SNEAP 2006 - Session 10

COMMISSIONING OF THE AUSTRALIAN SYNCROTRON

Mark Boland
Australian Synchrotron, Major Projects
Clayton, Victoria, Australia

The Australian Synchrotron is a 3 GeV electron accelerator designed to produce a broadband spectrum of photons for use in a wide range of research fields. Each research beamline will be tuned to a specific part of the spectrum; from IR to visible, through UV into soft x-rays and up to hard x-rays. The machine consists of a full energy injection system with a 100 MeV linac and a 100 MeV to 3 GeV booster synchrotron that feeds a 3 GeV storage ring synchrotron. A number of overseas and local contractors delivered specialised components, which were commissioned mostly by local physicists and engineers under the guidance of international experts. The storage ring is now in routine operation at 50 mA and detailed accelerator physics studies are under way to characterise the beam performance. Beamline commissioning will commence in early 2007. An overview of the accelerator commissioning is given here, with an emphasis on the technical integration of the machine subsystems required to produce the electron beams.

Questions:

Fred Johnson (ANU): Could you give me an idea of the physical size of the ring, the number of beam lines and what sort of vacuum is in the storage ring.

Mark Boland: The circumference of the storage ring is 216 metres to within the nearest couple of hundred microns according to our survey team. There is room for 28 bend magnet beam lines and about twelve insertion device beam lines. When the beam is off, it's about 10^{-10} and when the beam is on, we start scrubbing the vacuum chamber and it goes up to about 10^{-9} or 10^{-8} depending on where you look. We are up to an integrated beam of eight or nine ampere-hours so we want to get to about two hundred before we have a really nicely scrubbed vacuum system.

John McKay (retired): There is an interesting theme that comes from both your accelerator and Graham's in that you are having users come in that are not accelerator people. What steps are you taking to help those people do their experiments?

Mark Boland: As I mentioned, I am in the accelerator group and we're a very small group in a very large organization. What will be the largest group will be the beamline scientist group. They is currently one beamline scientist for seven beamlines that are fully funded and there will be another seven of those coming on line within the next six months or so. So there will be a dedicated beamline scientist for each beamline plus the control support group for software and we have mechanical engineering for hardware. So there is a huge team. Usually the first person you will meet will be the beamline scientist. You will have collaborated with them to get your beamtime in the first place. Then there is an army of people that can help you with software, hardware as well as the machine group which can do things for you if you want the beam to go slowly or with a slightly different polarization. We can do some specialized little chicanes for each beamline. As the user group becomes more demanding once the initial beam is there and they do the first experiments.

????: The injector energy is 90 keV and after the prebuncher, the energy is 100 keV. Where is this energy gain in the prebuncher system?

Mark Boland: We want to beat the space charge so we want to get the electrons relativistic as soon as possible. There are several prebunchers. There is the stop-harmonic prebuncher which will put the 500 MHz structure into it. Then there is the primary buncher which is the 6 GHz high gradient one. It is a four cell buncher. Then you do some more focusing after that and then you have a sixteen cell final buncher to get it up a beta of 95 and that has quite a high gradient. So you want to beat the space charge and get the structure to match the storage ring so that your longitudinal phase space will match from each accelerator.

????: You displayed a cell without any watercooling system?

Mark Boland: It is actually heated to 35 degrees +/- 0.1 or so for stability. It's just to keep it on resonance. It's not that critical. There are some cooling loads on the prebuncher.

