Diamond Sensors

BCM1F Frontend Mini-Workshop

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Status of Diamond Sensors
Zeuthen, 8.10.2013

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DESY

Content

- List of Diamonds
- Measurements
- Plans
- Progress of Measurements
  - Optical measurements
  - CCE Measurements
  - IV Measurements
  - TCT Measurements
- Problems

List of Diamonds

- See pdf file on Indico
- 6 new sCVD diamonds
  - Diamonds from Moritz
- 10 new sCVD diamonds
  - Two pad metallisation
  - 5/10 are in Zeuthen
  - 5/10 are in Princeton
- 15 new sCVD diamonds
  - Arrived some weeks ago, from E6
- 8 old sCVD diamonds
  - BCM1F diamonds
- 8 new pCVD diamonds
  - Arrived some weeks ago, from II-IV
- 8 old pCVD diamonds
  - BCM1L

Measurements

- > 6 new sCVD diamonds
  - Measurements are done (IV and CCE)
- > 10 new sCVD diamonds
  - 3/10 metal. diamonds are optical measured, IV and CCE are still missing
  - 2/10 metal. Diamonds need optical, IV and CCE meausrements
- > 15 new sCVD diamonds
  - 5/15 optical measurements are done
- > 8 old sCVD diamonds
  - 0/8 optical measurements are done
  - IV and CCE are done
- > 8 new pCVD diamonds
  - 0/8 optical measurements are done
- > 8 old pCVD diamonds
  - 0/8 optical measurements are done

!

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Most important measurements
→ have to be sent to Princeton
at end of October

Plans

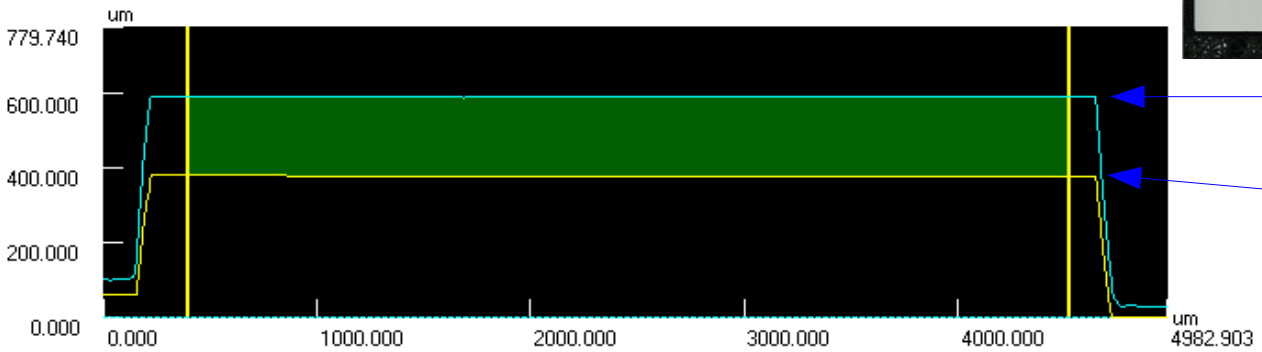
- 1. optical measurements of new diamonds (no metallisation yet)
- 2. optical measurements of BCM1F, BCM1L and two pad metallised diamonds
- 3. IV and CCE of BCM1L diamonds
- 4. IV and CCE of two pad metallised diamonds
- 5. TCT measurements if required
- 6. red light (laser diode) measurements

Progress of Measurements

- optical measurements are ongoing
- CCE measurements are ongoing
  - CCE setups showed up some problems
  - Needed to fix them again
- IV measurements are ongoing
  - Problems of the two setups
  - Still needs some investigation
  - New sCVD diamonds from E6 show high leakage currents (uA)
  - Need to redo the IV measurements
- Konstantin made a TCT setup (transient current technique)
  - First results are available

