



CLS & RBL



RSI SPORTS GROUP &
LA LIGA

2030

VISION: WHAT HAS CHANGED IN 2030 ?

By 2030 we will have

- CLOSED ROOF STADIUMS THAT WILL GROW GRASS TO THE BEST STANDARDS
 - DEVICES THAT “TALK” TO NATURAL GRASS AND MEASURE ITS INTERNAL GROWTH FACTORS
 - **Internet Of Grass** instead of IOT
- INTEGRATED GRASS MANAGEMENT SYSTEMS WHERE LIGHT - WATER – HEAT – AIR ARE BEING ADMINISTERED UPON REAL TIME NATURAL GRASS DATA

- Publicly listed company
- > 15 years old
- 3 business units
- BIO LED
- SPORTS LED
- Owned by Large multinational with football crazy CEO / Board member FC

2012 : After WC AFRICA

Can you become active in natural grass ?

BIO LED : Plant Research



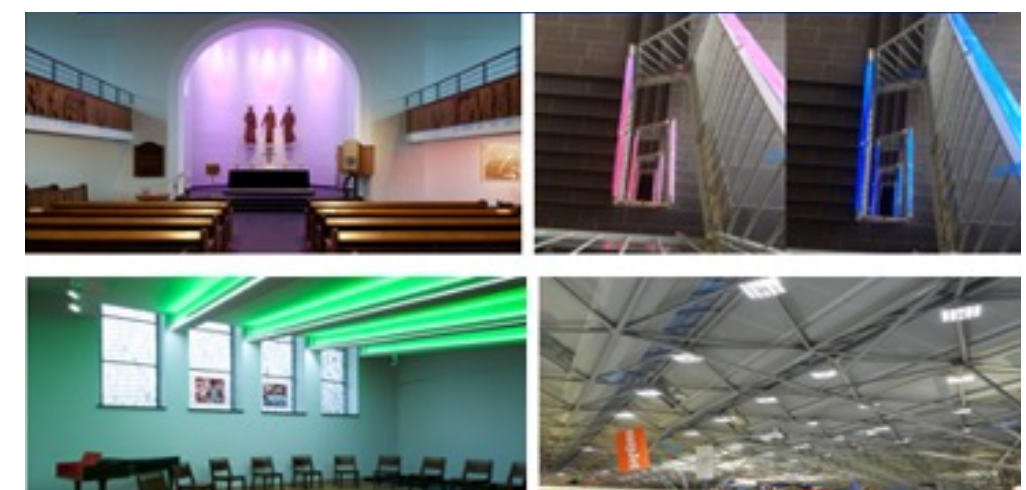
BIO LED Indoor Farming



SPORTS LED : Turfgrass solutions



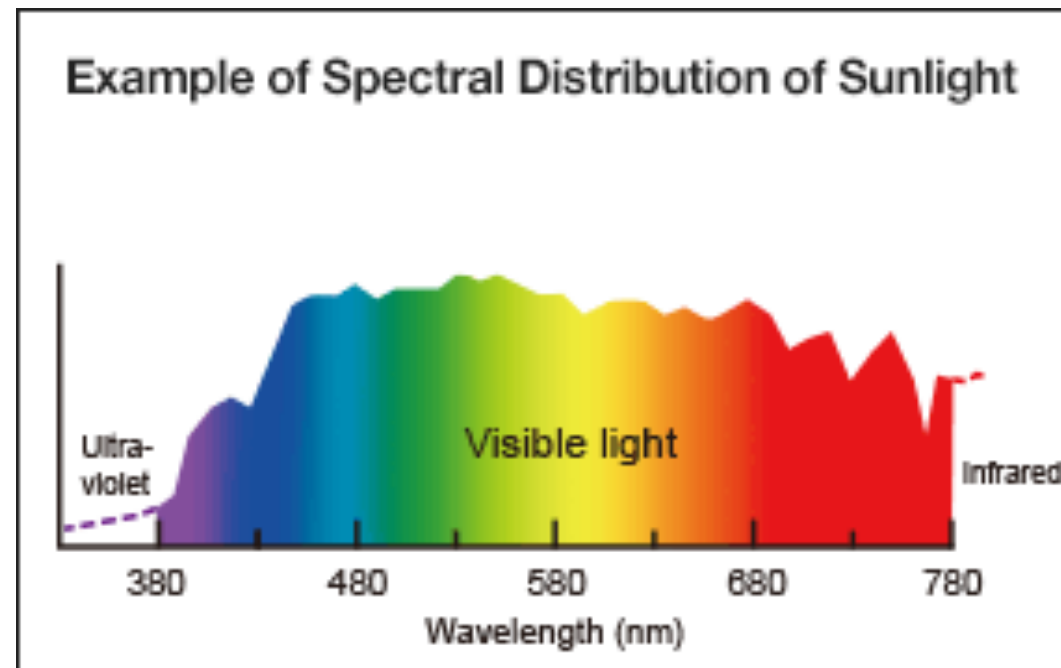
FLUX LED : Historical & Public Buildings



