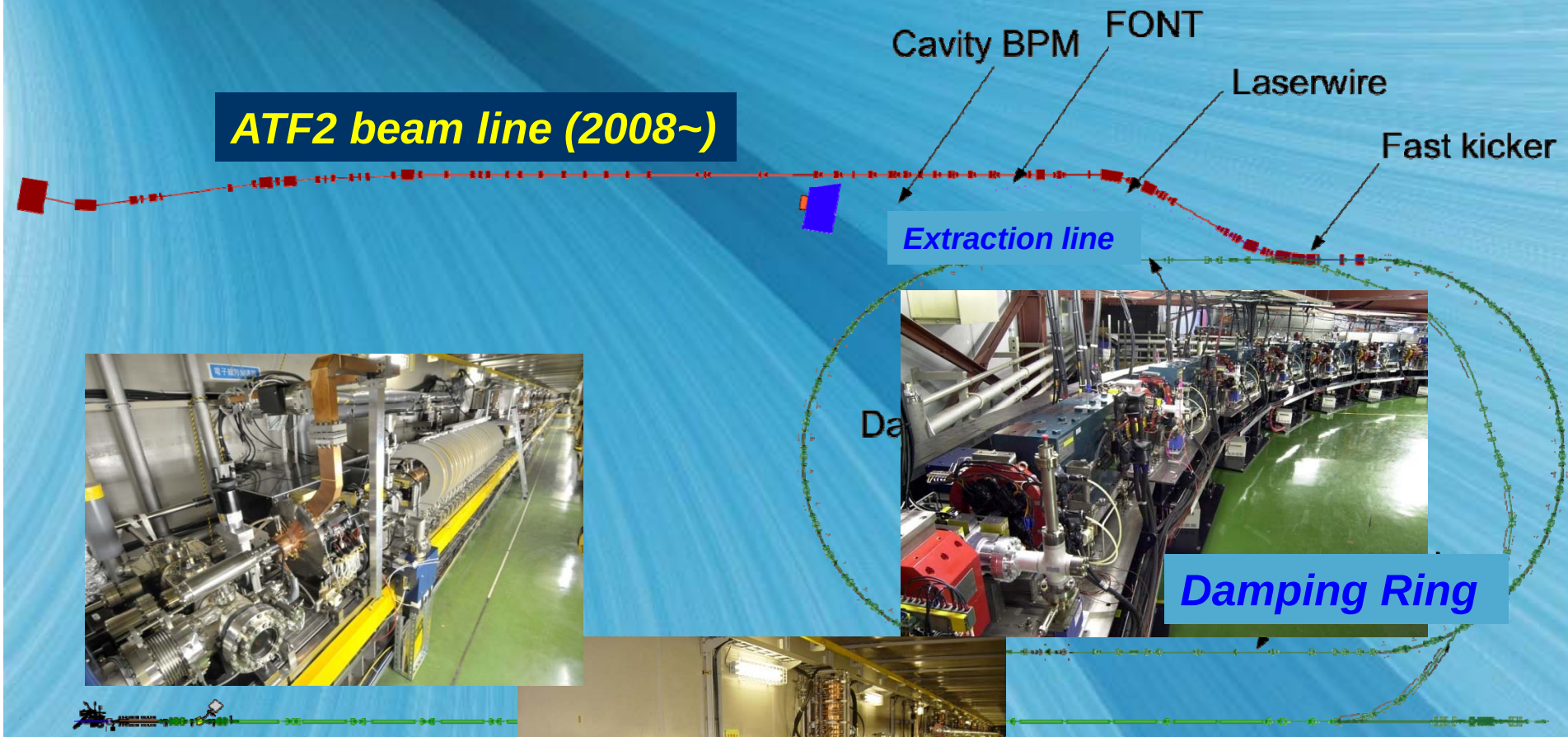
Greeting for 7th TB and ATF2 joint meeting

Accelerator Test Facility



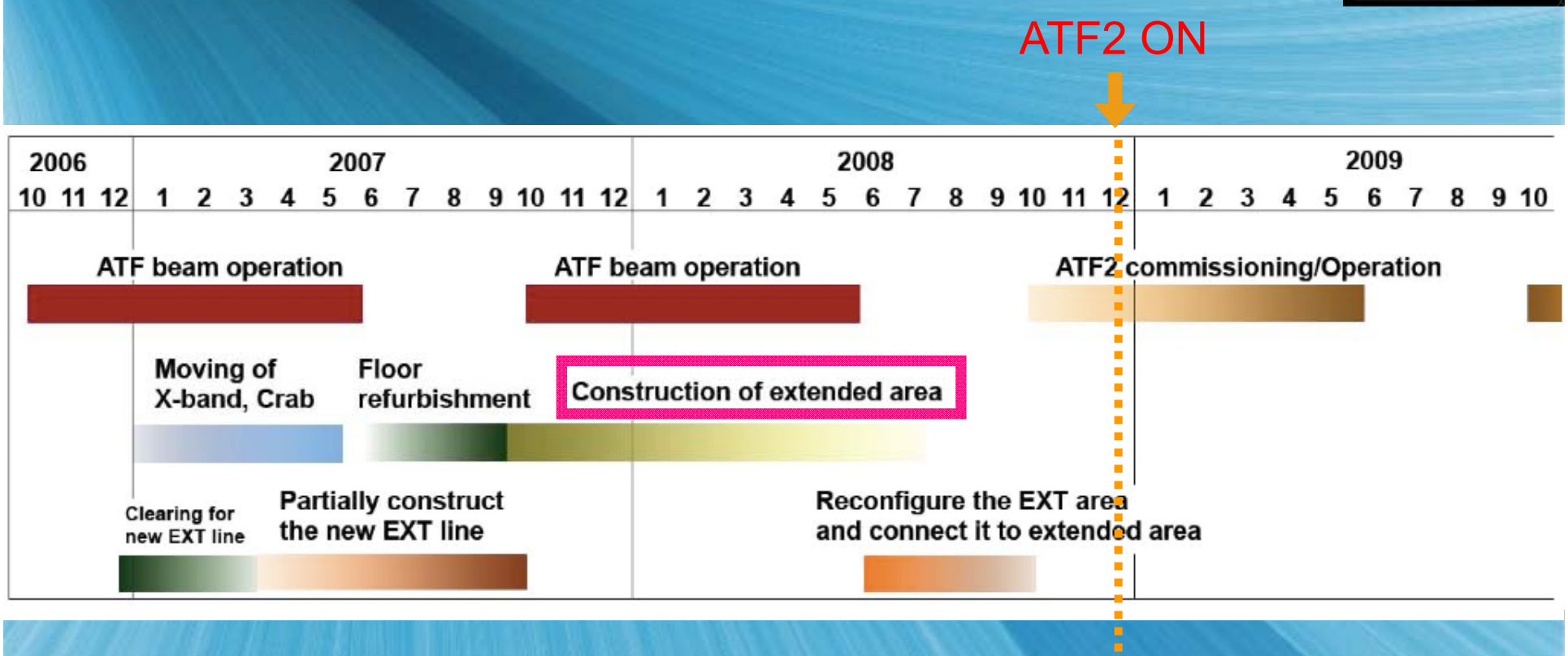
ATF2 beam line (2008~)

Photo-cathode RF gun (electron source)

S-band Linac

Δf ECS for multi-bunch beam

ATF – beam operation schedule



Commissioning to start in Dec. 2008

We got the temporary permission to operate ATF2 in Dec.. I think we will get the formal permission from MEXT in Jan..
Then, we can carefully operate ATF2 for beam commissioning. Thank you for your understanding in this situation.

Necessary Deliverables from TF for BDS and DR

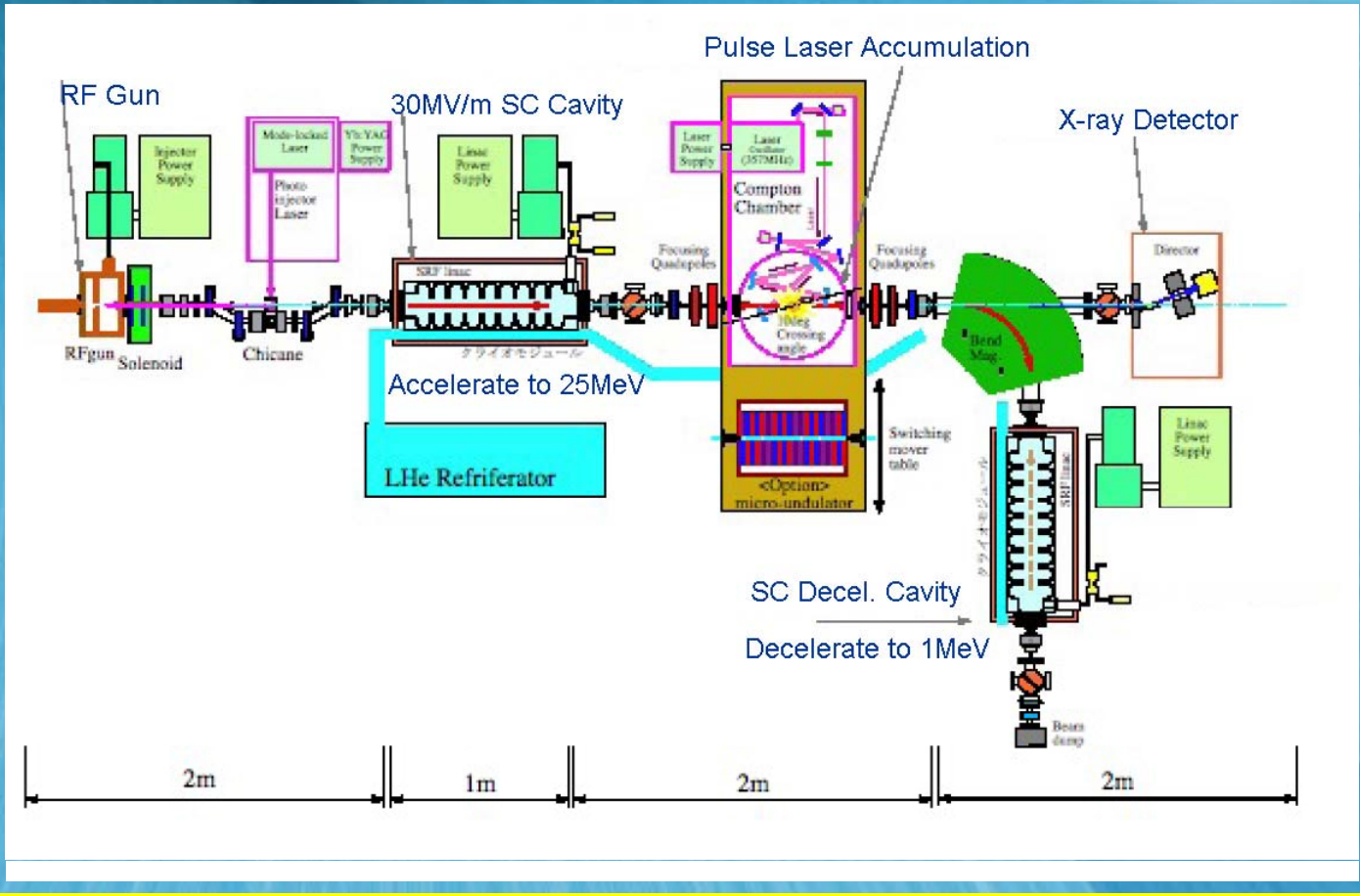
Test Facility	Deliverable	Date
Hardware development, Optics and stabilisation demonstrations:		
ATF	Demo. of reliable operation of fast kickers meeting the specifications for the ILC damping ring.	2010
	Generation of 1 pm-rad low emittance beam	2009
ATF2	Demo. of compact Final Focus optics (design demagnification, resulting in a nominal 35 nm beam size at focal point).	2010
	Demo. of prototype SC and PM final doublet magnets	2012
	Stabilisation of 35 nm beam over various time scales.	2012
Electron cloud mitigation studies:		
CESR-TA	Re-config. (re-build) of CESR as low-emittance e-cloud test facility. First meas. of e-cloud build-up using instrumented sections in dipoles and drifts sections (large emittance).	2008
	Achieve lower emittance beams. Meas. of e-cloud build up in wiggler chambers.	2009
	Characterisation of e-cloud build-up and instability thresholds as a func. of low vertical emittance (≤20 pm)	2010
DAΦNE	Fast kicker design and pulser reliability check	2010
	Characterisation of e-cloud build-up and instability thresholds	2010
SLAC/LLNL	Fast kicker pulser development	2010

- Thanks to many colleagues from the ATF Collaboration those on these photo.