Optical Measurements

- Information about dimension and thickness (see pdf file)
- Information about graphite inclusion
  - Not reliable → better to check electrical behavior
- What is done so far?
  - 4/15 sCVD diamonds are measured
  - 0/8 pCVD diamonds are measured
  - Missing manpower

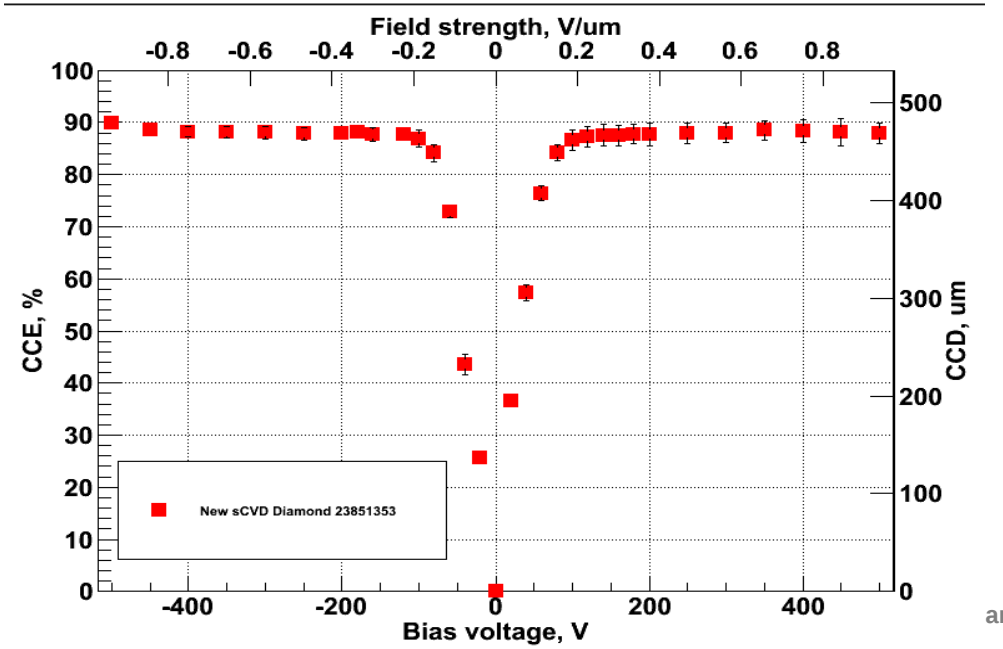


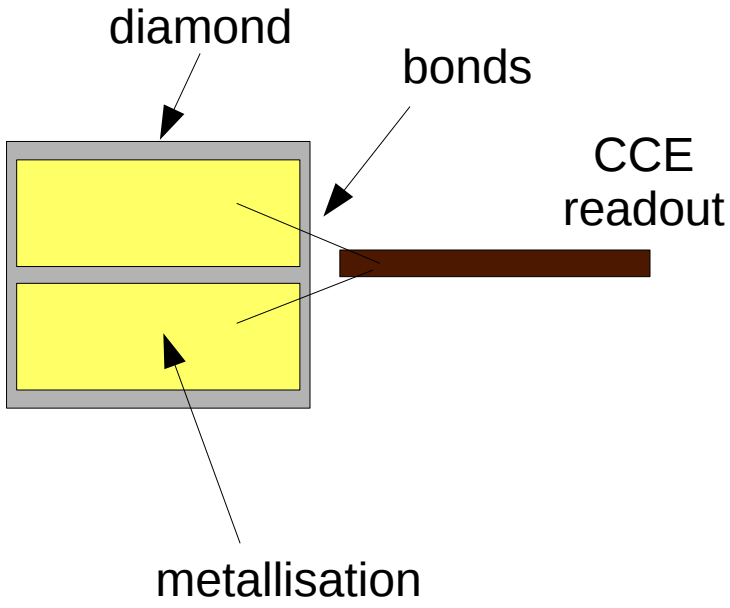
	Layer	Horz. dist.	Corr. coe...	Start film	End film	Max. film	Min. film	Average...	Std. DV	3sigma	Comment
All	1-2	4982.90...	2.420	101.999...	64.283um	550.909...	63.223um	473.023...	118.664...	355.992...	
	2-3	4982.90...	2.420	0.000um	0.000um	917.198...	0.000um	[illegible]	254.305...	762.915...	
	1-3	4982.90...		101.999...	64.283um	1432.33...	63.223[illegible]	1257.33...	[illegible]	1113.56...	
Seg.1	1-2	4124.24...	2.420	506.147...	515.893...	515.893...	506.0[illegible]	511.804...	[illegible]401um	7.204um	
	2-3	4124.24...	2.420	792.657...	916.347...	917.198...	791.99[illegible]	871.035...	[illegible].828um	122.483...	
	1-3	4124.24...		1298.80...	1432.23...	1432.32...	1298.09...	1382.83...	43.042um	129.125...	
Seg.2	1-2										

