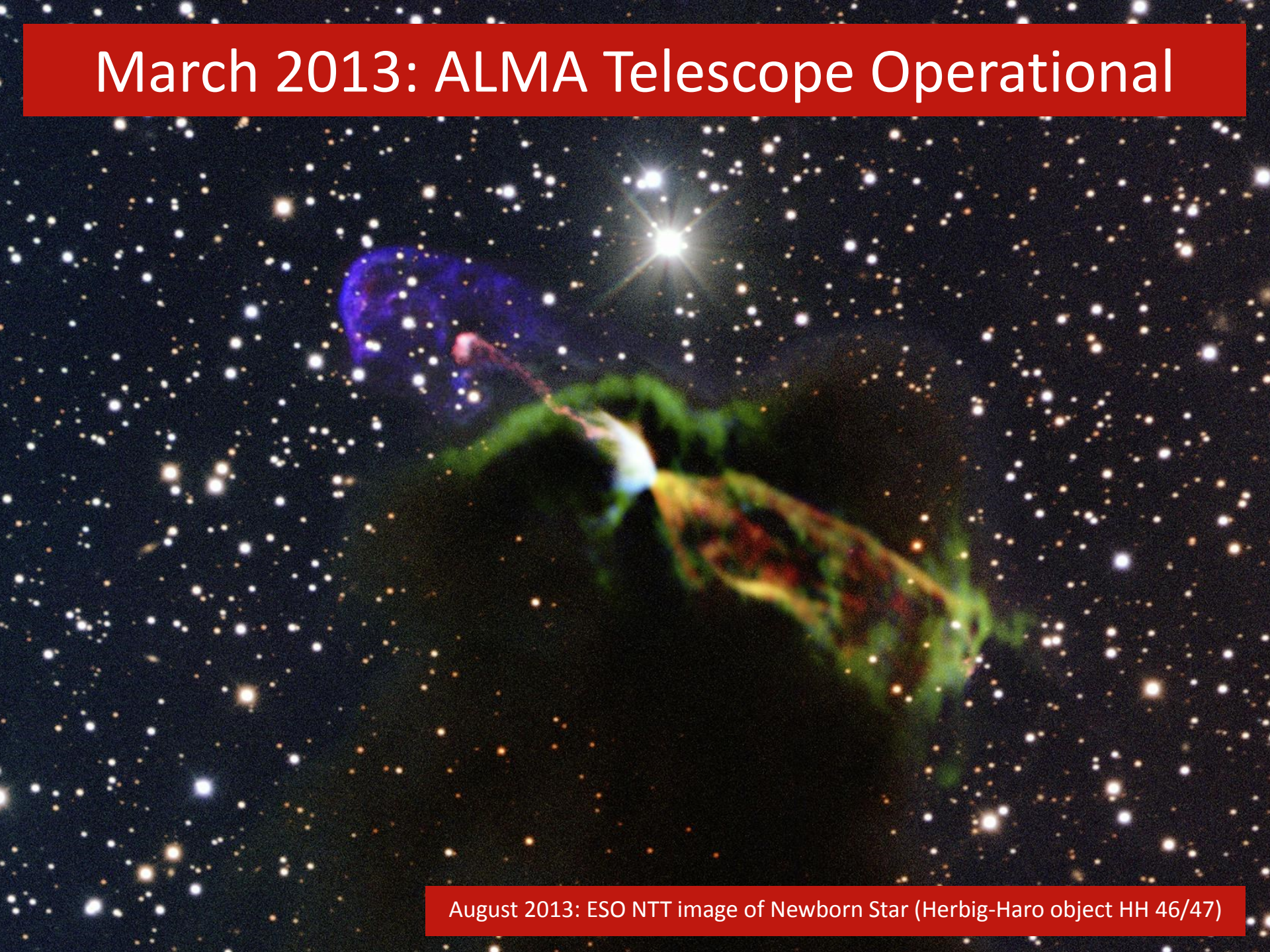
Slovene based computer science and engineering at the heart of mankind's most sophisticated machines

