



**MOTUS Engineering GmbH & Co. KG**

Am Wall 17

35041 Marburg

Germany

Phone +49 6420 43598 50

Email: [info@motus-engineering.de](mailto:info@motus-engineering.de)

Internet: <http://www.motus-engineering.de>



**Konstantin Große**



**Alexander Wagner**

In the year 2000 the MOTUS Engineering company was founded at Marburg together by Alexander Wagner and his long-term study fellow and college Ralf Battenberg. MOTUS focused on the development and manufacturing of loading and unloading systems for freeze dryers and on all nonstandard machines and devices in the fill finish area. Recently MOTUS offers new systems for monitoring in respect to the current annex 1 and retrofit for annex 1 requirements for lyo loading.

On 1<sup>st</sup> January 2023 MOTUS became part of the CHRIST group.

Konstantin Große supports Alexander Wagner in sales and management. After his first education as toolmaker and secondary education as mechanical engineering technician he deepened his work at Motus and graduated as a certified technician in business administration.

After his studies of physics at the University of Marburg and mechanical engineering at German THM Giessen Alex started as a young engineer in 1992 with mechanical design and stress calculation for freeze dryers at a today well known German freeze dryer manufacturer. Later on he was the head of the mechanical engineering department and project and sales manager. Today he is the CFO at Motus and head of sales.

## Conceptual Planning of Lyoloading in Projects





# Our Location





 **Machines**



 **Equipment**



 **Engineering**

- **Lyoloader for Freeze Driers**
- **Retrofit loading and unloading systems**
- **Frameloader / Trayloader**
- **Environmental monitoring**
- **Tray filling**
- **Powdertransportsystems**
- **Sterilcontainer**
- **Consulting**
- **Projectmanagement**



## Company profile

Numbers and facts

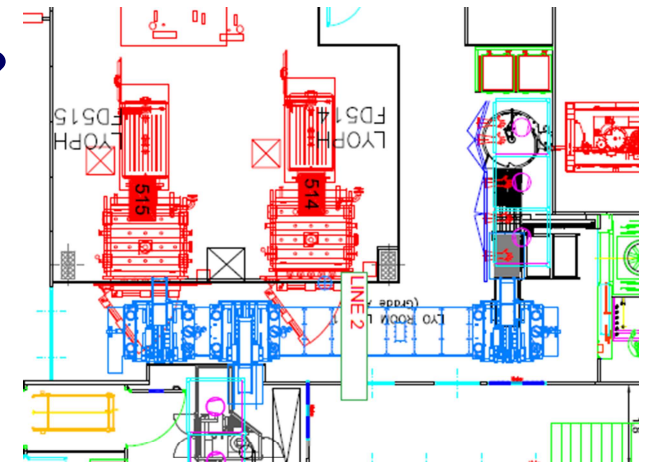
Activity	Driver
Freeze-dryer	MC
Sales, technical consulting, annex 1	MC and Motus
Project with new lyo and loading	MC and Motus
Retrofit projects lyoloading (all brands)	Motus
Frameloader, buffers, special machines, monitoring	Motus

- Christ and Motus share they entire expertise



## What to consider before starting planning ?

- Is it a retrofit project or a new project?
- Which constraints do you have ?
  - compliancy with „Annex 1“
  - space?
  - load on floor?
  - two level set up?
  - existing machines? E.g. filler, capper other lyos?
  - excape routes, emergency exits?
  - insertion, setup?
  - maintainance access?



# What to consider before starting planning ?

- Is the product hazardous?

- ATEX?

- OEB Level?

- special decontamination? (e.g. Hypochlorine, VHP,..)



- Containment ?

- production area classification (e.g. A, B, C)

- oRABS?

- cRABS?

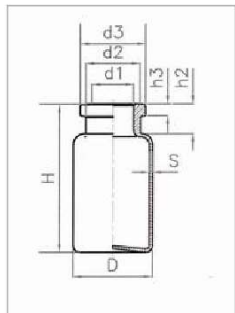
- Isolator?



## What to consider before starting planning ?

- **Primary packing materials?**
  - **Tubing glass DIN EN ISO 8362-1**  
2R, 4R, 6R, 10R, 15R, 20R, 25R, 30R, 50R
  - **Blow molded glass DIN EN ISO 8362-4**  
5H, 7H, 8H, 15H, 20H, 25H, 30H, 50H, 100H, 250H

Nominal Volume	Nominal Size	Height x Diam. in mm acc. to ISO 8362								
			D	d1	d2	d3	H	h2	h3	s
2 ml	2 R	35x16	16	7	10,5	13	35	8	3,6	1
4 ml	4 R	45x16	16	7	10,5	13	45	8	3,6	1
6 ml	6 R	40x22	22	12,6	16	20	40	8,5	3,6	1
8 ml	8 R	45x22	22	12,6	16	20	45	8,5	3,6	1
10 ml	10 R	45x24	24	12,6	16,5	20	45	9	3,6	1
15 ml	15 R	60x24	24	12,6	16,5	20	60	9	3,6	1
20 ml	20 R	55x30	30	12,6	17,5	20	55	10	3,6	1,2
25 ml	25 R	65x30	30	12,6	17,5	20	65	10	3,6	1,2
30 ml	30 R	75x30	30	12,6	17,5	20	75	10	3,6	1,2



## What to consider before starting planning ?

- **Performance?**
  - **Vials per minute [pce/min] filling / loading lyo?**
  - **Vials per minute [pce/min] capping/ unloading lyo?**
  - **Define performance for each vial size.**

	<b>Loading (Filling)</b>	<b>Max. Performance 2ml/2R pce/min</b>	<b>Unloading (Capping)</b>	<b>Max. Performance 2ml/2R pce/min</b>
Lab		60		60 to 120
Pilot		200		300
Production		400		600

# What to consider before starting planning ?

- **Lyo capacity / batch size?**
  - sqm shelf area?
  - kg ice capacity?
  - vials per batch for each vial size?
  
- **Working shift situation?**
  - 1 shift?
  - 2 shift?
  - 3 shift? – 7/24h?



No.	type	dia [mm]	row [pce/m]	row shape plate [pce/m <sup>2</sup> ]	hex-shape plate [pce/m <sup>2</sup> ]
1	2R	16	62	3844	4428
2	4R	16	62	3844	4428
3	6R	22	45	2025	2314
4	8R	22	45	2025	2314
5	10R	24	41	1681	1904
6	15R	24	41	1681	1904
7	20R	30	33	1089	1235
8	25R	30	33	1089	1235
9	30R	30	33	1089	1235
10	5H	20,8	48	2304	2613
11	7H	22,1	45	2025	2314
12	8H	23	43	1849	2125
13	10H	25,4	39	1521	1733
14	15H	26,5	37	1369	1570
15	20H	32	31	961	1068
16	25H	36	27	729	822
17	30H	36	27	729	822
18	50H	42,5	23	529	608
19	100H	51,6	19	361	407
20	INF50	46	21	441	492
21	INF100	49	20	400	449
22	INF250	66	15	225	247
23	INF500	78	12	144	161
24	INF1000	95	10	100	114

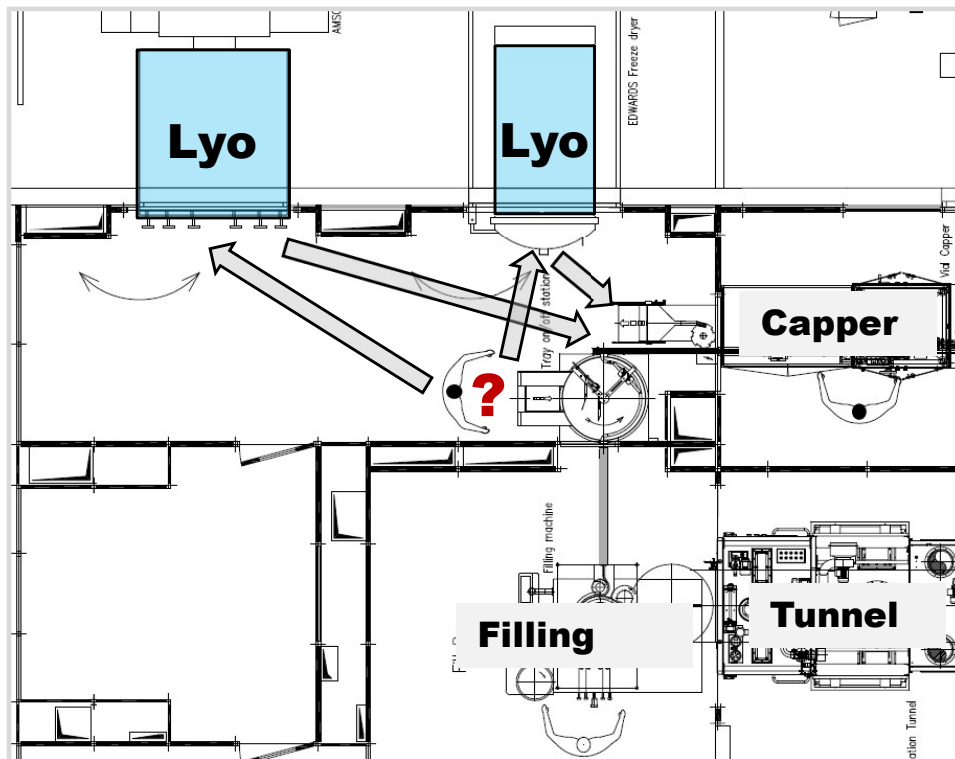
estimated hex-/row-shape factor : approx. 0,87

- all figures without warranty, calculation base without tolerances, related to 1 sqm -

## Case Studies

### Semi automatic loading, frames, trolley ACS001

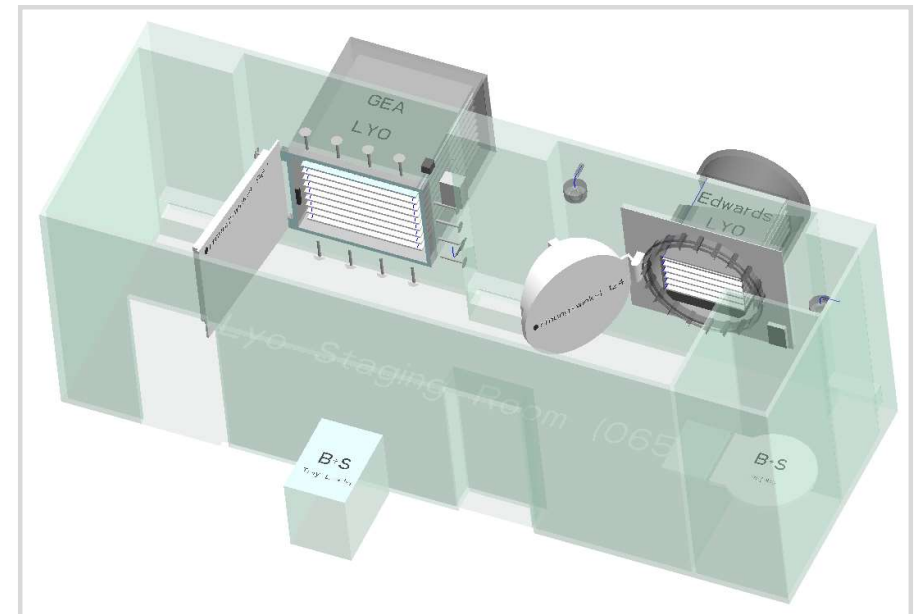
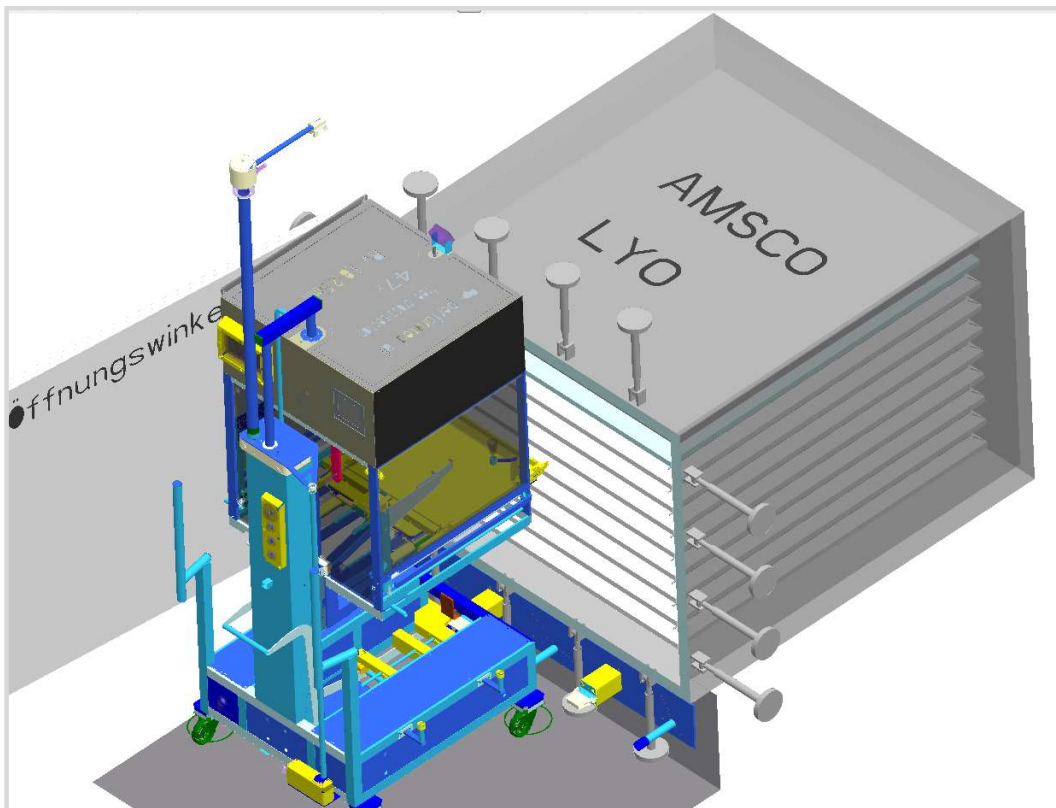
- Filling of Liquid- and Lyoproducts
- 2 x Freeze Dryer, 5m<sup>2</sup> and 16m<sup>2</sup> of different shape and no constant level possible
- No separation between operator and product during loading and unloading
- Manual transport of open vials between filling and freeze dryer



