

# BNL R&D ERL Lesson learned

✓ Compact SRF ERL construction completed: May 2015

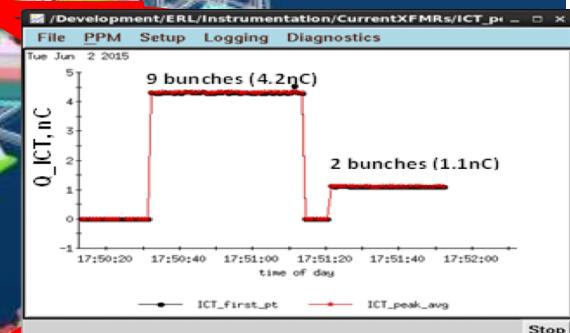
✓ SRF gun with photocathode demonstrated  $Q=0.55\text{nC}$ ,  $I=.26\text{mA}$  per 4 msec;  
June, 2015

✓ Beam instrumentation has been tested during July-Oct 2015 run.

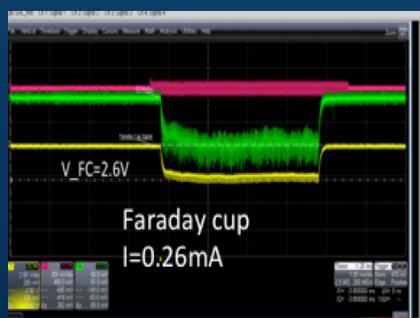
✓ During beam commissioning we found out that some components needs to be modified for better performance.

✓ Many ERL components have been reinstalled in new location to be used for RHIC upgrade project: LEReC

✓ Beam test of LEReC injector starts : Apr 2017.



SRF 5cell linac



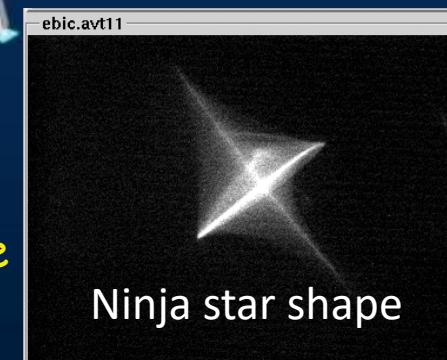
Beam dump



Returning loop

~20m circumference

\*more about LEReC on Wednesday afternoon



Ninja star shape

# Summary MOIDCC006

## ERL Mode of S-DALINAC: Design and Status



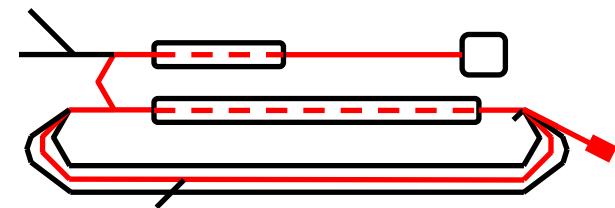
TECHNISCHE  
UNIVERSITÄT  
DARMSTADT



- Modification from twice to thrice recirculating layout including ERL mode finished
- Main design points: New separation dipole, beam dynamics
- Installation including lasertracker based alignment, tests of path length systems

### Under Commissioning

- Transmission of  $\sim 35\%$  in once recirculating operation reached
- Next step: Once recirculating ERL



## Summary and Outlook at present ERL17

- The Compact ERL was commissioned and is in stable operation.
- Learned many lessons from the commissioning.
- The photocathode DC gun and both (injector and ML) SC cavities are operating very stably.
- Achieved beam current of 1 mA
- Achieved low beam emittance ( $\sim 1$  mm·mrad) at medium bunch charges ( $< 7.7$  pC/bunch).
- X-ray production from Laser Compton Scattering was successfully demonstrated.

