



Framework for Multispectral Imaging Application to digital pathology

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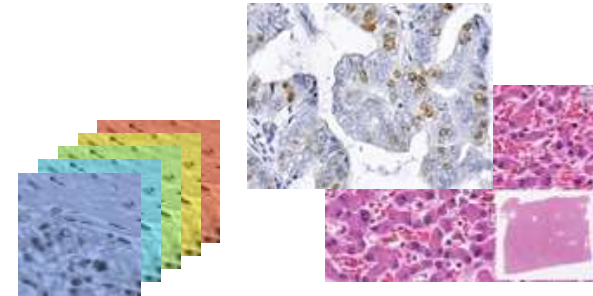
Bas Hulsken, Phillips

Max Derhak, Onyx Graphics Inc.

Multispectral imaging in pathology

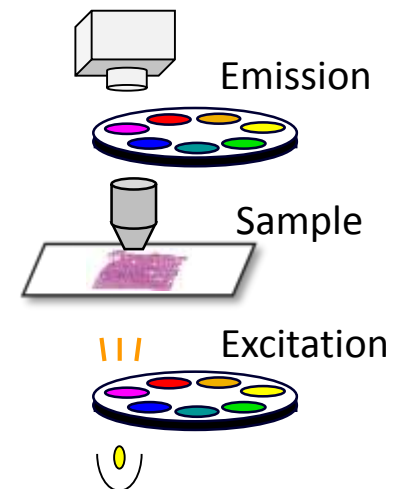
- Brightfield

- HE stain, Special stains, Immunohistochemistry(IHC) stains
- Object detection, segmentation
- Color unmixing – Stain amount image
- Digital adjustment of staining strength
- Digital staining



- Fluorescence

- Simultaneous imaging of multiple markers
- Cross-talk, auto-fluorescence removal
- Combined brightfield and fluorescent images



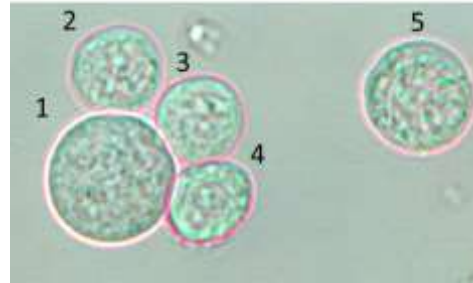
Classification of B lymphocytes without staining

Spectral imaging:

Nonproducing cells (NP)



Ab producing cells A (PA)

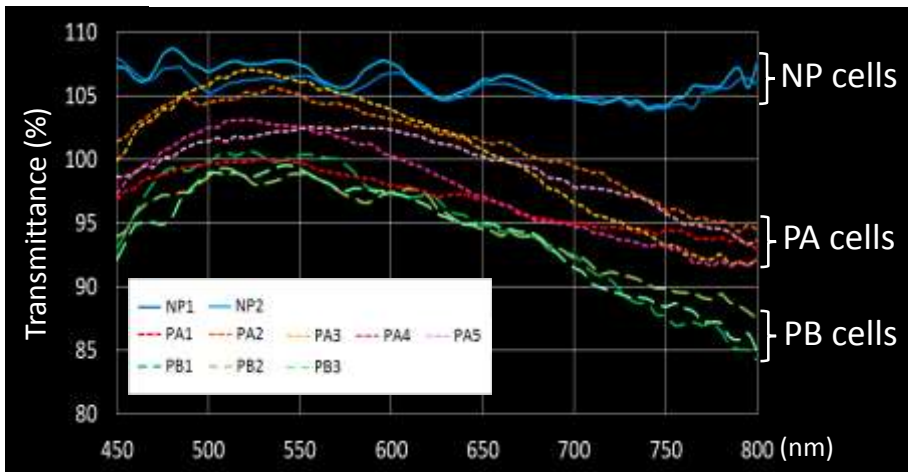


Ab producing cells B (PB)



