



CREMLIN WP7 BINP + CERN short report on parallel session

CREMLIN kick-off meeting
October 7th 2015

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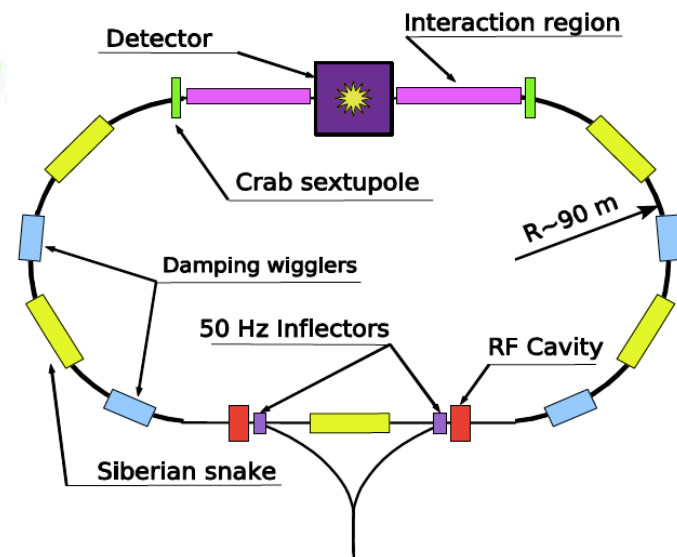
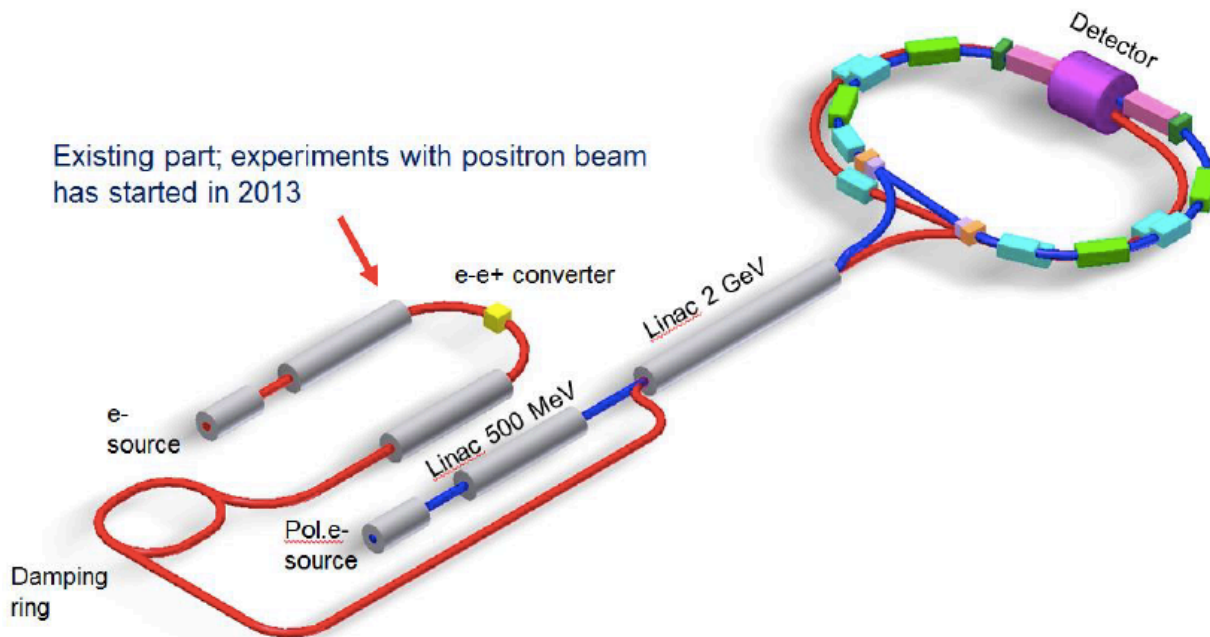
Super Charm-Tau (SCT) project @ BINP

Scientific case:

- D-Dbar mixing
- CP violation searches in charm decays
- Rare and forbidden charm decays
- Standard Model tests in τ lepton decays
- Searches for lepton flavor violation $\tau \rightarrow \mu \gamma$
- CP/T violation searches in τ decays