### Subjects in the near future

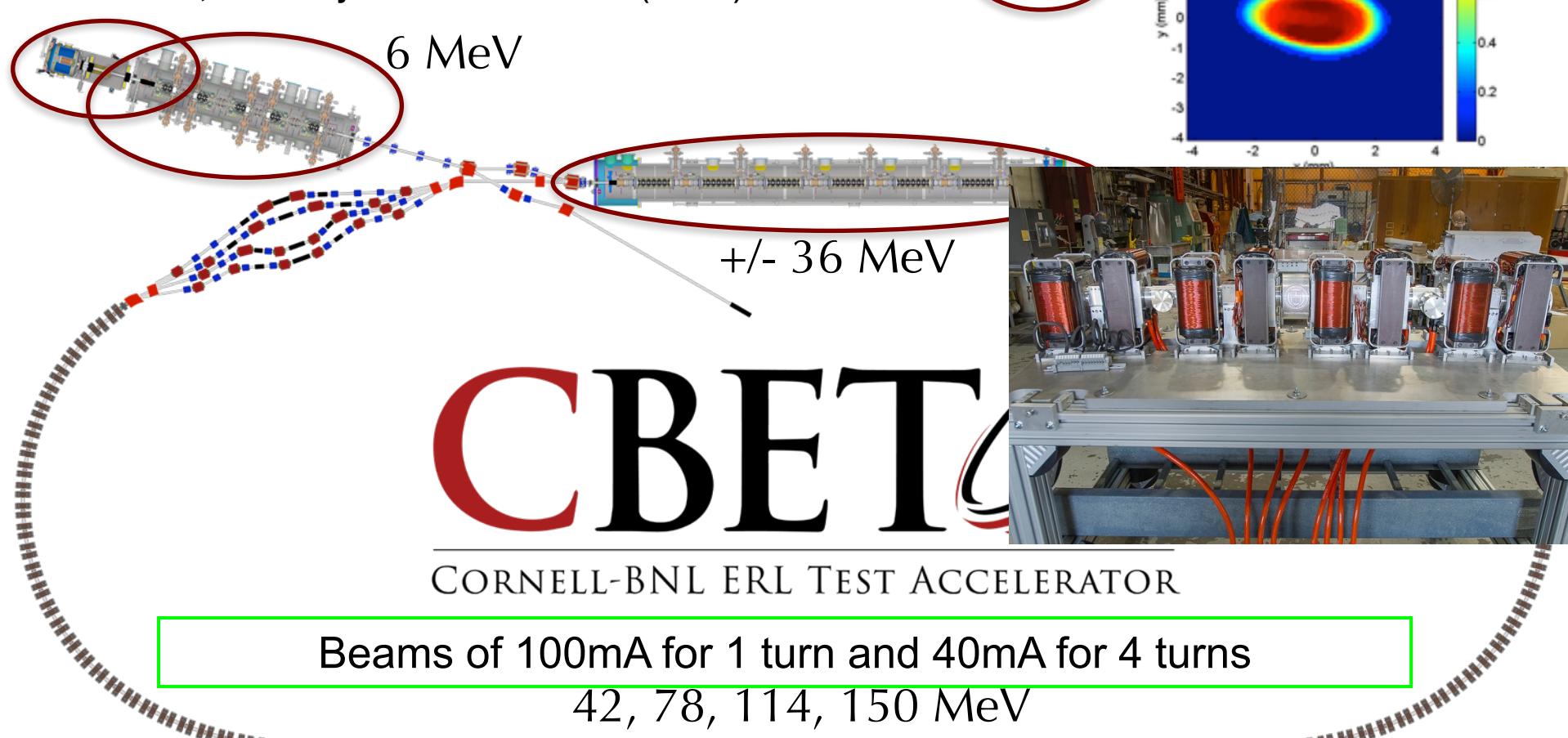
- Lower emittance at high bunch-charges ( $q_b \geq 7.7$  pC) Achieved
- Beam current: 1 mA ( $\rightarrow 10$  mA) Achieve 1mA operation and also demonstrate the possibility of 10mA operation
- Bunch compression ( $\sigma_t \sim 100$  fs) and THz production ( $\sigma_t \sim 250$  fs)