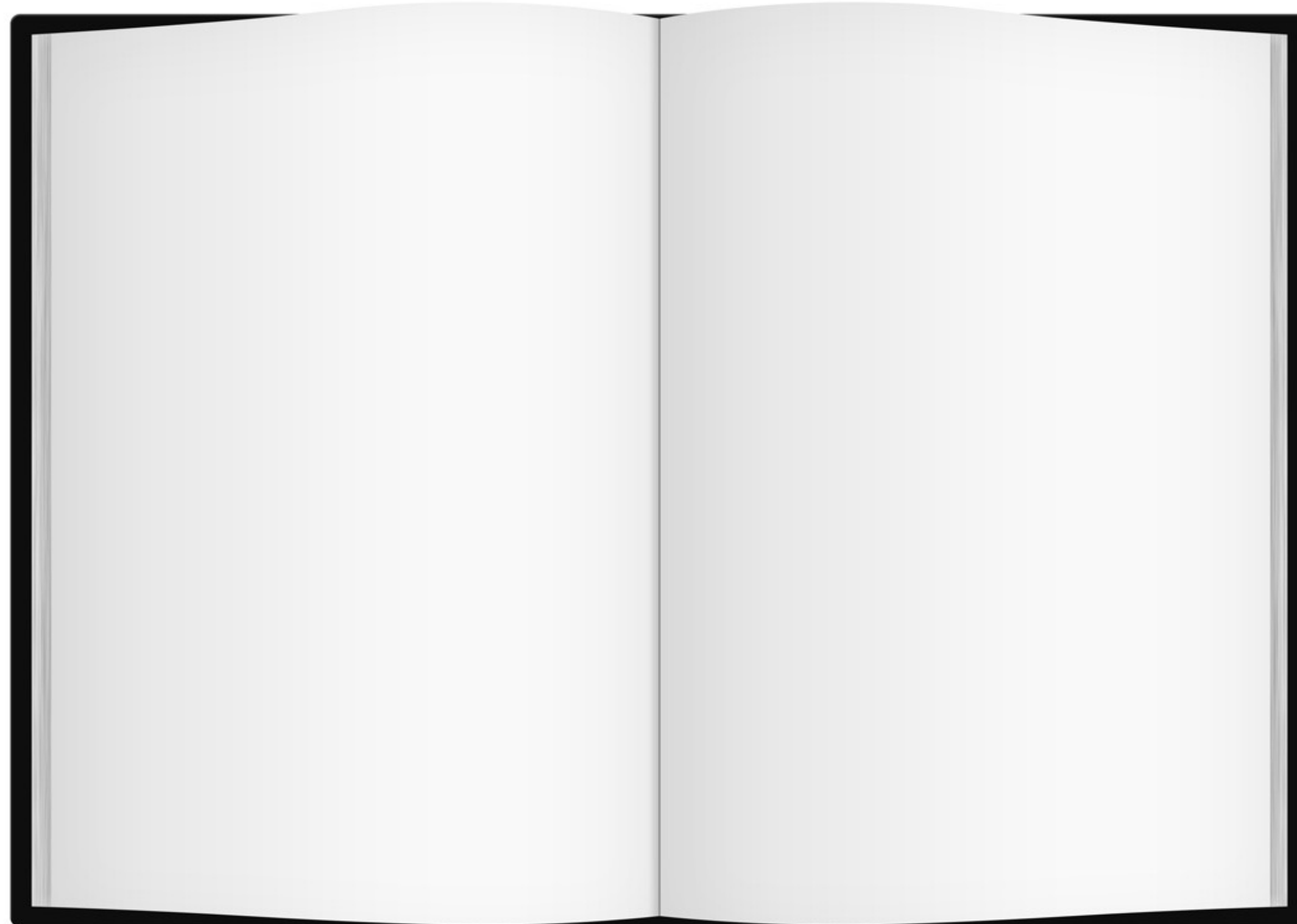
2012 : What is the dream?

Stadium as a Greenhouse

To have the knowledge, expertise and means to effectively grow natural grass in a permanently closed stadium environment

