

THE ART OF COMMUNICATION

OPTIMIZING THE INFORMATION FLOW BETWEEN TECHNICAL AND
MEDICAL STAFF AT THE MEDAUSTRON ION THERAPY CENTER

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On behalf of the MedAustron Ion Therapy Centre Team

Carbon Ion Centers Worldwide: 14

(in operation by September 2023)

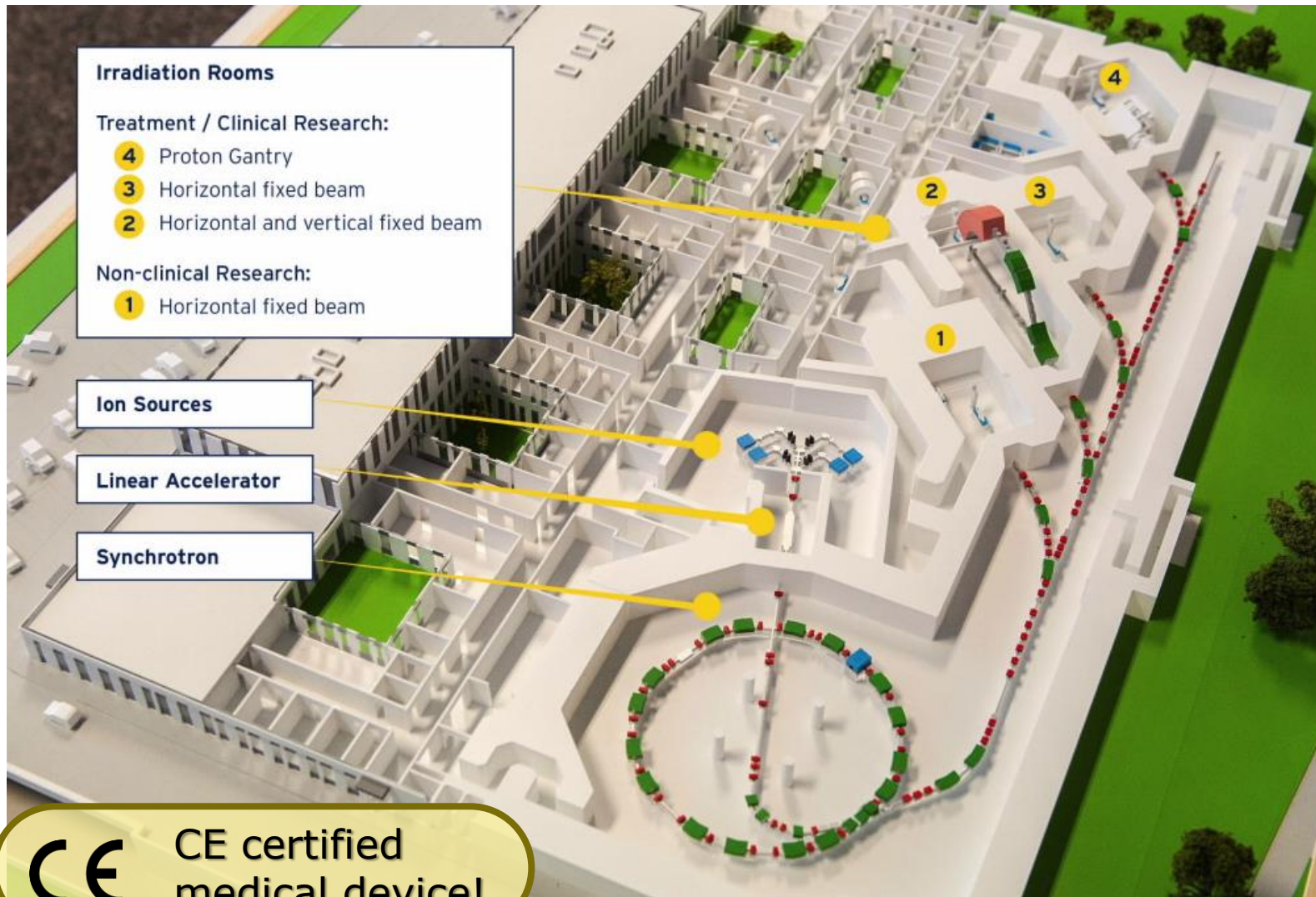


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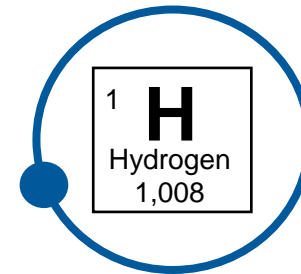
MedAustron in Austria



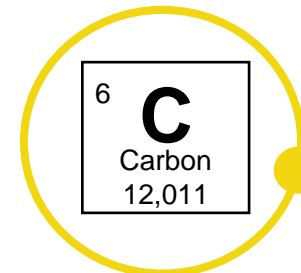
FACILITY OVERVIEW



- Synchrotron based
- Injector operated at 7 MeV
- $\varnothing = 25$ m Synchrotron with 140 m HEBT
- 24/7 operation, 364 days/year



