### DAONE operation for the KLOE-2 data taking

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### I Run Summary



## I Run Weekly Performances



## **Run 1 Monthly Performances**



#### **Best Consecutive 30 Days**



### KCKPL101 fault

#### KCKPL101 observations since Jun:

- irregular pulse shape
- anomalous vacuum spike at the place

#### Mini-bellows broken

On Jun 20<sup>th</sup> one of the KCKPL101 strip is short-circuited

On July 7<sup>th</sup> all the KCKPL101 minibellows have been replaced



### II Run Program

DA $\Phi$ NE restarted operation on September 18<sup>th</sup> with two days delay on the schedule

On September 28<sup>th</sup> started the **II KLOE-2 data taking run** 

During II run DA $\Phi$ NE is expected to deliver an integrated luminosity  $L_{\rm f}$ 

#### $L_{\rm f}$ = 1.5 fb<sup>-1</sup>

Il run agreement foresees the possibility to use al last two days a week for machine development compatibly with the data taking with the KLOE-2 collaboration accord

## II Run



#### **Peak Luminosity**



## **II Run Weekly Performances**



Collider uptime is defined as the percent fraction of the day in which the collider has been delivering luminosity, suitable for acquisition

# **II Run Monthly Performances**



### **Best Hourly Integrated Luminosity**







### **Best Daily Integrated Luminosity**



00:00

04:00

08:00

11:59 19/11/2015 15:59

19:59

23:59

- No beam loss
- 105 bunches
- I-<sub>MAX</sub>~1.48 A
- I<sup>+</sup><sub>MAX</sub>~ 1. A
- background parameters below the limits fixed by KLOE-2

 $\int_{del} L \sim 12.7 \ pb^{-1}$  $\int_{acq} L \sim 10.6 \ pb^{-1}$ Uptime 99.87%

#### Main Rings Orbit Stabilization

Horizontal orbits in the e+ ring showed a modulation having amplitude in the range  $\pm 0.15$  mm and a period  $\leq 1$  s

It was compatible with an anomalous behaviour of one of the dipole

Power Supply Inspection outlined a subtle regulation problem

Relying on this experience all the PSs of the MRs dipoles have been checked and a similar problem has been found and fixed in the e<sup>-</sup> ring too



Leading to improve stability and reproducibility during operation

## Vacuum in e<sup>-</sup> Ring

Since mid September an anomalous vacuum level has been detected by VUGES203

While fixing the vacuum leak in a flange there was a vent (P  $\sim 10^{-4}$  T) which affected the collider performances for several weeks



The collider setup has been revised in order to give L to KLOE-2 while recovering optimal vacuum condition





#### **Further Developments**

#### **Beam Physics**

A considerably higher luminosity might be attained by:

- refining transverse betatron coupling correction
- improving CW-Sextupoles alignment on beam orbit and optimizing their strengths
- pushing the microwave instability threshold toward higher single bunch current value by means of new optics configuration having higher  $\alpha_c$  and higher chromaticity
- vacuum conditioning and beam scrubbing to diminish the e-cloud impact on e+ beam dynamics
- further feedback noise reduction
- tuning the interplay between RF 0-mode feedback and longitudinal feedback.

#### Systems development and consolidation

Operation efficiency requires at least to

- complete the Control System upgrade
- improve diagnostics
- replace the Compressor of the Cryo plant (next summer holiday)
- plan regular and extensive maintenance intervention

### **Maintenance and Consolidation Program**

In addition to the ordinary maintenance program several interventions have been planned on the DAFNE hardware

- analyzing the occurrence of the different kind of faults and their impact on machine and uptime
- trying to optimize operation



## **Cryogenic Plant Consolidation**



The COMPRESSOR of the cryogenic plant is going to be replaced

- new generation device
- high efficiency electrical motor allowing energy saving of the order of 15÷20%
- connecting the waste heat recovery system to the existing district heating plant the cryogenic plant will warm up LNF buildings

