

UO MANET / MicroscopiA, imagiNg E big daTa

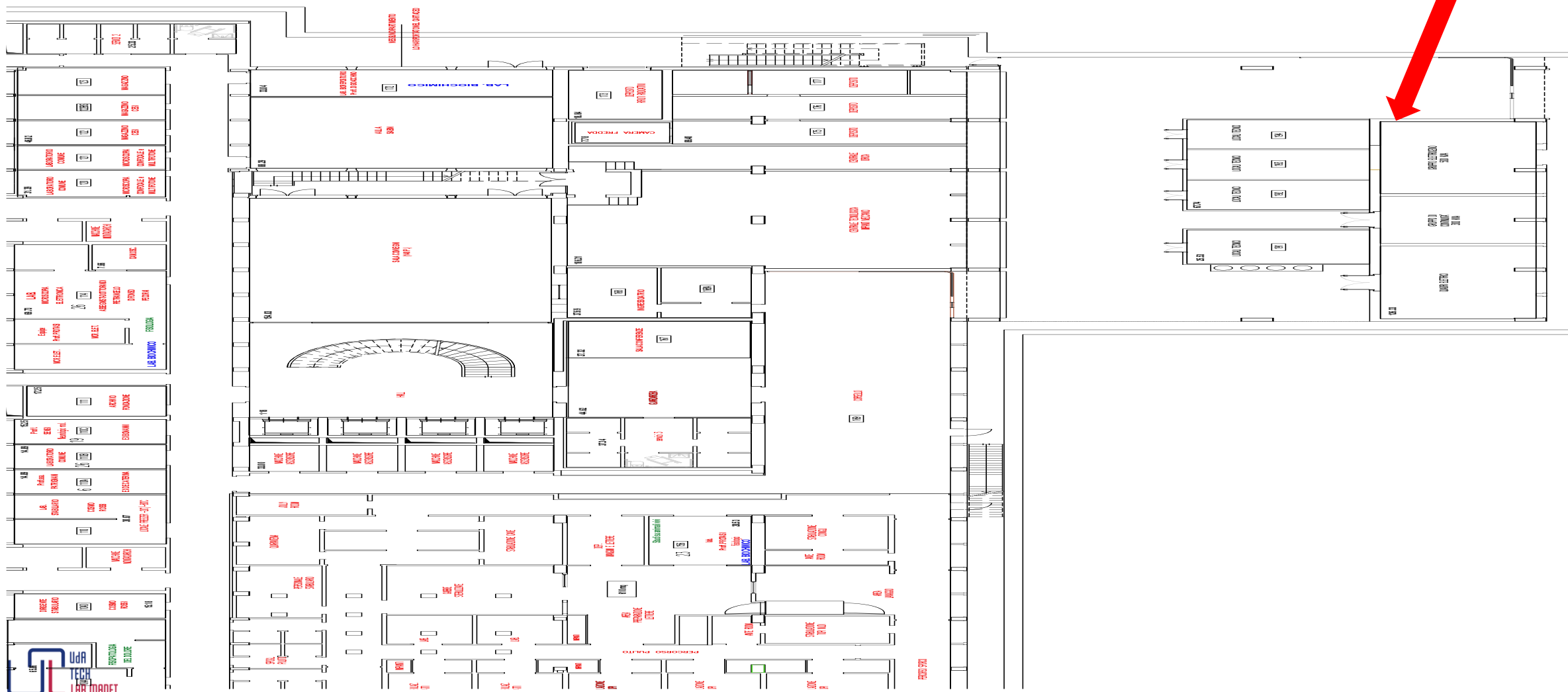


La UO *MANET* si occupa dell' investigazione di *materiali e strutture* (viventi e non) utilizzando tecniche avanzate di elaborazione delle immagini ottenute ad esempio da metodiche di microscopia, tomografia e topografia.

