Abnormal PLT-H result

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Summary

Case Background

Problem detail :

- Distributor perform study of PLT-H. They find out one sample with PLT-H is much higher than PLT-I. After that, they re-run the sample on RET channel. They also check the smear. Finally, PLT-O, PLT-I and smear result are similar while PLT-H is incorrect.
- 2. General parameter: Other PLT parameters are in the normal range. WBC increase, RBC flag...
- 3. Overall checking of machine, reagent, IQC, other samples results... indicates that testing

condition is good. This problem may happen randomly.

- 4. The patient medical record is unclear
- 5. Visual inspection of sample shows no problem

Sample reading: Multiple PLT channel comparison

Patient Information	\otimes	STAT	Para.	Flag	Result	Delta(#)	03-24	03-05	Unit	^ RBC	PLT		WBC	Flag	Count	%
Name: LYE LUK MOI Gender: FEMALE Age: 70Year(s) Patient ID: 530605025488 Sample Mode: WB Test Panel:			Mon#		0.47	0.280	0.19	0.55	10^3/uL	RBC	PLT		Segmented neutrophils		169	56.4
			Eos#	R	0.00	-0.020	0.02	0.32	10^3/uL				Band neutrophils	1.1	75	25.0
			Bas#	RH	0.78	0.760	0.02	0.02	10^3/uL				Lymphocytes	L	16	5.3
			IMG#		0.24	0.020	0.22	0.03	10^3/uL				Monocytes		10	3.3
			Neu%	RH	88.5	26.30	62.2	65.1	%	0 100 2	00 fL 0 10	20 30 fL	Metamyelocytes	1.1	28	9.3
			Lym%	L	5.9	-29.90	35.8	27.1	%	DIFF	⊕ WNB	\oplus	Myelocytes		2	0.7
D+300WBC+RBC+P	T+PL		Mon%		2.1	0.50	1.6	4.8	%	DIFF	wNB		Non-WBC	Flag	Count	%
epartment:			Eos%	RL	0.0	-0.20	0.2	2.8	%				Giant platelets		2	
			Bas%	RH	3.5	3.30	0.2	0.2	%			Section 2	Large platelets		10	
Diagnosis:			IMG%		1.1	-0.80	1.9	0.3	%		<u>é</u> 111		Smudge cells		10	3.3
			Neu-X	R	463.6			398.6					Artefacts		9	
			Neu-Y	R	604.7			501.7			55	FL	RBC	Flag	Grade	%
			Mon-X		261.8			217.1					Anisocytosis	1	2+	15.5
Comments 🛱 🖁	E 52		RBC		4.50	-0.930	5.43	5.36	10^6/uL				Microcytes	1	3+	29.3
	. , кя		HGB	L	9.0	-1.40	10.4	10.5	g/dL				Hypochromic cells	1	2+	11.8
			HCT	L	28.1	-6.90	35.0	34.0	%				Poikilocytosis	1.1	3+	
			MCV	L	62.4	-2.10	64.5	63.5	fL				Schistocytes	1.1	3+	5.9
			MCH	L	20.1	1.00	19.1	19.6	pg				Elliptocytes	1	2+	5.7
			MCHC		32.0	2.30	29.7	30.9	g/dL				Ovalocytes	1	2+	25.0
ule Record	X		RDW-CV	н	16.3	-0.50	16.8	16.4	%				PLT	Flag	Recult	
			RDW-SD		37.3	-1.90	39.2	38.4	fL	Flag		\times	Platelet clumps	1	0	
			Micro%	н	52.9	-0.60	53.5	47.4	%	- Immature G	ran?		PLT estimation		146	7043
			Macro%		0.6	-0.80	1.4	0.4	%	- Basophilia						/
			PLT	&RH	745	556.0	189	308	10^3/uL	 Neutrophilia Leucocytosi 						
			MPV	R	10.4	0.00	10.4	9.7	fL	- Microcytosi						
			PDW	R	15.5	-0.20	15.7	15.8		- PLT Clump?	!-					
			PCT	R	7.75	5.780	1.97	3.00	mL/L	- Thrombocyt - PLT-H Histo						
			P-LCC	R	262	199.0	63	86	10^9/L							
			P-LCR	R	35.2	2.10	33.1	27.8	%							
			PLT-I	R	133	-56.0	189	280	10^9/L							
			PLT-H	RH	745			308	10^9/L	Expert Tips		\otimes				
			NRBC#		0.000	0.0000	0.000	0.000	10^3/uL	ිස Sample Pro	ocedure 2					
			NRBC%		0.00	0.000	0.00	0.00	/100WBC	-0 oample Pit	200010	Validation	Review Mor			

