

# MERIT Pump/Probe Data Analysis

## Outline

- ❑ The pump/probe program
- ❑ Particle detector response correction
- ❑ Pump/probe analysis results

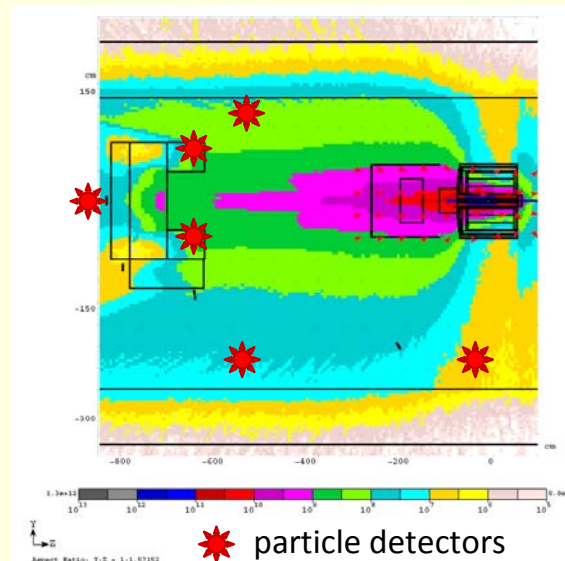
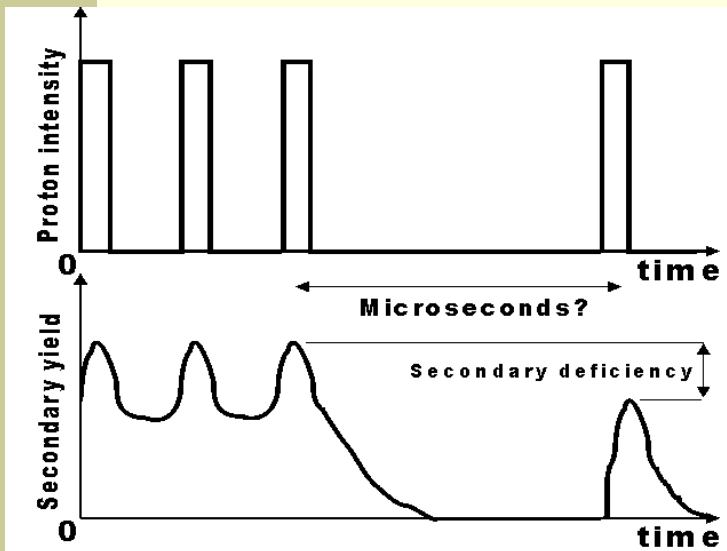


