



INTERNATIONAL
COLOR
CONSORTIUM

iccMAX, iccDEV and ICS Packages



ICC Experts Day

Colour management ICC.1 cannot express - made implementable

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Pre-approval, on the **staging** branch. Hands-on workshop in two days.



Three things, and the third is the point

iccMAX

6 min

What it buys you

iccDEV

6 min

How you reach it, without writing code

ICS packages

11 min

Five conformance packages that make it testable

iccMAX is large. No implementation is expected to support all of it.

An Interoperability Conformance Specification (ICS) draws a box around one use case.
An ICS package makes that box executable.

Hands-on workshop, same five packages, in CVCS workshop



What iccMAX actually provides

Expanded connection, and greater expression of transforms. ISO 20677-1 / ICC.2

Expanded connection	Greater expression of transforms
- The profile connection space (PCS) is no longer one fixed space - Colorimetric PCS beyond D50 and the 1931 2-degree observer - Spectral PCS, and bispectral for fluorescence - Multiplex channel space (MCS) - named channels, not colour definition - Profile Connection Conditions (PCC) travel with the profile	- Processing elements you can freely sequence - ICC.1 has three, in a fixed order - iccMAX extends those and adds thirteen more - calculatorElement: a script with fixed colour operators • It utilizes CMM environment variables, so behaviour is set at run time - Material/chromatic adjustment for illuminant and/or observer

On security: SafeDocs established that the calculatorElement is not a general-purpose language.



Pure *iccMAX*, or hybrid?

An ICC.1 profile can carry an *iccMAX* profile inside it.

- Three of the five packages are hybrids.

Pure *iccMAX*

- No base part at all
- Software without *iccMAX* cannot open it, and says so
- No compromise made to preserve v4 behaviour
- ColorimetricEncoding and SpectralEncoding
- Choose it when you control the pipeline

Hybrid

- ICC.1 base part + embedded *iccMAX* sub-profile
- A v4 CMM reads the base part, ignores the rest
- An *iccMAX* CMM sees both, and gains the capability
- Additive: remove it, a valid v4 profile remains
- Choose it when the file has to travel

An *iccMAX* CMM reads version 4 profiles. A version 4 CMM cannot read *iccMAX* profiles.

- That asymmetry is why hybrids exist.



...and that is the problem

"It is not envisioned that all colour management systems that use ISO 20677-1 will implement all the features or capabilities it specifies."

ISO 20677-1

For an implementer

Where do I stop?

For an integrator

Do two vendors' files interoperate? Against what?

For the ICC

How does a capability get validated, not just specified?

An ICS answers all three. Provides restrictions to ISO 20677-1 for individual use cases.



iccDEV

The ICC's open-source implementation



iccDEV

Formerly DemolccMAX. ICC-maintained cross-platform libraries and tools for ICC and iccMAX profiles with a BSD 3-clause license

IccProfLib parsing, validation, and the CMM that applies transforms

IccXML a profile round-tripped to XML and back

IccJSON the same idea in JSON

iccdev-mcp the tools exposed to AI assistants over MCP

XML/JSON are the ones that changes how you work. A profile stops being an opaque binary: read it, change a number, rebuild it - or author one from text alone.



Twenty-one tools. You need five.

Command-line, scriptable, same on every platform. You do not need to build iccDEV.

iccFromXml	compile a profile from XML
iccApplyProfiles	a profile chain over an image
iccApplyNamedCmm	a profile chain over colour values
iccApplySearch	invert a chain by search
iccTiffDump	what is inside a TIFF

Every scenario in all five packages utilizes one or more of those five tools.



You do not have to build it

```
brew install iccdev  
npm install iccdev  
docker pull ghcr.io/  
internationalcolorconsortium/iccdev
```

Or call it from your language

Python the iccdev package

MATLAB a +iccdev MEX package

WebAssembly the CLI tools as Node modules

iccdev-mcp hands the tools to an AI assistant. It can build a profile, apply it, and read back the result rather than guessing.

The workshop assumes none of this is installed. Anyone who cannot get the tools running still has every expected result.



ICS packages

Five conformance specifications, shipped with the evidence



What an ICS is

A box around one workflow domain. Minimum structural and operational requirements for writing and applying profiles in it.

Which sub-class, and which tags

what a conforming profile must carry

Which connection scenarios are in scope

numbered S1, S2, S3... a claim names the ones it covers

What is restricted

which parts of iccMAX are out of scope

And what is expected to fail

silent success is a conformance defect

It bounds implementations, not just files.

Note: an implementation may not support every scenario of an ICS.



...and what a package adds

- The specification says what conformance means
- The package lets you understand it, play with it, and test it

```
<PackageName>/  
  ICS-<Name>.pdf      normative  
  <Profile>.xml       under test  
  config/             one per scenario  
  BuildAndTest        the driver  
  ICC/  Results/      BUILT
```

The config files define how to configure the profiles for each scenario

The Results/ folder provides a mechanism for understanding, and an oracle for comparison

The BuildAndTest script ties everything together



The five packages

Two pure iccMAX; three hybrids; and they interrelate.