5th ATF2 Project Meeting, 19-21 Dec. 2007

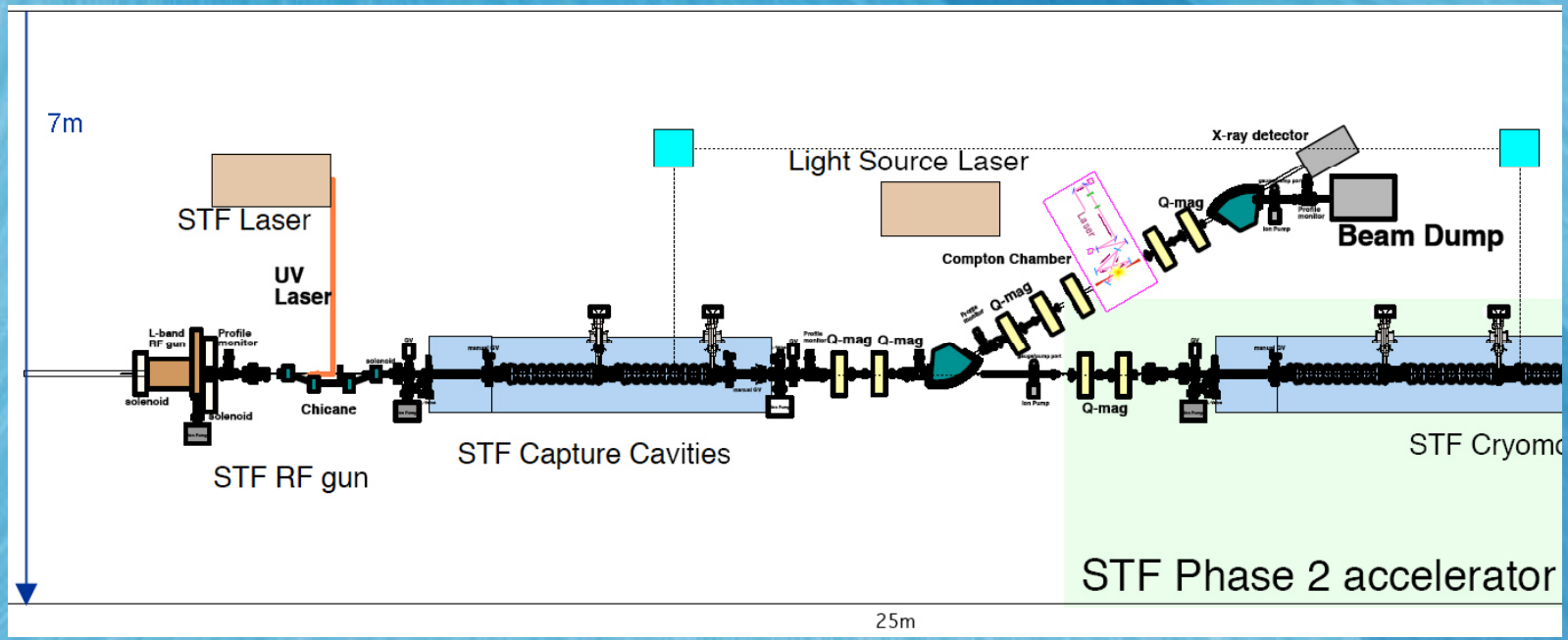
7th ATF2 Project Meeting, 15-18 Dec. 2008

High-Intensity Compact X-ray Source



- **Must be demonstrated by JFY2012**
- **Includes 25 MV SC acceleration and deceleration (but perhaps, deceleration can be omitted)**
- **Beam current (9mA) and pulse length (1ms) same as ILC, but bunch spacing 6.15nsec**

- Better to combine with STF2 for saving manpower and money
  - Build QB in STF tunnel
  - Identify 25MV acceleration cavity = STF capture cavity, though QB does not need 2 cavities
  - Can share the RF gun (but not the laser --- different pulse structure)
- But the price is the schedule delay
  - Interruption for at least half a year, likely ~1 year (installation of QB beam-line and tuning for X-ray)
  - To minimize the delay, plan to finish QB before 2012 summer vacation.



2. Photo-cathode RF gun

Cs_2Te Photo-cathode, 1.6 Cell S-band RF Gun
Multi-bunch beam generation

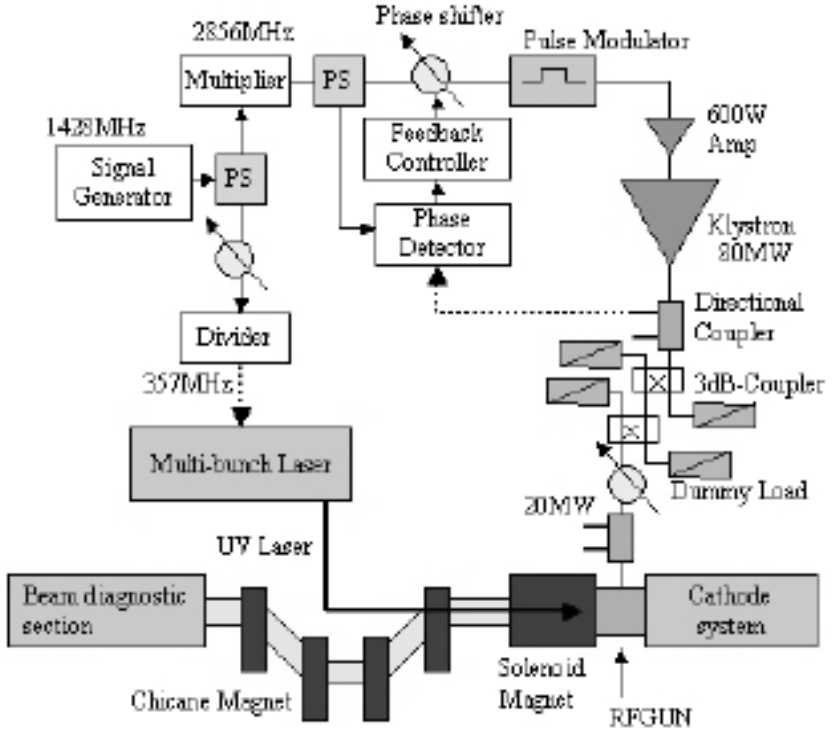


Figure 1: A schematic layout of the RFGTB

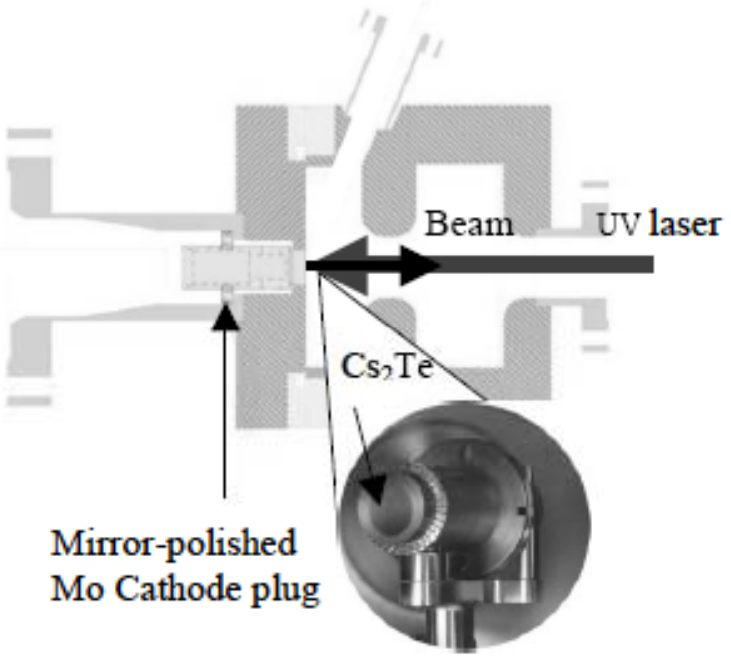


Figure 2: Cross section of the RF gun and the cathode plug.

