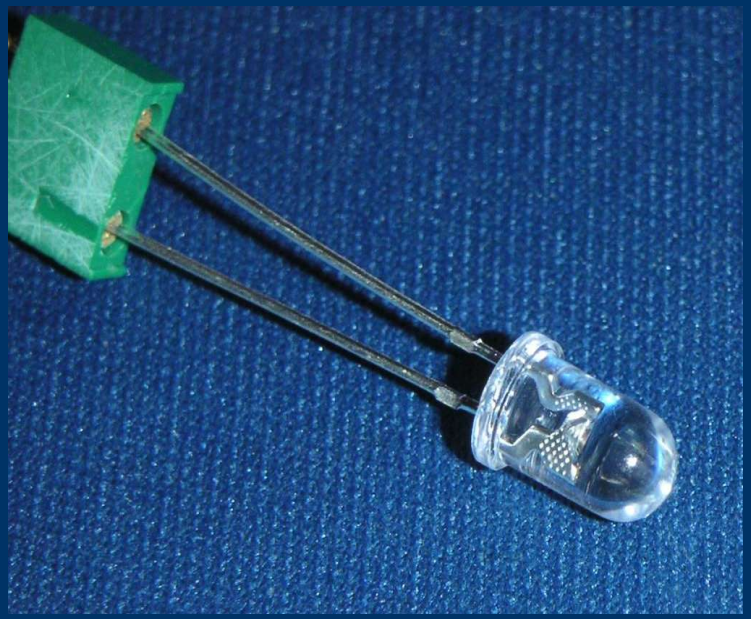
LED electronics

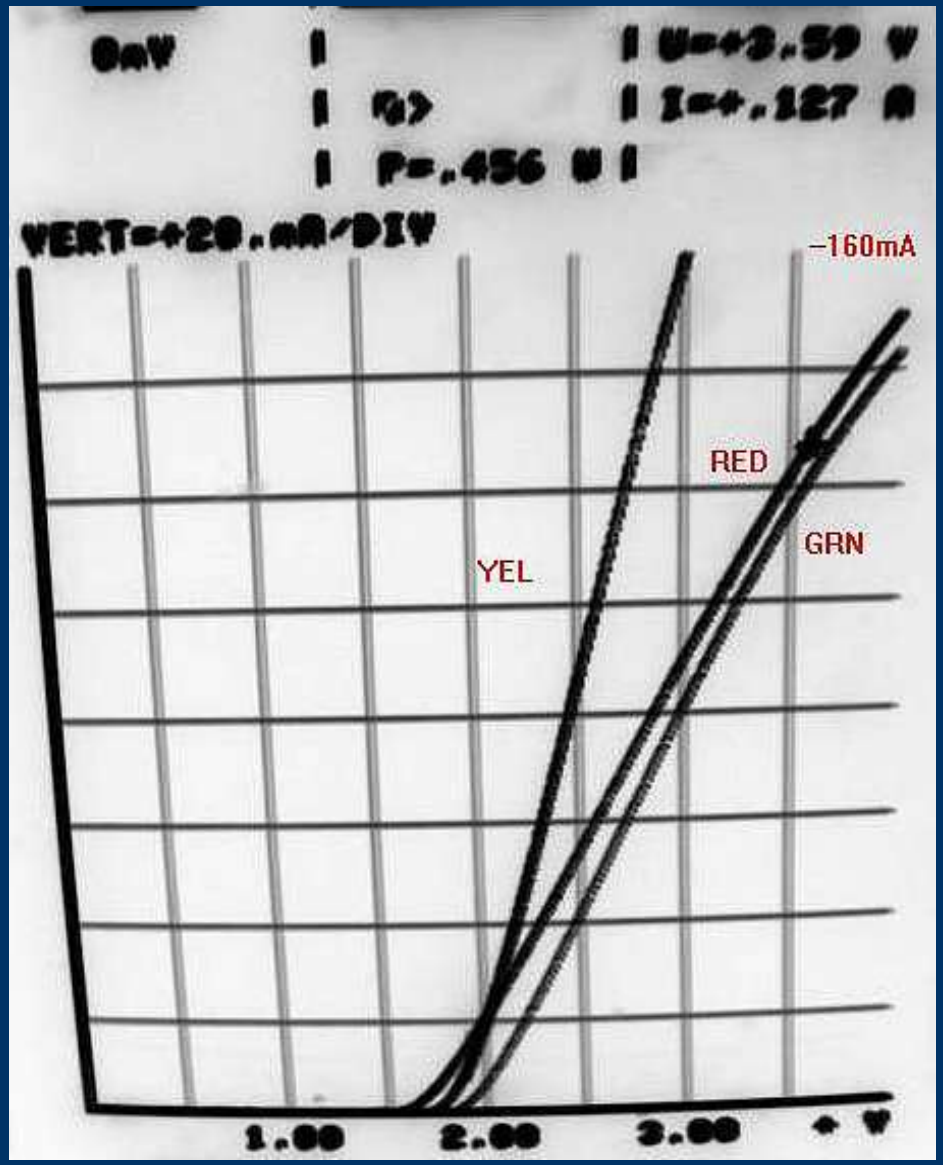
- UV-LED tests
  - Volt-Amp characteristics
  - Optical spectrum, linearity test
  - Small statistics
- Status of CMB design
- LED quality test proposal