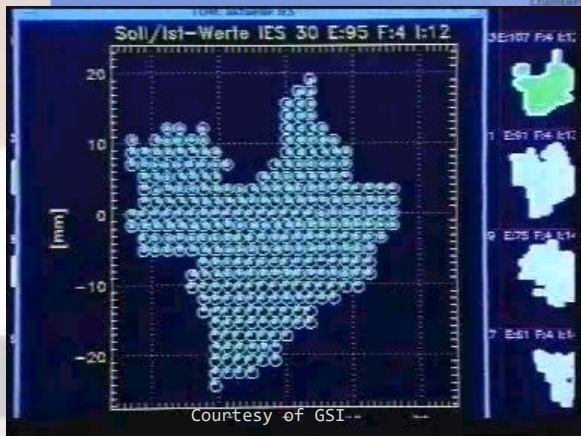
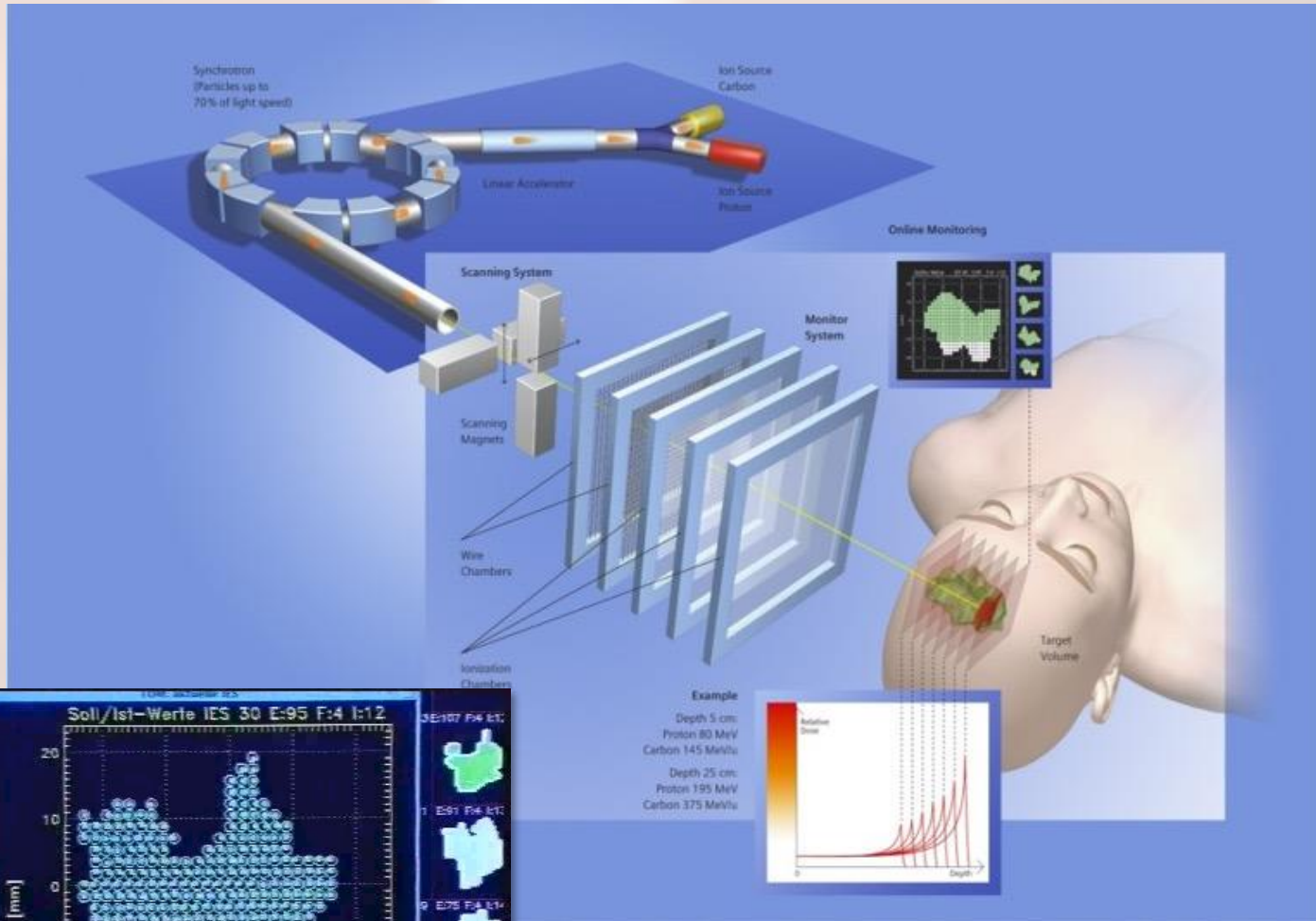
Clinical → 60 – 250 MeV
Research → 800MeV



120 – 400 MeV/n

IRRADIATION CONCEPT

- Fully automated process
- Active energy selection
-> penetration depth
- transverse pencil beam scanning by fast magnetic deflection (20m/s)
- online beam monitoring
- Integral part of patient safety system



