THE STATE OF BEAM DIAGNOSTICS

Tom Shea

and the ESS Beam Diagnostics Team

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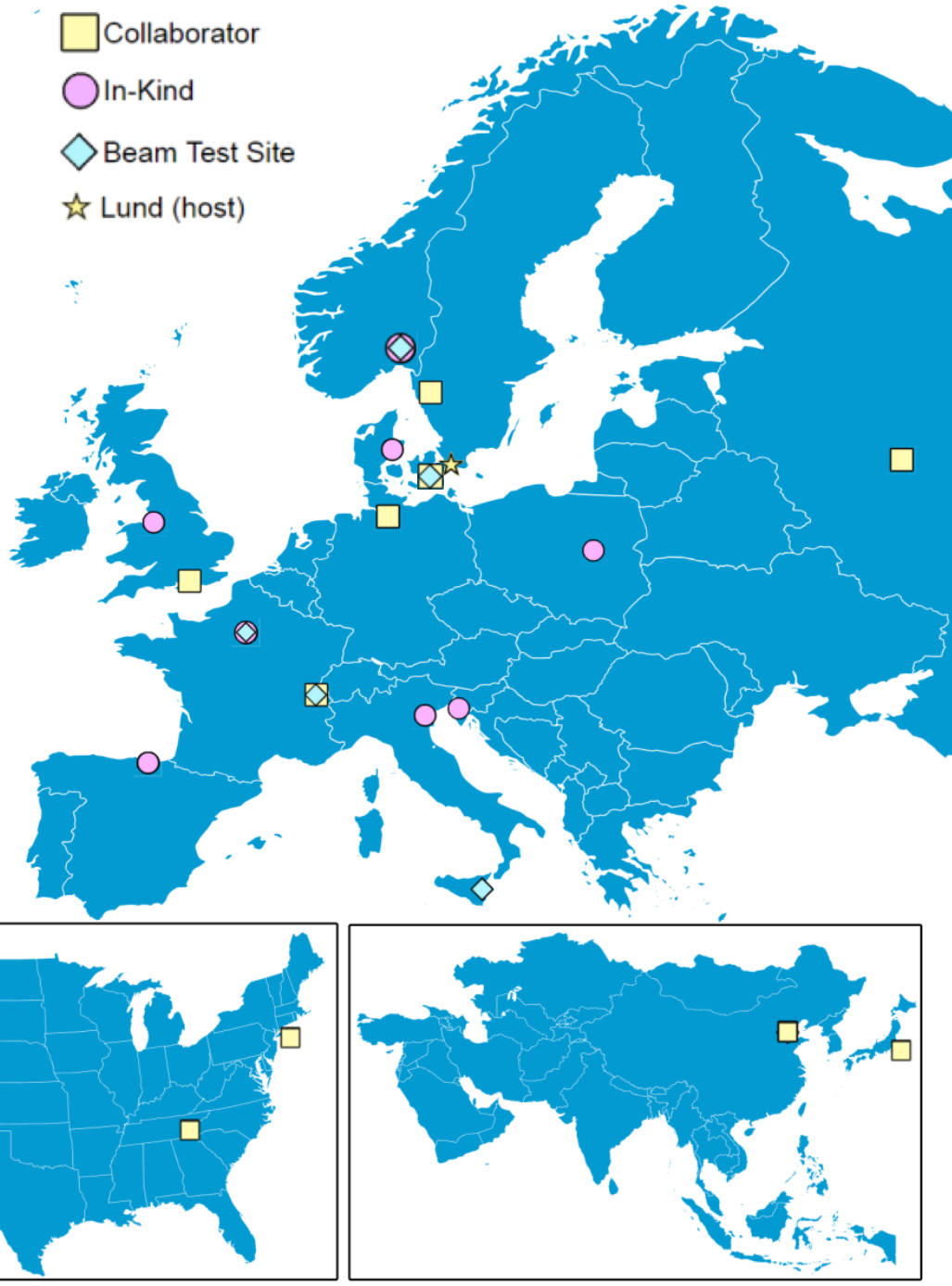
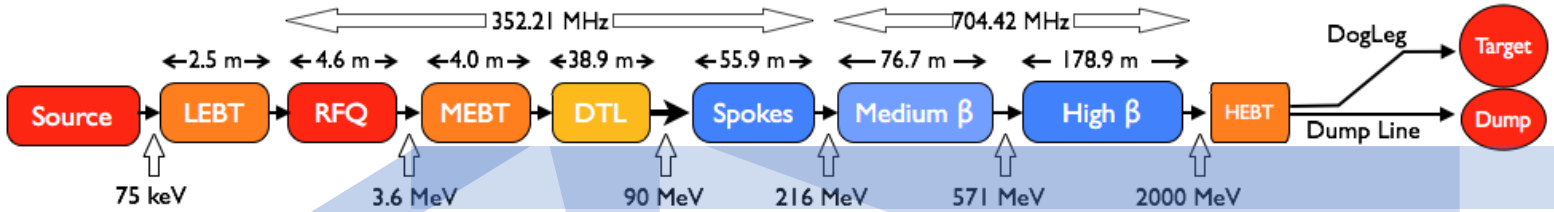
ESS Diagnostics: 20 Partners and Collaborators