CCE Measurements

- CCE measurements of two pad metallised diamonds are more complicated than expected
  - Read out of two pads at the same time
  - Working on a setup with two independent readouts

CCE of two pad sCVD

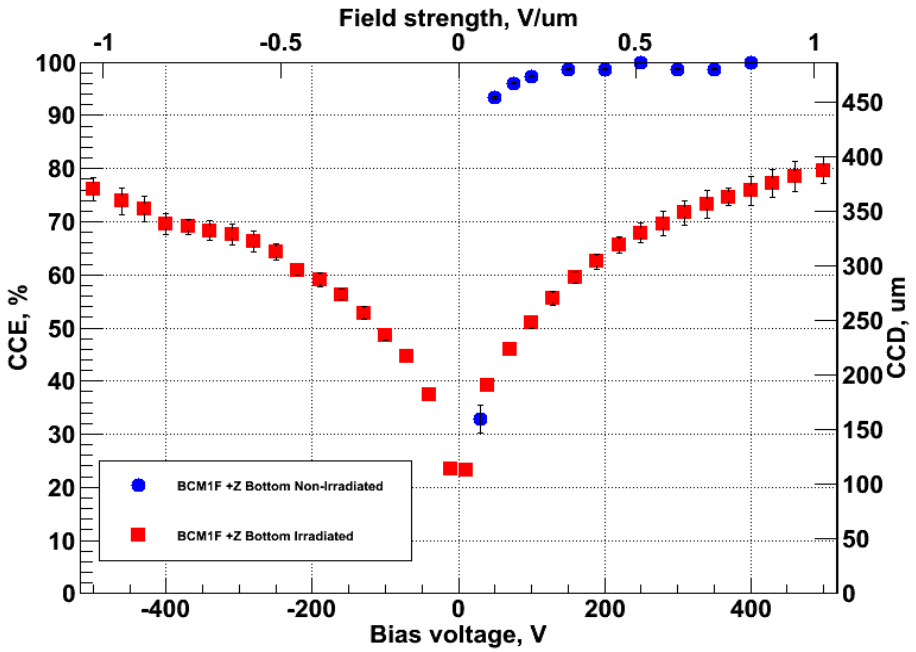




CCE Measurements

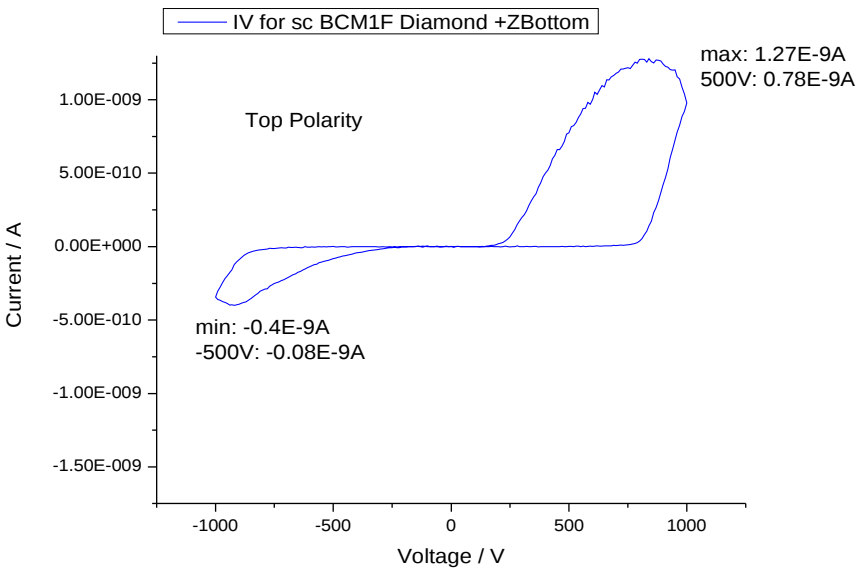