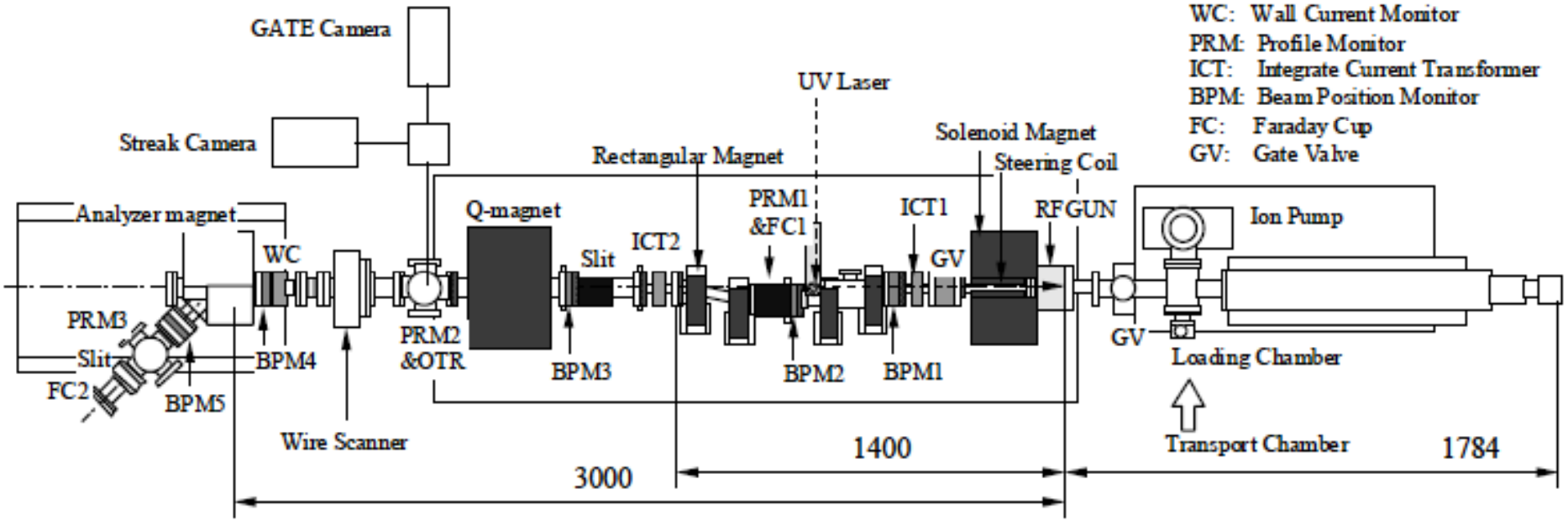


Figure 4: Schematic view of experimental setup

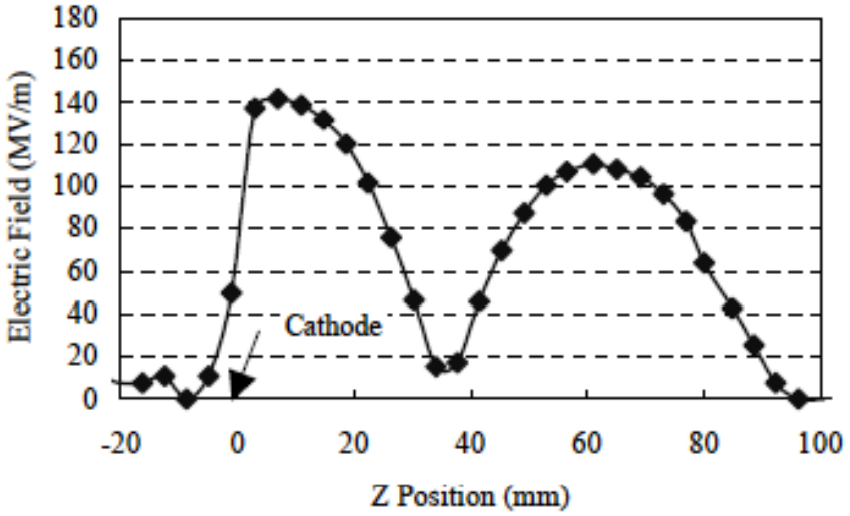


Figure 3: Electric field distribution in the RF gun cavity at the RF cavity power 15MW.

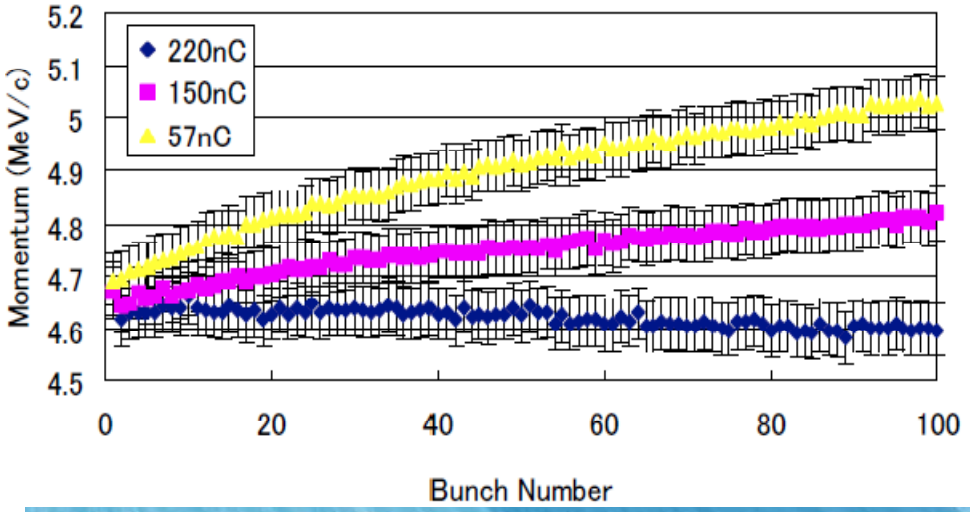
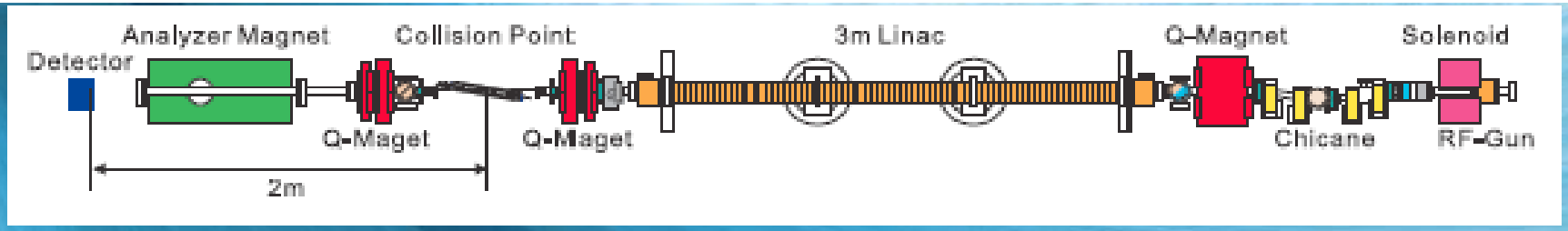
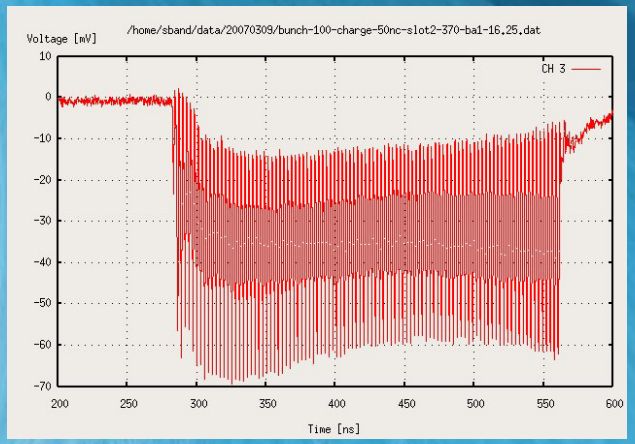
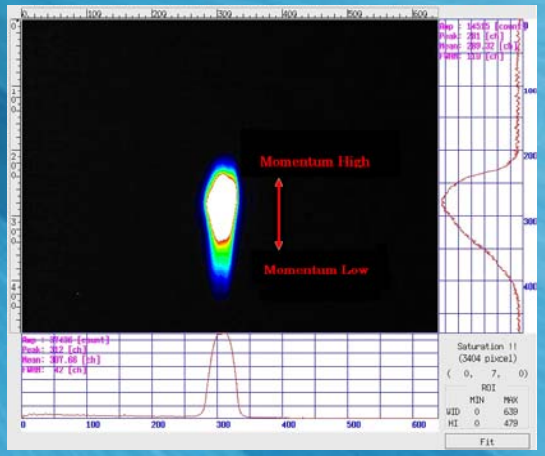
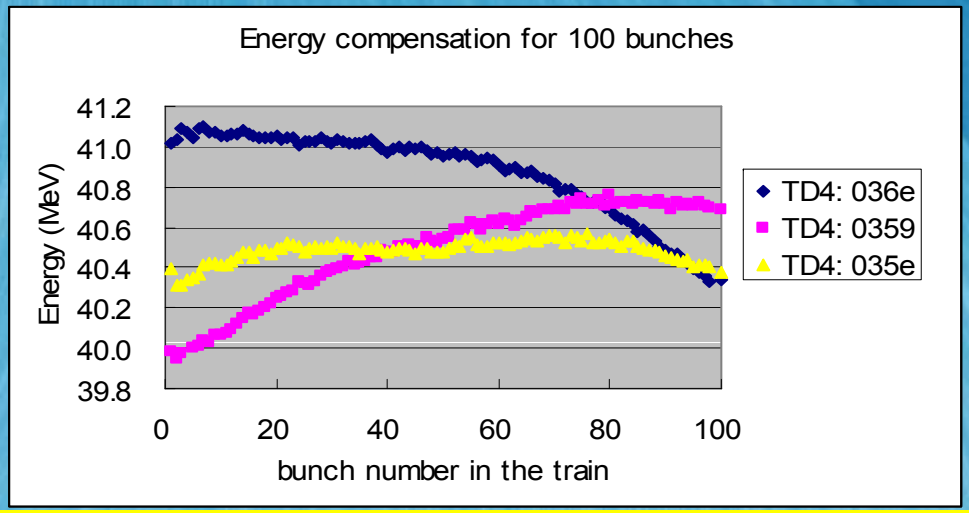


Fig.5 Momentum distribution of bunch trai





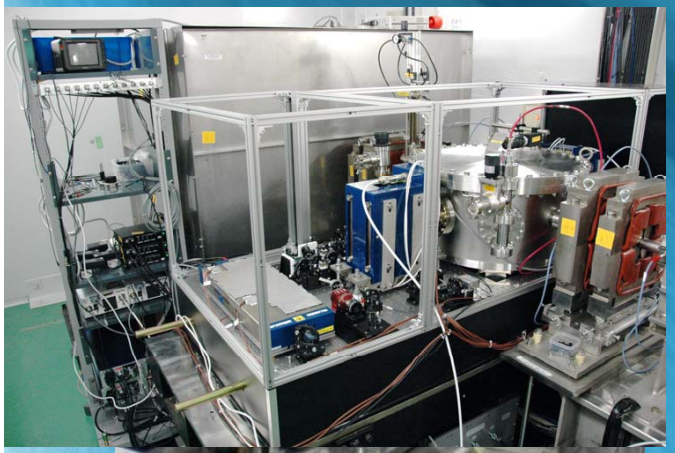


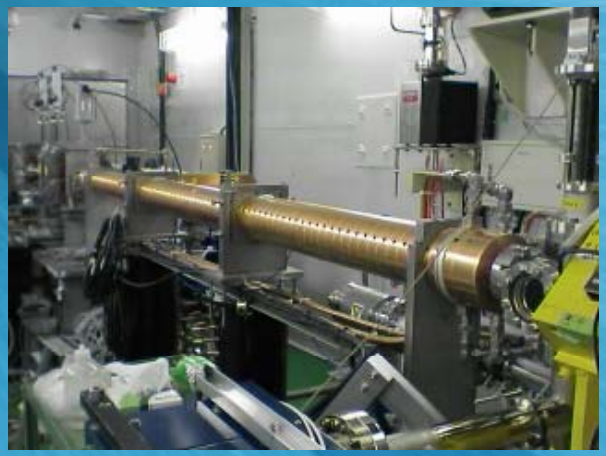


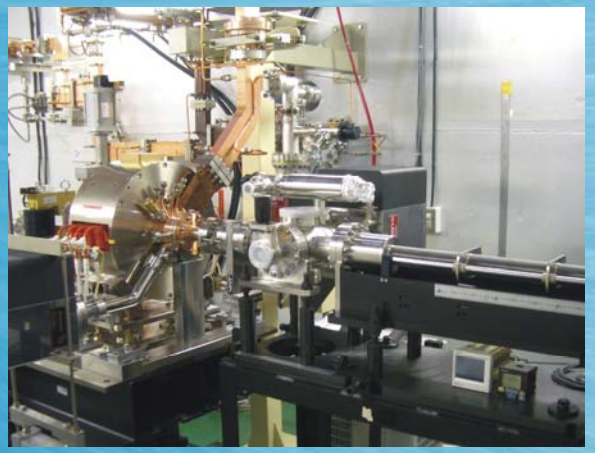
100 bunches/pulse ener
spread is less than 0.5%