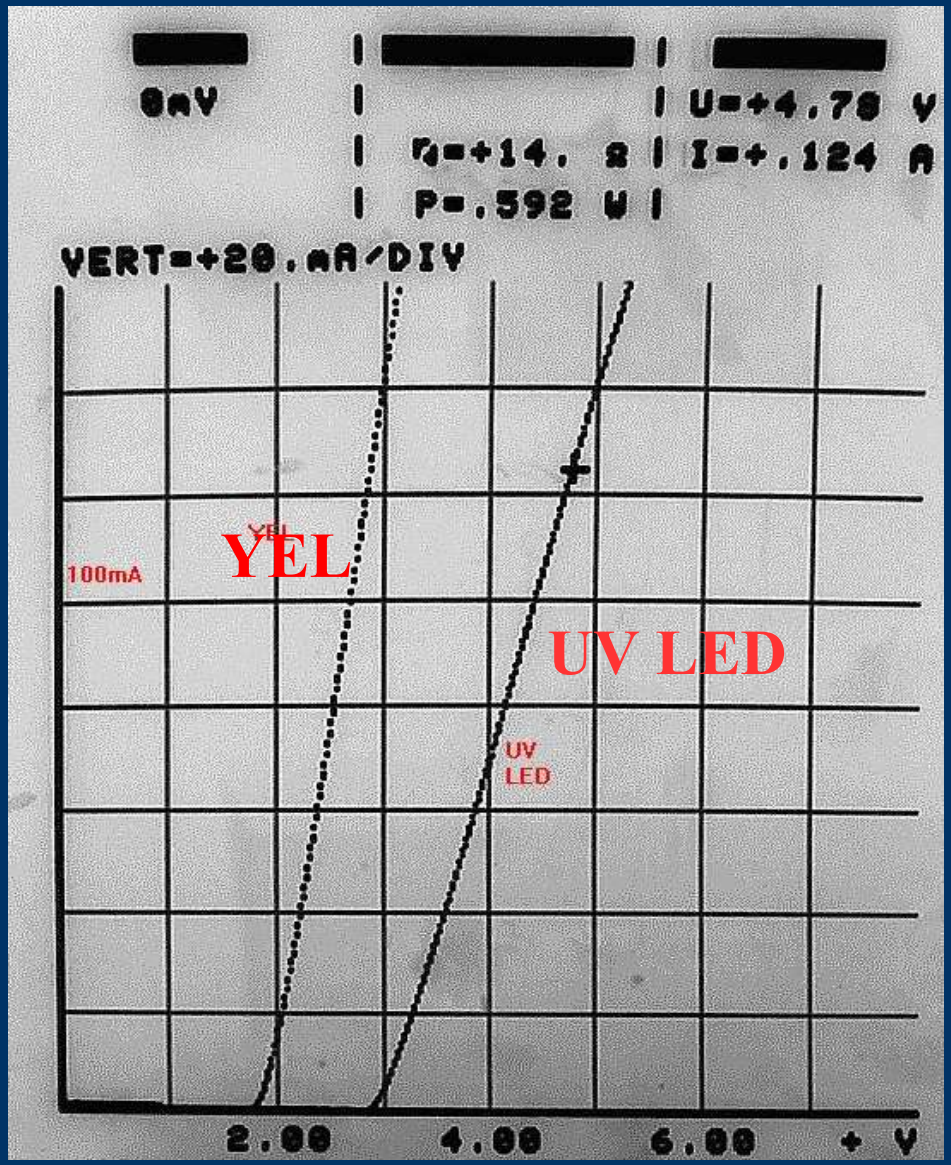


UV-LED tests

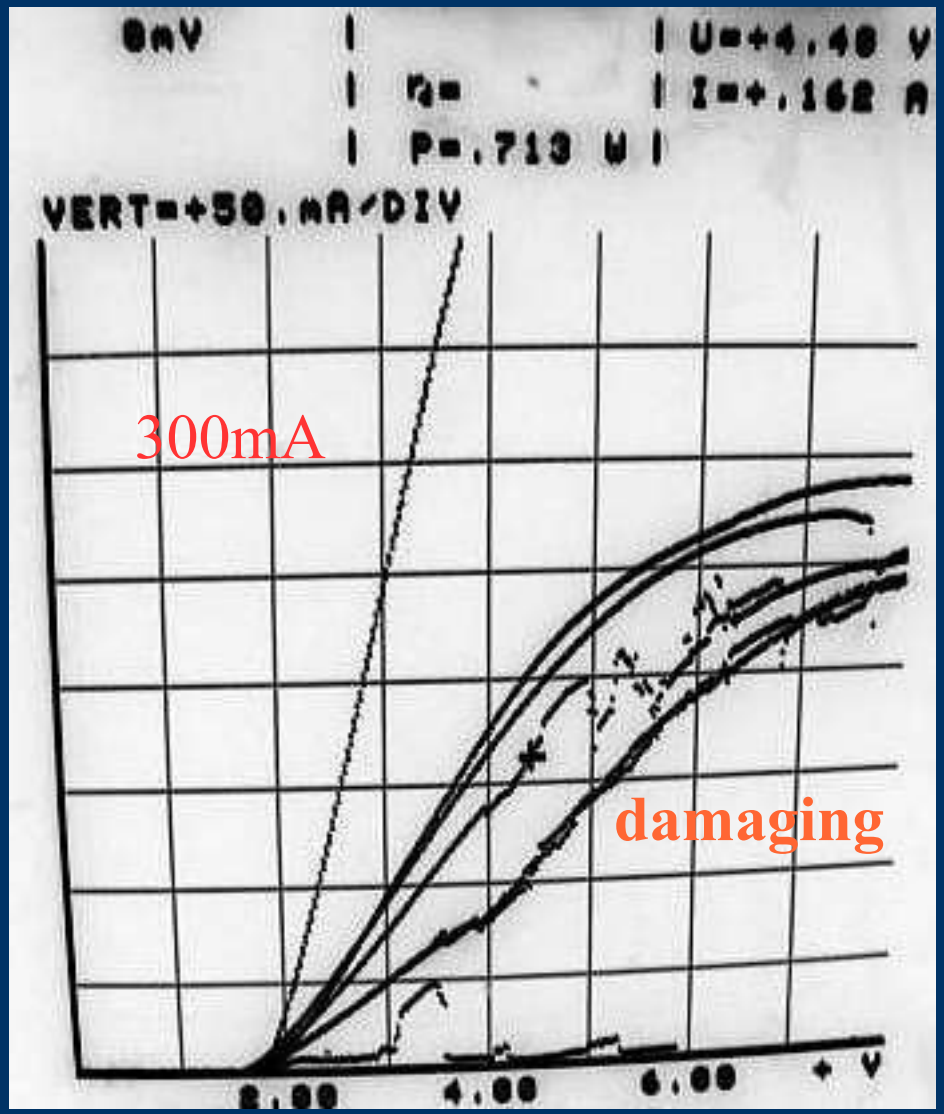
- Volt-Amp characteristics DC-mode
  - Forward and reversed characteristics
  - Tested with Characteroscope, 300µs pulses at 1kHz
  - Compared with precise 6.5 digits DMM at lower current
- Optical spectrum, linearity test DC-mode
  - Measured tnx to Martin Nikl, Inst. of Physics Prague
  - Test equipment spectrometer ORIEL 50540
- Small statistics
  - 4 pcs of UV LED only