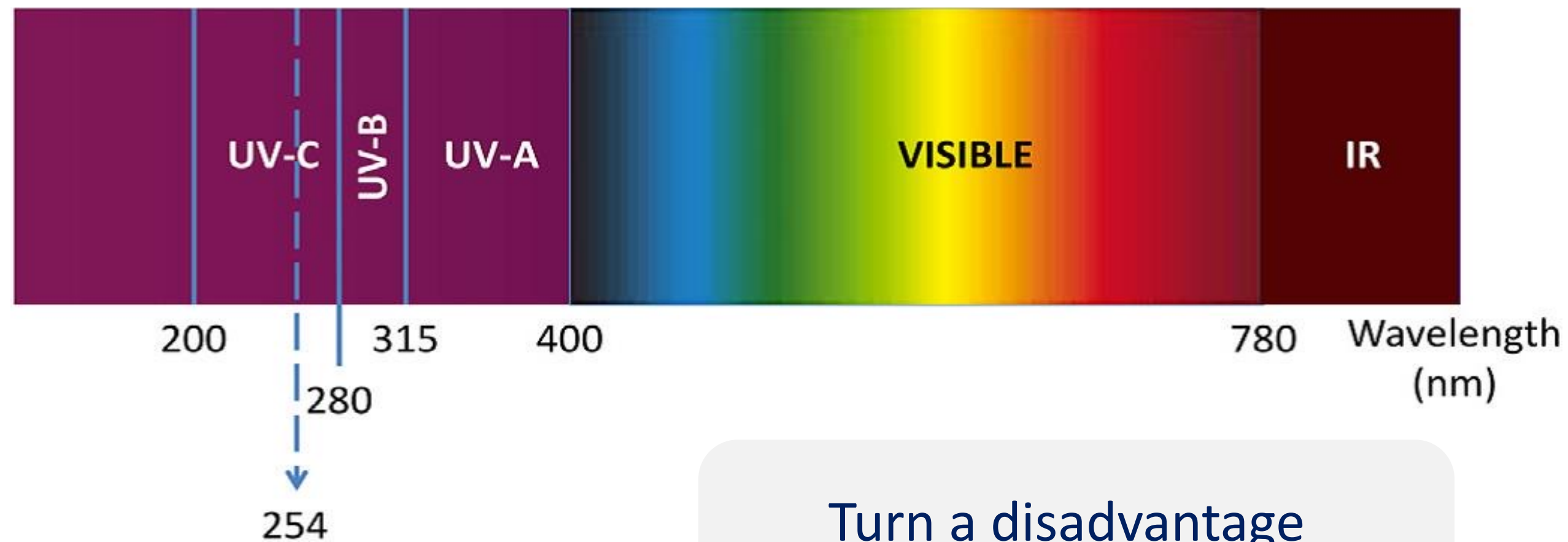


2012: Where did we start?



2012: Where did we start?

NO ASSUMPTIONS!!
Regarding light and natural turf



Turn a disadvantage
into an advantage



Over 8 years of research at the Technical University of Munich

Relationship between LED light and natural turf

Development of CLS – Complete Light Spectrum



Technical
University
of Munich

What do you need to grow grass in a closed roof environment

Objectification and
digitalization of
natural turf quality:
monitoring

Understanding
relationship between
light spectra and
grass growth

INTEGRATED MANAGEMENT SYSTEM
LIGHT – HEAT – VENTILATION – WATER

Understanding the
relationship between
other growth factors
to light and natural
turf:

Daylight reproduction
capability:
means, machinery
and software

2 INNOVATIONS FOR STADIUMS THAT WILL CHANGE STADIUM DESIGN AND USE

CLS

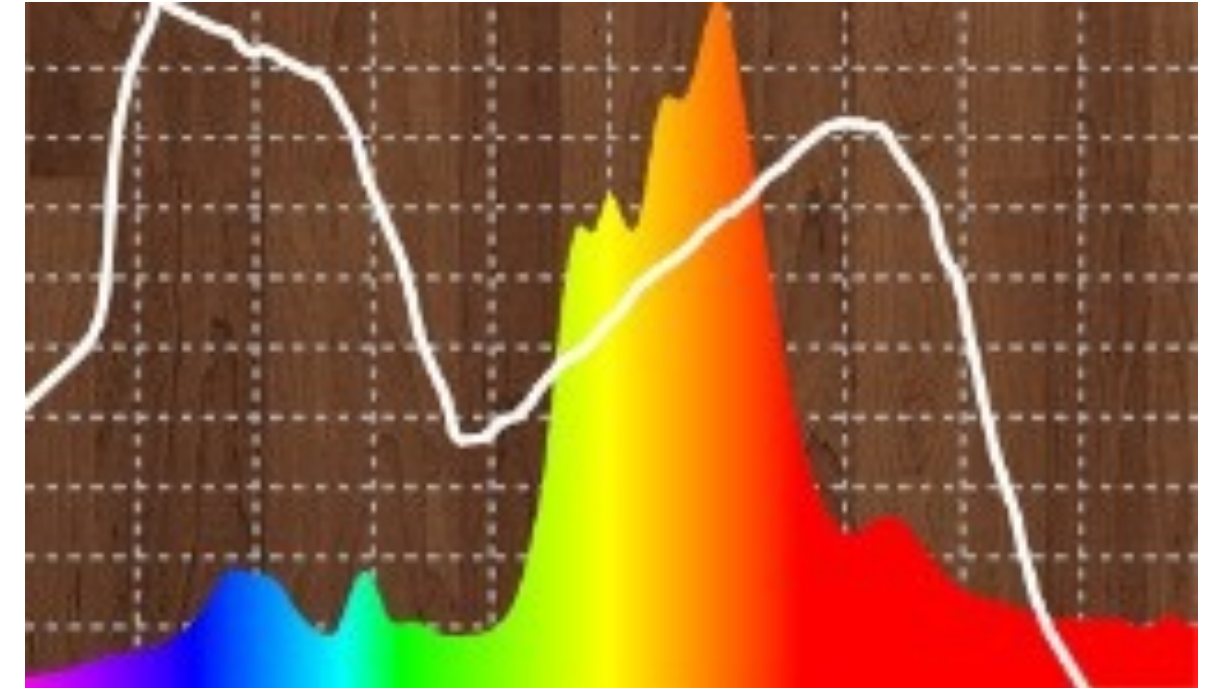
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RBL