Machine performance parameters:

- Beam energy from 1.0 GeV to 2.5 GeV
- Peak luminosity is $10^{35} \text{ cm}^{-2}\text{s}^{-1}$ at 2 GeV
- Longitudinally polarised electrons at IP
- Energy calibr. $< 10^{-4}$ by Compton backscattering





SCT@ BINP partially based on existing facility

Injection facility

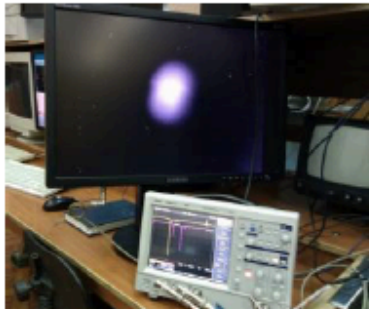
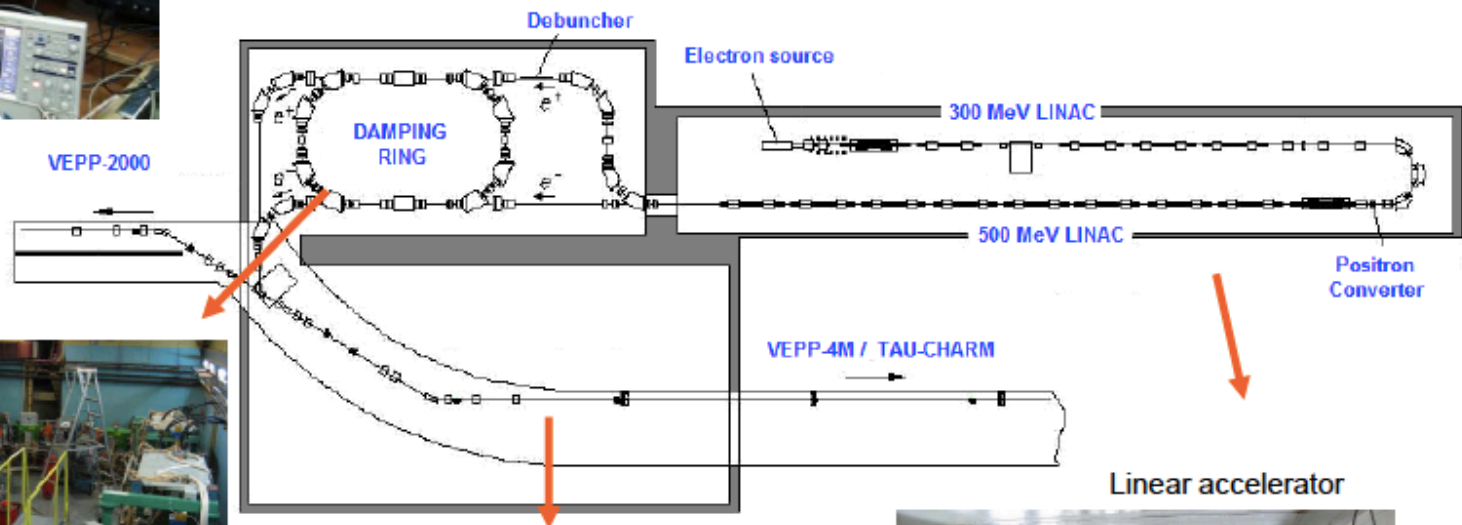


