Семинар ОФВЭ ПИЯФ РАН

Эксперимент UA9 по кристаллической коллимации пучка SPS CERN

Ю.М.Иванов

Гатчина, 14 апреля 2009

В докладе использованы материалы 4th Crystal Channeling Workshop, 24-27 March 2009, CERN, Geneva (presentations of Yu.Ivanov, N.Mokhov, W.Scandale, M.Prest, E.Metral, R.Assmann)

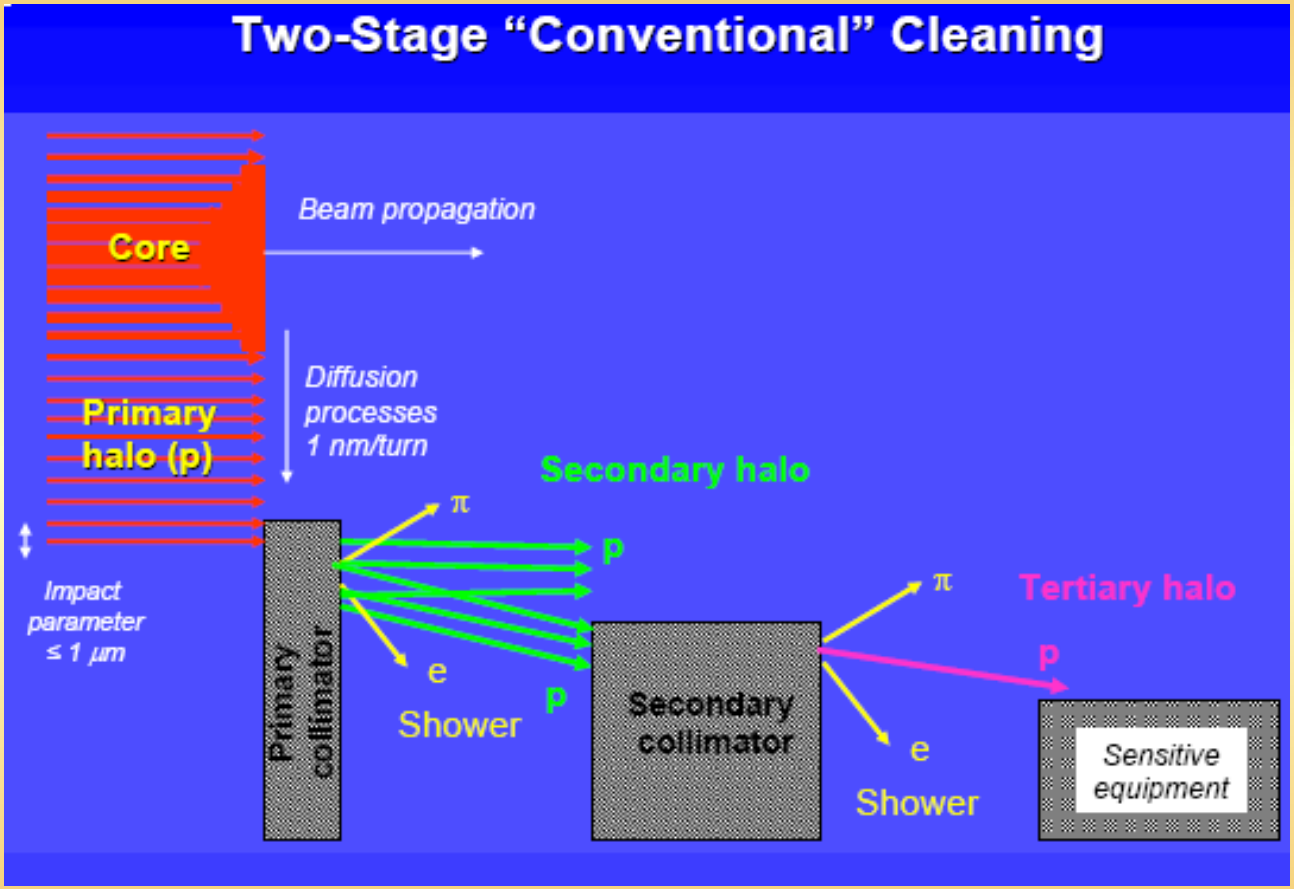
Мотивация исследований

LHC Project Report 918 (2006):

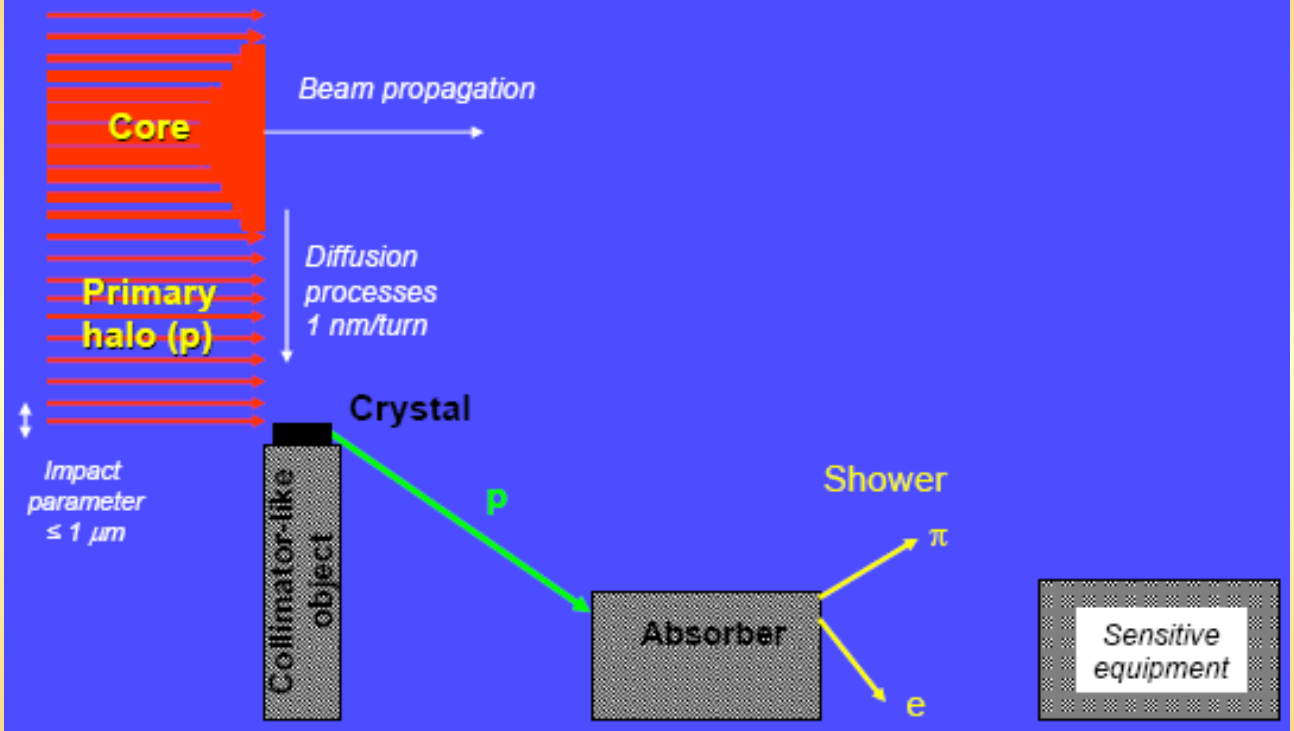
“The basic idea of crystal based collimation for the LHC is to use bent crystals for channelling and extracting the halo protons at 6 σ from the central beam orbit onto a special absorber where they hit with large offsets (impact parameters).

Due to large extraction angles and high impact parameters the extracted halo protons can in principle be efficiently removed from the LHC beam.

For example, a channelling and extraction efficiency of 90% would leave 10 times less load on the standard collimation system, enhancing its performance by a factor of 10”.


Two-Stage "Conventional" Cleaning
Core
Beam propagation
Primary halo (p)
Diffusion processes 1 nm/turn
Impact parameter ≤ 1 μm
Secondary halo
π
p
e
Shower
p
Primary collimator
Secondary collimator
π
Tertiary halo
p
e
Shower
Sensitive equipment

A possible crystal collimation scheme?



Primary halo directly extracted! No secondary and tertiary halos!?

R. Assmann

Введение: эксперименты в ИФВЭ, BNL, FNAL

Эксперимент в ИФВЭ по изучению многооборотного вывода протонного пучка из ускорителя У-70 с помощью короткого изогнутого монокристалла (1997-2001)

Письма в ЖЭТФ, том 67, вып.10, стр.741 - 745

ПЕРВЫЕ РЕЗУЛЬТАТЫ ЭКСПЕРИМЕНТОВ ПО ВЫСОКОЭФФЕКТИВНОМУ ВЫВОДУ ПРОТОНОВ ИЗ У-70 С ПОМОЩЬЮ МОНОКРИСТАЛЛА

А.Г.Афонин, В.М.Бирюков, В.А.Гаврилушкин, В.Н.Гресь, Б.А.Зеленов, В.И.Котов, В.А.Маишеев, А.В.Минченко, В.Н.Терехов, Е.Ф.Троянов, Ю.А.Чесноков[1)], М.Г.Гордеева, А.С.Денисов*, Ю.М.Иванов*, А.А.Петрунин*, В.В.Скоробогатов*, Б.А.Чунин**

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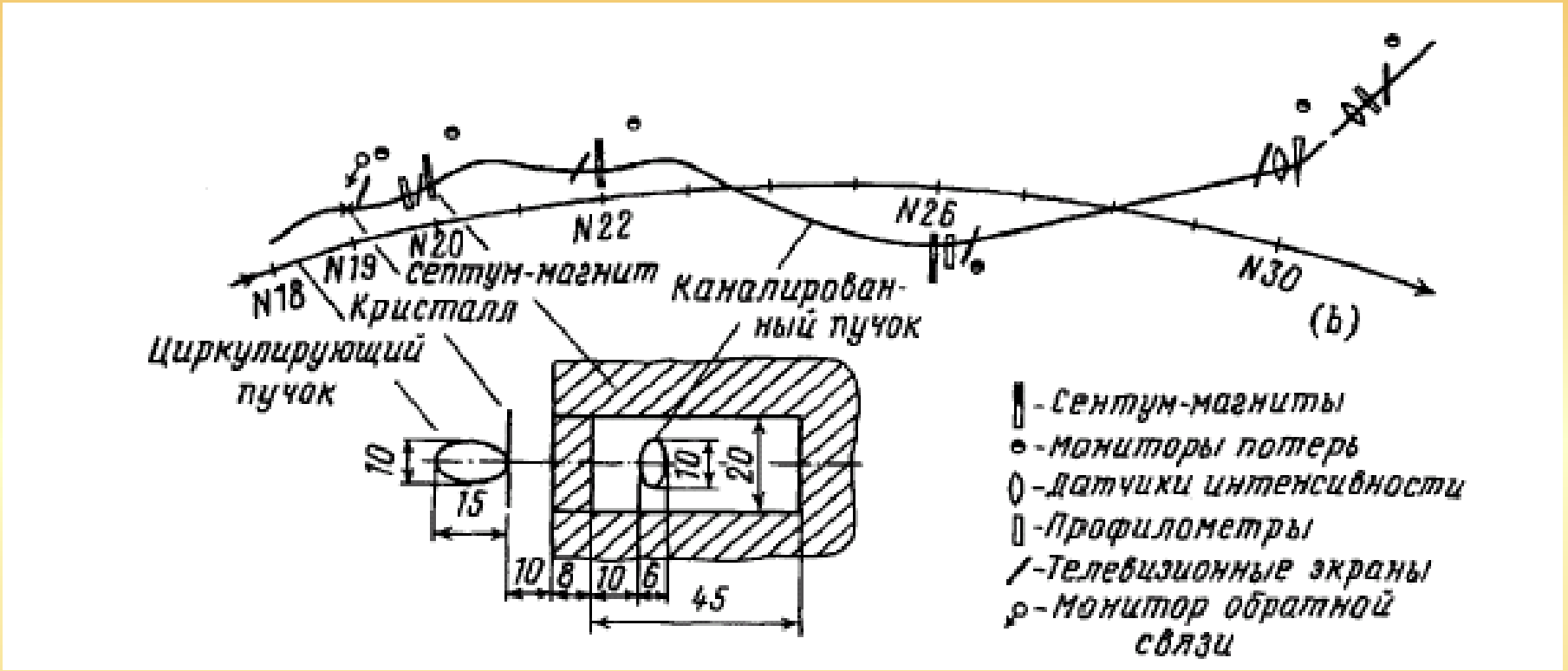
188350 Санкт-Петербург, Россия

Поступила в редакцию 13 апреля 1998 г.

Схема эксперимента на У-70

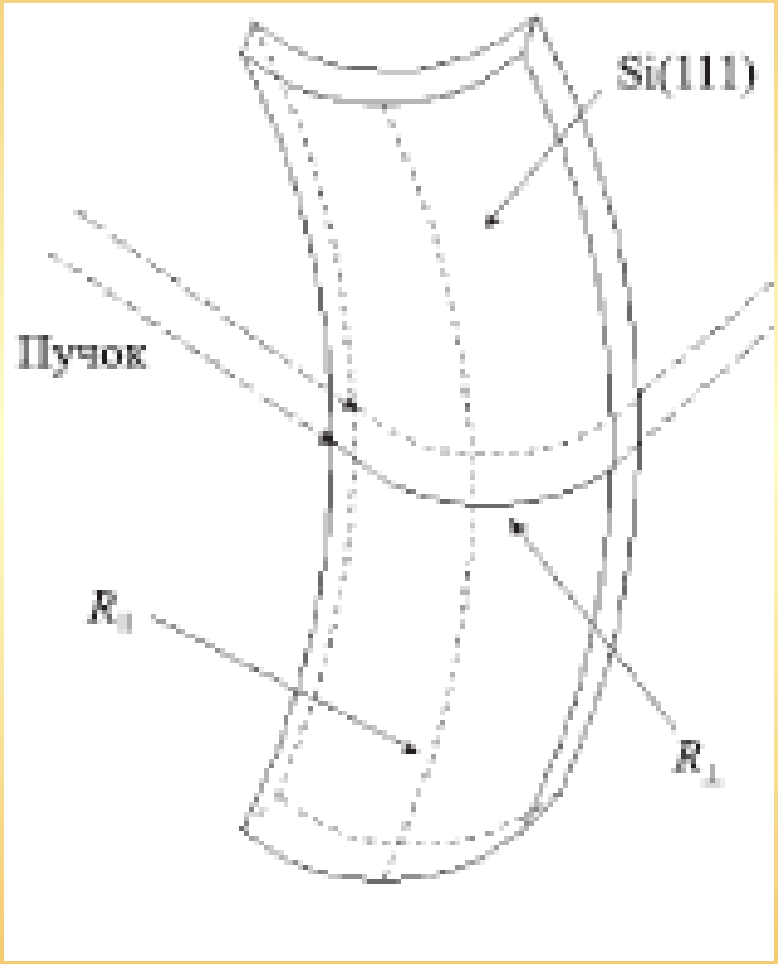


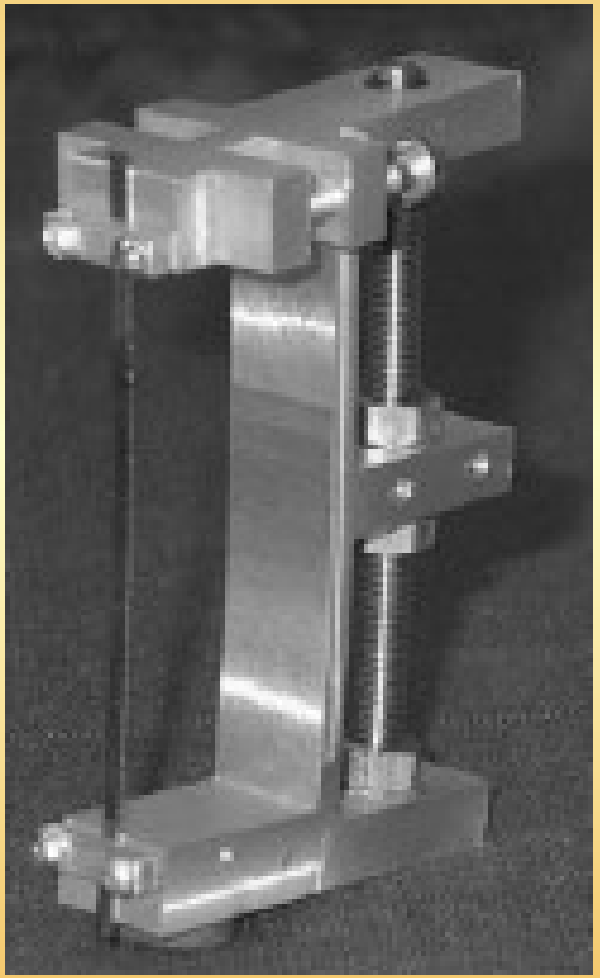
Малый угол изгиба кристалла (~ 0.5 – 1.0 мрад)

Малая длина кристалла вдоль протонного пучка

Многократность прохождения протонов через кристалл

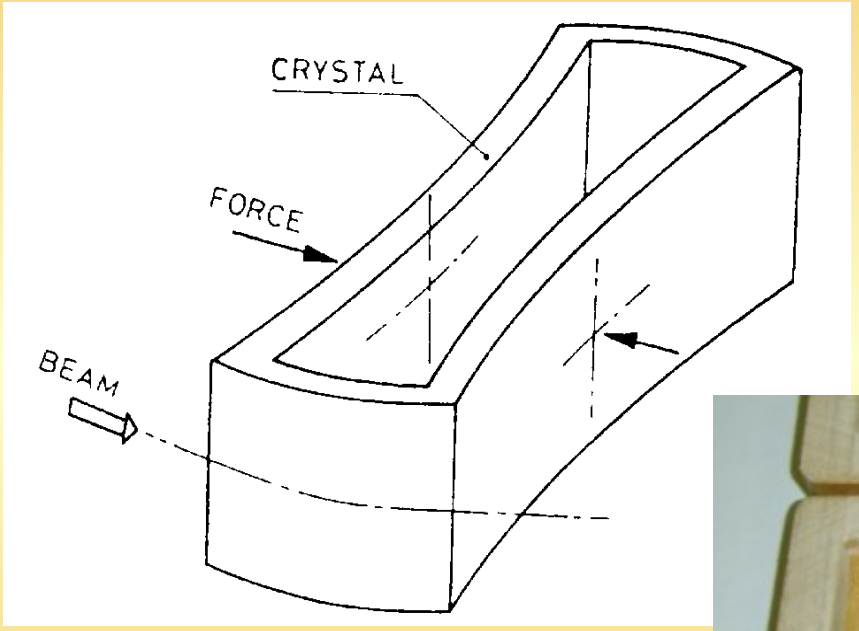
Кристаллы-полоски (ИФВЭ)





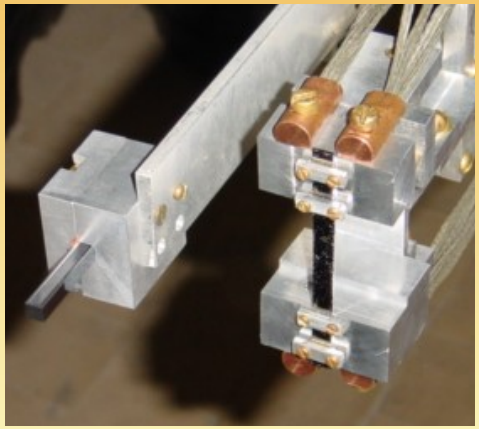
Размеры ≈ 3 x 1 x 60 mm3

О-кристаллы (ПИЯФ)



