

# Digital Trigger, difficulties & plans

## October 2022

# Letter of Intent

➤ August 2022

...

With this letter, we confirm that Irfu agrees to fund the Digital Trigger for NectarCAM, given the fact that DESY has ensured the development but is not today in a position to fund the production for the next 8 cameras.

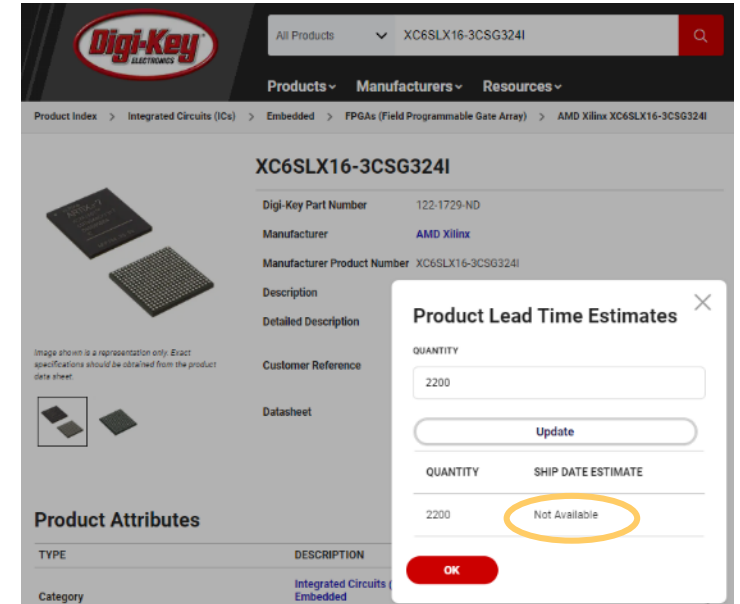
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Karl-Heinz confirmed that he can manage the production of the backplanes and the DTC electronics for the next 8 cameras, including the needed spares.

...

# Difficulties

- The Digital Trigger is based on Xilinx Spartan6 FPGAs
- at digi-key NO lead time estimates, e.g. for the DTB-FPGA
- According to Avnet, the main Xilinx distributor, Spartan6 FPGAs are obsolete
  - Avnet recommends to use Spartan7 instead
  - But there are also long lead times
- According to octopart.com, there are Spartan6 FPGAs on the gray market
  - check the impressive prices ...

