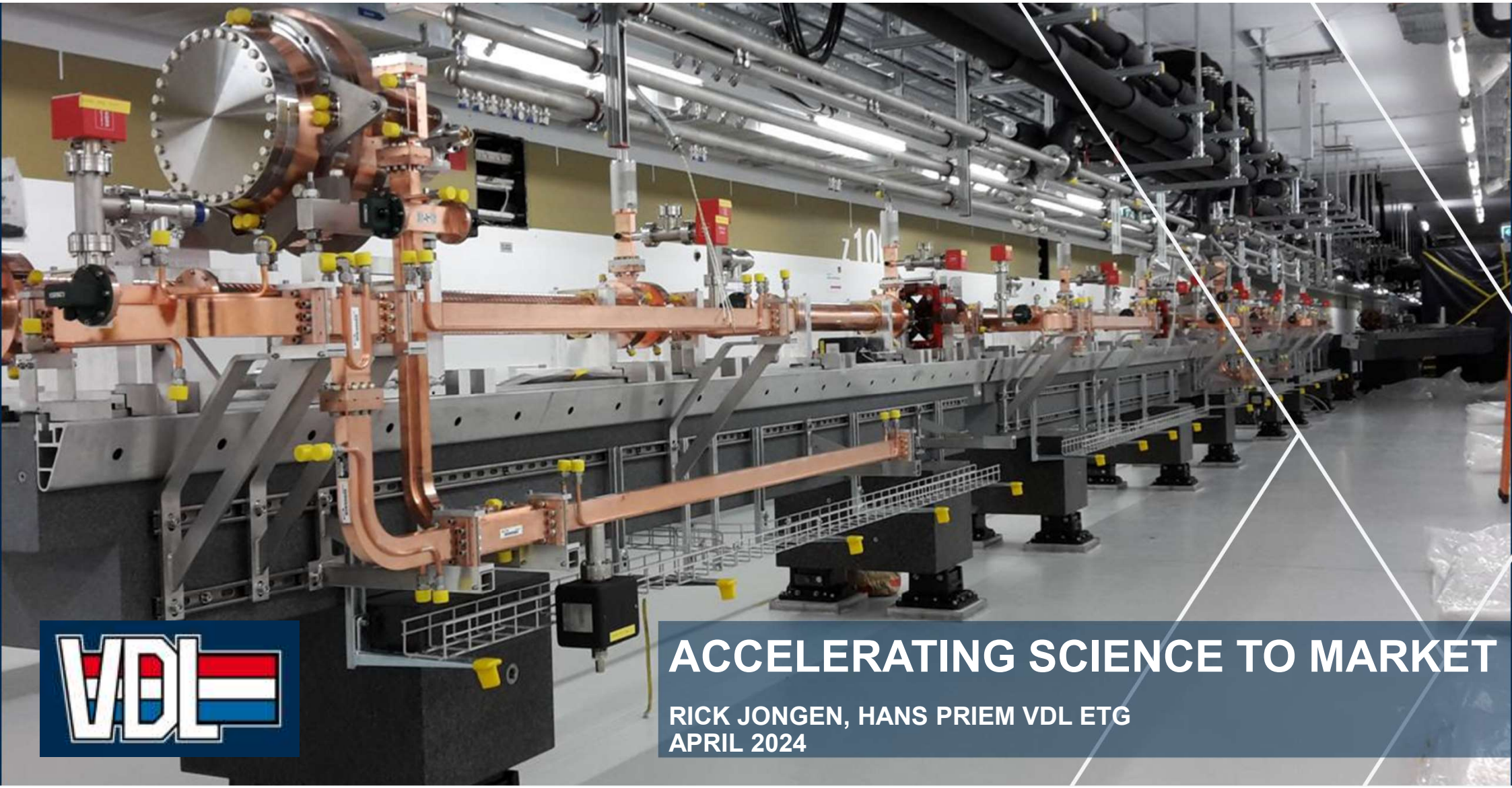


ACCELERATING SCIENCE TO MARKET

RICK JONGEN, HANS PRIEM VDL ETG
APRIL 2024

SR MANAGEMENT'S VIEW ON BIG SCIENCE

Industry perspective of technology driven companies having science not as their mainstream

A large scale, slow, complex, multi-national project where scientists do their thing

Aaaargh….tendering

Oh so slow

Technology rich, moving boundaries while building this "thing"

Interesting marketing

…technology rich…..wait a minute….