Размеры ≈ 5 x 5 x 50 mm3

Установка кристаллов в кольцо У-70



Полученные результаты

Длина кристаллов по пучку **2-7 mm**

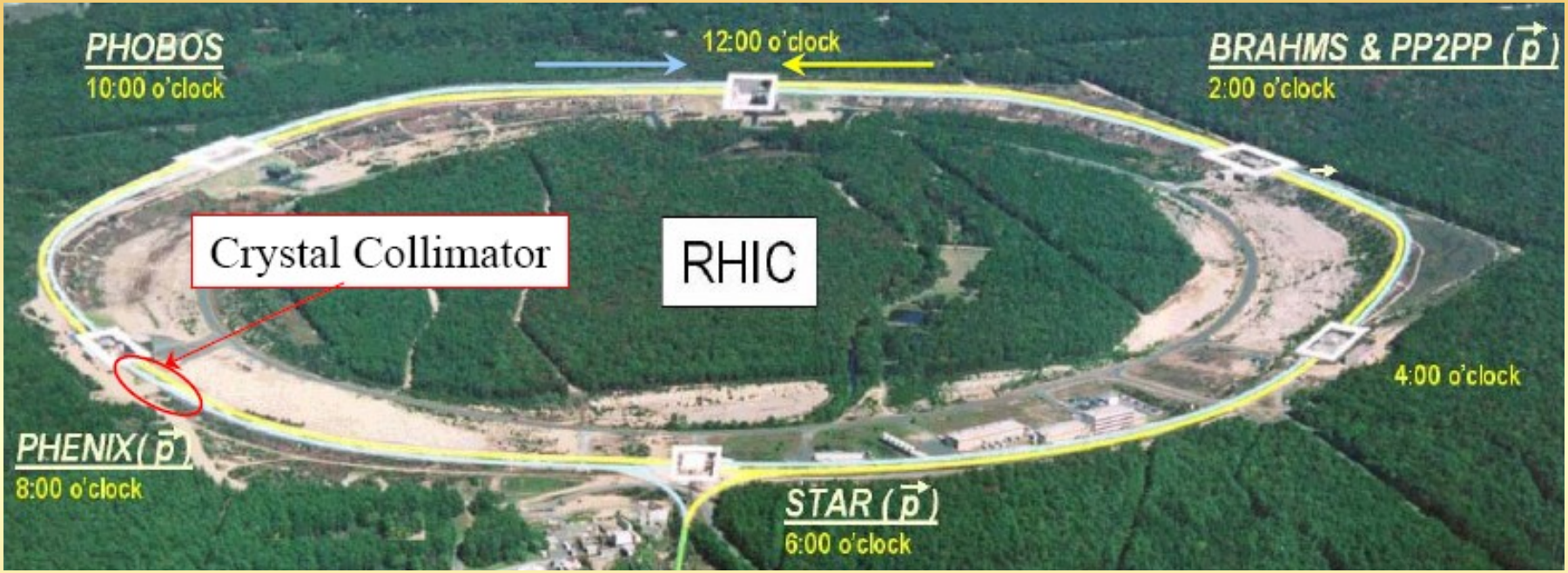
Эффективность вывода **20-85%**

Интенсивность выведенного пучка **~1x10^{12}**

Радиационная стойкость **~10^{20}**

(продолжает работать с эффективностью ~ 40%)

Crystal collimation at RHIC (BNL-IHEP, 2001-2003)



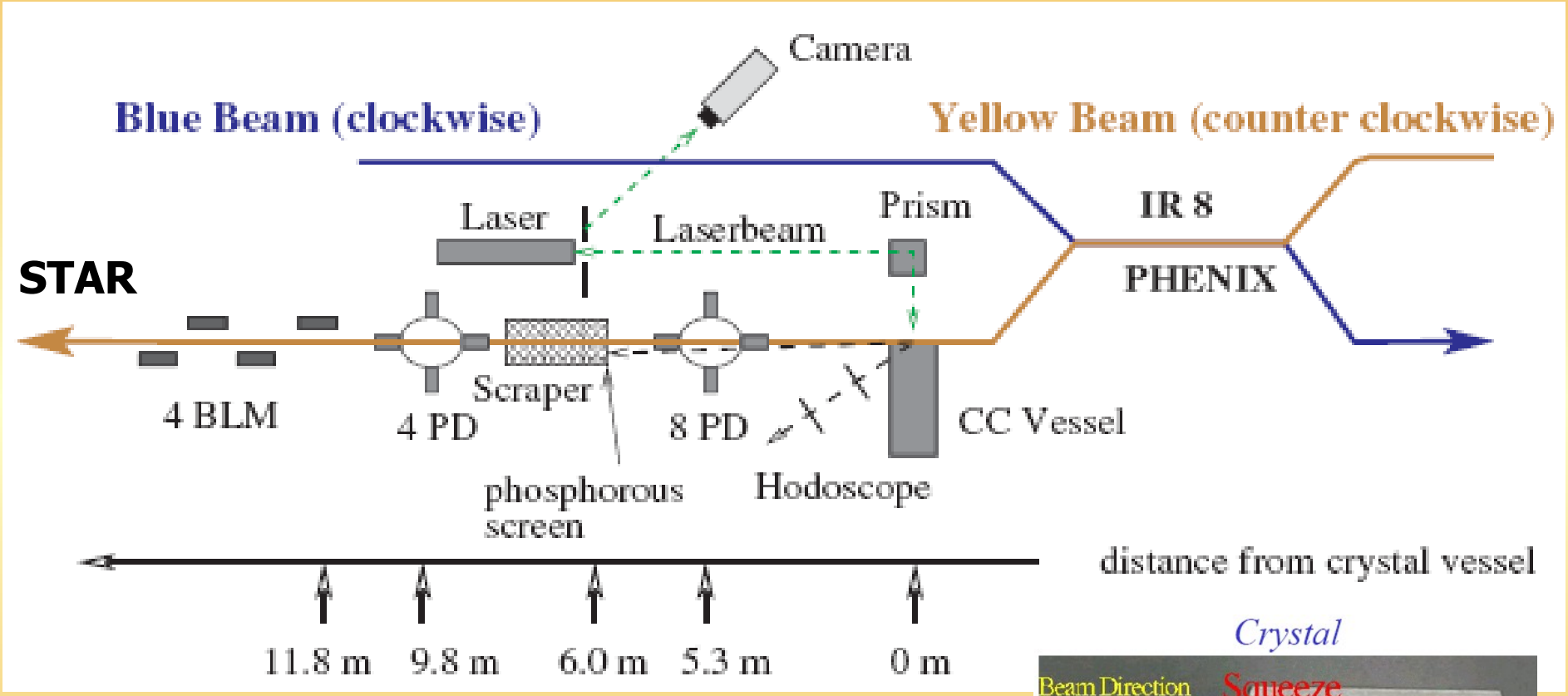
PHYSICAL REVIEW SPECIAL TOPICS - ACCELERATORS AND BEAMS 9, 013501 (2006)

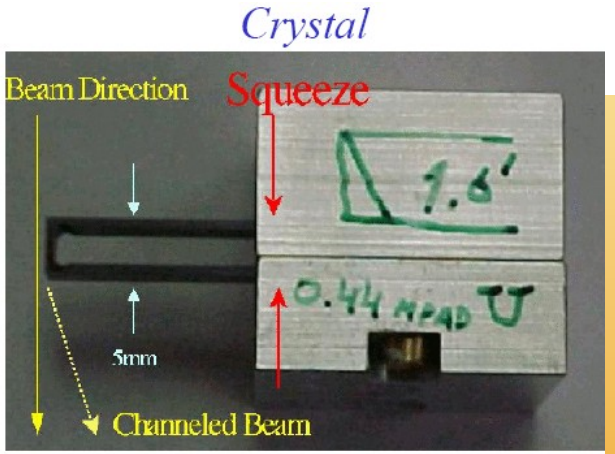
Results of bent crystal channeling and collimation at the Relativistic Heavy Ion Collider

R. P. Fliller III,[1,*] A. Drees,[2] D. Gassner,[2] L. Hammons,[2] G. McIntyre,[2] S. Peggs,[2] D. Trbojevic,[2] V. Biryukov,[3] Y. Chesnokov,[3] and V. Terekhov[3]

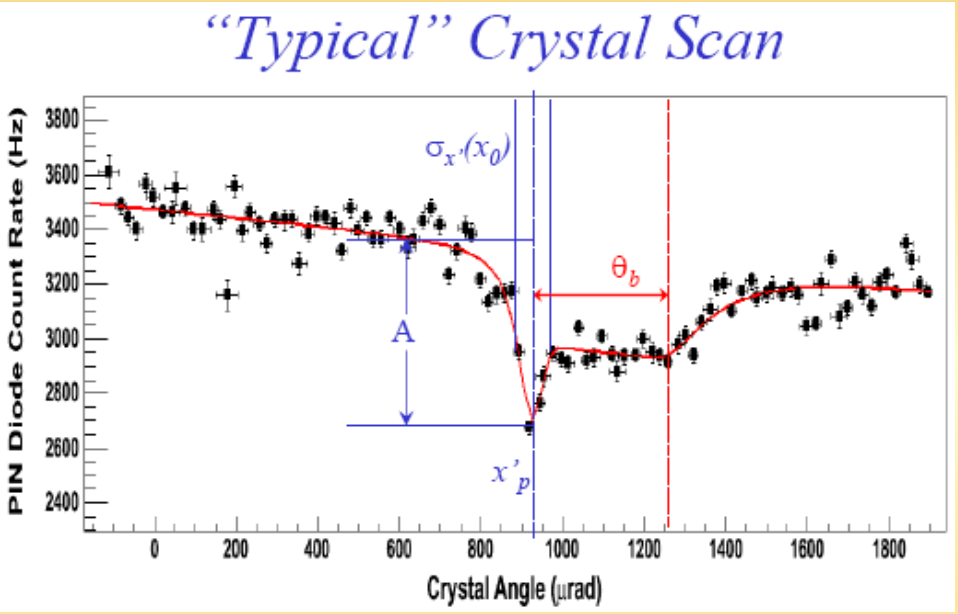
[1]*Department of Physics and Astronomy, University of Stony Brook, Stony Brook, New York, 11794, USA*
[2]*Brookhaven National Laboratory, Upton, New York 11973, USA*
[3]*Institute for High Energy Physics, 142281 Protvino, Russia*
(Received 16 September 2005; published 20 January 2006)

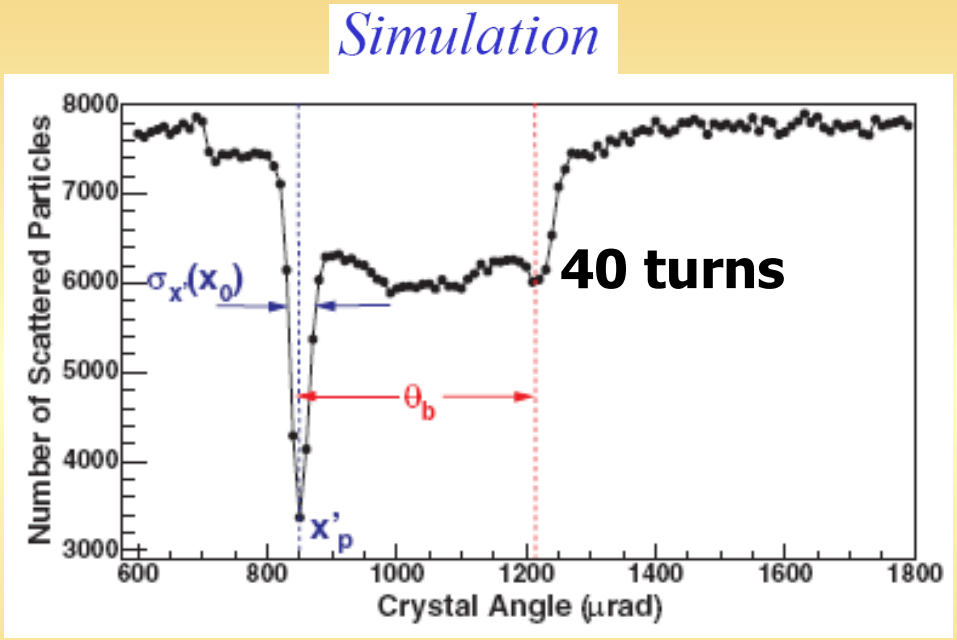
Crystal collimation at RHIC





Crystal collimation at RHIC

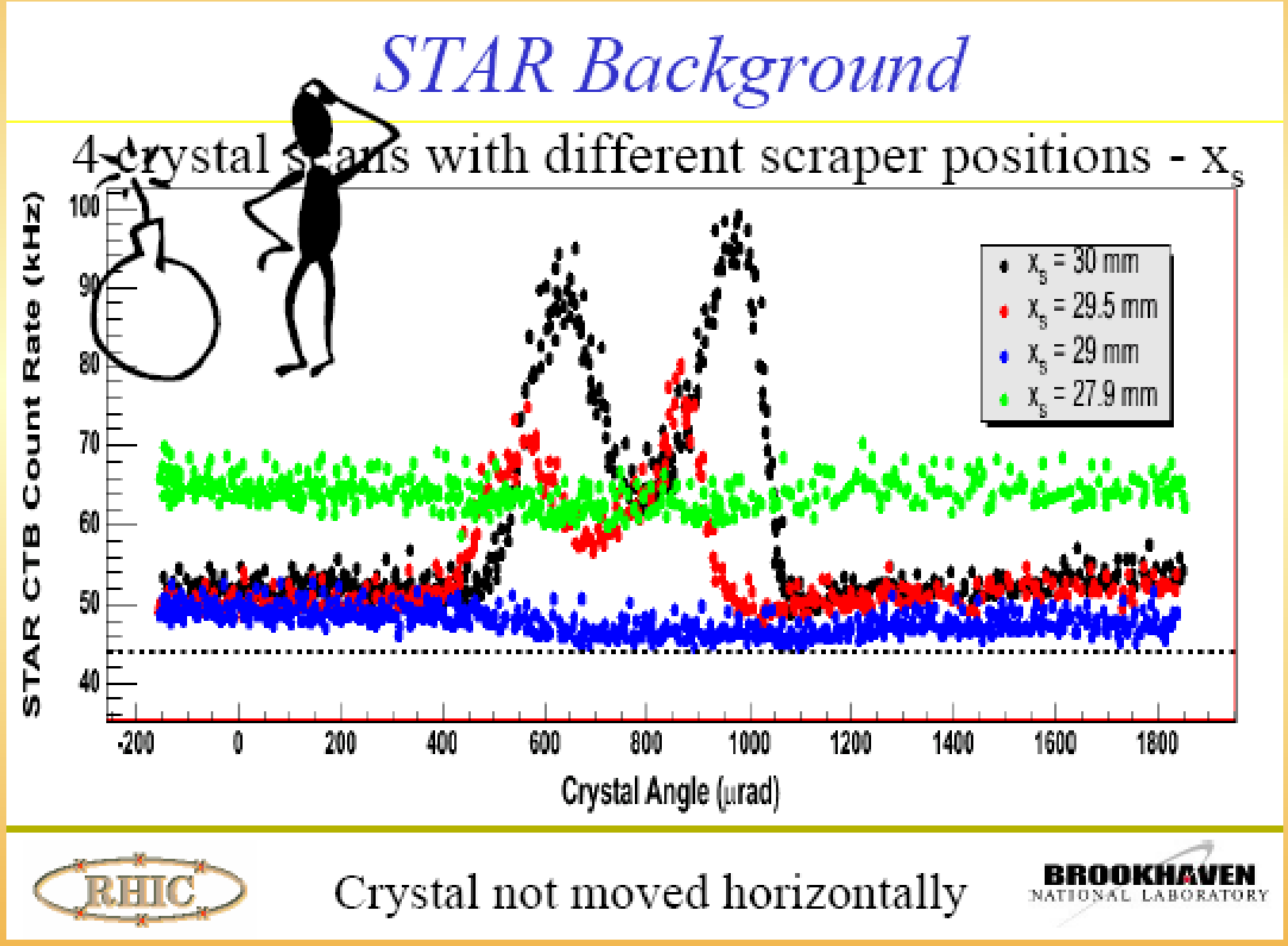




"Volume capture occurs when the crystal angle is between 900 and 1200 μrad. At these angles, the particles are not aligned to the planes upon entering the crystal, but can scatter into the planes after traversing some distance in the crystal". Phys.Rev.ST, 9, 013501 (2006)

Crystal collimation at RHIC

(slide from report of A. Drees to CC-2005 at CERN, March 7-8, 2005)



Crystal collimation at RHIC

(slide from report of A.Drees to CC-2005 at CERN, March 7-8, 2005)

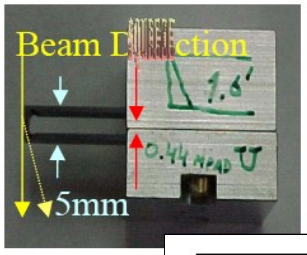
Crystal Collimation Results

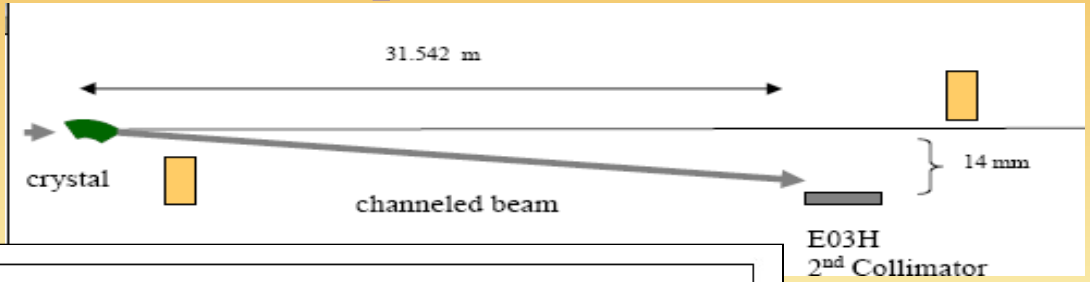
- Crystal can cause background in experiments.
- Scraper position very important.
- Because of low channeling efficiency, crystal collimation was not successful.
- **Scraper alone collimated the best.**
- Crystal Collimator removed from RHIC. Traditional two stage collimation system installed for FY2004 run.

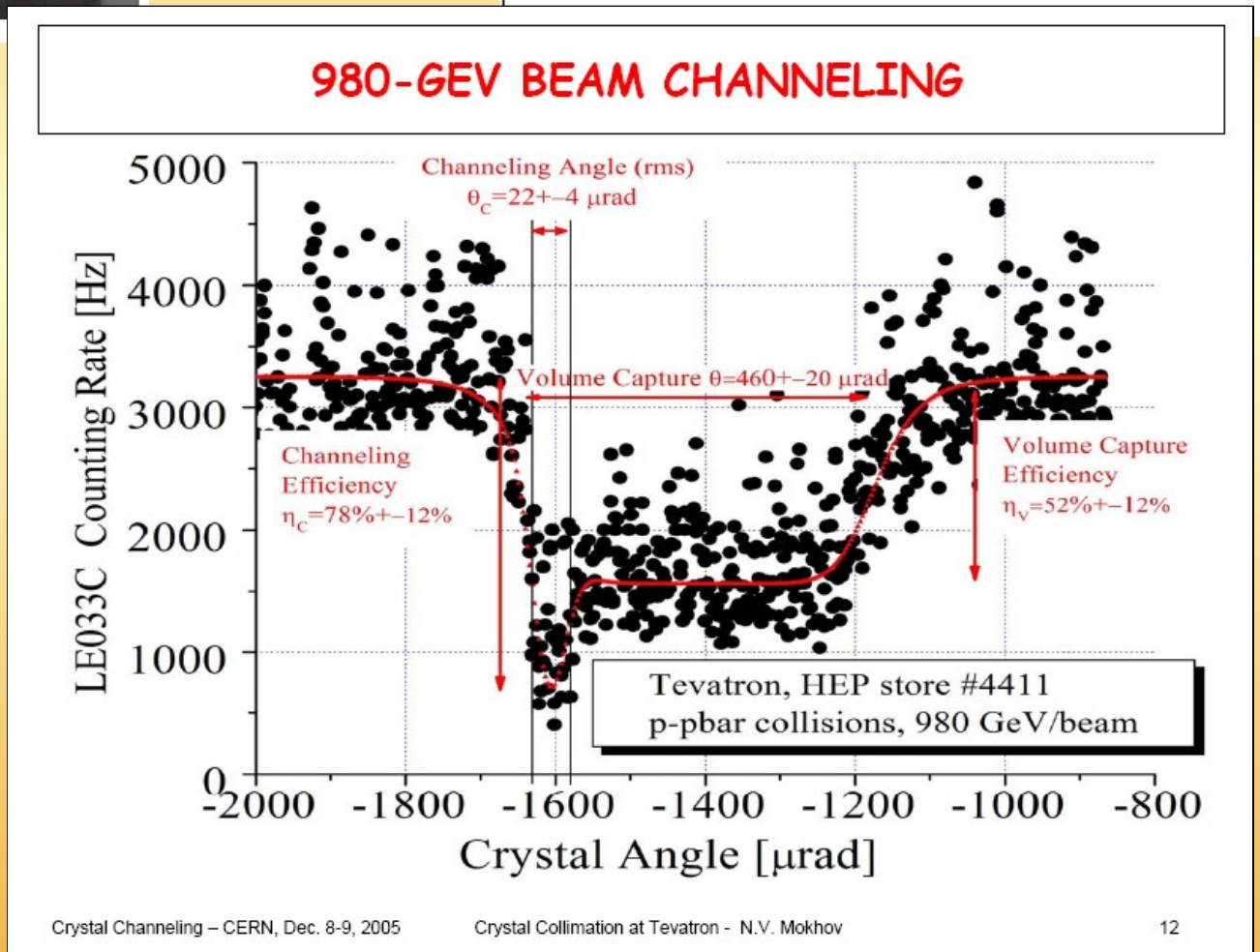
RHIC

BROOKHAVEN NATIONAL LABORATORY

Crystal collimation at Tevatron ring (Fall 2005)

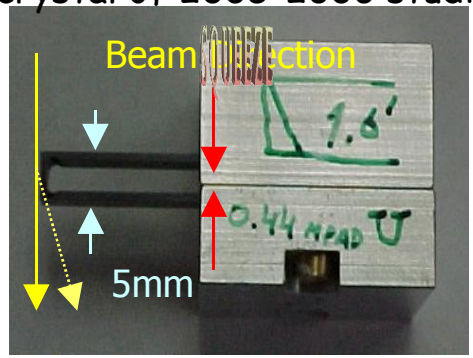




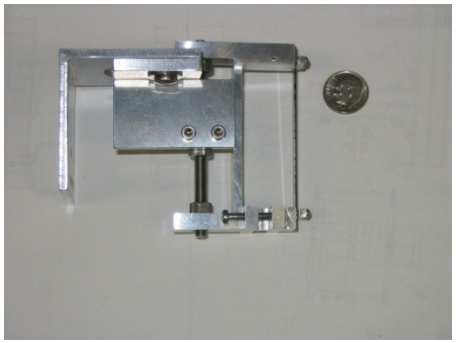


CRYSTAL ANALYSIS AND REPLACEMENT

"Successful" 0.44mrad O-shaped crystal of 2005-2006 studies



"Unsuccessful" 0.15mrad strip crystal of 2007 studies



Suspicious strip crystal and unstable goniometer were removed from the tunnel in December 2007 after several unsuccessful attempts during the year. After cooldown, the crystal was shipped to Italy last week for its analysis.

