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# Perception Motivated Hybrid Approach to Tone Mapping

Martin Čadík

Czech Technical University in Prague, Czech Republic



Computer Graphics Group



# Content

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- HDR tone mapping
- Hybrid Approach
- Perceptually plausible approach
- Cognitive approach
- Conclusion



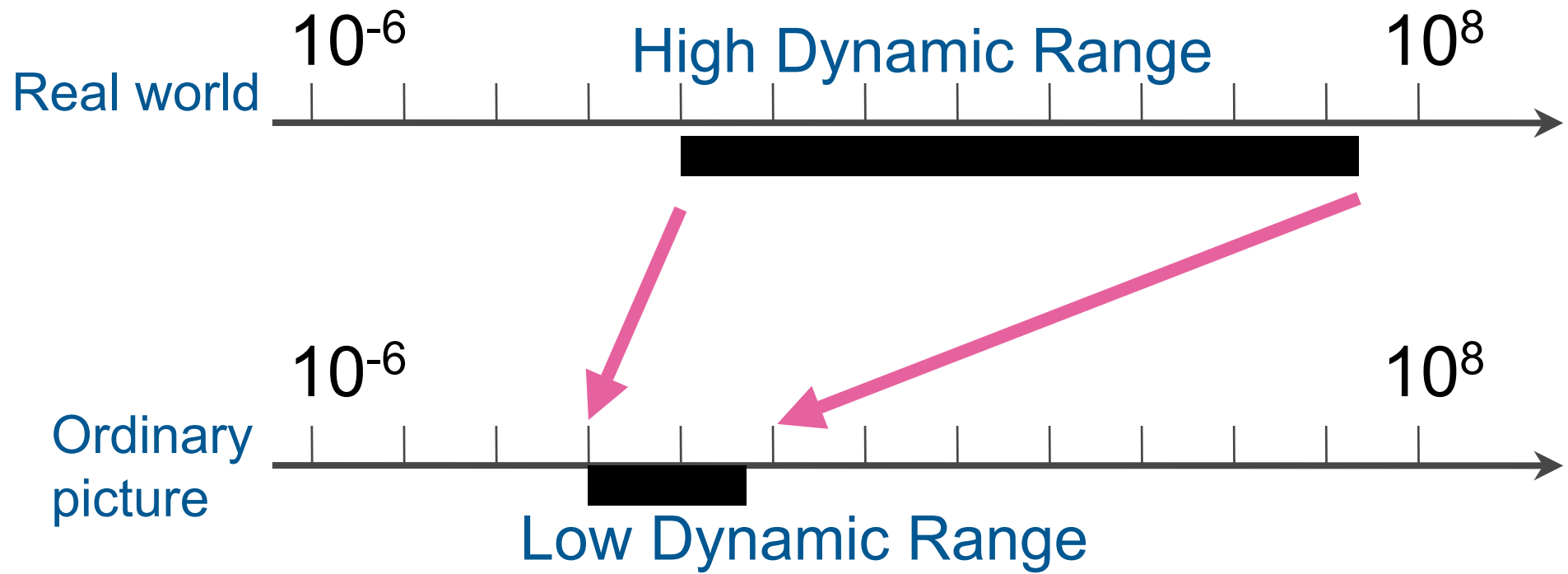
# High Dynamic Range Imaging

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- HDRI
  - useful in many areas of computer graphics and applications
- HDR images
  - several orders of magnitude
  - high precision
- [Reinhard et al. 05]



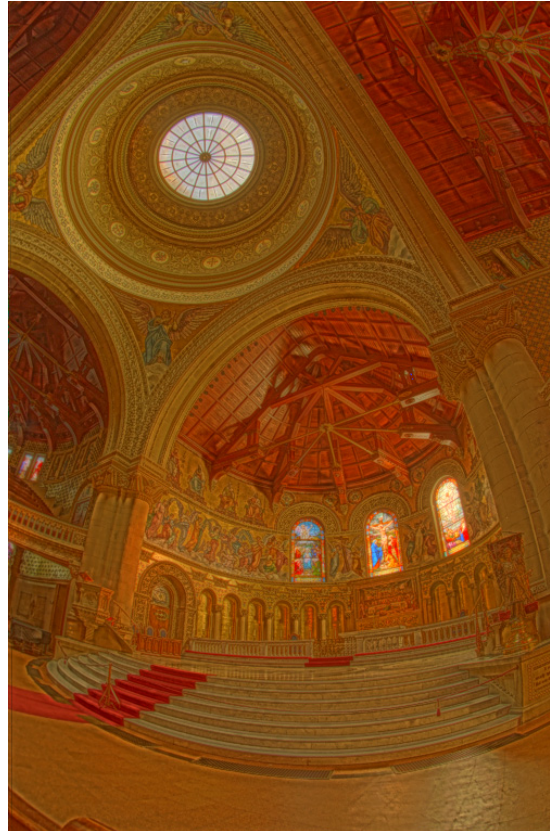
# Tone Mapping Issue



# Tone Mapping Goals



Aesthetical



Cognitive



Perceptual

[Cadik et al. 06]