ACCELERATING SCIENCE TO MARKET

- Why?
- Example – Competence partnership with PSI
- Example – Competence development with IFAST
- Example – Design for Manufacturing for ADAM AVO
- Example – Roadmap based investments in Ultra Precision Manufacturing
- Take away

VDL ETG: high-end contract manufacturing

Facts and figures

We manage via the technology axis

Markets					
Applications	Lithography Mask and wafer direct writing	Patterned wafer measurements Mask & wafer inspection & review	Laser based communication	Diagnostics Radiation therapy	Scientific material characterization and imaging

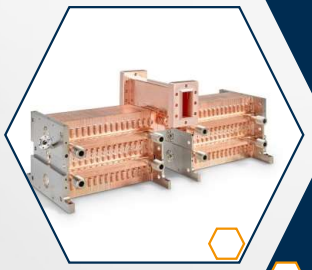
Functional module	Positioners	Handlers	Frames	Vacuum chambers	Charged particle beam systems

Technologies	Contamination	Maglev	Thermal ctrl	Data science	Super conductivity	Opto-mechatr.	E-beam manuf. & test

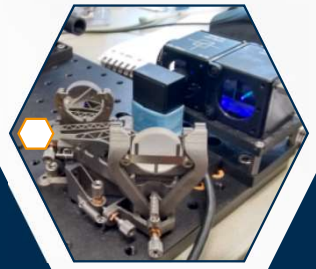
T&D Skills	MDev	EDev	SDev	Physics &mnf	MSD	MCD	SAEE	EC&I	SE	Project mng
	Precision mech Frames Design for vacuum Design for cleanl. Struc. Dynamics Pneumatics …	E system design Sensors EM actuators PCB design Firmware design Power conversion …	SW architecture SW design C/C++/C# SW testing Network communic. Realtime SW …	Heat&flow Manuf. techn. Contamination ctrl Material science Mathematics (Modelling) Magnetics, plasma …	System design System dynamics System analysis System integration	Control design Motion control Thermal Control Logic control Vision&Optics Opto-mechatr. ctrl	Df reliability Data science	Heat&flow Machine conditioning P & IDs Gas Handling Pneumatics	SE methodology Requirements mng.	Planning&scoping Project tracking&control Project governance Project reporting Stakeholder mng

Manufacturing technologies to be included (welding, ultra high precision technology,…)

Our key technologies



Vacuum technology



Contamination control

Optics

Systems engineering

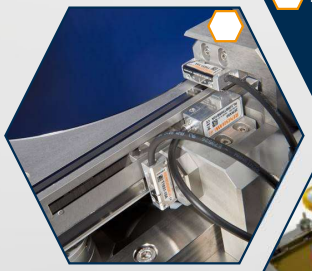
Mechatronics

Precision mechanics

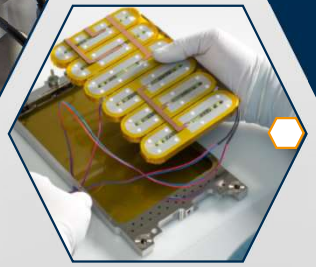
Cryogenics

Nanotechnology

Equipment design



Control systems



Science drives our long-term innovation power

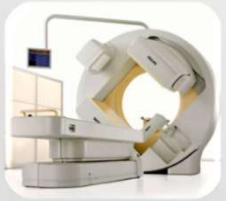
Science

&

Technology

FEEDS EXPERIENCE

DRIVES



New competences, new markets, disruptive technology

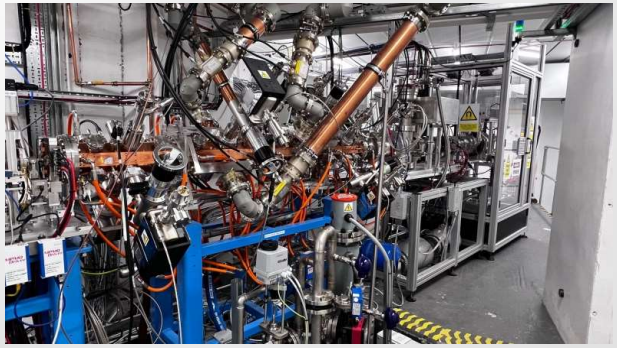
Why do we need each other?