End of questions

Commissioning of the Australian Synchrotron

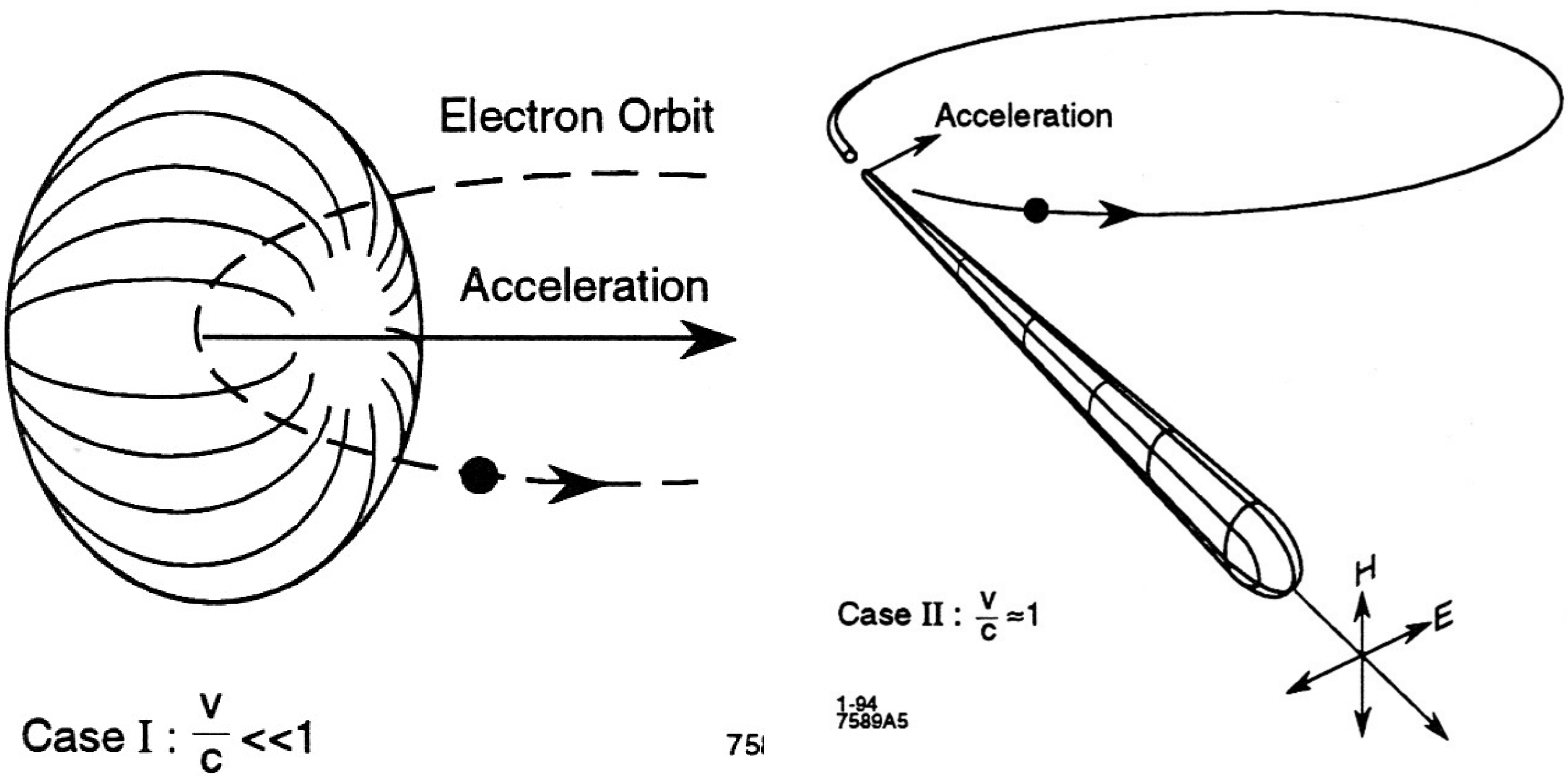
19 November, 2006

Mark Boland
Accelerator Physicist
Australian Synchrotron

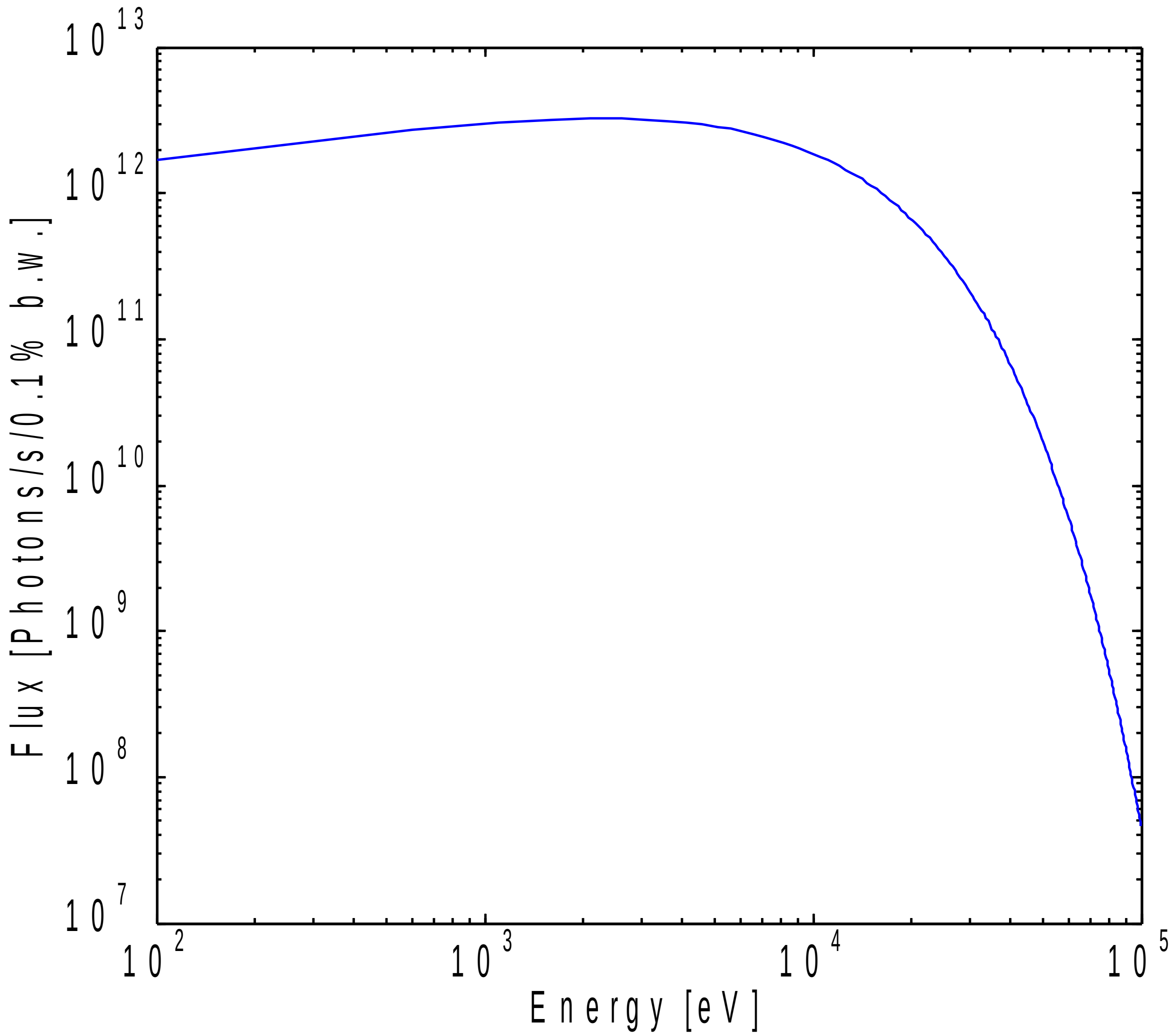
Australian Synchrotron

Synchrotron Science

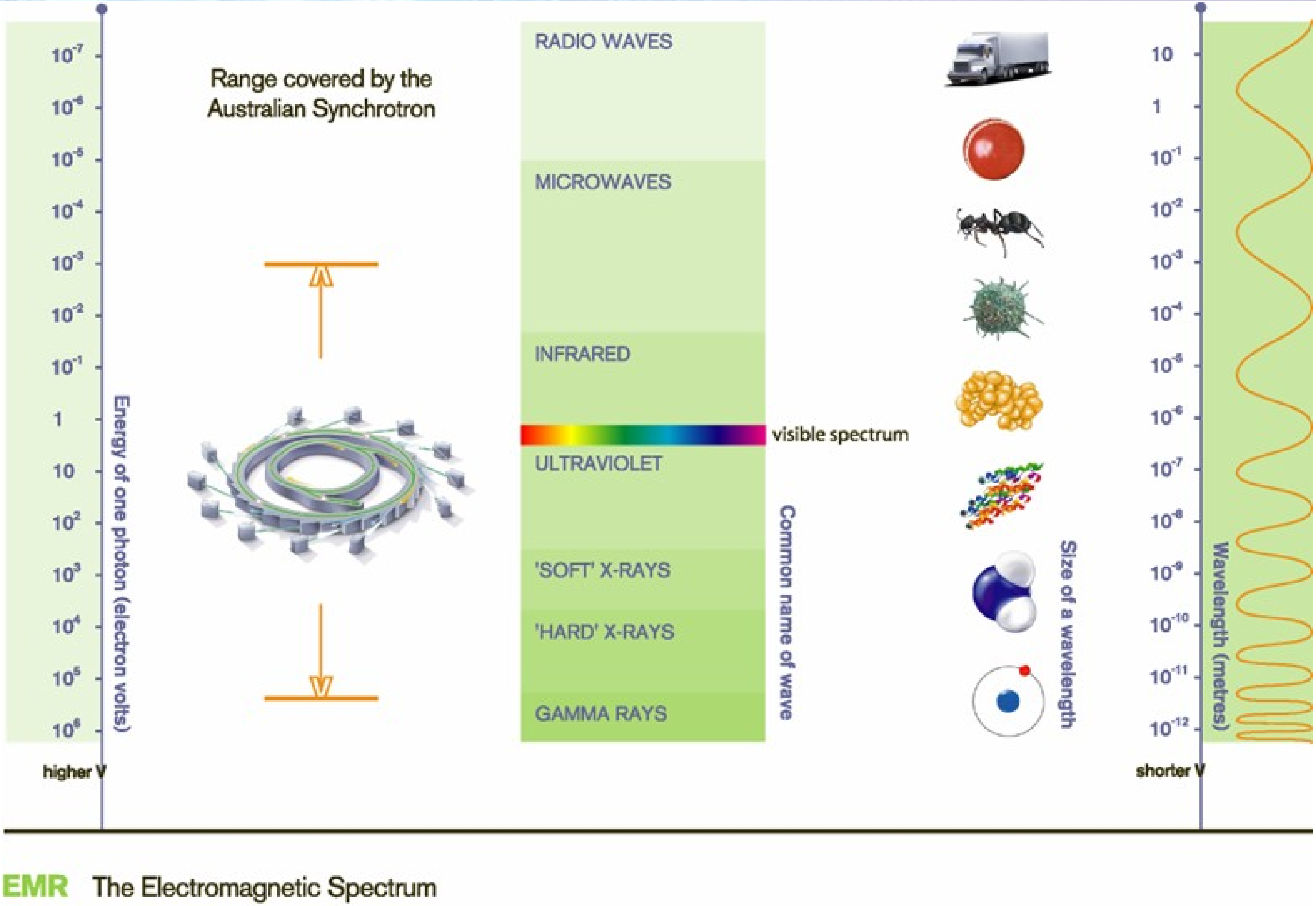
Synchrotron Radiation



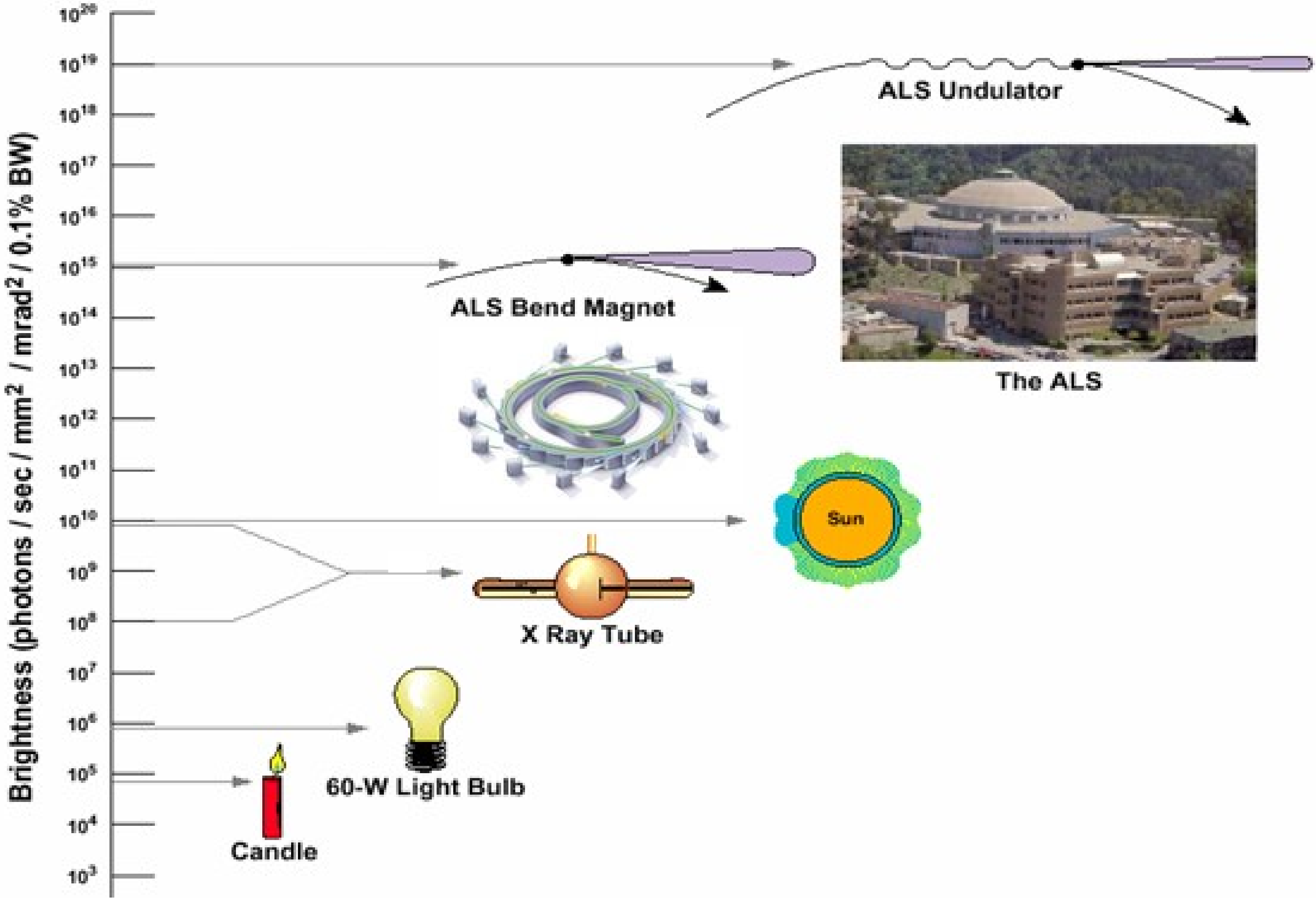
Bending Magnet Photon Spectrum



Broadness of Synchrotron Light

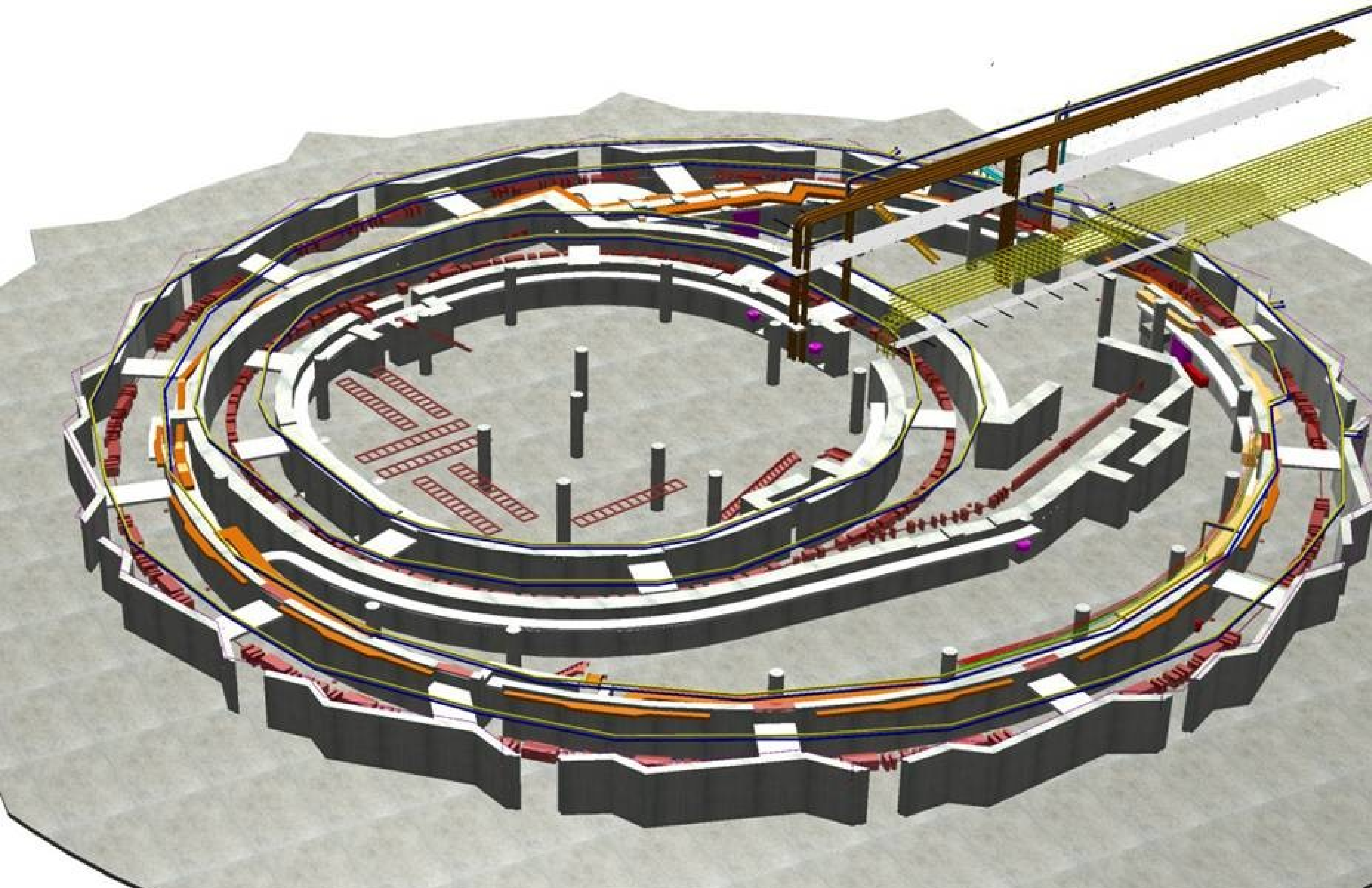


Brightness of synchrotron light



Machine Overview

Facility Engineering Model



Accelerator Tunnels

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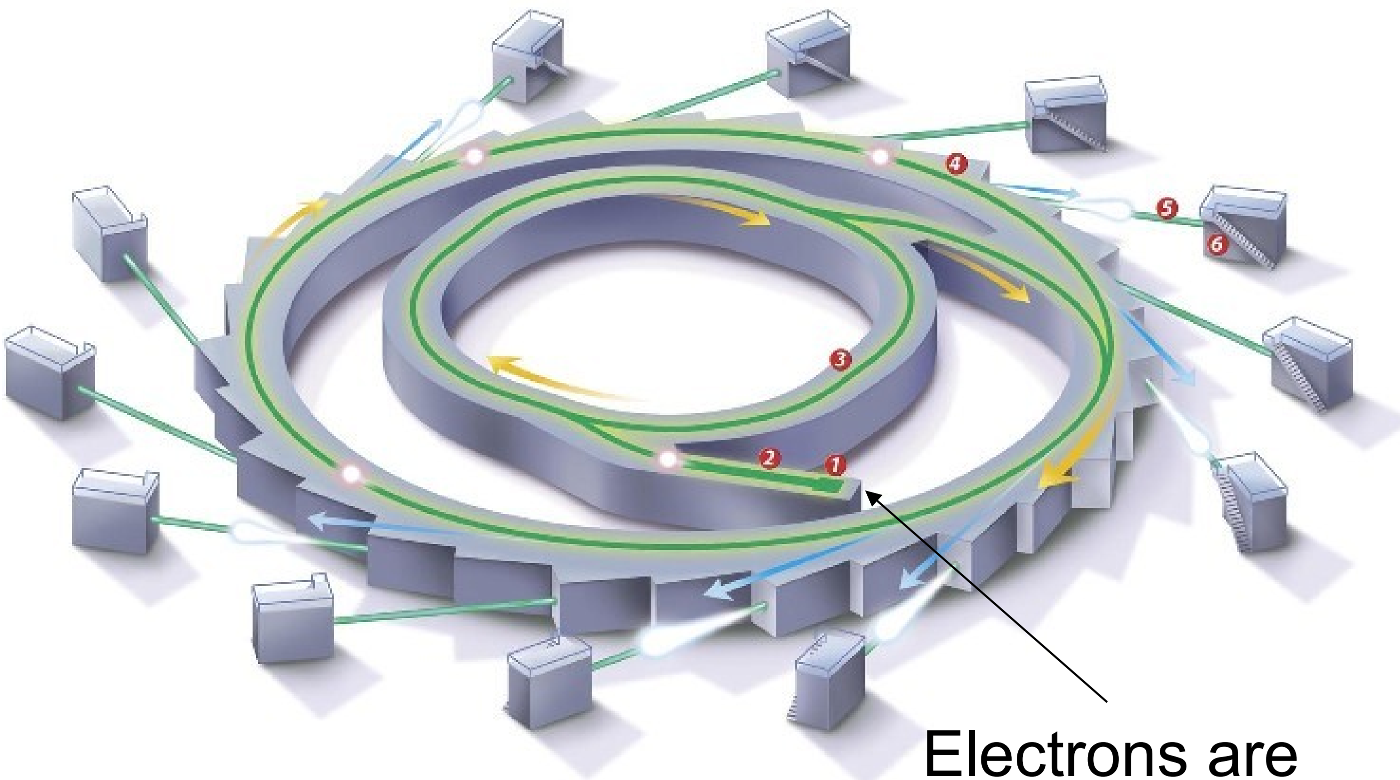
e-gun



Electrons are generated at the gun

90 keV from electron gun

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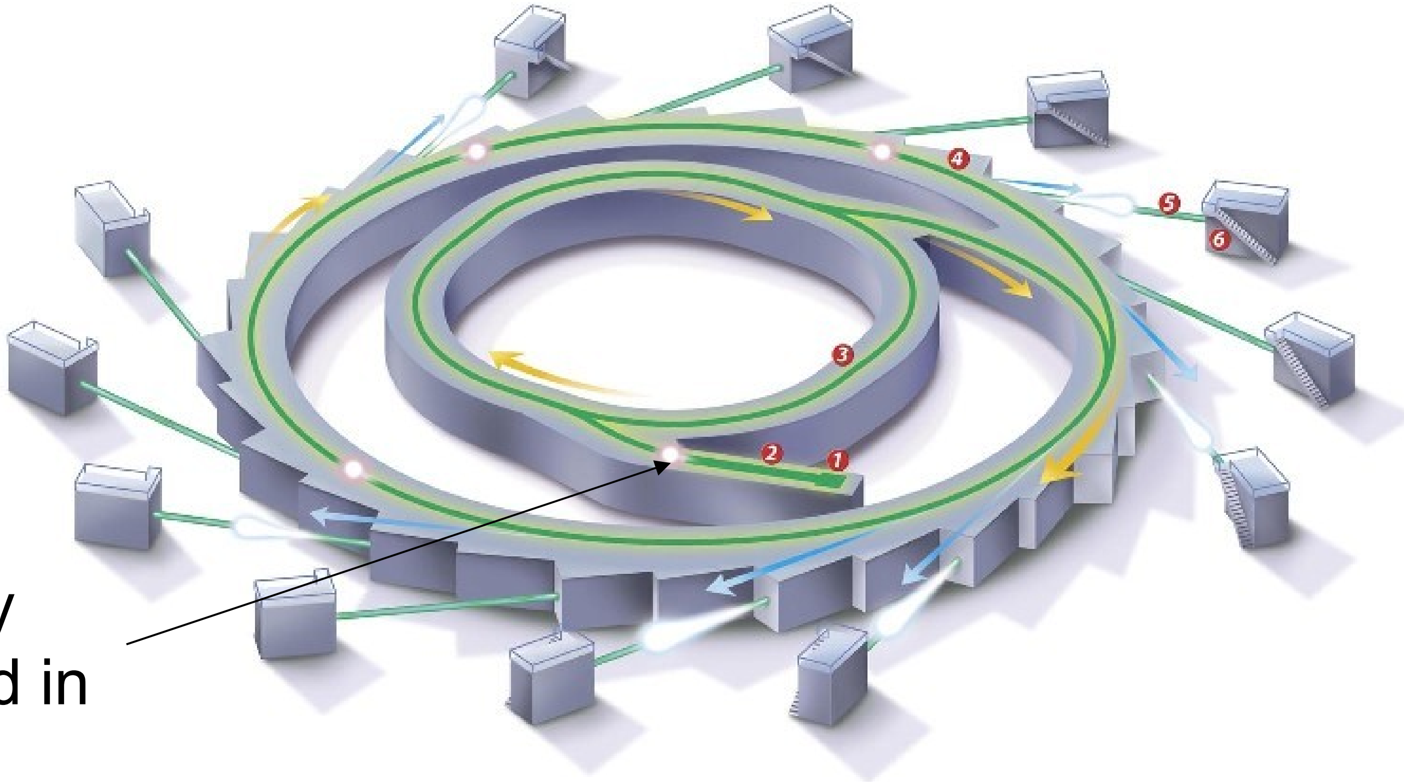
Linac



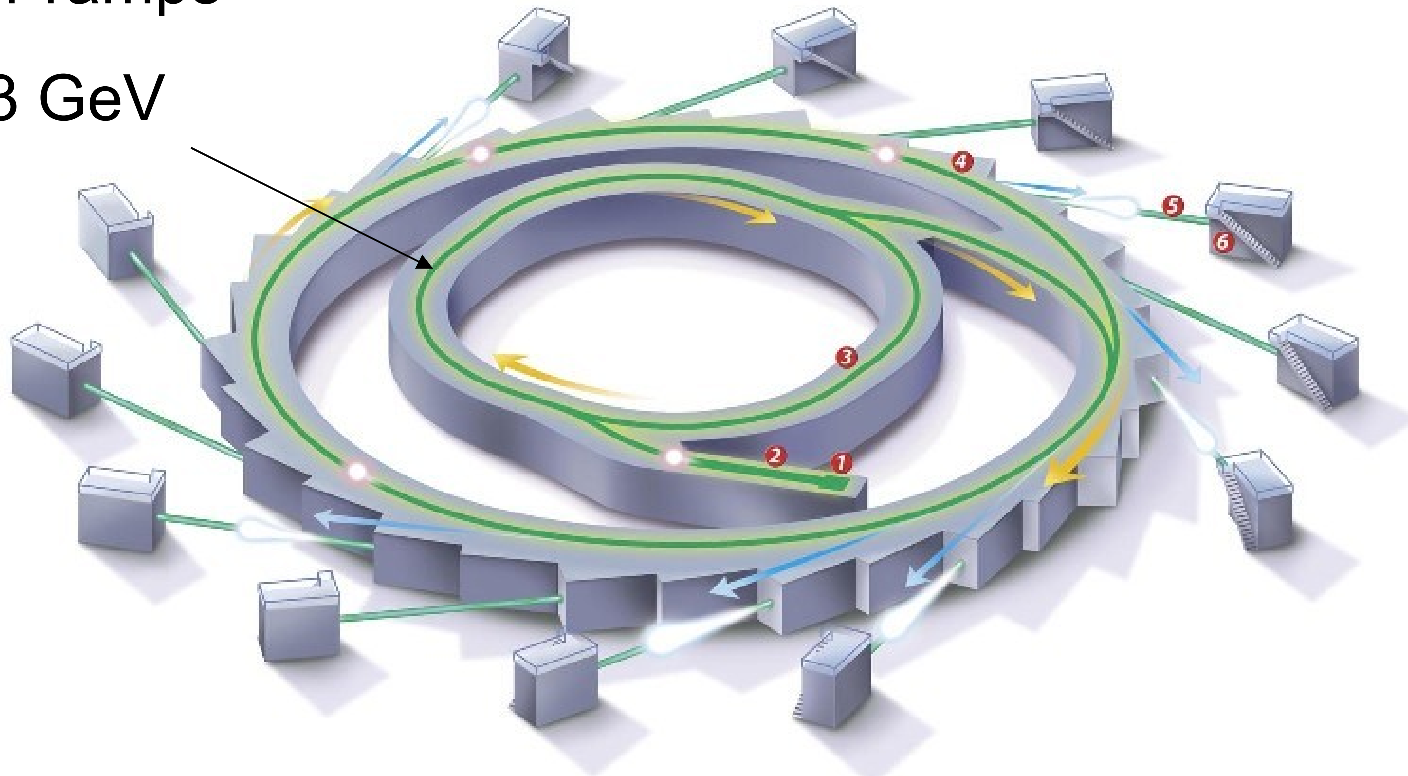
And initially accelerated in the LINAC

100 MeV from the linac

Booster

The booster ramps

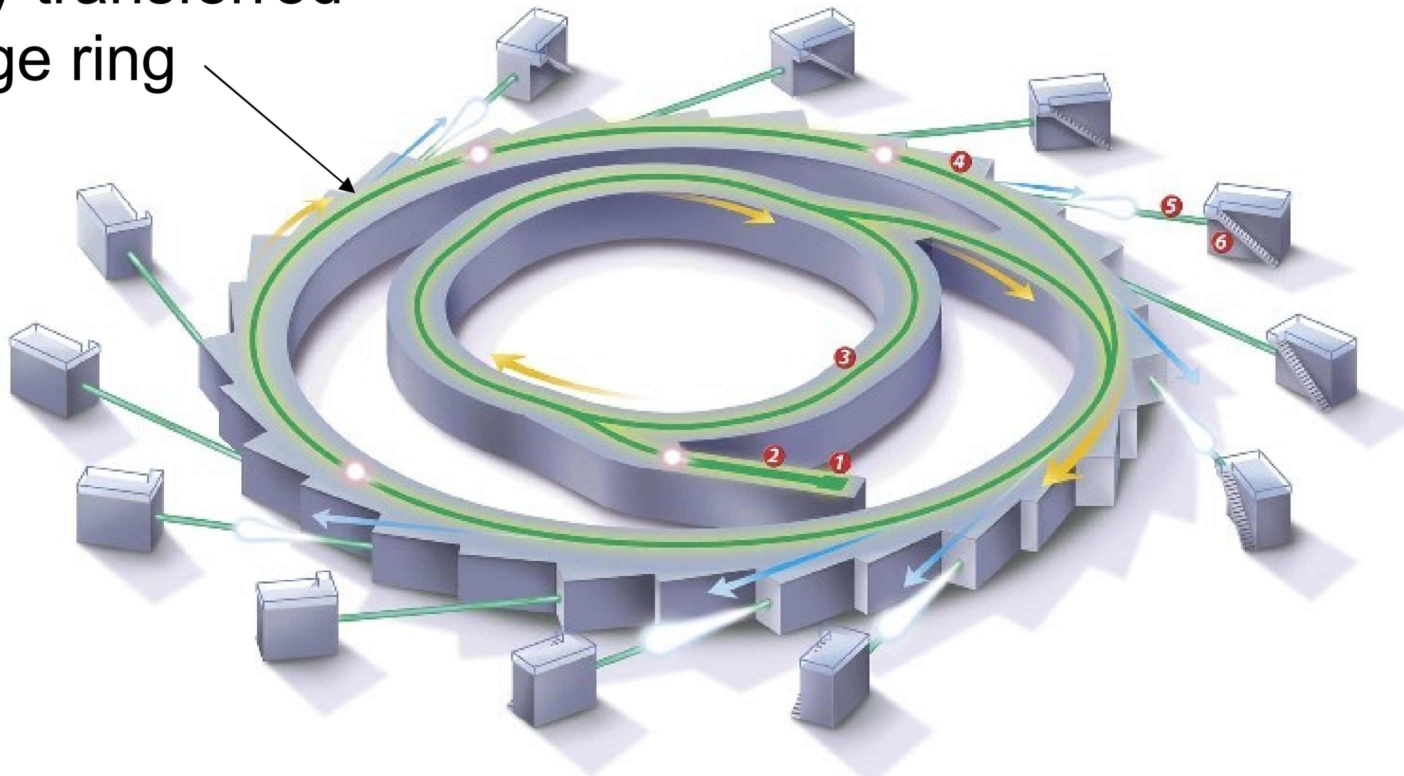
At 1 Hz to 3 GeV



3 GeV from the booster

Storage Ring

And are finally transferred into the storage ring



3 GeV in the storage ring

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Linac Commissioning

Linac Components

Component	Beam Energy after component
Electron Gun	90 keV
Sub-Harmonic Pre Buncher	100 keV
Primary Buncher	300 keV
Final Buncher	3 MeV
First Accelerating Section	50 MeV
Second Accelerating Section	100 MeV

