Study on a generic high volume low speed (HVLS) fan

IHPC
A*STAR

Examples of applications of HVLS fans

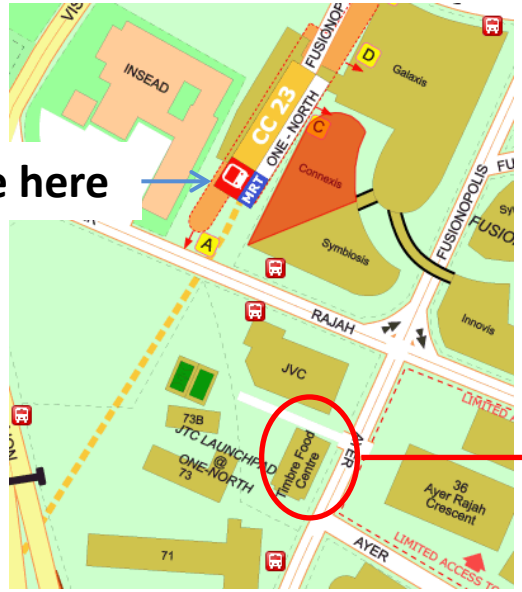




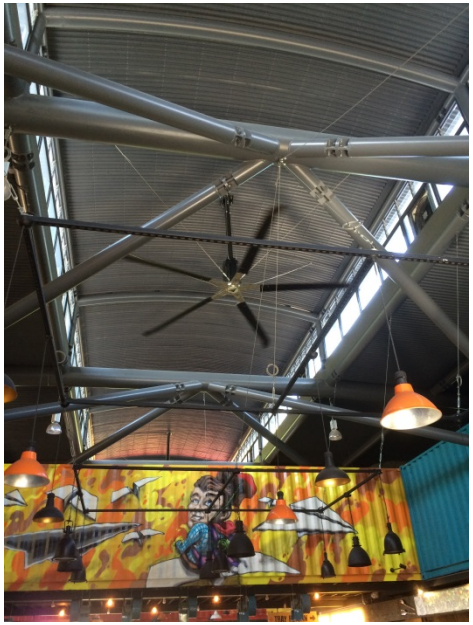
Pioneer MRT station

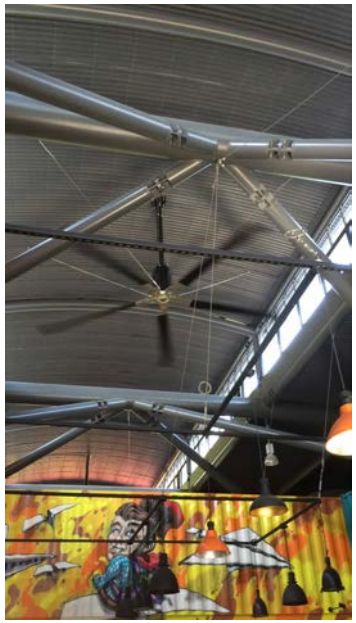
Jurong West Street 63

we are here









timbre+ food centre

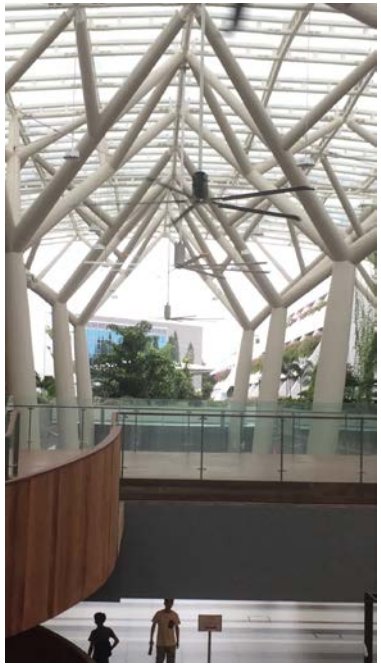
Ayer Rajah Crescent





Common area outside **Lee Wee Nam Library**, Nanyang Technological University (NTU)