## Case Studies

## Semi automatic loading, frames, trolley ACS001

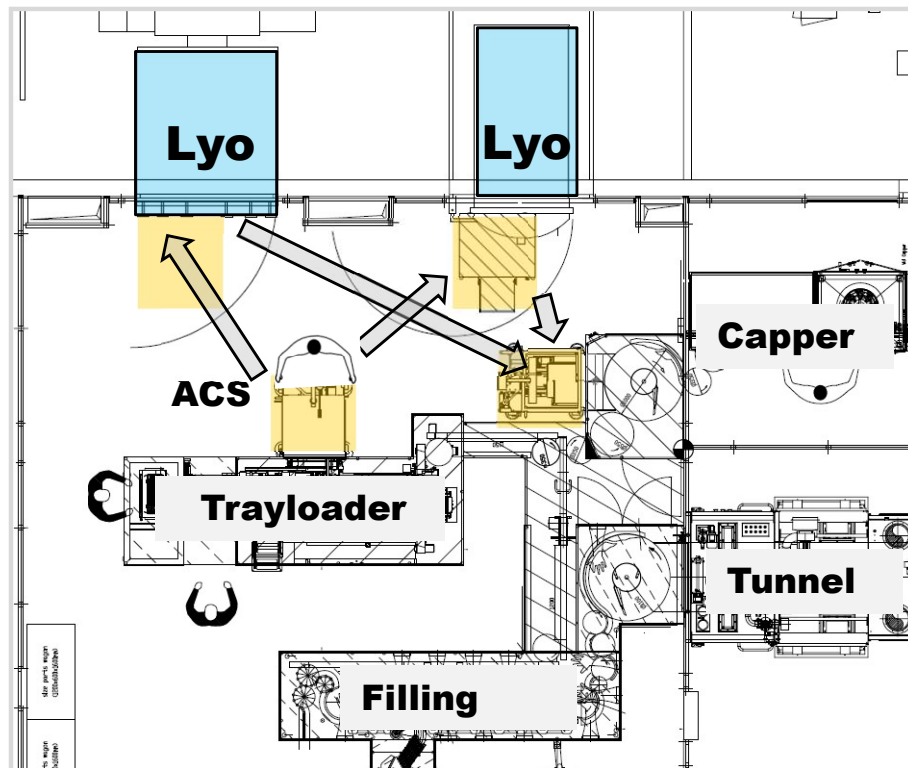
- Barrier system between operator and product
- Laminar air unit on top of loading/ unloading cart
- Vertical movement of loading height as no constant level is available at freeze dryers
- Flexible cable connection requested because of weight and reliability



## Case Studies

## Semi automatic loading, frames, trolley ACS001

- Semi-automatic loading system ACS001H-LF
- Flexible cable connection
- Loading frames out of PEEK for ergonomic and weight reasons
- Frames with coupling mechanism

**ACS001H-LF**



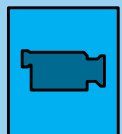
# Case Studies

Semi automatic loading, frames, trolley ACS001



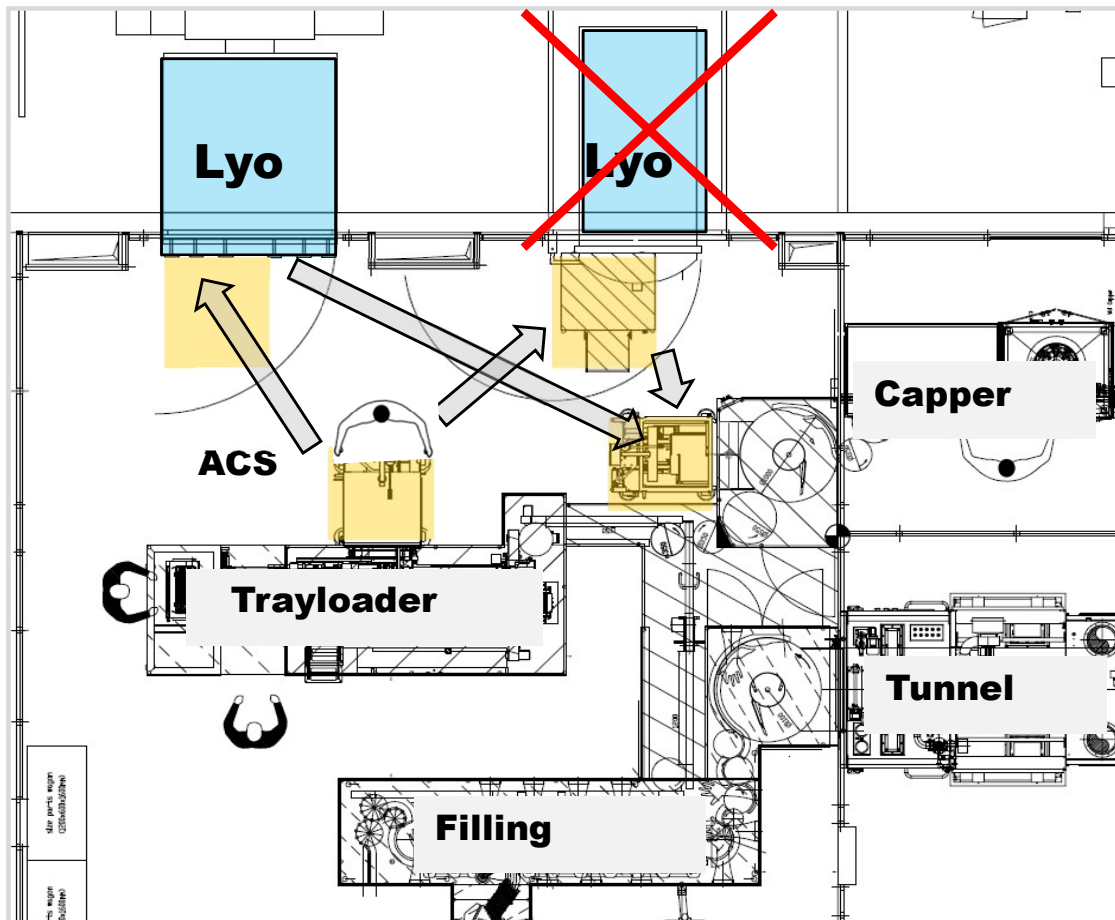
## LOADING TROLLEY ACS001-H-212

P1753



# Case Studies

Semi automatic loading, frames, trolley ACS001

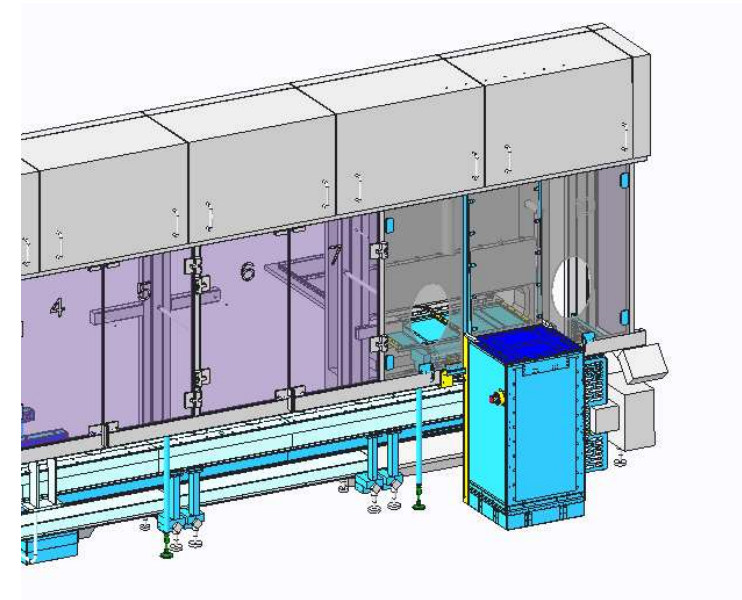
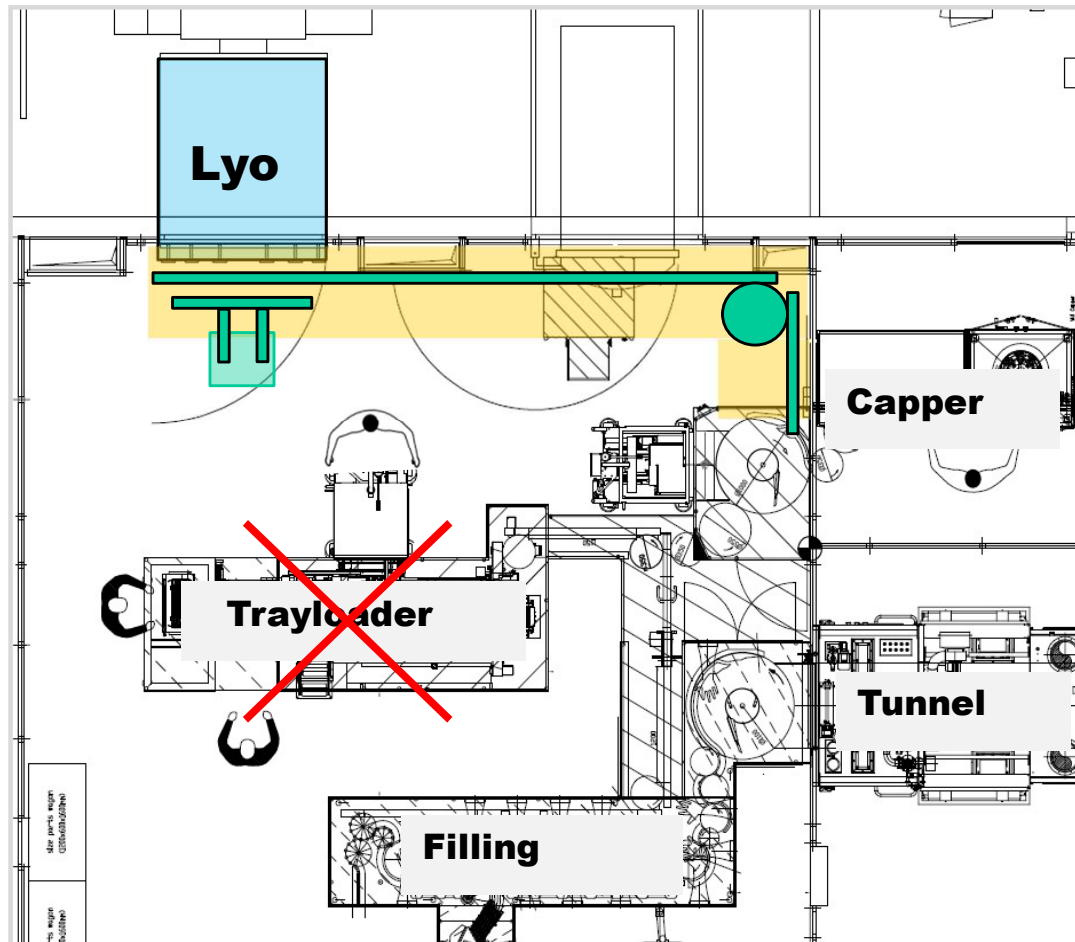


