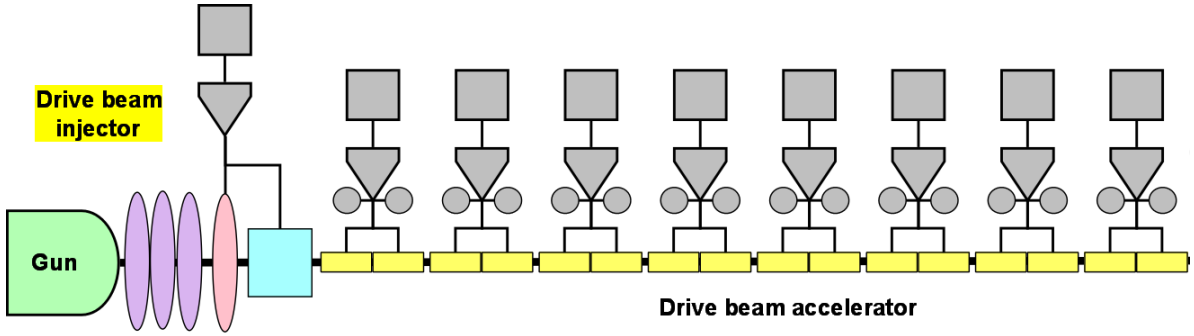
Startup 2011 chronology

- Mon 31/01: patrol of Linac and DL/CR
- Fri 04/02: permit for operation
- Mon 07/02: gun conditioned to nominal HV
- Fri 11/02: klystrons up to MKS07 fully conditioned
- … RF setup for new operation mode
- Fri 18/02: gun pulser faulty, replaced 22/02
- Tue 22/02: first beam to spectrometer girder 4
- Fri 04/03: first beam to spectrometer 10
  TWT broke (=> no more 1.5 GHz beam)
- Tue 15/03: linac rematched, first beam down to girder 15
- Wed 23/03: first beam to end of TL1

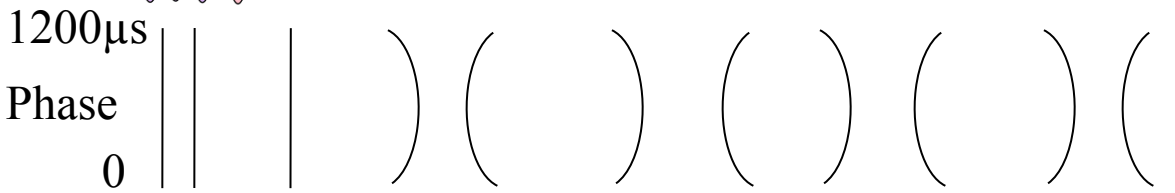
Startup

- Controls upgrades:
  - timing cards
    - wrong trigger – required still adjustment of ~250 timing delays after correction
  - power converters
    - very slow response of control system (2 min) – fixed now
- MKS13 (rebuilt after fire)
  - included in safety chain on March 4 (permission for RF)
  - reached nominal power with pulse compression on March 8
  - still many breakdowns and high vacuum rise afterwards
    getting better now
- another TWT broken, only one left => no 1.5 GHz beam
  - return from repair uncertain (repair starts April …)