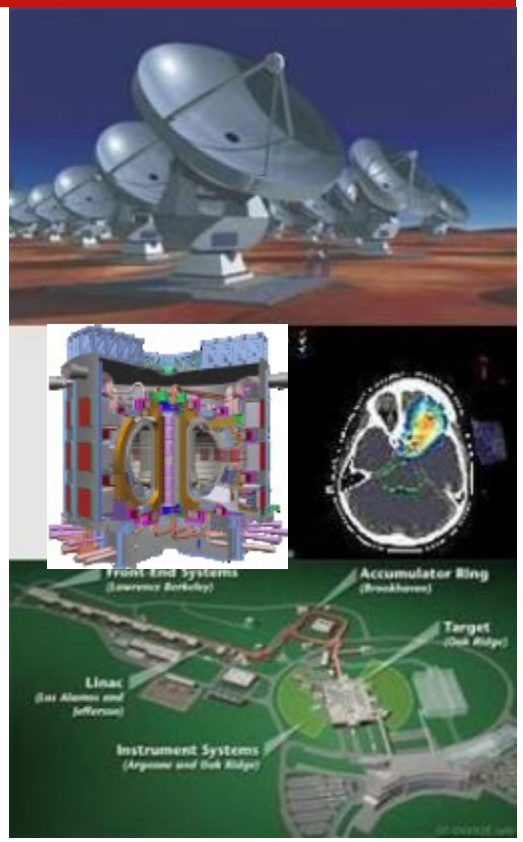
March 2013: ALMA Telescope Operational

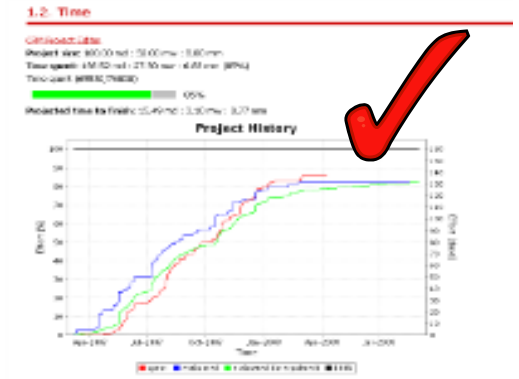


August 2013: ESO NTT image of Newborn Star (Herbig-Haro object HH 46/47)

The Company Cosylab

- **Worldwide leader** for control system integration of nuclear accelerators and large physics facilities, **chosen by the majority of projects**
  - We offer services and develop products where **expert knowledge** is required
  - We know how to use and develop **state-of-the-art electronics and software**
  - We **integrate** them into mankind‘s most complex systems





Who are we?

- 85 employees
  - 70 „production“ FTEs effectively
  - additional ~30 students in the pipeline
- Branches in the USA and Japan

Repeatable or just luck*?