## Slot door Lyo

- Integration of new Lyo
- Preparation for auto loading is foreseen

# Case Studies

automatic loading, row-by-row, ACS069



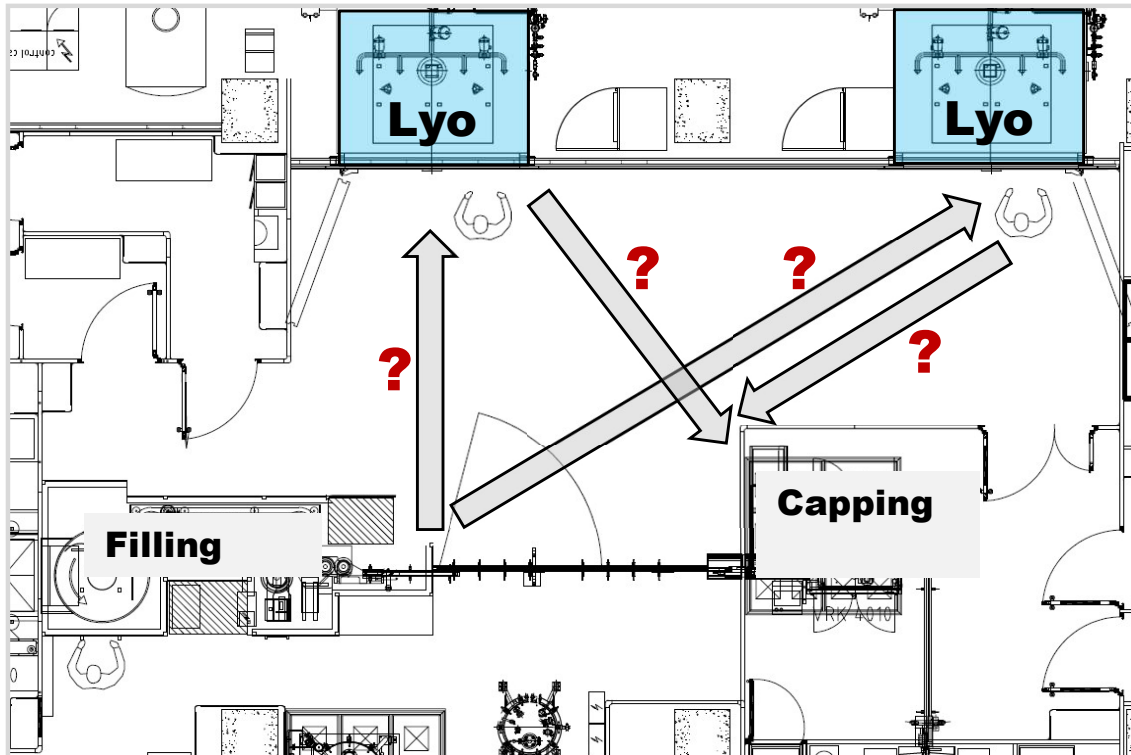
## automatic loading system

- push / pull system
- compact design
- suitable for installation on RABS and isolator

## Case Studies

### Semi automatic loading, frames, RABS unit ACS017

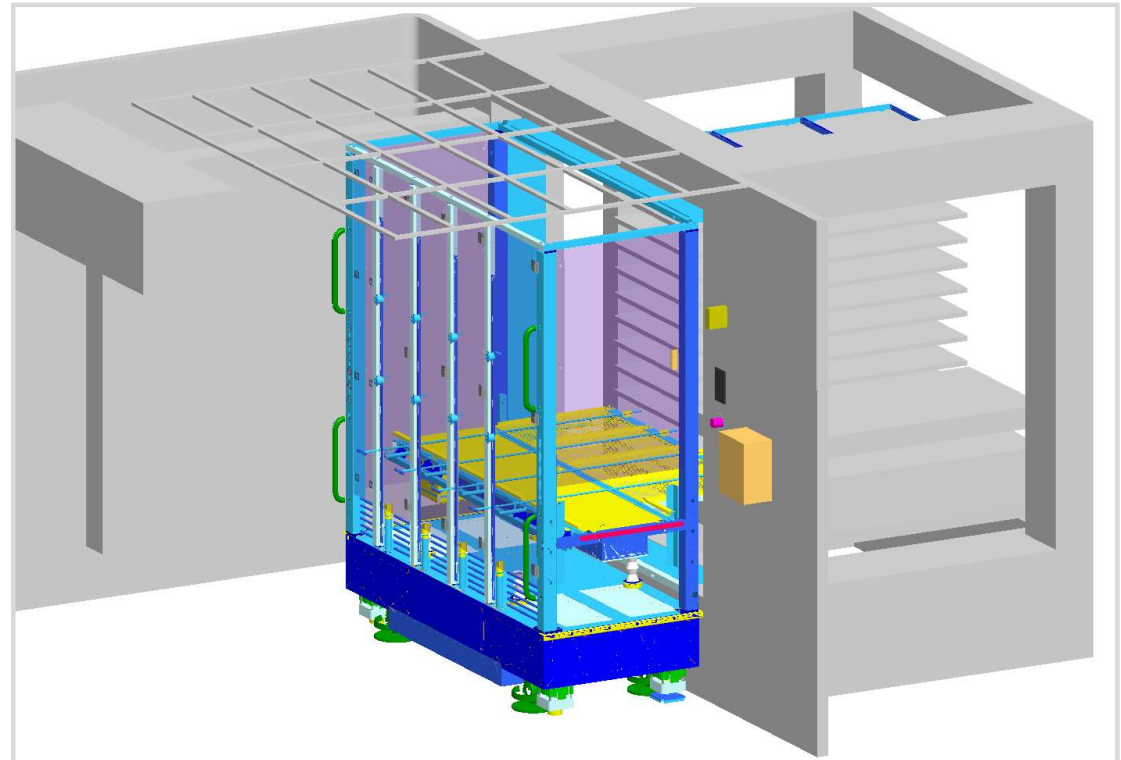
- Filling of Liquid and Lyoproducts
- 2 x freeze dryer with 24 m<sup>2</sup> shelf area each
- No separation between operator and product during loading and unloading
- Manual transport of open vials between filling and freeze dryer



## Case Studies

### Semi automatic loading, frames, RABS unit ACS017

- Barrier system between operator and product
- Semi-automatic loading / unloading
- Reliable product handling with frame system
- 4 vialformats (2ml – 400 pce/min)
- Connection to filler and capper

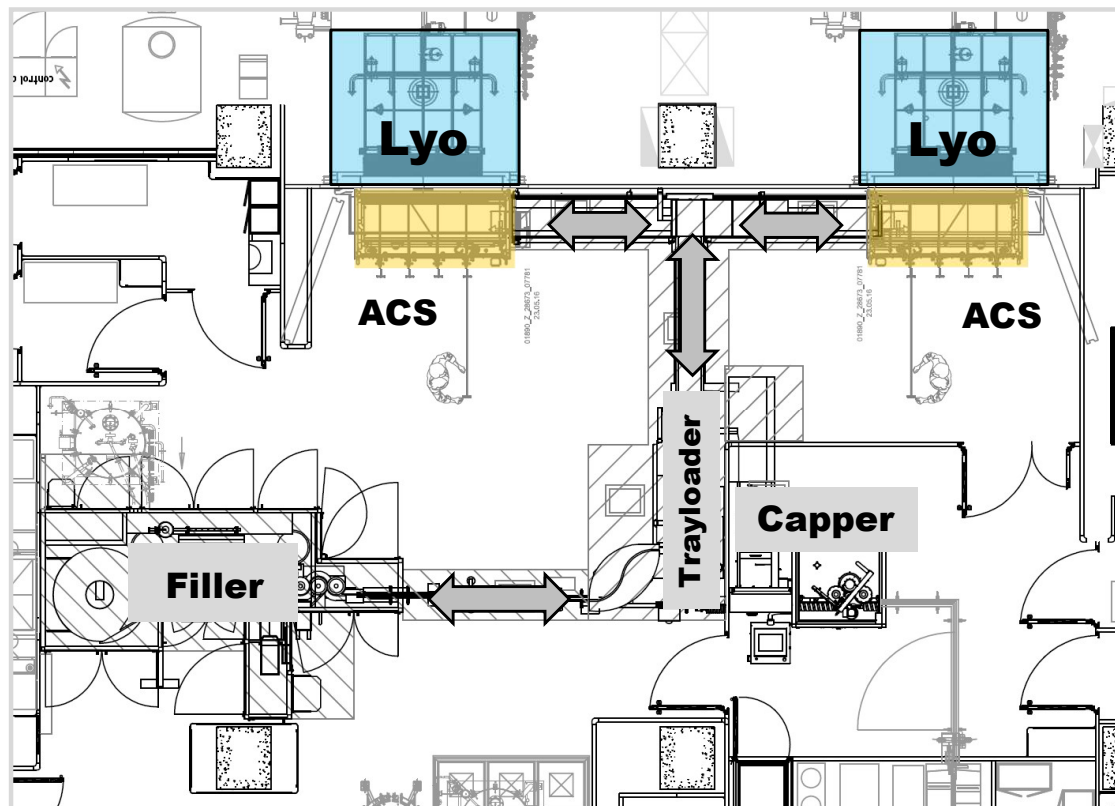


## Case Studies

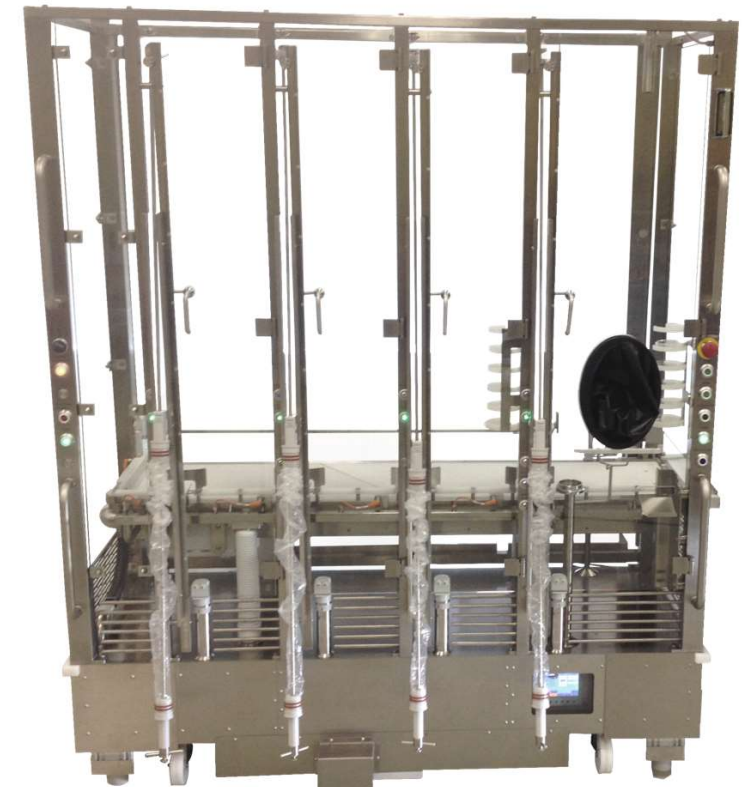
III - Execution

## Semi automatic loading, frames, RABS unit ACS017

- Semi-automatic loading system ACS017s
- Loading system movable, undock the system for door opening at freeze dryer
- automatic lift to shelf
- Frames with mechanical coupling mechanism