MANET ha acquisito le seguenti apparecchiature:

- ***Risorse di calcolo*** (1 CPU con 128 core e 512 Gb RAM da mettere a sistema con analoghe risorse e strutture complementari messe in campo dal progetto *Vitality*, dal progetto *Dipartimento di Eccellenza* del DNISC e dal progetto PNRR-CN3 "*National Center for Gene Therapy and Drugs development based on RNA Technology*"), complessivamente intese come espansione del centro di calcolo in formazione al CAST).).
- ***Microscopio Operetta*** (strumento per imaging basato su tecnologia di rilevazione ottica confocale per High Content Screening di nuova generazione, con avanzate capacità di rivelazione e di analisi delle immagini per lo studio e la quantizzazione delle variazioni fenotipiche.

Centro di calcolo in costruzione al CAST





Certificazioni di sicurezza

NORMA UNI CEI EN ISO/IEC 27001:2017

NORMA UNI CEI EN ISO/IEC 27017:2021

NORMA UNI CEI EN ISO/IEC 27018:2020

NORMA UNI EN ISO 22301:2019

NORMA UNI CEI ISO/IEC 20000-1:2020

Tier 3 compliant

Responsabile: *Dott. Piero Chiacchiaretta*

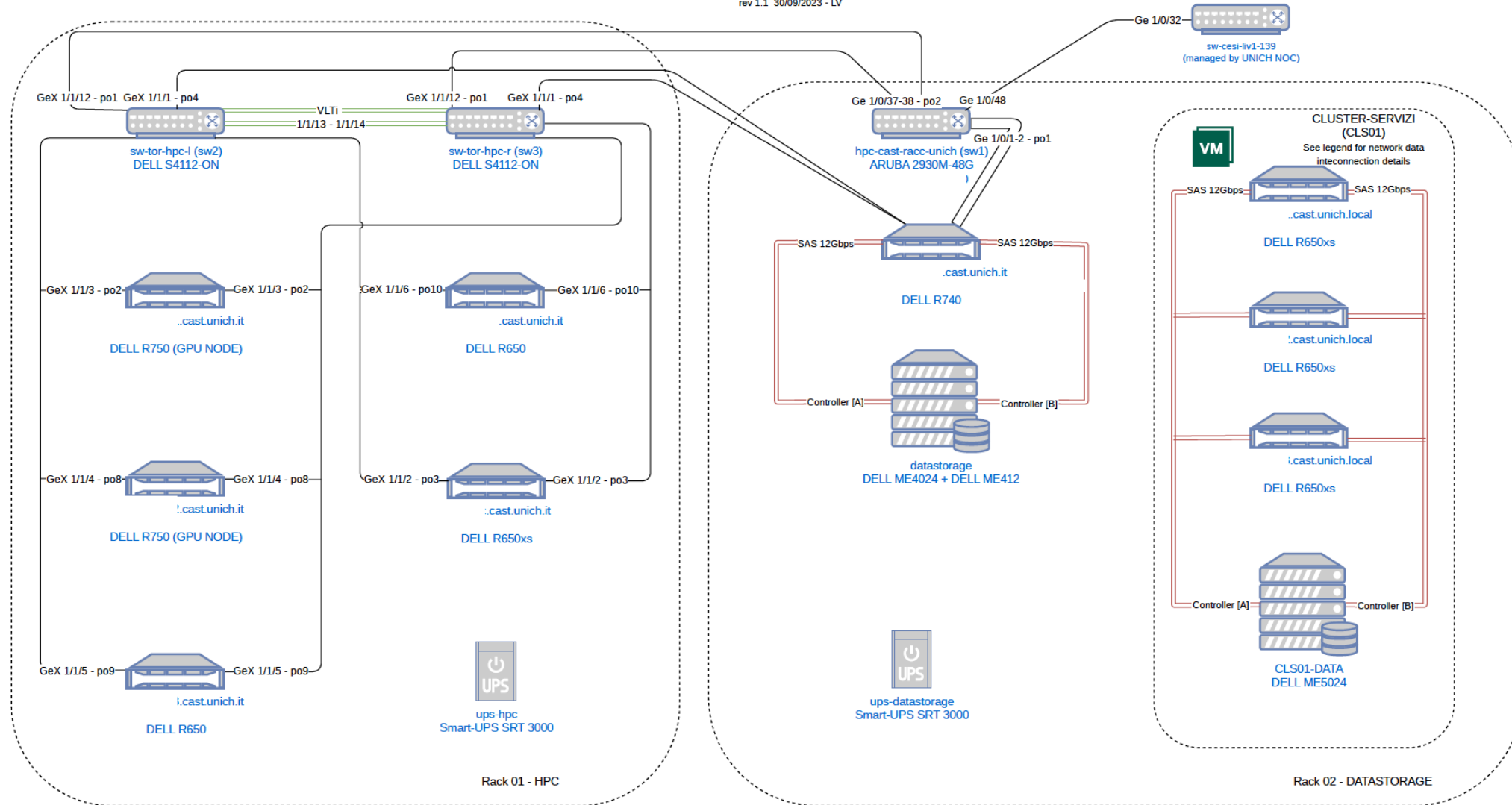
Risorse di calcolo complessive del centro di calcolo

