





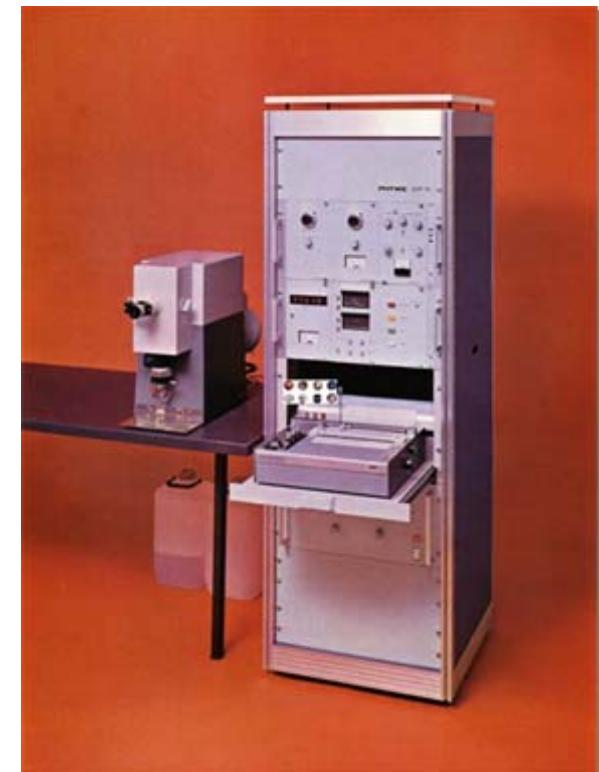
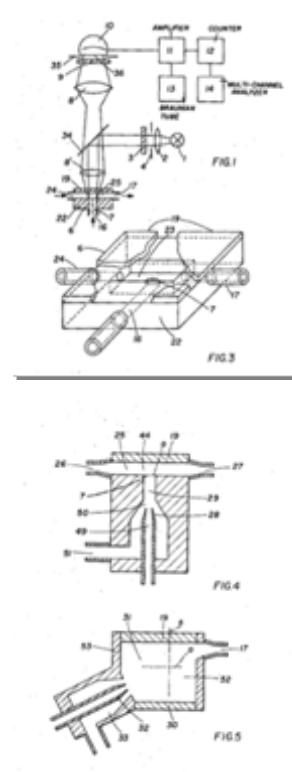
1967



2011

THE POWER OF 40 YEARS FLOW CYTOMETRY
From the first fluorescence-based FCM instrument
to the newest FCM Technologies for dedicated applications

The Birth of Fluorescence-Based Flow Cytometry



First Patent on Flow Cytometry: DE1815352 (1968)
ImpulsCytoPhotometrie
 Dittrich and Göhde, University of Münster

First Flow Cytometer: ICP 11
 Distributed by Phywe

First Applications performed with the ICP 11

The first applications covered by the ICP 11 have been (already in the years 1968-1972):

for research in:

- | pathology
- | quantitative cytology
- | gynaecology
- | haematology
- | radiology
- | cancer research
- | pharmacology
- | biophysics & molecular biology
- | oncology
- | dermatology
- | cell and proliferation kinetics

and in the clinical field, e.g. for:

- | differentiation of normal and neoplastic cell populations
- | prescreening of vaginal and cervical smears
- | leukemia
- | therapy control of skin tumours

Between 1969 and 1972, pulse cytophotometry by using the ICP 11 system was presented at 54 conferences and congresses in Europe, the US, Japan, and Brazil.

1973: First FCM applications in Plant Flow Cytometry

1974: Reference Method for Milk Quality Control in Switzerland (ETH Zürich)



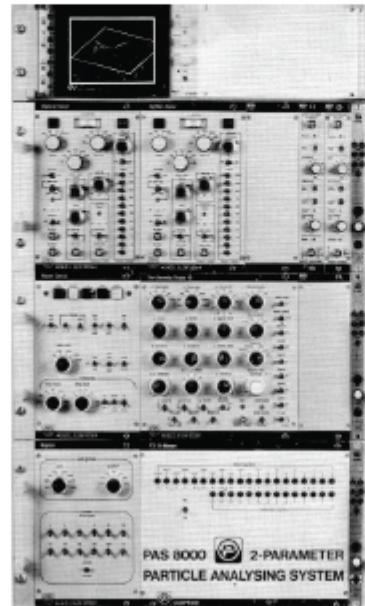
The Evolution of Fluorescence-Based Cytometry

Subsequently introduced fluorescence-based FCMs: Cytofluorograph (1971) from Bio/Physics Systems Inc. (later: Ortho Diagnostics), the PAS 8000 (1973) from Partec, the first FACS instrument from Becton Dickinson (1974), the ICP 22 (1975) from Partec/Phywe and the Epics from Coulter (1977/78). Using a sublicense from Phywe, Ortho introduced the ICP 22A in 1977. The PAS-II from Partec followed in 1979. Despite the significant potential of flow cytometry, only a relatively small number of manufacturers entered the field of which the majority exited relatively soon, including Ortho, Leitz, Skatron, BioRad, Heka, Bruker, and Showa Denko.

Cytofluorograph (1971)



PAS 8000 (1973)



FACS Instruments (1974)



ICP 22 (1975)



ICP 22A (1975)



Coulter EPICS V (1977/78)



PAS-II (1979)



Pictures of the Cytofluorograph and EPICS Courtesy of J. Paul Robinson, Purdue University

Company Introduction



- Partec Headquarter located in Münster/Germany (est. 1968)
 - + 100% privately held company with > 100 employees
 - + research, development, production, marketing, worldwide distribution % activities
 - + certified quality management system
 - + DIN EN ISO 9001:2000, DIN EN ISO 13485:2003, cGMP, CE, GS, TÜV
 - + Products are offered under in vitro diagnostic directive (IVDD) 98/79/EG
- Partec Group: Partec Flow Cytometry, Partec OEM (Münster) • Partec Essential Healthcare, CyTecs Components Technology (Görlitz) • Quantum Analysis (Münster)
- Subsidiaries in France, The Netherlands, United Kingdom, Italy, Japan, West Africa, East Africa, Central Africa, Southern Africa and a worldwide distributor network
- Mission: Innovative Cell Analysis Technologies & Dedicated FCM
- Installation Base: > 2000 FCM instruments worldwide (2006)

Healthcare:

- Immunology
- Stem Cell Counting
- Pathology
- Cell Culture
- Apoptosis
- Sorting



Partec Flow Cytometry

Microbiology:

- Bacteria
- Biotechnology
- Yeast
- Virus & Submicron Particle Detection
- Research