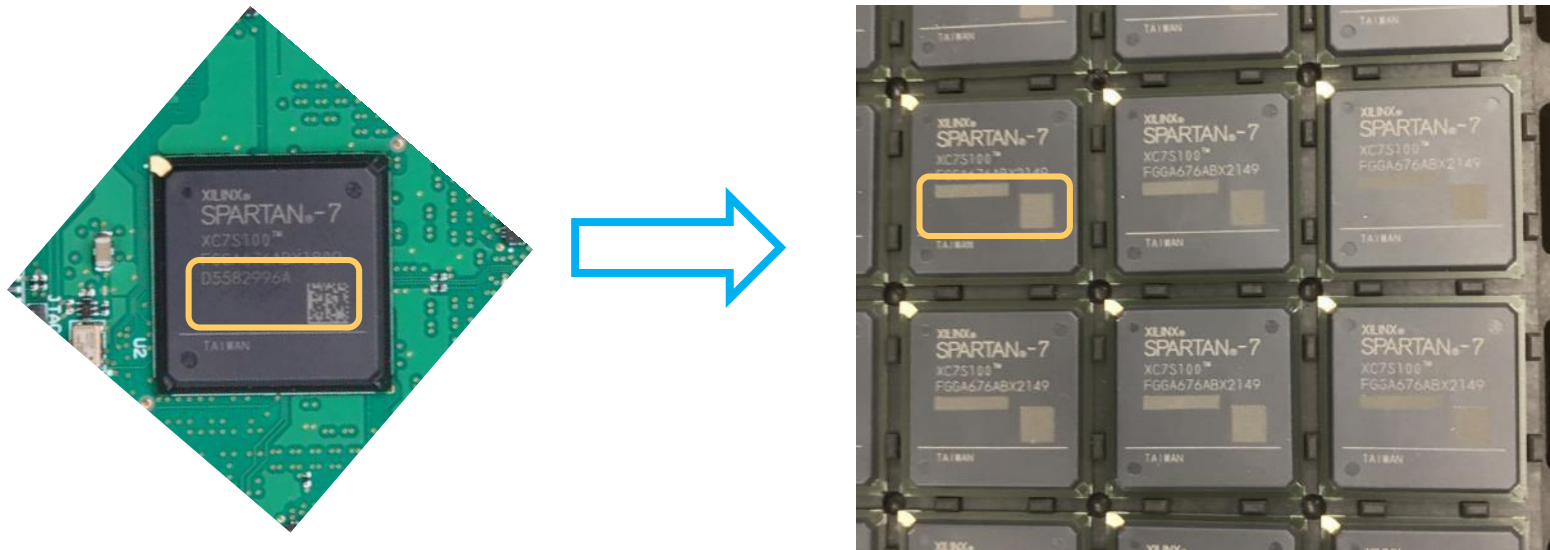


## Non-Authorized Stocking Distributors

Seller	SKU	Stock		1	10	100	1,000
☆ <a href="#">Win Source Electronics</a>	<a href="#">408446-XC6SLX25-3CSG324I</a>	<a href="#">860</a>	<a href="#">Visit site</a>	USD	<a href="#">2,258</a>	<a href="#">2,258</a>	<a href="#">2,258</a>
☆ <a href="#">Utmel Electronic</a>	<a href="#">903-XC6SLX25-3CSG324I</a>	<a href="#">11,823</a>	<a href="#">Visit site</a>	USD	<a href="#">1,046</a>	<a href="#">986.84</a>	<a href="#">930.98</a>
☆ <a href="#">Touchstone Systems</a>	<a href="#">XC6SLX25-3CSG324I</a>	<a href="#">1,764</a>	<a href="#">Visit site</a>				
☆ <a href="#">Ameva360</a>	<a href="#">XC6SLX25-3CSG324I</a>	<a href="#">630</a>	<a href="#">Visit site</a>				
☆ <a href="#">Component Stockers</a>	<a href="#">XC6SLX25-3CSG324I</a>	<a href="#">1,506</a>	<a href="#">Visit site</a>				
☆ <a href="#">Worldway Electronics</a>	<a href="#">XC6SLX25-3CSG324I</a>	<a href="#">2,503</a>	<a href="#">Visit site</a>				

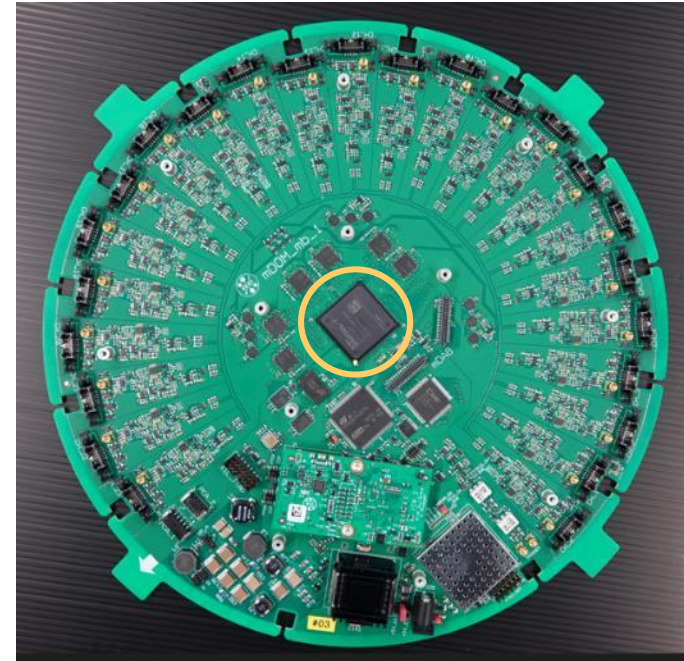
# Xilinx Spartan7 Gray Market FPGAs

- What we learnt recently
- unlike Spartan6, there is a QR-code, containing:
  - temperature range, speed grade and serial number
- These informations are blanked out, to prevent tracking
  - Not very trustworthy ...