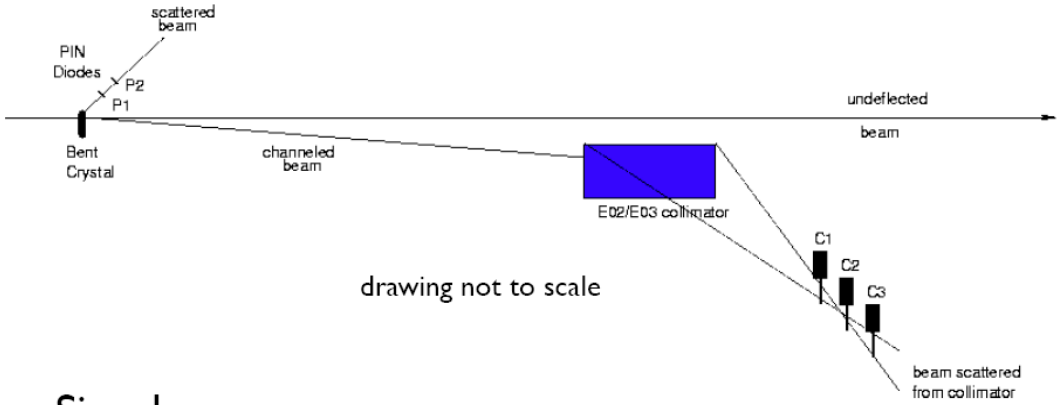
The O-shaped crystal of successful studies of 2005 was shipped to Europe in January 2008 for its characterization.

Analysis with 2-MeV He+ ions performed by V. Guidi at Ferrara, INFN, has shown that quality of the surfaces is very good, and it needs no treatment.

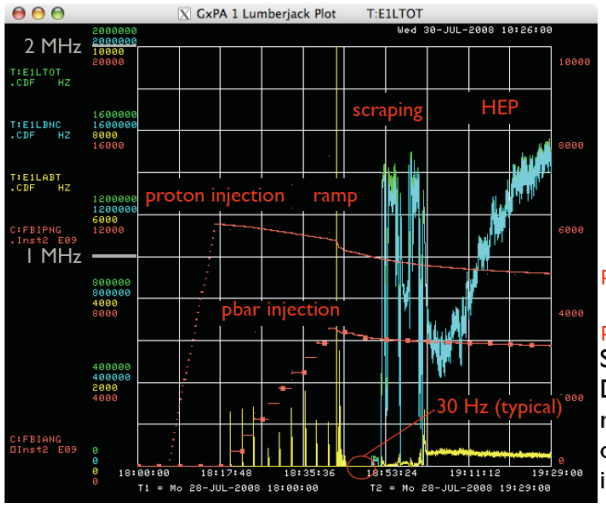
X-ray measurements of bending angle and miscut angle with 5% accuracy performed by Yu. Ivanov, PNPI; the angles are 0.41±0.02 mrad and 1.6±0.1 mrad, correspondingly.

The crystal received back in April and is now installed in the Tevatron tunnel.

E0CH COUNTERS



Injection



proton current

pbar current

Study rates w/ D49 (target) retracted, all other collimators in nominal pos.

Signal:

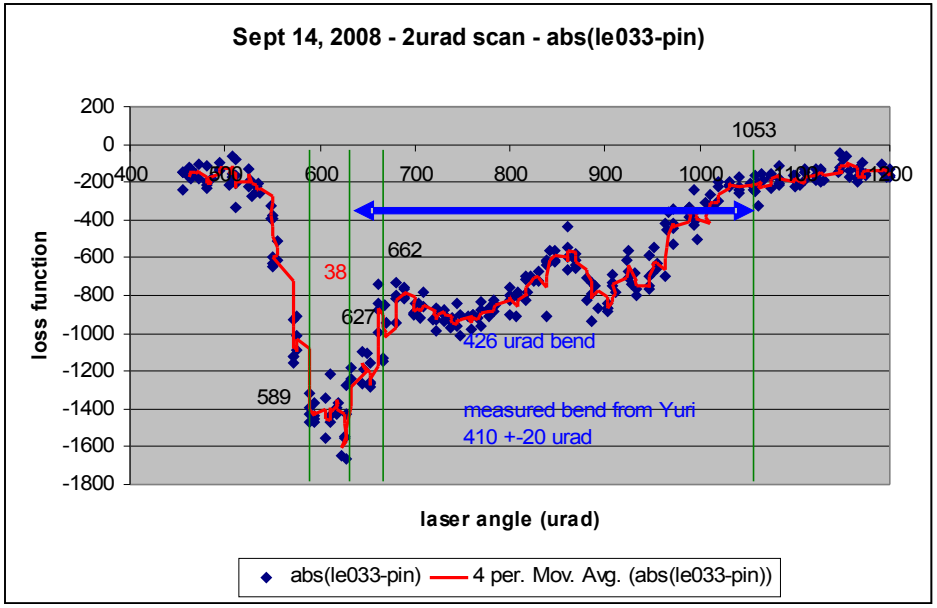
- increased rates in counters
- decreased rates in PIN diodes

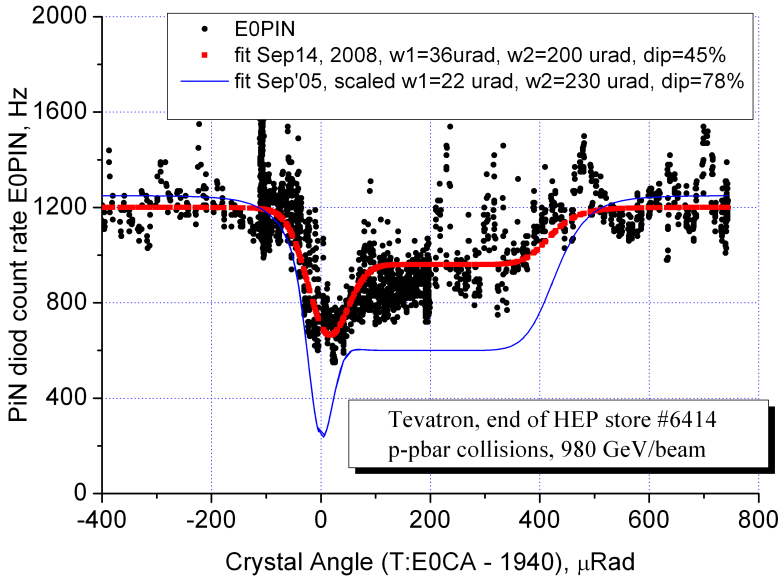
S. Shiraishi, R. Tesarek

FIRST T980 BEAM TESTS (1)

Sept. 14, 2008: First End-of-Store (EOS) study (3 hours) with the new setup:

- aligning crystal
- first angle scan produced channeling results!





Analysis by V. Shiltsev

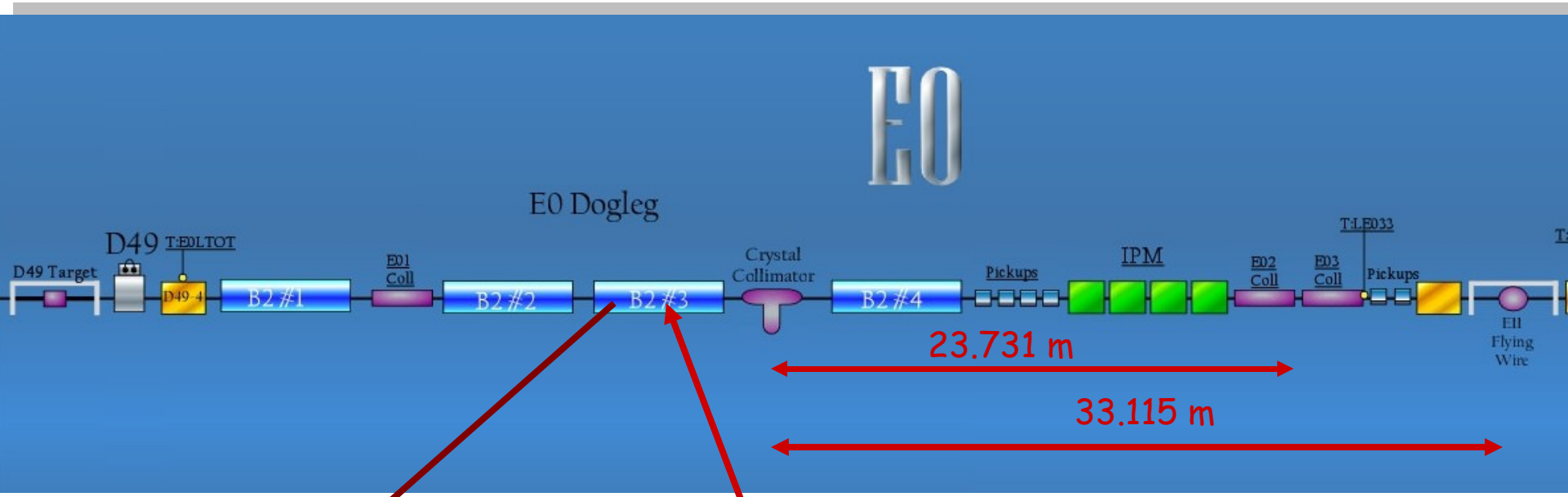
BOS Crystal Collimator Review, Feb. 4, 2009

Chaired by Roger Dixon with AD, CDF and D0 representatives on the Committee: review the progress of T980 and determine whether the experimenters should be allowed to insert the crystal into the Tevatron beam at the beginning of the collider stores.

The studies since September 2008 have demonstrated that the crystal can be moved into the beam without causing undo losses. In addition, there is some evidence that the crystal could lower losses at CDF and D0. To make further progress the group has asked to put the crystal in at the beginning of a store.

It was agreed that the beginning of store studies should be initiated at the discretion of the Run Coordinator. The goal of these studies should be to establish normal operating parameters and to more effectively determine the performance of the crystal.

New Vertical Goniometer Location



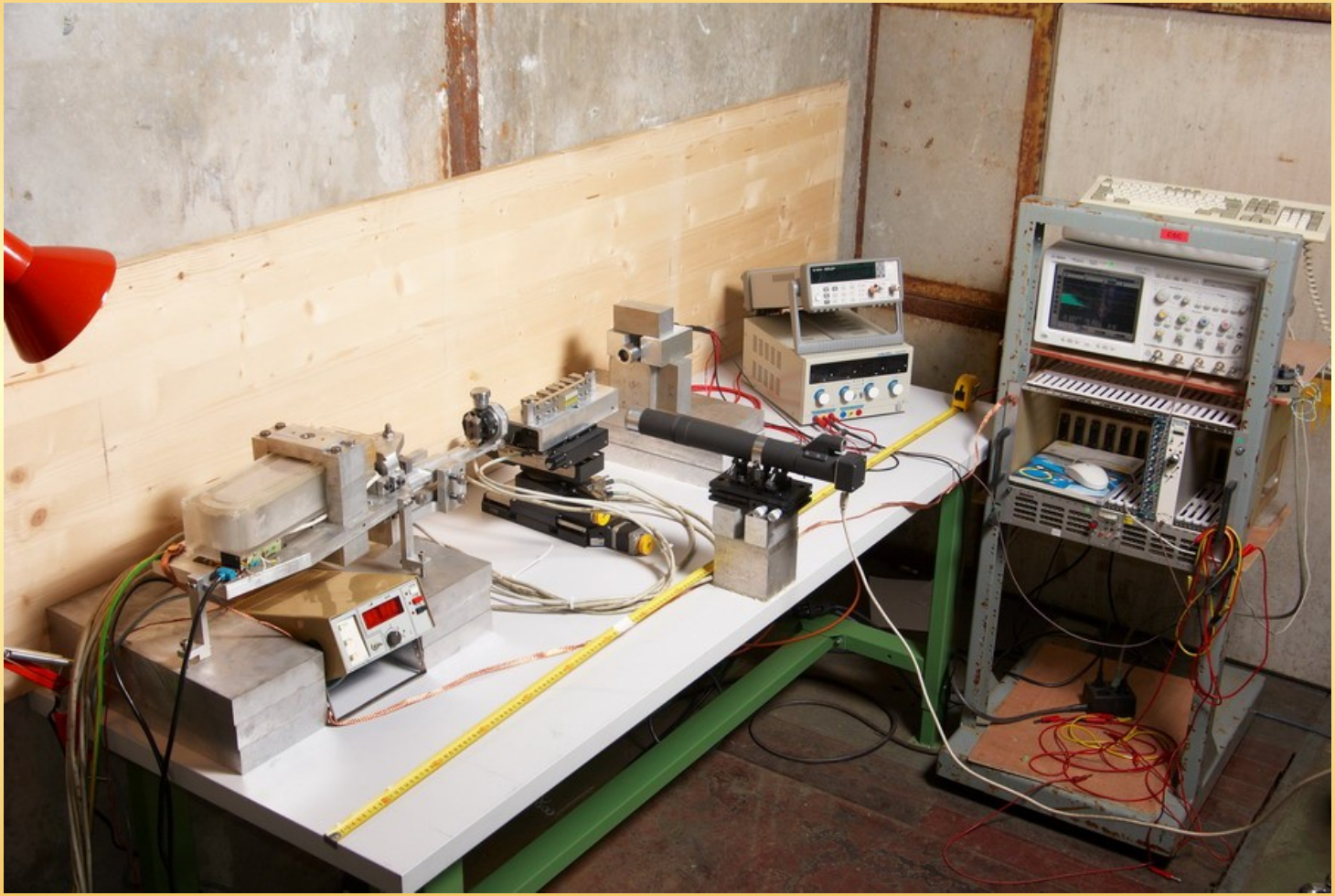
Remove B2-3 dipole

Install new goniometer here
Alternate crystals without breaking vacuum !

Plans for 2009 through Beginning of 2010

1. Continue BOS aiming at convincing reproducible loss reduction in the machine, CDF and D0; first, fix the angular drift problem for the entire store (15-20 hrs *vs* 2-hr EOS), insulate goniometer if heating is the problem.
2. Investigate alternatives to Flying Wire for beam profile measurements.
3. Install the new vertical goniometer at E0 ~2 m upstream of the horizontal one; in September 2009 start beam tests with it; study performance of alternating crystals of two different technologies: O-shaped (channeling) and multi-strip (VR).
4. Start two-plane beam cleaning with horizontal and vertical crystal collimators simultaneously.

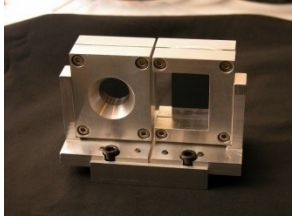
X-setup to check crystals at CERN



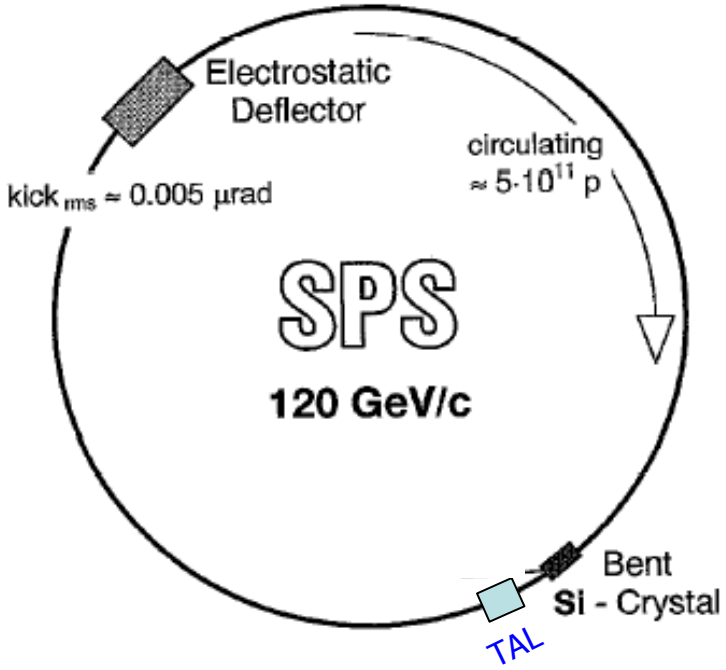
UA9 experiment at CERN SPS

UA9

The underground experiment in the SPS

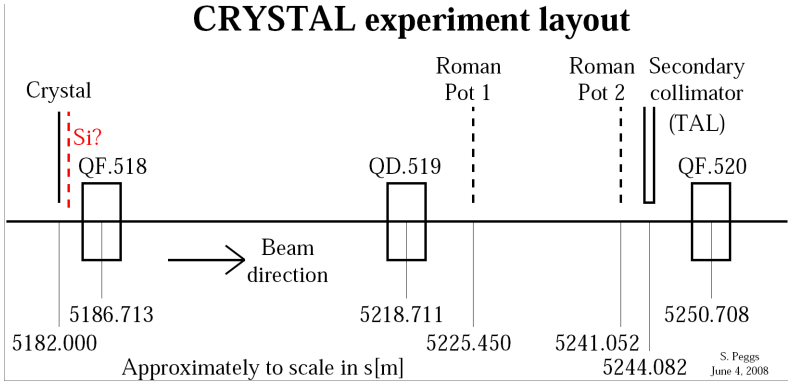


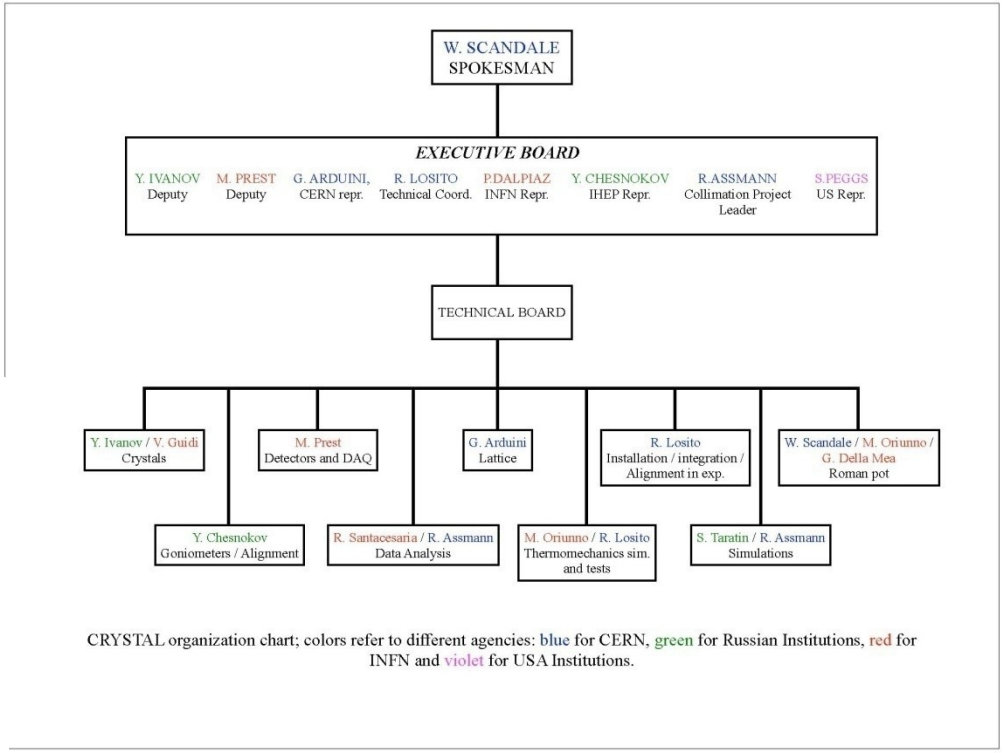
Approved by the CERN Research Board of the 3 Sept 2008



Goals:

- Demonstrate loss localization
- Measure channeling and collimation efficiency
- Measure the single particle dynamics (later ?)