*(Ab: antibody)

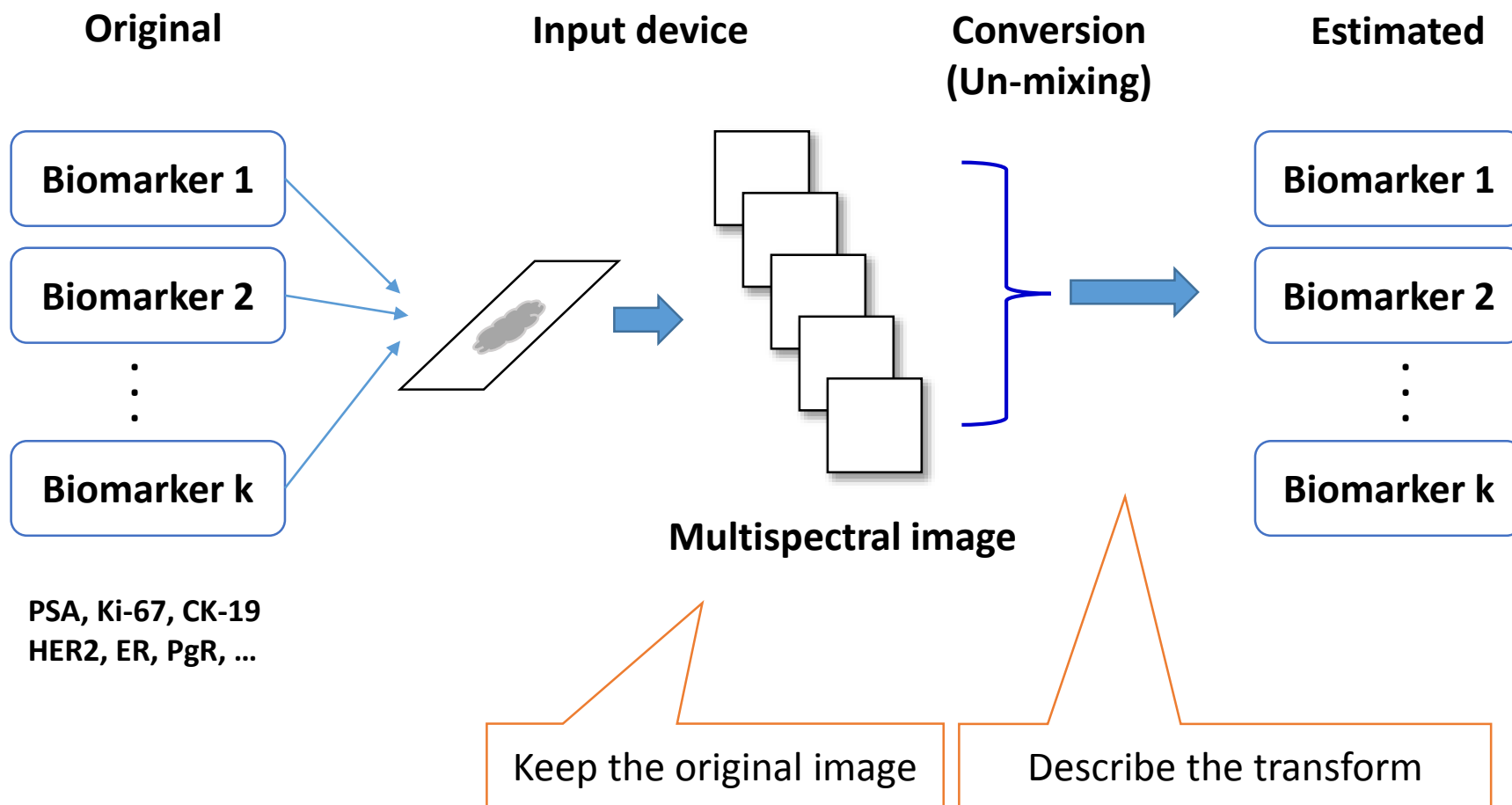
Spectral comparison



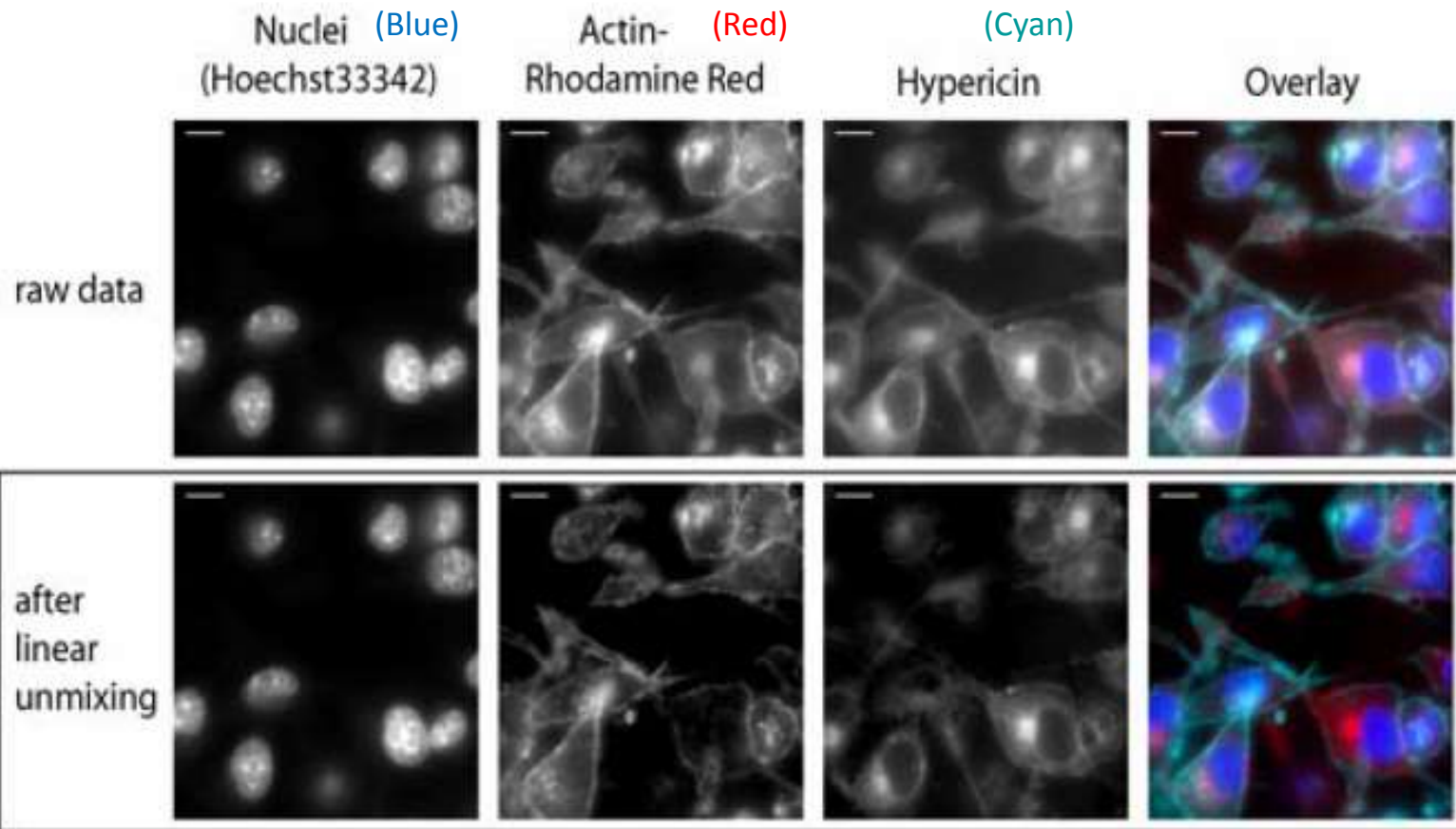
Live cell imaging and discrimination without any staining can be achieved using hyperspectral data.