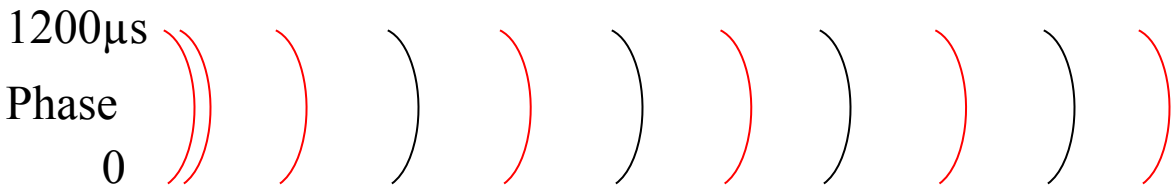
new RF phase setup



- 2010



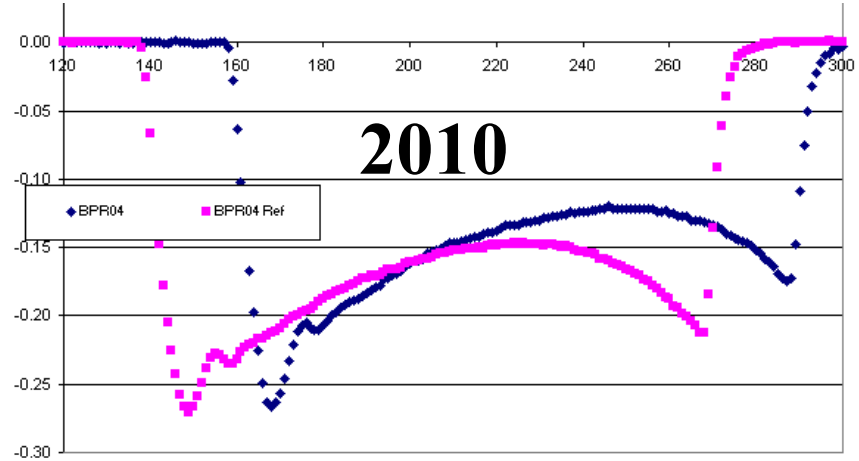
2011

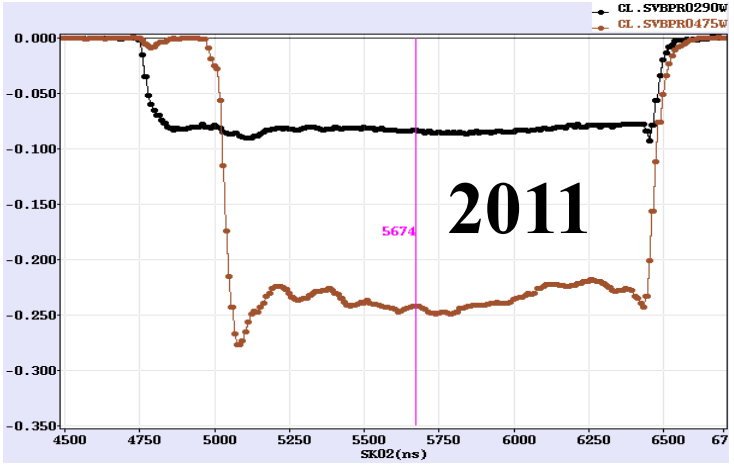


- same sag for SHBs and pre-/buncher + accelerating structures
- => ΔE/E = 0 along the pulse, no bunch length / energy spread variation
- => tuning all along the pulse identical
- still: bunch phase variation – could be compensated in Frascati or TL2 chicane (slight energy shaping along the pulse)
- much less sensitive to phase errors [cos(~few deg)]