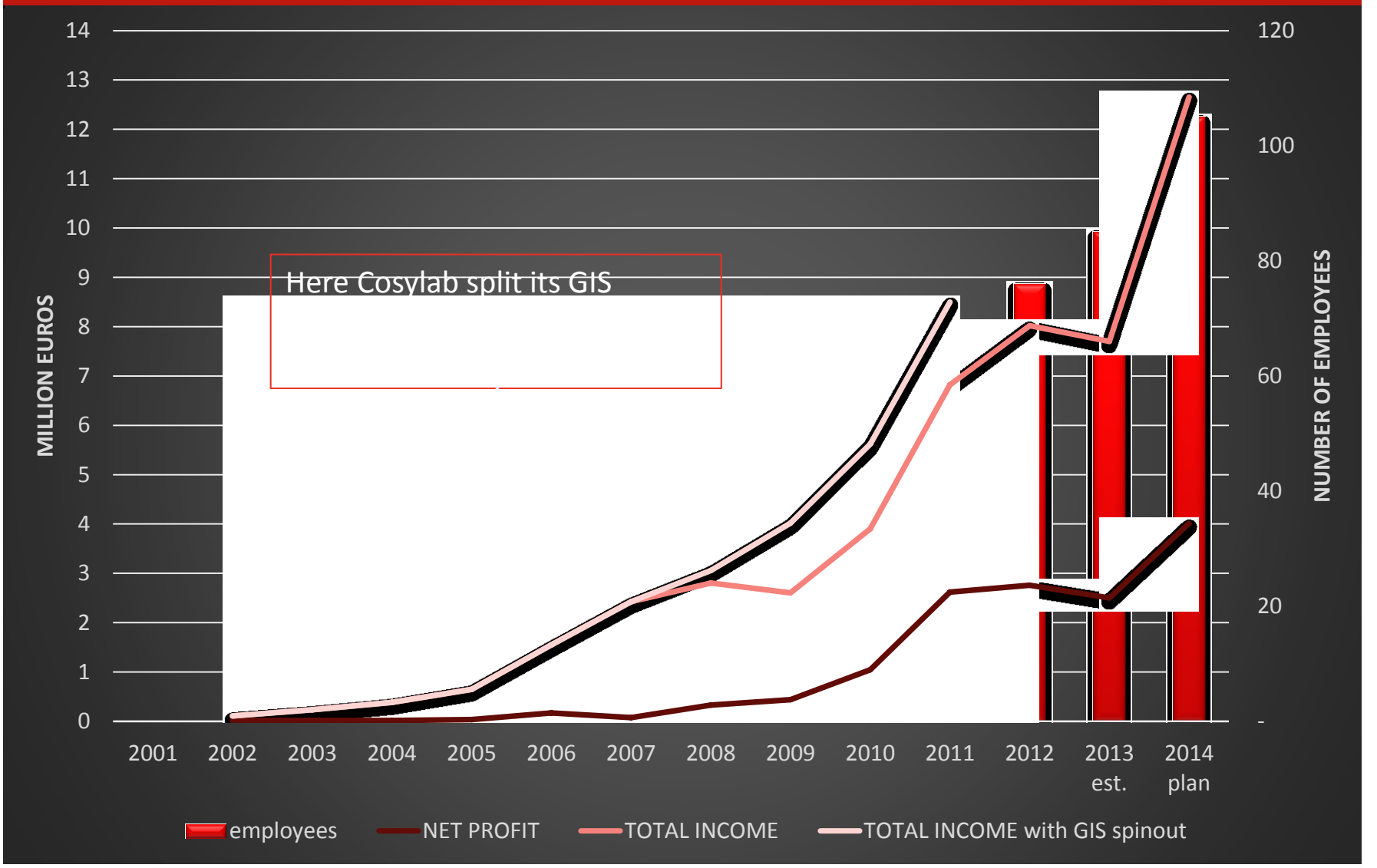
(*Yes, we had more than our fair share)

What are **key elements** in becoming a world-**leading** service provider in a **global** hi-tech niche **market**?

&

What is **the part of** the **engineers** and **computer scientists** to the story?

Sustained Growth



According to the Cosylab people…

…we're a *cool* company

Build a “Cool” Company, based on Shared Understanding

- ***“Cool” Company***
  - interdependence, shared values
  - agility, grow through change (crisis)
  - *networked* people & tools

- *Shared **understanding*** scientific **community** & their **technologies**
  - 3 Technology Areas

→ The best || the only one that can do it!

COSYLAB
Your TRUSTED Control System Partner

3 Big Physics Control System Technologies

1. **BIG** Open Source CS Frameworks
2. FAST FPGA, fibre-optics based Timing Systems
3. Control Applications for 