INDICATIONS TREATED AT MEDAUSTRON



Total patients 2023: **550**

Fields: > **150** fields per day

Complex patients: ~ 5-16 fractions C
~ 20-35 fractions P

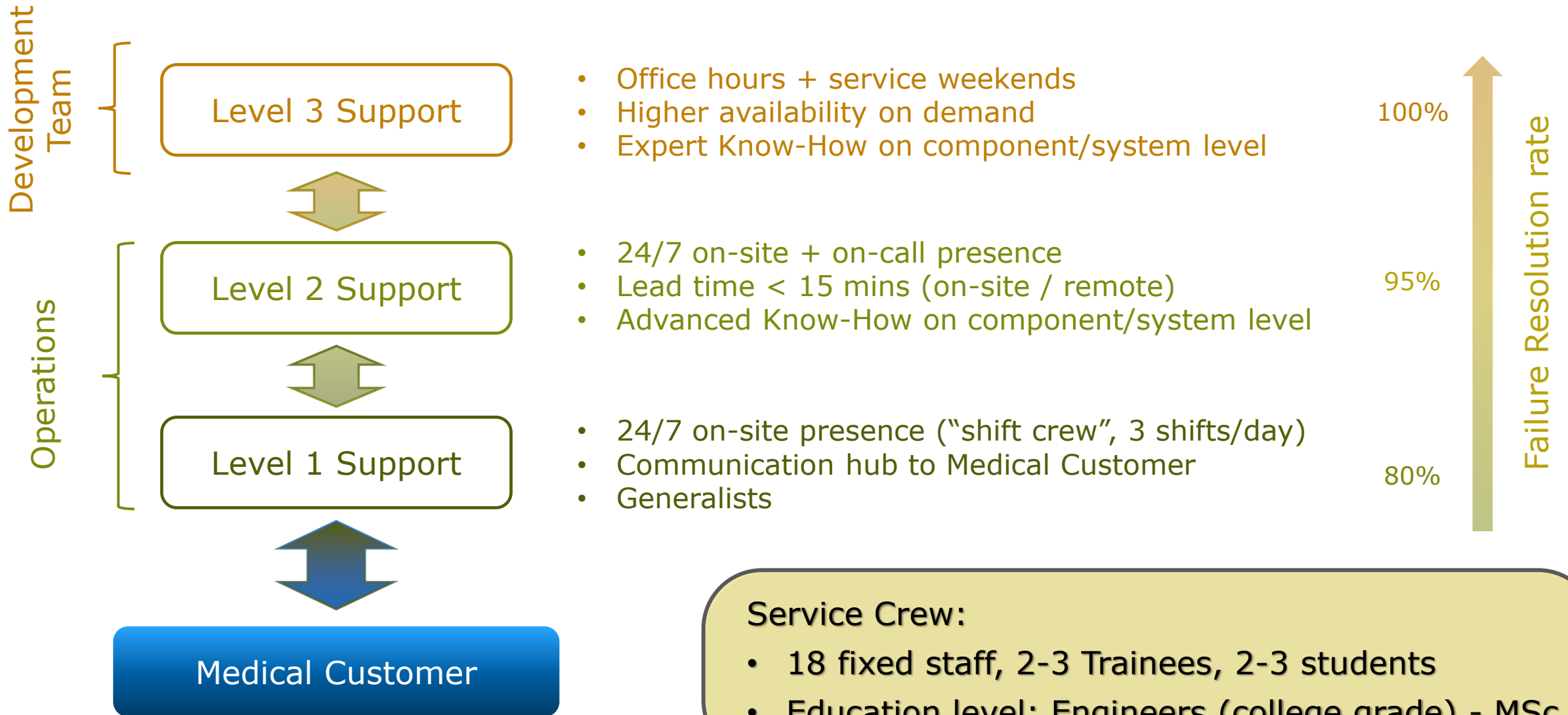
Single Fractions: > **11,000 p.a.**

Values (rounded) as of Sept 2023

CNS	26%
Head & Neck	20%
Re-Irradiation	16%
Pediatrics	16%
Sarcoma	11%
Skull Base	6%
Prostate	3%
Gastrointestinal (upper)	2%
Gastrointestinal (lower)	<1%
Gynecological Tumors	<1%
Urogenital Tumors	<1%
Breast/Mamma-Ca	<1%

Patient treatments: Mon – Fri, 06:00 – 22:00

SUPPORT STRUCTURE



CLINICAL OPERATION VS TECHNICAL INTERRUPTIONS

- Operating a Clinical machine demands very high reliability of the full Therapy System, including the Accelerator
- However, as you know, **100% are impossible to reach ...**

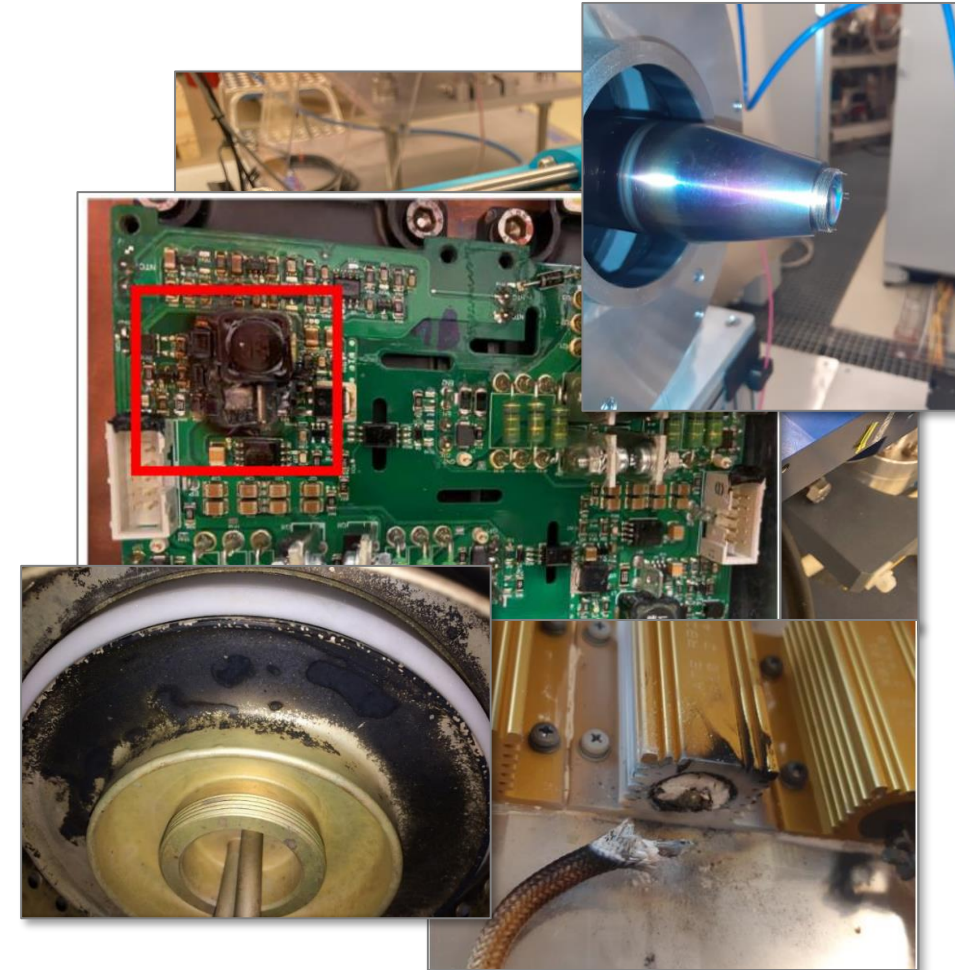
Limiting factors:

- External influences (Power Outings, ...)
- Random Hardware Failures (meet the bathtub!)
- Monitoring capabilities
- Deeply embedded software bugs
- User errors

$$Uptime \propto 1 - \sum_{\text{all Systems}} \frac{MTTR}{MTTR + MTBF}$$

MTTR ... Mean Time To Repair

MTBF ... Mean Time Between Failures



THE FOUR RULES OF HAPPINESS (AT A MEDICAL FACILITY)

Patient Well – Being \propto *Uptime*

Happiness (Medical Staff) \propto *Uptime* · *Patient Well – Being*

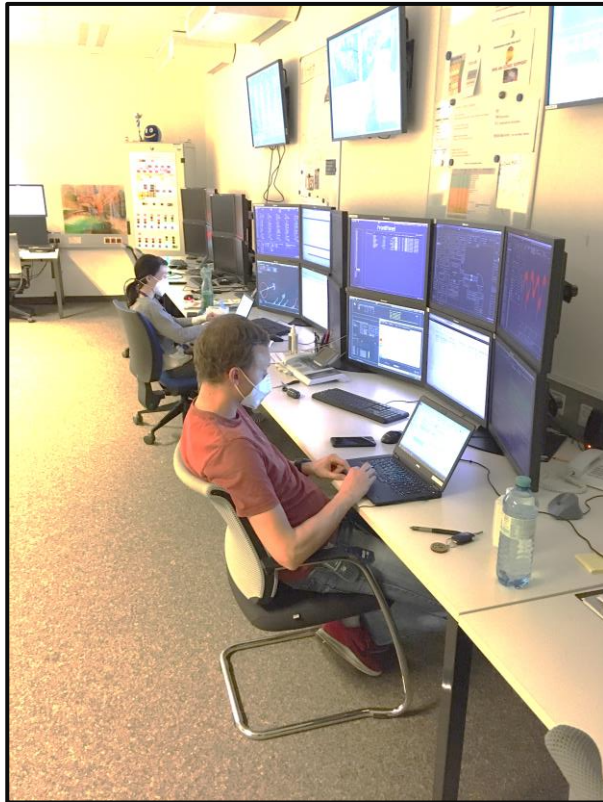
Happiness (Operations) \propto *Uptime* · *Happiness (Medical Staff)*



Happiness (Operations) \propto *Uptime*³

COMMUNICATION OF INTERRUPTIONS: FIRST ATTEMPTS

A simple set of rules was defined with the start of patient treatment:

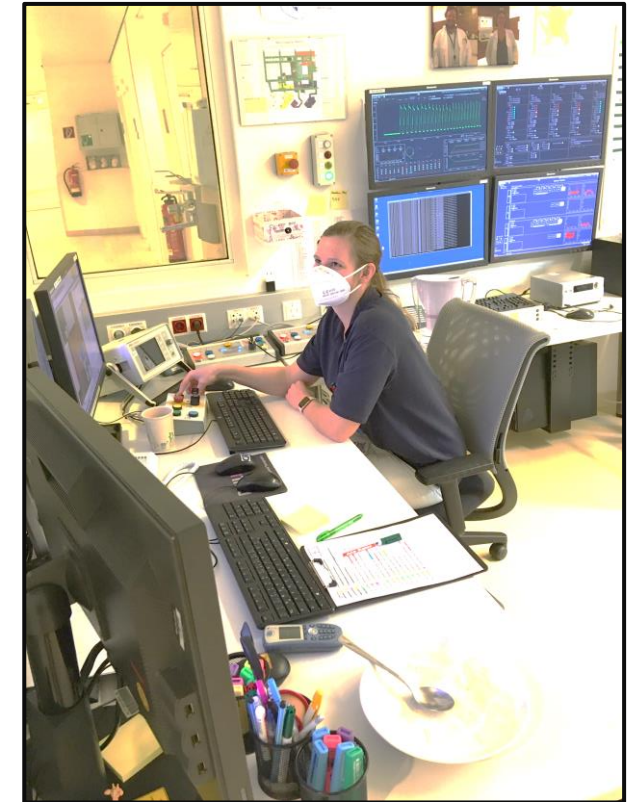


1) est. Downtime < 10min:

„Treatment interrupted, patient can stay on couch“

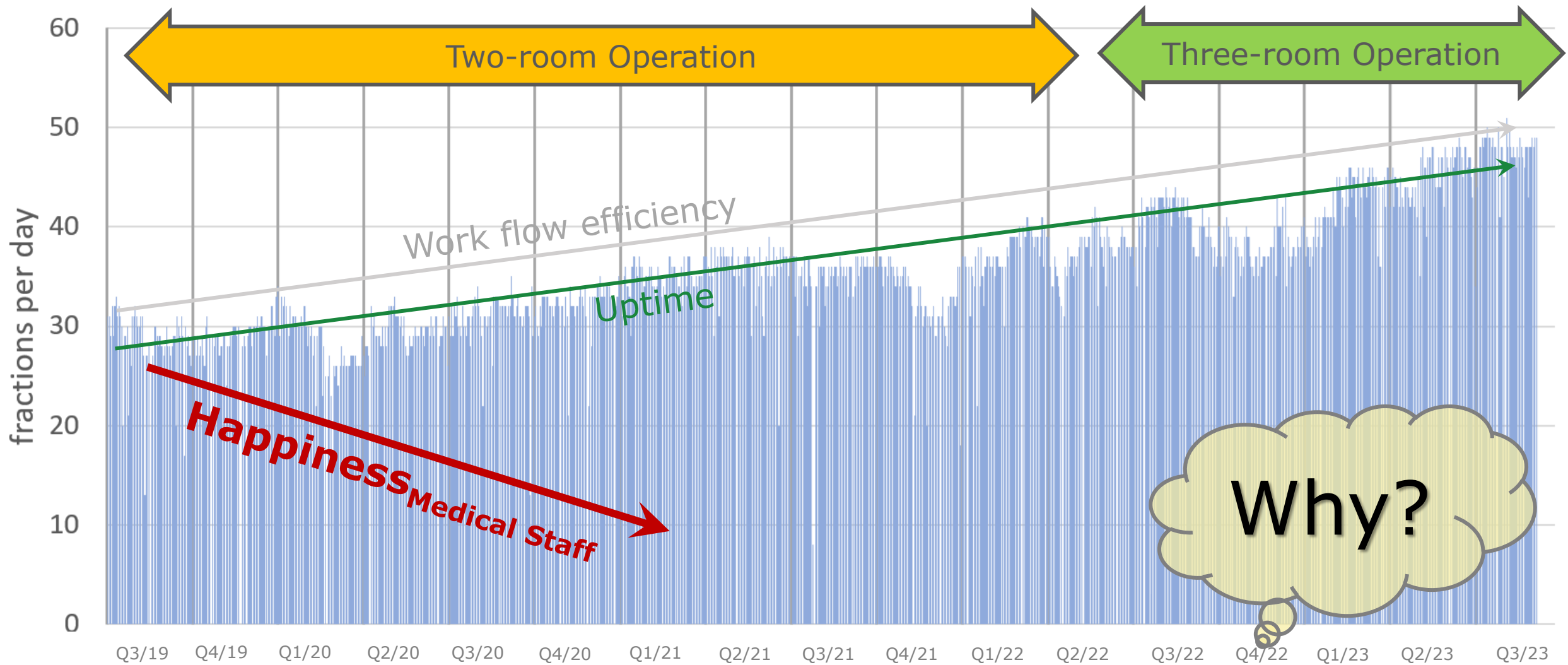
2) est. Downtime > 10min:

„Treatment interrupted, patient may be removed from couch“

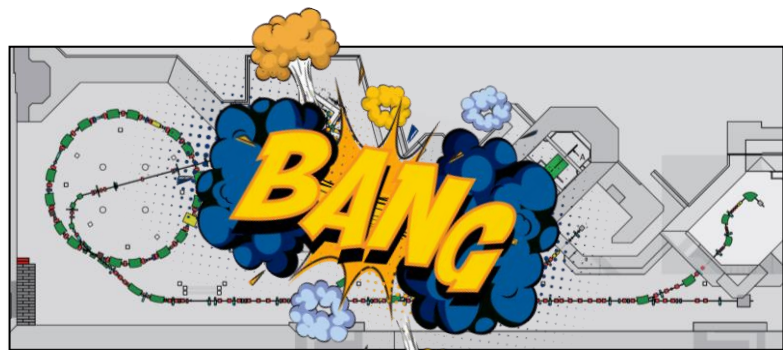
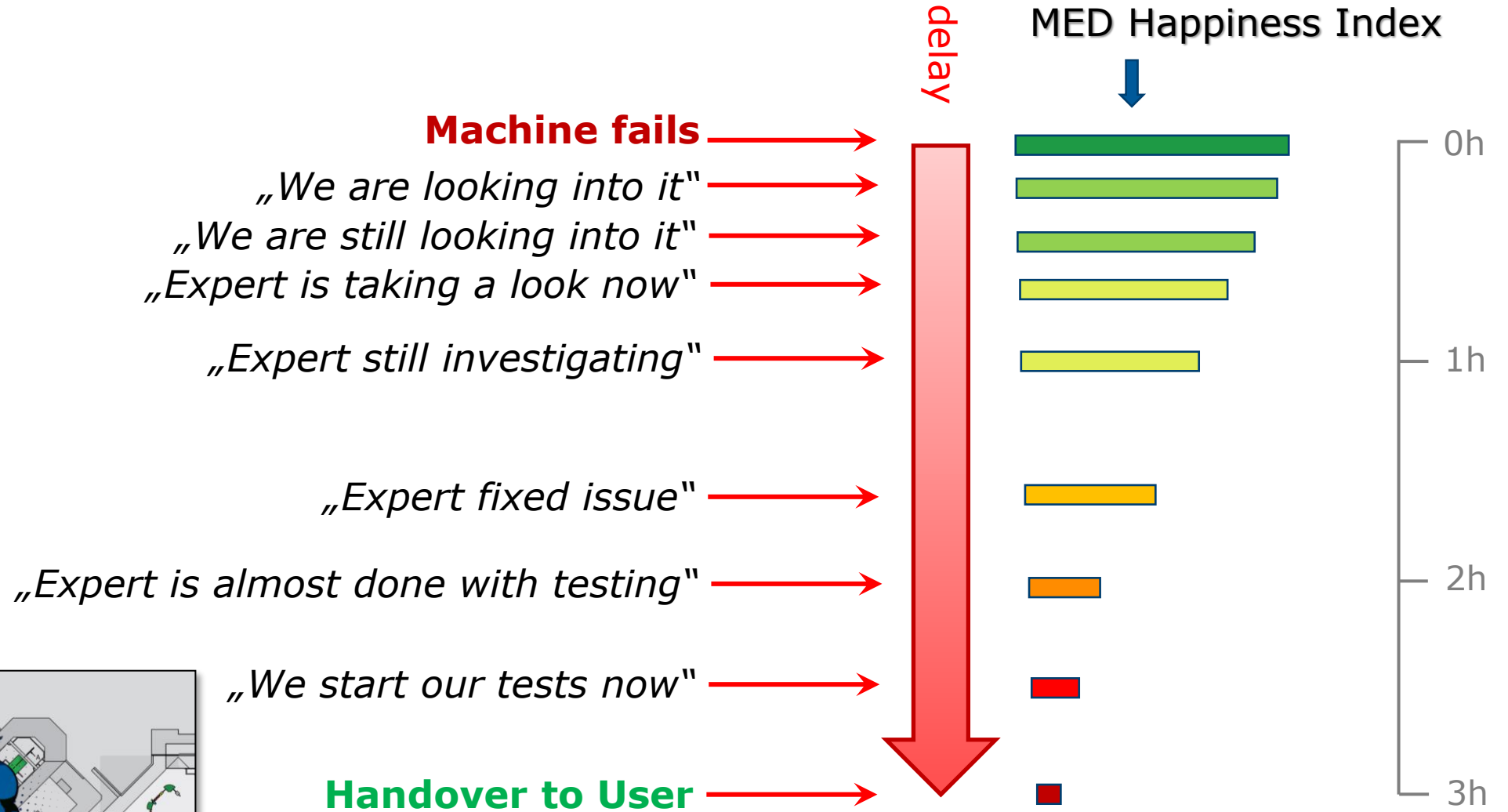