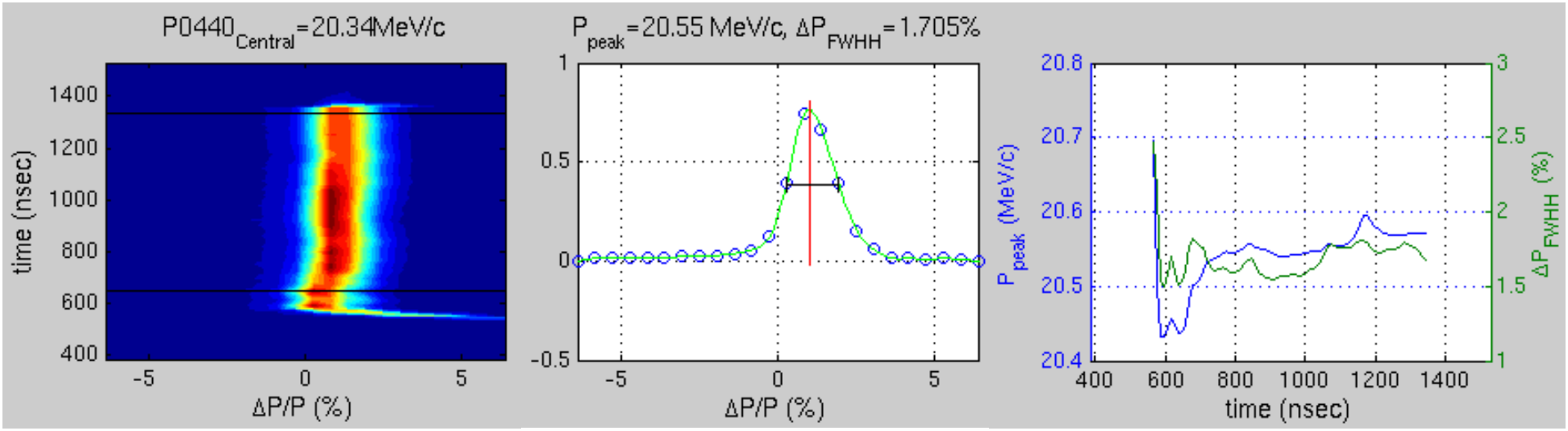
Beam status

- ~constant BPR signal along the pulse => constant bunch length



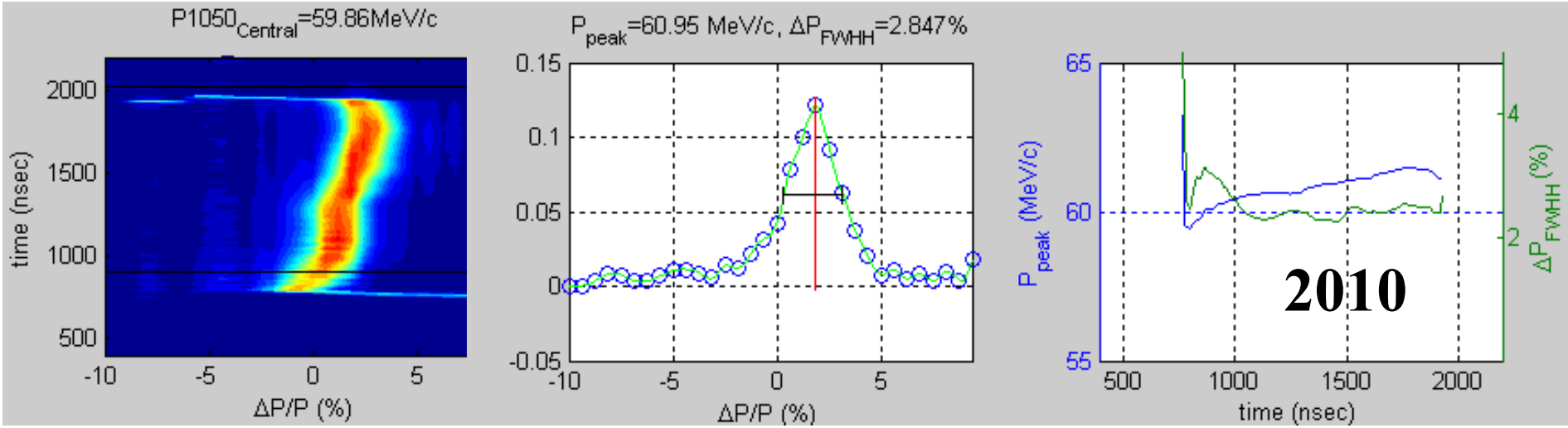


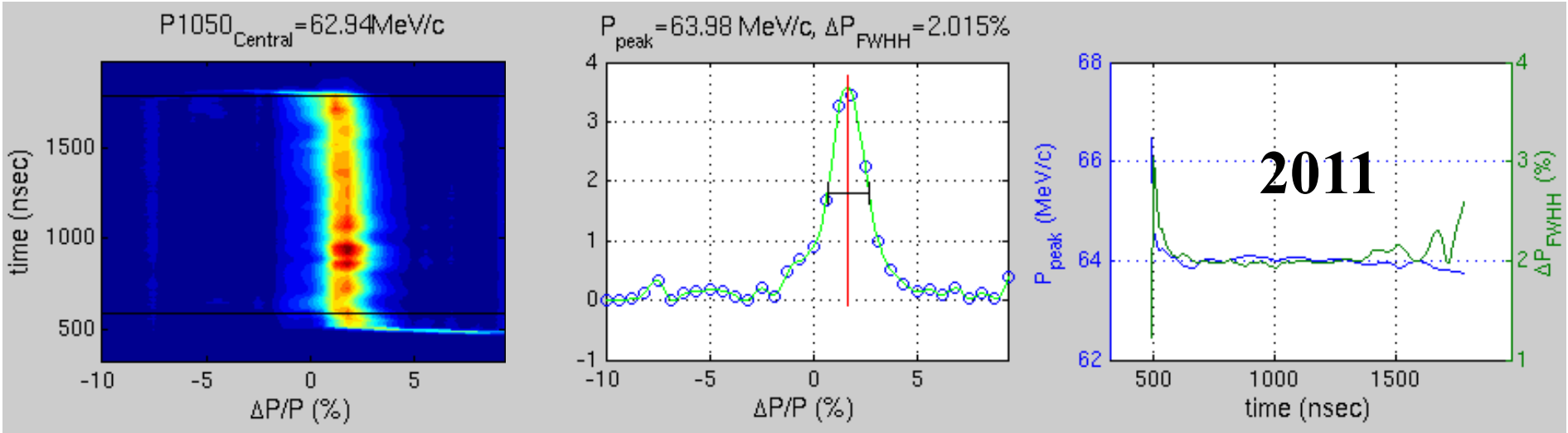
- => constant energy + energy spread



Beam status (cont.)

