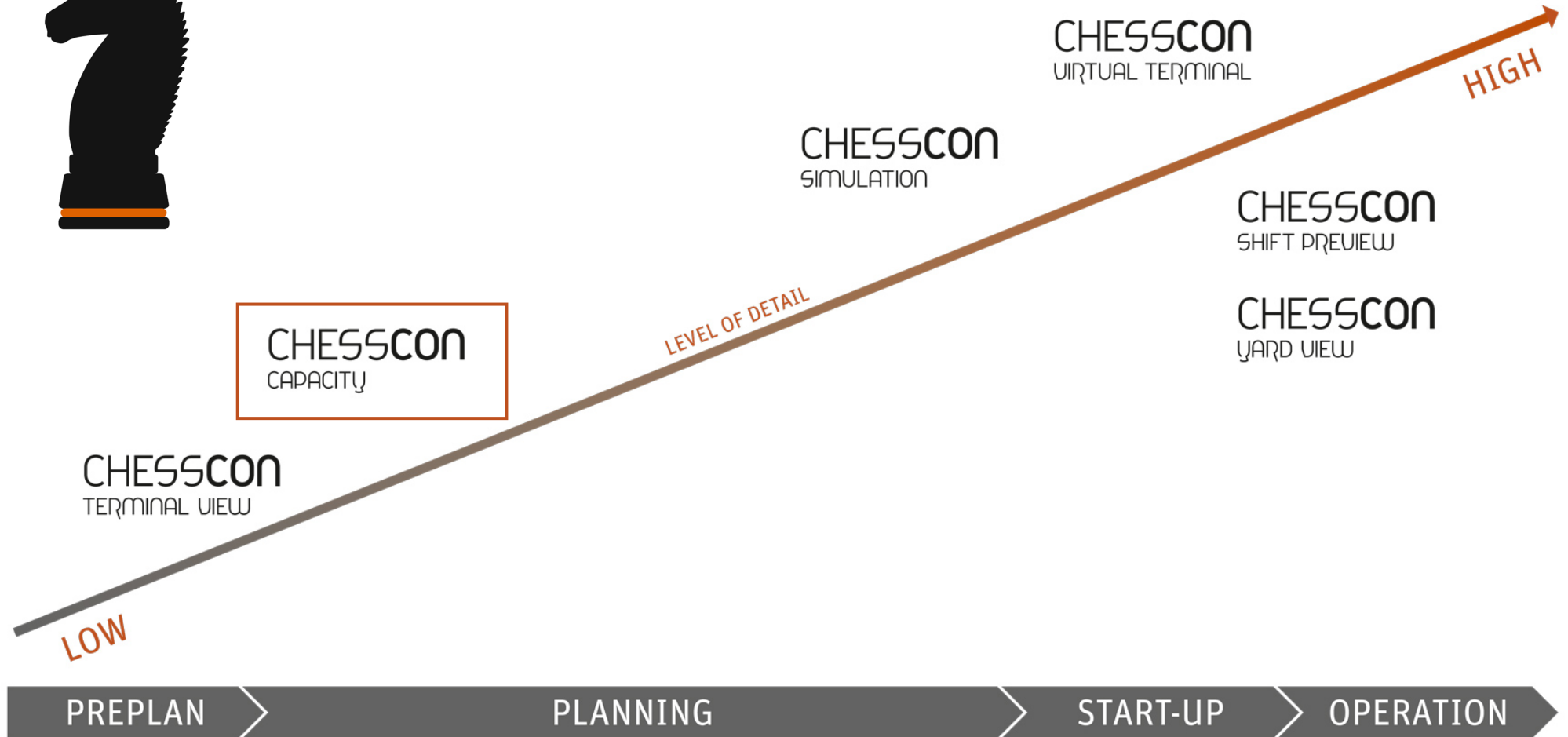




CHESSCON

CAPACITY

OPTIMIZATION SOFTWARE FOR CONTAINER TERMINALS



CHESSCON CAPACITY

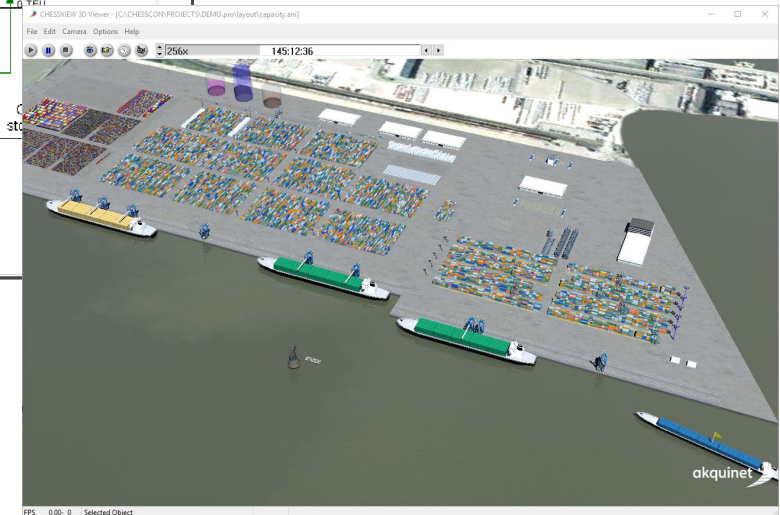
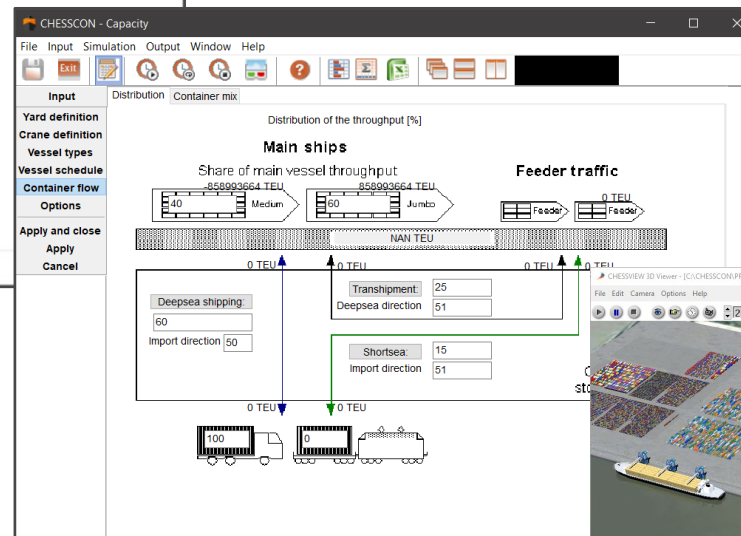