Fan over walkway



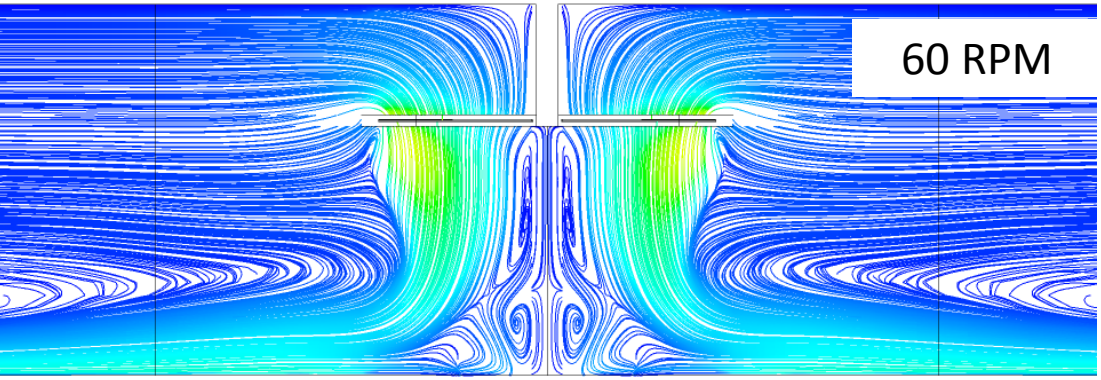


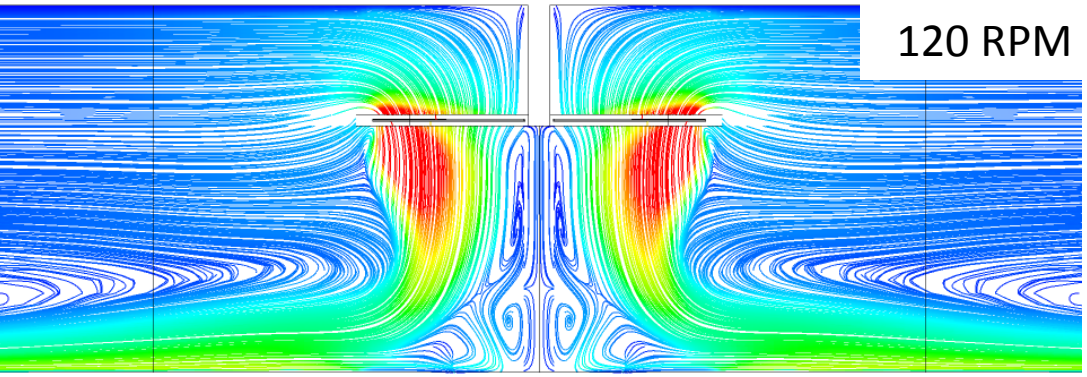
Fans over atrium space

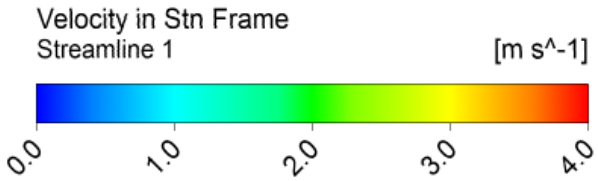




10 degrees blade pitch angle

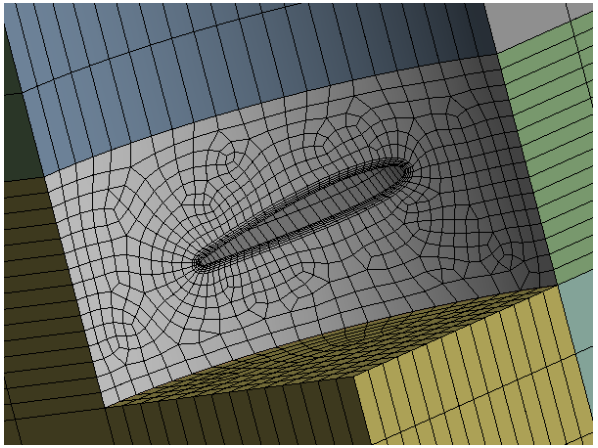