- constant beam energy without special RF shaping

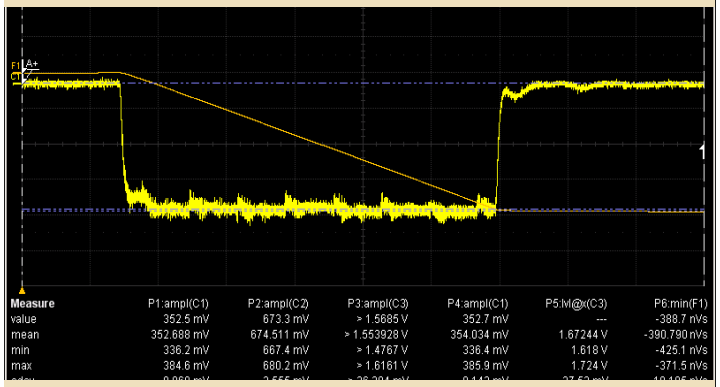




Phase-coding in PHIN

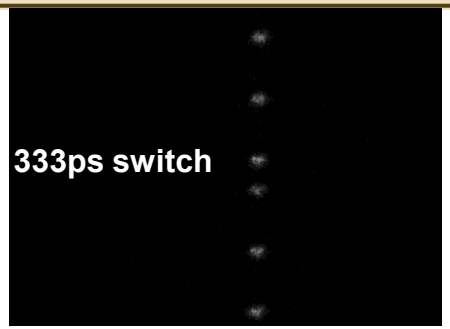
Marta Csatari

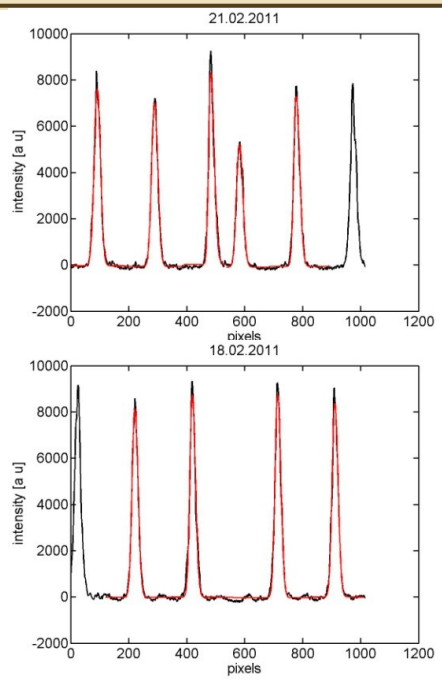
Measurement with Fast Current Transformer



1100 ns long phase-coded train in PHIN with nominal 2.36nC charge

Phase-switch measured with Cherenkov-light on Streak camera





New Cherenkov-line commissioned during run

CLEAN switching in one period with no satellites!!

Preliminary beam dynamics measurements show no significant difference between odd and even trains for:

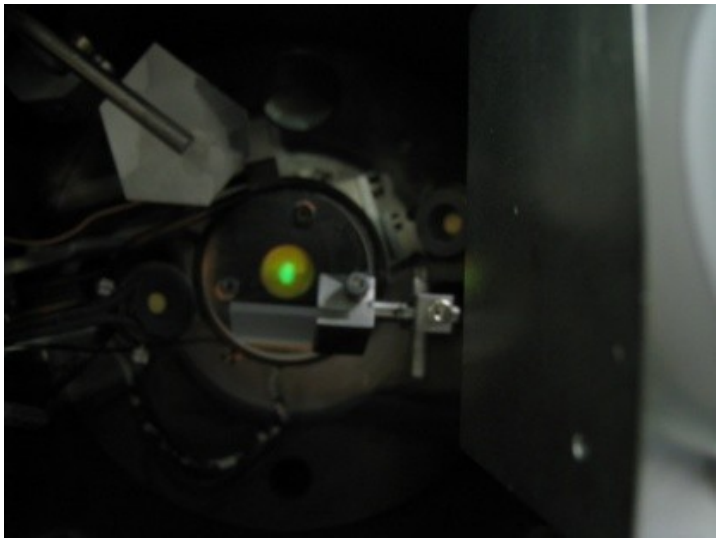
- Emittance
- Beamsize
- Energy
- Charge stability