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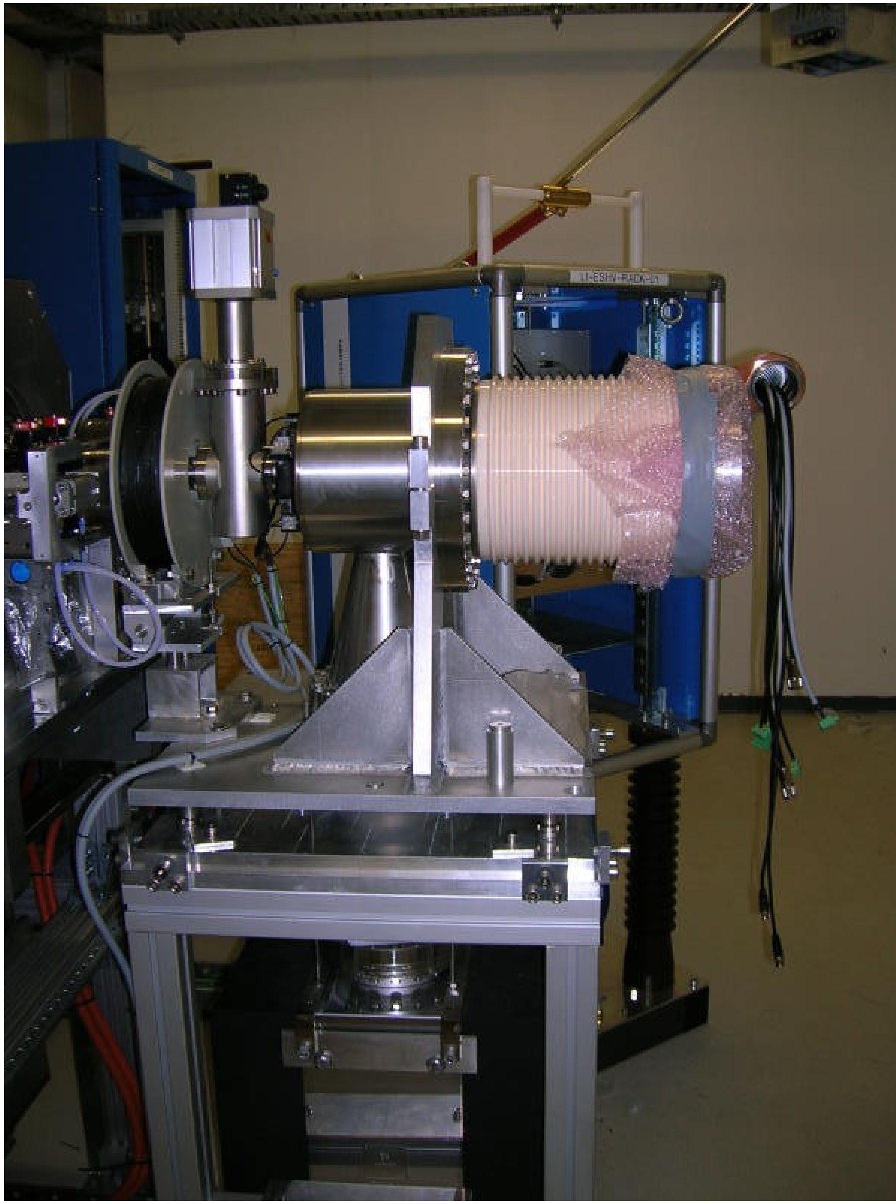
Electron Gun

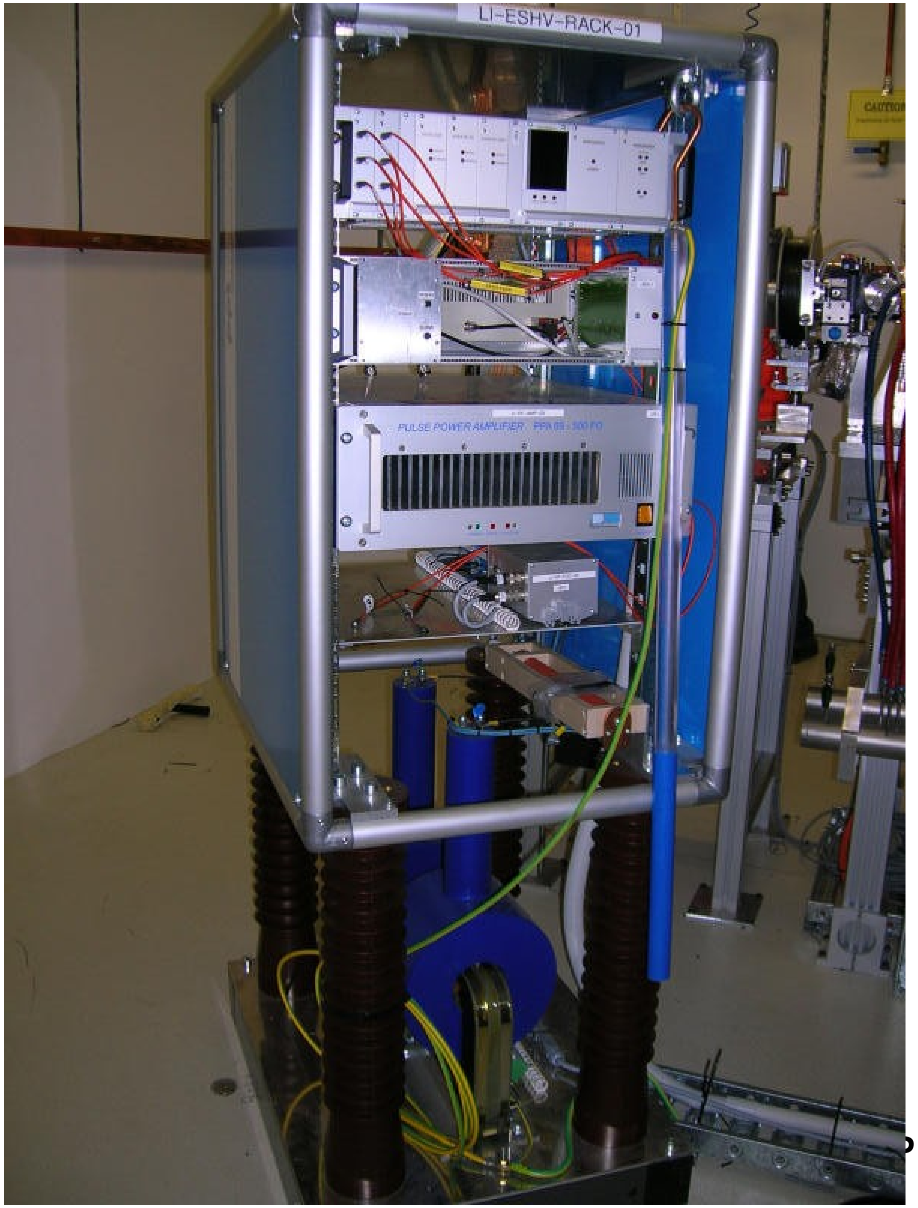


- Cathode: YU 171 EIMAC
- Size: 1 cm^2
- Energy: 90 keV
- Pulse width: 1 ns
- Peak Current: 0.07-2.1 A
- Output Charge: 0.42 nC
- Rate: < 5 Hz

Multi-bunch mode

- 150 ns pulse
- 500 MHz modulation

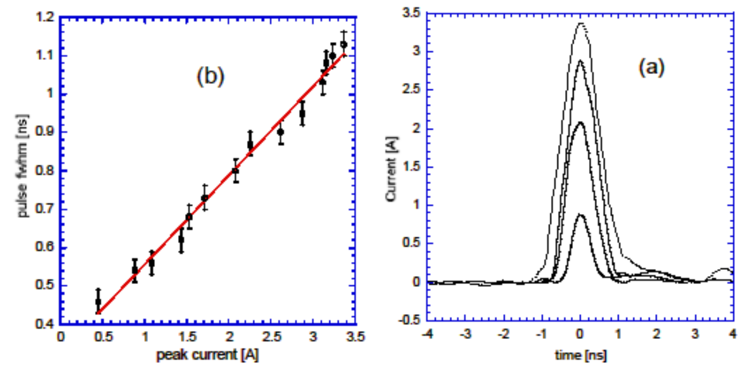
Electron Gun Controller, Pulser and Power



Pulse Mode:

- Short Pulse Mode (SPM)
- Long Pulse Mode (LPM)

Modulated by Booster RF frequency 500 MHz



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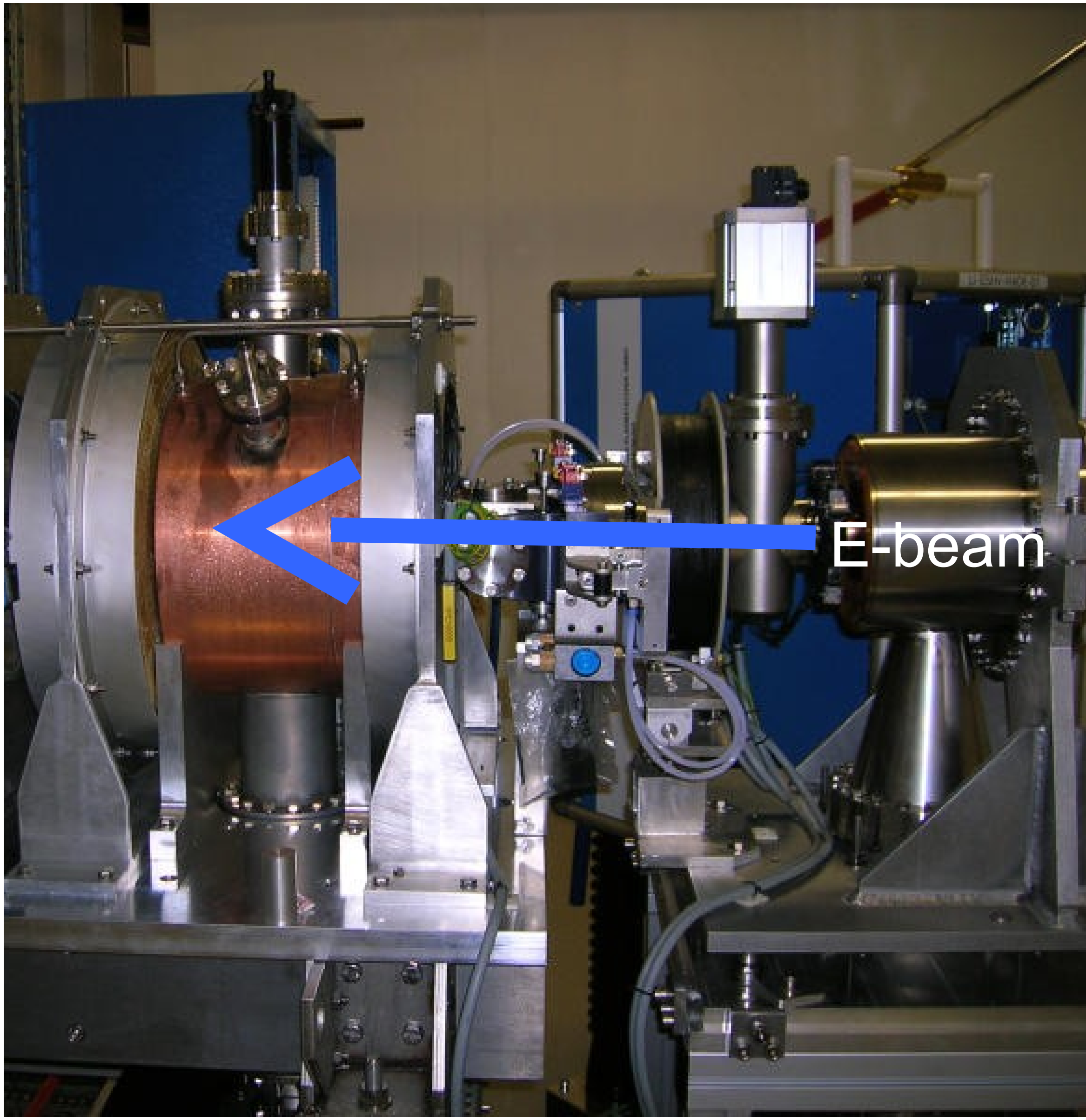
Bunchers

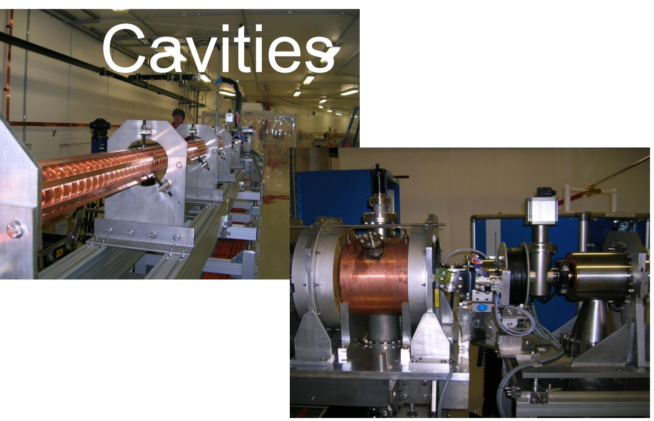


Sub-Harmonic Pre Buncher (SPB):
- Freq.: 500 MHz
- Power: 500 W

4 Cell Primary Buncher:
- Freq.: 3 GHz
- Phase Vel.: 0.6 *c*
- Grad.: 7 MeV/m

16 Cell Final Buncher:
- Freq.: 3 GHz
- Phase Vel.: 0.95 *c*
- Grad.: 12 MeV/m

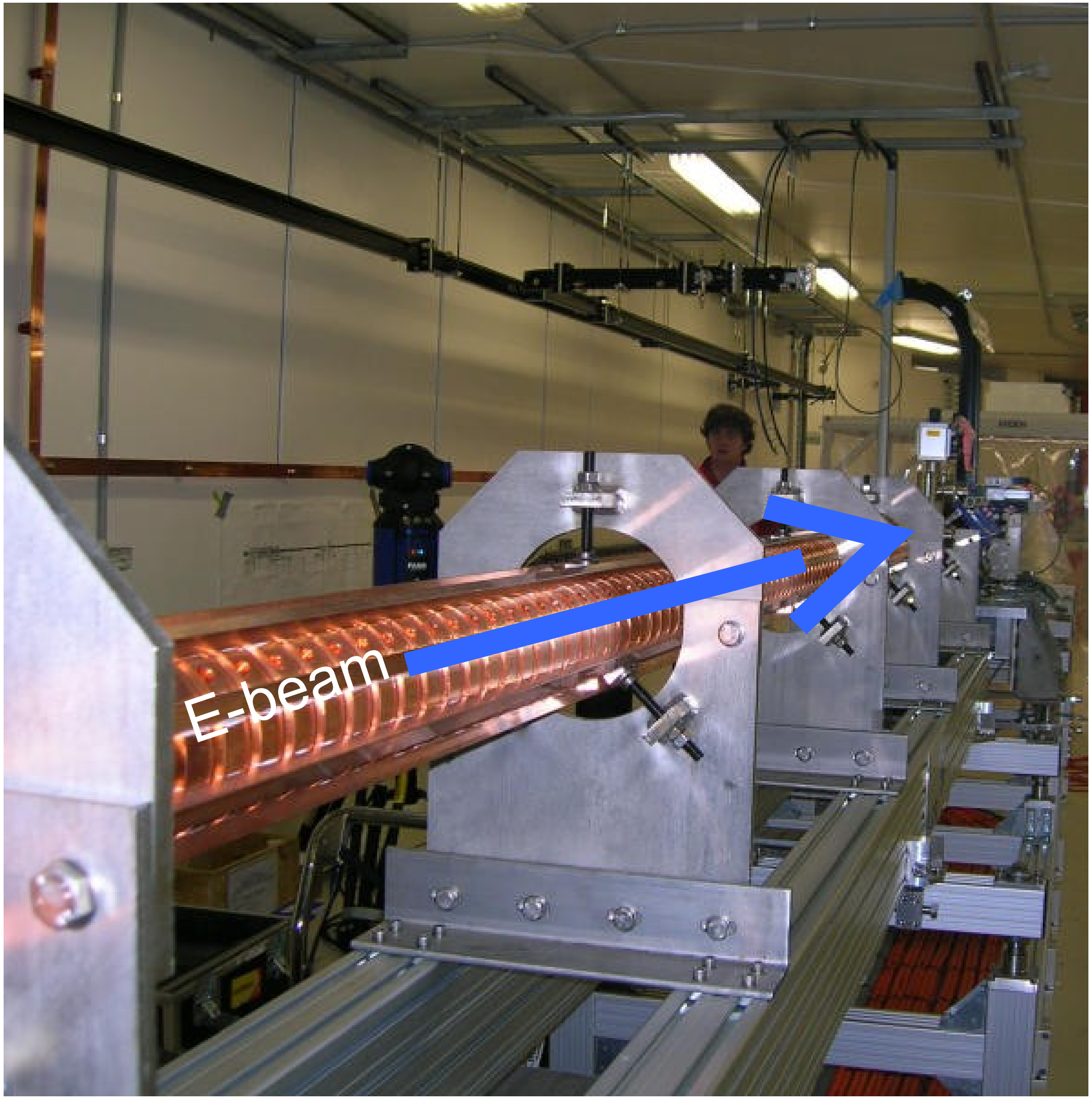
RF Power



Pre-Amplifier:
- Power: 350 W
- Pulse: 30 μs

Klystron:
- Freq.: 3 GHz
- Power: 35 MW
- Voltage: 280 kV
- Current: 290 A
- Pulse: 3.5 μs

Accelerating Structures



S-Band structure
DESY Linac II Type

Accelerating Structure:
- Frequency: 3 GHz
- Energy Gain: 50 MeV
- Length: 5 m
- Grad.: 10 MeV/m
- Power: 25-35 MW
- Temperature: 40°C
- Filling Time: 0.74 μs
- Two Accelerating Structures
- 156 Cells each
- Phase Vel.: c