users

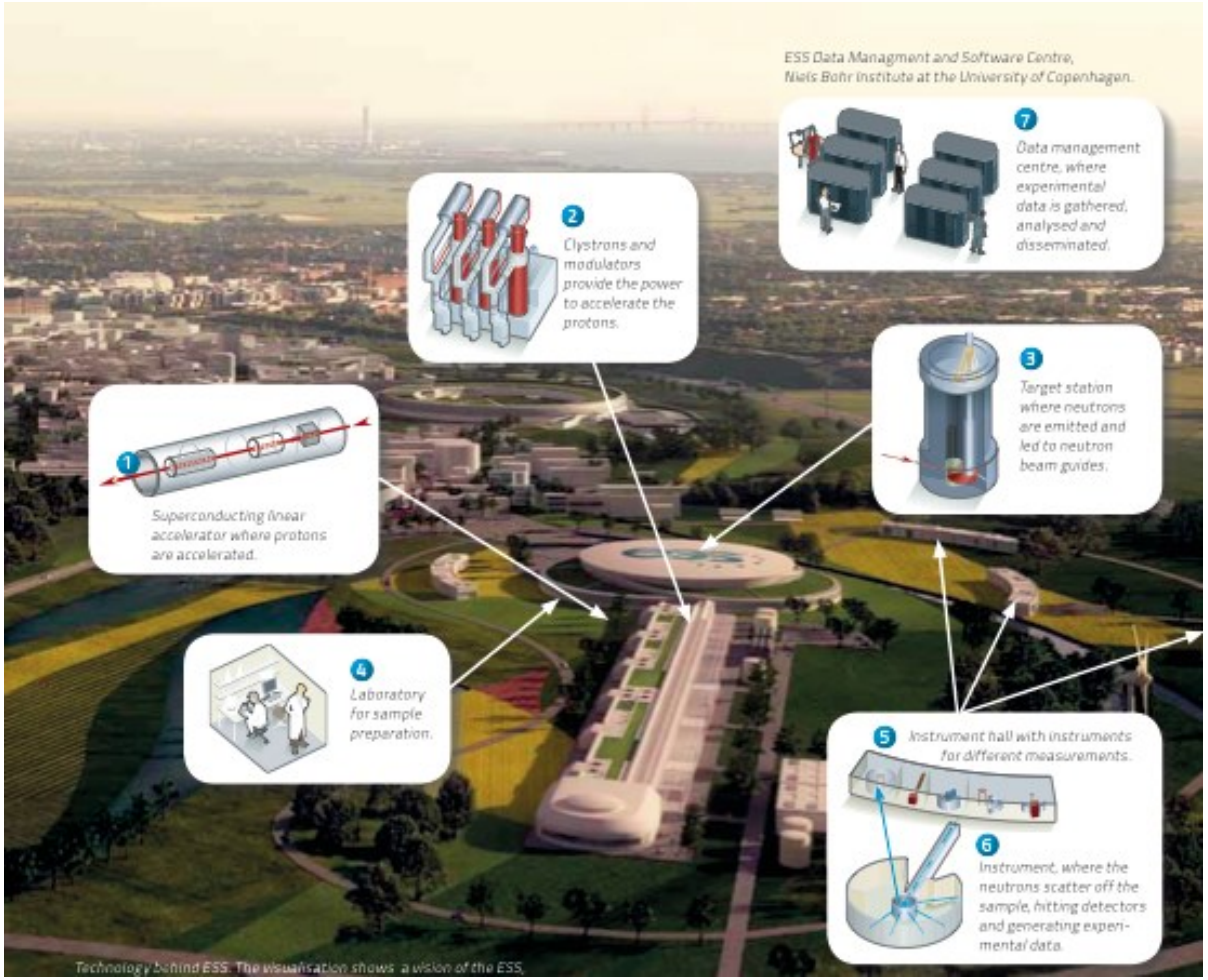
1. Not just “SCADA’s for Big Physics”

- Industrial customers focus on application, avoid programming
- Scientists want (and need) flexibility

→ Open Source CS Framework, Package, Middleware, Software Bus, …

- Technical challenges
  - not in computing power needs → off-the-shelf PC HW
  - in **managing system complexity** of large, distributed CS

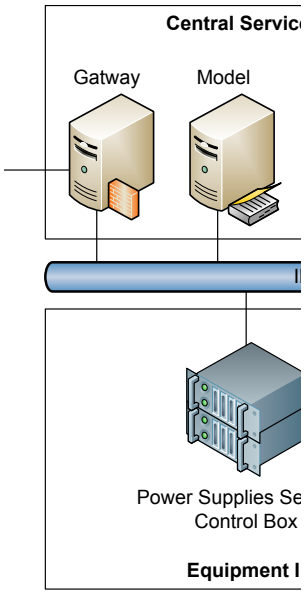
Example Project:



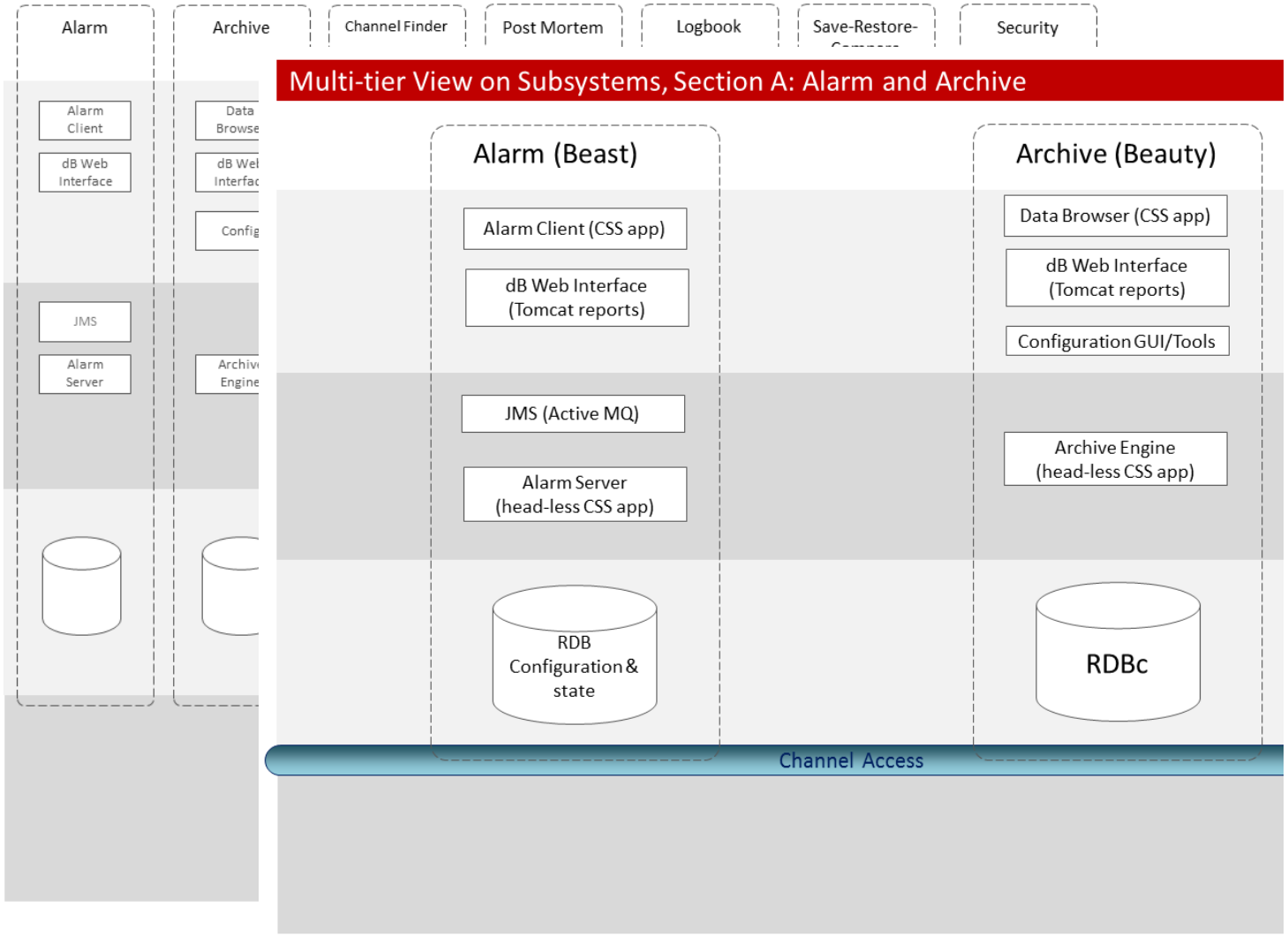
- @SNS: 150.000 Process Variables (PV's) → ESS ?
- Total budget: 1.4 B EUR
- subsystems of various nature (target = *nuclear* system)

→ flexible, scalable Control System for large number of distributed components → **EPICS**

EPICS & Data Management



Multi-tier View on Subsystems, Overview



A few recommendations on managing (technological) complexity

- Establish crucial standardization,
  - "Control Box" HW platform standardization (cPCI PlusIO, microTCA)
  - Early choice of CS framework ("*no matter which one*")

- While staying flexible as control system integrator
  - no "religions" on technologies
  - fact: many viewpoints in large international collaboration
  - offer shopping list of supported DAQ solutions