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# The pump/probe program

# The pump/probe program

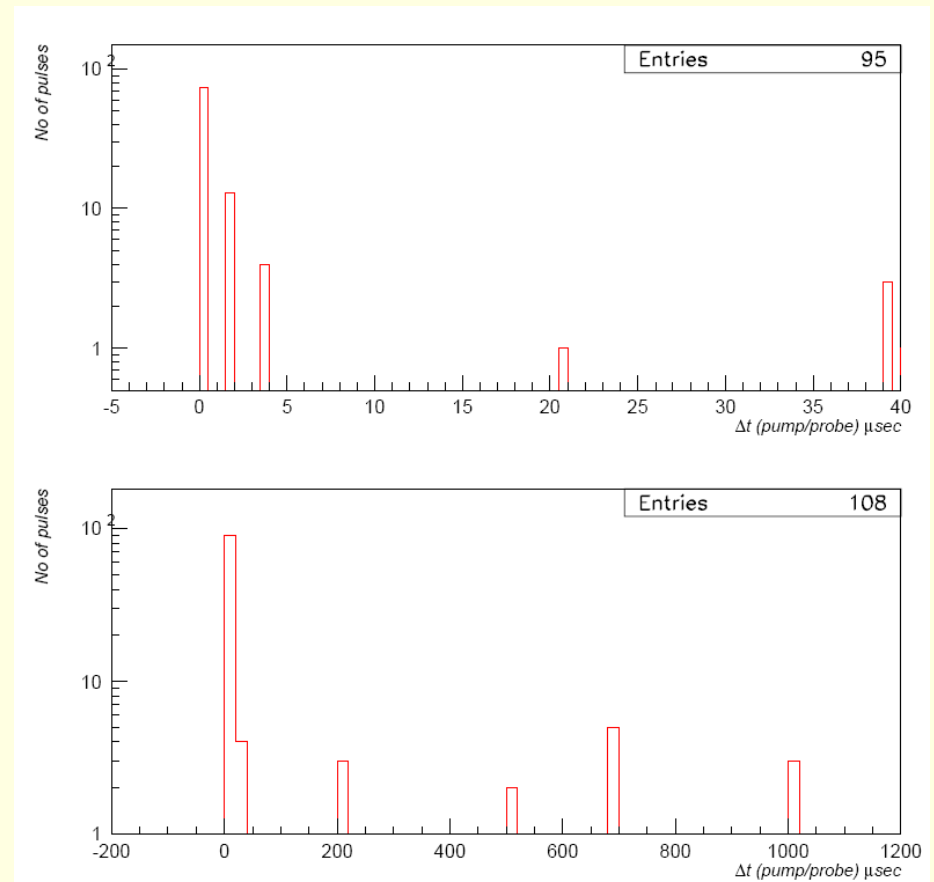
- Use of the CERN PS flexibility to change the time structure of the extracted beam
  - PS normally set for  $h=16$  (i.e. up to 16 bunches in the machine)
  - 1<sup>st</sup> extraction : some bunches → pump
  - 2<sup>nd</sup> extraction : remaining bunches → probe
  - ↳ same or following turns :  $\Delta t$  up to 700us



- Detectors installed around the experimental setup to measure the secondary particle flux
- A pump/probe signal deficiency in the detectors could be interpreted as a sign of target density variation → cavitation
- Expected accuracy: ~5%

# The pump/probe program – run summary

- In total 108 beam pulses in pump/probe configuration
  - Including setting up shots
- Only 6 shots at 24 GeV/c – the rest at 14 GeV/c beam
- Unfortunately not valid BCT information for all pulses
  - Need more work to extract and analyze all signals