This model worked well for the first 2, 3 years.

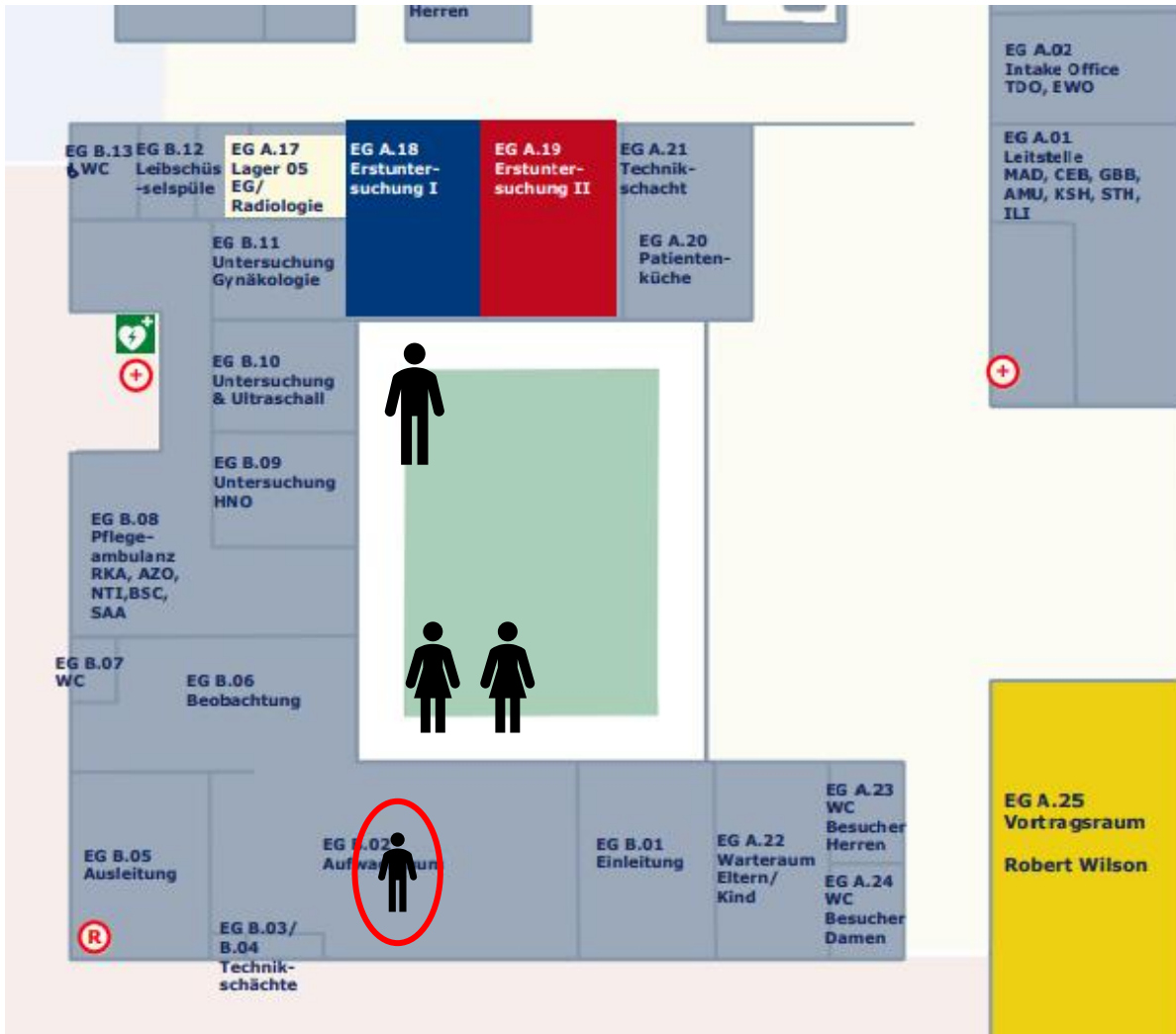
COMMUNICATION OF INTERRUPTIONS: FIRST ATTEMPTS