High charge & cathode tests

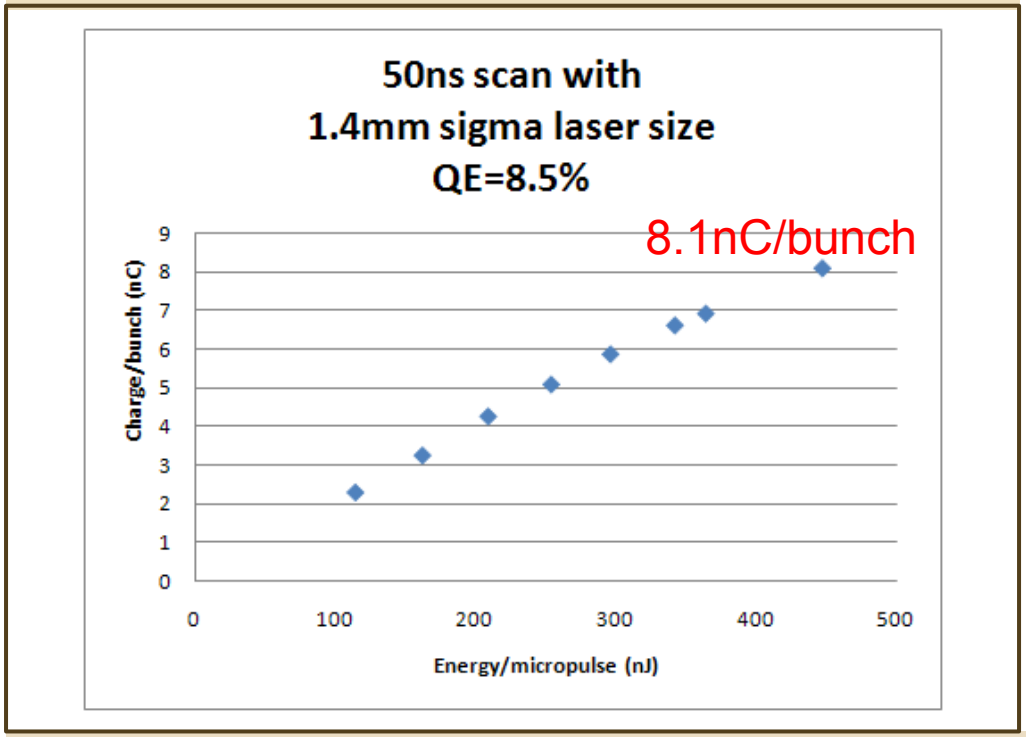
Marta Csatari

=> see CLIC meeting tomorrow

- New green responsive cathode tested in UV Cs_3Sb
- Cathode lifetime measurements



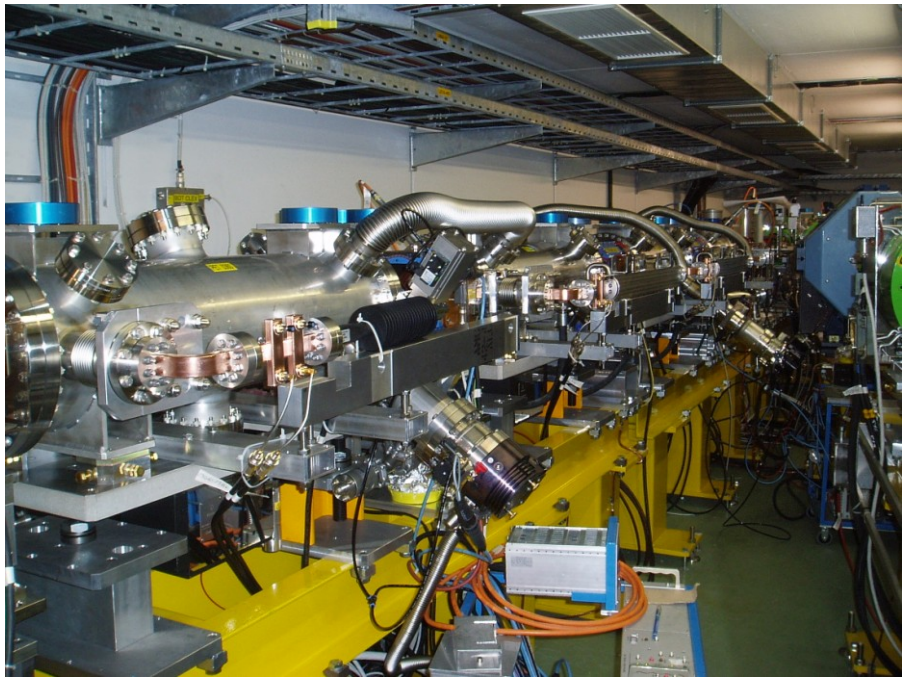
Maximum charge extracted with 75 bunches



HIGHEST charge extracted from PHIN to date

CLEX status

- TD24 accelerating structure + 3 new TBL PETS installed
  => see Steffen's presentation about TBL
- Laser for CALIFES aligned
- power converter tests started today
- => CALIFES beam next week



DB generation – mid 2011

- Bunch train recombination
  - Consolidate results, routine operation, stability of fully combined beam
- Transverse rms emittance
  - Complete TL2, TL2', TBTS commissioning – full transport to CLEX
  - < 100 π mm mrad after ring, combined beam
  - < 150 π mm mrad in CLEX, combined beam
- Bunch length control to < 1 mm rms (combined beam)
  - Measurement campaign with different meas. systems (RF defl.& screen, fast streak-camera, RF monitors)
  - R_{56} tuning experiments in Frascati chicane and TL2
- Beam current stability: improve slow variations, obtain ~0.2 % for combined beam
  - Full measurement campaign (find correlations, jitter sources)
  - Gun pulse flatness, "slow" feedback
  - Improve overall klystron stability (at least up to best performing klystrons)
  - Slow RF feedback (temp. in pulse compressors)

RF structures – mid 2011

- Consolidate RF measurements
- Variable power splitter between PETS and ACS taken out
- PETS TBTS
  - Goal: nominal power / pulse length inside PETS with recirculation (135 MW, 250 ns total pulse length, 170 ns flat-top)
  - Breakdown rate measurements (at high BD rate - extrapolation to lower rates)
  - Operation w/out recirculation – may have different breakdown rate…
  - Test of new PETS on-off scheme (from summer)
- Acc. structure in TBTS
  - TD24, initial reconditioning in the shadow of PETS operation
  - Goal: nominal power / pulse length delivered to structure (65 MW, 250 ns total pulse length, 170 ns flat-top)