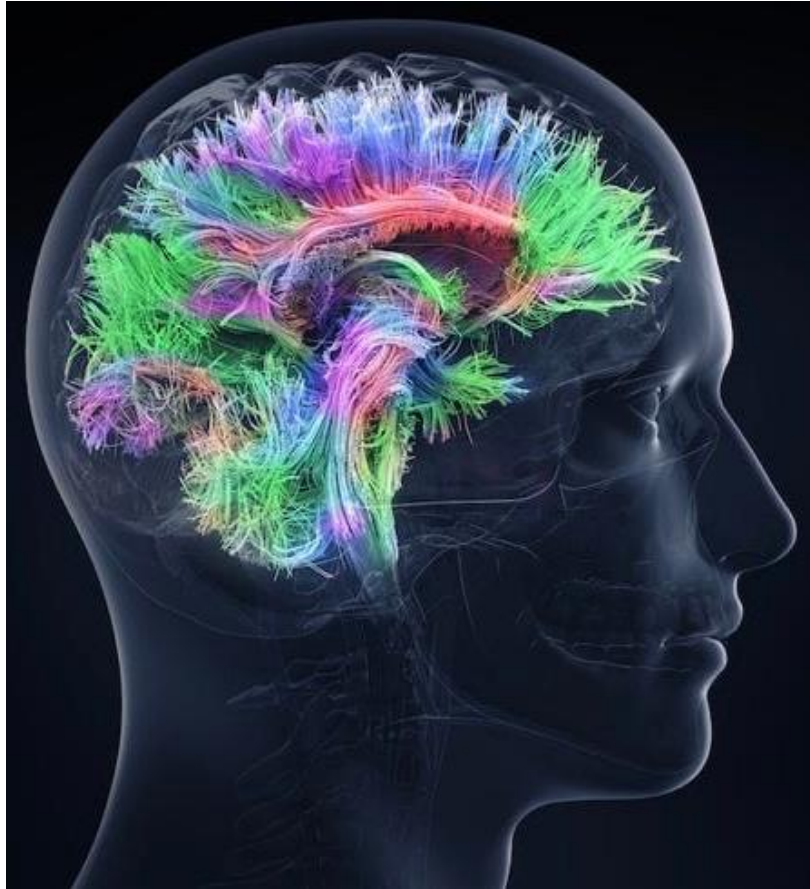
- **2 GPU - 160 GB RAM**
- **3 CPU (Intel® Xeon® Gold 6338 2G, 32C/64T, 11.2GT/s, 48M Cache, Turbo, DDR4-3200), 384 core totali, 2 TB RAM totali**
- **Data storage about 500 TB (espandibili fino a 2PB)**
- **3 DELL 650xs (Clustering mode) for services application**