# Global and Local Methods

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- Global methods (TRC)
  - fast
  - simple, easy to implement
  - good reproduction of overall image attributes (perceptual)
  
- Local methods (TMO)
  - spatial processing
  - time-consuming
  - good in reproduction of details (cognitive)
  - artifacts



# Global and Local Methods



[Ward94]



[LCIS99]



# Subjective Perceptual Experiments

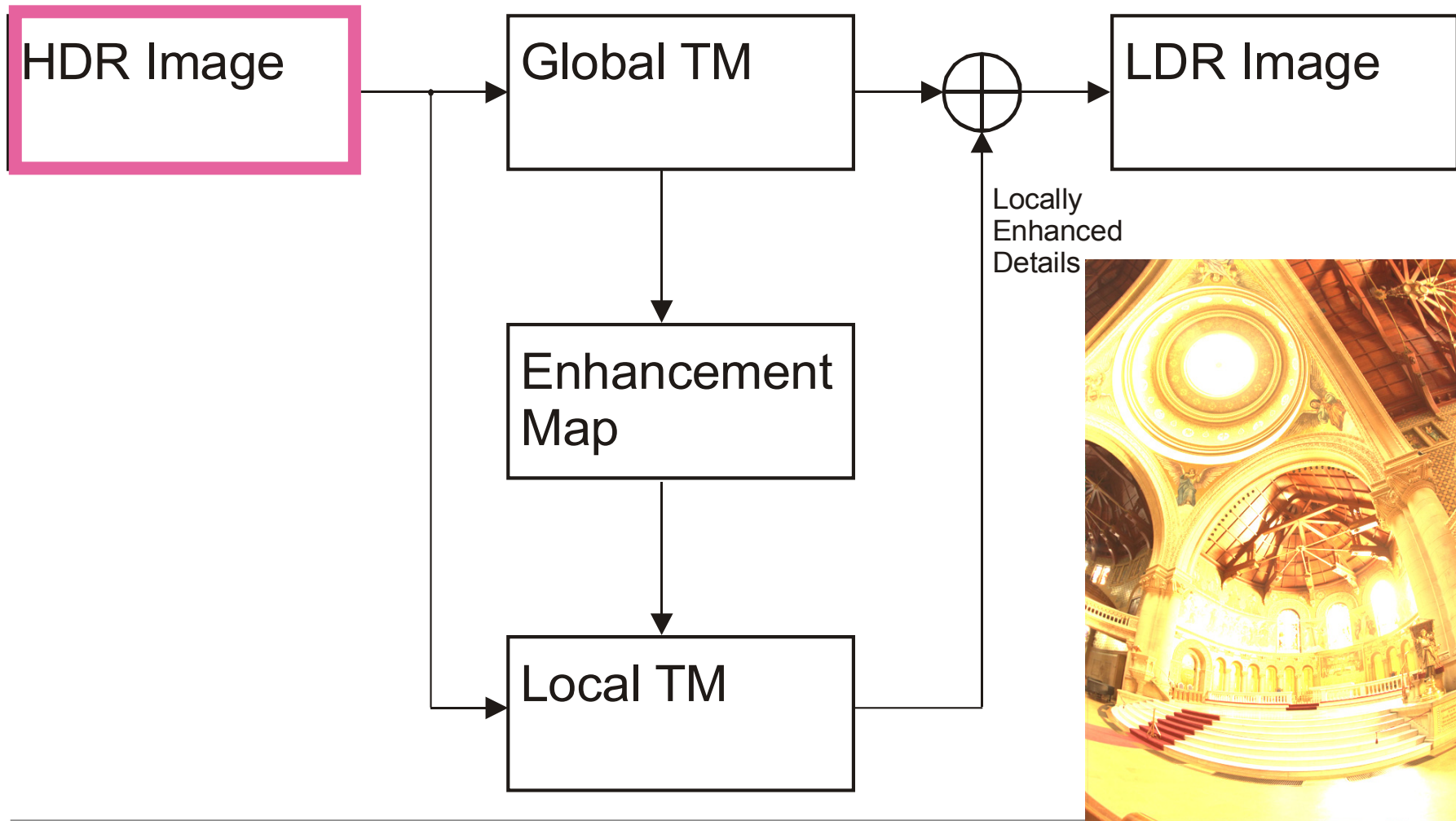
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- [Cadik et al. 06]
  - superiority of **global** methods for reproduction of natural scenes