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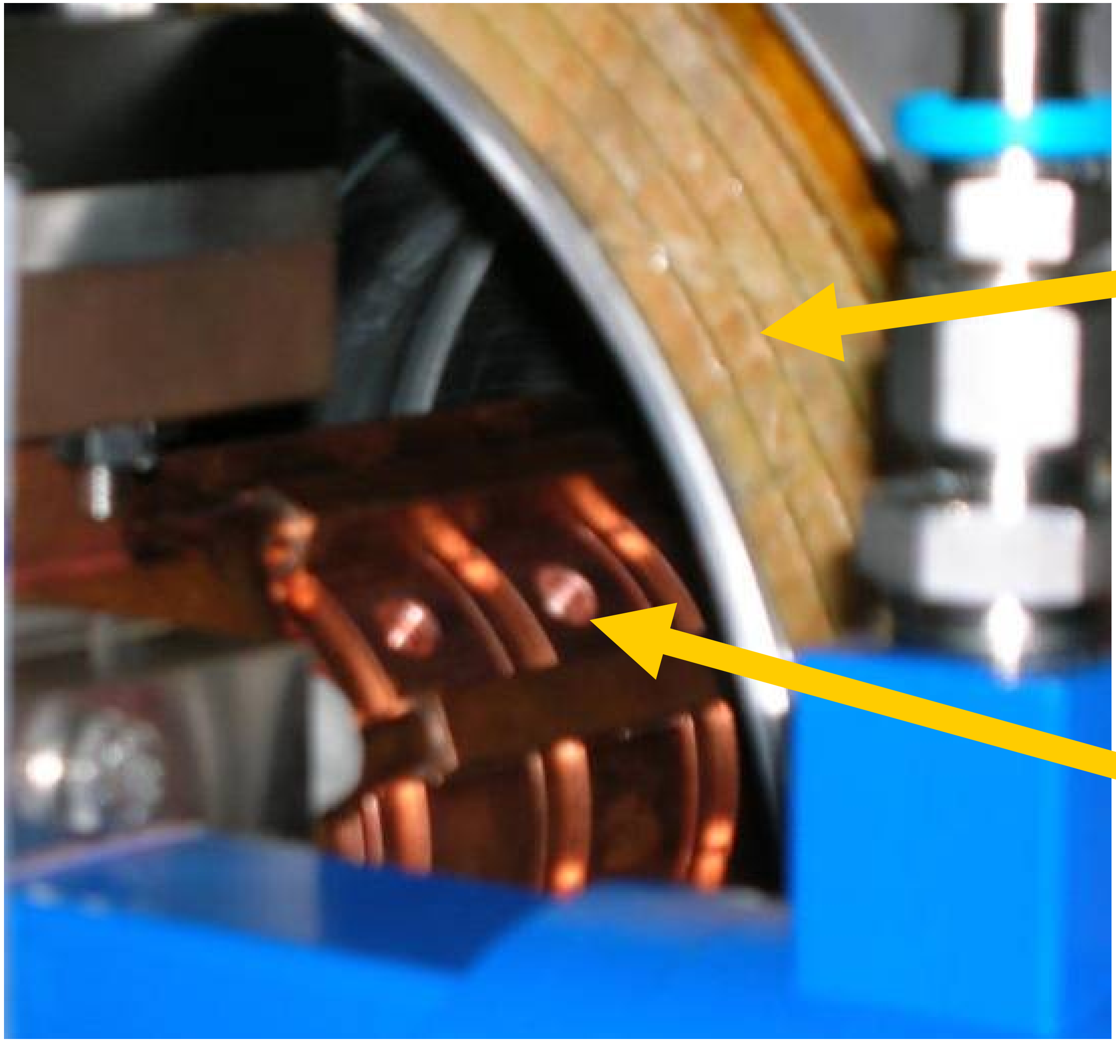
3 GHz Cavities

