Modelling of BRDF of textured surfaces

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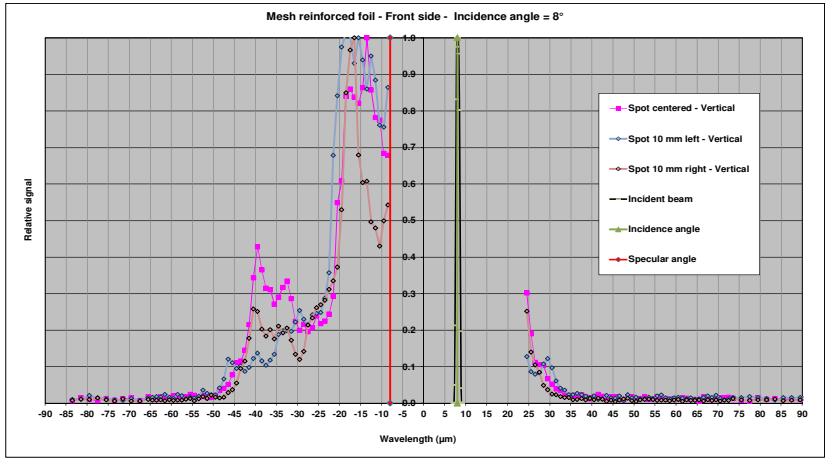
Task A1.1.8

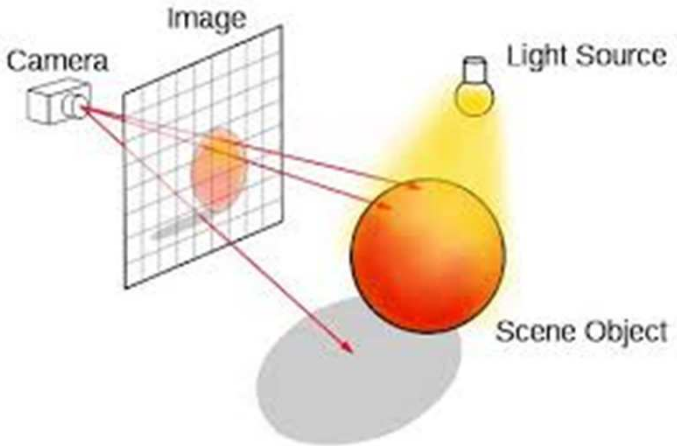
- The **shapes of the surfaces** will be calculated with **ray-tracing** technique and using angular diffusions **measured** on the main types of reflective foils commercialized.

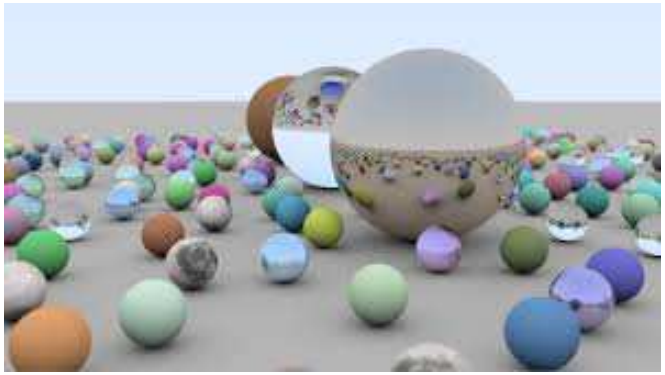
The essence of the problem



Ray-tracing as a solution

- Works as virtual laboratory
- Allows automatization
- Performs as precisely as are mathematical models behind simulations