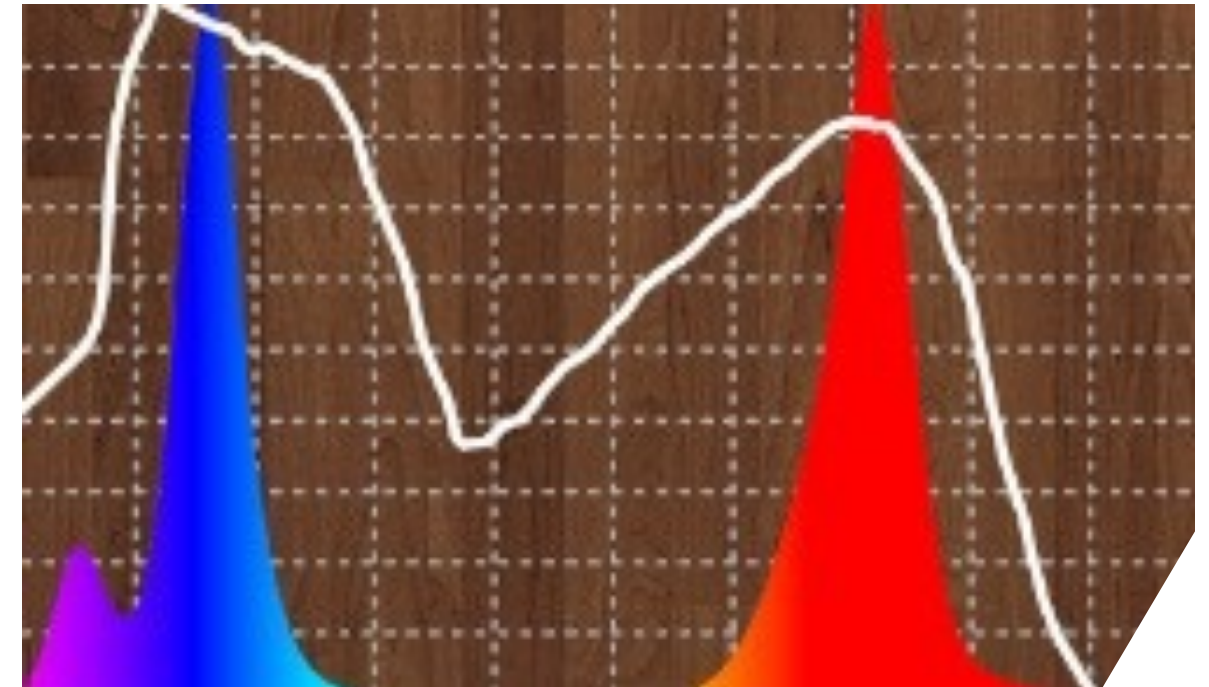
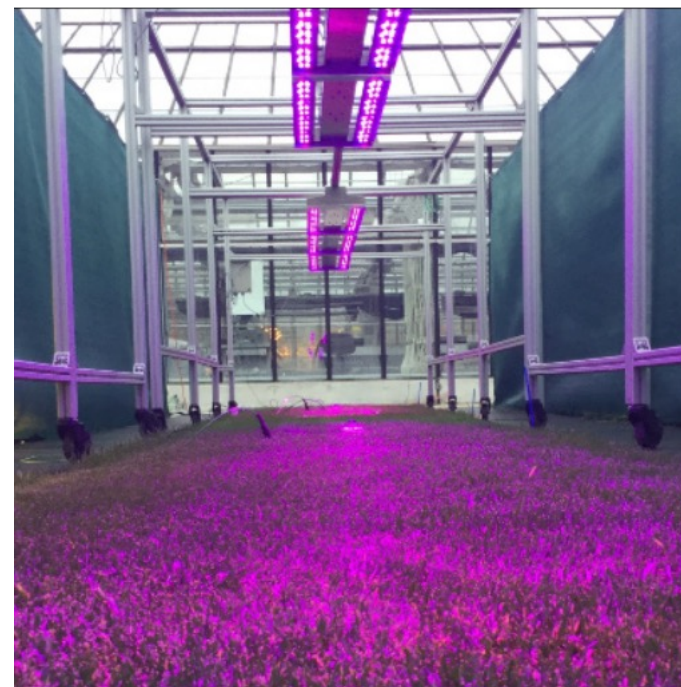
Very different light spectrum

- HPS can only peak in narrow band (yellow-orange)
- RHENAC CLS can peak in any wavelength
- RHENAC CLS changes needed light intensity automatically
- Rhenac LED can mix these colours
- Fully-automated LED grass growth & germination programs