Patient Information	\otimes	STAT	Para.	Flag	Result	Delta(#)	03-24	03-05	Unit	^	RBC	PLT	WBC	Flag	Count	%
Name: LYELUK MOI			IMG%		0.3	-1.60	1.9	0.3	%		RBC ,	PLT	Segmented neutrophils		169	56.4
Gender: FEMALE			Neu-X	R	464.7			398.6					Band neutrophils	1	75	25.0
Age: 70Year(s)			Neu-Y	R	601.0			501.7					Lymphocytes	L	16	5.3
Patient ID: 53060502	5488		Mon-X		253.1			217.1					Monocytes		10	3.3
Sample Mode: WB			RBC		4.54	-0.890	5.43	5.36	10^6/uL		0 100 200 fL	0 10 20 30 f	Metamyelocytes		28	9.3
Test Panel:			HGB	L	9.1	-1.30	10.4	10.5	g/dL		DIFF 🕘	RET @	Myelocytes		2	0.7
DR+300WBC+RBC+R	PLT+P		HCT	L	28.3	-6.70	35.0	34.0	%	1	DIFF	RET	Non-WBC	Flag	Count	%
T-Pro			MCV	1	62.3	-2.20	64.5	63.5	fL	- 1			Giant platelets		2	
Department:			MCH	1	20.1	1.00	19.1	19.6	pg	11		in in the	Large platelets		10	
Diagnosis:			MCHC	-	32.2	2.50	29.7	30.9	g/dL		200	ALL STREET, ST. THE	Smudge cells		10	3.3
			RDW-CV		16.2	-0.60	16.8	16.4	%	11			Artefacts		9	0.0
			RDW-SD		37.2	-2.00	39.2	38.4	fL			La transfer	RBC	Flag	Grade	%
			HDW		43.0	-2.00	33.2	50.4	g/L		\$5	FL	Anisocytosis		2+	15.5
			HYPO-CH%						%		WNB 🕘		Microcytes		3+	29.3
Comments 🗒 🕅			MYPER-		0.0				%		WNB		Hypochromic cells		2+	11.8
			CH% Micro%		53.1	-0.40	53.5	47.4	%	. 11			Poikilocytosis		3+	11.0
			Macro%	- 7	0.4	-0.40	1.4	0.4	%	11					3+	5.9
				-		-1.00	1.4	0.4					Schistocytes			5.7
			MCHm		19.2			0.0.0	pg	11			Elliptocytes		2+	
			PLT	&RL	130	-59.0	189	308	10^3/uL				Ovalocytes		2+	25.0
Rule Record	\otimes		MPV	R	11.0	0.60	10.4	9.7	fL	112	PL.		PLT	Flag	Result	
			PDW	R	15.8	0.10	15.7	15.8			Flag	\times	Platelet clumps		0	
			PCT	R	1.43	-0.540	1.97	3.00	mL/L		- Left Shift?		PLT estimation		147	10^3/
			P-LCC	R	50	-13.0	63	86	10^9/L		 Neutrophilia Leucocytosis 					
			P-LCR	R	38.7	5.60	33.1	27.8	%		- Ecologiusia - Fragments? - Microcytosis - PLT Ciump? - PLT Histogram Abn. - PLT-H Histogram Abn.					
			IPF	R	4.8				%							
			PLT-0	R	130				10^9/L							
			PLT-I	R	130	-59.0	189	280	10^9/L			L.:				
			PLT-H	RH	726			308	10^9/L							
			IPF#	R	6.2				10^9/L							
			RET#	L	45.4				10^9/L				1			
			RET%		1.00				%		Expert Tips	X				
			IRF		10.2				%		Sample Procedure	A To Manual				
			LFR		89.8				%		-0 sample rissedule	25 Validation	Review Mo	phology	Results	
											C Refresh Sample	E Adjust test nanel				