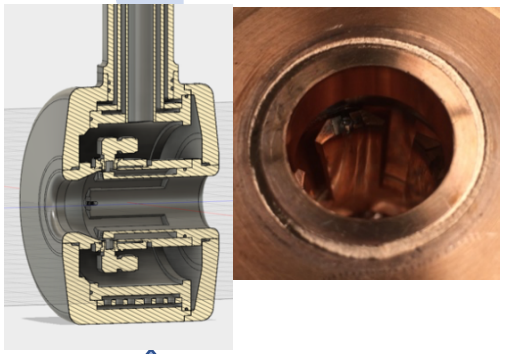
- Aarhus University
- CEA Saclay, Paris
- CERN, Geneva
- Cockcroft Institute, Daresbury
- DESY, Hamburg
- Elettra – Sincrotrone Trieste
- ESS Bilbao
- INFN, Catania
- INFN, Legnaro
- Lund University
- University of Oslo
- Technical University of Denmark
- Science and Technology Facilities Council, Daresbury
- Warsaw University of Technology
- Chinese ADS
- J-PARC, Japan
- Oak Ridge National Laboratory
- Los Alamos National Laboratory
- INR, Moscow
- Högskola Väst, Trollhättan



Position Monitors

	LEBT	RFQ	MEBT	DTL	Spk	MBL	HBL	HEBT	A2T	DumpL	TOTAL
BPM	-	-	7	15	14	9	21	16	12	4	98



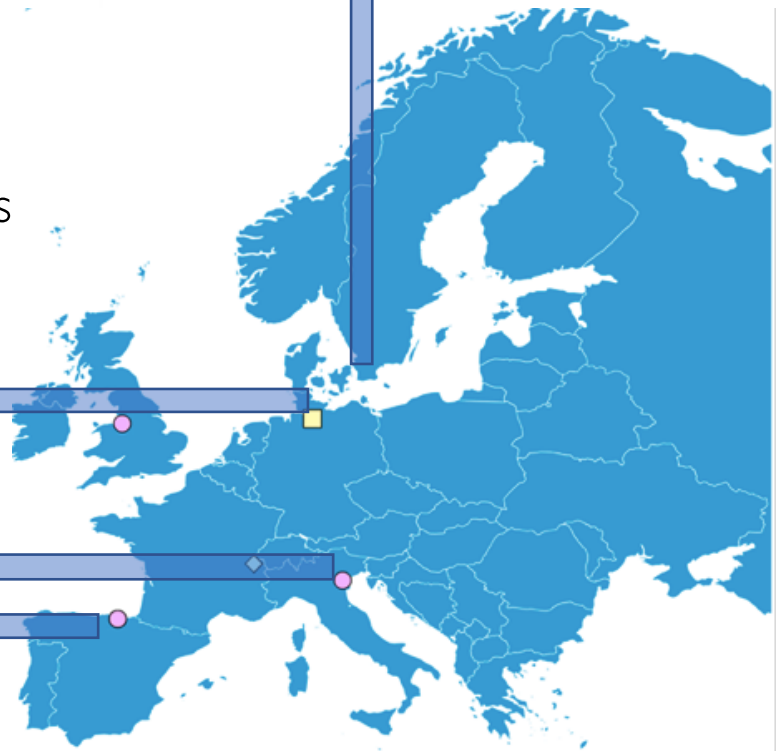


Electronics
from ESS-Lund

Striplines
from Bilbao

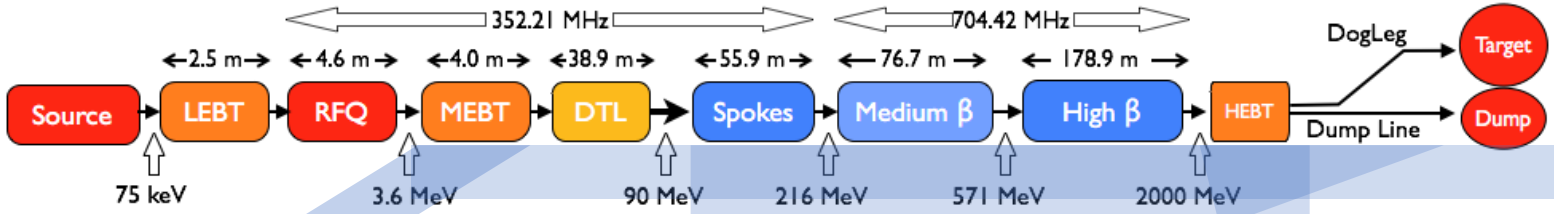