HPS

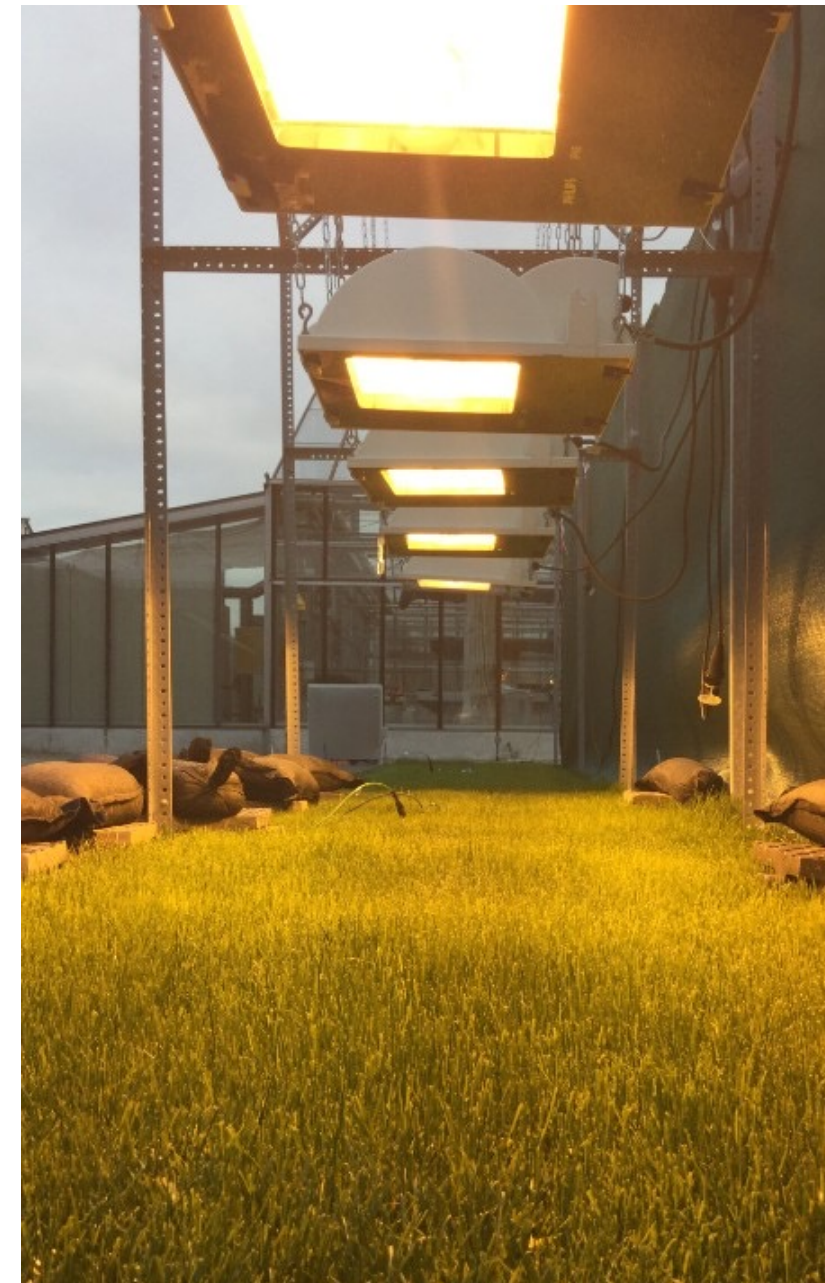


CLS

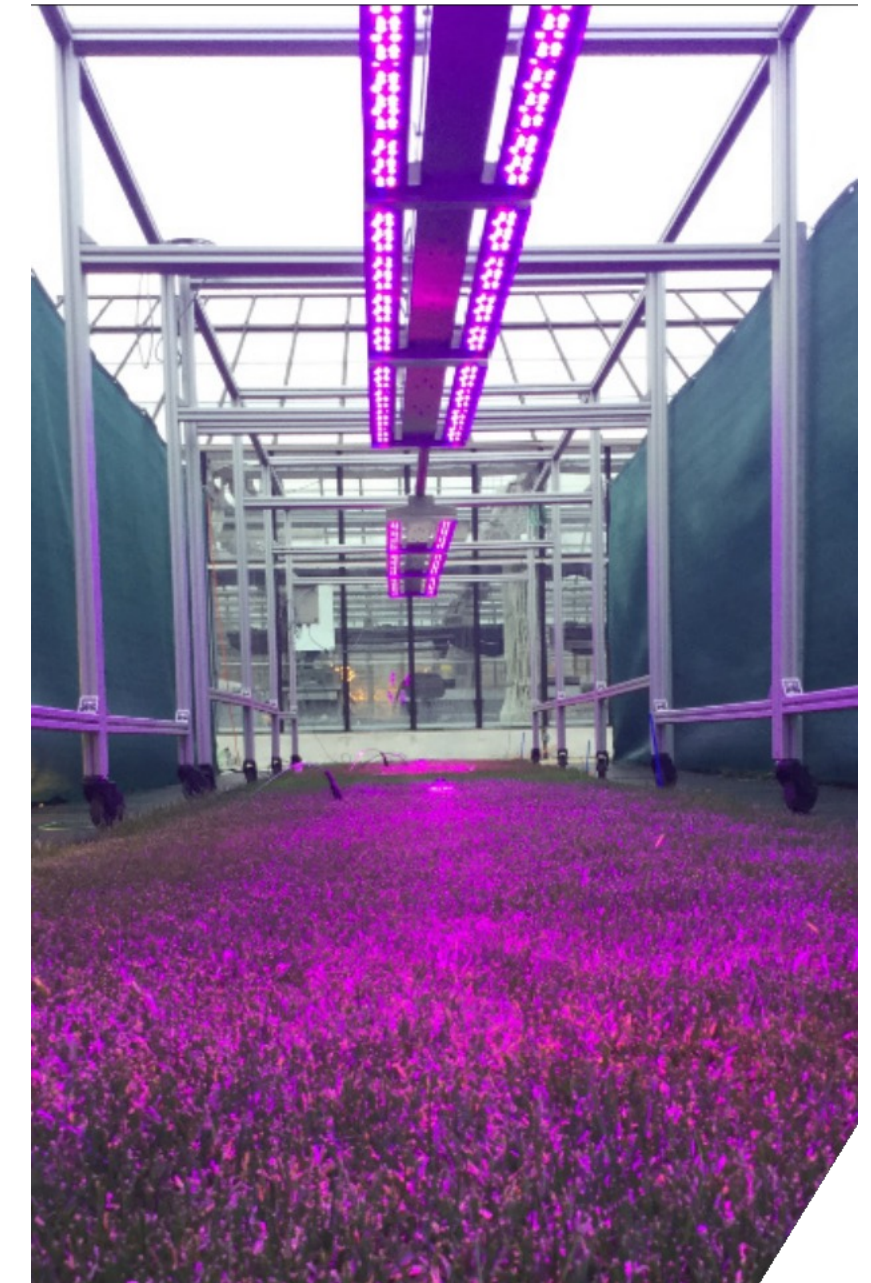


Rhenac LED Technology vs HPS

- 35%-50% less electricity consumption
- Perfect light spectrum
- Multi-channel: flexible mix of blue, red, white,...
- Shading sensor
- Remote access
- LED = cold light: no stress
- IR heater: only when needed
- Automated LED programs
- Digital interface with pitch analyser