Ideas

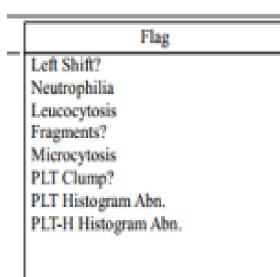
Background

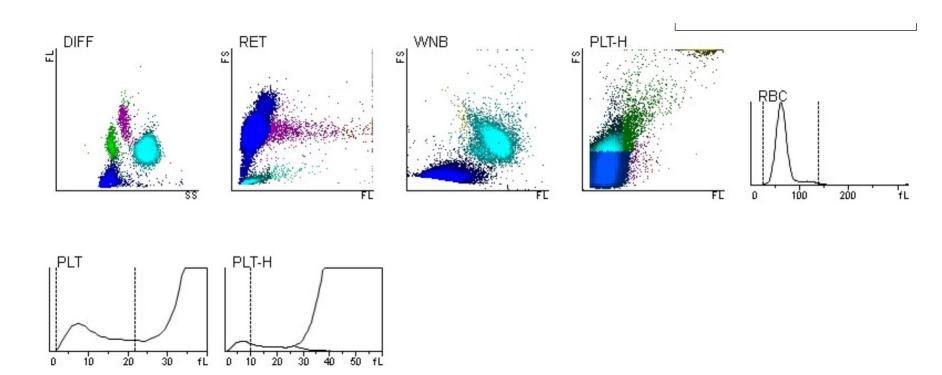
Solution

Summary

Test panel: CD+morphology check PLT-H >> PLT-I ~ Morphology result Test panel: CDR+morphology check PLT-H >> PLT-I ~ PLT-O ~ Morphology result

Sample reading: Flags and Graphs





Background

Ideas

Solution

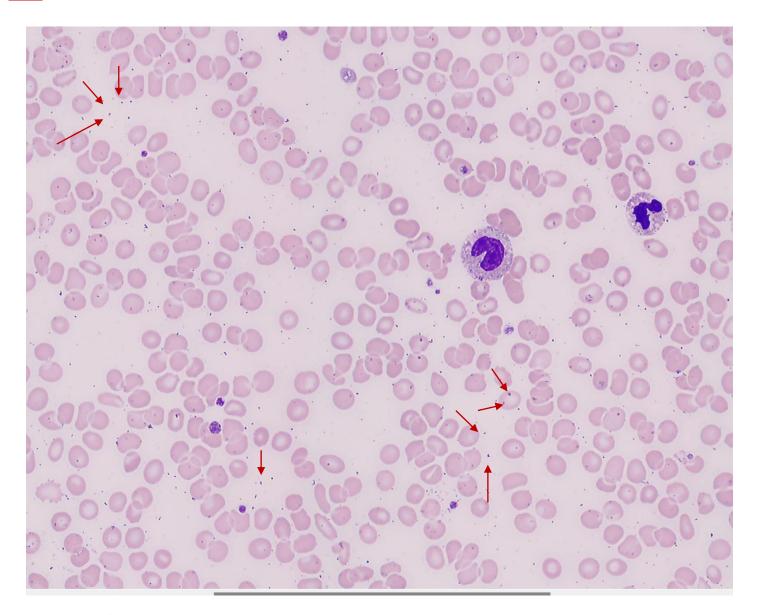
Summary

Observation:

- 1. PLT and PLT-H histogram are abnormal, PLT clump
- 2. PLT-I threshold is ~20fL, PLT-H threshold is >30 fL > result difference

