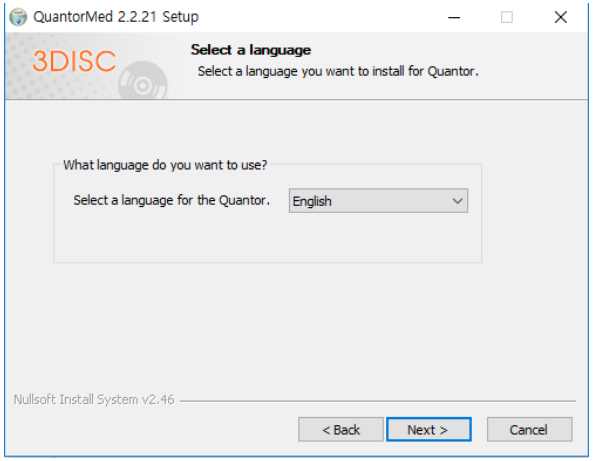
• Choose your language and click “Next” button.



• Choose FireCR model and click the “Next” button.

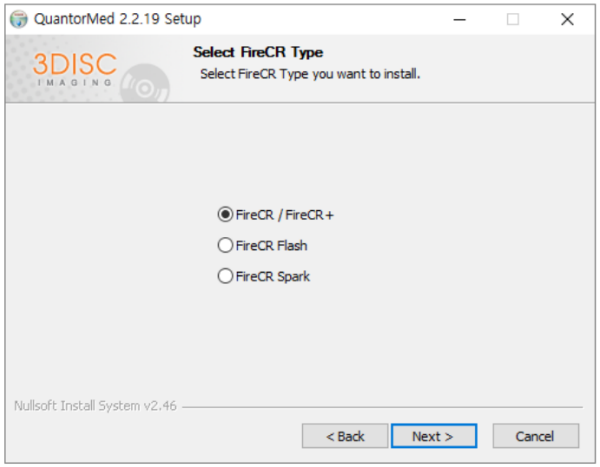
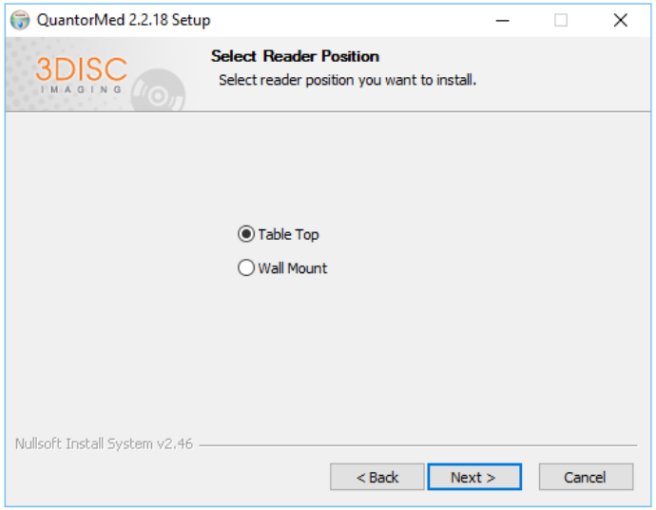
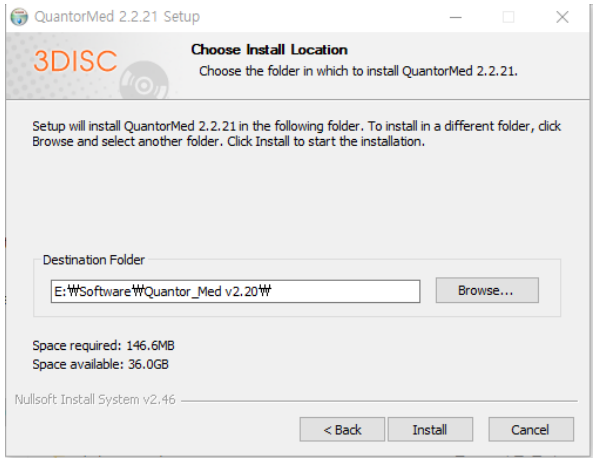


Figure 2-4 FireCR Model Selection Dialog Box

• Choose the reader position and click the “Next” button.



• Choose the destination folder and click the “Install” button.



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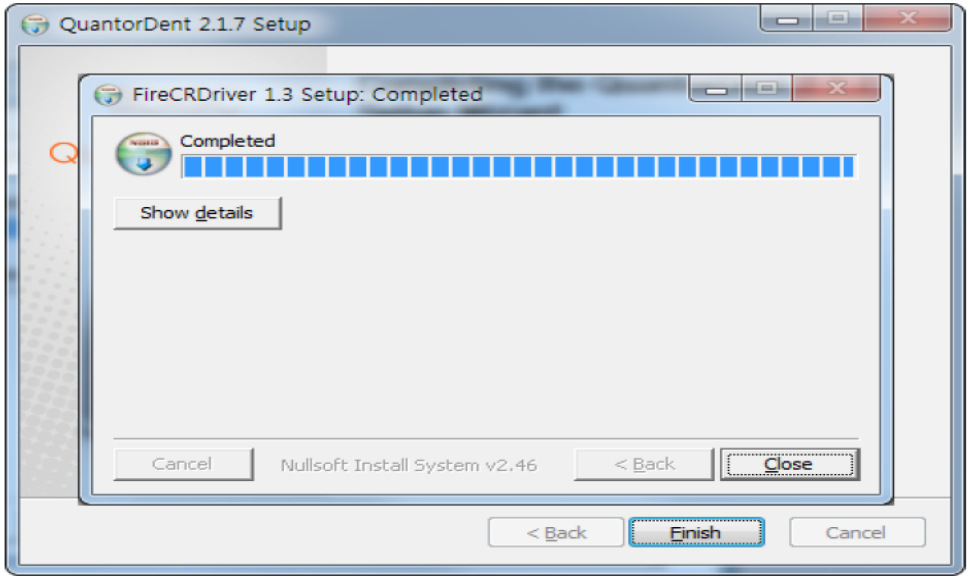
• Installation status of the FireCR USB driver will be displayed.



• Installation is successful..
• Click “Finish to finish the installation.

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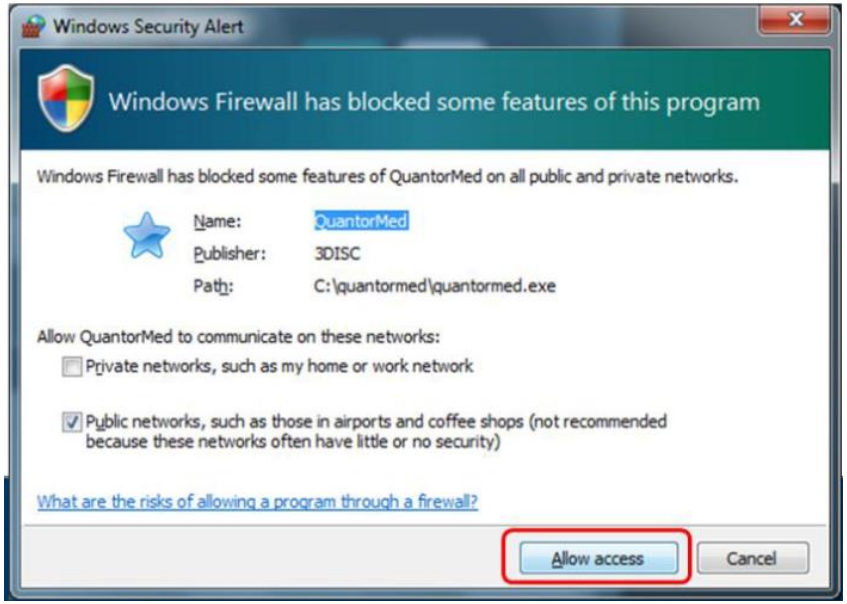
• The Windows Security Dialog Box pops up after installation, click [Allow access].



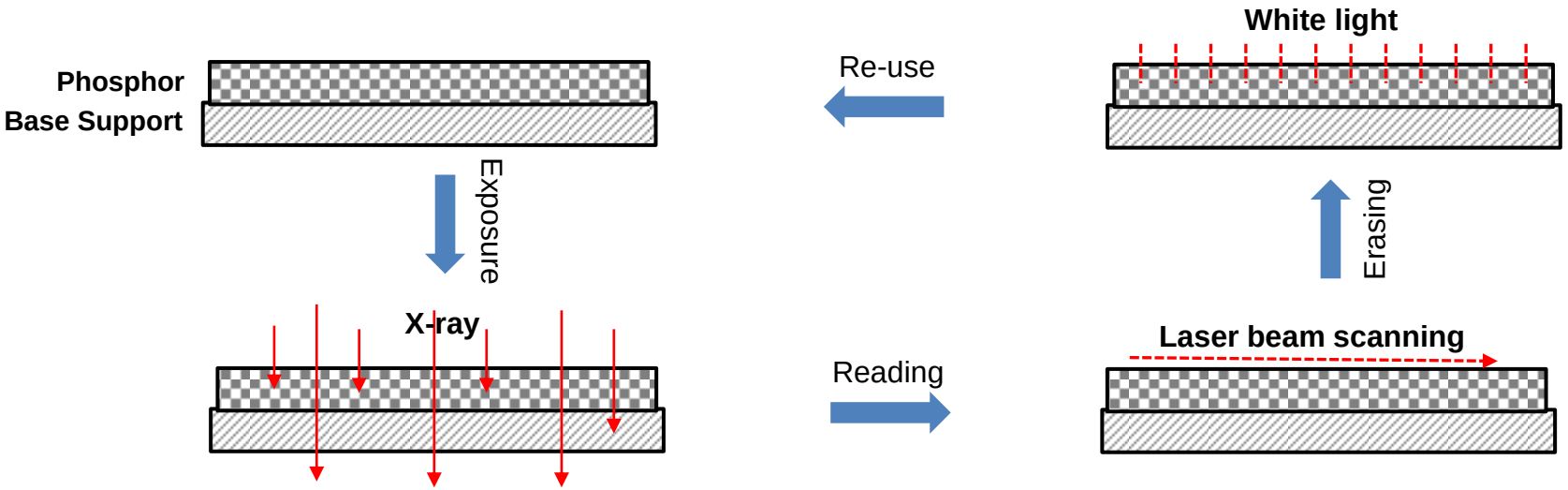
9. Run the Quantor+ as administrator rights.
10. It is automatically downloaded when it starts up

❖ Imaging Plate

- The function of **“Imaging Plate”**

  1) Imaging plate is a flexible plate of 1mm or less thickness coated with fine photostimulable phosphorus crystal.
  2) Temporarily stores the X-ray energy image in portion to the X-ray intensity it receives.
  3) The stored energy is released as visible light when a laser in the CR Reader scans the IP.
     This phenomenon is generally called “photostimulable luminescence” (PSL)
  4) The image on the imaging plate is erased when exposing excessive light.

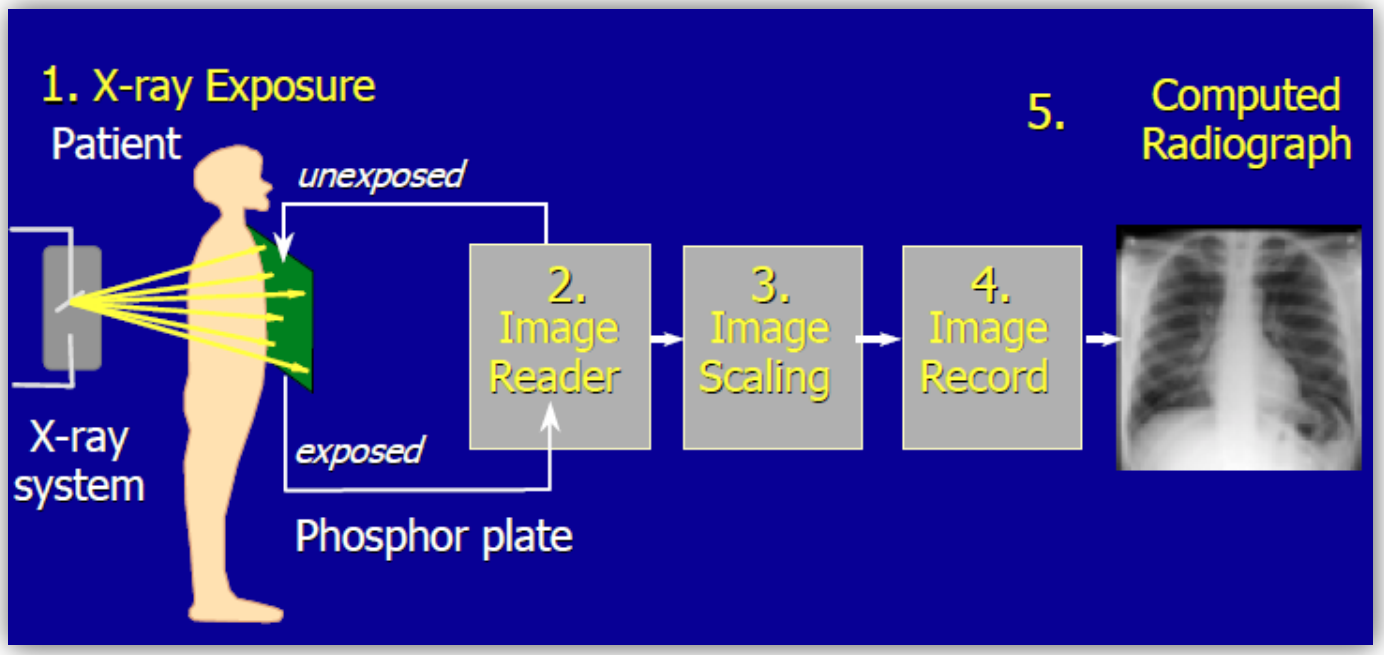
- the phenomenon of fading (loss of the recorded signal) occurs, which is disadvantageous for image acquisition.



[Description of CR system workflow]

❖ Basic configuration of CR (=Computed Radiography) system

1. X-ray image is stored on IP.
2. It is scanned with a 650 nanometer (nm) laser beam to produce PSL radiation corresponding to the absorbed x-ray energy.
3. The luminescence radiation stimulated by laser scanning is collected through a light guide into photomuliplier tube(PMT) which converts it into electric signals.
4. The signal output from the detector is an analog signal and the output from the analog to digital convertor is time-series digital signal that is being processed.
5. The residual image is erased when exposing excessive light.



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❖ Scanner Youtube Vedio

https://www.youtube.com/user/3DISCimaging

❖ 3DISC FireCR Scanner Specification

▪ FireCR Plus Scanner

- High throughput – up to 70 plates per hour.
- Resolution, 100 micron meter [um]
- Ultra light, 30 kg
- Accomodates two standard cassettes sizes, 17 x 14 [Inch], 10 x 12 [Inch]
- Wall mount option for minimum space occupancy.
- One step integrated scanning and erasing

▪ FireCR SPARK Scanner

- High throughput – up to 70 plates per hour.
- Resolution, 100 micron meter [um]
- Ultra light, 19.5 kg
- Accomodates three standard cassette sizes. 35 x 43[cm], 24 x30[cm], 18 x 24[cm]
- Wall mount option for minimum space occupancy.
- One step integrated scanning and erasing.

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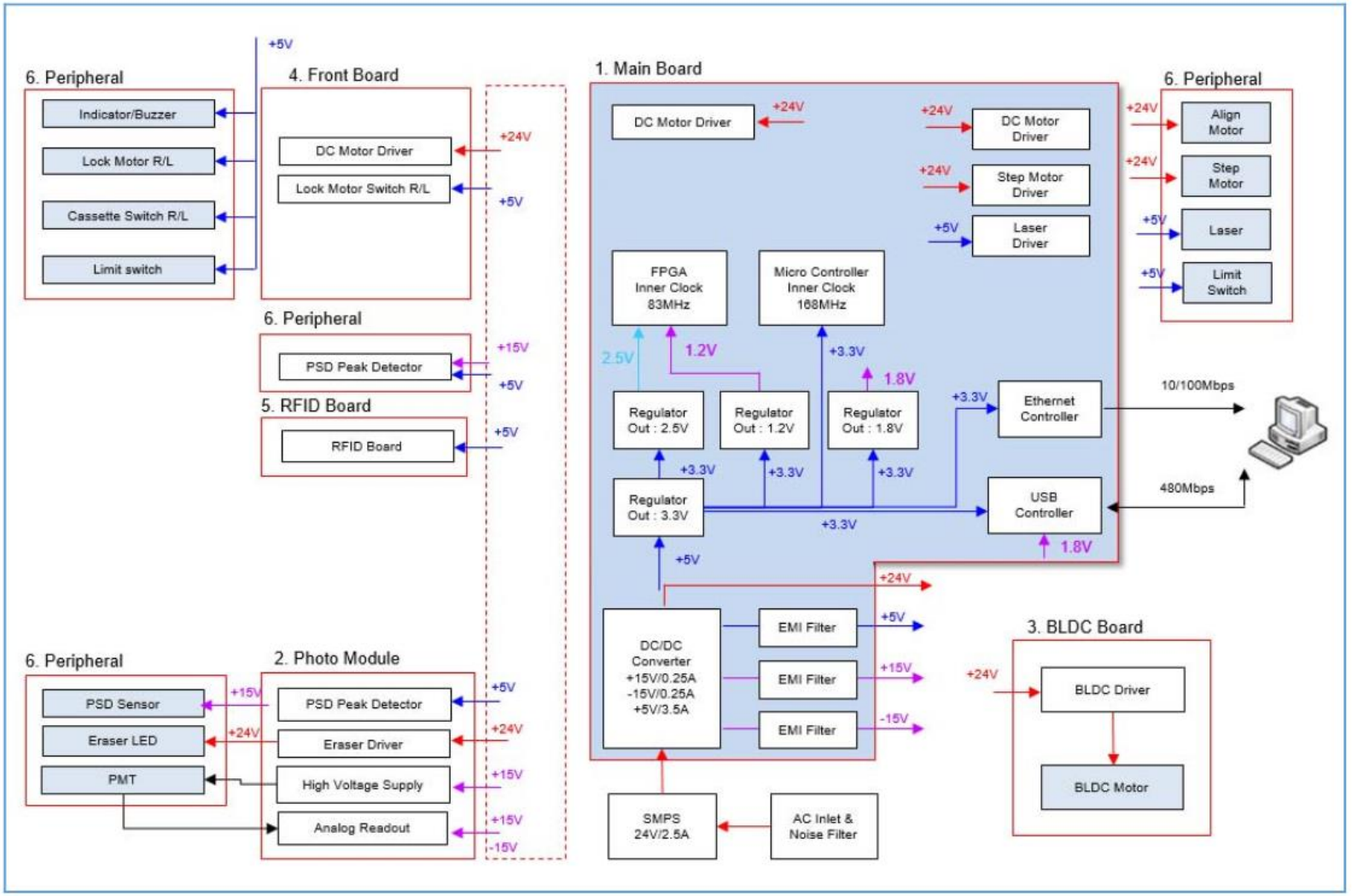
❖ Understanding FireCR; Spark Block Diagram

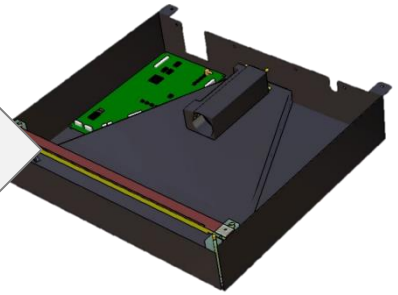


❖ Understanding FireCR Spark;

SPARK scanner largely consists of three assemblies

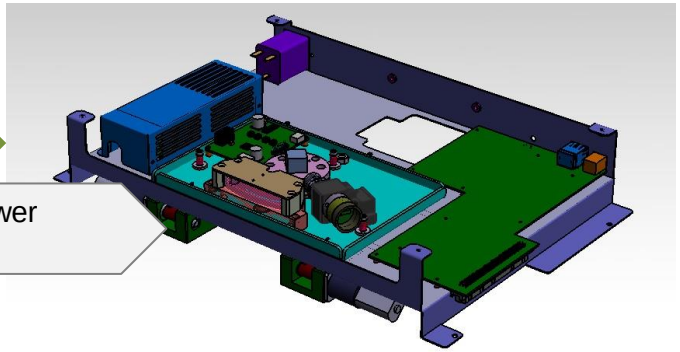
FiberModuleAssembly

It collects the light released from IP, and then light is transformed to analog signal, image processing.



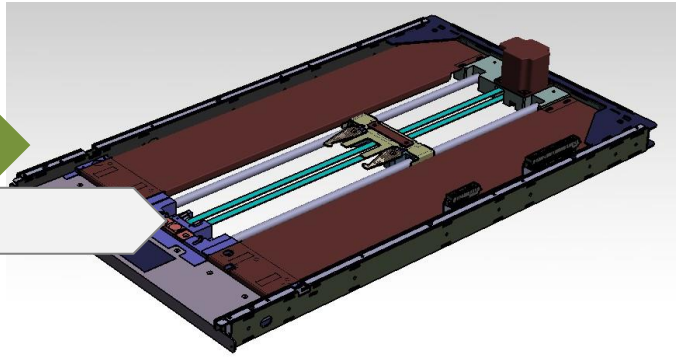
LaserOpticsModuleAssy

It manages laser control and power distribution.