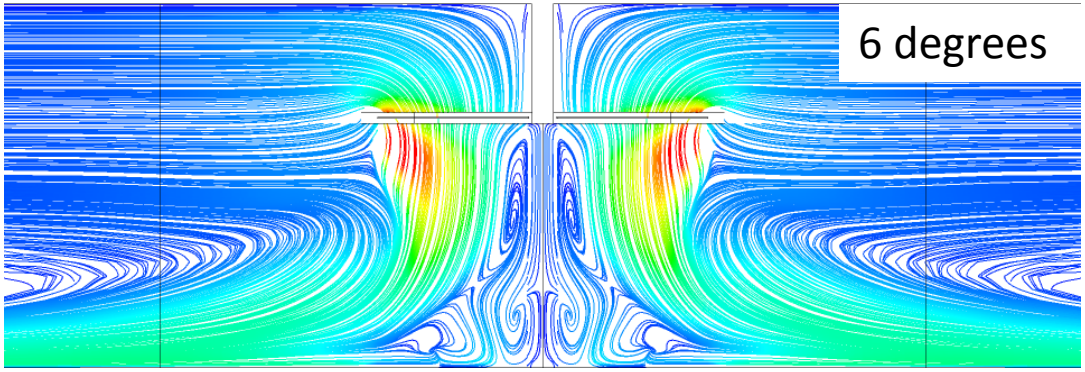


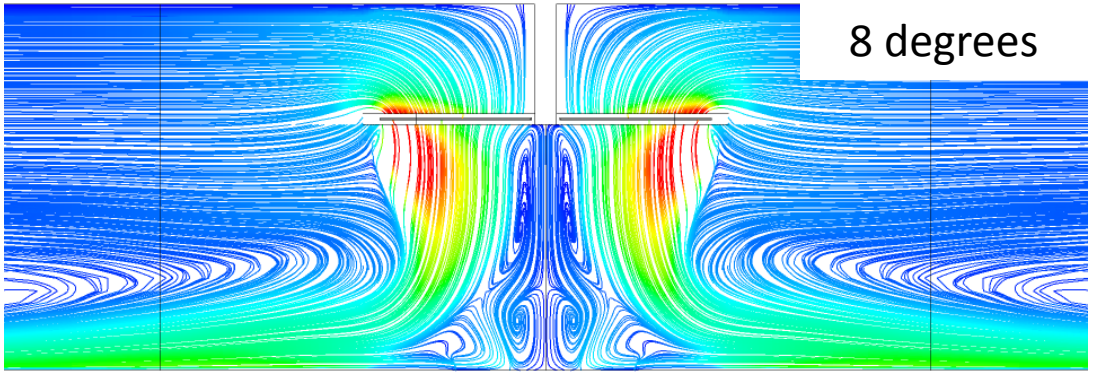
Pre-testing: stage 1

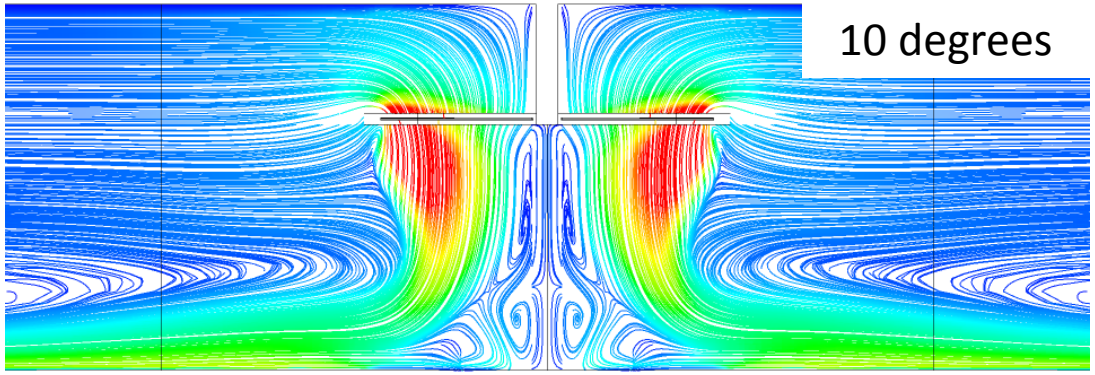
- Generic four-bladed 20 ft HVLS fan
- NACA 0012 blade profile
- Floor height = 4.5 m
- Ceiling depth = 2.0 m
- Flow domain = 20 m diameter