HPS
(High Pressure Sodium /
Halogen)



LED
(Light Emitting
Diode)

Analogue vs Digital

1st Generation LED

- Blue and red mix: bio mass, root strength, pitch density
- 35-50% less energy consumption
- LED = cold light: no heat stress
- Added infra-red heat only when necessary
- Up to 15 DLI added. (HPS 7 DLI)



2nd Generation LED

- Higher power
- Higher flexibility
- Automated programs
- Low energy consumption
- Germination programs
- Perfect light mix
- Up to 25 DLI



3rd Generation CLS

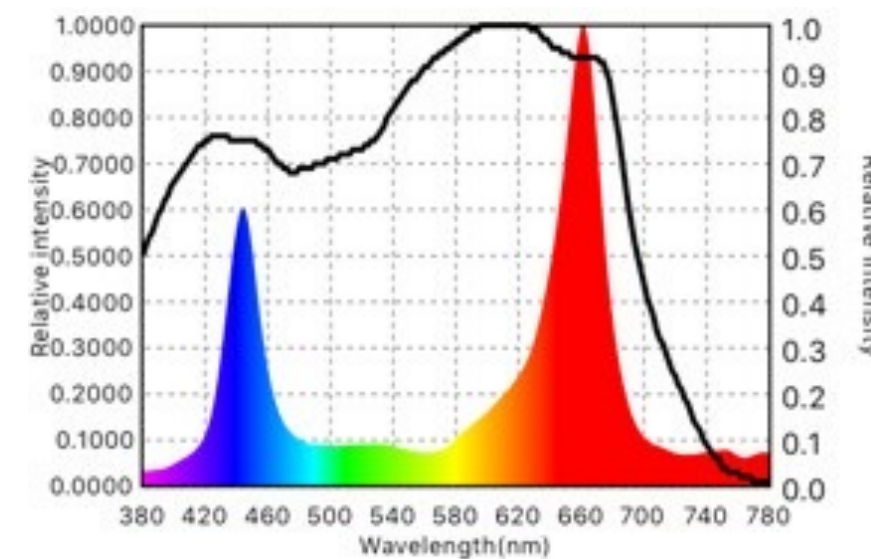
- FLEXIBLE – peak where needed
- AUTOMATED – automatic adaptation of light spectrum
- **COMPLETE LIGHT SPECTRUM**
– blue, red, white, ...
- MAXIMUM POWER 100% in EACH separate channel
- 95%+ EFFICIENCY ➡ 3x more BIOMASS
- Up to 30 DLI (Sunlight appr 33 DLI)



USPs of CLS Lighting

3rd Generation Mobile Units

- RML 30
- RML 100
- RML 200
- Flexible Light Quality
- Sun Light Dim Function
- Shadow Sensor
- Remote Access
- Ir Heater For Additional Heat
- Digital Interface