2. The extreme power of FPGA

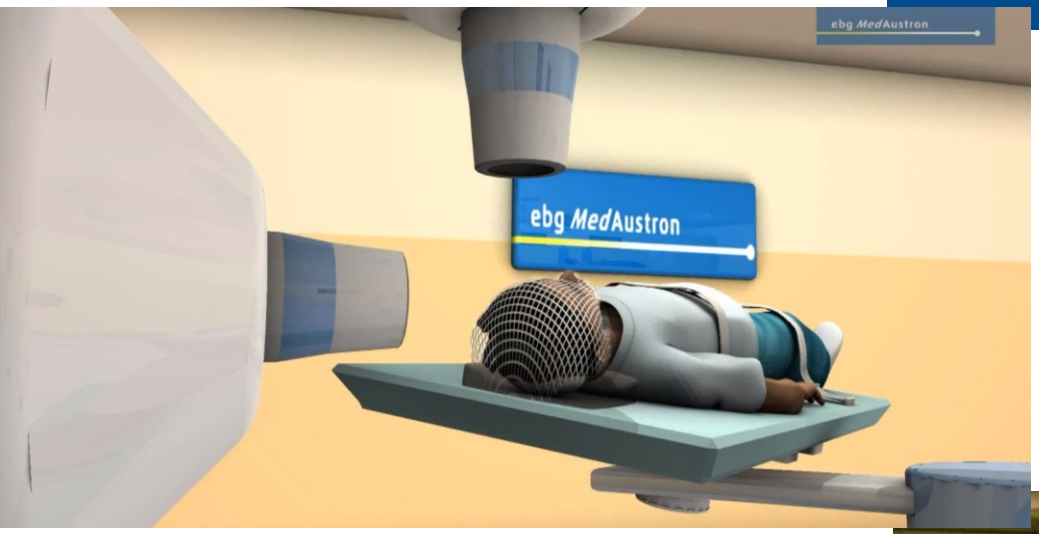
- Need for Speed?

  Free Electron Laser clock distribution → µs to fs level (analog domain)

- Hardware group in Cosylab
  - FPGA programmers
  - understanding of fiber-optic communication
  - custom hardware development

Example Project:

ebg *Med*Austron



- Ion Beam Therapy: Cancer treatment
- Wiener Neustadt, Austria
- First patient treatment planned 2015

Cosylab did the development of control system for medical synchrotron accelerator 2010-…

main timing system, **power converter control**, front-end controller, LV RT communication framework, injector and synchrotron LLRF integration, FPGA programming, LV RT drivers

now: dose delivery system (medical part)

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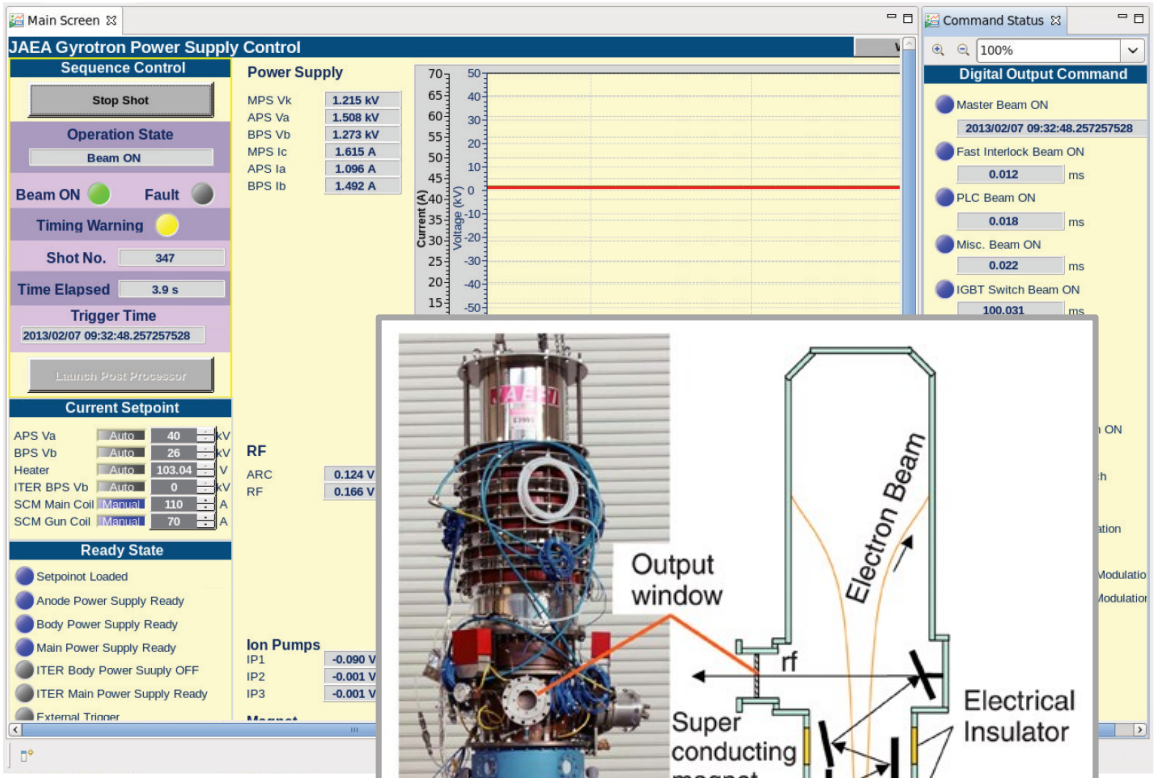
MedAustron: Power Convertor Control