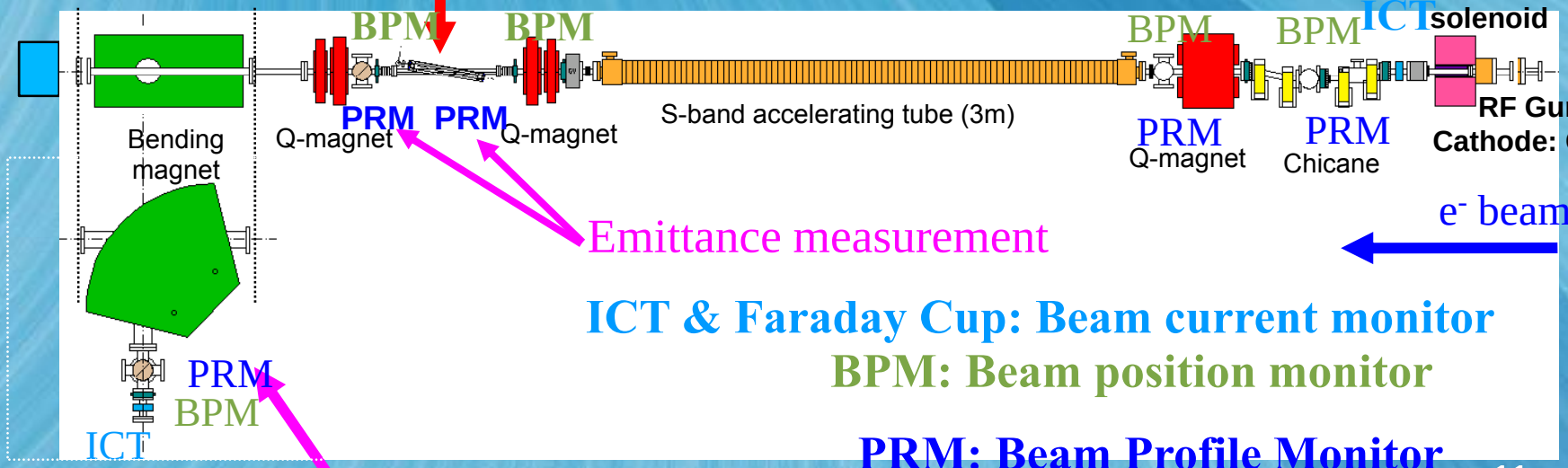
Fig. 7 Upper-left : ICT signal of 100 bunches, upper-right : 100 bunches on the OTR screen, bottom figure : energy of each bunch in the train

er Pulse Stacking Chamber, 3m long S-band accelerating tube a Photo-cathode RF Gun









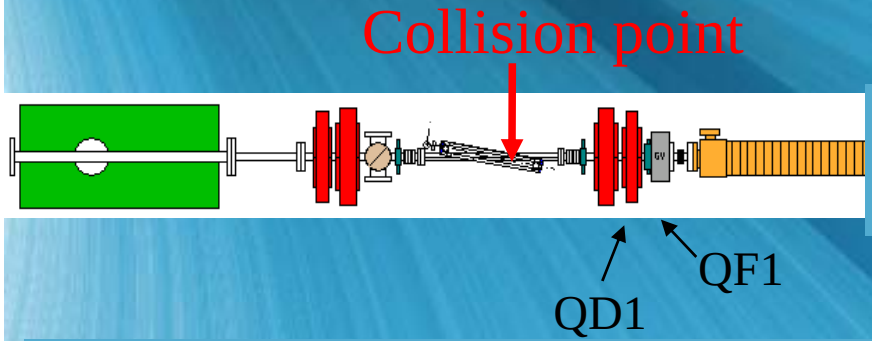
ICT & Faraday Cup: Beam current monitor

BPM: Beam position monitor

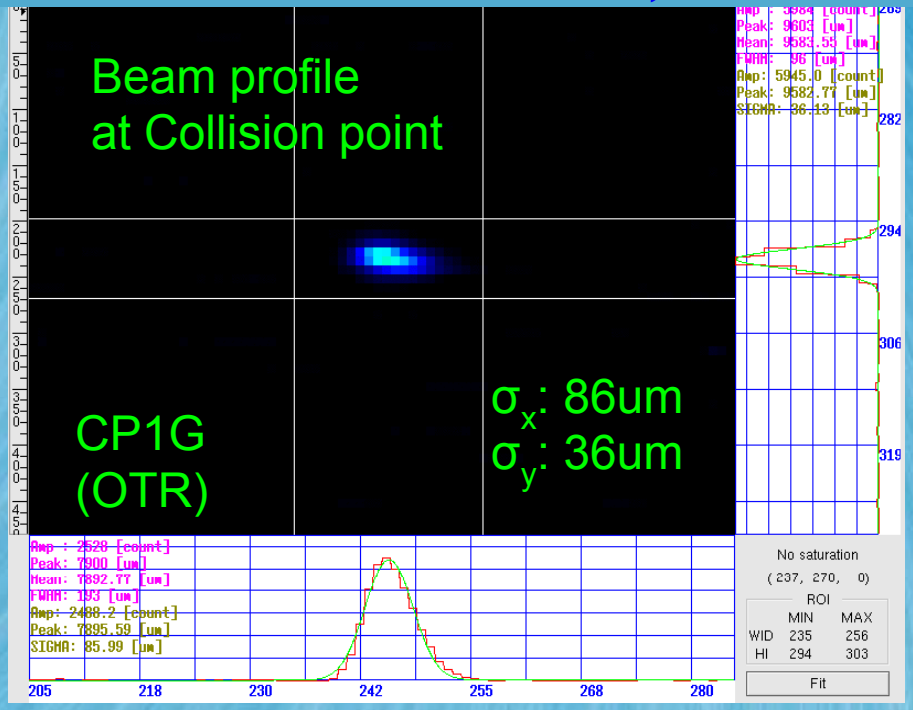
PRM: Beam Profile Monitor

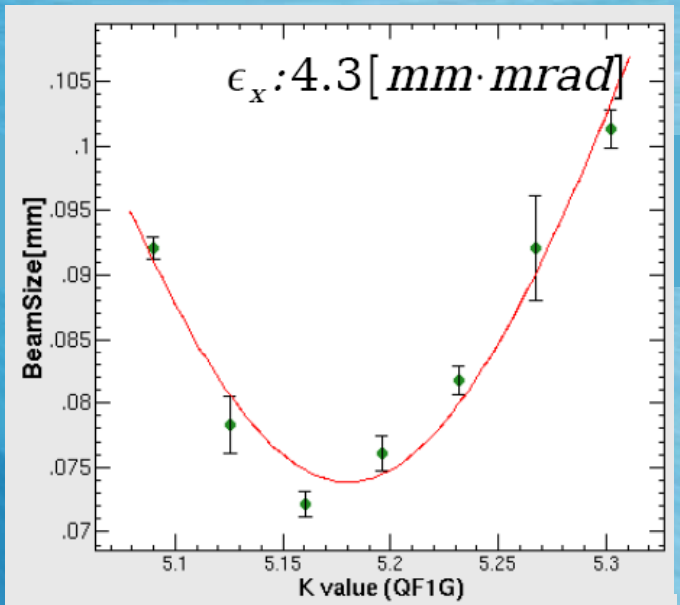
OTR target or Al_2O_3 (Cr^{3+} doped)