Spesa complessiva attuale circa 700000 euro

DATACENTER HPC - Center for Advanced Studies and Technology (CAST@UNICH) PHYSICAL INTERCONNECTION DIAGRAM

rev 1.1 30/09/2023 - LV





Esempio di use case

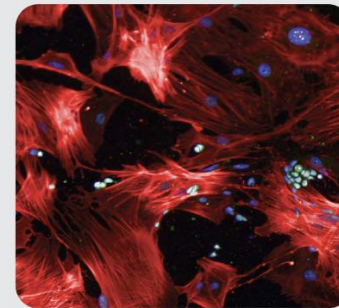
La risoluzione attuale della risonanza magnetica funzionale permetterebbe di testare circa 60 miliardi di connessioni :

Grande richiesta di potenza di calcolo e storage ...

Operetta CLS: Features

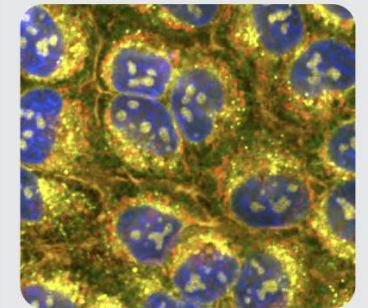


- Imaging di cellule vive ad alto contenuto (high-content imaging): Operetta CLS consente l'imaging rapido e automatizzato di grandi set di campioni.
- Screening ad alto contenuto: acquisisce ed analizza più parametri cellulari contemporaneamente.
- Modalità di imaging versatili: imaging in campo chiaro, fluorescenza e confocale per una comprensione completa degli eventi cellulari.
- Controllo ambientale preciso: mantenimento delle condizioni ottimali per gli esperimenti su cellule vive.



Complex cell models

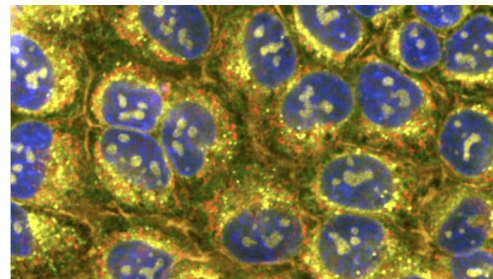
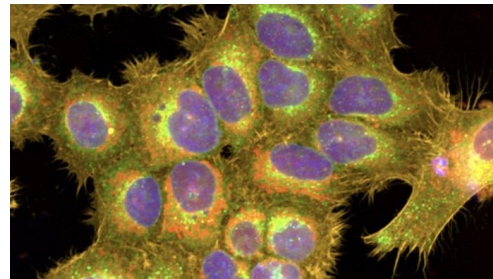
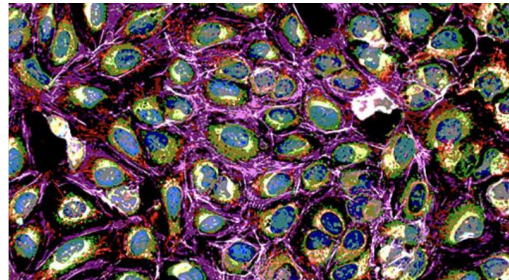
The Operetta CLS combines a large-format sCMOS camera with water-immersion objectives for sensitivity and high resolution, while machine-learning-based PhenoLOGIC™ software helps you distinguish and characterize cell types based on morphology, fluorescence intensity/distribution, texture, and more.



Cell painting

Cell painting is a powerful application of high-content screening technology. In cell painting, specific cellular compartments are stained with six different fluorescent bioprobes simultaneously, followed by imaging and analysis to phenotypically profile the cells and elucidate their behavior.