UV LED forward V-A char





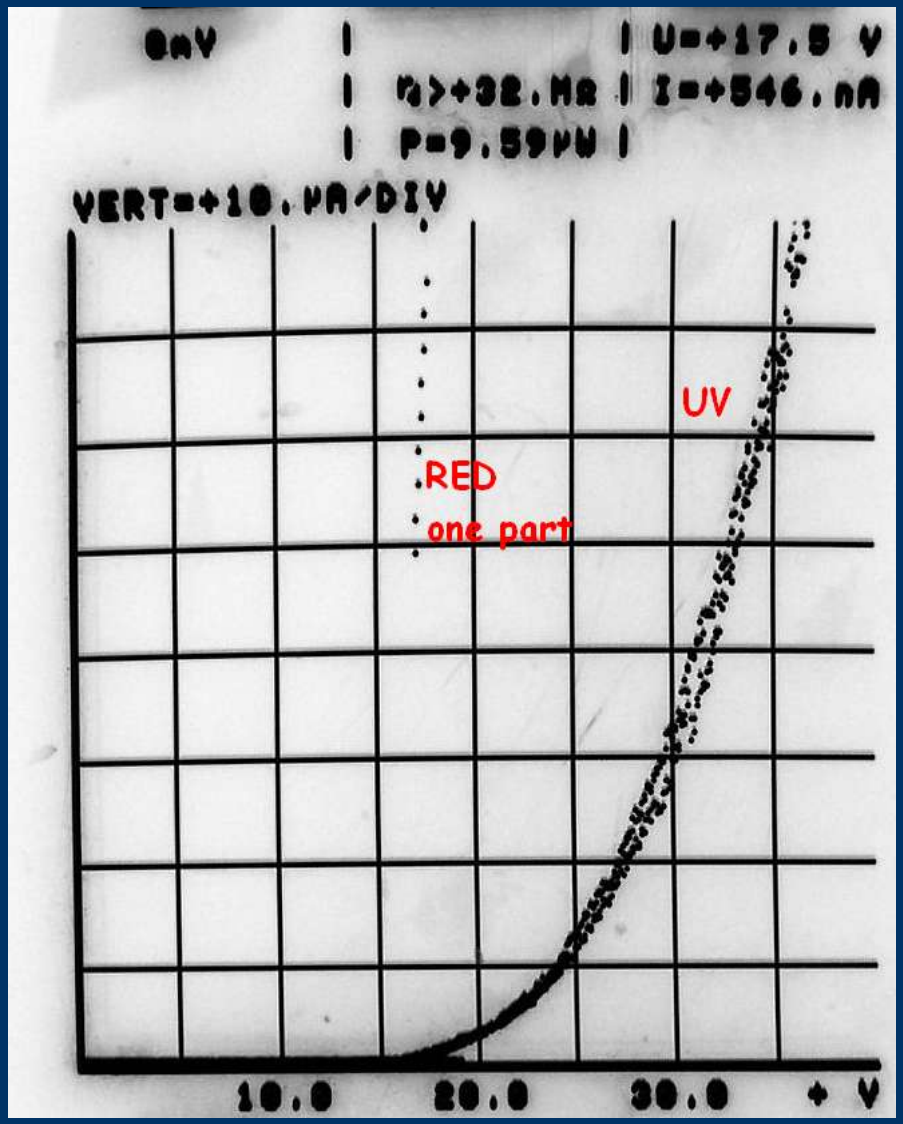
UV LED forward V-A char

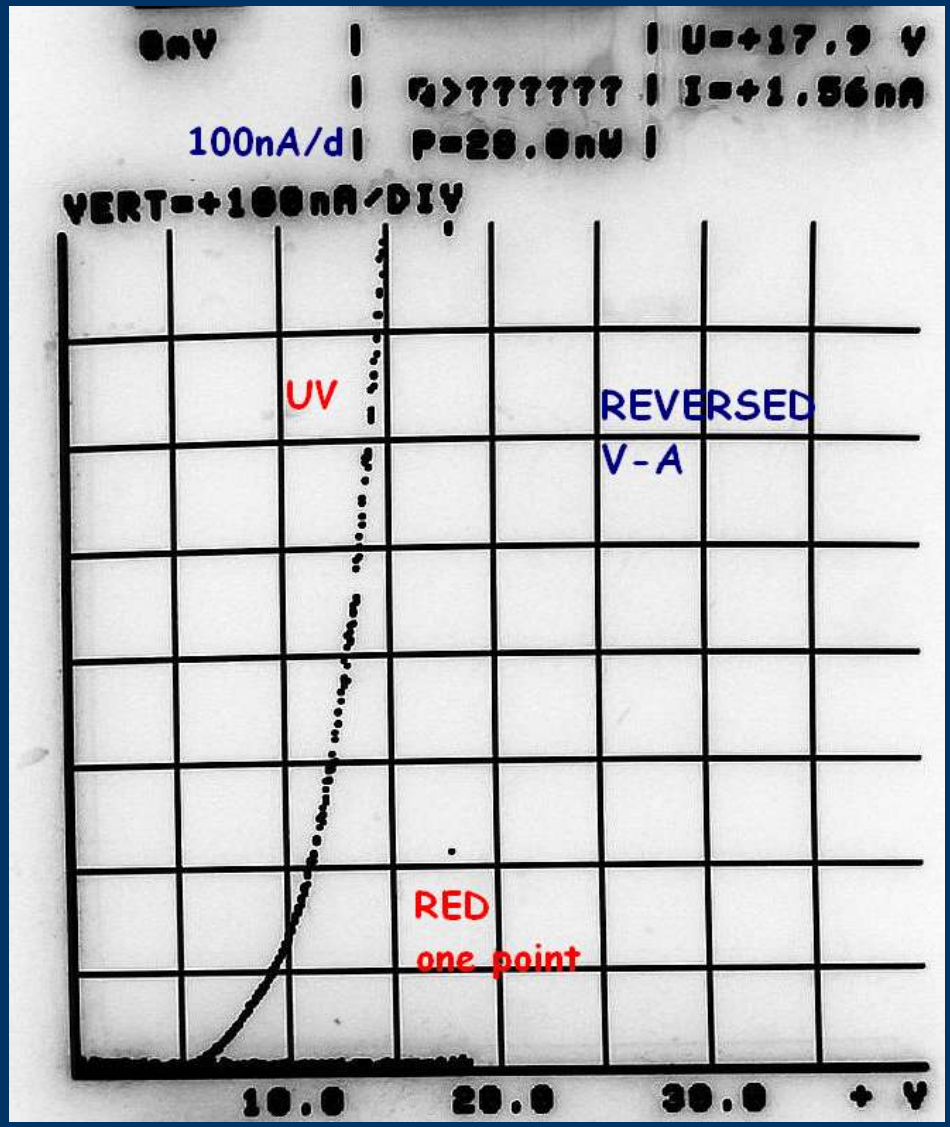


300 μs pulses at 1kHz rate
i.e. 33% duty factor

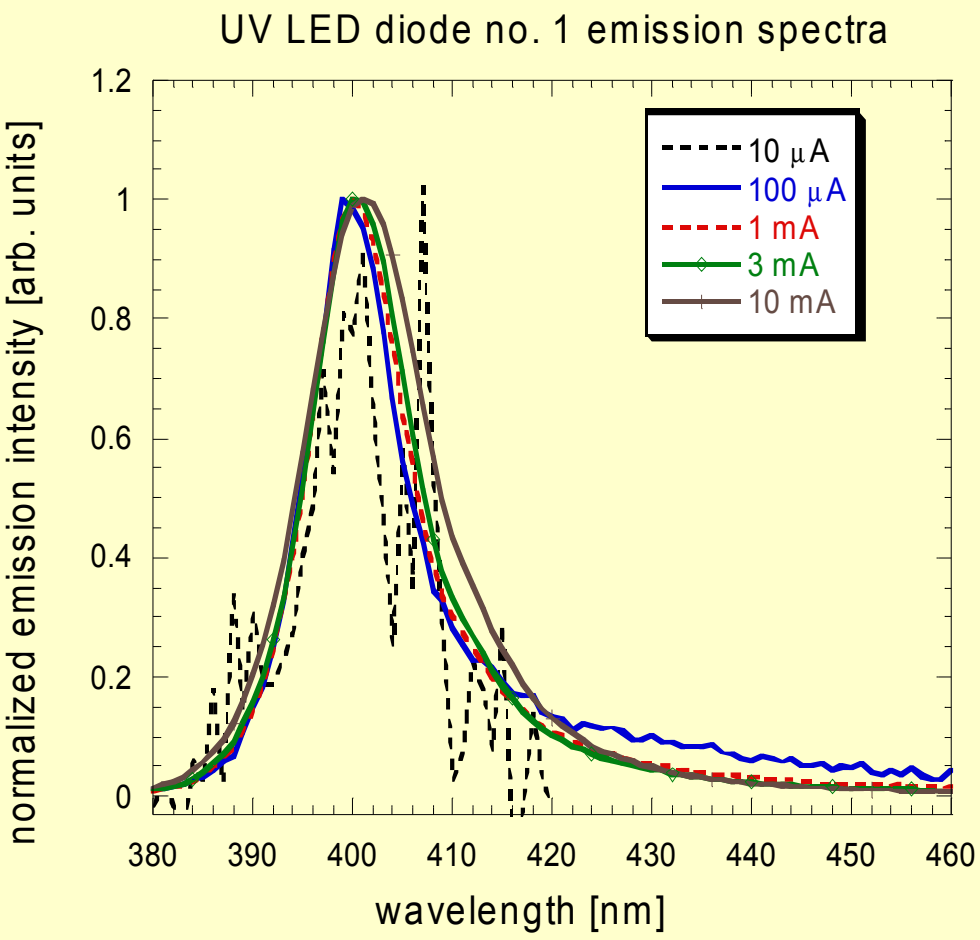
UV LED is more sensitive to the overheating than common LED