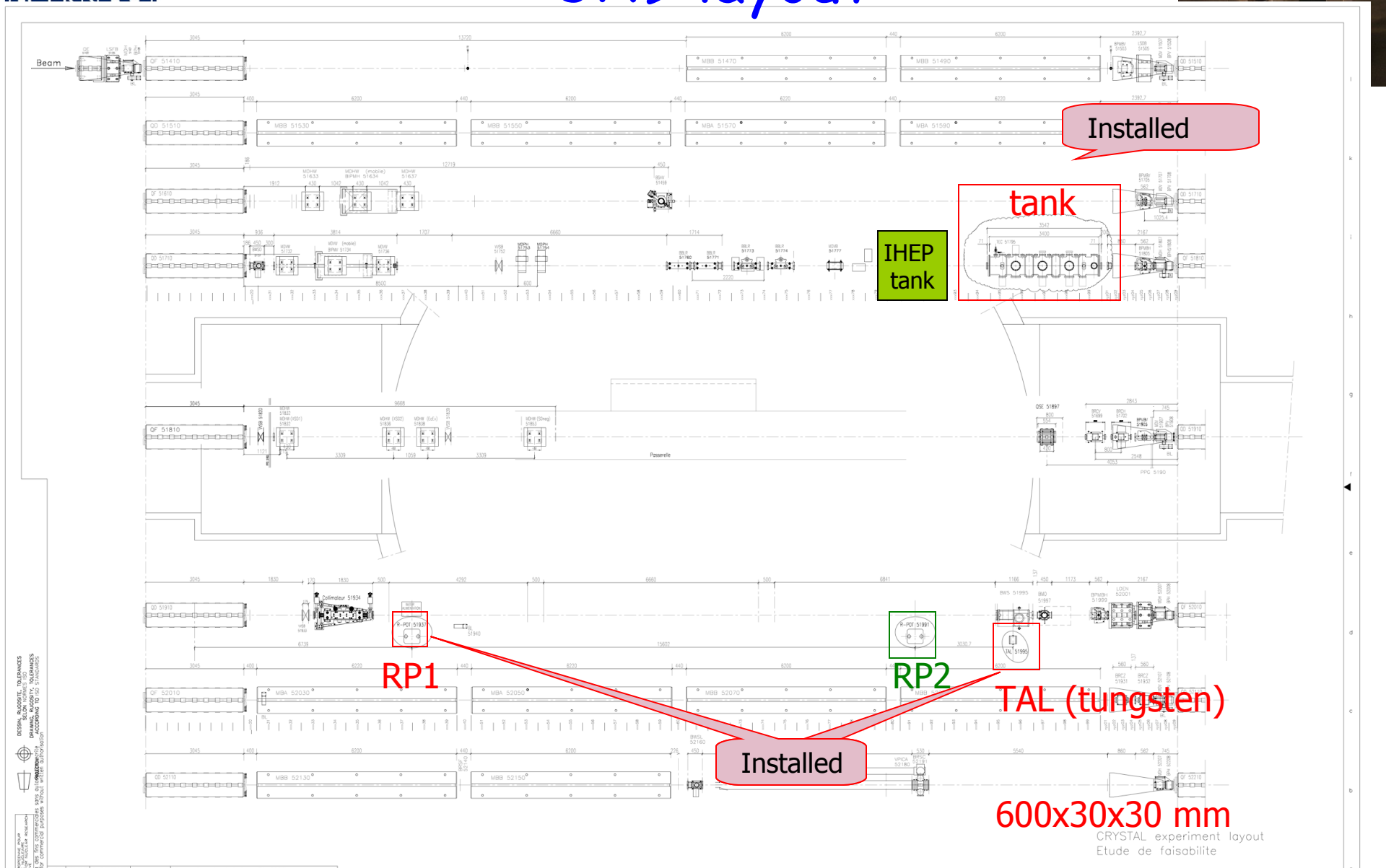




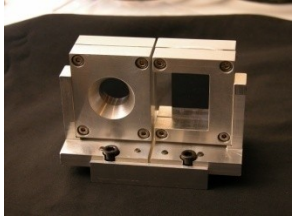
CRYSTAL organization chart; colors refer to different agencies: blue for CERN, green for Russian Institutions, red for INFN and violet for USA Institutions.

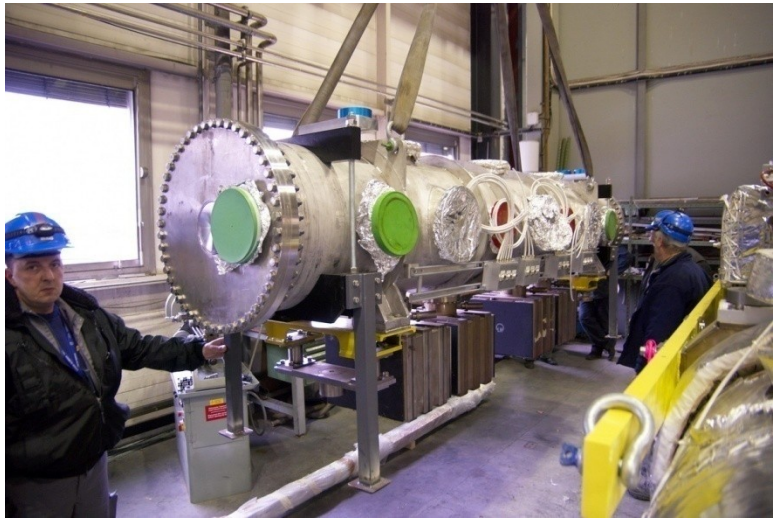
CERN
INFN
PNPI
IHEP
JINR
SLAC
FNAL
LBNL

UA9 layout

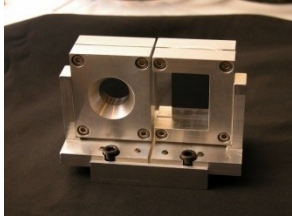

Beam
Installed
tank
IHEP tank
RP1
RP2
TAL (tungsten)
Installed
600x30x30 mm
CRYSTAL experiment layout
Etude de faisabilite