- CCE measurements of 6 BCM1F diamonds are done
- Typical CCE at 500V of ~70% for all diamonds

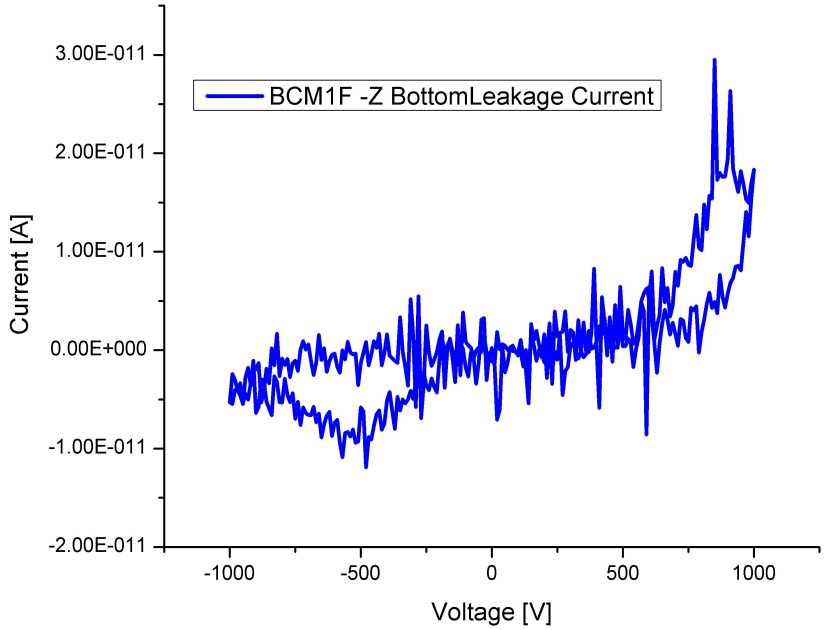
CCE of BCM1F +Z Bottom



IV Measurements

- Leakage current of two pad metallised diamonds is <uA
  - Too high leakage current
  - Need to redo the measurements with better setup
- Leakage current of BCM1F is < 10E-9 A