Striplines
from Legnaro

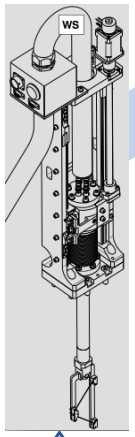
Button BPMs
from DESY,
Daresbury

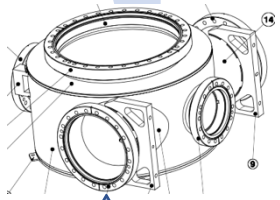


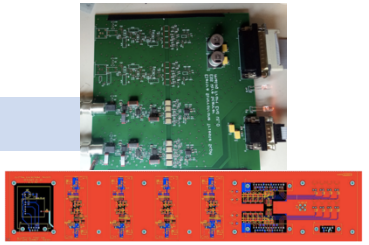
Wire Scanners

	LEBT	RFQ	MEBT	DTL	Spk	MBL	HBL	HEBT	A2T	DumpL	TOTAL
WS	-	-	3	-	3	3	1	3	1	-	14







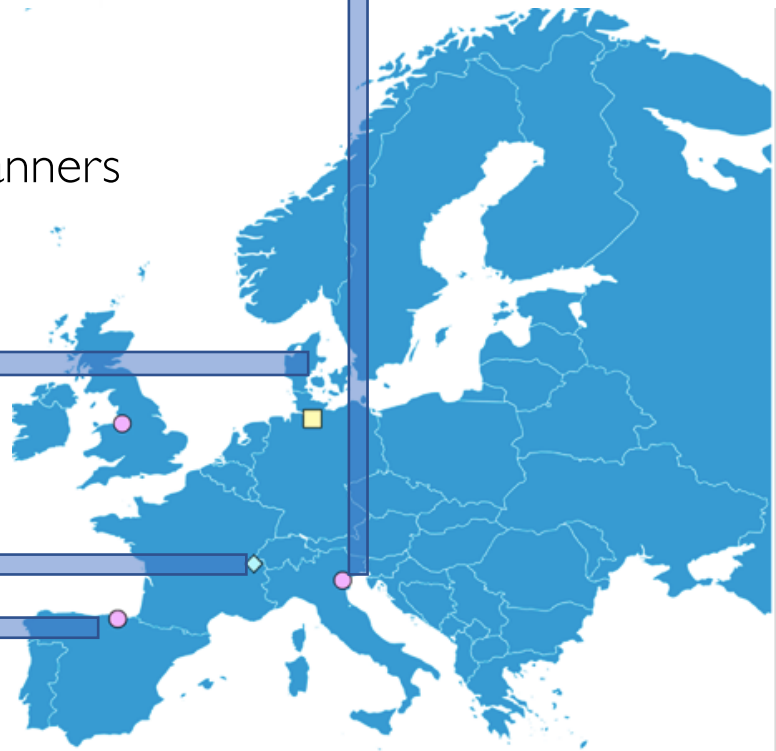


Electronics from Trieste

Scanning Actuators from Bilbao

Scanning Actuators from Århus

Fast Wire Scanners from CERN



The Big Picture

Keeping track of what we are building

Accelerator Lattice Synoptic Viewer

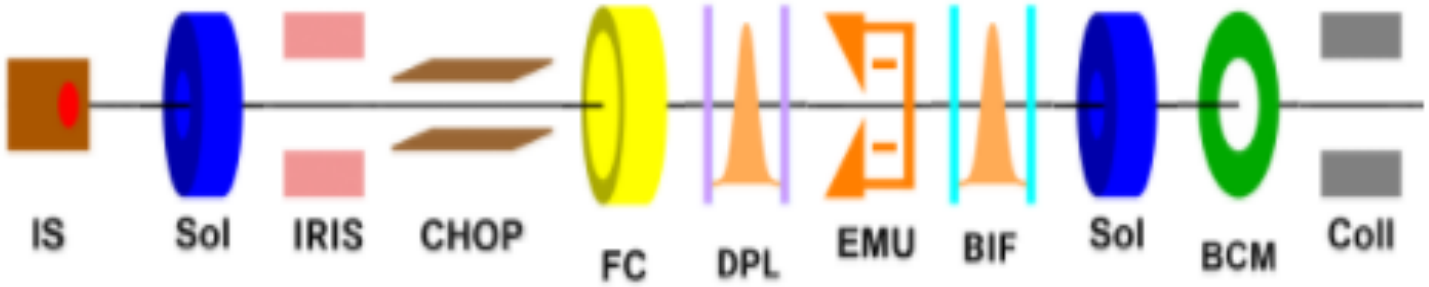
Features:

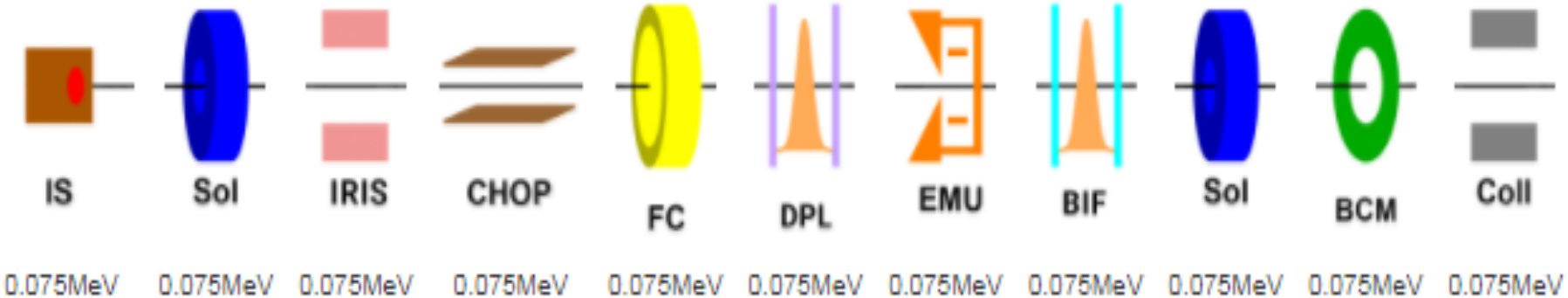
- Over 1000 Elements
- 3D (and VR) views of components
- Energies
- Apertures
- Locations
- ESS IDs
- Links to insight
- ... And more?