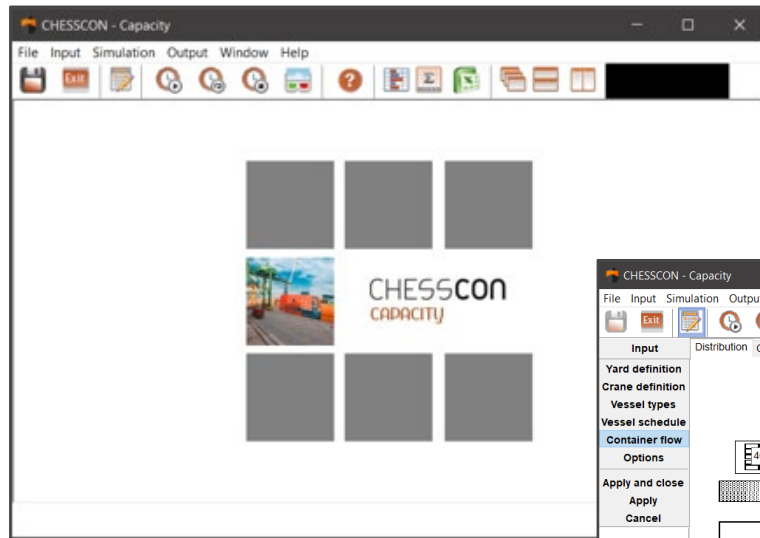
- determination of quay capacity
- analyzing stacking area's capacity
- evaluation of required STS cranes
- vessel plan based on various vessel types