Qualitative evaluation of live cells (eg. activation state of cells) is also possible.

General model for multispectral un-mixing

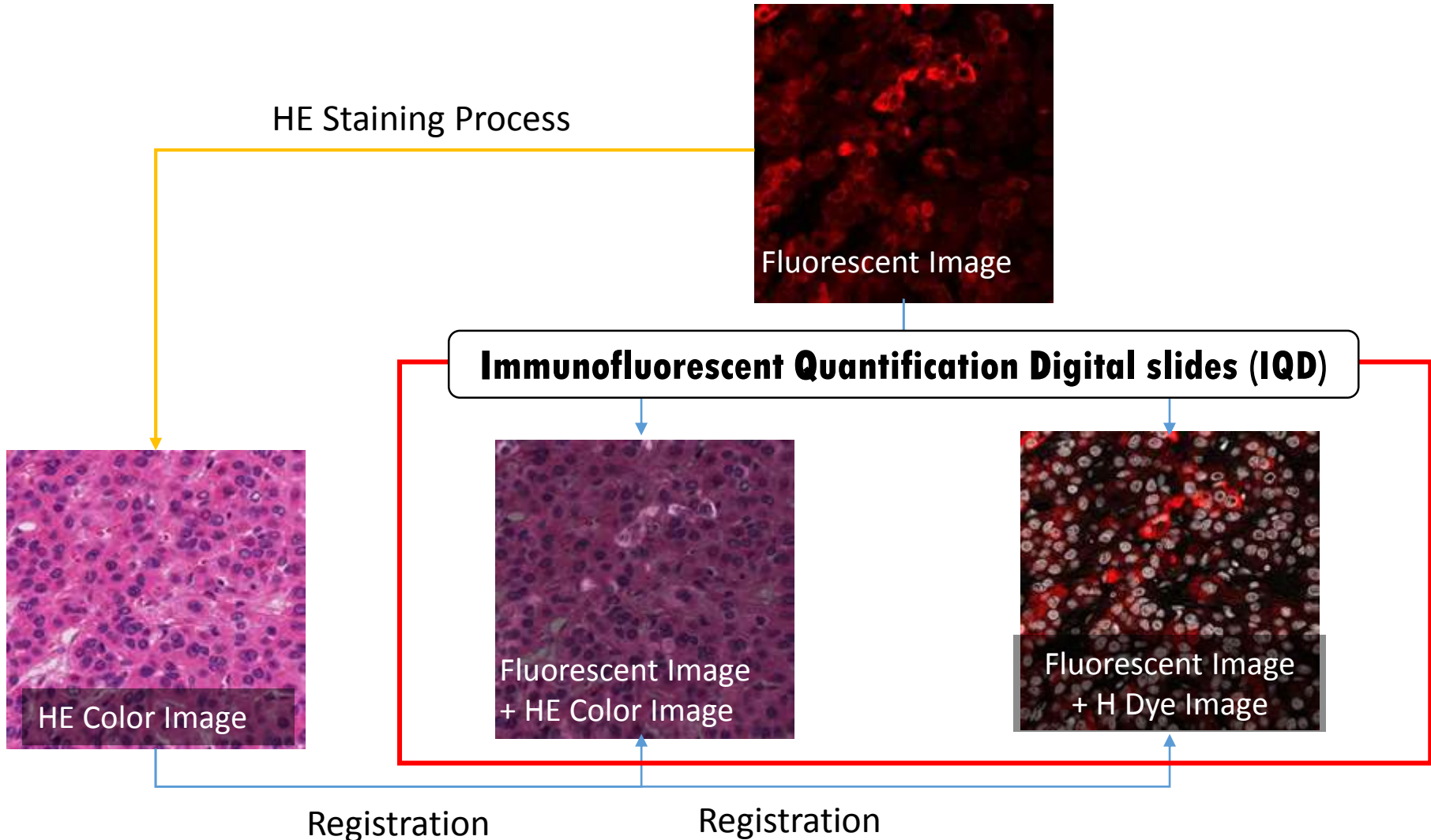


