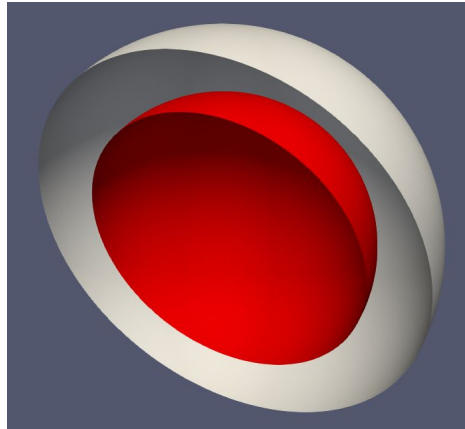


# 'viewFactorsGen' output errors depending on decomposition type and number of processes

## Case:

- Concentric Spheres:



- Geometric parameters and analytical heat transfer calculation:

1- inner sphere; 2- outer sphere		
sigma	5.67E-08	W/m <sup>2</sup> /K <sup>4</sup>
r1	0.7	m
r2	1	m
A1	6.158	m <sup>2</sup>
A2	12.566	m <sup>2</sup>
A1/A2	0.49	
T1	350	K
T2	300	K
epsilon1	1	-
epsilon2	1	-

1/R	1	W
Qtotal	2411.362989	W
qr1	<b>391.61</b>	<b>W/m^2</b>
qr2	<b>191.9</b>	<b>W/m^2</b>

## The Issue with results:

Regardless of the agglomeration settings the following trend was observed:

Qr for the outer surface of the sphere (inner surface was ok):

Analytical reference:		<b>191.9 [W/m^2]</b>		
nProc	Qr [W/m^2]		ERR%	
	scotch decomp.	simple decomp.	scotch decomp.	simple decomp.
4	132.14	191.97	<b>31.14%</b>	-0.04%
16	183.99	191.96	<b>4.12%</b>	-0.03%
32	189.63		<b>1.18%</b>	
64	191.71	191.96	<b>0.10%</b>	-0.03%
96	191.99		<b>-0.05%</b>	

Qr error came from incorrectly calculated view factors:

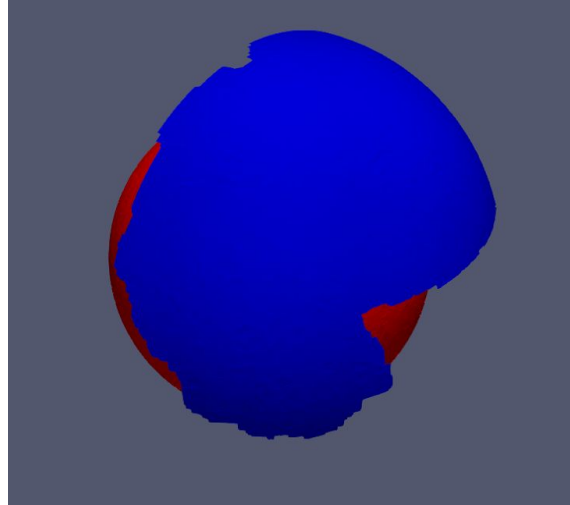
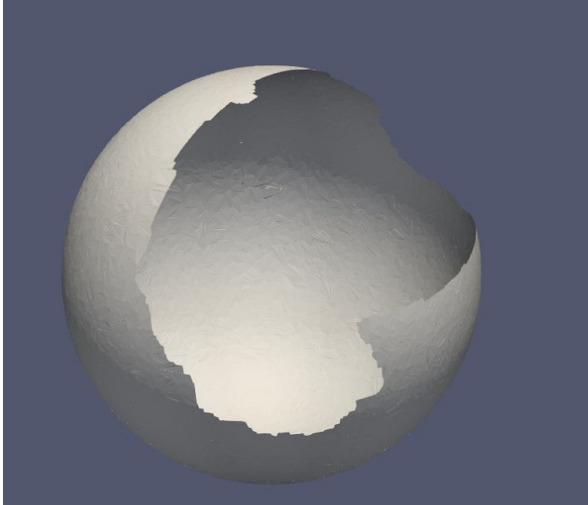
SIMPLE (correct):	SCOTCH:
F00: 0.509618276076	F00: 0.966268116914
F01: 0.490042355602	F01: 0.490150852091
F10: 1.00086598969	F10: 1.00086982073
F11: 0	F11: 0