- requires precise 1 µs synchronization of 260 magnet power converter
- critical parts of functionality FPGAs and custom designed hardware.

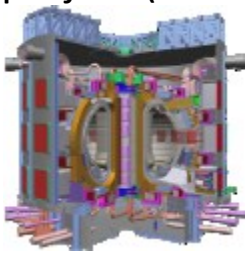
- host side: PXIe FlexRIO FPGA Module
  - generation of reference values and acquisition of measurements.
- device side: a custom FPGA-based front end device
  - gateway between the power converter and the host FPGA fiber optic link.
- host &device FPGA: custom real-time protocol
  - on fiber optic link, guarantees deterministic latency.
- host FPGA has access to a DRAM
  - buffers measurements from power converters
  - reads out new reference values provided by the system controller.
  - DRAM accessed through DMA (high throughput).

3. Power to the user

Gyrotron Integration for Japan Atomic Energy Agency JAEA



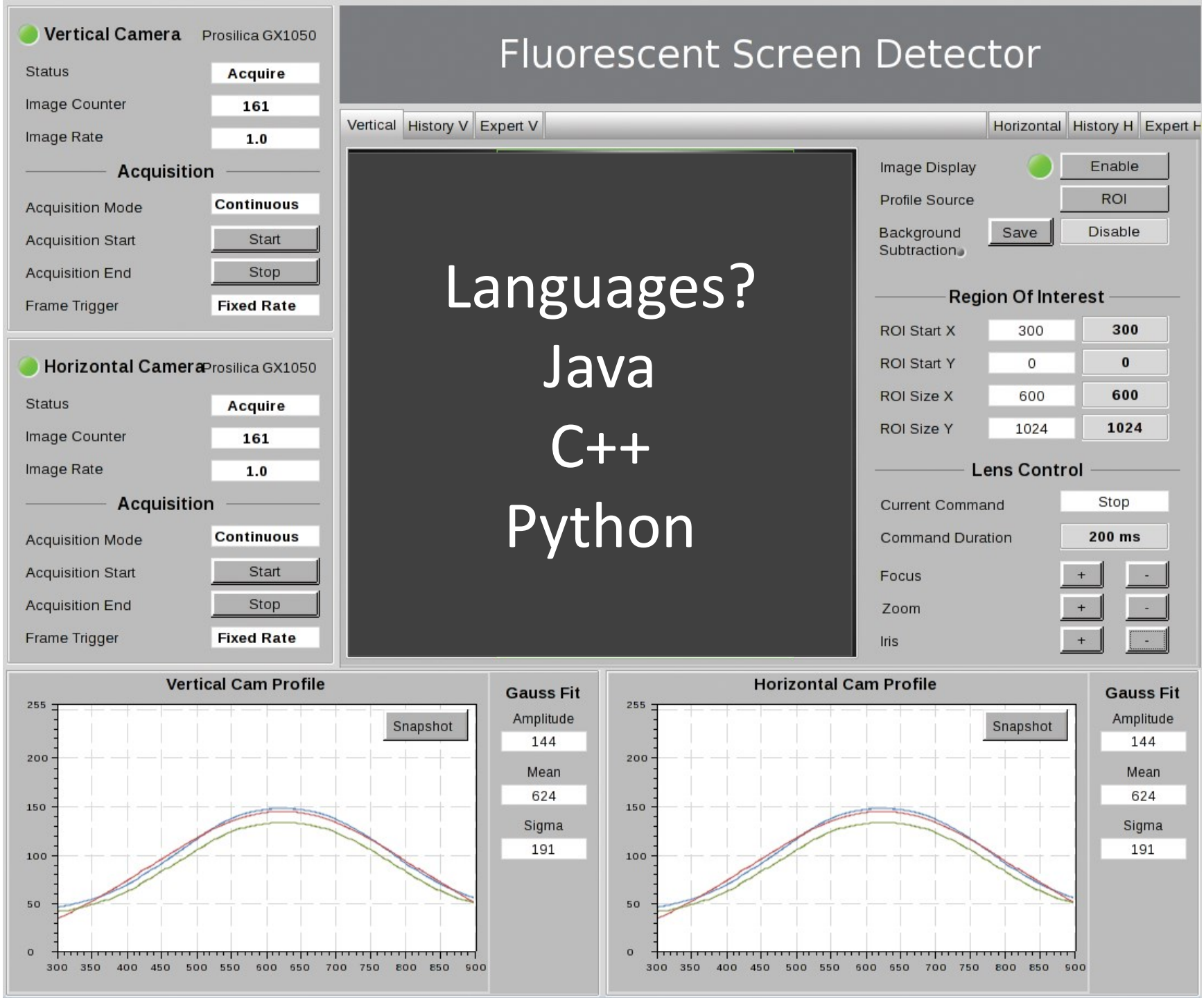
- Japanese in-kind contribution to ITER project (RF source)