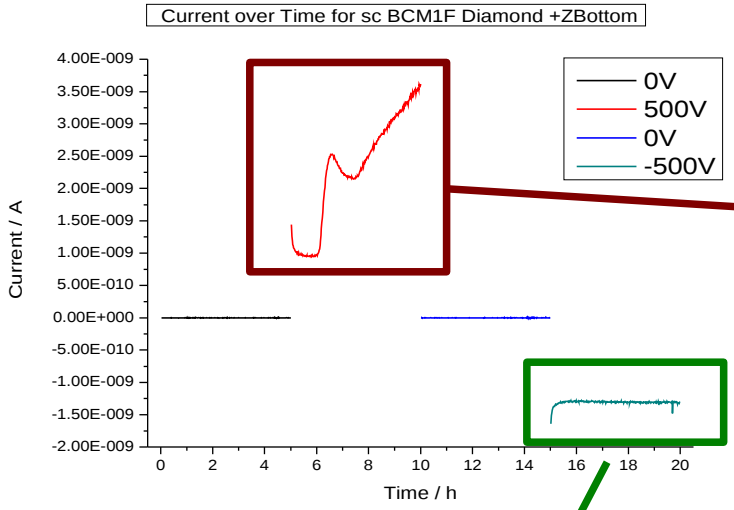




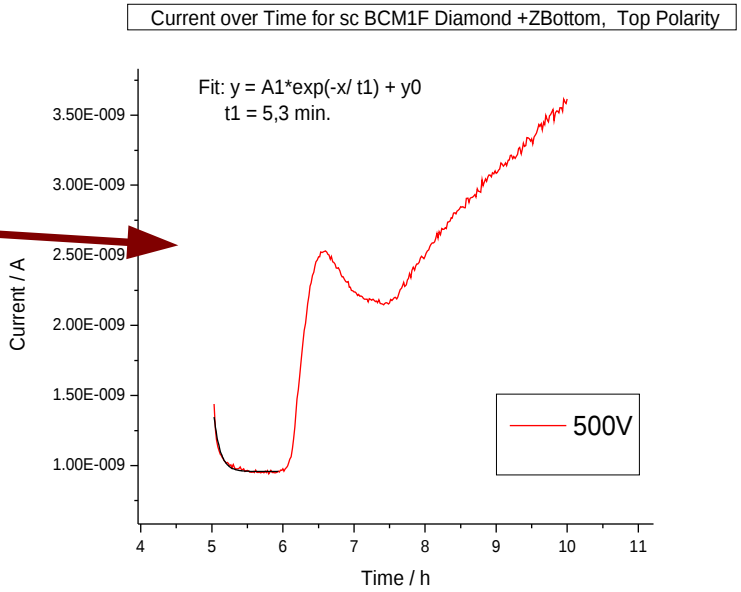
IV Measurements

> Current over time measurements are also done for BCM1F diamonds

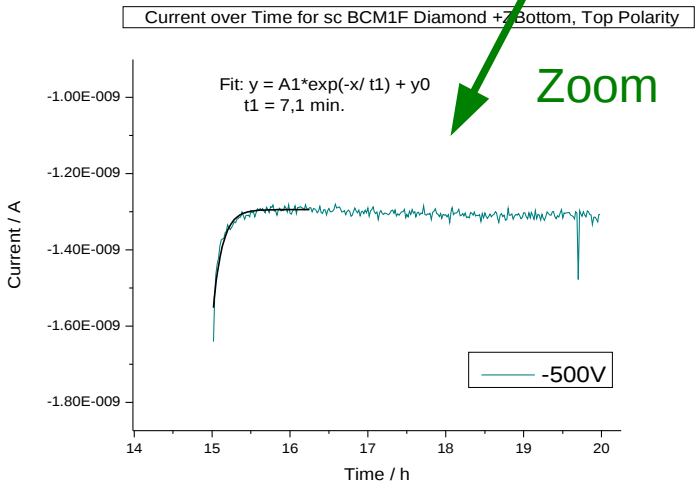
- Done with Sr-90 source → pumping



Zoom



Zoom



> Current increases after 60min

> Additional peak appears

