



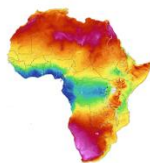
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SOLAR THERMAL ENERGY RESEARCH GROUP

An optimized aiming strategy using approximate flux mapping

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Outline



- Purpose of aiming strategies
- HFLCAL approximation
- Aiming Strategy Method
- Results
- Improved flux density approximation
- Conclusion

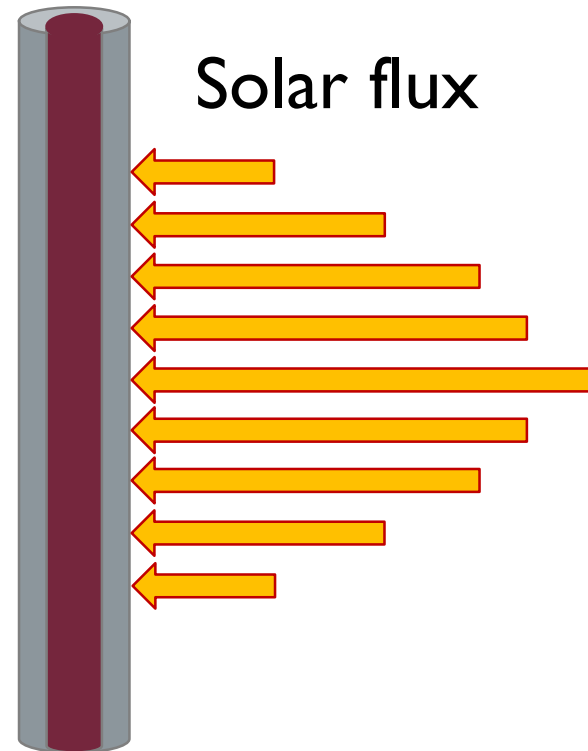




Purpose of aiming strategies



- Thermal gradients exist
- Induces thermal stress
- Leading to plastic deformation
- Loss of receiver life
- Higher maintenance costs





HFLCAL approximation



$$Flux(x, y) = \frac{P_h}{2\pi\sigma_{HF}^2} e^{-\frac{(x^2+y^2)}{2\sigma_{HF}^2}}$$