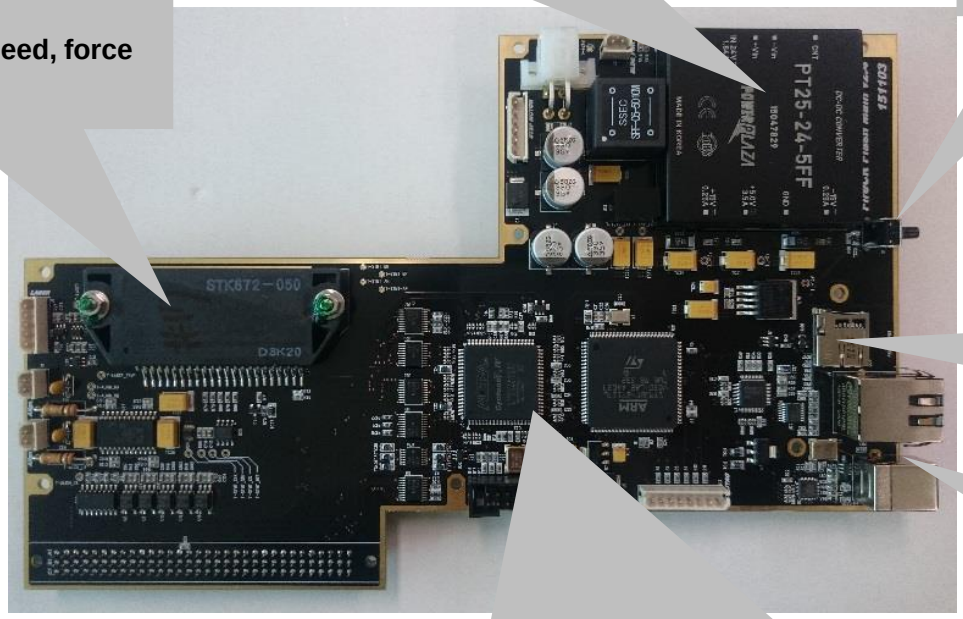
BottomModuleAssembly

It manages moving an IP



❖ Basic Function of Main board (1)

- It control all the peripheral to be allowed to work as predefined process.



- **DC/DC convertor chip**
  - **Distribute different power to several parts.**

- **Reset switch**
  - **Reboot the scanner**

- **Step motor drive chip**
  - **It controls step motor speed, force etc**

Micro SD card has their own unique data, so SD card is not exchangeable each other. Must program it before installing it.

Flash scanner supports both ethernet connection an USB connection.

- **MCU & FPGA**
  - **The brain that controls the Hardware.**
  - **It is a semiconductor chip to control the function that can be allowed to acquire the images.**
  - **System parameters, Firmware info etc are loaded to MCU when booted up**

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❖ Basic Function of Main board (2)

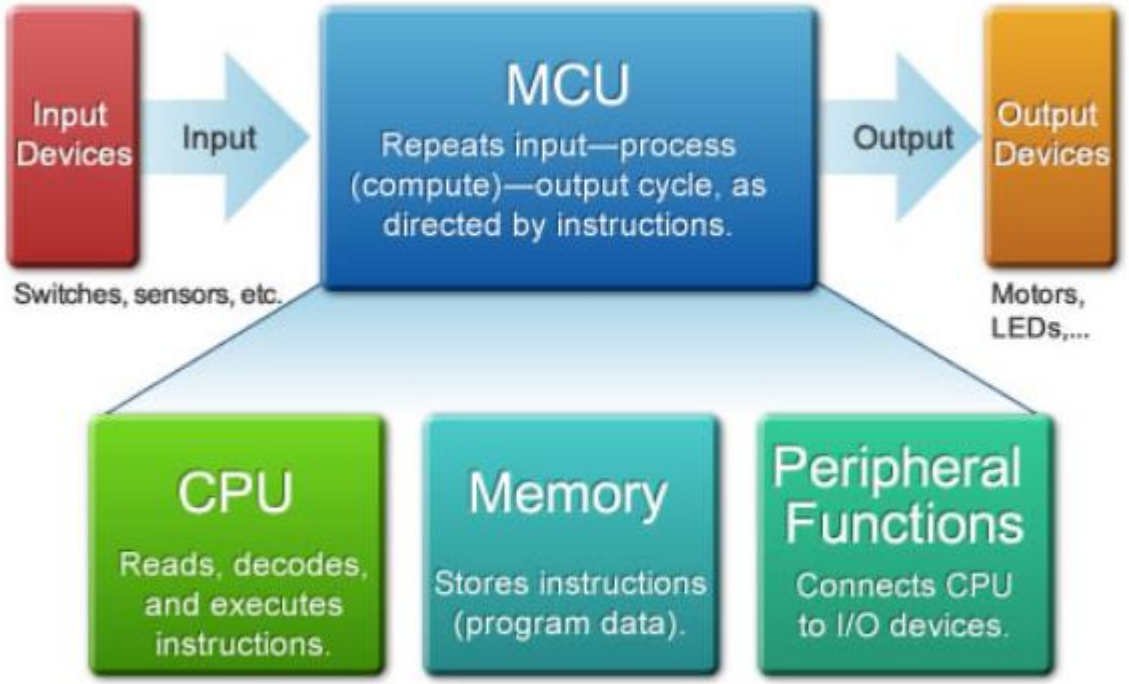

Figure 1: MCU Structure

❖ Common Issue with Main Board (1)

Losing USB connection or stopped reading the image data during midscan.

1) Lack of power from USB port on PC. Adding a powered USB hub can solve this issue.

The latest main board applied circuit medication to prevent USB connection issue from shortage of power from PC USB port.

2) Damaged USB chipset on the main board. Main board need to be replaced.

Booting issue

1) Square mirror is spinning, front led is off, and red laser is off while booted up. Firmware, Sysinfo data are not loaded to MCU while booted up.

2) Poor micro SD card connection can cause booting issue. In this case, reconnecting a micro SD card can solve this issue. If it does not help, it means that bootloader file is corrupt in the MCU chip, so it can not download data from micro SD card.

3) Either main board replacement or installing data to MCU using ST-link can solve the issue.

One horizontal line in the middle of image

1) Most cases of one horizontal line is caused by broken tag. Bad writing speed on micro SD card and main board have been an issue with broken tag.

2) Tag is information per each data. Each line has tag. Tag contains information triggered by PSD such as scanning start, scanning end, RPM or the number of line etc.

3) Tag information is found in raw image only acquired by SDKContainer.

❖ Main board Revision History

Main board version	Released date	Improvement	Compatibility
V2.3A		Initial board	
V2.4	2015.Nov.18	Add USB protection circuit to prevent “Losing USB connection.”	
V2.4A	2015.Dec.14	Add a pull up register. 3.3V and ground are short-circuited when micro SD card is removed.	
V2.4B	2016.Mar.2	VBUS register change 10kΩ → 1kΩ to prevent “Stop in the middle of scan.”	
V2.5	2016.Mar.3	TVS diode change 5V→3.3V to prevent “Losing USB connection.	
V2.6	2016.Apr.19	1) Add single buffer to make continuous 5V at VBUS. 2) Improve noise immunity of reset switch.	

❖ Basic Function of BLDC Board

- It maintains the square mirror rotate at same speed.
- Predefined RPM 1800 is controlled by dip switch.

- **Dip switch**

- Dip switch is switch to get BLDC motor rotate at defined speed.
- It must set “0101”.

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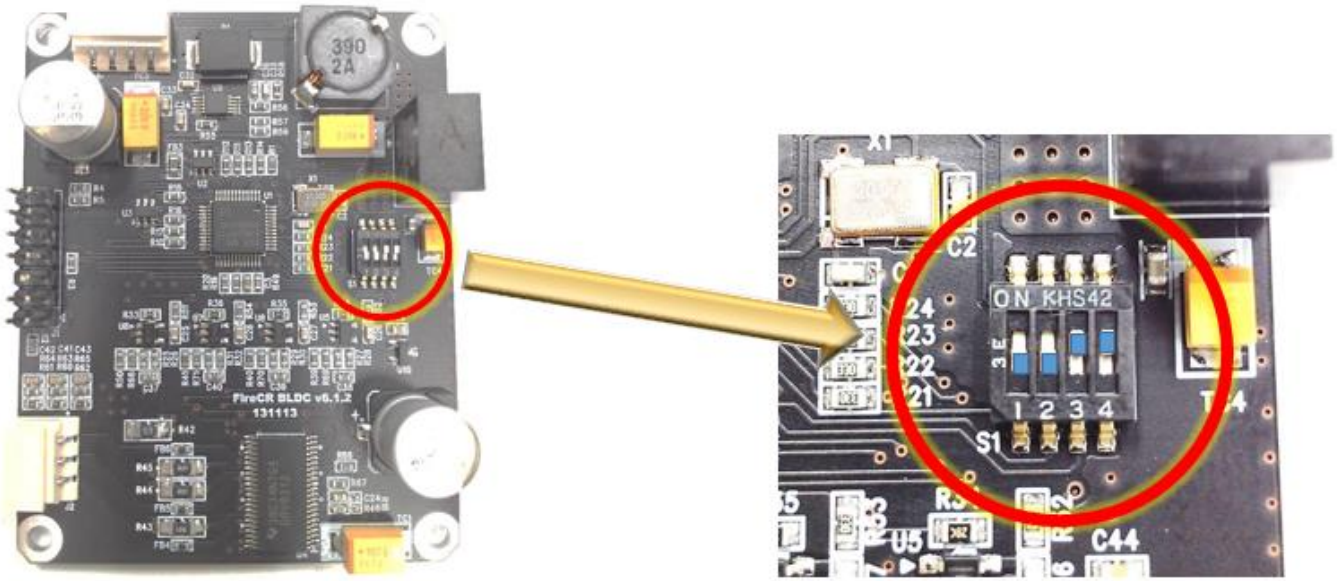


현재 상태 = 0011

				SW1	SW2	SW3	SW4
				ON/OFF	Project		Motor Type
ON	FireCR+	old motor		0	0	0	0
		new motor		0	0	0	1
	Dental						
		new motor		0	0	1	1
	Flash						
		new motor		0	1	0	1

스위치 1 번은 차후에 변경 예정입니다.

옵틱스 모듈 번호 OYYMMVV-XXXXX 에서 VV(=Version)가 '07' 이상인 모듈은 신형모터 적용 되었음

❖ Common Issue with BLDC Board

Unstable RPM

1) Unstable RPM can cause bad image quality.
2) Either bad BLDC motor or bad BLDC board cause unstable RPM.

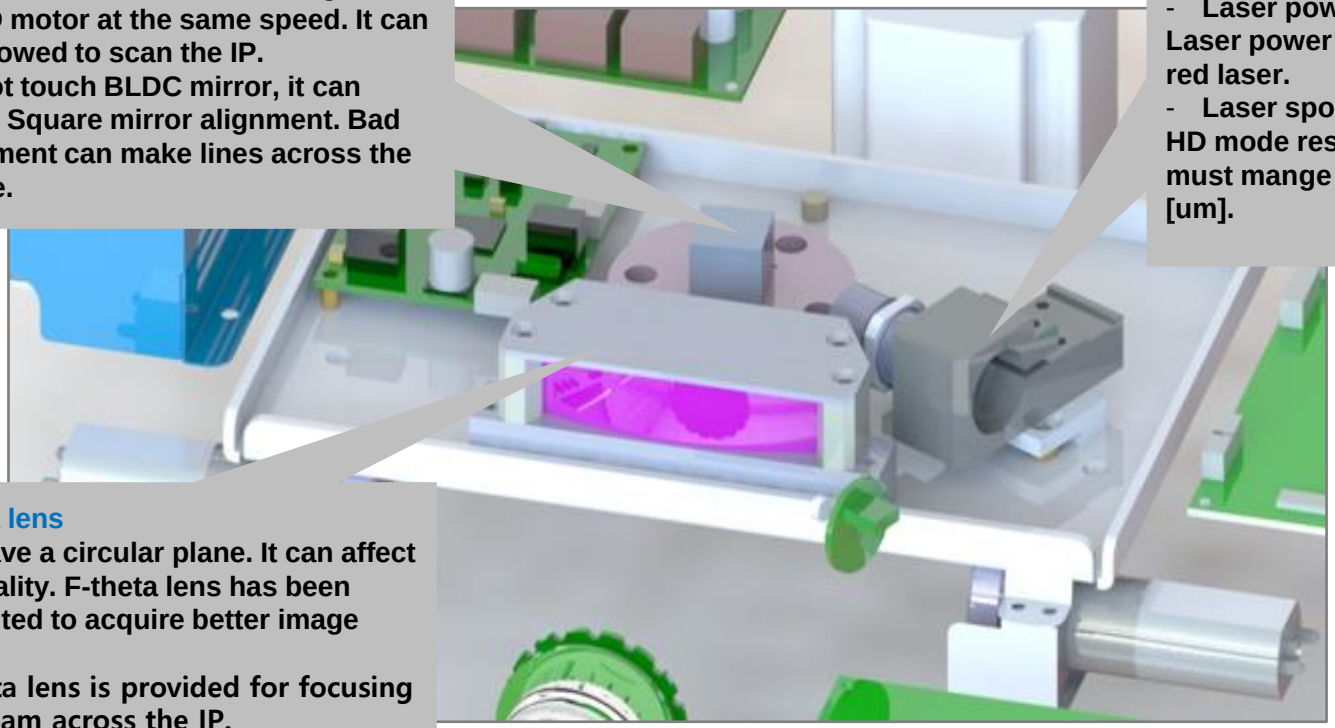
If you can hear noisy operation sound from BLDC motor, we need to replace a laser steering assembly. If not, a BLDC board need to be replaced.

❖ Basic Function of Laser Steering Assembly (1)

• The purpose of laser steering assembly is to stimulate the image plate, and then release the blue light.

• Laser steering assembly consists of three parts. Laser module, Square mirror and F-theta lens.

- **Square mirror**
- **It rotates at 1800 [RPM]**
- **BLDC board maintains rotating a BLCD motor at the same speed. It can be allowed to scan the IP.**
- **Do not touch BLDC mirror, it can affect Square mirror alignment. Bad alignment can make lines across the image.**



- **Laser module**
- **It is a source of red laser.**
- **Transmit 650 [nm] ± ∂ wavelength Red light**
- **Laser power is within 50 ± 2mW. Laser power is weak, PSD can not read red laser.**
- **Laser spot size is less than 70um HD mode resolution is 100[um], so we must mange beam size less than 100 [um].**

- **F-theta lens**

- It can have a circular plane. It can affect image quality. F-theta lens has been implemented to acquire better image quality.
- A F-theta lens is provided for focusing a laser beam across the IP.

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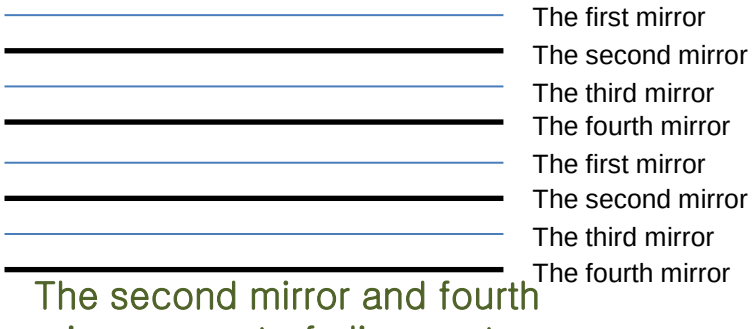
❖ Basic function of Laser Steering Assembly (2)

Square mirror

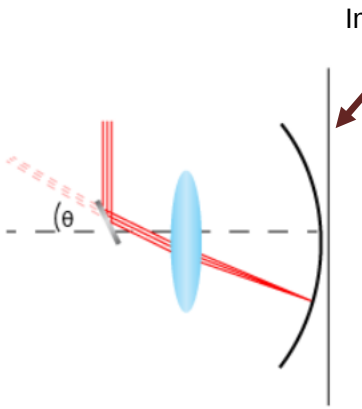
Square mirror has four mirrors. Each mirror create each line.

Well aligned mirrors

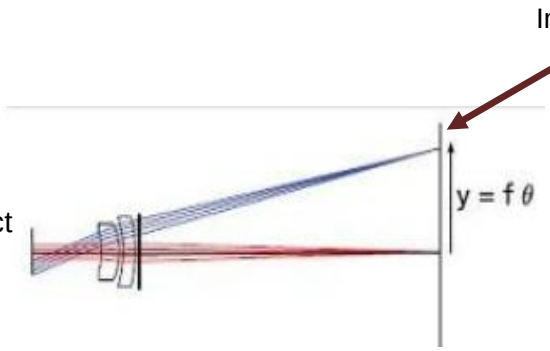


The second mirror and fourth mirror are out of alignment.

F-theta Lens



It has an circular focus plane Without F-theta lens. I can affect the image quality



F-theta has an flat focus plane. It is designed with a barrel distortion to provide a flat focus plane.

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❖ Common Issue with Laser Steering Assembly

Auto align issue because of either dim laser or no laser

1) Degraded diode can cause RPM issue. PSD can not read dim laser.
2) Suspect that overcurrent can cause damaging a diode or main board does not supply enough power to a diode. Before replacing laser steering assembly, we'd better measure power on the main board.
3) Depending on test result, a laser steering assembly or a main board need to be replaced.

Horizontal lines across the image

1) Regular horizontal lines have appeared across the image.
2) Bad alignment on the square mirror can cause regular line across the image.
3) We need to check the image with horizontal lines in the factory software named SDKContainer because line removal function has been applied to the image acquired in the Quantor+.

Bad RPM

1) RPM value is out of tolerance. Most bad RPM value is caused by BLDC board, but if you hear noisy sound from BLDC motor, we need to replace a laser steering assembly

Blurry image

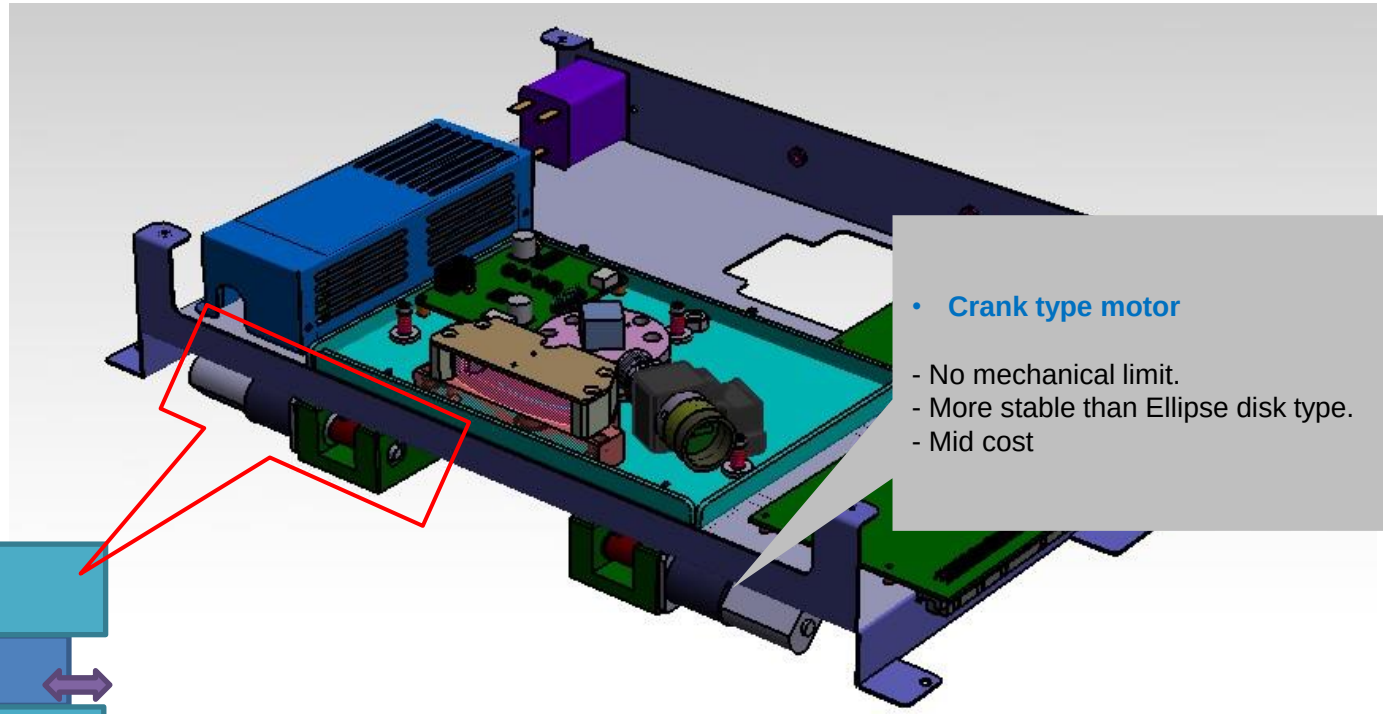
1) If the image acquired still become blurry even though best beam find and recalibration have been done properly, there is possibility to be caused by red laser being out of focus or red laser being dim.

❖ Laser Steering Assembly Revision History

Laser Steering Assembly version	Released date	Improvement	Compatibility
	2015.Oct.20	1) Degraded laser diode caused by overcurrent 2) 2 Channel → 1 channel	

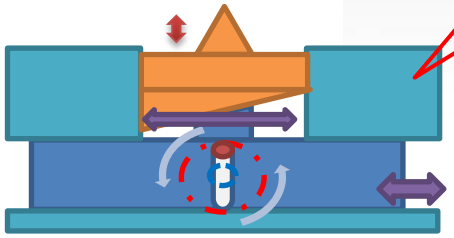
❖ The Basic Function of Aligner Motor

- The purpose of aligner motor is to move up and down the laser steering assembly during auto align process.
- There are two aligner motor to put laser steering assembly being tilted, up and down.



- **Crank type motor**

- No mechanical limit.
- More stable than Ellipse disk type.
- Mid cost



No Mechanical limits
(removed gear damage)

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❖ Common Issue with Aligner Motor

Auto align failure

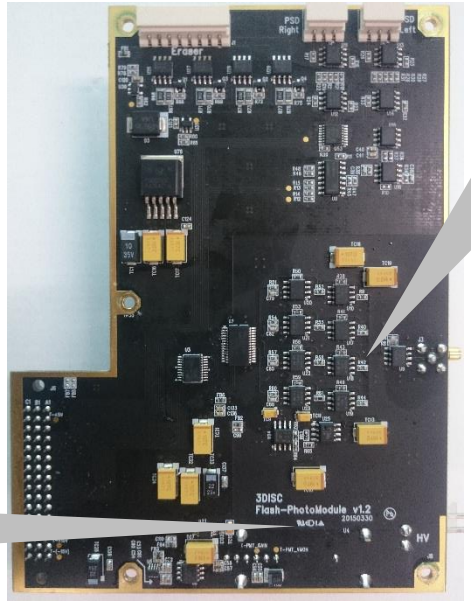
1) Auto align fails because aligner motor does not work. In this case the faulty aligner motor need to be replaced.