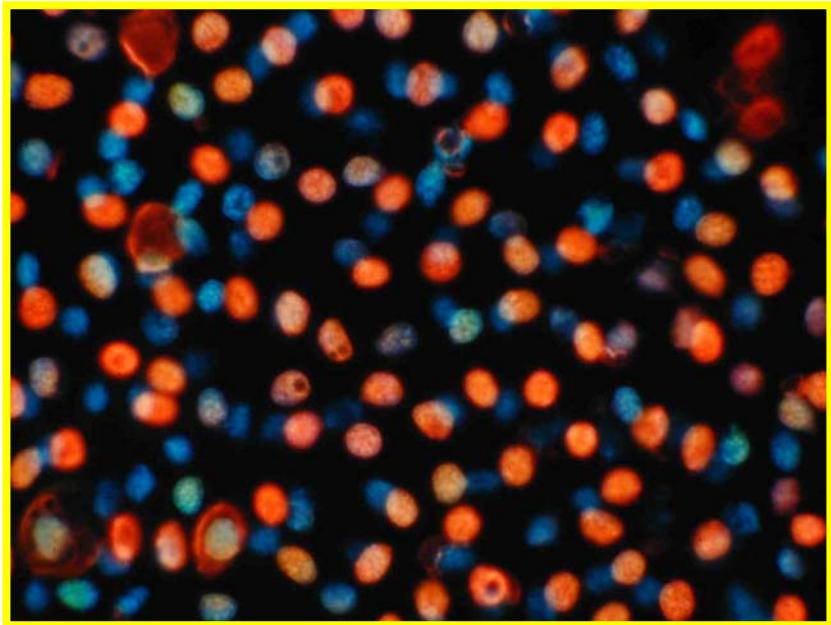
Agrosciences:

- Agrosciences
- Animal & Wildlife Research
- Aquaculture
- Plant Breeding

Industrial Applications:

- Food & Beverages
- Milk & Dairy Products
- Personal Care
- Pharmaceuticals
- Paper

螢光顯微鏡用來判定
細胞濃度及
螢光強弱細胞的數量比例



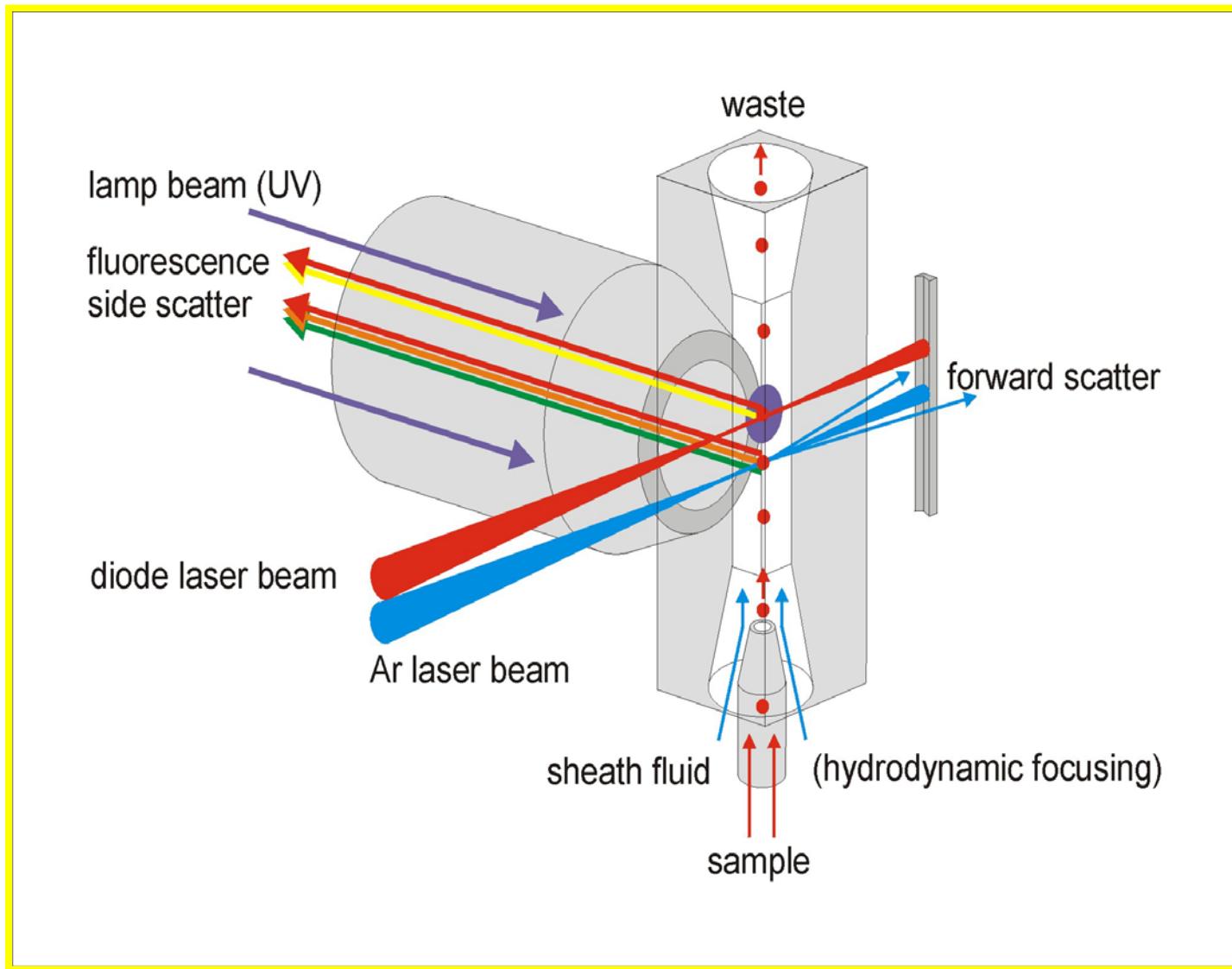
- 因個人眼睛對螢光強弱的靈敏度不同，而容易有主觀的判定
- 數百顆細胞來分析、統計學上不夠客觀
- 一顆一顆計算非常的費時
- 眼睛容易疲勞而誤判