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Sample reading: Smear image



Red arrow: Which event? Batch staining quality or contamination

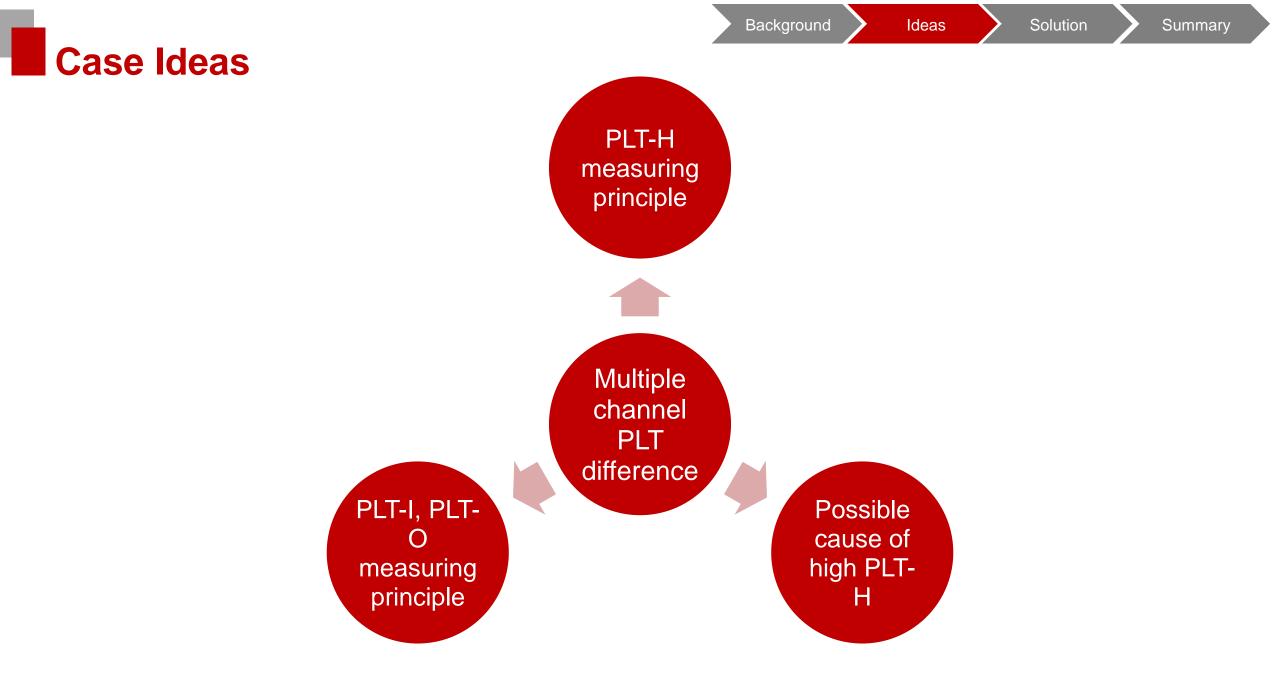
Ideas

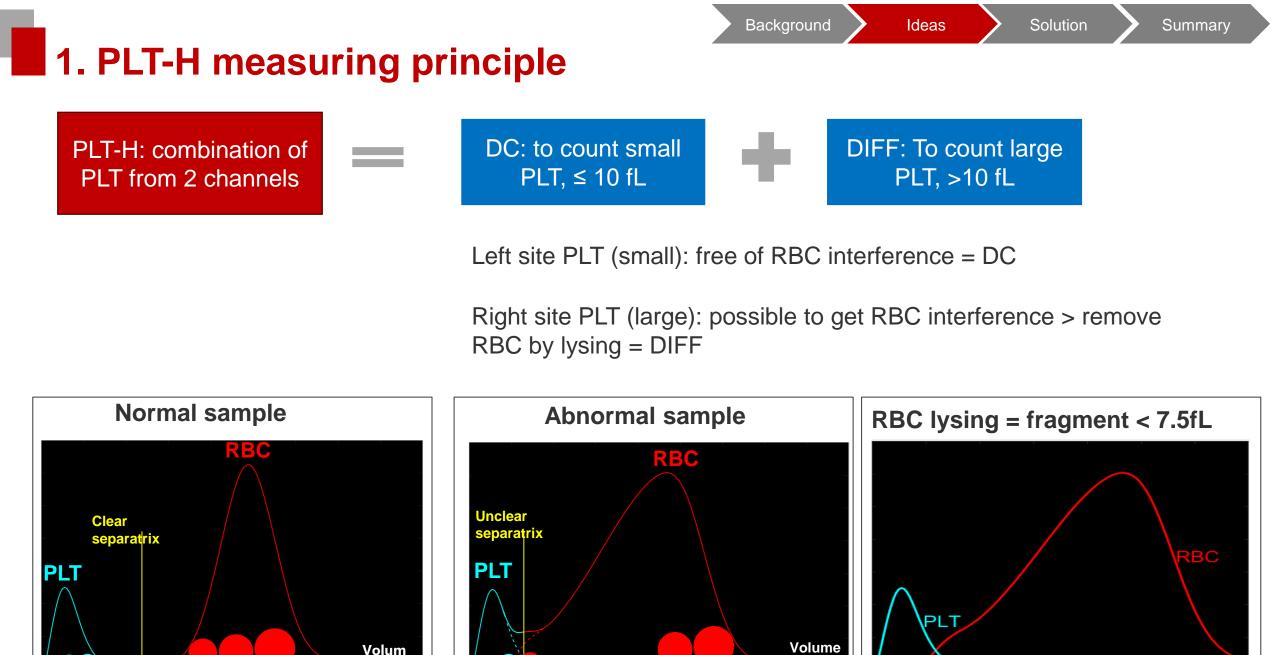
Background

Solution

Summary

- Since we only obtain the smear image of this sample > cannot go studying deeply > it is impossible to conclude which event is
- Small size particle > may not affect directly to PLT-H counting but there might be large particle that we miss out or any side effect of that "small event"



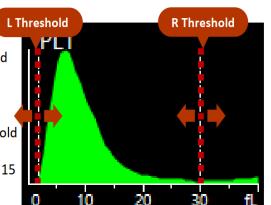


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PLT-I and PLT-O measuring principle

PLT-I parameter: impedance method

- PLT counting area, all the particles that measured between L and R thresholds.
- Left threshold : the L threshold moving range is between 0-2 fL to find the first particle of PLT
- Kight threshold : the R threshold will search for the lowest point between PLT and RBC peak within 15 ~ 32 fL