❖ Basic Function of Photo Module Board

- Amplify PSD signal, and then convert analog signal into position data.
- Drive Eraser unit.
- Provide high voltage to PMT during scan only
- Analog to Digital conversion

- **ADC**

- **Convert Analog signal to Digital..**



- **High voltage generator**

- Provide power to PMT during scan only.

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❖ Basic Function of Photo module board (2)

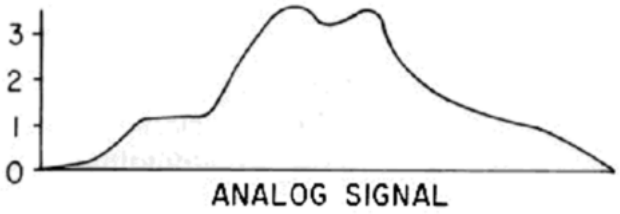
ADC Analog to Digital Conversion

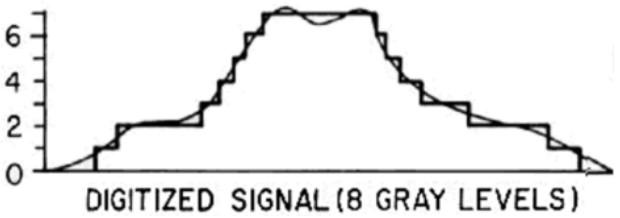
The role of the Analog-To-Digital Conversion (A/D) is to convert analog voltage values to digital values.
Digital values mean Binary number of 16 bits. The more bits the binary number has, the higher the resolution, the better the accuracy.

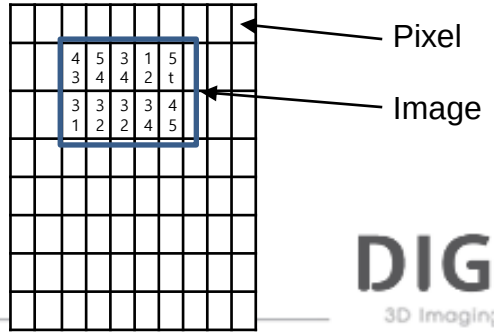
			.....	
0000000000000000	0000000000000001	0000000000000010		1111111111111111

65536 levels

It displays the image more precisely with 65536 levels







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❖ Common Issue with Photo Module Board

White image

1) The image acquired become white.
2) Damaged HVPS does not provide power to PMT, and then it gets the PMT not turned on during scanning.

Auto align failure because of no PSD values

1) Red laser is bright enough, also hitting PSD, but if PSD values are abnormal, it means that PSD data is not processed in the driver board.

The image with horizontal band

1) If it has an issue with the image with horizontal bands, either an ADC board or a PMT can cause this issue.
2) The purpose of Photo module board is to convert an analog signal into digital signal. Wrong ADC can cause horizontal band across the image.
3) There are two types of PMT. One with Mu metal. The other without Mu Metal. The purpose of Mu metal minimizes bad effect on magnetic field.

❖ Photo Moduel Board Revision History

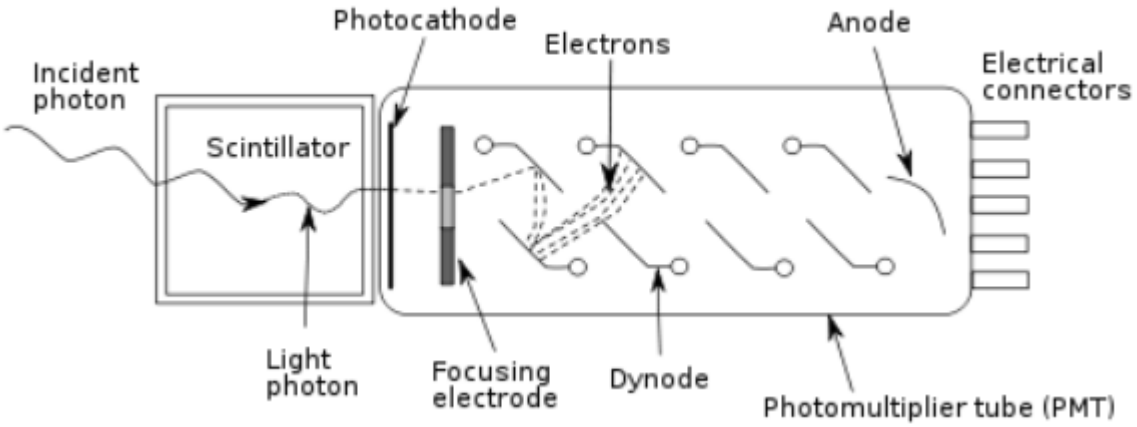
Photo Module board version	Released date	Improvement	Compatibility
V1.2A	2015.Oct.6	Silk position and size change	
V1.2B	2016.Mar.3	Prevent premature PSD saturation.	
V1.3	2016.Apr.11	Prevent white image	

❖ Basic Function of PMT (Photo Multiplier Tube)

• PMT is a sensor to detect the amount of light.
• High light sensitivity – It can detect the signal even though using less light.

• Path
: Image plate → Light → Fiber Bundle → Photocathode → Electron multiplier→ Anode

1) Photocathode: Emit photoelectron by photoelectric effect when receiving above specific frequency.
2) Electron multiplier (Dynode) : Amplify electrons by the process of secondary emission.
This amplifies signal.
3) Anode: It converts light into the electric signal.



❖ Common Issue with PMT

White image

1) PMT is a sensor to read the light.
2) If The image become white even though HVPS provides power to PMT, PMT should be defective.

Vertical band or horizontal band

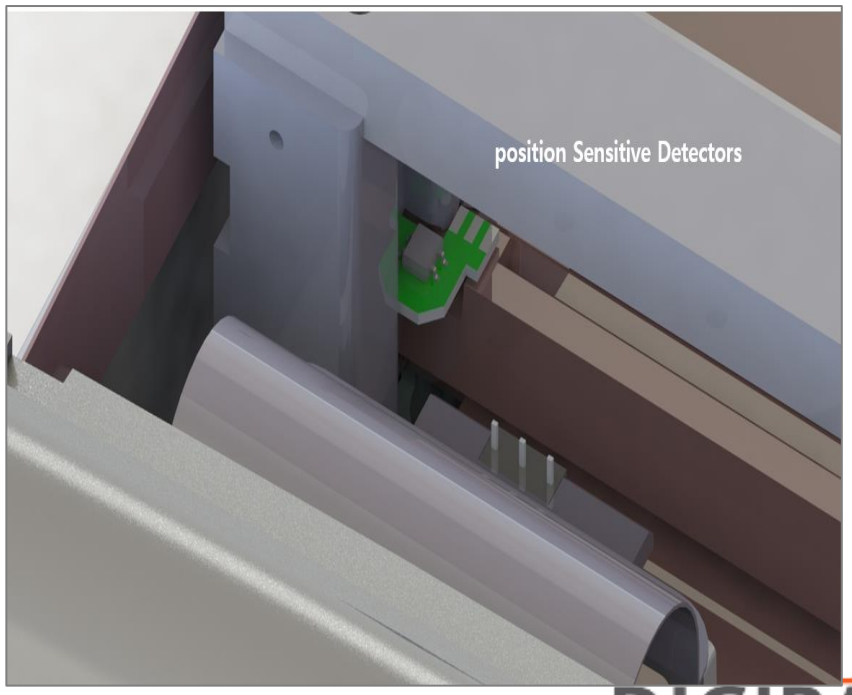
1) Vertical bands have appeared when they installed a brand new scanner at clinic or move the scanner from one place to another.
2) According to RnD's research, Electromagnetic field change according to scanner location change causes the mismatch between calibration file and current fiber bundle profile image, and then it leads to the image with vertical band. Mu Metal minimizes electromagnetic field affected to the image quality.

❖ PMT Revision History

PMT version	Released date	Improvement	Compatibility
	2015.Nov.18	Add Mu metal to minimize magnetic field effect.	

❖ Basic Function of PSD (Position Sensitive Detector) (1)

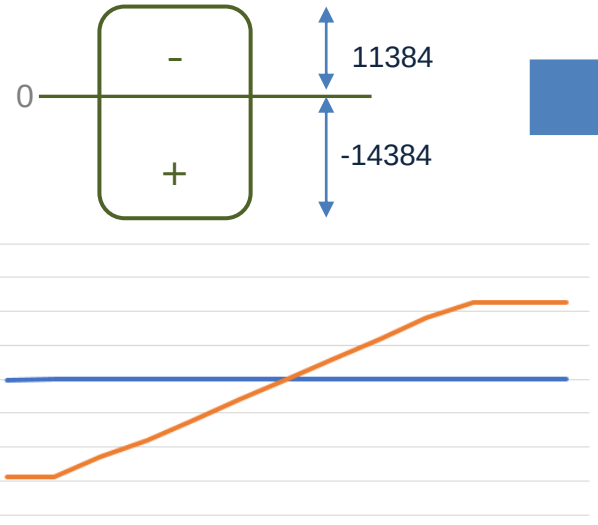
- PSD means Position Sensitive Detector.
- It measures a position of a light spot on a sensor surface.
- It converts an light spot into continuous position data.
- It can determine scan start position and scan end position



❖ Basic Function of PSD (Position Sensitive Detector) (2)

Actual PSD

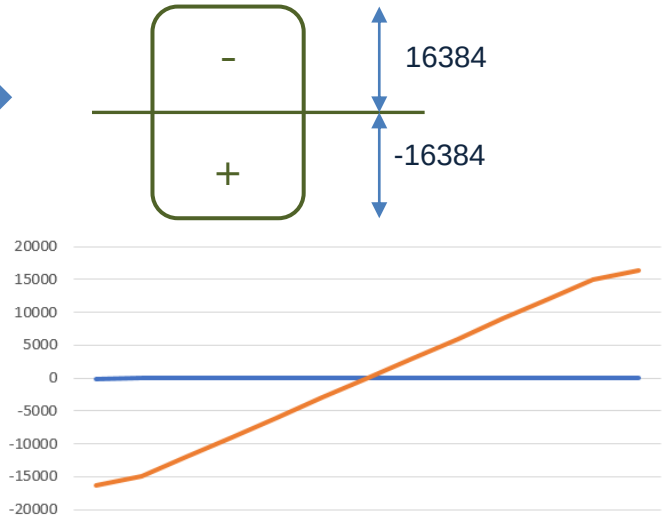
PSD reading range: -14384 ~ 11384



PSD Calibrator

Ideal PSD

PSD reading range: -16384 ~ 16384



- The purpose of PSD calibrator is to optimize the scale of PSD reading range to prevent premature PSD saturation.
- Higher negative PSD value, the closer fiber bundle, the better image quality

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❖ Common Issue with PSD

Auto align failure

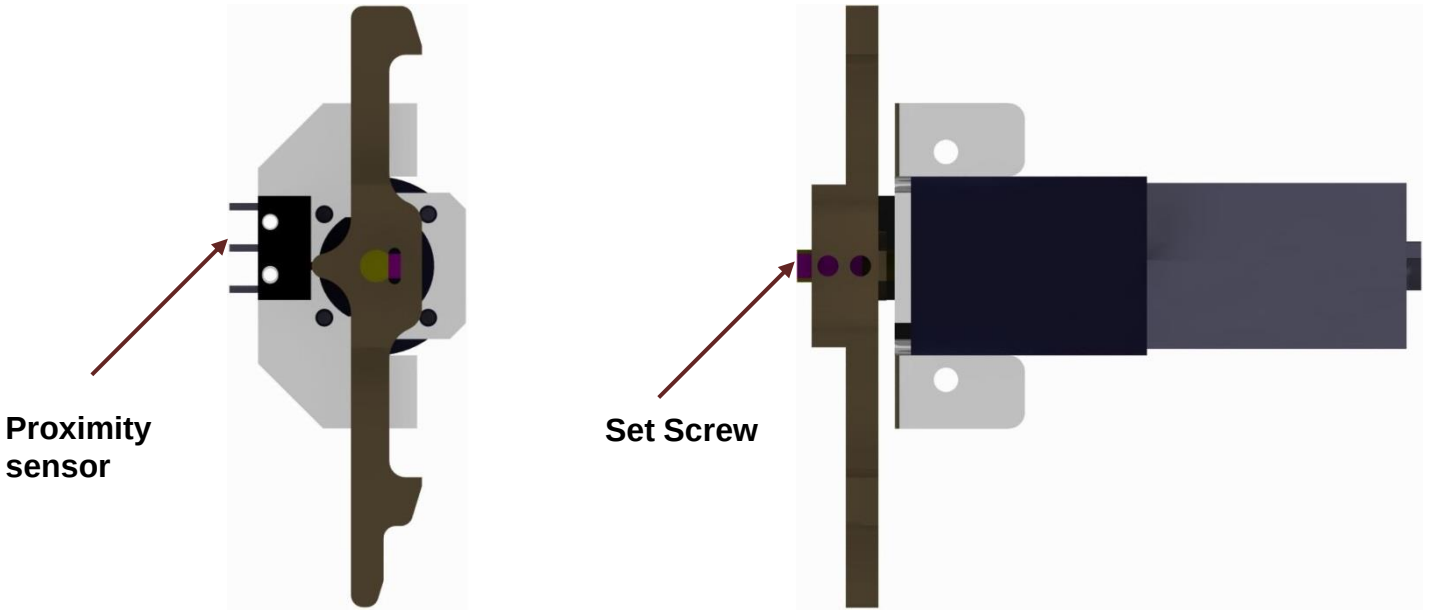
1) If either PSD can not read the red laser, there is a possibility to be caused by damaged PSD.
2) It rarely happens.

Jagged image

1) Both PSDs determine scanning starting position and scanning ending position.
2) Scanning starting position and scanning ending position per each line can be varied by damaged PSD. It can cause jagged image.
3) It rarely happens.

❖ Basic Function of Cassette Lock Motor

- The purpose of cassette lock motor is to firmly hold the cassette not to move during scanning.
- Bi directional of C-lock lever depending on the cassette size
- It can recognize which direction a C-lock lever moves through a proximity sensor.



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❖ Common Issue with Cassette Lock Motor

Knocking noise in the end of erasing process

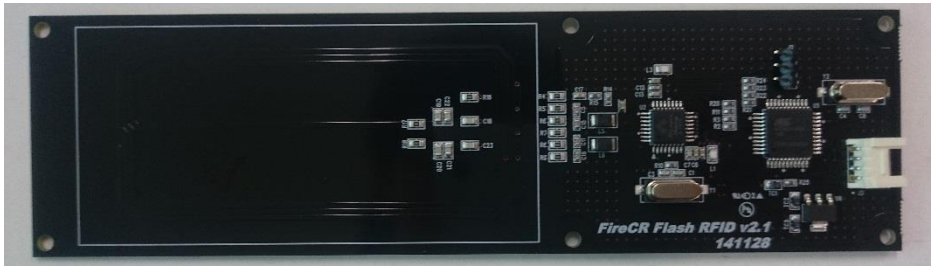
1) Cassette lock motor is not released because set screw is a little bit loosen.
2) New cassette lock motor that improves the way of C-lock lever assembly has been released.
3) If old version of cassette lock motor is installed, recommend replacing new version of cassette lock motor.

Cassette lock motor working is not stopped

1) You can hear non-stopped cassette lock motor working noise when either the cassette is inserted or scanning is in the end of process.
2) In this case, proximity sensor is damaged, so that scanner does not detect the position of C-lock lever.
3) Need to replace either faulty cassette lock motor.

❖ Basic Function of RFID Board (1)

• The main purpose of RFID board is to recognize Cassette info and Speed plate info through RFID communication.



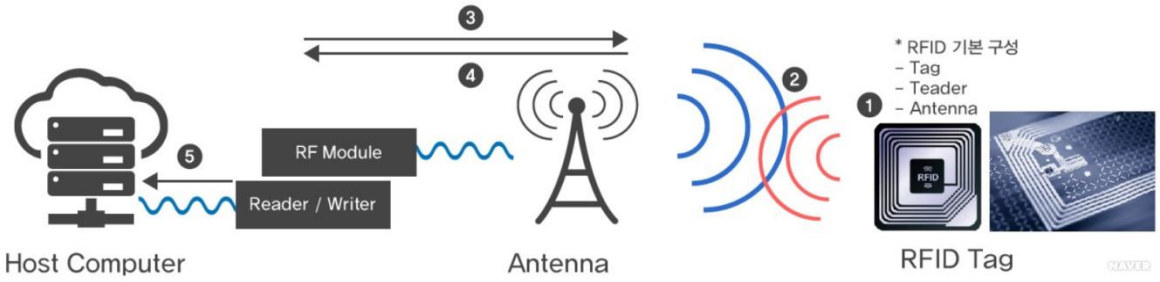
❖ Basic Function of RFID Board (2)

• RFID (Radio-Frequency Identification) is the technology to identify product through radio frequency.

• RFID system consists of RFID chip and RFID reader. RFID chip (Antenna and Tag) is attached on Cassette housing and Speed plate. RFID board (RFID reader) can identify information that saved in the RFID tag.

• Advantage of RFID Communication

1) Contactless method (they need to be close.)
2) RFID communication is reliable and fast
3) RFID has a permanent long life span if there is no physical damage.



❖ Common Issue with RFID Board

Scanner can not read the IP

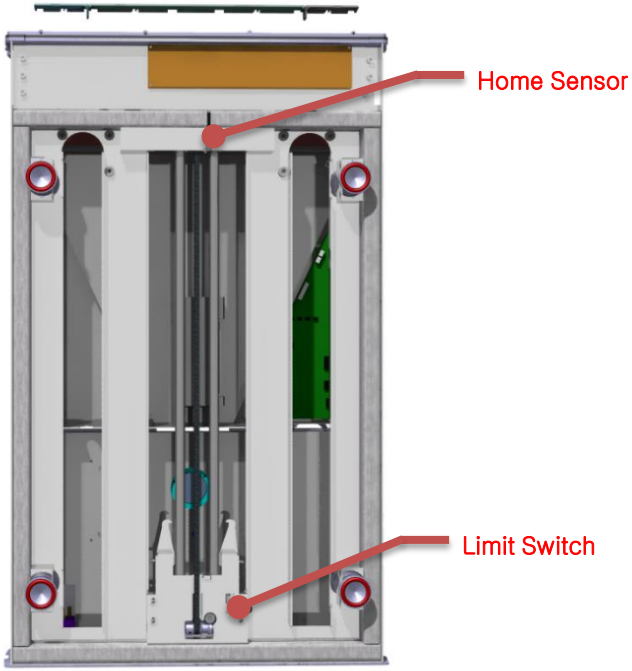
1) Either RFID chip broken or RFID board malfunctioning can cause IP recognition issue.
2) If it has an issue with multi cassettes, there is more possibility to be caused by a RFID board.
If it has an issue with specific cassette, there is more possibility be caused by a cassette housing.

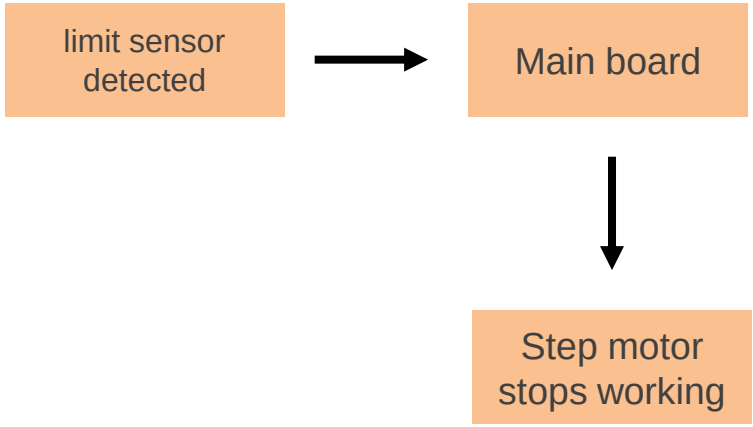
❖ RFID Board Revision History

RFID board version	Released date	Improvement	Compatibility
V2.1A	2015.Jul.17	Antenna matching for reliable RFID recognition	
V2.2	2016.Apr.11	Circuit change to minimize electrostatic effect	

❖ Basic Function of Home Sensor and Limit Sensor

- The purpose of home sensor and limit sensor are to stop a stage at home position and limit position.
- Home sensor and Limit sensor are all micro switches.
- Home position and Ready to Scan position are different





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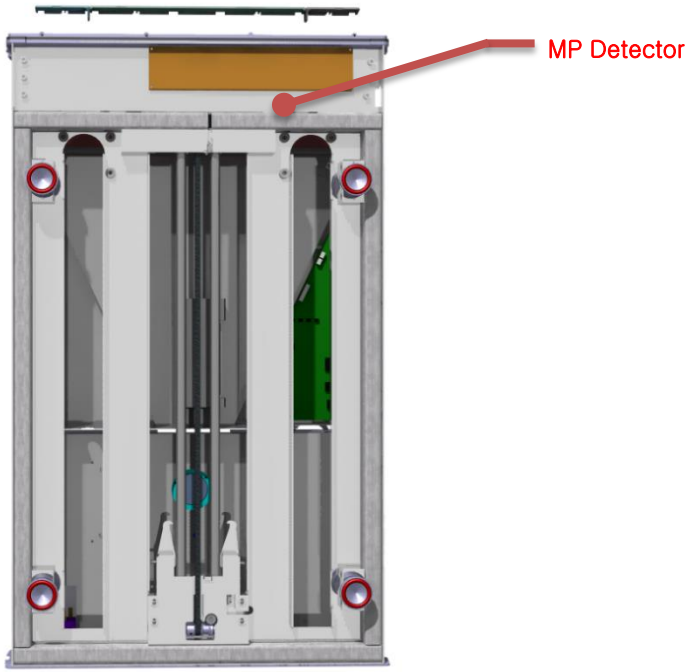
❖ The Common Issue with Home Sensor

Knocking noise when turning on the scanner power.
1) Stage moves to home position when turning on the power.
2) If home sensor is broken, step motor keeps working in order for stage to move backward to reach home position, so it leads to knocking noise. In this case, a home sensor needs to be replaced.

❖ Basic Function of MP Detector

- The purpose of MP detector is to detect the IP inside the scanner.
- MP detector is photo type sensor.
- The function of MP detector can turn on or off in the FireCRF.ini.



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❖ The Common Issue with MP Detector Sensor

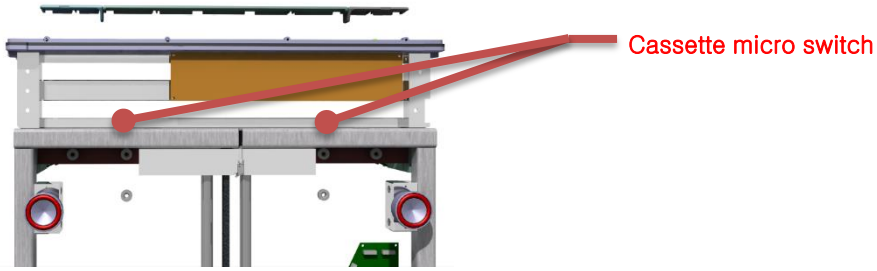
Moving plate time out error

1) If MP detect is not on predefined time from scanning start, Moving plate time out error happens.
2) There are several reason that can delay scanning.

- Step motor shaft and ShaftBackHolder brass gear are worn off, and then it can cause delaying scanning.
- Tiny contact between CassetteTopPlate and IP can cause this issue.
- Step motor drive belt is worn out.
- As temporary workaround, MP can be disabled in the FireCRF.ini file.

❖ Basic Function of Cassette Micro Switch

- The purpose of both cassette micro switches is to detect cassette when it is inserted in the scanner.
- When it is detected, the cassette lock motor is engaging.



Micro switches detected → Main board

↓

Cassette lock motor engaging

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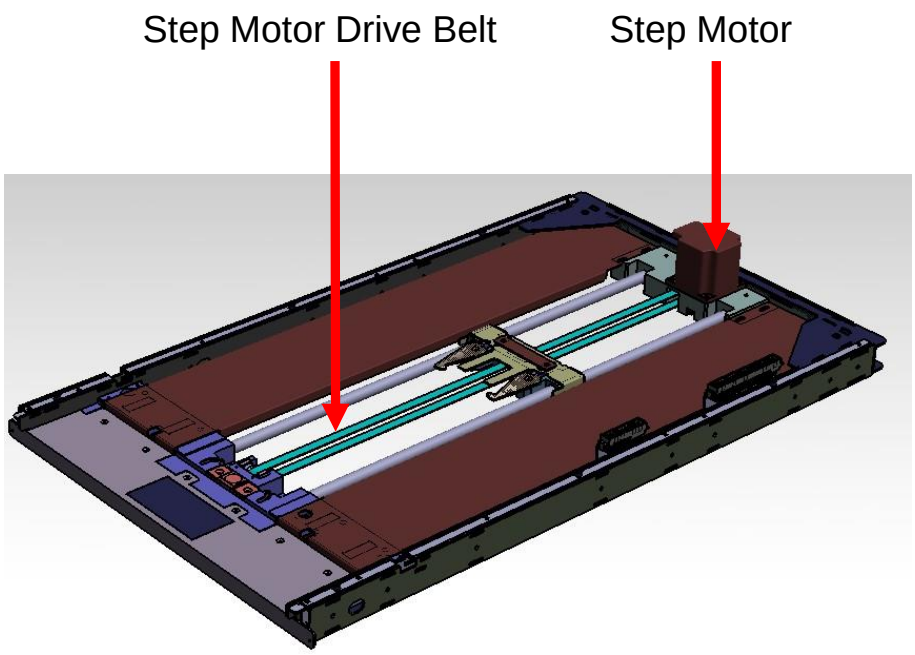
❖ The Common Issue with Cassette Micro Switch

Cassette lock motors are not engaging from time to time

1) Both cassette lock motors are not engaging even though cassette is inserted. Put up or move right or left the cassette, and they suddenly work because Micro switches are insensitive.

❖ Basic Function of ShaftHolderBack and Step Motor

• A step motor and a ShaftHolderBack work with a step motor drive belt to be allowed for stage to move back an forth.



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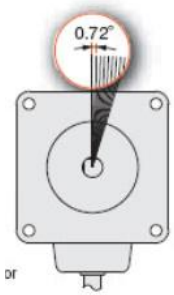
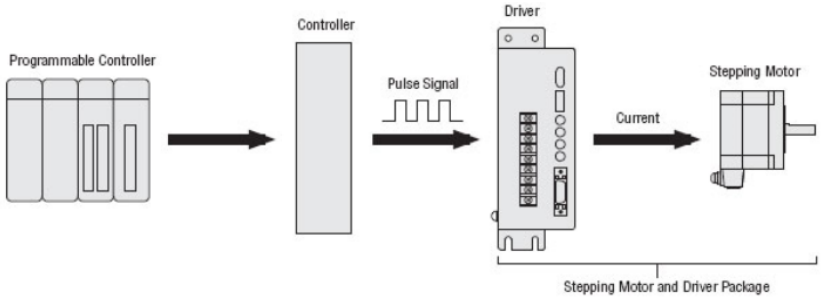
❖ Basic Function of ShaftHolderBack and Step Motor (2)

• A stepper motor is used to achieve precise positioning via digital control.



A stepper motor rotates with a fixed step angle, just like the second hand of a clock. This angle is called "basic step angle".



The amount the stepper motor rotates is proportional to the number of pulse signals (pulse number) given to the driver. The relationship of the stepper motor's rotation (rotation angle of the motor output shaft) and pulse number is expressed as follows:

❖ The Common Issue with ShaftHolderBack

Knocking noise has appeared when turning on the scanner power.

1) The stage moves to the home position when turning on the scanner power.
2) The stage stops moving when home sensor is manually detected.
3) The stage does not move in the guide of ShaftFrontHolder assembly because gear of the shaftHolderBack was worn out, and then it can not overcome the friction in the guide of ShaftFrontHolder Assembly.

❖ The Common Issue with Step motor

Stage movement malfunctioning in the middle of scan.
1) Step motor shaft was fallen out in the middle of scan.

❖ The Common Issue with Step motor drive belt

Knocking noise
1) Step motor drive belt is worn out.

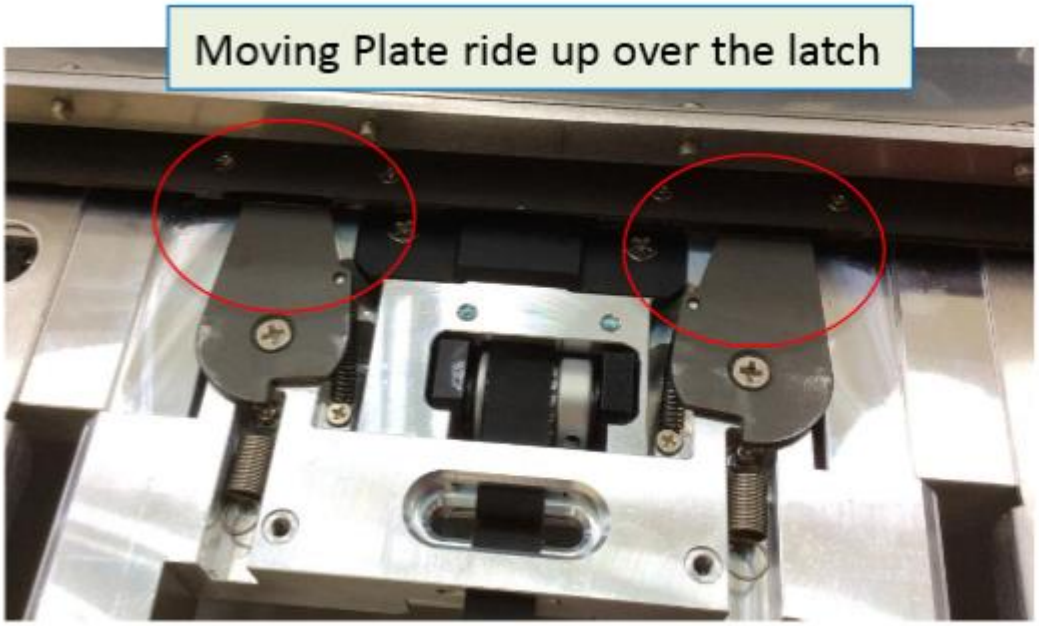
❖ Basic Function of InterConnect Board

- An InterConnect board allows slot connection type.
- Interface board

❖ Upgrade Kit

• Why implemented AD Wall mount kit_1

1) Some of our distributors reported that IP was stuck when wallmounted.
2) It turned out that latch did not grap the image plate. It rides up over the latch



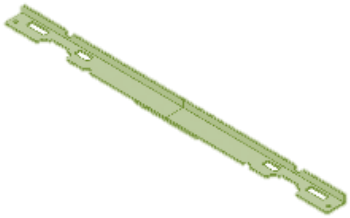
❖ Upgrade Kit

• AD Wall mount kit_1

1) CassetteTopPlate Clamp

2) The purpose of AD wall mount kit_1 is to prevent IP stuck inside scanner when wallmounted.

CassetteTopPlate Clamp



❖ Upgrade Kit

• Why implemented AD Wall mount kit_2

1) Some of our distributors reported that IP was not completely fitted in the cassette housing from time to time.

2) It turned out that both cassette housing lock bearing were partially pushed at initial position when wallmounted, so that either IP was still remained in the scanner or IP was not fitted in the housing when cassette was removed.

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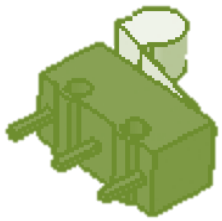
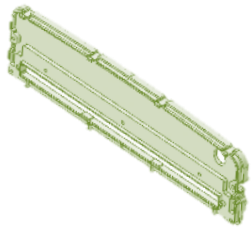
❖ Upgrade Kit

• AD Wall mount kit_2

1) Home sensor, Latch locker and Home sensor

2) The purpose of AD wall mount kit_2 is to completely fit the IP in the housing when wallmounted

Home Sensor	Latch Locker	Mold Adaptor
		

❖ Upgrade Kit

• With AD Wall mount kit_2

1) No contact between cassette lock bearing and CassetteTopPlate at home position.

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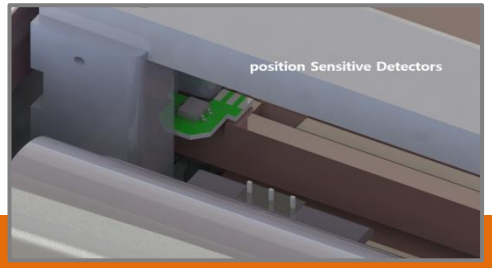
❖ Understanding FireCR Spark; Auto Alignment

- The purpose of Auto Alignment is to bring the red laser back to the best beam position to acquire better image quality.
- Best beam position is one of our system parameter. It is saved in the factory.
- Auto alignment function is performed either just before scanning or during calibration.

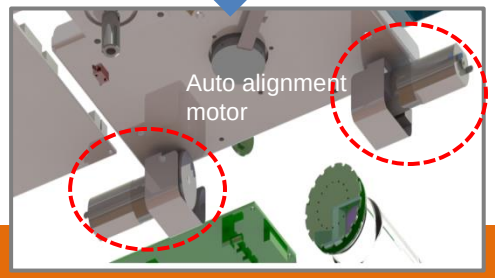


PSD reads the position of red light.

Position is in range

Start to scan.

Position is out of range



Both auto alignment motors work.

PSD reads the best position of red light.

Stop working both alignment motors.

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❖ Understanding FireCR Spark; Precondition for Scanning

Cassette recognition

Scanner read the cassette itself and cassette size.

Calibration file

Calibration file need to be in the Quantor+ folder.

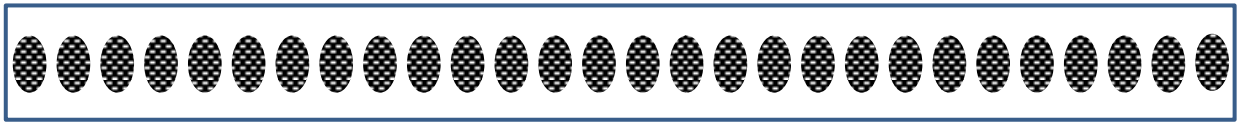
Auto align

Red laser need to hit both PSDs.

Three preconditions are satisfied.
It can scan the cassette.

❖ Understanding FireCR Spark; Calibration

• Every scanner has a different “**Fiber Bundle Condition**”.
Fiber bundle collectors have different light sensitivity.



Fiber Bundle

Less sensitive Less sensitive

13	14	13	17	18	15	14	13
13	14	13	17	18	15	14	13
13	14	13	17	18	15	14	13
13	14	13	17	18	15	14	13
13	14	13	17	18	15	14	13
13	14	13	17	18	15	14	13
13	14	13	17	18	15	14	13
13	14	13	17	18	15	14	13

More sensitive, Vertical band

After Calibration

18	18	18	18	18	18	18	18
18	18	18	18	18	18	18	18
18	18	18	18	18	18	18	18
18	18	18	18	18	18	18	18
18	18	18	18	18	18	18	18
18	18	18	18	18	18	18	18
18	18	18	18	18	18	18	18
18	18	18	18	18	18	18	18

Uniform brightness

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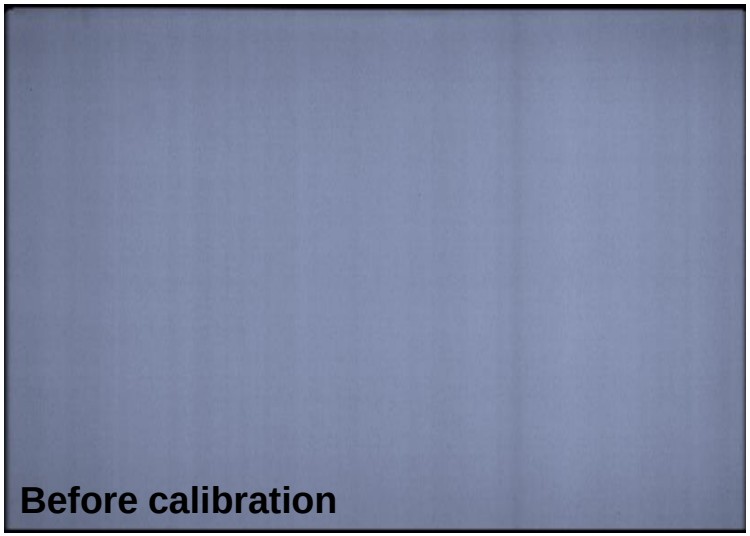
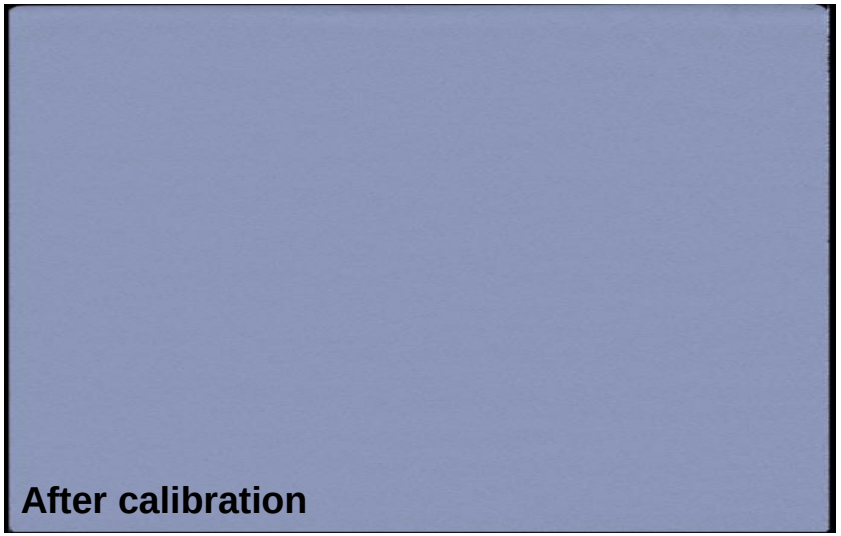
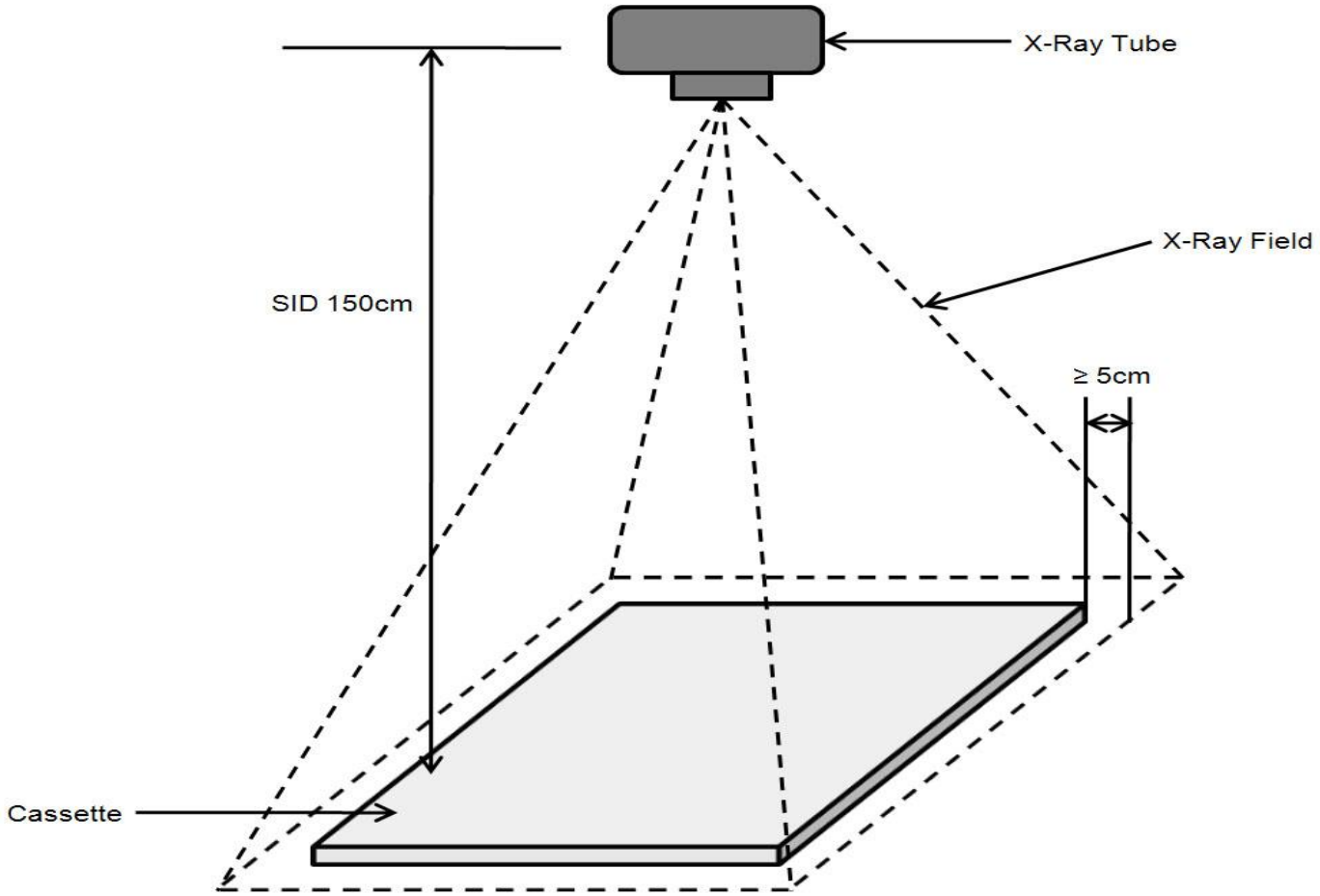
❖ Understanding FireCR Spark; Calibration





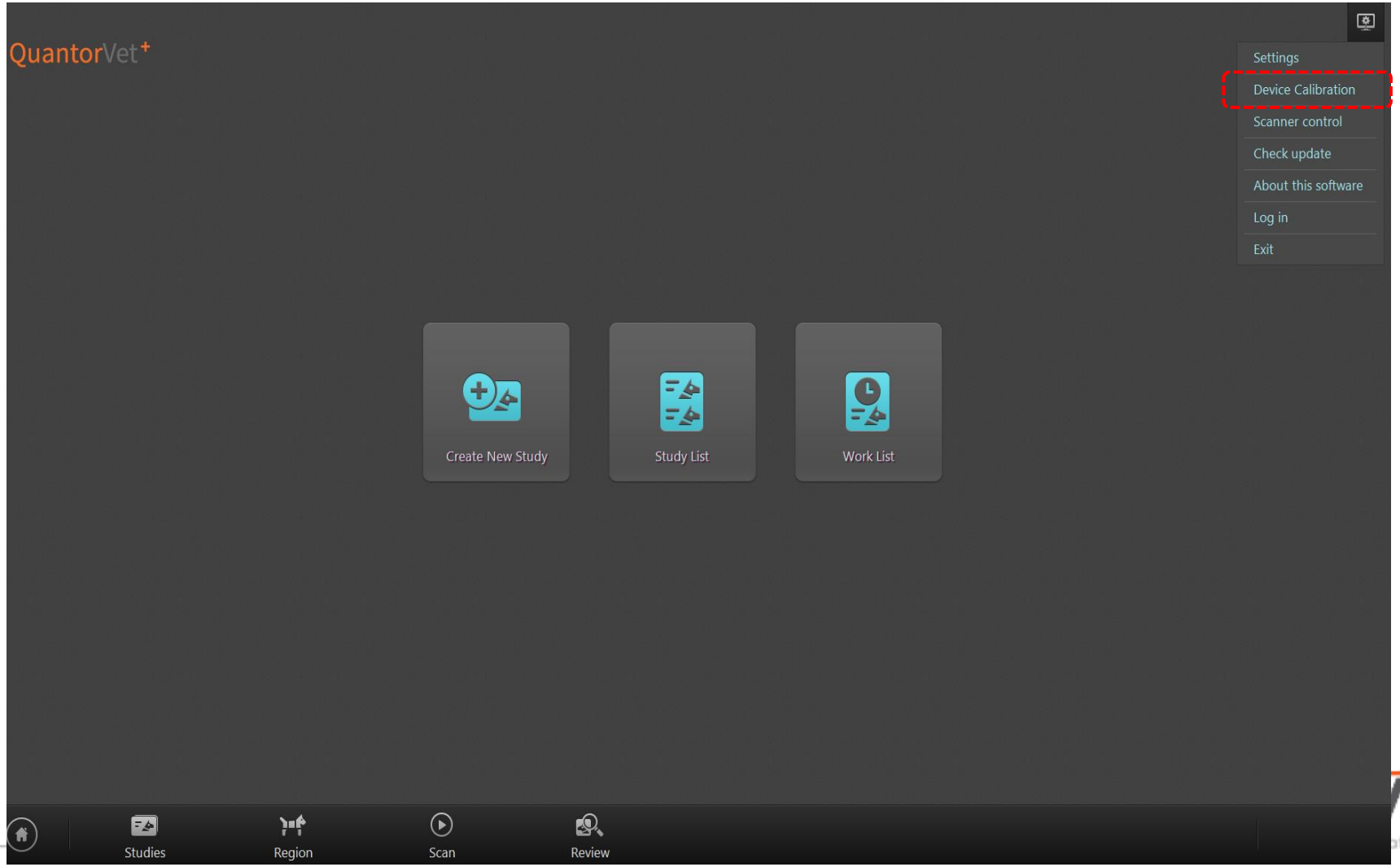
❖ Understanding FireCR Spark; Calibration

Note: X-ray exposure must cover entire cassette



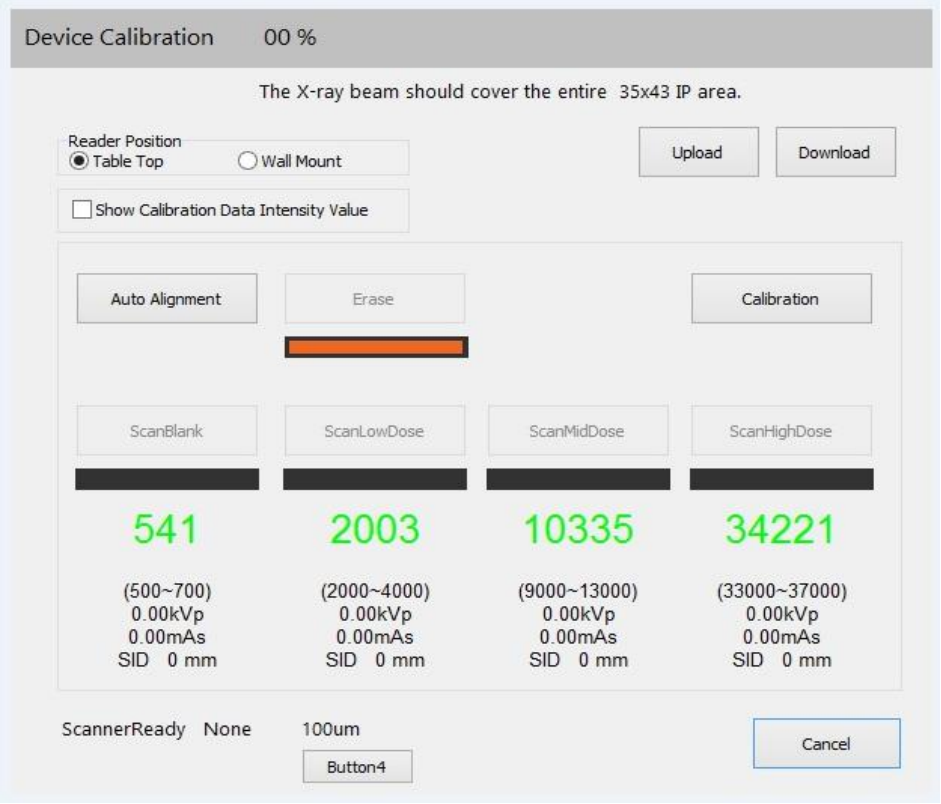
❖ Understanding FireCR Spark; Calibration

- Menu/Device Calibration



❖ Understanding FireCR Spark; Calibration

- Calibration Procedure



Step 1: Select Reader Position

Step 2: Auto alignment

Step 3: Erase
Run an erase cycle to remove any residual radiation that may be left on the phosphor.

Step 4: Scan Blank
Without exposing the cassette, insert it into the reader and press the “Scan Blank” button. Note: Use the same cassette for the entire calibration.

Step 5, 6, & 7: Scan Low, Medium, & High Dose
Expose the entire cassette at the recommended values and if the value is out of range adjust mAs until the numbers are green. Step 7: Calibration!
Press and wait until the software confirms that the calibration was successful.

Note: Cancelling the calibration before completion will force you to start over.

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❖ Understanding FireCR Spark; Calibration

Understanding the Cal-files:

- Calibration files can be found in the software folder. Windows Photo Viewer can view the Cal-files. We recommend that you open the “High Dose” calibration of each cassette size to verify an artifact free calibration.

3543 Cassette Calibration	
File	Description
Calf0.tif	ScanBlank
Calf1.tif	ScanLowDose
Calf2.tif	ScanMidDose
Calf3.tif	ScanHighDose
Sectionf.dat	**TableTop Calibration file**
Sectionfw.dat	**Wallmount Calibration file**

* Need to confirm Artifact free through Calf3.tif

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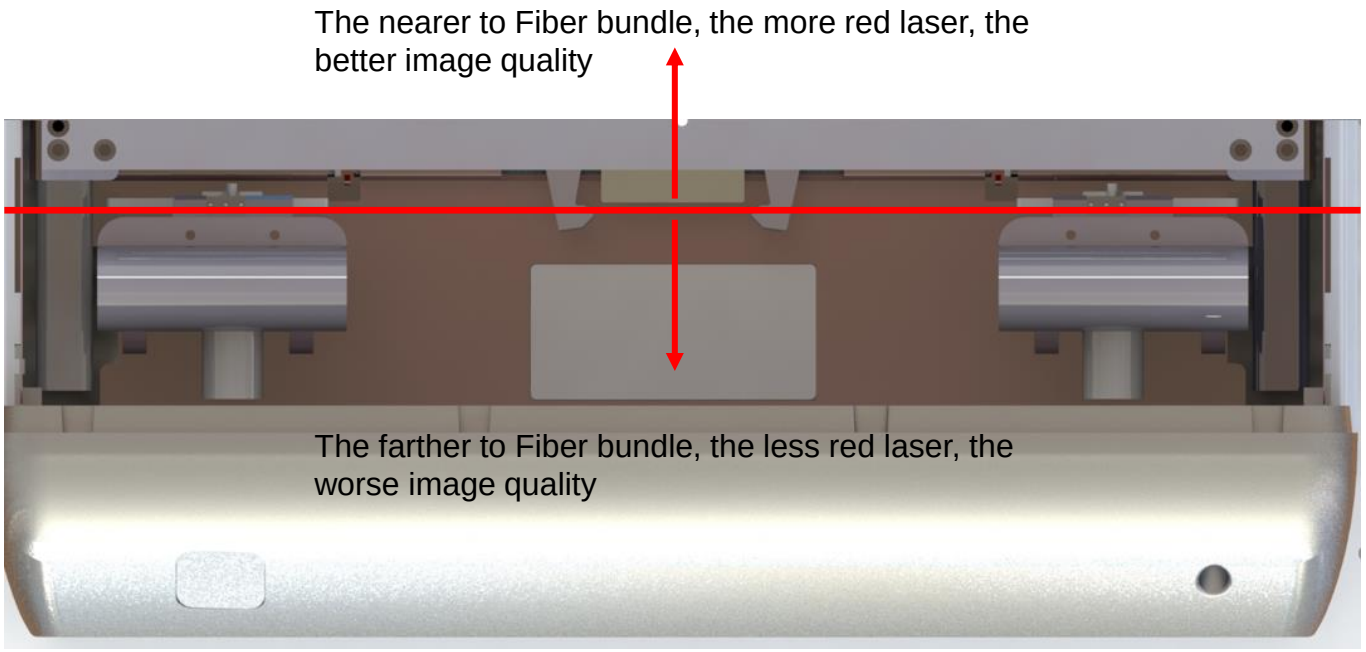
❖ Understanding FireCR Spark; Image Quality Setup

• Basic understanding Image quality setup

1) The basic concept of the image quality setup is to bring the red laser near to fiber bundle.

2) Uniform image brightness.



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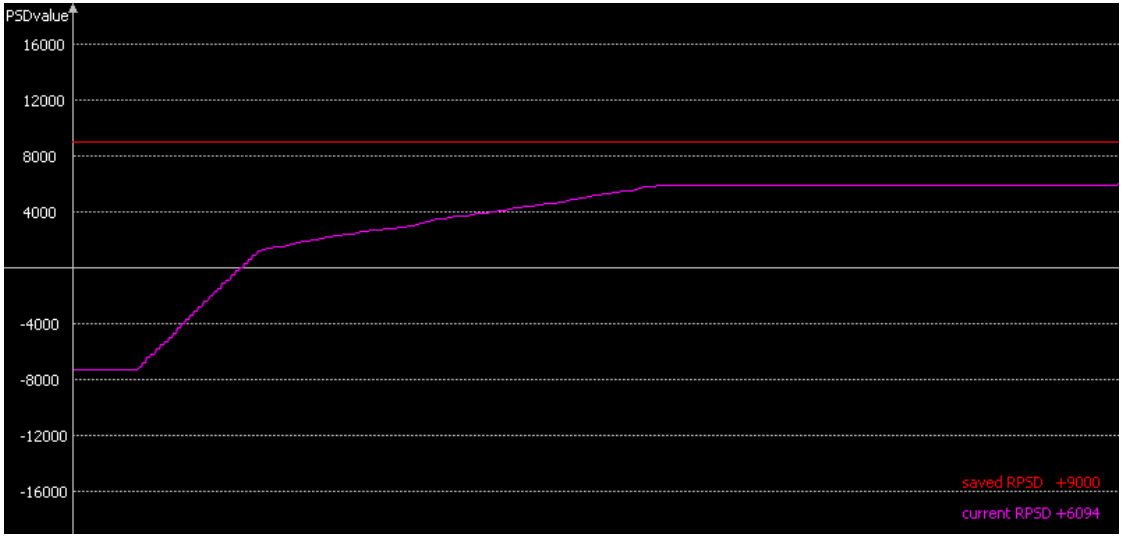
❖ Understanding FireCR Spark; Image Quality Setup

• Image quality setup order

1) Align Calibrator

The purpose of the align calibrator is to optimize the slow speed value for bringing out the best aligner motor performance for fine tuning the best beam position.



In case of low SlowSpeed value

Aligner motor force is too low, and the it is approaching the saved best beam position, but it is not within range.

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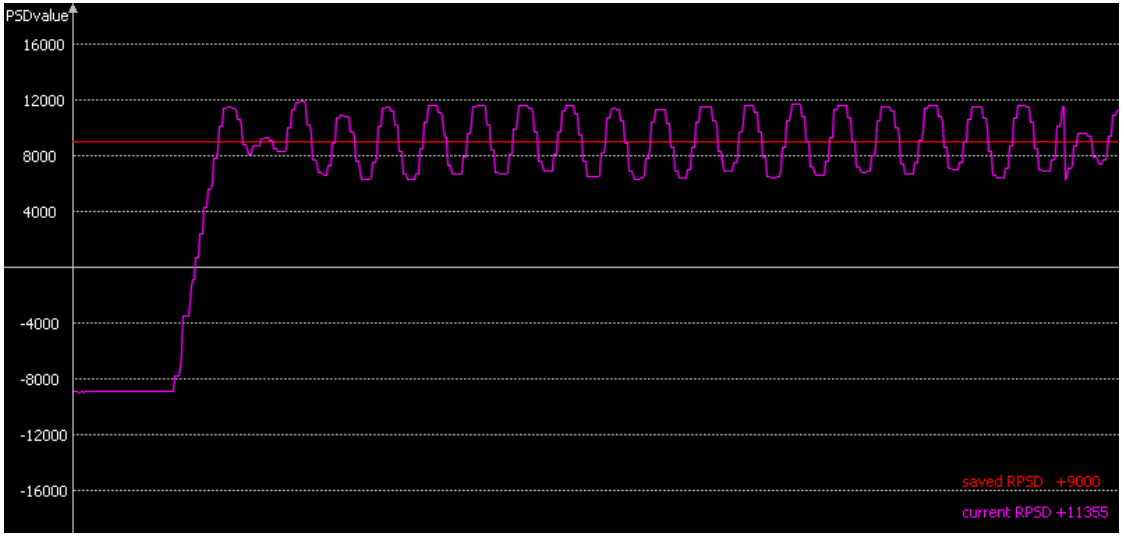
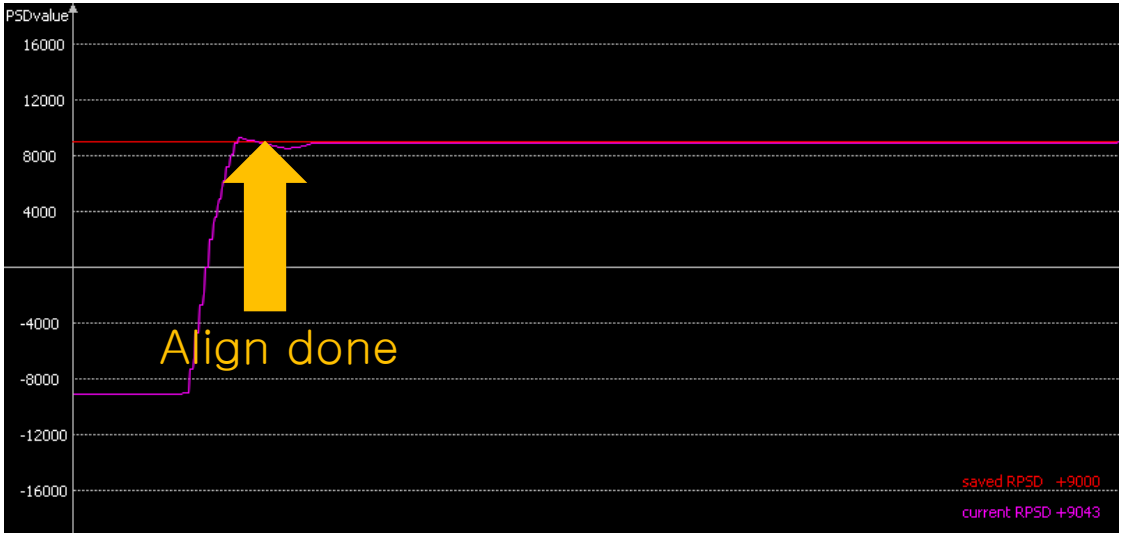
❖ Understanding FireCR Spark; Image Quality Setup



In case of high SlowSpeed value

The aligner motor force is way too strong, it overshoots the best beam position.

❖ Understanding FireCR Spark; Image Quality Setup



In case of optimal SlowSpeed value

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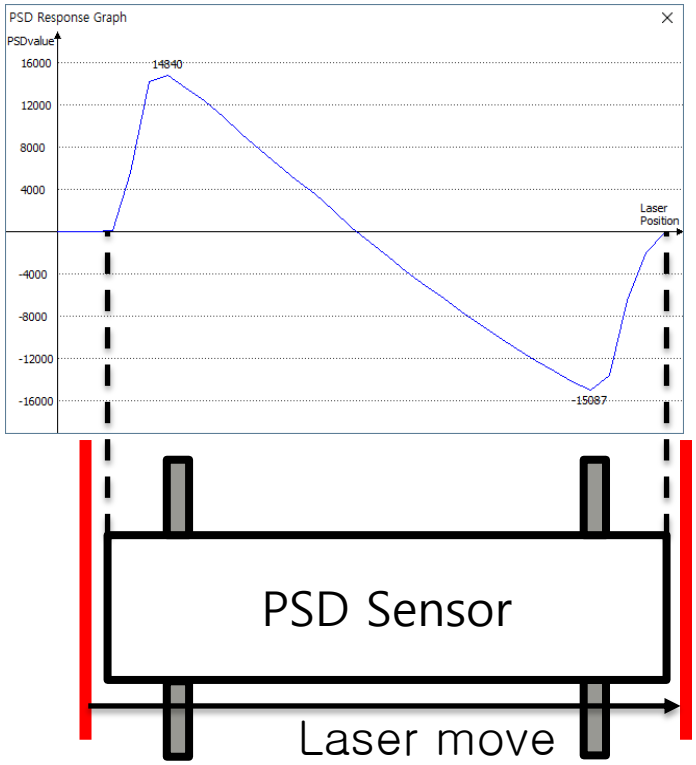
❖ Understanding FireCR Spark; Image Quality Setup

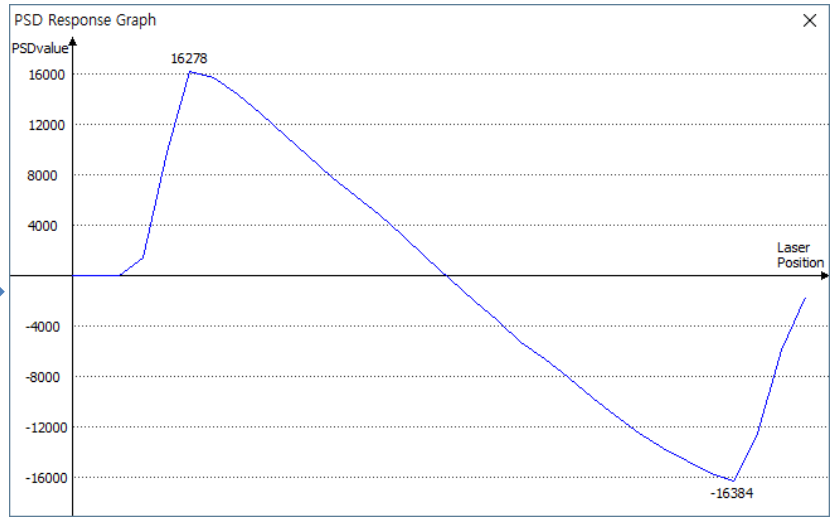
- Image quality setup order

2) PSD Calibrator



change actual reading range into ideal reading range through scale change.

After PSD calibrator



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❖ Understanding FireCR Spark; Image Quality Setup

• Image quality setup order

3) Best Beam Find

The purpose of the best beam find process is to find the best red laser position to show the best image quality.

Software calculates the best PSD position to meet following two condition simultaneously.

- Red laser is as near as possible to the fiber bundle.
- Uniform image brightness

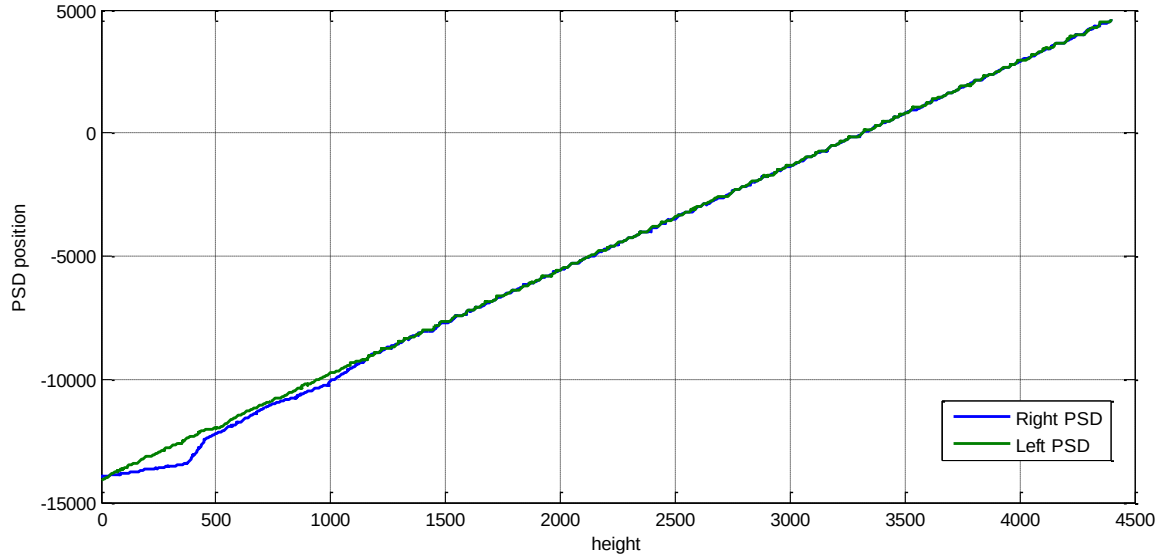
Best Beam Find in order

- Cal0 Run
- Find Best PSD

❖ Understanding FireCR Flash; Image Quality Setup

Cal0 Run

1) Align motor stability test



2) Rough PSD position calculation

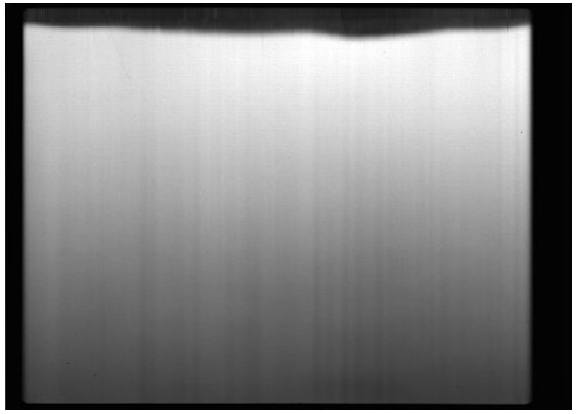
3) Automatic ADC offset value calculation.