120 RPM

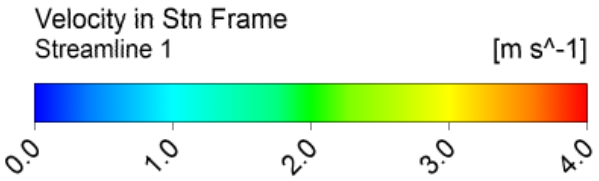


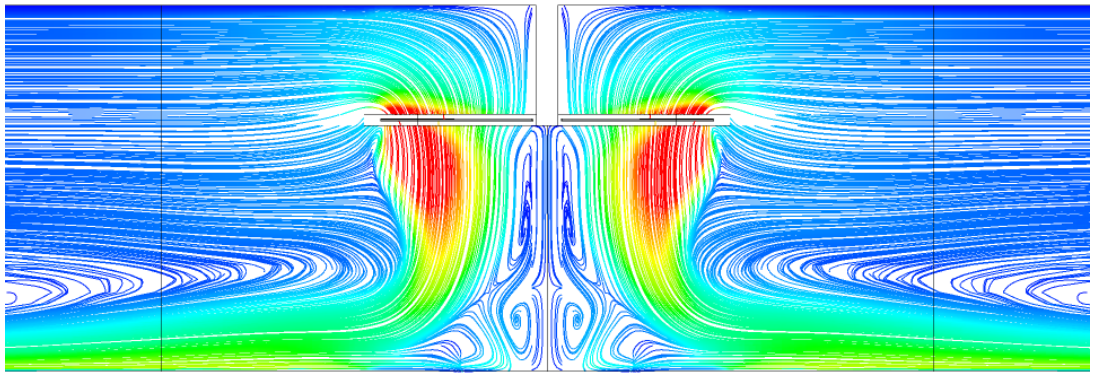




Pre-testing stage 1: steady-state periodic slice

- Periodic slice domain
- “ Frozen stator” solution
- Computationally inexpensive





Steady-state periodic slice:

- Although not as accurate as a proper transient solution, useful for preliminary explorations
- Can you spot the differences in the flow fields ?

Basic validation with scale model in progress with Newcastle University International Singapore