Rationalizing a natural fit…

- **Development cycles are shortening – need shorter time from new technologies to application**
- Equipment complexity is increasing – increased demand for new technologies to help address
- Process complexity is increasing – demand for improved technologies
- Requirements overlap
- Big science gets big – high-tech equipment does as well
- More fundamental understanding of materials and material science
- Where else does industry find the time to look into the fundamentals?

Right now..technology hitting the market takes too long

- ICS (CLIC based) 5 years, no light
- Proton therapy (ADAM based) 7 years, almost there
- Radio therapy technology from the 1960s



- The process from fundamental science to concept to product takes much too long, delaying innovation
  - No win-win
- Industrial innovation power is Europe’s strength!

Shortening science to market

Let's take a suggestion from ChatGPT: how can industry benefit from big science research

In summary, the high-tech industry can benefit from big science through

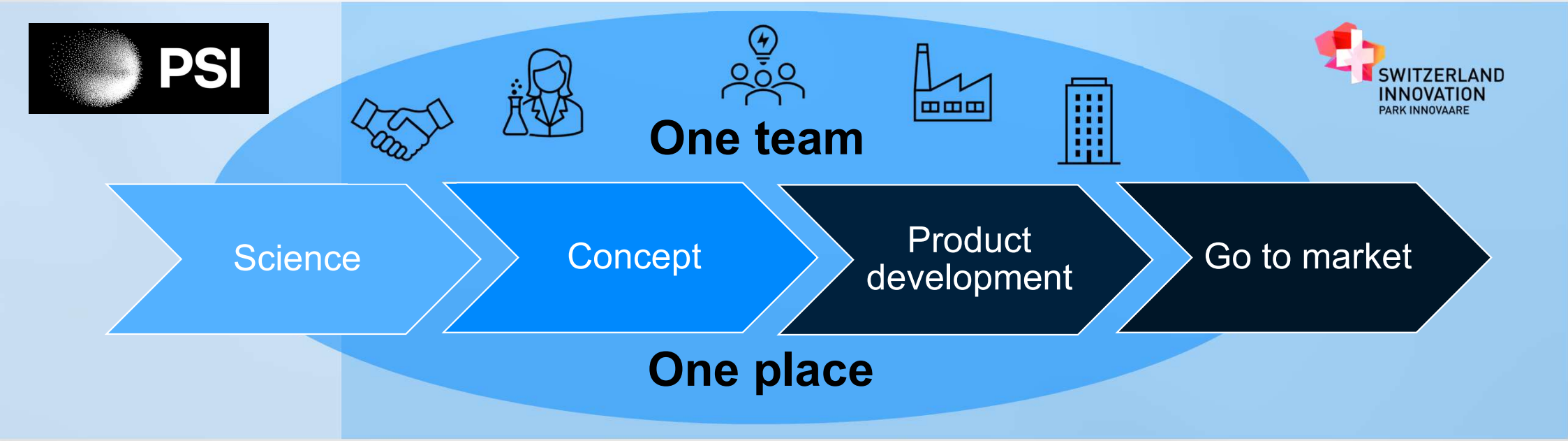
- Collaborations focused at WIN-WIN
- access to data and knowledge,
- technology transfer,
- commercialization opportunities, and
- talent development.

The partnership between big science and the high-tech industry can drive innovation, create new business opportunities, and contribute to technological advancements with wide-ranging societal and economic impacts.

Introducing PSI

Introducing Innovaare

Vision: Cut science to market time in half



From invention to innovation in half the time

We are looking for leverage

Not from ChatGPT

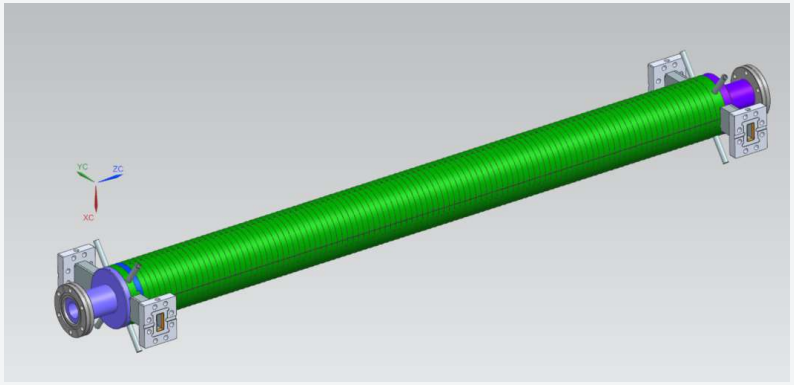
- We build semiconductor equipment, medical and analytical equipment
- Big Science, large scale projects, are not in the core of our sales plans
- So..no opportunistic behavior
- We focus on partnerships with relevant science; eg accelerator technology, astronomy, fusion
  - Positioning, magnets, engineering, cryo technology, joining, coatings, high(est) vacuum,..
- We focus at building international networks of partners to address science challenges, which in the long term benefit our current of future mainstream business