Image of the first positron beam in 2013



500 MeV damping ring



Beam transfer line

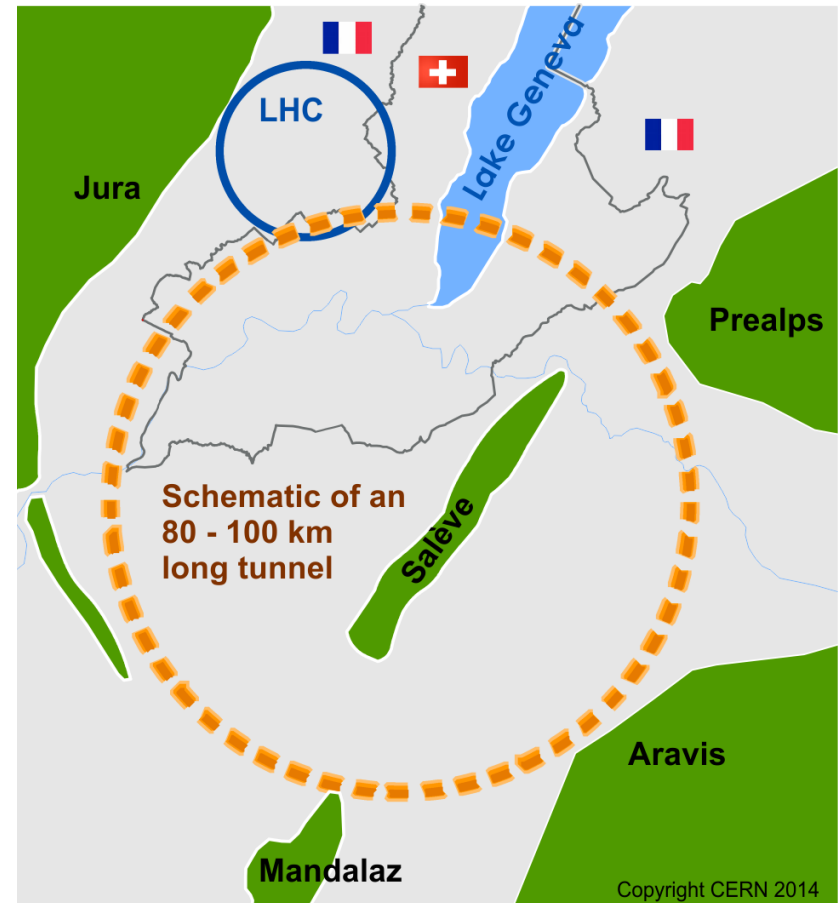


Linear accelerator

FCC-ee circular e^+e^- collider project @ CERN

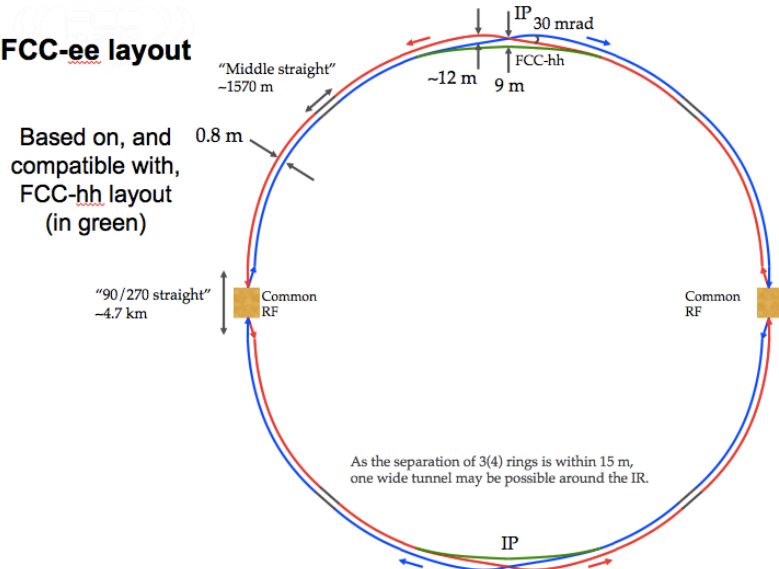


parameter	FCC-ee		
energy/beam [GeV]	45	120	175
bunches/beam	13000-60000	500-1400	51- 98
beam current [mA]	1450	30	6.6
luminosity/IP x $10^{34} \text{ cm}^{-2}\text{s}^{-1}$	21 - 280	5 - 11	1.5 - 2.6
energy loss/turn [GeV]	0.03	1.67	7.55
synchrotron power [MW]	100		
RF voltage [GV]	0.2-2.5	3.6-5.5	11



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FCC-ee layout



- e^+e^- collisions \sqrt{s} up to 3 TeV
- Luminosity: a few $10^{34} \text{ cm}^{-2}\text{s}^{-1}$
- Physics operation 350 GeV - 3 TeV
- 2-beam acceleration scheme
- At room temperature
- Gradient 100 MV/m
- Conceptual Design Report published in 2012