Display Lattice Data

Created by Thomas Grandsaert, last modified on Nov 13, 2017

Show MCS Distances | Show TCS Distances | Show Energies | Show apertures | Show aperture chart | show BLMs



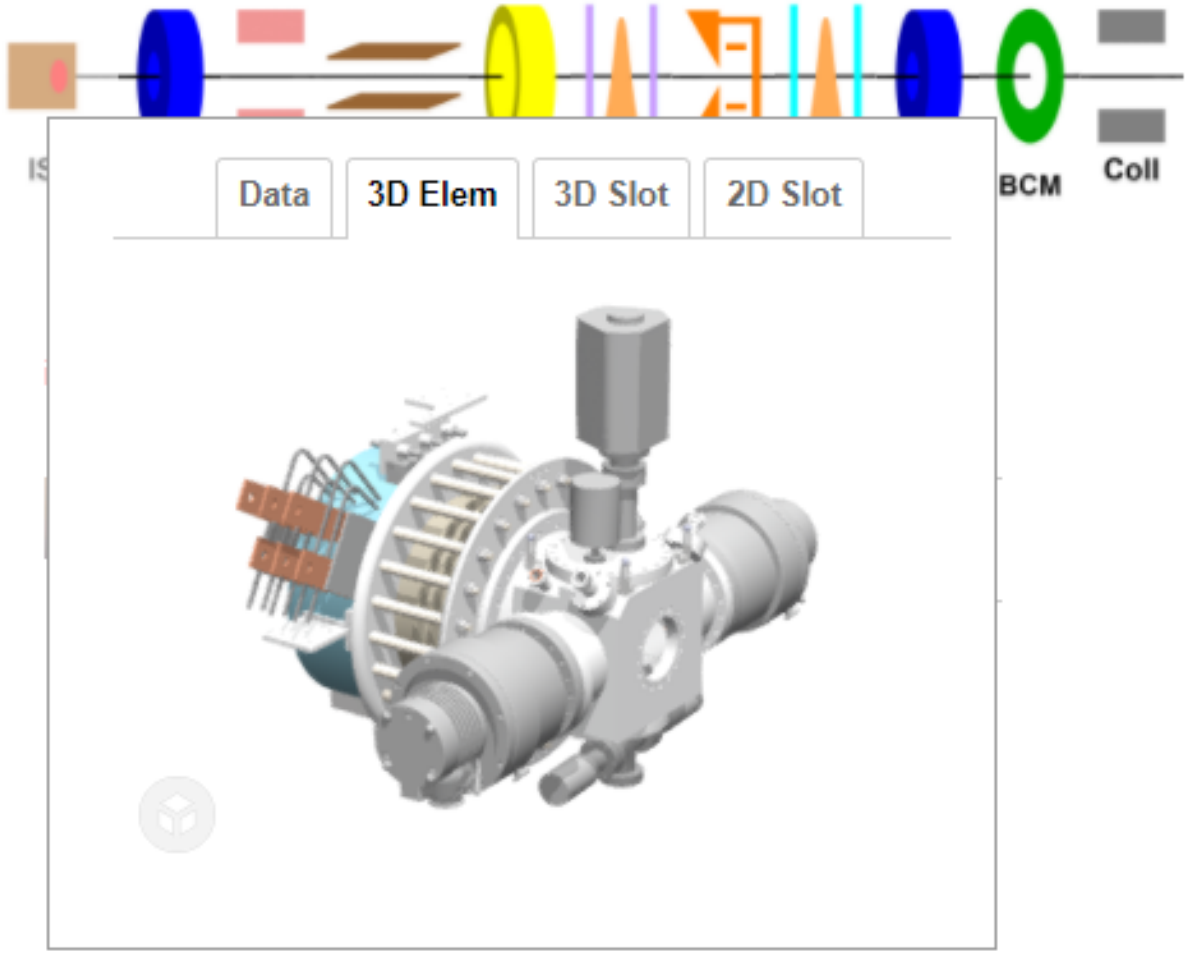


Energy

3D Element

Created by Thomas Grandsaert, last modified on Nov 13, 2017

Show MCS Distances | Show TCS Distances | Show Energies | Show apertures | Show aperture chart | show BLMs



Data

Created by Thomas Grandsaert, last modified on Nov 13, 2017

Show MCS Distances | Show TCS Distances | Show Energies | Show apertures | Show aperture chart | show BLMs

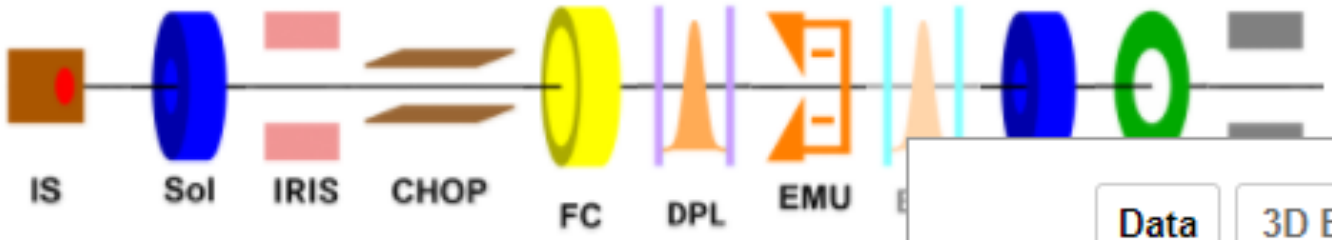
Data | 3D Elem | 3D Slot | 2D Slot

Element: **Sol**,
Model: **n/a**,
Energy: **0.1** MeV,
Index: **1**,
Section: **LEBT**,
Slot type: **N/A**
TCSz: **-602019.054** mm,
TCSy: **-4500.0** mm,
ESS Name: **LEBT-010:BMD-Sol-001**