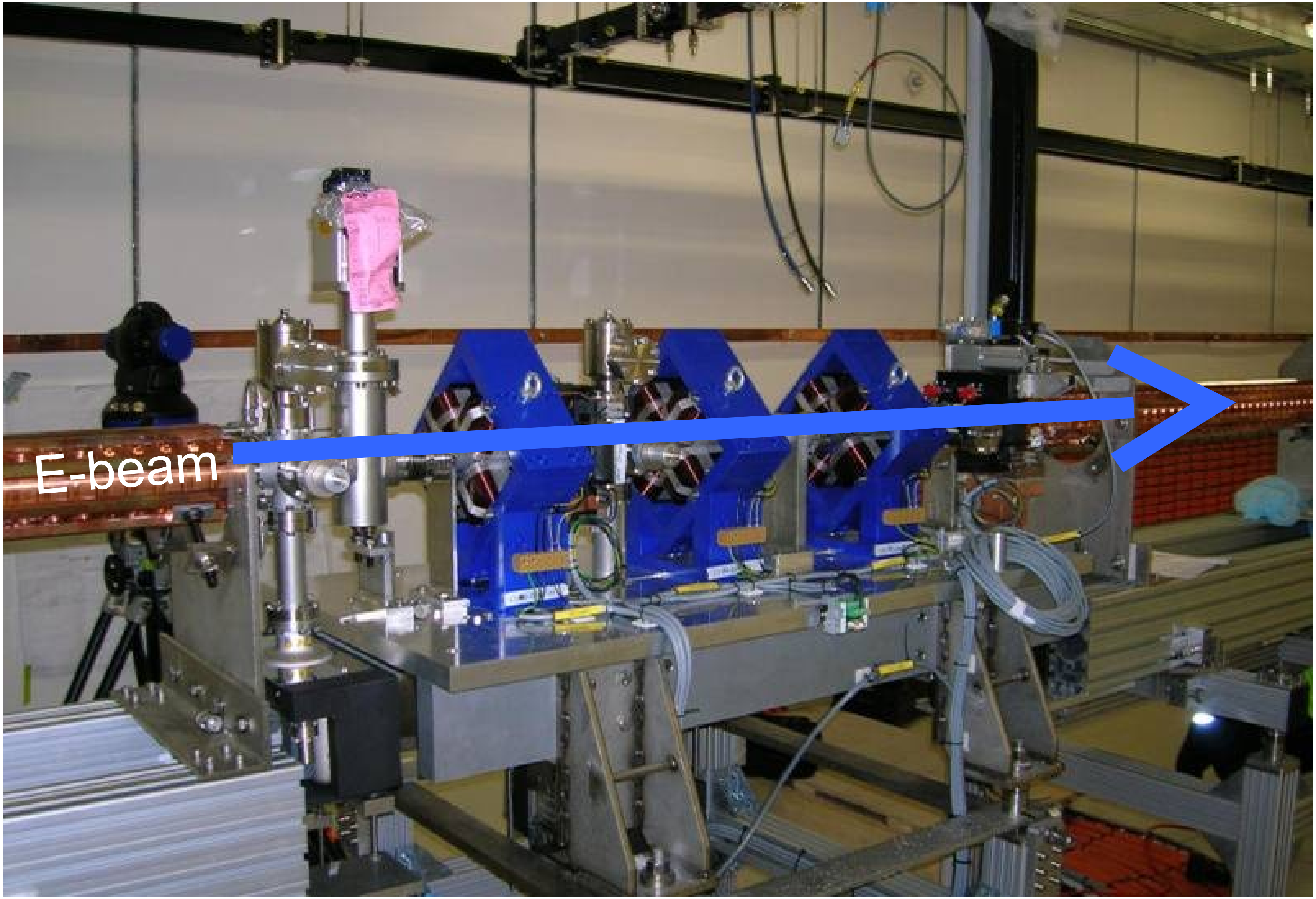


Solenoid Focusing Coils

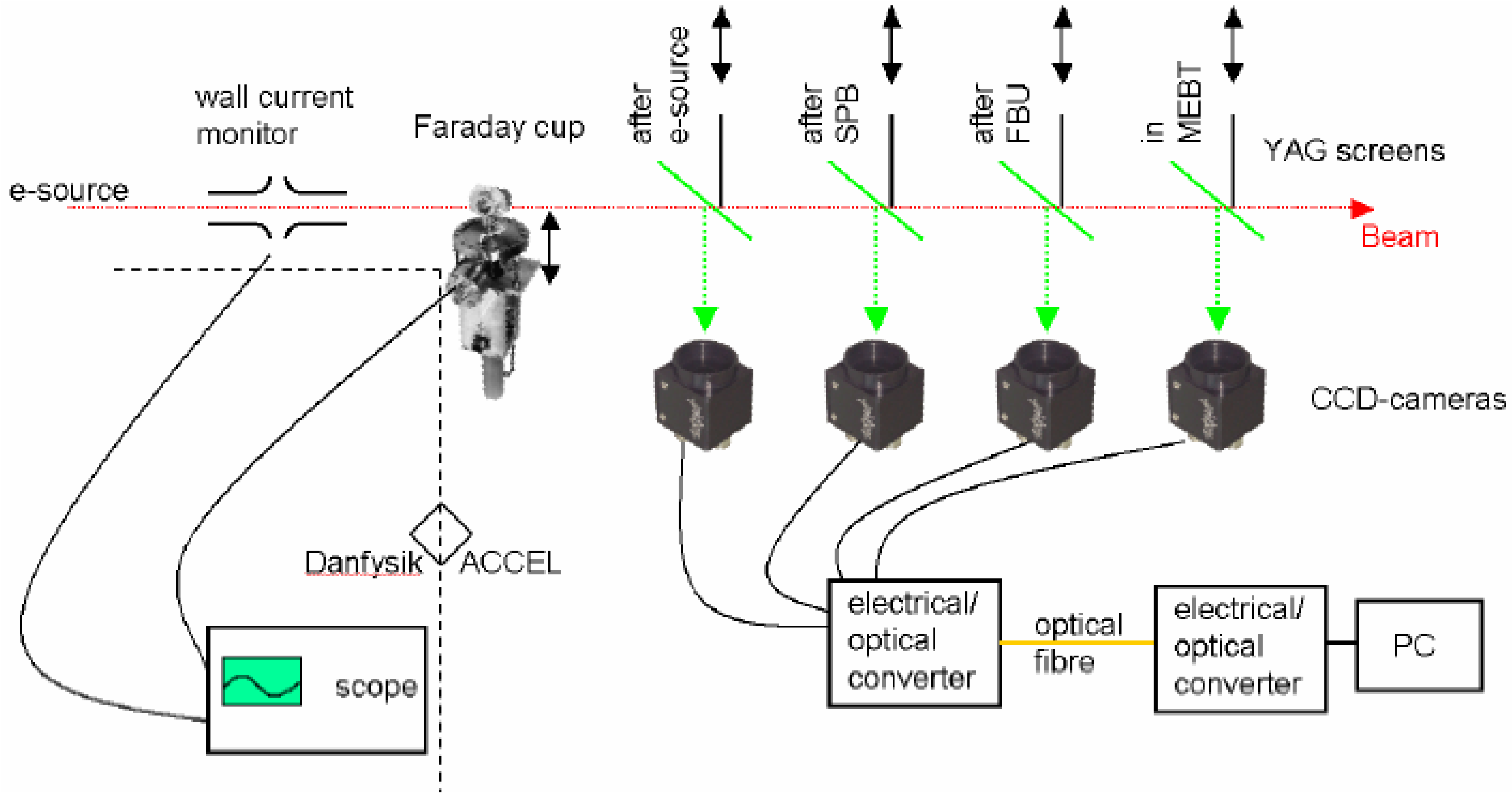
4 Cells
16 Cells
156 Cells
156 Cells

Accelerating Cavity Cell

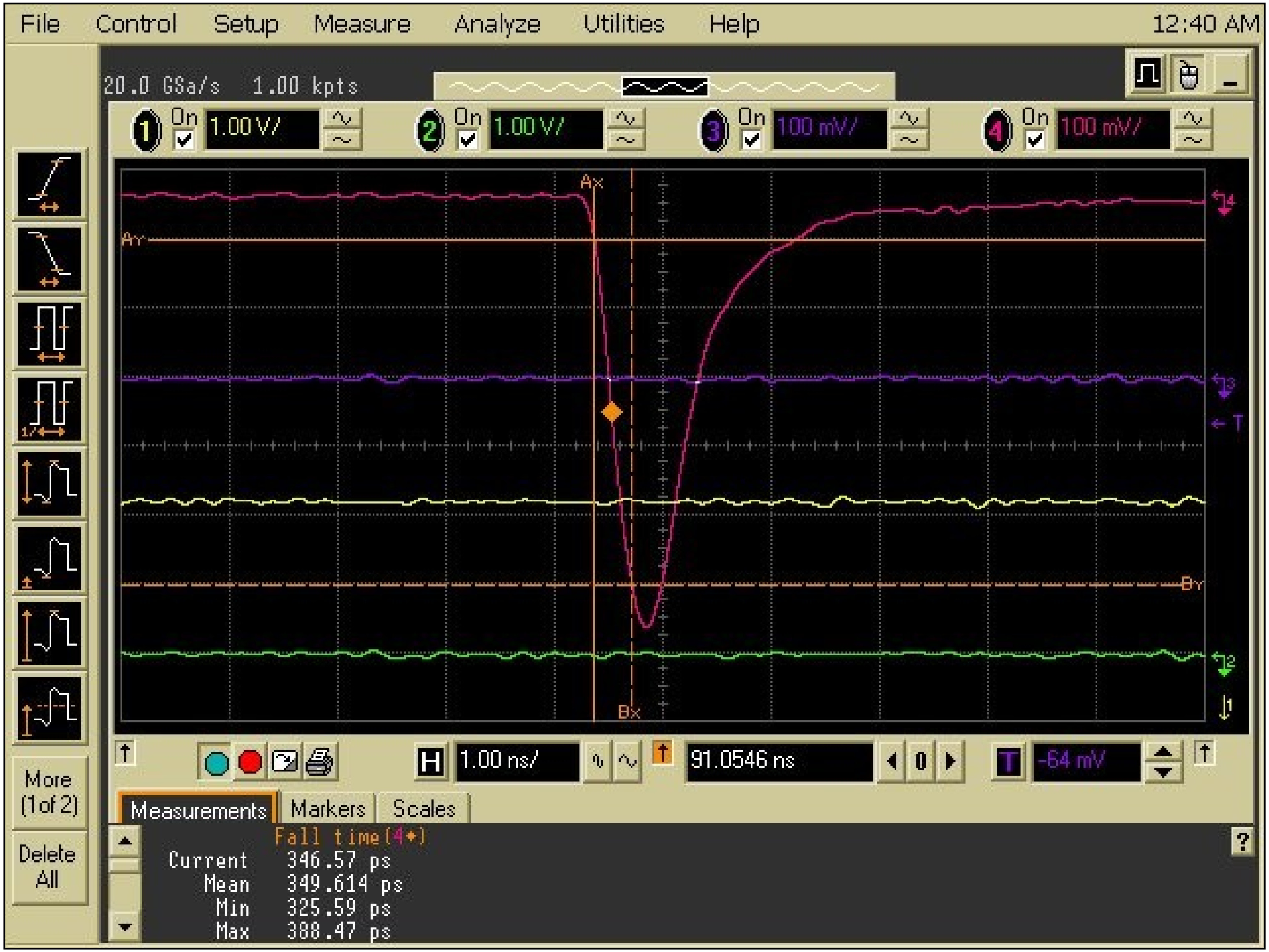
Focusing



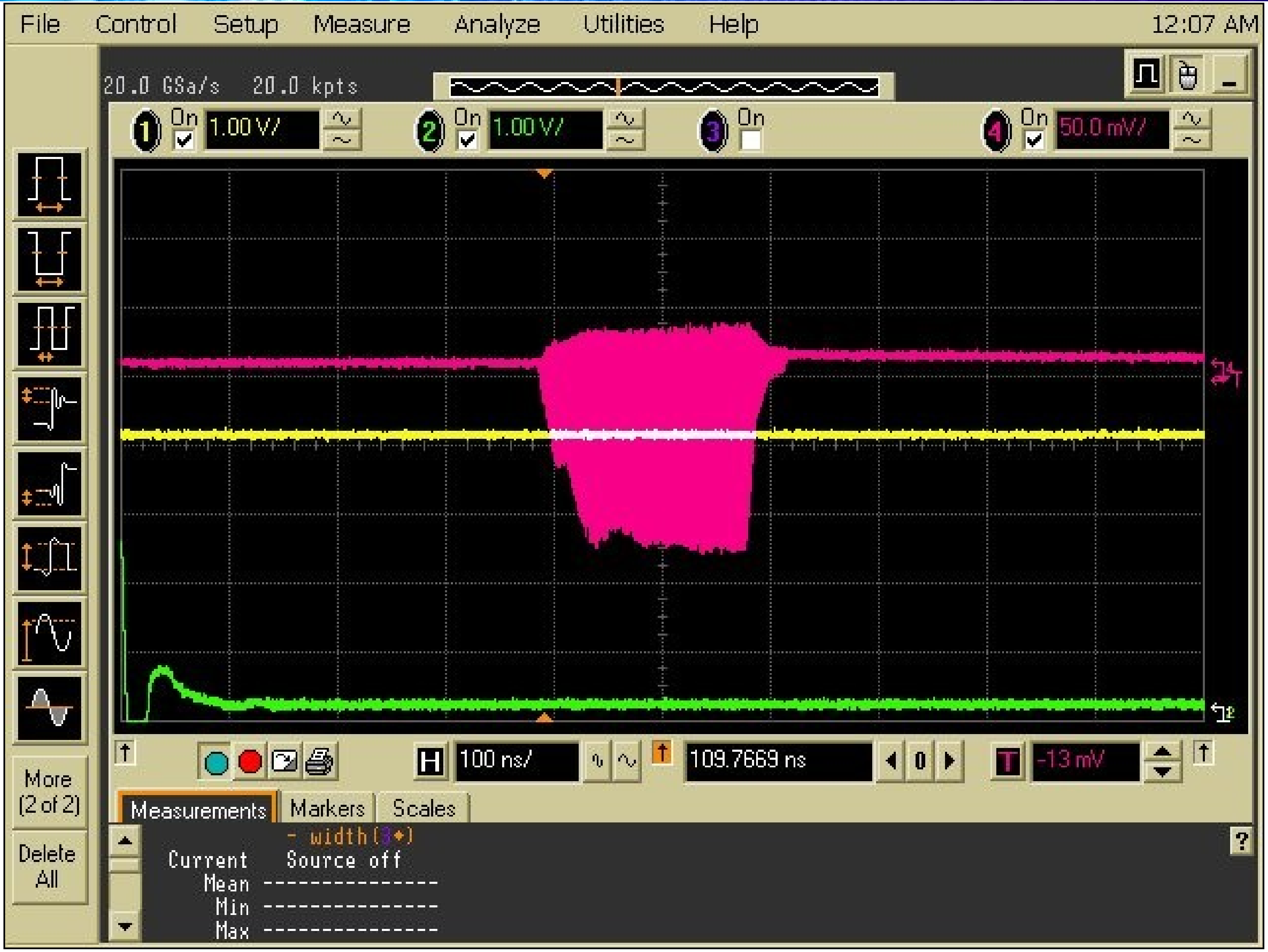
Diagnostics



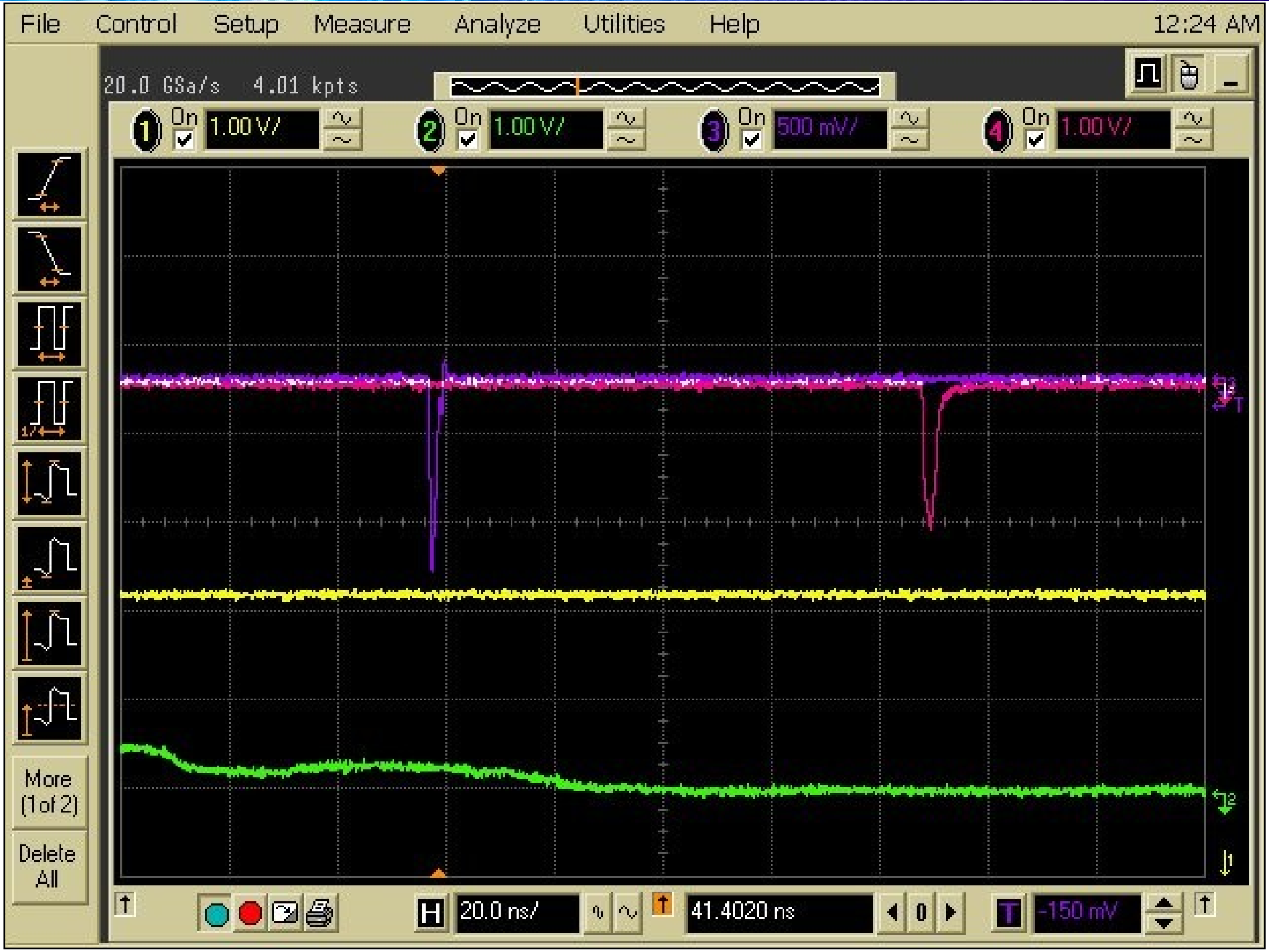
Single Bunch Mode



Multi Bunch Mode



Linac Transmission



Linac Panorama

Booster Commissioning

Booster FODO Lattice

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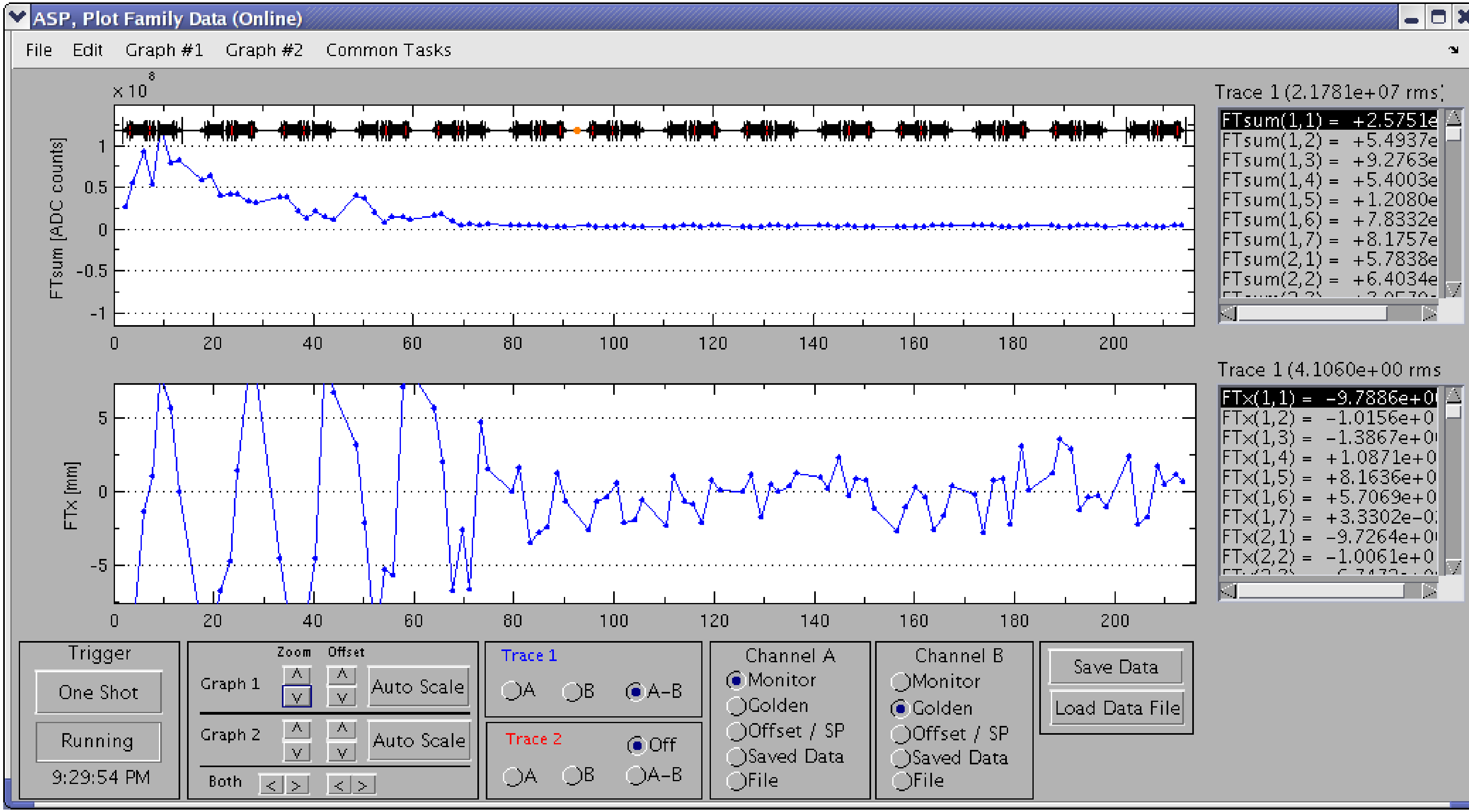
Booster RF Cavities

Storage Ring Commissioning

Control Room

First beam in the ring



First Turn

VNC: tekscope-782674
File Edit Vert Horz/Acq Trig Display Cursor Meas Mask Math App MyScope Utilities Help Button
Tek Run Sample
08 Jun 06 23:46:46
1
C1 2.0mV Ω
400ns/div 1.4µs
10.0GS/s IT 16.0ps/pt
A Aux 400mV

First Turns

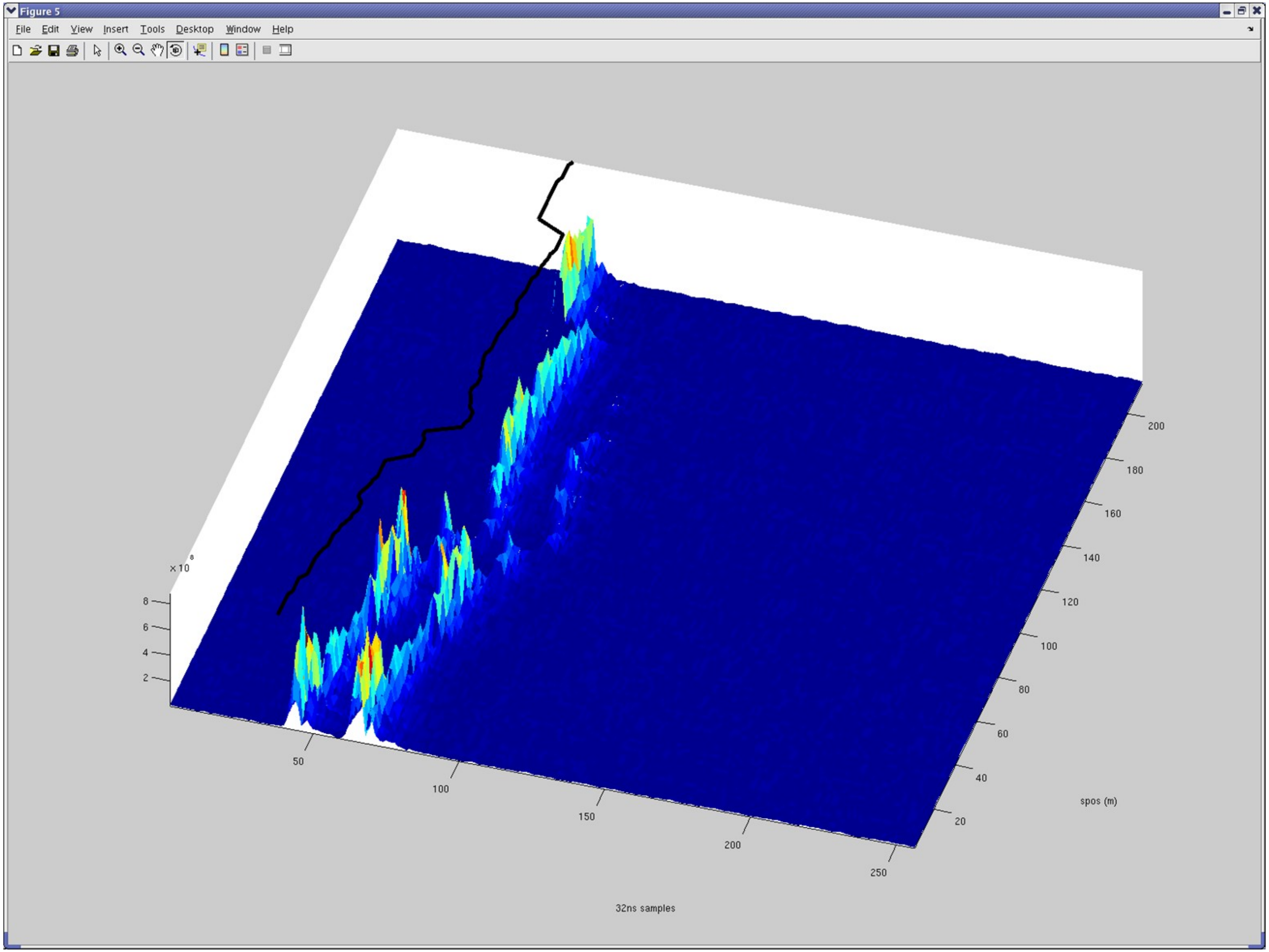
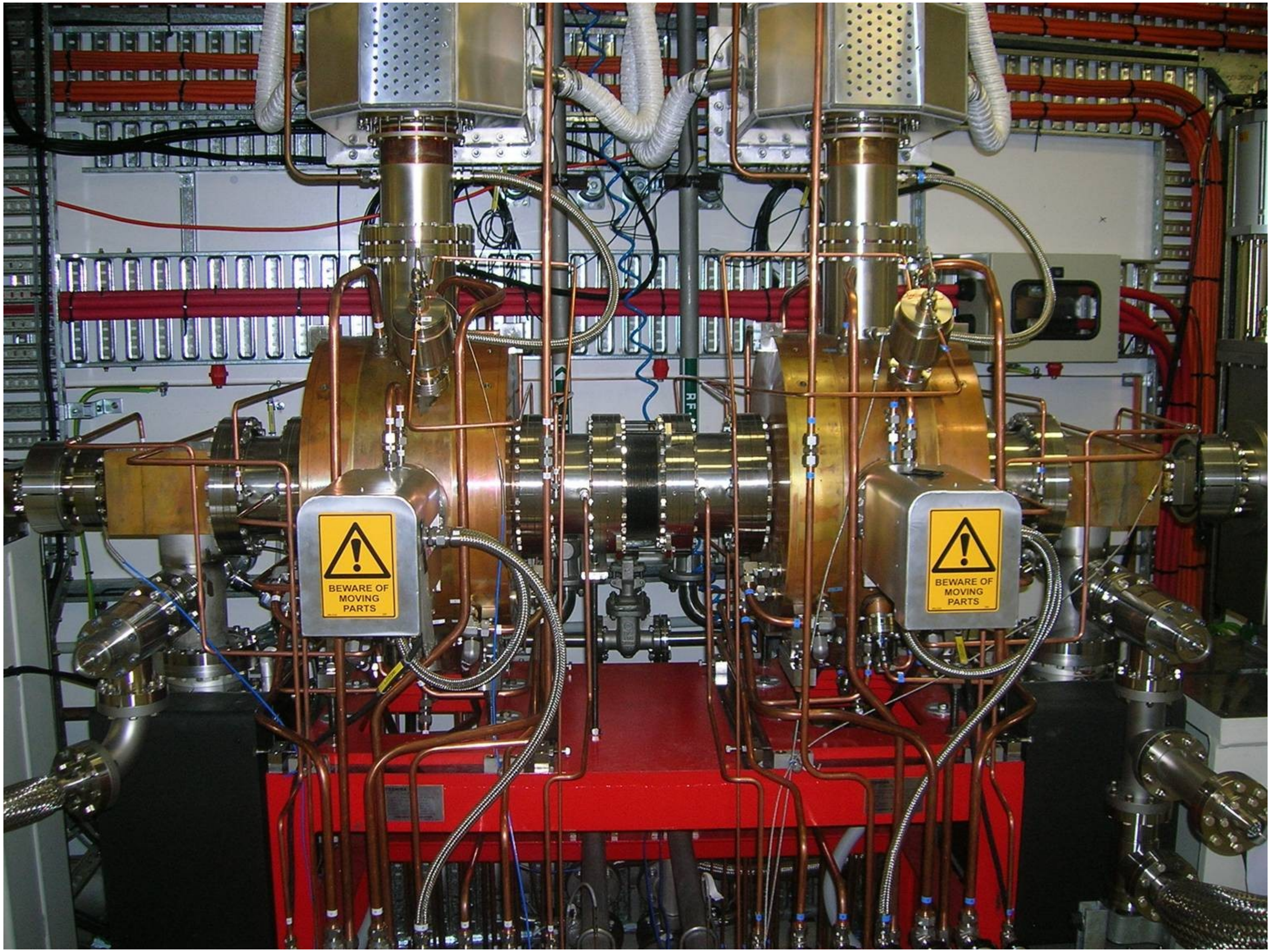
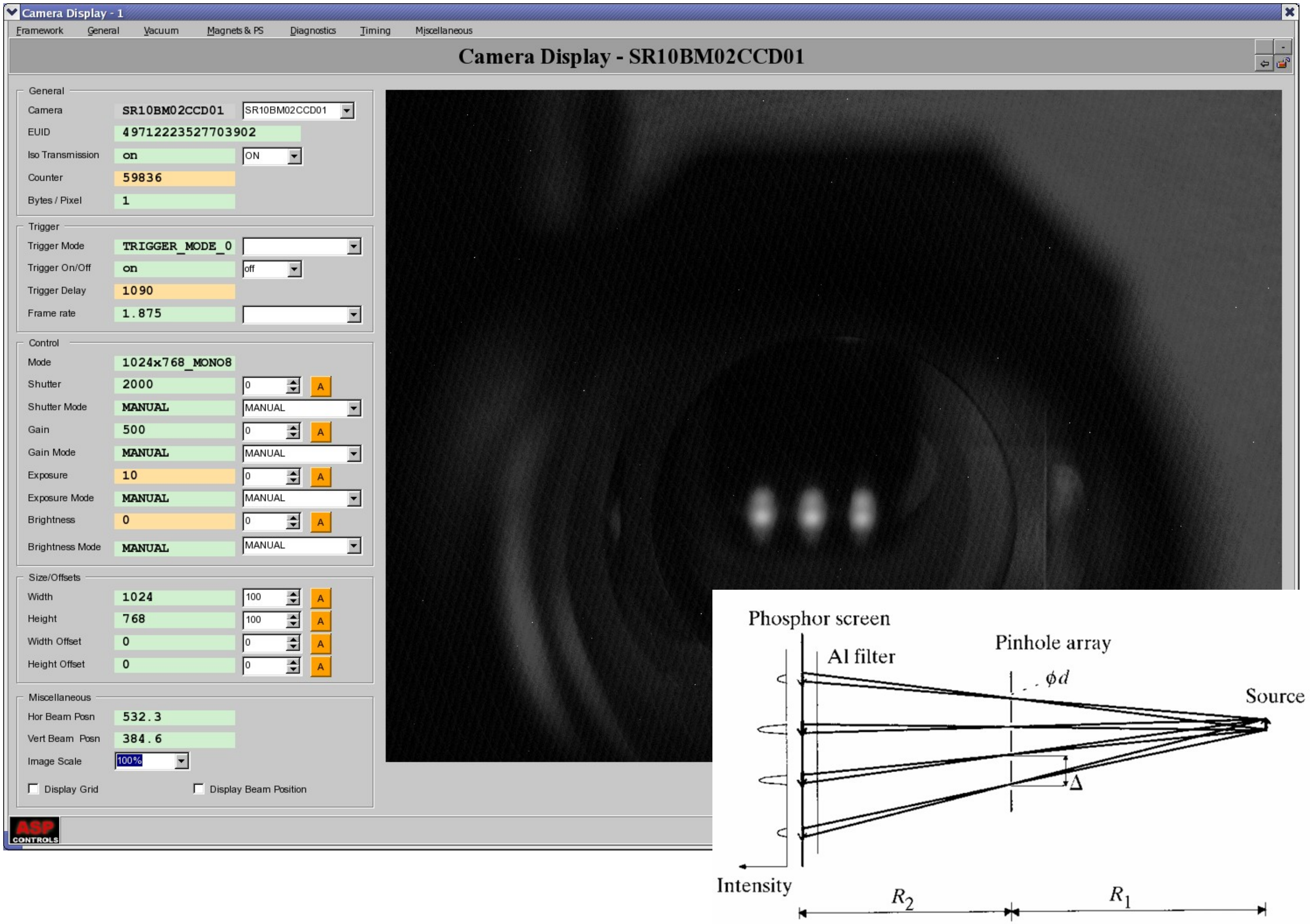