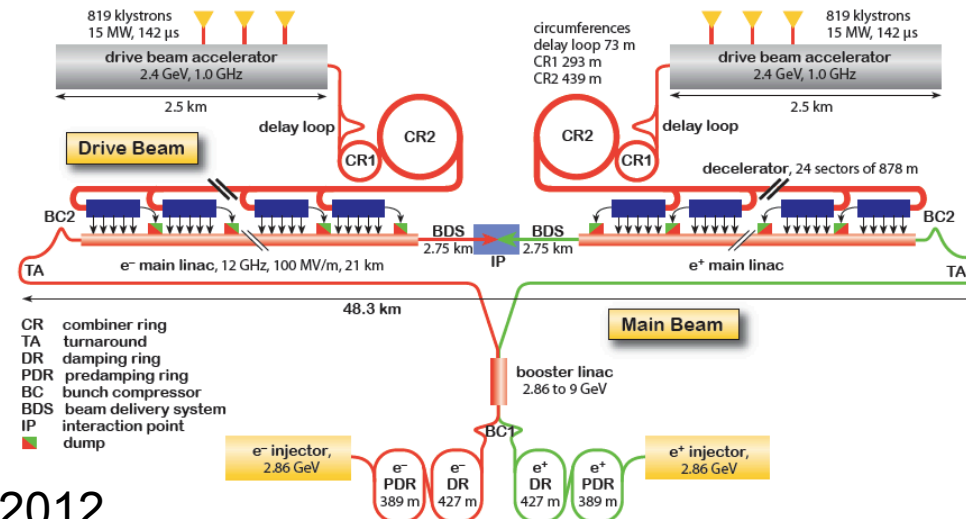
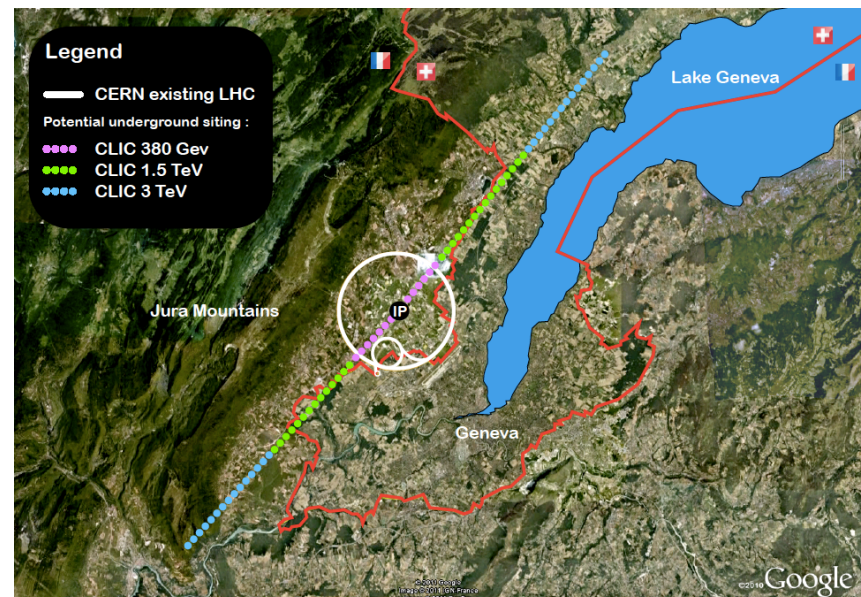


Fig. 3.1: Overview of the CLIC layout at $\sqrt{s} = 3 \text{ TeV}$.

Parameter	Unit	380 GeV	3 TeV
Centre-of-mass energy	TeV	0.38	3
Total luminosity	$10^{34}\text{cm}^{-2}\text{s}^{-1}$	1.5	5.9
Luminosity above 99% of \sqrt{s}	$10^{34}\text{cm}^{-2}\text{s}^{-1}$	0.9	2.0
Repetition frequency	Hz	50	50
Number of bunches per train		352	312
Bunch separation	ns	0.5	0.5
Acceleration gradient	MV/m	72	100
Site length	km	11	48





Task 7.1: research challenges and synergies



Milestone 7.1, month 4

STC session at the kick-off meeting; charge and formation of an international team of experts for task 7.1.