CHESSCON
CAPACITY



CHESSCON CAPACITY

DETERMINE YOUR QUAY
AND YARD CAPACITY



- Fast and easy way to plan a greenfield terminal or to evaluate expansion plans

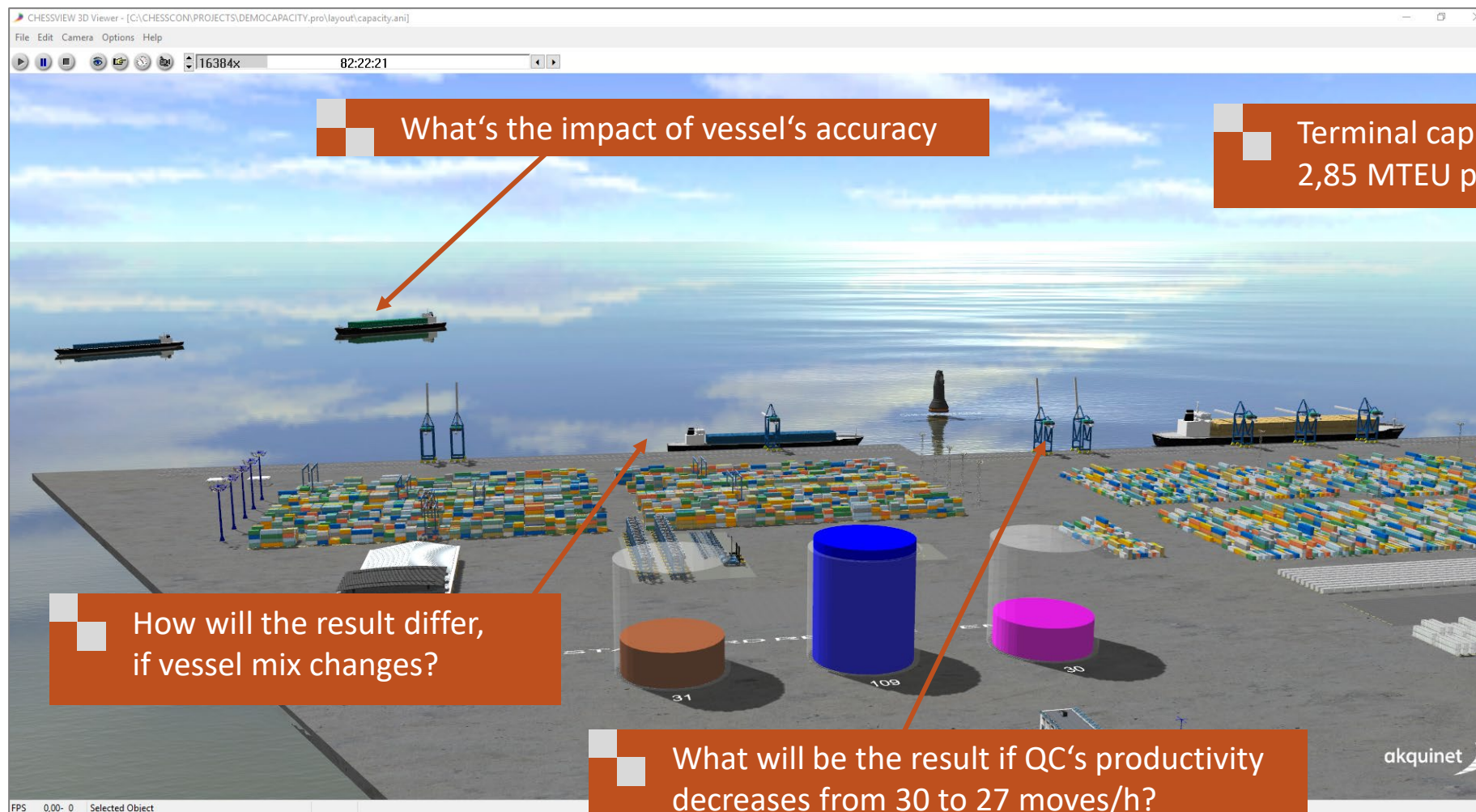
TERMINAL CAPACITY

- 1,500 m quay length
- 24/7 operation
- Average vessel length 330 m (incl. safety distance)
- Average throughput per vessel 2,300 TEU
- Average service time 24 h

- ~~■ → Theoretical capacity
(1,500 / 330) * 365 * 2,300 TEU ≈ 3.8 MTEU pa ????~~

- Static view is insufficient
→ Simulation is recommended

CAPACITY PLANNING



TARGETS

- Where is the bottleneck of the terminal? Quay or stacking area?
- With how much throughput does a terminal cope with the existing capacity?