### **Next Planned Shutdown**



In 2016 DA  $\Phi$ NE is expected to run for 290 days

### Conclusions

 $DA \Phi NE$  performances:

- operation is more stable and reproducible
- peak and integrated luminosity are growing
- background is compatible with an efficient data-taking

There are many ideas to further improve the present achievements

The I KLOE-2 run has been completed delivering  $\int L \sim 1 \ fb^{-1}$  according the schedule

DAFNE is now expected to deliver 1.5 fb-1 by the end of July 2016  $\int L \sim 1.5 \ fb^{-1}$ 

Uptime and reliability of the DA $\Phi$ NE subsystems are improving several interventions have been planned to maintain and hopefully ameliorate the present uptime compatibly with the available resources

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They did, and are doing an excellent work!

### Thank you for your attention

### Spare Slides

# DA $\Phi$ NE and KLOE-2

Colliding beams have: low E high currents long damping time

*E<sub>CM</sub>* = 1020 *MeV* 

Crab-Waist collision scheme implemented for the first time with a large detector including a strong solenoidal field

Luminosity achieved at DA $\Phi$ NE is 2 order of magnitude higher than the best measured in colliders working at the same E



fault

on operation can be deduced from UPTIME plots

#### KLOE-2 Data Taking (2014 ÷ 2015)



### Wiggler Cooling System

#### On November 2014 the slide below has been presented

#### High pressure cooling water circuit

flow rate almost halved in order to prevent: holes in the wiggler coils rubber pipes damaging In order to avoid destructive faults we experienced in the past



#### Since then this fault no longer occurred

### $\mathsf{DA}\Phi\mathsf{NE}$ Luminometer



100 R<sub>2</sub>corr (Hz)  $\chi^2/ndf$ 1.549 20 1.448  $\pm$ 2.037 A0 **4.395** ± 0.2995 A1 80 2 crystal only 60 40 20 <sup>0</sup> 0  $\frac{7.5}{\text{Trg Lum}} \frac{10}{10^{31}} \frac{12.5}{\text{cm}^{-2}} \frac{15}{\text{s}^{-1}}$ 2.5 5

Luminometer based on CCAL-T calorimeter of KLOE-2 (2 side coincidence) near the IP

MC expectation for Bhabha Events in one of the two CCAL-T



Good linearity with small background contribution (<10%). Too slow with 2 crystal only (40-70 Hz @ $10^{32}$  cm<sup>-2</sup>s<sup>-1</sup>)

### **Peak Luminosity**





	DA <b>PNE CW</b> upgrade SIDDHARTA (2009)	<b>DAΦNE</b> KLOE (2005)	<b>DA<b>•NE (CW)</b> KLOE (2012)</b>	<b>DA<b>PNE (CW)</b> KLOE-2 (2014)</b>
L <sub>peak</sub> [cm <sup>-2</sup> s <sup>-1</sup> ]	4.53•10 <sup>32</sup>	1.50•10 <sup>32</sup>	1.52•10 <sup>32</sup>	<b>2.0•10</b> <sup>32</sup>
I <sup>-</sup> [A]	1.52	1.4	0.93	1.03
I <sup>+</sup> [A]	1.0	1.2	0.72	1.03
N <sub>bunches</sub>	105	111	100	103

 $L_{peak}$  exceeds by a **33%** the best luminosity ever achieved, at DA $\Phi$ NE, during operations for an experimental apparatus including high field detector solenoid.

**Background** presently has been **considerably reduced** especially the component due to the e<sup>-</sup> beam



All started with an anomalous  $DP_{T1-C} \approx 3 \text{ b}$  (Jan 2014) KLOE solenoid warmed up and cleaned (Aug 2014) Since Spt 2014:

- some air leakage found and fixed after extensive checks
- seal of the compressor screw replaced
- oil contamination detected before the cold box first turbine imposing washing the Cold Box circuit by acetone
  oil contamination in the gas management system -> washing

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