主辦單位想知道，來欣賞演奏會觀眾中來賓的性別統計資料及人數，站在台上數明顯不可能。

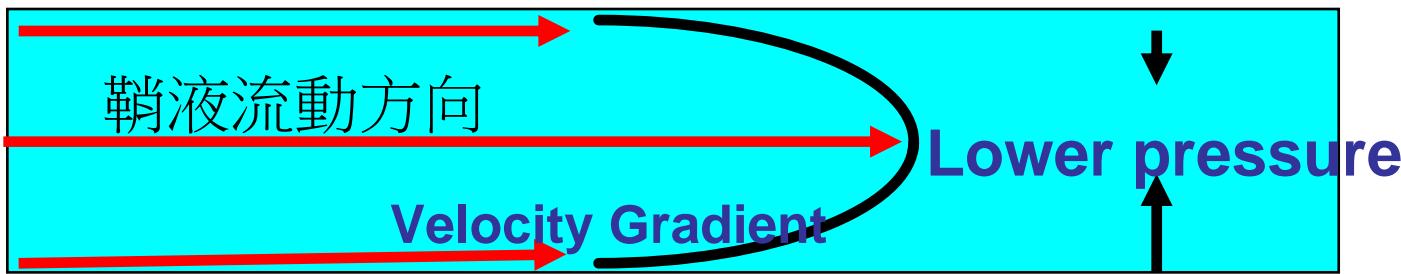
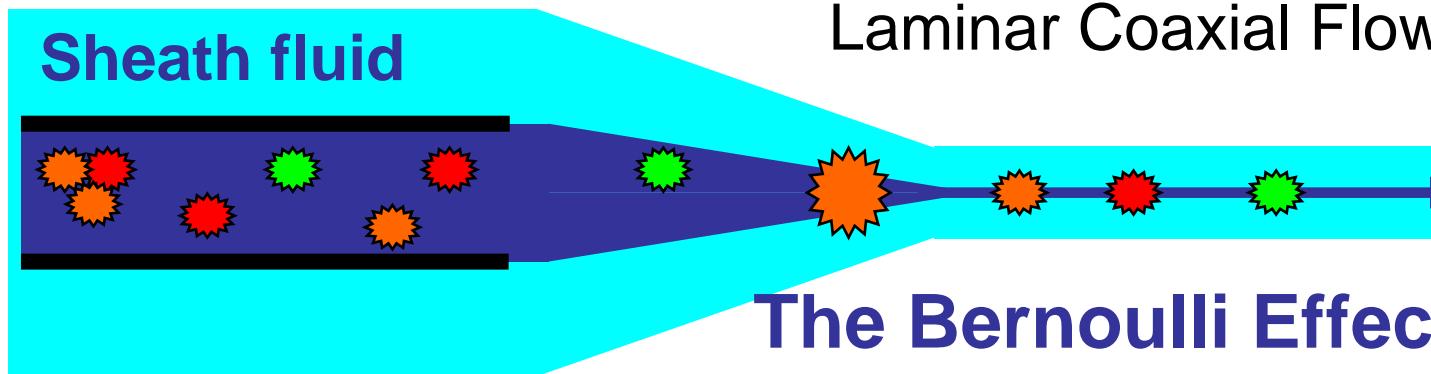


在入口處裝設

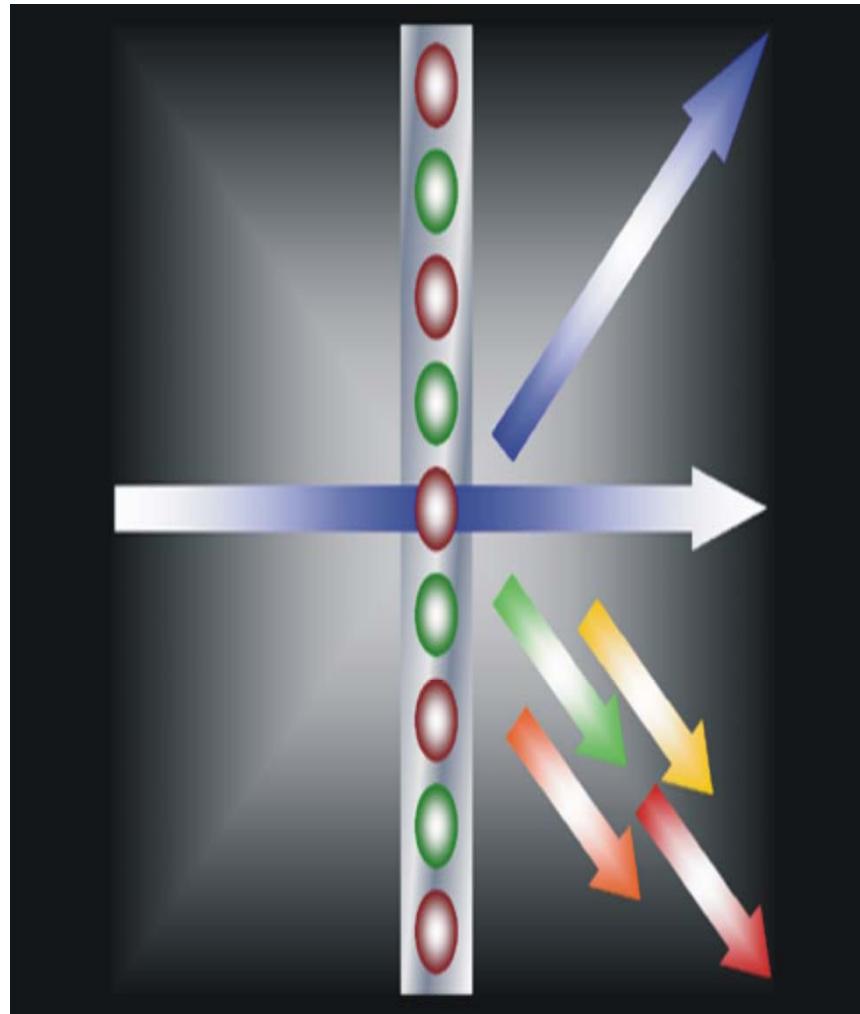
- 一個光學高度計
- 一個磅秤
- 一個紅光、綠光與橘光偵測器及計數器
- 並在入口處分發螢光棒
 - 男生拿綠光
 - 女生拿紅光
 - 有人認為不一種可以拿橘光
- 讓來賓漁貫進入...
- 最後一個客人進入時，全部資料也得到了



Hydrodynamic Focusing



石英管璧摩擦阻力將細胞往中間低壓區推



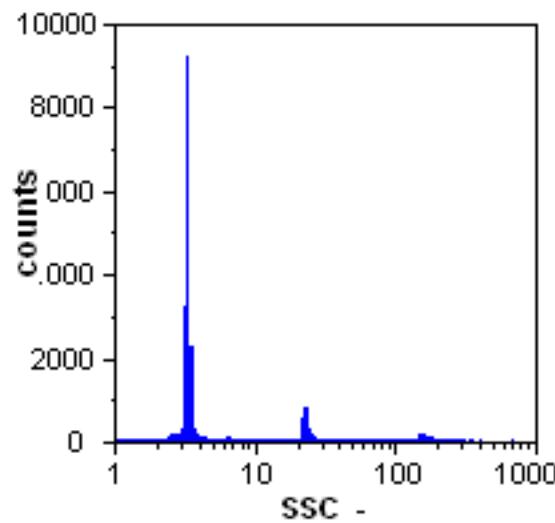
SSC:
側面散射光 Side Scatter
大角度散射代表細胞表面顆粒性(Granularity)及內部細胞質密度

FSC:
正前方散射 Forward Scatter
細胞顆粒大小(Size)

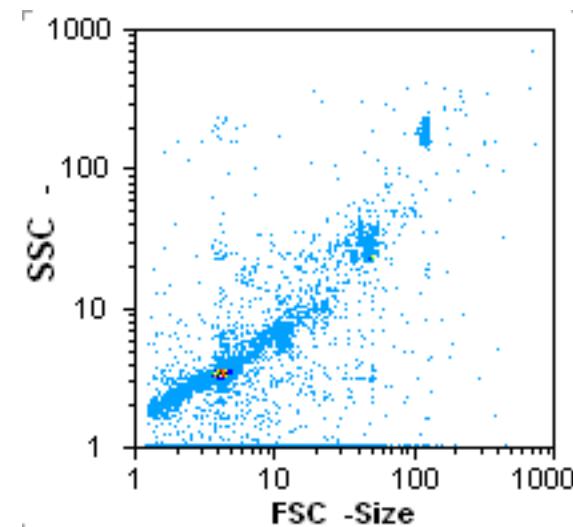
Fluorescence 螢光散射
細胞上螢光物質散射之訊號

Data display options

Histogram



Dotplot



Is 7 Decades Necessary?