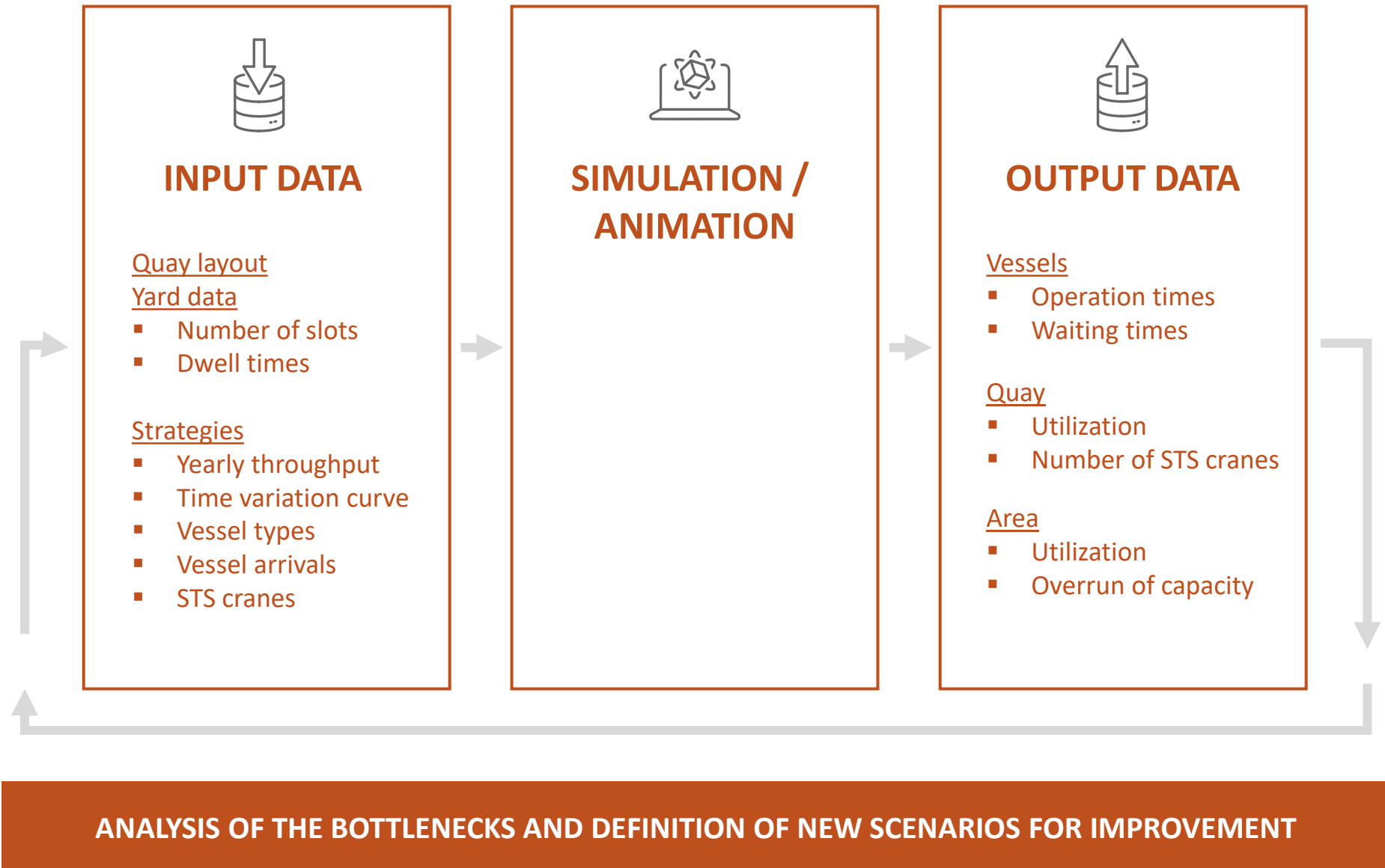
QUAY EVALUATION

- Is there sufficient quay length to operate a given container volume?
- What is the utilization of the quay?
- What is the number of quay cranes required to handle the container volume?