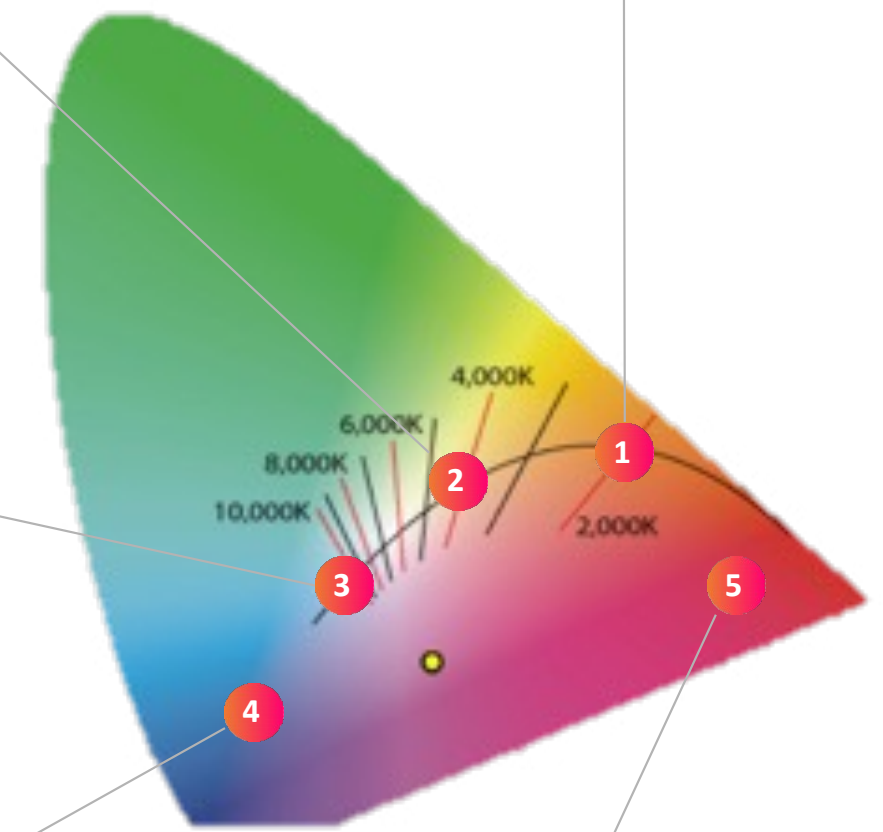
(2) Density / Branching

(1) Length Growth

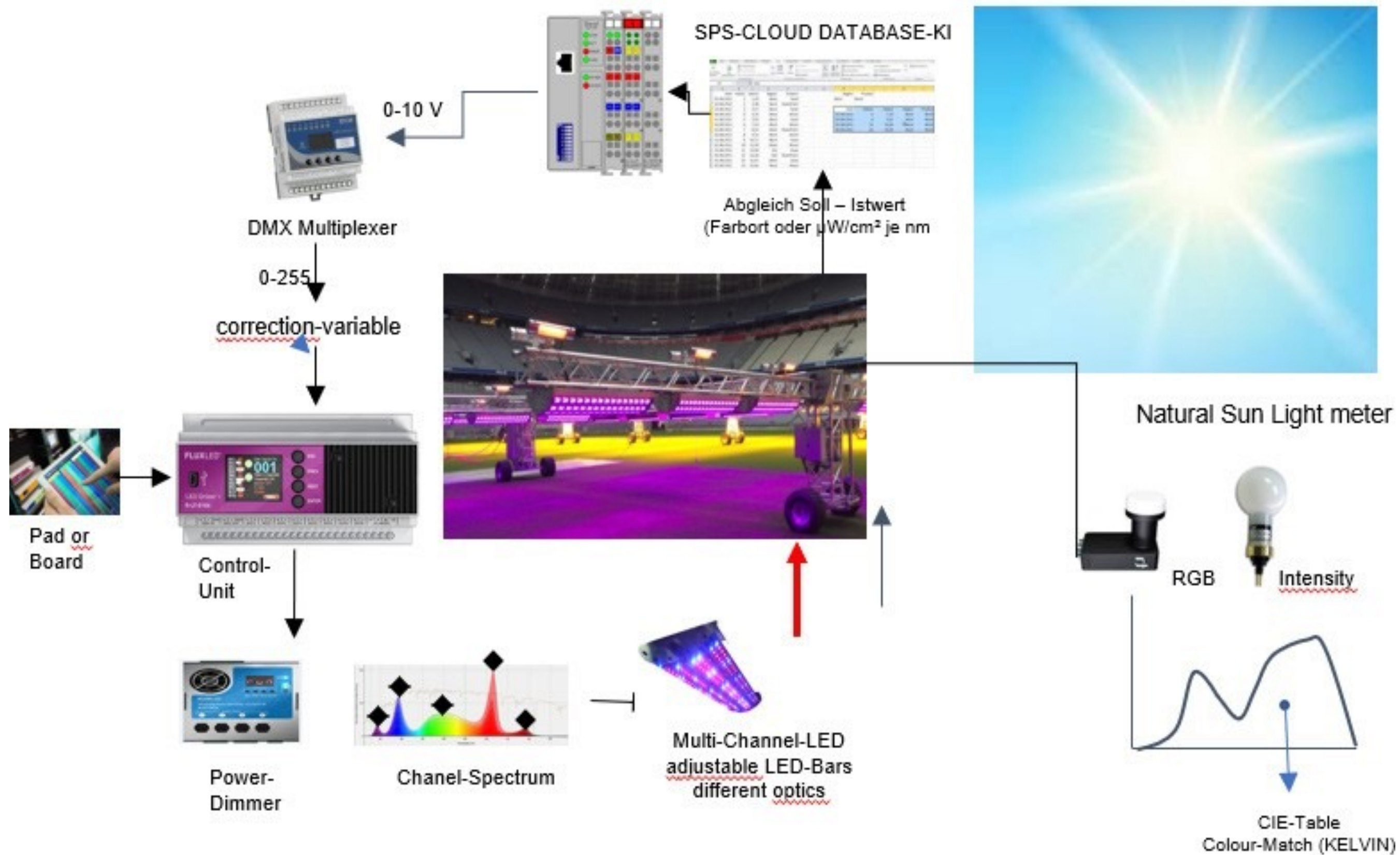
(3) Shear Resistance

(4) Different Germinating

(5) Different Germinating



Pitch Data -> Cloud Platform -> Led Program



2 INNOVATIONS FOR STADIUMS THAT WILL CHANGE STADIUM DESIGN AND USE

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RBL: FULLY AUTOMATIC STEERING





VELTINS ARENA



Bernd

Technical

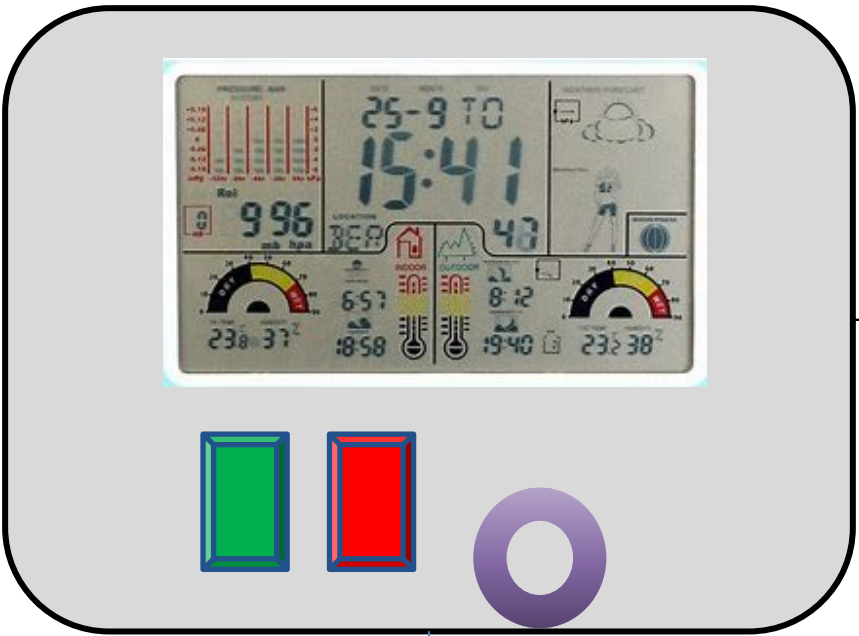
They convinced us over time that they have designed the right technique.