❖ Understanding FireCR Flash; Image Quality Setup

Find Best PSD

1) Fiber bundle bending test

Bad fiber bundle shape



Good fiber bundle shape

2) Align motor stability test

3) Fine PSD position calculation

4) Automatic PMT gain value calculation

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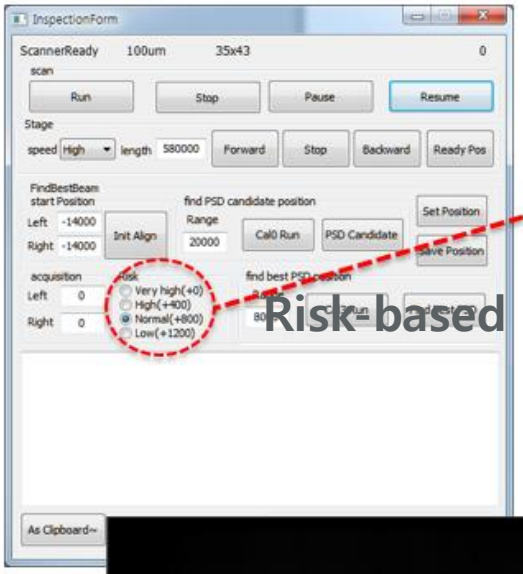
❖ Understanding FireCR Flash; Image Quality Setup

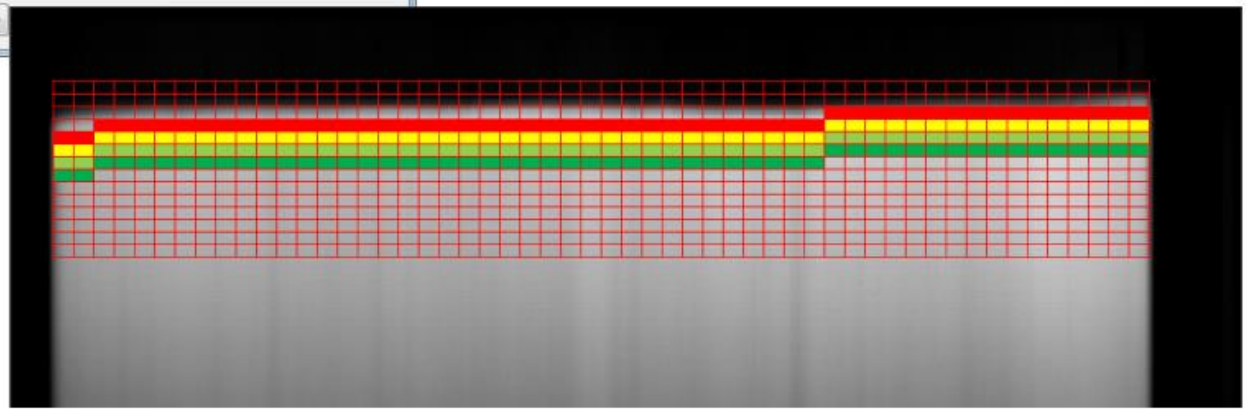
Risk-based PSD position adjustments



Box color	Intensity Value	Risk	Risk ratio(%)
	Very high	Very high	150
	High	High	125
	Normal	Normal	100
	Low	Low	70

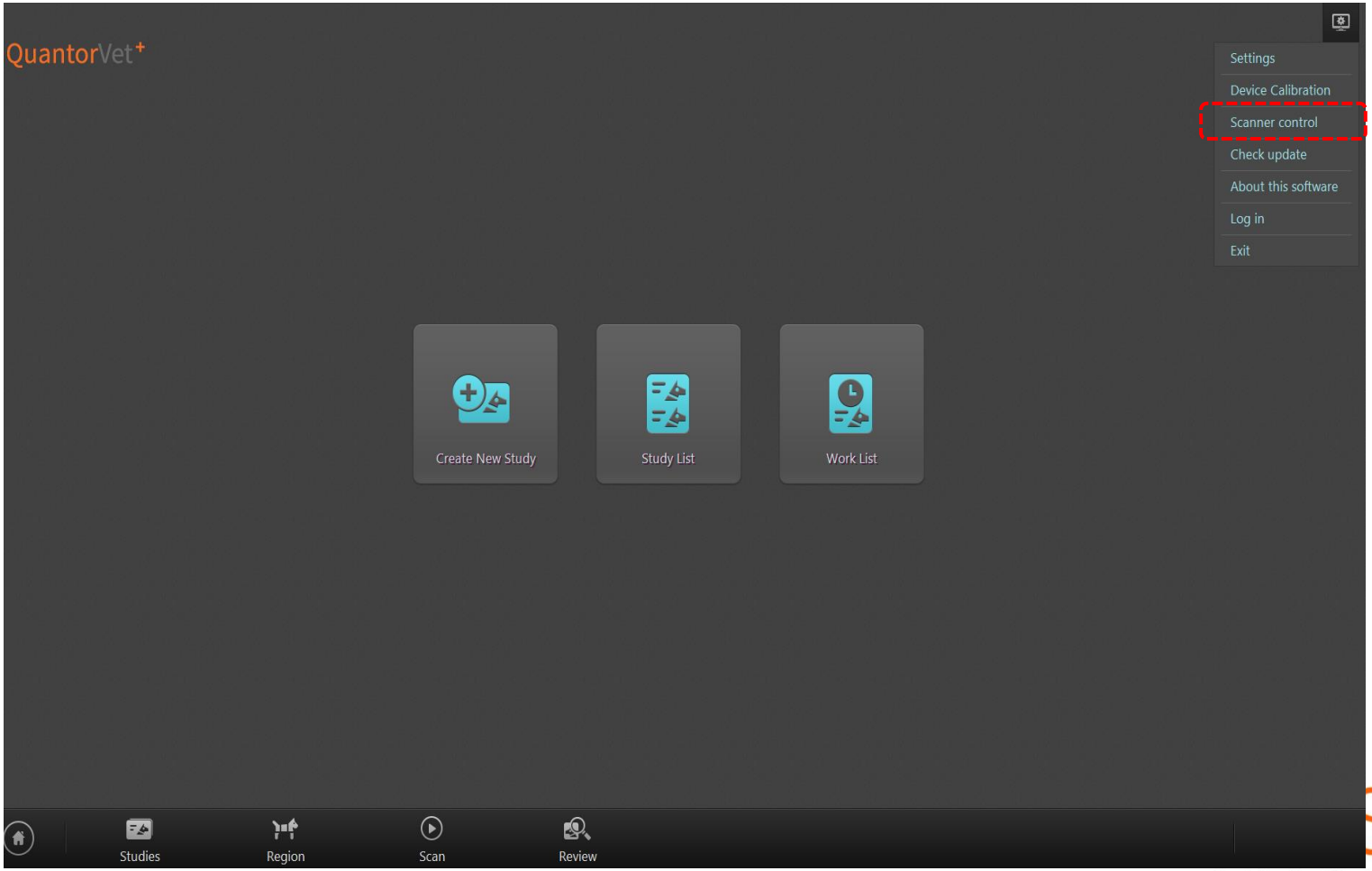
Default :
Normal(+800)

Risk-based PSD position adjustments

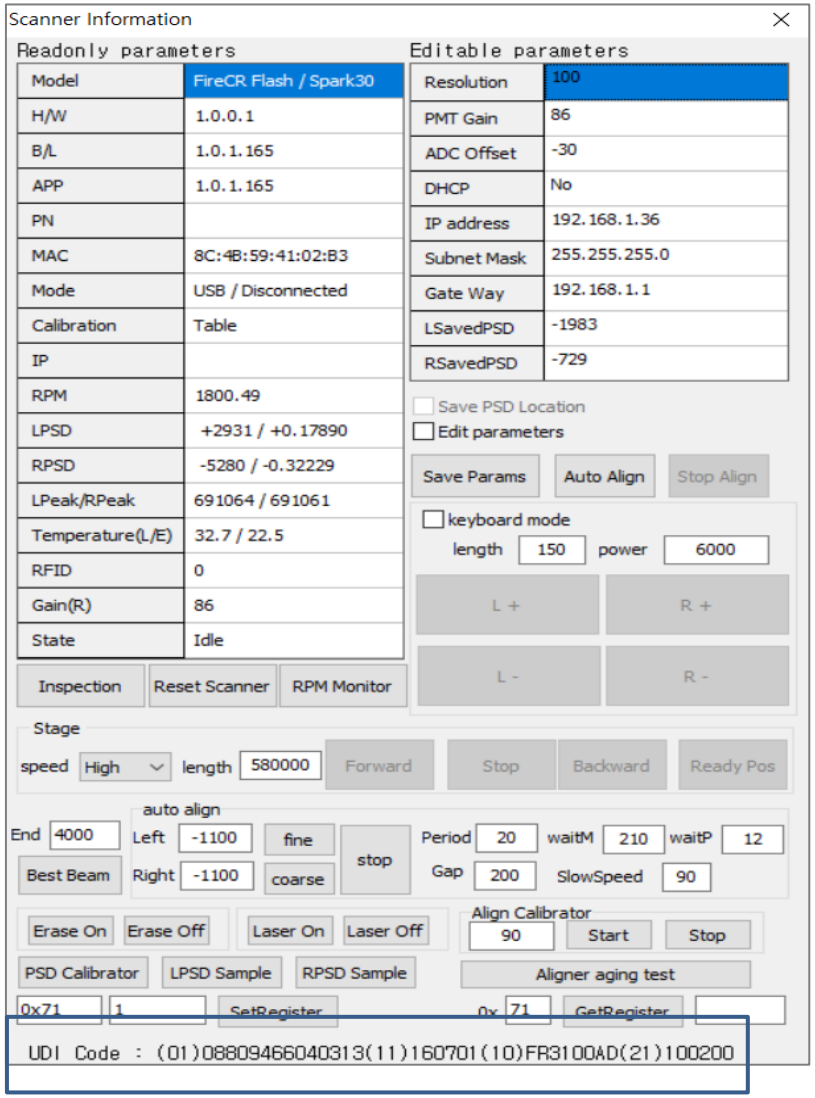


❖ Understanding FireCR Spark; Scanner Control

- Menu/Scanner Control



❖ Scanner Control



- APP: Firmware version
- BL: BootLoader version
- Resolution: HD or SD
- LsavedPSD: Optimized LPSD setting value
- RsavedPSD: Optimized RPSD setting value

- They are saved through Best Beam Find process.

- LPSD: Actual LPSD value
- RPDS: Actual RPSD value
- RFID: Cassette housing RFID info
- IP: Cassette size
- RPM: The rotation speed of square mirror
- Forward: Stage manually move forward.
- Backward: Stage manually moves backward.
- Ready Pos: Stage moves to ready position
- UDI code

Ready position means the stage position for ready to scan.

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❖ Scanner Control

• UDI Code

The Unique Device Identification (UDI) is a system used to mark and identify medical devices

(01)08809466040214(11)160111(10)FR3100AD(21)100212 : Production Identification category.

(01)**0880**9466040214(11)160111(10)FR3100AD(21)100212: Country Code

(01)0880**946604**0214(11)160111(10) FR3100AD(21)100212: Company Code

(01)088094660**021**4(11)160111(10) FR3100AD(21)100212: Product Code

(01)08809466040214(11)160111(10) FR3100AD(21)100212: CheckDiget

(01)08809466040214**(11)**160111(10) FR3100AD(21)100212: Production date category

(01)08809466040214(11)**160111**(10) FR3100AD(21)100212: Date ex)yymmdd

(01)08809466040214(11)160111**(10)**FR3100AD(21)100212: Lot number category

(01)08809466040214(11)160111(10)**FR31**00AH(21)100212: FireCR Spark

(01)08809466040214(11)160111(10)FR11**00**AH(21)100212: 3DISC

(01)08809466040214(11)160111(10)FR1103**AD**(21)100212: Version

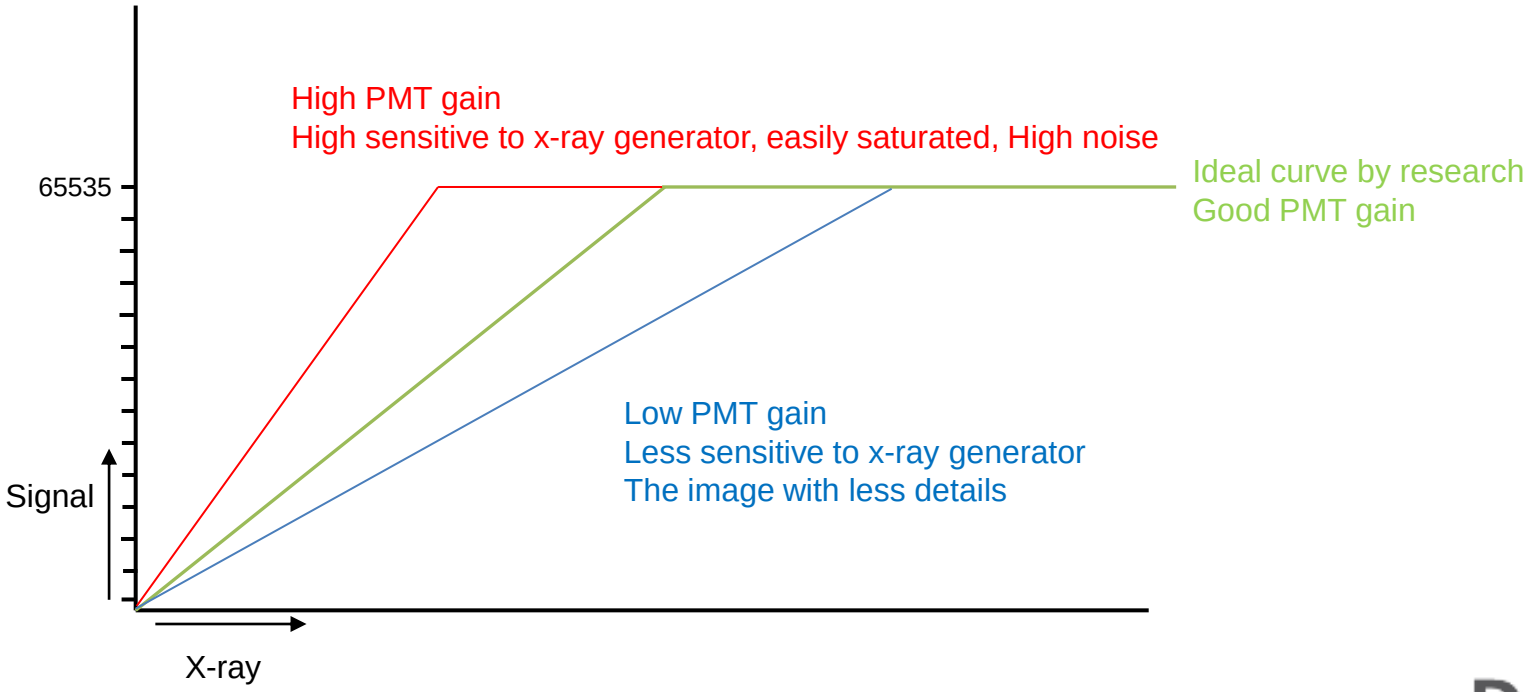
(01)08809466040214(11)160111(10)FR1103AH**(21)**100212: Serial number category.