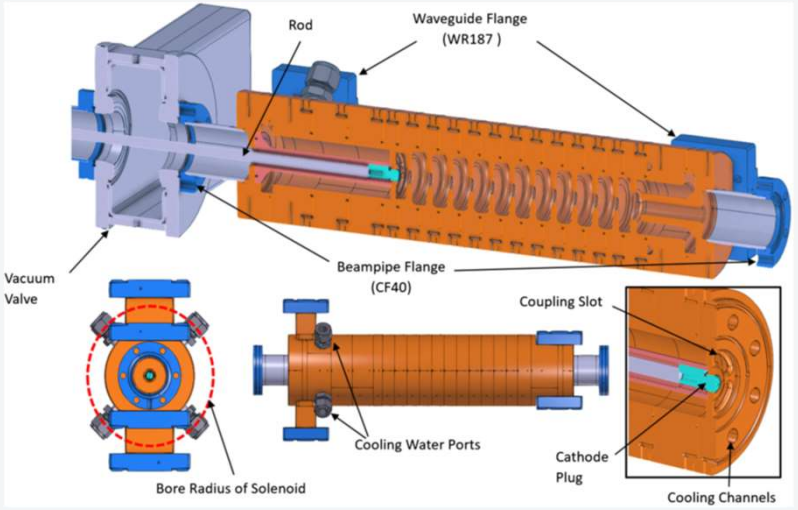
- Large scale projects / big science cooperation is at the core of our strategy

COMPETENCE DEVELOPMENT - IFAST

- We aim on scientific areas that need to transfer to industry in the next 5 years
  - Permanent magnets
  - Cryogenics
  - Vacuum & contamination control
  - Machining & brazing

- DO projects with science to develop competence (IFAST highlight)
  - IFAST brazed accelerator structure
    First structure parts delivered (2023), 2nd in production (2024)
  - IFAST Travelling Wave RF Photogun
    Parts delivered, ready for brazing (2024)





IFAST TW GUN MANUFACTURING @ VDL ETG PRECISION

Parts shipped to PSI for brazing (March 2024)