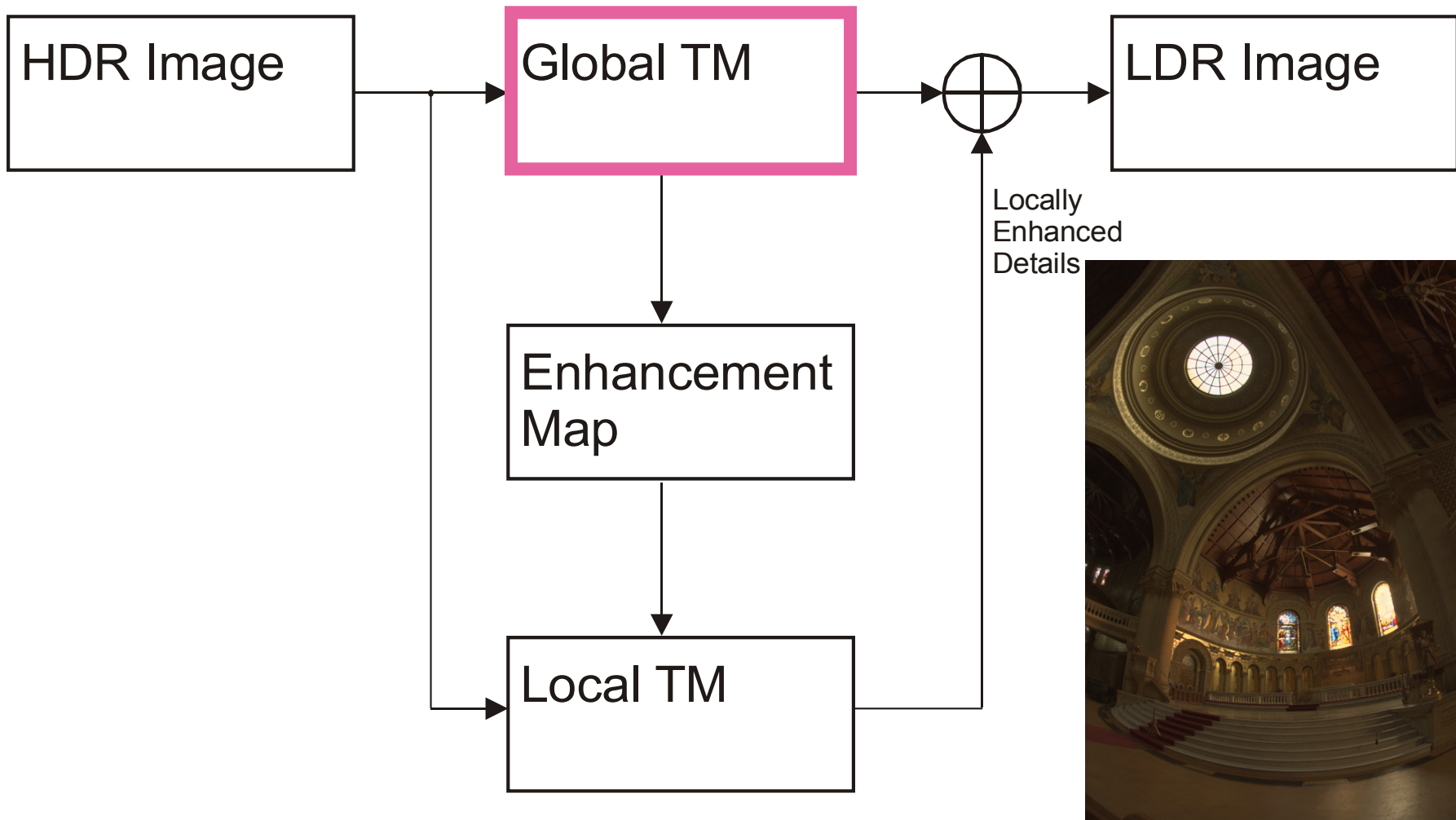




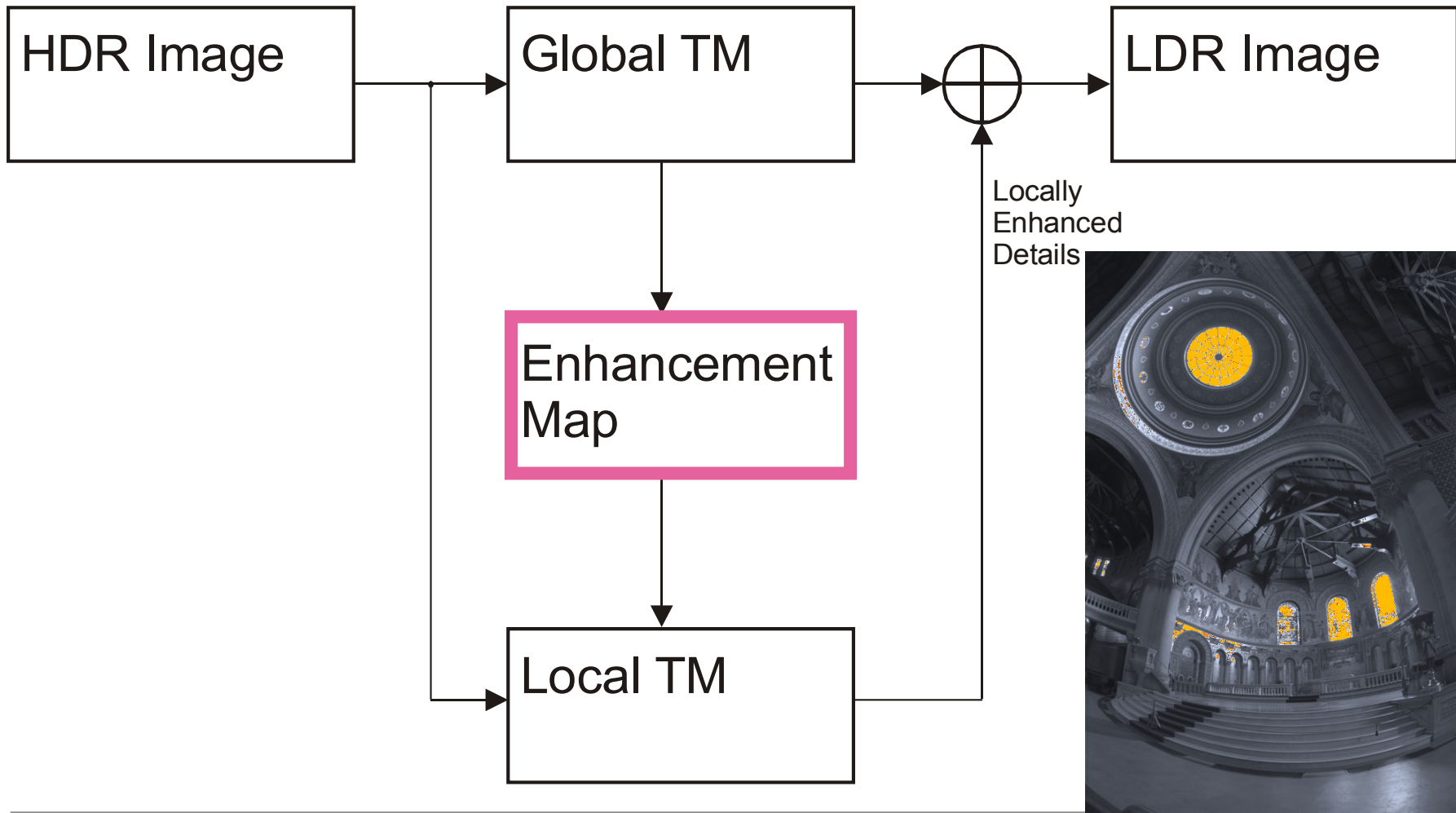
# Hybrid Approach to Tone Mapping



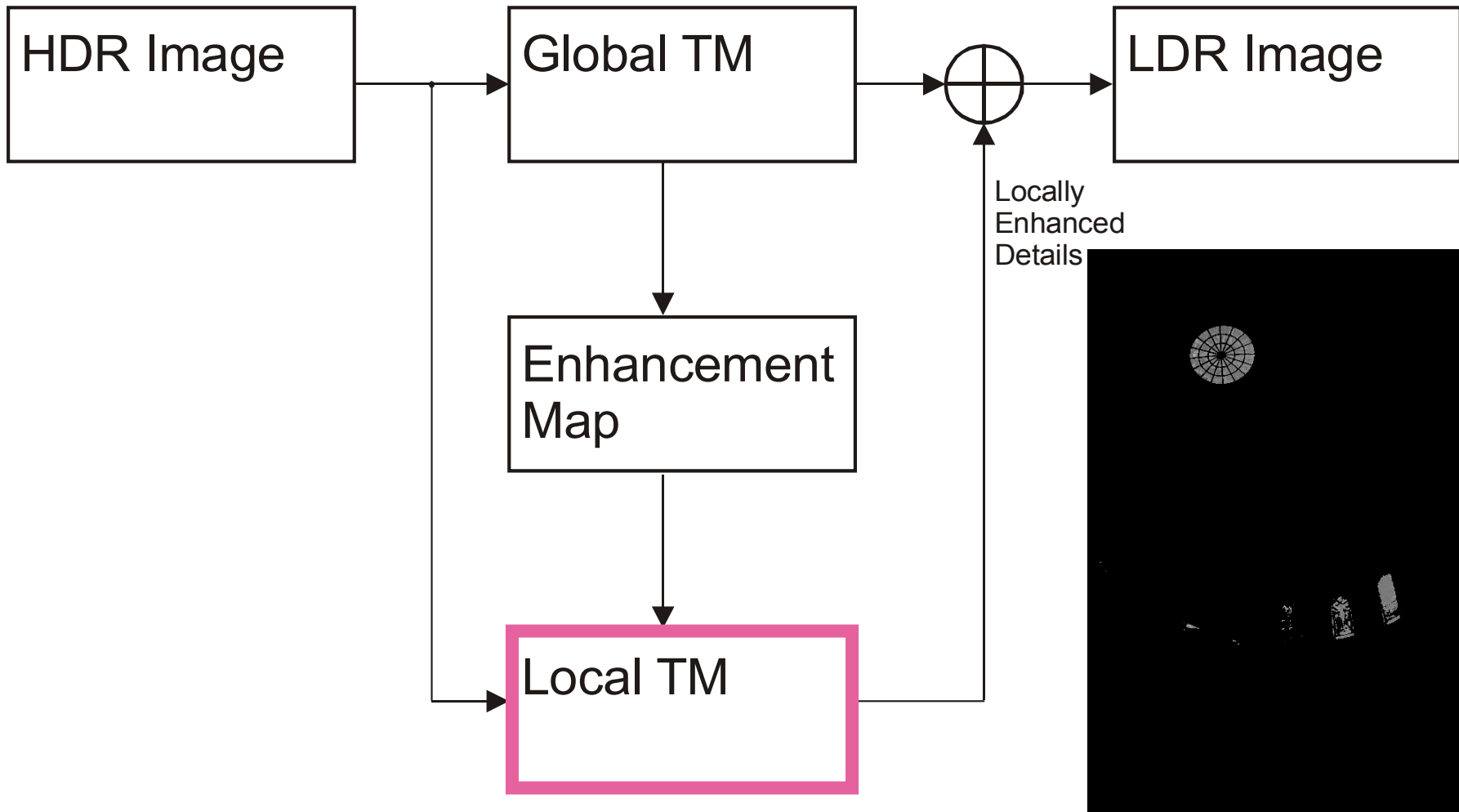
# Hybrid Approach to Tone Mapping



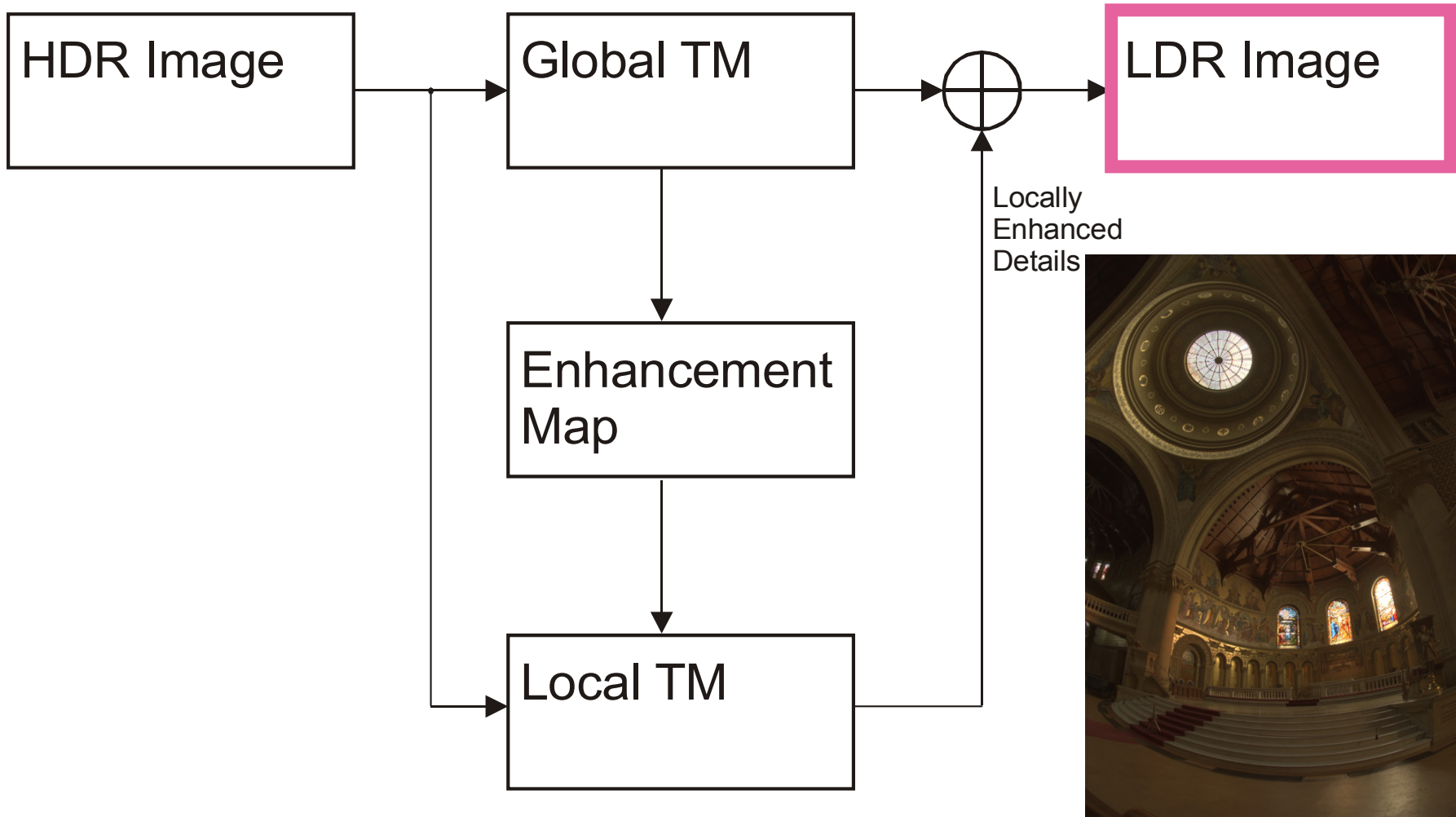