Operetta CLS High Content Analysis System



Intelligent image acquisition



Machine learning



Easily quantify cellular phenotypes in complex 3D models



Powerfully simple analysis capabilities



High efficiency excitation design



Fast Frame Rate Imaging

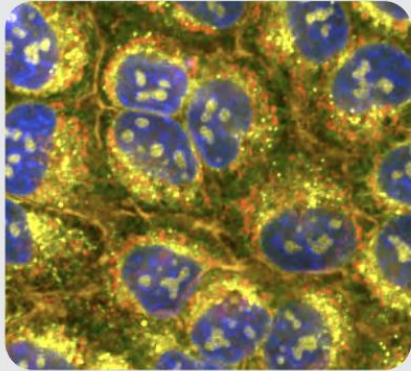


Automated water-immersion objectives



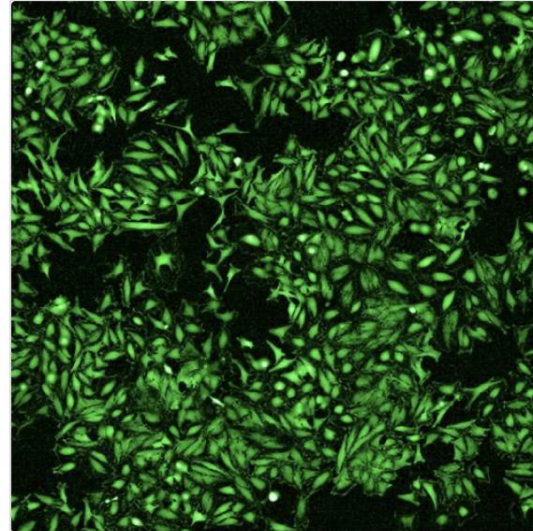
Confocal spinning-disk technology

High Content Screening Applications



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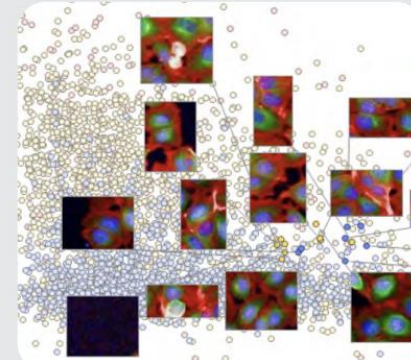


Live-Cell Imaging

Live-cell imaging is the study of living cells using images acquired by time-lapse microscopy. It is becoming a requisite technique in many fields of life science.

[Learn More](#)

time laps



Phenotypic fingerprinting

At the core of successful phenotypic assays is the ability to create robust fingerprints of subtle differences. The Operetta CLS system combines high-resolution imaging with advanced software tools such as STAR morphology and machine learning for true multiparametric hit selection.