Deliverable 7.1, month 12

Workshop on technical and research challenges of the STC project, placed in a European and fully international context, synergy of the STC, FCC-ee and CLIC projects.

Deliverable 7.2, month 18

Overview report on technological requirements and R&D progress, linking European and world-wide know-how to the new generation of the highly efficient lepton colliders.

- Many technological synergy projects between STC, FCC-ee and CLIC already ongoing
- Further ideas on common challenges/technologies will be documented
- Organisation of a workshop at CERN for (by!) **young scientist in e^+e^- colliders** (accelerator+experiment), with involvement of experts from within CREMLIN consortium



Task 7.2: Internationalisation



Deliverable 7.3, month 24

Workshop focusing on internationalisation and joint research for STC

Deliverable 7.4, month 36

Follow-up report on internationalisation and joint research for STC

What does internationalisation mean?

- At higher strategic level => what are the objectives and rules for foreign involvement?
- At scientist level:
 - => make Super Charm-Tau project better known
 - => work together on science/technology aspects (link to task 7.1)
 - => organise a scientific workshop at BINP
- At strategic+scientist level => put in place International Advisory Committee



Task 7.3: e^+e^- data management platform



Milestone 7.2, month 8

Creation of a "CREMLIN data management platform for lepton colliders" and a data management repository for exchange of information and sharing of applications.

Deliverable 7.5, month 22

Status report on the "CREMLIN data management platform for lepton colliders"

Deliverable 7.6, month 36

Final progress report on the "CREMLIN data management platform for lepton"

- Task already well described in grant agreement
- Will link the task further to the corresponding across-CREMLIN activity
- Part of the WP7 funding will be used for the bi-directional (!) BINP-CERN exchange of young scientists for this task

Summary for WP7

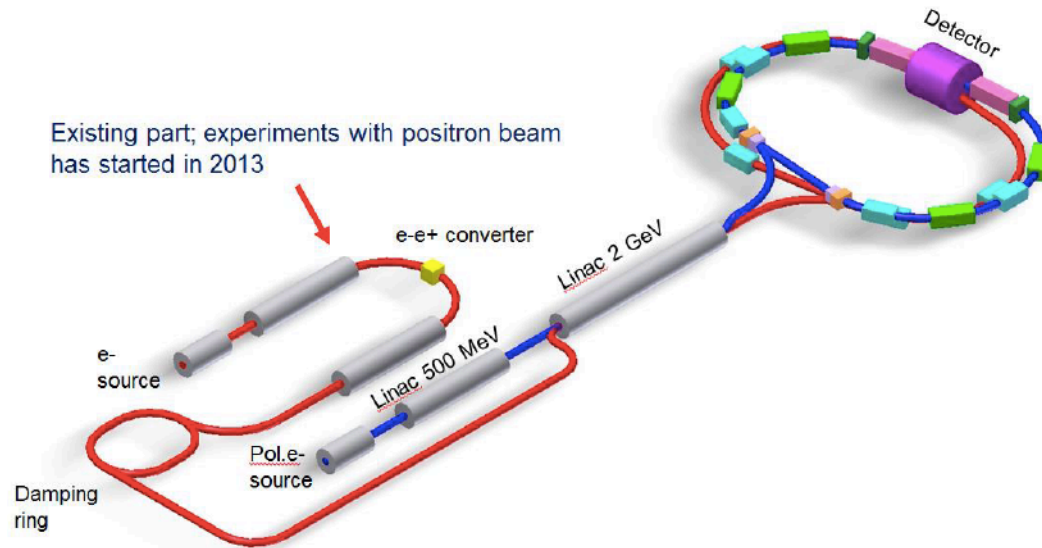
Fruitful discussions at the kick-off meeting !