AREA EVALUATION

- Is there a sufficient number of stacking slots?
- What is the utilization of the stacking area?

MAIN MODULES OF CAPACITY



CAPACITY SIMULATION

SIMULATION TIME

- 1 year

SIMULATION

- single runs for configuration check
- several runs for evaluation



SAVING OF SIMULATION RESULTS

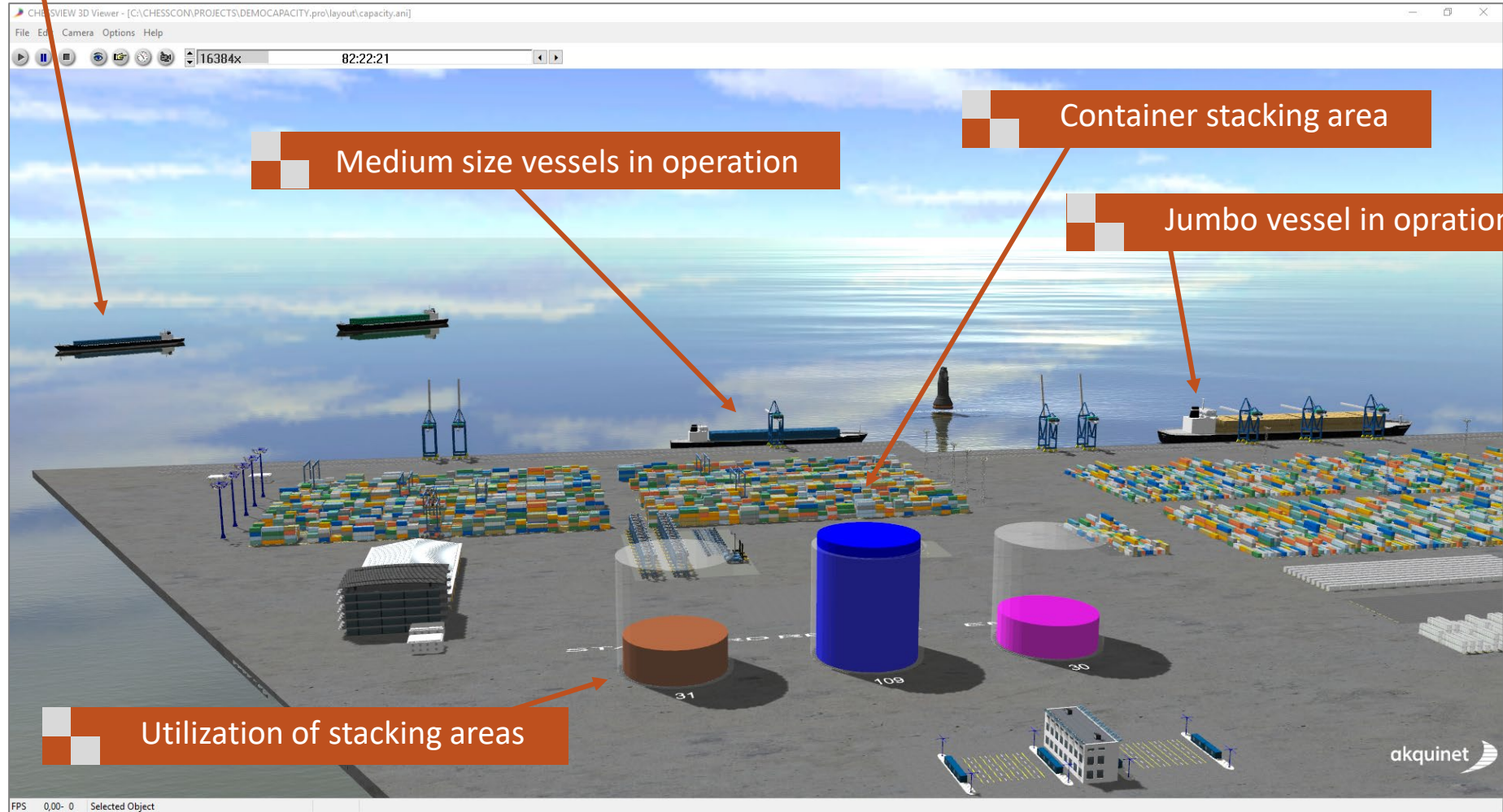
- average data over all simulation runs
- if necessary data of each single run