Color unmixing for unwanted fluorescence removal



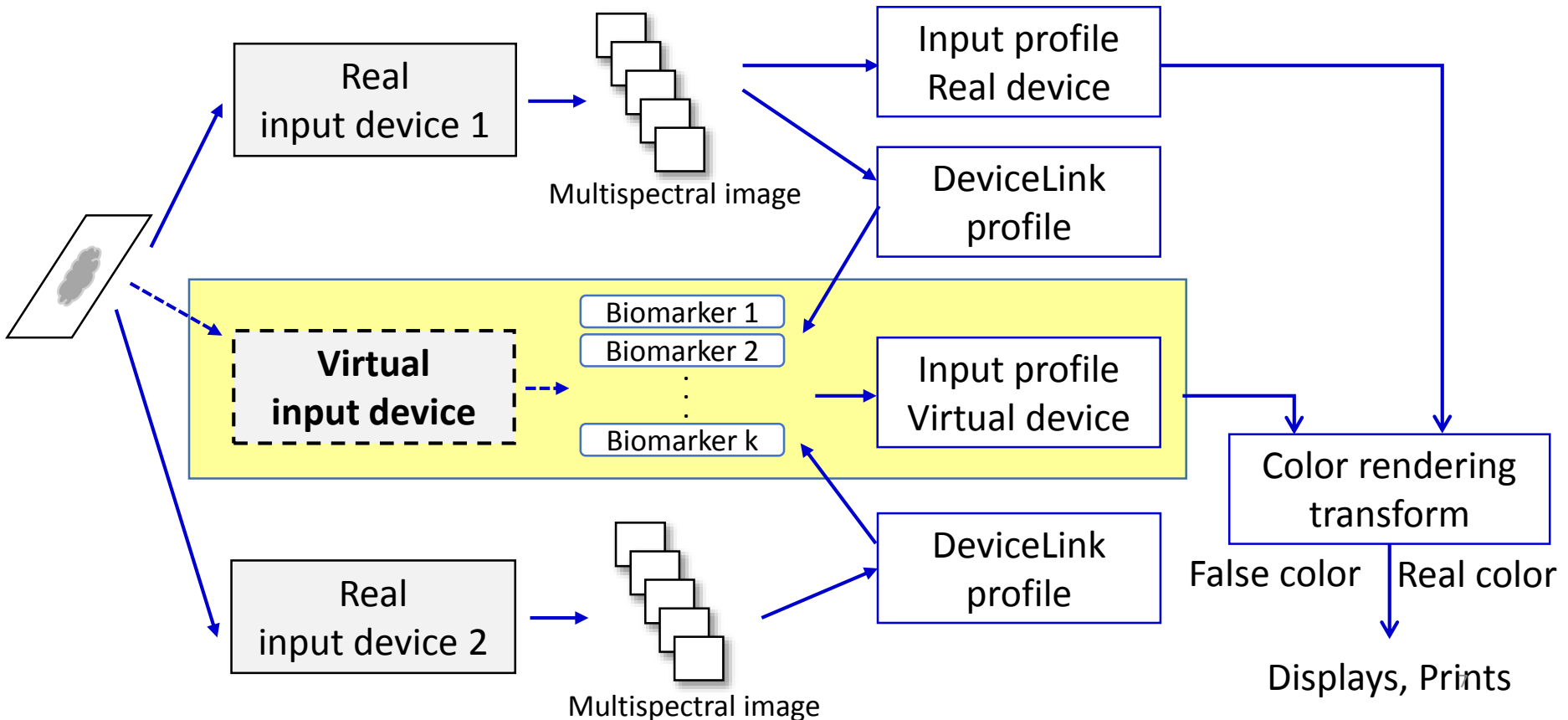
Modern Research and Educational Topics in Microscopy.
A. Méndez-Vilas and J. Díaz (Eds.)