Common view between scientists how to proceed within the work package

- Scientific/technological exchanges (bidirectional)
- Stimulate and help involvement of young scientists in e^+e^- colliders
- Internationalisation with help of International Advisory Committee

The main BIG questions are of a higher strategic nature:

- Strategic objectives/rules for SCT as a Russian mega-science project
- Prospects for making SCT happen !!



spare slides



Super Charm-Tau (SCT) project @ BINP

Energy	1.0 GeV	1.5 GeV	2.0 GeV	2.5 GeV
Circumference	780 m			
Emittance hor/ver	8 nm/0.04 nm @ 0.5% coupling			
Damping time hor/ver/long	30/30/15 ms			
Bunch length	16 mm	11 mm	10 mm	10 mm
Energy spread	$10.1 \cdot 10^{-4}$	$9.96 \cdot 10^{-4}$	$8.44 \cdot 10^{-4}$	$7.38 \cdot 10^{-4}$
Momentum compaction	$1.00 \cdot 10^{-3}$	$1.06 \cdot 10^{-3}$	$1.06 \cdot 10^{-3}$	$1.06 \cdot 10^{-3}$
Synchrotron tune	0.007	0.010	0.009	0.008
RF frequency	508 MHz			
Harmonic number	1300			
Particles in bunch	$7 \cdot 10^{10}$			
Number of bunches	390 (10% gap)			
Bunch current	4.4 mA			
Total beam current	1.7 A			
Beam-beam parameter	0.15	0.15	0.12	0.095
Luminosity	$0.63 \cdot 10^{35}$	$0.95 \cdot 10^{35}$	$1.00 \cdot 10^{35}$	$1.00 \cdot 10^{35}$



Work package 7

Work package number	WP 7	Start date or starting event:				Month 1	
Work package title	Science cooperation with the Super tau-charm factory STC in the field of lepton colliders						
Participant number*	20	19					
Participant short name	BINP	CERN					
Total Person-months per participant ¹	8	7					
Person-months per participant ² requested by EC	4	4					

Objectives

- To identify and map the research interests and needs of EU and Russian partners for scientific cooperation in the STC project;
- To work out measures and action plans to foster joint research projects towards the implementation of the project;
- To create synergies and exploit complementarities between STC and CERN in new lepton colliders;
- To ensure state of the art data management and storage for collaborations in new lepton colliders.



Task 7.1, month 1-18

The aim of this task is to provide an **overview of technical and research challenges of the STC project** and place them **in the context of European lepton collider facilities** (e.g. FCC-ee, CLIC) as well as other **lepton collider projects else where in the world** (e.g. BEPC-II/BES in China, SuperKEKB/Belle-II in Japan, PEP-II/BaBar in the USA, ILC international). Lepton colliders pose particular challenges in beam dynamics and beam-beam effects on the accelerator side and high-precision requirements under specific high-rate conditions on the experiment side. Yet there are pronounced differences between the typical ultra-high luminosity environment at the moderate energies of flavour and tau factories on the one hand, and the high-luminosity environment at energy-frontier lepton colliders on the other hand. In view of exploiting the potential for synergies and complementarities between Europe and Russia on lepton colliders, it is important to provide a detailed **technology mapping**. **A small international team of experts** will be in charge of providing an overview of project overlaps and differences and to summarise the status of the corresponding technology R&D. **This task will be initiated at the CREMLIN kick-off meeting**. Subsequently, **within the first year of the project, a workshop will be organised at CERN** that will bring a representation of accelerator and experiment experts of STC, FCC-ee, CLIC and other lepton colliders together. The international team of experts will take responsibility for providing a **concise technology overview report summarising its findings**.



Task 7.2, month 7-36

Fostering internationalisation and joint research for STC

This task makes use of the findings of task 7.1. Furthermore, it links closely to the exchange platform of WP2. One of the major activities of the task will be the **organisation of an international workshop at BINP**, involving a maximum of partners with whom common and complementary research interests have been identified. **The workshop will follow the outcome and trends of WP2 in order to promote and facilitate collaboration forming for STC.** This requires a careful preparatory phase leading up to the event, in order to set the stage for an optimal participation in the event and an effective preparation of the formal context for such collaborative actions. After the workshop the progress of STC participation and internationalisation will be tracked and laid down in a final report on the task.