ANIMATION

- 3D animation of the quay
- Animation of the area utilization
- Online animation during simulation
- Supplementary animation for fault analysis
 - The last simulation run is recorded as a “film” which can be turned back and forward
- Adaptation of the animation speed according to the requirements
- Zoom and sight onto the terminal from various perspectives

ANIMATION

Arriving vessels



Medium size vessels in operation

Container stacking area

Jumbo vessel in operation

Utilization of stacking areas

SIMULATION RESULT EVALUATION

QUAY EVALUATION

- quay utilization – maximum and average
- crane requirement – maximum and average

VESSEL EVALUATION

- berthing times - maximum and average for any vessel type
- waiting times - maximum and average for any vessel type
- „rejected “ vessels – waiting time over maximum
- crane performance - minimum, maximum and average

STACKING AREA EVALUATION

- evaluation of the area utilization regarding to capacity overrun as well as maximum utilisation overrun

TOTAL EVALUATION – SEASIDE OPERATION



simulated container volume

Total volume: 1063440.70 TEU

Total volume [including rejected ships]: 1072945.40 TEU

Feeder

| Number | | | Berthing time | | Operation time | | Waiting time | | | TEU | | Container | | Ship to shore cranes | |
|--------|----------|----------|---------------------------------------|----------|----------------|----------|--------------|---------------|----------|-----------|-----------|-----------|------|----------------------|----------|
| total | waiting* | rejected | av. | max. | av. | max. | av. (total) | av. (waiting) | max. | total avg | total max | av. | max. | no. | boxes/hr |
| 398.00 | 70.70 | 3.70 | 22:33:54 | 54:23:24 | 22:32:06 | 47:14:12 | 01:56:06 | 10:47:31 | 35:52:30 | 753.71 | 1266.00 | 539.06 | 905 | 0.51 | 20.99 |
| | 17.76% | 0.93% | Berthing without waiting time: 82.24% | | | | | | | | | | | | |

Medium

| Number | | | Berthing time | | Operation time | | Waiting time | | | TEU | |
|--------|----------|----------|---------------------------------------|----------|----------------|----------|--------------|---------------|----------|-----------|-----------|
| total | waiting* | rejected | av. | max. | av. | max. | av. (total) | av. (waiting) | max. | total avg | total max |
| 162.00 | 19.00 | 2.00 | 36:10:45 | 87:27:54 | 36:09:46 | 75:39:52 | 00:53:56 | 07:34:10 | 23:44:19 | 2003.19 | 2587.00 |
| | 11.73% | 1.23% | Berthing without waiting time: 88.27% | | | | | | | | |

Jumbo

| Number | | | Berthing time | | Operation time | | Waiting time | | | TEU | | Container | | Ship to shore cranes | |
|--------|----------|----------|---------------------------------------|----------|----------------|----------|--------------|---------------|----------|-----------|-----------|-----------|------|----------------------|----------|
| total | waiting* | rejected | av. | max. | av. | max. | av. (total) | av. (waiting) | max. | total avg | total max | av. | max. | no. | boxes/hr |
| 113.00 | 0.40 | 0.60 | 39:48:38 | 61:19:06 | 39:47:31 | 61:19:06 | 00:01:23 | 06:28:01 | 13:06:54 | 3965.68 | 5161.00 | 2836.39 | 3690 | 2.47 | 30.00 |
| | 0.35% | 0.53% | Berthing without waiting time: 99.65% | | | | | | | | | | | | |

| | | |
|-------|--------|-------|
| Total | 13.39% | 0.94% |
|-------|--------|-------|

*excludes rejected ships

Share of waiting and „rejected“ vessels

Vessel type evaluation:

- Operation time
- waiting time
- container volume
- Quay crane performance

Aim: decrease these numbers

TOTAL EVALUATION – STORAGE AREA (YARD AND QUAY)



Statistic

| Quay length | Quay util. | | no. of StSC used | |
|-------------|------------|--------|------------------|------|
| | av. | max. | av. | max. |
| 1388m | 40.56% | 99.78% | 3.44 | 9 |