With

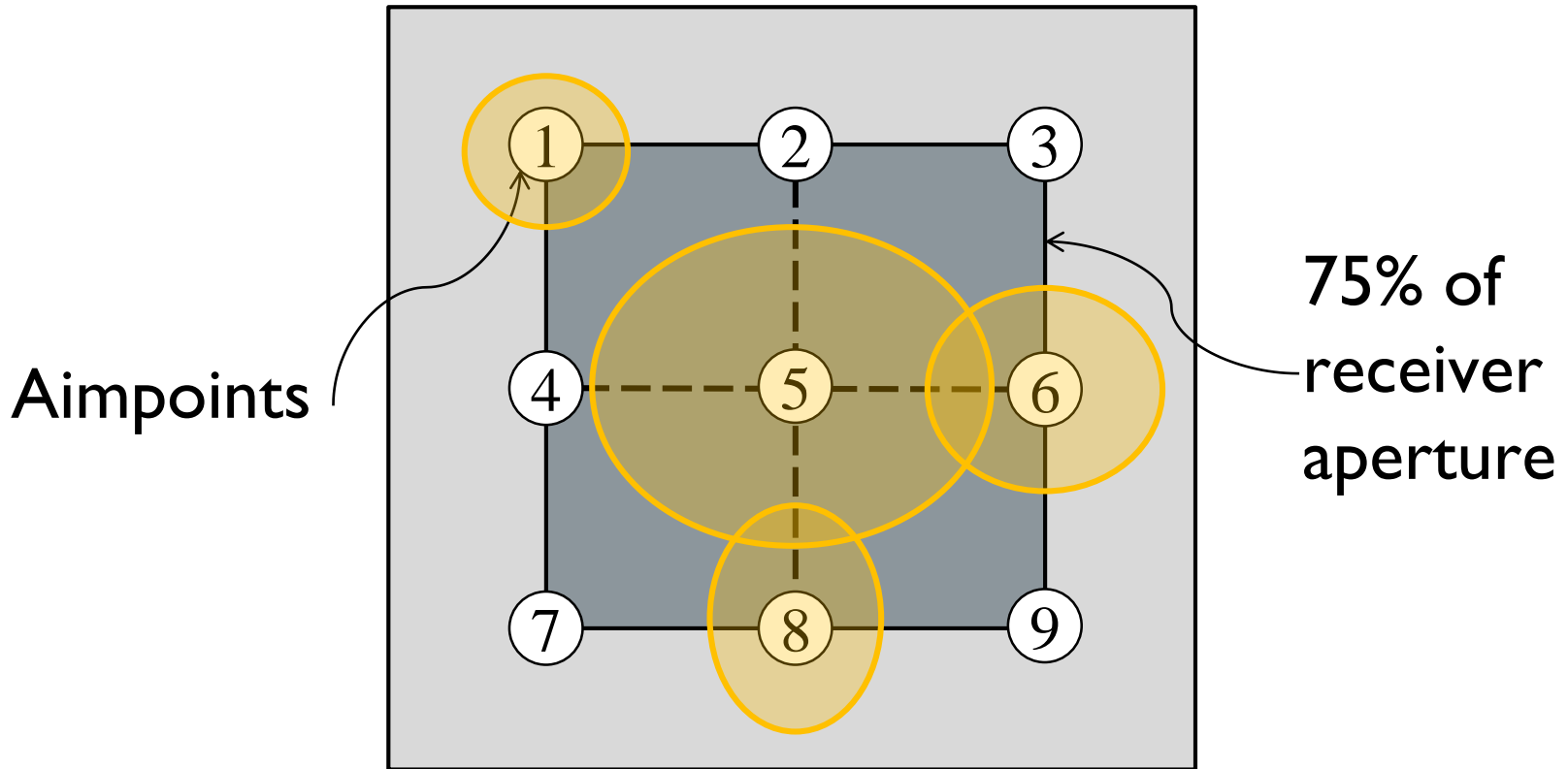
P_h = the amount of intercepted power

σ_{HF} = effective deviation as a function
of the sun shape error, beam quality,
astigmatic error and tracking error