PACKAGE	SUB-CLASS	WHAT IT IS FOR	V4 APP
 ColorimetricEncoding	'pcc '	Going beyond D50 and the 1931 2-degree observer	no
 SpectralEncoding	'sref '	Colour managed spectrally based images	no
 HybridMultiSpectral Encoding	'mspc '	Spectral content and legacy reach in one file	yes
 HybridPrinterWith Reflectance	hybrid	A printer profile that knows its reflectance	yes
 HybridPrinterWith OverprintSimulation	'osim'	Colour managed previews of spot inks	yes

82 scenarios. 68 profiles. 80 recorded results.



Colorimetry beyond D50 and the 1931 2-degree observer

Pure iccMAX, sub-class 'pcc'. No spectral data anywhere.



S3a Lab(D93) decoded back to sRGB

- The on-ramp and off-ramp for colorimetry that isn't D50 with the 2-degree standard observer
- Package provides profiles for multiple illuminants and observers
- The basis for PCC profiles - connection-condition overrides
- Scenario 7 changes observing conditions with no spectral transform at all

This is the package that says iccMAX is not synonymous with spectral



Spectrally based images, colour managed

One file, correct under any illuminant and observer. Sub-class 'sref'.



D50



Illuminant A



F11

The same file, rendered three times.

MetaCow is built from metameric pairs - the halves match under D50 and separate under other illuminants.

A colorimetric profile cannot produce this. The information is not in the encoding.



Full spectral content and legacy reach

A hybrid. Colorimetric base part plus a MultiSpectral ('mspc') sub-profile.



D65 from MS



A from MS



Legacy preview

Of the two spectral packages, usually the one.

- SpectralEncoding ICS needs iccMAX software to open at all
- The HybridMultiSpectral ICS does not (works with existing v4 ICC systems)

Do not embed it in an image lacking the extra samples

- Scenario 6 builds an image that a Scenario 3-style preview then fails

Note: The open source BeyondRGB project (beyondrgb.github.io) now encodes HMSE profiles.



A printer profile that knows the reflectance of what it prints

ICS | PRINTER WITH
REFLECTANCE

A hybrid. CMYK base part plus a sub-profile carrying spectral reflectance.



D50



Illuminant A



D93

The round trip example closes

CMYK 50/40/40/0 returns

**49.62 / 39.63 /
39.63 / 0.77**

through 36-band reflectance and an
inverse search.

The capability is spectral reproduction. Not 'print this colour' but 'print something whose reflectance more closely matches, so it keeps matching when the light changes'.

The only package using iccApplySearch - going backwards is a search, and the point is that it converges.

Scenario S6b performs a search per pixel, over a whole image. Bounded by the destination's spectral gamut, not by the method.



Overprint simulation of spots - colour management for spot inks

ICS | OVERPRINT SIMULATION

A hybrid. CMYK base part plus an OverprintSimulation ('osim') sub-profile.



under white



under silver



silver on top

Why it matters commercially

Consistent overprint simulation from design through to print, because the simulation travels in the profile.

The industry has wanted this for decades.

A key use case: the OutputIntent profile in a PDF. The base part covers process colour; the extension previews process plus spot channels.

It does not change the PDF rendering pipeline - it adds a stage, for preview.



The pattern is the transferable part

Five packages exist. The interesting question is the creation of a sixth

1

Bound the domain

the restriction is the useful part

2

Enumerate the scenarios

including the ones that must fail

3

Ship profiles as XML

readable, diffable, buildable by anyone

4

Ship the answers

that is the oracle

The ICC would rather review a package than a proposal.



Where this stands

Pre-approval, on the **staging** branch. Treat everything here as preliminary.

```
git clone https://github.com/InternationalColorConsortium/ICS.git
git checkout staging
cd packages && BuildAndTest.bat
```

Most useful now

open a hybrid in a v4 CMM: does the base part render, and is the extension ignored?

Coming

the ICS documents as Metanorma AsciiDoc - not written yet



You do not have to wait

A new format is usually worthless until everyone supports it. **Not here.**

- A hybrid profile works in v4 software today - the benefit starts with the first implementer, not the last
- An ICS bounds the work: you implement one box, not all of iccMAX
- And there is more than one way in

C++

IccProfLib

Python

research and analysis

MATLAB

a +iccdev MEX package

WebAssembly

in the browser

MCP

AI-assisted development

So the question is not whether the ecosystem is ready. **It is whether one (or more) ICS is worth implementing for your use case(s).**



Where everything is

ICS packages

[github.com/InternationalColorConsortium/ICS](https://github.com/InternationalColorConsortium/ICS/tree/staging)
tree/staging

The iccDEV tools

github.com/InternationalColorConsortium/iccDEV
brew / npm / Docker

iccMAX specification

color.org/iccmax
ISO 20677-1 and ICC.2



ICS repository

The workshop, in two days: ninety minutes, hands-on, everything on a USB drive.



Questions

iccMAX expresses what ICC.1 cannot.

An ICS makes a workflow small enough to implement.

An ICS package makes it easier to work with and check.



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github.com/InternationalColorConsortium/ICS (staging)