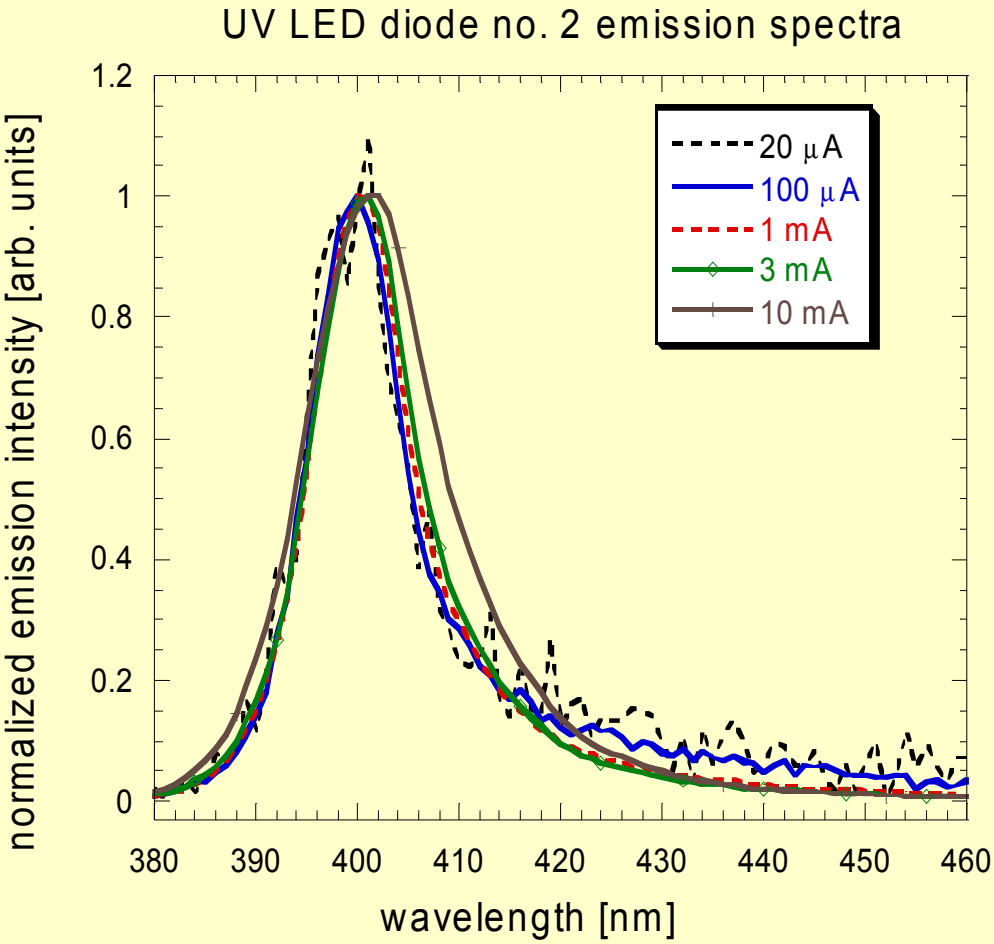
UV LED reversed V-A char



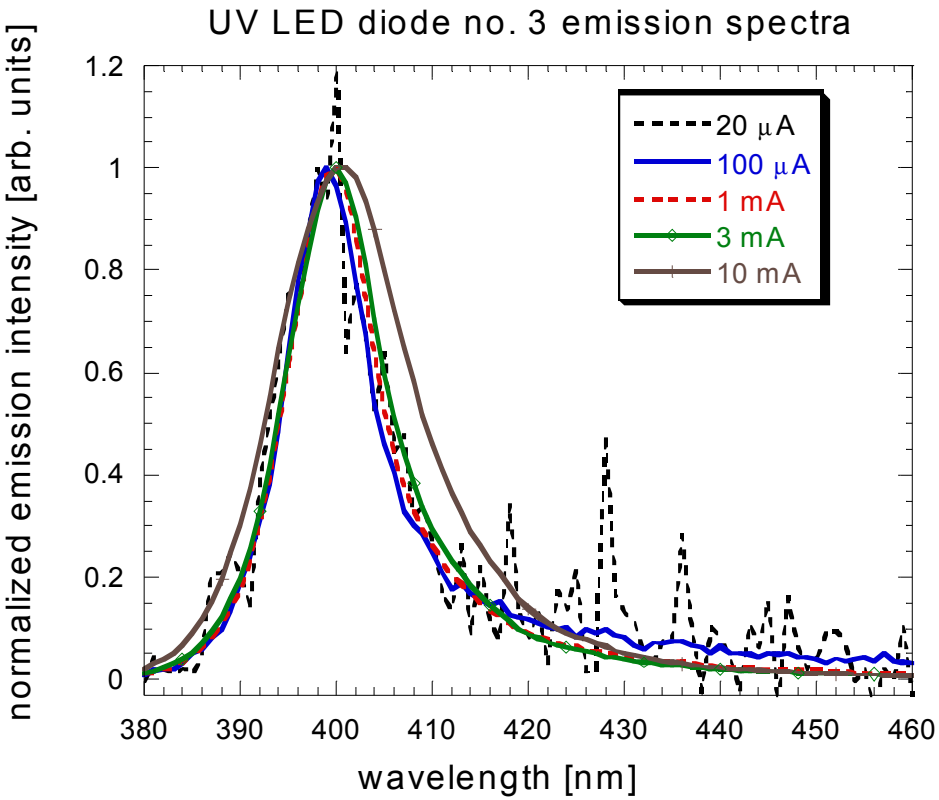


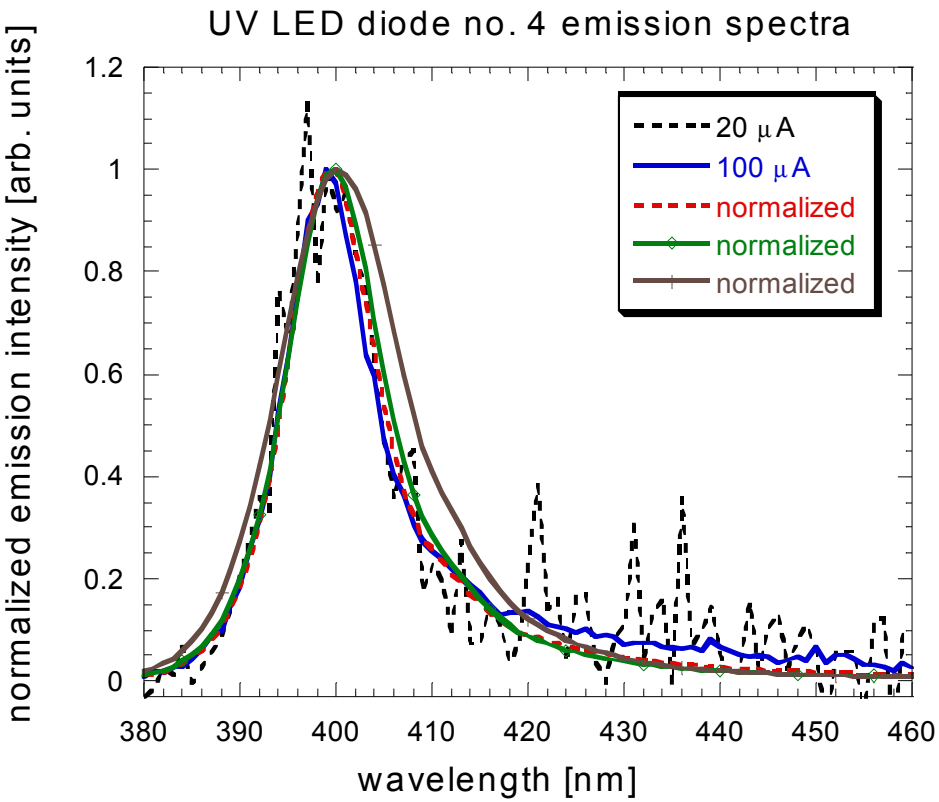