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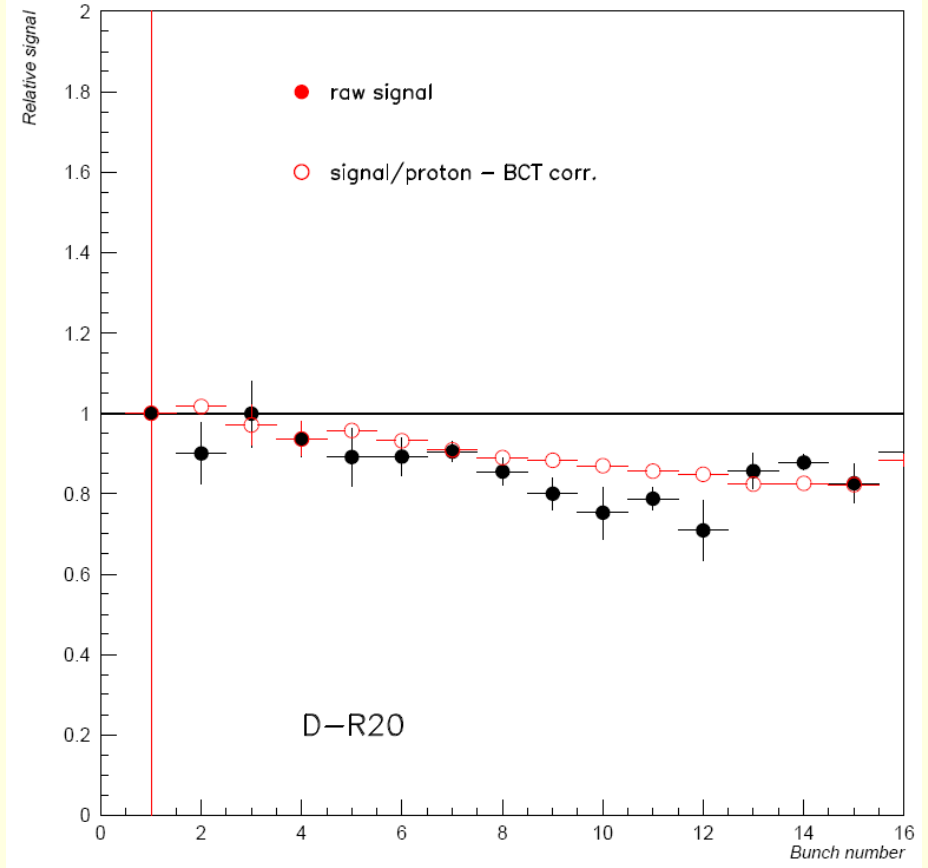
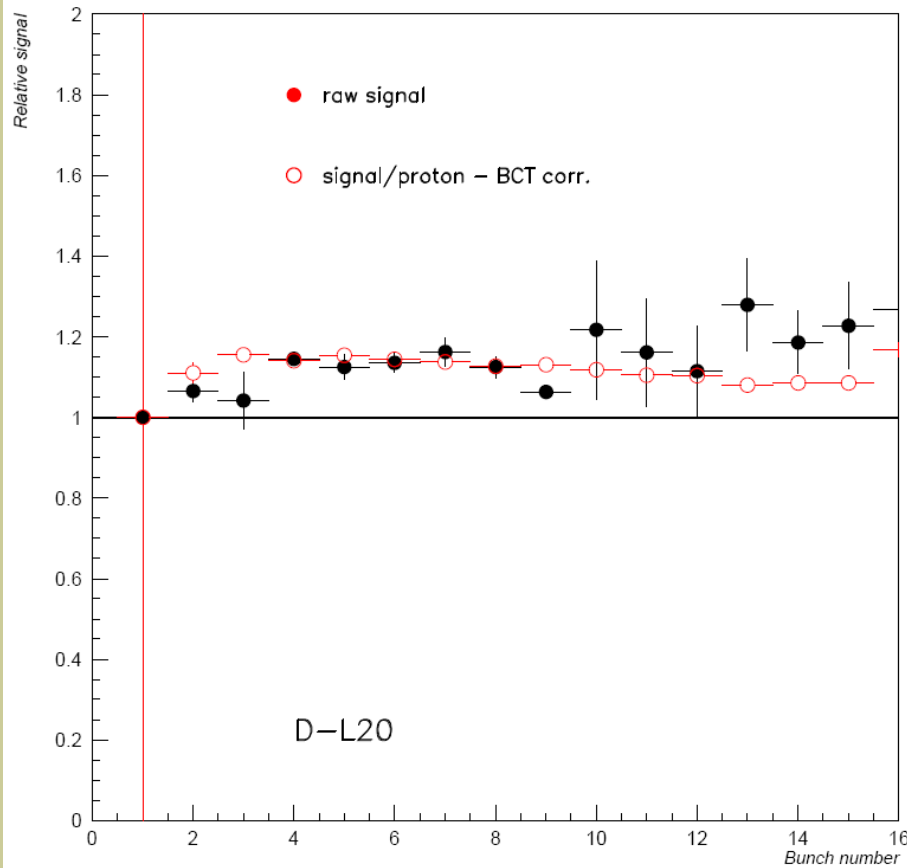
# Particle detector response correction

# Detector response analysis

- Concentrate on the diamond detector signal
  - pCVD diamonds:  $\sim 1\text{cm}^2$  sensitive area; only charged particle detection
  