Figure 5
File Edit View Insert Tools Desktop Window Help
× 10^8
8
6
4
2
50
100
150
200
250
32ns samples
20
40
60
80
100
120
140
160
180
200
spos (m)

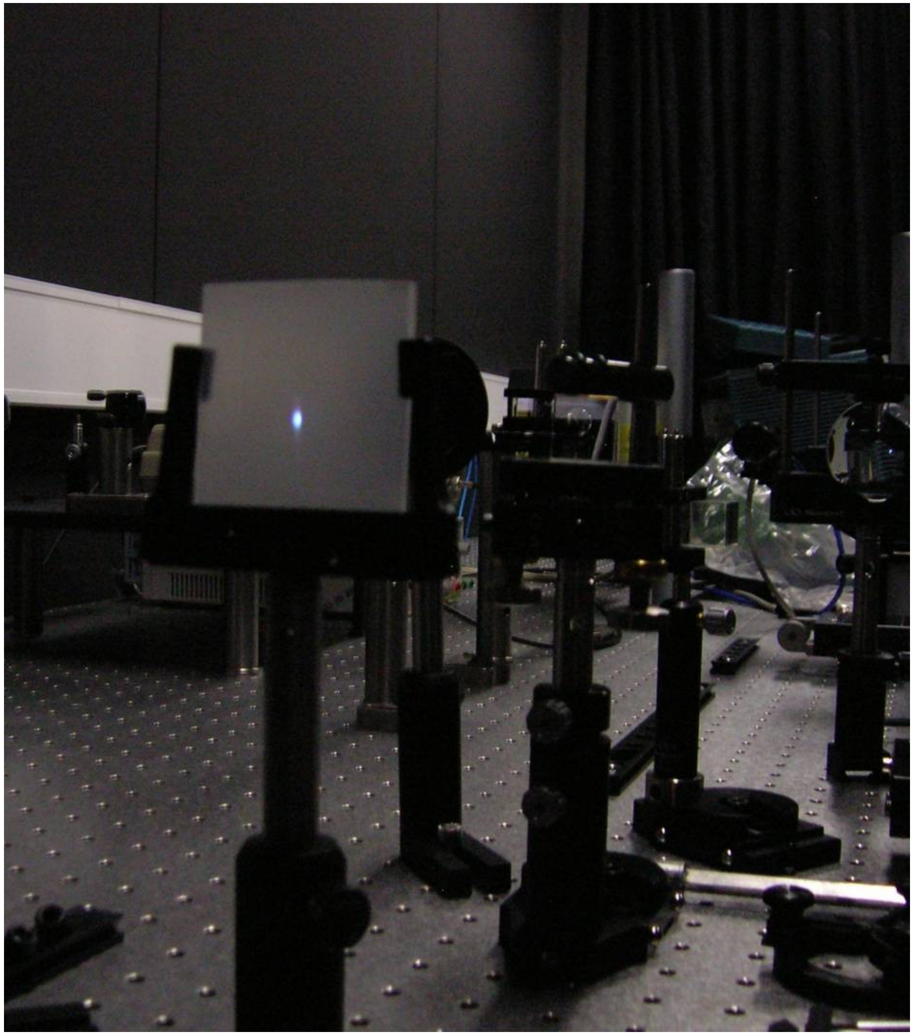
RF Cavities



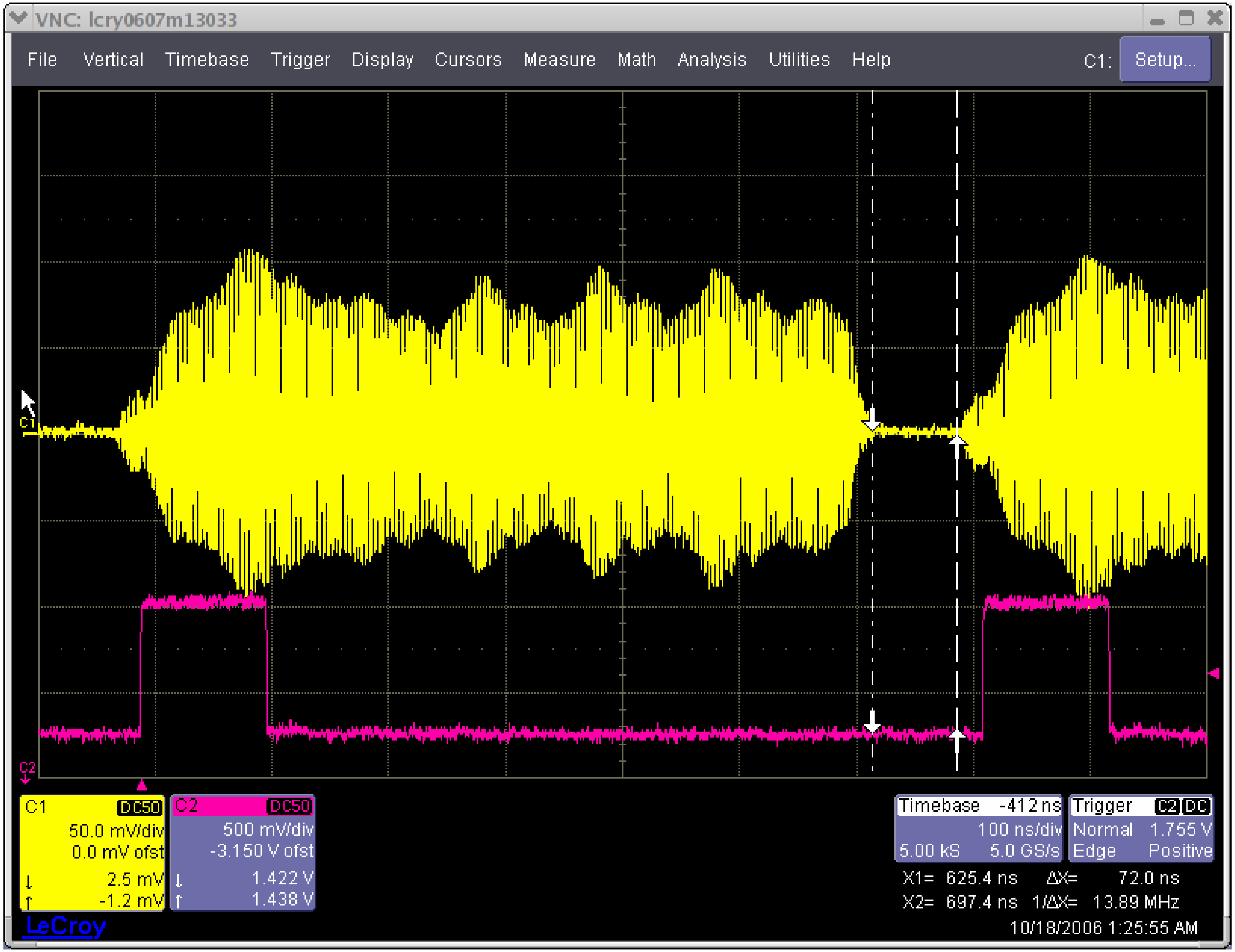
First Light


Camera Display - 1
Framework
General
Vacuum
Magnets & PS
Diagnostics
Timing
Miscellaneous
Camera Display - SR10BM02CCD01
General
Camera
SR10BM02CCD01
SR10BM02CCD01
EUID
49712223527703902
Iso Transmission
on
ON
Counter
59836
Bytes / Pixel
1
Trigger
Trigger Mode
TRIGGER_MODE_0
Trigger On/Off
on
off
Trigger Delay
1090
Frame rate
1.875
Control
Mode
1024x768_MONO8
Shutter
2000
0
A
Shutter Mode
MANUAL
MANUAL
Gain
500
0
A
Gain Mode
MANUAL
MANUAL
Exposure
10
0
A
Exposure Mode
MANUAL
MANUAL
Brightness
0
0
A
Brightness Mode
MANUAL
MANUAL
Size/Offsets
Width
1024
100
A
Height
768
100
A
Width Offset
0
0
A
Height Offset
0
0
A
Miscellaneous
Hor Beam Posn
532.3
Vert Beam Posn
384.6
Image Scale
100%
Display Grid
Display Beam Position
ASP CONTROLS
Phosphor screen
Al filter
Pinhole array
ϕd
Source
Δ
Intensity
R_2
R_1

Optical Diagnostic Beamline



50 mA Beam Conditioning Yesterday



Future Developments

Commissioning Phase…

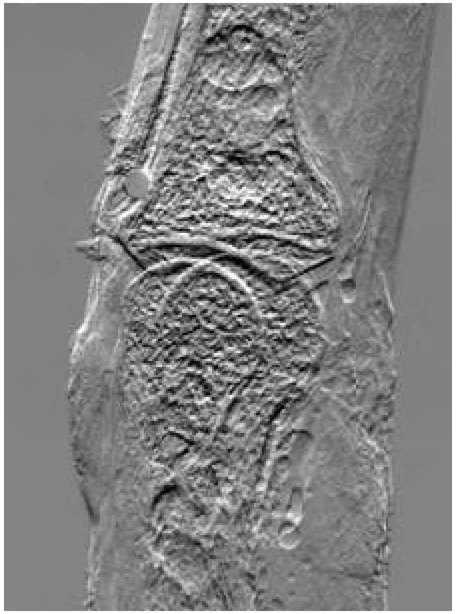
In the future with beamlines…

PX Beamline Hutch

X-ray imaging: human finger

Conventional X-ray

Synchrotron



Synchrotron: phase contrast

Rob Lewis, Monash University/
SYRMEP, Sincrotrone Trieste, Italy
Energy = 20keV

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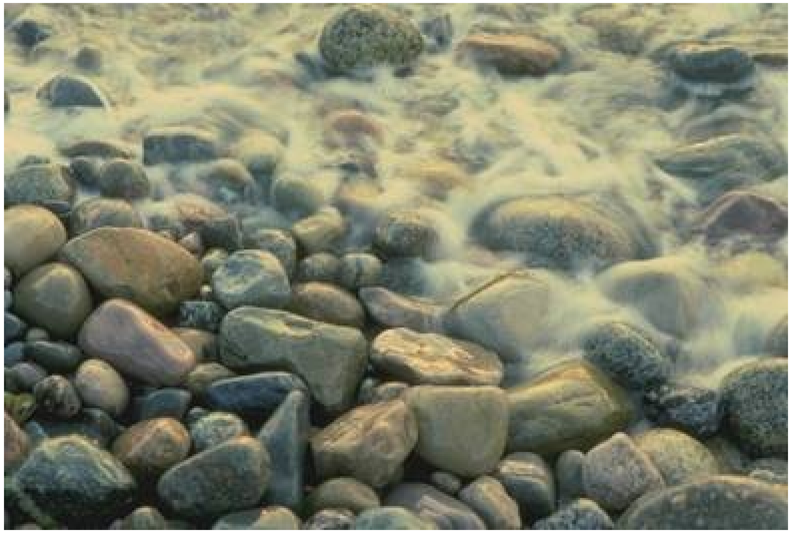
Materials Engineering

The Australian Defence Force has used synchrotron light to help develop improved ceramic coatings for jet engines.

These coatings protect the engines and allow for greater thrust.

Environment



Synchrotrons are being used to investigate the sources of pollutants in water supplies.

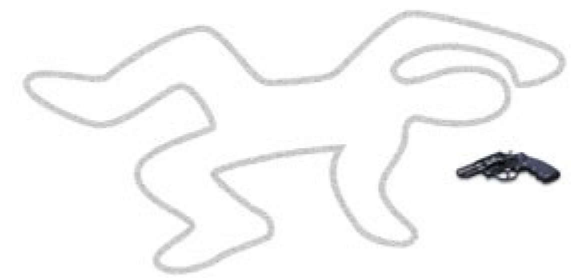
Resulting in cleaner drinking water in developing countries.

Environment

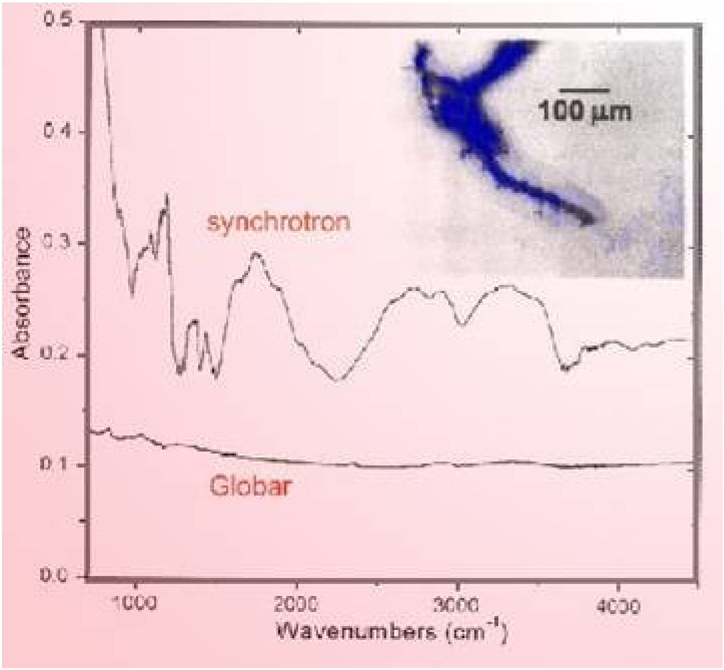
Air samples collected from New York after the collapse of the World Trade Centre were analysed at a US synchrotron.

The results showed how the debris pile acted like a chemical factory and emitted toxic metals, acids and organics, all with potential health impacts.

Forensics



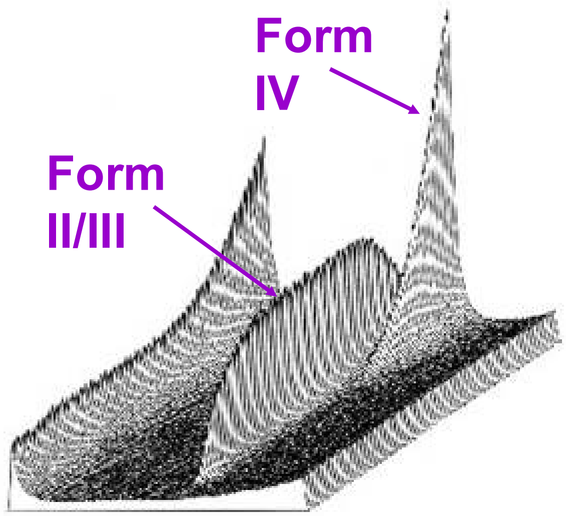
Extremely small samples from crime scenes can be analysed using synchrotron technology.



Forged documents and counterfeit money can be detected using synchrotron techniques.

Manufacturing

Cadbury UK wanted to produce the most stable, smooth and best-tasting chocolate.



They utilised a synchrotron to investigate the manufacturing process at the molecular level to optimise production conditions.

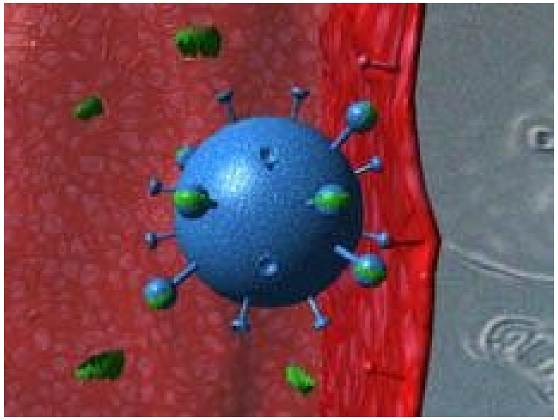
Manufacturing

Researchers used synchrotron x-rays to improve the chemical structure of the absorbent particles used inside disposable baby nappies.

Resulting in lighter, more absorbent nappies.

Medicine and pharmaceuticals

By modelling virus proteins, medicines can be created to block these proteins.



For example, Relenza which blocks the life cycle of the flu virus and was created by CSIRO scientists.

Agriculture

A synchrotron was used to confirm the structure of a new wool fibre in comparison to silk.

Scientists created Optim - a fibre made from wool that mimics the structure of silk. The fibre is now in commercial production.