0-10 MESF	10-100 MESF	100-1,000 MESF	1,000-10,000 MESF	10,000-100 ,000 MESF	100,000-1,000,000 MESF	>10,000,000 MESF
1	2	3	4	5	6	7
		1	2	3	4	

1. 流式細胞儀分析極限，視螢光約在 100 MESF，很多電子零件雜訊強度都高於此一極限。
2. 生物細胞可以染上單株抗體或可負載之螢光分子，鮮少超過 1,000,000 MESF
3. 因此絕大多數之流式細胞儀設計上以 4 個 Log Decade 為主。

Partec True Volumetric Absolute Counting (TVAC) feature

What can I quantify the cell concentration?

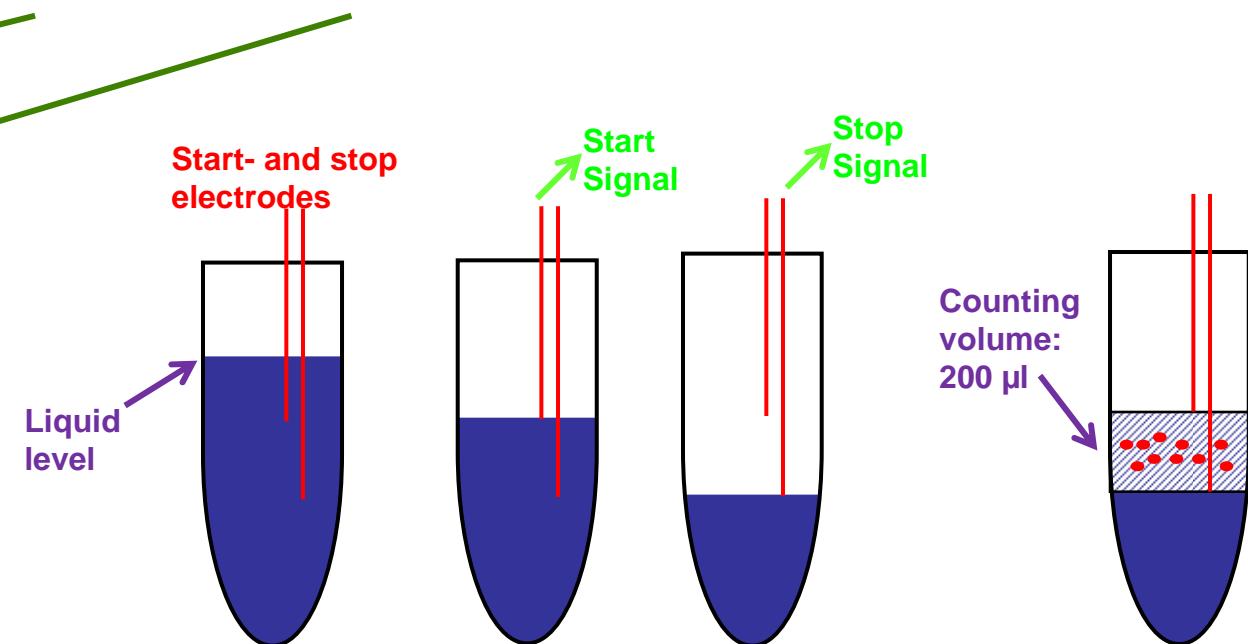
→ Beads method: indirect, additional handling steps, running costs

→ Partec True Volumetric Absolute Counting (TVAC): direct, no handling, no costs

Principle: Concentration = **Cell Number / Volume**

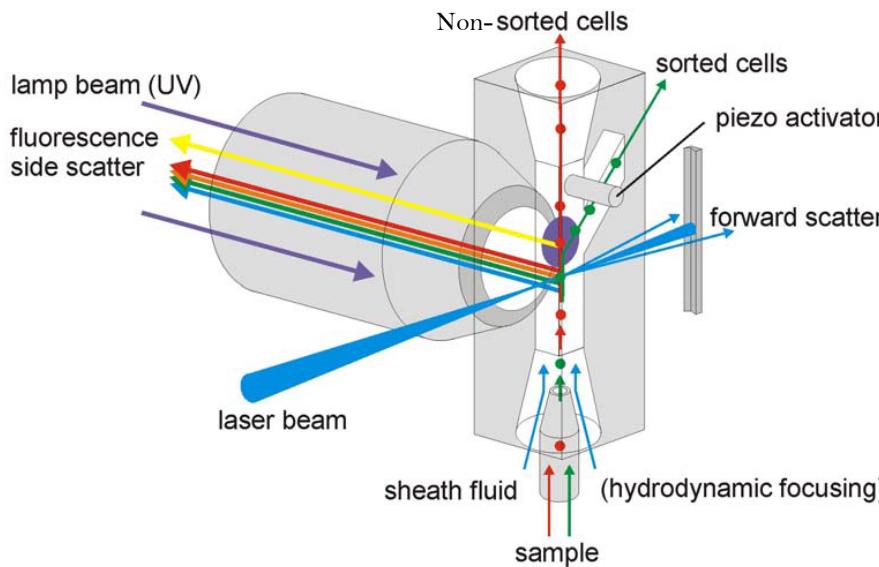
Detected by scatter /
fluorescence signals of the
cells

Based on geometry



CyFlow Sorter

Partec Particle and Cell Sorter PPCS



- **General:**

- Add-on option for CyFlow® space
- Built-in module for safe closed Piezo sorting
- No environmental contamination, no aerosols
- Sterile sorting possible
- Due to relatively low pressure differences the morphology and viability of the cells are not influenced

- **Software:** FloMax 2.5

- **Laser Spots:** maximum of 2 laser spots

- **Sorting flow cell:** completely closed quartz type flow cell with 200 µm sorting channel for particle sizes up to 60 µm diameter (other sorting channel dimensions optional)

- **Sorting speed:** Input of up to 100,000 cells/sec, output for highest purity (99%) of sorted fraction up to 300 cells/sec

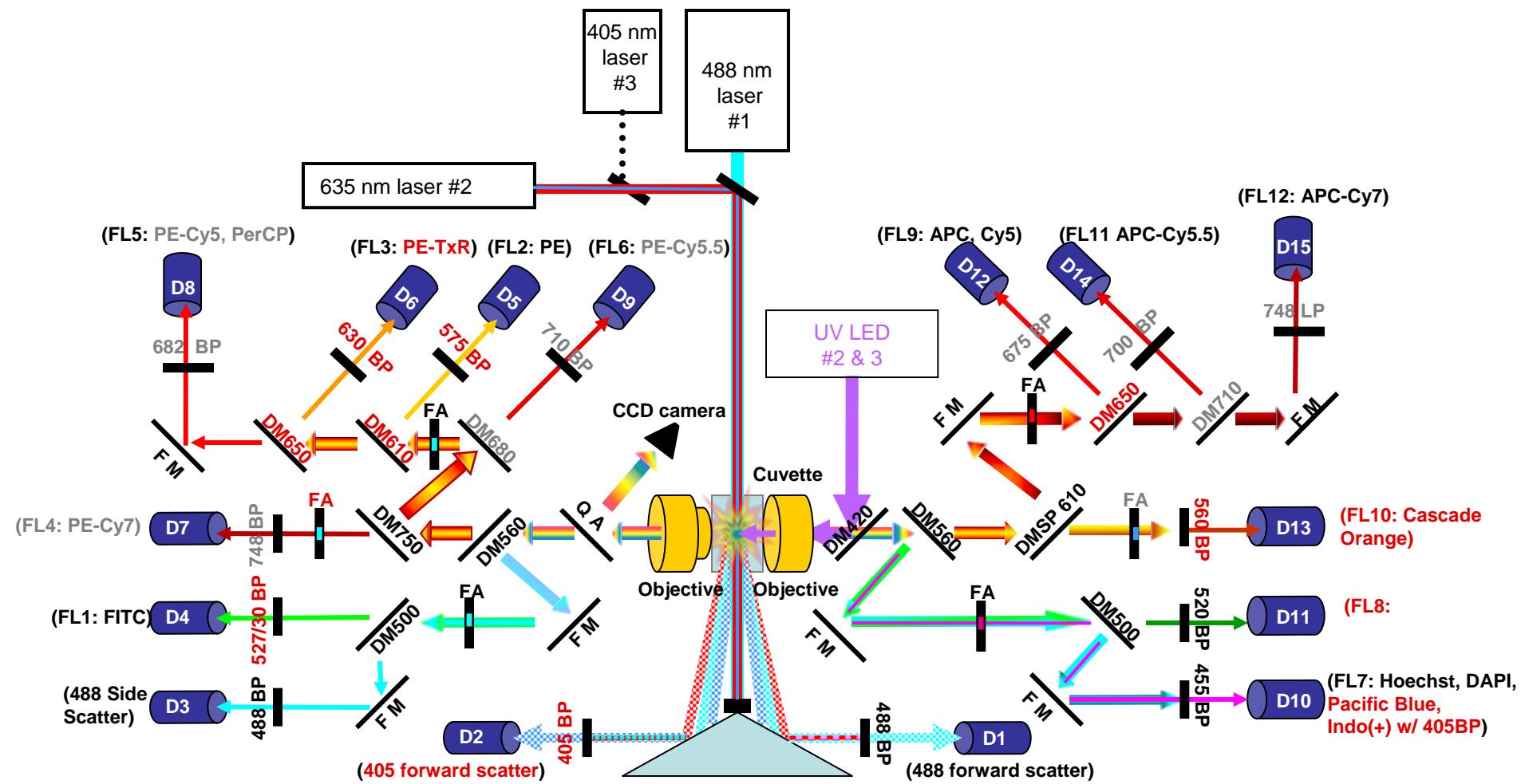
CyFlow® ML



The Benchmark FCM System for High-End Research in any Application

- **4 to 5 Light Sources:**
3 Laser Configurations, including
200 mW @ 488nm (!) Solid State Laser
50 mW @ 407 nm Solid State Laser
40 mW @ 640 nm red diode laser
Additional Laser Options: UV 375 nm, Green 532nm, Yellow 561 nm
100 W UV Lamp/UV LED for DNA Analysis (DAPI, Hoechst)
- **16 Optical Parameters:** 2 x FSC, SSC, FL1 - FL13
- **True Volumetric Absolute Counting**
- **New Era of Single Molecule Sensitivity:**
< 100 MESF (FITC), <50 MESF (PE)
- **New Era of Scatter Resolution:**
< 200 nm particle size
- **Stand-Alone System with small Footprint:**
56 x 65 x 30 cm (LxDxH)
- **Upgrade options:**
Autoloader

CyFlow® ML Optical Bench Layout





Key specifications

High-performance, bench-top design with fully-integrated fluidics, built-in PC and a 19" TFT monitor

- Choice of 488, 638, 407, 355, 375, 532, 561, 594, 785 nm lasers
- Optional high power 365 nm UV LED for highest resolution DNA analysis with CV < 1%
- Superior fluorescence sensitivity: <= 100 MESF (FITC), <= 50 MESF (PE)
- Down to nanotechnology: superior small particle detection > 50 nm
- Flexible and modular CyFlow® Cube system configurations
- Optional sorter function for closed, non-destructive, non-hazardous cell and particle sorting
- Optional CyFlow® Robby autoloader for well plates and tubes

90% of all flow cytometry applications include up to 2 light sources and 6 parameters

The CyFlow® Cube is presented as the working horse of Partec flow cytometry

General



Dedicated



CyFlow® Cube 8 and CyFlow Sorter

Instrument Design:

Optical bench: 2-fold fluorescence collection efficiency



Configuration with up to 8 optical parameters—8 colors



Configuration with CyFlow® Sorter and 5 optical parameters



Excitation flexibility: up to 4 light sources simultaneously
(available wavelengths see table below)

Dual optical bench
(8 detectors)

Optical bench +
Sorter (5 detectors)

Laser Selection
(any choice....)
And UV LED

CUBE 6

High Performance
2 Laser 6 Parameter
4 Color Flow Cytometer
with UV LED Option

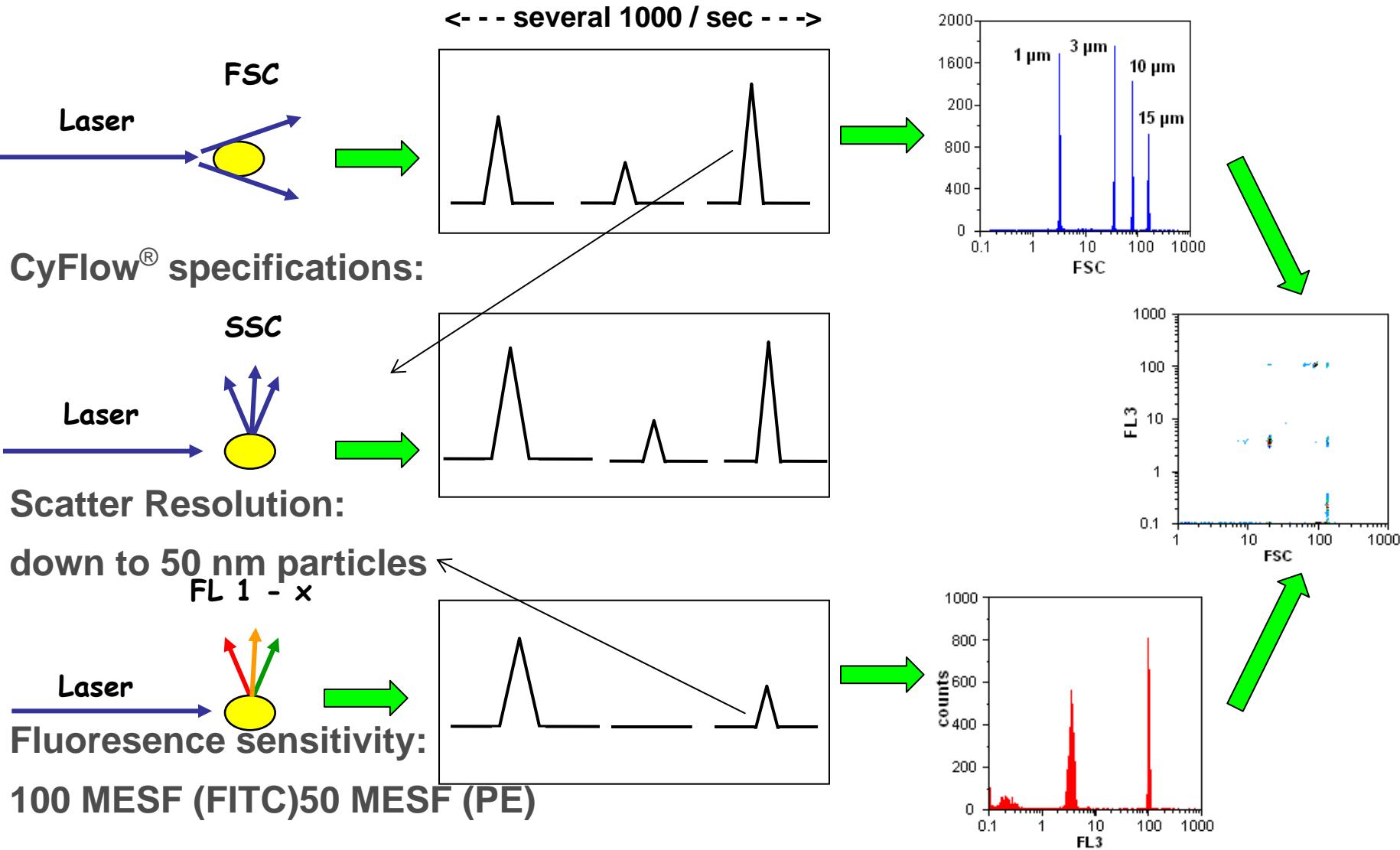


Single optical
bench
→ 6 Detectors





Instrument type	Cube 6	Cube 8
Laser light sources	2	3
UV - LED	yes	yes
Maximum Parameters	6	8
Maximum Fluorescences	4	6
Autoloader Robby	yes	yes
Sorter module	no	yes



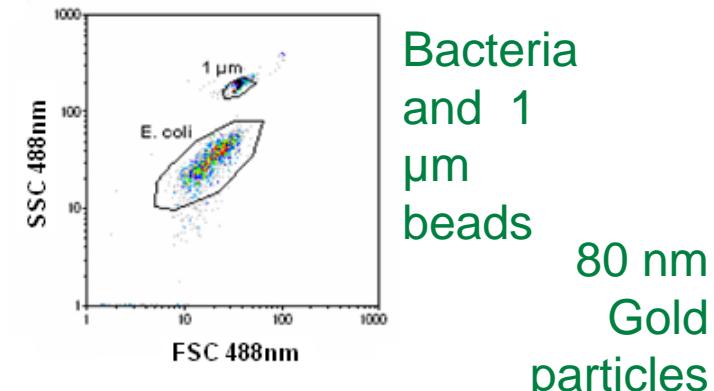
CyFlow® specifications:

Scatter Resolution:
down to 50 nm particles

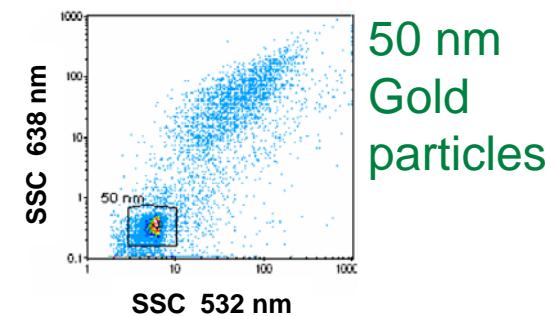
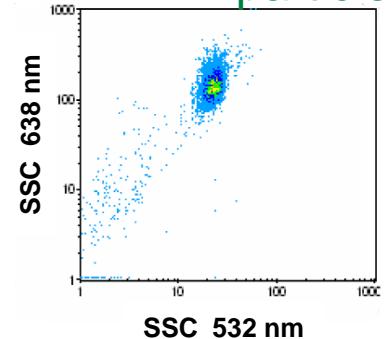
Fluorescence sensitivity:

100 MESF (FITC)

50 MESF (PE)



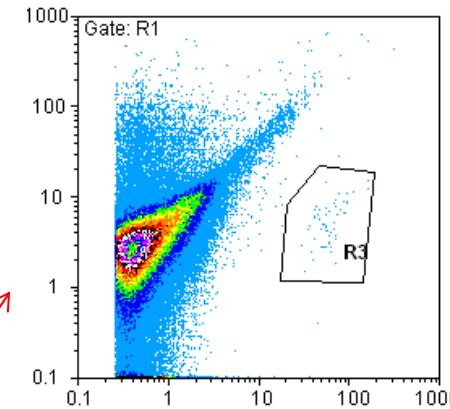
80 nm Gold particles



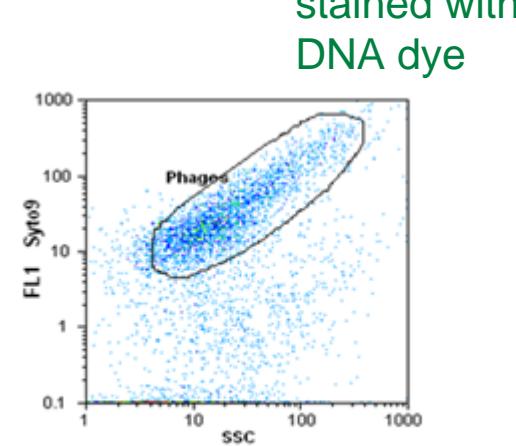
CyFlow® specifications:

Scatter Resolution:
down to 50 nm particles

Fluorescence sensitivity:
100 MESF (FITC)
50 MESF (PE)



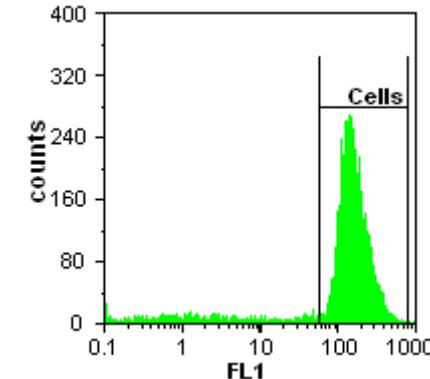
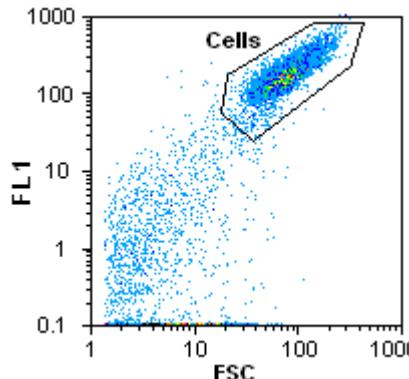
Bacteria
stained
with DNA
dye



Virus
particles
stained with
DNA dye

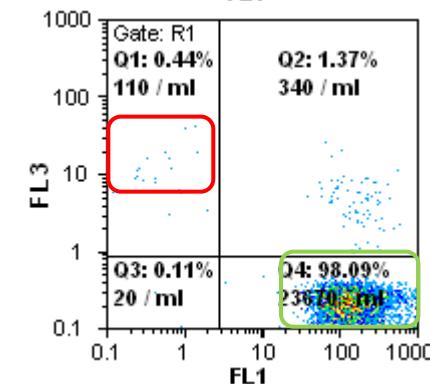
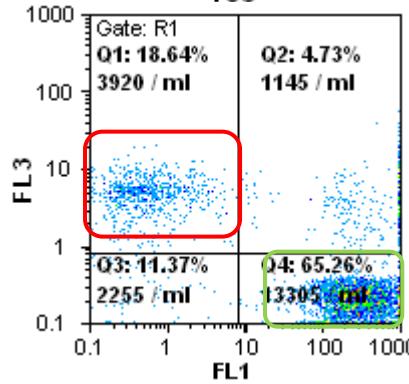
Cell Counting

Based on a DNA dye that penetrates the cell membrane



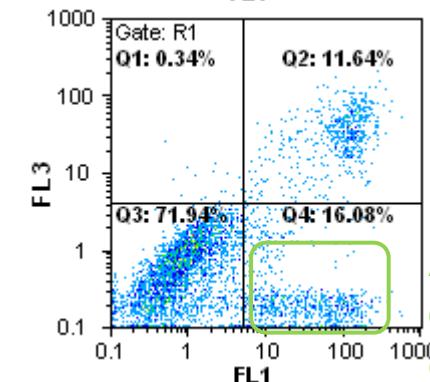
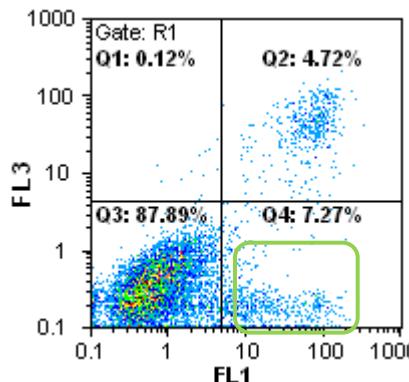
Viability

Based on metabolic activity and PI counter stain



Apoptosis

Based on Annexin V – FITC staining and PI counter stain

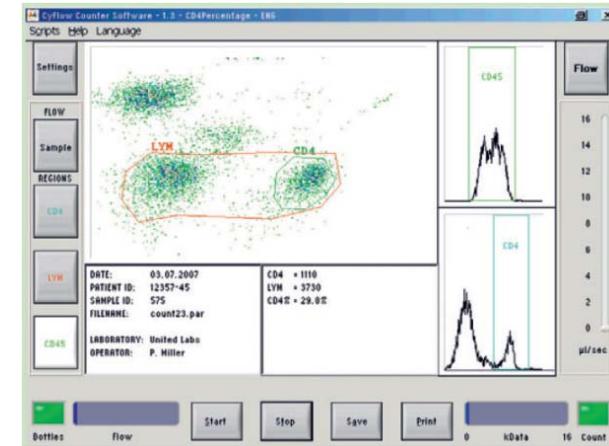


2

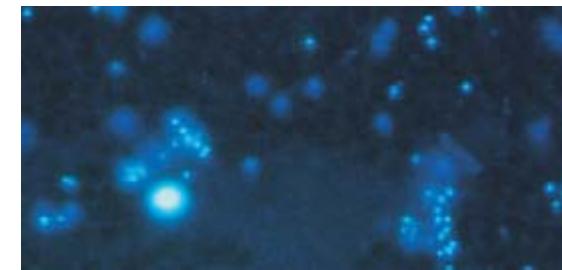


HIV/AIDS

Partec Essential
Healthcare

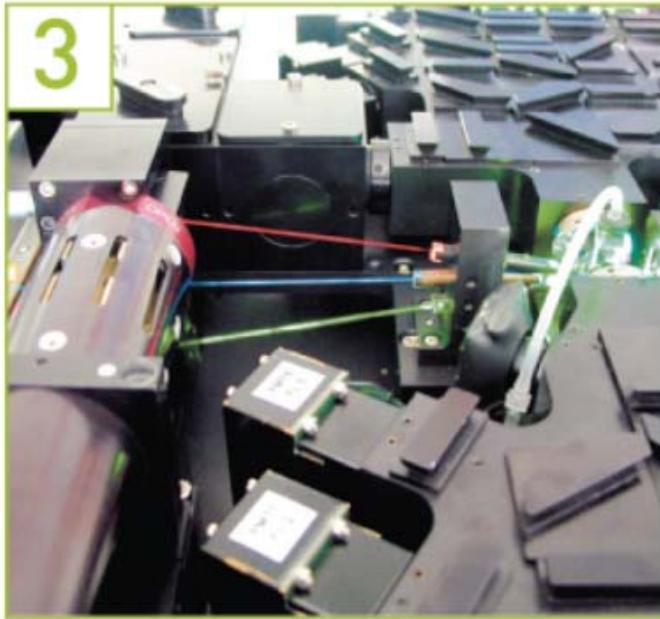


Malaria



Tuberculosis





Partec OEM

Partec is your reliable Original Equipment Manufacturer (OEM) partner!