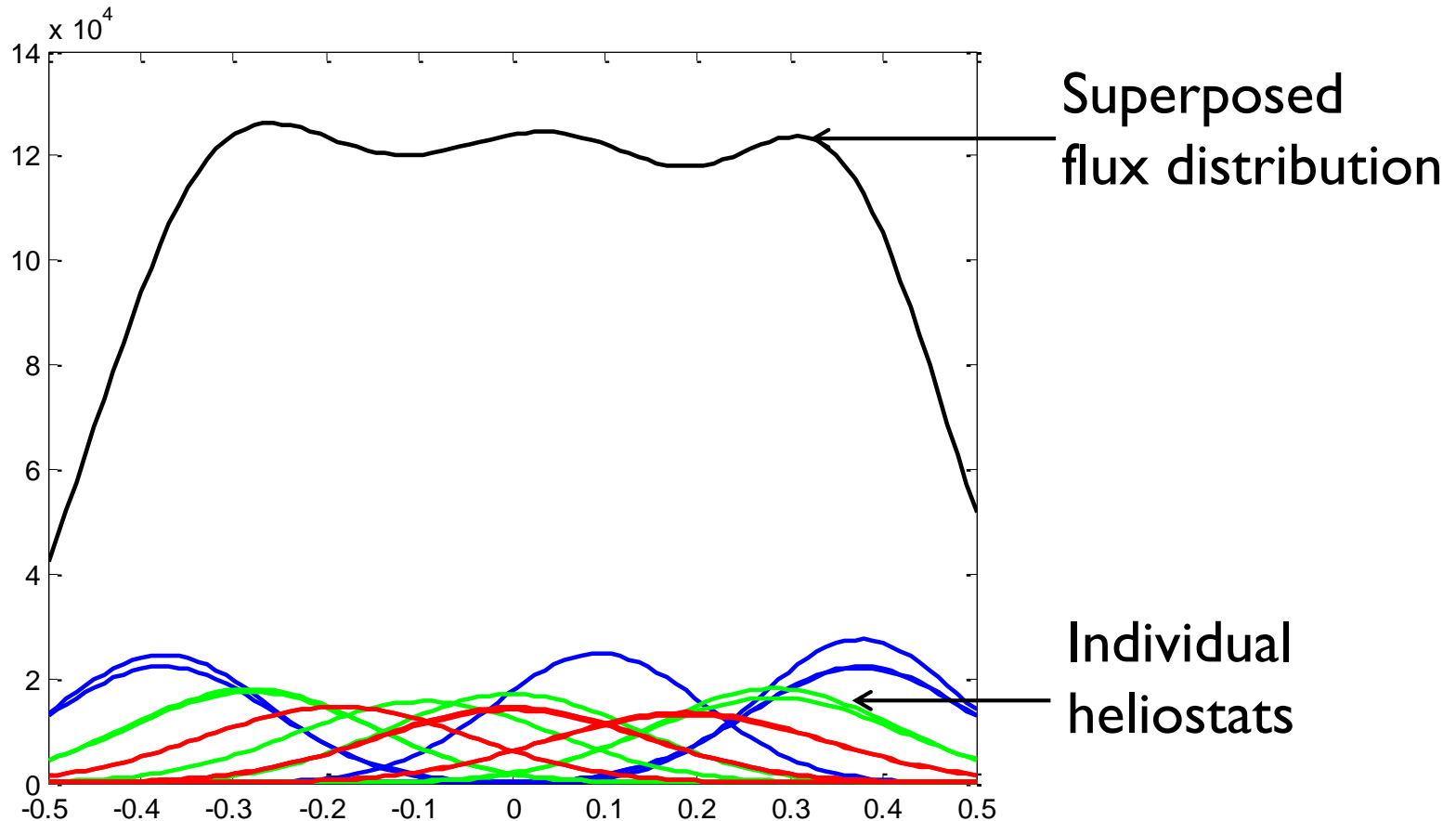


Aiming Strategy Method





Results – vertical aiming (20 heliostats)