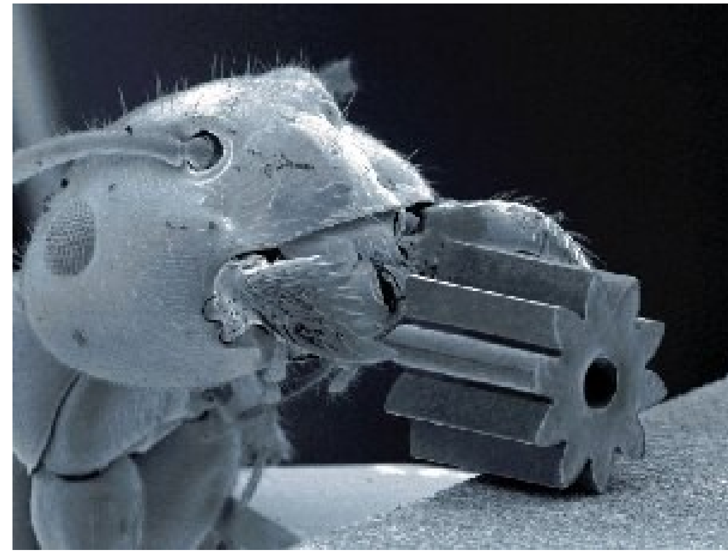
Minerals

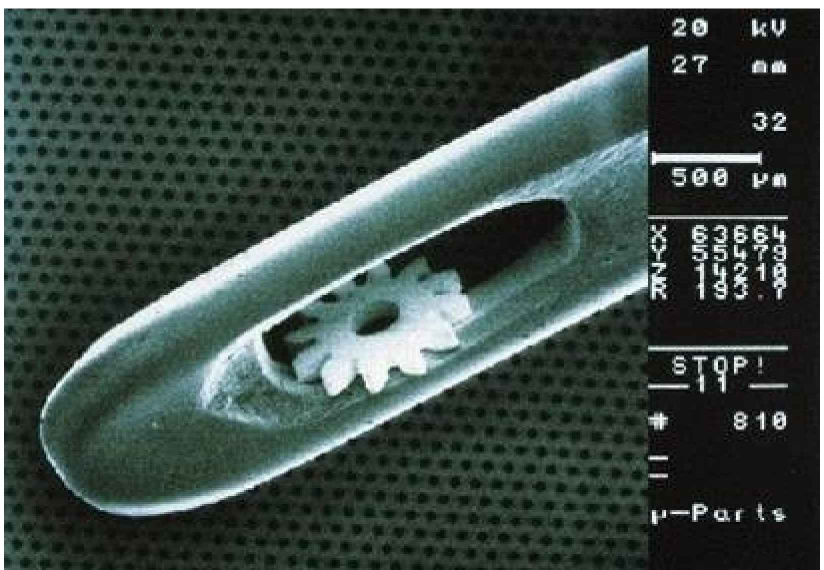
Using synchrotron light scientists have studied nickel and cobalt during extraction.

Using these studies to optimise production conditions can increase extraction rates from 60% up to 95%.

Micromachining

Synchrotron light is used to manufacture tiny machine parts.





An everyday example is inkjet printer heads


Australian Synchrotron

VACUUM SYSTEMS AND MAINTENANCE OF THE ANTARES AND STAR ACCELERATORS

Michael Mann, David Button and Peter Bond
Accelerator Science Project – Institute for Environmental Research
Australian Nuclear Science and Technology Organisation
Sydney, NSW, Australia

Managing the vacuum systems on the two ANSTO accelerator facilities requires a well defined maintenance plan and expertise to ensure all servicing can be undertaken “in house”. This talk will discuss the types of systems used and some special features as well as giving an overview of the maintenance system.

Questions:

Martha Meigs (Oak Ridge National Laboratory): Could you remind us what the conversion is for pascals?

Michael Mann: 10-6 Pa is 10-8 mbar. I'm not going to do the Torr conversion.

Larry Lamm (University of Notre Dame): We have an accelerator that is similar in many ways to ANTARES. We don't have as many cryopumps as you do, but we probably have a dozen. They are all the CTI 8's that you talked about. The maintenance is a very rare thing. I change the absorber once a year and I can go three to five years without touching the pump. So we don't have an in-house maintenance procedure for our pumps but send them out.

Michael Mann: We replaced maybe four pumps in a year, so that gives us a life cycle of about four years which is quite reasonable for something with wearing parts. Probably our number one problem is contamination of the helium circuit. On our older compressors, they have the stainless steel flexible tubing and we find that they do fatigue over time and crack leading to leaks and, of course, possible contamination. Purity on the helium circuit is pretty critical.

David Garton (ANSTO): A question to Larry as well. How many heads do you run per compressor? We have run up to three on one compressor and that could be part of the problem because there are obviously more points for leakage.

Larry Lamm: One per compressor.

Roland Syzmanski (university of Melbourne): You have the same problems {with dry pumps} that we have. You run pumps continuously on a dry system. Something you said contradicted what Craig said yesterday. He said that we should actually run it with the gas ballast on. We run it continuously on a UHV system so if moisture us a problem, where is the moisture coming from?

Michael Mann: We are running it on an end station. We back fill it with argon but every time you open it, there is a chance of introducing moisture. It is a very small amount and that's why we assumed that it would be fine.

???? : You can get great co-operation from the vacuum companies to do long term tests. How long have you been carrying this out and do you have a deadline when you can give us the final results?

Michael Mann: It's an ongoing process really. At the moment we have two or three dry pumps in use that we own hooked up to the system. I think that we got the first dry pumps in perhaps February of this year.

David Button (ANSTO): We started looking about six to eight months ago. It was after Dave came back from the last SNEAP conference and we were looking into oil free pumps. When we approached the pump providers such as John Morris, since they are also trying to get into this they were quite happy to bring them in. As to a deadline, we're probably at the stage of buying a few things to give them a twelve month trial before we go further. We were under the impression that these extra dry pumps were going to be a good thing and we got quite a few of them and we have been sort of beaten a little bit as far as things breaking down. I wouldn't have perceived that we had much moisture in that chamber either.

Craig Marshall (Scitek Pfeiffer): I've got to respond to that. I can't say hoe much water vapour is required to degrade the performance, but what I do know is that with diaphragm pumps I've seen applications where they are air-ballasted to remove even small quantities of water vapour to prevent it from sticking on the rubber valves ans seals. Now after hydrogen and helium, water vapour is the next hardest thing to get out of any system so even in a vacuum system that appears to be totally dry, it is still compressing the sum of all the partial pressures including the water vapour. No mater how dry the system is, you are operating in the 1 mbar down to 10^{-5} mbar range, you are going to compress droplets of water. Depending on how long the pump is run and how it is ballasted, will depend on how much. I don't know what that critical mass of water vapour is, but what Pfeiffer is doing with the extra dry pumps is modifying the gas ballast and modifying the piston so there should be a ten to twelvefold improvement on that sort of performance.

????: There should be no issue at all about running three CTI 8's on a compressor. CTI are manufacturing over 20,000 of these per year. The majority of them go into the semiconductor market in Asia and its routine to have maybe 50 compressors running 150 heads all with no issues. If you are concerned with leaks, I would probably look at connecting the lines the correct way and if you want to be doubly sure, do a leak check on each connection that you make. So if you rebuild a pump, immediately do a leak check on it. That is the standard thing that happens in the factory at CTI.

Mann: When you do connect the Airequip couplings, I do find that especially on ones that are a bit older, you do get an amount escaping as you screw it on. Is there a chance of getting contamination through there?

????: There would be a slight chance. I would suggest that if you are having a problem there, it probably indicates that the fitting is wearing out. The cost of replacing those is not much and its fairly easy to do a service on a line as well. If you are having problems with a particular fitting, just change it. With the dry pumps, there are a number, mostly people with the XPS pumps, most of them don't operate the gas ballast at all because they are pumping clean dry system and don't seem to have too many issues. I imagine the proof is to contact the people using them and get their opinions.

John McKay (retired): You have been talking about moisture in systems and so on. I haven't heard any mention of using partial pressure or residual gas analysers. In a lot of applications it is not how much you have got in your system, but what you have got in your system. You have been talking about water vapour. In accelerators, a little bit of sulphur-hex can do tremendous damage.

Roland Syzmanski (Melbourne): We have the Balzers helium leak detector but we only use that for equipment coming out of the workshop. Everything associated with the accelerator or a beamline is done with an RGA and that always gives a clear indication of what is going on in the vacuum system. For us it is the best diagnostic tool.

End of questions

Australian Government

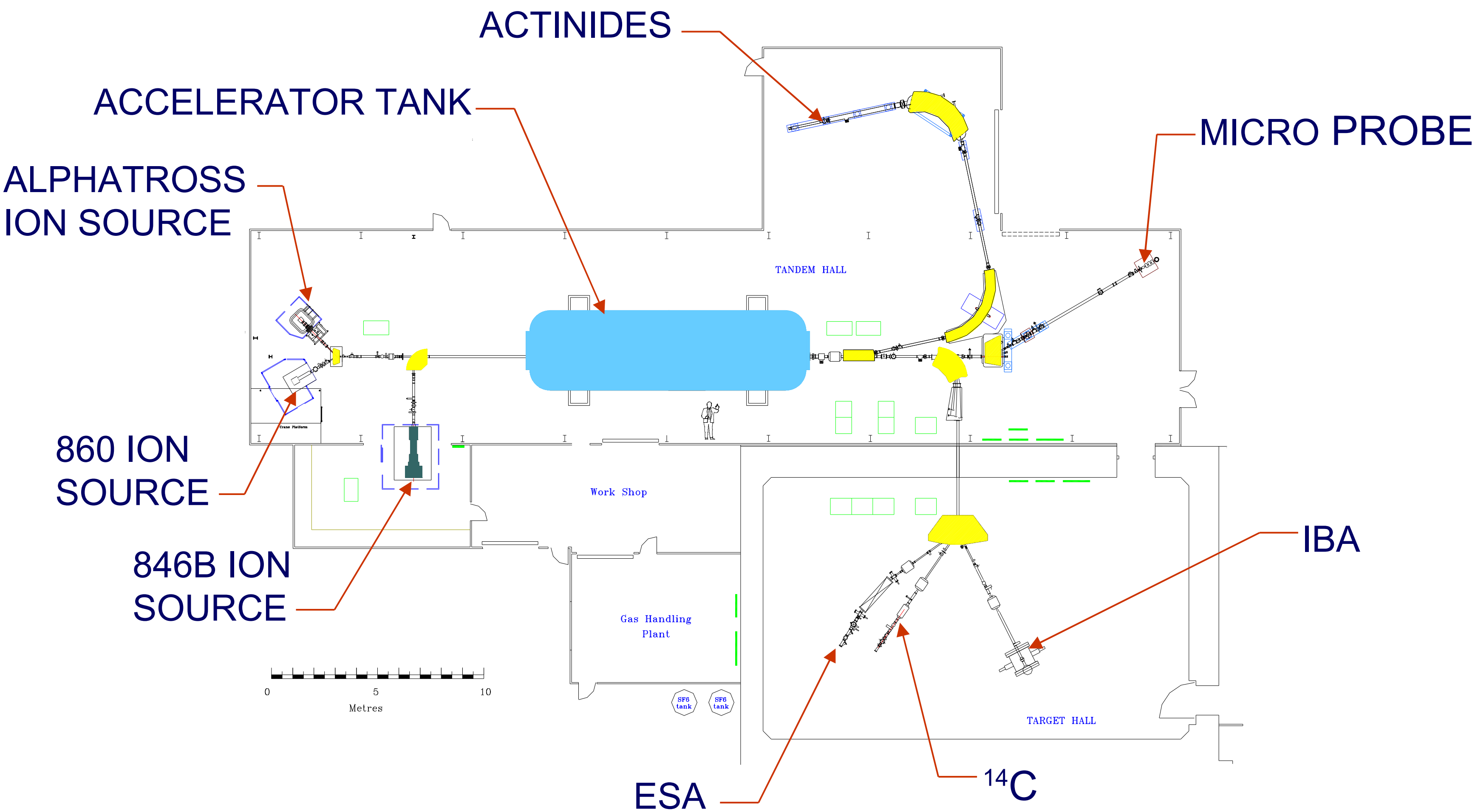
ansto

Australian Nuclear Science and Technology Organisation

Vacuum systems and maintenance for ANTARES and STAR accelerators

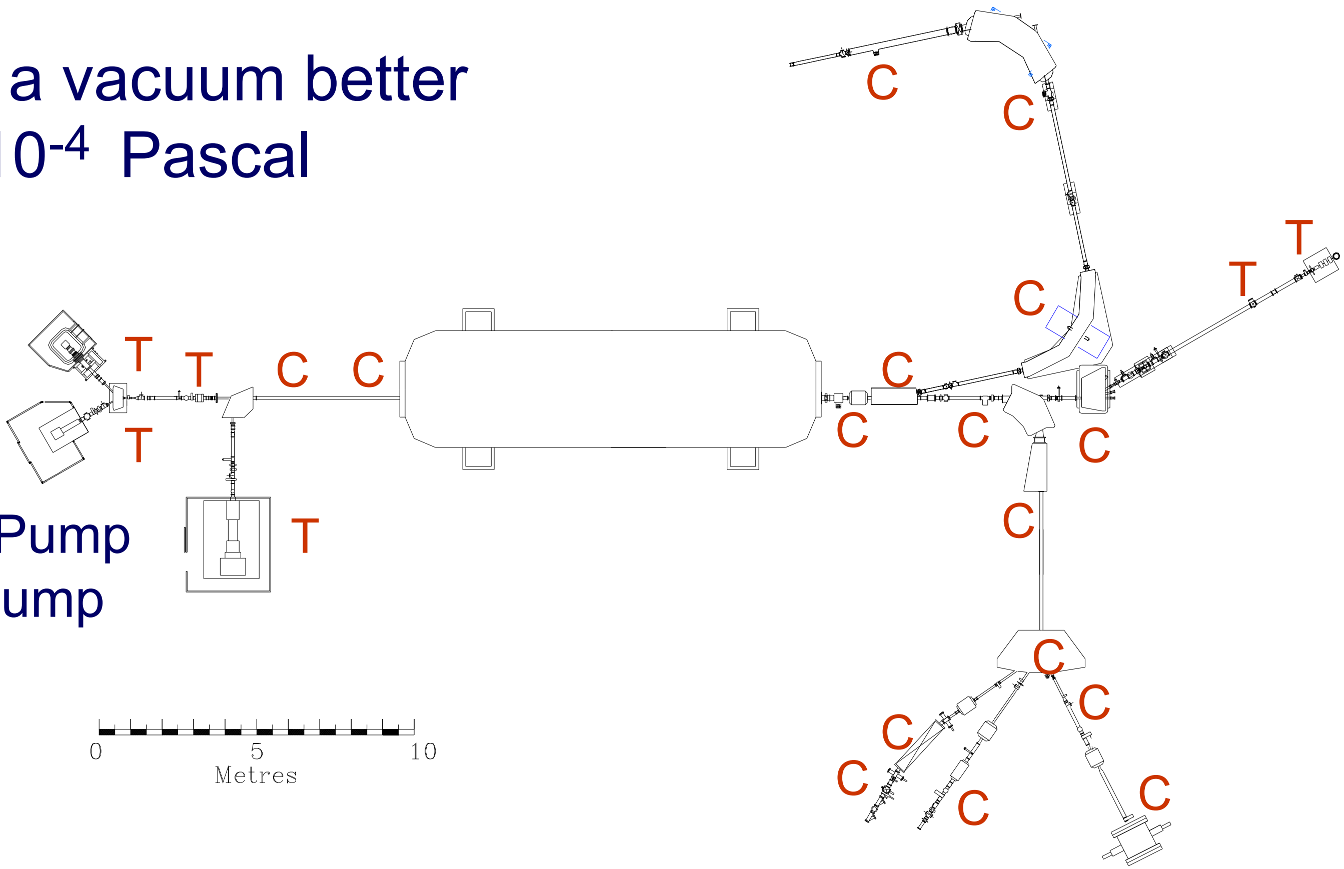
Michael Mann

ANTARES 10MV accelerator



ANTARES 10MV accelerator

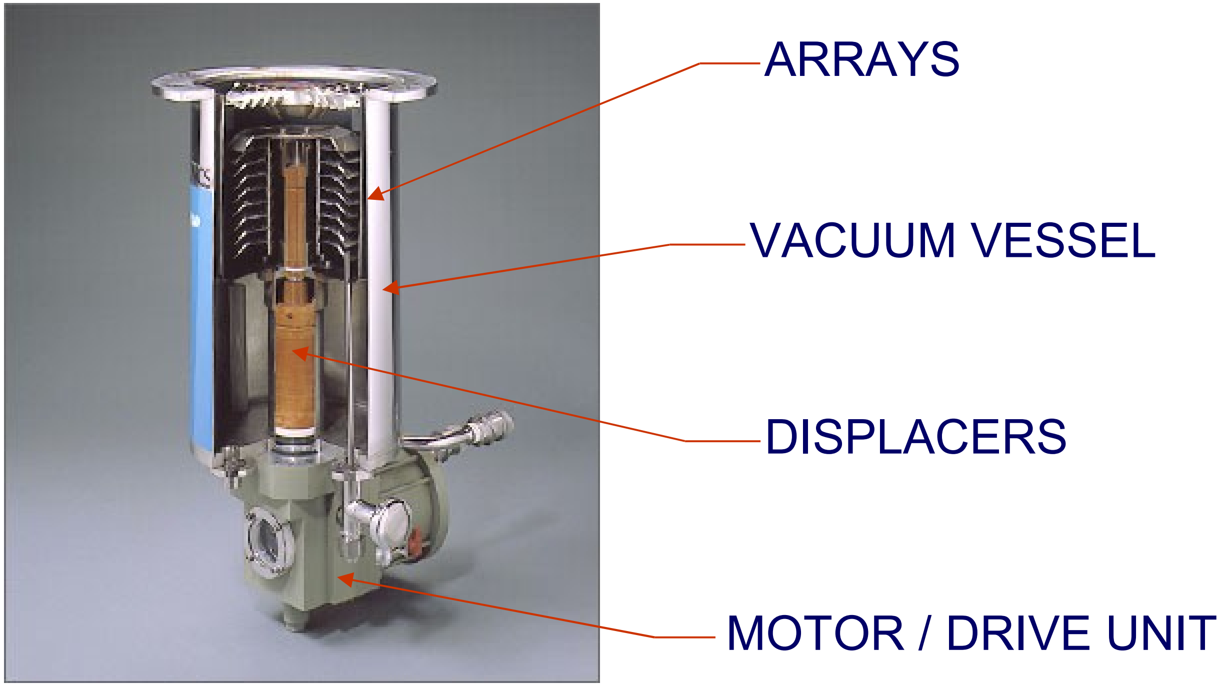
Achieves a vacuum better than 5 x 10^{-4} Pascal