- **Bunch signal** : integral of response over a fixed time window (131ns)
  
- **Corrections:**
  - ↪ Beam intensity fluctuations : BCT current transformer
  - ↪ Detector response vs flux : apply average correction from ALL runs (i.e. not only pump/probe)

# Diamond response vs bunch number

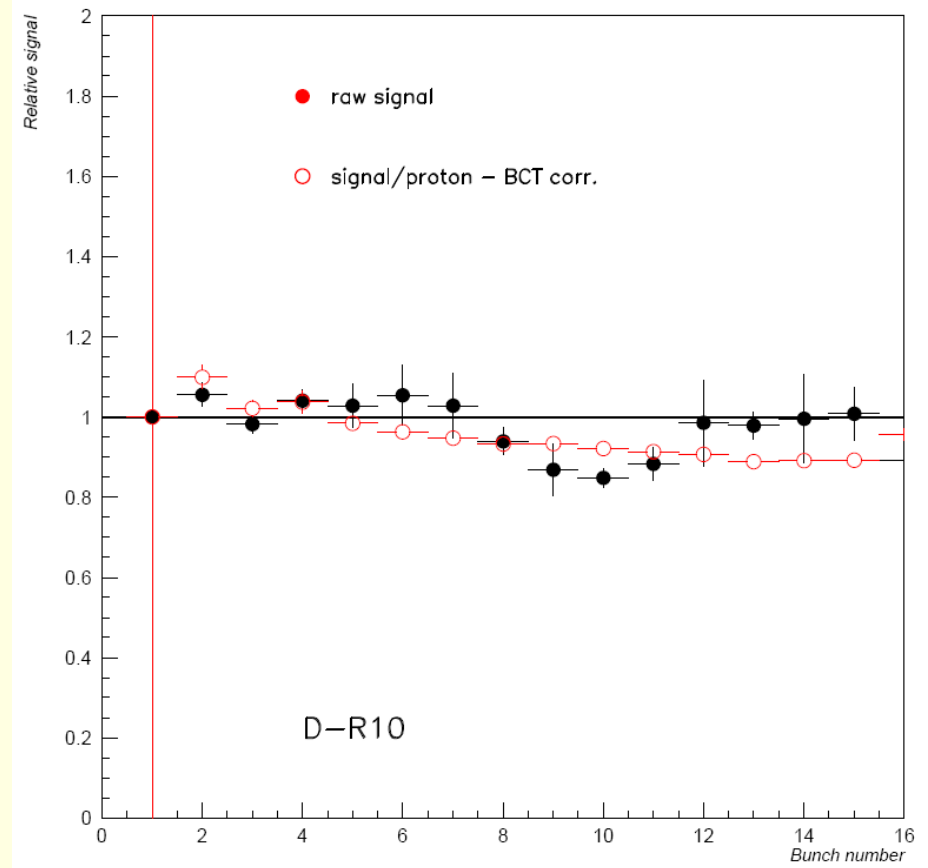
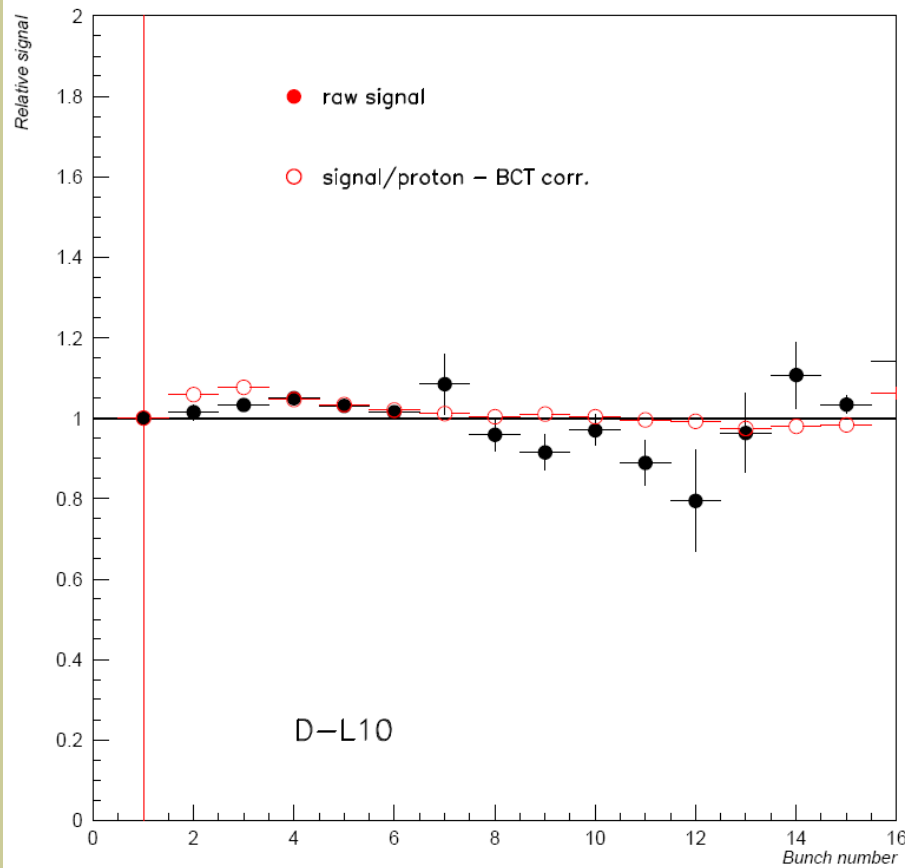
Data from ALL good runs with  $\Delta t(\text{bunch})=131\text{ns}$