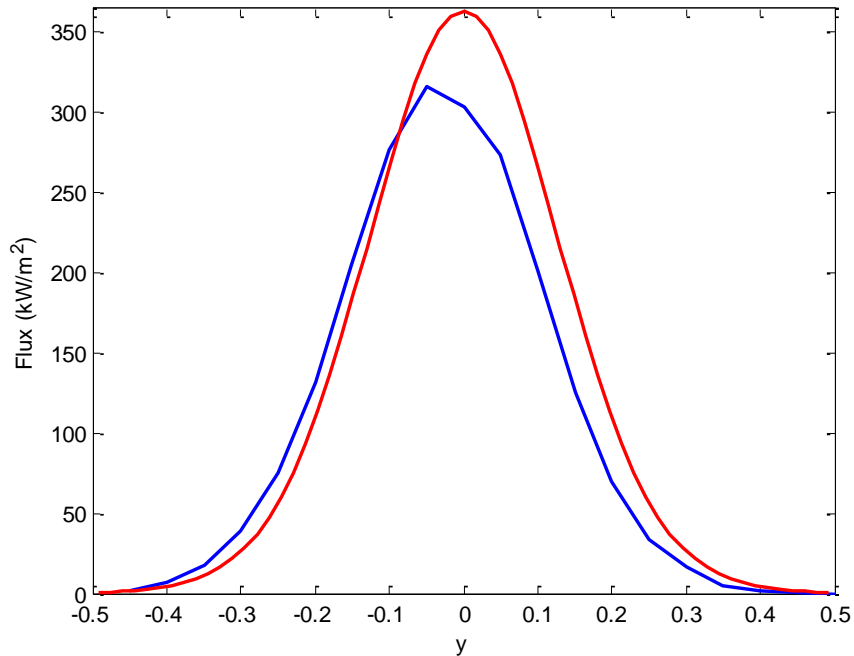




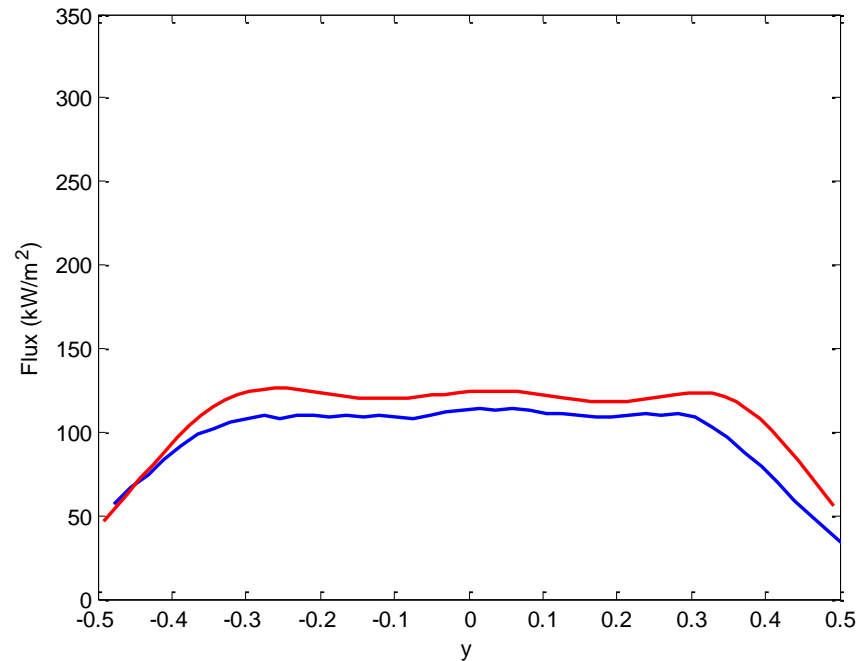
Results – vertical aiming (20 heliostats)