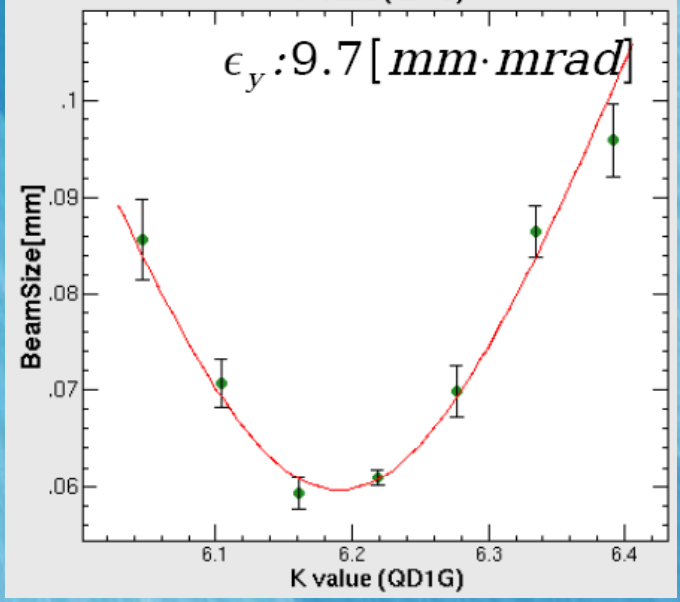
Emittance measurement



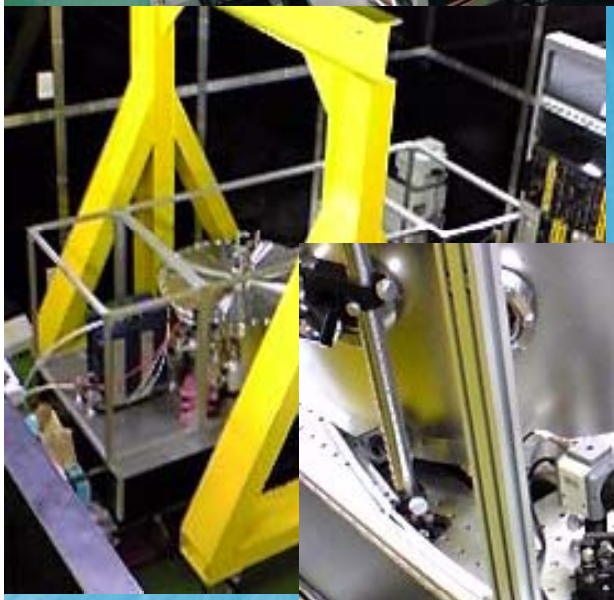
Beam current : 2.5nC/train, 3bunches

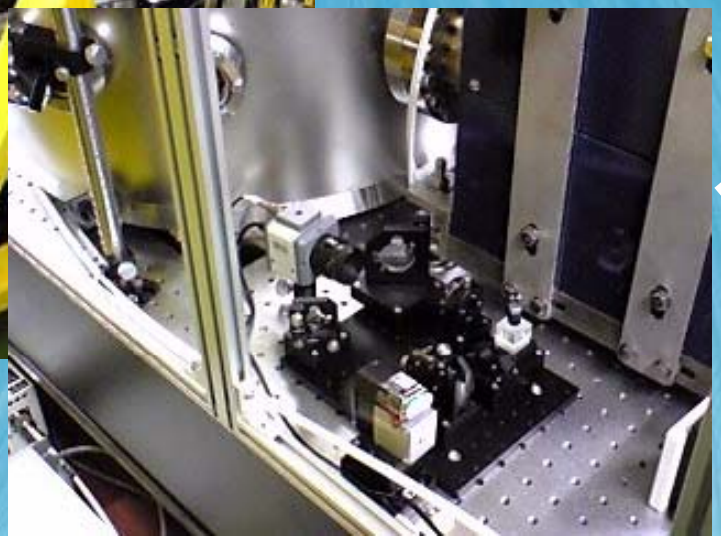




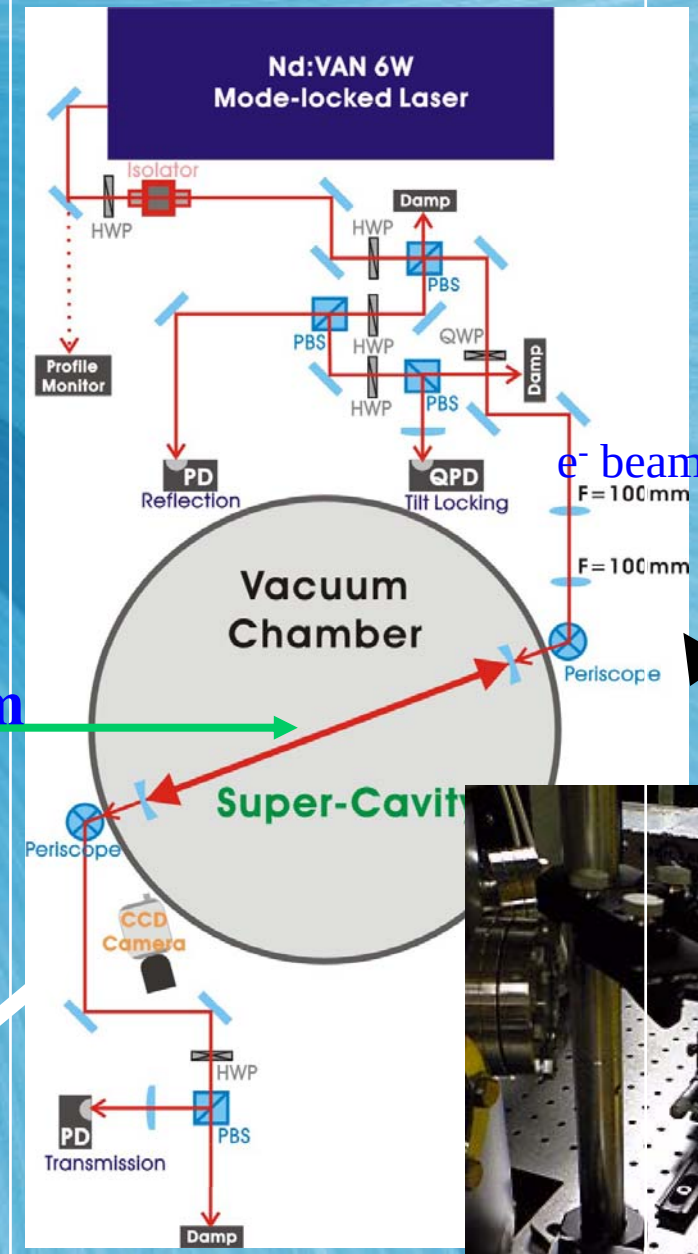


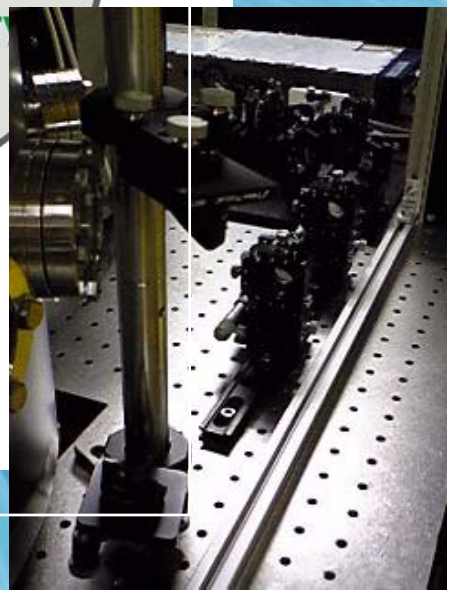
P-LW-CAV installed in APR2007.



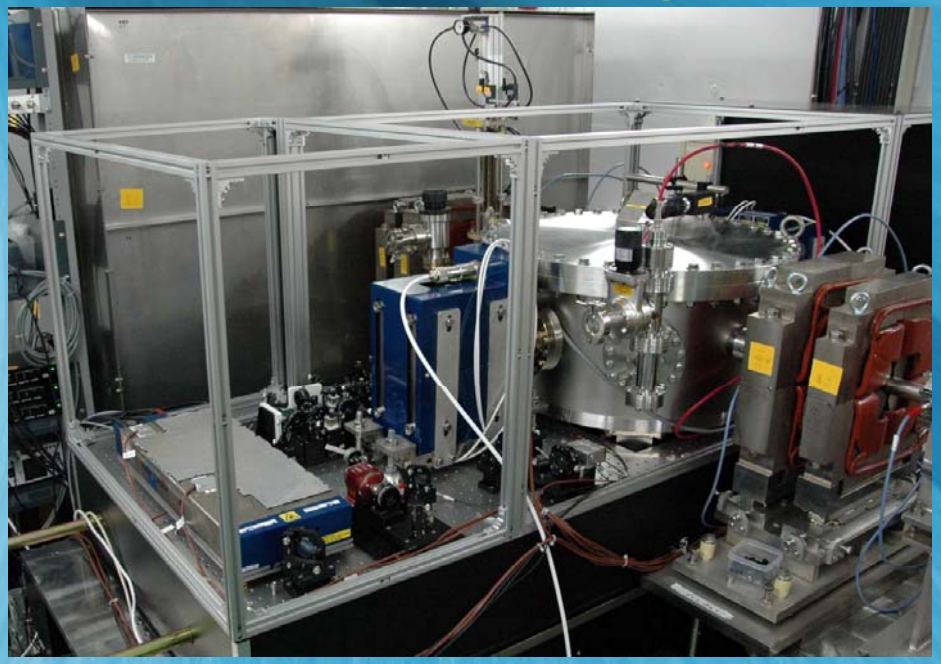


e- beam

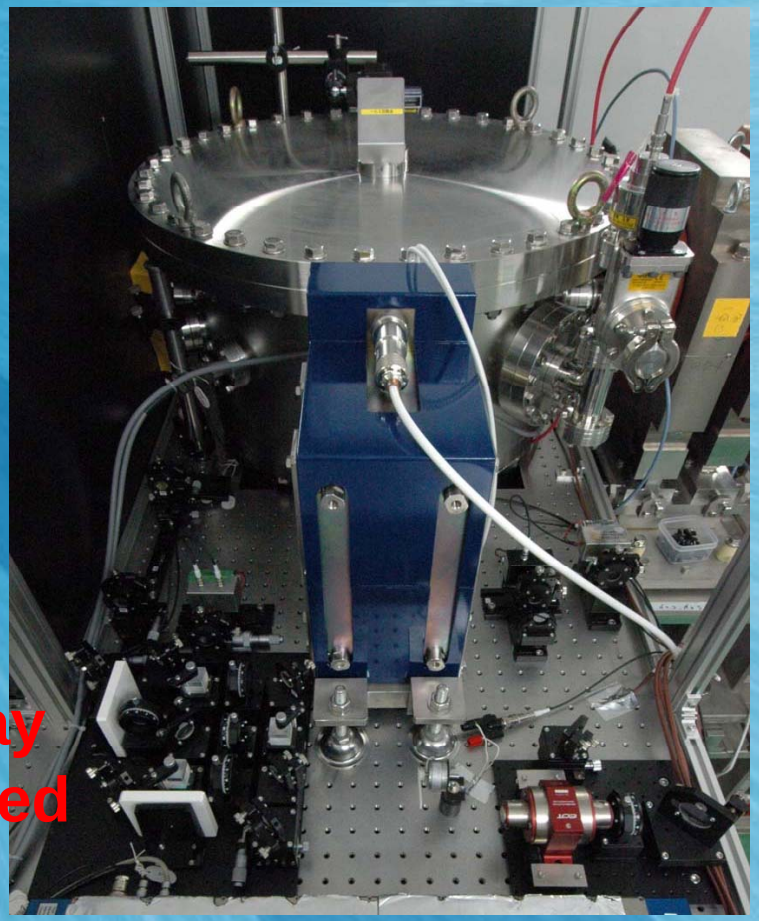




X-ray Generation



43MeV end station to separate X-ray and e-beam. 33keV X-ray is deflected by Crystals.

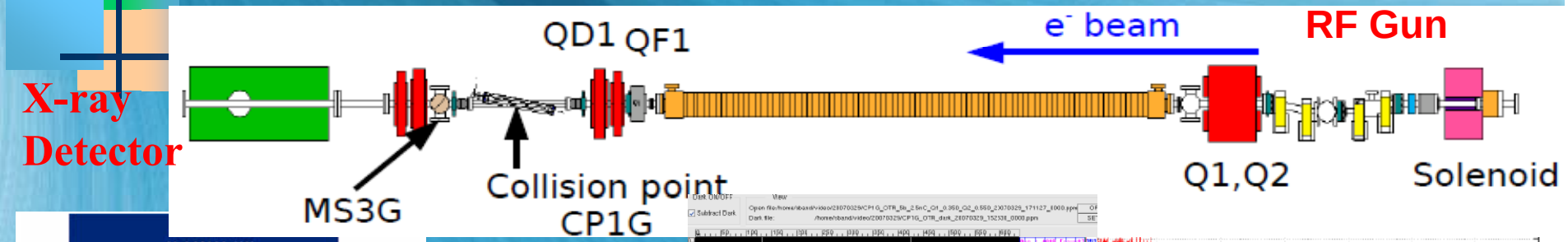


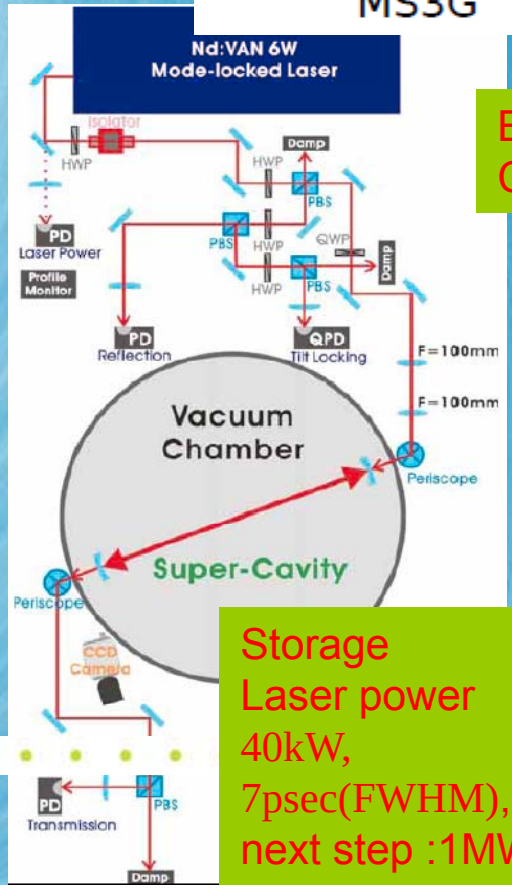
Pulsed laser stacking cham

Laser Undulator Compact X-ray (LUCX) Project at KEK-ATF

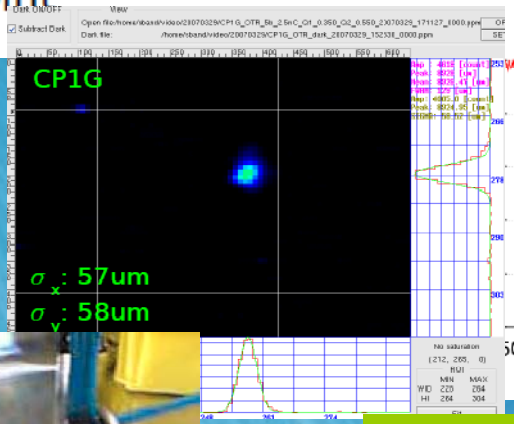
43MeV Multi-bunch beam+ Super-Cavity = 33keV X-ray.