Link to More Data

Created by Thomas Grandsaert, last modified on Nov 13, 2017

Show MCS Distances | Show TCS Distances | Show Energies | Show apertures | Show aperture chart | show BLMs

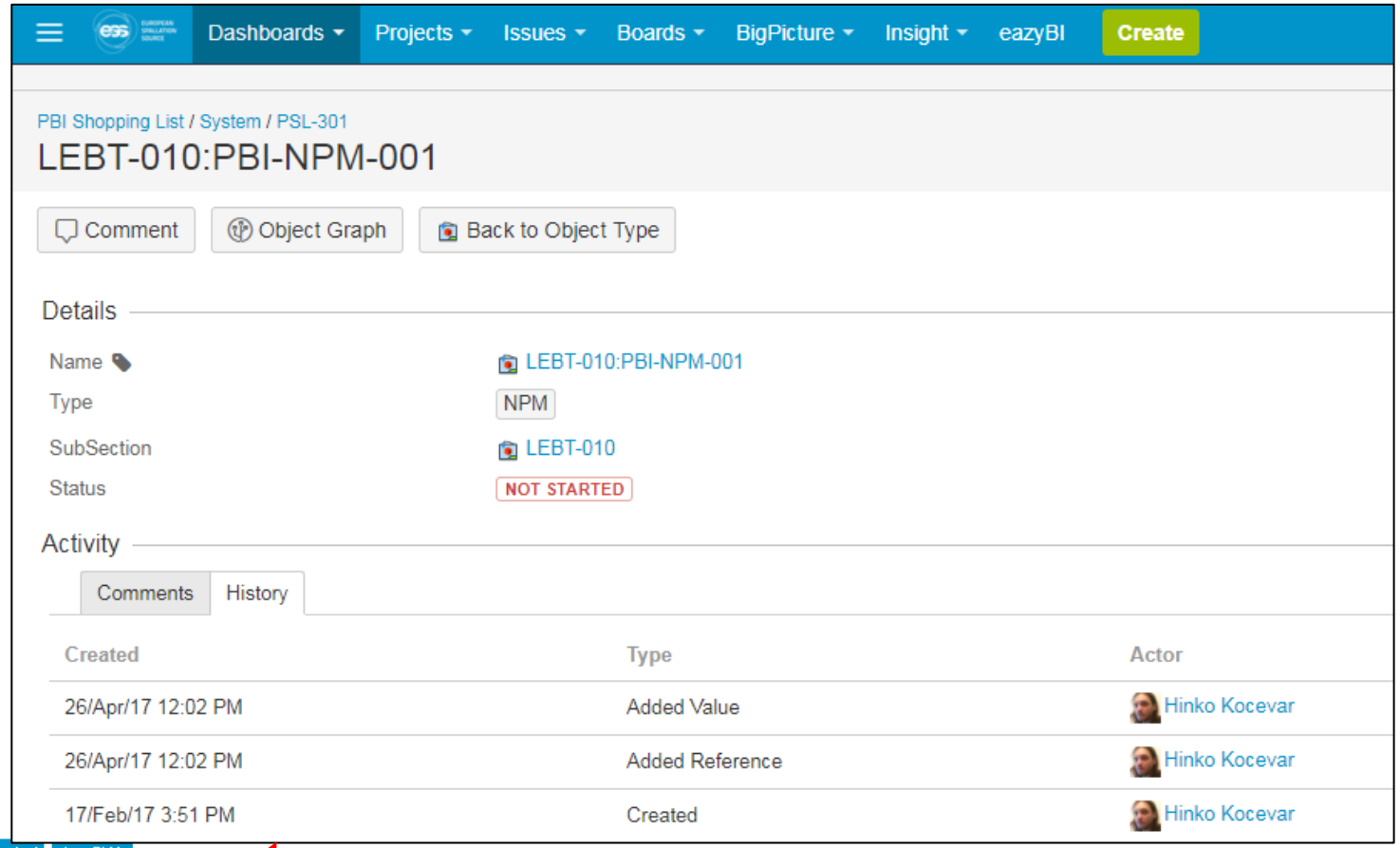


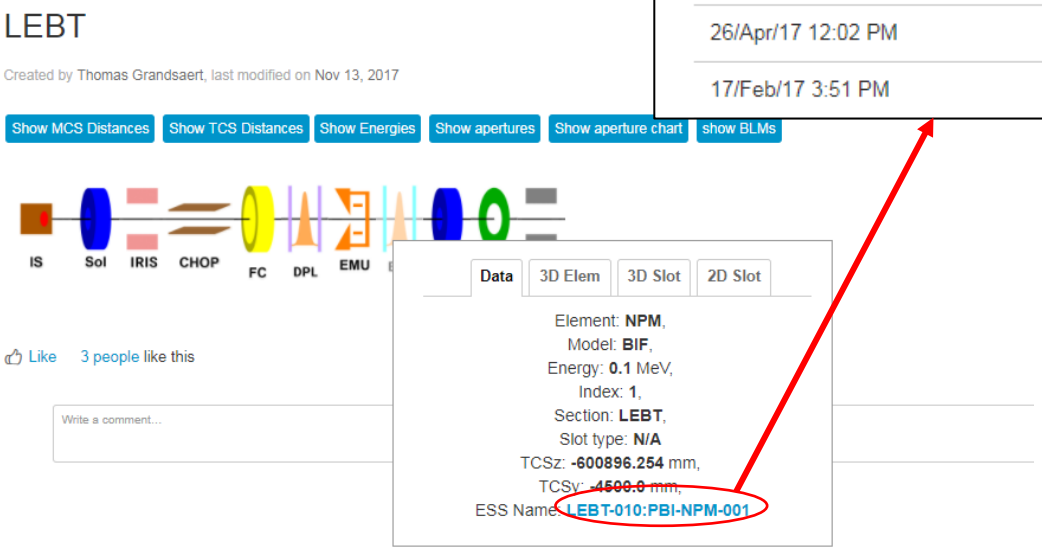
Data | 3D Elem | 3D Slot | 2D Slot

Element: **NPM**,
Model: **BIF**,
Energy: **0.1** MeV,
Index: **1**,
Section: **LEBT**,
Slot type: **N/A**
TCSz: **-600896.254** mm,
TCSy: **-4500.0** mm,
ESS Name: **LEBT-010:PBI-NPM-001**

Link to insight (other data sources to come)