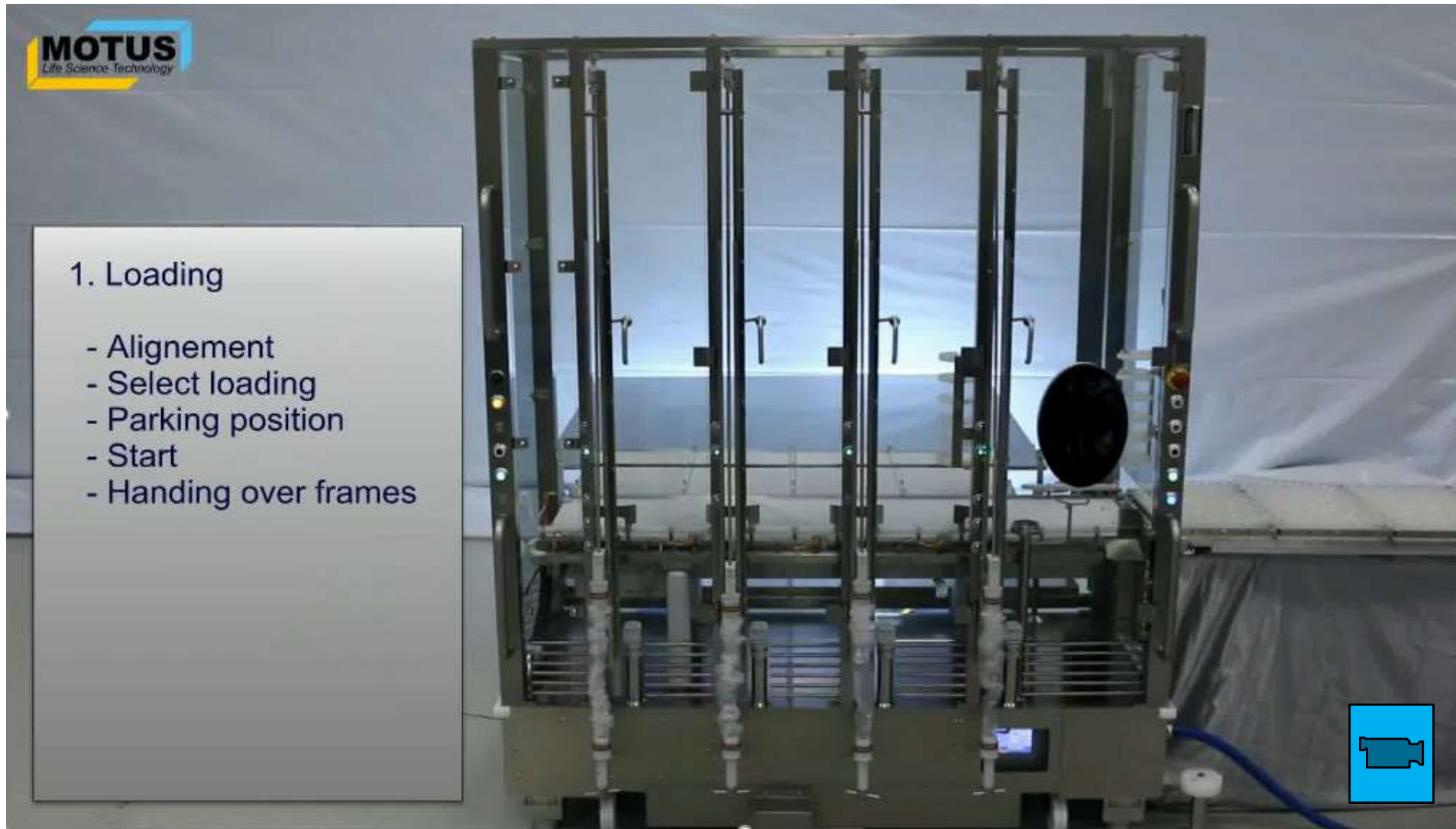


ACS017s



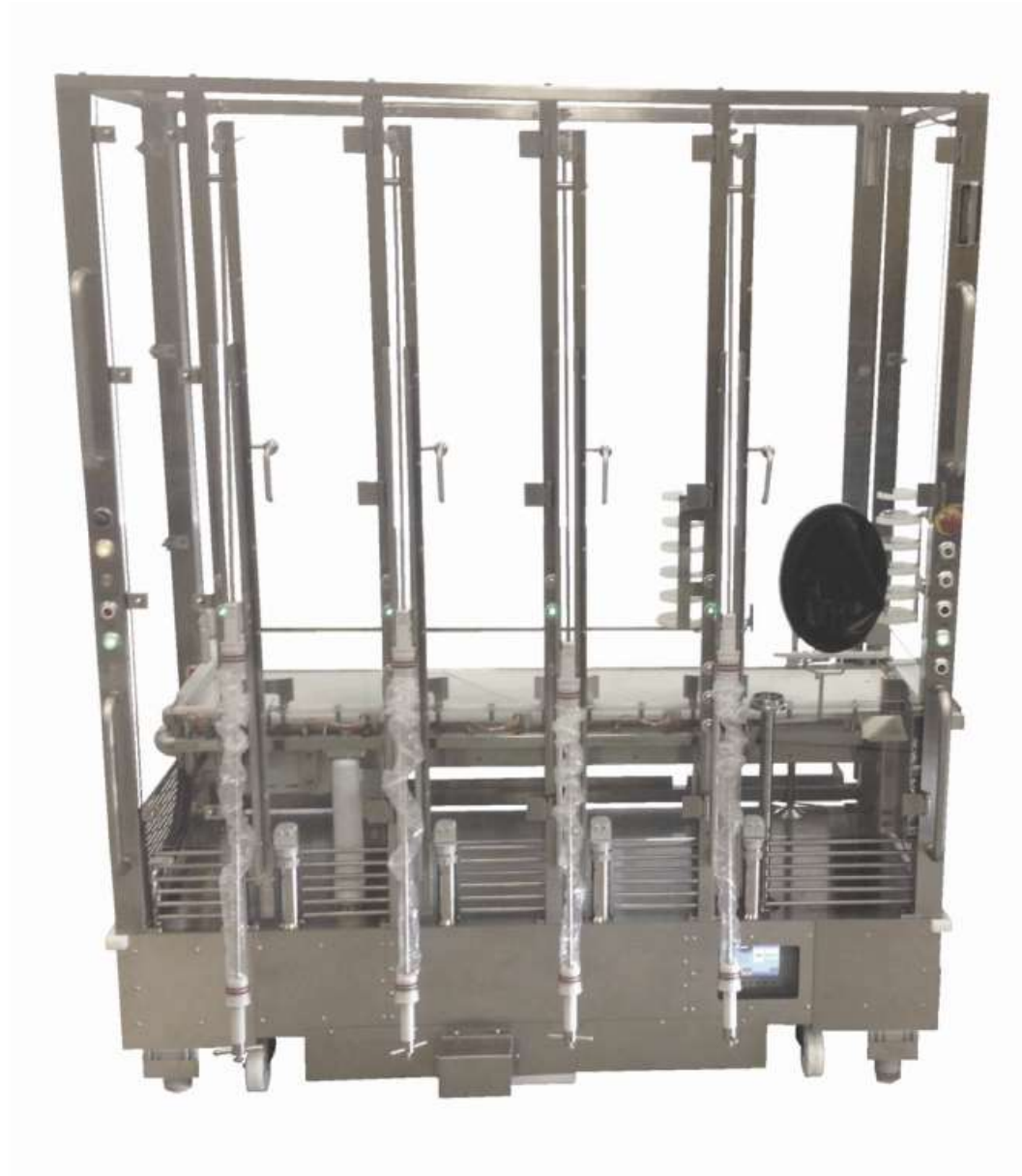
## Case Studies

Semi automatic loading, frames, RABS unit ACS017



# Loading system ACS017

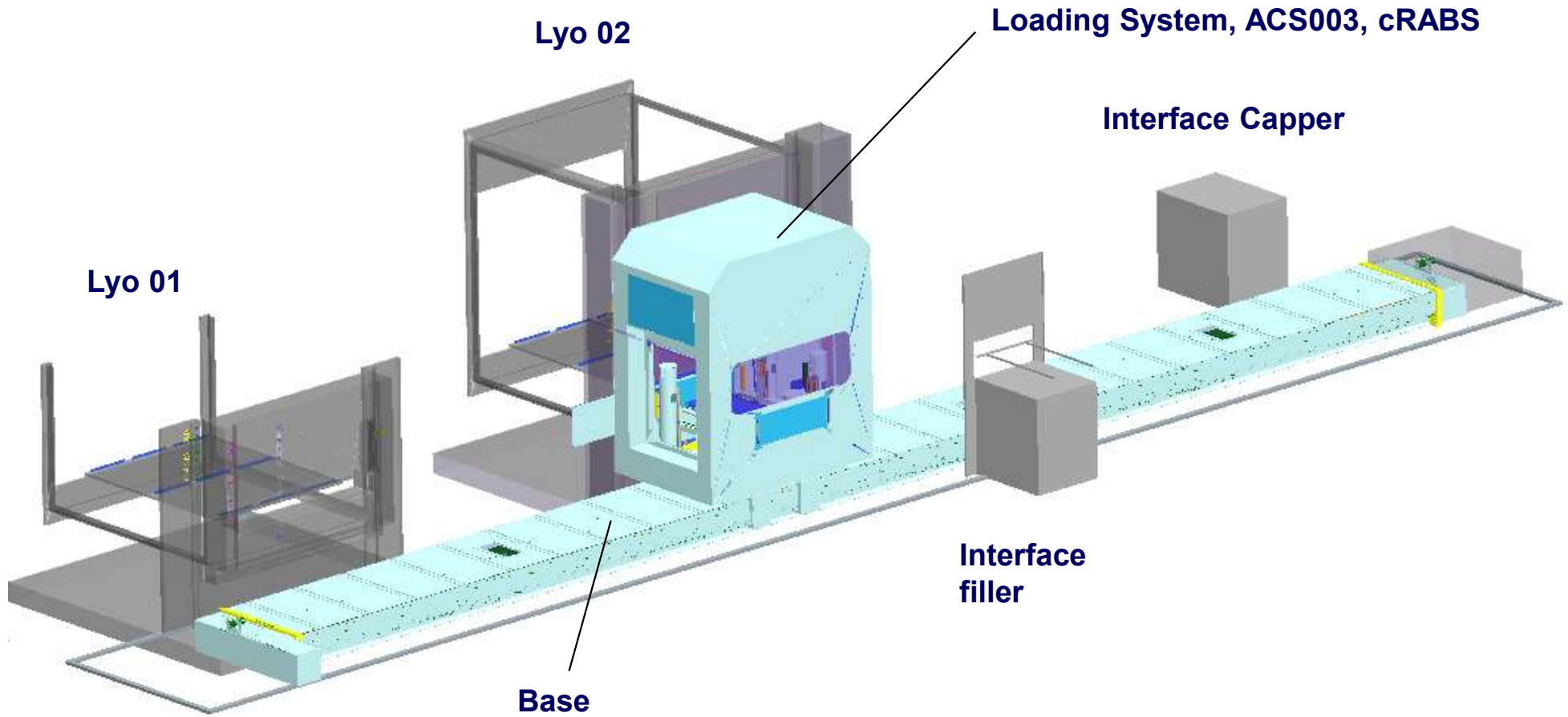
Semi automatic frames





# Case Studies

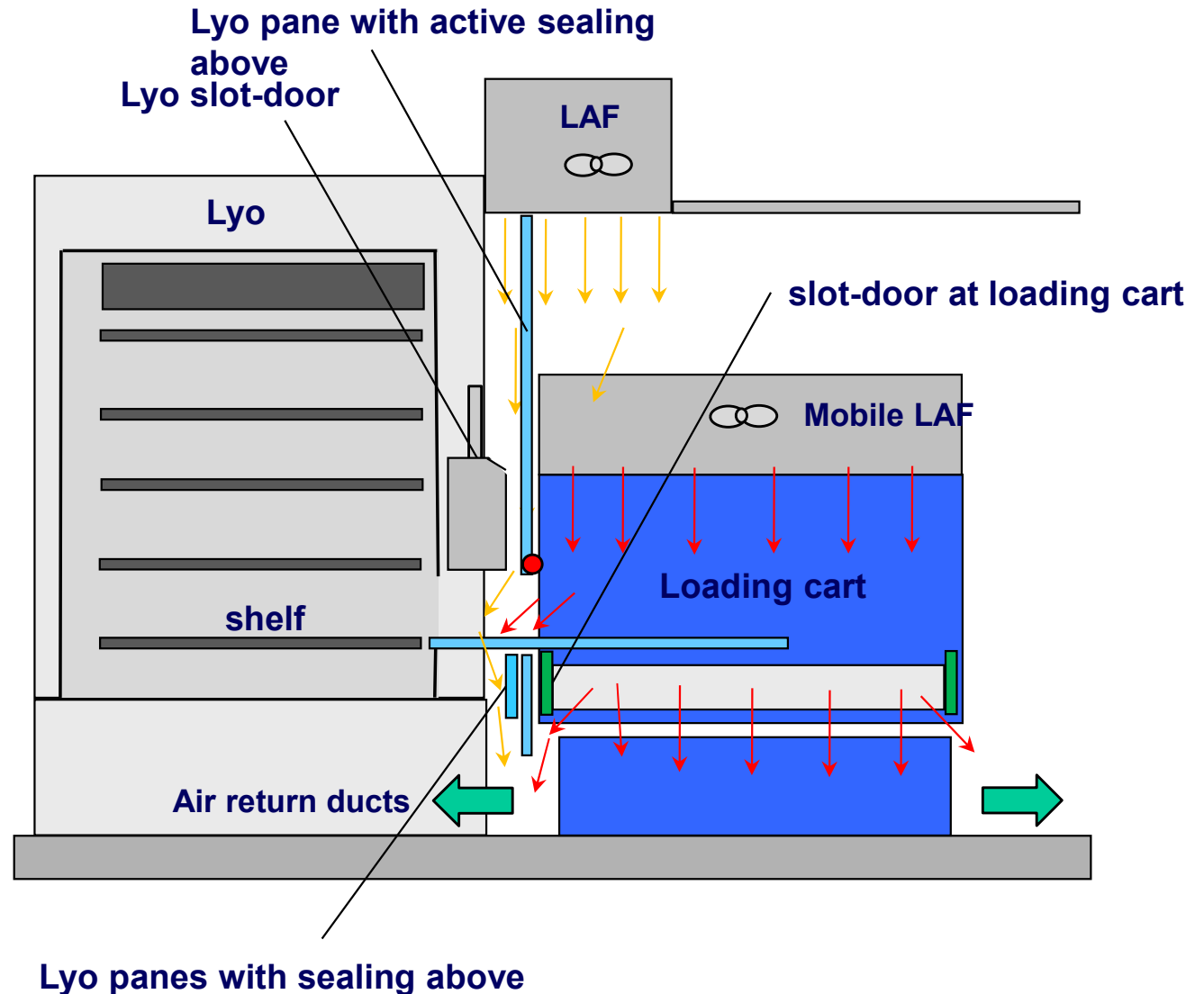
Automatic loading, frames, ACS003



# Case Studies

## Automatic loading, frames, ACS003

- Class B surfaces travel into Class A areas
- Air flow at Lyo slot door area improved with sealing, slot pane at cart, slot pane at lyo
- Air turbulences at lyo slot door area improved
- Air return ducts necessary below lyo slot door area