RD22 tank

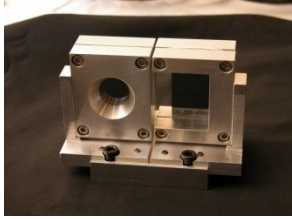


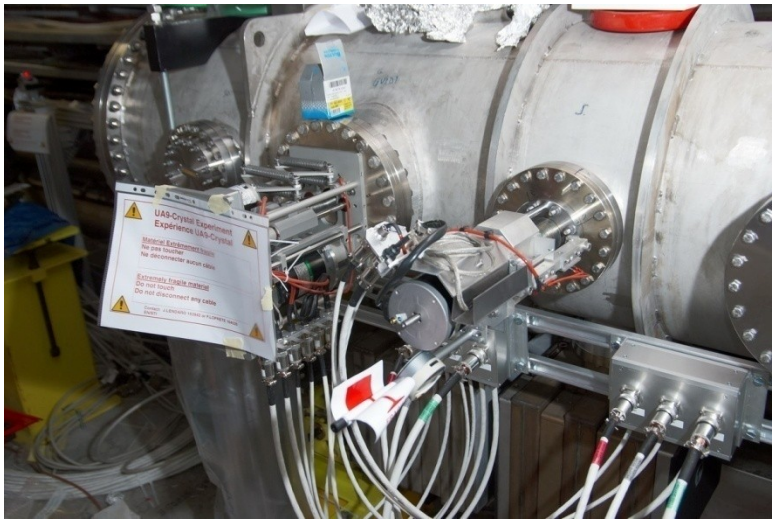


RD22 tank

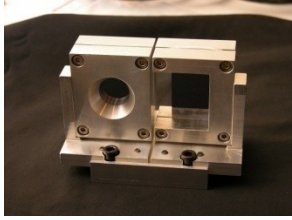


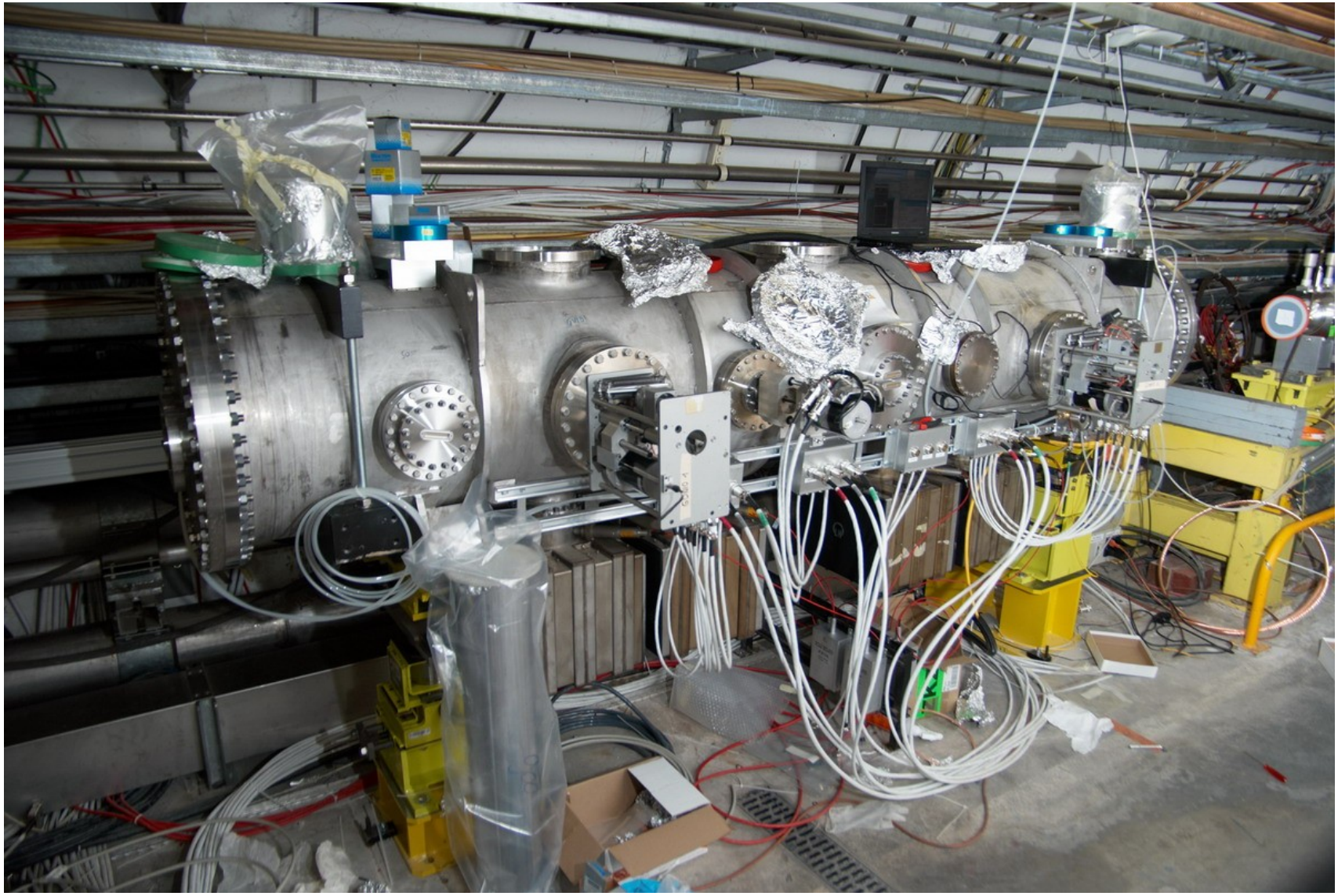
RD22 goniometer



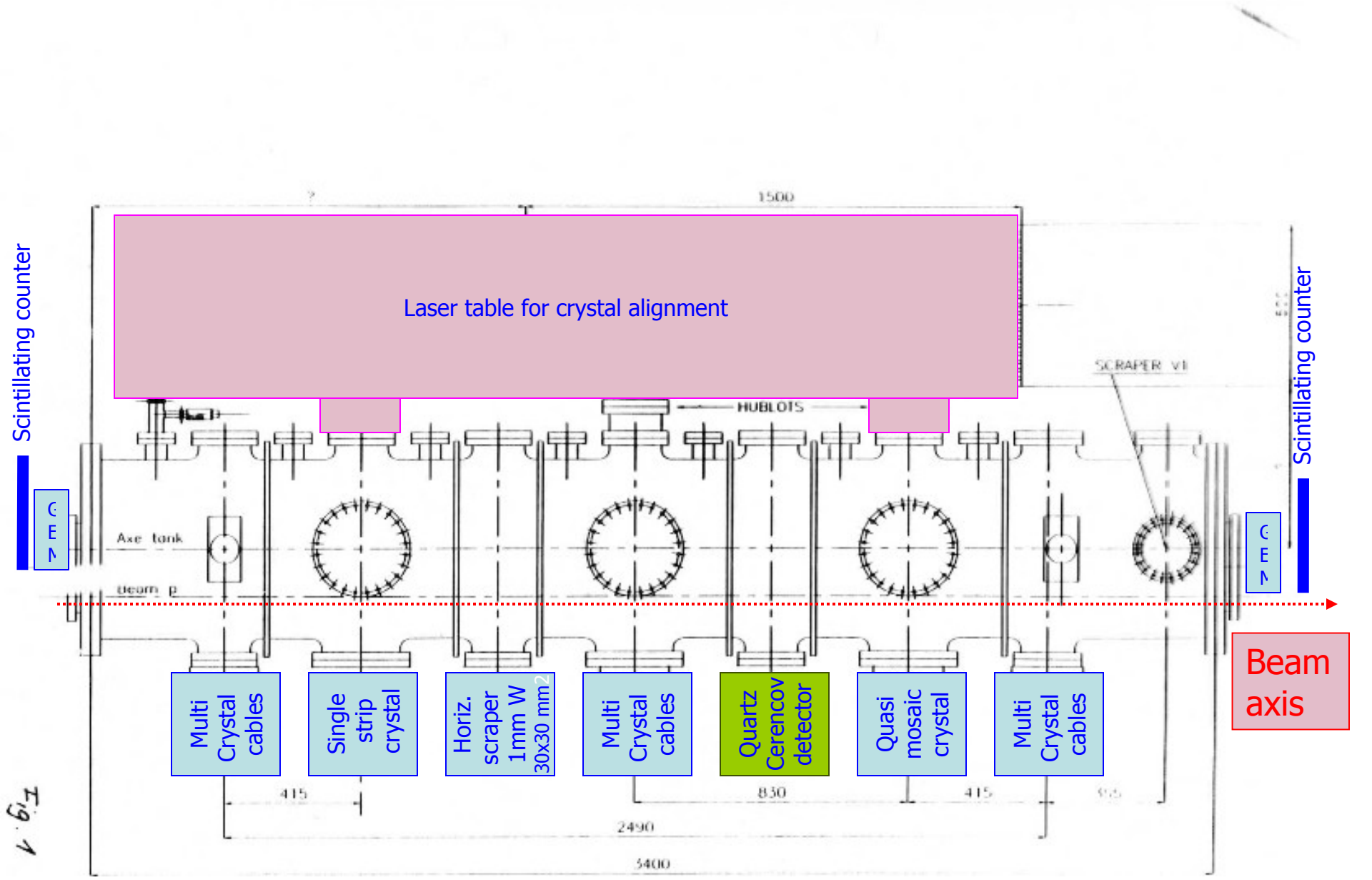


RD22 tank with goniometers and thin target

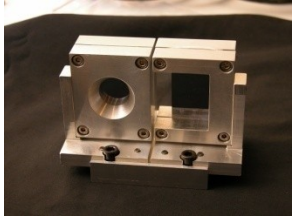


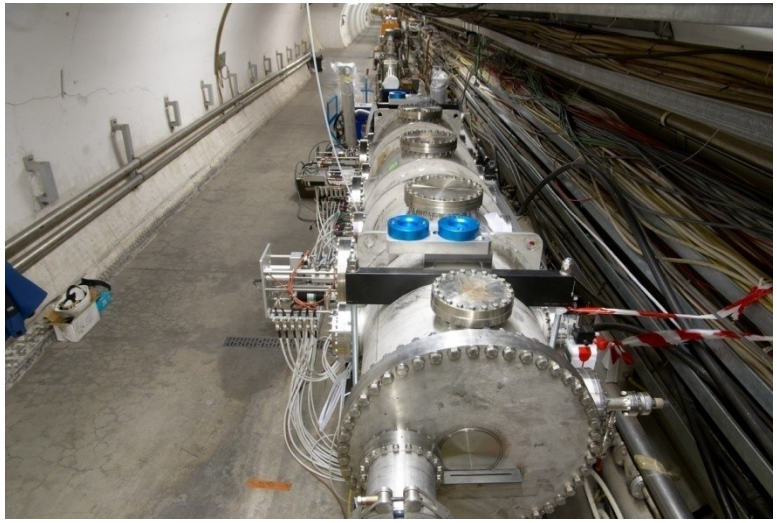


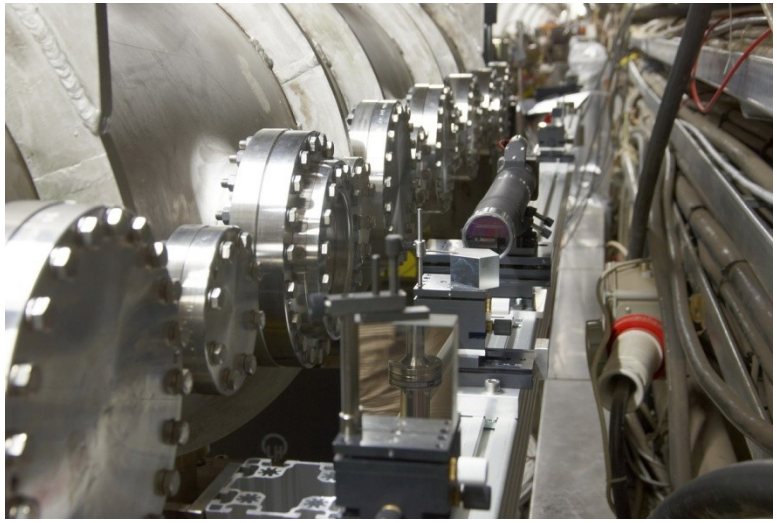
Layout of the RD22 tank



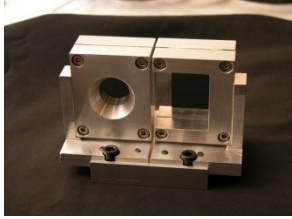
Crystal alignment table

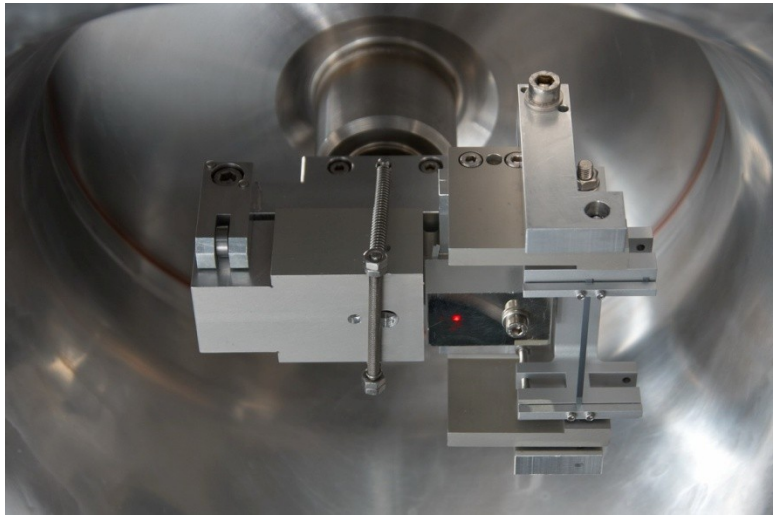


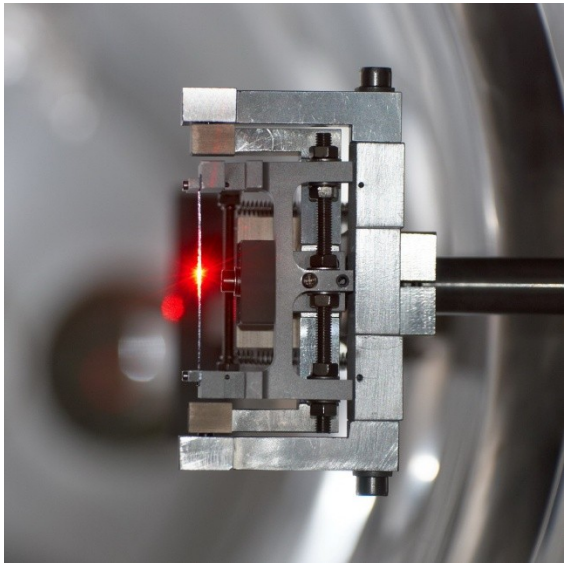


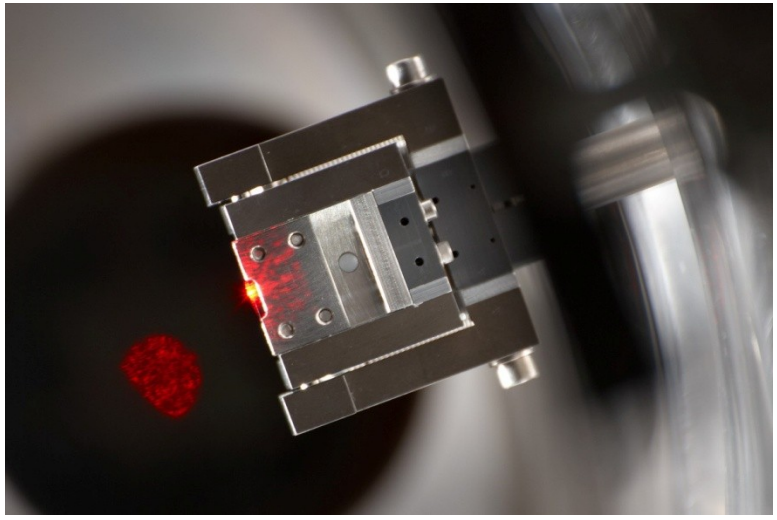


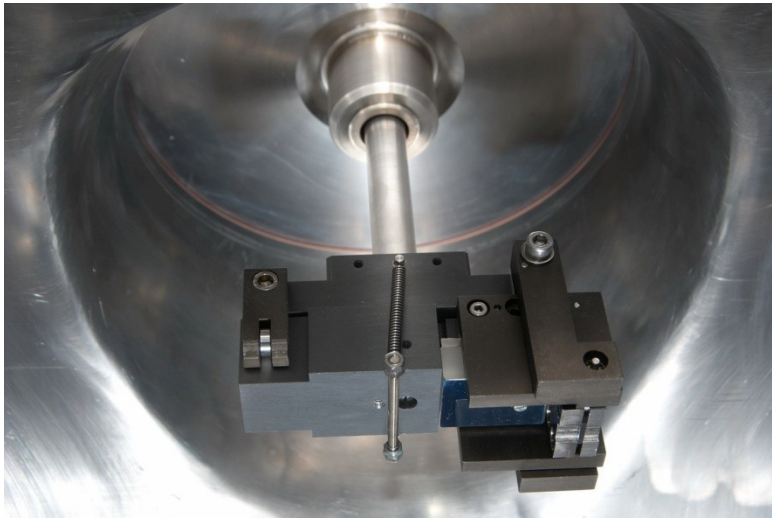
crystals



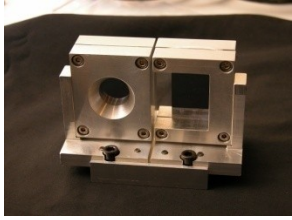


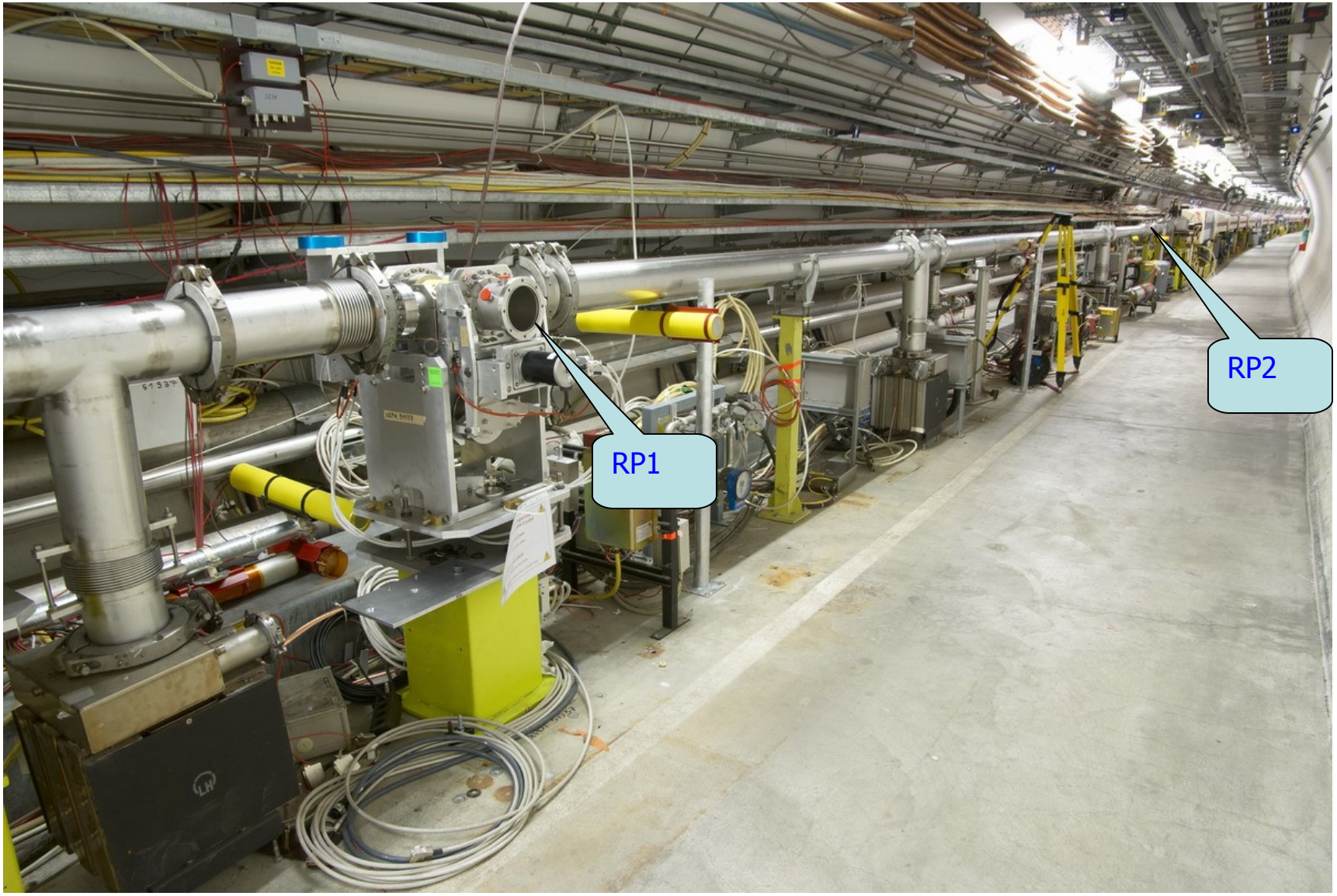




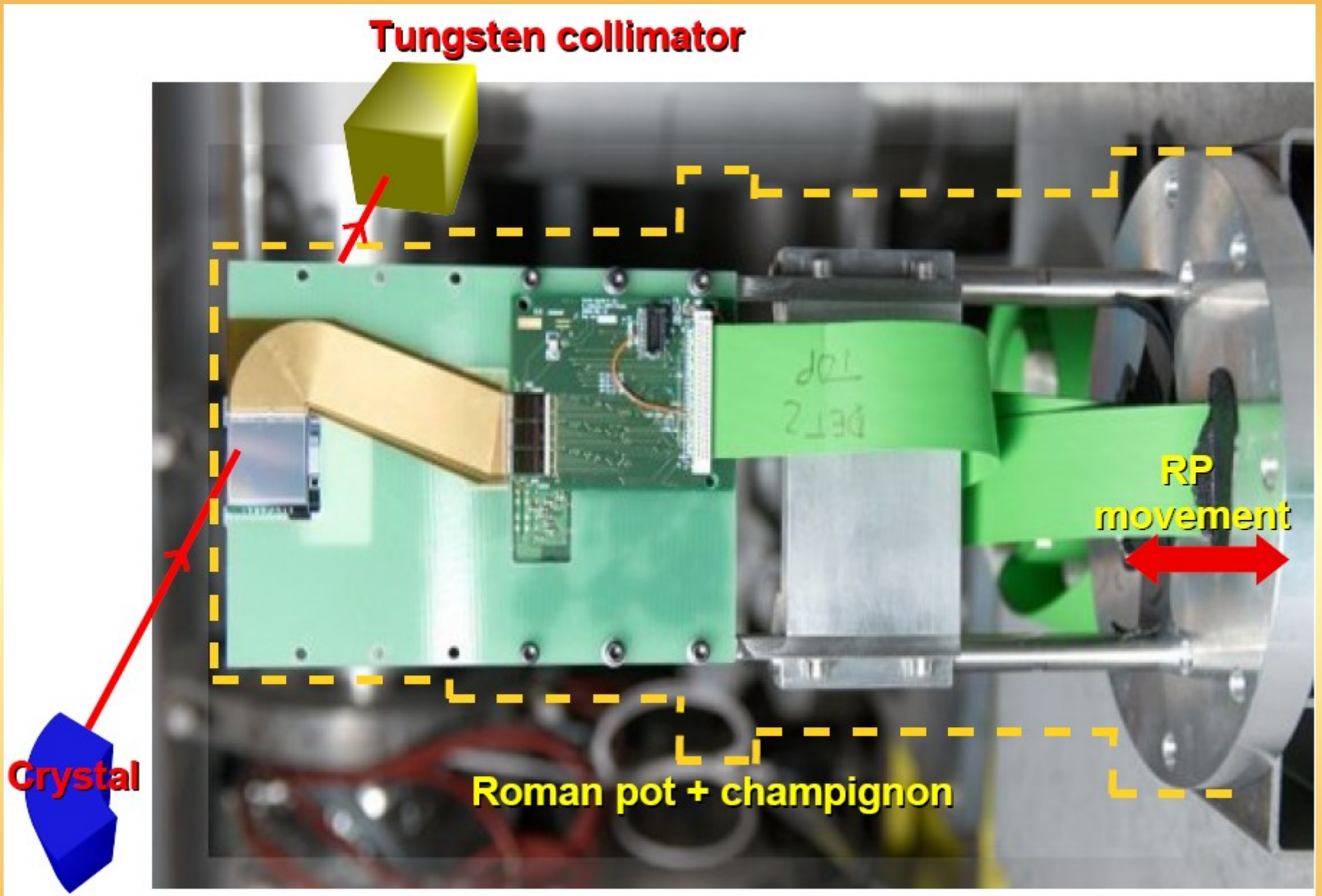


RP1 (the CERN roman pot)

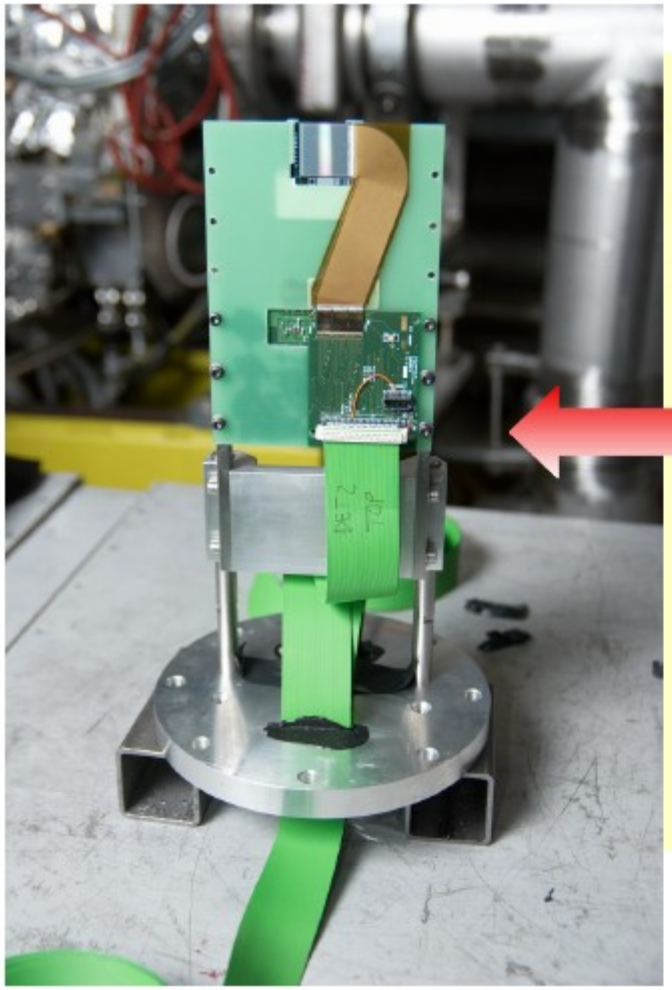




Silicon strips for UA9


Tungsten collimator
RP
movement
Crystal
Roman pot + champignon

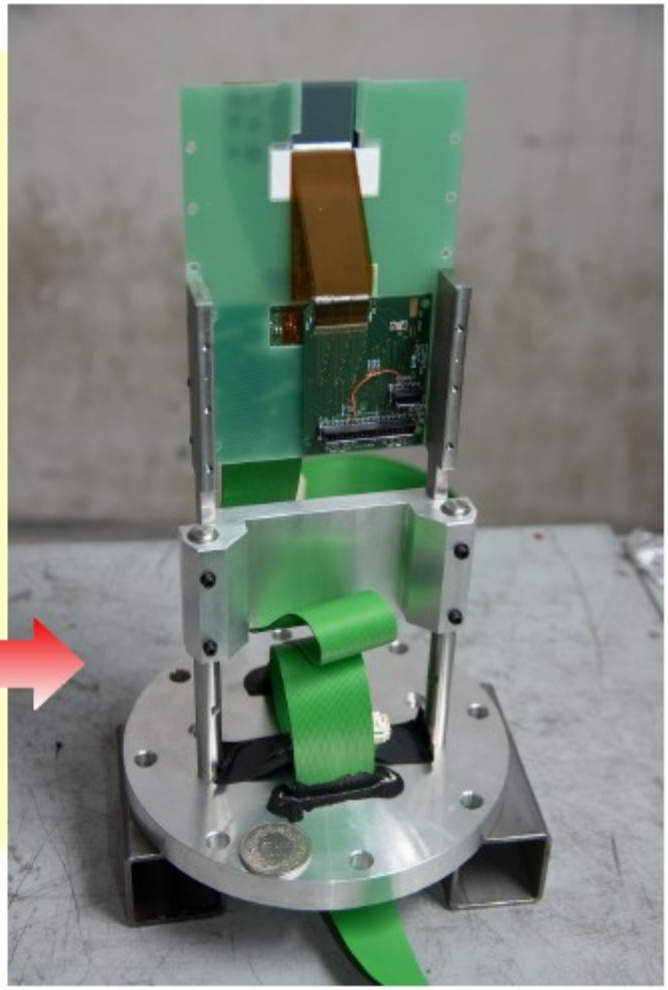
The prototype



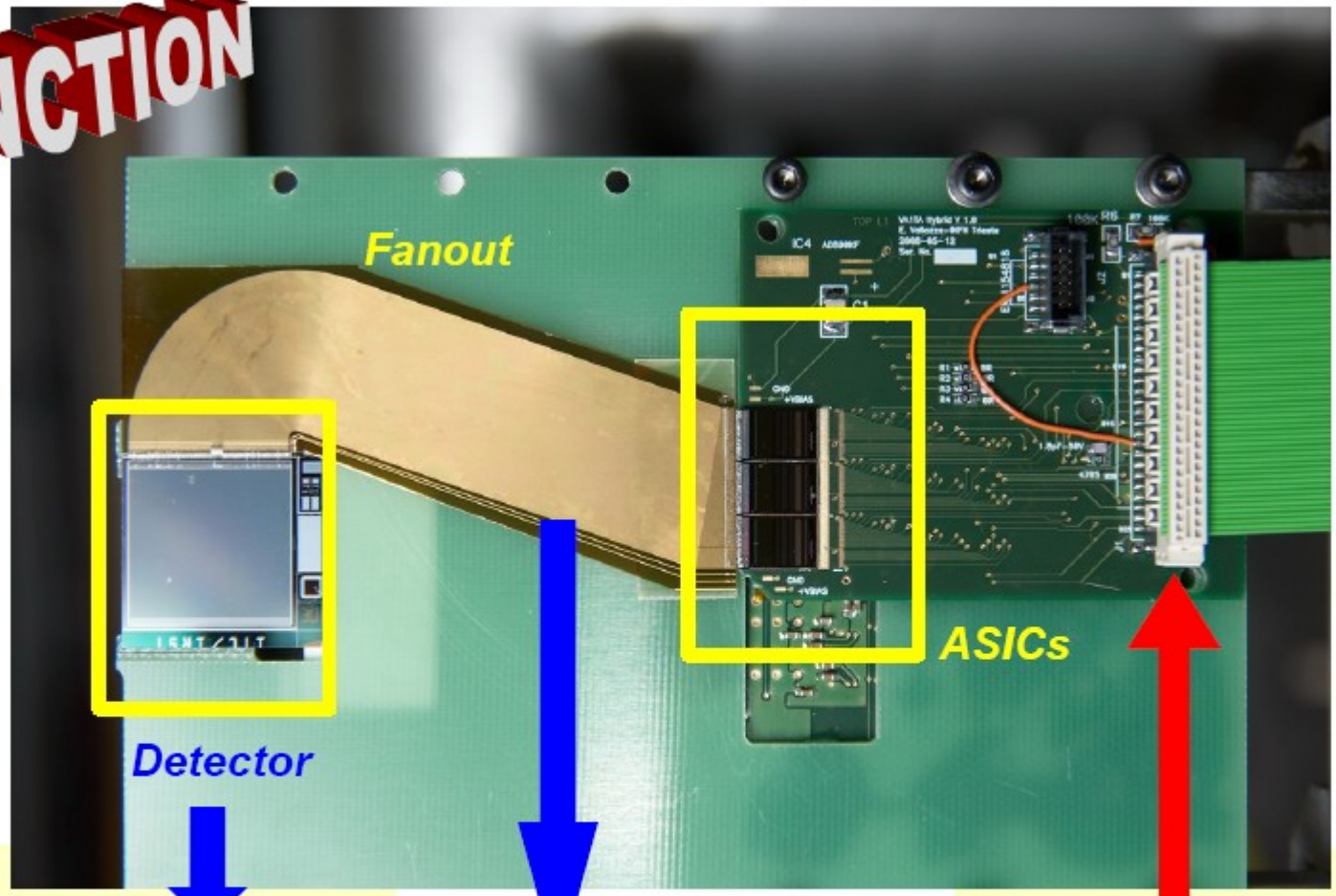
- ✔ 1 FBK detector readout by 6 VA1TA ASICs
- ✔ 1 FR4 board for the support of the detector
- ✔ upilex fanouts for the connection between the silicon and the ASICs

JUNCTION
(HORIZONTAL)

OHMIC
(VERTICAL)