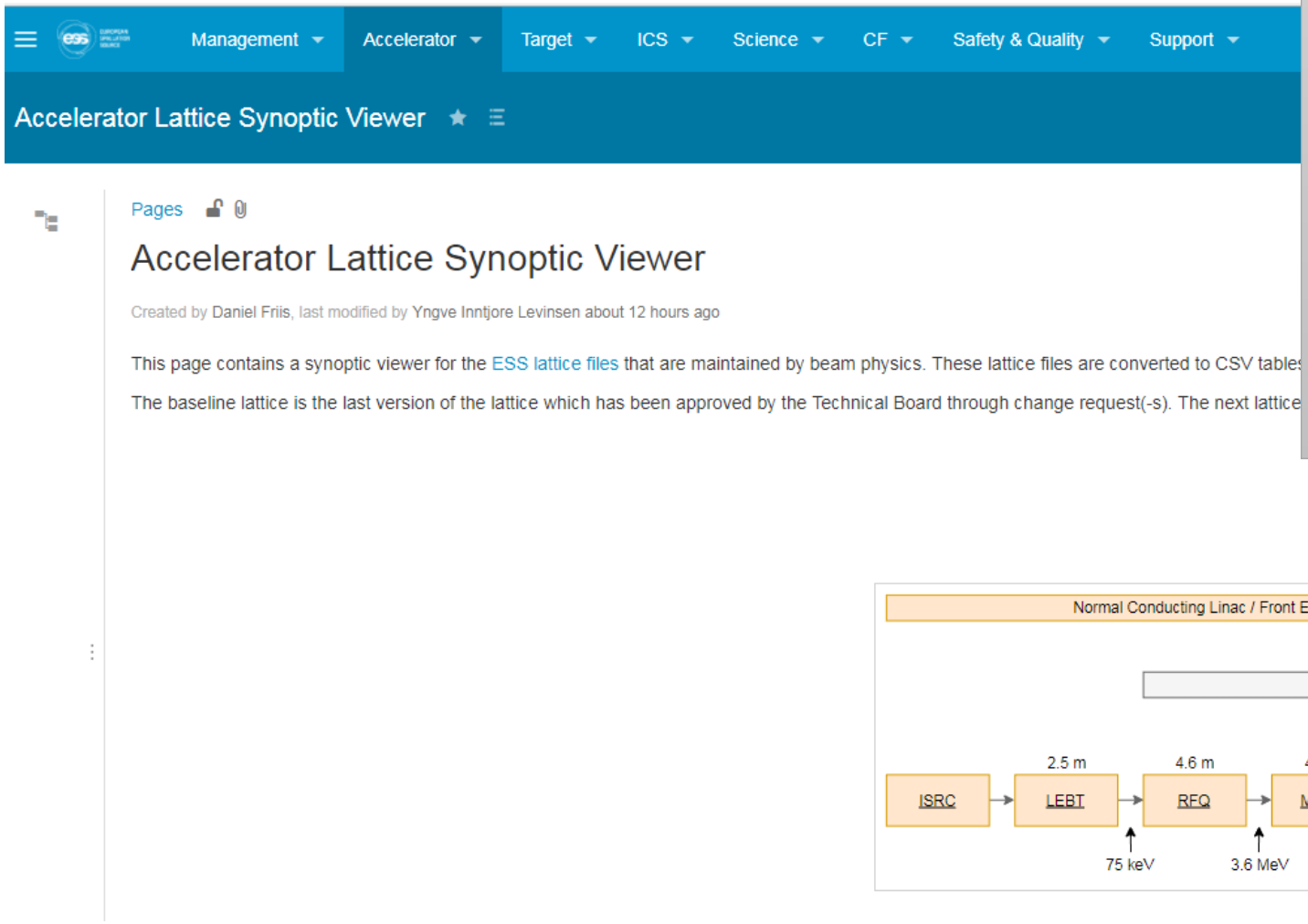
Data in Insight

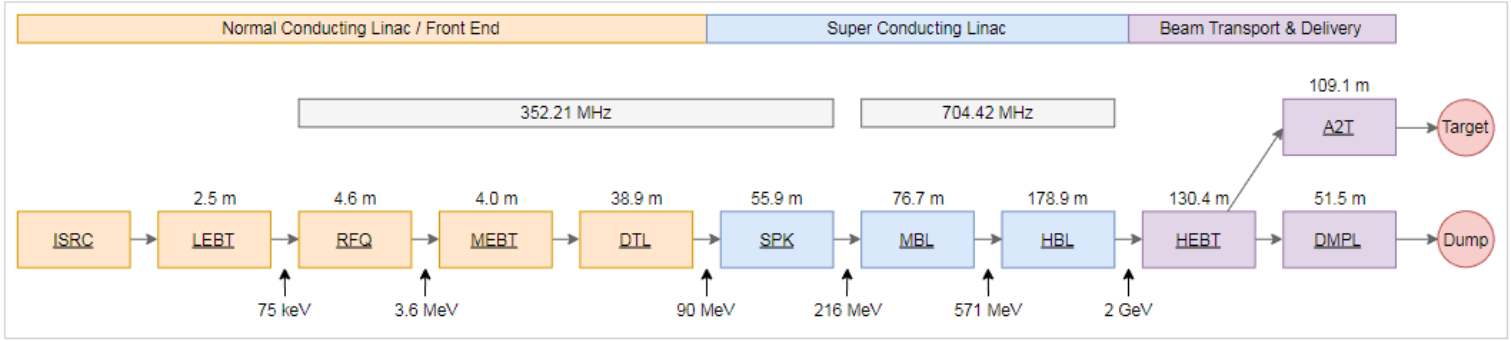




Accessible on Confluence

- The entire lattice is under version control, including scripts that transform, verify and display the data
- We verified the locations of devices in the lattice and 3D model to micron accuracy
- Effort of the Beam Physics and Beam Diagnostics Sections





[Official Link: Accelerator Linac Synoptic Viewer]

https://confluence.esss.lu.se/display/ALSV/Accelerator+Lattice+Synoptic+Viewer

	LEBT	RFQ	MEBT	DTL	Spk	MBL	HBL	HEBT	A2T	DumpL	TOTAL	
BPM	-	-	7	15	14	9	21	16	12	4	98	
IPM	-	-	-	-	1	3	1	-	-	-	5	
BIF	1	-	2	-	-	-	-	-	1	-	4	
ICBLM	-	-	-	5	52	36	84	49	37	6	269	
nBLM	-	-	5	11	14	4	-	1	-	-	35	
WS	-	-	3	-	3	3	1	3	1	-	14	
LBM	-	-	1	-	1	1	-	-	-	-	3	
FC	1	-	1	2	-	-	-	-	-	-	4	
BCM	1	1	4	5	-	1	1	2	3	2	20	