RBL: FULLY AUTOMATIC STEERING

Part of Greentec AG

DATA COLLECTION

- Temperatures
- Humidity of air and soil
- Turf growth parameters
- Stress parameters
- Infections indicators

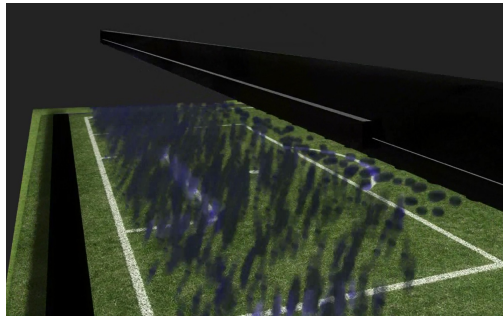
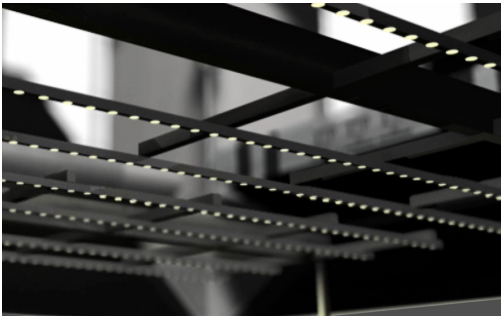


Additional DATA

- Stress levels
- Nutrition levels
- Energy balance
- Tear rations
- ...

STEERING VARIABLES

- Light intensity
- Light spectrum
- Nutrition guidelines
- Watering guidelines
- Heating guidelines



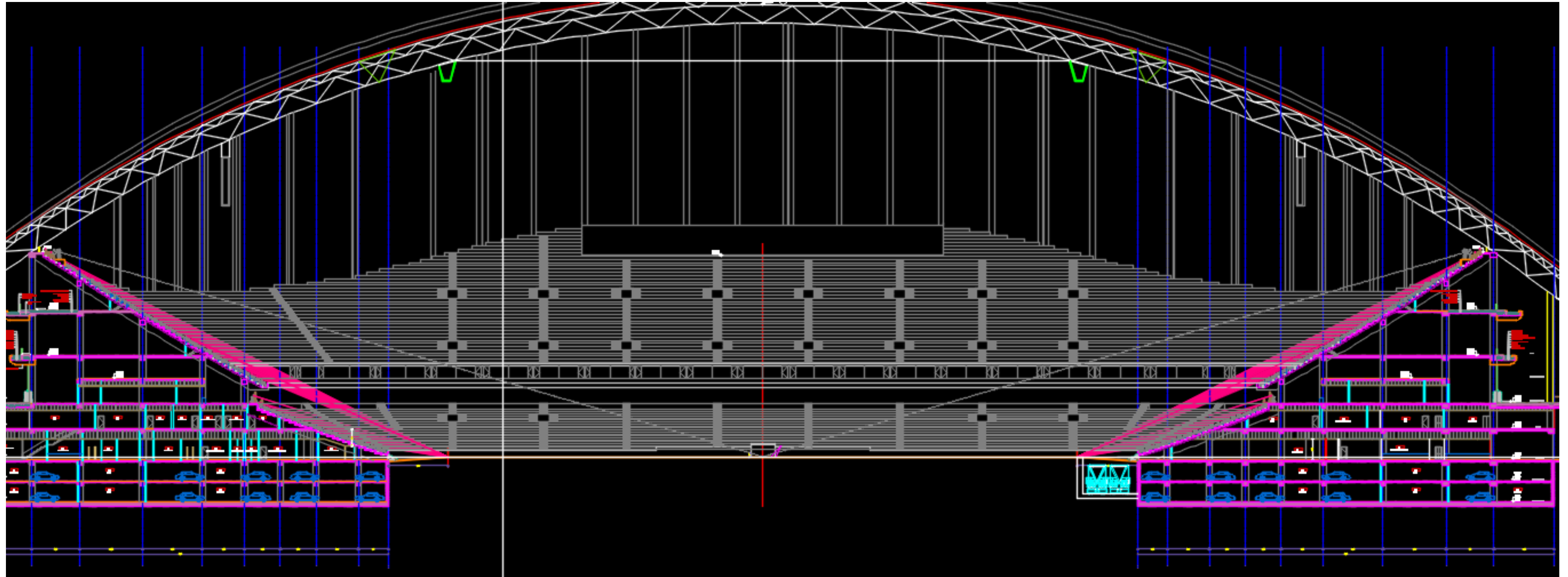
By 2025 we will have

- Closed roof stadiums that will grow grass to the best standards
- Devices that talk natural grass and measure its internal growth factors
- IOT- IOG integrated grass management systems that controls the underlying systems to administer light – water – air and temperature.

Implications:

- Better quality / cost ratio's => SUSTAINABILITY
- Better decision making on energy

RBL: FULLY AUTOMATIC STEERING





THE POWER TO GROW

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