Spectra of UV-LED



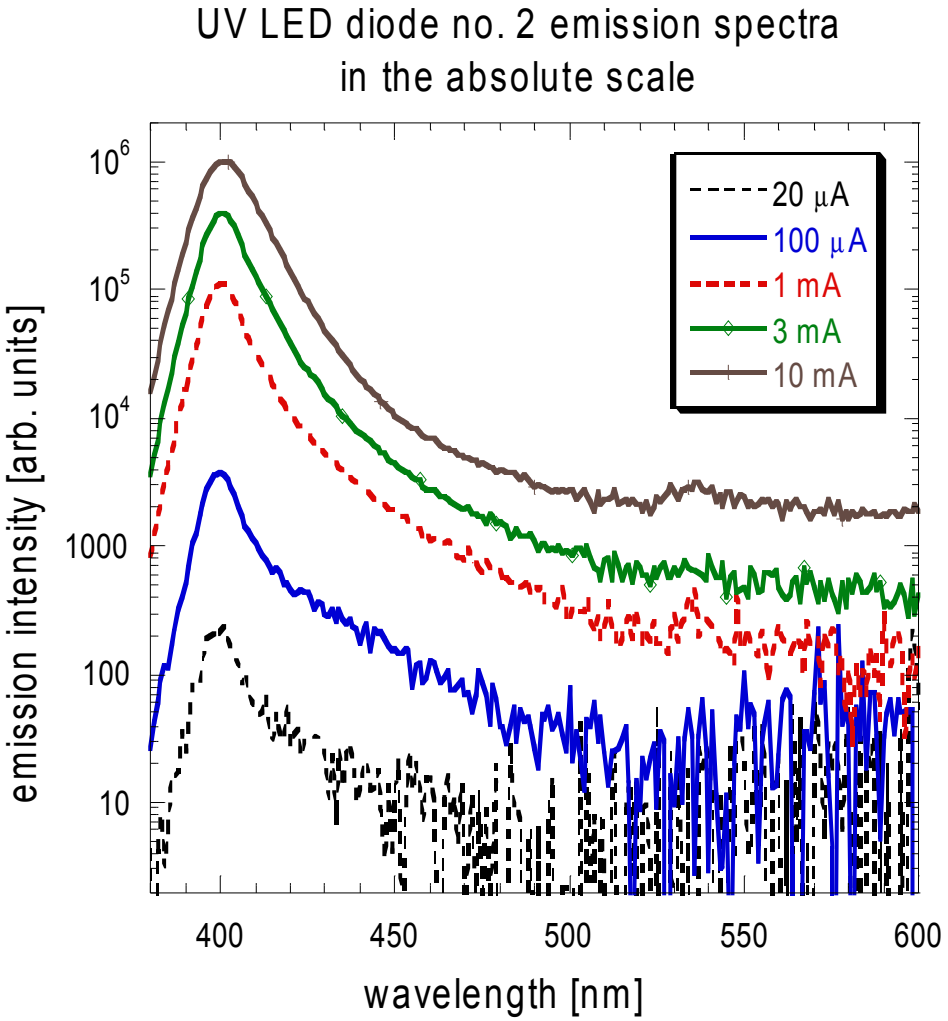


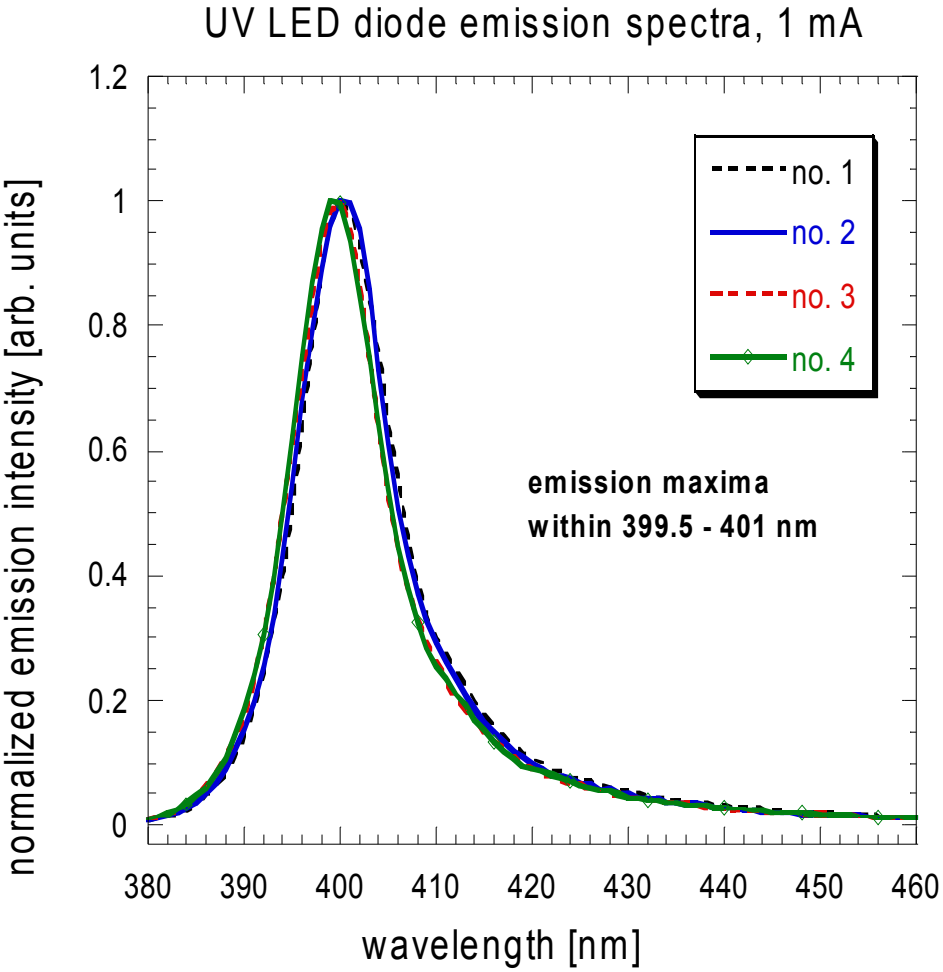
Spectra of UV-LED





Spectra of UV-LED