Quay evaluation

Yard utilisation

| Stack name | maximum | average | over capacity | over max. util. | below max. util. |
|------------|---------|---------|---------------|-----------------|------------------|
| EMPTY | 86.32% | 45.88% | 0.00% | 0.04% | 99.96% |
| REEFER | 308.40% | 163.89% | 95.68% | 98.82% | 1.18% |
| STANDARD | 86.33% | 45.77% | 0.00% | 0.04% | 99.96% |

area evaluation

almost 100% =
overrun of stack

Ship distribution

| avg | Mon | Tue | Wed | Thu | Fri | Sat | Sun |
|--------|------|------|------|------|------|------|------|
| Feeder | 1.53 | 1.92 | 0.90 | 0.92 | 0.96 | 1.08 | 0.31 |
| Medium | 0.00 | 0.83 | 0.60 | 0.00 | 1.38 | 0.17 | 0.13 |
| Jumbo | 0.25 | 0.33 | 0.27 | 0.21 | 0.23 | 0.35 | 0.54 |

Quay segment occupation Share of container sizes

| % | GRTG | GSC | % | 20' | 40' | 45' |
|--------|------|-------|--------|------|------|-----|
| Feeder | 38.0 | 62.0 | Feeder | 60.2 | 39.8 | 0.0 |
| Medium | 42.8 | 57.2 | Medium | 60.2 | 39.8 | 0.0 |
| Jumbo | 0.0 | 100.0 | Jumbo | 60.2 | 39.8 | 0.0 |

vessel schedule

Throughput distribution

| % | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|--------|-------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| Feeder | 76.66 | 100.30 | 81.40 | 100.97 | 95.89 | 105.00 | 104.93 | 113.59 | 118.34 | 102.70 | 96.74 | 103.48 |
| Medium | 83.85 | 67.24 | 112.46 | 79.48 | 89.58 | 116.92 | 107.00 | 110.11 | 101.44 | 116.95 | 114.07 | 100.91 |
| Jumbo | 80.23 | 91.66 | 89.71 | 119.49 | 105.79 | 96.89 | 118.81 | 99.93 | 112.99 | 93.84 | 95.07 | 95.60 |
| Total | 80.32 | 86.72 | 94.24 | 102.26 | 98.14 | 105.19 | 111.37 | 106.81 | 111.01 | 103.28 | 101.26 | 99.40 |

throughput distribution

TOTAL EVALUATION – UTILIZATION OF STS CRANES

simultaneous utilization of StSC [% of time]

| no. of StSC | Share of time | Sum |
|-------------|---------------|---------|
| 0 | 8.42% | 8.42% |
| 1 | 12.14% | 20.55% |
| 2 | 15.98% | 36.54% |
| 3 | 17.78% | 54.32% |
| 4 | 16.03% | 70.35% |
| 5 | 12.25% | 82.60% |
| 6 | 8.36% | 90.96% |
| 7 | 4.93% | 95.89% |
| 8 | 2.51% | 98.40% |
| 9 | 1.18% | 99.58% |
| 10 | 0.33% | 99.91% |
| 11 | 0.08% | 100.00% |
| 12 | 0.00% | 100.00% |



StSC total boxes

| StSC | boxes |
|------|-----------|
| QC 1 | 761903,50 |

| no. of StSC used | |
|------------------|------|
| av. | max. |
| 3.42 | 12 |

average number of cranes working simultaneously

AREA EVALUATION

slot capacity overrun

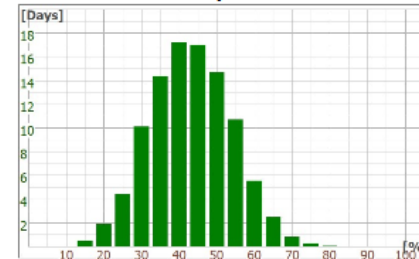
STANDARD Yard Utilization



area utilization during simulation

area occupancy and slot requirement

STANDARD yard utilization



Calculated Values

| Yard occupation [TEU] | | |
|------------------------------------|---------|----------|
| Min. | Av. | Max. |
| 1583.00 | 5478.38 | 10429.00 |
| Given operational capacity: 80.00% | | |

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