Wide range of applications:

- Healthcare
- Microbiology
- Agroscience
- Industrial Applications

AES Chemunex:

- Fruit juices
- Beverages
- Cosmetics
- Personal care

Delta Instruments:

- Milk & Dairy Products

Partec 流式細胞儀客戶名單

2011/07

	客戶	使用者	電話	型號
1	基隆水試所水產養殖組	趙乃賢博士	02-2462-2104	PA
2	明生生物科技股份有限公司	江煜勳先生		PA
3	國立屏東科技大學	陳福旗教授	08-774-0371	PA
4	高雄大學生科系	陳文輝主任	07-591-9449	PA
5	邵港生物科技股份有限公司	林學廉先生	02-2298-3508	PA
6	台灣大學 生命科學院	李心予博士	02-2363-0231	SL
7	高雄醫學大學 免疫風濕科	蔡文展醫師	07-312-1101	PAS - Robby
8	清華大學 原科系	彭維義先生	03-571-5131	SL
9	交通大學 生科所	李宗益先生	03-571-2121	SL
10	常春藤生命科技公司	陶先生	02-8200-0203	SL
11	台南水試所海水繁養殖中心	許晉榮博士	06-788-0461	SL
12	國防醫學院 藥理所	林慧卿博士	02-8792-3100	ML
13	輔仁大學 醫學系	林鈺玲教授	02-2905-2000	ML
14	高雄醫學大學 藥理所	羅怡卿 老師	07-312-1101	SL
15	農試所花卉研究中心	莊耿彰 先生	05-582-0822	PA
16	國防醫學院 海底醫學所	萬芳榮所長	02-8792-3100	SL
17	中央研究院地球所	夏復國教授	02-2783-9910	Space
18	清華大學 原科系 同位組	周鳳英教授	03-571-5131	SL
19	聖馬爾定醫院	宋茂林醫師	05-271-7809	ML
20	高雄醫學大學附設醫院	蔡錦蓮主任	07-312-1101	SL
21	弘光科技大學醫護學院	郭志宏老師	04-2631-8652	ML
22	輔仁大學生命科學系	郭育綺教授	02-2905-2000	SL
23	台灣海洋大學	唐世杰所長	02-2462-2192	SL
24	國立陽明大學醫技所	孫光惠教授	02-2826-7228	SL
25	東海大學生科系	胡承波教授	04-2359-0121	SL

	客戶	使用者	電話	型號
26	農業試驗所生技中心	夏奇鋐博士	04-2330-2301	PA
27	宜蘭大學動物系	李德南教授	03-9357-400	SL
28	工研院生醫中心	張秀鳳博士	03-574-3938	Space Sorter
29	實踐大學 食品營養系	黃惠宇教授	02-2538-1111	SL
30	沙克電子股份有限公司	吳先生	07-812-5652	PA
31	勞工安全衛生研究所	衛生組 莊先生	02-2660-7600	SL Green
32	中山醫學大學	程兆明醫師	04-2473-0022	SL
33	中央研究院地球所	夏復國教授	02-2783-9910	Space Sorter
34	輔仁大學食品科學系	吳文勉老師	02-2905-3816	SL
35	農試所高雄農業改良場	黃柄龍先生	08-774-6736	PA
36	中興大學食品暨應用生物科技系	溫曉薇老師	04-2284-0385	Space
37	水產試驗所東港分所	鄭金華博士	08-832-4121	Space UV LED
38	農試所嘉義分所	張淑芬小姐	05-277-1341	PA
39	台東農業改良場	許嘉錦先生	089-318-570	PA
40	種苗改良繁殖場	劉明宗先生	04-2582-5462	CUBE8 488/UV
41	中央研究院生化所	王寬院士	02-2576-5696	CUBE8 488/UV Auto Loader
42	清華大學 電機系	李曉菁 老師	03-571-5131	Cube 488/594

	Partec CUBE 8	Becton Dickinson Canto II	Beckman Coulter Gallios
光源	488nm, 20 mW (3 Cs) 635 nm, 25mW (1 C)	488 nm, 20 mW (4 Cs) 633 nm, 17mW (2 Cs)	488 nm, 22 mW (5 Cs) 635 nm, 25mW (1 C)
	532 nm, 30mW (1 C)	405 nm, 30mW*	405 nm, 40mW*
	UV 365 nm LED (1 C)	No UV capability	No UV capability
可用參數	8 參數 6 色螢光	8 參數 6 色螢光	8 參數 6 色螢光
FCS 偵測器	PMT(光電倍增管) 0.05 um	Photo Diode(光電二極體) 1 um	Photo Diode(光電二極體) 1 um
SSC 偵測器	PMT(光電倍增管) 0.05 um	PMT(光電倍增管) 0.5 um	PMT(光電倍增管) 0.4 um
螢光偵測極限	<100 MESF (FITC), <50 MESF(PE)	<100 MESF (FITC), <50 MESF(PE)	Unknown
使用鞘液	純水	專用試劑	專用試劑
流速控制	0 - 20 uL/sec 任意微調	10/ 60/ 120 uL/sec 三段調整	Low / Med / High 三段調整
細胞計數	Yes, 純對體積細胞計數	N/A	N/A
自動進樣	40 Tube / 96 well plate	40 Tube only, plate options	32 Tube Loader only

YES 廠牌	Partec	Millipore	ABI	BD Accuri
型號	CyFlow CUBE 8	Guava EasyCyte 6HT/2L	Attune	C6
圖片				
年代	2011	2003	2009	2007
標準雷射	LED, 固態雷射 488nm 20mW	Blue, Red (非傳統流式)	405 nm (50 mW) , 488 nm (20 mW)	488nm, 640nm
參數/螢光	6 參數/4 螢光	6 參數/ 4 螢光	8 參數/6 螢光, 3 for Blue & 3 for Violet	6 參數/ 4 螢光
擴充性	4 光源, 8 參數/6 螢光	NO, 8 參數/6 螢光	NO	NO, (No PMT Gain Control)
螢光靈敏	<100 MESF (FITC) <50 MESF (PE)	Not Mentioned	Not Mentioned	<150 MESF (FITC) <100 MESF (PE)
偵測粒徑	50 nm – 200 um	Not Mentioned	1 um – 45 um	Max. 200um (Quartz Size)
最小偵測粒徑	0.05 um	Not Mentioned	1 um	0.5 um
其他雷射	375, 638, 407, 355, 375, 532, 561, 594, 785	NO	NO	NO
絕對細胞計數	YES (Volumetric)	NO	YES (base on Time flow rate)	NO
細胞分選	YES (選配)	NO	NO	NO
流量控制	電腦控制	Microcapillary	電腦控制	3 steps, slow, Medium, Fast
Tube Loader	YES, 40 tubes	YES	NO	YES, 24 tube
96 well	YES	NO	NO	NO