- **Automated**, millisecond level control of gyrotron operation.
- Includes integration of high voltage power supplies, RF sensors arc sensor, ion pumps and superconducting magnets power supplies.
- High continuous sampling rates (40 ksps x 16 analog inputs for 3600 secs.) with NI PXI-6259 DAQ card.
- Control of superconducting magnets power supplies (Oxford Instruments) via RS-232

Operator / Scientist Apps

- no need for “fancy”, but power
- low level access to everything (engineering screens)
- right level of (highly accurate) automation
- user configurable
  - custom GUI e.g. Control System Studio
  - scripting interface
  - interface with other tools (machine model, Matlab, excel!)


Vertical Camera
Prosilica GX1050
Status
Acquire
Image Counter
161
Image Rate
1.0
Acquisition
Acquisition Mode
Continuous
Acquisition Start
Start
Acquisition End
Stop
Frame Trigger
Fixed Rate
Horizontal Camera
Prosilica GX1050
Status
Acquire
Image Counter
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Acquisition
Acquisition Mode
Continuous
Acquisition Start
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Acquisition End
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Frame Trigger
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Fluorescent Screen Detector
Vertical
History V
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Horizontal
History H
Expert H
Languages?
Java
C++
Python
Image Display
Enable
Profile Source
ROI
Background Subtraction
Save
Disable
Region Of Interest
ROI Start X
300
300
ROI Start Y
0
0
ROI Size X
600
600
ROI Size Y
1024
1024
Lens Control
Current Command
Stop
Command Duration
200 ms
Focus
Zoom
Iris
Vertical Cam Profile
Snapshot
255
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Gauss Fit
Amplitude
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Sigma
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0
300 350 400 450 500 550 600 650 700 750 800 850 900
Gauss Fit
Amplitude
144
Mean
624
Sigma
191

Back to the cool company: Company Culture

Our Motto:

Think bold, Work hard, Act modest and Enjoy life

What does that mean to a e.g. a Rookie engineer?

How the Rookie engineer:

- Thinks bold: on-site, see an extra sale → put wheels in motion
- Works hard: 34/40 on paid hours → push his TC
- Acts Modest: A lot to learn, also how this business works
- Enjoy Life:

Time to Recap

What are the **key elements** in becoming a world-**leading** service provider in a **global** hi-tech niche **market**?

-

What is **the part of** the **engineers** and **computer scientists** to the story?

Understanding Scientific Community (Domain) and their **Technologies**

-

shared in an **open** culture

There are **many niches** world-wide, **larger** then **local** mass-markets

-

Slovenian Eng. and **Comp. Sc.** has what it takes

No easy ride: Growth → Change → Crises → "Real" Growth

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Crisis is a Real Growth Opportunity!

Thank You