Scale model developed and tested by Newcastle University International Singapore



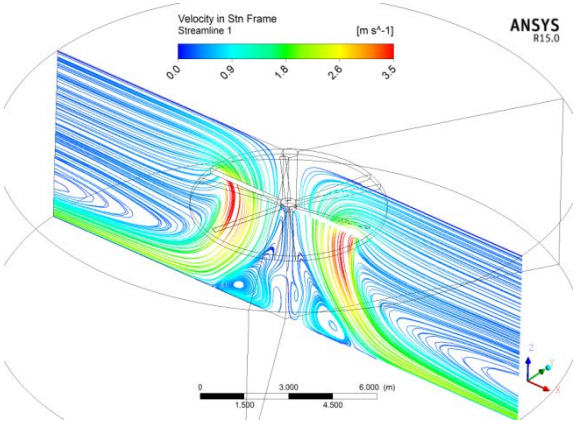
Off-the-shelf NACA 0012 blade

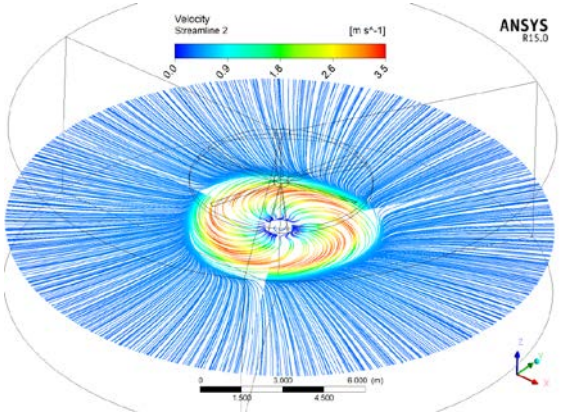




Rotor hub

Pre-testing stage 2: transient solution full domain





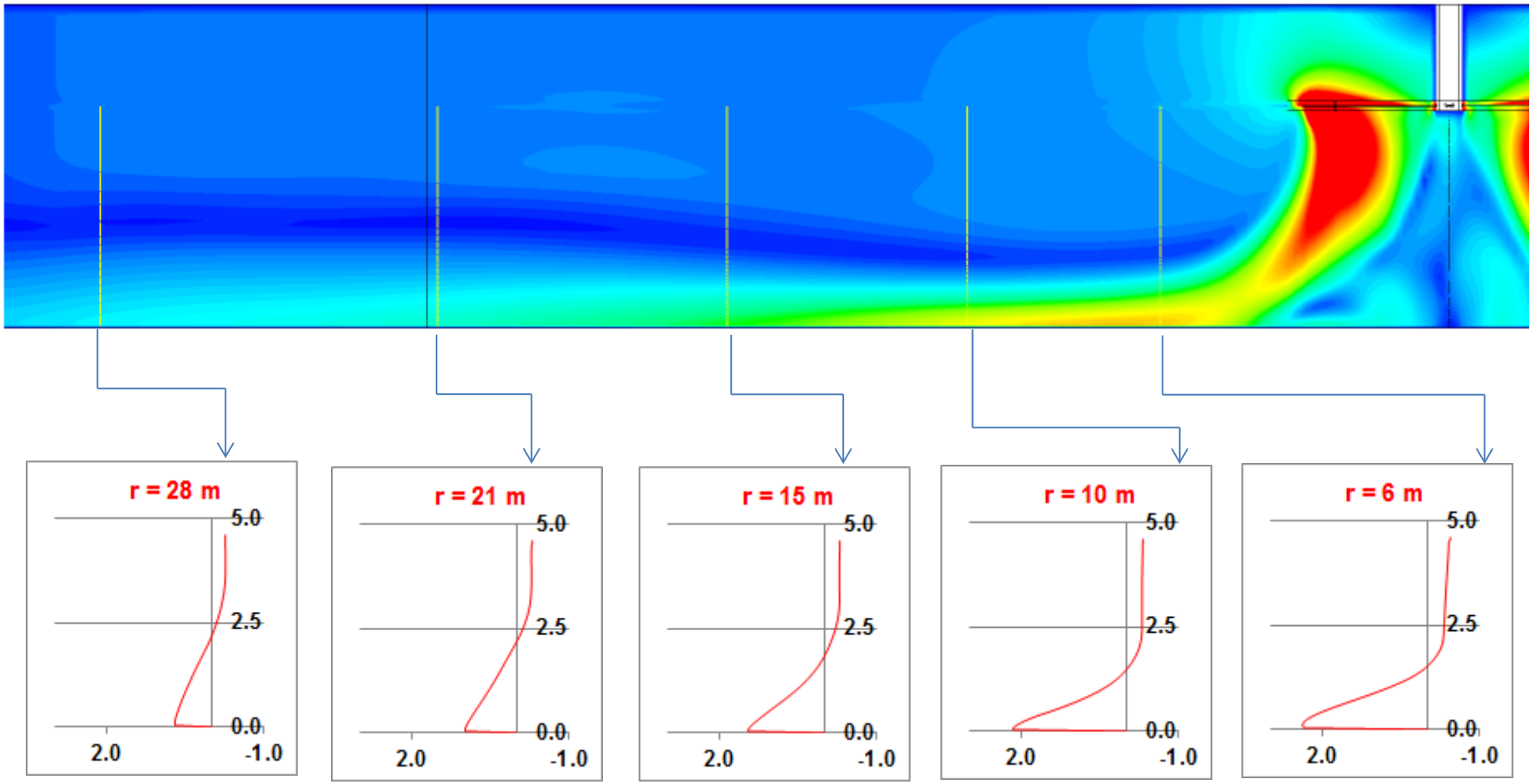
Transient simulation

- Complete domain
- Computationally more expensive
- More realistic
- **Time averaged results: extract directional momentum source terms for input in computationally inexpensive momentum source models**

Stage 3: Detailed calculations (in preparation)

- Investigate and probe using a scale resolving turbulence model
- Particle dispersion studies
- Much finer grid and smaller time steps
- Need massively parallel computations

Parting slide: generation of floor jet



Radial velocities [m/s] vs height above floor [m]