Preturning

Premilling

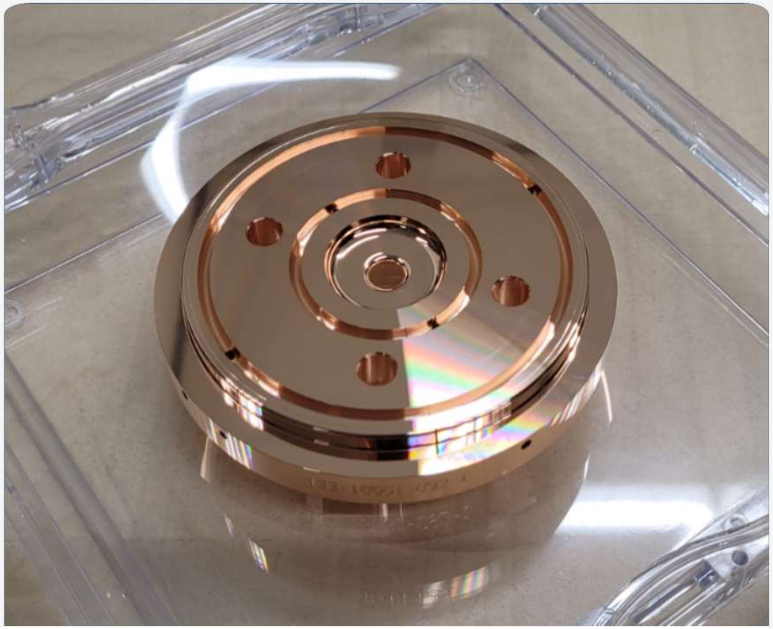
Flycutting

Precision turning

Ultra precision Milling

SHIPPED PARTS

Parts shipped out for brazing



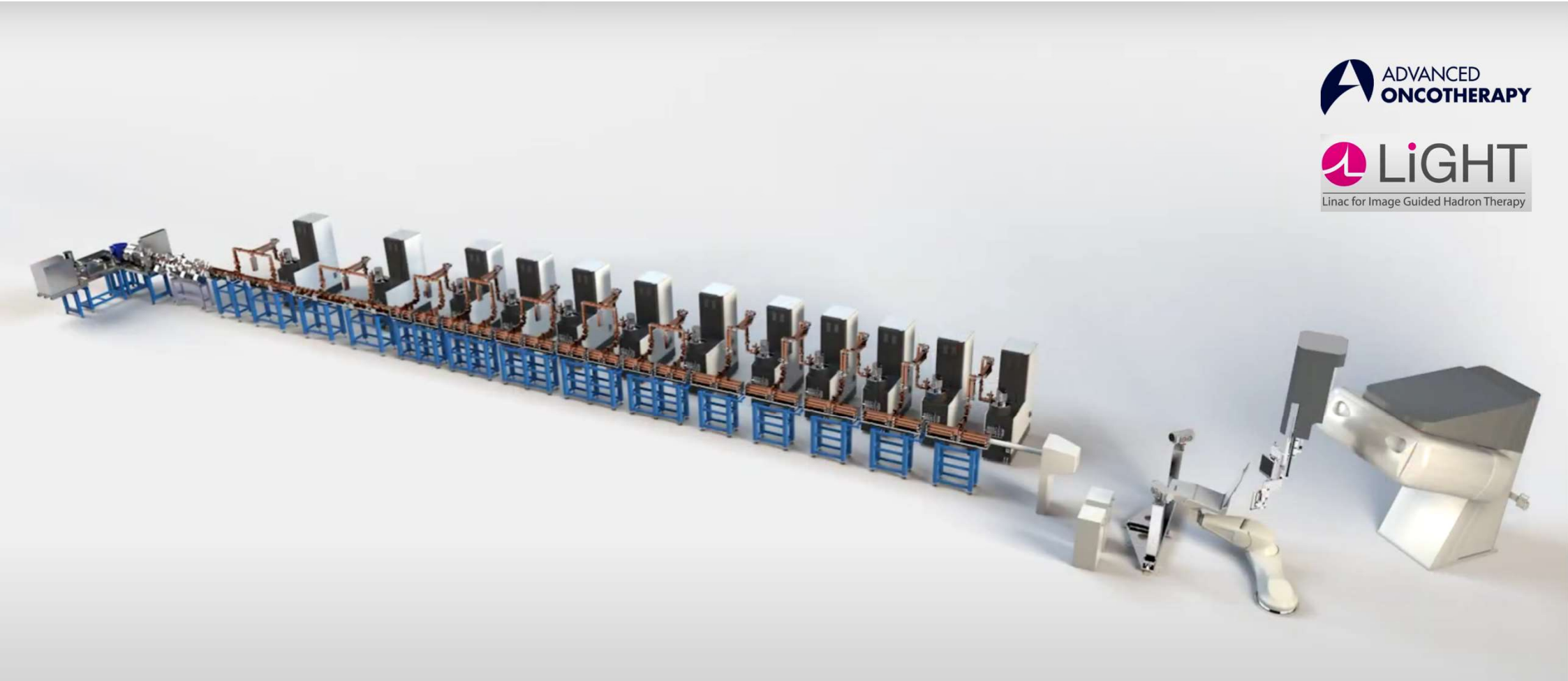
IFAST Structure parts (108 cells + couplers)

IFAST TW GUN Parts

EARLY SUPPLIER INVOLVEMENT

- During design phase, involvement of manufacturing partner is vital for shortening time to market
  - Reach system specification as easy as possible
  - Improve production yield and throughput time by Design for Manufacturing
  - Reduce cost

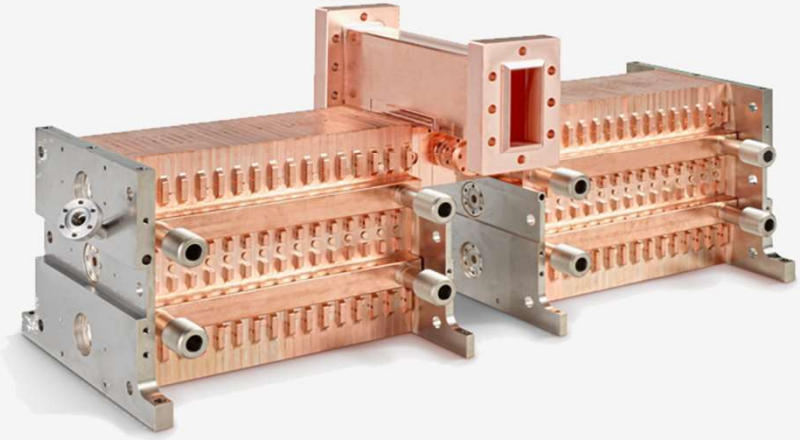
- Critical precondition: Speak ‘language’ of system designer (competence development!)