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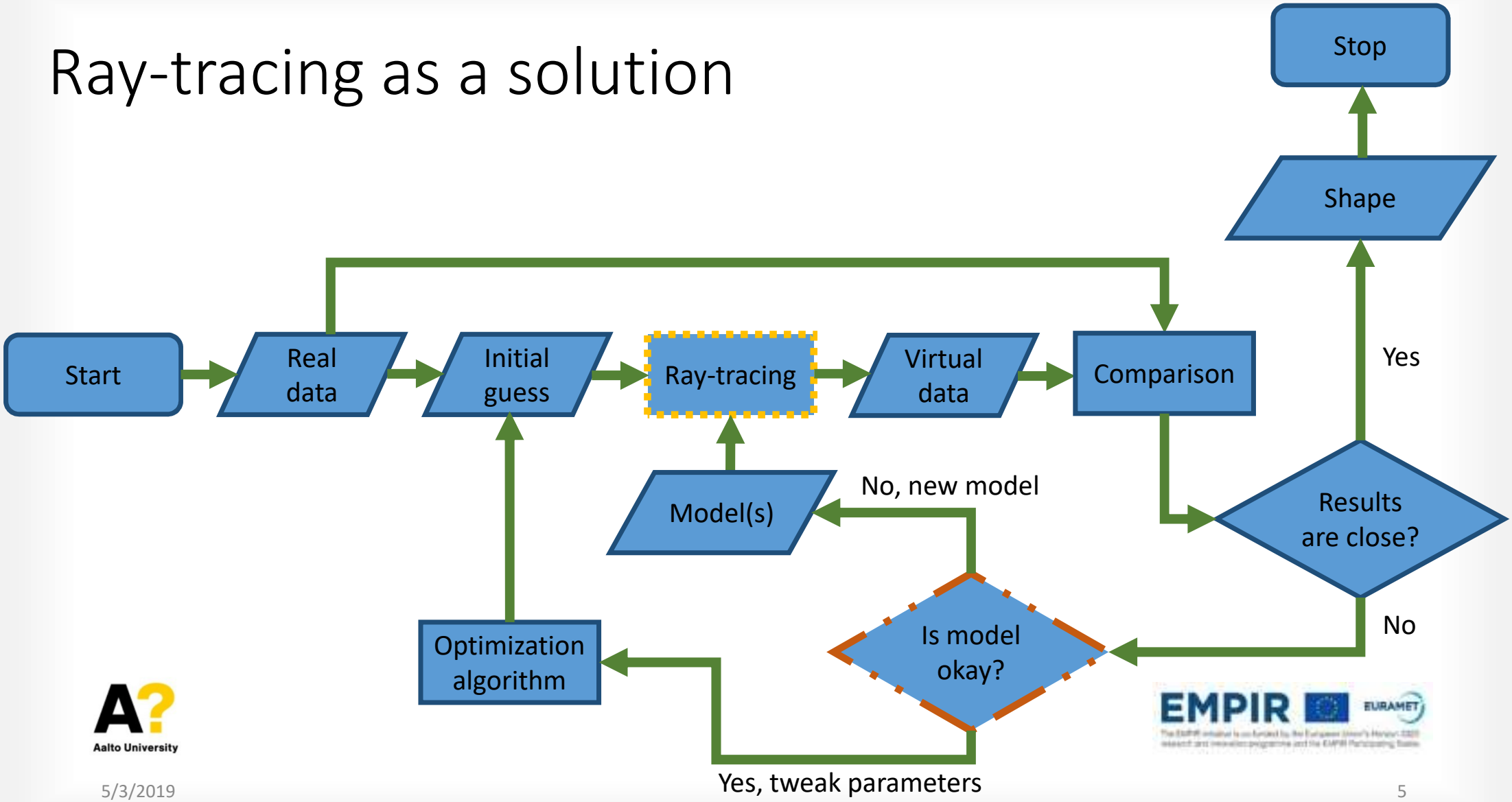
Ray-tracing as a solution



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What about models?

- Break reality to **mathematical function** and a **set of parameters**
- Parameters can be changed during optimization within reasonable limits
- Difficult models are more precise, but require more computational resources (memory, time)
- The most difficult problem within this task

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What model to use?