\* indices: 0 - outer surface; 1 - inner surface

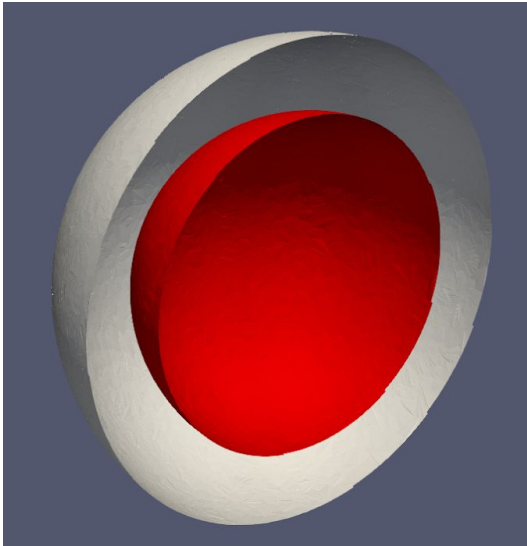
In the incorrect case the outer surface (concave one) 'sees itself' more than it should. Result 0.96 would maybe make sense if there was no inner surface.

# Investigation:

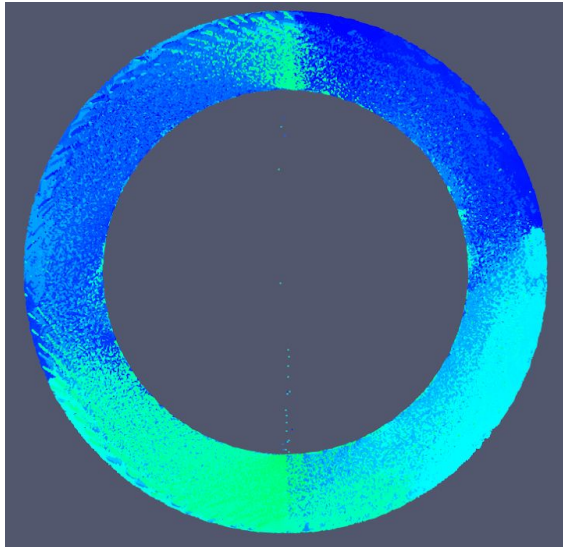
Scotch decomposition domains:



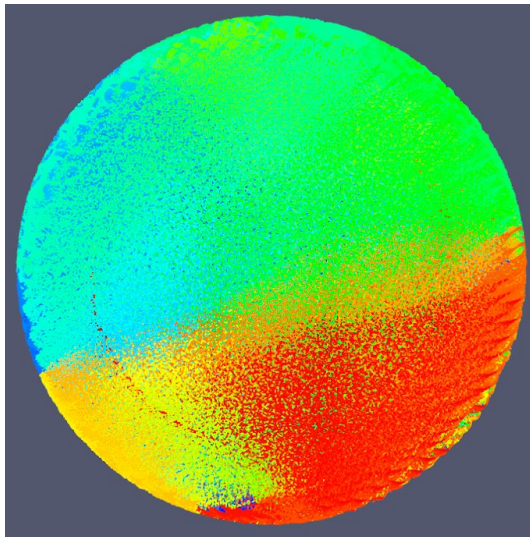
Simple decomposition domains:



Ray tracing Simple:



Ray tracing Scotch:



- rays incorrectly passing through the inner surface

Problem: The shadowing effect is not correctly communicated across processors. If a concave surface on one decomposed domain gets shadowed by a surface belonging to another processor domain, it's effect won't be registered.

## Fix:

Removing 65 lines of “optimisation” -code preventing checking other decomposed domains.  
Commit:

Result for scotch, 4 procs:  $Q_r = 191.97 \text{ W/m}^2$

F00: 0.509639480732

F01: 0.490044594067

F10: 1.00077571858

F11: 0

Ray tracing for scotch, after fix:

