

ISOLDE Technical Report

ISCC Meeting 9th July 2013

Richard Catherall, EN-STI

Outline

- Hall Activities
 - Infrastructure
- Target Area Activities
 - Shielding
 - Robot upgrade
 - Accumulated collective dose
 - Hot cell progress
- The ISOLDE machine
 - RFQ Cooler
 - REX (and TSR)
 - RILIS
 - Target development
- Medicis
- News from EN-STI-RBS
 - Labs
 - Test stand
- Design Study Progress

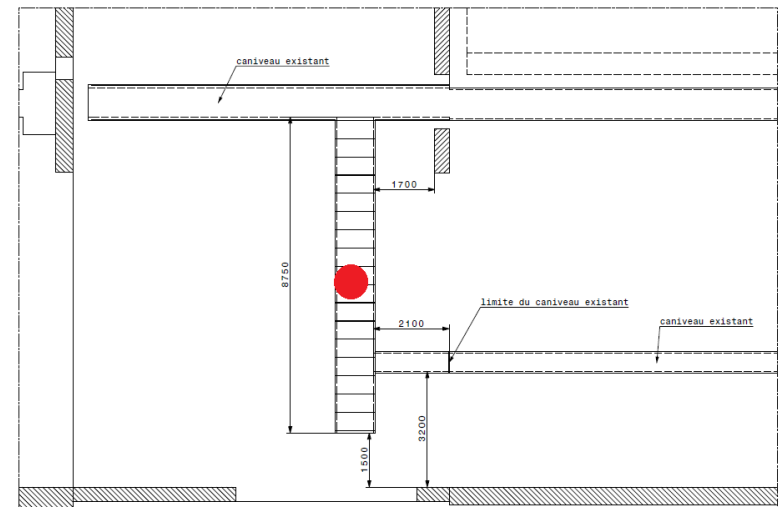
ISOLDE Hall

- Cutting of the wall now done
 - After removal of MINIBALL, cables etc



ISOLDE Hall

- Cutting of the service trench now in progress
 - Protected but still a dust problem



Building 199: CV

- Metallic structures in place
 - 2nd floor inside the building



Building 199: CV

- Installation of support structure and chillers put in place on roof.



before



after

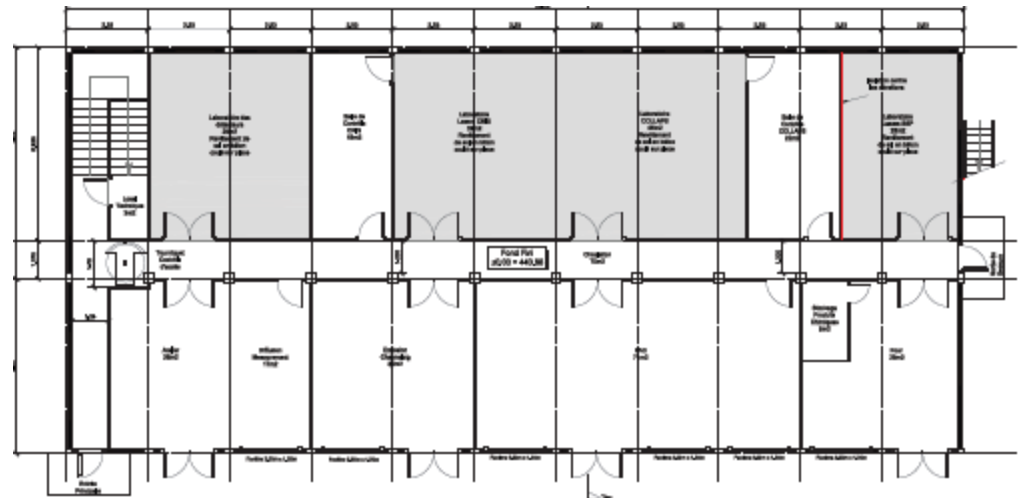
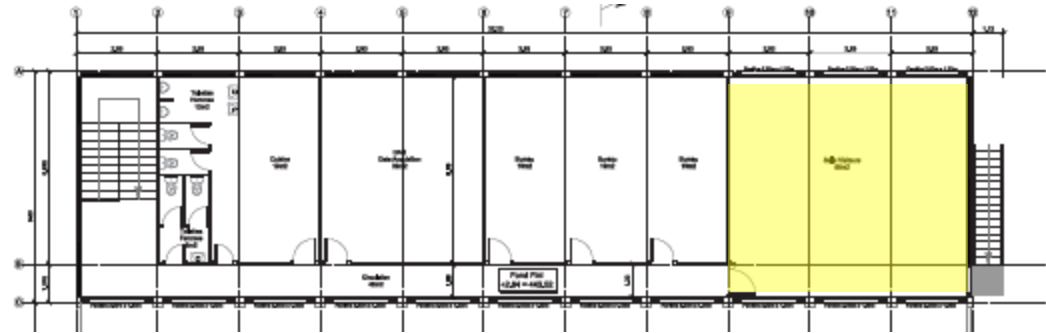
Building 198: Compressor building

- Installation of sound-proofing doors done



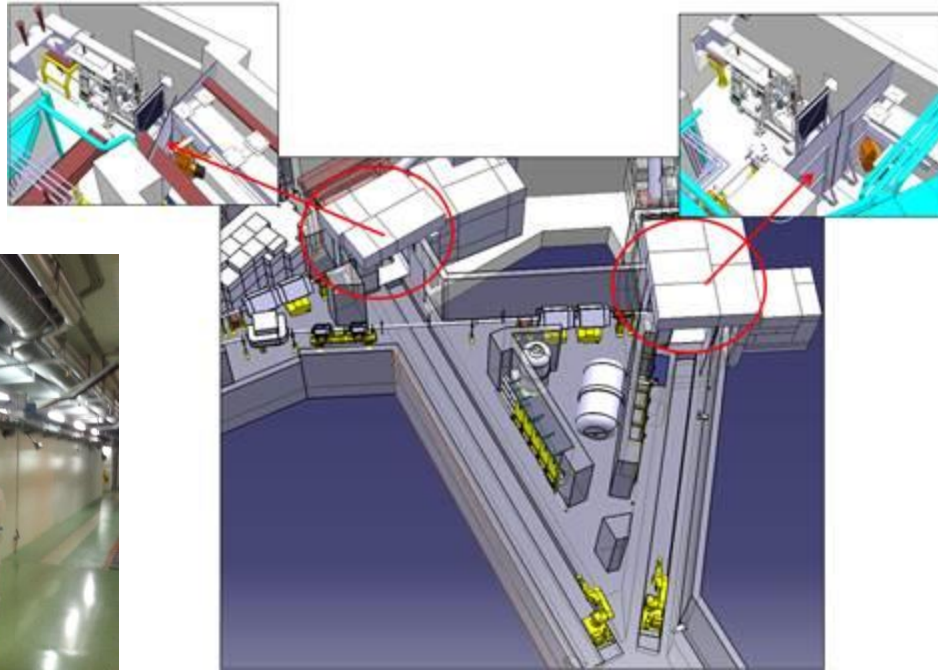
Building 508

- Demolition to start soon
- Tremendous effort by everyone to remove everything from building 507 and 115
- To be finished by the end of October



Target Area

- Installation of first layer of shielding



Target Area

- Installation of second layer of lead shielding in front of faraday cage.
- Shielding not as effective as first estimated
 - Re-evaluation of WDP planning required
 - Further measures put in place



Target Area

- Removal of robots and infrastructure
 - Cables, cable trays, rails etc
- Trench covers to be put in place after cleaning
 - This week

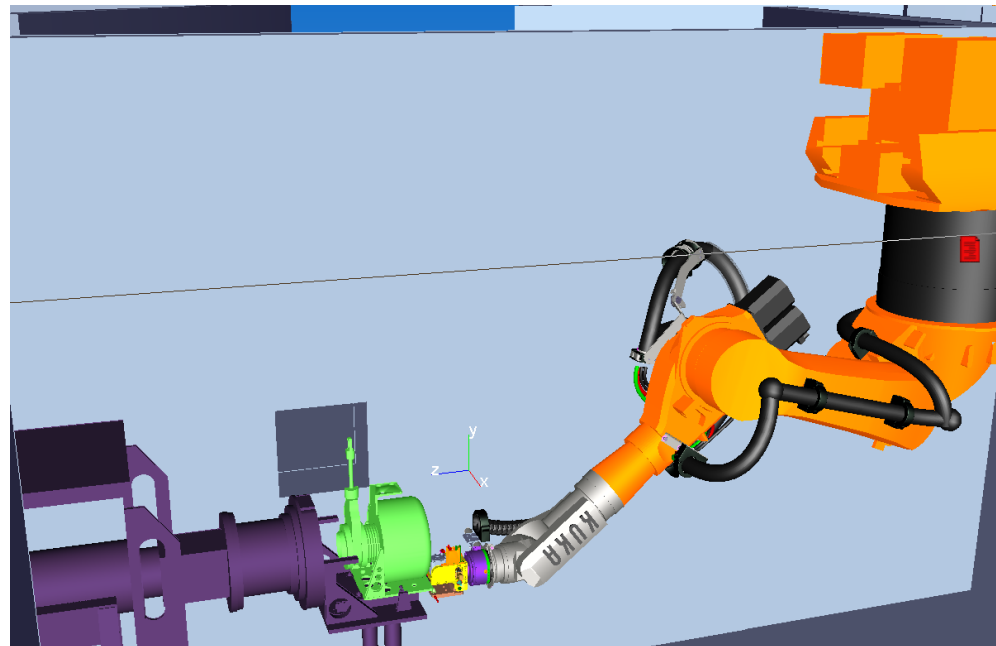
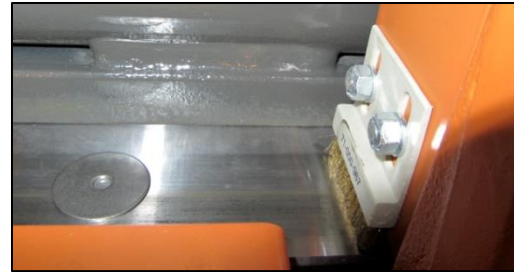


Not only used them



Robot upgrade

- Many failure scenarios being addressed on the test bench in B. 927
 - Motor failures
 - Obstacles on rails etc.
- New gripper
- New exchange point
- Tests on bigger targets
 - PbBi target module
 - LIST targets etc
- Shelf upgrade on-going
- Redundant micro-switches for target position
- Kuka Sim Pro
 - Programming of cycles that can be loaded into real robots

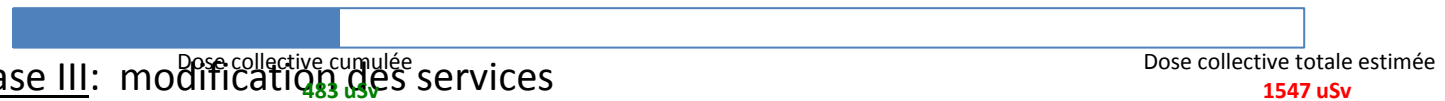


Suivi des débits de dose

- Phase 1: installation des blindages



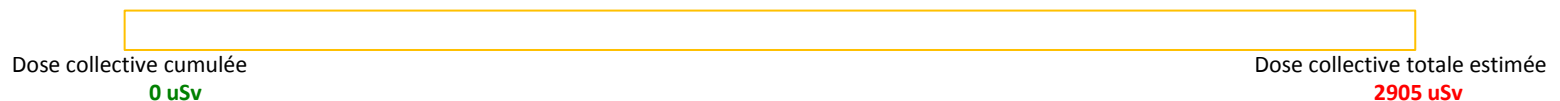
- Phase II: démantèlement des robots



- Phase III: modification des services



- Phase IV: installation des robots



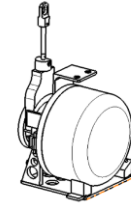
- Phase V: test des robots



Alpha Gamma Hot Cell

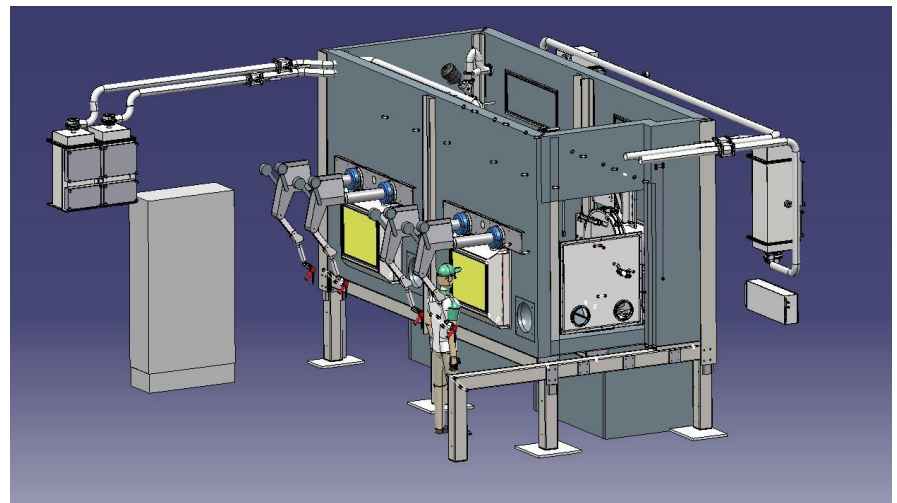
Dismantling of irradiated ISOLDE target units:

- Separation of materials
- Controlled oxidation of Uranium-oxide (most used target material)

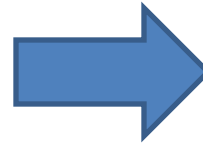


Project time line:

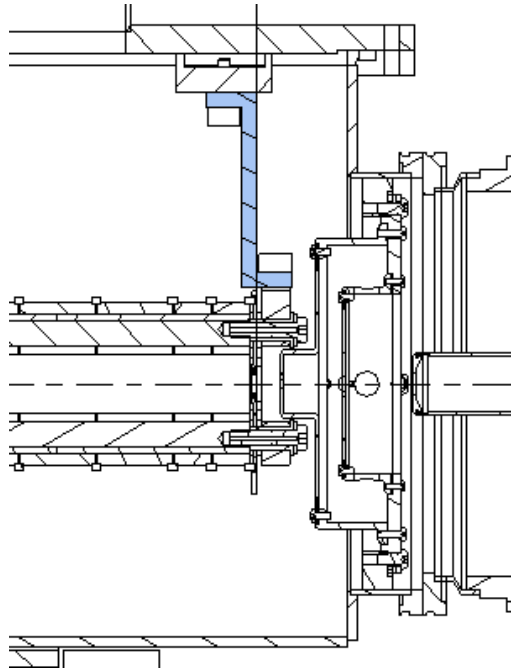
- Contract awarded to *Isotope Technologies Dresden (ITD)* in March 2013
- Final design presentation July 2013
- Installation March 2014



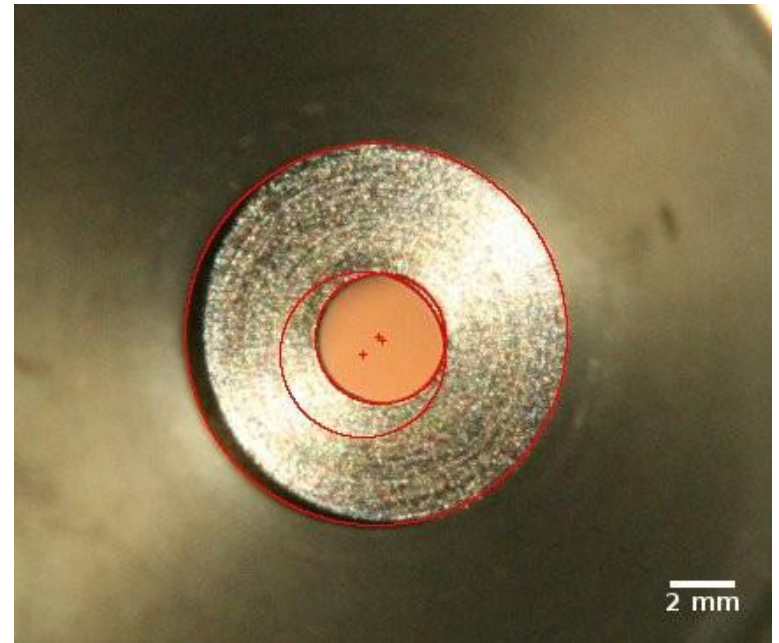
Old Hot Cell



RFQ Cooler Alignment

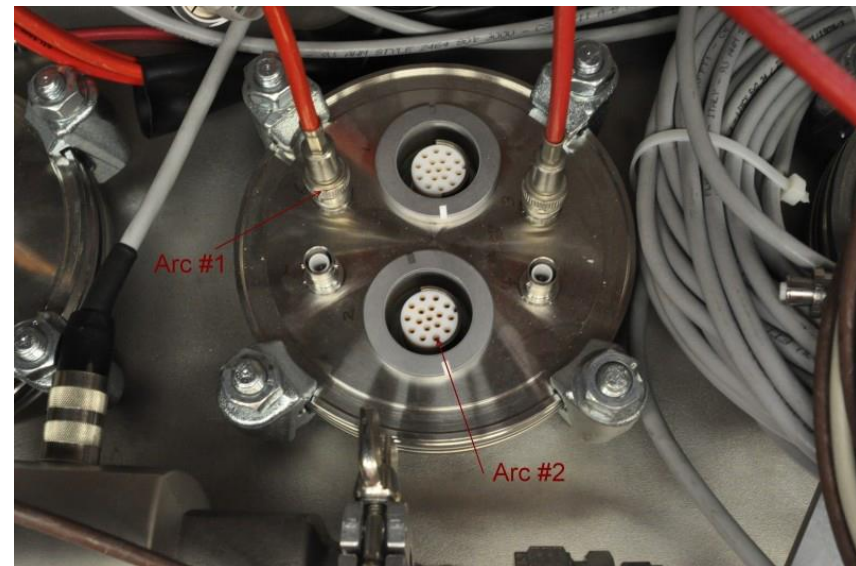


1. Re-alignment
The old supports have been replaced with pieces allowing position adjustment
The mis-alignment was measured (shown, extraction mis-alignment of 0.75mm)



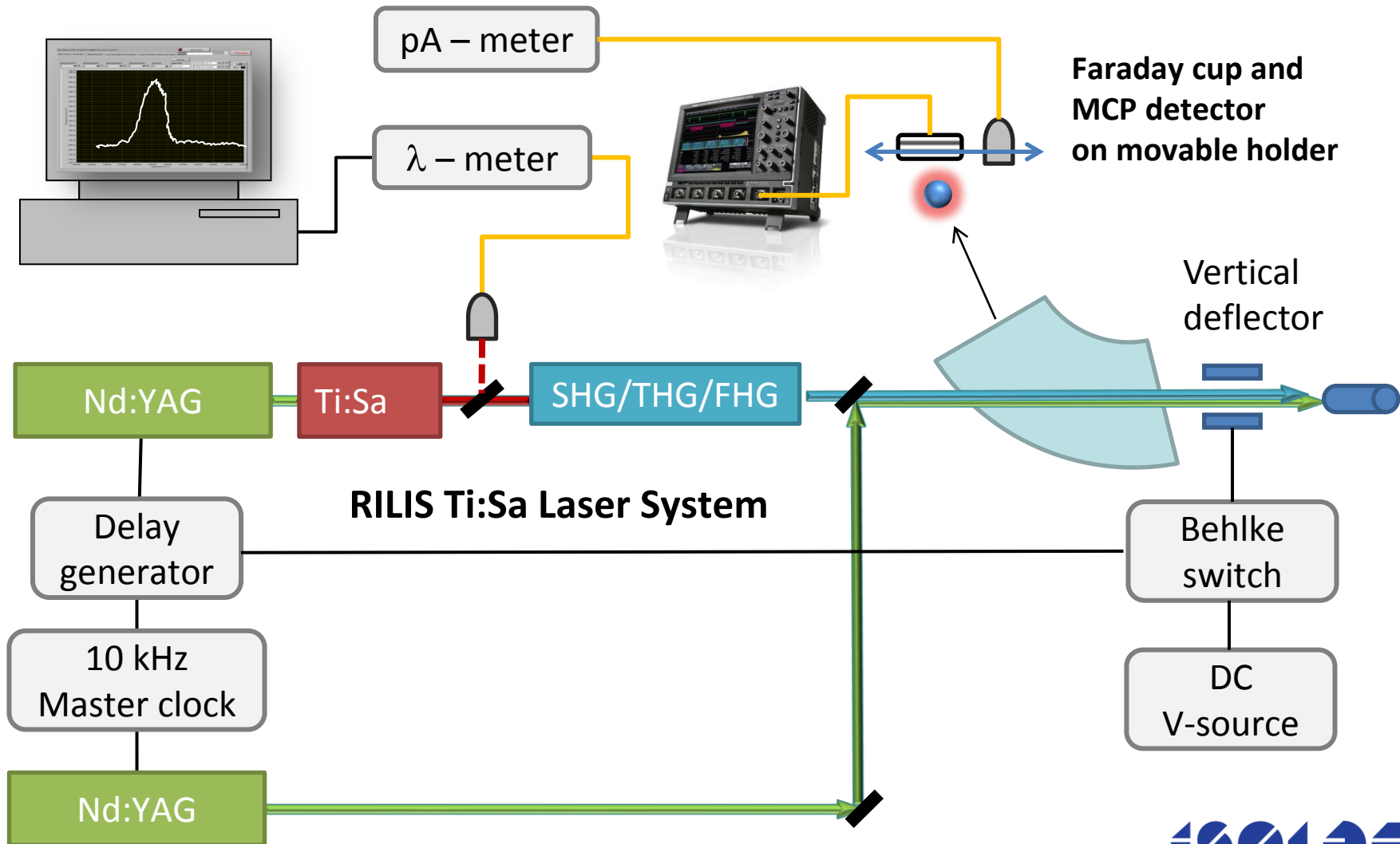
2. Re-wiring

ISCOOL will be re-wired to separate high and low voltage lines, in order to avoid discharges



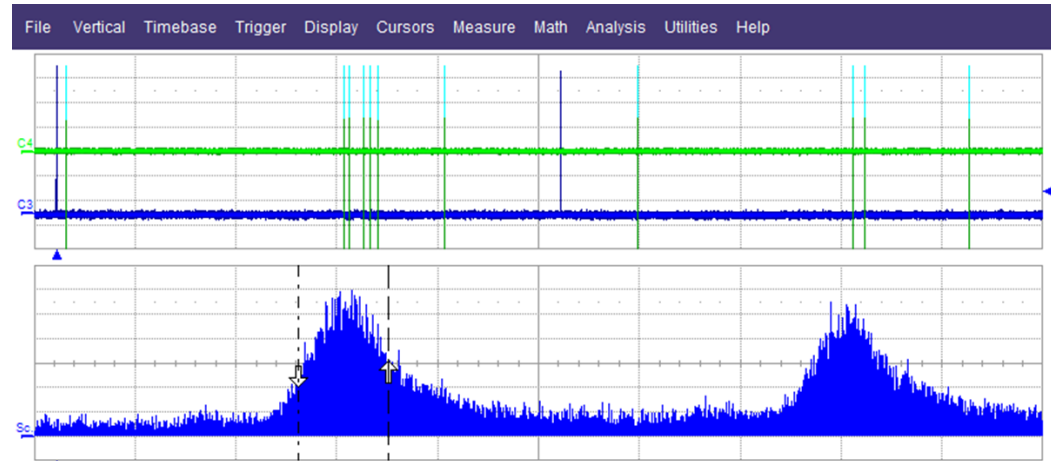
RILIS at off-line mass separator

A simplified laser system is installed at the off-line ISOLDE mass separator – capable to produce Ga ion beams for testing RILIS cavities



Time structure of laser ionized beam

MCP measurement,
3 pA beam scattered on
the Faraday cup



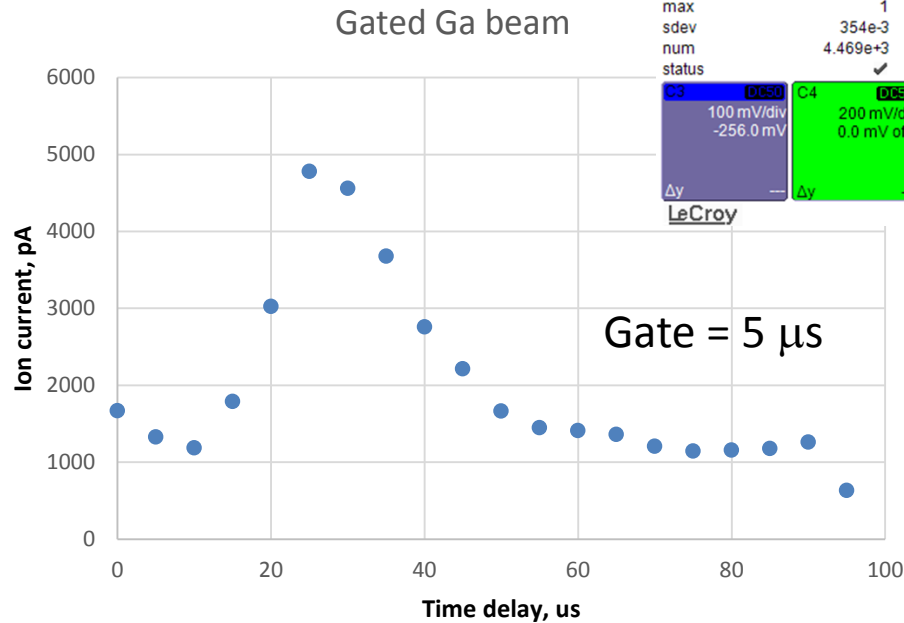
Measure	P1:edge@lv(...)	P2:area(C4)	P3:area(C4)	P4:widn(F1)	P5:widn(F1)	P6:hmean(F2)	P7:hmean(F2)	P8:x@min(C4)
value	1							
mean		853e-3						
min		0						
max		1						
sdev		354e-3						
num		4.469e+3						
status		✓						

C3	D050	C4	D050	ScanHisto
100 mV/div		200 mV/div		19.0 #/div
-256.0 mV		0.0 mV ofst		20.0 μs/div
Δy		Δy		55.028 k#
				19 #

LeCroy

Timebase	-95.6 μs	Trigger	C3 DC
	20.0 μs/div	Stop	304 mV
1.00 MS	5.0 GS/s	Edge	Positive
X1=	48.0 μs	ΔX=	17.9 μs
X2=	65.9 μs	1/ΔX=	55.9 kHz

6/6/2013 2:43:06 PM



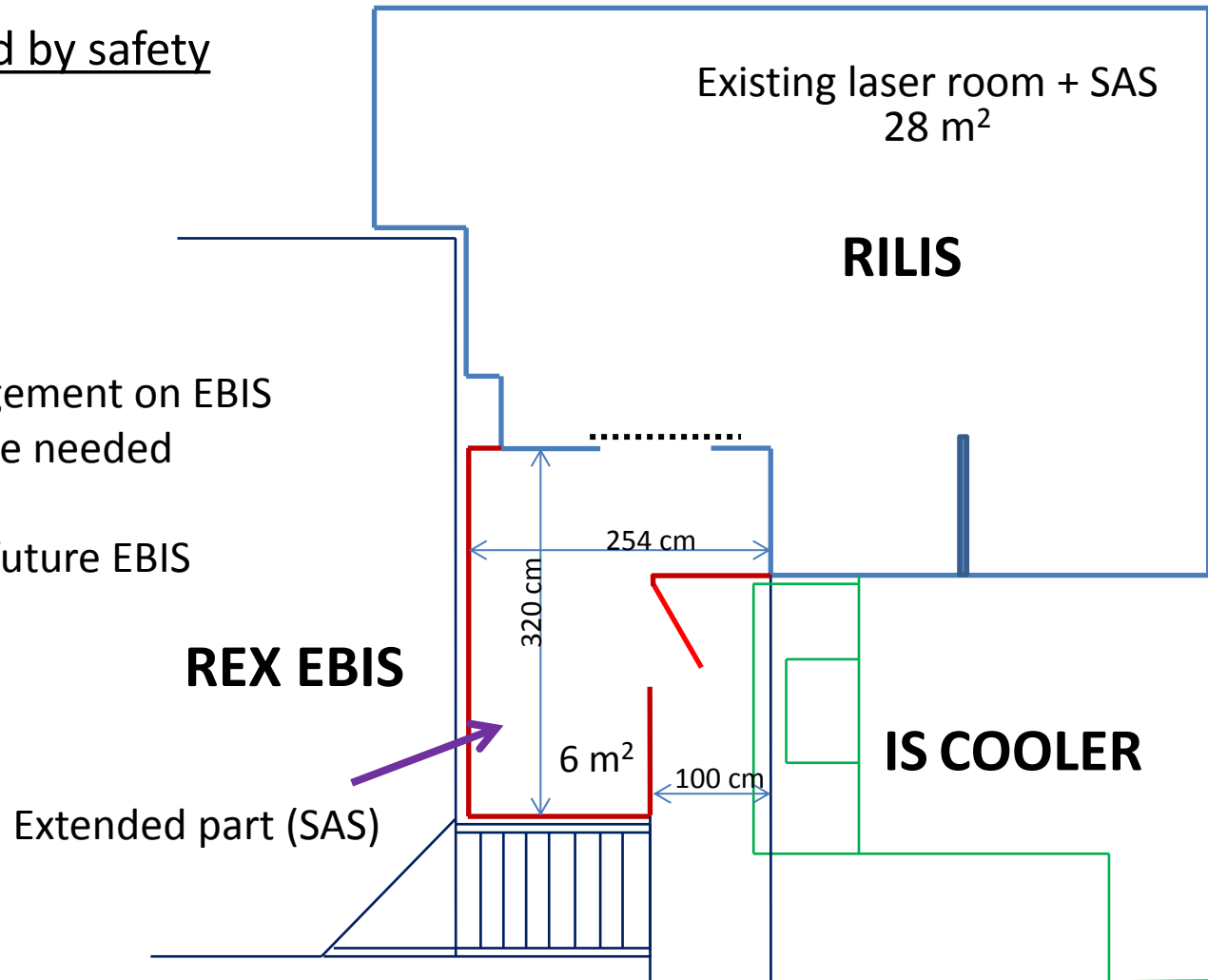
FC measurement,
42 nA beam sliced by
5 μs gate

RILIS room extension

Required by safety

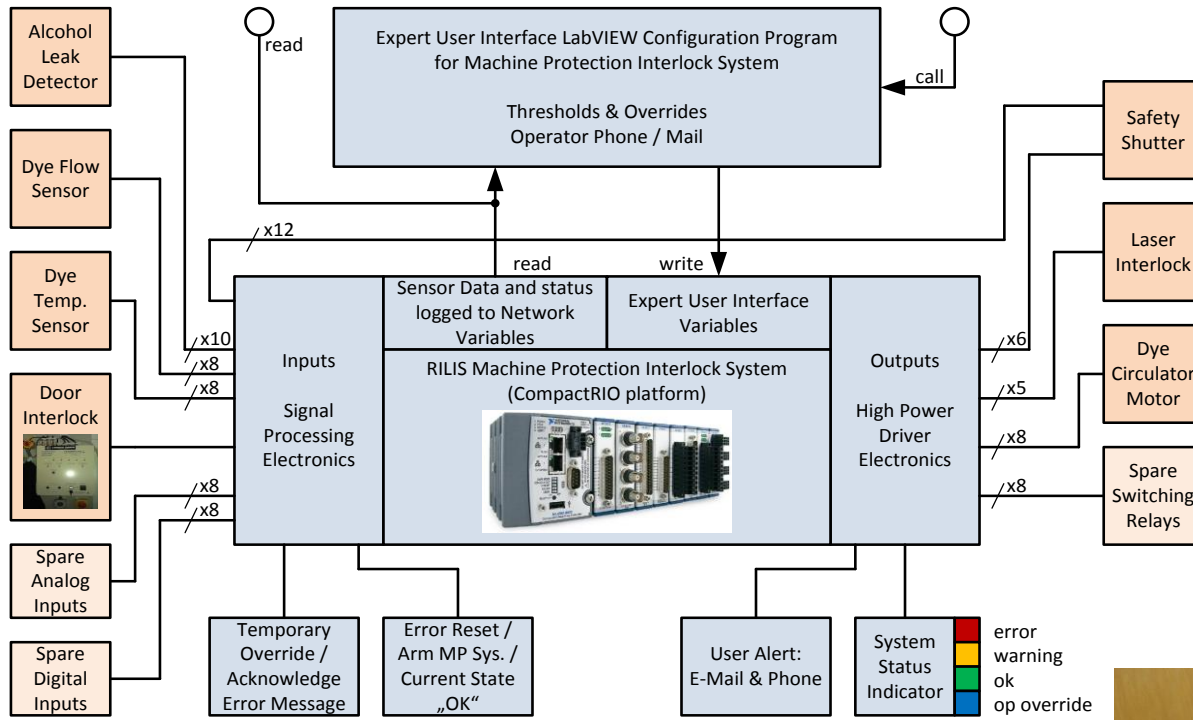
Side effects:

- Some rearrangement on EBIS platform will be needed
- Limitation on future EBIS extension

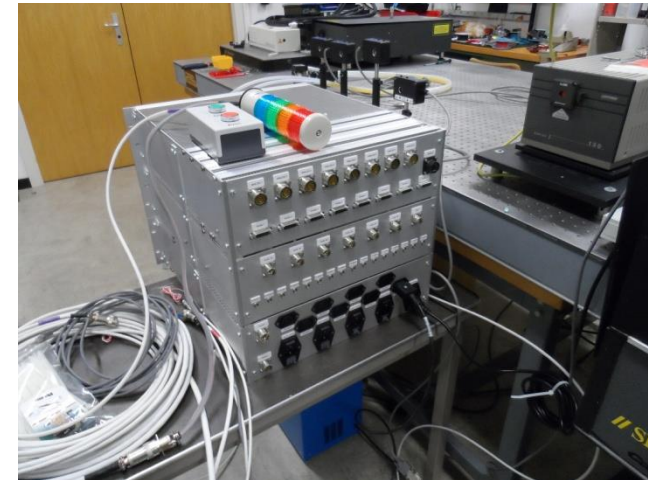


Work by external contractor is planned for July

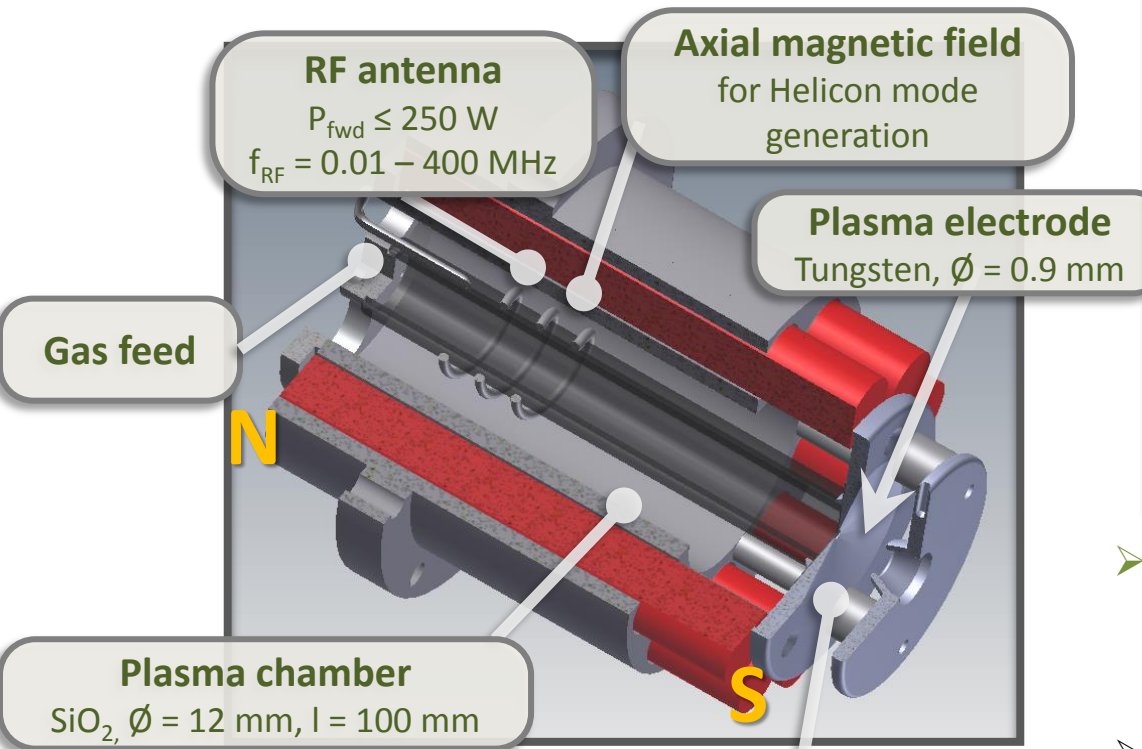
RILIS machine protection



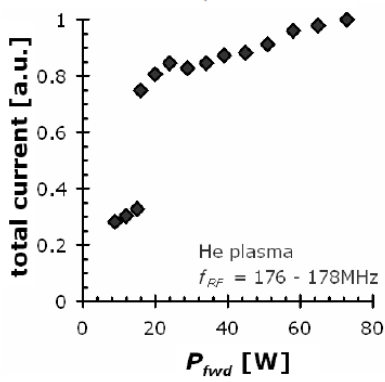
- Hardware to control multiple laser interlocks and shutters are assembled by STI-ECE
- Testing has started



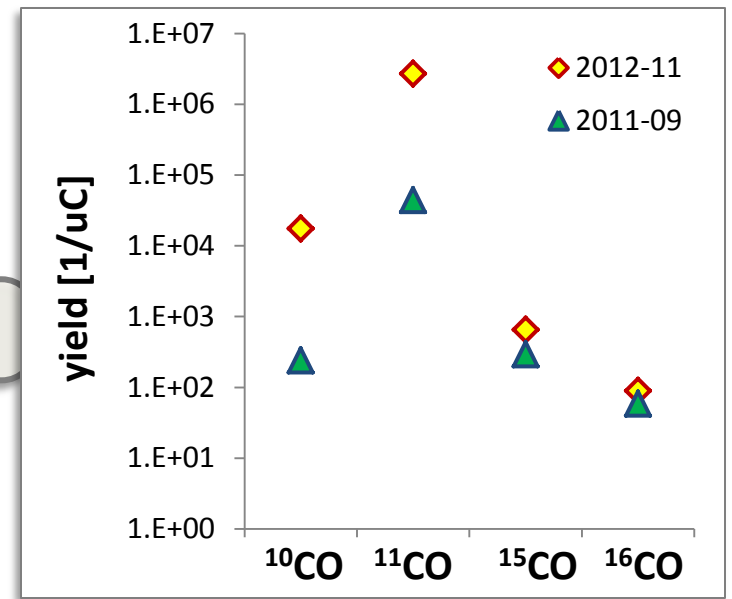
Helicon source



Two-stage extraction system
 for improved ion beam quality
 $U_{\text{el}} = 0 - 3 \text{ kV}$



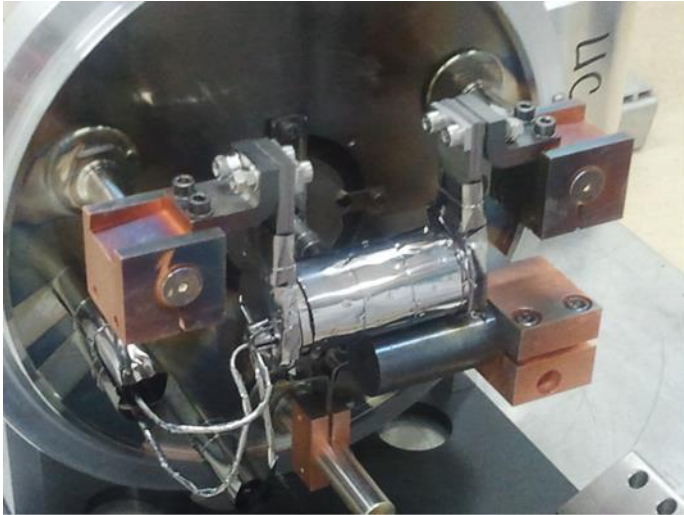
Capacitive → inductive transition



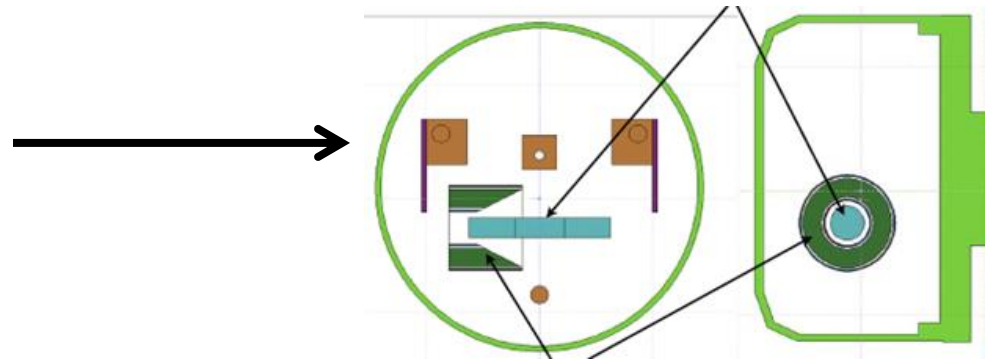
- Developed by the TISD group for the production of CO^+ and CO_2^+ , N_2^+ , and noble gas beams;
 - First online operation **2011/09**, upgraded system tested **2012/11**;
 - Strong gain achieved on ^{10}CO and ^{11}CO ;
 - Measurements of short-lived carbon isotopes difficult due to instrumental issues.
- M. Kronberger et al., EMIS proc.**

Neutron converter – phase II

Concept: R. Luis et al, EPJ A 2012

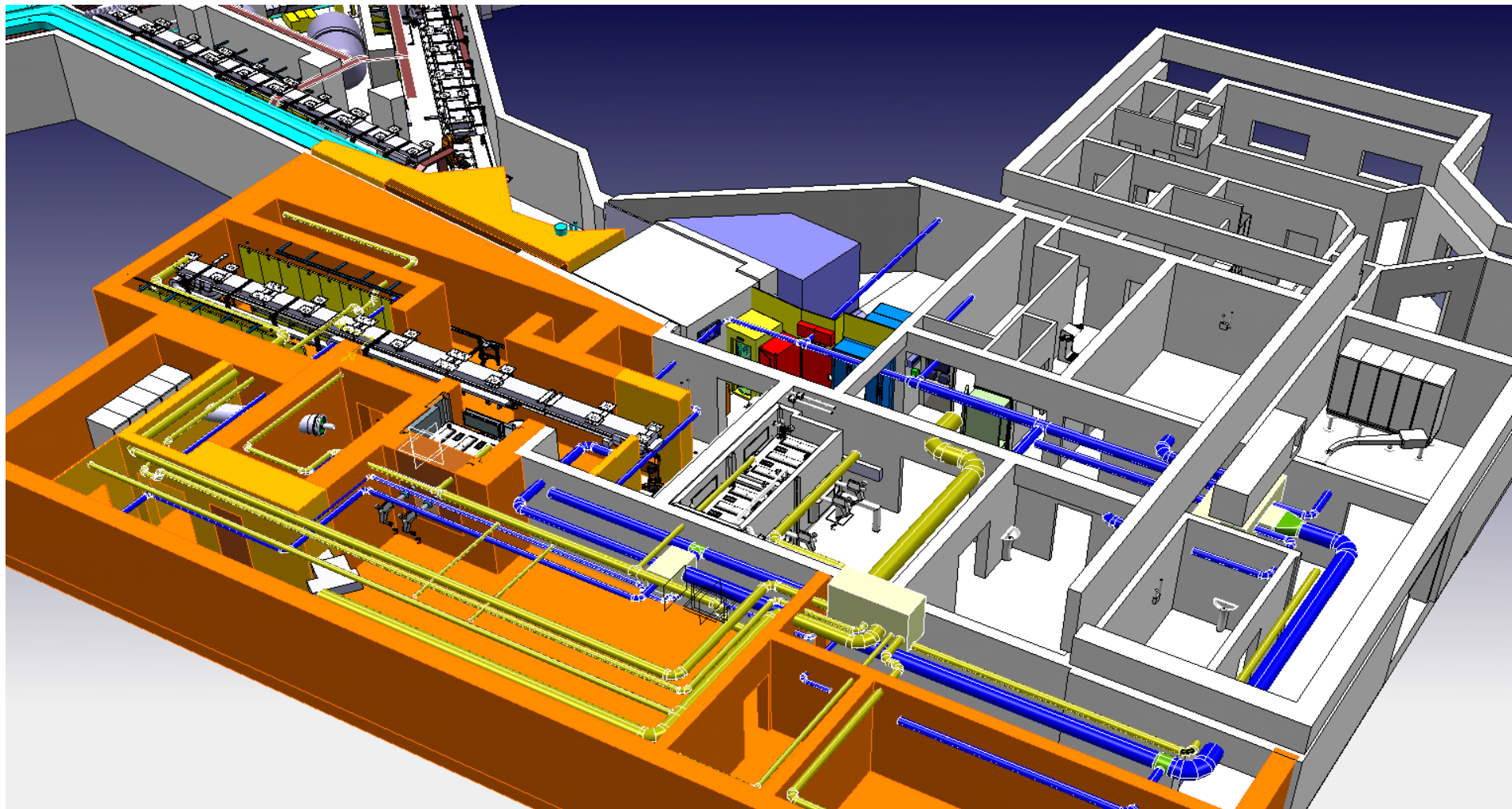


Phase I tested at ISOLDE
T. Mendonca et al.,
to be subm. to NIM B



Onboard for phase II:

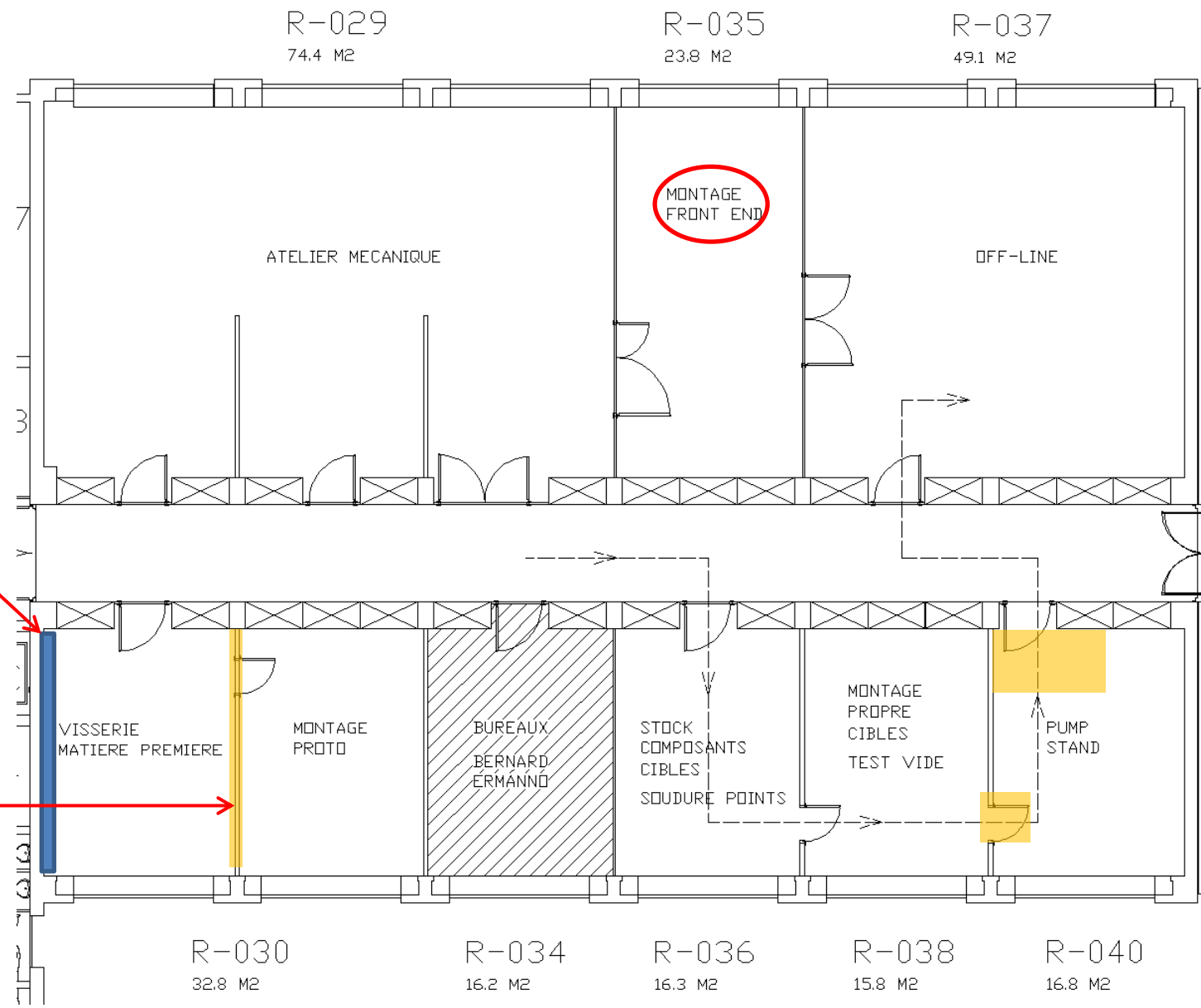
S. Cimmino et al.,
@ TRIUMF in 2014



*Catia 3D preliminary view:
by Vincent Barozier*

Favorable internal safety review end of June
Ground work to start beginning of July

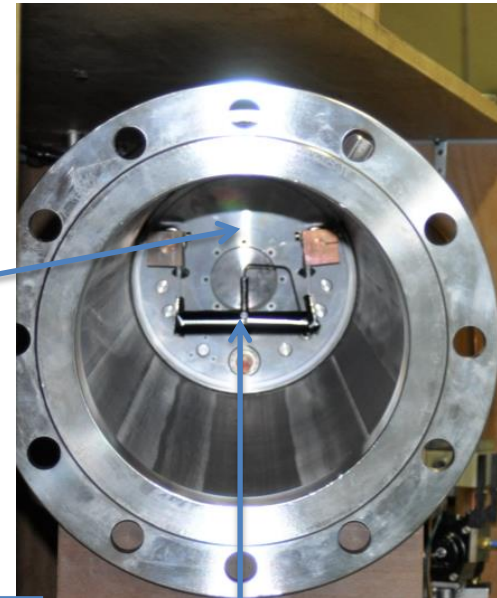
Labo 3-R modifications



Water leak test bench

- Objective: understand the consequences of a water leak in a hot target
- Water leak occurred on past but on cold target.
- Risk analysis on “pressure cooker” effect

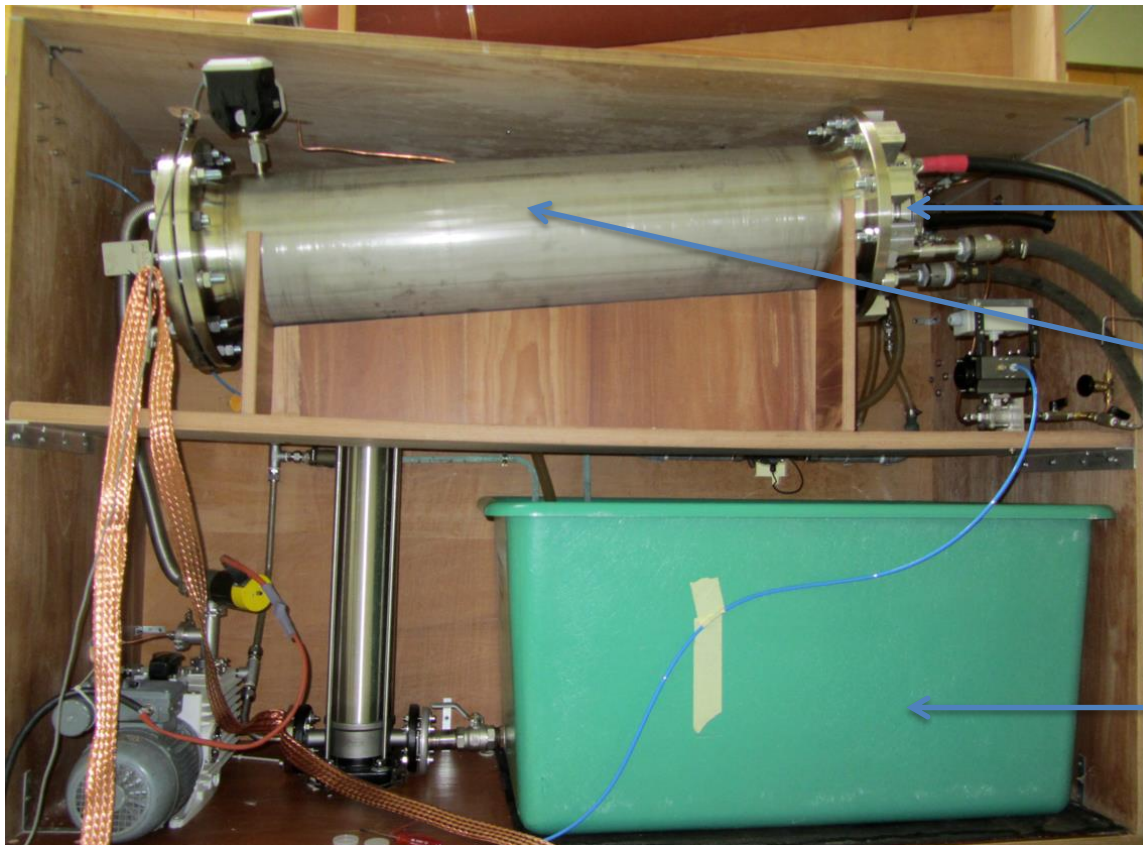
Water leak
on container



Target position

Front-end volume

Water cooling for
target

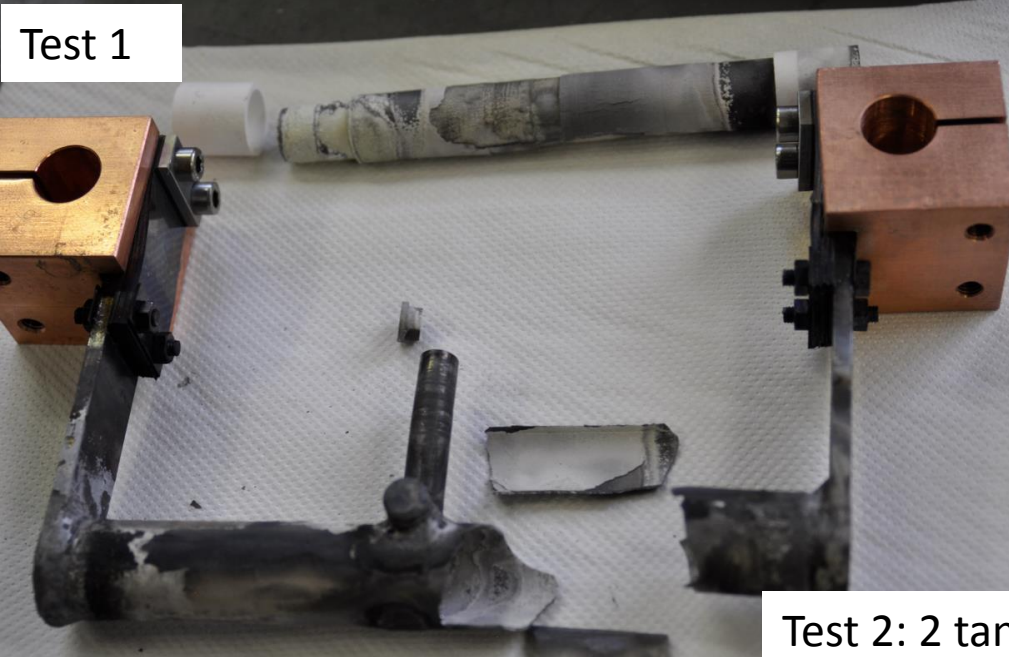


Water leak test bench

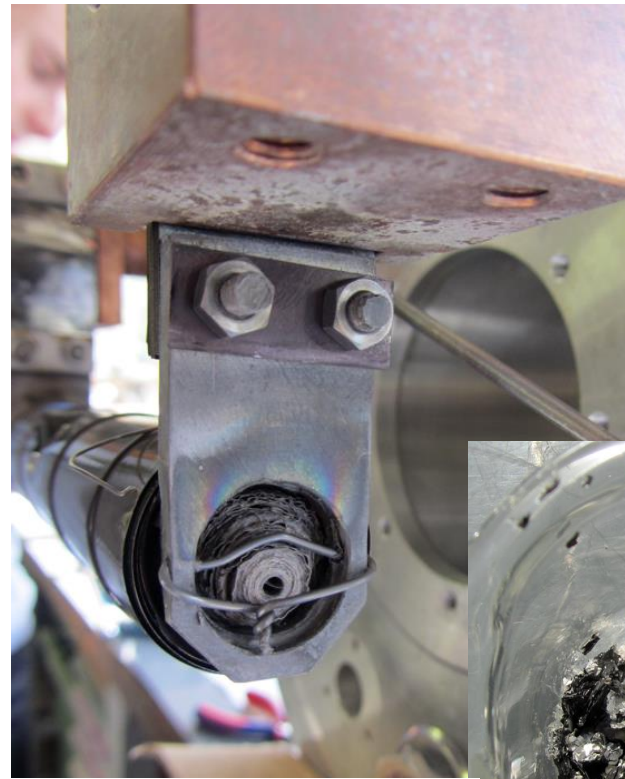
- Thermal shock breaks the container
- Water reacts with Tantalum (container and target material)
 - $2 \text{ Ta} + 5 \text{ H}_2\text{O} = \text{Ta}_2\text{O}_5 + 5 \text{ H}_2$
- Production of H_2 proportional to exchange surface between tantalum and water
- Water condenses on cold surfaces of Front-end
- Pressure increase due to the production of H_2 .

→ Objective: remove water circuit from target

Test 1



$\text{H}_2 < 1$ liter



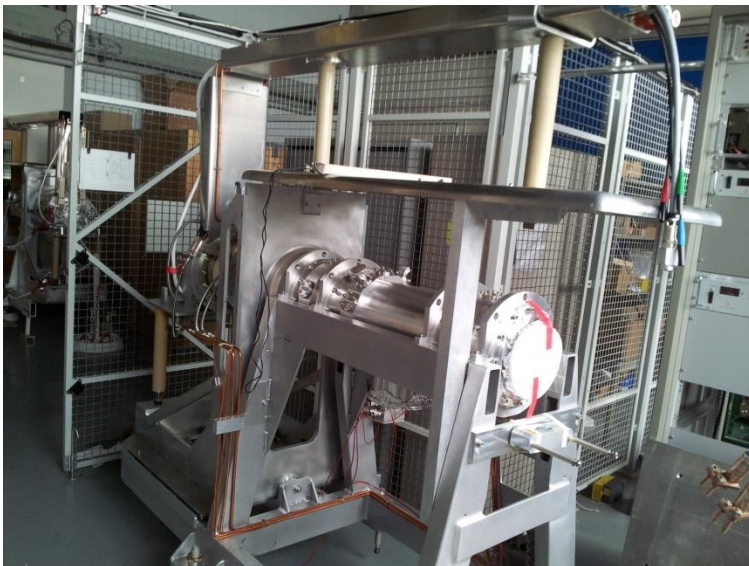
Test 2: 2 tantalum rolls → $\text{H}_2 > 5\text{l}$
 Test 3: 8 tantalum rolls → $\text{H}_2 > 20\text{l}$

Design Study progress

- Ventilation
 - User requirement document under approval
 - Covers all aspects of ventilation requirements
 - Compatible with Medicis Project
- Double extraction electrode system
 - Under test on the off-line separator
- New RFQ Cooler
 - All parts ordered and assembly started
- HT
 - Belke switch test stand operational