Microfacet model to describe plane surfaces
Torrance-Sparrow, for exaple

Macrostructure model – yet to be determined

Torrance-Sparrow model

$$\rho(\theta_2, \phi_2) = \frac{1}{\pi}\left(D\cos\theta_2 + S\frac{F(n,k)T(m)A}{4\cos\theta_1\cos\theta_2}\right)d\omega_2$$

$\boldsymbol{n}$ is the ratio between the index of refraction of the surface and the current medium
$\boldsymbol{k}$ is the extinction coefficient
$\boldsymbol{D} \in [0; 1]$ is the ratio of diffusely reflected radiation
$\boldsymbol{m} \in [0; 1]$ is the root mean square slope of the facets
$\boldsymbol{S}$ is weight of specular component
($\boldsymbol{A}$ is geometrical attenuation factor that is found using other parameters)

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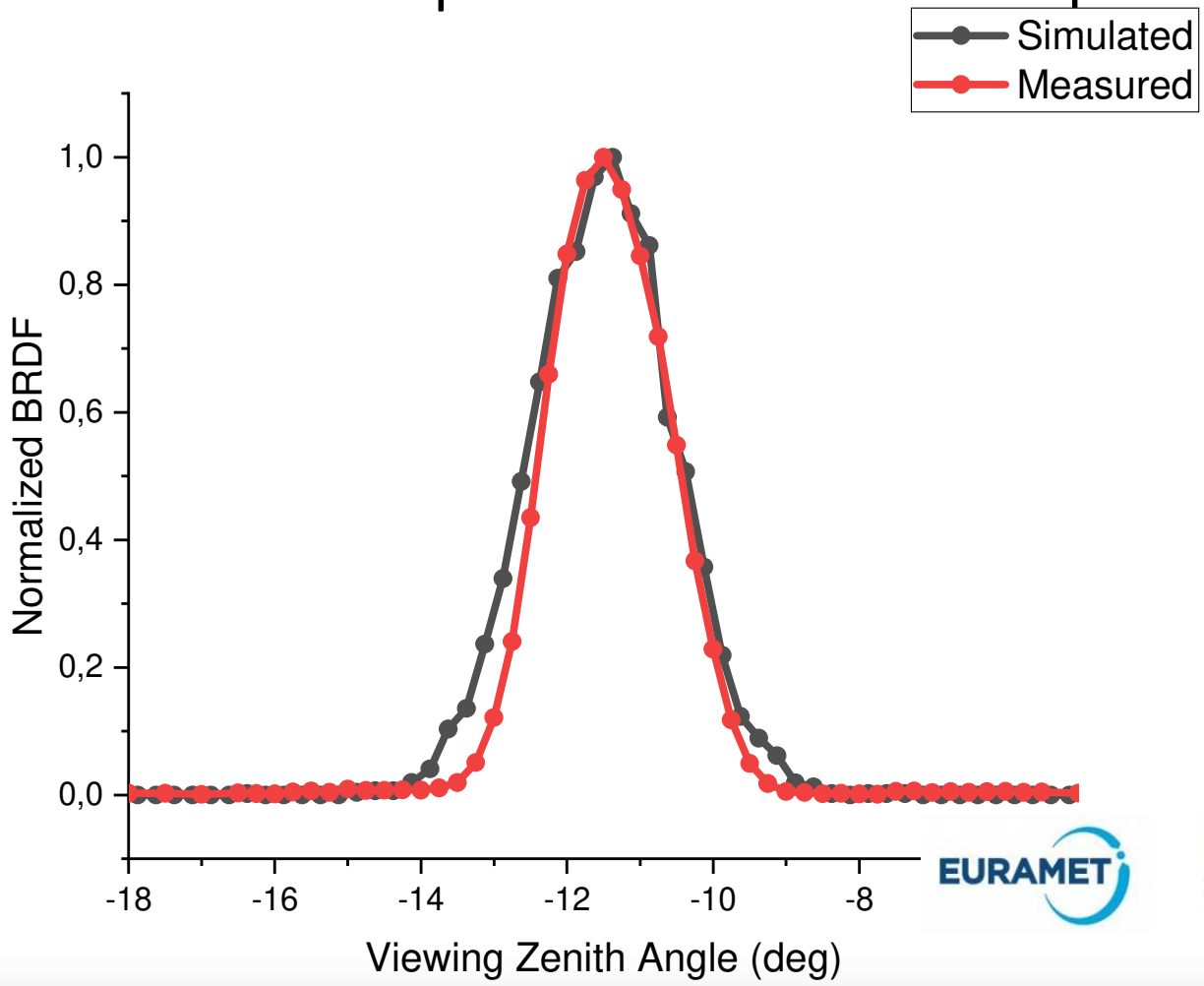
Result of Torrance-Sparrow model implementation