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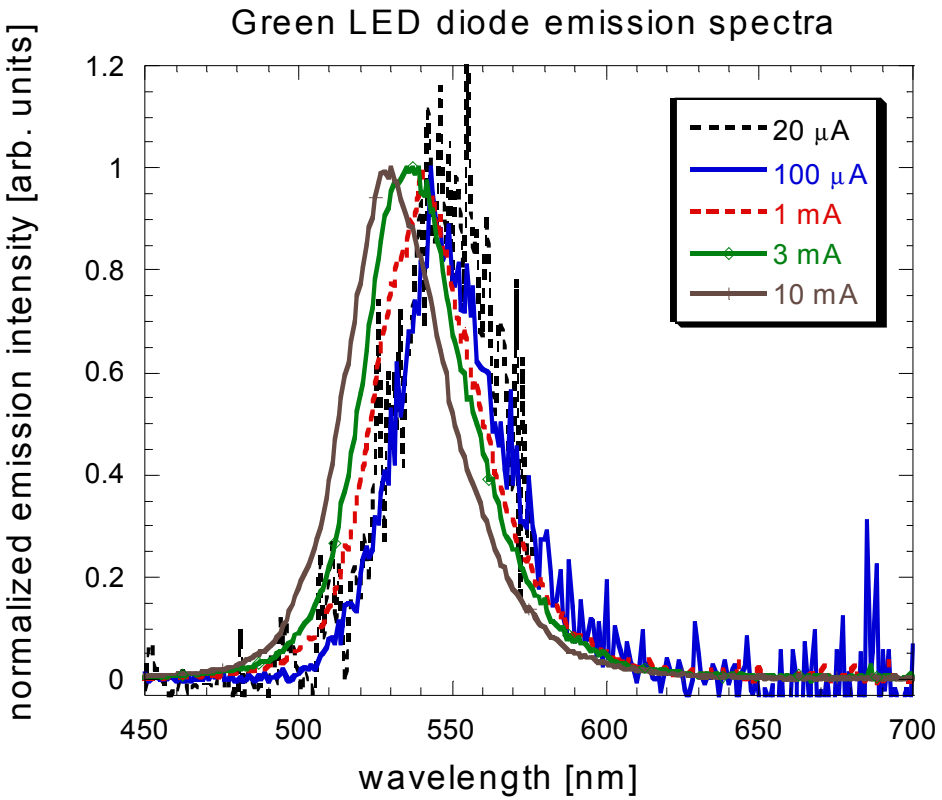
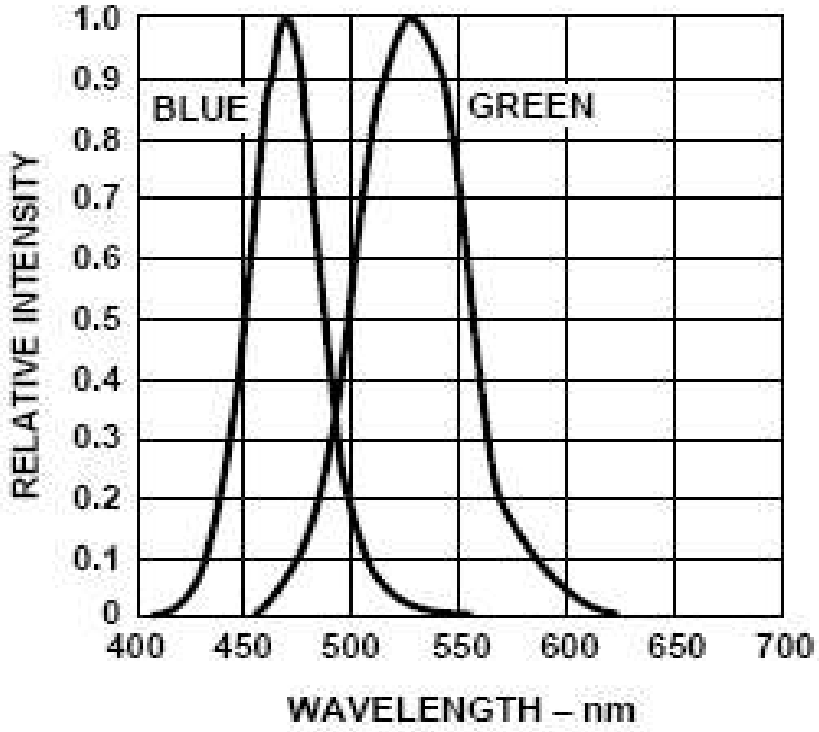
Spectra of GRN-LED Agilent HLMP-CM15