A NOT-SO-FICTIVE EXAMPLE

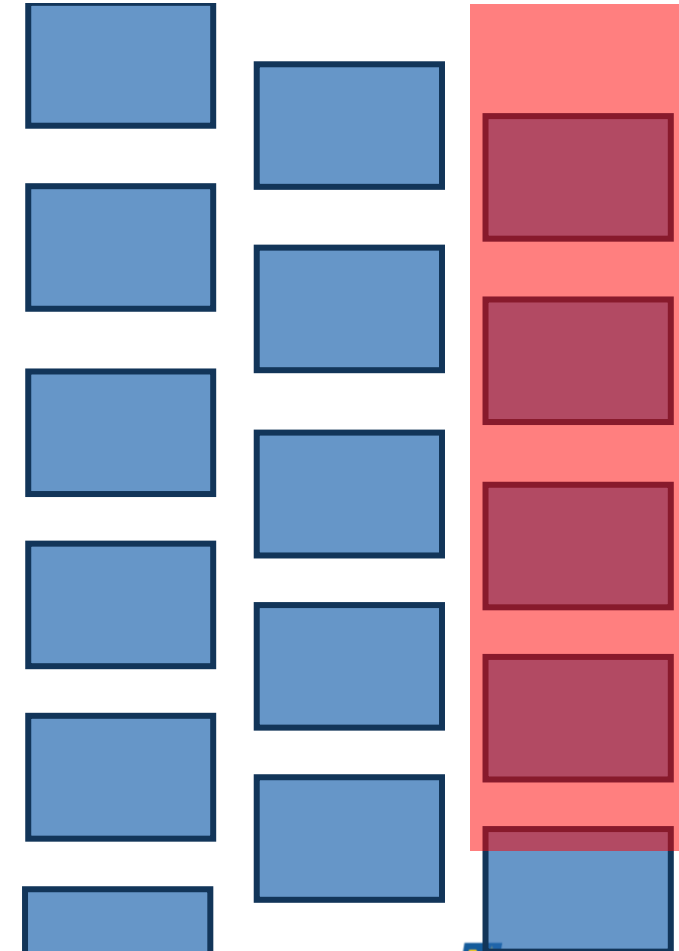
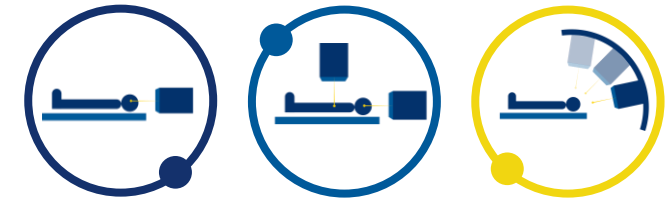