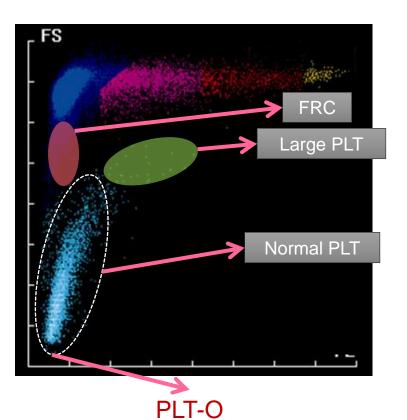
PLT-O* parameter **Optical + Fluorescence** measurement + anti-clump technology

Ideas

Background

Solution

Summary



Ideas

Solution

Common interference factors of PLT

Which PLT channel can solve those interference?

Common interfe	rence substances	PLT-I	PLT-H	PLT-O
PLT reported	PLT clump			٧
Falsely low	Large/giant PLT		V	V
	Microcytosis		V	V
PLT reported	RBC fragment		V	V
Falsely high	WBC fragment		V	V
	Cryoglobulin		?	٧

- *PLT-O is most reliable results to report on the final report.*
- However, still need combine with microscopic results

False high PLT-H

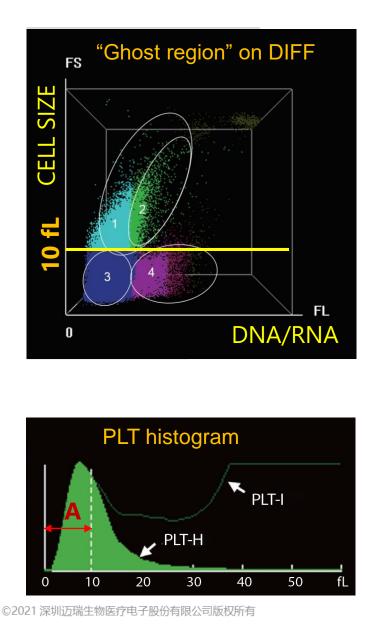
(1+2)

and IPF

PLT

H → Large

Small PLT (A)



PLT-H can solve most RBC interference, how about other factor?

If PLT-H is falsely increased:

Ideas

1. Interference in region 1 and 2 – Any particles, which

character is similar as *large PLT and IPF* (size > 10fL)

- Non-lysing RBC/fragment of RBC, nucleated cell
- Bacteria/fungi/Cryoglobulin/lipid/ disease (leukemia,

lymphoma..)