We have established many important technologies for the ERL light source.  
We continue to conduct R&D effort on remaining issues such as:

- Improved cavity-assembly technique for higher accelerating gradient
- Mass-production technique for main-linac cavities



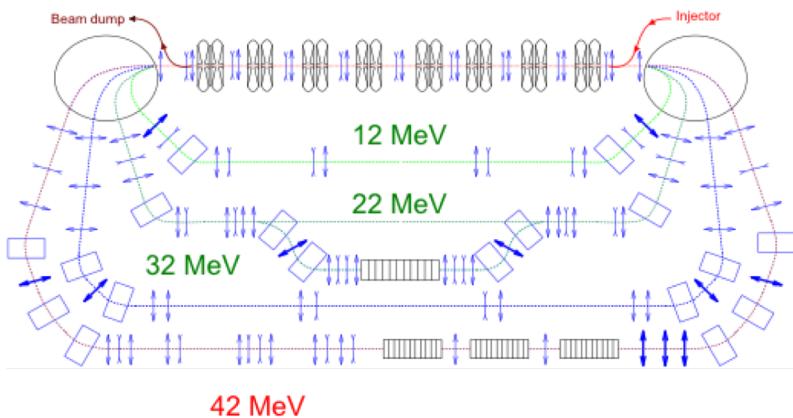
- Cornell DC gun
- 100mA, 6MeV SRF injector (ICM)
- 600kW beam dump
- 100mA, 6-cavity SRF CW Linac (MLC)



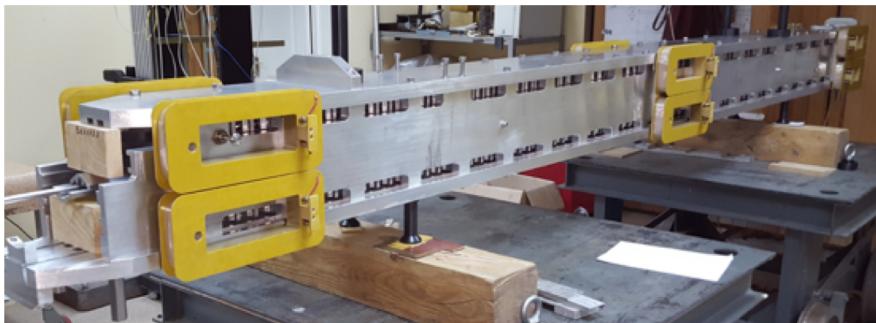
# Novosibirsk ERL facility

## G.N. Kulipanov and NovoFEL team, BINP

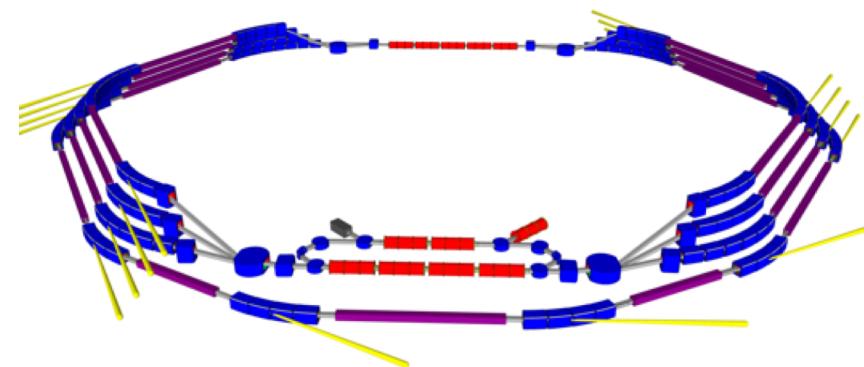
NovoFEL



High current NCRF gun



Variable period undulator



MARS – multi-turn acceleration  
recuperator – an ERL-based x-ray source