I Central aimpoint



9 Vertical aimpoints



75% of area homogenized

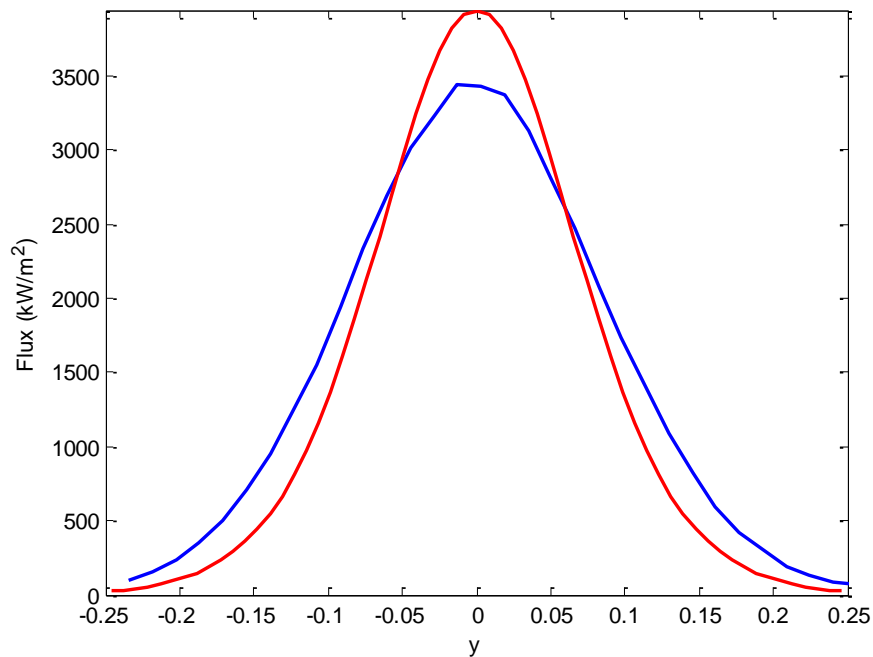




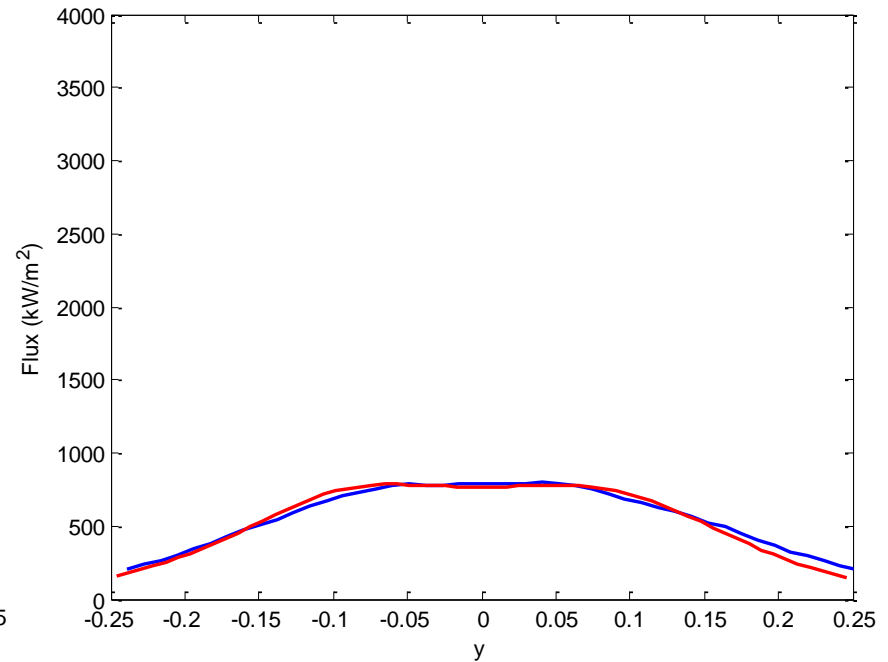
Results – 2D aiming (60 heliostats)



I Central aimpoint



25 aimpoints



50% of area homogenized

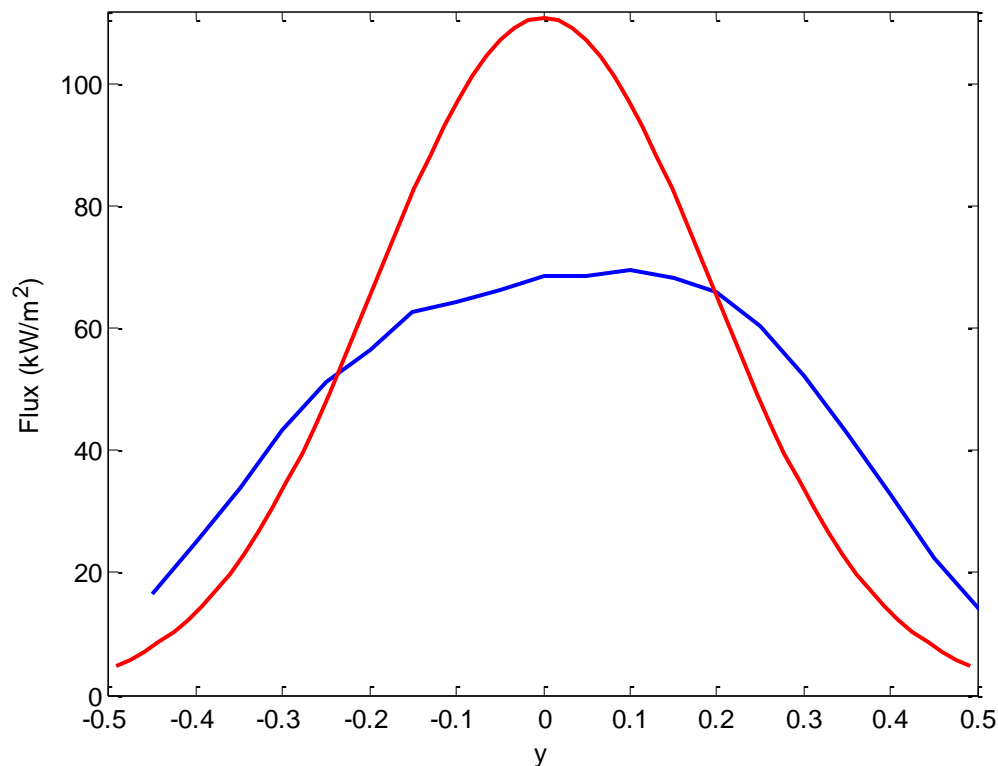




HFLCAL approximation issues



- At high incidence angles and low focal ratios
- Poor correlation between HFLCAL and ray tracer:

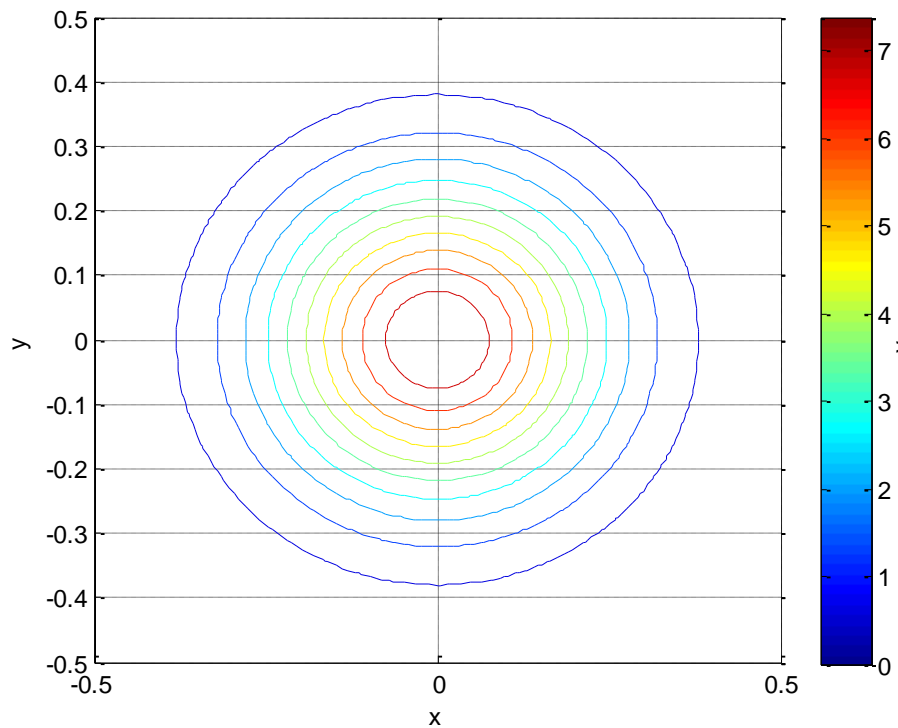




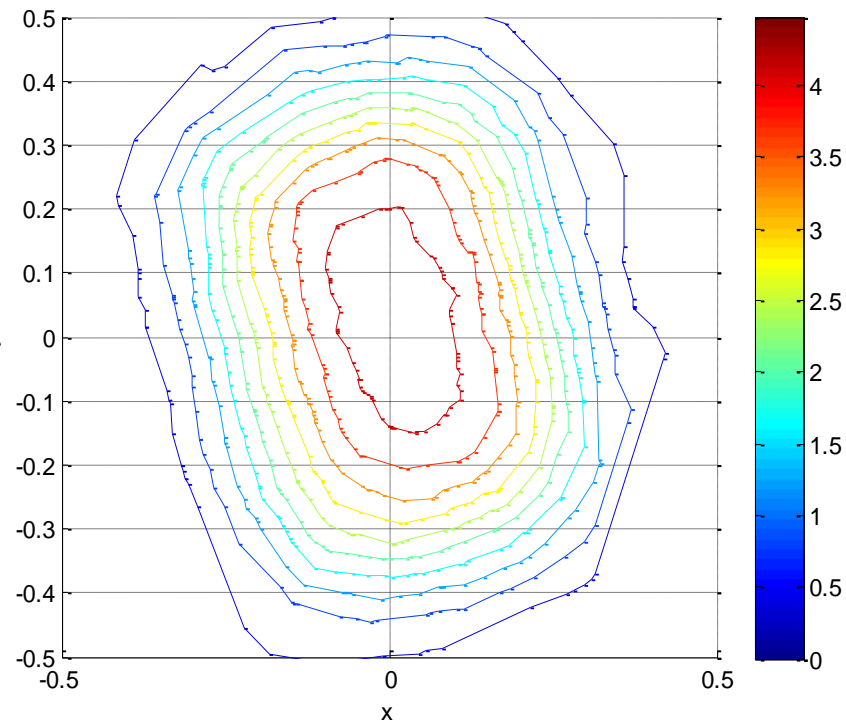
Improved flux map approximation



HFLCAL approximation



Ray trace results

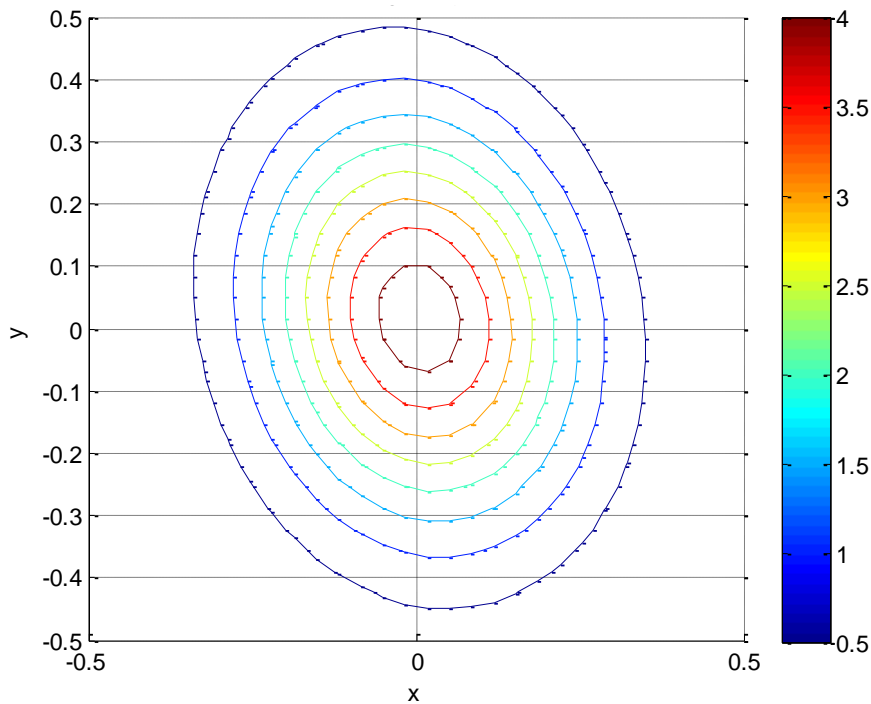




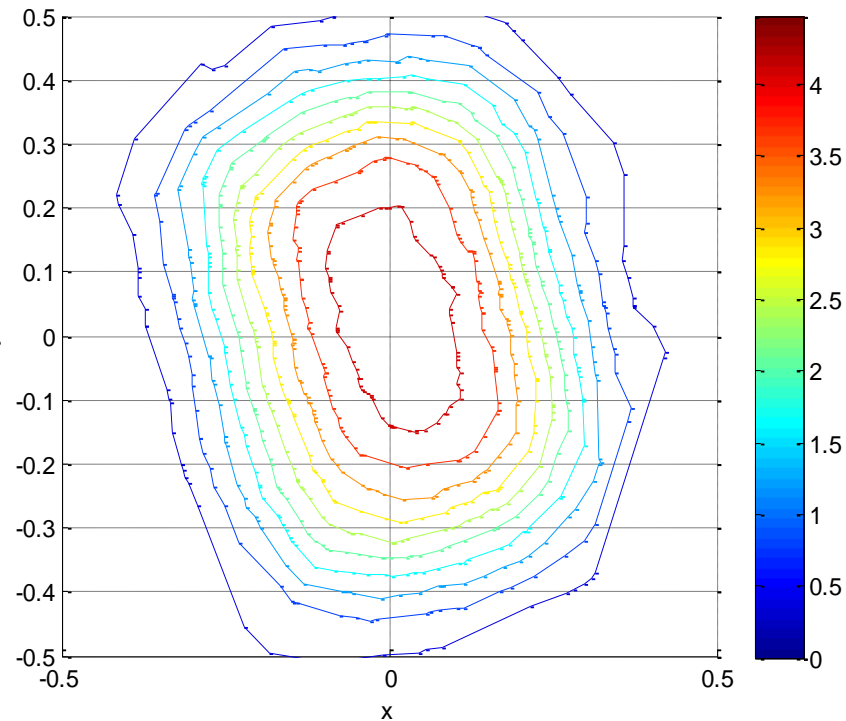
Improved flux map approximation



Bivariate normal distribution