Task 7.3, month 1-36

Data throughput and large data management in the field of lepton colliders

The high-intensity environment and fine detector granularities at future lepton colliders will give rise to very **high data rates**. These call for state-of-the-art applications in **on-detector electronics, data acquisition, distributed computing and data management**. In these domains industrial technologies will continue to evolve rapidly, so there will be an interest in keeping up and exploiting the latest trends. A **"CREMLIN data management platform for lepton colliders"** will be created to share common experiences, software applications and hardware solutions. It will involve the organisation of expert meetings, mostly in the form of **video-based meetings, and the sharing of an application repository**. This platform will link to the "big data management of research activities" in WP3, WP4, WP5 and WP6 through the exchange platform of WP2. *Short working trips for experts and junior researchers are foreseen within this task.*

Injection facility

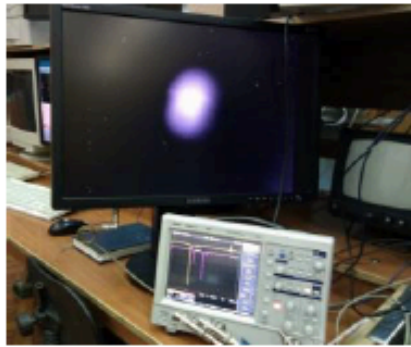
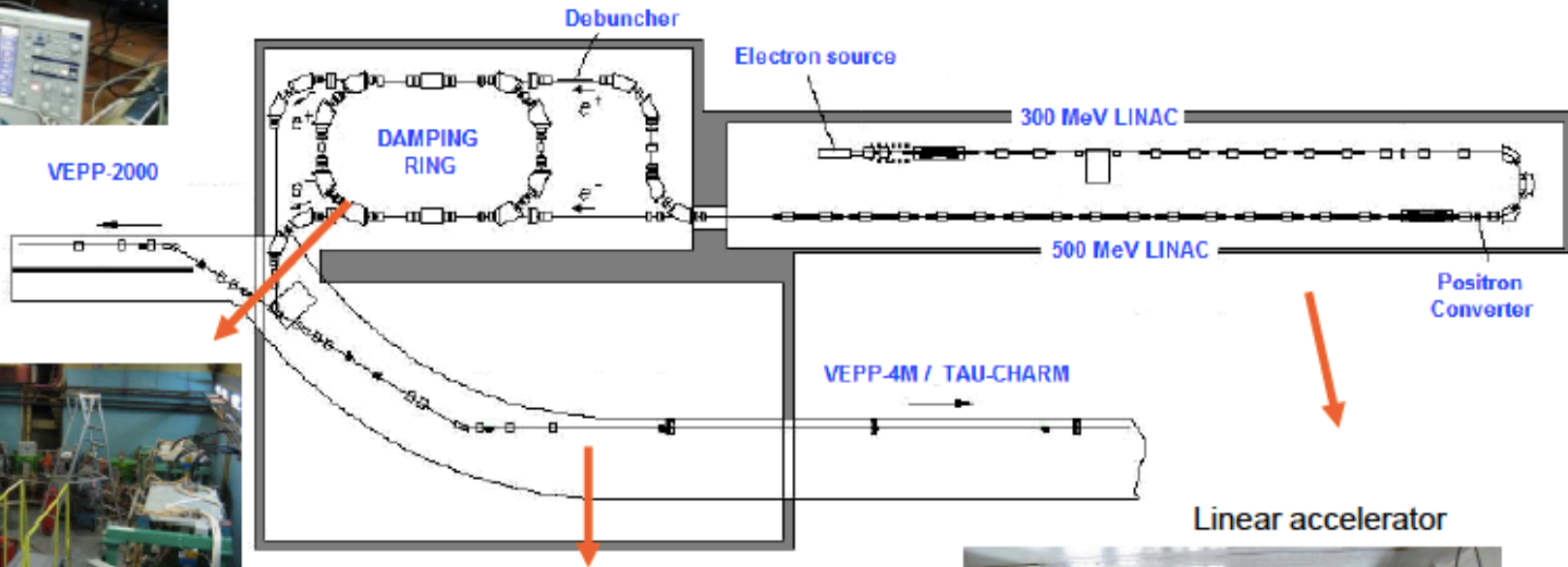


Image of the first positron beam in 2013



500 MeV damping ring



Beam transfer line