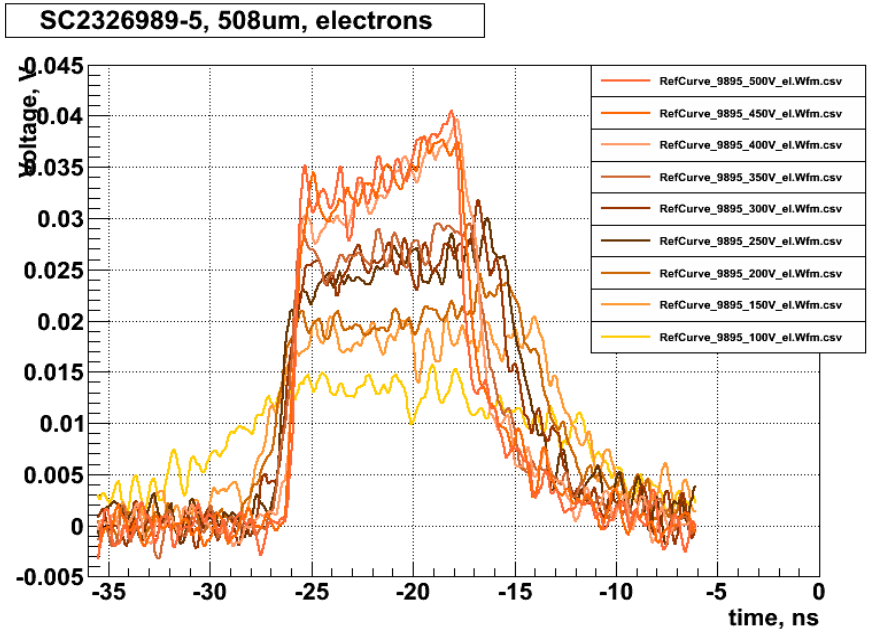
> Reproducible observation

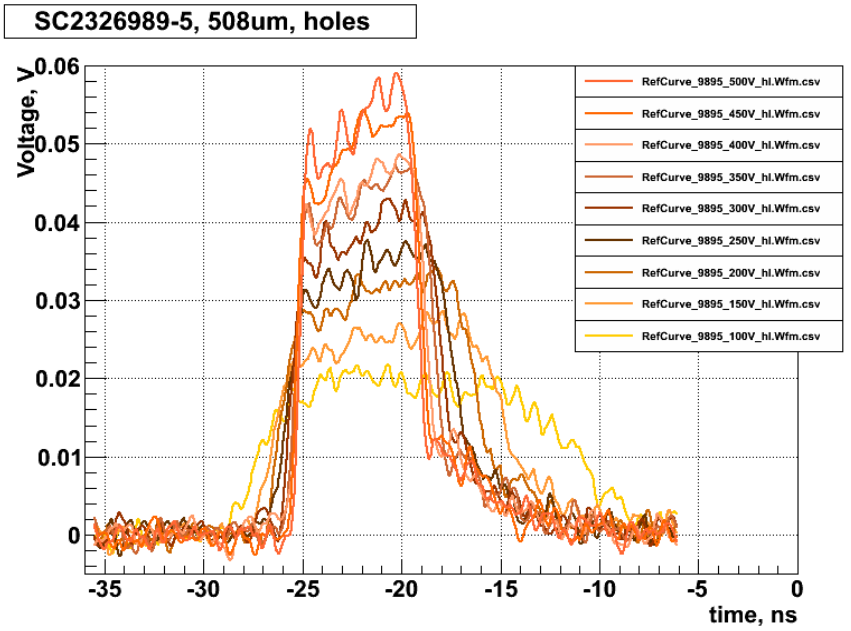
TCT Measurements

- First TCT measurements are done with
  - New sCVD diamond from Moritz
  - BCM1F diamond (irradiated)
- Holes are faster than electrons
  - Already observed by Moritz and Eleni

Many Thanks to Konstantin!!!