Pic from Agilent datasheet



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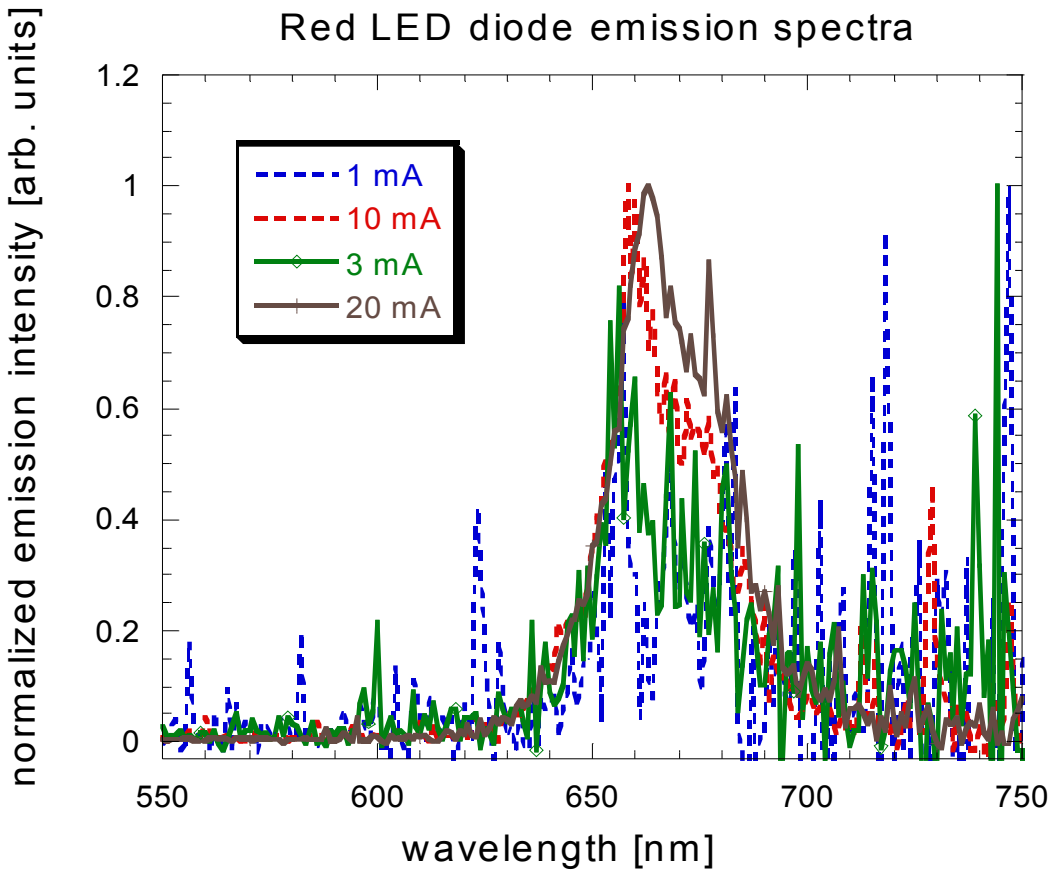
Spectra of RED-LED



Not nice spectrum

it was chosen no name LED

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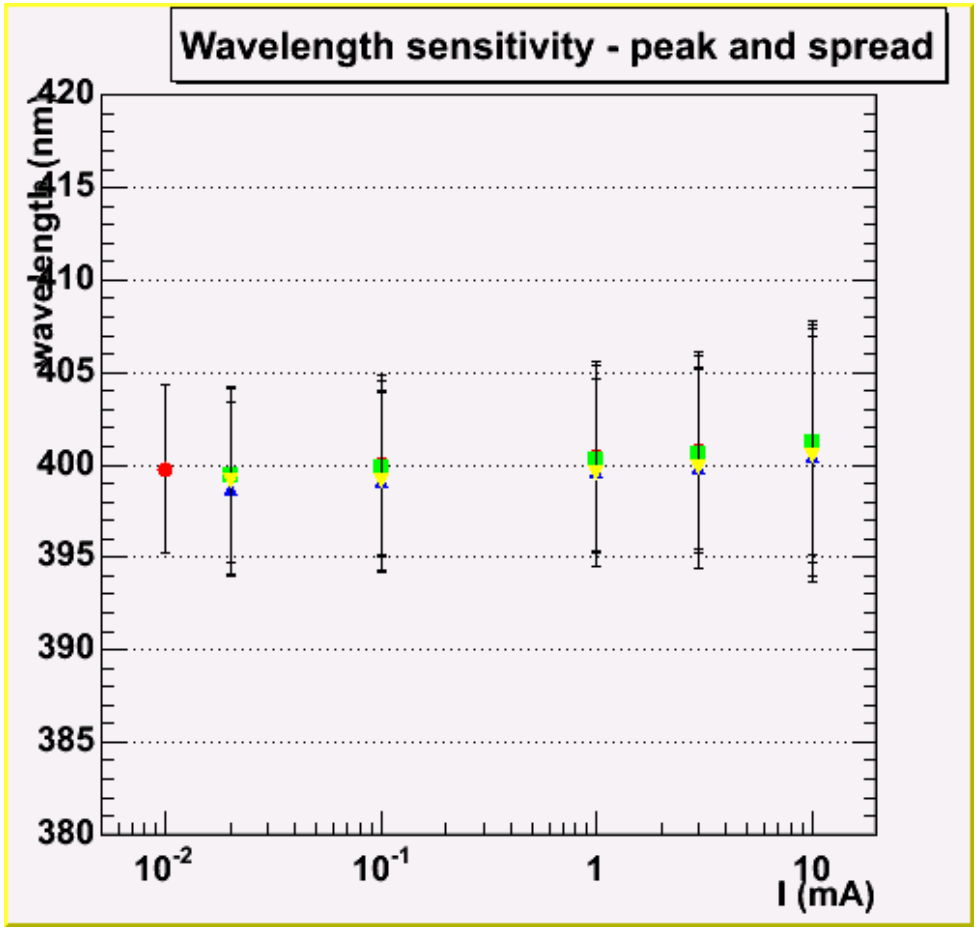
Wavelength emission of UV-LEDs