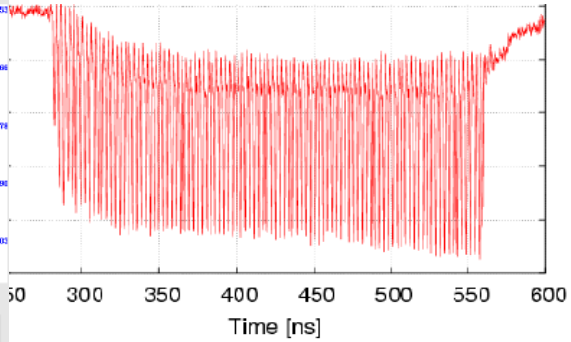
Multi-bunch photo-cathode RF Gun





Beam size at CP 60μm in σ



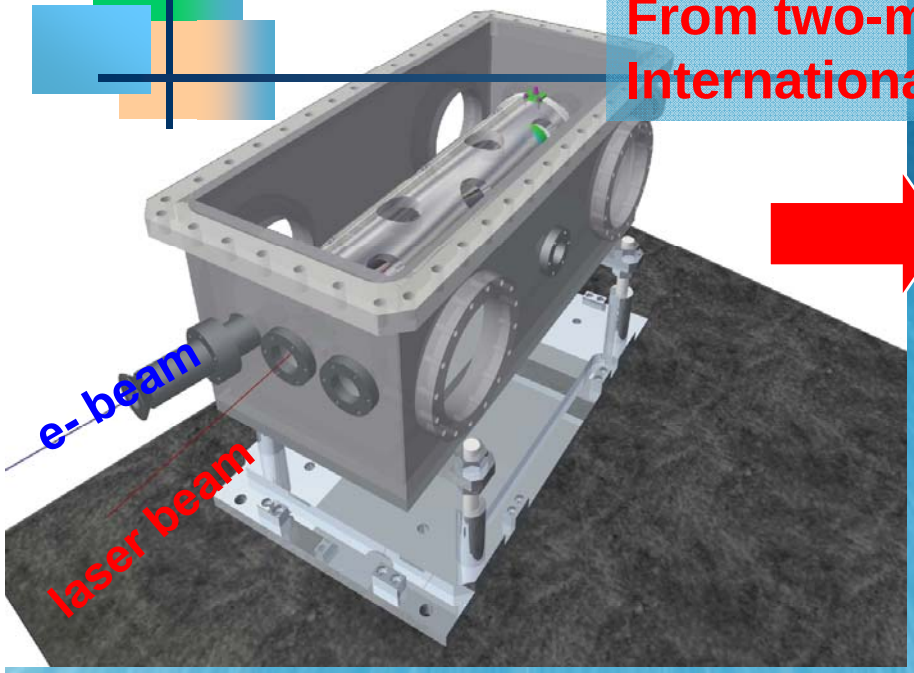


Storage Laser power 40kW, 7psec(FWHM), next step :1MW

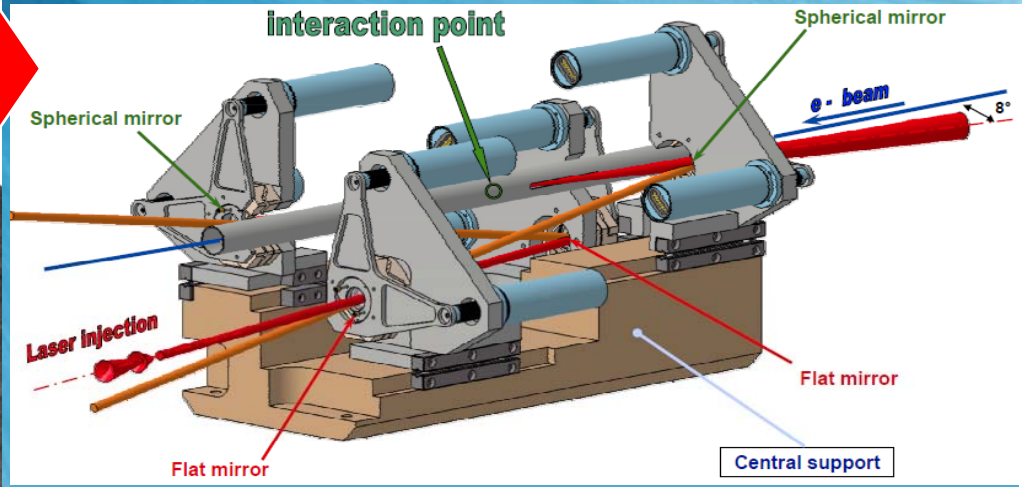
Multi-bunch e- beam 300nC at gun

At present, laser waist size is 30μm in σ. We should reduce both beam size at CP down to 30μm.
33keV X-ray generation based on inverse Compton scattering was started from May 2007 with Super-Cavity.

3. Pulsed laser storage cavity

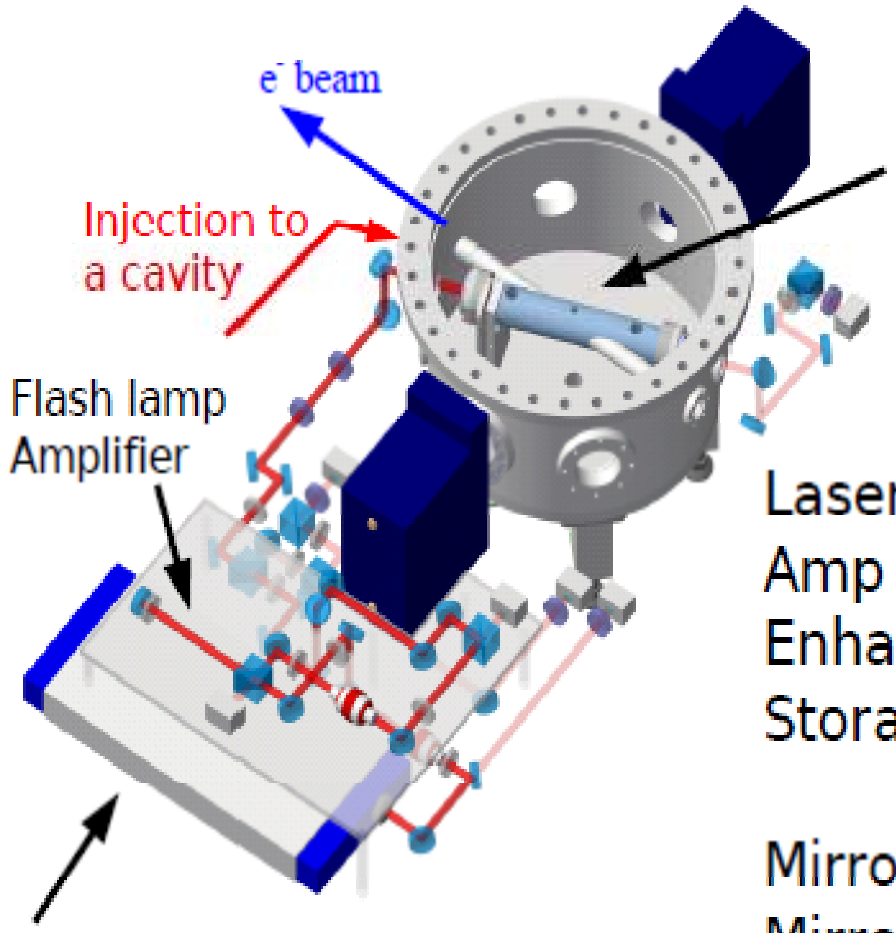


From two-mirror cavity to four-mirror cavity under International collaboration with LAL.



50 mJ / pulse, waist = 8 μm

Burst mode cavity parameters

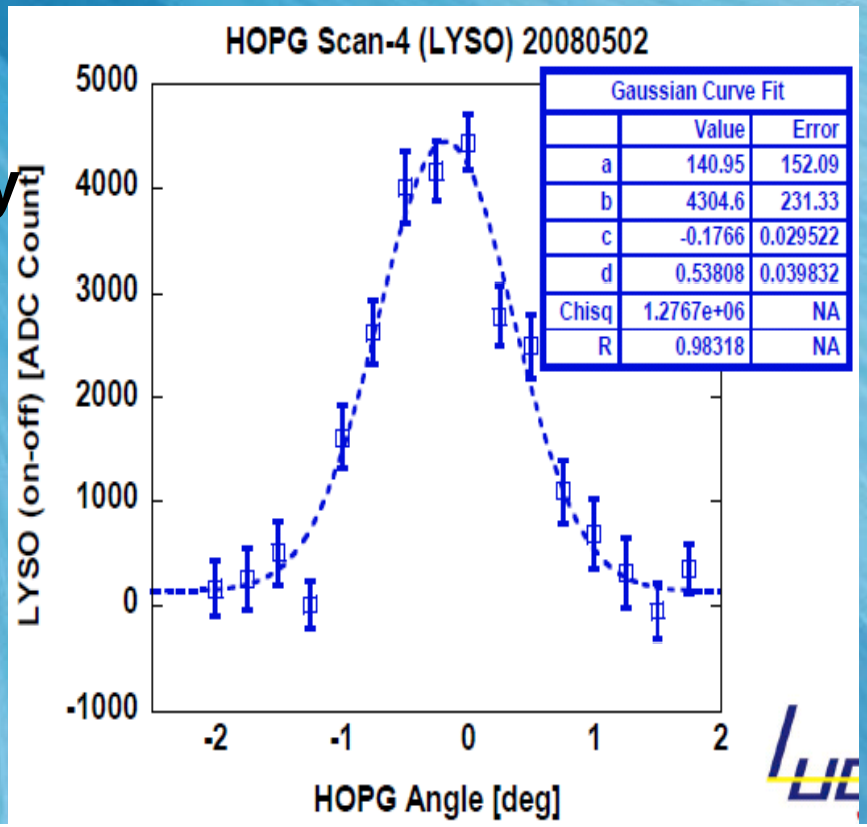


Laser power	2.5 W
Amp gain (2 pass)	80
Enhancement factor	200
Storage peak power	**40 kW**
	112 uJ/pulse
Mirror curvature	210.5mm
Mirror Reflectivity	99.6%
Waist size	**30.3 um**
Finesse	878.5
Cavity length	420 mm
Pulse length (FWHM)	7ps

R/D Status in Japan

Moderate Enhancement ~ 1000
Moderate spot size ~ 30 micron
Simple cavity stucture with two mirrors
Get experinence with 43MeV and 1.3GeV e- beam

Laser Undulator Compact X-ray (LUCX) Project at KEK-ATF
43MeV Multi-bunch beam+ Super-Cavity = 33keV X-ray.
Expected X-ray is generated.