- Air return ducts necessary opposite to lyo slot door area
- less filters, lower air exchange rate, lower energy consumption, lower invest, lower service costs, less surfaces contaminated



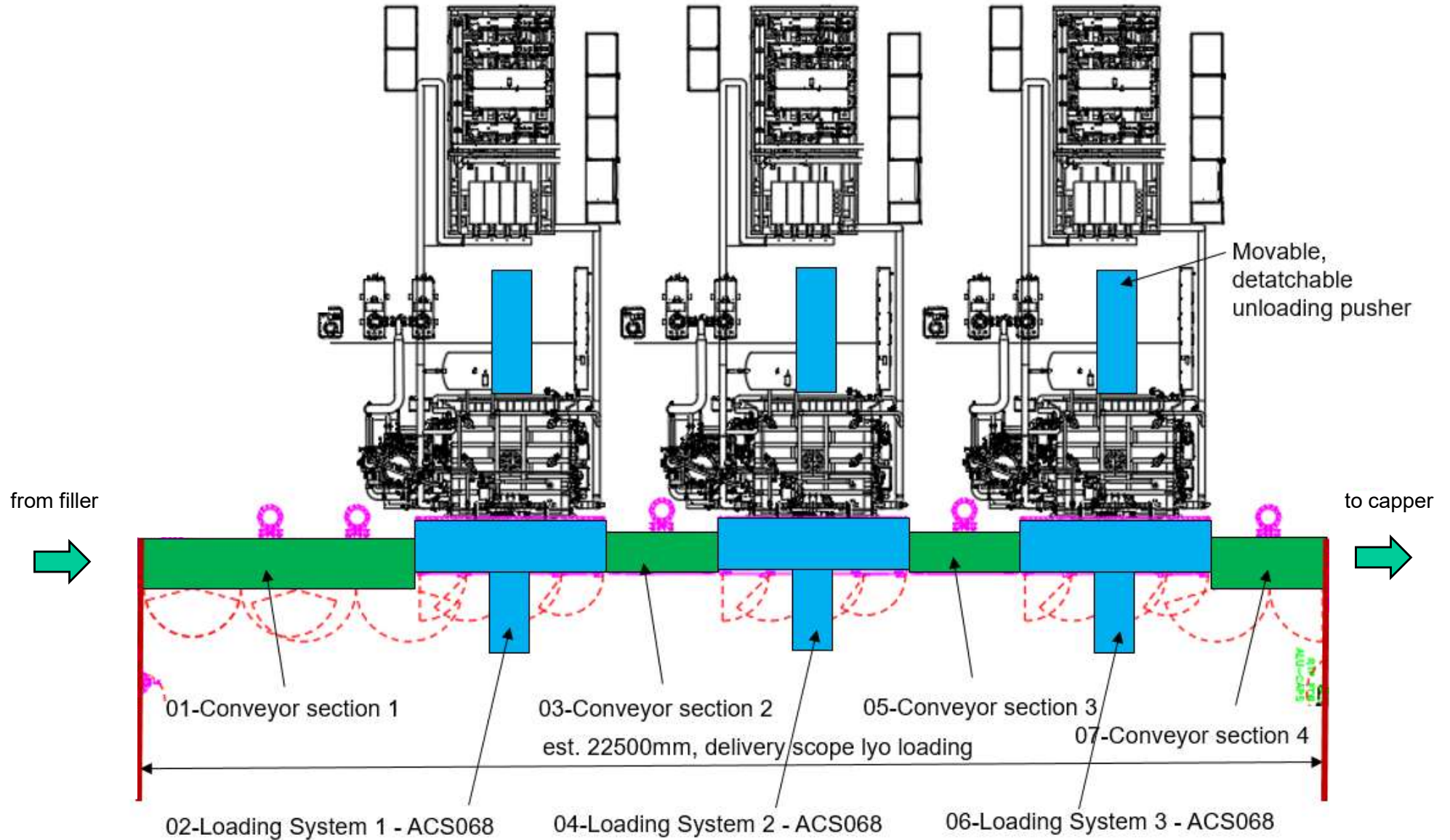
# Case Studies

Automatic loading, frames, ACS003



# Case Studies

Automatic loading, row by row, ACS068



# Case Studies

## Automatic loading, row by row, ACS068

Performance ACS068:

- 2R – 400 pce/min
- 10R – 270 pce/min
- 20R – 210 pce/min
- 50H – 100 pce/min

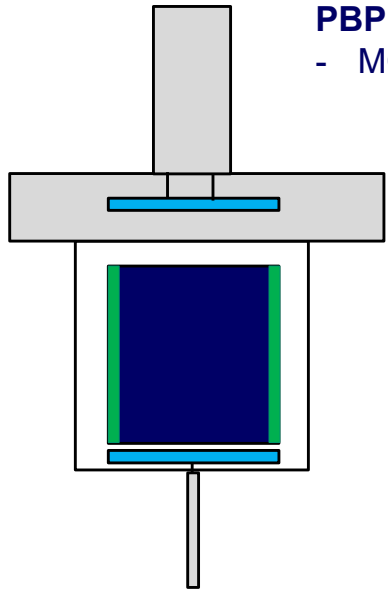
Total 4 format sets loading

Total 2 x format sets unloading (left, right)

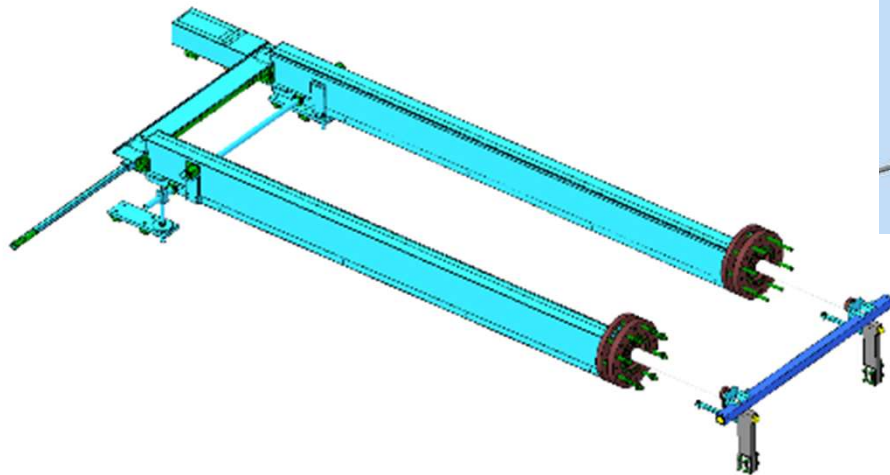
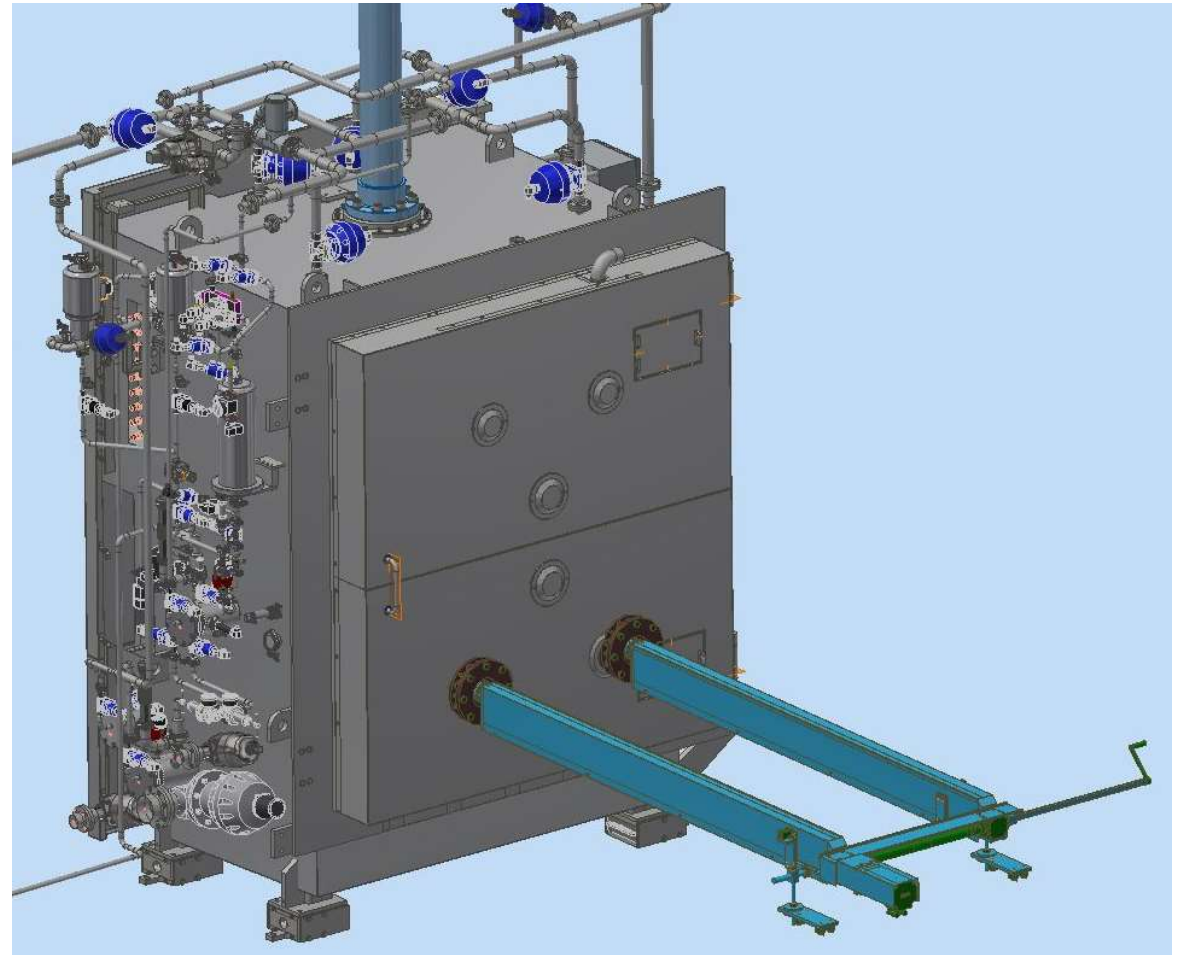