(01)08809466040214(11)160111(10)FR1103AH(21)**100212**: Batch Number

❖ Scanner Control

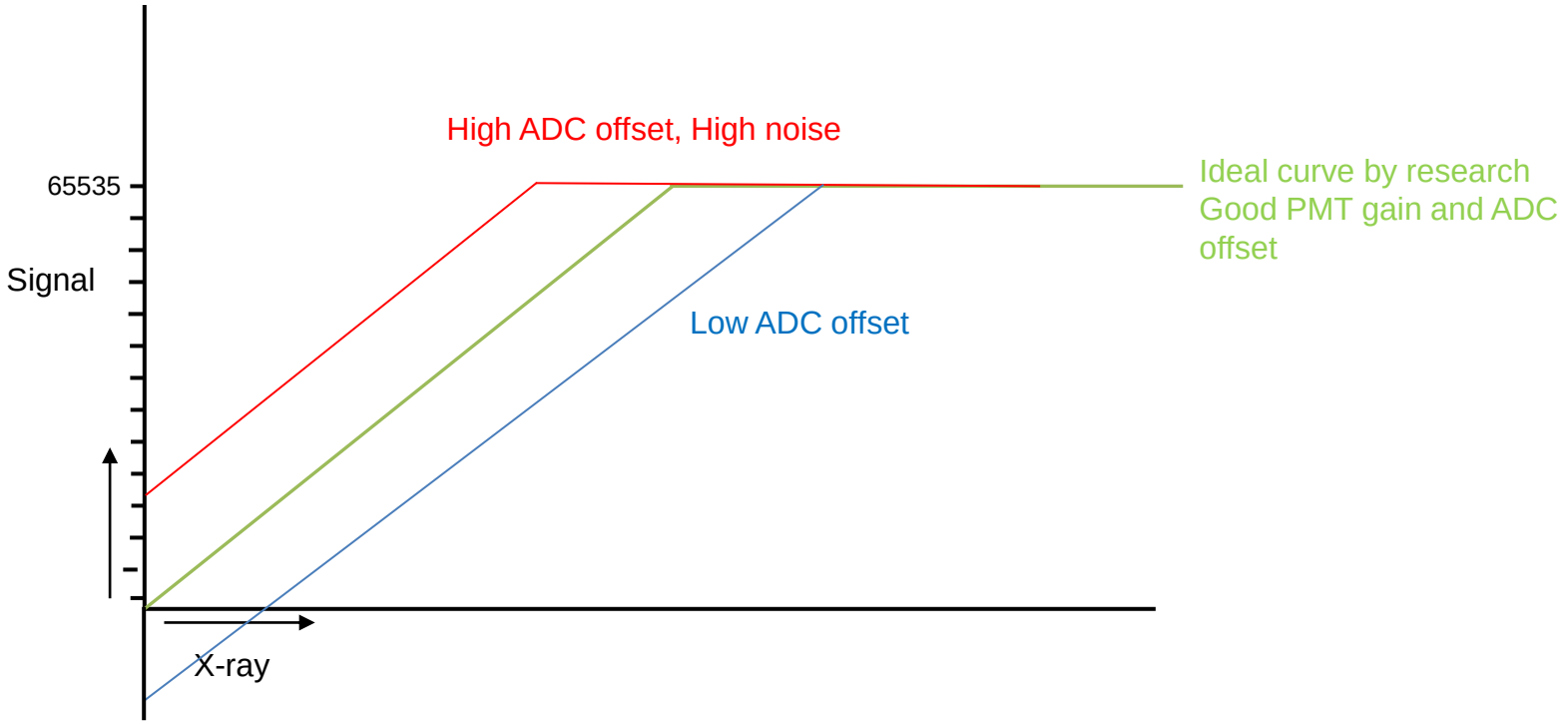
• PMT gain

PMT gain value is adjusted by applied voltage

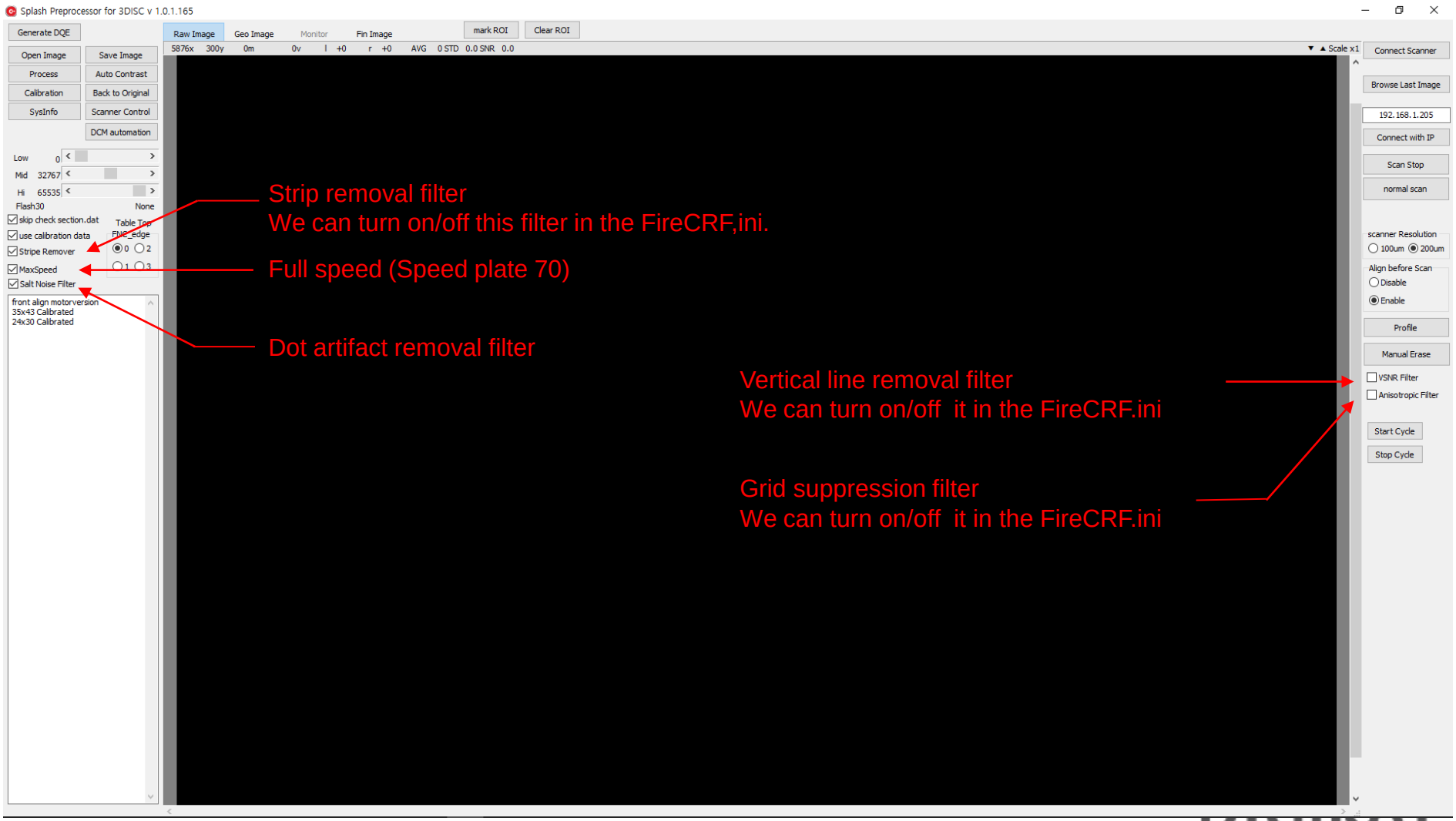


❖ Scanner Control

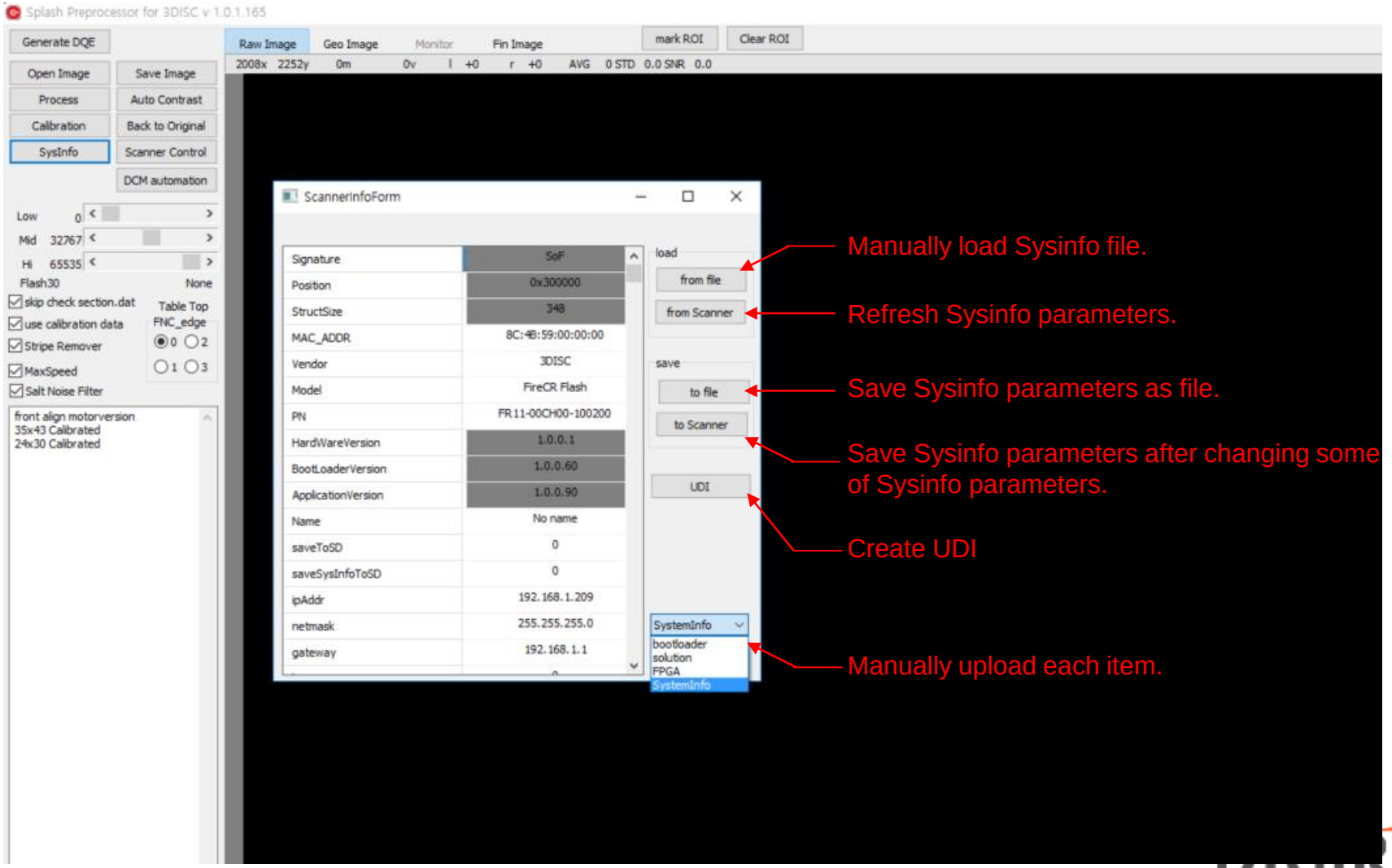
• ADC Offset



❖ Factory Software, SDKContainer



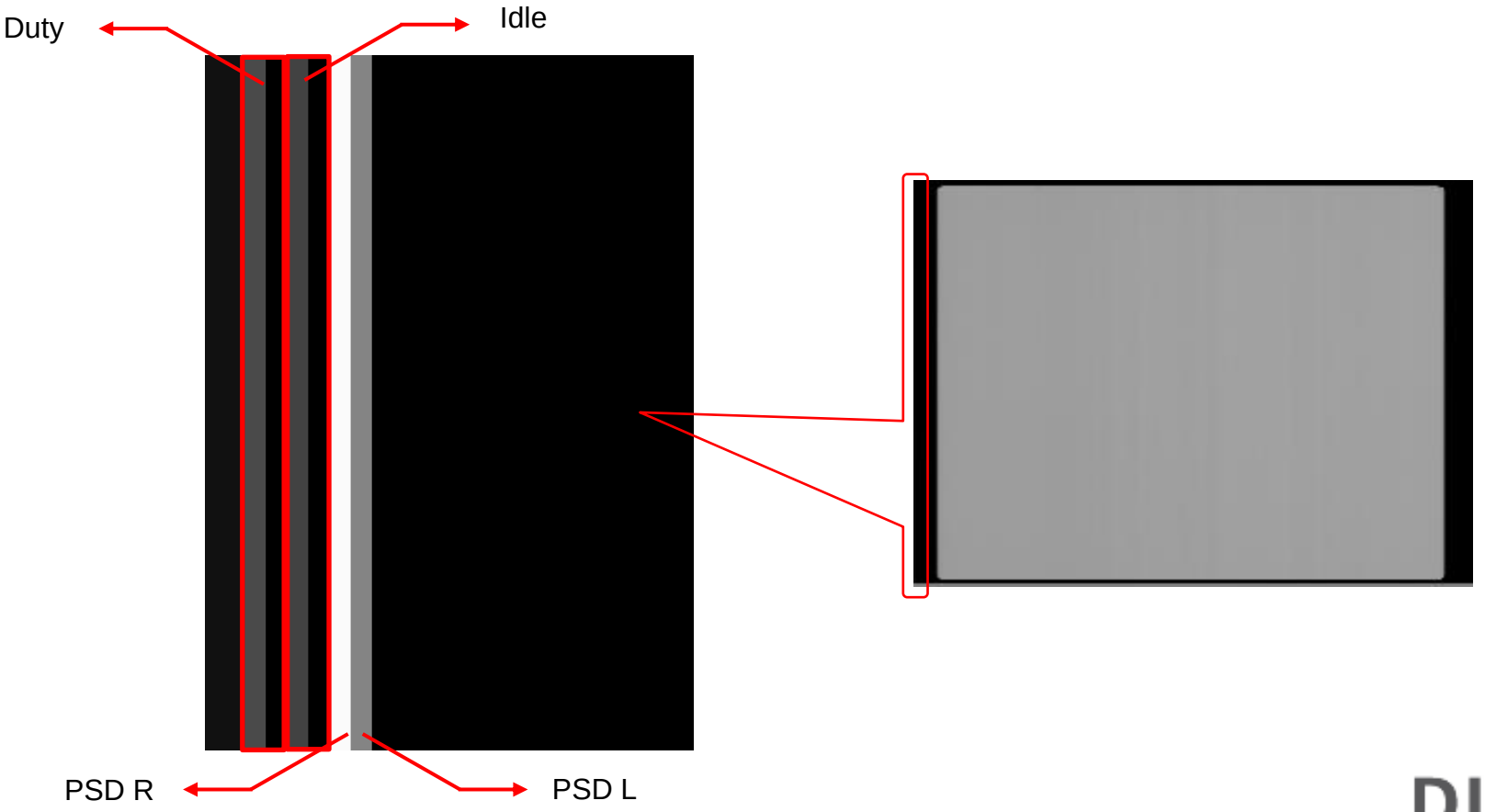
❖ Factory Software, SDKContainer



❖ Factory Software, SDKContainer

• Tag

Tag contains very important information related with PSD reading – Tag data를 통하여 알 수 있는 정보 문의



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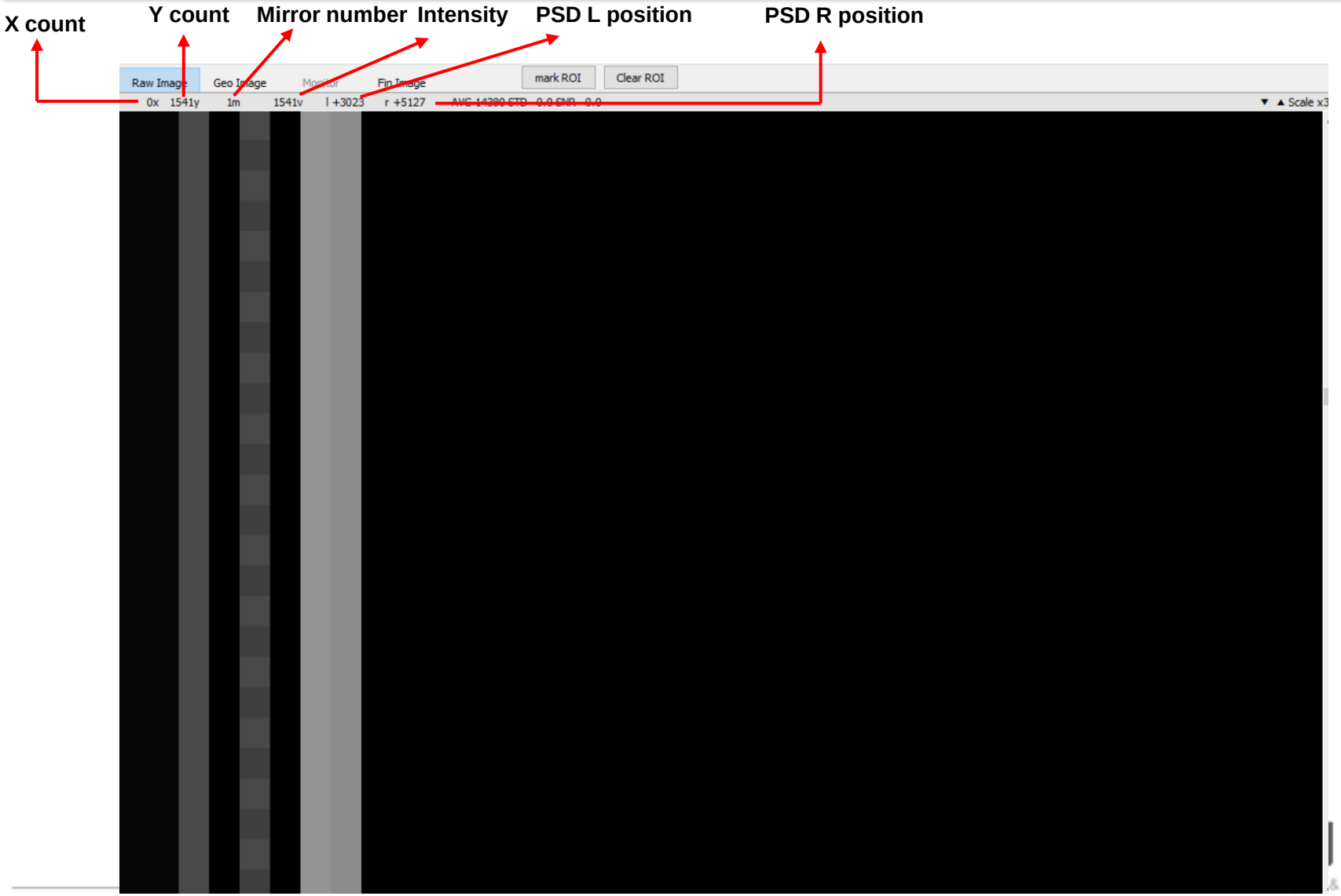
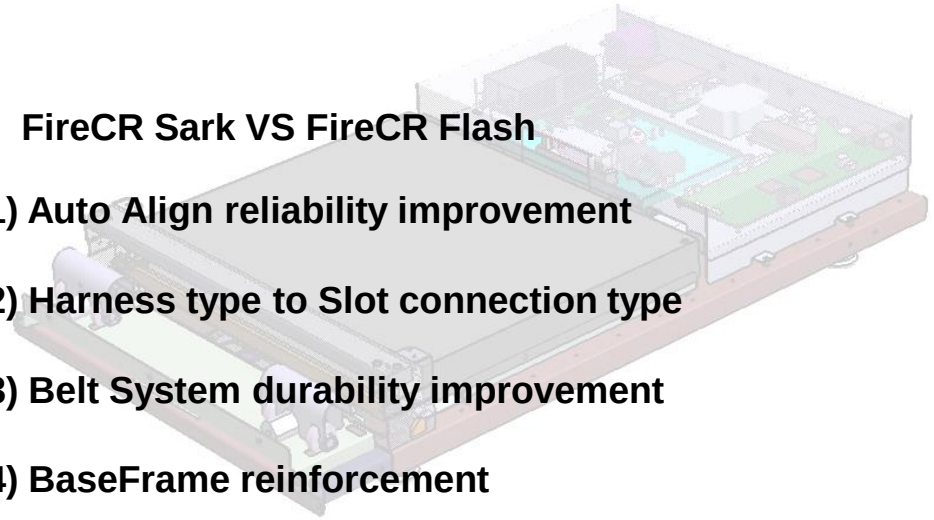
❖ Factory Software, SDKContainer