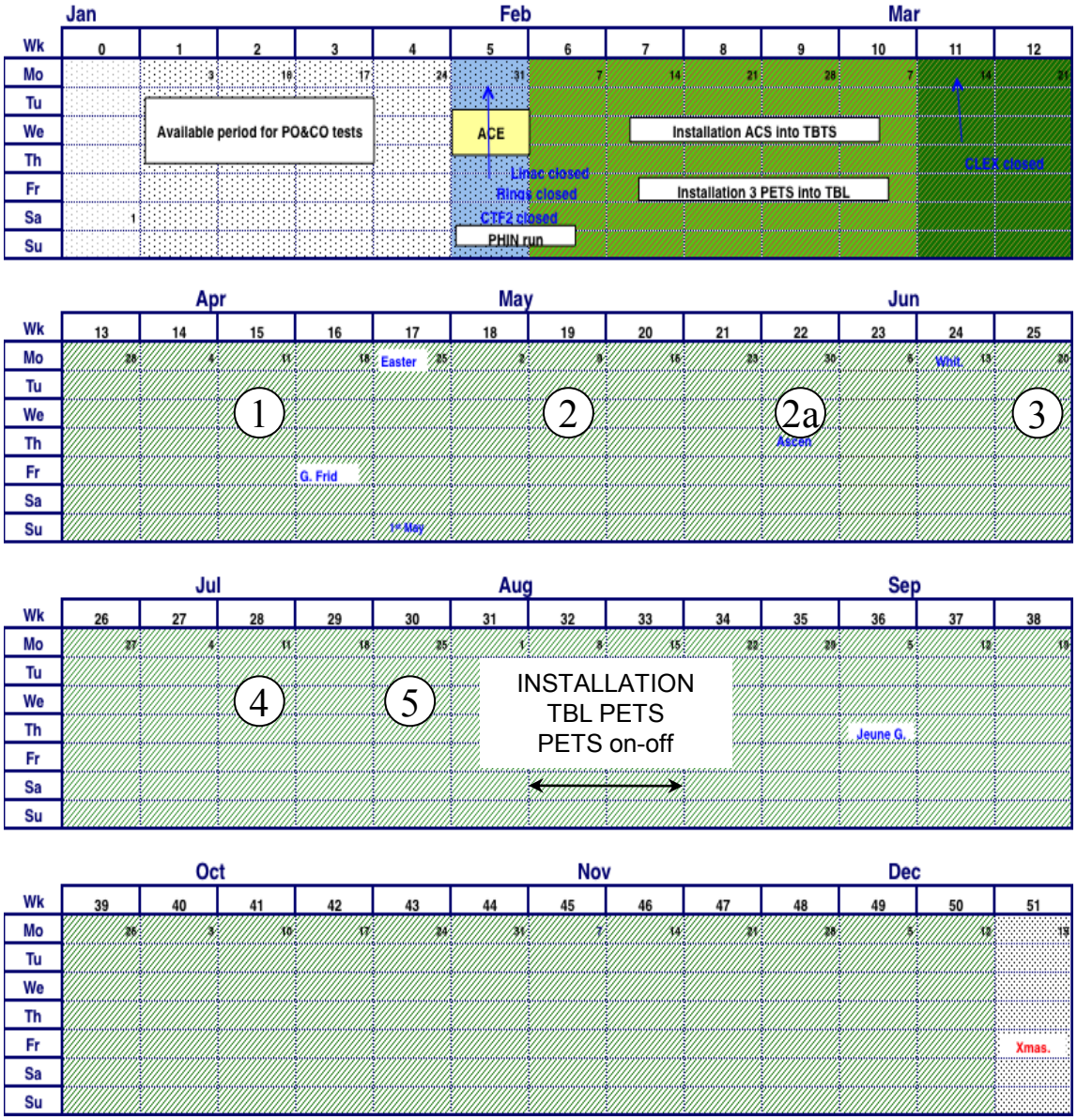
Two beam issues – mid 2011

- TBTS
  - Two-Beam test – 100 MV/m, with correctly tuned structure
  - consistency between power & beam energy gain
  - Drive beam, deceleration, power produced
  - Probe beam, power delivered to accelerating structure, energy gain
  - Beam Loading compensation experiment - by varying fast phase switches – check control of RF pulse shape with probe beam acceleration
  - Measurement of breakdown kicks
  - Measurement of effect of beam loading on breakdown rate (???)
- TBL
  - Measurement of deceleration / produced power
  - Measurement of energy spectrum
  - Optics, steering algorithm studies

Other issues – mid 2011

- CALIFES
  - Fully reach nominal parameters (total charge ?)
  - Bunch length measurements (RF defl. & screen)
- Other
  - First measurements of phase stability (PETS output, RF pickups…)
  - Operation at 5 Hz
  - Control of beam losses
  - Coherent Diffraction Radiation (RHUL collaboration)
  - …