# Case Studies

## Automatic loading, row by row, ACS068

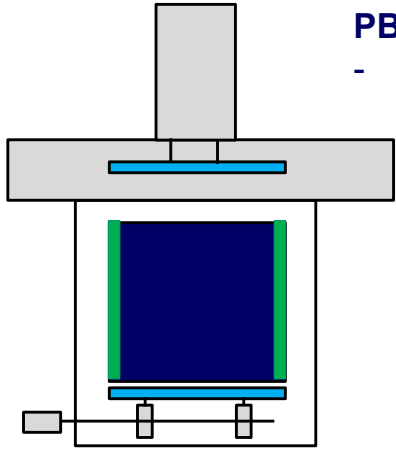


**PBP – Pusher / BackPusher**  
- MO ACS068

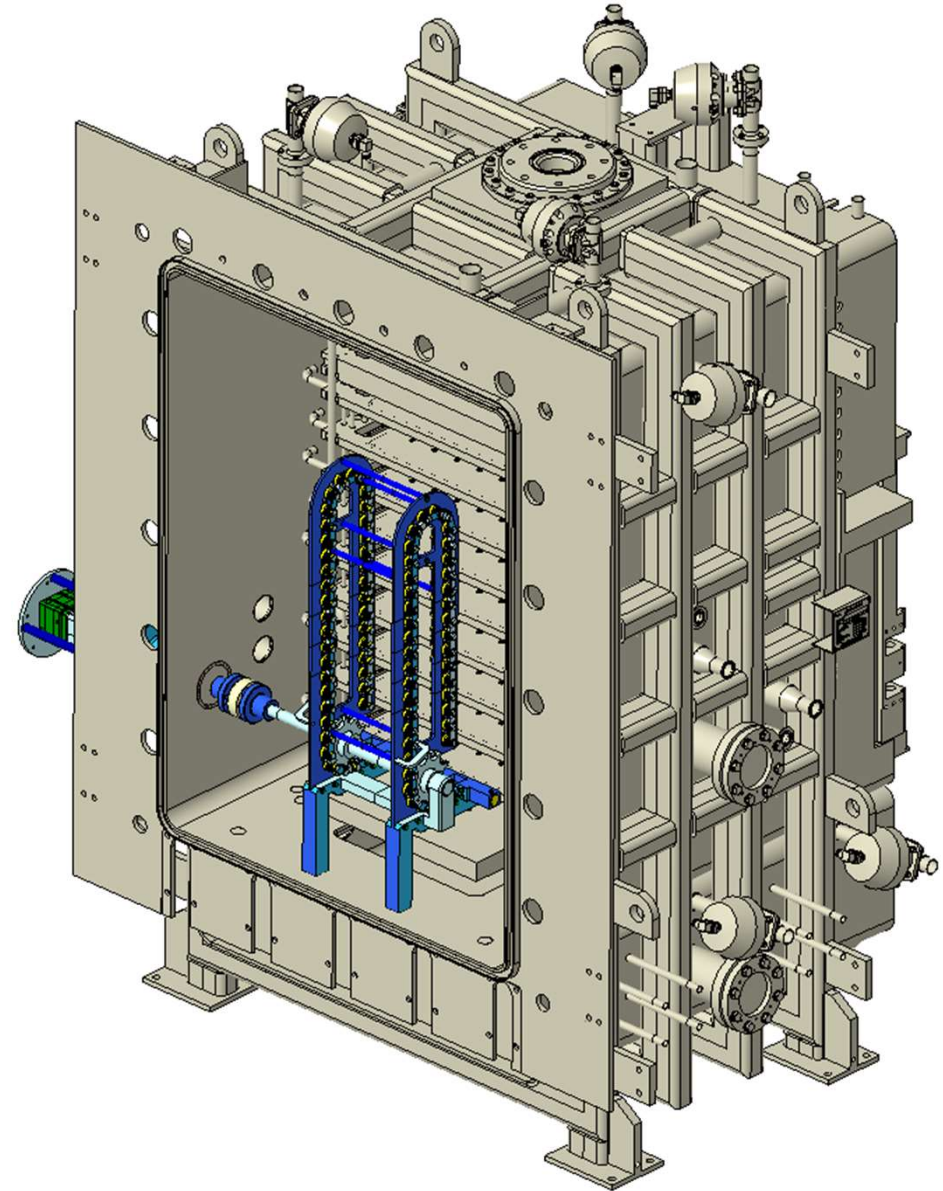
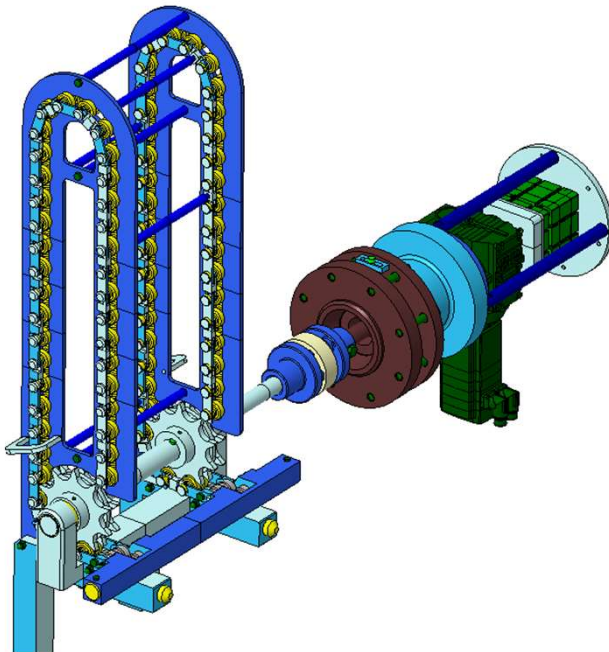