4. Quantum beam project

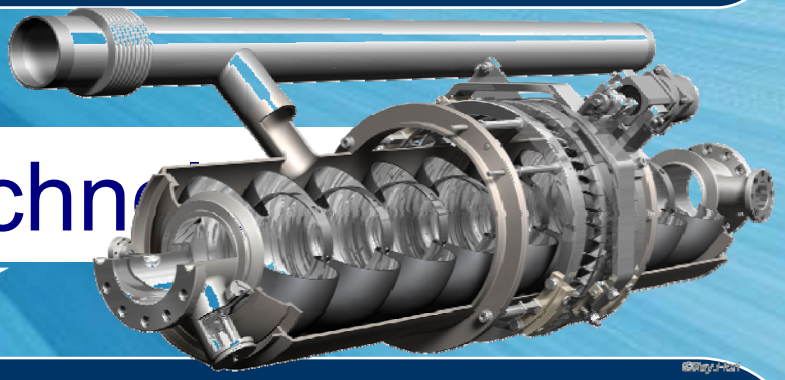
Characteristic of proposed machine

Compact (less than 10m) quasi-monochromatic (less than 1%)

High Flux (100 times than Compact normal Linac X-ray : 10^{11} photons/sec 1% b.w.)

High Brightness (10^{17} photons/sec mrad^2 mm^2 0.1% b.w.)

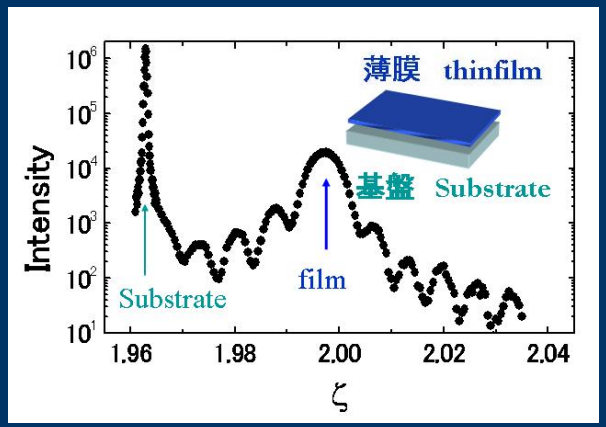
Ultra-short pulse X-ray (40 fs ~)



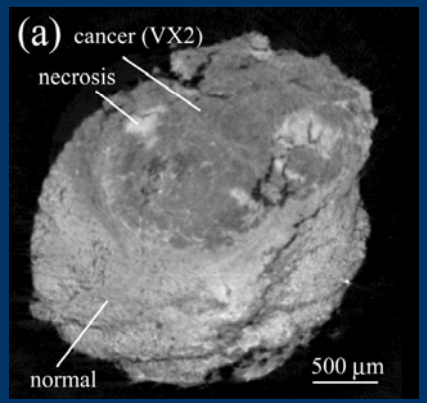
SCRF acceleration techn

Structural genetic analysis,

Nano-material evaluation,



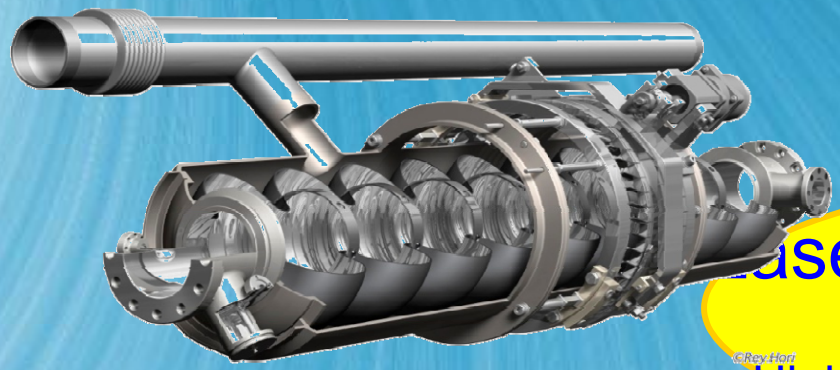
Highly fine X-ray Imaging



http://mml.k.u-tokyo.ac.jp/

SCRF Cavity

Ultra-low loss(10nΩ)
➔long pulse acceleration
➔high intensity and low emittance



Pulsed laser storage

Storage energy : 100 times
Beam size < 8 μm

aser Inverse Compton scattering

High intensity, high quality, monochromatic X-ray

Photo-cathode RF gun

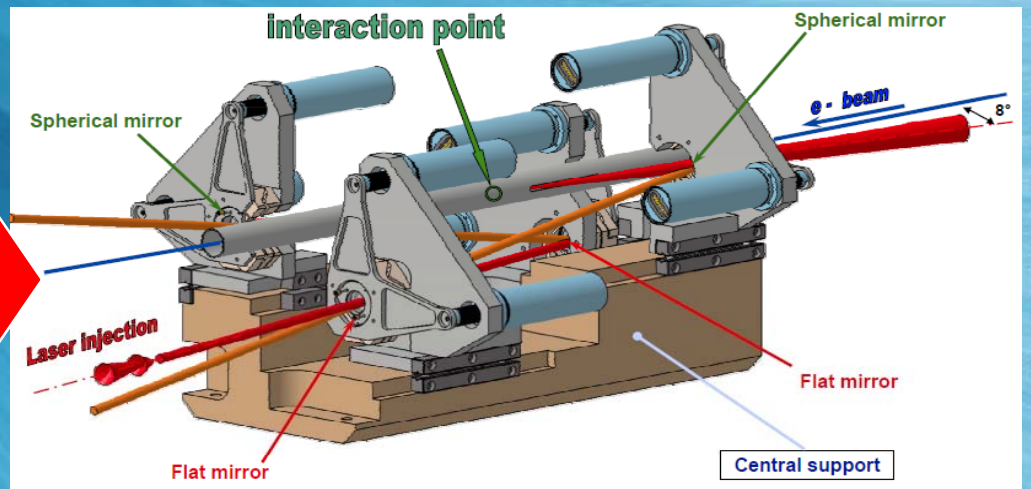
Low emittance beam 3mmmrad
Short pulse, 162.5MHz bunch train