JUNCTION

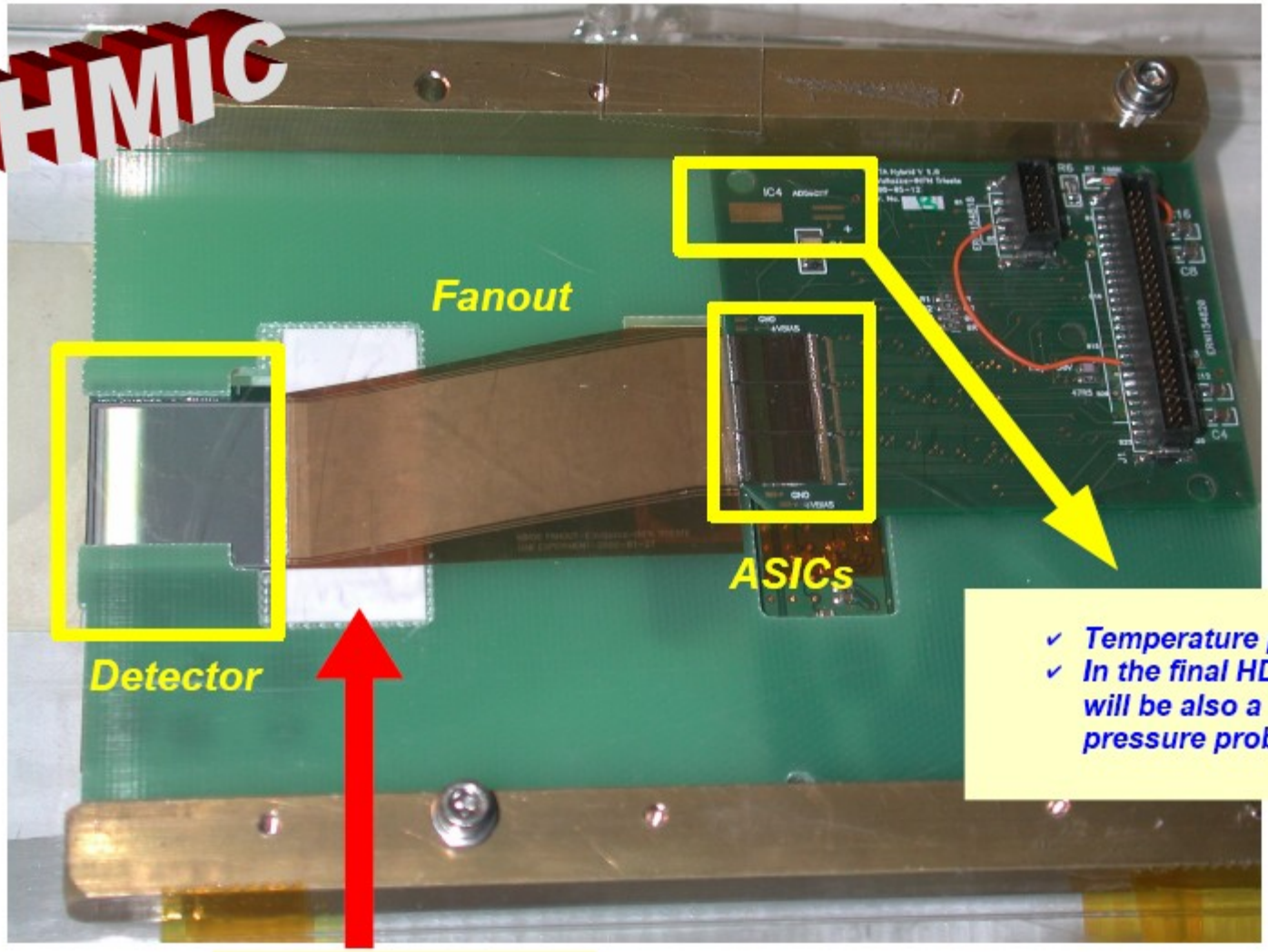


- ✔ 1.92x1.92 cm^2
- ✔ readout @50µm on the junction side (1 floating strip)
- ✔ produced by FBK

- ✔ upilex fanout
- ✔ gold tracks at 50µm pitch
- ✔ produced by CERN

- ✔ HDI: identical to the final version apart from the connector (from straight to 90deg) and the presence of a buffer for the mask readback

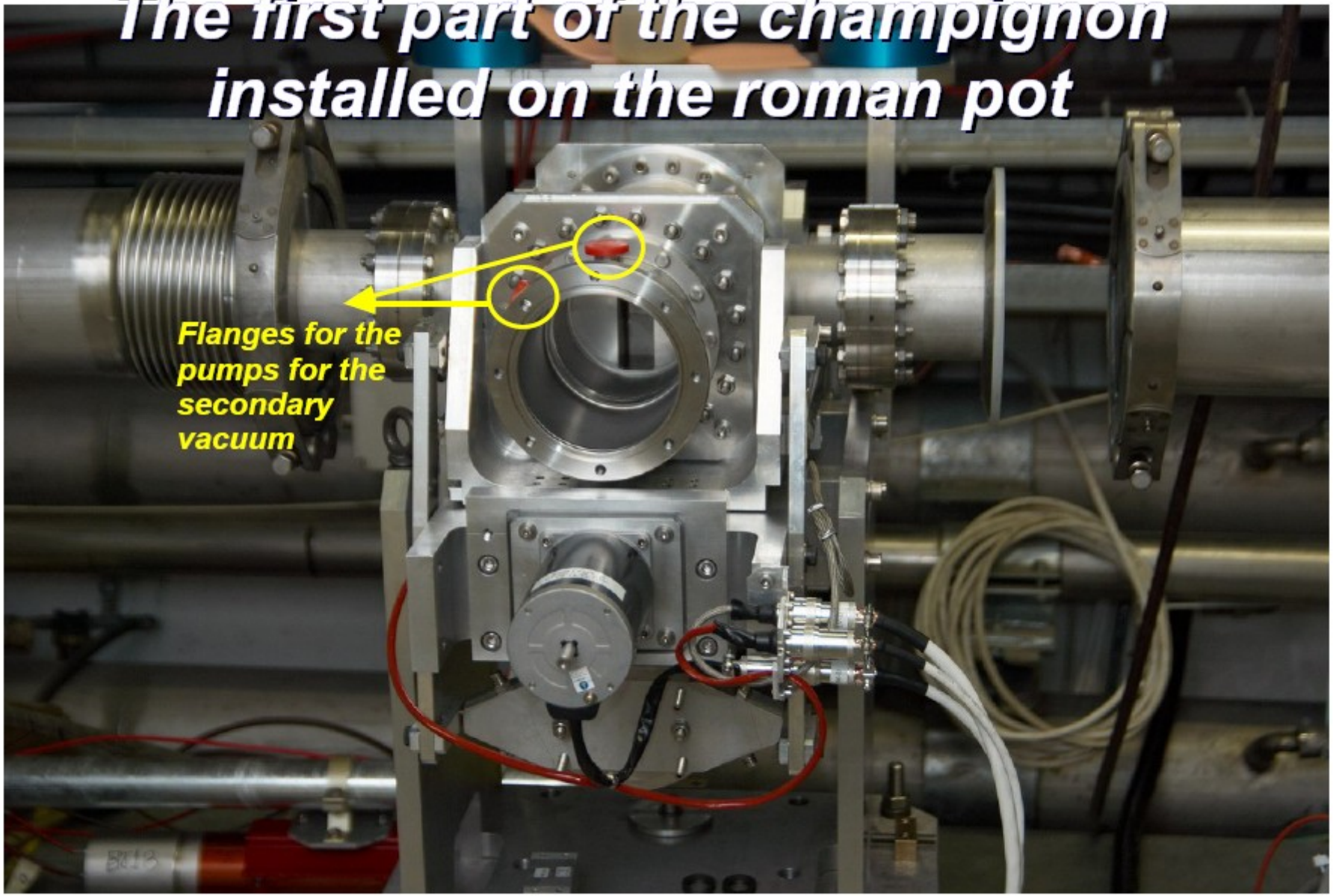
OHMIC

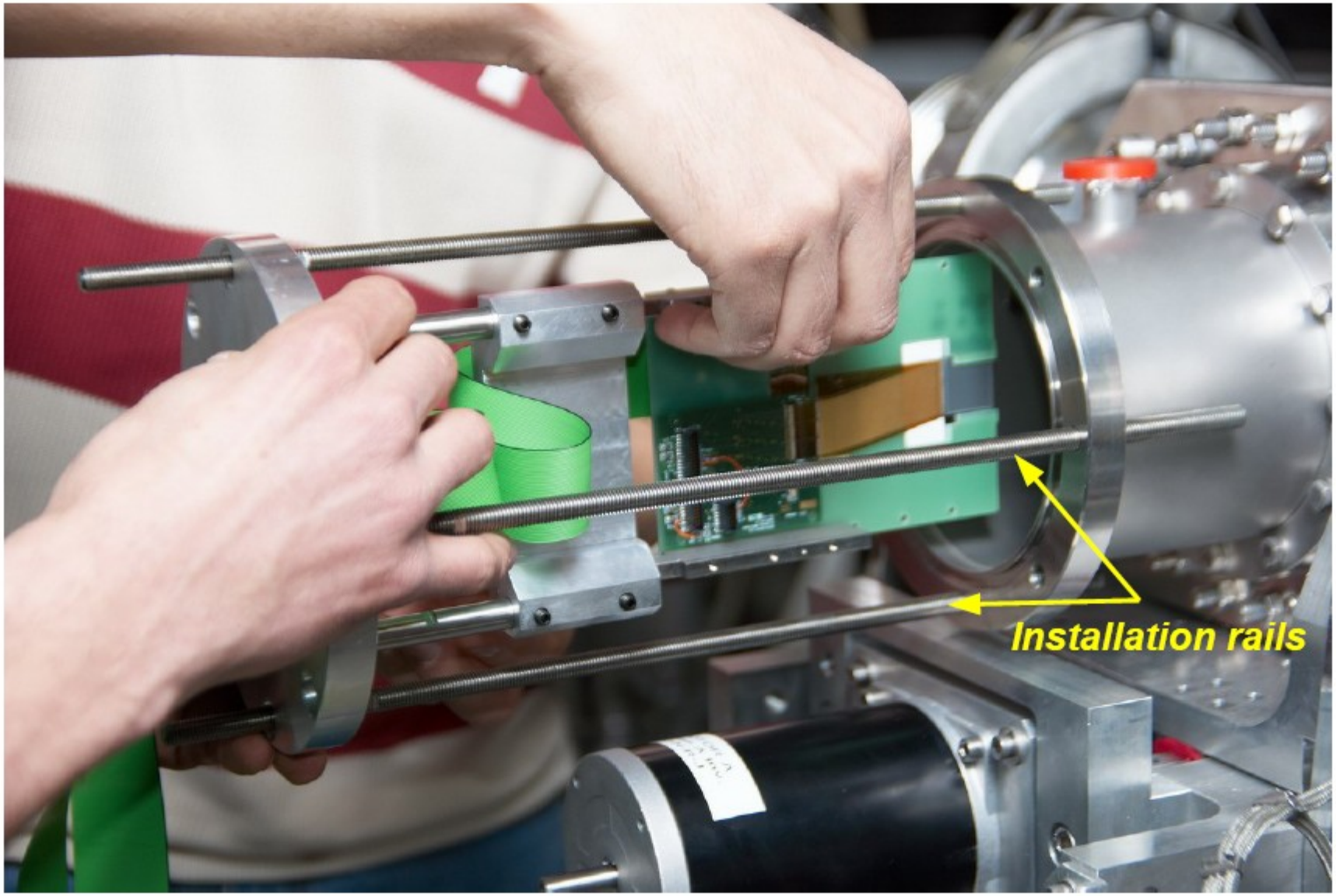


- ✔ *Temperature probe*
- ✔ *In the final HDI, there will be also a pressure probe*

- ✔ *Ceramic support for the bonding in the upilex region*

The first part of the champignon installed on the roman pot




Installation rails


Support for the electronics boards prototype

Electronics setup

TUNNEL

- Detector
- Frontend electronics

- Total dose tested
- FPGA programmable from surface

CAVERN

- Power supplies
- Repeaters

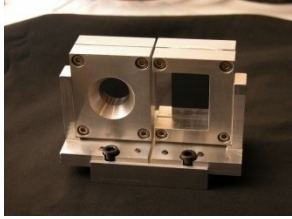
- No radiation problem
- Repeaters for fibers and cables

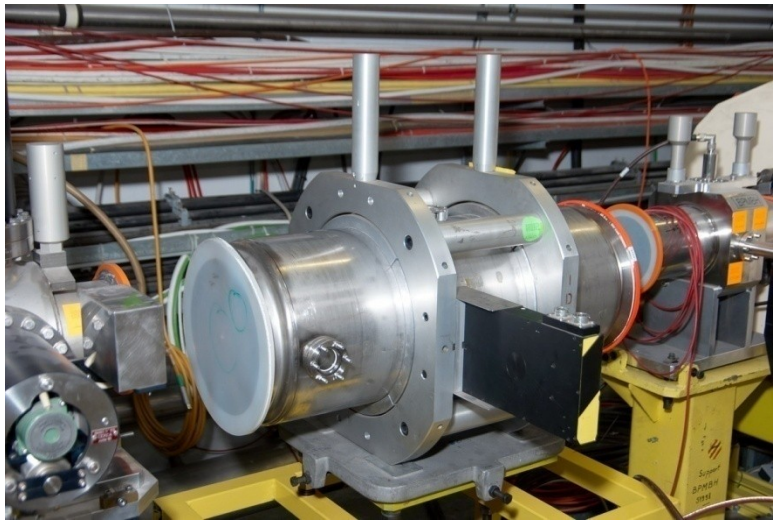
SURFACE

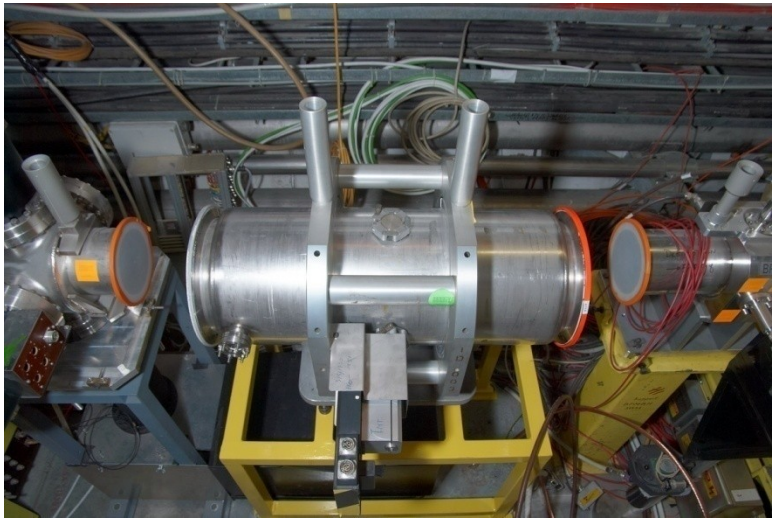
- DAQ
- Slow Controls

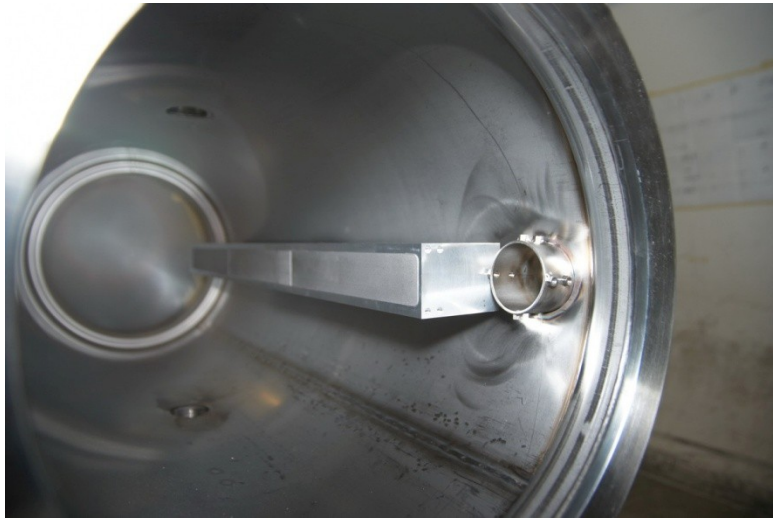
- 1 VME crate
- 2 PCs (1 for DAQ and 1 for slow controls)
- Remotely accessible

TAL (secondary collimator)

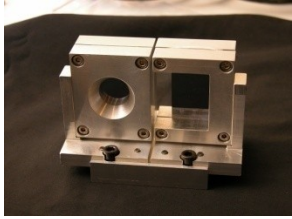


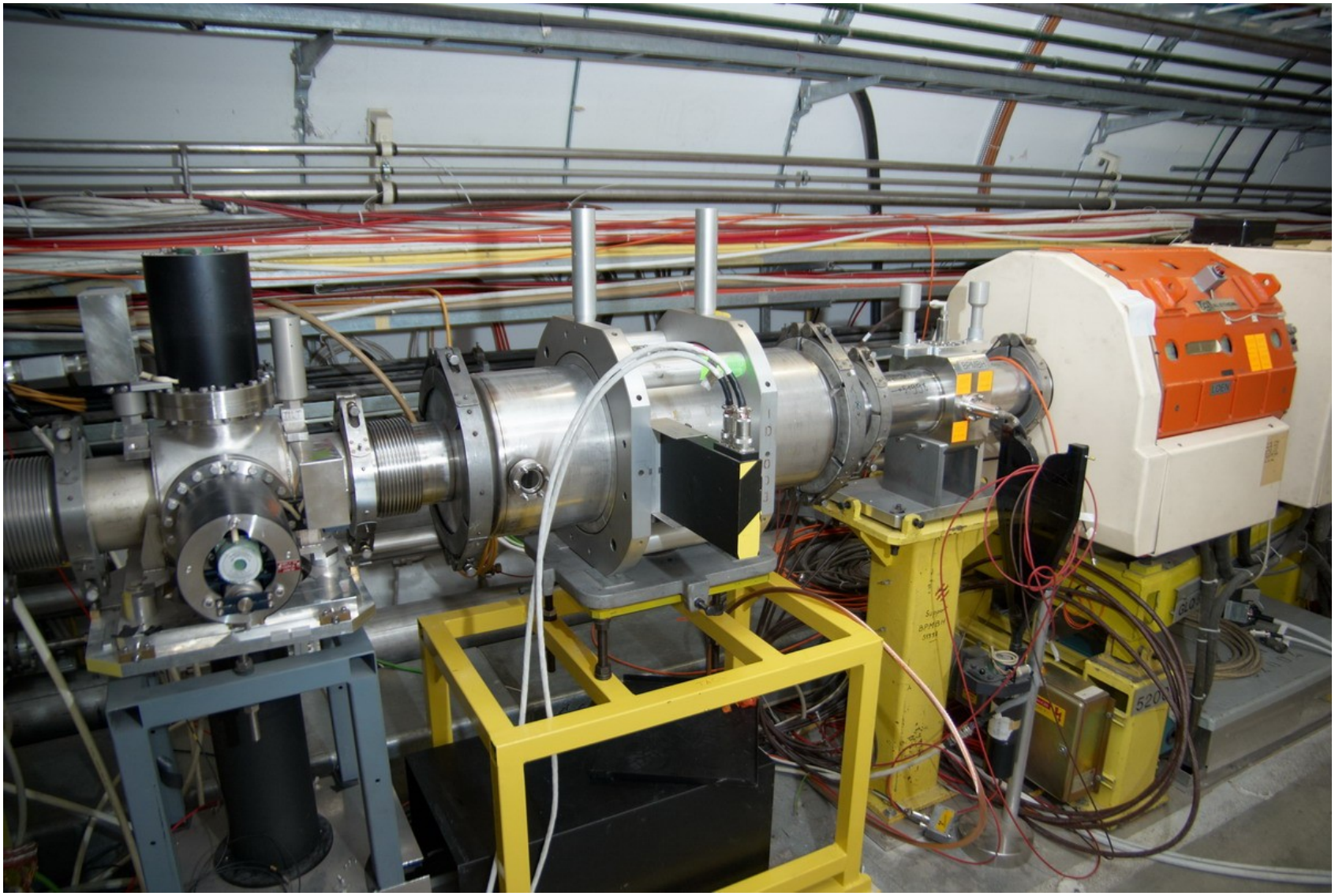






TAL (secondary collimator)