# Case Studies

Automatic loading, row by row, ACS070

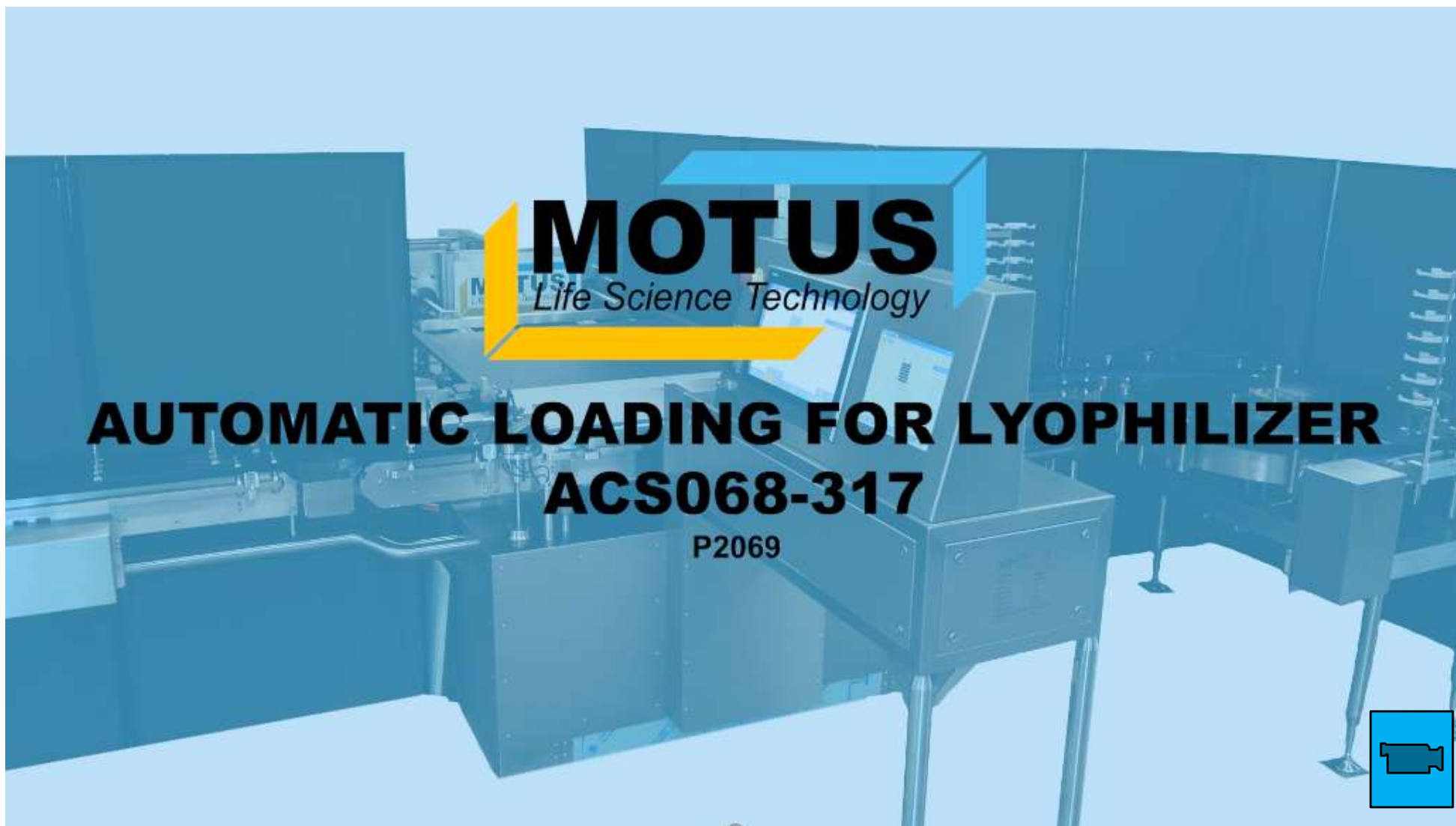


**PBC-Push / BackChain**  
- MO ACS070



# Case Studies

Automatic loading, row by row, ACS068





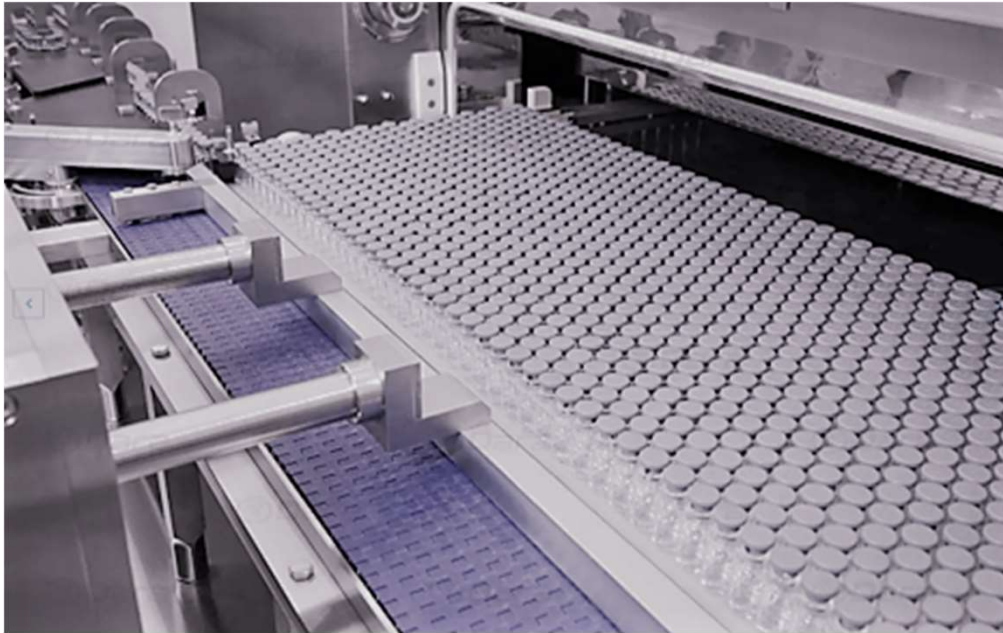
# Loading system ACS068

Automatic vials row by row



# Loading system ACS068

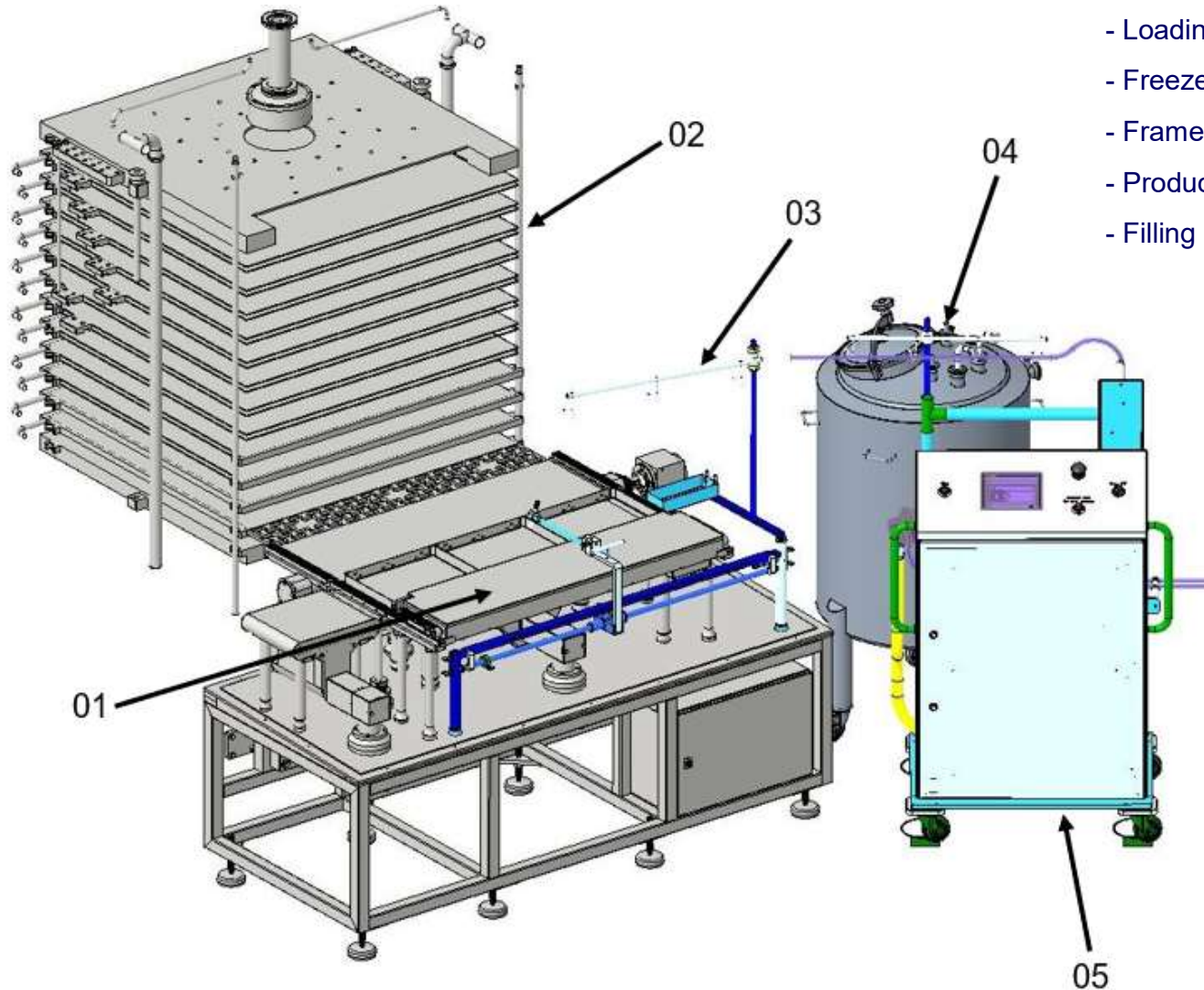
Automatic vials row by row



# Filling-Loading system tray FLS

mobile Filling unit, LyoShuttle, personal protection isolator

## Filling-Loading system tray FLS



- Loading system by Christ
- Freeze dryer by Christ
- Framework for tray filling
- Product tank
- Filling system by MOTUS

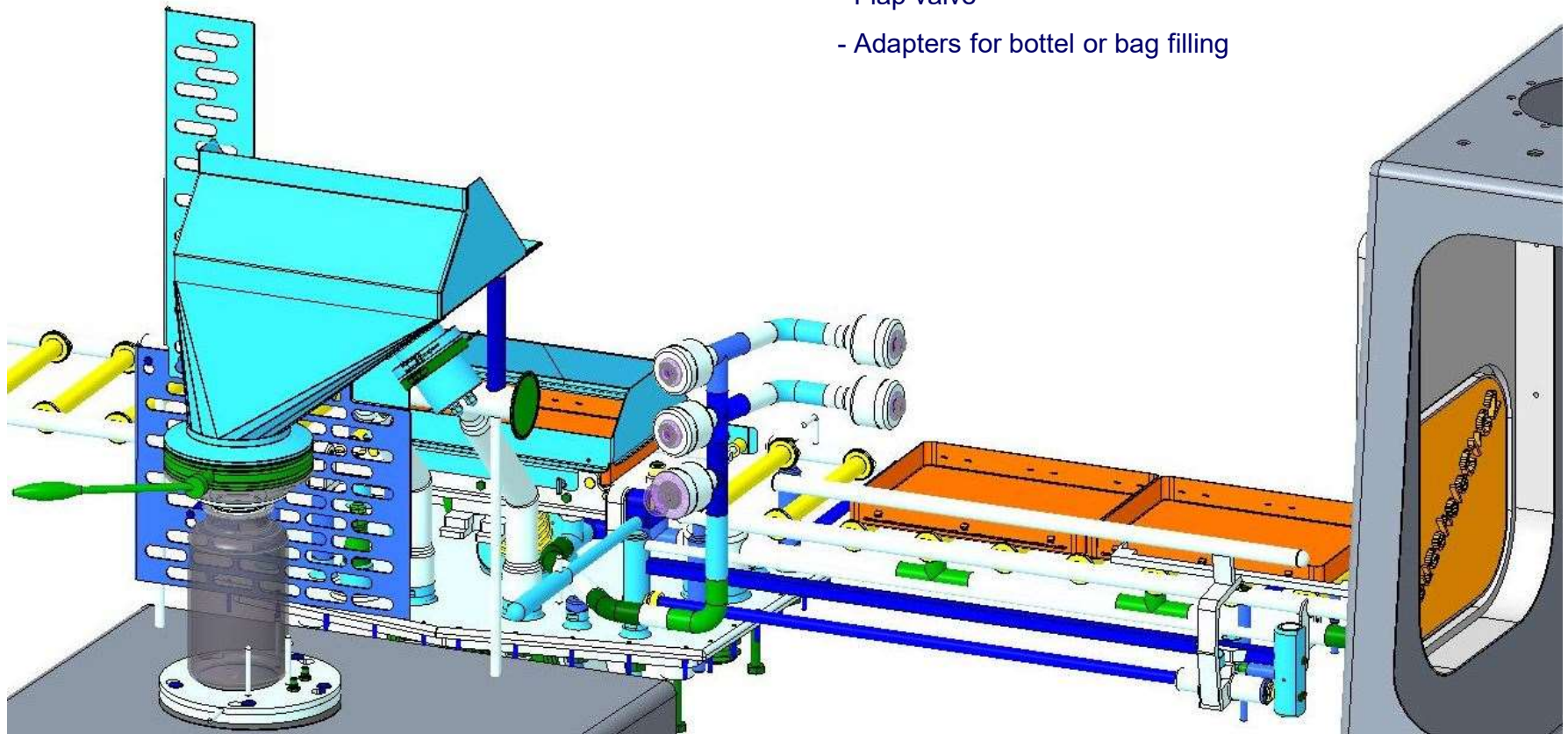


# Detraying unit IE-321

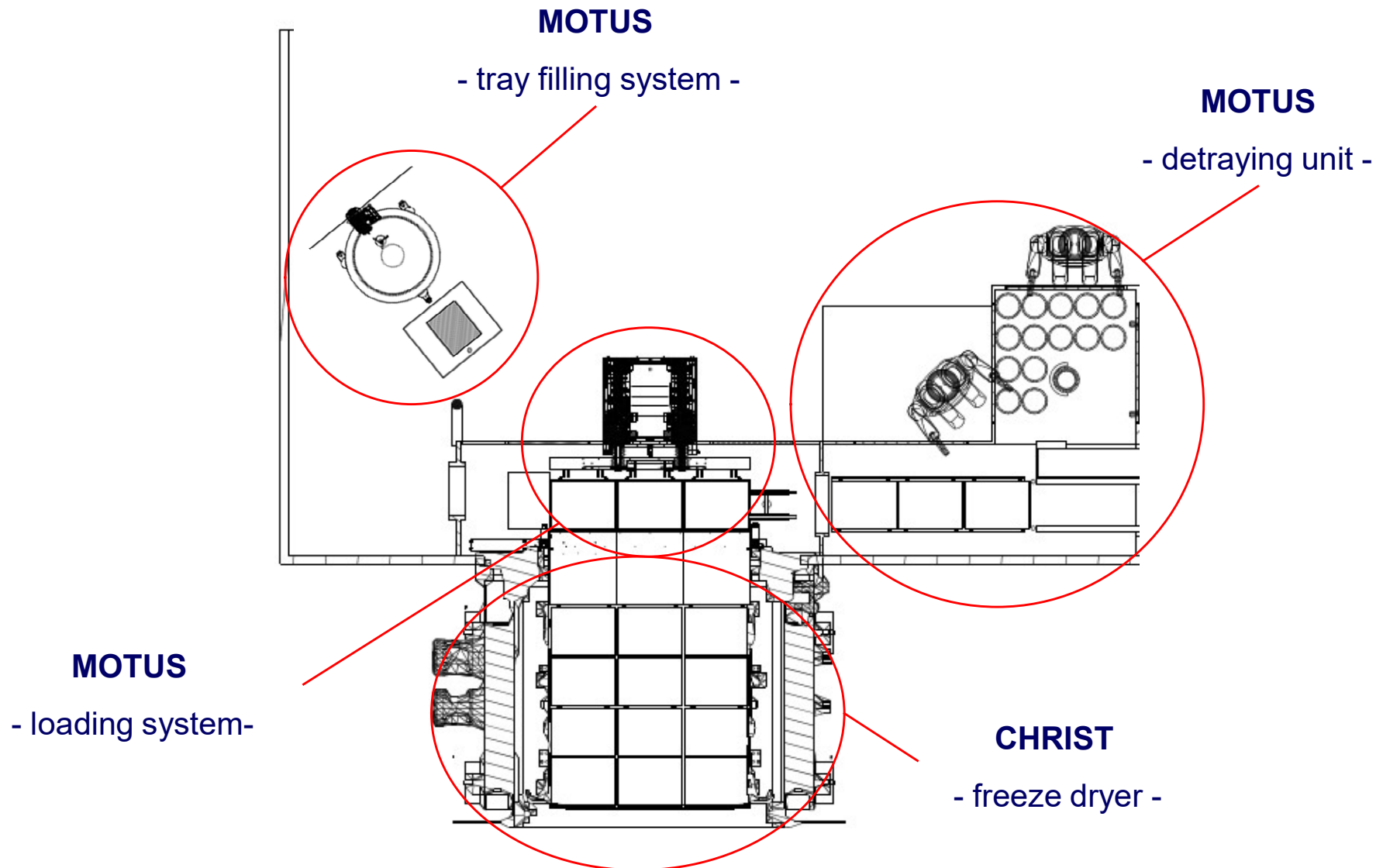
Transport unit and semi automatic detraying unit for trays