# Hybrid Approach to Tone Mapping



# Hybrid Approach to Tone Mapping

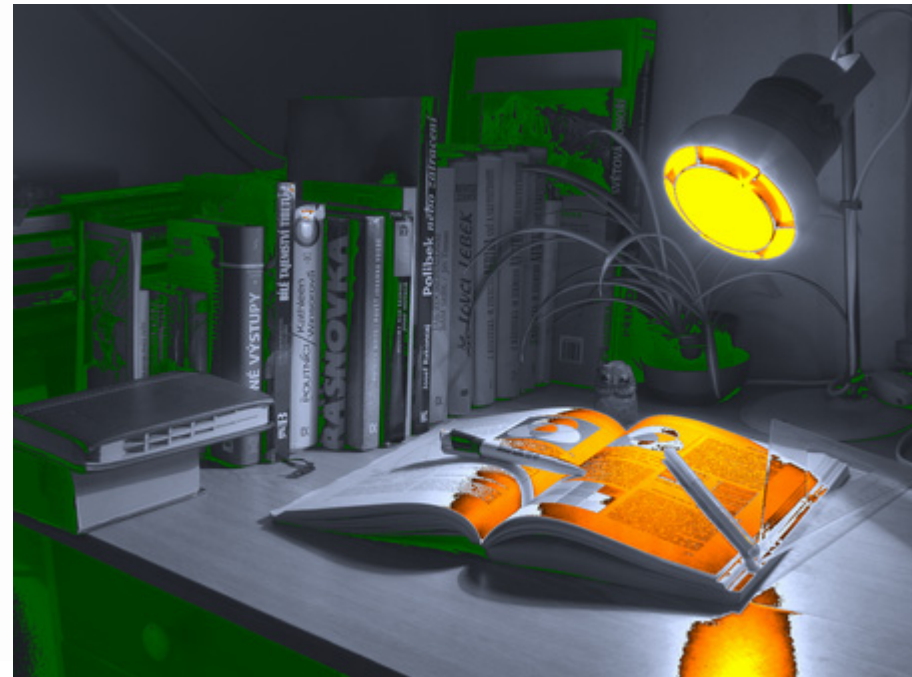
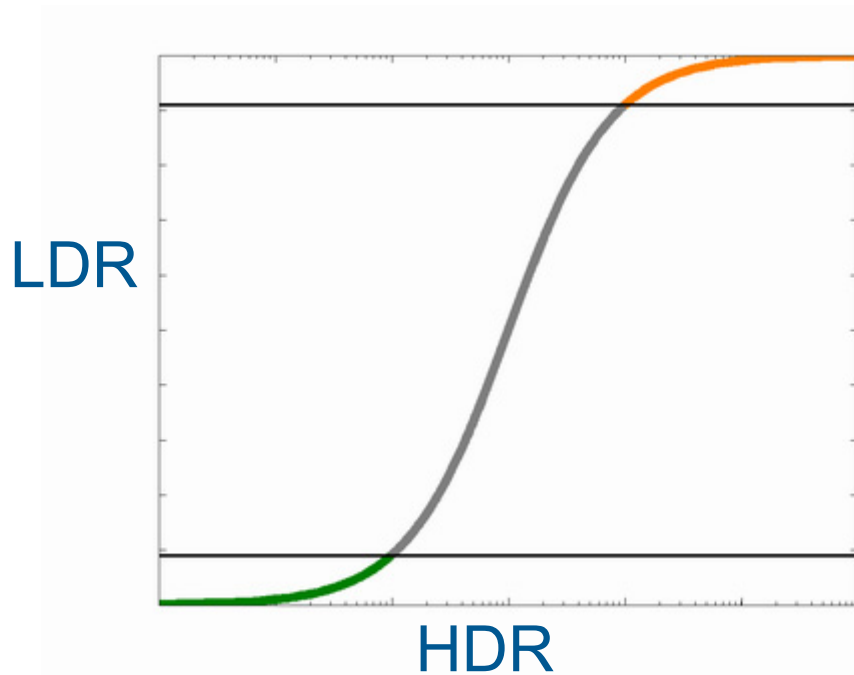


# Hybrid Approach to Tone Mapping



# Enhancement Map

- map we use to guide local enhancement
- construction according to the aim of the method
- floating point values (blend of TRC and TMO)



# Enhancement Map Benefits

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- Reproduction of overall attributes
  - not affected by local method
- Lost details recovered
- Fast computation
  - local method applied to small portion of image



# Perceptually Plausible Implementation

[Ward 94]