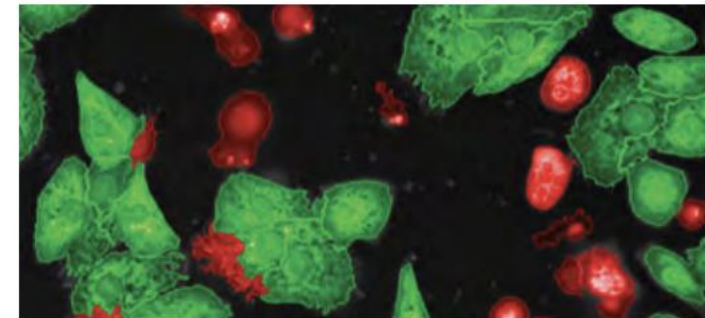
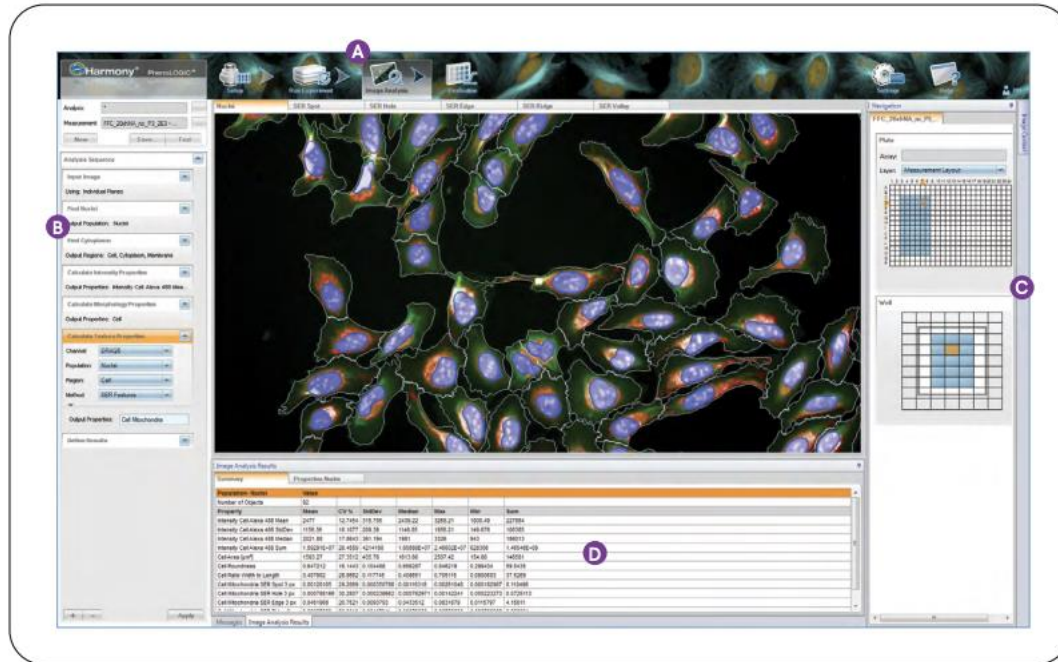
Examples:

- nuclear to cytoplasmic intensity ratio of a labeled receptor,
- distribution patterns of the receptor
- how spread out the cells are, other aspects of cellular morphology

can be simultaneously collected and quantified



Operetta e Harmony Software



PhenoLOGIC classification of primary hepatocytes (green = healthy, red = dying).

- A. Workflow-based interface with easy-to-read icons
- B. Analysis building blocks for easy protocol design
- C. Clear plate navigation and wizard for easy setup of new plate types
- D. Results summary with immediate numerical output for faster insights

Applicazioni di Operetta CLS

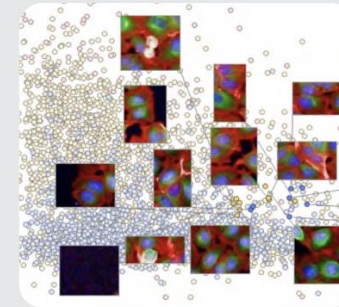


Farmaci: accelera lo sviluppo di farmaci esaminando in modo efficiente le nuovi composti.

Ricerca sulla biologia cellulare: studia i processi e le dinamiche cellulari con l'imaging ad alto contenuto.

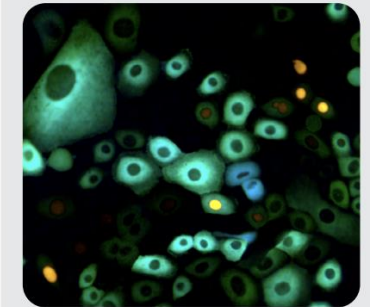
Profilo fenotipico: identificare e caratterizzare i fenotipi cellulari in modo ad alto rendimento.

Saggi live: studia gli eventi cellulari dinamici in tempo reale con un controllo ambientale preciso.



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Protein-protein interaction assays

FRET is a powerful tool for investigating conformational changes and protein-protein interactions. With a good FRET sensor, it's possible to track activity of kinases such as ERK in live cells and much more. And with imaging and dedicated analysis tools for ratiometric imaging, robust results are easy to obtain.