- BCT correction improves the uniformity of response – as it should!
- Overall dependence to ~10% level → extract correction factors to remove the effect

# Diamond response vs bunch number

Data from ALL good runs with  $\Delta t(\text{bunch})=131\text{ns}$

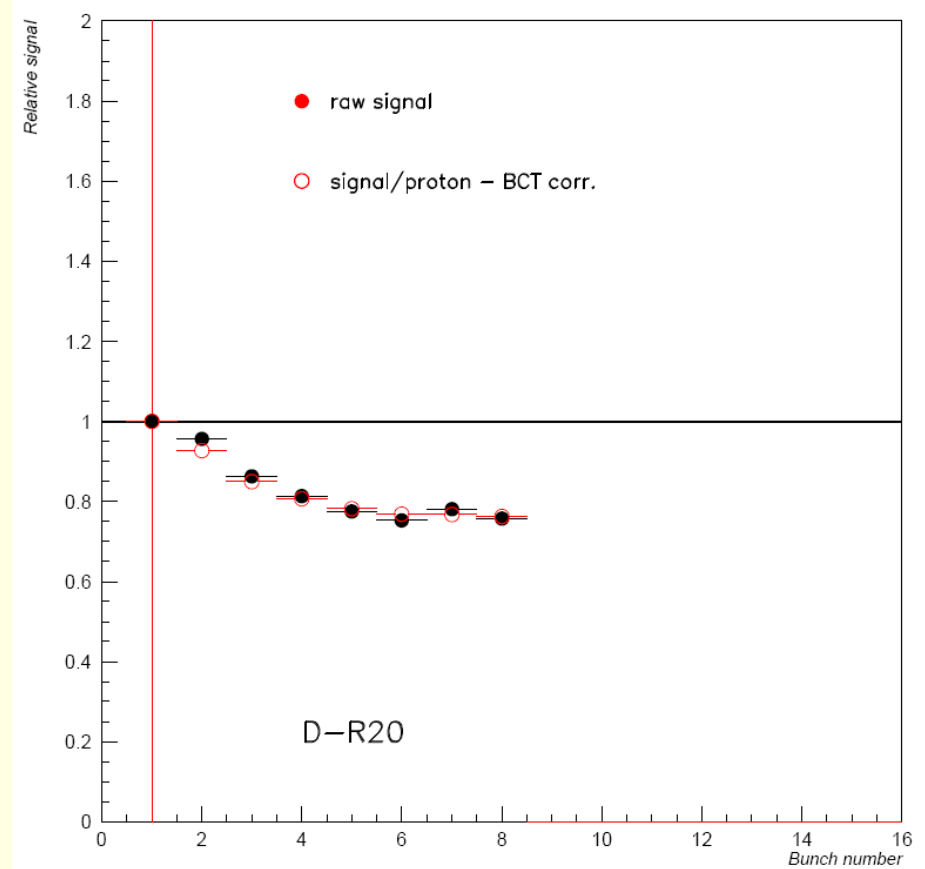
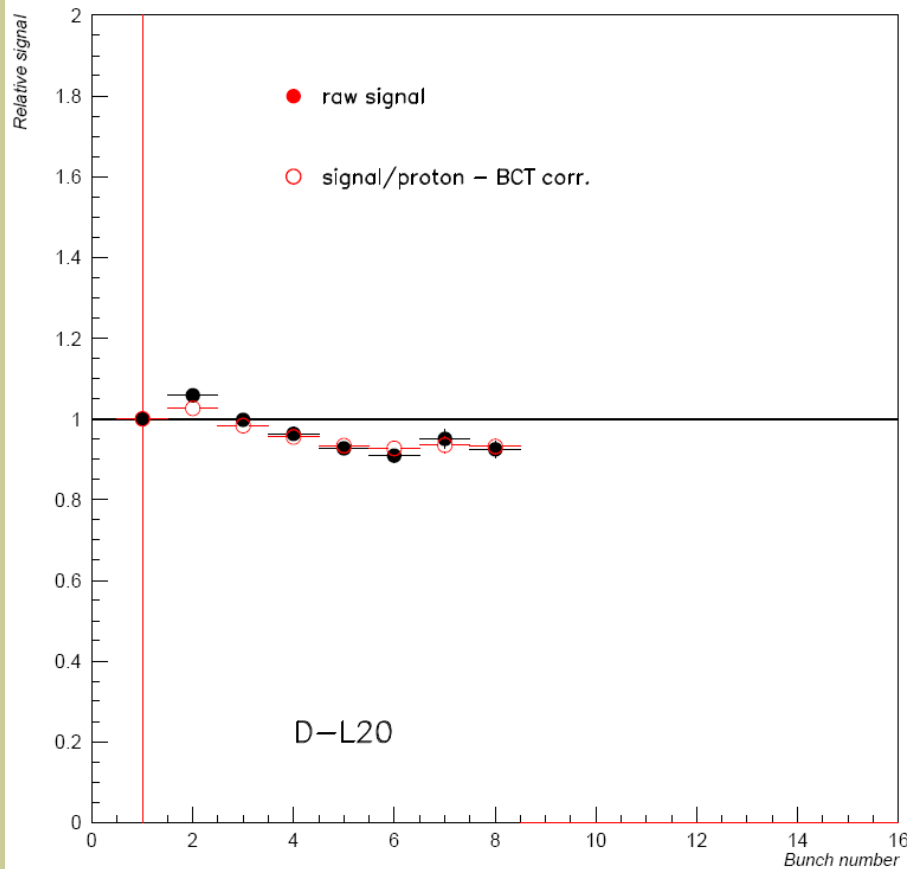