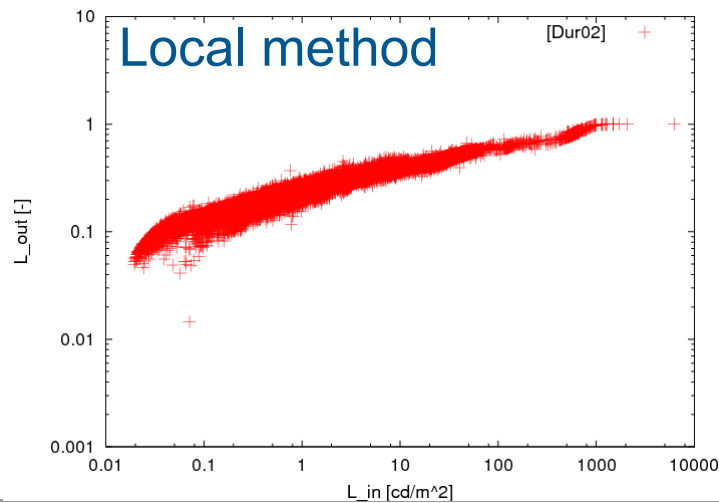
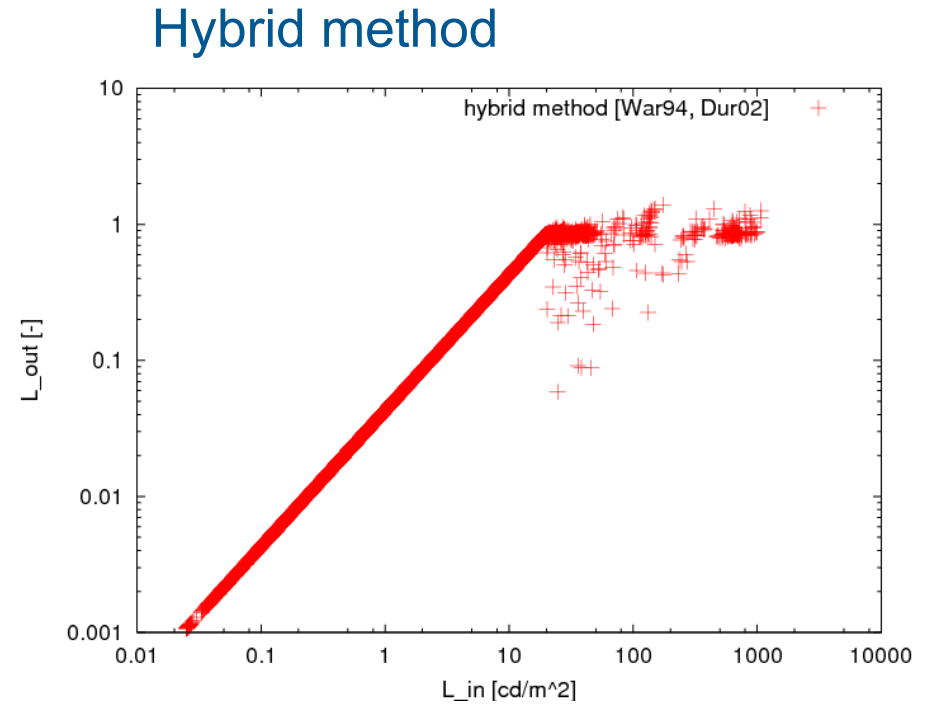
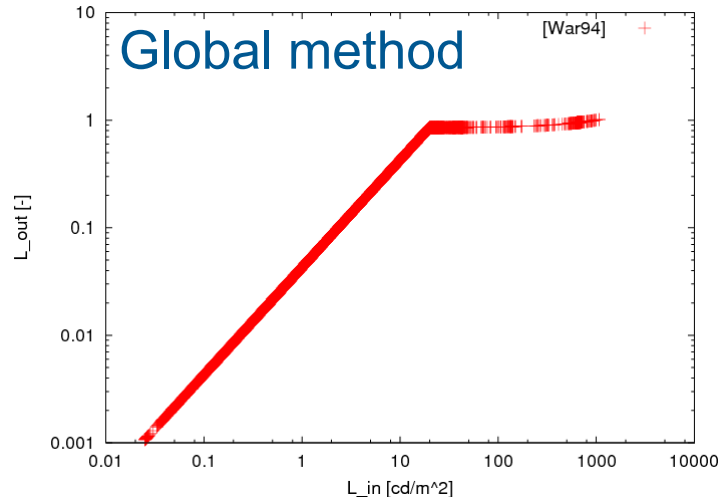


Bilateral filtering  
[Durand & Dorsey 02]