LINEAR ACCELERATOR FOR PROTON THERAPY

LINEAR ACCELERATOR FOR PROTON THERAPY

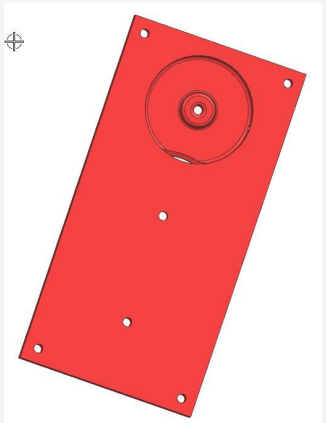
- Manufacturing redesign
- Parts manufacturing
- Assembly and joining (brazing)



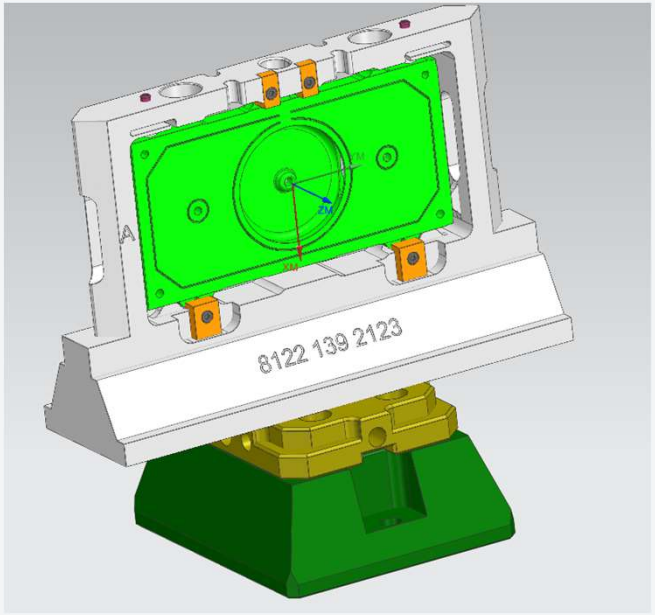
EARLY SUPPLIER INVOLVEMENT

ADAM AVO – proton therapy

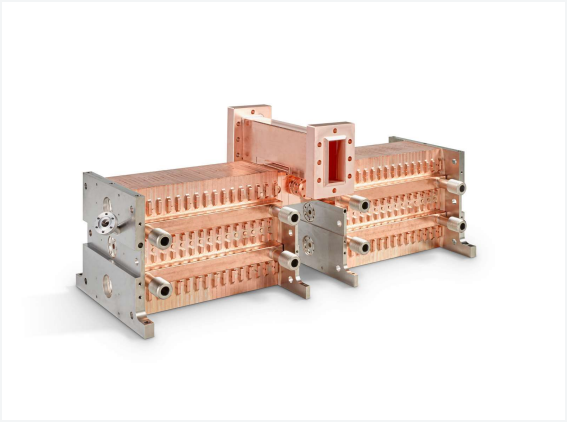
- Make it quicker, easier, cheaper
- Reduce time to market!



Customer input



Design for Manufacturability



Output

ROADMAP BASED INVESTMENTS

- Prepare for market demand of the future
- Science partners help us understand industry needs 5-10 years from now

ROADMAP BASED INVESTMENTS
~ 2M € IN ULTRAPRECISION MANUFACTURING

Flycutting

Single Point Diamond Turning

Cleaning

Optical measurement

TAKEAWAY

- Shorter science to market is vital factor of innovation power
- Focus on win – win collaborations with strategical partners to develop competences
  - IFAST (and similar projects) drive these collaborations
- Science: Involve suppliers (industry) early to make use of manufacturing know-how
- Industry: Invest strategically to enable manufacturing demand of the future, as defined by scientific development

VDL ETG

Where groundbreaking innovations meet precision manufacturing