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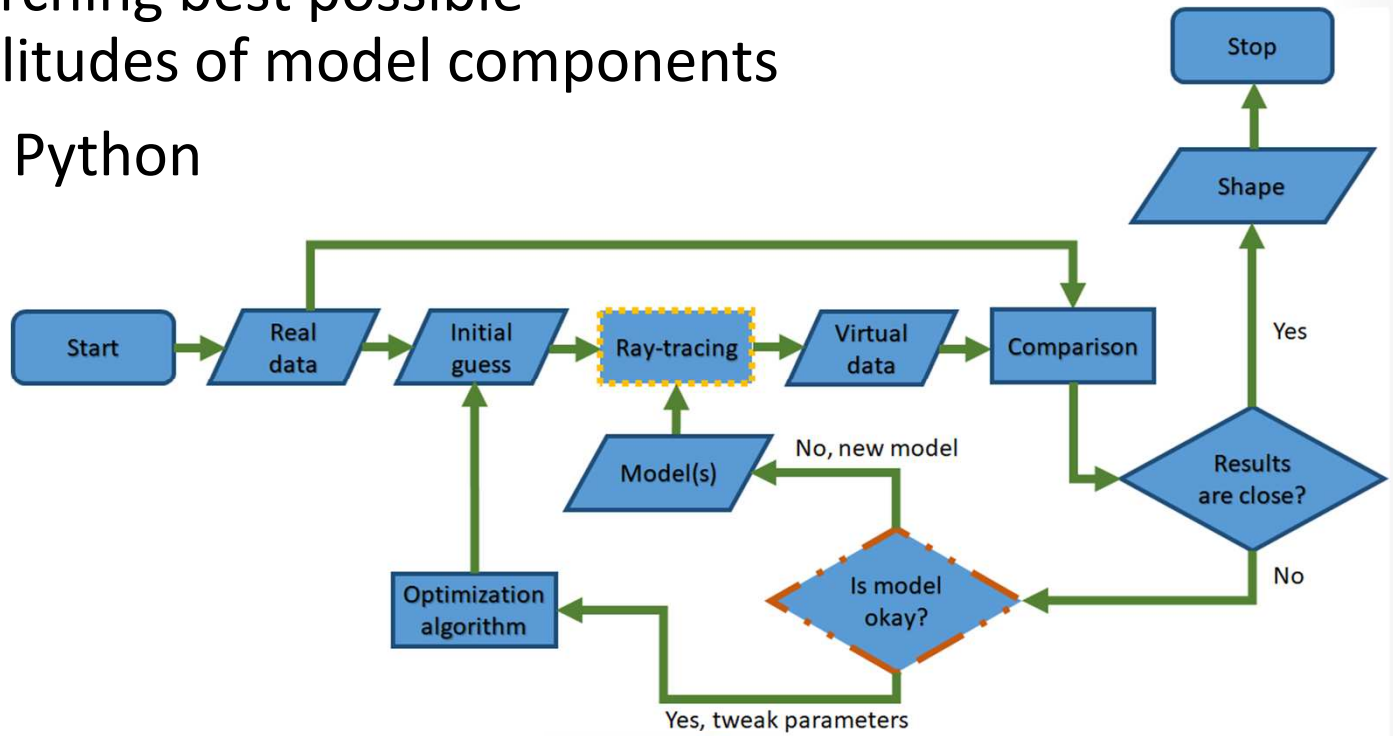
Future plans

- Describe the surface with periodical 2D functions
- Run optimization searching best possible frequencies and amplitudes of model components
- Transfer code fully to Python



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Thank you for the attention!