New FE's under construction

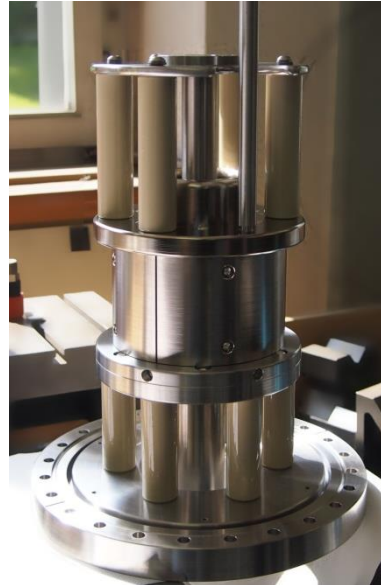
- One to be used as a test stand for the design study
 - To validate RFQ operation
- The other as a spare/off-line FE for UC target testing in B. 179 (Class A labs)



EBIS upgrade

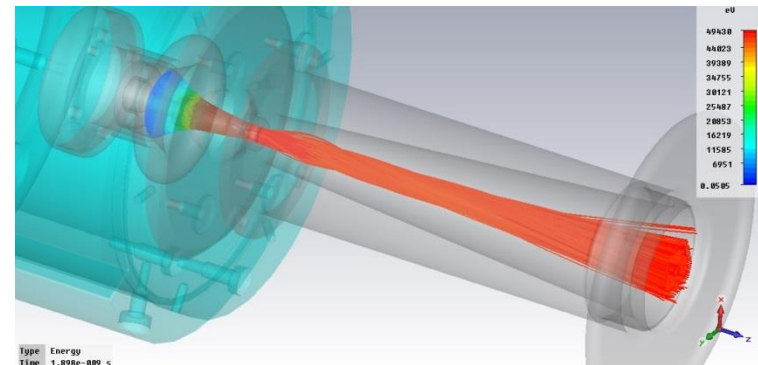
The electron gun is the most critical item for the charge breeder upgrade

Building up 3D e-beam simulation experience



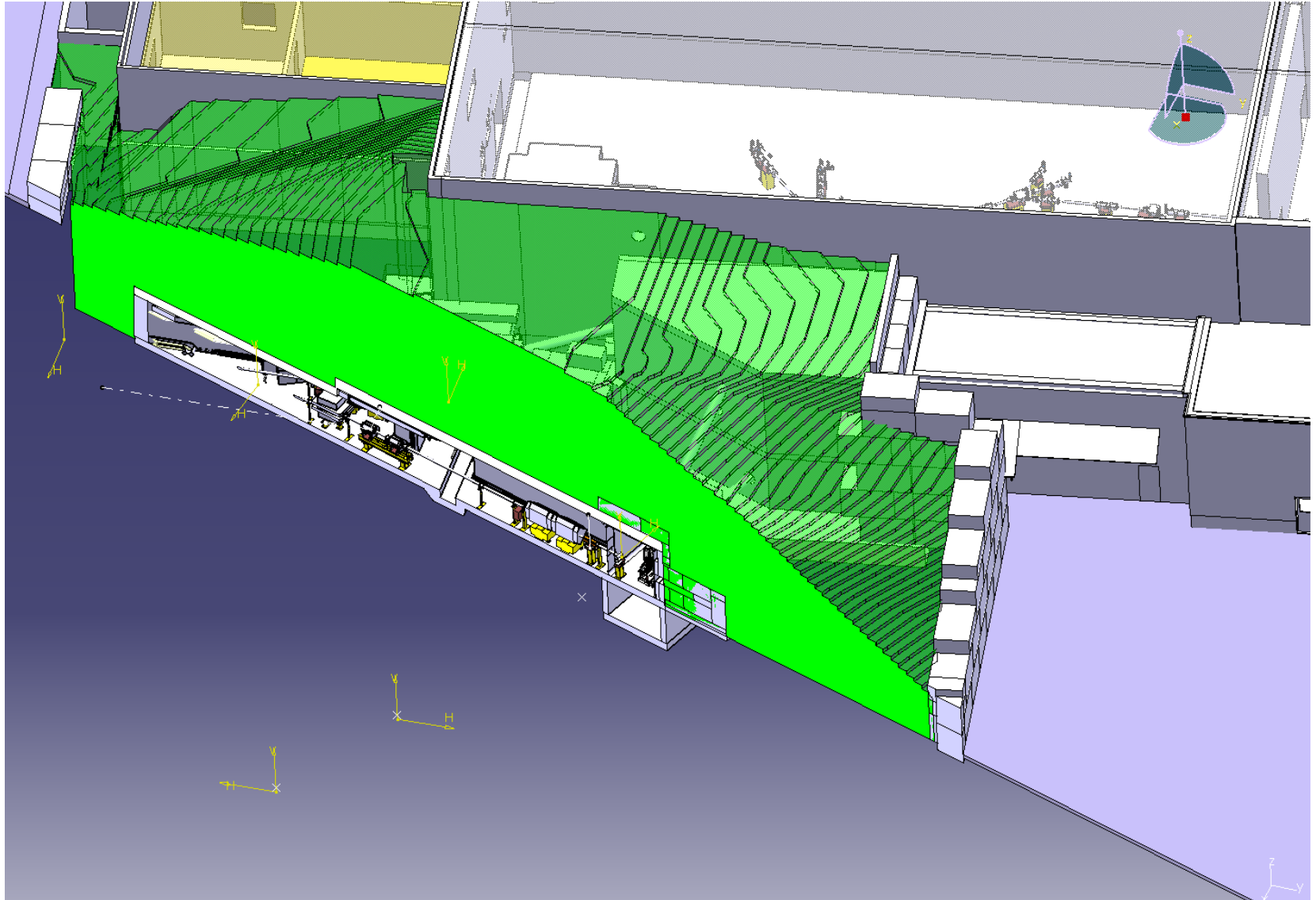
Left. BNL EBIS test stand. Suitable for HEC² tests and operational.
Right. HEC² electron gun pre-assembled at CERN.

- * High Energy Current Compression (HEC²) gun produced at CERN
- * First gun tests foreseen at BNL test EBIS summer 2013
- * TSR@iSOLDE integration study on-going
- * CERN groups in the process of giving feedback
- * Report to be submitted beginning of September



TSR@ISOLDE

HRS Beam Dump



Beam Dumps

- Following a thermo-mechanical analysis:
 - The present situation seems critical for the HRS dump
 - An upgrade of the beam intensity at 1.4 GeV would lead to a failure of the material if no active cooling is added
 - An upgrade of the beam intensity and energy to 2.0 GeV would lead to a failure of the material
- But it gets worse...

Soil Samples



Soil samples: results

Echantillon	Nuclide	A Total (Bq/g)	A Total (Bq/kg)	LE (Bq/kg)	Multiple LE
S10 Profondeur carotte 4.55 - 4.70 m Masse échantillon 1.31 kg	Be-7	2.36E-01	2.36E+02	4.00E+05	5.90E-04
	Na-22	6.81E-01	6.81E+02	3.00E+03	2.27E-01
	Sc-46	4.27E-02	4.27E+01	7.00E+03	6.10E-03
	Mn-54	2.90E-01	2.90E+02	1.00E+04	2.90E-02
	Co-60	4.25E-02	4.25E+01	1.00E+03	4.25E-02
	Y-88	1.75E-03	1.75E+00	8.00E+03	2.19E-04
	Cs-134	9.79E-03	9.79E+00	5.00E+02	1.96E-02
	Eu-152	4.50E-02	4.50E+01	7.00E+03	6.43E-03
	Somme				3.31E-01
BTY IS3 Profondeur carotte 4.95 - 5.10 m Masse échantillon 1.535 kg	Be-7	1.95E-01	1.95E+02	4.00E+05	4.88E-04
	Na-22	5.78E-01	5.78E+02	3.00E+03	1.93E-01
	Sc-46	3.47E-02	3.47E+01	7.00E+03	4.96E-03
	Mn-54	2.74E-01	2.74E+02	1.00E+04	2.74E-02
	Co-57	3.81E-03	3.81E+00	5.00E+04	7.62E-05
	Co-60	3.94E-02	3.94E+01	1.00E+03	3.94E-02
	Y-88	1.61E-03	1.61E+00	8.00E+03	2.01E-04
	Cs-134	8.68E-03	8.68E+00	5.00E+02	1.74E-02
Eu-152	3.88E-02	3.88E+01	7.00E+03	5.54E-03	
	Somme				2.88E-01

Beam dumps: Status

- An endoscopy will be performed in the beginning of 2014.
- Based on the Booster beam dump design, a design for a water cooled copper block to be placed in front of the existing beam dump has been launched
- Fluka simulations on dose rates resulting from the above have been launched
 - Improvements include: size, collimators, further shielding
- Awaiting a reply from RP on their position concerning soil activation.

Thank you for your attention

- The HIE-ISOLDE workshop will be held on the **28th & 29th November 2013**