sCVD from Moritz

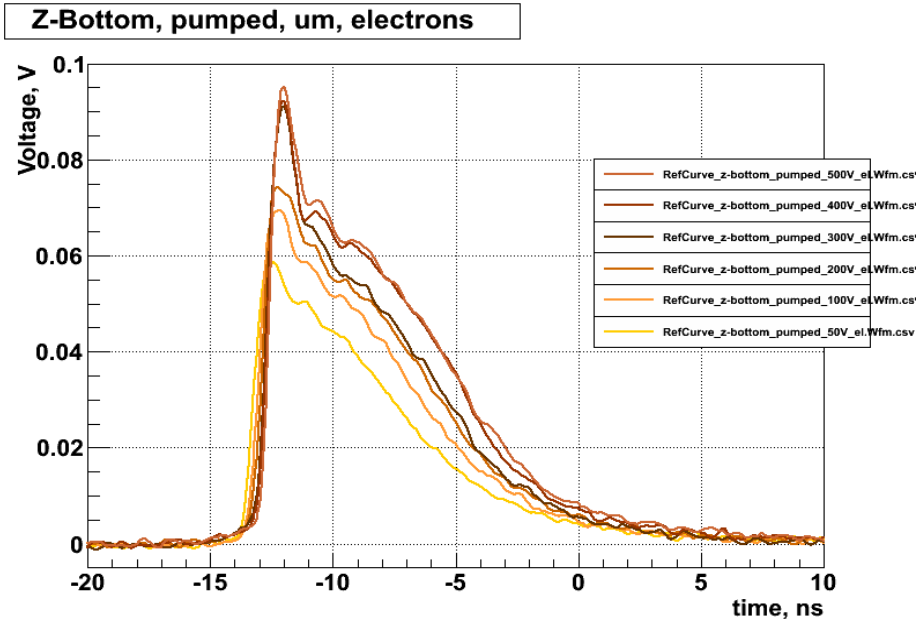


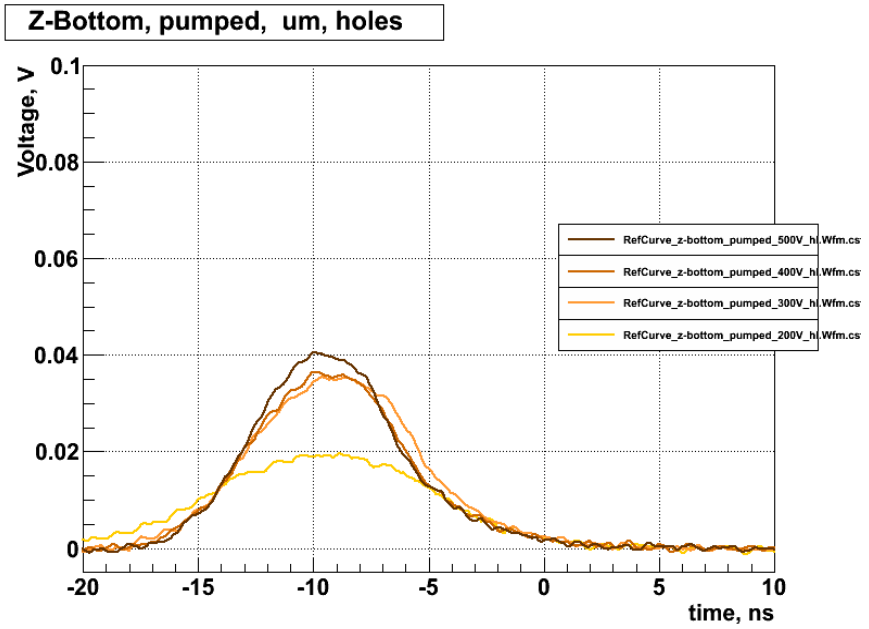


TCT Measurements

- BCM1F +Z Bottom was measured
- Electrons are faster than holes for irradiated diamond
  - Signal from holes is much smaller
- Information will be used for Jannis simulations

BCM1F +Z Bottom sCVD





Problems

- We need more man power
- Optical measurements are time-consuming
  - Only two diamonds per day
- We had some problems with CCE setups → too much noise and shifted baseline
  - Fixed now
- Problems with IV measurements
  - Probe station with needle setup is not suitable for diamond → break trough → needs investigations
  - Bonds are now used for IV measurements

Backup Slides