EMU	1	-	1	-	-	-	-	-	-	-	2	
IMG	-	-	-	-	-	-	-	-	2	1	3	
APTM	-	-	-	-	-	-	-	-	3	1	4	
DPL	1	-	-	-	-	-	-	-	-	-	1	

News from Lund

People Changes

- Irena returns
- Johan returns
- Slava arrives
- Maurizio departs
  - Mehdi arrives
- Benjamin will depart
- Staff positions opening
  - 2 Technicians
  - 1 Engineer (plus 1 term appointment)
  - 1 Scientist

- Lali "arrives" as Head of Operations Section

Schedule Changes

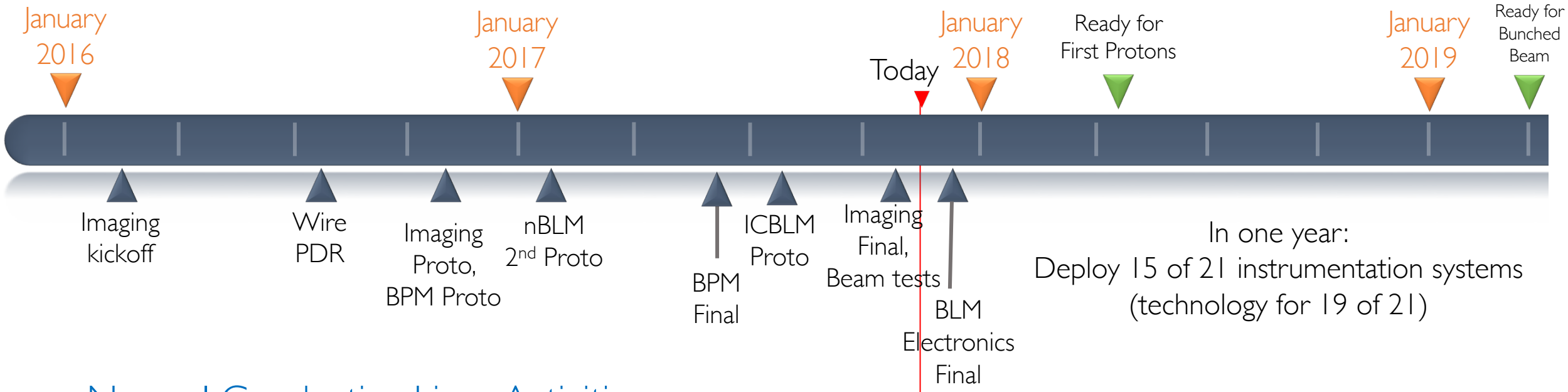
- New installation, testing and commissioning plan
- Ion Source and LEBT commissioning begins in April 2018
  - Components arriving now through December
  - Repairs needed
- Beam through entire linac now planned for late 2020
- Contract issue
  - We want our partners to remain engaged through commissioning
  - Many systems will see first beam after 2019

And we are considering additional scope:

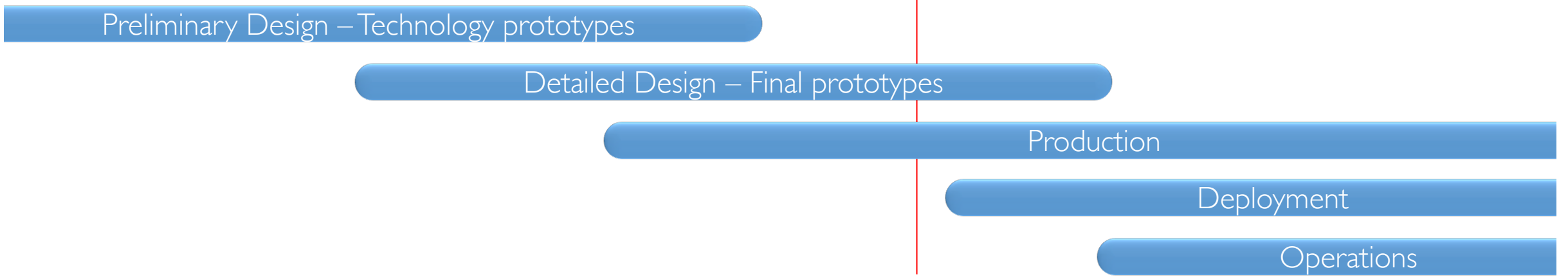
- Scraper systems
- X-ray/gamma spectroscopy

23 unique system types

Recent and Near Term Schedule



Normal Conducting Linac Activities



Outlook

Example near term challenges
(what keeps me up at night):

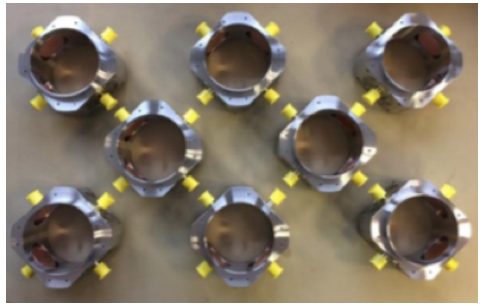
- Readiness for LEBT commissioning
- Cabling and infrastructure
- Controls integration
- Etc…

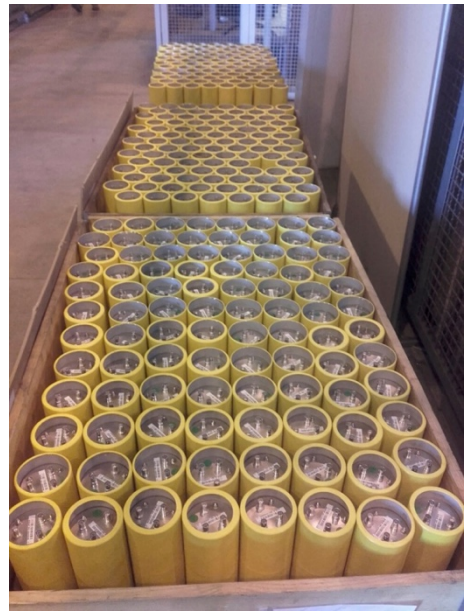
Approach:

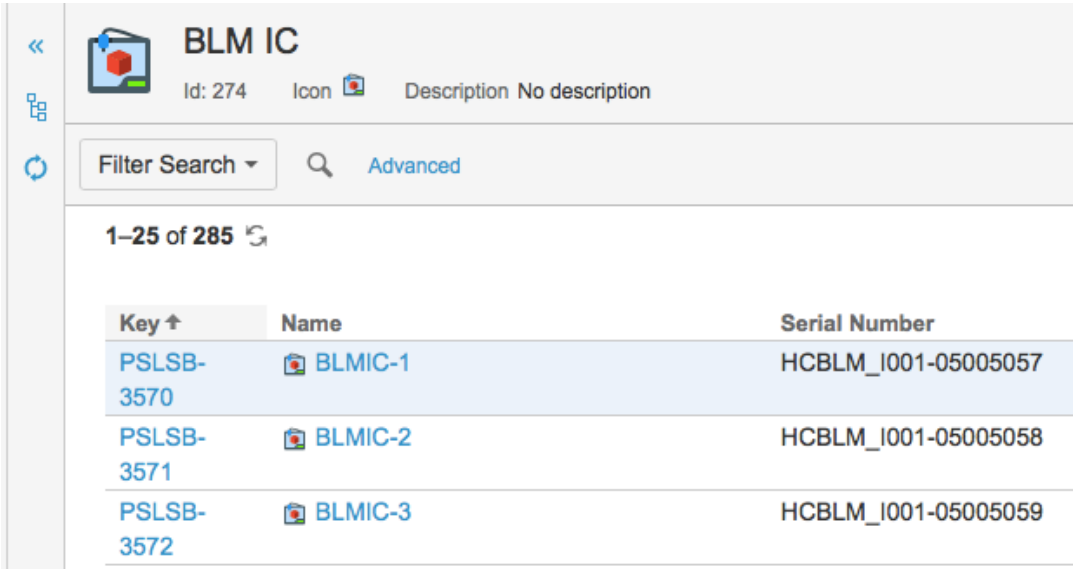
- Leverage the capabilities of this large BI team
- Data driven approach to deployment
- Inclusive team: beam diagnostics, beam physics, operations, and controls

Supply chain metrics:

- 500 Systems
- 10,000 tracked components
- Test, install, integrate ~25 components per day







Thank you