A NOT-SO-FICTIVE EXAMPLE: THE MEDICAL CUSTOMER VIEW



delay

Patient Schedule



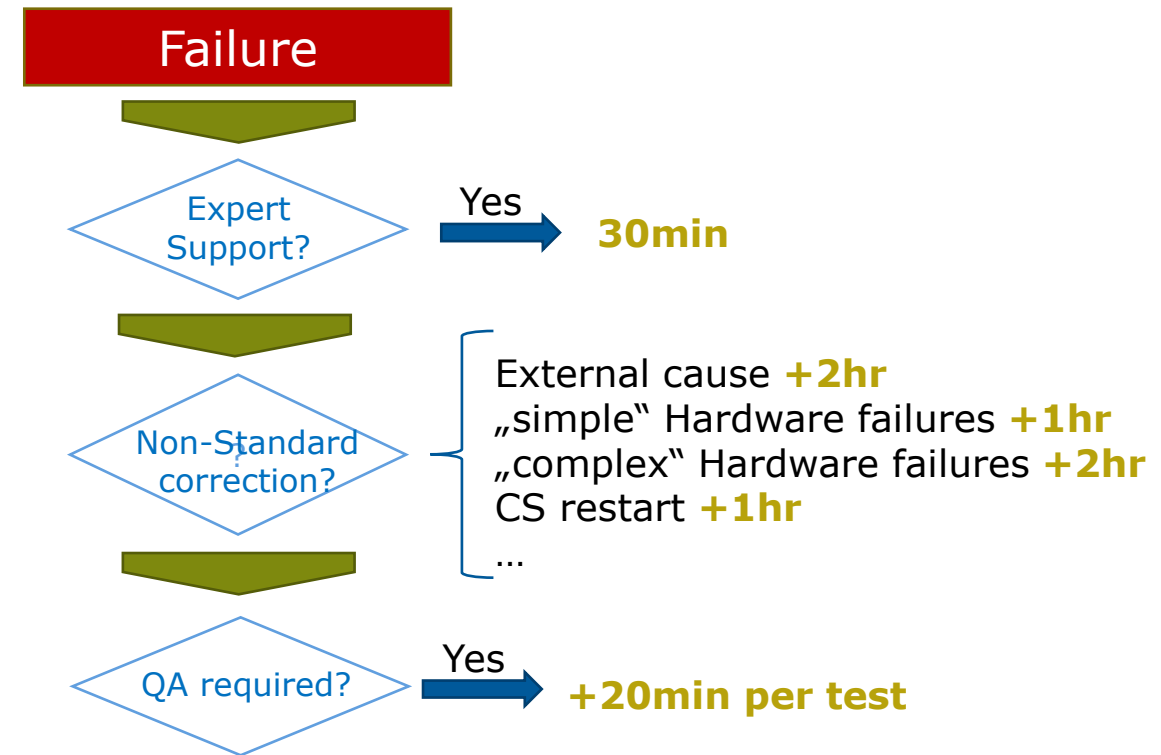
LEARNINGS

- Interruptions are challenging for the Medical Customer for the following reasons:
 - Re-scheduling of patients not straightforward due to many boundary conditions:
 - Anesthesia, pain medication, other special protocols (e.g. prostate), ...
 - Complex patient positioning
 - Scheduled patient transports
 - ...
 - 10mins technical downtime can lead to much more Clinical Downtime
- A pile-up of patients must be avoided!
- The Medical Customer requires clear, reliable statements about the needed repair time for their planning.

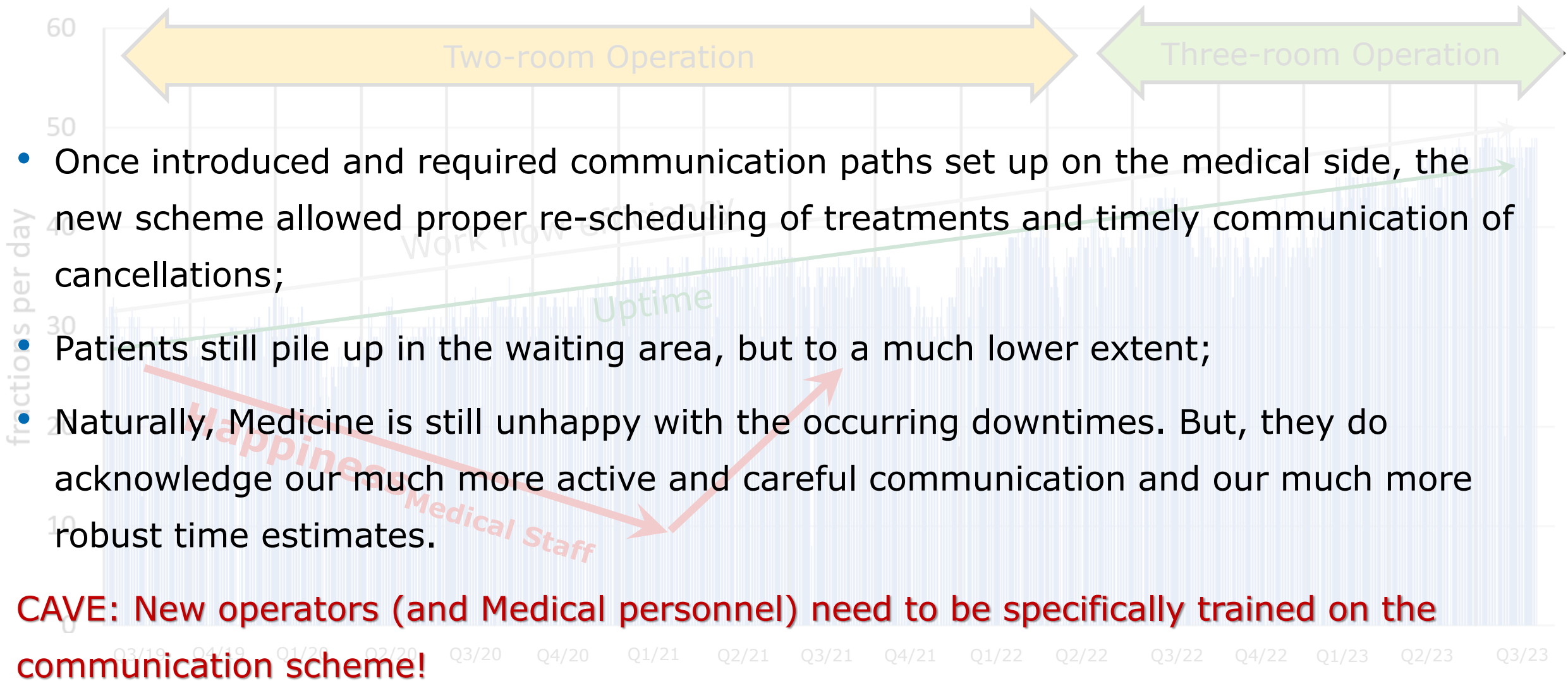
→ **Communication OPS with Clinical User must be properly set up to avoid running into unplannable situations!**

NEW COMMUNICATION SCHEME

- Clear communication hub on Medical side (MP-on-duty)
- Decision tree for initial downtime estimate
- Arrange status updates with MP-on-Duty at defined intervals: in 30min; in 1h; in 2h; ...
- Immediately forward important status changes (unexpected delays, ahead of time, ...) to the MP-on-Duty
- Involve supervisor to support communication latest after 30mins of downtime
- Generally, better be safe than sorry w.r.t. time estimates; +30min ... 1hr buffer is OK.



OUTCOME



CONCLUSIONS

- Besides Uptime, communication with the Clinical User is a critical factor during clinical operation.
- The simplistic model introduced at the start of patient treatment did not work out any more with increased patient numbers.
- The situation largely improved when a new communication scheme was implemented comprising more realistic downtime estimates together with a much more active communication to the Clinical User.

THANK YOU FOR YOUR ATTENTION!