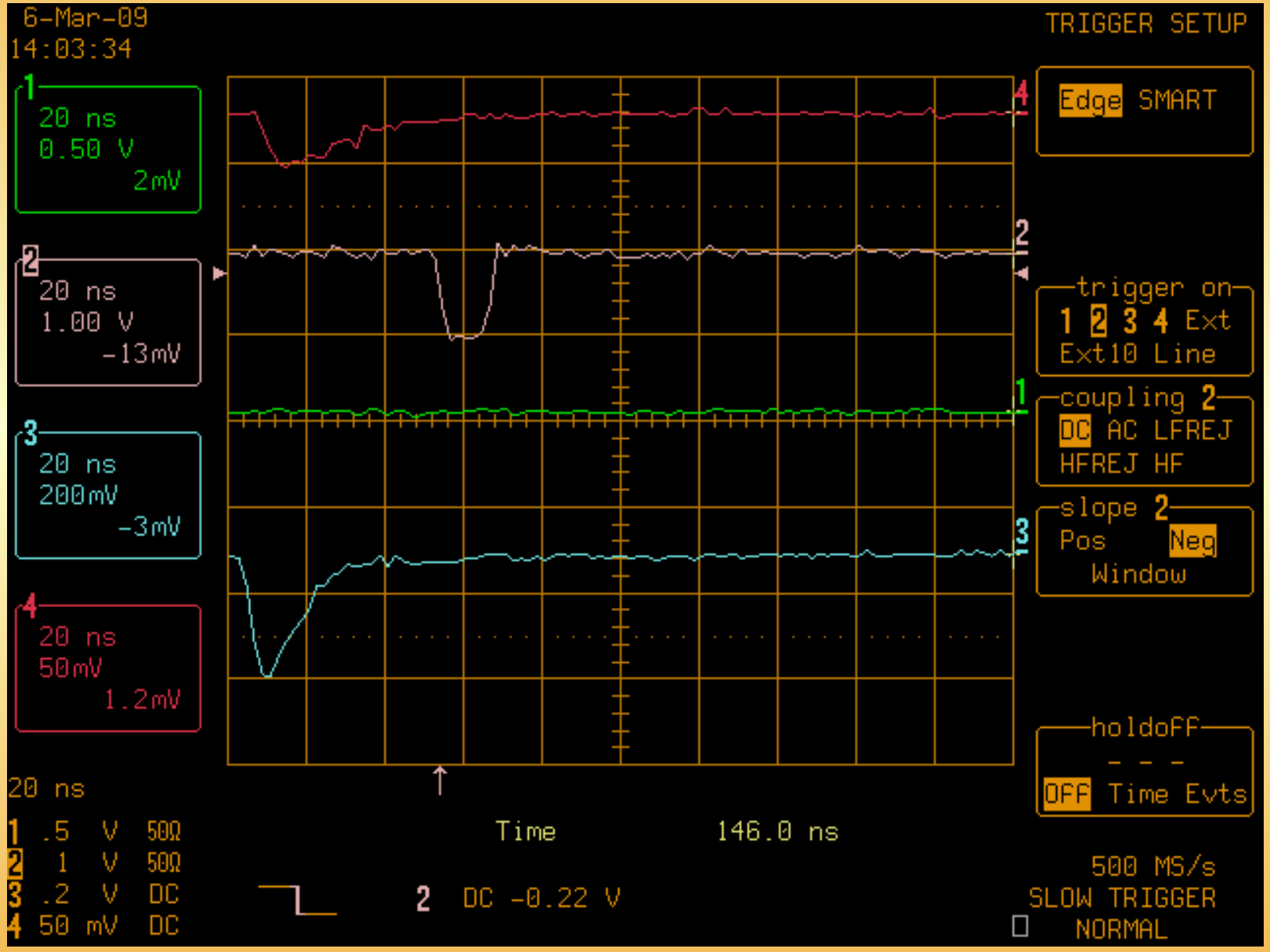




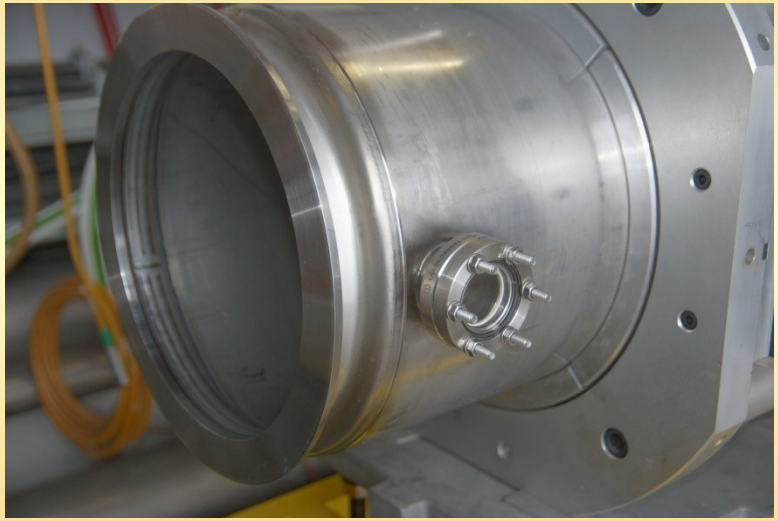
Cerenkov detectors for UA9

Quartz, lihgt pipe and PMT

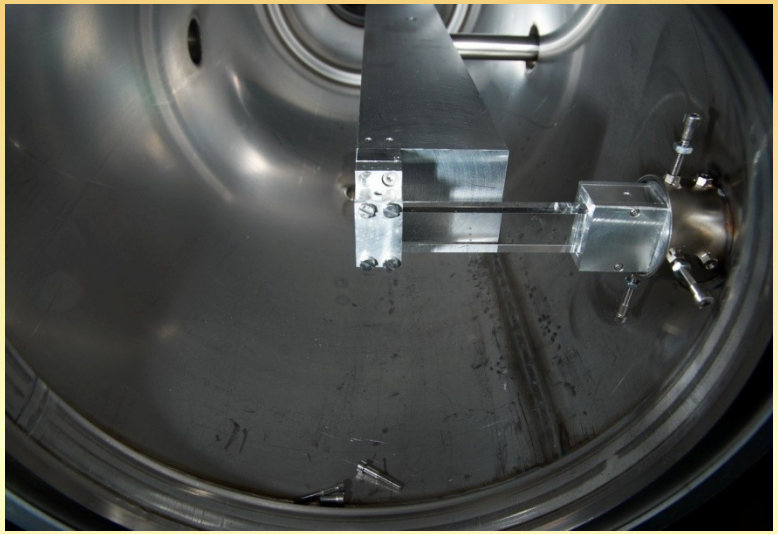
Test of Quartz with 1 GeV protons

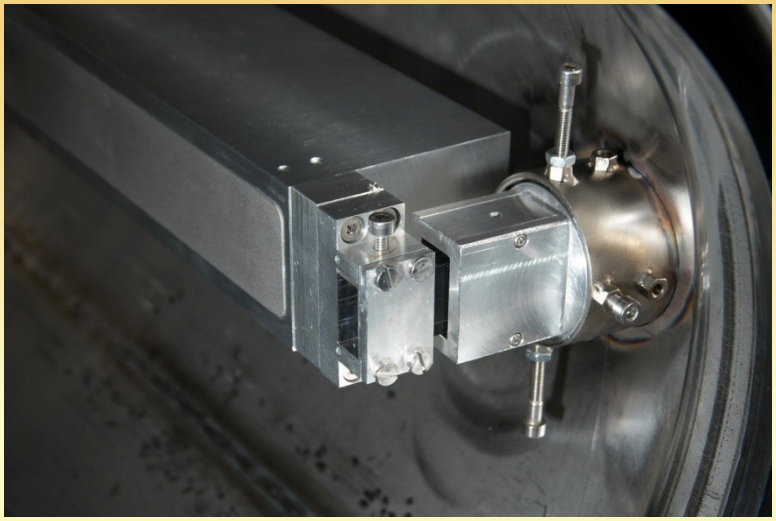


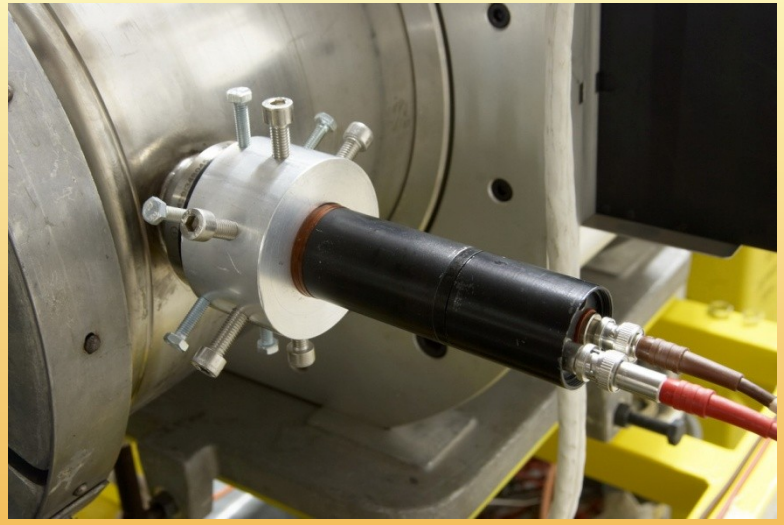
Collimator tank with viewport for Cerenkov detector



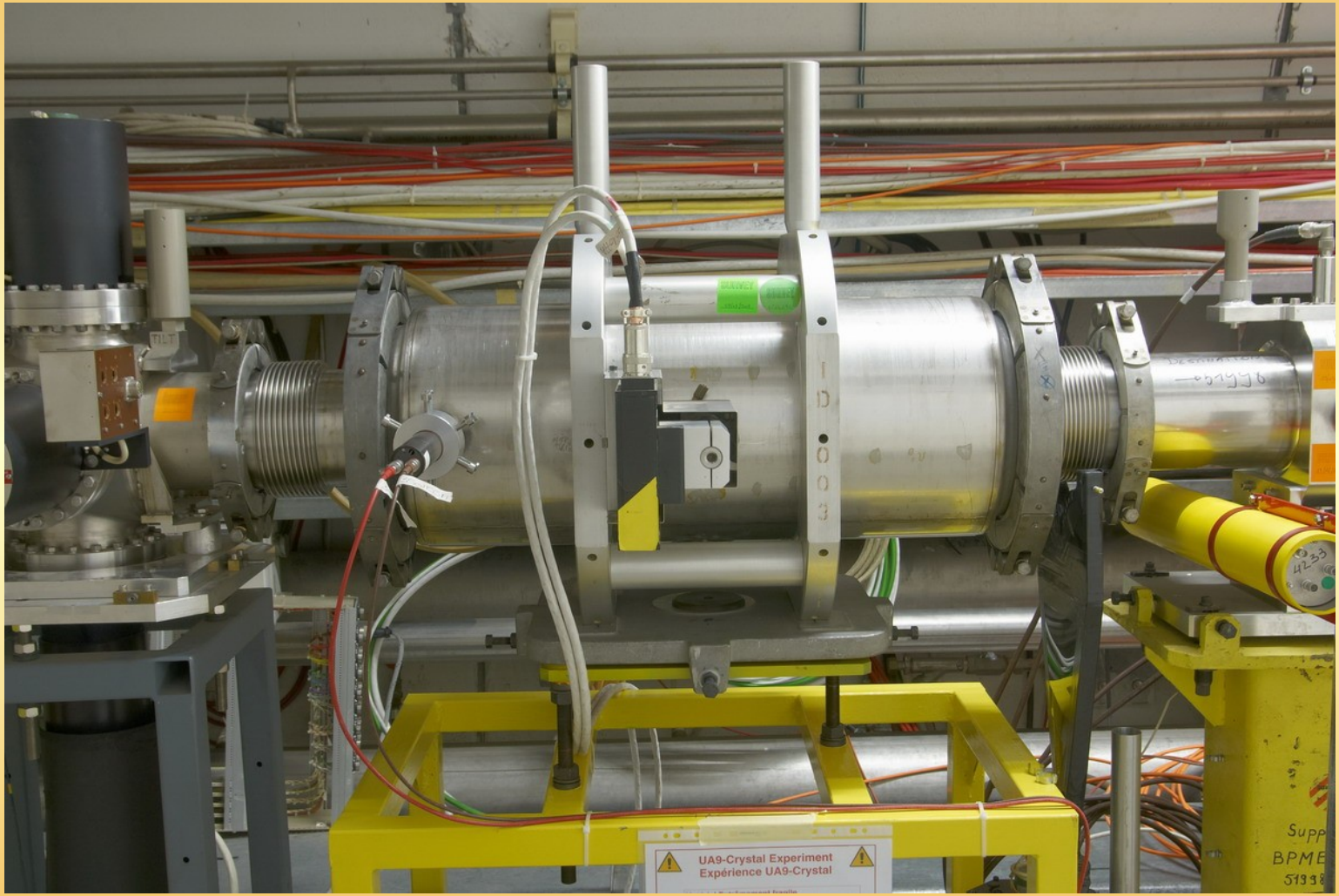
Quartz in and out the beam and PMT







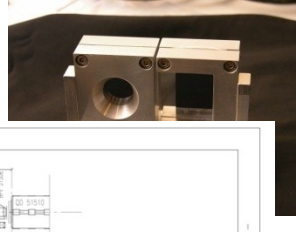
Collimator tank with Cerenkov

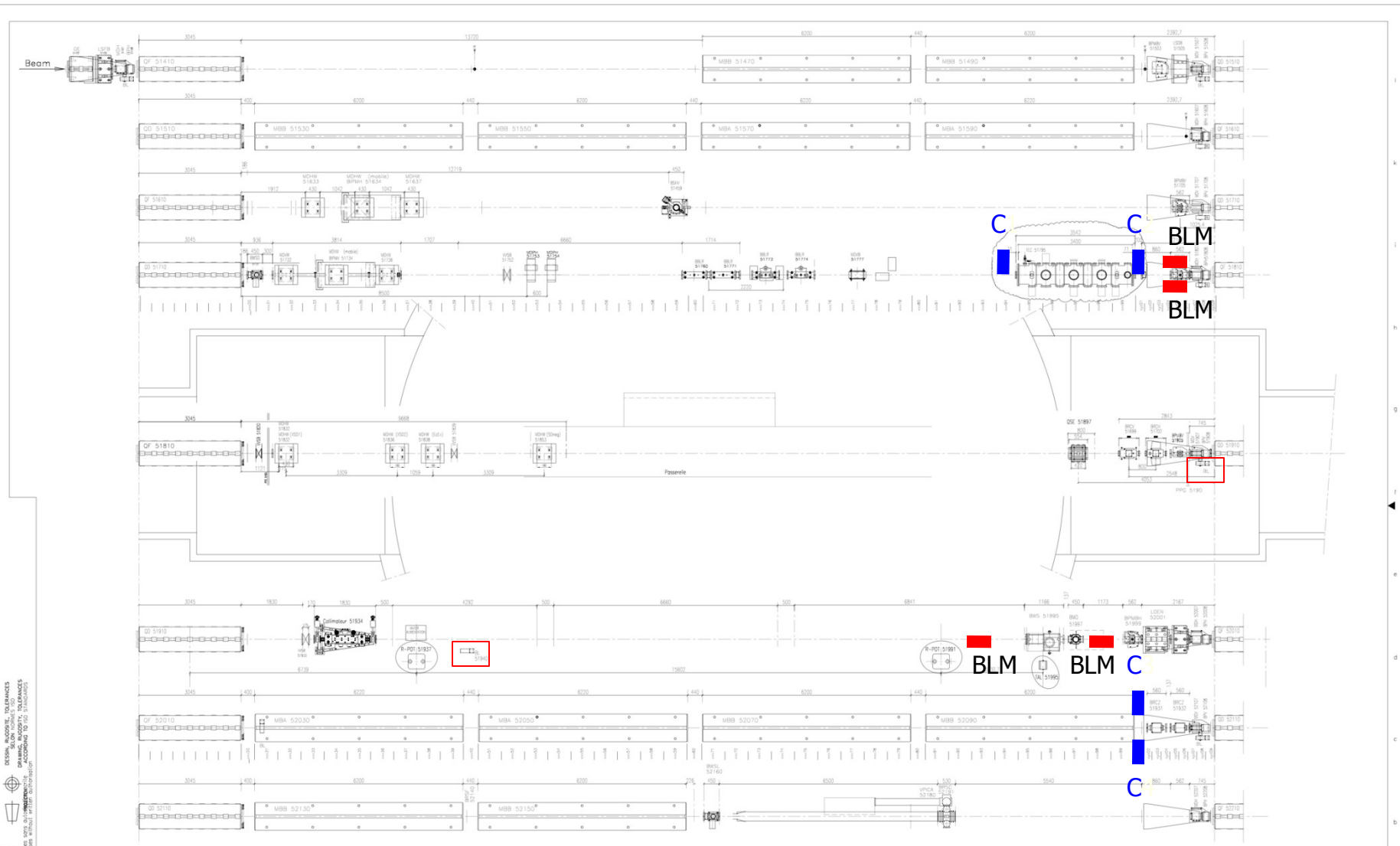


Background will be studied when SPS will start (after April 20, 2009).

Improvements of setup is planned to do on May 25, 2009.

Beam loss and scintillator counters





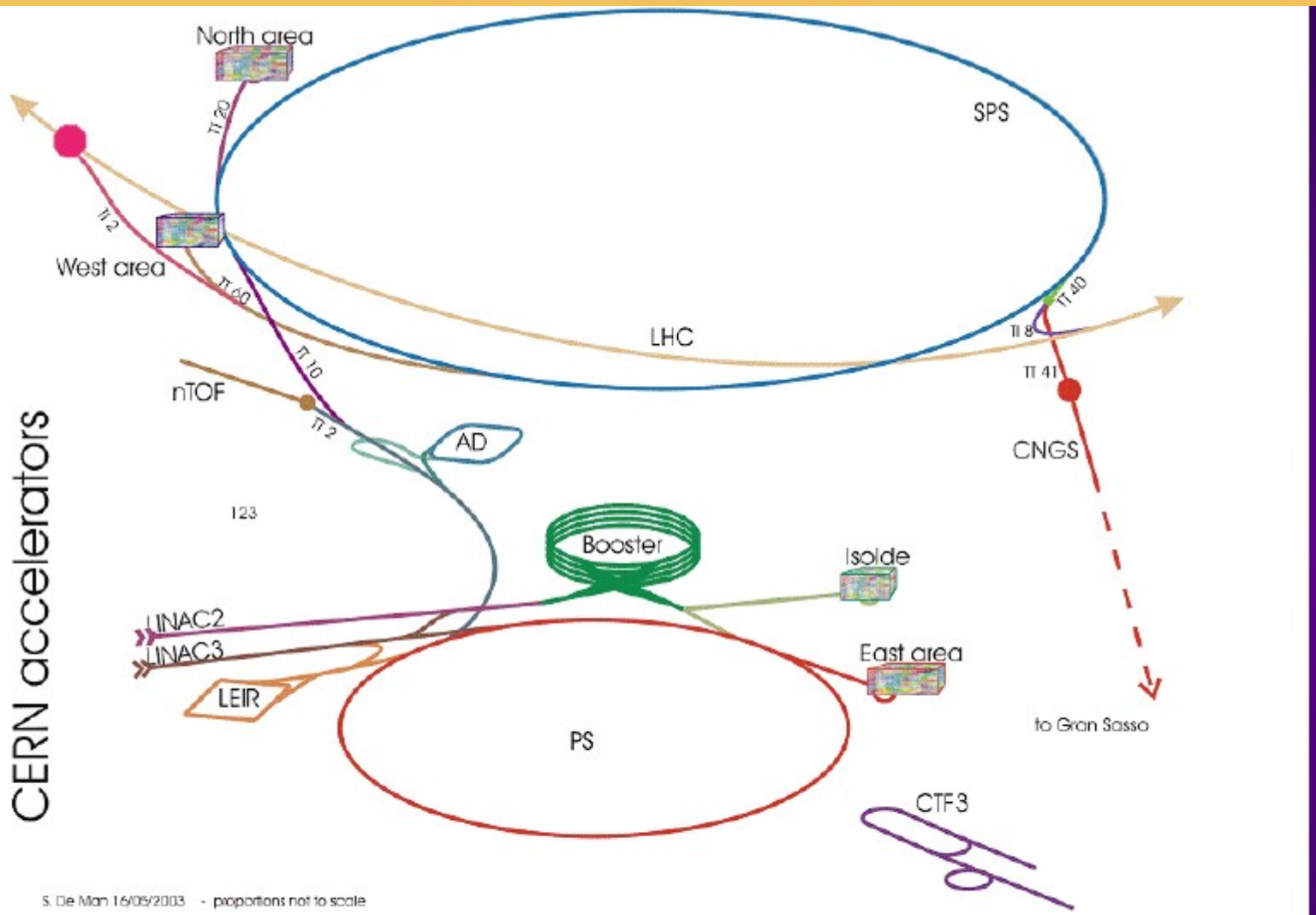
CRYSTAL COLLIMATION STUDIES AT CERN: PLANS FOR 2009

E. Métral

(Coordinator of the machines studies of the PS&SPS complex)

We will start with a single bunch of 5E10 p/b

- **UA9 experiment in the SPS**
  - 120 or 270 GeV/c in coast, few p bunches of few 1E10 p/b (kept bunched or debunched) + slow transverse blow-up (BU) ➔ Slow and constant diffusion of the tails
- **UA9 experiment in the North Area (NA): Fixed Target experiments**
  - 400 GeV/c p (no ions)


CERN accelerators
North area
TT 20
SPS
TT 2
West area
TT 60
LHC
TT 40
TI 8
TT 10
nTOF
TT 41
TT 2
AD
CNGS
123
Booster
Isolde
LINAC2
LINAC3
East area
LEIR
PS
to Gran Sasso
CTF3
S. De Man 16/05/2003 - proportions not to scale