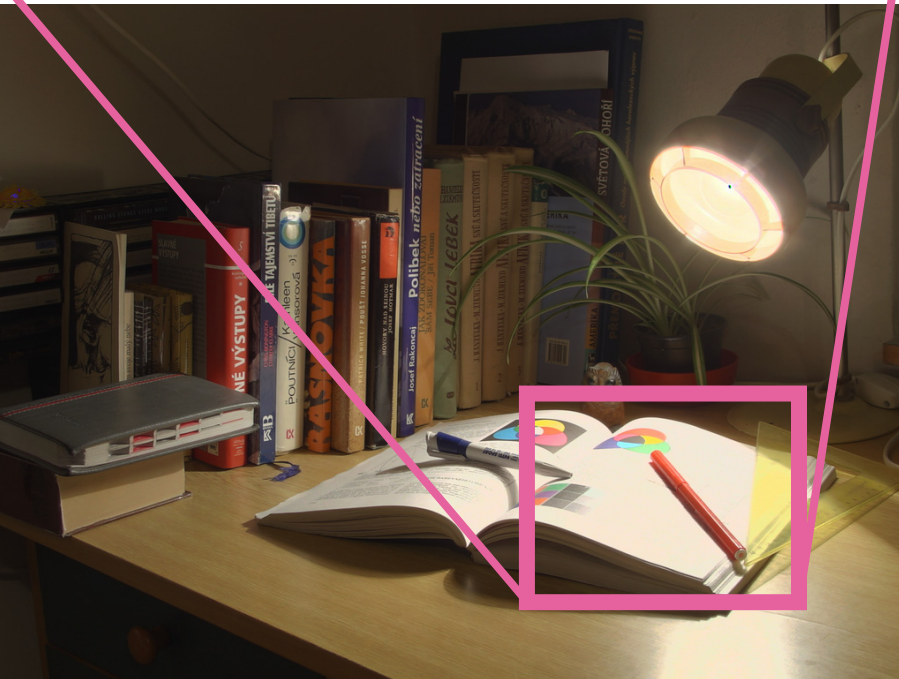
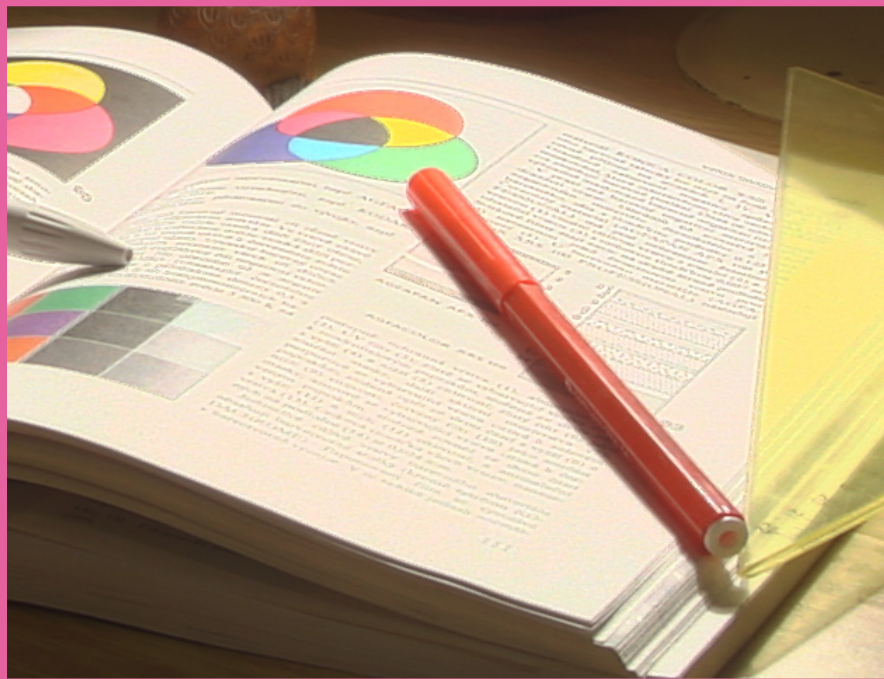




# Transformations







# Our Results

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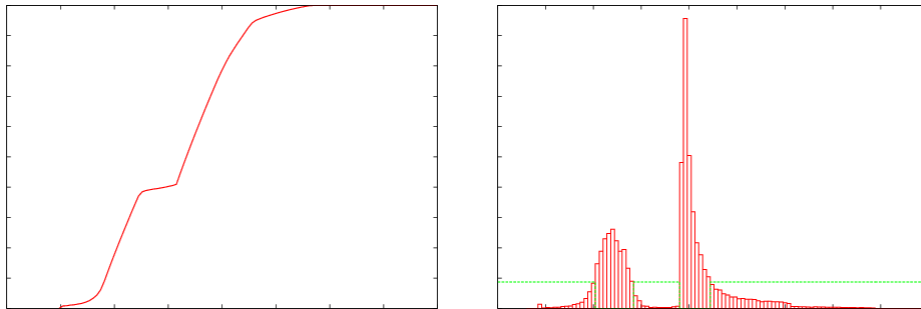


# Our Results



# Cognitive Approach

- [Ward et al. 97] + Trilateral filter
- [Choudhury & Tumblin 03]
- different construction of enhancement map



- details in the paper



# Performance Results

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- slight slowdown of original global approaches (we ‘pay’ a bit for the wanted details)
- speedup to the original local approaches (average results over 10 HDR images)

Perceptually plausible		Cognitive implementation	
Enhancement map [%of pixels]	Speedup	Enhancement map [%of pixels]	Speedup
1.4e-3%	118.5	0.132%	41.7



# Conclusions

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- **General hybrid approach**
  - utilization of existing methods
  - can be tailored to miscellaneous goals
- **Global method (TRC) + local method (TMO)**
  - general paradigm of perceptually plausible TMO design
- **Enhancement map**
- **Fast, simple, scalable, perceptually plausible**
  - suitable also for time-critical HDR applications





**Thank You for Your Attention**

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# Perception Motivated Hybrid Approach to Tone Mapping

Martin Čadík

[cadikm@fel.cvut.cz](mailto:cadikm@fel.cvut.cz)

<http://www.cgg.cvut.cz/~cadikm>



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