Planning 2011



1. 3 GHz beam setup to CR
   initial beam to CLEX
   CALIFES setup
2. CR x4 combination
   emittance studies
   combined beam to CLEX
2a. 1.5 GHz beam setup
   x8 combination
   (if TWT is available)
3. 100 MV/m acceleration
   breakdown kicks
   TBL deceleration
   (1-2 days for DB beam studies)
4. ε < 150 mm mrad
   longitudinal studies
   stability x8 combination
   (night running for BDR)
5. breakdown rate measurements
   PETS / ACS
> Test of new PETS on-off scheme
   TBL deceleration up to 8 PETS

Beam phase
rep. rate / losses

CSR
night supervision

Conclusion

- Startup relatively long due to
  - controls renovation
  - careful new RF setup
- excellent 3 GHz beam setup
  - beam to TL1
  - can hopefully profit from the good beam quality for easier setup
- 1.5 GHz setup will depend on return of TWT
- very successful PHIN run
- CALIFES can start operating next week

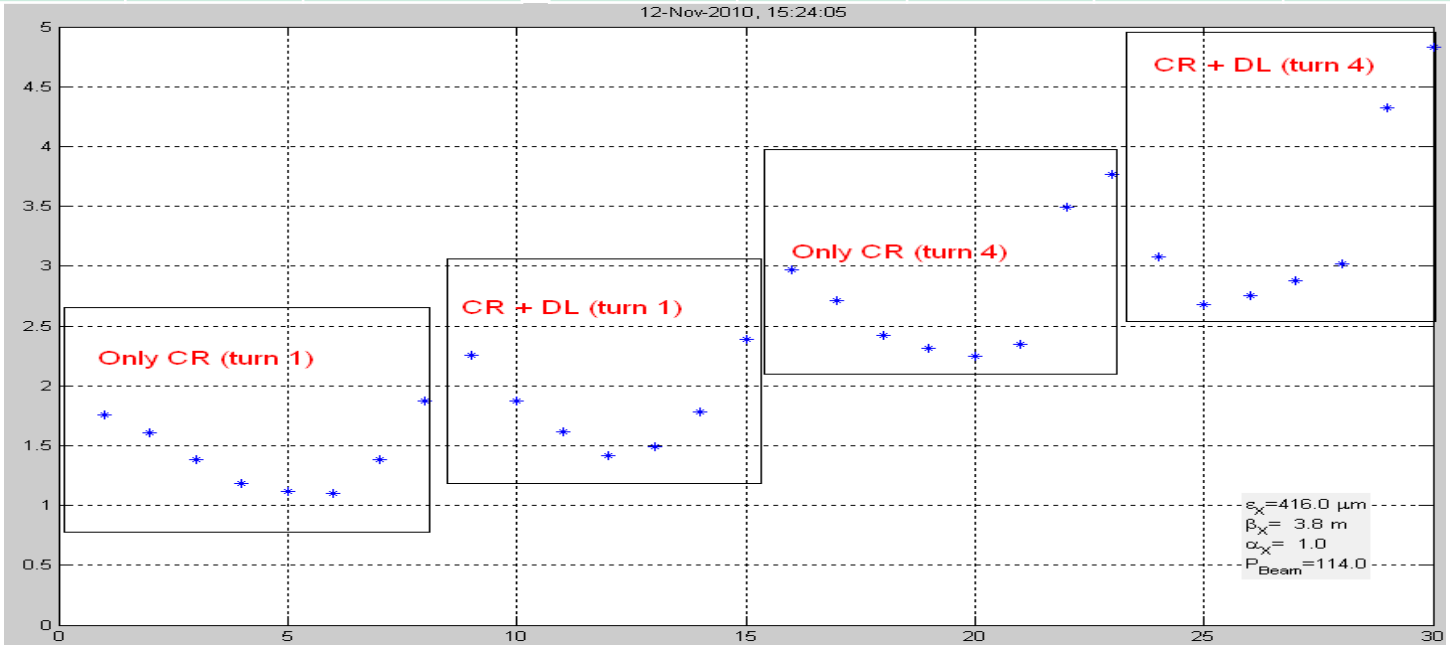
Spare slides

Emittance

- measured in H and V for various stages of combination
- emittance increase more from CR than from DL