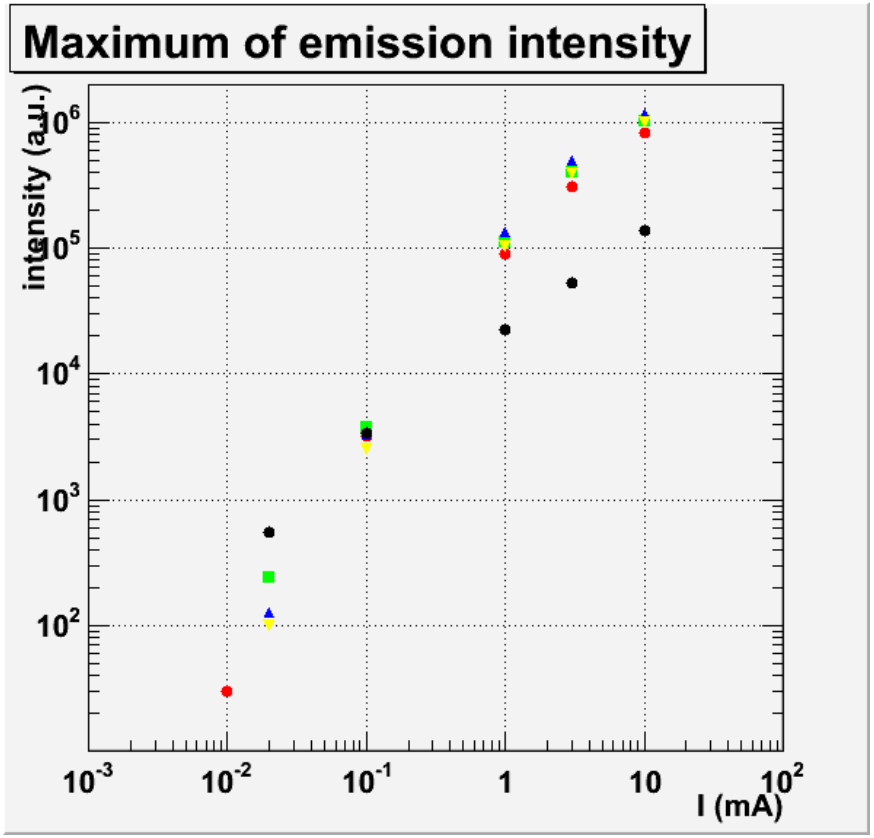


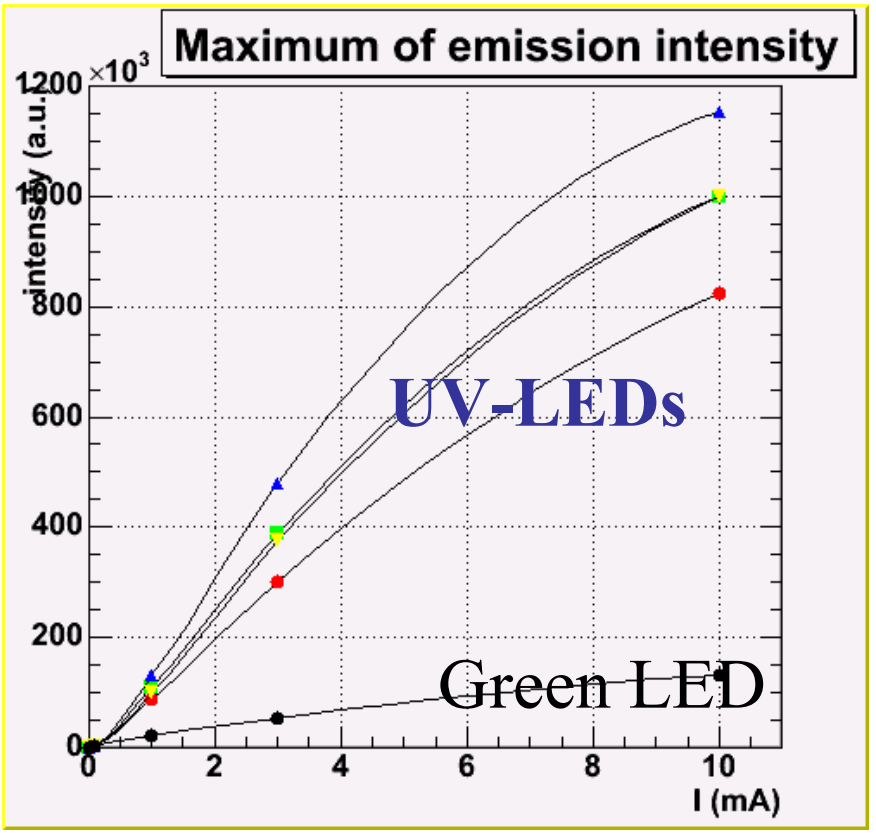
- Peak and spread derived from Gaussian fit on LED emission frequency spectrum (-2,+1)*σ
- Peaks @ (400±1) nm for all 4 UV-LEDs and all light intensities
- Spread of emission (1 sigma from fit) in average:

  (4.8), 4.9, 5.1, 5.4, 6.6 nm for

  (0.02), 0.1, 1.0, 3.0 10.0 mA

LED intensity vs current (coarse measurement)





- Intensity determined as height of gauss. fit on emission freq. spectrum
  → light intensity at spectrum peak position)
- Assumption of same spectrum shape (peak position and width as well)
  in all currents, else needed integration in some freq. range (~20% variation 1-10 mA)

➢ Not fully comparable absolute light intensity (adjustment of measurement uncertainty, small variation in spectrum shape, few points)

Status of CMB design

- The schematics of complete 12CH system is ready
- PCB design is on the way
- Already fixed subsystems of CMB:
  - CAN bus controller, Temp reading, PIN PD readout
- Some mechanical parameters will be upgraded at real one layer of detector, connection segmentation
- CMB is divided into 2 parts, kept in one frame designed by Karsten
- All the features are implemented, include settings of puls width
- Not clear is a **new requirement** for very short puls ~2ns, it has to be discussed soon to prove design of LED driver
- We need about 5-7week to build the board such complexity

Large LED Quality test in Prague

- **Setup:**
  - Ivo's LED driver, tested UV-LEDs
  - Light adapter (~2-3 mm air gap), fiber bundle (glued one end)
  - APD mask holding fibers on 9 APDs (small gain ~10) + 1 PIN
  - Preamp + Camac / oscilloscope readout
- **Measurements:**
  1. "Qualitative" -- 9 chosen fibers from bundle with 9 APDs for each UV-LED, sub-sample 30 (50?) pieces
     a) Light cone homogeneity – turning led around axis, 9 fibers in cross
        average values and spread for each position (same current)
     b) Variation light intensity – measure at low-medium-high LED currents
  2. "Qualification test" – selection 500 good LEDs of all
     - Using 4 channels oscilloscope measurement of signal shape satisfying some criteria (amplitude, width,..) derived from 1.
  3. "Ageing test"
- **General problems:**
  - How to determined 'good' value of LED current in MIP units
  - How to figure out what amplitude corresponds to 1 or 10 MIPs

Completed by Jaroslav Zalesak, apr05