T – Turbo Pump
C – Cryo pump

Cryo pumps

- The majority of the pumps used are cryo pumps. Cryo-Torr 8 manufactured by CTI



Cryo pumps

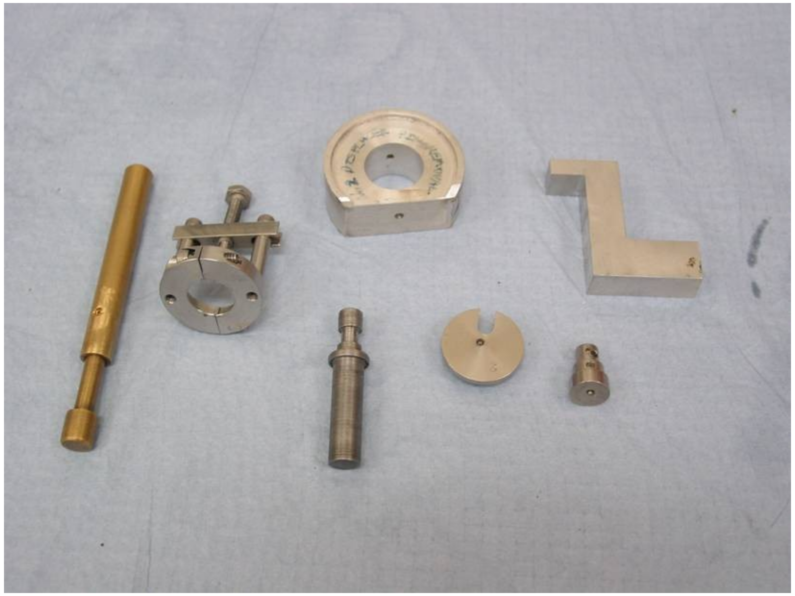
- **Pumping Speeds -.**
- Water Vapor 4000 litres/sec
- Air 1500 litres/sec
- Hydrogen 2500 litres/sec
- Argon 1200 litres/sec
- **Capacity -**
- Condensable gases (Argon, nitrogen, oxygen etc) 1000 std. litres
- Hydrogen (5x10-6 Torr) 12 litres
- **Mass -**
- 20Kg

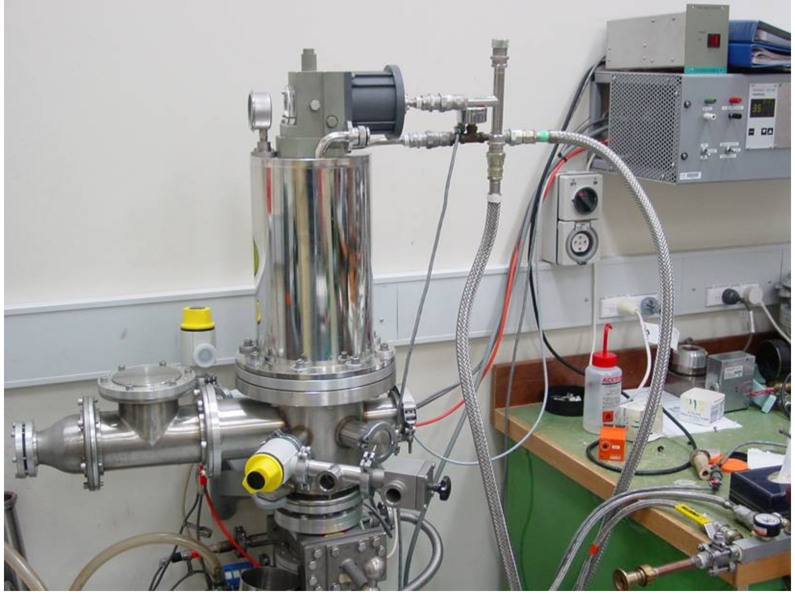
Cryo pumps

- Typical failures for cryo pumps:
- Broken motor shaft
- Seized / contaminated displacer
- Contaminated arrays
- Scored valve seats / valve timing

Cryo pumps

- Servicing and testing of the cryo pumps is done in house using various specially made tools and fixtures.





Cryo pumps

- Cryo pumps are monitored by TPG300 vacuum gauges also controlling interlocked gate valves to protect beam line and pumps.

Maintenance

- System maintenance is scheduled by a daily, monthly and yearly programme.

ANTARES MONTHLY MAINTENANCE LOG

REQUIREMENT	OPERATOR	DATE	OPERATIONAL YES	OPERATIONAL NO	ACTION
8.3.1 Chilled water system	[signature]	4/7/06	✓		
8.3.2 Danfysik power supplies	[signature]	5/7/06	✓		
8.3.3 Electrical ducts and cables	[signature]	5/7/06	✓		
8.3.4 Cryo pump compressors	M.M.	4.7.06	✓		
8.3.5 Compressed air supplies	[signature]	4/7/06	✓		
Roughing / Backing pumps	MM	4-7-06	✓		See attached sheet.

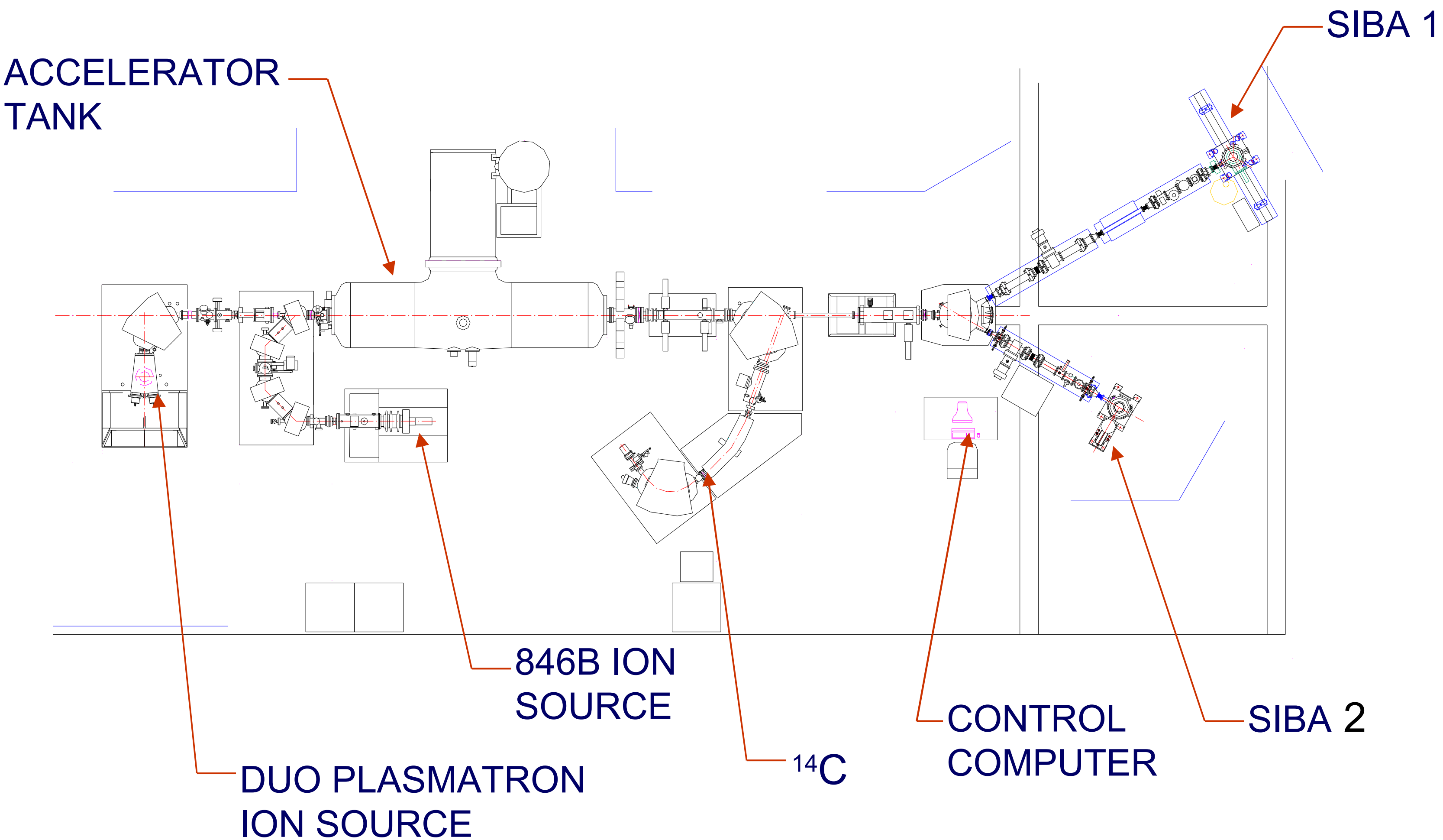
Comments: Chilled water 4/7/06 @ 12:30
Pump 1 in service – Operating OK
Pressure S/R – 525/235 kPa
Temperature S/R – 17°C / 20°C
Selected Pump 2 – Operating OK
Pressure S/R – 520/230
pH – 8.29 (8.14)
Conductivity – 137 (139.6)
Tank water clarity – Slightly cloudy
(ran SF6 compressors previous day)
High temp. alarm test – OK

Compressed air supplies
Tandem Hall – 620
Tandem Hall act. mag – 635
846 ion source – 635
Target Cell – 620

Cryo Compressors: Recharge to 200 PSI
* Analysing magnet.
* Injection magnet.

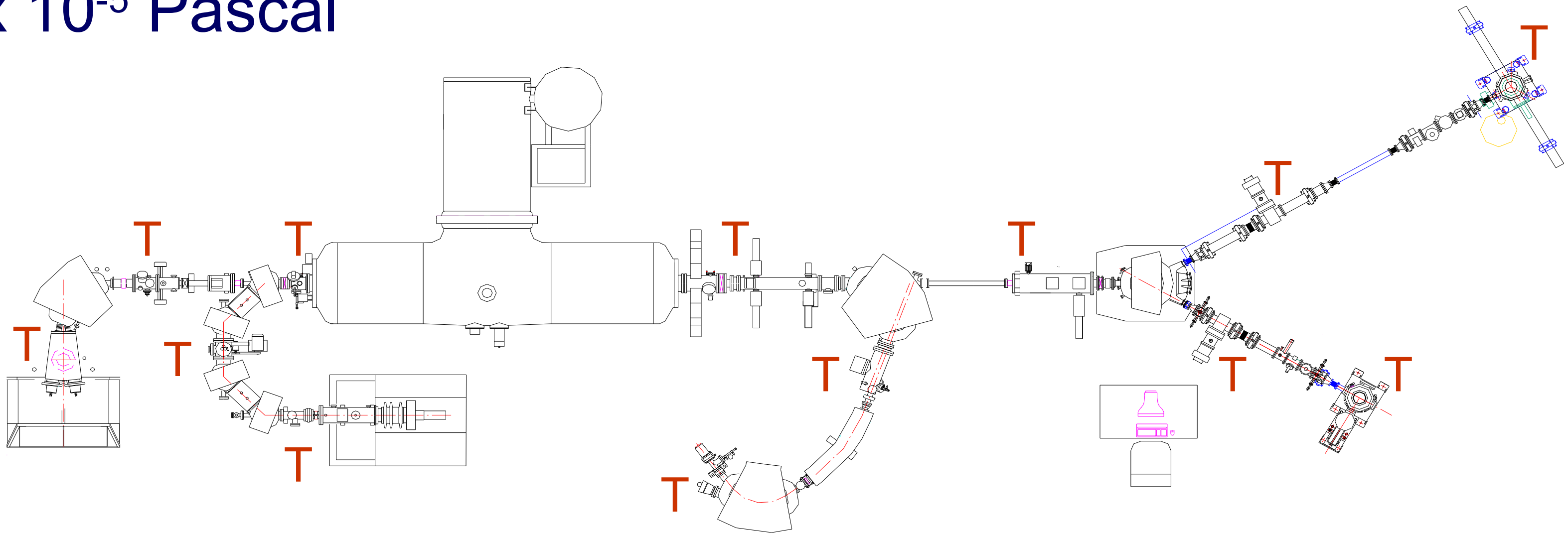
- Changed adsorber on CTI compressor at injection magnet.

STAR 2MV accelerator



STAR 2MV accelerator

Achieves a vacuum around
5 x 10^{-5} Pascal



T – Turbo Pump

Oil free pumping

- Why oil free on SIBA 2?

Oil free pumping

- SIBA 2 has been trialling various oil free pumps:

Diaphragm pump –
VACUUBRAND MV10 Vario

Molecular drag and diaphragm pump –
Alcatel Drytel 1025

Oil free pumping

5 stage roots blower –
Alcatel ACP15

Piston pump –
Pfeiffer XtraDry 250-2
Pfeiffer XtraDry 150-1

Scroll pump –
Edwards XDS5

Questions?

Presentation of a Problem:
Ovidiu Toader ,University of Michigan

Thanks for the opportunity to speak. The week after Victor Rotberg retired we started having serious problems. We have been able to run some surface analysis experiments so we don't have a problem with low current. I only have problems when I try to put more than 20 to 25 microamps through the accelerator. This is a 2MV accelerator made by General Ionics in 85/86. It is 1.7 MeV and we have two beamlines. The problem is as follows. We have a ?? torvis source from NEC which can deliver up to 300 microamps at the low energy end and routinely we run about 75 microamps at the high energy end for proton irradiation. I have sudden beam current drops at the high energy end as observed in the Faraday cup. They are instantaneous drops so the current drops to zero and then comes back up. It only occurs when the current exceed 20 to 25 microamps. The high the current, the more often the drops are. For 25 microamps, I have 3 or 4 drops per minute. If I go to 45 microamps, it is one drop every second or two. I notice the following. I can get 30 microamps by pushing up the source and dropping the stripper gas. With low gas pressure, I see the same number of drops as with normal stripper gas and not pushing the source. Either increasing the stripper gas pressure or increasing the current will cause these drops. The first culprit that came to mind was the quadrupole. I opened it and saw signs of arcing on some of the cylinders. I don't know how normal that is. I also looked at the contacts and some of the had signs of arcing, a black coating in some areas only. This accelerator has a tube mesh at the low energy end between the second and third ring inside. It is about three inches in diameter and it has a small hole, about half an inch, in it. It is a little bit off-centre. I also noticed some degradation of the tube at the low-energy end. I don't think we have any oil inside. I looked for signs of oil damage and saw none. I took the quadrupole out and installed a Faraday cup and plan to look step by step. The culprit can be the tube, the quadrupole or the high energy magnet, but someone may have a different idea about what I could or should do.

Jim Stark (McMaster University): Yesterday you mentioned this hole in the grid. John Southon and I had a similar problem on our FN. We found hanging wires and the grid also had a very thin coating of oil. We decided that if you got a big beam, there were electrons flying around charging up sweeping the beam off. As soon as you discharged the grid the beam came back on. Larry said that they removed the grid and its resistor and just don't use it any more.

Ovidiu Toader: I put the scope at the low-energy end and the high-energy end and there is no unusual activity there from the power supplies. The photomultiplier doesn't detect anything so it is not in an area that can be detected by light.

Jan Klug (Ruhr-Universität Bochum: Can you explain again where this grid is mounted?

Ovidiu Toader: Inside the accelerator tube, if you look from the low-energy end, it is between the second and the third ring. It is inside the tube. It is very difficult to replace it. We were quoted $40,000 just to do it so at this point I would rather just remove it.

John McKay: I have a couple of thoughts; contradictory unfortunately. I agree with Jim that usually if you have a hole in the grid, it should be replaced but you said that the fault showed up relative to the total current at the high-energy end. It can be low current in with high stripper gas or high current in with low stripper gas. That would suggest to me that it is not the grid that is the problem because if it is the grid, that would vary with the input current. That suggests that it is something in the high energy end or outside of it. Your pictures of the quadrupole suggest to me that there is a serious problem there and you description of the phenomenon does sound like something charging up.

Ovidiu Toader: I put a piece of phosphorous in and saw the beam sweeping left or right. It could also be the magnet. Unfortunately, this accelerator doesn't have too many points where you can troubleshoot. I only have a low-energy Faraday cup and a hight-energy Faraday cup and nothing in between.

John McKay: If you are seeing this on the output current this tends to point to that quadrupole and charing around the quadrupole says that you have got a problem there. Are the electrodes aluminum?

Ovidiu Toader: No, the electrodes are stainless steel.

John McKay: I have seen lens structures that look pretty good, but are starting to have an insulating layer build up on them. If it's build up on a surface, that means that cleaning must be done.

Ovidiu Toader: I took it out, but before I put it back, I decided to just put the Faraday cup after the accelerator and see if it is the accelerator that is causing it. I got that done right before I left so I can try it when I get back.

Mark Roberts (WHOI): Did you put an oscilloscope on the column currents to see if they are stable? Second, have you looked in your magnet chamber to see if it is clear? Finally I would try to get a beam profile monitor to mount on the end of the accelerator to see if you can see which way the beam is moving.

Ovidiu Toader: We have a beam profile monitor but it's right near the high-energy Faraday cup. The best I could do was with the phosphorous and I saw the beam going left right.

Jim Stark: Everything is okay under to 25 microamps?

Ovidiu Toader: I wouldn't say so but I have to wait maybe more than a half hour to see one. It might be worth mentioning that I saw this problem about four months ago but then it went away by itself. We operated for a couple of months and the we had a power shut down and the accelerator vented without me knowing it. When we started up again, the problem was there so i don't know if it is related to the power shut down or the vacuum degradation for a week.

Alfred Priller (VERA, Universität Wien): You mentioned that it also is there with high stripper gas pressure. It means that the beam after the stripper has a completely different shape and it may hit the quadrupole lens.

Ovidiu Toader: It may enlarge. I don't know. I have a picture of the beam and it is blown up.

Jim Stark: I hope that everyone noticed that Larry reported in his lab report that the Seigling belt is working very well in the KN.

Larry Lamm: We tried the blue and green belts from Seigling and they did not work well and I know that other people have tried them and they didn't work well for them either. What we have tried recently is also a belt that Claus Bahner recommended to us. It's a Seigling belt, actually approve by the FDA in the US for handling food products. It works very well in the KN. We've run, I think, in excess of eight hundred hours. The belt cost less than $500. We have other fail, but if you get one that works, it works well for a very long time.

End of discussion