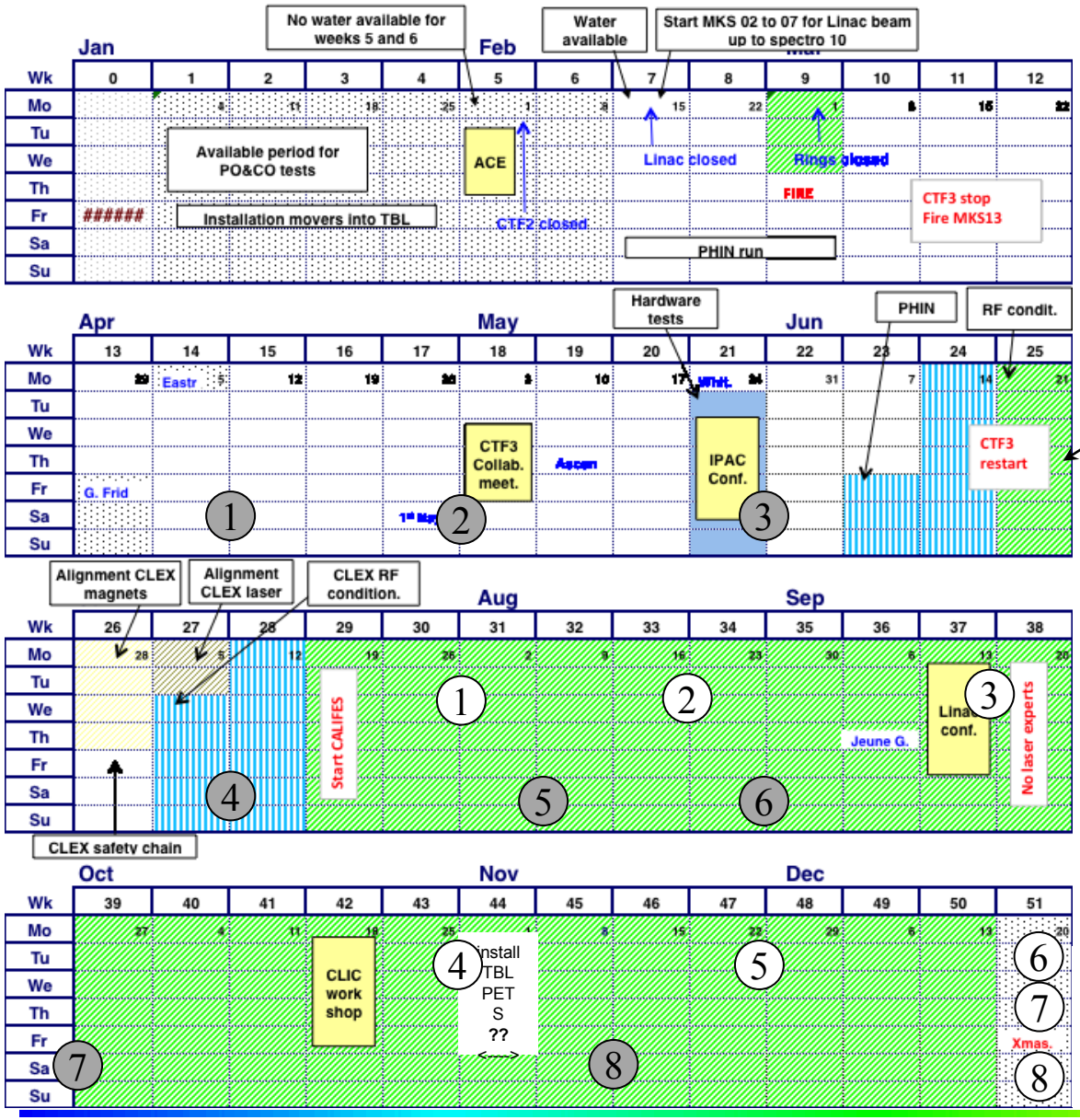
horizontal	CR 1st	DL+CR 1st	CR 4th combined	DL+CR 4th combined
emittance [mm mrad]	**148**	**262**	**532**	**682**
beta [m]	4.8	5.0	3.7	3.6
alpha	0.9	0.9	1.0	1.2

vertical	CR 1st	DL+CR 1st	CR 4th combined	DL+CR 4th combined
emittance [mm mrad]	**88**	**129**	**152**	**170**
beta [m]	17.2	11.0	7.3	9.9
alpha	-8.1	-5.1	-3.1	-4.3



Simona Bettoni

Schedule – restart 31/1/2011



1. Optics improvements (DL dispersion)
   Full transport to CLEX
   Bunch length control (first tests)
   TBTS initial PETS tests
   CALIFES setup
   ~~new setup when MKS13 available?~~
2. PETS conditioned to nominal power/pulse length
   TBL PETS tests
3. Accelerating structure conditioned to nominal power/pulse length — Two-Beam test power & energy gain, 100MV/m
4. TBL studies (limited) — PETS breakdown rate measurements???
5. Measurement of breakdown kicks — Beam Loading compensation experiment
6. Measurement of effect of beam loading on breakdown rate
7. Test of new PETS on-off scheme
8. TBL studies 30% deceleration ?

2nd TBL PETS installation

6 weeks PHIN phase-coding Laser preparation

- Stability studies & improvements
- PETS no recirculation
- Phase stability
- Operation at 5 Hz (or more)
- Control of beam losses
- Coherent Diffraction Radiation …