- Foreign subject (from tube, environment?)
- 2. Machine reading problem

mindray迈瑞

Summary

Background Ideas Solution Summary

False high PLT-H root cause

R&D analysis and solution:

- 1. No problem of machine reading for this sample
- 2. The root cause could be interference but cannot identify which type of interference is
- 3. Upcoming plan for software update



Solution

Short-term action: set the re-exam rule

- Set system flag rule to exclude abnormal sample check, system error.. (aspiration abnormal/clot...)
- Panic value check rule for parameter with value is out of clinical range: e.g. PLT < 50 or PLT > 500-600 (*10^9/L)
- Set Parameter/Flag check: out of reference range + self-definitive flag + suspected flag: e.g, RBC+PLT related flag and low/high count
- 4. Set range delta check to exclude pre-analytical error...
- ⇒ Re-exam mode for PLT: Smear, run on CDR/CR mode
- ⇒ Or PLT-H abnormal histogram: check sample by decision
- \Rightarrow ([PLT-H]-[PLT-I])/[PLT-H]>30%, could automatic

reflux PLT-O

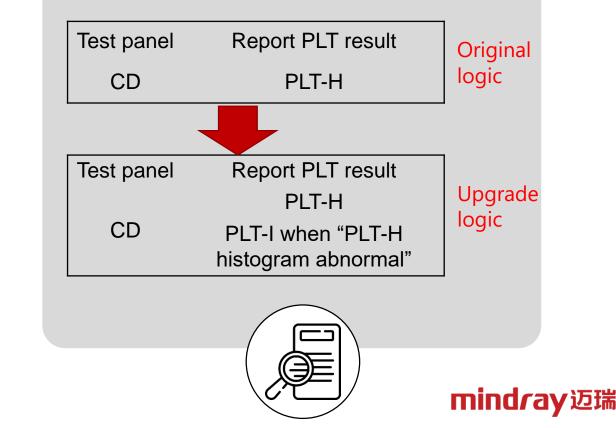


Long-term action: HQ further investigation

Ideas

Background

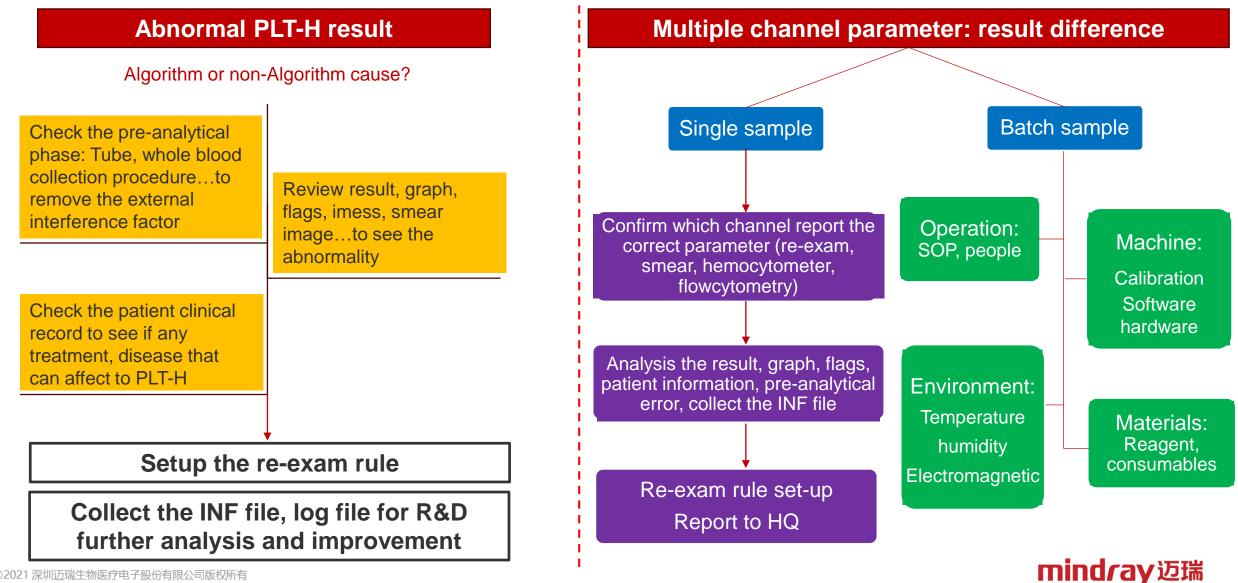
Collect the INF file, log file of normal sample and abnormal sample and send to HQ for analysis for **software upgrade**



Summary

Summary:

Ideas



Thanks!