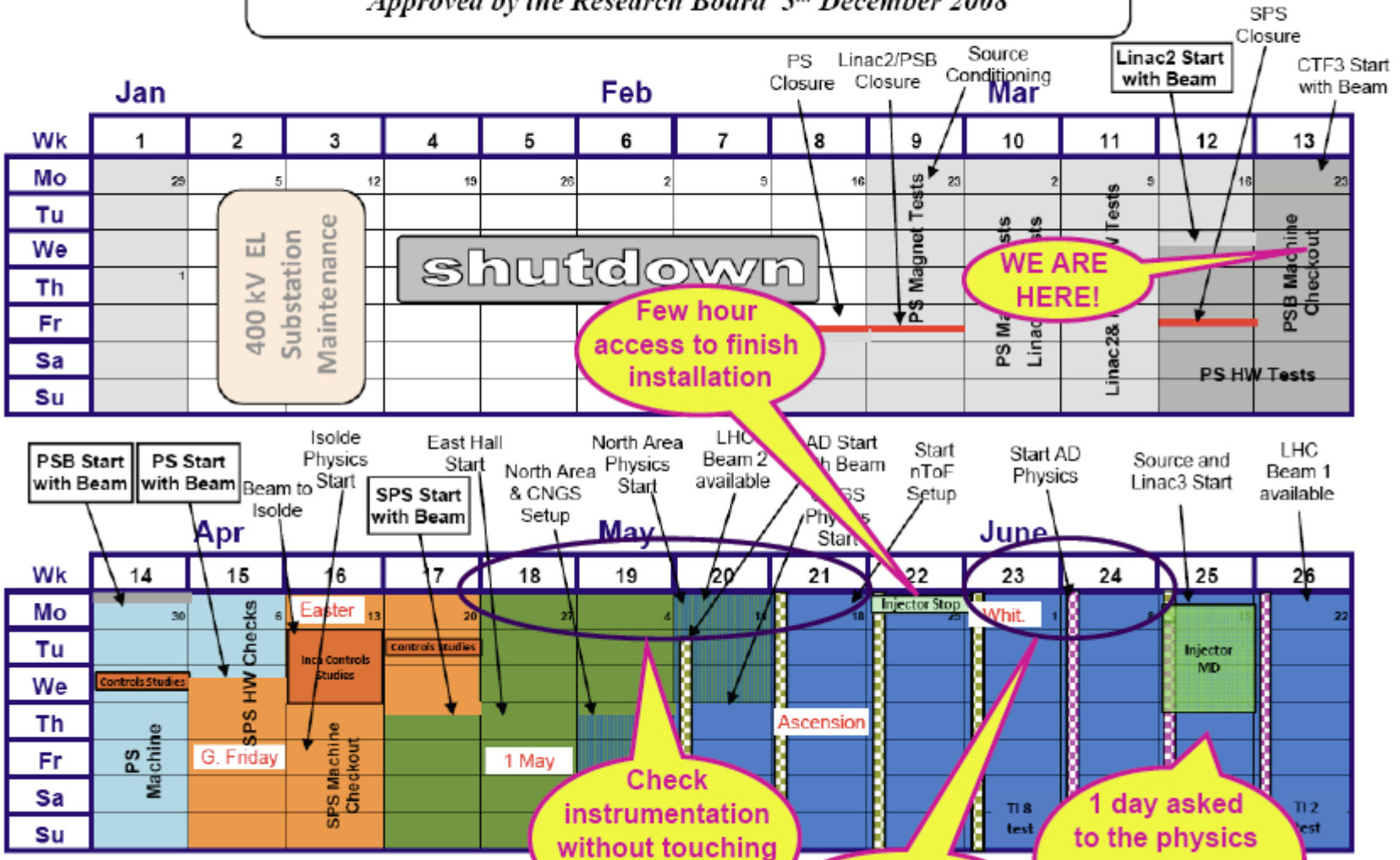
IN THE SPS

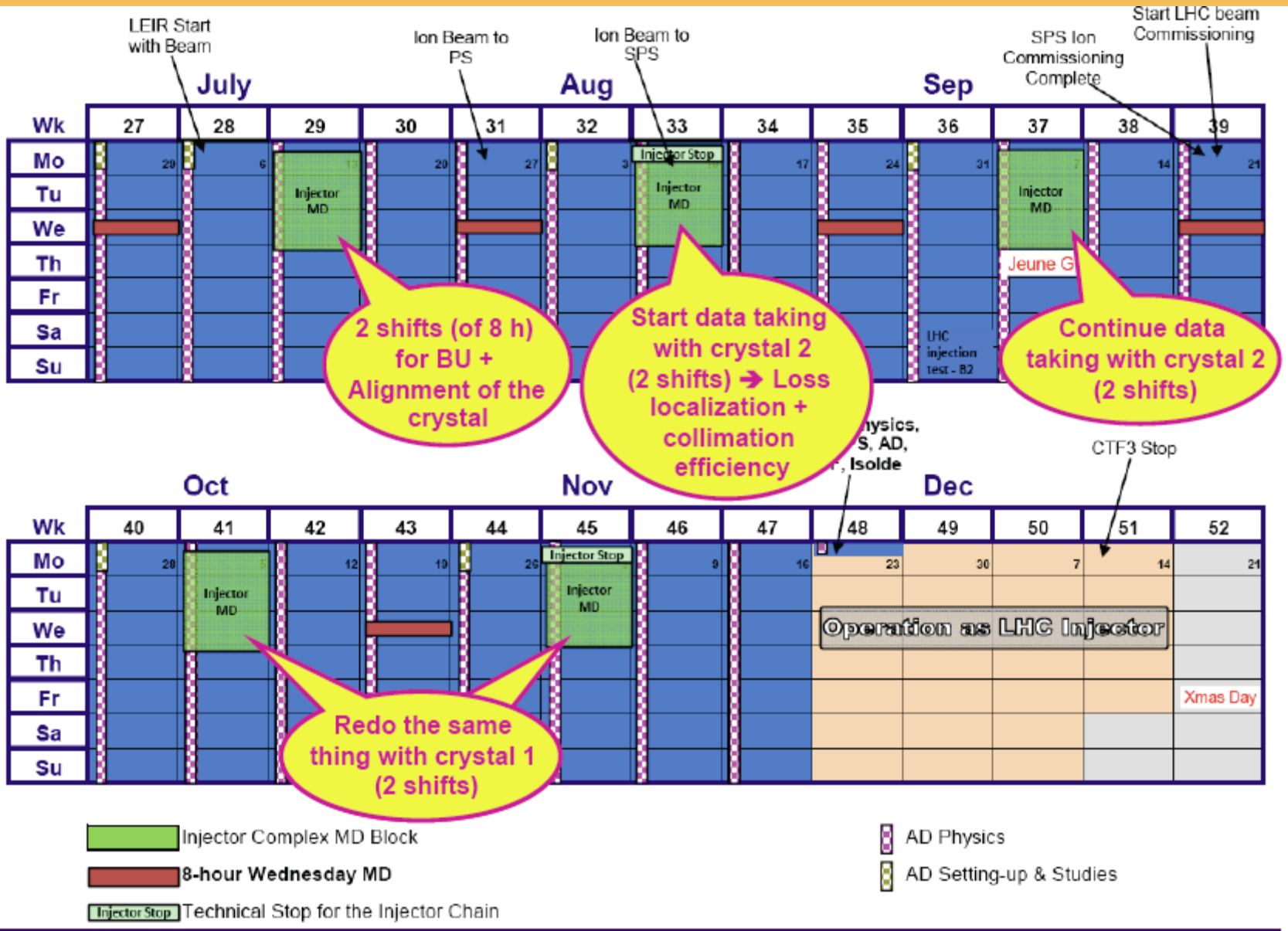
pc

1/3/2009
V3.3

2009 Injector Accelerator Schedule

Approved by the Research Board 5th December 2008




LEIR Start with Beam
Ion Beam to PS
Ion Beam to SPS
SPS Ion Commissioning Complete
Start LHC beam Commissioning
July
Aug
Sep
Oct
Nov
Dec
Wk
Mo
Tu
We
Th
Fr
Sa
Su
Injector MD
Injector Stop
Jeune G
LHC injection test - B2
CTF3 Stop
Operation as LHC Injector
Xmas Day
2 shifts (of 8 h) for BU + Alignment of the crystal
Start data taking with crystal 2 (2 shifts) → Loss localization + collimation efficiency
Continue data taking with crystal 2 (2 shifts)
Redo the same thing with crystal 1 (2 shifts)
Injector Complex MD Block
8-hour Wednesday MD
Technical Stop for the Injector Chain
AD Physics
AD Setting-up & Studies

IN THE NA

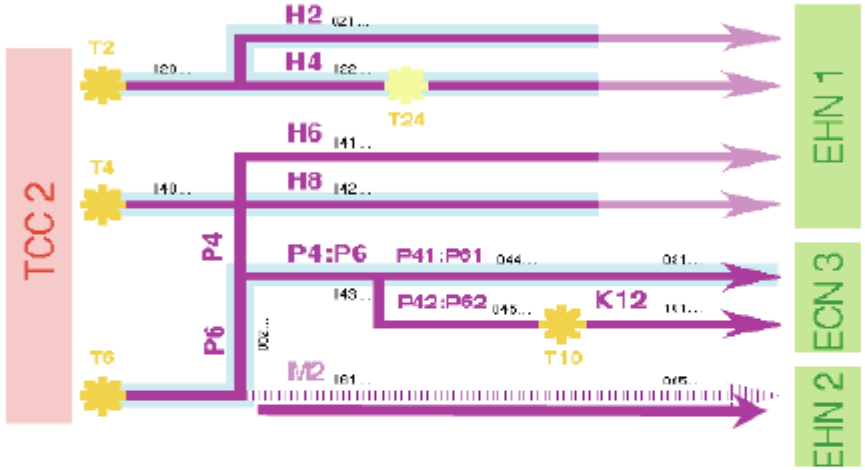
Targets and secondary beams

The 3 proton beams are directed onto the primary targets:

T2 → H2 and H4 beam lines

T4 → H6, H8, and P0 beam lines

T6 → M2 (muon) beam line



Experimental Areas:

- ECN3: underground experimental hall that can receive the primary proton beam with high intensity in ECN3
- EHN1: surface experimental hall that can receive secondary beams and/or attenuated primary proton beams
- EHN2: surface experimental hall that receives the secondary beams or intense muon beam.

Courtesy of J. Wenninger

20-March-2009

2009 SPS Fixed Target Programme

Version 2.0

Colour code: green = SPS-exp ; purple = LHC-exp ; dark blue = Outside exp ; yellow = not allocatable or Machine Development

	P1	P2	P3	P4	P5	P6
	35 30 Apr 4 Jun	35 4 Jun 9 Jul	35 9 Jul 13 Aug	35 13 Aug 17 Sep	35 17 Sep 22 Oct	32 22 Oct 23 Nov
T2 -H2	NA 3 | CMS DATOR 7 | CREAM 7 | TRI 3	TRI 4 | CMS HCAL 10 | WCALO 11 | CMS Slhcgrade 10	CMS 4 | CMS HCAL 13 | NA61 18	NA61 35	NA61 11 | CREAM 7 | NA61 17	NA61 24 | NUCLEON 8
T2 -H4	NA 3 | CMS BCM 7 | CMS ECAL 6 | 4	3 | SITRD 7 | SITRD 7 | RD51 15 | 3	CMS ECAL 9 | DREAM 14 | RPC 6 | CALO 6	CALO 9 | CALET 7 | INSURAD 14 | CMS ECAL 5	CMS ECAL 5 | NA63 20 | UA9 10	RD51 10 | CMS ECAL 9 | LHCf 13
T4 -H6	0 | 5 | 5 | 7 | 3	7 | MEGAS 7 | ATLAS BCM 7 | RD42 7 | 7 | ATLAS LUCID 7	6 | ATLAS MMEGAS 8 | EUDET 14 | 6 | 1	LCFI 6 | SiLC 12 | ATLAS FP420 7 | 8 | 2	ATLAS BCM 7 | RD42 7 | ATLAS LUCID 13 | ATLAS FP420 8	ATLAS 14 | 8 | 7 | 3
T4 -H8	NA 3 | 3DSi 16	12 | 4 | ATLAS 10 | 7 | 3 | MDT Roma 9	3 | STRAW 14 | 3 | UA9 10 | RP 5	ATLAS RP-MDT-MPI 13 | 3 | AMS 19	AMS 28 | 3 | RP 4	ATLAS RP 7 | 3 | UA9 22
T4 -P0	NA Setup 10	NA62 10 | NA62 7 | 21 | NA62 7	NA62 7 | 28	35	30 | NA62 5	NA62 10 | 22
T6 -M2	NA 3 | COMPASS 17	COMPASS 35	COMPASS 35	COMPASS 35	COMPASS 35	COMPASS 32
CNGS	NA 3 | CNGS 17	CNGS 35	CNGS 35	CNGS 35	CNGS 35	CNGS 32

SPS/PS-Coordinator: Horst Breuker

E-mail: SPS.Coordinator@cern.ch

phone: 73777 (ext. +41 22 767 3777)

mobile: 164212 (ext. +41 76 487 4212)

Comments:

- Shift and Compress Schedule by 1 week w.r.t V1.0

SPS Operation — Period 3 2009 Jul 9 to Aug 13

Schedule issue date: 20-March-2009 Version 2.0 (colour code: purple (dark) = scheduling meeting , light green (light) = weekend or holiday)

	Thu 9 Jul	Fri 10 Jul	Sat 11 Jul	Sun 12 Jul	Mon 13 Wk28	Tue 14 Jul	Wed 15 Jul	Thu 16 Jul	Fri 17 Jul	Sat 18 Jul	Sun 19 Jul	Mon 20 Wk29	Tue 21 Jul	Wed 22 Jul	Thu 23 Jul	Fri 24 Jul	Sat 25 Jul	Sun 26 Jul	Mon 27 Wk30	Tue 28 Jul	Wed 29 Jul	Thu 30 Jul	Fri 31 Jul	Sat 1 Aug	Sun 2 Aug	Mon 3 Wk31	Tue 4 Aug	Wed 5 Aug	Thu 6 Aug	Fri 7 Aug	Sat 8 Aug	Sun 9 Aug	Mon 10 Wk32	Tue 11 Aug	Wed 12 Aug	Thu 13 Aug
Machine								8 BIG MD 8																								8 BIG MD 8			
NORTH AREA T2 -H2					8h CMS-SlUp			8h D Lazic							CMS-HCAL			8h Z Fodor																NA61 proton		
NORTH AREA T2 -H4					8h A Singovski			CMS-ECAL						8h R Wigmans							DREAM		8h CALICE-RPC I Laktineh										COMPASS-CALO			
NORTH AREA T4 -H6					8h ATLAS-LUCID H Wilkens			8h						ATLAS-MMEGAS H Wilkens						8h I Gregor							EUDET		8h M Vos				DEPFET		LCFI	
NORTH AREA T4 -H8					8h MDT-Roma			8h S Mouraviev							STRAW			TOTEM	8h W Scandale									UA9 proton			8h ATLAS-RP H Wilkens			
NORTH AREA T4 -P0					8h A Ceccucci			NA62																											
NORTH AREA T6 -M2					8h G Mallot																												COMPASS hadron		
-CNGS					8h Neutrinos			CNGS																											

For further information contact the SPS/PS-Coordinator

Remarks

SPS/PS-Coordinator: Horst Breuker
E-mail: SPS.Coordinator@cern.ch
phone: 73777 (ext. +41 22 767 3777)
mobile: 164212 (ext. +41 76 487 4212)

- The indicated Machine Stops might not be up to date.
  Please consult http://ab-div.web.cern.ch/ab-div/Schedules/schedule2009.pdf

SPS Operation — Period 5 2009 Sep 17 to Oct 22

Schedule issue date: 20-March-2009 Version 2.0 (colour code: purple (dark) = scheduling meeting , light green (light) = weekend or holiday)

	Thu 17 Sep	Fri 18 Sep	Sat 19 Sep	Sun 20 Sep	Mon 21 Wk38	Tue 22 Sep	Wed 23 Sep	Thu 24 Sep	Fri 25 Sep	Sat 26 Sep	Sun 27 Sep	Mon 28 Wk39	Tue 29 Sep	Wed 30 Sep	Thu 1 Oct	Fri 2 Oct	Sat 3 Oct	Sun 4 Oct	Mon 5 Wk40	Tue 6 Oct	Wed 7 Oct	Thu 8 Oct	Fri 9 Oct	Sat 10 Oct	Sun 11 Oct	Mon 12 Wk41	Tue 13 Oct	Wed 14 Oct	Thu 15 Oct	Fri 16 Oct	Sat 17 Oct	Sun 18 Oct	Mon 19 Wk42	Tue 20 Oct	Wed 21 Oct	Thu 22 Oct
Machine																			8 BIG MD			8														
NORTH AREA T2 -H2	8h Z Fodor NA61 proton														8h A Malinin CREAM proton				8h Z Fodor																NA61 proton	
NORTH AREA T2 -H4	8h A Singovski CMS-ECAL							8h U Uggerhoj																										NA63	8h W Scandale UA9 eminus
NORTH AREA T4 -H6	8h H Wilkens ATLAS-BCM							8h H Kagan RD42							8h H Wilkens																				ATLAS-LUCID	8h H Wilkens ATLAS-FP420
NORTH AREA T4 -H8	8h V Plyaskin																																	AMS hadron	TOTEM 8h H Wilkens ATLAS-RP
NORTH AREA T4 -P0																																			8h A Ceccucci NA62
NORTH AREA T6 -M2	8h G Mallot																																		COMPASS hadron
-CNGS	8h Neutrinos																		CNGS																

For further information contact the SPS/PS-Coordinator

Remarks

SPS/PS-Coordinator: Horst Breuker
E-mail: SPS.Coordinator@cern.ch
phone: 73777 (ext. +41 22 767 3777)
mobile: 164212 (ext. +41 76 487 4212)

- The indicated Machine Stops might not be up to date.
  Please consult http://ab-div.web.cern.ch/ab-div/Schedules/schedule2009.pdf
- H4: still need to find an arrangement for CMS Ecal...

SPS Operation — Period 6 2009 Oct 22 to Nov 23

Schedule issue date: 20-March-2009 Version 2.0 (colour code: purple (dark) = scheduling meeting , light green (light) = weekend or holiday)

	Thu 22 Oct	Fri 23 Oct	Sat 24 Oct	Sun 25 Oct	Mon 26 Wk43	Tue 27 Oct	Wed 28 Oct	Thu 29 Oct	Fri 30 Oct	Sat 31 Oct	Sun 1 Nov	Mon 2 Wk44	Tue 3 Nov	Wed 4 Nov	Thu 5 Nov	Fri 6 Nov	Sat 7 Nov	Sun 8 Nov	Mon 9 Wk45	Tue 10 Nov	Wed 11 Nov	Thu 12 Nov	Fri 13 Nov	Sat 14 Nov	Sun 15 Nov	Mon 16 Wk46	Tue 17 Nov	Wed 18 Nov	Thu 19 Nov	Fri 20 Nov	Sat 21 Nov	Sun 22 Nov	Mon 23 Wk47
												8			8																	
Machine												BIG MD																				
NORTH AREA T2 -H2	8h Z Fodor																					NA61 phys			8h L Tkachev	NUCLEON						
NORTH AREA T2 -H4	8h M Alfonsi	RD51										8h A Singovski			CMS-ECAL					8h Y Itow									LHCf			
NORTH AREA T4 -H6	8h H Wilkens	ATLAS-3DSi-Silrr													8h M Winter	MonoPix				8h H Wilkens	MMEGAS				8h H Wilkens	BCM						
NORTH AREA T4 -H8	8h H Wilkens	ATLAS-RP			TOTEM							8h W Scandale																	UA9 proton			
NORTH AREA T4 -P0	8h A Ceccucci	NA62																														
NORTH AREA T6 -M2	8h G Mallot																												COMPASS muons			
-CNGS	8h Neutrinos														CNGS																	

For further information contact the SPS/PS-Coordinator

Remarks

SPS/PS-Coordinator: Horst Breuker
E-mail: SPS.Coordinator@cern.ch
phone: 73777 (ext. +41 22 767 3777)
mobile: 164212 (ext. +41 76 487 4212)

- The indicated Machine Stops might not be up to date.
  Please consult http://ab-div.web.cern.ch/ab-div/Schedules/schedule2009.pdf

Our Goals

- Experimentally assess the cleaning behavior of a bent crystal, acting as primary collimator ➔ Understand crystal as primary collimator.
- Do this with parameters relevant to the LHC such that we can extrapolate SPS crystal results to the LHC regime. This leads us to variations in a number of parameters.
- Mostly interested in losses around the ring, in particular losses in the SPS magnets. Therefore we put the focus on the loss measurements with Beam Loss Monitors (BLM's). Also interested in Roman Pots.
- Approach very successful for LHC collimator tests with loss maps.
- Want to prove that we can reproduce in simulation the measured losses in the accelerator with a bent crystal as primary collimator.
- Not so important to minimize losses, as long as we can get reliable measurements, proving that we understand the crystal physics and cleaning process.

From SPS/Tevatron Measurements towards LHC… (My Guess for Discussion)

- SPS/Tevatron:
  - Characterization of **crystal as primary collimator with stored beam and diffusive beam halo.**
  - Verification of predictive tools and models.
- LHC predictions:
  - Based on experimental data predict LHC collimation performance with crystal enhancement (at the moment simulations look promising).
  - Based on operational experience predict operational efficiency with 8 crystals for the LHC.
- Based on predictions, decide. If crystal upgrade confirmed:
  - Start prototyping of LHC crystal.
  - Modify cleaning insertions to implement power dump etc.
  - Test, produce all, install and commission.
- Timeline: **Phase II upgrade of the LHC** (2016?) or before?