400 times by CW operation : ERL

Pulsed Laser Storage

From 2-mirror cavity to 4-mirror cavity

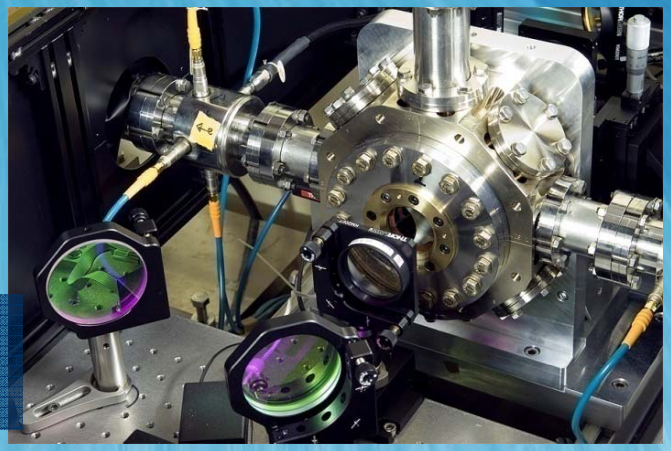
0.5 mJ / pulse, waist = 30 μm

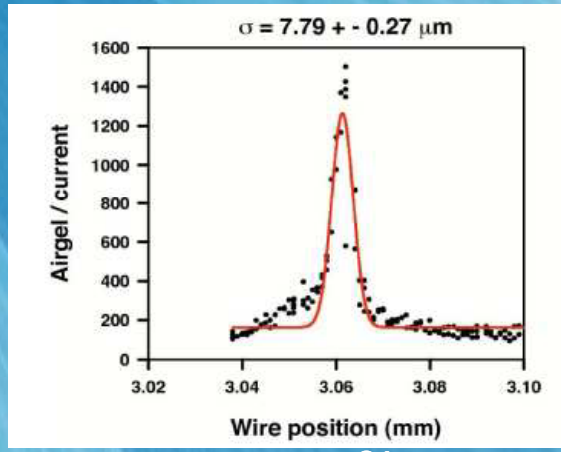


50 mJ / pulse, waist = 8 μm

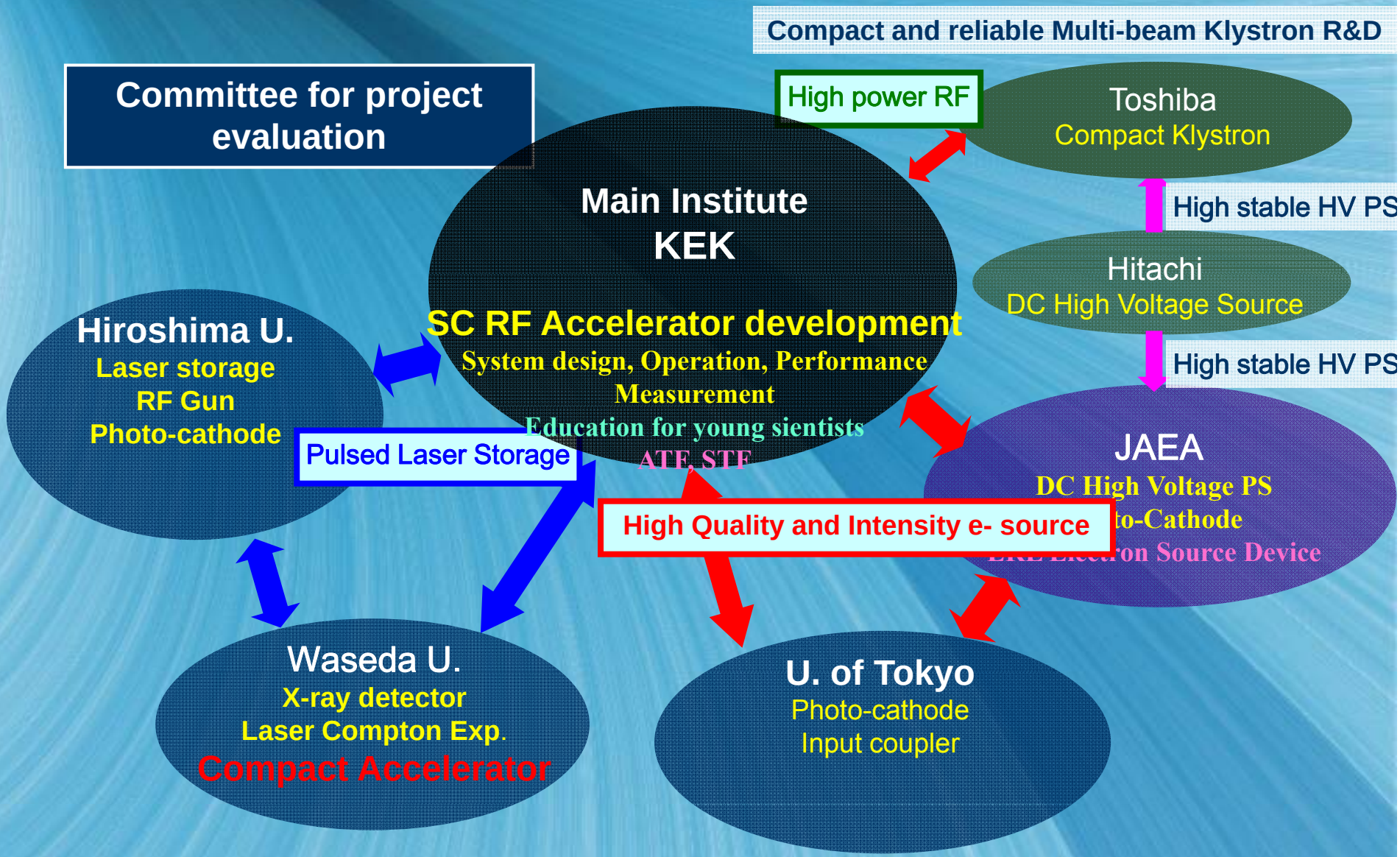
Beam orbit control Achieved by ATF

Laser wire waist : σ ~ 3 μm
Electron beam size : σ ~ 2 μm



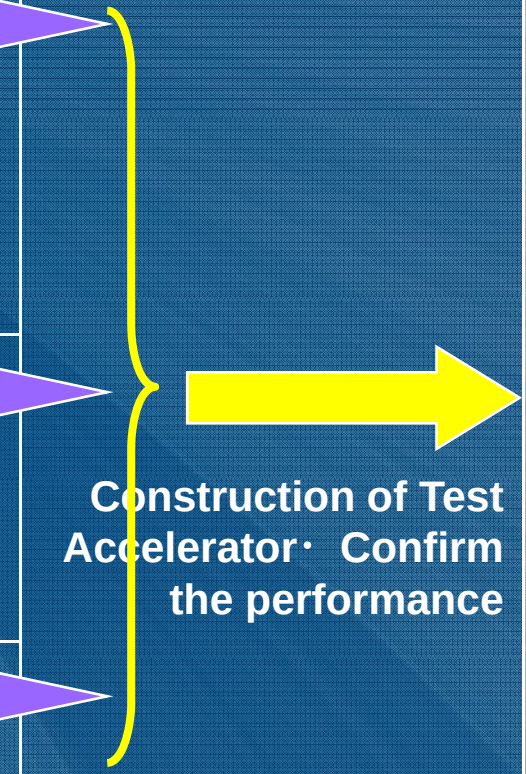


Organization & Responsibility



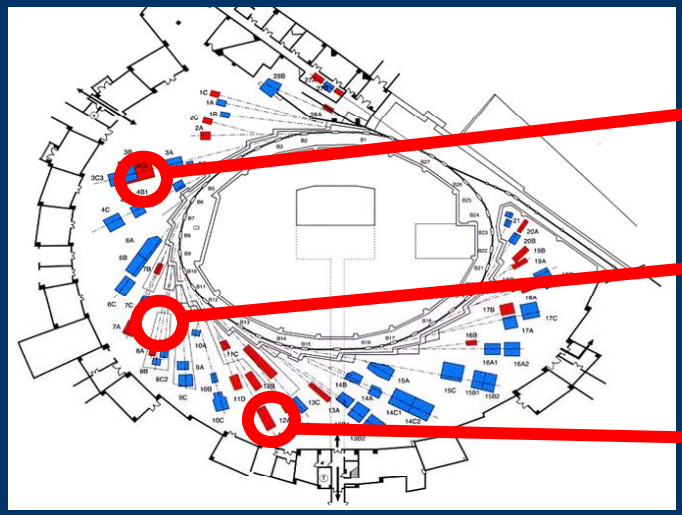
Annual Schedule and Budget

Item	2008	2009	2010	2011	2012
S. Cavity Development ($1.5M/year), HRF + Cly ($0.8M/year)	Upgrade of SC Cavity performance Compact RF power source system Control system for SCRF				
Electron Source ($0.5M/year)	High Q and long life photo-cathode 500 kV DC High Voltage High Intensity Beam Generation				
Pulsed Laser Storage System ($0.4M/year) X-ray Detector ($0.1M/year)	Design and R&D on laser storage X-ray Detector				



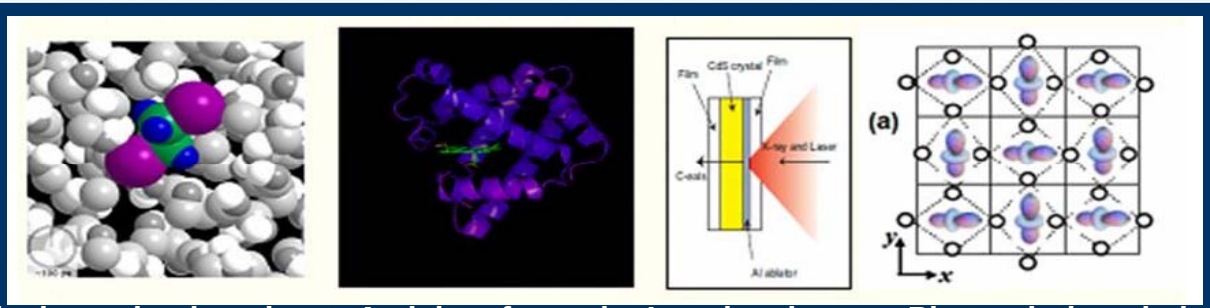
Impact by Compact High Brightness Photon Beam

1) *Performance of 2nd Generation PF will be obtained in usual Lab. Space!*



- Analysis of Genome @A University
- Evaluation of Material @Lab. of B Company
- Precise X-ray Imaging @C Hospital

2) *Sub-psec X-ray is generated*→Study fast transient phenomena



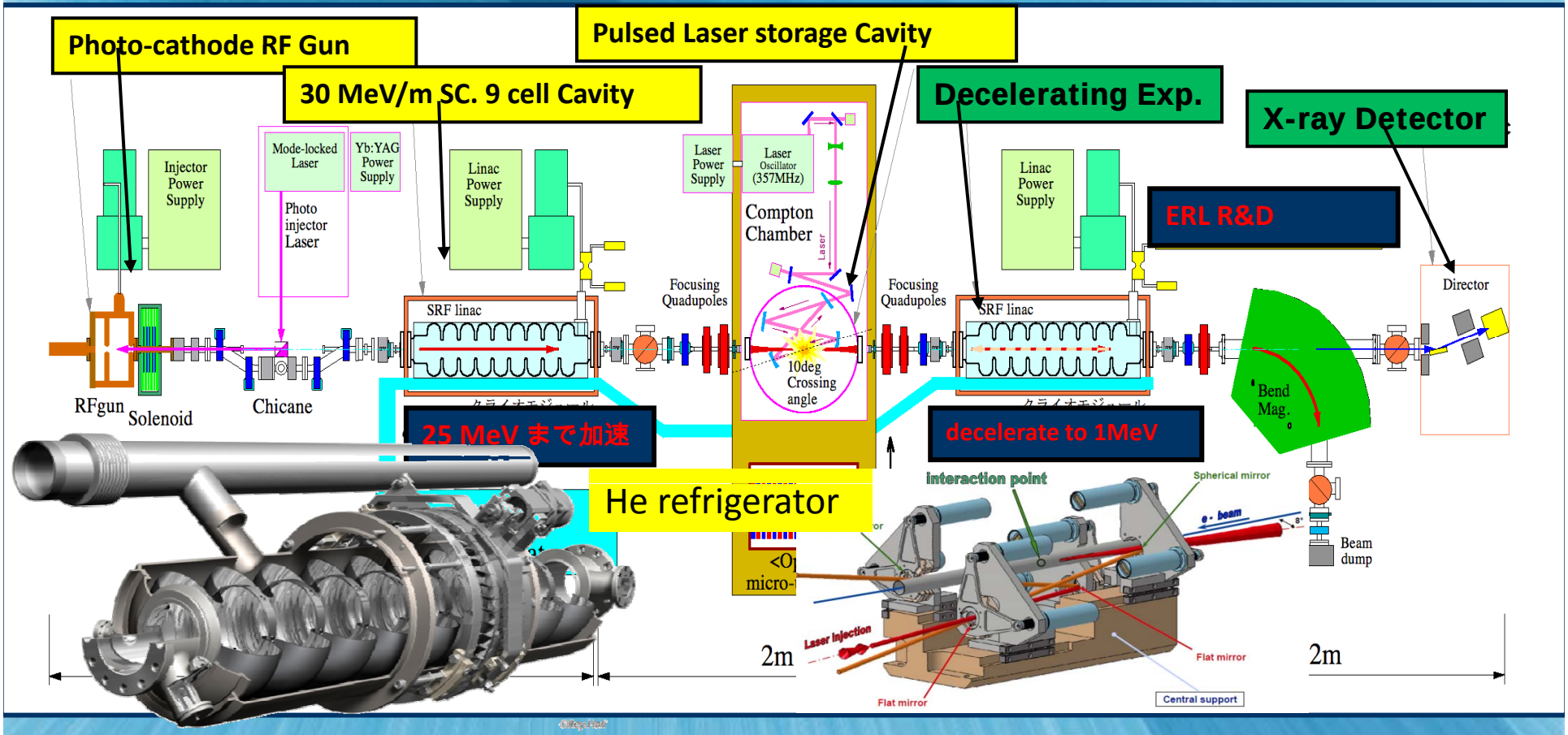
Chemical reaction in solvent, Activity of protein, Impulse destroy, Photon induced phase transition

3) *Precise Nuclear Isotope detection by NRF* (*Solve energy and environmental problems*)

Target of component technology

technology	Present status	Target	Key points
Electron source	**300 nC/pulse** **10,000nC/pulse (2008-2009)**	**48,000 nC/pulse (2010-2012)**	Pulse laser, new photo-cathode, **1 msec** pulse length
SC Cavity	**Pulse: 25 MV/m** **CW: 12 MV/m**	**Pulse: 30 MV/m** **CW: 20 MV/m**	**Non-defect and clean surface, Precise electron beam welding, High precision forming, Non-contamination material**
Pulsed laser storage	**0.5 mJ/pulse, Waist: 30 μm**	**50 mJ/pulse, Waist: 8 μm**	**4-mirror optical cavity**
Colliding control	μm beam orbit control	**Sub-** μm beam orbit control	**minimizing environmental effect, Fast feedback control**

Quantum beam project(2008-2012) approved by MEXT
Compact high brightness X-ray source using SC Cavity



Join and Enjoy 忘年会(End year Party) in this evening.

Thank you for your attention.