❖ FireCR Spark versus FireCR Flash



- **FireCR Sark VS FireCR Flash**

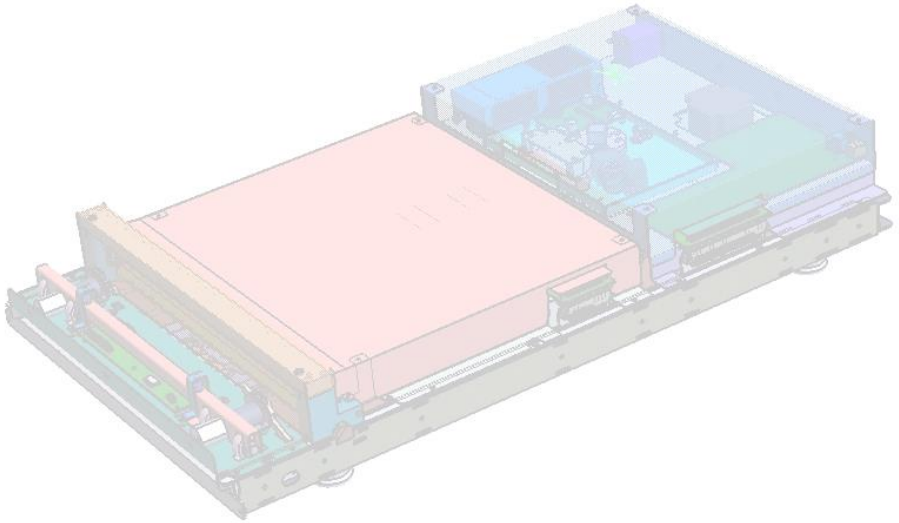
1) Auto Align reliability improvement

2) Harness type to Slot connection type

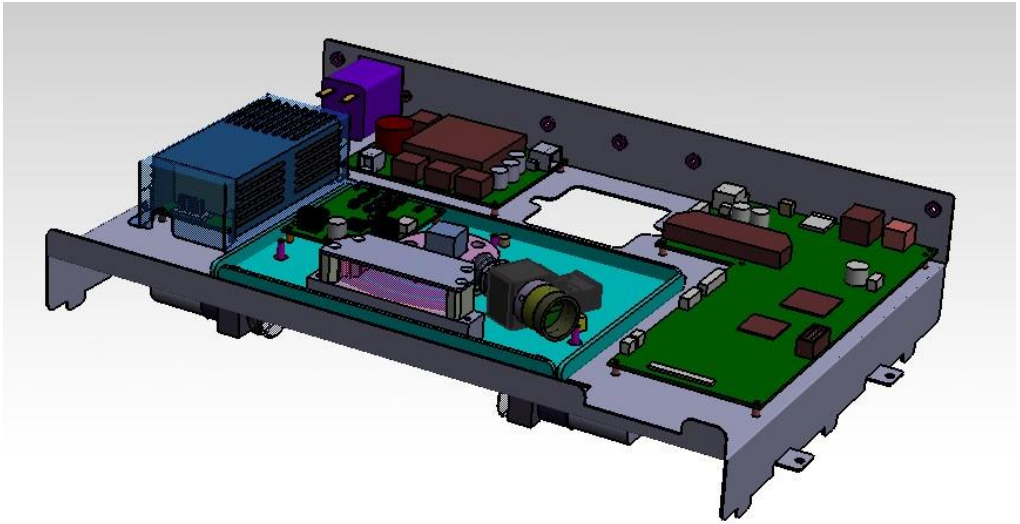
3) Belt System durability improvement

4) BaseFrame reinforcement

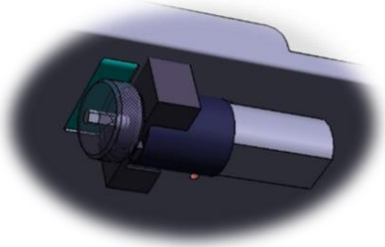
5) Board quality improvement



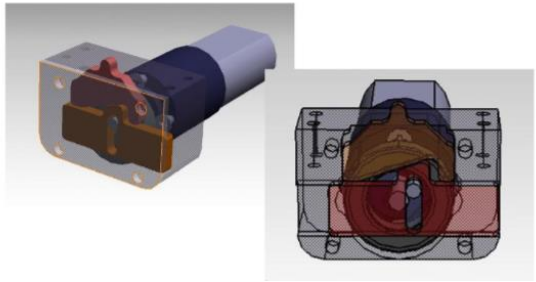
❖ FireCR Spark versus FireCR Flash

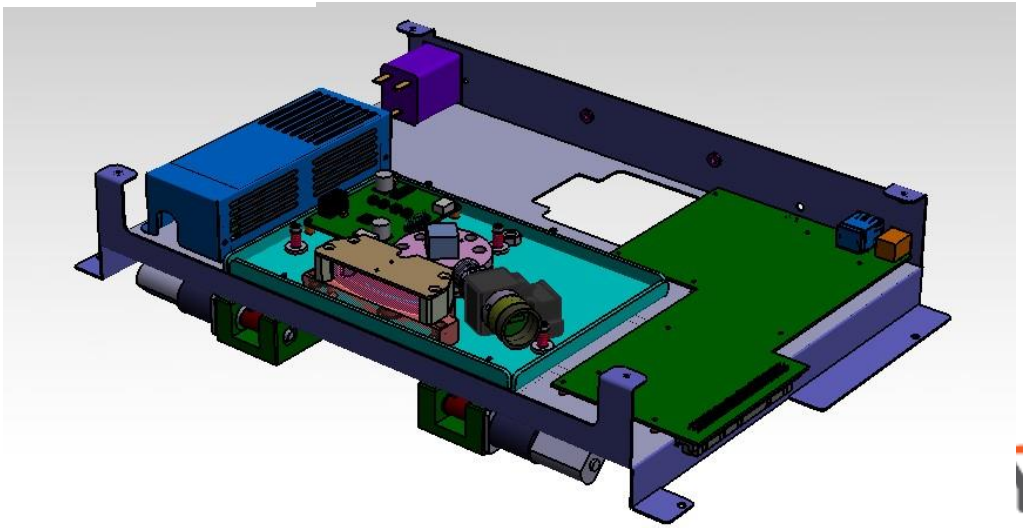


Disk type alignment module

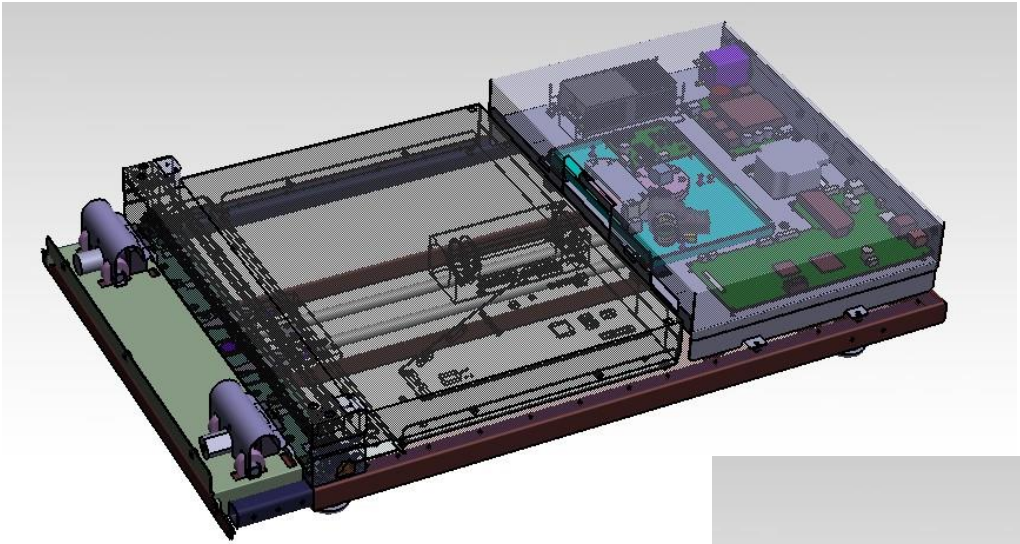


Crank type alignment module

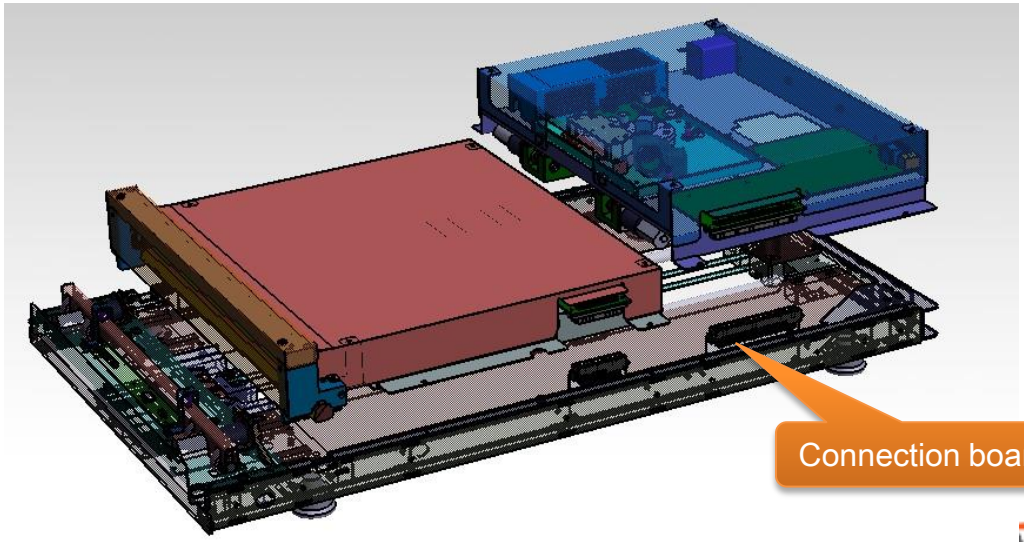




❖ FireCR Spark versus FireCR Flash



FireCR Flash
Harness connection

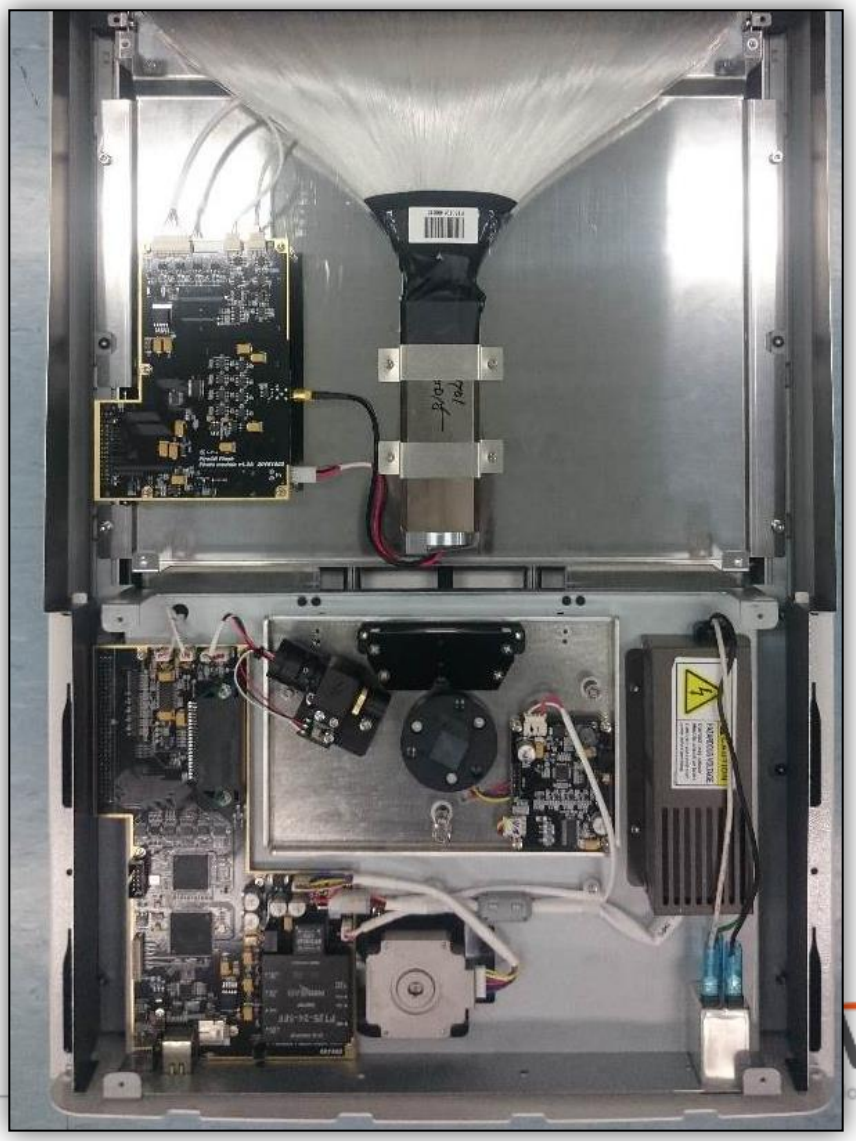


FireCR Spark or Flash AD
Slot connection

❖ FireCR Spark versus FireCR Flash

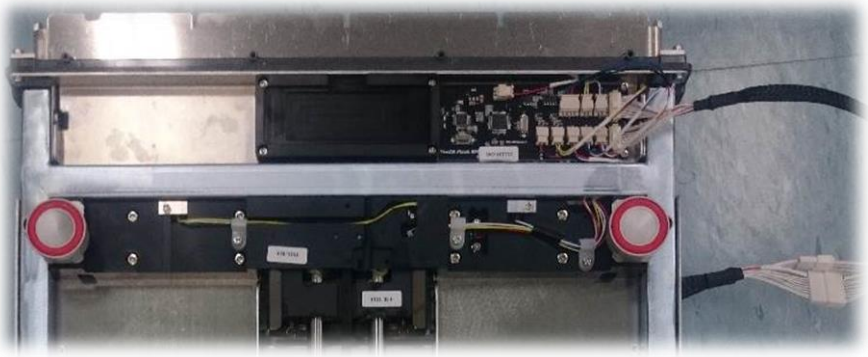
Top View of FirCR Flash AC

Top View of FireCR Spark or Flash AD

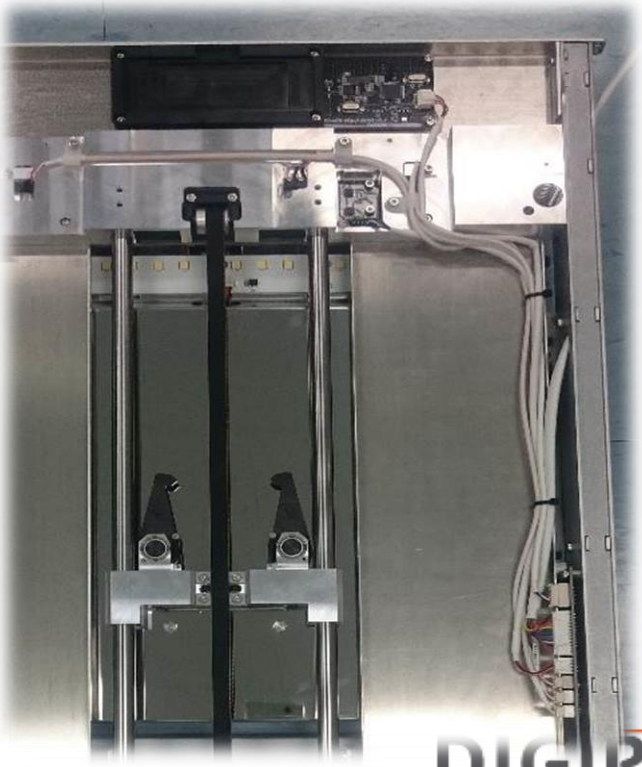


❖ FireCR Spark versus FireCR Flash

Bottom plate of FireCR Flash AC

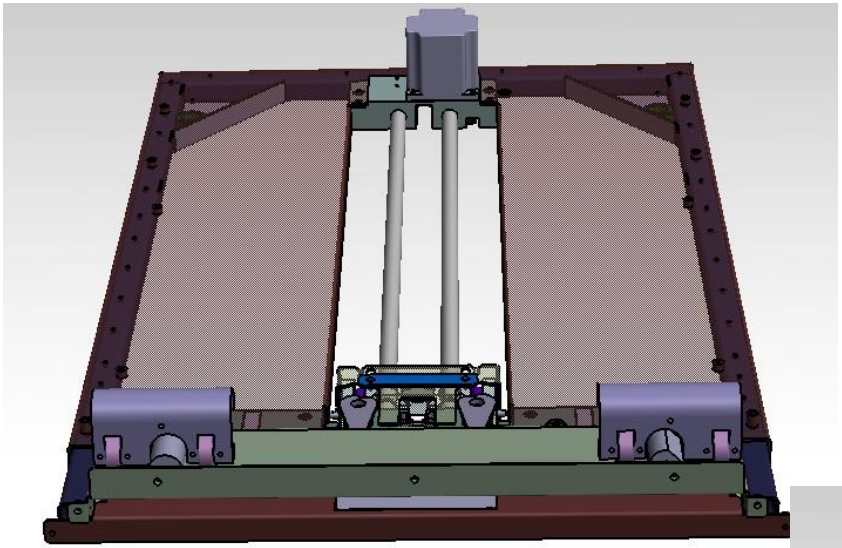


Bottom plate of FireCR Spark or Flash AD

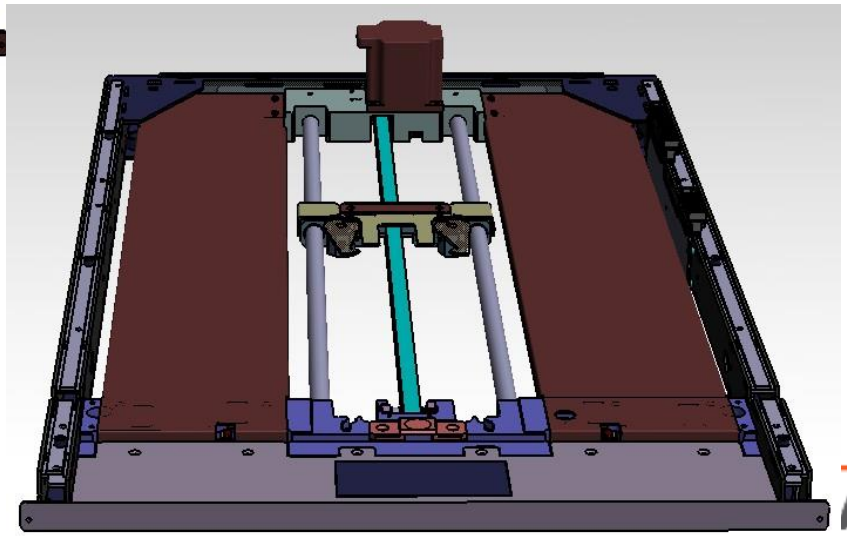


❖ FireCR Spark versus FireCR Flash

Belt system reinforcement



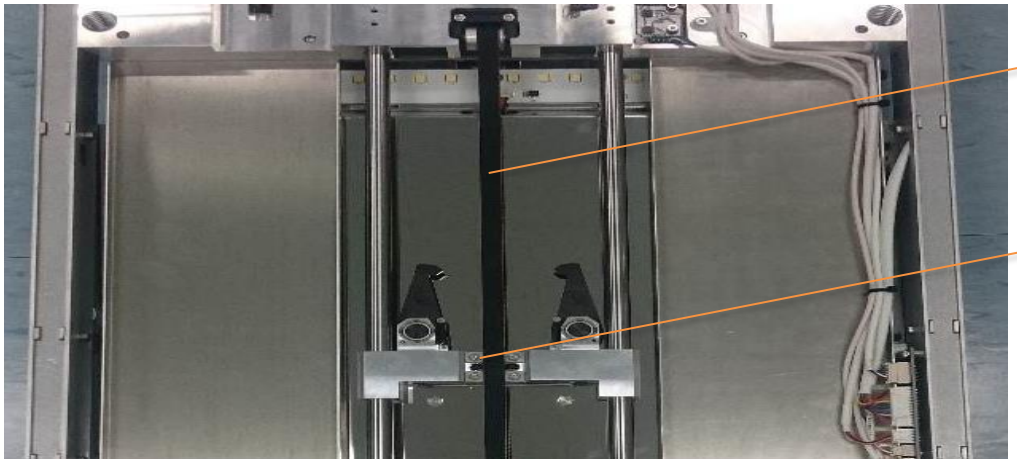
High torque timing belt



Wide type high torque timing belt

❖ FireCR Spark versus FireCR Flash

Bottom plate of Flash AD type



Wide type high torque belt

Belt holder design change

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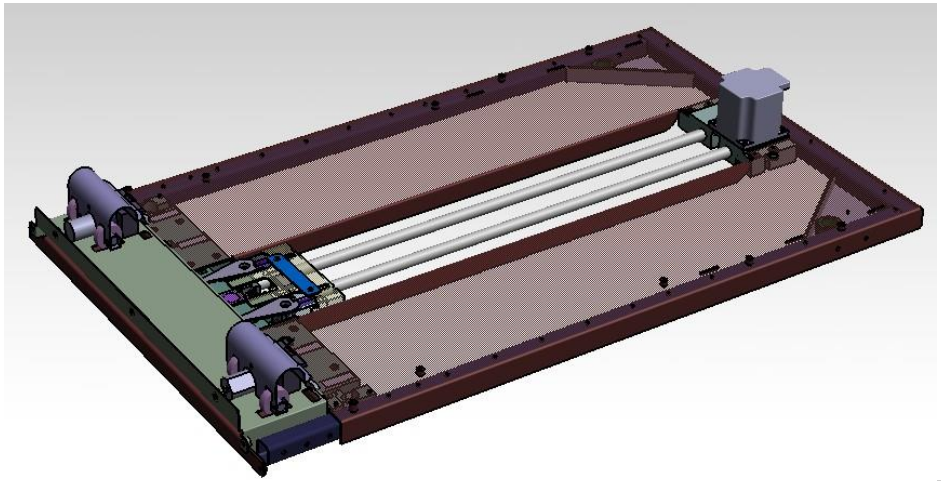
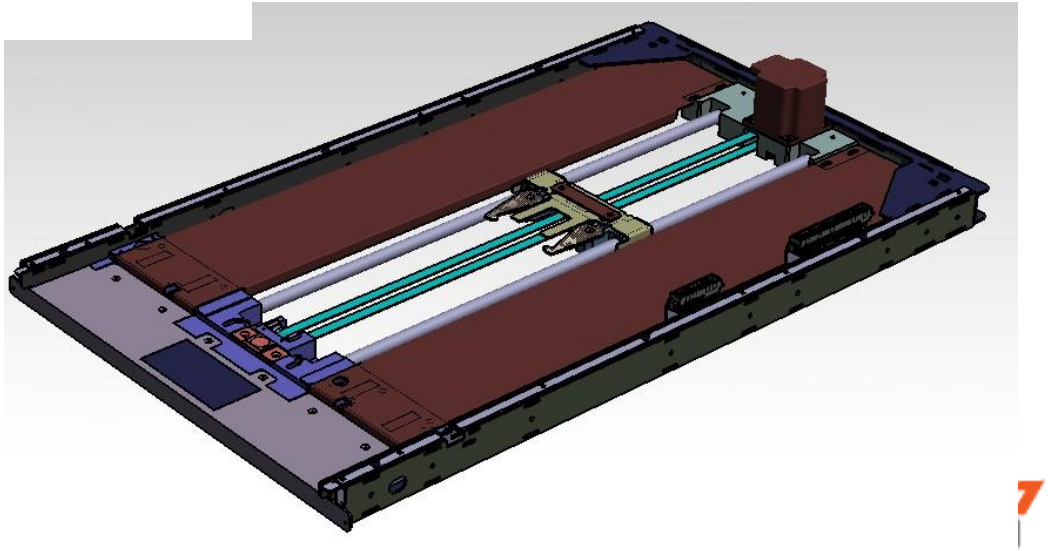
❖ FireCR Spark versus FireCR Flash

BaseFrame reinforcement



AC
Pipe Welded frame

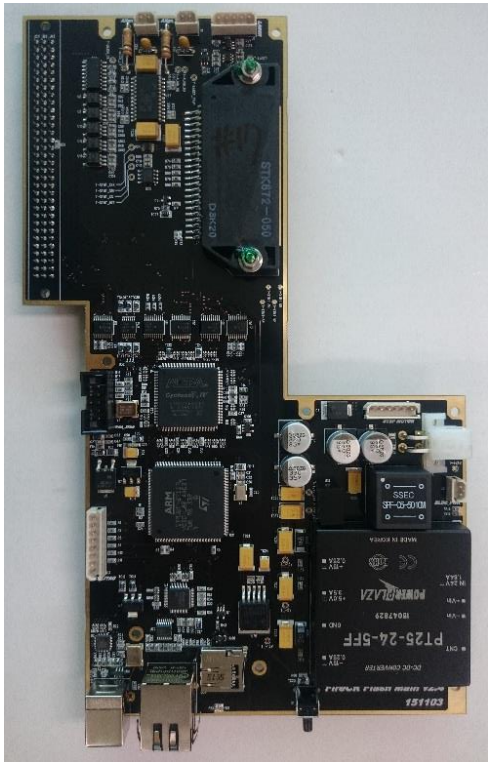


AD
Assembling type frame

❖ FireCR Spark versus FireCR Flash

Main board

Main board is added power board of AC type



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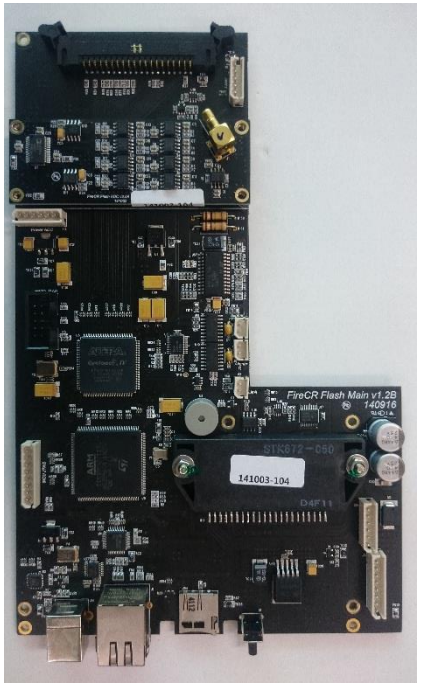

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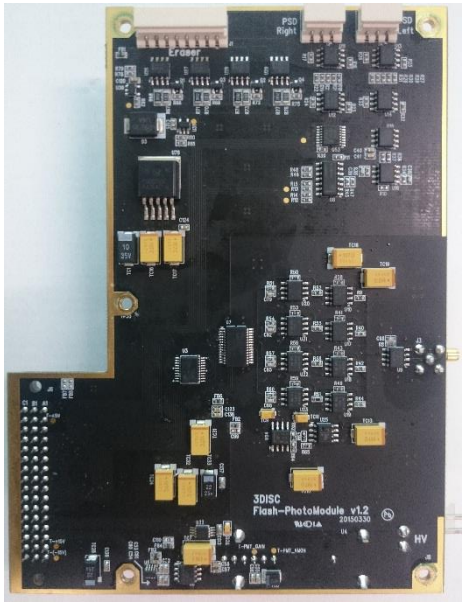
❖ FireCR Spark versus FireCR Flash

Photo module board

Photo module board is added driver board and ADC board of AC type



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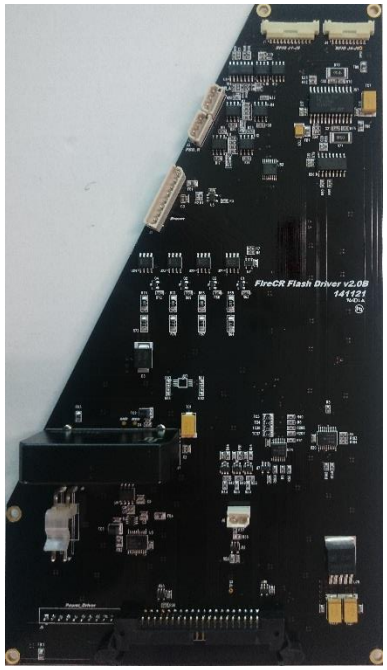

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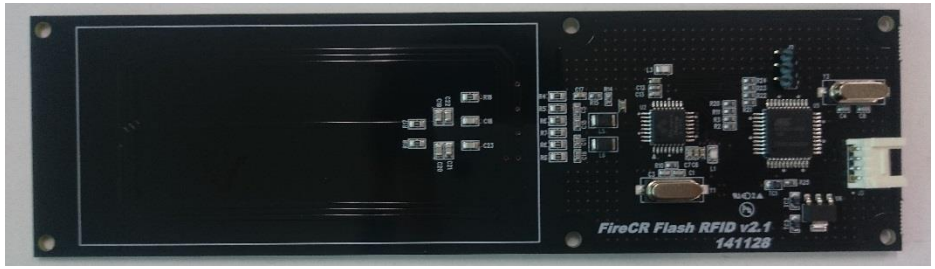
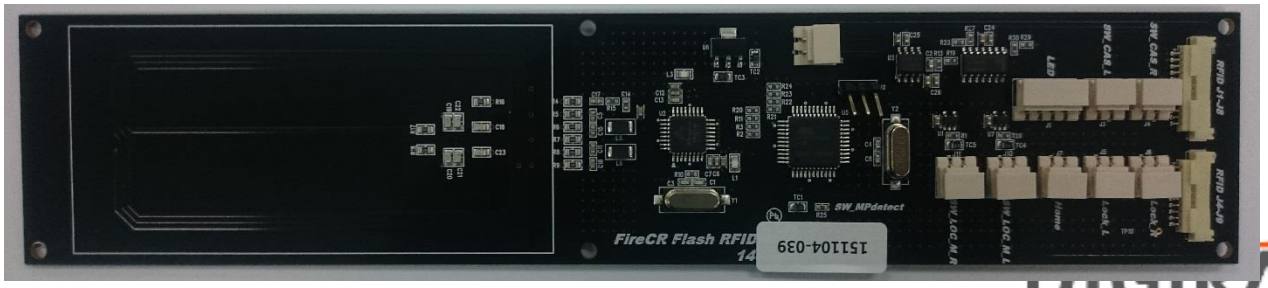
❖ FireCR Spark versus FireCR Flash

- **RFID board**





❖ FireCR Spark versus FireCR Flash

Add new boards

Front board & Inter connect board

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