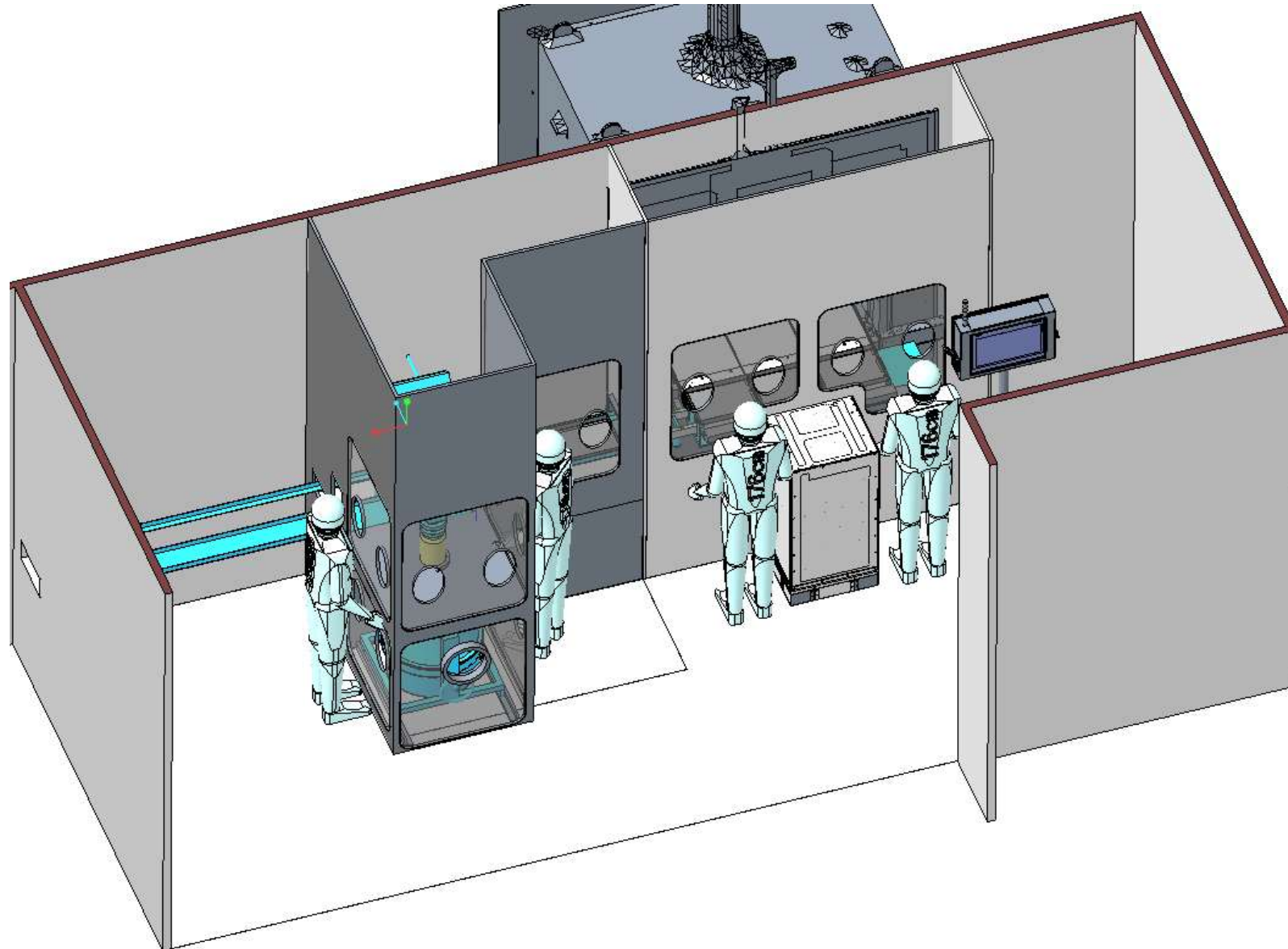
## Detraying unit

- Two hand controls buttons
- Electric cylinder for tray lifting
- Funnel with vibrator
- Flap valve
- Adapters for bottle or bag filling

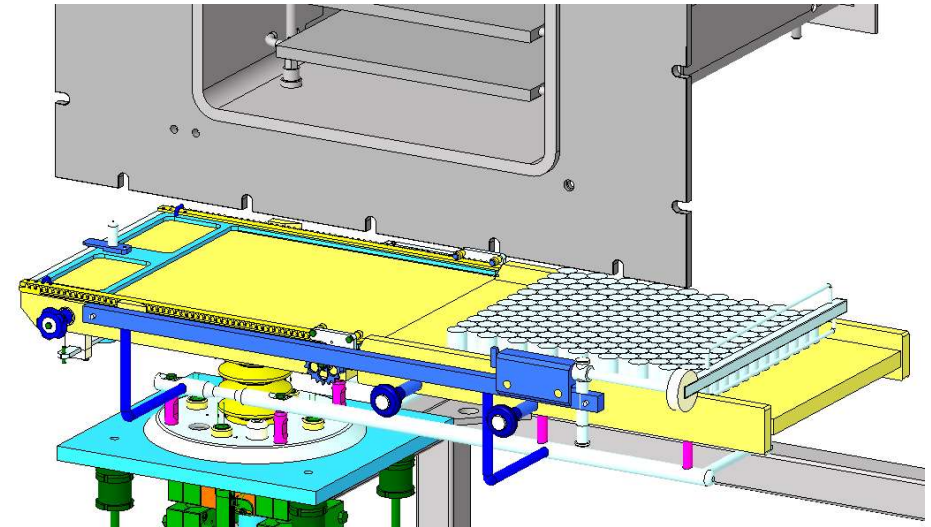


# layout





Pilot Lyoloading

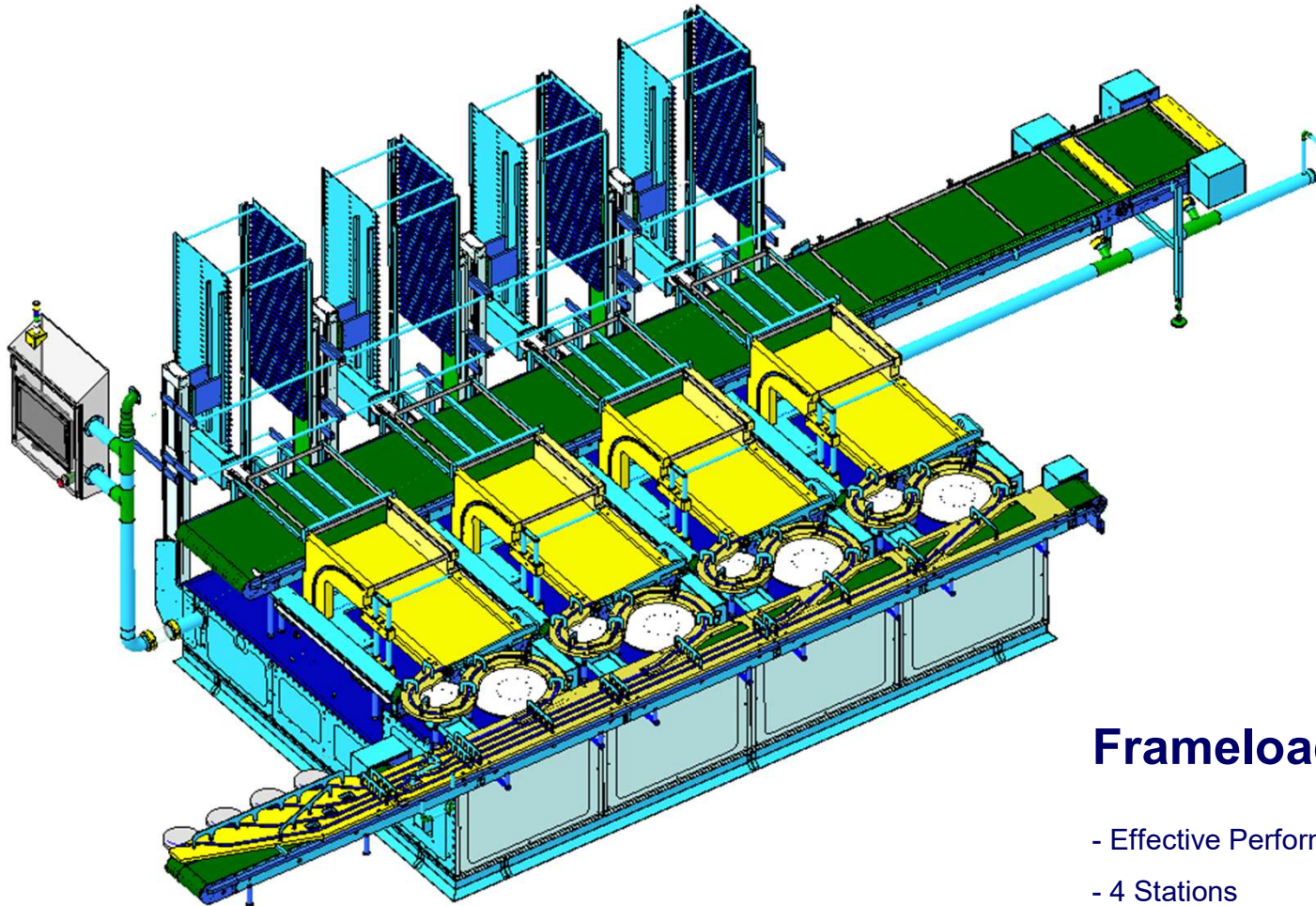


**Lyolift**

- Easy loading and unloading on different shelf levels
- All movements are guided and assisted – safe for production
- Easy cleaning due to hygienic design – suitable for WIP
- Safe handling of vials to avoid product losses
- Mechanical and electrical safeguards to ensure correct loading or unloading operations
- Flexible interfaces to filling lines
- Patent pending

# Frameloader Q-HPFL-391

Automatic high performance frameloader with 4 stations



## Frameloader Q-HPFL-391

- Effective Performance 600pce/min 2R
- 4 Stations
- Vial counting
- Integrated framebuffer



# Frameloader Q-HPFL-391

Automatic high performance frameloader with 4 stations



# Brochure and Catalog



***Thanks for your attention !***