# IceCube Upgrade, Experiences with Gray Market FPGAs

- E.g., mDOM mainboard FPGA
  - Xilinx Spartan7, XC7S100-2FGGA676I
    - Complex firmware
    - challenging high speed design
    - 24 ADC channels, DDR3 RAM, MCU ...
- Avnet lead time is 20 month now !
  - Ordered 01.02.2022
  - delivery (?) 21.09.2023
  - ~110€ (batch of 200)
- Last week I tested two mainboards with FPGAs, delivered by Utmel and Jotrin (gray market vendors)
  - Both are performing like expected, one tested at -45°C already
  - 3 orders
  - Prices dropped from 1300€ down to 220€ (Utmel, ordered last week)



# Production of the DTBs, Plan A

1. Staying with the original Spartan6 FPGAs
2. Order some (e.g. 20) DTB-FPGAs on the gray market, provided the price is acceptable (2..3 x market price)
3. Test the DTBs
4. If tests passed, order 2200 pcs. from the same broker
5. If tests not passed, goto 2., try another vendor
6. Else, produce backplanes

## ➤ Pros

- No extra effort is required

## ➤ Cons

- Is the vendor trustworthy?
- Possibly very high price
- Risky, usually the gray market vendors require payment in advance

# Plan A, Gray Market Quotations, received 2022-10-10

By Utmel

Inquired Part #	Quoted Part #	MFR	Package	D/C	Quoted QTY	U/P \$USD	AMOUNT	Lead Time Workdays	Remark
<b>XC6SLX25-3CSG324I</b>	<b>XC6SLX25-3CSG324I</b>	XINLINX	FPGA324	15+	100	785.72	78572	1-3	
<b>XC6SLX25-3CSG324I</b>	<b>XC6SLX25-3CSG324I</b>	xilinx	FPGA324	21+	2500	785.72	1964300	1-3	

By Jotrin

No.	Part No.	MFG	PACKAGE/DESCRIPTION	Qty	Unit/Price	Lead Time
1	XC6SLX16-3CSG324I	XILINX	BGA 21+ Lead free/RoHS Compliant	630	\$ 1130.0000	7-10 days
TOTAL: (USD)						711900.00

By Win Source

NO	Part Number	Brand	Package	Date Code	Qty(pcs)	Lead Time	Unit Price USD	Remark
1	XC6SLX25-3CSG324I	XILINX	BGA	15+	100	One Day	820.90	252pcs in stock

➤ Prices not acceptable

# Production of the DTBs, Plan B

1. Using Spartan7 FPGAs, e.g. XC7S50-2FGGA484I (with enough I/Os)
2. Adapt the existing firmware
3. To allow short term testing, order some (e.g. 20) DTB-FPGAs on the gray market, provided the price is acceptable (2..3 x market price)
4. Adapt the DTBs schematic, DTB4 -> DTB5
5. Test the new DTBs
6. If tests passed, order 2200 pcs. at Avnet and / or from the broker
7. If tests not passed, find the reason and jump back
8. Else, produce backplanes

## ➤ Pros

- faster FPGAs, 3x more logic cells for more complex trigger algorithms
- Less power consumption