Ray Traced Results

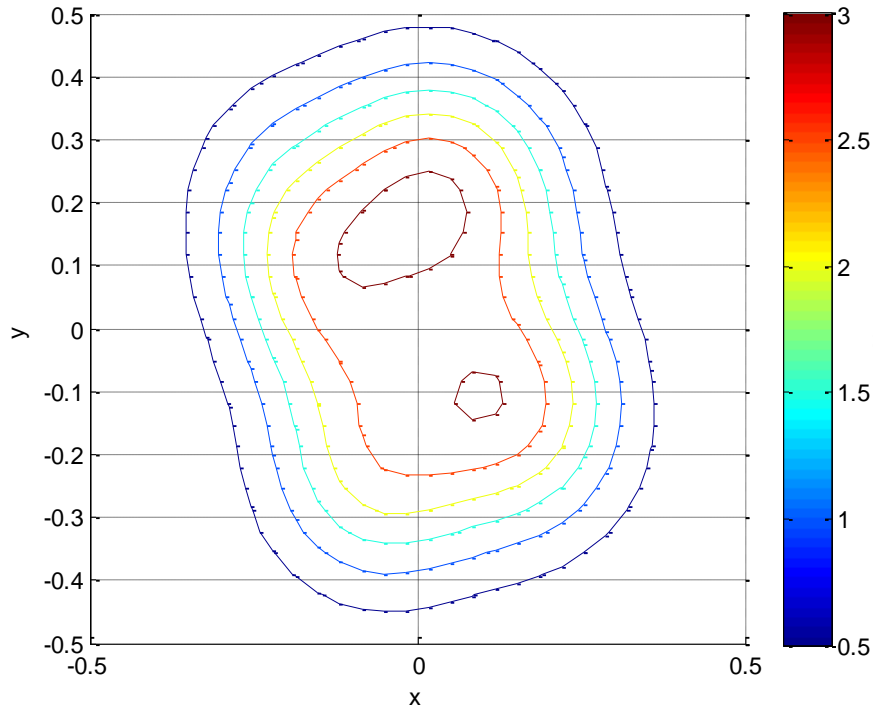




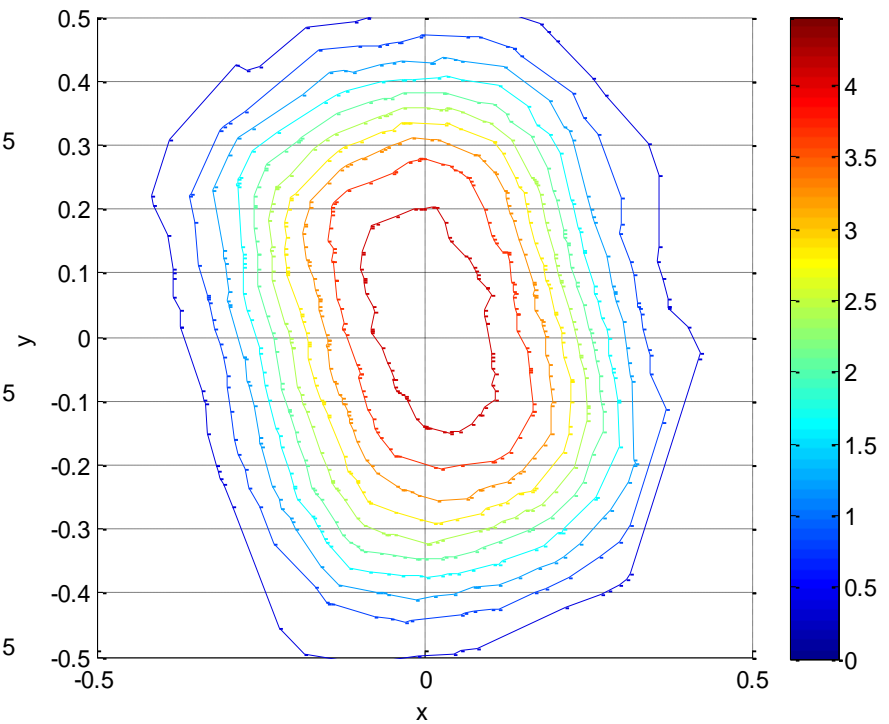
Improved flux map approximation



Multivariate normal distribution



Ray Traced Results





Conclusion



- Aiming strategy developed using HFLCAL approximation
- Good correlation for low incidence angles/high focal ratios
- Multivariate Gaussian distributions are suggested to improve the HFLCAL method for flux approximation
- Further studies will include the implementation and testing of the MGD as flux approximation





Questions
Problems
Suggestions



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