□ Smaller dependence – most likely due to higher signal amplitude



# Diamond response vs bunch number

Data from ALL good runs with  $\Delta t(\text{bunch})=262\text{ns}$



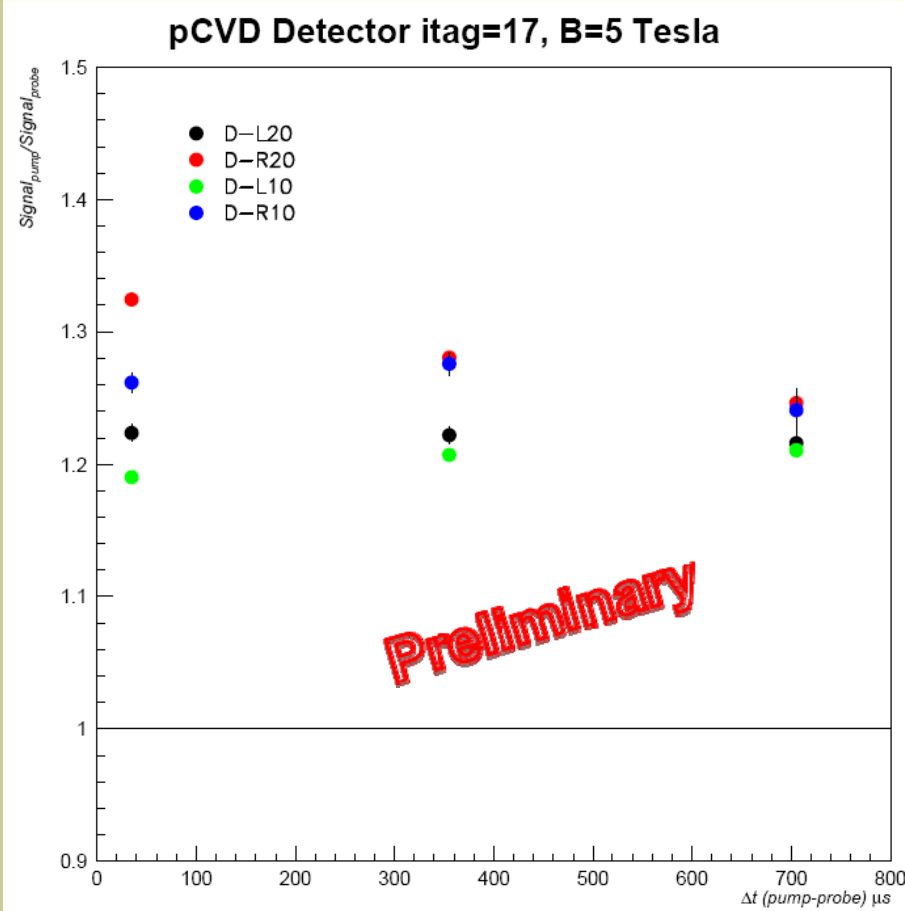
- Different effect with increased inter-bunch spacing
- Signal amplitude is higher  $\rightarrow$  drain capacitance effect gets visible

# Pump – probe analysis results

**Preliminary**

# Pump – probe analysis result

Data from pump-probe runs – various  $\Delta t(\text{bunch})$



- The plotted ratio is:

$$R(\text{det}) = \frac{\sum_{i=1, N_{\text{pump}}} A(dt_{\text{bunch}}, \text{det})_i \cdot \frac{S_i}{BCT_i}}{N_{\text{pump}} \cdot \sum_{i=1, N_{\text{probe}}} B(dt_{\text{bunch}}, \text{det})_i \cdot \frac{S_i}{BCT_i}}$$

■ where A, B are the correction coefficients evaluated as before for each bunch

- No significant variation with  $Dt(\text{pump/probe})$  observed
- If cavitation is formed in the target, then the ratio should increase with the pump-probe time distance (lower denominator)
- Need to better understand why the ratios turn higher than 1.0
  - Systematic in the analysis
  - Wrong response of BCT transformer

## Summary - next steps

- Status of the analysis putting together the BCT and particle detector data is presented.
- Average corrections to the particle detector signals has been developed.
- Preliminary results indicate no large difference in the response in pump/probe signals
- **Next steps:** continue working on the analysis, refine the applied corrections and combine the real data with MC simulation results