## ➤ Cons

- Firmware, schematic and PCB adaption are required



# Plan B, Avnet Quotation

Pos	Beschreibung	Menge	Preis USD/Einheit	GESAMTPREIS USD																																
10	<b>XC7S50-2FGGA484I</b> XILINX IRELAND UNLIMITED COMPANY XC7S50-2FGGA484I/XC7S50	100	5.655,00 / 100	5.655,00																																
<div><div><div>DPA with steps:1-1PSJQ7D-1-DE</div><table><tr><th>Step</th><th>Qty From</th><th>Qty To</th><th>Impact Qty</th><th>Price / Unit</th><th>Curr</th><th>Start Date</th><th>End Date</th></tr><tr><td>1</td><td>0</td><td>100</td><td>100</td><td>5.655,00 / 100</td><td>USD</td><td>21.09.2022</td><td>21.09.2023</td></tr><tr><td>2</td><td>101</td><td>5.100</td><td>5.000</td><td>3.770,00 / 100</td><td>USD</td><td>21.09.2022</td><td>21.09.2023</td></tr><tr><td>3</td><td>5.101</td><td>15.100</td><td>10.000</td><td>3.300,00 / 100</td><td>USD</td><td>21.09.2022</td><td>21.09.2023</td></tr></table><div>Step Pricing Bedingungen für Xilinx-Produkte - Staffelpreise: -&gt; 37.7 USD</div><div><div>1. Der Kunde ist verpflichtet, die gesamte jeweilige Staffelmenge zu erwerben um den nächstniedrigen Staffelpreis zu erhalten.</div><div>2. Aus dem ersten Gültigkeitsdatum geht hervor, wann der Preis der jeweiligen Teilenummer gilt. Darauf folgende Gültigkeitsdaten und sämtliche Enddaten sind geschätzte Termine für die angegebene Menge. Diese Daten werden nicht verwendet, um das Wirksamkeitsdatum des nächstniedrigen Preises zu bestimmen.</div><div>3. Die Preise sind eine Einschätzung die auf dem gegenwärtigen Stand der Mengenabnahme basiert, bis zur Rechnungsstellung kann der Preis entsprechend der tatsächlich abgenommenen Menge angepasst werden.</div></div></div></div>					Step	Qty From	Qty To	Impact Qty	Price / Unit	Curr	Start Date	End Date	1	0	100	100	5.655,00 / 100	USD	21.09.2022	21.09.2023	2	101	5.100	5.000	3.770,00 / 100	USD	21.09.2022	21.09.2023	3	5.101	15.100	10.000	3.300,00 / 100	USD	21.09.2022	21.09.2023
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3	5.101	15.100	10.000	3.300,00 / 100	USD	21.09.2022	21.09.2023																													
<div>RoHS(10) Compliant(1)</div> <div><div>Herstellerbezeichnung:</div><div>XC7S50-2FGGA484I</div></div> <div><div>Kundenbestellnr:</div><div>3915205609</div></div> <div><div>Stat. Warennummer:</div><div>85423990 AL nr. / ECCN nr.: N.E. / 3A991D</div></div> <div><div>Verpackungseinheit:</div><div>60 PCE</div></div> <div><div>Verpackungsart:</div><div>Trays</div></div> <div><div>Standard Lieferzeit (Wochen) (2):</div><div>66</div><div>-&gt; Delivery time 66 weeks, not guaranteed!</div></div>																																				

# Personal Plans

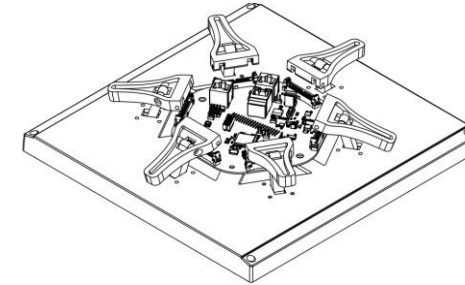
- My official retirement date is 1st of April 2023
- The plan is to extend my working period by at least two more years, on a 30 hours per week basis
  - More time for hobbies then 😊
- Presently, still working full time for the Icecube project
  - Two more PCB designs to be finalized (Fieldhub, controller board and backplane)
  - Likely finished in April 2023
- Due to the FPGA market situation, following plan B
- FPGAs (smaller batch) ordering next weeks
- adapting the DTB firmware first, followed by schematic & PCB redesign
  - In any case, staying 100% software compatible

# Successor

- Marko Kossatz, 43 years old, with a lot of talents
  - Firmware development
  - Low level software (Linux based)
    - knows the L2CBs MCU unit (stamp9g45) very well
  - Excellent practical skills
- Was responsible for the commissioning of the HESS I upgrade trigger (4 cameras)
- He agreed to take over

# Production of the backplanes and DTC for the next 8 cameras

- The production of the DTBs and the CTDBs by a company (or DESY-Hamburg) will be based on a call for tender. These companies are taking care of the parts procurement and initial board testing (optical + flying probe test)
  - Likely FPGA procurement by DESY Zeuthen
- DESY can do temperature cycling (HALT) now
- Special DTB test hardware is in development (by an intern)
- The production of the L2CBs and the L2-Crate: by the DESY-Zeuthen workshop
- The time scale is unclear
- According to the present market situation (no chips), the production of the DTBs could start earliest in June 2023



# Thanks!