Combination of Fluorescent and HE-stain



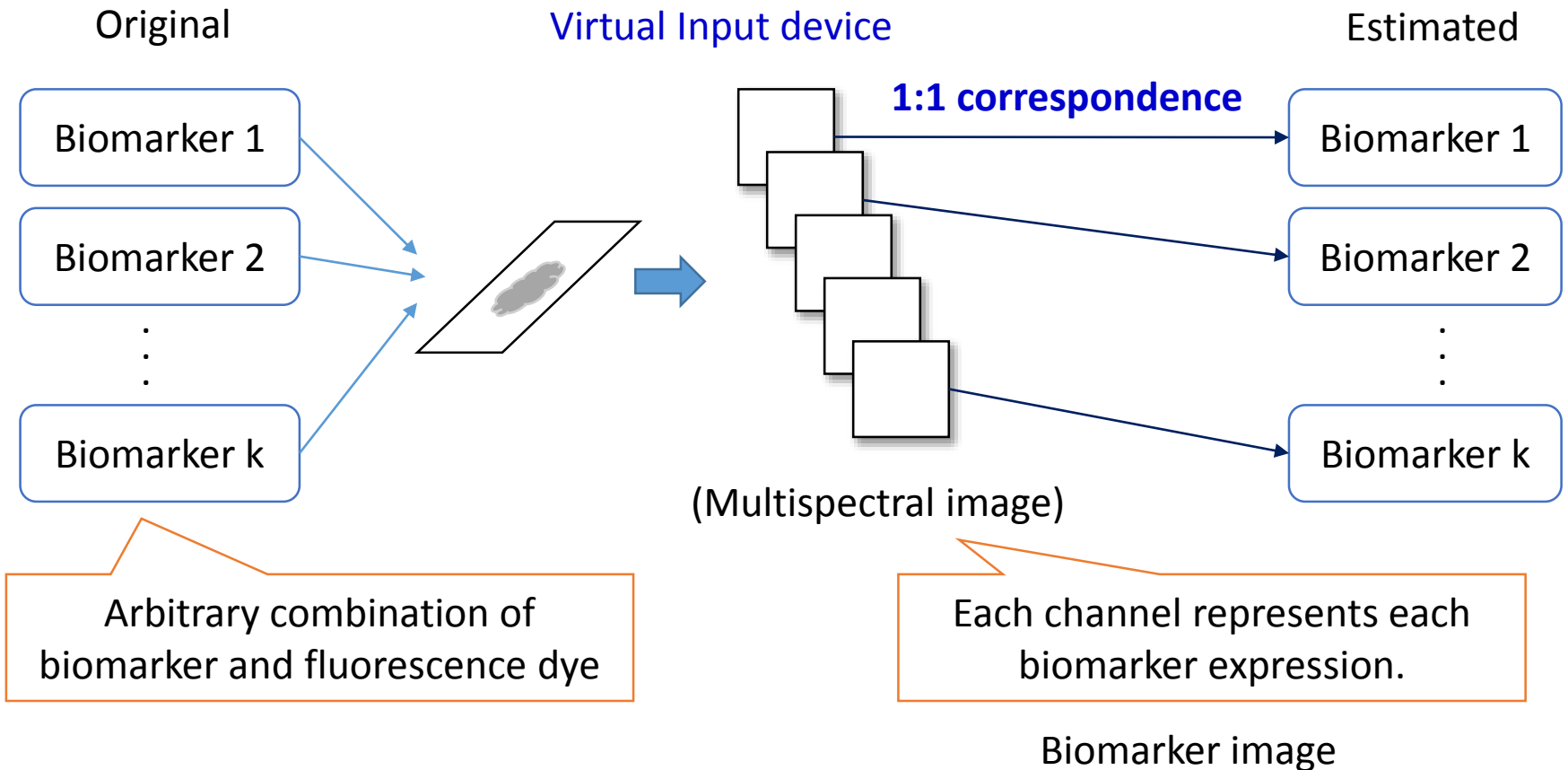
Solution to color unmixing by ICC v4

- Consider a virtual input device that can directly capture un-mixed biomarker images
- Use DeviceLink profile



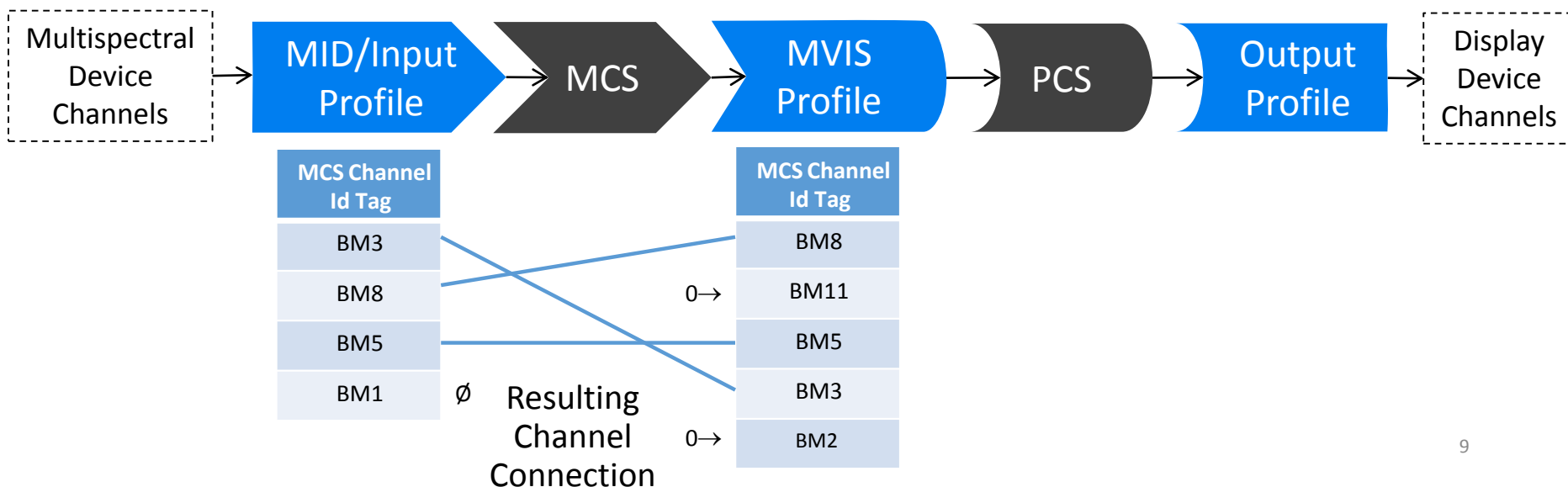
Virtual 'ideal' input device

that can directly capture un-mixed biomarker images



Solution to color unmixing by iccMAX

- Spectral profiles
- Multi-processing elements
- Application of “Material Connection Space” Profiles
 - MCS connection allowed between source biomarker Material Identification (MID) and destination biomarker Material Visualization (MVIS) profiles



Current status

- Investigating the adoption of ICC v4 considering the upper compatibility in iccMax.
- Documentation for implementation to DICOM.
- Planning the test implementation of iccMax MCS approach for investigating its advantage and feasibility.
- * We welcome contribution from anyone who can provide sample multispectral fluorescent images